NHLABATHI MINERALS (PTY) LTD

RIETKOL MINING OPERATION

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT
SEPTEMBER 2021

RIETKOL MINING OPERATION - NHLABATHI MINERALS (PTY) LTD

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mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

PART A

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED RIETKOL MINING OPERATION

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: Nhlabathi Minerals (Pty) Ltd

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FILE REFERENCE NUMBER SAMRAD: MP 30/5/1/2/2/10268 MR

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVES OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process—

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, biophysical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the -

    i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

    ii) degree to which these impacts -

        a. can be reversed;

        b. may cause irreplaceable loss of resources; and

        c. can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

(g) identify suitable measures to manage, avoid or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored.

_____

In terms of the NEMA 2014 EIA Regulations contained in GN R982 of 04 December 2014 (as amended in 2017) the Environmental Impact Assessment Report (EIAR) must comply with Appendix 3 of the NEMA 2014 EIA Regulations (GN R982 of 04 December 2014).

Legal Requirement		**Relevant Section in EIAR**
(1)	An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-	
(a)	Details of- (i) the EAP who prepared the report; and (ii) the Expertise of the EAP, including a curriculum vitae;	Section 1.2.2 Appendix 2
(b)	the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including (i) the 21digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in terms(i) and (ii) and is not available the coordinated of the boundary of the property or properties;	Section 1.3
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on the land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Figure 6 Appendix 25
(d)	a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development;	Section 2
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 3
(f)	a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context to the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 4
(g)	a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 5.8
(h)	a full description of the process followed to reach the proposed development footprint within the approval site as contemplated in the accepted scoping report including; (i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41of the regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reason for including them; (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 5 Section 8

	(v) the impacts and risks identified including the nature, significance; including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and (x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred (location) development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including— (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 7.1-7.3
(j)	an assessment of each identified potentially significant impact and risk, including— (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	Section 7.4
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 7.5
(l)	an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping	Section 9 Appendix 25

	report indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Section 7.3 Section 9.1
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 5.8
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 9.2
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 7.6
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 9.3
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	N/A
(s)	an undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	EMPr
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Appendix 19
(u)	an indication of any deviation from the approved scoping report, including the plan of study, including– (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	7.7
(v)	any specific information that may be required by the competent authority; and	Section 10
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Section 10

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GLOSSARY OF TERMS

TERM / ABBREVIATION	MEANING
ABA	Acid-base accounting
AEL	Atmospheric Emissions Licence
AH	Agricultural Holding
AHs	Agricultural Holdings
AMD	Acid Mine Drainage
AQA	National Environmental Management: Air Quality Act 39 of 2004
AQMP	Air Quality Management Plan
BAS	Best Attainable State
BAMP	Biodiversity Action Management Plan
BCM	Bank cubic meters
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate
BM&C	Blast Management & Consulting
CA	Competent Authority
CARA	Conservation of Agricultural Resources Act 43 of 1983
CBA	Critical Biodiversity Area
CFP	Chance Find Protocol
CRR	Comments and Response Report
DAFF	Department of Agriculture, Forestry and Fisheries
DALRRD	Department of Agriculture, Land Reform and Rural Development
dBA	Decibels
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
DoA	Department of Agriculture
DRDLR	Mpumalanga Department of Rural Development and Land Reform
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Ecological Importance and Sensitivity

TERM / ABBREVIATION	MEANING
EMC	Environmental Management Committee
EMPr	Environmental Management Programme
ESA	Ecological Support Area
FAII	Fish Assemblage Integrity Index
FSR	Final Scoping Report
GC	Groundwater Complete
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GN	Government Notice
GPS	Global Positioning system
HHRA	Human Health Risk Assessment
HIA	Heritage Impact Assessment
HPA	Highveld Priority Area
IAPs	Interested and Affected Parties
IBA	Important Bird Area
IDPs	Integrated Development Plans
IHAS	Invertebrate Habitat Assessment System
IHIA	Intermediate Habitat Integrity Assessment
ISP	Internal Strategic Perspective
IUCN	International Union for Conservation of Nature and Natural Resources
IWUL	Integrated Water Use Licence
IWWMP	Integrated Water and Waste Management Plan
LC	Leachable concentration
LCC	Land Claims Commissioner
LM	Local Municipality
LOM	Life of Mine
Mamsl	Meters above mean sea level
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Run-off
mbs	Meters below surface
MBSP	Mpumalanga Biodiversity Sector Plan
MDARDLEA	Mpumalanga Department of Agriculture, Rural Development, Land Reform, Environmental Affairs
MDEDET	Mpumalanga Department of Economic Development, Environment and Tourism

TERM / ABBREVIATION	MEANING
MNCA	Mpumalanga Nature Conservation Act 10 of 1998
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002
MRA	Mining Right Application
Mt	Million tonnes
Mtpa	Million tonnes per annum
MTPA	Mpumalanga Tourism and Parks Agency
NBA	National Biodiversity Assessment
NDP	National Development Plan
NEMA	National Environmental Management Act 107 of 1998
NEMBA	National Environmental Management: Biodiversity Act 10 of 2004
NEMWA	National Environmental Management: Waste Act 59 of 2008
NFA	National Forest Act 84 of 1998
NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act 25 of 1999
NPAES	National Protected Areas Expansion Strategy
NWA	National Water Act 36 of 2008
NWCS	National Wetland Classification System
OES	One Environmental System
PCD	Pollution Control Dam
PES	Present Ecological State
PFD	Process Flow Diagram
PIA	Palaeontological Impact Assessment
PM	Particulate matter
PRECIS	Pretoria Computer Information Systems
RDL	Red Data List
RDM	Resource Directed Measures
RE	Remaining Extent
REC	Recommended Ecological Category
RHP	River Health Programme
RMO	Resource Management Objective
RoM	Run of Mine
RWD	Return Water Dam
RWQO	Receiving Water Quality Objective
SAHRA	South African Heritage Resources Agency
SAM	Social Accounting Matrix

TERM / ABBREVIATION	MEANING
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SAS	Scientific Aquatic Services
SCC	Species of Conservational Concern
SDF	Spatial Development Framework
S&EIR	Scoping and environmental impact reporting process
SEIA	Socio-Economic Impact Assessment
SIA	Social Impact Assessment
SUR	Strict Unemployment Rate
SWMP	Surface Water Management Plan
TC	Total concentration
TDS	Total Dissolved Solids
TFR	Transnet Freight Rail
TIA	Traffic Impact Assessment
TOPS	Threatened or Protected Species
TSP	Total suspended particulates
TWQR	Target Water Quality Range
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
WMA	Water Management Area
WML	Waste Management Licence
WQO	Water Quality Objective

1 INTRODUCTION

1.1 BACKGROUND

Consol Glass (Pty) Limited (Consol) was the holder of a prospecting right over portions of Olifantsfontein 196 IR and Rietkol 237 IR. Consol commenced with an internal restructuring process of its mining interests in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002) in 2013. The restructure included the establishment of Apex Silica Mining (Pty) Ltd (Apex Silica) and Nhlabathi Minerals (Pty) Ltd (Nhlabathi). Following the restructuring process, Consol gave consent to Nhlabathi to apply for a Mining Right over the area to which it held the prospecting right, for the Rietkol Mining Operation (referred to as the **Rietkol Project**).

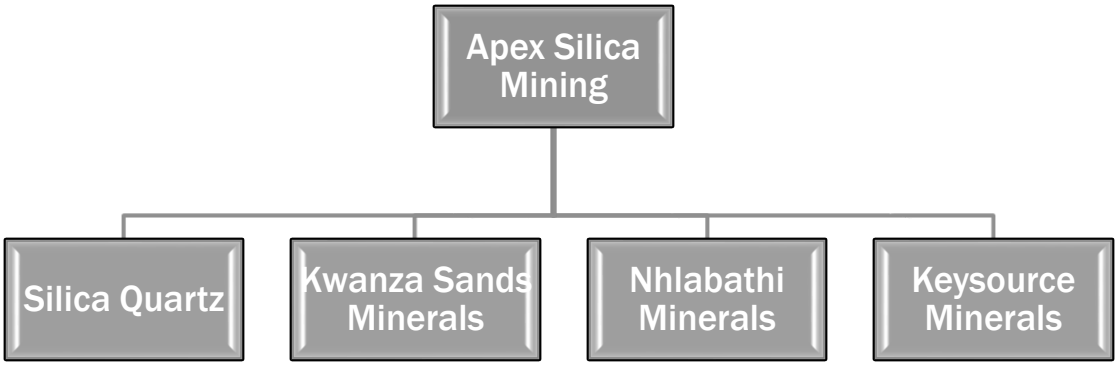


Figure 1: Company Structure

Nhlabathi applied for a Mining Right to mine silica in February 2018 and commenced with the Environmental Impact Assessment (EIA) process as contemplated in the National Environmental Management Act 107 of 1998 (NEMA) and Government Notice (GN) No. R. 982-986 of 4 December 2014: NEMA: EIA Regulations, as amended, for the Rietkol Project.

Several specialist studies were conducted within the Mining Right Application (MRA) area in support of the EIA process, and a comprehensive Public Participation process was initiated. The final Scoping Report was submitted on 3 April 2018 and accepted by the Department of Mineral Resources and Energy (DMRE) on 26 April 2018. However, the MRA was rejected by the DMRE Mpumalanga Mine Economics Directorate on the basis that the MRA formed part of another right granted in terms of the MPRDA. This decision resulted in a delay in the EIA process, ultimately causing the application for Environmental Authorisation to lapse.

After research by DMRE officials and Nhlabathi employees, it was established that the prior right, on which basis the MRA was rejected, was the prospecting right registered over the properties held by Consol. To remedy the situation, Consol submitted a letter to the DMRE on 8 June 2018 granting Nhlabathi the consent to proceed with the MRA. As a result, the DMRE withdrew the refusal letter by issuing an acceptance letter on 12 September 2018. Nhlabathi could, therefore, continue with the EIA process.

However, on 31 August 2018, Mineral Resources and Energy Minister Gwede Mantashe closed the Mpumalanga DMRE Office until further notice, with the result that DMRE accepted no new applications for Environmental Authorisation. The DMRE Office was only re-opened for business on 5 August 2019.

Following the re-opening of the DMRE Office, Nhlabathi has re-initiated the MRA process and applied for a Mining Right over the same farm portions in early 2020. The MRA was accepted by the DMRE on 21 January 2021 and Nhlabathi has since re-initiated the EIA process with Jacana Environmentals cc (Jacana) appointed as the independent Environmental Assessment Practitioner (EAP).

Consol has appointed Jacana to apply for Integrated Environmental and Water Use Authorisation for the Rietkol Project in terms of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998), the 2014 Environment Impact Assessment (EIA) regulations, the National Environmental Management: Waste Act (NEMWA), 2008 (Act 59 of 2008) and the National Water Act (NWA), 1998 (Act 36 of 1998), as amended. The integrated application for Environmental Authorisation (EA) and the Waste Management Licence (WML) was submitted to the DMRE on 18 March 2021, the Competent Authority (CA) for any mining and related activities.

The Final Scoping Report (FSR), following a 30-day commenting period by registered Interested and Affected Parties (IAPs) and commenting authorities on the draft Scoping Report (DSR), was submitted to the CA on 7 May 2021. The FSR and Plan of Study was accepted on 11 August 2021.

This document serves as the **Draft Environmental Impact Assessment Report** (EIAR) which is, together with the Draft Environmental Management Programme (EMPr), available for comment by registered Interested and Affected Parties (IAPs) and commenting authorities for a period of 30 days, from 4 October to 4 November 2021.

1.2 APPLICANT AND SPECIALIST DETAILS

1.2.1 Applicant

Project applicant	Nhlabathi Minerals (Pty) Ltd
Responsible person	Prince Fikile Holomisa
Physical address	Consol House, Osborn Road, Wadeville
Postal Address	PO Box 157, Delmas, 2210
Telephone	013 665 7900
Facsimile	013 665 7910
E-mail	fikile@silq.co.za

1.2.2 Environmental Assessment Practitioner

Independent EAP	Jacana Environmentals cc
Responsible person	Marietjie Eksteen
Physical address	7 Landdros Mare Street, Polokwane
Postal address	PO Box 31675, Superbia, 0759
Telephone	015 291 4015
Facsimile	086 668 4015
E-mail	marietjie@jacanacc.co.za
Professional Affiliation	Registered Environmental Assessment Practitioner at the Environmental Assessment Practitioners Association of South Africa (EAPASA) – Number 2020/1800 Registered as a Professional Environmental Scientist (Pr.Sci.Nat.) at the South African Council for Natural Scientific Professions – Registration No. 400090/02 Member of the Land Rehabilitation Society of Southern Africa (LaRSSA): Membership ID 30835
Abbreviated Curriculum Vitae	Marietjie Eksteen is the Managing Member of the consulting firm Jacana Enviromentals cc, an environmental consulting firm based in Polokwane. She is an environmental scientist with 30 years' experience, her main fields of expertise being water quality management, mine water management, environmental legal compliance, and project management. She obtained a Masters' degree in Exploration Geophysics (MSc) from the University of Pretoria in 1993. Since establishing Jacana Enviromentals in 2006, she has been involved in a variety of mine- and industry-related environmental projects serving clients such as MC Mining Limited, South32 SA Coal Holdings, Glencore Operations South Africa, Consol Glass and Silicon Smelters, amongst others. Prior to 2006 she was employed by Pulles Howard & De Lange Inc as an environmental consultant for 2 years. Before consulting, Ms. Eksteen was employed by BHP Billiton as a mine environmental manager at their operations in Mpumalanga, as well as the Department of Water Affairs where she was appointed as a water quality specialist for the mining industry. Her career started off as a geophysicist at Genmin in 1990.
Curriculum Vitae	Refer to Appendix 2.

1.2.3 Specialist Team

The specialist team that has been appointed to assist Jacana Environmentals with the EIA is:

Soils, land use and capability, Hydropedology	SAS Environmental Holdings
Terrestrial / Aquatic Biodiversity	SAS Environmental Holdings
Groundwater	Groundwater Complete
Air Quality	EBS Advisory (Pty) Ltd
Ambient Noise	Enviro-Acoustic Research cc
Blasting & Vibration	Blast Management & Consulting
Traffic	AvzconS Civil Engineering Consultant
Heritage and Cultural Resources	R&R Cultural Resource Consultants
Palaeontology	ASG Geo Consultants (Pty) Ltd
Visual and Aesthetics	SAS Environmental Holdings
Social	Diphororo Development (Pty) Ltd
Hazard Identification and Risk Assessment (HIRA)	AirCheck Occupational Health, Environmental and Training Services
Land Trade-off & Macro-Economic Analysis	Mosaka Economic Consultants
Human Health Risk Assessment	Independent Consultant: MA Oosthuizen
Poultry Impact Statement	C4 Africa Professional Consultants
Surface Water Management Plan	Onno Fortuin Consulting (Pty) Ltd

The team members, with their qualifications and professional registrations and affiliations is presented in Table 1.

Table 1: Qualification and professional registrations and affiliations of EIA specialists

Aspect	Firm	Specialists	Qualification	Professional registrations and affiliations
Soils, land use & land capability Hydropedology	SAS Environmental Holdings	Tshiamo Setsipane	MSc (Soil Science)	Cand.Sci.Nat. – SACNASP Reg No. 114882.
		Braveman Mzila	BSc (Hons) Hydrology BSc (soil Science and Hydrology)	Member of the SA Soil Surveyors Organisation (SASSO), the Soil Science Society of SA (SSSSA), and the Land Rehabilitation Society of Southern Africa (LaRSSA).
		Stephen van Staden	BSc (Hons) Zoology MSc Environmental Management	Member of the SA Soil Surveyors Organisation (SASSO), the Soil Science Society of SA (SSSSA), and the Land Rehabilitation Society of Southern Africa (LaRSSA).
Terrestrial / Aquatic Biodiversity	SAS Environmental Holdings	Stephen van Staden	BSc (Hons) Zoology MSc Environmental Management	Pr.Sci.Nat. - SACNASP Reg No. 400134/05. Registered by the SA RHP as an accredited aquatic biomonitoring specialist. Member of the Gauteng Wetland Forum and SA Soil Surveyors Association (SASSO). Cert. Tools for Wetland Assessment.
		Christopher Hooton	National Diploma: Nature Conservation B Tech Nature Conservation	Extensive experience in undertaking faunal studies throughout South Africa.
		Christien Steyn	BSc Environmental Management and Botany BSc (Hons) Plant Science	Pr.Sci.Nat. - SACNASP Reg No. 127823/21. Extensive experience in undertaking floral studies throughout South Africa.
Groundwater	Groundwater Complete	Gerhard Steenekamp	MSc Geohydrology / Hydrology	Pr.Sci.Nat. - SACNASP Reg No. 400385/04.
		Wiekus du Plessis	MSc Geohydrology	Pr.Sci.Nat. - SACNASP Reg No. 400148/15.
		Paul Naude	BSc (Hons) MSc (Mol. Phylogenetics)	Pr.Sci.Nat. - SACNASP Reg No. 400130/10.
Air Quality	EBS Advisory (Pty) Ltd	Stuart Thompson	BSc (Hons) Applied Environmental Science	Society South African Geographers. South African Geophysical Association, M07/007. National Association for Clean Air. Air Pollution Information Network - Africa, Lifetime Membership. Astronomical Society for SA, Committee Member, THO003.
		Raylene Watson	PhD (Toxicology)	Pr.Sci.Nat. - SACNASP Reg No. 400126/07. National Association for Clean Air. Air Pollution Information Network - Africa, Lifetime Membership.
Ambient Noise	Enviro-Acoustic Research	Morné de Jager	B. Ing (Chemistry)	Acoustic Society of America. South African Acoustic Institute.
Blasting and Vibration	Blasting Management & Consulting	Danie Zeeman	1985 - 1987 Diploma: Explosives Technology, Technicon Pretoria	International Society of Explosives Engineers.

Aspect	Firm	Specialists	Qualification	Professional registrations and affiliations
			1990 - 1992 BA Degree, University of Pretoria 1994 National Higher Diploma: Explosives Technology, Technicon Pretoria 2000 Advanced Certificate in Blasting, Technicon SA	
Heritage and Cultural Resources	R&R Cultural Resources	Frans Roodt Principal Investigator	BA Hons MA Archaeology Post Grad Dip. in Museology	Association of Southern African Professional Archaeologists (ASAPA) Member No. 120.
Palaeontology	ASG Geo Consultants	Dr Gideon Groenewald	PhD Geology National Diploma in Nature Conservation	Pr.Sci.Nat. Earth Scientist, Reg no 401946/83. Accredited by the Palaeontological Society of Southern Africa (society member for 25 years).
Visual and Aesthetics	SAS Environmental Holdings	Sanja Erwee	BSc Zoology	Extensive experience undertaken visual assessments throughout South Africa for numerous mining and infrastructure assessments.
		Stephen van Staden	BSc (Hons) Zoology MSc Environmental Management	Pr.Sci.Nat. - SACNASP Reg No. 400134/05. Registered by the SA RHP as an accredited aquatic biomonitoring specialist. Member of the Gauteng Wetland Forum and SA Soil Surveyors Association (SASSO). Cert. Tools for Wetland Assessment.
Traffic	Avzcons (Pty) Ltd	Awie van Zyl	BSc Eng. Civil	ECSA Reg. No: 920506.
Land trade-off and Macro-economic Analysis	Mosaka Economic Consultants	William Mullins	BSc – Trained as Mathematician and Statistician. 16 years' experience as macro- and micro-economist	Specialising in application of econometric models in analysing specific socio-economic impacts.
		Riekie Cloete	M. Com (Agricultural Economy)	Specialising in Cost-benefit Analyses and Macro-Economic Impact Modelling.
		Tefelo Majoro	M. Com (Economics)	Specialising in public economic and finance and SAM modelling.
Social	Diphororo Development	Lizinda Dickson	BA (Geography) BA (Hons) Environmental Management M Inst Agrar Environment and Society	International Association for Impact Assessment (IAIA).
		Carien Joubert	PhD Social and Behavioural Sciences	-
Hazard Identification and Risk Assessment (HIRA)	AirCheck	Piet Marais	MSc (Occupational Physiology)	Registered Occupational Hygienist (SAIOH).
		Lisa Roux	B Tech (Environmental Health)	Registered Occupational Hygienist (SAIOH).
		George Farmer	BSc (Hons) Biokinetics	Registered Occupational Hygiene Assistant (SAIOH).
Human Health Risk Assessment	Independent consultant	MA Oosthuizen	M Med Sc in Community Health	Registered as a Medical Scientist with the Health Professions Council of South Africa (HPCSA) Reg No. MW 0005320.

Aspect	Firm	Specialists	Qualification	Professional registrations and affiliations
				National Association for Clean Air.
Poultry Impact Statement	C4 Africa Professional Consultants	Dr Christopher Henderson	BVSc	South African Veterinary Council – 83/1851.
		Dr Neil Duncan	M Med Vet (Aves) Diplomate: American College of Veterinary Pathologists	South African Veterinary Council – S95/78.
Surface Water Management Plan	Onno Fortuin Consulting (Pty) Ltd	Onno Fortuin	BEng (Civil) - University of Pretoria GDE in Project Management - Wits University	ECSA - Reg No 900166. Member of SAICE.
		Robert Fortuin	BEng (Civil) - Stellenbosch University MSc (Water Management) - TU Delft (in progress)	Member of SAICE.

1.3 PROJECT LOCATION

The Rietkol Project is in Wards 8 and 9 of the Victor Khanye Local Municipality within the Nkangala District Municipality of Mpumalanga Province. Delmas/Botleng are approximately 6 km east and Eloff 4 km south of the MRA area. The Rietkol Project is located strategically close to major roads in the area, including the N12 (to the north-west), R50 (to the north-east) and R555 (to the south). The Springs/Durban Transnet Freight Rail (TFR) railway line is situated to the south, alongside the R555.

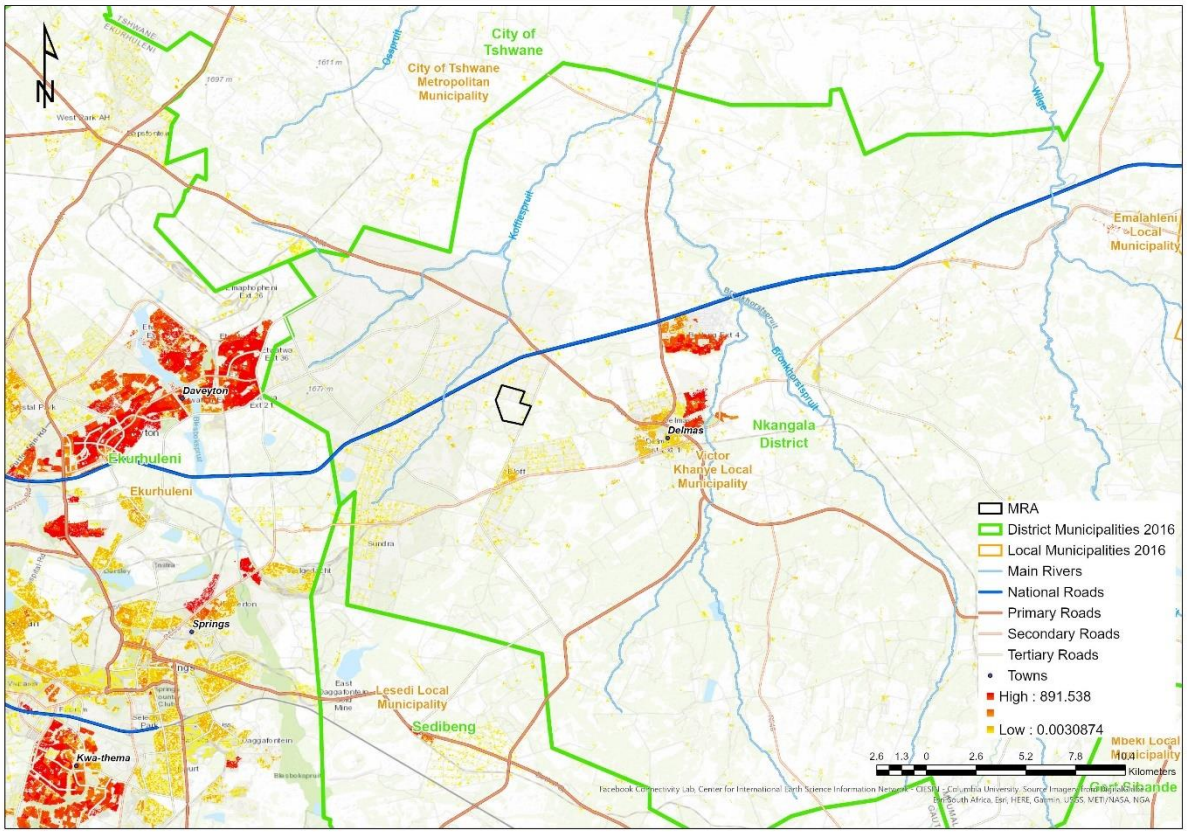


Figure 2: Project locality and institutional map

The Rietkol MRA covers an area of 221 ha consisting of:

- 16 Modder East Agricultural Holdings (AHs) on the farm Olifantsfontein 196 IR, each approximately 4.1 ha in extent;
- Portion 71 of the farm Rietkol 237 IR; and
- A portion of Remaining Extent (RE) of portion 31 of the farm Rietkol 237 IR.

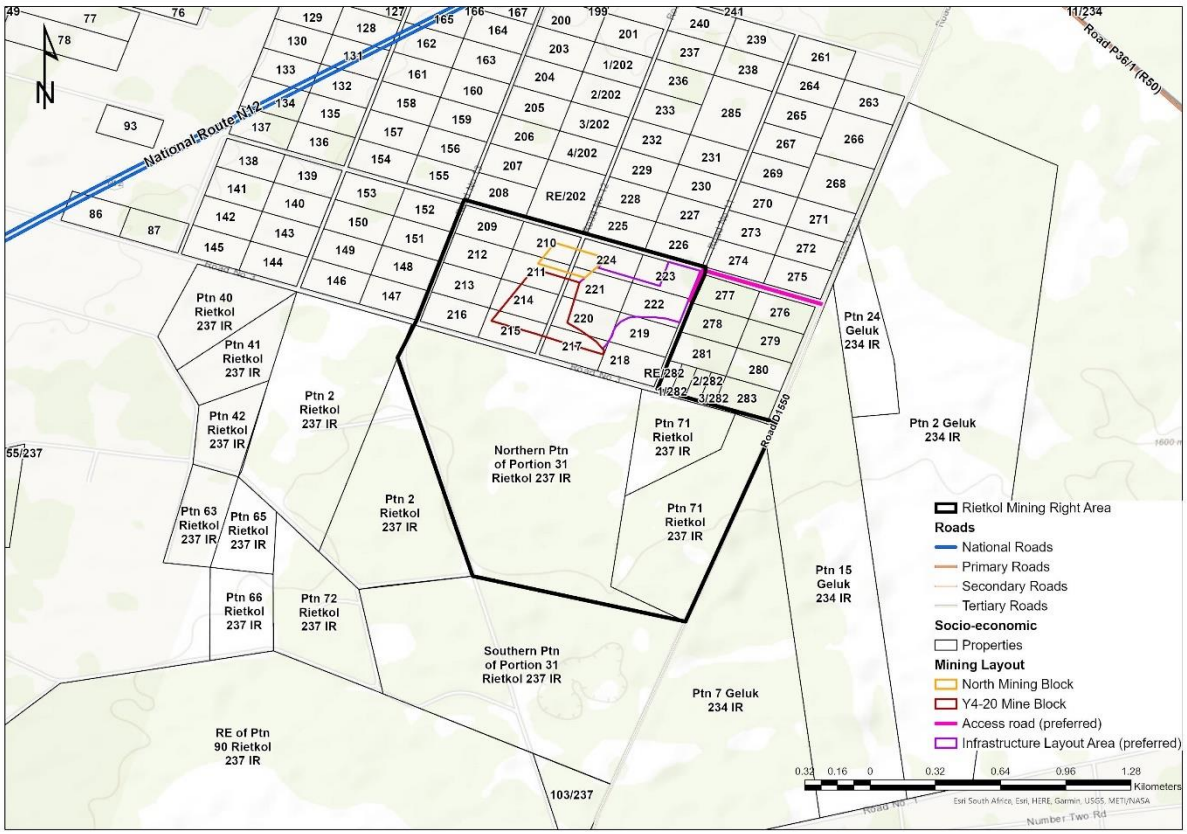


Figure 3: Property map of MRA area and surrounds

The registered description of the properties involved is tabled below, as indicated in Figure 3.

Table 2: Registered landowners

Portion Number	Title Deed Number#	SG Number	Owner
AH 209	T11927/2019	TOIR04410000020900000	Consol Glass (Pty) Ltd
AH 210	T8896/2019	TOIR04410000021000000	Consol Glass (Pty) Ltd
AH 211	T38311/1969	TOIR04410000021100000	Willem Christoffel Meyer
AH 212	T1558/2020	TOIR04410000021200000	Consol Glass (Pty) Ltd
AH 213	T171746/2005	TOIR04410000021300000	Johanna Elizabeth van der Walt
AH 214	T5414/2018	TOIR04410000021400000	Consol Glass (Pty) Ltd
AH 215	T2743/2003	TOIR04410000021500000	Veizaj Sokol
AH 216	T116099/2006	TOIR04410000021600000	Bheki & Lorraine Mthethwa
AH 217	T2918/2019	TOIR04410000021700000	Consol Glass (Pty) Ltd
AH 218	T7171/2019	TOIR04410000021800000	Consol Glass (Pty) Ltd
AH 219	T7171/2019	TOIR04410000021900000	Consol Glass (Pty) Ltd
AH 220	T2918/2019	TOIR04410000022000000	Consol Glass (Pty) Ltd
AH 221	T2918/2019	TOIR04410000022100000	Consol Glass (Pty) Ltd
AH 222	Pending	TOIR04410000022200000	Consol Glass (Pty) Ltd

Portion Number	Title Deed Number[#]	SG Number	Owner
AH 223	T2918/2019	TOIR04410000022300000	Consol Glass (Pty) Ltd
AH 224	Pending	TOIR04410000022400000	Consol Glass (Pty) Ltd
RE of Ptn 31 of Rietkol 237 IR	T16617/1993	T0IR00000000023700031	Christiaan Le Cordeur Rossouw
Ptn 71 of Rietkol 237 IR	T1885/2018	T0IR00000000023700071	Rossouw Pluimvee-Eiers (Pty) Ltd

[#]Pending: Consol (Pty) Ltd purchased the property, in process of transfer.

The Department of Rural Development and Land Reform (DRDLR) in Mpumalanga indicated the following regarding land claims within the MRA area:

Olifantsfontein 196 IR	According to the DRDLR database there are no land claims against the property.
Ptn 31 & 71 of Rietkol 237 IR	There is a land claim against the property, but so far only Ptn 91 has been affected and settled. Ptns 31 & 71 are not affected, but research is ongoing.

For further details, refer to the correspondence with the DRDLR included in Appendix 1.

No traditional authority is present in this area, and none was identified in close proximity of the proposed mine.

The landownership associated with the MRA area and surrounds (1 km radius) is provided in Figure 4.

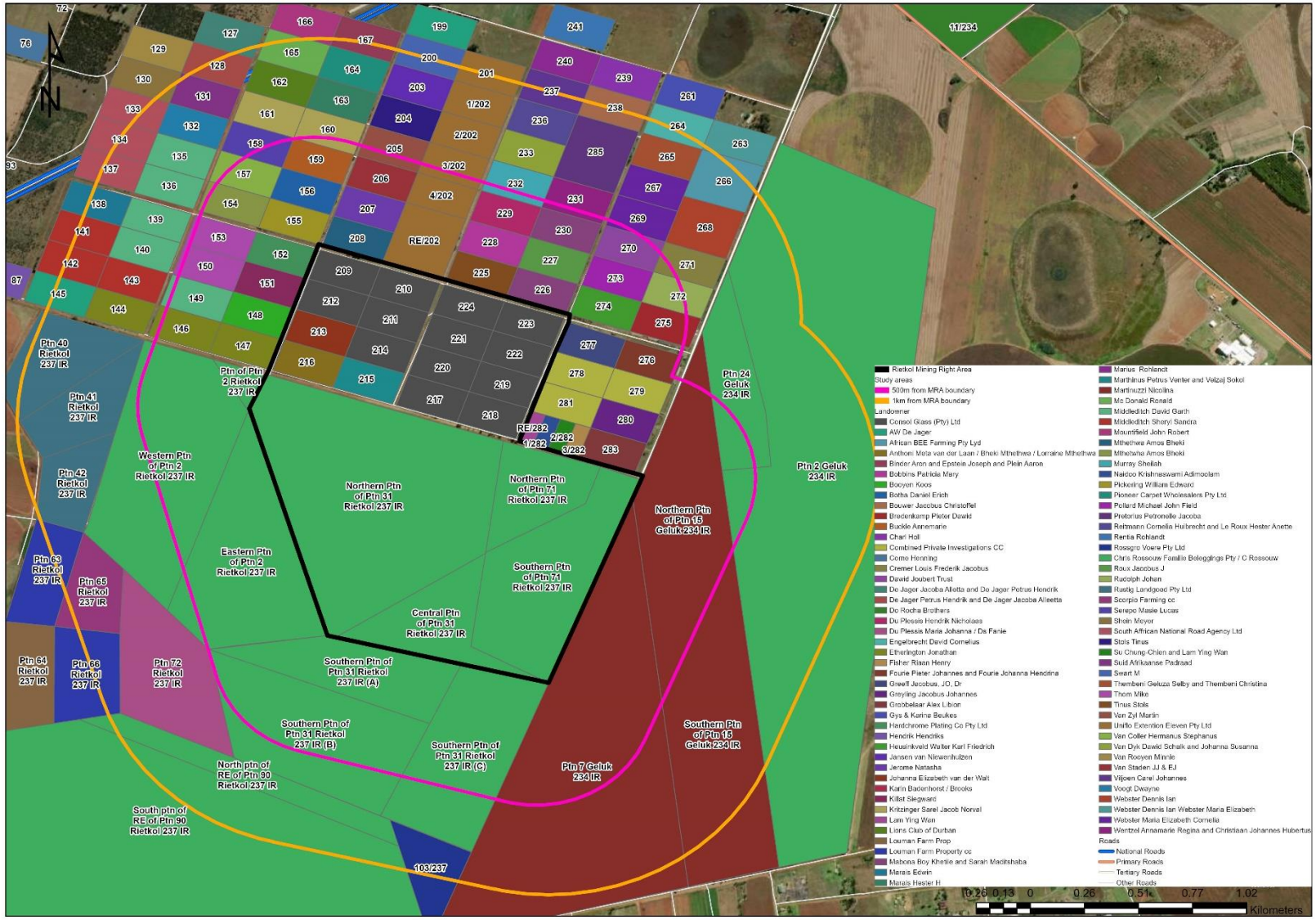


Figure 4: Landownership map within 1 km radius of the MRA boundary

2 PROJECT SCOPE AND ACTIVITIES

Silica is planned to be mined by means of conventional opencast methods to a depth of between 30 and 50 meters below surface (mbs). The estimated life of mine (LOM) for the proposed Rietkol Project is 20 years. Further exploration drilling will be conducted during the operational phase, which may increase the LOM and mining depth if the resource proofs viable. **It is important to note that this EIAR deals with the first 20 years of mining only.**

The proposed project includes the following mining and related infrastructure:

- Opencast pits;
- Run of mine (RoM) stockpiles;
- Processing plant (crushing, screening, washing and drying operations);
- Product stockpiles;
- Administration office facilities (security building, administration and staff offices, reception area, ablution facilities);
- Production facilities (locker rooms, laboratory, workshops, stores, ablution facilities);
- Bagging facility and warehouse;
- Weighbridge;
- Access roads; and
- Clean and dirty water management infrastructure.

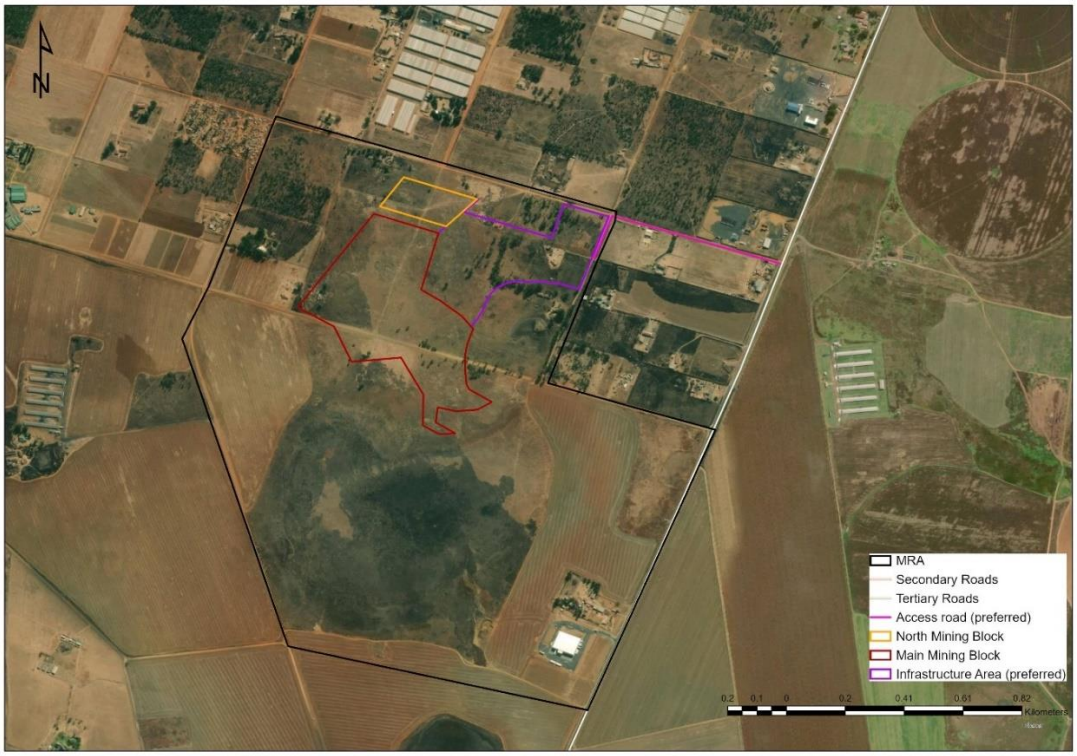


Figure 5: Rietkol Project Layout

2.1 LISTED ACTIVITIES

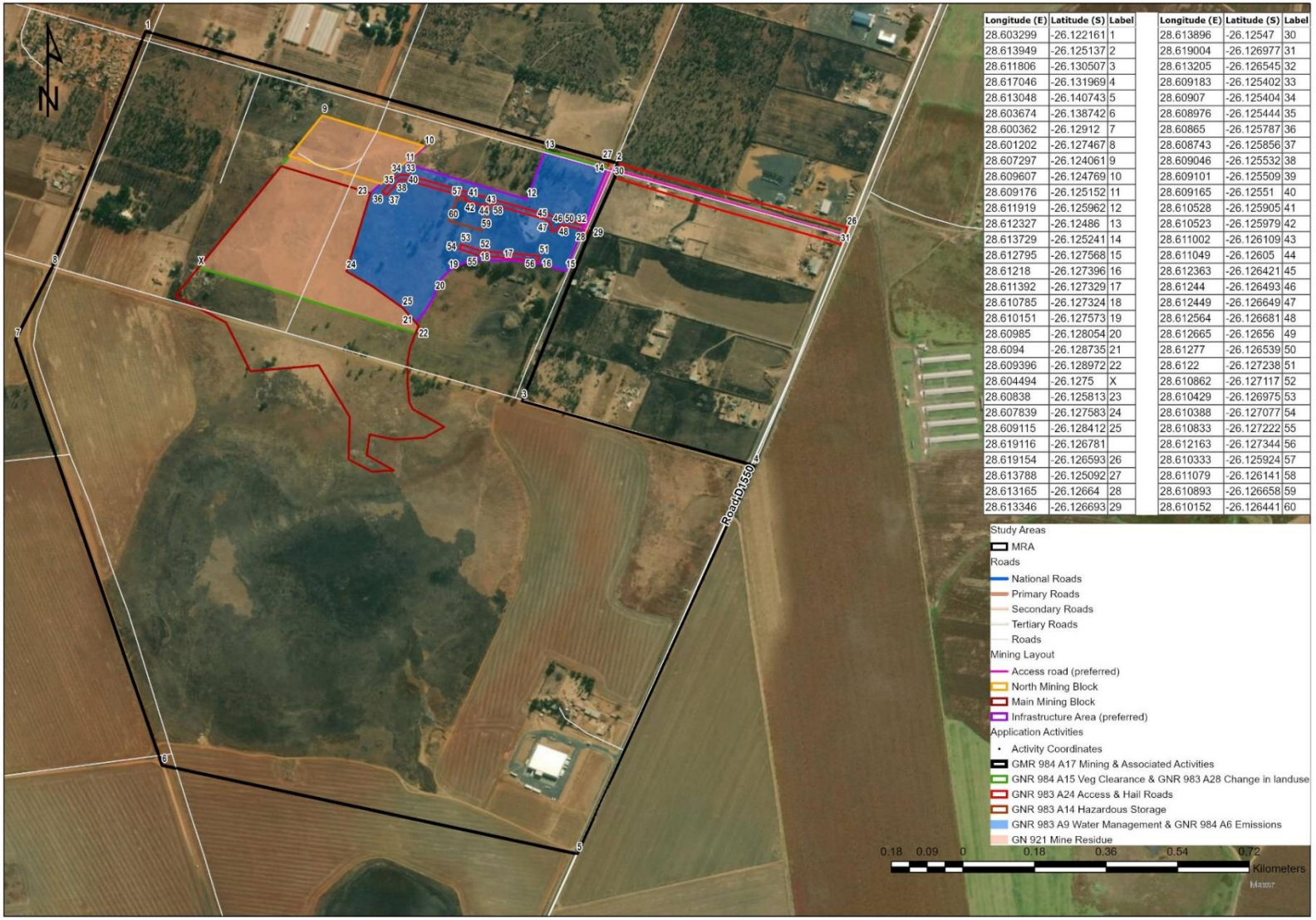
In terms of the 2014 EIA Regulations (as amended), several listed activities are triggered by the proposed Rietkol Project which require an EA. In addition, the disposal of tailings constitutes a waste management activity which requires a WML.

Table 3: Listed and waste management activities

Activity	Approximate Extent	Listed or Waste Management Activity	Applicable Notice
Open Pit Mining	North Block: 2.8 ha Main Block: 9.4 ha	X	GNR 984 – A15 GNR 984 – A17 GNR 983 – A28
Infrastructure area, including processing facility, workshops, and stockpiles	12.9 ha	X	GNR 984 – A6 GNR 984 – A15 GNR 983 – A28
Access / haul roads	35 433 m^2	X	GNR 983 – A24 GNR 983 – A56
Water management facilities (including dams)	PCD: 6 000 m^3 RWD: 5 000 m^3 Clean water canals: 215 m Dirty water canals: 1 300 m	X	GNR 983 – A9
Bulk hydrocarbon facilities	128 m^3	X	GNR 983 – A14
Waste management (incl. sewage)	45 m^3/day (septic tank)	N/A (below threshold)	-
Mine residue (tailings) disposal	404 443 m^3	X	GN No. 921 – Category B11
Blasting	N/A	N/A	-
Product transport	N/A	N/A	-

GNR 984 (Listing Notice 2) triggers a Scoping and Environmental Impact Reporting (S&EIR) process contemplated in regulation 21 to regulation 24 of the 2014 EIA Regulations for Environmental Authorisation. Similarly, a Category B waste management activity triggers a S&EIR process. Application for both authorisations is done in parallel in terms of the One Environmental System – refer to Section 3.3 for more detail on the S&EIR process.

The listed and waste management activities are indicated in Figure 6.



Longitude (E)	Latitude (S)	Label
28.603299	-26.122161	1
28.613949	-26.125137	2
28.611806	-26.130507	3
28.617046	-26.131969	4
28.613048	-26.140743	5
28.603674	-26.138742	6
28.600362	-26.12912	7
28.601202	-26.127467	8
28.607297	-26.124061	9
28.609607	-26.124769	10
28.609176	-26.125152	11
28.611919	-26.125962	12
28.612327	-26.12486	13
28.613729	-26.125241	14
28.612795	-26.127568	15
28.61218	-26.127396	16
28.611392	-26.127329	17
28.610785	-26.127324	18
28.610151	-26.127573	19
28.60985	-26.128054	20
28.6094	-26.128735	21
28.609396	-26.128972	22
28.604494	-26.1275	X
28.60838	-26.125813	23
28.607839	-26.127583	24
28.609115	-26.128412	25
28.619116	-26.126781	
28.619154	-26.126593	26
28.613788	-26.125092	27
28.613165	-26.12664	28
28.613346	-26.126693	29

Longitude (E)	Latitude (S)	Label
28.613896	-26.12547	30
28.619004	-26.126977	31
28.613205	-26.126545	32
28.609183	-26.125402	33
28.60907	-26.125404	34
28.608976	-26.125444	35
28.60865	-26.125787	36
28.608743	-26.125856	37
28.609046	-26.125532	38
28.609101	-26.125509	39
28.609165	-26.12551	40
28.610528	-26.125905	41
28.610523	-26.125979	42
28.611002	-26.126109	43
28.611049	-26.12605	44
28.612363	-26.126421	45
28.61244	-26.126493	46
28.612449	-26.126649	47
28.612564	-26.126681	48
28.612665	-26.12656	49
28.61277	-26.126539	50
28.6122	-26.127238	51
28.610862	-26.127117	52
28.610429	-26.126975	53
28.610388	-26.127077	54
28.610833	-26.127222	55
28.612163	-26.127344	56
28.610333	-26.125924	57
28.611079	-26.126141	58
28.610893	-26.126658	59
28.610152	-26.126441	60

Figure 6: Listed and waste management activities associated with Rietkol Project

In addition to the above, the construction and operation of a dryer will be undertaken as part of the processing at the Rietkol Project. Drying is listed as an activity which results in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social, economic, and ecological conditions, or cultural heritage (GN 893 of 22 November 2013 published in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)):

Category 5: Mineral Processing, Storage and Handling

Subcategory 5.2: Drying

Description: Drying of mineral solids including ore, using dedicated combustion installations

Application: Facilities with a capacity of more than 100 tons/month product

An Atmospheric Emissions Licence (AEL) will need to be acquired for the dryer installation prior to construction. Application for an AEL will be conducted on approval of the MRA.

2.2 OPEN PIT MINING

2.2.1 Geology

Stratigraphically, the MRA area and mine occur on the boundary between the Malmani Subgroup and the Pretoria Group of the Transvaal Supergroup. The Malmani Subgroup consists of several hundred meters of cherty, stromatolitic dolostone, about 2.6 billion years old that was deposited on an intra-cratonic marine basin under tidal conditions (MWP, 2019).

The Malmani Subgroup is unconformably overlain by a layer, informally known as the Giant Chert, of cryptically brecciated chert, grading into typical breccia, which is set in a black, silicified mudstone matrix. Its thickness varies along the strike from 0 to 20 m. The Giant Chert forms the base of the Pretoria Group and represents a palaeosol formed because of dissolution of the carbonate fraction of siliceous dolostone during a period of emersion and denudation. The cryptically brecciated chert formed because of small mechanical disturbances and where soil and alluvial movements were active; more typical breccia in silicified mudstone resulted. Sinkholes and cave systems, filled with residual material, which formed during this long period of denudation, have been described in detail outside the MRA area.

The Bevets Conglomorate Member directly overlies the Giant Chert and consists of irregularly rounded chert pebbles, grading upward into pure quartzite. Both the Giant Chert and the Bevets Member form the Rooihoogte Formation. Conglomerate and quartzite are impersistent along the strike and are not more than a few meters thick. This stratigraphic unit marks the appearance of allochthonous terrigenous material, such as quartz, although variable amounts of autochthonous chert and clay are

admixed in places. The Bevets Member marks the transgression of a coastline and was followed by the deposition of shale, minor quartzite and ironstone of the Timeball Hill Formation.

The Bevets conglomerate and quartzite as well as the Timeball Hill Formation are generally accepted as marine sediments. Nevertheless, a latchstring environment was recently proposed as an alternative, but without excluding the possibility of a marine environment. Its age is not accurately established but is probably 2.3 - 2.2 billion years old. The Malmani Subgroup and the Pretoria Groups are disconformably overlain by late Carboniferous – Permian diamictite, shale and sandstone of the Karoo Supergroup. The Proterozoic and Permian strata are intruded by several generations of diabase and dolerite sills and dykes.

The Malmani Subgroup and the Pretoria Group underwent a mild static metamorphism, probably within the greenschist facies, which undurated the argillaceous rocks into slate and recrystallized the sandstone into quartzite. The Karoo strata are unmetamorphosed.

The Delmas silica deposit is referred to as a mega-sinkhole filled with beach sand during the Pretoria Group transgression. The deposit forms a kidney-shape of pure quartzite overlying agrillitic rock and chert breccia. The latter represents residual material left after dissolution of siliceous dolostone from the Malmani Subgroup of the Transvaal Supergroup during the pre-Pretoria Group karst event. The residual material and the quartzite are interpreted as the filling of a mega-sinkhole. From the sedimentological and structural relations between the residual material and the quartzite, it is suggested that the latter could be correlated with the basal, transgressive marine beds of the Pretoria Group. It is proposed that during this transgression, due to progressive subsidence, the mega-sinkhole was filled with pure arenitic quartz beach sand that had been washed and sorted by tidal action. The sand was later transformed into quartzite by low-grade metamorphism.

A flat dipping dolerite sill of approximately 30 m thick cuts through the deposit and divides it into an Upper- and a Lower Quartzite band. Due to the thickness of the sill, mining will not cut through the sill and only the Upper Quartzite band will be mined to a maximum depth of approximately 30-50 meters.

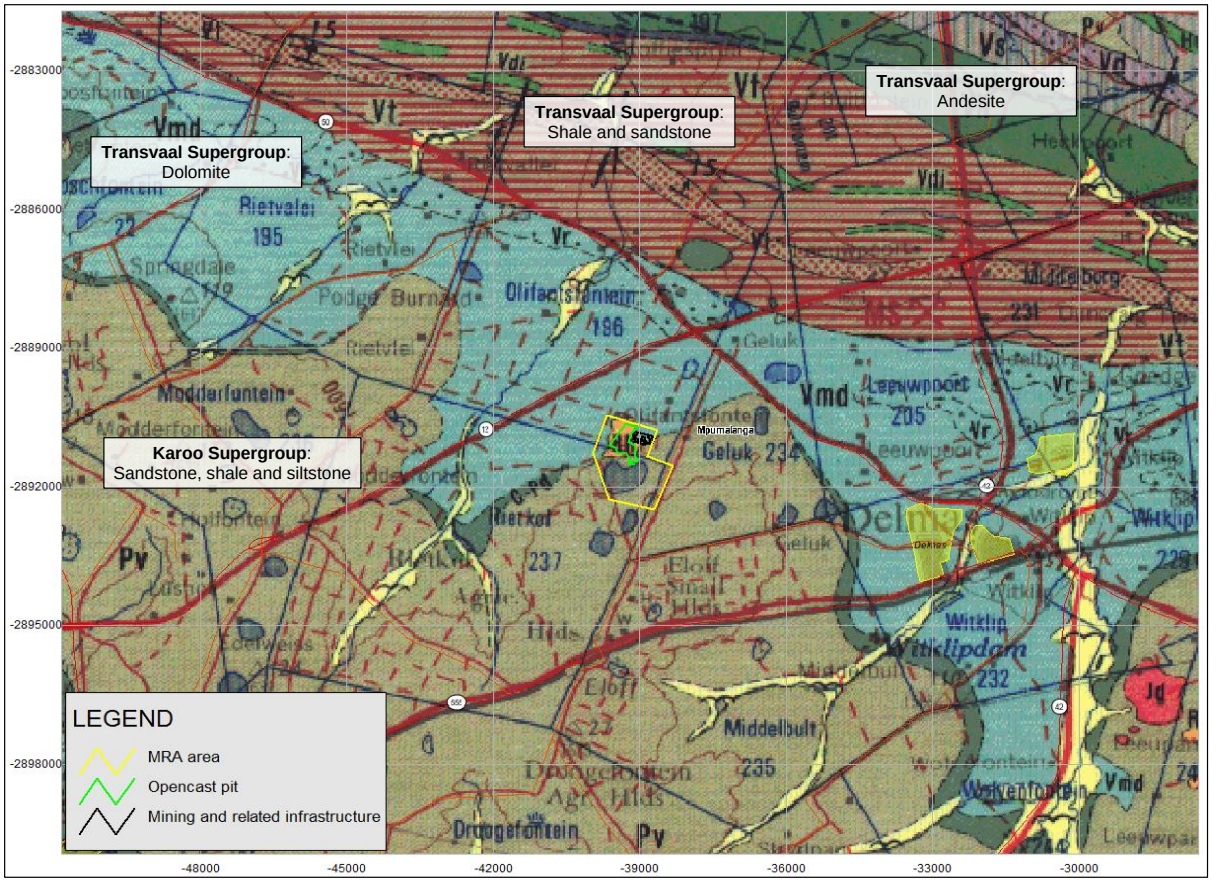


Figure 7: 1:250 000 geological map of the Rietkol Project area

The existence of a deposit of good quality quartzite on the Modder East Orchards AHs has been known for many years and therefore various studies have been done over the past decades to determine the quality and quantity of the silica deposits in the Delmas region.

Pilkington has investigated the surface and found the quartzite is suitable for glass making in the early 1980's. A geological survey of the Delmas area was carried out in 1983 and showed that the Eloff deposit was the only worthwhile deposit to investigate further.

From the earliest studies all indications were that the Eloff deposit is derived from the Daspoort Formation and was deposited or slumped into an uneven sinkhole in the dolomite of the Chuniespoort Group of the Transvaal Supergroup. The material was subsequently leached which resulted in a very pure quartzite. The sinkhole is lined with chert or chert breccia plus green and khaki shales.

From the drilling it appears as though the degree of surface weathering is much more restricted at Eloff than at Delmas, however the quartzite throughout the deposit appears to be exceptionally pure. Limited clay minerals are present on most joints and fractures, which means the clay should be released both in the mining and processing of the rock.

2.2.2 Type of Mineral

The borehole analytical results and the associated geological report correlates with the historic geological model. Inclusive of the additional borehole results, the total in-situ resource is estimated to be 29.75 million tonnes (Mt).

The predominant minerals to be mined are:

- Glass Sand (Silica) QG Type Q
- Silica sand (general) Q Type Q
- Sand (general) QY Type I
- Silica Sand QD Type Q

The mining may encounter the following minerals, which will be mined as part of the planned mining operations:

- Clay (CA) Type Cy
- Ball Clay (CL) Type Cy
- Concrete Sand (QO) Type Q
- Building Sand (QB) Type Q
- Clay (general) (Cy) Type Cy
- Crusher Sand (Silica) (QC) Type Q
- Foundry Sand (Silica) (QF) Type Q
- Filling Sand (Silica) (QL) Type Q
- Fuller's Earth (Clay) (CE) Type Cy
- Group (Clay) (Cl) Type Cy
- Metallurgical Silica (QM) Type Q
- Shale/Brick Clay (CS) Type Cy
- Silcrete (Silica) (QS) Type Q

2.2.3 Products and Markets

The main reason for this MRA is for the supply of silica sand to various markets including the glass, foundry and filtration industries in the Gauteng and Mpumalanga regions. In addition to this, many other local industries rely on various grades of silica sand to manufacture their products. The main products that are envisaged to be sold are River Sand, Amber Sand, Flint Sand, Chemical Sand and Filter Sand.

Roughly 95% of the products will be distributed within the region while the remaining 5% is destined for the remainder of South Africa and surrounding African countries. The main industries that make use of the products are as follow:

Product	Industry
River Sand	Construction and road works
Amber Sand	Container glass industry
Flint Glass	Flat glass industry and container glass (such as pharmaceuticals, baby food, etc.)
Chemical Sand	Sodium Silicate
Filter Sand	Water Purification

Based on the current market structure approximately 70% of the mined material would be supplied to the glass industry, and the remaining to other silica sand users, including but not limited to:

- Silica Distributors
- Adhesive Manufacturers
- Metal Foundries
- Golf Course Maintenance
- Building Maintenance
- Coatings and Adhesives Producers

2.2.4 Mining Methodology

Silica will be mined through an opencast bench mining method. The benches will be mined at a width of 8m and a height of 10m. Final mining depth will be between 30 and 50 mbs. Mining will commence in the northern portion of the MRA area and will progress in a south-easterly direction.

Drilling and blasting of the rock face will be conducted on a predetermined schedule in accordance with projected volumes of production and will be undertaken by blast professionals and with the required safety procedures applied.

The mining method will include:

- Vegetation and topsoil will be stripped ahead of mining. At least one cut (8m width) should already be stripped and available for drilling between the active topsoil stripping operation and the open void;
- The topsoil will be loaded onto dump trucks by excavators and hauled to areas that require rehabilitation or used to construct stormwater berms;

- Drilling operations will commence in the front of the advancing pit after the topsoil has been removed;
- The blasted Run of Mine (RoM) will be stockpiled with excavators; and
- Thereafter RoM will be transported to the crushing plant by means of haul trucks with a loading capacity of approximately 40 tons.

2.2.5 Mining Model and Schedule

Access ramps will be located along the eastern pit limit and are laid out within the orebody to minimise the mining of waste.

The North Block will be mined for the first 3 years of LOM in a northernly direction, commencing from Block S04. Block S04 is the deepest and the ore body floor slopes up to the outcrop in Block S01. The ore from Block S04 will be used as a strategic stockpile in readiness for plant start-up.

Once Block S04 has been mined out a void exists to dump the tailings from the washing plant from about YR2 onwards. Since it is the deepest portion of the block the water will not negatively impact on the mining operation of S03, S02 and S01. The void created by mining the North Block is 309 197 bank cubic meters (BCM) and tailings can be dumped in the North Block for the first 16 years of mining.

Once the North block has been mined out, mining in the Main Block will commence in YR4, in a southernly direction up to Block 14 in YR20. The barrier between North Block and the Main Block is 30m. This constitutes a loss and can be optimized by means of further detailed geotechnical analysis.

Various machinery and vehicles will be used in the pit and to transport the RoM to the crushing plant. The equipment includes excavators, front-end loaders, and ADT's.

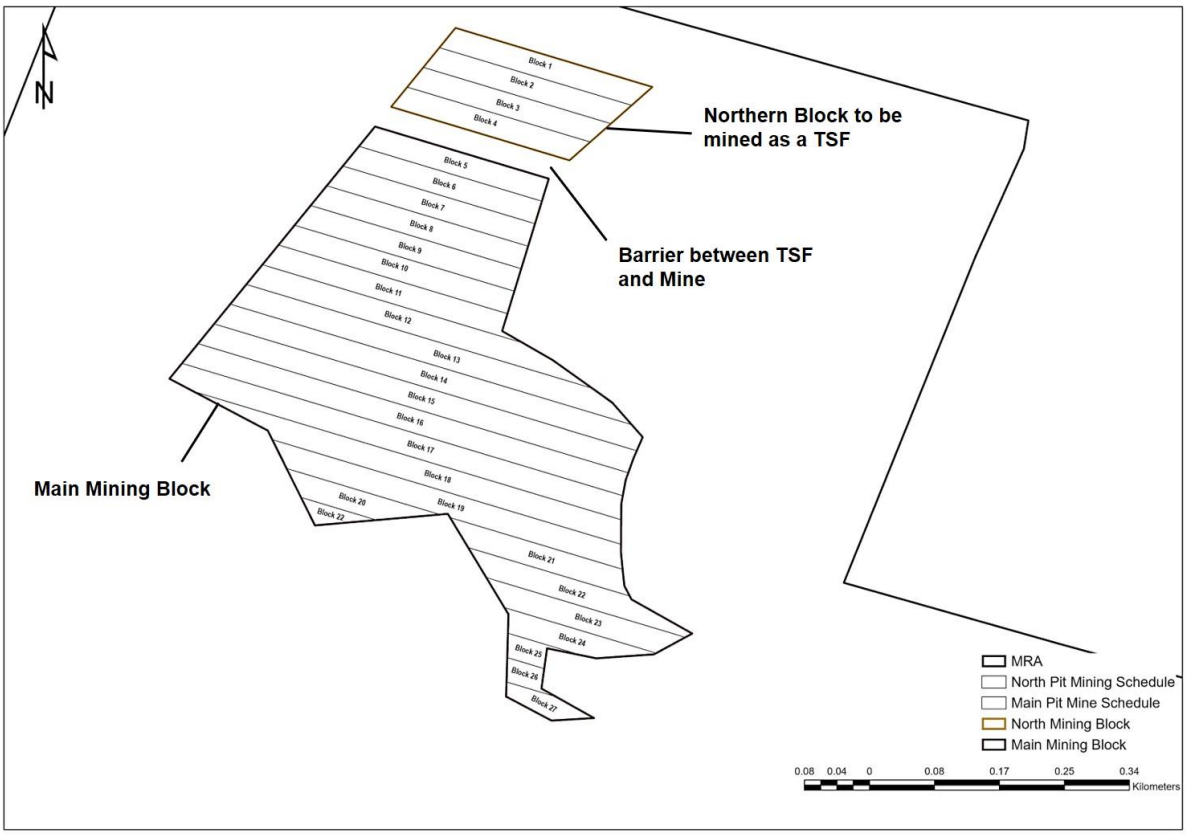


Figure 8: Plan view of the mining blocks

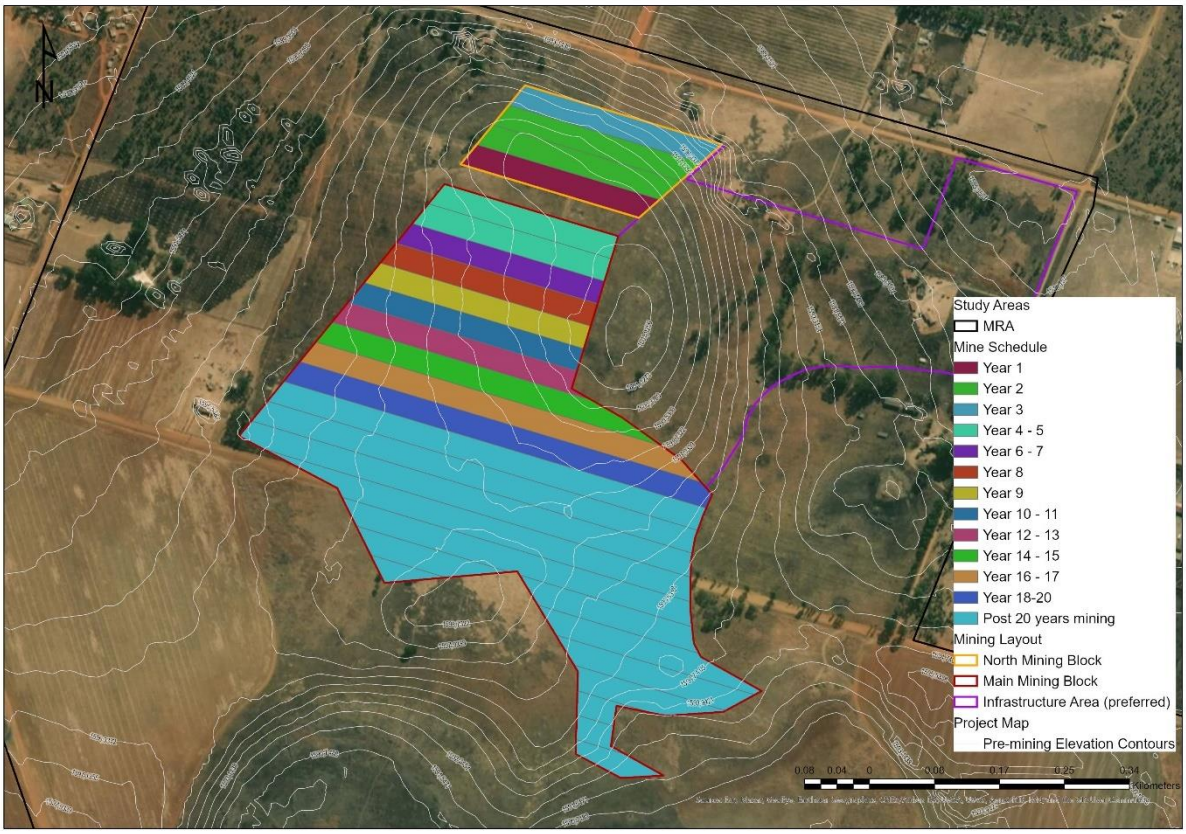


Figure 9: Mine schedule for first 20 years of mining

Figure 10 shows a cross-section of the North and Main Blocks in a north-south direction.

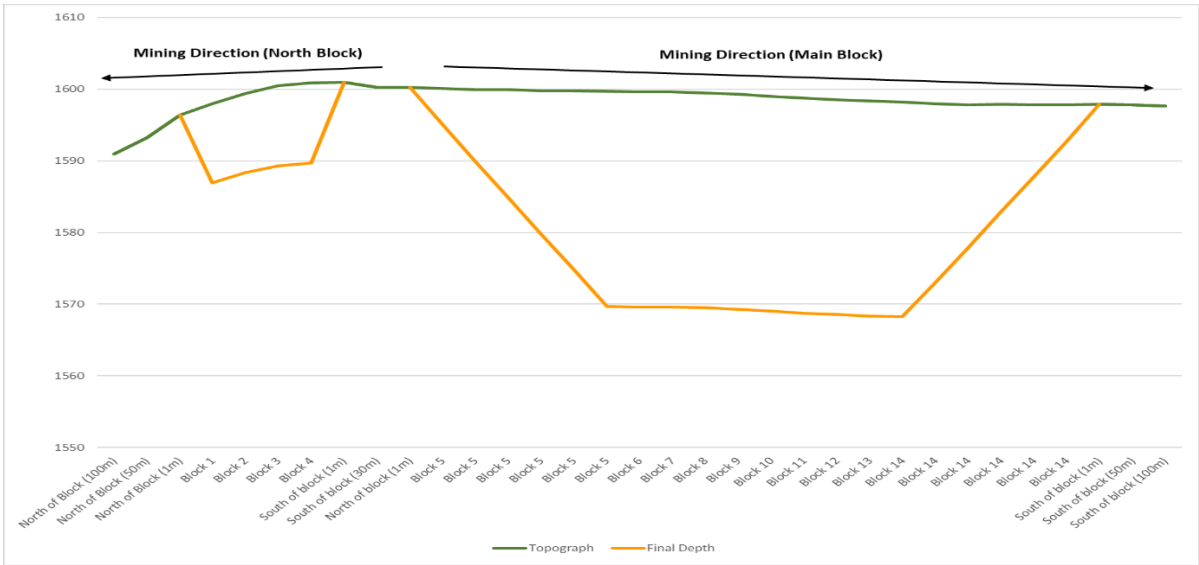
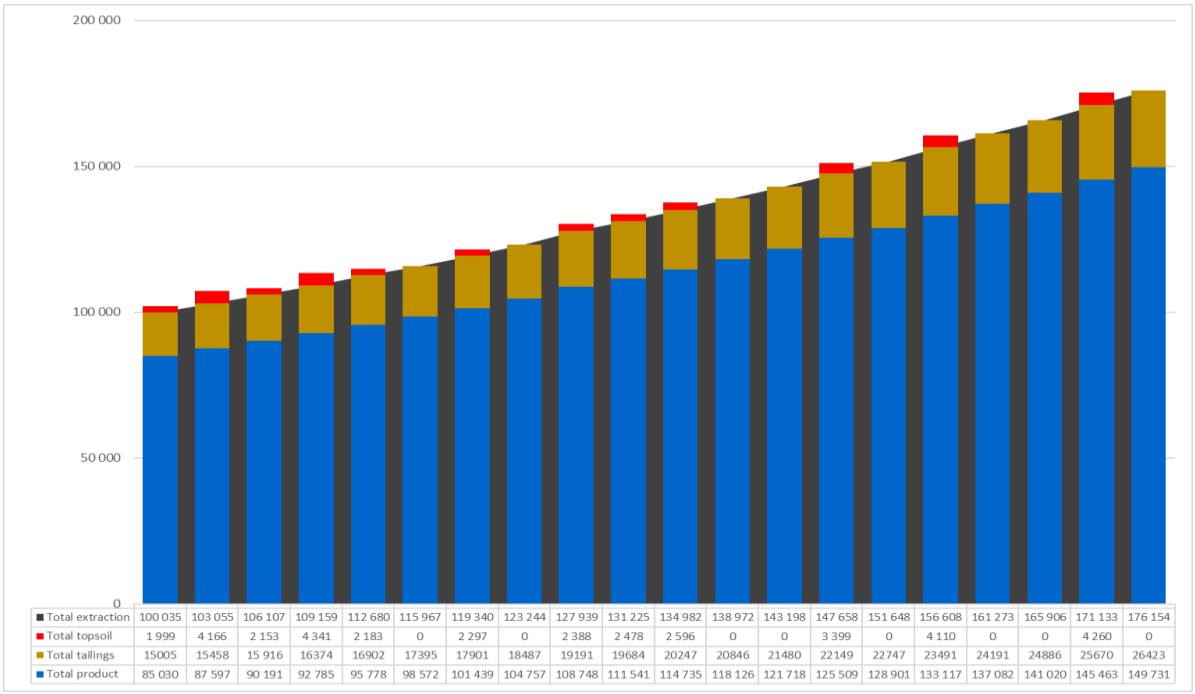


Figure 10: Cross-section through the Rietkol mining pits

The production schedule over the first 20 years of mining is indicated in Figure 11 below.



Total extraction	100 035	103 055	106 107	109 159	112 680	115 967	119 340	123 244	127 939	131 225	134 982	138 972	143 198	147 658	151 648	156 608	161 273	165 906	171 133	176 154
Total topsoil	1 999	4 166	2 153	4 341	2 183	0	2 297	0	2 388	2 478	2 596	0	0	3 399	0	4 110	0	0	4 260	0
Total tailings	15005	15458	15 916	16374	16902	17395	17901	18487	19191	19684	20247	20846	21480	22149	22747	23491	24191	24886	25670	26423
Total product	85 030	87 597	90 191	92 785	95 778	98 572	101 439	104 757	108 748	111 541	114 735	118 126	121 718	125 509	128 901	133 117	137 082	141 020	145 463	149 731

Figure 11: Rietkol Project production schedule

2.2.6 Rehabilitation and Closure Planning

A Rehabilitation, Decommissioning and Closure Plan was developed for the proposed Rietkol Project in line with the requirements of Government Notice No. R.1147 (GN R.1147) of 20 November 2015: Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations – refer to Appendix 19.

North Block will be backfilled with tailings to original pre-mining levels, topsoiled and revegetated. This will be completed prior to decommissioning. As most of the material mined is processed and removed from site as product, backfilling of the Main Block will not be possible as insufficient tailings will be produced. A final void of approximately 2 Mm^3 will be left after mining.

The sides of the pit will be sloped and vegetated to a stable environment. Safety/access control berms will be constructed around the Main Block to prevent unsafe access to the open void high-risk areas.

Infrastructure with a beneficial re-use potential will be retained for transfer to a third party. This could include the water dams, provided that the water quality is acceptable for third party use. All non-beneficial infrastructure will be demolished/dismantled, and the area rehabilitated to facilitate the post-mining land use.

Demolition material will be recycled as far as possible. The Main Block will be backfilled with inert demolition material and building rubble, all other material will be disposed of at an appropriate landfill site. No remnant stockpiles would remain on site post-closure. All remaining stockpile material will be dumped into Main Block.

The proposed final post-mining land use in the infrastructure areas and at North Block will be grazing, with the Main Block area constituting a wilderness area – refer to Figure 12. Of the total disturbed area of approximately 25 ha, approximately 15.6 ha will constitute a final post-mining use of grazing, the remaining 9.4 ha associated with the Main Block will be wilderness.

Financial provision will be updated on an annual basis in line with the requirements of GN R.1147.

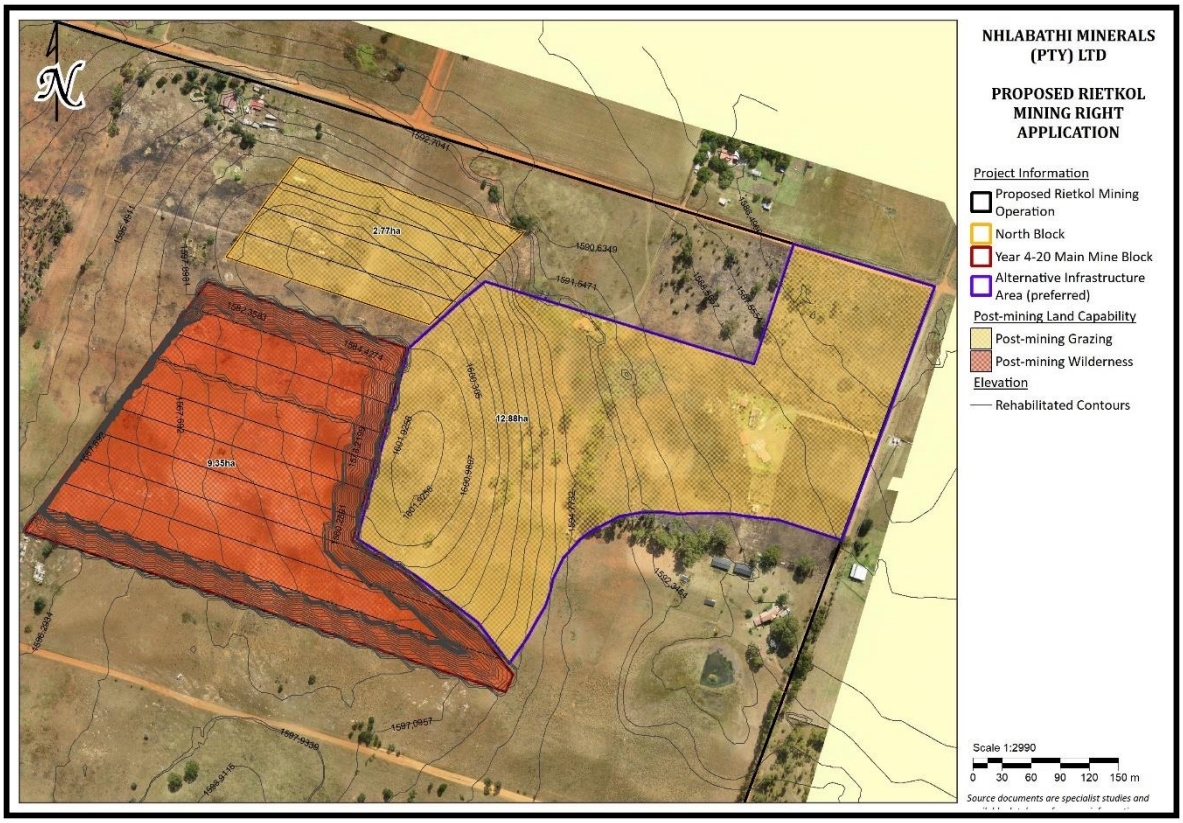


Figure 12: Proposed post-mining land use within disturbed footprint for mining and infrastructure

2.3 PROCESSING

The processing plant comprises of crushing, screening, washing and drying operations. Amber and flint sand will not go through the dryer.

2.3.1 Crushing

RoM is fed to the crushing plant by tipping it into a feed chute feeding a grizzly screen which screens the RoM before the oversize material is crushed. The crushed RoM is fed via conveyor to a screen with the upper and lower decks consisting of larger and smaller screening panels respectively. The oversize material from the upper deck is fed with a conveyor to a jaw crusher which crushes the material to the desired size. River sand product is stockpiled (undersize) while the oversize together with a recycle stream and the crushed product is discharged into a chute.

The final crushing plant screen consists of varying screening panels to yield different grades of material which are used as feed stocks for the various wash plant products. The -20mm particles are screened out in the front of the screen while the undersize is collected at the rear of the screen. The oversize material of is fed to a Gyro crusher with conveyor and the crushed product (100% passing 40mm) is

recycled for washing. The material is drawn from underneath the -5mm stockpile by a tunnel conveyor that feeds the wash plant.

2.3.2 Wash Plant

Various products are produced in the wash plant using crusher feed stock. Depending on the category and quality requirement, additional crushing, screening, and hydro-sizing equipment is employed.

2.3.3 Screening Process

A vibratory feeder feeds the feedstock onto conveyor which discharges the material onto a grizzly screen which cuts at the desired size. The material from the grizzly screen is wet screened on the main screen. The oversize from the first screen is discharged onto the dewatering screen containing a mixture of screening panels (arranged in increasing aperture size in the direction of flow). The oversize material from the second screen is fed to a vertical shaft impactor from where the material crushed to -5mm which is recycled and recombined with the raw feed.

The slurries collected underneath the first screen and the front section of the dewatering screen gravitates into a pot in which slimes overflow to the thickener pot and the underflow is pumped, dewatered, and stacked with a separator on the product stockpile. The overflow from the separator returns to the pot below the screens.

The material collected in the collection pan at the rear section of the dewatering screen gravitates into another pot in which slimes are removed in the overflow to the thickener pot and the underflow is pumped to a separator, dewatered, and stacked onto the Filter Product stockpile. Finally, the overflow from this separator returns to a pot.

All the overflows from the various pots in the screening and hydro-sizing plants combine into a pot from where it is pumped to the thickener.

2.3.4 Screening with Hydro-sizing Process

Feedstock is fed onto a conveyor with a vibratory feeder that combines with the recycled oversize material from screen the dewatering float glass screen onto a single conveyor. This feeds the vertical side impactor (VSI) that crushes the -40mm feed to 100% passing 5mm. The crushed material from the VSI is fed onto the main screen consisting of only 1mm screening panels and the oversize from the screen is discharged onto the dewatering screen which consists of 1mm panels in the front and 4 rows of panels with 5mm apertures at the rear section of the screen.

The material screened out in the main and dewatering screens is collected and discharged into a pot. From this pot it is pumped to a dewatering cyclone where the solids are dewatered in preparation of further washing. The cyclone overflow is returned to the pot under the main screen and the overflow from this pot is gravity fed to the pot that goes to the thickener.

The cyclone underflow comprises the feed to the primary classifier where the D50 cut size of 665µm is achieved by an upward flow of water. The underflow of the cyclone gravity feeds to a pot from where the underflow is dewatered with a separator and stacked as filter product. The overflow of the separator is returned to another pot and the overflow from this pot gravitates to the thickener pot.

The overflow from the first classifier gravitates into a secondary classifier of which the D50 cut size is 75µm. The underflow of this classifier is fed into a pot from where the underflow is pumped to and dewatered with a separator and stacked as the final product. The overflow of the separator is returned to a pot and the overflow from the pot gravitates to the thickener return pot. Finally, the overflow from the secondary classifier flows into a pot, the underflow of which is pumped to a dedicated separator, dewatered, and stacked onto the chemical sand product stockpile. The separator's overflow is returned to the pot and the overflow from this pot feeds into the into the tailings facility (open pit).

2.3.5 Dryer Plant

After being dried in the respective stockpiles to a moisture content of 5%, amber and float glass filter products are fed with a tunnel conveyor into a silo from which it is fed to driers with vibratory feeders.

The energy required to dry the material to a desired moisture content of less than 1% is obtained by combusting a heavy hydrocarbon fuel blend. The combusted fuel (flue gas) heats the filter sand, thereby evaporating the moisture associated with the sand. Flue gas exits the drier and entrained dust is removed in a dust suppression system before the gas is discharged into the atmosphere. The dried filter product is discharged from the drier onto conveyors and is stockpiled in the dry sand shed before being sized in the screening plant according to product specifications.

Material that is not fed through the driers is placed on drying beds adjacent to the plant. Water run-off from the drying beds is collected in a sump and channelled to the process water dam located to the south-west of the plant for re-using in the plant.

The dried filter sand is fed by means of conveyor to the dry screening plant where it is sized into fractions by means of vibratory screens in accordance with product specifications.

2.4 PROJECT INFRASTRUCTURE

Currently little infrastructure exists to service the planned mining activities and most of the infrastructure requirements will be established as part of the planned mining operation. The infrastructure components and layout are presented in Figure 13.

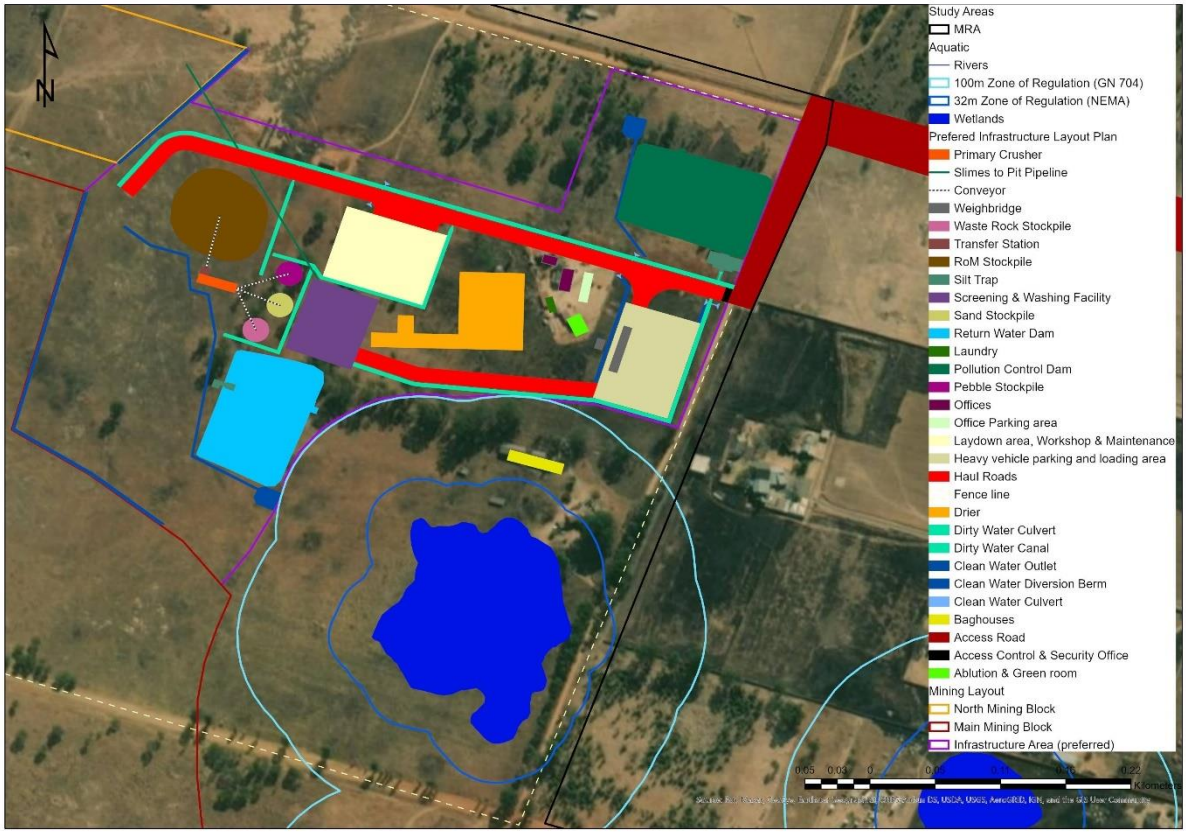


Figure 13: Infrastructure Layout Plan

It is noted that the baghouses situated within the 100m zone of regulation of the wetland area to the south of the project infrastructure area are existing structures that will be utilised. No new infrastructure will be constructed within the 100m zone of regulation.

2.5 WATER MANAGEMENT

2.5.1 Water requirements

2.5.1.1 Potable water

Potable water will be used in the change houses and the offices. The potable water demand has been calculated at between 150 and 200 litres/person/day. At full production a peak demand of 20 m^3/day of potable water will be required.

2.5.1.2 Process water

Limited water is consumed during processing and all processing water will be recycled. However, there will be a loss of approximately 20% through moisture in the product and evaporation.

Water for processing and dust suppression will be obtained from the open pit (groundwater influx) and the existing boreholes within the MRA area. The estimated water requirements for the mining operation at full production is indicated in Table 4.

Table 4: On-site anticipated water requirement at full production (MWP, 2019)

Dust Suppression		
Minimum Demand	m^3/month	650
Maximum Demand	m^3/month	1 040
Average Demand	m^3/month	845
Maximum Demand	ℓ/s	0.4
Processing		
Minimum Demand	m^3/month	6 627
Maximum Demand	m^3/month	8 694
Average Demand	m^3/month	7 610
Maximum Demand	ℓ/s	3.4
Potable Water – washrooms and consumption		
Minimum Demand	m^3/month	450
Maximum Demand	m^3/month	600
Average Demand	m^3/month	525
Maximum Demand	ℓ/s	0.2
Total Water (excluding recycling)		
Average	m^3/month	8 980
	m^3/day	299
	ℓ/s	3.5
Maximum	m^3/month	10 334
	m^3/day	345
	ℓ/s	4.0

Note: The above volumes exclude any recycling.

The maximum on-site water requirement at full production is expected to be 4 ℓ/s (i.e. 0.4 ℓ/s dust suppression, 0.2 ℓ/s potable water and 3.4 ℓ/s plant). The groundwater testing (refer to Table 20) shows that the combined sustainable yield of the on-site tested boreholes is around 4 ℓ/s. The existing boreholes on site would therefore be sufficient to supply the Rietkol operations, not taking into account groundwater influx and direct rainfall. The long-term sustainable groundwater yields of such

boreholes would however have to be accurately determined through pumping tests and analytical analyses before pumping can successfully go ahead.

2.5.2 Water balance

A detailed average daily water balance was compiled for the proposed Rietkol Project (Onno Fortuin Consulting (OFC), 2021). The main items to highlight from the water balance are the following:

- Return water dam (RWD) inflows: The RWD will receive inflows from dewatering operations in the opencast pit as well as borehole water.
- Pollution control dam (PCD) inflows: The PCD will only receive inflow from dirty stormwater runoff.
- Dust suppression: Dust suppression will be done at a rate of 6 ℓ/m²/d for a 12-hour working day. Dust suppression will be done from by using water from the PCD and RWD.
- Plant demand: The plant demand of 3.4 ℓ/s will be supplied by water from the RWD and PCD.

The water balance is detailed in Figure 14. Also refer to Appendix G of the Storm Water Management Plan (SWMP) attached as Appendix 18 to this report (OFC, 2021).

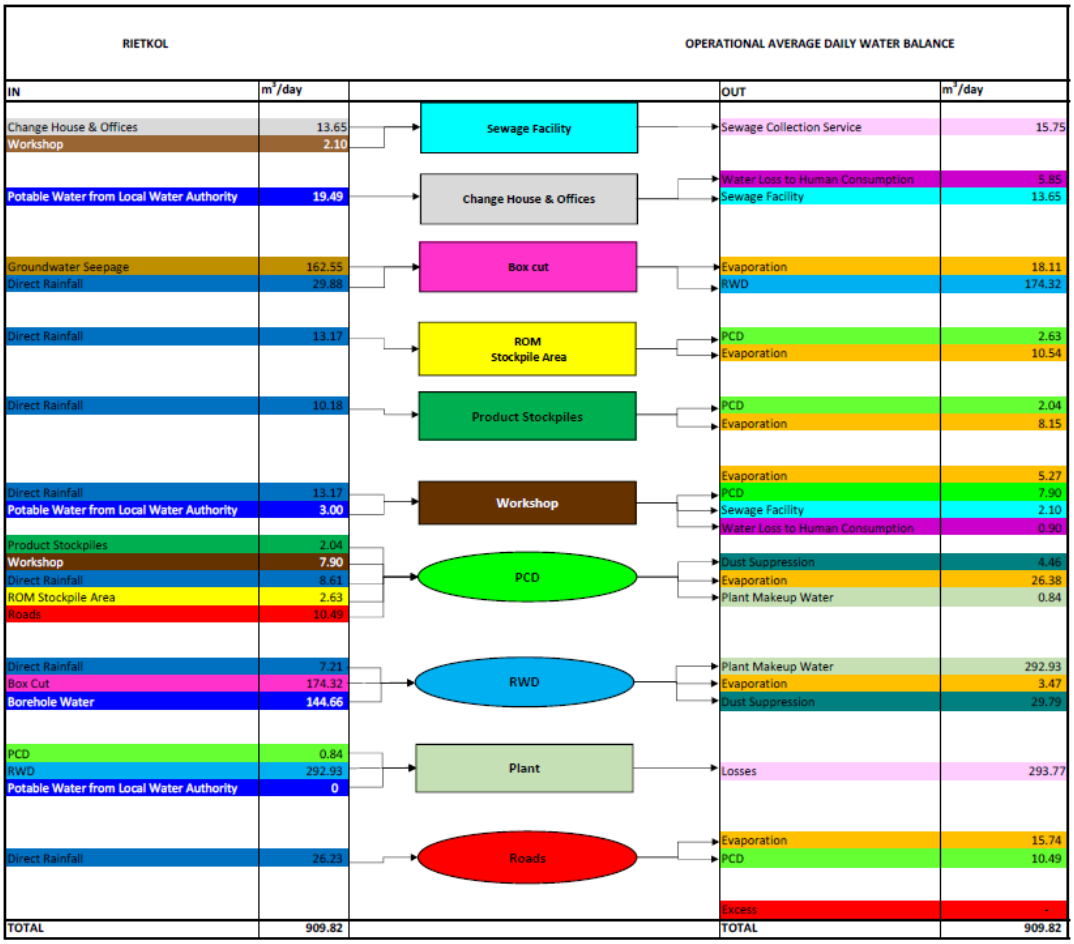


Figure 14: Daily average water balance for proposed Rietkol Project

2.5.3 Clean and Dirty Water Management

Onno Fortuin Consulting (OFC, 2021) developed a Surface Water Management Plan (SWMP) for the proposed Rietkol Project. This report is attached as Appendix 18.

The infrastructure area was divided into clean and dirty water areas, as indicated in Figure 15.

The clean areas are indicated as the green sub-catchments. The water from these clean areas is diverted away from the impacted dirty water areas shown as red and orange sub-catchments on Figure 15. Surface water collected from the dirty water areas will be captured in trapezoidal canals and routed to the main PCD situated in the north-eastern corner of the infrastructure area.

Any groundwater influx into the opencast pit as well as the runoff from the opencast pit will be dewatered to a silt trap that feeds into the RWD.

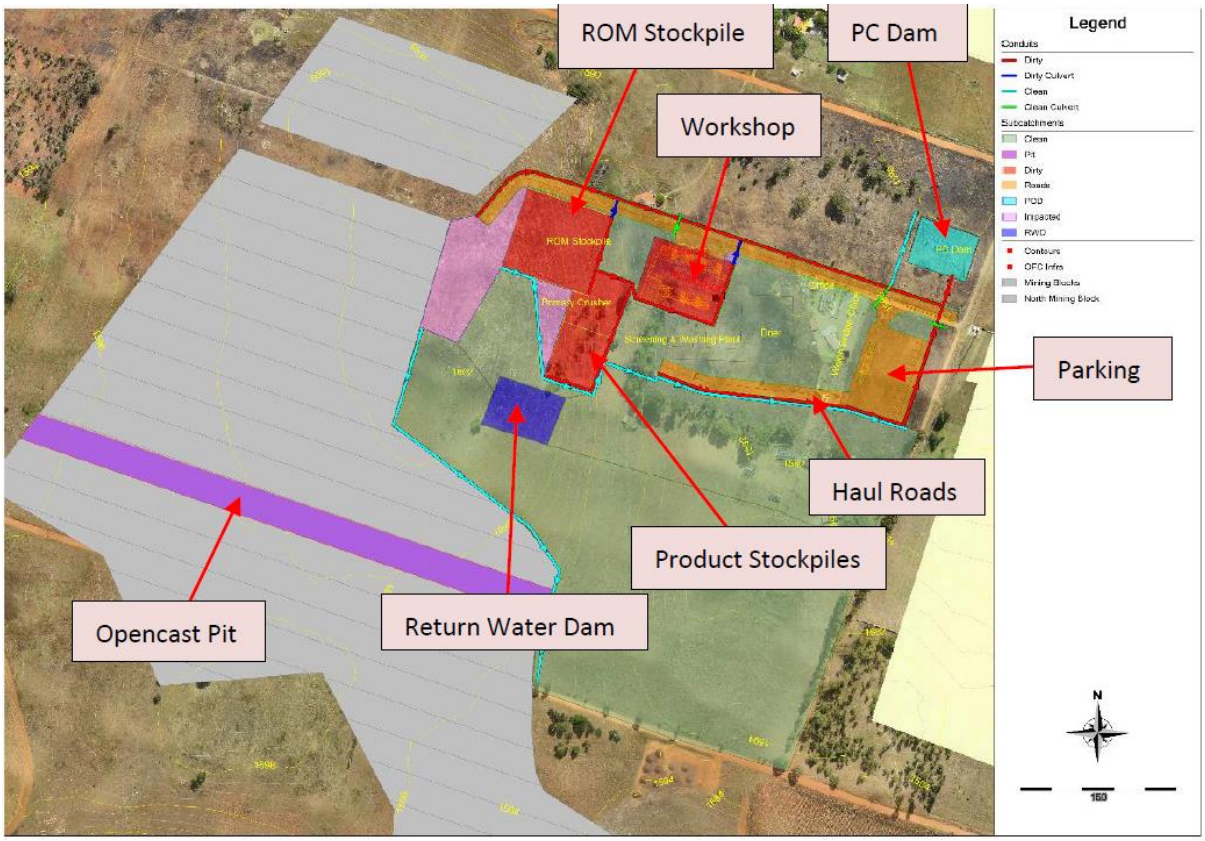


Figure 15: SWMP for proposed Rietkol Project indicating clean and dirty water areas

The dirty water system comprises the following:

- Hard Park area located to the east of the infrastructure area
- Stockpile and crusher area, to the west of the infrastructure area
- Workshop and maintenance area
- Screening and Washing Plant
- Haul roads
- PCD and silt trap
- Dirty water canals and culverts

The clean water system comprises the remainder of the mining area where the clean water areas are diverted with gravel drains and side berms away from the impacted mining areas. Clean water diversion canals/berms have been placed strategically throughout the mining area to ensure that the clean water is diverted to the natural environment.

2.5.3.1 Waste classification and barrier designs

Recommendations and comments on an appropriate barrier design have been made by the groundwater specialist based on the waste classification conducted for the project, and involves the following:

- PCD: Standard Class C
- RWD: Standard Class D
- Stockpiles: Standard Class D

Refer to Section 2.7.2 below for more details regarding the waste classification.

2.5.3.2 Stockpile and crusher area

The stockpile and crusher area is situated to the west of the screening and washing facility and includes the:

- RoM stockpile
- Primary crusher area
- Sand stockpile
- Pebble stockpile
- Waste rock stockpile

The area is approximately 1.25 ha in extent and will be sloped engineering platforms (Class D barrier). It forms part of the dirty water areas as indicated in the SWMP (Appendix 18) and runoff from this area will drain towards the v-drain to the north of the haul road that ultimately flows into the PCD.

2.5.3.3 Hard Park area and haul roads

The hard park area is situated at the mine entrance and includes the heavy vehicle parking and loading area and weighbridge. It is approximately 0.5 ha in extent and will be a sloped engineering platform (Class D barrier). Runoff from this area will drain towards the v-drains to the south and east that drains towards the PCD.

The haul roads are 12m wide and have been designed with a single cross-fall of 3%. The haul roads are classified dirty water areas and surface water draining from the road surface must be captured and managed as part of the dirty water system. Surface water runoff from the roads will be captured in trapezoidal canals at the downstream edge of the road surface and routed to the PCD.

2.5.3.4 Workshop and maintenance area

The workshop and maintenance area floorplan is indicated in Figure 16.

The workshop and fuelling station area will be shaped to drain into two v-drain canals that run next to the workshop. The v-drains will run into a small silt trap from where it will overflow to an oil separator. The oil separator will separate the water and oil in a 3-chamber structure from where the water will flow to the dirty water canal that ultimately flows into the PCD.

The wash-bay will be bunded but will be shaped to be able to drain towards a dirty water v-drain running next to the workshop via a small sluice gate in the wall.

2.5.3.5 Screening and washing facility

The screening and washing plant will be beneath a corrugated roof structure thereby preventing pollution of the rainfall water. The water within the plant will be self-contained and will be diverted to the PCD via the dirty canal system running next to the workshop. The water falling on the roof and draining via the down pipes will form part of the clean water system.

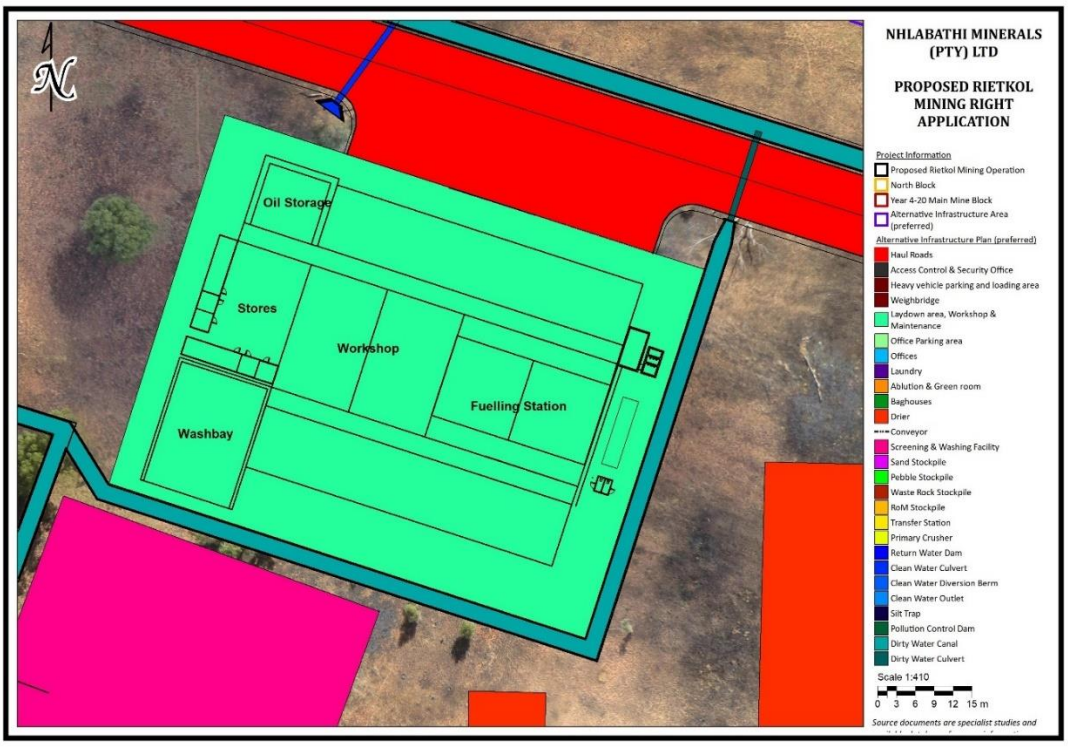


Figure 16: Workshop and maintenance area

2.5.3.6 Water holding facilities

The water in the PCD will be mainly surface water accumulated from the dirty water areas, whilst the RWD is fed by groundwater influx into as well as the run-off from the opencast pits. The water captured in the PCD and RWD will be reclaimed back to the mine's operations for the washing and screening plant.

The final sizing of the dams is (SWMP, Appendix 18):

- PCD: 6 000 m³
- RWD: 5 000 m³

2.5.3.6.1 Pollution control dam (PCD)

All dirty water collected from the mine is discharged via canals into the silt trap located at the inlet to the PCD. The silt trap is a concrete lined structure with a double chamber system to allow for regular cleaning. A special sloping drying slab is provided adjacent to the silt trap from where any seepage water is drained back into the silt trap.

The dam wall height is restricted to maximum 2m above the natural surface level. This was done to ensure that the wall embankment does not go above the 5m safety risk impoundment limitation. The

side slopes for the PCD were limited to maximum 1:3 side slopes to ensure built-in stability of the wall. The wall embankments will be built from selected fill material material compacted in layers of maximum 150mm.

The PCD has been designed with a freeboard height of minimum 0.8m. A special overflow structure has been provided where this structure has been designed to accommodate at least a 1:100-year flood event.

The PCD was designed to a Class C Landfill barrier system, details of which are shown in Figure 17.

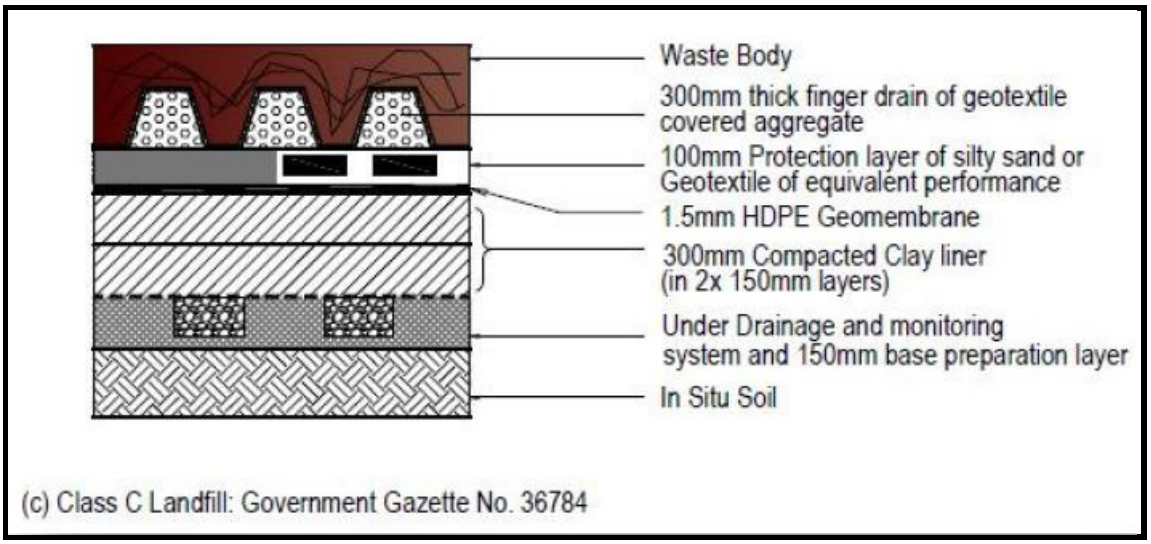


Figure 17: Class C Landfill (Barrier Design - GN36784)

2.5.3.6.2 Return water dam (RWD)

The water accumulated in the opencast pits will be pumped to the RWD via a silt trap to improve the turbidity of the water as well as prevent the RWD from silting up. A single chamber system design is proposed for the RWD silt trap.

The RWD is classified as a Class D barrier design, details of which is shown in Figure 18.

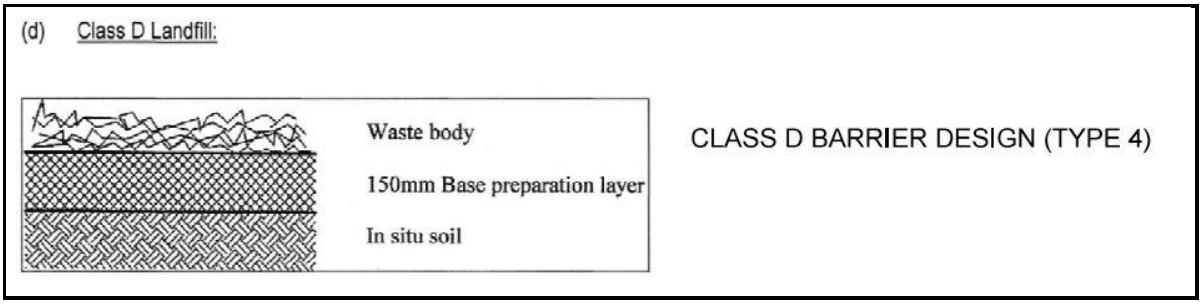


Figure 18: Class D Landfill (Barrier Design - GN36784)

A concrete emergency overflow structure has been designed at the outlet of the RWD to protect the safety of the dam for extreme storm events bigger than the 1:50 year event.

2.5.3.7 Clean water discharge points

Clean water discharge from the mining area has been allowed for at two (2) strategically placed outlet positions as indicated in Figure 13. No flood attenuation will be required for the clean water systems. However, special erosion outlet chutes have been designed at these outlets to limit erosion damage and high flows into the surrounding environment, dispersing the water gently into the environment.

The detail of a typical erosion outlet structure is shown in Figure 19.

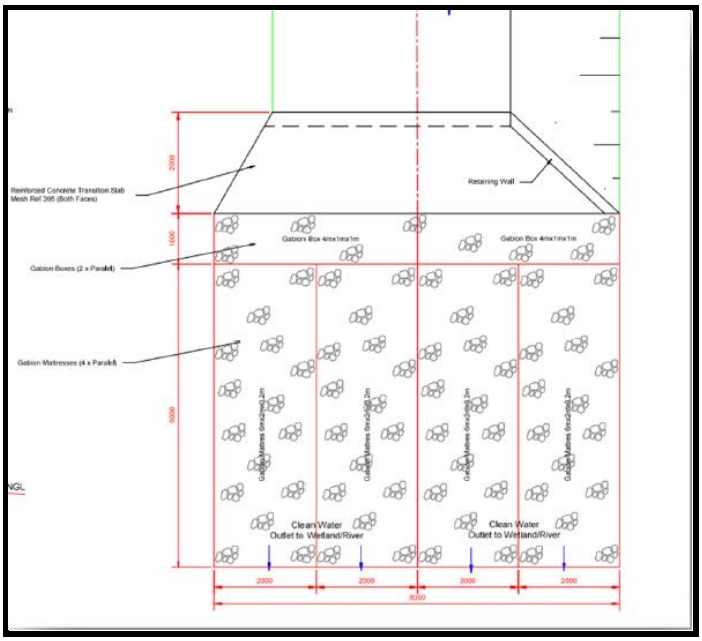


Figure 19: Typical erosion protection at clean water diversion berm outlets

2.6 ROADS AND TRANSPORT

2.6.1 Mine Traffic

The vehicle traffic related to the mine includes (refer to Table 5):

- Transport of staff to and from work working on a three (3) shift rotations per day;
- Routine maintenance of equipment, site vehicles and production equipment;
- Transport of fuel and on-site refuelling;
- Management and visitor transport and supervision activities; and
- Transport of final product to the markets, estimated at approximately 36 trucks (one-way) per day, at highest production levels (worst case scenario).

Product will be transported from Monday through to Sunday during daylight hours.

2.6.2 Access and Haul Roads

Access to the site will be gained via the N12 and the R50. From the R50, access to site will be via Provincial Road D1550, a paved secondary provincial road. This road will be upgraded to handle the additional traffic associated with the proposed mining project. From the D1550 the mine will be accessed via an existing gravel road turning off the D1550 just north of AH 276. Similarly, this gravel road will be upgraded to carry the additional traffic load. Formal access will be constructed to the pit and the infrastructure as the development progresses.

Table 5: Transport at Rietkol (MWP, 2019)

Type of vehicle	**Estimated Vehicle Movements (round trips)**		
	Per day	Per month	Per annum
Light vehicle traffic	16	350	4 200
Buses	12	360	4 320
Deliveries	3 trips per week	12	120
Other (Customers etc.)	2	44	528
Product Transport			
Tippers (40 ton)	54	1 620	19 440
33-ton tipper and flatbed vehicles	4	120	1 440
Flatbed trucks	10	300	3 600
Bulk tankers	4	96	1 152

2.7 WASTE MANAGEMENT

2.7.1 Mine Residue

Tailings will be backfilled into the open pits and no surface tailings facilities are planned. The tailings backfill schedule of North and Main Blocks are presented in Figure 21.

The void created by mining the North Block is 309 197 BCM's and tailings can be dumped in the North Block for the first 16 years of mining. From YR17 onwards the tailings will be dumped in Block S05 – 07 of the Main Block. A berm of 2m will separate the tailings disposal area from the active mining operations to the south. Figure 22 shows the final pits and associated voids after backfilling (at decommissioning).

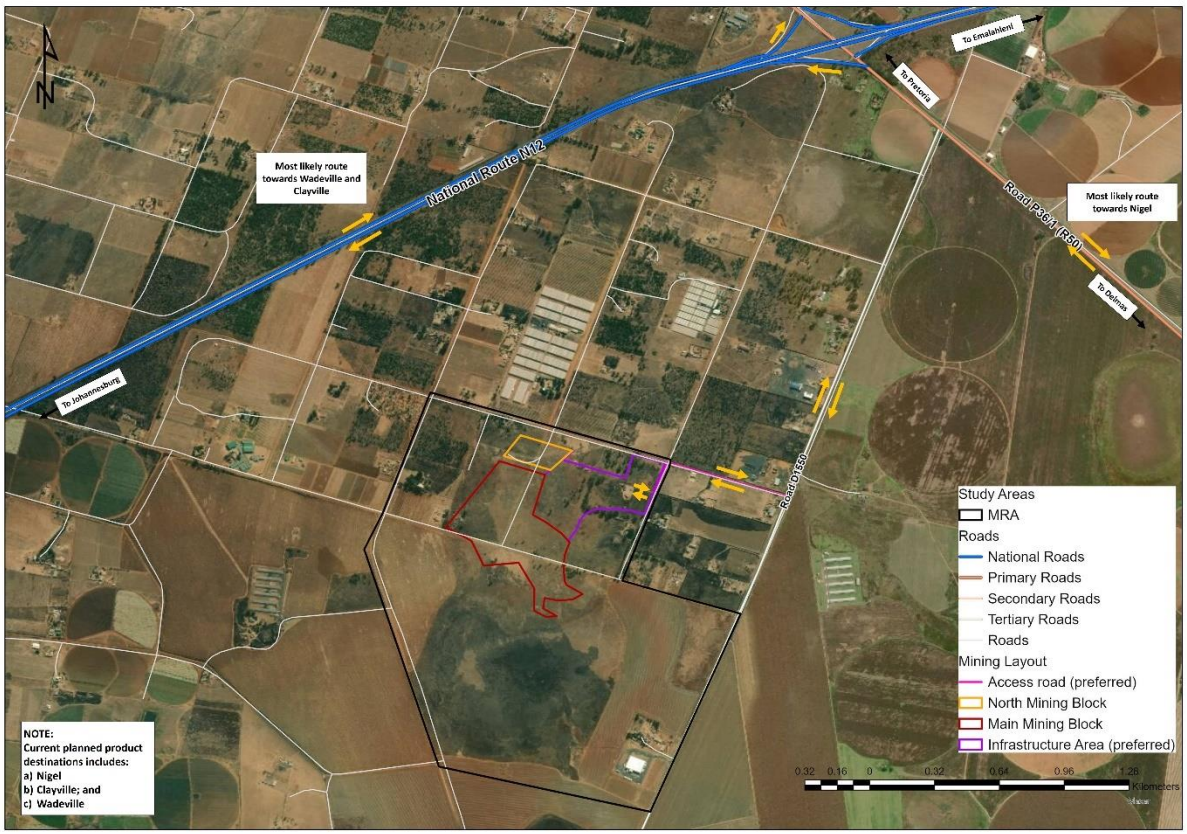
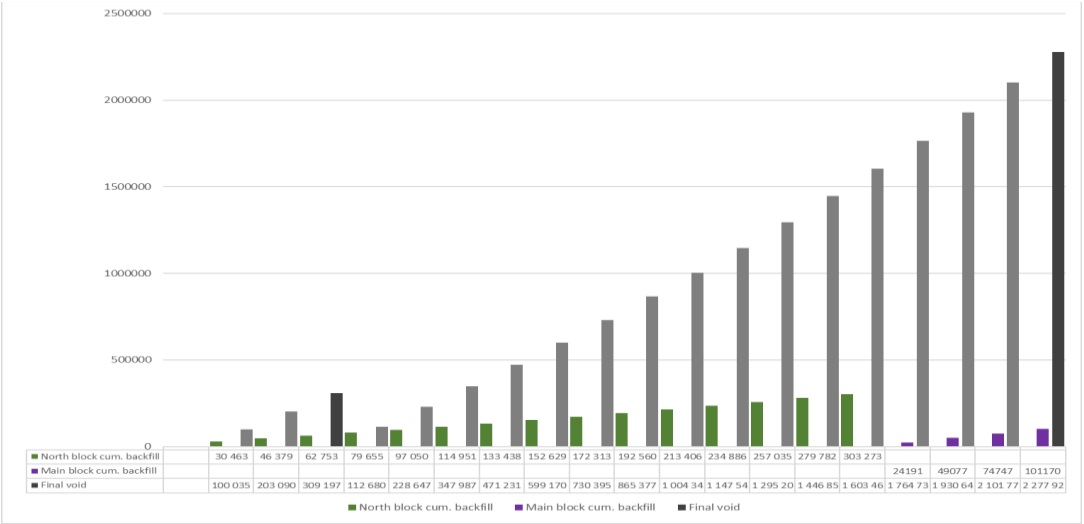


Figure 20: Site access and product transport routes



North block cum. backfill		30 463	46 379	62 753	79 655	97 050	114 951	133 438	152 629	172 313	192 560	213 406	234 886	257 035	279 782	303 273				
Main block cum. backfill																	24191	49077	74747	101170
Final void		100 035	203 090	309 197	112 680	228 647	347 987	471 231	599 170	730 395	865 377	1 004 34	1 147 54	1 295 20	1 446 85	1 603 46	1 764 73	1 930 64	2 101 77	2 277 92

Figure 21: Tailings backfill schedule

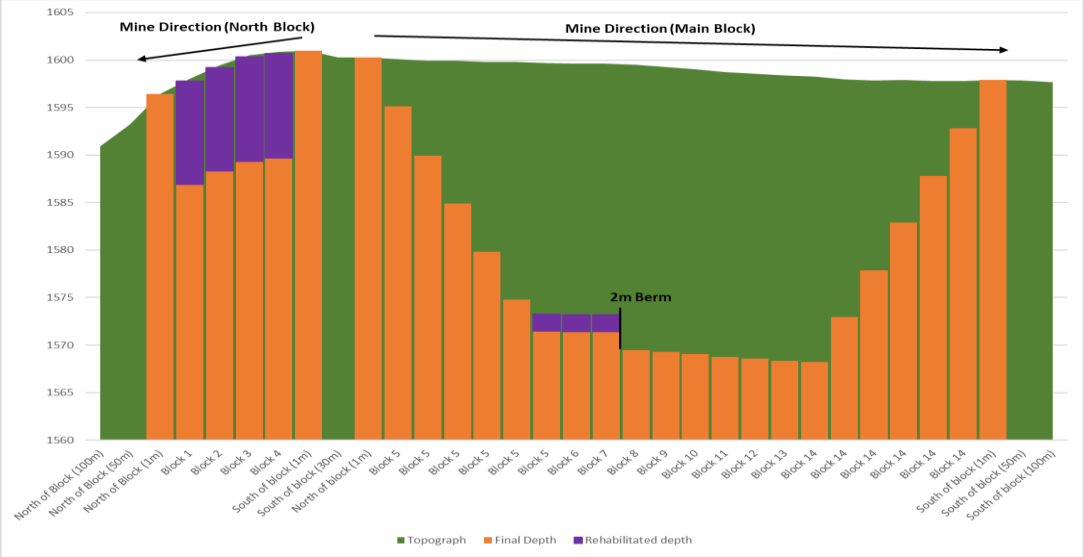


Figure 22: Cross-section through the Rietkol mining pits after backfilling

2.7.2 Waste Classification and Radiological Assessment

A waste classification was conducted by Aquatico Scientific in April 2021, with the aim to chemically characterise the waste material that will be generated and stockpiled during the operational phase of the project. Mining is yet to commence, meaning that no silica ore or waste material was available for sampling and testing purposes. Two composite samples (i.e. tailings material and waste rock) were consequently collected from the operational Thaba Chueu mine (previously known as SamQuarz) situated approximately 17 km east/north-east of the Rietkol MRA area. The ore deposit currently being mined at Thaba Chueu is chemically very similar to the Rietkol deposit, meaning that the results of the waste classification would be applicable to Rietkol.

Two types of tests or analyses were conducted, namely total concentration (TC) and leachable concentration (LC). The results of the total concentration and leachable concentration analyses are provided in Table 5-2 to Table 5-5 of the Geohydrological Specialist Study (Appendix 7) and is not repeated here. The results show no exceedances of the TCT0 and LCT0 guideline limits, hence both the tailings material and waste rock can be regarded as a Type 4 or inert waste. It was concluded that a Class D (or GSB-) disposal facility would suffice for both the tailings material, waste rock dumps and stockpiles as specified in the Minimum Requirements Waste Disposal by Landfill (2nd Edition, 1998).

The uranium and thorium concentrations (both leachable and total) are not considered during the waste classification process. These two radioactive elements, when present at high enough concentrations, do however pose a serious threat to public health. For this reason, the uranium and thorium content of both the waste rock and tailings samples were also determined, and the results are provided in Table 5-2 to Table 5-5 of the Geohydrological Specialist Study. Both samples contain

very low concentrations of the two elements and pose no threat to human health in terms of harmful radiation. A dedicated radiological assessment of the waste material is therefore not required.

2.7.3 Non-Mining Waste

2.7.3.1 Sewage

The only sewage expected to be generated on the mine is from the ablution facilities and washrooms at the infrastructure area. The wastewater and greywater originating from the change houses and laundry will drain into a modular calcamite septic tank system that will need to be emptied twice a week.

The wastewater flows were calculated as follows:

- 150 people.
- The design flows were taken as 70ℓ/person/day as per SABS 1993 for workers per shift.
- The septic tank will be cleaned twice a week giving a maximum retention time of 4 days.

The septic tank will therefore need a capacity of 42 000 ℓ (150 people*70 ℓ*4 days). It is recommended to install a 44 500 ℓ modular calcamite tank to allow for some additional storage capacity.

2.7.3.2 General and hazardous waste

Upon approval of the project, a dedicated, approved (registered) waste contractor will be appointed by the mine to manage the non-mining waste generation and safe disposal thereof.

The following waste types will be generated during the project:

- Domestic waste
- Hazardous waste, including used oil/diesel/greases
- Fluorescent tubes
- Glass and plastics
- Chemicals
- Medical waste
- Scrap metal
- Building rubble (construction & demolition activities)
- Used tyres

The different waste streams will be segregated and disposed of in appropriate designated receptacles. All waste will be disposed off-site at approved landfill sites. No landfill site will be established on the Rietkol Project site.

2.8 BULK ELECTRICITY

An 11 kV electricity supply line is located on the northern boundary of the MRA area and discussions with Eskom is underway to connect to this supply line. Generators will be installed to supplement Eskom power where required.

Table 6: Anticipated Power Requirement (MWP, 2019)

Lighting, Workshops and Offices		
Energy	Kilowatt-hour/month	14 040
Average Power	Kilowatt	30
Peak Power	Kilowatt	50
Plant Conveyors and screens		
Energy	Kilowatt-hour/month	156 000
Average Power	Kilowatt	250
Peak Power	Kilowatt	400
Pumps		
Energy	Kilowatt-hour/month	436 800
Average Power	Kilowatt	700
Peak Power	Kilowatt	950
Crushers		
Energy	Kilowatt-hour/month	280 800
Average Power	Kilowatt	450
Peak Power	Kilowatt	790

2.9 HYDROCARBON REQUIREMENTS

A total of 128 m^3 of hydrocarbon storage facilities will be required for the operational phase, as indicated in Table 7.

Table 7: Hydrocarbon requirements for the Rietkol Project

Total Volume	Location
82 000 litres	Bulk storage facility for diesel at the workshop area
23 000 litres	Bulk storage facilities for oils and lubricants at the workshop area
23 000 litres	Bulk storage facilities for used oils at the workshop area

3 POLICY AND LEGISLATIVE CONTEXT

3.1 LEGAL FRAMEWORK FOR THE ENVIRONMENT

The legal frameworks within which the mining development and associated infrastructure aspects operate is complex and include many acts, associated regulations, standards, principle, guidelines, conventions and treaties on an international, national, provincial and local level. The main legal frameworks that require compliance in terms of Environmental and Water Use Authorisation are:

- Act No. 28 of 2002: Mineral and Petroleum Resources Development Act (MPRDA), as amended
- Act No. 107 of 1998: National Environmental Management Act (NEMA), as amended
- Act No. 36 of 1998: National Water Act (NWA), as amended
- Act 25 of 2014: National Environmental Management Laws Amendment Act (NEMLAA)

Other legislative frameworks applicable to the Rietkol Project include:

- Act No. 108 of 1996: The Constitution of South Africa
- Act 25 of 2014: National Environmental Management Laws Amendment Act (NEMLAA)
- Act No. 25 of 1999: National Heritage Resources Act (NHRA)
- Act No. 10 of 2004: National Environmental Management: Biodiversity Act (NEMBA)
- Act No. 43 of 1983: Conservation of Agricultural Resources Act (CARA)
- Act No. 84 of 1998: National Forests Act (NFA)
- Act No. 39 of 2004: National Environmental Management: Air Quality Act (AQA)
- Act No. 57 of 2003: National Environmental Management: Protected Areas Act
- Act No. 101 of 1998: National Veld and Forest Fire Act
- Act No. 15 of 1973: Hazardous Substances Act
- Act No. 15 of 2019: Carbon Tax Act
- GN No. 704 of 4 June 1999: Regulation on use of water for mining and related activities aimed at the protection of water resources
- GN No. R.267 of 24 March 2017: Water Use Licence Application and Appeals Regulation
- GN No. R. 982-985 of 4 December 2014: NEMA: EIA Regulations, as amended
- GN No. 960 of 5 July 2019: Notice of the requirement to submit a report generated by the National Web-based Environmental Screening Tool
- GN No. 320 of 20 March 2020: Procedures for the assessment and minimum criteria for reporting on identified environmental themes when applying for Environmental Authorisation

- GN No. R.993 of 8 December 2014: National Appeal Regulations, as amended
- GN No. 634 of 23 August 2013: NEMWA: Waste Classification and Management Regulations
- GN No. R. 921 of 2013: NEMWA: Waste Management Activities, as amended by GN No. R.332 of 2 May 2014 and GN No. R.633 of 24 July 2015
- GN No. R632 of 24 July 2015: Regulations regarding the planning and management of residue stockpiles and residue deposits, as amended
- GN No. R.893 of 22 November 2013: Atmospheric Emissions Activities
- GN No. R.152 of 2007: NEMBA: Threatened or Protected Species (TOPS) Regulations
- GN No. R.598 of 2014: NEMBA: Alien and Invasive Species Regulations
- GN No. R.1147 of 20 November 2015: Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, as amended
- GN No. R527 of 23 April 2004: Mineral and Petroleum Resources Development Regulations, as amended
- GN No. 1556 of 29 November 2019: Regulations on Carbon Offsets under section 19 of the Carbon Tax Act
- Act No. 29 of 1996: Mine Health and Safety Act
- Act No. 125 of 1991: Physical Planning Act
- Act No. 16 of 2013: Spatial Planning and Land Use Management Act (SPLUMA)
- Act No. 117 of 1998: Municipal Structures Act
- Act No. 32 of 2000: Municipal Systems Act
- Act No. 67 of 1995: Development Facilitation Act (DFA)
- Act No. 2 of 2000: Promotion of Access to Information Act
- Act No. 3 of 2000: Promotion of Administrative Justice
- Act No. 75 of 1997: Basic Conditions of Employment Act
- Act No. 66 of 1995: The Labour Relations Act
- Act No. 4 of 2000: Promotion of Equality and Prevention of Unfair Discrimination Act
- Act No. 85 of 1993: Occupational Health and Safety Act
- Act No. 53 of 2003: Broad Based Black Economic Empowerment Act
- Act No. 9 of 1972: National Road Safety Act
- Act No. 93 of 1996: National Road Traffic Act
- Act No. 19 of 1998: Prevention of Illegal Eviction from and Unlawful Occupation of Land Act
- Act No. 22 of 1994: Restitution of Land Rights Act, as amended
- Act No. 112 of 1991: Amendment of the Upgrading of Land Tenure Rights Act

The following provincial legislation has bearing on the project:

- Mpumalanga Local Government Ordinance 17 of 1939 that deals with nuisance pollution
- Mpumalanga Land Administration Act No. 5 of 1998, which regulates land administration
- Mpumalanga Nature Conservation Act No. 10 of 1998 (MNCA), which regulates nature conservation

Strategies, guidelines, and other documents of importance to this project (list not exhaustive) are:

- National Protected Areas Expansion Strategy, 2010 (NPAES)
- National List of Threatened Terrestrial Ecosystems for South Africa, 2011
- National Biodiversity Assessment, 2011 (NBA)
- Mining and Biodiversity Guideline: Mainstreaming Biodiversity into the Mining Sector, 2013
- Implementation Manual for Freshwater Ecosystem Priority Areas, 2011
- Important Bird Areas, BirdLife South Africa
- Mpumalanga Biodiversity Sector Plan (2014)
- Good Practice Guidance for Mining and Biodiversity: International Council on Mining and Metals
- Convention on Biological Diversity (1995)
- Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora
- International Union for Conservation of Nature (IUCN)
- Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention)
- Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA)
- World Summit for Sustainable Development (2002)
- National Climate Change Adaption Strategy, 2017

Policies and planning documents include:

- Mpumalanga Provincial Growth and Economic Development Strategy
- Mpumalanga Tourism Growth Strategy / Master Plan
- Mpumalanga Spatial Development Framework
- Nkangala District and Victor Khanye Local Municipal Spatial Development Framework
- Nkangala District and Victor Khanye Local Municipal Integrated Development Plan
- Highveld Priority Area Air Quality Management Plan, 2012

- Environmental Management Framework (EMF) for the Olifants and Letaba Rivers Catchment Areas, 2009

3.2 LICENSING REQUIREMENTS

The following licencing requirements have been identified:

Legislation	Requirement	Status
MPRDA **Nhlabathi Minerals (Pty) Ltd to apply for a mining right**	Submission of MRA to Mpumalanga DMRE	MRA submitted on 21 January 2020, acceptance received 21 January 2021.
NEMA, EIA Regulations (2014) **Several listed activities are applicable, the majority triggering the threshold limit for a S&EIR required in terms of GN984**	Application for Environmental Authorisation to Mpumalanga DMRE	EA application submitted on 18 March 2021. Final Scoping Report submitted to DMRE on 7 May 2021. Final Scoping Report was accepted on 11 August 2021. Draft EIAR and EMPr available for comment.
NEMWA, Waste Regulations (2013) **Mine residue is classified as a waste management activity**	Application for WML to Mpumalanga DMRE	As above, parallel application.
NWA, S21 **A Water Use Licence will be required for a number of water uses**	IWULA and IWWMP for submission to Mpumalanga DWS	Draft IWWMP available for comment.
NEM:BA, TOPS regulations **Permits required for the destruction and/or relocation of protected species**	Permit application to MTPA	To follow once mining right is granted, prior to construction activities.
NEM:AQA	Application for AEL to DFFE	To follow once mining right is granted, prior to construction of the dryer plant.
NHRA **Permits required for relocation of burial sites**	Permit application to SAHRA	To follow once mining right is granted, if mining or any other infrastructure is closer than 100m to the informal graveyard.
SPLUMA **Rezoning of property**	Application to municipality for required rezoning	To follow once mining right is granted.

3.3 APPROACH TO THE ENVIRONMENTAL AUTHORISATION AND STAKEHOLDER ENGAGEMENT

The enactment of the NEMLAA introduced the One Environmental System (OES) on 8 December 2014. In terms of the OES every applicant who applies for a mining right in terms of Section 22 of the MPRDA must conduct an EIA and submit an Environmental Impact Assessment Report (EIAR) and Management Programme Report (EMPr) in terms of the NEMA and its EIA regulations (2014, as amended).

Under the OES these reports are submitted to the DMRE who is the Competent Authority for any mining and related activities. The system requires all permitting applications to be conducted in parallel to facilitate integrated decision-making at Government level and the Environmental Authorisation application should therefore ideally include the requirements of the NEMA, the NEMWA and others, as applicable.

The proposed Rietkol Project triggers a S&EIR process, which entails the following (Figure 23):

- **Pre-Application and Application Phase:** Notification of IAPs prior to submission of the Application and conducting such consultation as may be required to commence with baseline investigations. Thereafter, the submission of the application form to the relevant Competent Authority, in this case the Mpumalanga DMRE.
- **Scoping Phase:** Compilation of a draft Scoping Report (DSR) and providing it for comment to all registered IAPs. The DSR will identify the key issues and alternatives to be assessed and recommend the approach to be followed during the EIA Phase to follow (Plan of Study). Comments received from IAPs are incorporated in the DSR and the final Scoping Report (FSR) is submitted to the Competent Authority, whereupon they accept or refuse it.
- **EIA Phase:** Upon acceptance of the FSR and Plan of Study, the EIA Phase can commence. This includes the preparation of the Environmental Impact Assessment Report (EIAR), which provides detailed assessments of the significance of biophysical and social impacts, as well as the Environmental Management Programme (EMPr). The draft EIAR and EMPr are again provided to registered IAPs for comment. Comments are responded to in the final EIAR and EMPr, which is submitted to the Competent Authority for decision-making.
- **Authority Review and Decision-making Phase:** The Competent Authority reviews the information and recommendations provided in the final EIAR and EMPr and is required to issue a decision to authorise (or refuse to authorise) the project within 107 days of submission of the documents.

The total timeframe for a "non-substantive" EIA process is legislated to take no more than 300 calendar days (excluding public holidays and the December break). This implies an EIA process where all issues could be satisfactorily resolved, and no substantive changes needed to be made or new and unexpected information needed to be added to the environmental report. These timeframes imply, in practice, that the specialist work must commence before an application is submitted to the Competent Authority.

In parallel to the EIA process, a comprehensive Public Participation process must be conducted. This offers stakeholders the opportunity to learn about the project, to raise issues that they are concerned about, and to make suggestions for enhanced project benefits.

The application for a Water Use Licence (WUL) will be conducted in parallel to the EIA process and the stakeholder engagement integrated as far as practically possible. The draft Integrated Water and Wastewater Management Plan (IWWMP) will be made available for comment at the same time as the draft EIAR and EMPr and combined public meetings and focus groups will be held.

The following diagram indicate the process and the steps to follow.

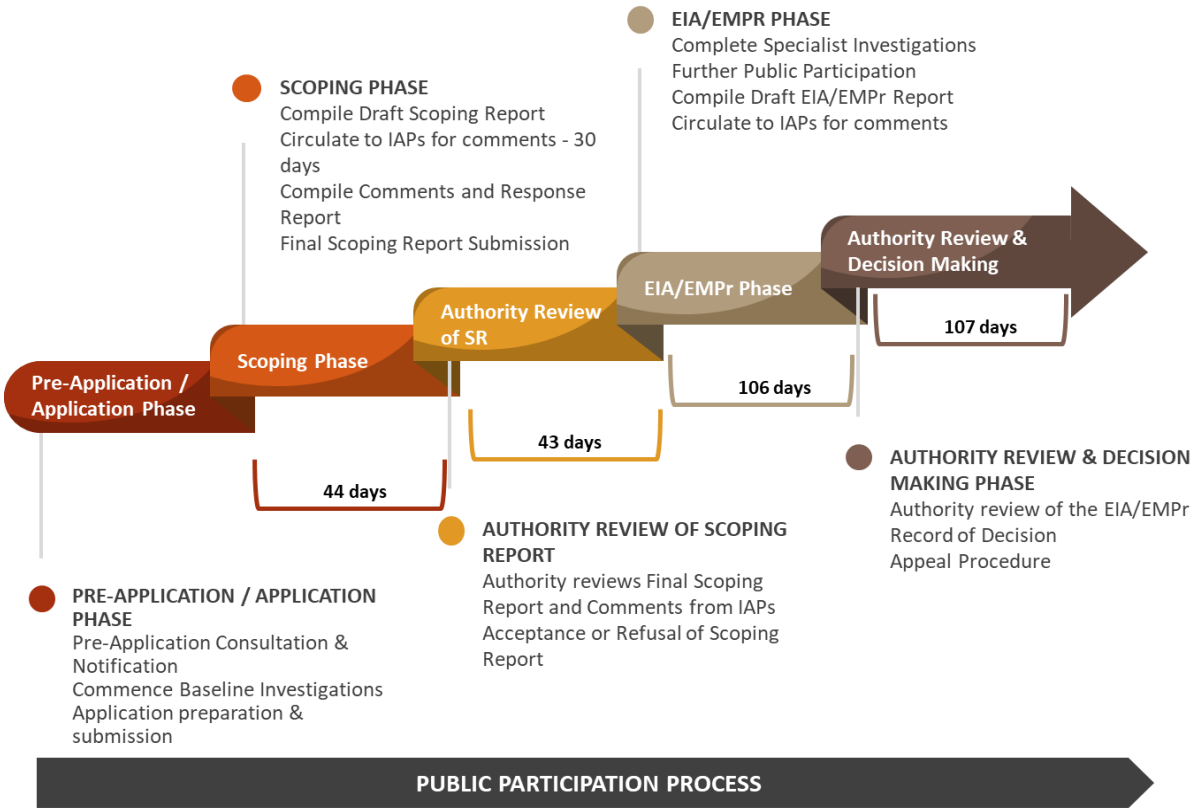


Figure 23: S&EIR process and timeframes

3.4 PERIOD FOR WHICH ENVIRONMENTAL AUTHORISATION IS REQUIRED

Environmental Authorisation is required for a minimum of 30 years.

4 NEED AND DESIRABILITY OF THE PROJECT

4.1 SPECIALIST MARKET ANALYSIS

Global consumption of industrial silica sand is expected to climb 4.4% annually through 2020 to 304 million metric tons valued at $12.8 billion. Growth in crude steel output, motor vehicle production, and specialty silica manufacturing activity will drive sales gains. While horizontal oil and gas drilling activity will be less robust than it has been over the past decade, hydraulic fracturing will remain a key component of demand into the near term (Freedonia group website).

A market research study conducted by the National Industrial Sands Association (NISA) in 2011 indicate demand for silica sand can be segmented into various major markets including glass, metal castings foundries, hydraulic fracturing, building products and chemicals as outlined below:

- Glassmaking: Silica sand is the primary component of all types of standard and specialty glass. It provides the essential SiO_2 component of glass formulation and its chemical purity is the primary determinant of colour, clarity, and strength. Industrial sand is used to produce flat glass for building and automotive use, container glass for foods and beverages, and tableware. In its pulverized form, ground silica is required for production of fiberglass insulation and reinforcing glass fibres. Specialty glass applications include test tubes and other scientific tools, incandescent and fluorescent lamps, television, and computer CRT monitors.
- Metal Casting: Industrial sand is an essential part of the ferrous and non-ferrous foundry industry. Metal parts ranging from engine blocks to sink faucets are cast in a sand and clay mold to produce the external shape, and a resin bonded core that creates the desired internal shape. Silica's high fusion point (1760°C) and low rate of thermal expansion produce stable cores and molds compatible with all pouring temperatures and alloy systems. Its chemical purity also helps prevent interaction with catalysts or curing rate of chemical binders. Following the casting process, core sand can be thermally or mechanically recycled to produce new cores or molds.
- Metal Production: Industrial sand plays a critical role in the production of a wide variety of ferrous and non-ferrous metals. In metal production, silica sand operates as a flux to lower the melting point and viscosity of the slags to make them more reactive and efficient. Lump silica is used either alone or in conjunction with lime to achieve the desired base/acid ratio required for purification. These base metals can be further refined and modified with other ingredients to achieve specific properties such as high strength, corrosion resistance or

electrical conductivity. Ferroalloys are essential to specialty steel production, and industrial sand is used by the steel and foundry industries for de-oxidation and grain refinement.

- Chemical Production: Silicon-based chemicals are the foundation of thousands of everyday applications ranging from food processing to soap and dye production. In this case, SiO_2 is reduced to silicon metal by coke in an arc furnace to produce the silica precursor of other chemical processes. Industrial sand is the main component in chemicals such as sodium silicate, silicon tetrachloride and silicon gels. These chemicals are used in products like household and industrial cleaners to manufacture fibre optics and to remove impurities from cooking oil and brewed beverages.
- Construction: Industrial sand is the primary structural component in a wide variety of building and construction products. Whole grain silica is used in flooring compounds, mortars, specialty cements, stucco, roofing shingles, skid resistant surfaces and asphalt mixtures to provide packing density and flexural strength without adversely affecting the chemical properties of the binding system. Ground silica performs as a functional extender to add durability and anti-corrosion and weathering properties in epoxy-based compounds, sealants, and caulks.
- Paint and Coatings: Paint formulators select micron-sized industrial sands to improve the appearance and durability of architectural and industrial paint and coatings. High purity silica contributes critical performance properties such as brightness and reflectance, colour consistency, and oil absorption. In architectural paints, silica fillers improve tint retention, durability, and resistance to dirt, mildew, cracking and weathering. Low oil absorption allows increased pigment loading for improved finish colour. In marine and maintenance coatings, the durability of silica imparts excellent abrasion and corrosion resistance.
- Ceramics and Refractories: Ground silica is an essential component of the glaze and body formulations of all types of ceramic products, including tableware, sanitary ware and floor and wall tile. In the ceramic body, silica is the skeletal structure upon which clays and flux components attach. The SiO_2 contribution is used to modify thermal expansion, regulate drying and shrinkage, and improve structural integrity and appearance. Silica products are also used as the primary aggregate in both shape and monolithic type refractories to provide high temperature resistance to acidic attack in industrial furnaces.
- Filtration and Water Production: Industrial sand is used in the filtration of drinking water, the processing of wastewater and the production of water from wells. Uniform grain shapes and grain size distributions produce efficient filtration bed operation in removal of contaminants in both potable water and wastewater. Chemically inert, silica will not degrade or react when

it comes in contact with acids, contaminants, volatile organics or solvents. Silica gravel is used as packing material in deep-water wells to increase yield from the aquifer by expanding the permeable zone around the well screen and preventing the infiltration of fine particles from the formation.

- Recreational Products: Industrial sand even finds its way into sports and recreation. Silica sand is used for golf course bunkers and greens as well as the construction of natural or synthetic athletic fields. In golf and sports turf applications silica sand is the structural component of an inert, uncontaminated, growing media. Silica sand is also used to repair greens and to facilitate everyday maintenance like root aeration and fertilization. The natural grain shape and controlled particle size distribution of silica provides the required permeability and compaction properties for drainage, healthy plant growth and stability.

Glass is the largest market accounting for 37% of global silica sand consumption (in volume terms). With 32% of overall sales, foundries represent the next largest market, followed by hydraulic fracturing, building products, and chemicals, with other applications (such as abrasives and recreation) accounting for the remainder of demand. The Global Industrial Silica Sand market is witnessing many growth drivers such as increased adoption of industrial silica sand for hydraulic fracturing.

International trade in silica sand is limited due to the high cost of transporting silica sand relative to its value. Thus, quarries and processing facilities are typically located near major centres of demand.

4.2 SOCIAL DEVELOPMENT

The Executive Summary of the National Development Plan (NDP, 2030) notes 10 critical actions on the road to success for South Africa. They are:

1. A social compact to reduce poverty and inequality and raise employment and investment.
2. A strategy to address poverty and its impacts by broadening access to employment, strengthening the social wage, improving public transport, and raising rural incomes.
3. Steps by the state to professionalise the public service, strengthen accountability, improve coordination, and prosecute corruption.
4. Boost private investment in labour-intensive areas, competitiveness, and exports, with adjustments to lower the risk of hiring younger workers.
5. An education accountability chain, with lines of responsibility from state to classroom.
6. Phase in national health insurance, with a focus on upgrading public health facilities, producing more health professionals, and reducing the relative cost of private health care.

7. Public infrastructure investment at 10 percent of Gross Domestic Product (GDP), financed through tariffs, public-private partnerships, taxes, and loans and focused on transport, energy and water.
8. Interventions to ensure environmental sustainability and resilience to future shocks.
9. New spatial norms and standards – densifying cities, improving transport, locating jobs where people live, upgrading informal settlements and fixing housing market gaps.
10. Reduce crime by strengthening criminal justice and improving community environments.

Consol and its subsidiary companies work closely with provincial government structures in support of the NPD, and is committed to the above actions in the form of:

- Job creation;
- Human resource development;
- Human and community development;
- Strategic infrastructure;
- Environmental sustainability;
- Governance and policy; and
- Spatial equity.

4.3 ECONOMIC BENEFITS

The Rietkol Project will develop a sustainable, quality silica resource with a minimum LOM of 20 years, which has the potential to deliver huge economic benefits at the local, provincial, and national level in terms of multi-generational employment, power security, and the contribution to the Gross Domestic Product (GDP).

Any new capital investment always has a positive impact on the economy, national and provincial. Mosaka Economic Consultants conducted a Land Trade-Off Study and Macro-Economic Impact Analysis of the proposed Rietkol Project – refer to Appendix 17.

The following sections present the macro-economic results of the construction and the operational phases of the proposed Rietkol Project for which the National Social Accounting Matrix (SAM) was adapted and applied.

4.3.1 Construction Impact

Table 8 presents the detailed results of the construction phase of the mine.

Table 8: Macro-Economic Impacts of the Construction Phase of the Rietkol Project

	Construction Impact: National [R million, 2020 Prices or Numbers]			
	Direct impact	**Indirect impact**	**Induced impact**	**Total impact**
Impact on Gross Domestic Product (GDP)	**R 14.2**	**R 6.2**	**R 12.0**	**R 32.4**
Impact on capital formation	**R 27.0**	**R 15.1**	**R 32.1**	**R 74.2**
Impact on employment [person years]	**24**	**14**	**28**	**66**
Skilled impact on employment [person years]	*8*	*3*	*6*	*17*
Semi-skilled impact on employment [person years]	*13*	*6*	*12*	*31*
Unskilled impact on employment [person years]	*3*	*5*	*10*	*18*
Total Payments to Households				**R 23.3**
Low Income Households				*R 3.8*
Medium Income Households				*R 4.5*
High Income Households				*R 15.0*
Fiscal Impact				**R 9.8**
National Government				*R 9.1*
Provincial Government				*R 0.1*
Local Government				*R 0.6*

Note: All Rand values reflected are expressed in Rand Millions

In the evaluation of the construction results it must be kept in mind that this is for a very limited period of time.

- Gross Domestic Product (GDP) Impact: GDP is a good indicator of economic growth and welfare as it represents, among other, criteria, remuneration of employees and gross operating surplus (profits) as components of value added at all the levels of the economy. The direct impact generated during the total programming period is estimated at R 14.2 million with the total GDP at R 32.4 million in 2020 prices.
- Capital Formation: Productive capital assets are required to support or generate any given amount of economic activity (i.e. GDP). These capital assets, together with labour and entrepreneurship, form the core productive factors needed for production. The effectiveness and efficiency with which these factors are combined will determine the overall level of productivity and profitability of such assets. The former will in turn depend on a whole array of factors, of which the appropriate technology and skills content of the labour force are important. According to the results the direct capital will be around R 27.0 million supplemented by the indirect component of R 15.1 million, the induced element of R 32.1 million providing a total of R 74.2 million.
- Employment Created: Labour input is a key element of the production process. It is one of the main production factors in any economy and employment levels are indicators of whether the extent of labour is effectively absorbed in the economy. This study determines the

number of new employment opportunities that will be created through the impact of the construction and operation of the identified project on an average annual basis. In the case of the construction these employment opportunities will only be for a two-year period and decreases during this period. The direct employment of 24 is supplemented by 14 indirect and 28 induced opportunities providing a total of 66 opportunities. This is a 2.64 growth factor in terms of the direct jobs to the total opportunities created.

- Impact on Households: One of the crucial aspects of any macro-economic assessment is determining the personal income distribution characteristics thereof, especially how low-income households will be impacted. The total payments to households are estimated at R 23.3 per annum with R 3.8 million (16.3%) to the low-income households in the first year of construction and then decline for years two and three.
- Fiscal Impact: The total taxes paid are estimated at R 9.8 million with R 9.1 to the central Fiscus.

4.3.2 Operational Impact

Table 9 presents the results of operational YR7 of the production period of the proposed mine as calculated by applying the National SAM.

Table 9: Macro-Economic Impact Assessment of the Operational Phase of the Rietkol Project

	Operational Impact: National [R million, 2020 Prices or Numbers]			
	Direct impact	**Indirect impact**	**Induced impact**	**Total impact**
Impact on Gross Domestic Product	**R 35.8**	**R 28.5**	**R 10.3**	**R 74.6**
Impact on capital formation	**R 68.8**	**R 48.8**	**R 36.5**	**R 154.1**
Total impact on employment [job opportunities]	**100**	**54**	**51**	**205**
Skilled impact on employment [job opportunities]	*36*	*10*	*18*	*64*
Semi-skilled impact on employment [job opportunities]	*37*	*21*	*17*	*75*
Unskilled impact on employment [job opportunities]	*27*	*23*	*16*	*66*
Total Payments to Households				**R 46.4**
Low Income Households				*R 13.4*
Medium Income Households				*R 8.2*
High Income Households				*R 24.9*
Fiscal Impact				**R 26.4**
National Government				*R 24.5*
Provincial Government				*R 0.3*
Local Government				*R 1.6*

Note: All Rand values reflected are expressed in Rand Millions

In evaluating the results of the operational phase, it is important to take into consideration that although this is a new mine, it is replacing another mine where silica stock is running low. This is therefore not new macro-economic results, but the maintenance of the socio-economic results produced by another mine in the Delmas area.

- GDP Impact: The direct impact generated during YR 7 is estimated at R 35.8 million with the total GDP at R 74.6 million in 2020 prices.
- Operational Capital Formation: According to the results the direct operational capital in YR 7 will be around R 68.8 million supplemented by the indirect component of R 48.8 million and the induced element of R 36.5 million providing a total of R 154.1 million. New capital formation is an important element of any future economic growth, keeping in mind that the new capital is formed in a number of sectors, not only mining.
- Employment Created: The direct employment of the mining company and service providers is 100, 54 are indirect and 51 induced opportunities providing a total of 205 opportunities. This is a 2.1 growth factor in terms of the direct jobs to the total opportunities created.
- Impact on Households: The total annual payments to households, including management fees and the indirect and induced labour, is estimated at R 46.4 million per annum with R 13.4 million (28.8%) to low-income households for YR 7.
- Fiscal Impact: The total taxes paid are estimated at R 26.4 million with R 24.5 million to the central Fiscus for YR 7.

In addition to the quantifiable economic benefits that will result from this development, there are also several benefits that are not measurable in the same way, but that should be considered. These benefits could include:

- ***Technology***: Technology used on the mine will work towards improving knowledge on available technologies and skills in using such technology. This may enable local communities to run their own successful businesses in the future.
- ***Skills development***: Local community members who may not have any marketable skills other than a basic education will be able to acquire skills through employment on the mine. In addition to technical skills, there will be numerous roles imparting valuable management and leadership skills as well.
- ***Asset base***: The capital expenditure outlaid into the land in the area will result in an asset base upon which future development can occur. In addition to this, the asset base adds value to the municipality itself and provides a starting point for future developments.

- ***Local procurement and SMME opportunities***: Local communities will be enabled and provided with opportunities to participate in contracts and other new businesses that would become available during the construction and operational phases.
- ***Downstream socio-economic benefits***: Most of the silica is earmarked for the domestic market including the glass making industry. The glass making industry is a major contributor to the national GDP and employment and provides further economic opportunities downstream of the mine and factories, including the bottling and container glass industries (wine, soda, and beer) as well as building and float glass industries.

4.4 JOB CREATION

The Rietkol Project will create a peak of approximately 100 temporary job opportunities at authorisation and commencement of construction. Within the first year of mining, there is an opportunity to create approximately 100 permanent positions once production reaches steady state. In addition, approximately 40 - 50 workers will be employed by support consultants.

Table 10: Employee numbers (MWP, 2019)

Year	YR01	YR02	YR03	YR04 onwards
Employees	96	100	100	100
Construction contractors	100	50	50	-
Total	196	150	150	100

Nhlabathi will employ people from the local community as a priority, provided sufficient skills are available within the surrounding communities.

Consol Glass is currently receiving quantities of glass sand from an existing mine in the Delmas area where the available product will be in short supply in the next decade. About 30% of the output of the three processing units in Gauteng at Wadeville, Clayville and Nigel, depend on glass sand. In practical terms a reasonable possibility exists that some employment opportunities can be lost if the Rietkol Project does not go ahead. It is estimated that about 550 people currently employed by the glass making industry will probably have to be laid off if additional glass sand resources are not secured. Thus, in addition to the direct employment opportunities, the Rietkol Project has the ability to sustain approximately 550 existing employment opportunities within the glass making industry.

4.5 WORKFORCE DEVELOPMENT

As part of the Social and Labour Plan (SLP), Nhlabathi plans to implement a comprehensive workforce development plan through adult basic education and training, core business training, artisan training, learnerships, bursaries and internships programmes. These will be supported by career-path planning and mentorship.

4.6 COMMUNITY DEVELOPMENT

Nhlabathi is committed to optimise opportunities in the local communities through the implementation of the SLP. To further support local communities, Nhlabathi is proposing a Local Economic Development (LED) project and support small business development. Nhlabathi proposes the implementation of a school infrastructure and support project over the first 5 years of mining. The proposed projects and the SLP budget must however still be approved by the DMR and SLP implementation will only commence once a decision has been made by the DMRE on the granting of the Mining Right.

Furthermore, Nhlabathi is committed to support business initiatives through the provision of opportunities, assistance and support to SMME's and new HDSA business ventures. Various 100% black-owned and operated SMME companies are earmarked for further development at the Rietkol Project through the Enterprise Development programme, including:

- Bophelo Baka Wellness Solutions – Wellness training
- Yanboy Trading Enterprises – Bus service
- Thulukhanye Laundry Services and Projects – Cleaning services
- Analungile Trading & Projects – Laundry services

5 DEVELOPMENT ALTERNATIVES CONSIDERED

5.1 SITE LOCATION ALTERNATIVES

No site location alternatives have been considered as mining can only be undertaken in areas where economically mineable resources occur. The Rietkol resource was established through extensive prospecting and geological modelling over many years.

5.2 LAND USE ACTIVITY ALTERNATIVES

The Modder East AHs on the farm Olifantsfontein cover a substantial area with plots varying from 4 to 28 ha. The land use on these AHs is very disparate, covering intensive horticultural enterprises (rose and cut flower cultivation), dry land crop production, commercial businesses (such as panel beaters, construction contractors and a guest house), residential, horse training (equestrian centre), etc. The surrounding area includes irrigation and dry land farming, horticulture, and large poultry enterprises. Groundwater pivot irrigation is common.

The areas surrounding the Modder East Orchards AHs host several wetlands and dams and are located on the south-eastern end of the Botleng Dolomite Aquifer. A great demand for groundwater arises from the agricultural sector with large-scale irrigation practices occurring extensively in the Delmas area mainly to produce maize, soya beans and vegetables (summer and winter). Meat and poultry abattoirs also make use of large volumes of water for their manufacturing processes.

Mosaka Economic Consultants conducted a Land Trade-Off Study and Macro-Economic Impact Analysis of the proposed Rietkol Project – refer to Appendix 17. The macro-economic analysis of the present land use in the area is detailed in Section 6.5.5 of this report. In summary:

- The direct GDP contribution of the existing land uses within a 1 km radius from the Rietkol MRA area is estimated at R 121.388 million with a total of R 244.4011 million if the ripple impact (indirect and induced) is taken into consideration.
- number is estimated 775 jobs of which 425 is direct employment and 350 indirect and induced. The main labour-intensive activities are poultry, egg packhouse, roses and cut flower production.
- Total salaries and management fees paid to households, not only those working on the farms but also the indirect and induced labour, are estimated at R 83.761 million with R 24.8489 million to low-income households.
- It was concluded that current agricultural activities provide many direct jobs, as well as a healthy income to households.

The macro-economic impact analysis indicated that, based on a worst-case scenario where impacts cannot be mitigated, there is a potential risk that as many as 20 direct jobs could be lost should the Rietkol Project proceed, with a possible loss in income to low-income households estimated at R 0.962 million per annum. A negative result of R5.708 million reduction in direct GDP is predicted.

Table 11 presents a comparison between the estimated negative impact of the mine on current activities and the projected positive impact of the proposed mine together with the projected future values of the GDP, low household income, and direct employment opportunities.

Table 11: Estimated net benefit of the proposed Rietkol Project

	Agriculture		**Mining**	**Net benefit parameter**	**Future total parameter**
	Current	**Estimated Loss**	**Projected**	**Projected**	**Projected**
Direct GDP	R 121.388 mil.	R 5.708 mil.	R 35.8 mil.	R 30.092mil.	R 151.48 mil.
Direct Employment	425	20	100	80	505
Low Household Income	R 24.8489mil.	R 0.962mil.	R 13.40	R 12.438 mil.	R 37.2869 mil.

Currently the economic activities within the MRA area are limited and the mine will be an economic improvement. However, for the intensive horticulture, poultry and equestrian activities in the Buffer Area, the mine will pose a certain financial and economic risk which as presented above.

Although the proposed mine could potentially impact negatively on the current land activities, the net result is a positive improvement in benefits for the area, as indicated in Table 11. The positive economic contribution to the Mpumalanga and Gauteng economies is an additional positive factor. It is therefore possible to recommend the construction of the mine from a land trade-off perspective (Mosaka Economists, 2021).

5.3 TECHNOLOGY ALTERNATIVES

5.3.1 Mining Methodology

Selection of a mining method is always dictated by the orebody or resource. The silica resource at the Rietkol Project is shallow, with various outcrops occurring on the proposed mining footprint. Mining will take place to a depth of 30 m with potential resource up to 50 mbs and opencast mining is therefore the only viable mining methodology.

5.3.2 Mine Residue Disposal Methodology

The mine schedule allows for mining in North Block to be mined within a short period of time. Slimes (tailings) will be pumped into the mined-out void. The alternative is to construct surface tailings facilities within the infrastructure area.

The in-pit disposal of tailings material is more environmentally friendly for the following main reasons (Groundwater Complete (GC), 2021):

- The tailings material is effectively enclosed by mostly quartzite that is characterised by low hydraulic properties. This will greatly reduce the rate of contaminant migration (if present).
- The tailings material (or a portion thereof at least) will be deprived of oxygen in the event of the pit being flooded, which will reduce oxidation and the formation of potentially poor quality leachate.

Thus, in-pit disposal of the mine residue (tailings) is deemed positive in terms of groundwater quality management, visual impact (no residual surface tailings dams) and the general biodiversity of the area. Backfilling of the North Block also allows full rehabilitation of this area back to grazing capability.

Surface tailings facilities were therefore not further considered.

5.4 DESIGN OR LAYOUT ALTERNATIVES

5.4.1 Surface Infrastructure Layout and Placement

Infrastructure to support the Rietkol Project has been laid out and engineered to best suit the topography and mining pit layouts, as well as the relatively small footprint of the MRA area.

The initial infrastructure layout was informed by the following environmental and cultural attributes:

- Aquatic resources (wetlands): The infrastructure layout avoided the wetlands in the MRA area, with an appropriate buffer between the more sensitive southern depression wetland.
- Land use and capability: The infrastructure layout avoided the land currently used for cultivation (crops and feed production, orchards), as well as the timber plantation located in the north-western corner of the MRA area. These land uses within the MRA area can therefore continue despite mining.
- Heritage resources: The infrastructure layout avoided the heritage resources of significance (graves), as well as the old trigonometrical beacon. It must be noted that mining will take place near the graves from YR15 onwards, which may necessitate the relocation of the graves at that point in time.

- Existing infrastructure: Existing infrastructure within the infrastructure layout will be utilised as far as possible for offices, workshops, ablution facilities, etc. to reduce the impact footprint and associated vegetation clearance requirements.

The total area of disturbance of the initial layout amounts to approximately 26.6 hectares (ha), as follow (Figure 24):

	Extent	Current Land Use
North Block	2.77 ha	Grazing = 1.45 ha Wilderness = 1.32 ha
Main Block	9.36 ha	Grazing = 5.32 ha Wilderness = 4.04 ha
Infrastructure and stockpile area	14.51 ha	Grazing = 10.64 ha Wilderness = 2.8 ha Residential = 1.07 ha

A total area of approximately 17.4 ha currently used as grazing will be destroyed by this alternative. A total of approximately 8.2 ha is classified as wilderness (rocky outcrops).

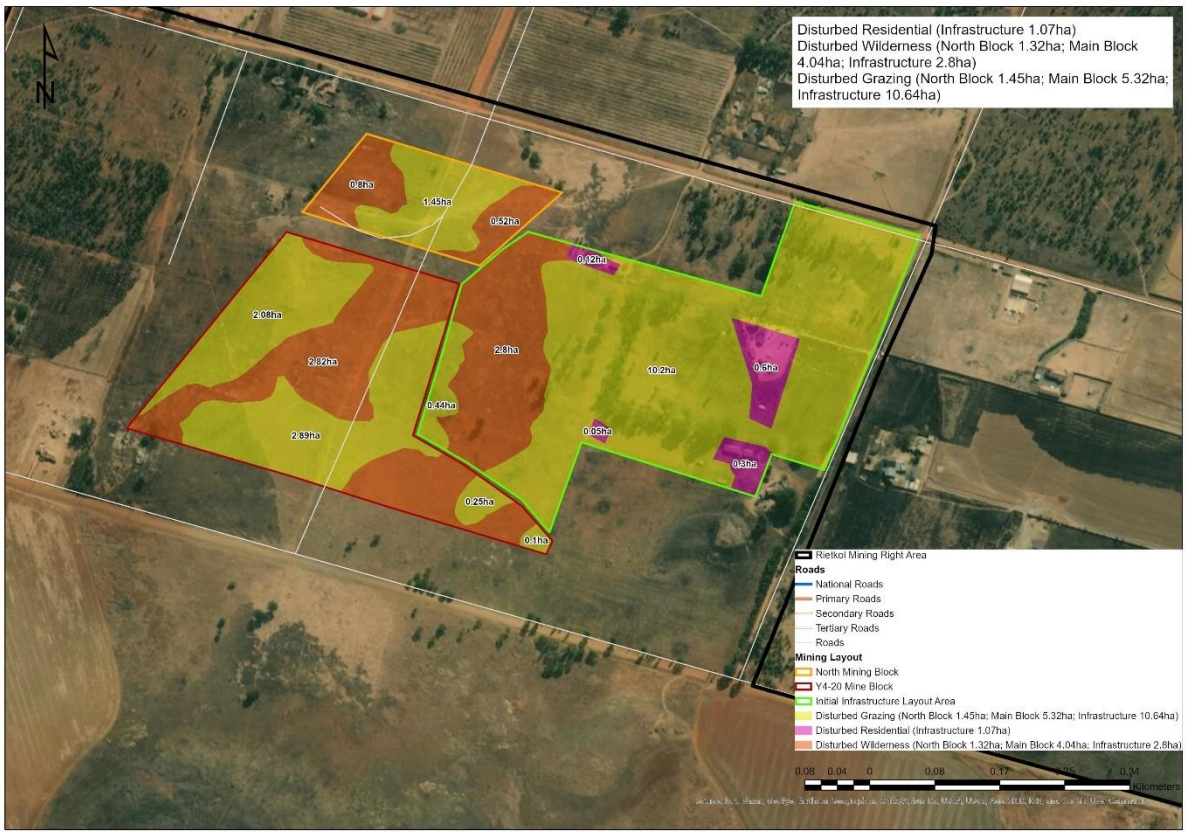


Figure 24: Pre-mining land use – initial infrastructure layout option

Following baseline studies, an alternative option for the infrastructure layout and placement was proposed to:

- Avoid placement of new infrastructure development within the 100m buffer of the hillslope seep wetland to the south; and
- Reduce the infrastructure footprint and associated dirty water management areas.

Figure 25 indicates the two infrastructure layout alternatives in relation to the hillslope seep wetland and associated 100m buffer. The initial layout (indicated in green) was positioned well within the 100m buffer zone of the wetland, almost encroaching on its edge. The alternative (indicated in purple) is outside of the 100m buffer zone and resulted in a reduction in footprint of approximately 1.6 ha.

The reduced infrastructure layout footprint was therefore chosen as the preferred alternative going forward and infrastructure was relocated to fit within this reduced footprint. This alternative is supported by the wetland specialist report which recommended that a minimum buffer of 100m be maintained between the wetland systems and any new infrastructure and mining developments.

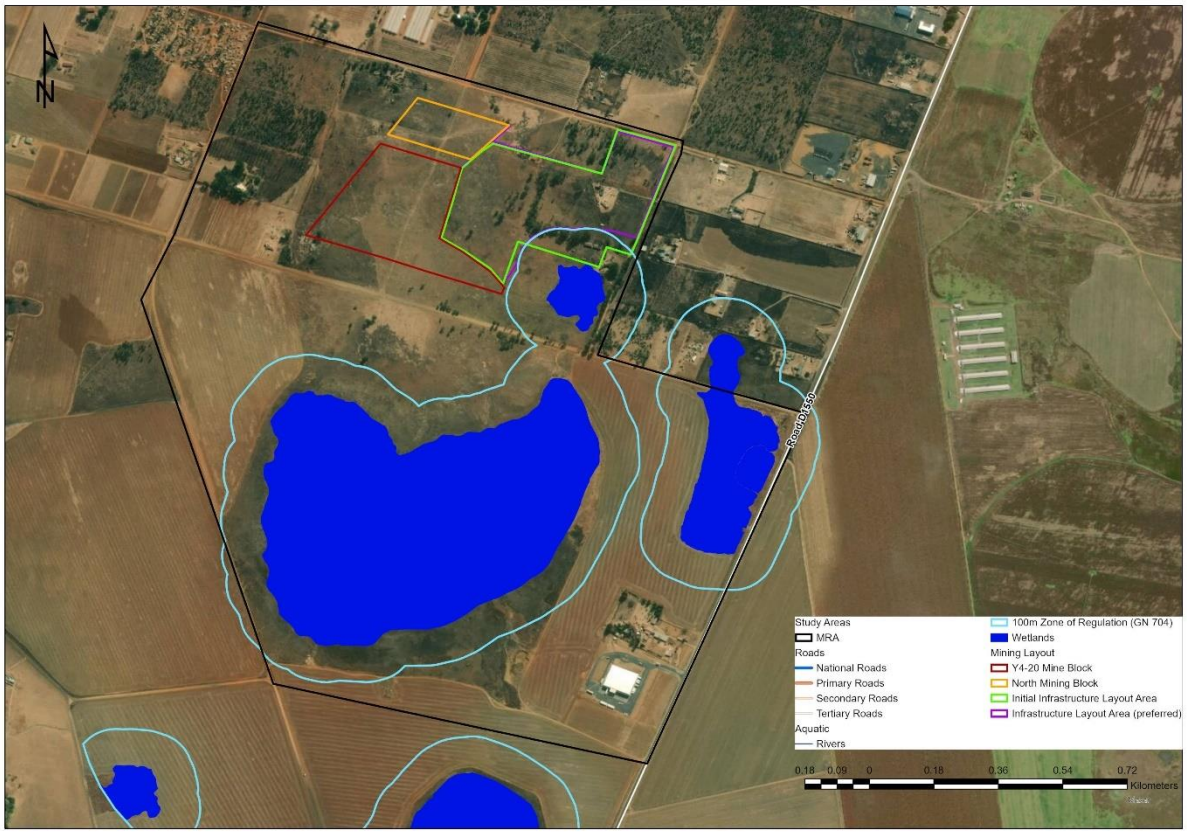


Figure 25: Infrastructure layout and placement alternatives

The total area of disturbance of the preferred layout alternative amounts to approximately 25 hectares (ha), as follow:

	Extent	Current Land Use
North Block	2.77 ha	Grazing = 1.45 ha Wilderness = 1.32 ha
Main Block	9.36 ha	Grazing = 5.32 ha Wilderness = 4.04 ha
Infrastructure and stockpile area	12.89 ha	Grazing = 9.34 ha Wilderness = 2.8 ha Residential = 0.75 ha

A total area of approximately 16 ha currently used as grazing will be destroyed. A total of approximately 8 ha is classified as wilderness (rocky outcrops).

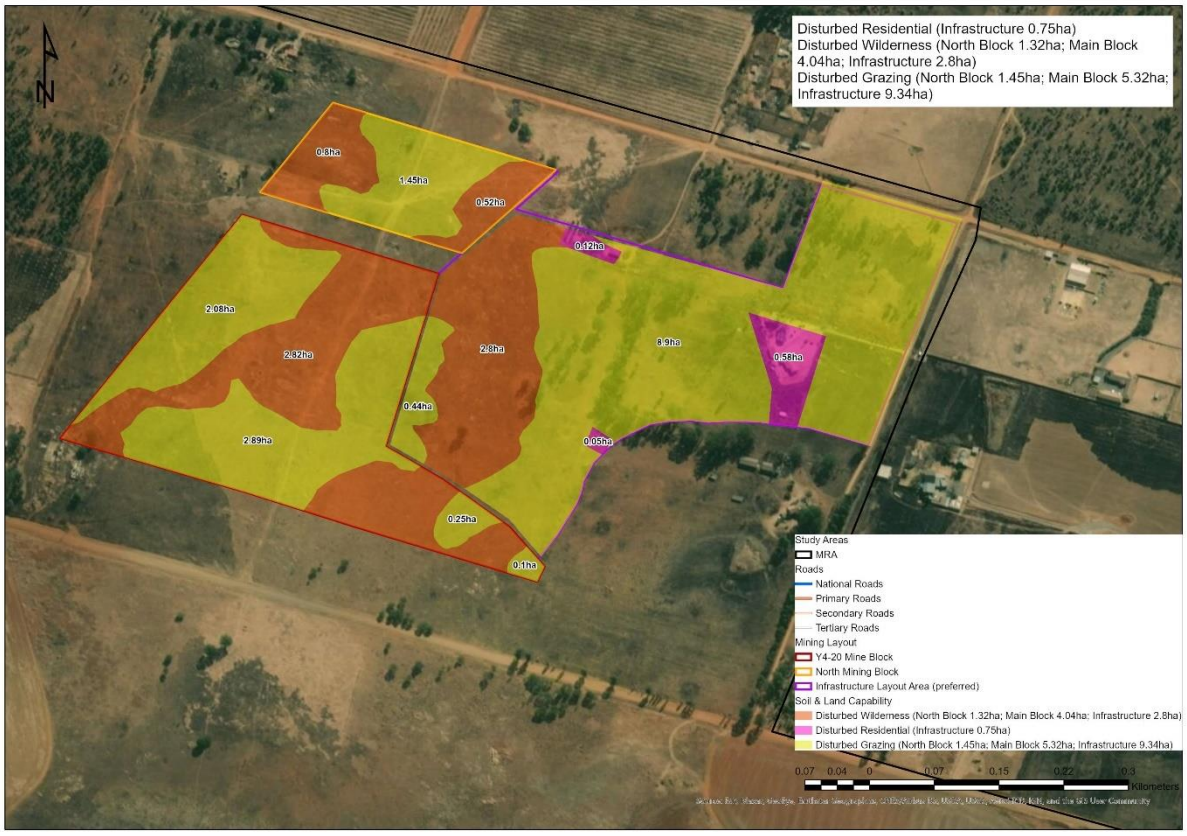


Figure 26: Pre-mining land use – preferred infrastructure layout option

5.4.2 Access Road from D1550 to Infrastructure Area

Two alternative access routes are available from the D1550 to the mine infrastructure area, as indicated on Figure 27.

The southern access road is a wide gravel road which will require minimum upgrading and from an economic perspective is thus the more viable option. However, the southern access road passes through the hillslope wetlands to the east of the MRA area, as well as between the southern depression and the northern artificial hillslope seep situated to the south of the infrastructure area.

The ecological impact assessment (backed up by landowners' comments) indicated that it is highly likely that *Pyxicephalus adspersus* (Giant Bullfrog) will occur within and around the non-cultivated areas of the large wetland in the southern portion of the MRA area and the hillslope wetlands to the north and east of this depression wetland. The wetland further south of this (outside of the MRA area) is further likely to also provide suitable habitat and *P. adspersus* will most likely move between the various wetlands (Scientific Aquatic Services (SAS), 2021).

The proposed mining activities will result in increased traffic frequency, which will inevitably result in a higher risk of *P. adspersus* mortality rates associated with vehicles. Thus, where possible, the roads between the large wetland systems should not be used for heavy traffic movement, particularly during peak breeding seasons or following events of high rainfall when bullfrogs emerge from aestivation.

Therefore, from a biodiversity perspective and the potential impact on the protected Giant Bullfrog, the southern access route is not considered viable, and the northern access route is thus put forward as the preferred option.

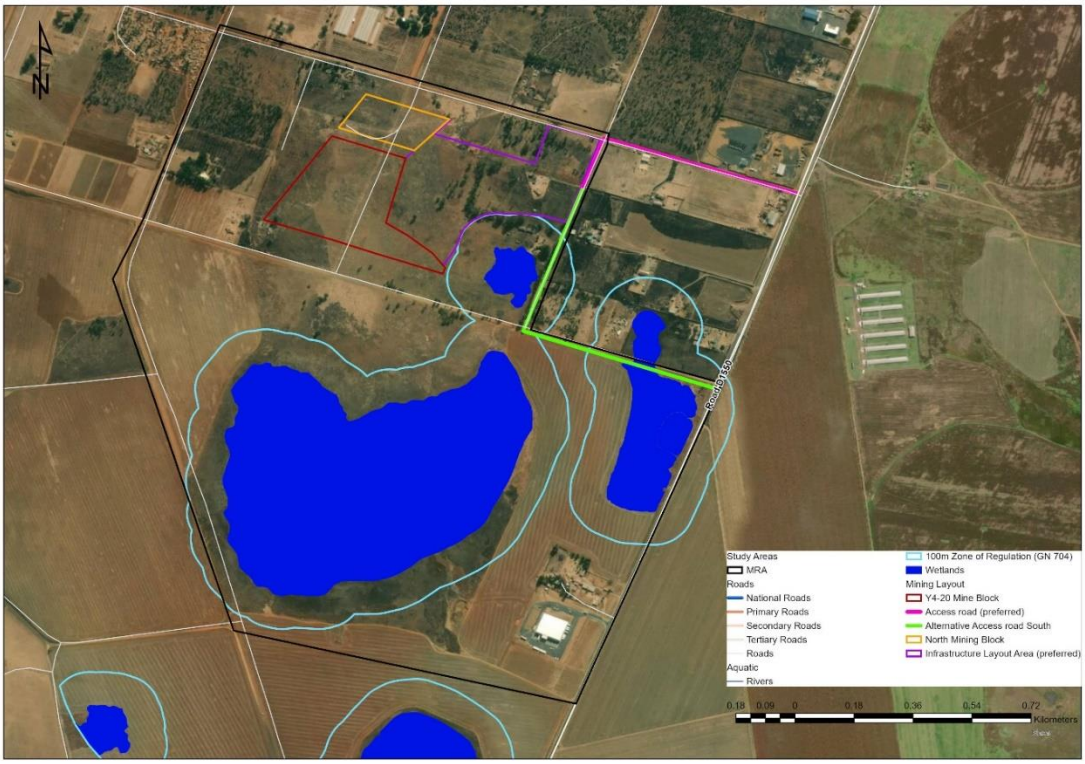


Figure 27: Alternative options for mine access

5.5 OPERATIONAL ALTERNATIVES

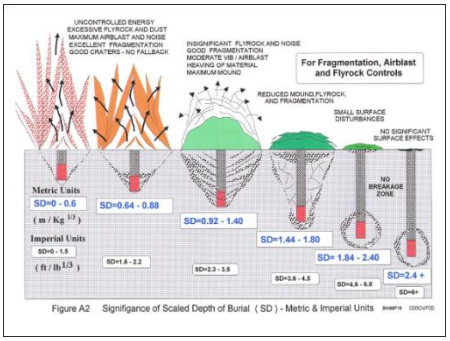
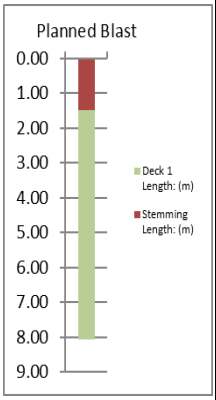
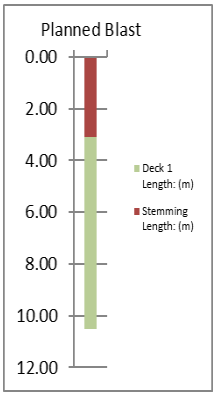
5.5.1 Blasting Methodology

Blast Management & Consulting (BM&C) conducted a blast impact assessment as part of the EIA process, based on a blast design provided by the applicant. It concluded that in view of the specific concerns regarding the project and the impacts identified for the original blast design, a reviewed blast design will be required. A proposed new design is suggested below which considers specific measures to address the possible impacts and provide outcomes that will be better suited for the project, i.e.:

- New blast design consideration with change blast hole diameter.
- Changed stemming lengths and material.
- Changed initiation systems with initiation sequence changes.
- Third party assessment on blast preparation to ensure control measures are in place.

Table 12: Recommended blast design for Rietkol Project (BM&C, 2021)

	Old Blast Design (Nhlabathi)	**Recommended Blast Design**	**Notes**
B/H Diameter (mm)	102	89	Smaller diameter
Explosive Type	Emulsion	Emulsion	
Explosive Description	Hef 100	Hef 100	
Explosive Density (1.0 - 1.25 g/cm^3)	1.12	1.12	
Burden (m)	2.5	2	Changed burden and spacing
Spacing (m)	2.5	2.3	
Pattern	Staggered	Staggered	
Min Depth (m)	7.5	10	Changed depth of blast holes, less blasting required. More volumes for same areas.
Maximum Depth (m)	7.5	10	
Average Depth (m)	8.07	10.50	
Stemming Length (m)	1.50	3.10	Stemming is crucial. The recommended is better for fly rock and air blast control. Original stemming length is much too short.
Stemming Material		Crushed aggregate	Crushed aggregate with size +6-13 to be used as stemming material.
Stemming: BH Diameter Ratio	14.0	34.0	Ratio required to have high level of control on fly rock
Explosives Per B/H (incl. Sub drill) (kg)	60.1	51.5	Smaller diameter blast hole reduces the charge mass per blast hole
P/F Blast hole (kg/m$^{3)}$	1.19	1.07	

	Old Blast Design (Nhlabathi)	Recommended Blast Design	Notes
Initiation systems to be used	Not defined	Electronic	Electronic initiators should be used. This allows for firing times of the blast holes so that a single hole firing can be achieved. Single blast hole firing will help management of the charge mass per delay and thus management of ground vibration.
SD = D/W1/3	1.1	1.8	Factor of ground-breaking calculated that relates to fly rock and air blast. Higher valuer signifies higher control on fly rock and air blast. See figure below for guideline.
Fly Rock Control	Not Good	Very Good	 Figure A2 Significance of Scaled Depth of Burial (SD) - Metric & Imperial Units
Clearance Calc - ISEE			
Clearance Distance (m)	526	105	Recommended minimum distance to be cleared. Final clearance distance will remain the responsibility of the blaster as the legal appointed person and the client / mine final standard operating procedure as submitted to DMRE. This does not alleviate the mine from other requirements as specified in the various applicable acts and regulations associated with mining operations.
			

It is noted that the recommended blast design was considered during the impact assessment provided in Section 7.4.4. The blast design should be reviewed and refined during the operational phase to ensure a final optimal design.

5.6 NO-GO OPTION

The main consequence of the No-Go Option is the loss of opportunity to develop a high-quality mineral resource with an estimated LOM of 20 years which has the potential for increased economic benefits on local, provincial, and national level in terms of employment and the contribution to the GDP – refer to Section 4 of this report for more detail on the economic benefits and employment opportunities associated with the Rietkol Project.

Furthermore, most of the silica is earmarked for the domestic market including the glass making industry. The glass making industry is a major contributor to the national GDP and provides further economic opportunities downstream of the mine and factories, including the bottling and container glass industries (wine, soda, and beer) as well as building and float glass industries.

Other socio-economic benefits that will be lost include the skills development opportunities, community development projects as proposed in the SLP and local procurement and SMME opportunities.

5.7 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

No alternatives site locations have been considered as mining can only be undertaken in areas where economically mineable resources occur. The relatively small size of the MRA area and occurrence of wetlands further limit the potential for alternative sites.

5.8 MOTIVATION FOR PREFERRED DEVELOPMENT ALTERNATIVES

Table 13: Motivation for preferred development alternatives

Aspect	Preferred Development Alternative	Motivation
Land use activity	Mining	Currently the economic activities within the MRA area are limited and the mine will be a definite economic improvement. Although the proposed mine could potentially impact negatively on the current land use activities in the surrounding area, the net result is a positive improvement in benefits for the area. The positive economic contribution to the Mpumalanga and Gauteng economies is an additional positive factor.
Mining methodology	Opencast mining	The silica resource is shallow, and mining will take place to a depth of 30 m with potential resource up to 50 mbs. Underground mining is not possible at these depths.
Mine residue disposal	In-pit disposal of tailings	In-pit disposal of tailings will allow full rehabilitation of the North Block, with a final land capability of grazing. No surface tailings facilities will be left on surface after mining is completed, which is positive in respect of

Aspect	Preferred Development Alternative	Motivation
		aesthetics (visual), groundwater and post-mining land use.
Surface infrastructure placement and layout	Revised, preferred alternative indicated in Figure 25	Reduction in footprint of approximately 1.6 ha. A buffer of 100m is maintained between new infrastructure and the wetland systems. Only 16 ha currently used as grazing will be destroyed vs the 17.4 ha of the original layout alternative.
Access Road	Northern access road to the north of AHs 276 & 277	Keep possible migratory routes open between the wetlands identified in the area, thereby reducing the potential risk to *Pyxicephalus adspersus* (protected Giant Bullfrog) due to the increase in heavy vehicle traffic.
Blasting	Recommended blast design (BM&C, 2021)	Reduces the safe blasting distance and evacuation zone from 526 m to 105 m. Blasting impact is restricted to MRA area, except for possible damage to nearest plastic tunnels (flowers). No safety risks envisaged with revised blast design.

The preferred mining and layout infrastructure footprint are indicated in Figure 28.

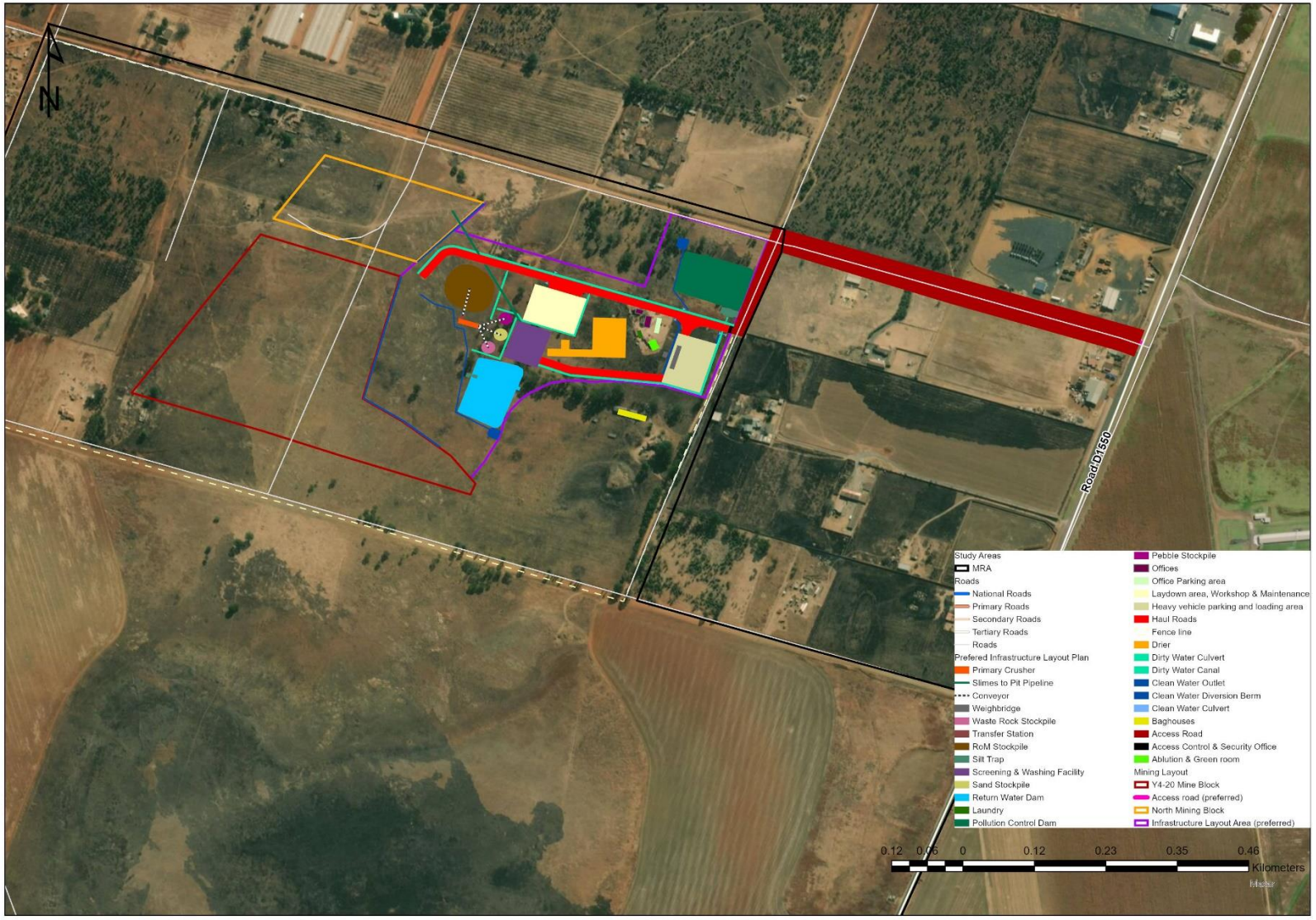


Figure 28: Preferred mining and layout infrastructure footprint (Masterplan)

6 ENVIRONMENTAL AND SOCIAL CONTEXT (BASELINE)

6.1 APPROACH TO EIA PROCESS

Several specialist studies were commissioned for the proposed Rietkol Project during 2016-2018 in support of the previous application, including:

- Soils, land use and capability, Hydropedology
- Terrestrial / Aquatic Biodiversity
- Groundwater
- Air Quality
- Ambient Noise
- Blasting & Vibration
- Traffic
- Heritage and Cultural Resources
- Palaeontology
- Visual and Aesthetics
- Social
- Hazard Identification and Risk Assessment (HIRA)
- Land Trade-off & Macro-Economic Analysis

6.1.1 EIA Screening Tool and Site Sensitivity Verification Statement

Several additional requirements when applying for Environmental Authorisation (EA) have emerged since the 2018 EIA process, including but not limited to:

1. Notice was given in Government Notice No. 960 (GN 960) dated 5 July 2019 of the requirement to submit a report generated by the National Web Based Environmental Screening Tool in terms of section 24(5)(h) of the NEMA and regulation 16(1)(b)(v) of the 2014 EIA Regulations. Such a Screening Report became compulsory when applying for an EA 90 days from publication of GN 960 (5 October 2019). The purpose of the Screening Report is to identify the list of specialist assessments that needs to be conducted in support of the EA application, based on the selected classification, and the environmental sensitivities of the proposed development footprint. The Screening Report for the Rietkol Project is attached as Appendix 24.
2. Government Notice No. 320 (GN 320) dated 20 March 2020 prescribes general requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum

report content requirements of environmental impacts for environmental themes for activities requiring EA in terms of sections 24(5)(a), (h) and 44 of NEMA. These procedures and requirements came into effect 50 days after publication of GN 320 (15 May 2020). The purpose of the site sensitivity verification is to verify (confirm or dispute) the current use of the land and the environmental sensitivity of the site under consideration as identified in the Screening Report. This will determine the level of assessment required for each environmental theme, i.e. Specialist Assessment or Compliance Statement.

As indicated above, several specialist studies were commissioned for the Rietkol Project during 2016-2018 in support of the previous application. Comprehensive specialist assessments were conducted for all the environmental and social themes listed above, irrespective of the sensitivity identified by the specialist assessment (2018) or the Screening Report. Therefore, no site sensitivity verification has been done for this EA application as all themes have been considered to have a **high to very high sensitivity**, requiring a full Specialist Assessment.

The list of specialist assessments listed in the Screening Report and the extent to which it has been addressed in the re-application for EA for the Rietkol Project is indicated Table 14. Where applicable, motivation is provided for the exclusion of certain specialist assessments.

Table 14: GN 960 specialist assessment requirements

GN 960 requirement (Appendix 24)	**Extent to which it has been addressed**
Agricultural Impact Assessment	Soil and Land Capability Assessment by Scientific Aquatic Services (Appendix 3).
Landscape/Visual Impact Assessment	Visual Impact Assessment by Scientific Aquatic Services (Appendix 13).
Archaeological and Cultural Heritage Impact Assessment	Phase 1 Heritage Impact Assessment by R&R Cultural Resource Consultants (Appendix 10).
Palaeontology Impact Assessment	Palaeontology Impact Assessment by ASG Geo Consultants {Dr Gideon Groenewald} (Appendix 11).
Terrestrial Biodiversity Impact Assessment	Faunal, Floral and Freshwater Assessment by Scientific Terrestrial Services (Appendix 5).
Aquatic Biodiversity Impact Assessment	Faunal, Floral and Freshwater Assessment by Scientific Terrestrial Services (Appendix 5).
Hydrology Assessment	Baseline Water Quality Assessment by Scientific Aquatic Services (Appendix 6). Surface Water Management Plan – Design Development Report by Onno Fortuin Consulting (Appendix 18).
Noise Impact Assessment	Environmental Noise Impact Assessment by Enviro Acoustic Research (Appendix 9).

GN 960 requirement (Appendix 24)	Extent to which it has been addressed
Radioactivity Impact Assessment	Waste Classification by Aquatico Scientific. Analysis included Uranium and Thorium to determine potential for radioactivity within the resource. (Section 5.2.2 of Geohydrological Assessment – Appendix 7)
Traffic Impact Assessment	Traffic Impact Assessment by Avzcons Civil Engineering Consultant (Appendix 14).
Geotechnical Assessment	Geotechnical Assessment undertaken by J D Geotechnical Services as part of the SWMP (Appendix 18).
Climate Impact Assessment	A greenhouse gas emissions statement was compiled by EBS Advisory (Appendix 21).
Health Impact Assessment	Hazard Identification and Risk Assessment by AirCheck Occupational Health, Environmental & Training Services (Appendix 16). Human Health Risk Assessment by Independent Consultant MA Oosthuizen (Appendix 23).
Socio-Economic Assessment	Social Impact Assessment by Diphororo Development (Appendix 15). Land Trade-off Study and Macro-Economic Impact Analysis by Mosaka Economic Consultants (Appendix 17).
Ambient Air Quality Impact Assessment	Air Quality Impact Assessment by EBS Advisory (Appendix 8).
Seismicity Assessment	A Blasting Impact Assessment is included and has been conducted by Blast Management Consulting. It deals extensively with the potential impact in respect of air blast and vibration from blasting operations (Appendix 12).
Plant Species Assessment	Part of Terrestrial Biodiversity Impact Assessment.
Animal Species Assessment	Part of Terrestrial Biodiversity Impact Assessment.

Further studies that are not included in the GN 960 requirements, but were commissioned for the proposed Rietkol Project, are:

- Hydropedological Assessment and Impact Modelling by Scientific Aquatic Services (Appendix 4).
- Geohydrological Investigation by Groundwater Complete (Appendix 7).
- Blasting Impact Assessment by Blast Management Consulting (Appendix 12).
- Rehabilitation, Decommissioning and Closure Plan by Jacana Environmentals (Appendix 19).
- Poultry Impact Statement by C4 Africa (Appendix 22). This work was commissioned in response to comments made by the IAPs on the DSR.

Where a specific environmental theme protocol has been prescribed by GN 320, the specialist assessments adhere to such protocol. Where no protocol has been prescribed, the specialist assessments comply with Appendix 6 of the EIA Regulations.

6.1.2 Plan of Study (Specialist Studies)

This re-application comes some 3 years after the previous specialist fieldwork was conducted. The environmental context in the area has not changed significantly, nor has the mining and infrastructure footprint been altered from the 2018 application. The findings of the specialist reports are therefore considered valid for this re-application and limited additional specialist work was proposed in the Plan of Study for this re-application.

The following additional specialist work was conducted to confirm the baseline environmental context, based on further desk-top and fieldwork investigations during March-July 2021:

- Revision of sensitive receptors map and landownership.
- Update of community surveys and social baseline information.
- Additional baseline fauna and flora fieldwork to confirm the existing baseline information.
- Further baseline fieldwork and water quality sampling to confirm the Present Ecological State (PES) of the wetlands.
- Update of the groundwater numerical model (pollution plume) and impact assessment based on the preferred layout for the project.
- Classification of waste material to confirm waste properties at Rietkol.
- Additional round of baseline noise monitoring.
- Additional round of baseline air quality monitoring and re-run of the dispersion model.
- Addressing the comments received from SAHRA during the previous EIA process and liaise with the Mpumalanga Heritage Authority in this regard.
- Update of the macro-economic impact analysis and cost benefit analysis with more recent prices and adapted costs, and remodelled.
- Consultation with SANRAL and Mpumalanga Roads & Transport to confirm the proposed upgrading of the roads.
- Update of the GN1147 Rehabilitation, Decommissioning and Closure Plan in respect of comments received from the IAPs and authorities and the financial provision revised.
- Commissioning of the Human Health Risk Assessment (Medical Research Study).

The other specialist impact assessments were only reviewed considering the IAP comments received during the Scoping Phase to ensure that all relevant issues are addressed satisfactorily. No further impact modelling was however be conducted apart from that listed above.

The Plan of Study presented in the final Scoping Report was approved by the DMRE on 11 August 2021, based on the above approach. The specialist reports have addressed the baseline environment

in detail and are attached as appendices. The following section is a summary of the specialist baseline work and relevant important environmental attributes associated with the mining site.

6.2 CONSERVATION CHARACTERISTICS

The Mpumalanga Biodiversity Sector Plan (MBSP, 2014) indicates that the MRA area is dominated by natural areas, with some occurrence of moderately and heavily modified areas, as presented in Figure 29. No protected areas are in close vicinity to the project.

According to the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database several wetlands occur in the area, including a natural depression wetland situated within the southern portion of the MRA area, with a second natural depression situated ± 30m to the south. Both features are considered to be in a moderately modified (Class C) ecological condition. These wetlands have been included in the MBSP aquatic dataset as Ecological Support Area (ESA) wetlands.

According to the NFEPA database there are no rivers located within the MRA area or the immediate vicinity (within 500m). The Koffiespruit River is situated ± 2.5 km northwest of the MRA area.

According to the Mining and Biodiversity Guidelines (2013) most of the central portion and various other smaller portions of the MRA area are of Moderate Biodiversity Importance. Only a small section within the south-western corner of the MRA area (associated with the depression wetland) is of Highest Biodiversity Importance.

According to the National Biodiversity Assessment (NBA, 2011), no formally or informally Protected Areas are located in the vicinity of the MRA area, while the South African Protected Areas Database (SAPAD, 2020) indicates provincial and local nature reserves to be present in the larger region. These include the National Protected Areas Expansion Strategy (NPAES) formally protected Bronkhorstspruit Municipal Nature Reserve (approximately 24 km north of the MRA area) and the Marievale Bird Sanctuary Provincial Nature Reserve (23 km southeast of the MRA area), while the South African Conservation Areas Database (SACAD, 2020) indicates the Blesbokspruit, located approximately 16 km southwest of the MRA area, as a conservation area.

The MRA area is not located within 10 km of an Important Bird Area (IBA). The Devon Grassland IBA is situated ± 11 km southwest of the MRA area.

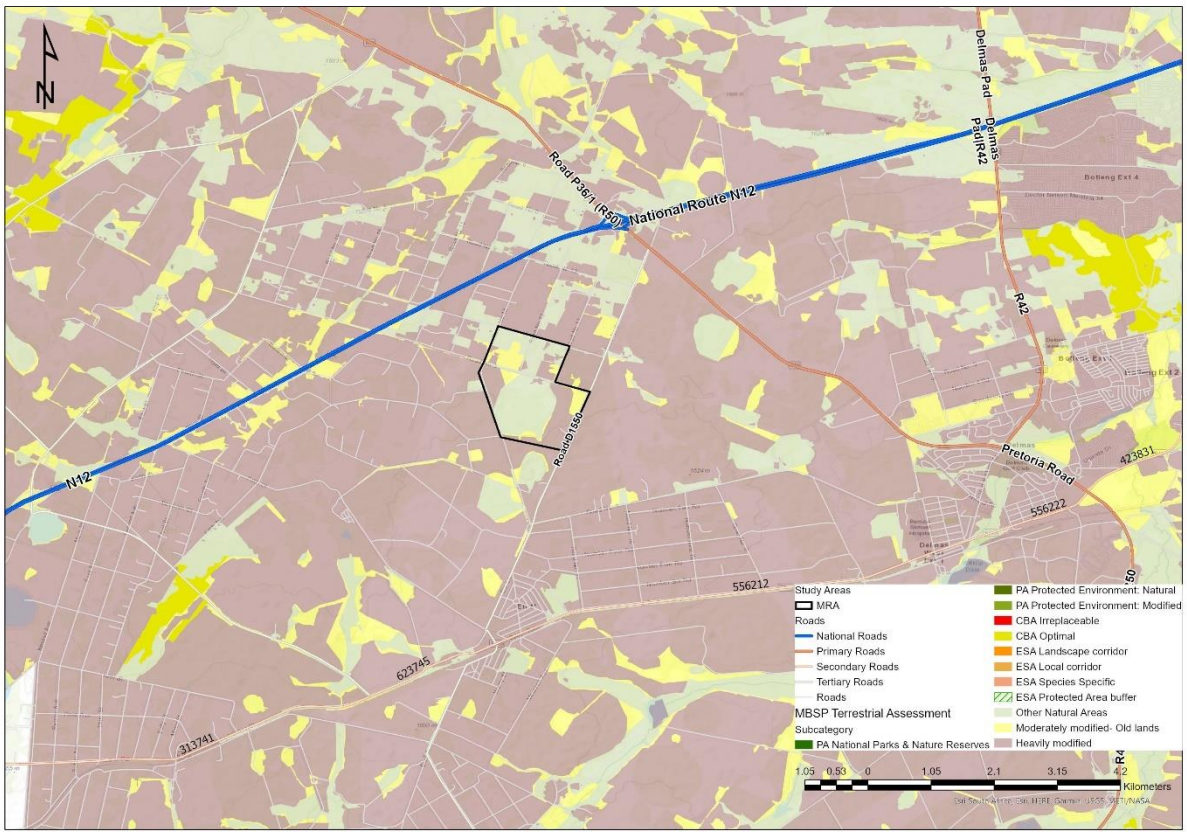


Figure 29: Mpumalanga Biodiversity Sector Plan classification

6.3 BIOPHYSICAL ENVIRONMENT

6.3.1 Topography and Landscape Character

The topography of the larger area can be described as gently undulating with surface elevations varying from approximately 1 450 to 1 670 meters above mean sea level (mamsl). The highest surface elevations occur to the south and south-west and decrease towards the north-east in the flow direction of the Koffiespruit. The lower-lying Koffiespruit River is situated approximately 2.5 km north-west of the MRA area and the proposed project area slopes somewhat in this direction.

The topography associated with the MRA area is mostly level, with some undulations present. No prominent topographical features are present within the MRA area, although some low rocky outcrops are present towards the centre. The lower-lying portion of the MRA area in the south is however characterised by a pan wetland feature.

General views of the landscape associated with the MRA area and surrounds are indicated below.

Figure 30: General views of the MRA area and the surrounding region

The landscape associated with the MRA area, and its immediate surroundings exhibit a common, discernible pattern, is considered to have broadly similar landforms, vegetation, and settlement configurations, and thus comprise a single landscape character type. This landscape character type can be described as rural, undulating open grasslands, intersperses with cultivated fields, alien tree stands and low-density development.

Due to the nature of the project and its location within an area currently unaffected by significant mining activity, the proposed project will lead to a moderate level of visual intrusion on the landscape and is expected to be clearly noticeable in relation to its surroundings. The undulating landscape, the overall limited height of the proposed surface infrastructure and the inherent Visual Absorption Capacity (VAC) of the MRA area, will however serve to somewhat limit such intrusion from certain receptor sites. In addition, the MRA area is somewhat screened by existing vegetation and infrastructure, and existing light industrial activities are present in the region.

Figure 31: Landscape character of the MRA area, indicating grassland, alien tree clumps and low-density development

The landscape character type is not unique to the MRA area and can also be found within the larger region. The sense of place associated with the MRA area is therefore not highly significant when compared to its surroundings, but the rocky outcrops towards the centre of the MRA area and local landscape diversity in combination with the calm nature of the site, do provide some visual interest.

As a result of seasonal climate variations, the appearance and perception of the landscape within and surrounding the MRA area changes with the seasons. The MRA area and its surroundings are expected to appear muted during the winter months, while it appears more vibrant and greener during the summer months. Seasonal variation may have an effect on the area from where project components would potentially be visible, with visibility of the proposed project expected to be higher during the winter months when seasonal screening effects such as vegetation density and relative cover is lower.

6.3.2 Soils and Land Capability

The dominant soil types in the MRA area include Hutton (Hu), Clovelly (Cv), Mispah/Glenrosa/Dresden (Ms/Gs/Dr), Pinedene (Pn) and Fernwood (Fw) soil forms. The MRA area is dominated by Hutton and Clovelly soil forms, which collectively constitute approximately 92.5 ha, amounting to 41.8% of the MRA area. Rocky outcrops constitute approximately 31.2 ha, equating to 14.1%, whilst the shallow Mispah/Glenrosa/Dresden soil forms occupy approximately 15.1 ha, which amounts to 6.8% of the

MRA. The remainder of the study area is occupied by wetland soil types including Pinedene, Fernwood, and Avalon soil forms. Sandstone outcrops were observed where the bedrock is exposed on the ground surface around the crest (hilltop) landscape position. This is indicative of intense erosion likely attributed to historic land uses, particularly overgrazing. Abandoned buildings and other residual concrete structures from historic infrastructure were also observed. Such area and other existing buildings were classified as Witbank (anthrosols) (man-made soil deposit) and delineated as equivalent to the observed rocky outcrop areas.

Table 15 summarises the total area for each soil form as well as their associated percentage areal extent. The soil forms and associated land capability is presented in Figure 32.

The land capability for the MRA area is classified as a mixture of arable, grazing, wetlands, and wilderness (rocky outcrops). According to the 1993 grazing capacity index, the grazing capacity is 3 ha/LSU; however, the veld has been transformed due to overgrazing and other historic anthropogenic activities and can be best described as a transformed rangeland. Other limitations include rocky outcrops (low productivity Mispah soils) which are not suitable for any cultivated agricultural related activities. As such, livestock commercial farming is not considered ideal for this area and a grazing capacity of 3 ha/LSU is unlikely to be achieved across most of the proposed extent of the mining footprint (SAS, 2021).

Table 15: Soil forms identified within the MRA area

Soil Form	Total Area (Ha)	% Areal Extent
Hutton/Clovelly	92.5	41.8
Rocky Outcrop	31.2	14.1
Westleigh/Avalon	20.5	9.3
Mispah/Glenrosa/Dresden	15.1	6.8
Witbank (Anthrosols)	3.7	1.7
Pinedene	1.4	0.6
Wetland (Katspruit)	50.8	23
Residential Properties	6.0	2.7
Total Area	221.2	100

Current land use activities within the MRA area (Figure 33) include livestock grazing and cultivated agriculture (i.e. maize and orchards). Notably, the wetlands occupy a fairly large portion of the MRA area. The MRA area in its present state has not been impacted by mining and industrial activities and therefore the proposed mining activities will lead to a noticeable change in land use in the area. Light industrial activities are however common in the immediate vicinity of the MRA area and a few smaller mining operations are situated within 5 km of the MRA boundary.

Several dominant land uses have been identified in the vicinity of the MRA area, namely:

- Agricultural, in the form of cultivated lands;
- Commercial and industrial structures;
- Arable land for grazing and open veld;
- Livestock farming;
- Cultivated orchards;
- Flower and vegetable tunnels;
- Residential, which includes low-density residential dwellings associated with individual farms;
- Several main roads in the vicinity of the MRA area, including the N12, R50, D1550, R555; and
- Numerous local gravel roads, one road forming the northern boundary and the other forming the southern border of the MRA area.

Figure 32: Soil form and land capability map

Figure 33: Existing land use map

6.3.3 Biodiversity

6.3.3.1 Habitat units

The habitat associated with the MRA area is mostly of low to intermediate sensitivity, with only the wetland habitat unit being of a higher sensitivity rating (SAS, 2021). Much of the MRA area has been disturbed through agricultural activities because of crop farming and to a lesser extent grazing of cattle, with remnant patches of natural, undisturbed grassland present, including rocky outcrop areas, which are also utilised as grazing for livestock. Stands of alien trees are mainly present in the vicinity of homesteads and vegetation of low height in the form of grassland dominates the vegetation. The occurrence of bare and exposed soils is limited.

Four habitat units were identified. These habitat units are:

- Three wetland systems located within the MRA area;
- Rocky Grassland located predominantly in the central portion of the MRA area, running from north to south. This habitat unit is of a higher elevation than the surrounding areas;

- Disturbed areas associated with overgrazed pastures and old lands where ecological succession processes have commenced; and
- Agricultural areas where the vegetation has been completely transformed by current crop cultivation activities.

6.3.3.2 Vegetation cover

The majority of the MRA area is situated within the Grassland Biome, the Mesic Highveld Grassland Bioregion and falls within the Eastern Highveld Grassland vegetation type. The depression wetland falls within the Azonal Vegetation Biome, within the Freshwater Wetlands Bioregion, within the Eastern Temperate Freshwater Wetlands vegetation type.

Several floral SCC which are listed under Schedule 11 of the MNCA (1998), namely *Hypoxis hemerocallidea, Gladiolus vinosomaculatus, Gladiolus permeabilis, Gladiolus crassifolius, Habenaria galpinii* and *Crinum graminicola,* were encountered within the MRA area. Two other floral SCC listed by the SANBI PRECIS Red Data List for the MRA area (*Crinum bulbispermum* and *Kniphofia typhoides*) were not encountered, however it is likely that they may occur within the wetland habitat unit. If individuals or communities of these species will be disturbed by mining activities, they must be relocated to suitable, similar habitat in close proximity to where they were removed from, but outside the disturbance footprint after obtaining the relevant permits from the Mpumalanga Tourism and Parks Agency (MTPA).

The MTPA also raised concern regarding the critically endangered orchid species *Brachycorythis conica subsp. transvaalensis,* which has previously been recorded in nearby areas. However, this orchid species was not observed within the MRA area.

A moderately low diversity of medicinal species is present, most of which are common and widespread, including star flower, wild geranium, and wild scabious. The proposed activities are not likely to pose a significant threat to medicinal species locally and regionally.

In total, 19 Alien and Invasive Plant (AIP) species were recorded within the study area. Of these 19 species, seven are listed as NEMBA Category 1b, one is listed as NEMBA Category 2, one is listed as NEMBA Category 3 and the remaining 10 species are not listed. Although a large majority of the species are not listed as per NEMBA, these species are considered to be problem plants (i.e. any plant, shrub or tree which has a negative environmental impact in a particular locality and result in the subsequent loss of biodiversity, and (potential) excessive water consumption although not listed under NEMBA) and pose a significant threat to the biodiversity and ecosystem functionality of the area.

A relatively low diversity of alien species occurs within the MRA area. The presence of *Campuloclinium macrophalum* (Pompom weed) is however of great concern, as this species is known to spread rapidly and is hard to control once it is formally established. Due to the extent of AIPs within the study area, as well as the proximity to wetlands, it is highly recommended that an Alien and Invasive Eradication Plan be set up and implemented to ensure further loss of indigenous floral communities do not occur.

6.3.3.3 Faunal environment

Historical evidence of mammal activity (burrows) was observed within both the Disturbed Grassland and the edges of the Rocky Grassland habitat units, however active hunting by the local communities as well as anthropogenic activities have resulted in a large loss of these species.

The faunal habitat associated with the MRA area is mostly of intermediate sensitivity, with the exception being that of the Wetland Habitat, which is considered to be moderately high. The MRA area has been disturbed as a result of anthropogenic activities, notably relating to agriculture (crops), grazing activities and unsuitable veld management.

The MRA area provides habitat to several common faunal species, whilst the wetland area was noted to provide habitat to an increased number of species with a higher level of diversity. The wetland habitat and adjacent grasslands are considered important in terms of Species of Conservational Concern (SCC), namely *Pyxicephalus adspersus* (Giant Bullfrog), Metisella *meninx* (Marsh Sylph), *Geronticus calvus* (Bald Ibis), *Sagittarius serpentarius* (Secretarybird), *Tyto capensis* (African Grass Owl) and *Phoenicopterus ruber* (Greater Flamingo). *Pyxicephalus adspersus* (Giant Bullfrog) is known to utilise the wetlands within the MRA area, and it is important that the wetland habitat and potential movement corridors between the wetlands are maintained as far as possible.

P. adspersus (Giant Bullfrog) is under threat as a result of habitat loss, namely wetlands and moist grassland. Further, in some areas of distribution *P. adspersus* is utilised as a food source, however this utilisation is not sustainable. Additionally, *P. adspersus* is at risk of vehicle related mortalities during the breeding seasons and following heavy rains, when individuals move between the wetlands in search of breeding partners and suitable breeding habitat. Likewise, *Metisella meninx* (Marsh Sylph) is known to breed and inhabit the wetland systems within Mpumalanga. This species largest threat is that of the loss and degradation of wetland ecosystems in the region. Although no individuals were found, it remains a possibility that this species may still occur within the MRA area. *Geronticus calvus* (Bald Ibis) is being faced with similar threats of natural habitat loss, however grazing activities that create short grasslands have proven to be favourable to this species. Although the MRA area provides no suitable breeding sites for *G. calvus*, it is considered suitable for foraging purposes. *Sagittarius*

serpentarius, *Tyto capensis* and *Phoenicopterus ruber* are likely to occur within the MRA area, but will be localised around the southern pan systems, away from areas of increased anthropogenic activities. Additionally, these areas provide the most favourable habitat for these species, including potential breeding habitats. These avifaunal species are unlikely to venture into nor use the northern sections of the MRA area due to unfavourable habitat and insufficient food resources.

6.3.3.4 Ecological sensitivity mapping

Figure 34 conceptually illustrates the areas considered to be of increased ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for floral and faunal SCC, habitat intactness and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. Table 16 presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Table 16: A summary of sensitivity of each habitat unit and implications for development

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Rocky Grassland	Intermediate	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Mining activities in this area are unlikely to have a significant impact on the receiving environment, faunal species will be impacted upon due to loss of foraging area. Floral SCC rescue and relocation programmes will have to be implemented prior to any activity within this habitat unit.
Disturbed Grassland	Intermediate (Fauna) to Moderately Low (Flora)	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Mining activities in this area are unlikely to have a significant impact on the receiving environment, faunal species will be impacted upon due to loss of foraging area. Floral SCC rescue and relocation programmes will have to be implemented prior to any activity within this habitat unit.
Wetlands	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance, no-go alternative must be considered.	Any disturbance or new development in this habitat unit is discouraged and may lead to denied environmental authorisation by authorities.
Agricultural Fields	Low	Optimise development potential.	Although mining development in this area is unlikely to have a significant impact on the receiving environment, care must be taken to limit edge effects on the surrounding natural areas.

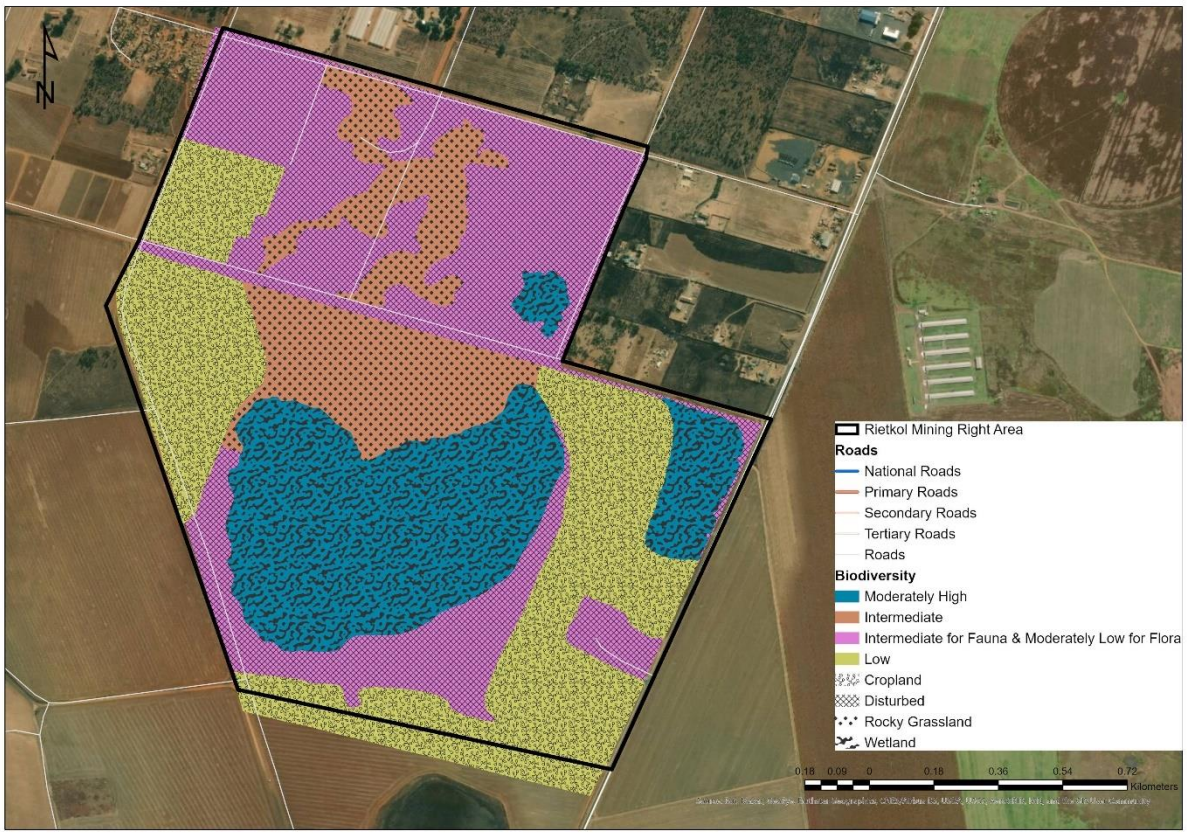


Figure 34: Ecological sensitivity map

6.3.4 Surface Water

The MRA area is located within the B20B quaternary catchment, which covers an area of approximately 323 km^2. A prominent watercourse, namely the Koffiespruit, is located ± 2.5 km west of the Rietkol MRA area and within the same catchment. The Bronkhorstspruit is located approximately 9 km east of the MRA area, but in a neighbouring catchment (B20A). No streams or watercourses transect the MRA area.

Surface elevations and watercourses for the Rietkol Project area are indicated in Figure 35.

The NFEPA database (2011) and Present Ecological State/Ecological Importance and Sensitivity (PES/EIS) database, developed by the Department of Water and Sanitation (DWS), were utilised to obtain additional background information on the Rietkol Project area. The information therein is summarised in Table 17.

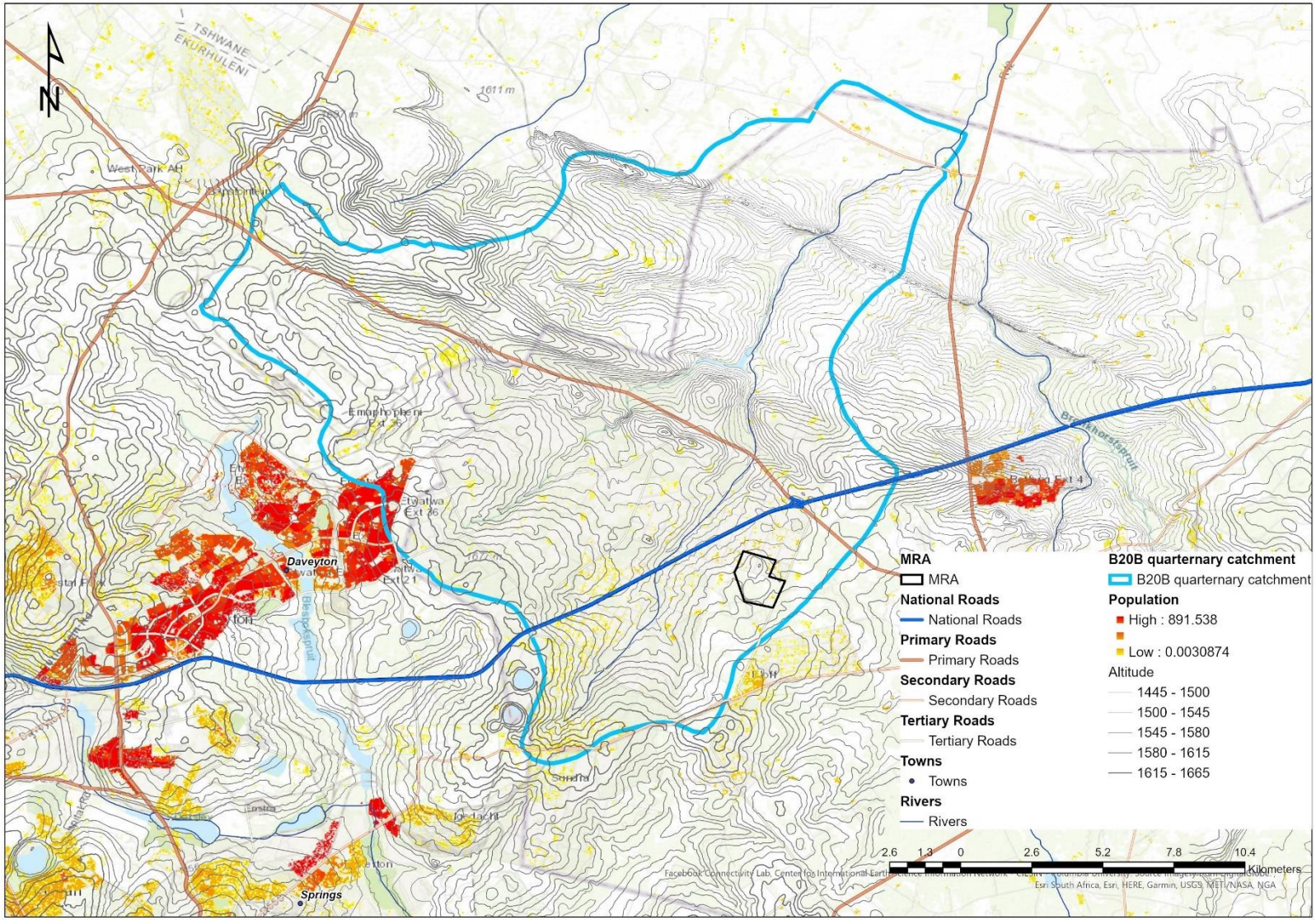


Figure 35: Watercourses associated with quaternary catchment B20B

Table 17: Summary of desktop information pertaining to the proposed Rietkol Project

Ecoregion	**Highveld**
Catchment	Olifants North
Water Management Area (WMA)	Olifants
SubWMA	Upper Olifants
Quaternary Catchment	B20B
Most proximal sub-quaternary reach	B20B-01285
Proximity	2.5 km north-west of Rietkol MRA area
Sub-quaternary reach name	Koffiespruit
Expert PES assessment	Y
PES category median	D (Largely Modified)
Mean Ecological Importance Class	Moderate
Mean Ecological Sensitivity Class	Moderate
Stream Order	1
Default Ecological Class	C (Moderately Modified)

Additionally, the NFEPA database identified the following in respect of the proposed Rietkol MRA area:

- Not an important FEPA;
- Not important in terms of cranes, frogs or water birds;
- The MRA area is located within a subWMA currently not considered important in terms of fish species or freshwater resource conservation;
- The NFEPA database identified the natural depression to the south as a natural feature that is in a moderately modified condition; and
- The Koffiespruit was identified as an NFEPA River, however it is located 2.5 km north-west of the proposed Rietkol MRA area.

The Koffiespruit is regarded as a perennial river; however, in its upper reaches and directly west of the Rietkol MRA area this is not the case, and it is therefore not believed to receive any significant baseflow. The Koffiespruit is thus not considered to be an important receptor of contamination that may potentially originate from the MRA area. Furthermore, the mineral to be mined is silica, a chemically inert mineral, that is hosted within a very clean (inert) quartzite. Both the resource mineral and host rock are inert, meaning that any seepage that may potentially originate from the MRA area is expected to be of good quality.

6.3.4.1 Wetlands

Three hydrogeomorphic (HGM) units were identified within the proposed MRA area, classified as a depression (pan) and two hillslope seep wetlands. In addition, a wetland flat and another depression wetland was identified within the investigation area of the proposed MRA (500m radius).

The identified wetlands were classified as Inland systems falling within the Highveld Ecoregion and within the Mesic Highveld Grassland Group 4 wetland vegetation group.

Table 18: SANBI wetland classification of the identified wetlands in the vicinity of the MRA area

Level 1: System	Level 2: Regional setting	Level 3: Landscape unit	Level 4: HGM unit
Inland: An ecosystem that has no existing connection to the ocean, but which is inundated or saturated with water, either permanently or periodically.	Ecoregion: Highveld Ecoregion NFEPA WetVeg Group: Mesic Highveld Grassland Group 4	Plain: An extensive area of low relief, characterised by relatively level, gently undulating or uniformly sloping; with a very gentle (typically ≤ 1%) slope gradient.	Hillslope Seeps: A wetland area located on gently to steep sloping land and dominated by colluvial unidirectional movement of water and material downslope.
		Valley Floor: The typically gently sloping, lowest surface of a valley.	Depression: A wetland system with closed or near-closed elevation contours.

These wetlands have been considerably modified by anthropogenic activities and have an intermediate to moderately low level of ecoservice provision with relatively good (natural) water quality. The wetlands and the associated buffer zones are indicated in Figure 36.

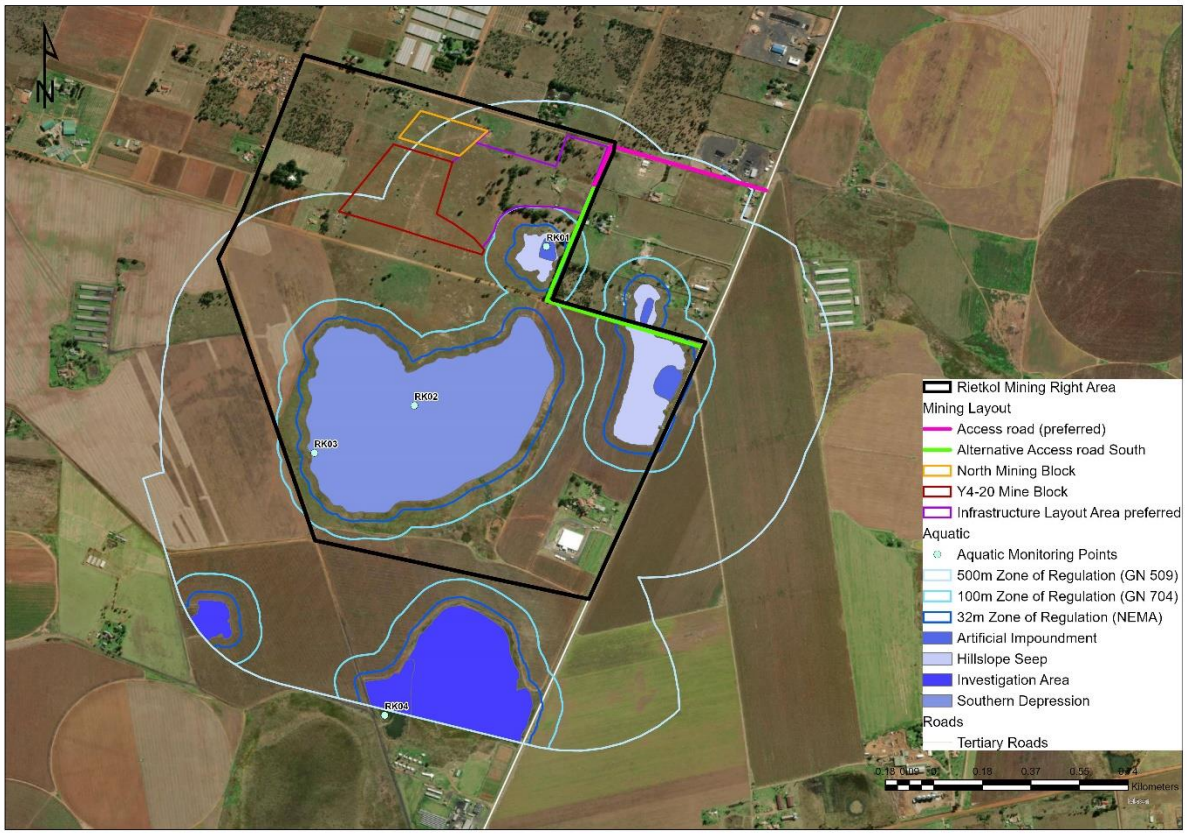


Figure 36: Wetland delineation and buffer zones

The wetland habitat was observed to be modified in the seep wetlands with extensive modifications including artificial impounding of these features to enhance water collection for livestock and/or aesthetic purposes observed. The pan wetland (Pan 1) located within the southern portion of the MRA area was observed to be fairly intact, with moderate edge-effect modifications attributed to the adjacent cultivation activities and impounding on the western portion of the wetland.

Various land transformations have occurred throughout the MRA area and the surrounding landscape, resulting in large alterations to the hydrological regime of some of the identified wetlands. Seep wetland 2 has been impounded throughout its extent (farm dams and an on-site impoundment within the wetland) which has altered the natural flow regime, pattern, and timing of water within the wetland. This has been exacerbated by infrastructure developments on the farm portions situated north of seep wetland 2, in which excavation activities to facilitate laydown of infrastructure have further altered flow regime, soil profiles and associated soil infiltration rates.

As a result, soil identified was noted to be anthropogenically derived in various areas (anthrosols). Whilst it was noted that these anthrosols displayed some degree of saturation, indicators distinctly indicative of a fluctuating water table (such as mottles and gleying) could not be accurately discerned. As a result, it was the specialist opinion that the farm portions adjacent to the study area contained relic patches of wetland which have been severely altered due to the fragmentation and landscape transformation that has occurred. These remnant patches, although displaying some attributes associated with wetlands, did not constitute wetland habitat as defined in the NWA (1998) and as such, were not included as part of the delineation or further assessment.

The hillslope seep wetlands are hydrologically isolated and not connected to other surface water resources, as inferred from the local micro-topography. The hillslope seeps within the MRA area are recharged by surface water from seasonal rainfall as well as subsurface flows (SAS, 2021). According to the hydrocensus report, the ground water levels around the MRA area varies between ±10 and 100 mbs (Groundwater Complete, 2021). Therefore, the groundwater is not anticipated to have a significant direct interaction with the surface and shallow sub-surface hydrogeological processes. Surface water was observed at the time of assessment, and the hydrological regime seems to be significantly enhanced by the impoundment features within the wetlands. The ecological integrity of the wetlands is largely modified with marginal EIS, as it is associated with artificial impoundments due to historic excavation. As such, it is recommended that these wetlands be managed as a class D (largely modified) Recommended Ecological Class (REC) to avoid further deterioration of these wetlands from its PES.

The depression (pan) is hydrologically isolated from other surface water resources, as inferred from the local micro-topography in its vicinity. This pan is recharged by surface water from seasonal rainfall as well as subsurface flow (SAS, 2021). Groundwater is not anticipated to have a direct significant interaction with the surface and shallow sub-surface hydrogeological processes which drive this pan (SAS, 2021). The surrounding agricultural activities is up to the edge of this pan and have already reduced the catchment yield that enters the pan. Nevertheless, the pan is sustained by hydropedological interflow (subsurface water within the vadose zone of the pan). The ecological integrity of this wetland is moderately modified due to surrounding agricultural activities. The Category C REC management class is recommended to enhance the PES and avoid further degradation.

Table 19: Summary of the results of the assessments applied to the wetlands

Freshwater ecosystem	PES	Ecoservices	EIS	REC/RMO/BAS
Seep wetland 1	D (Largely modified)	Intermediate	Low/Marginal	D/Maintain/D
Seep wetland 2	D (Largely modified)	Moderately low	Low/Marginal	D/Maintain/D
Pan 1	C (Moderately modified)	Intermediate	Moderate	C/Maintain/C

PES: Present Ecological State; EIS: Ecological Importance and Sensitivity; REC: Recommended Ecological Category; RMO: Resource Management Objective; BAS: Best Attainable State

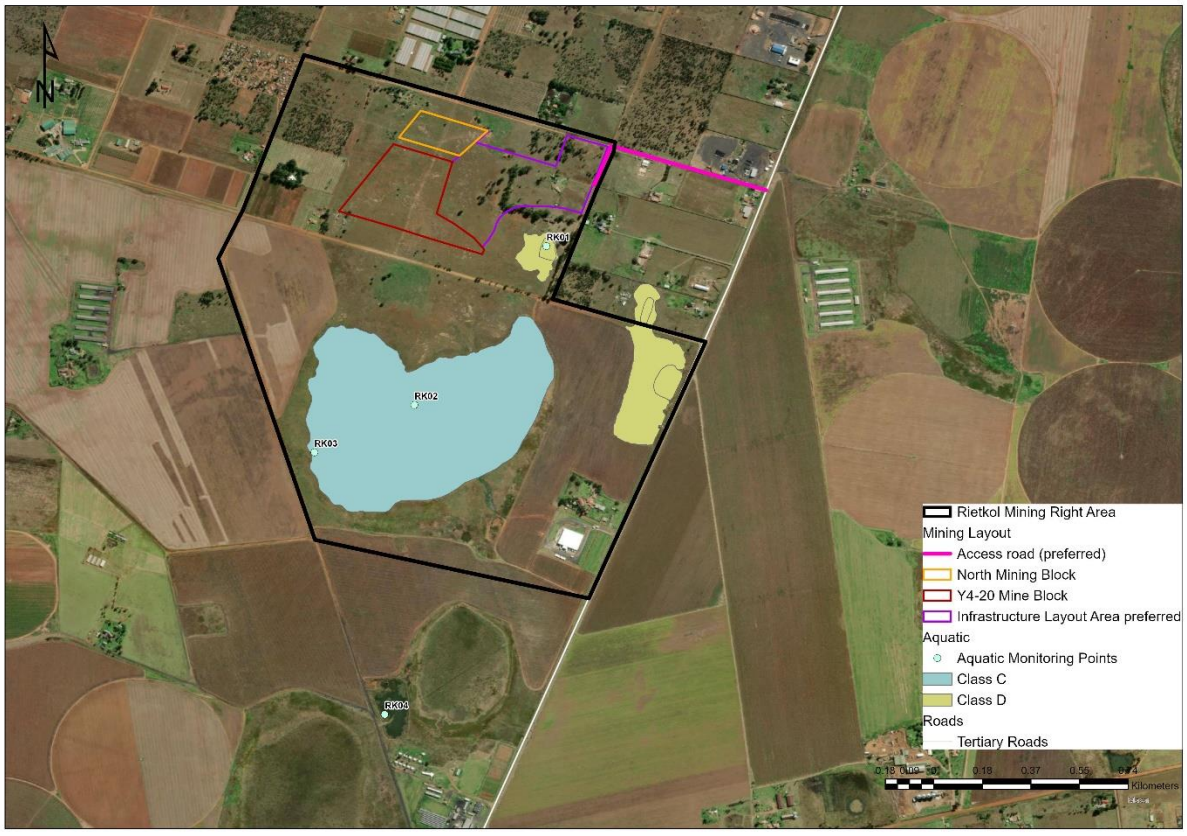


Figure 37: Wetland PES categories

The proposed mining and related activities are not anticipated to hinder water infiltration or distribution across the wetland system (during all phases) due to the proposed project being located on soil resources not considered flow drivers of the wetlands except for their contribution to overland flow. It must be noted that the surface runoff from the responsive (shallow) soils located north of the road does not contribute to either the pan or hillslope seep to the north of the road. This is due to the catchment as well as hydropedological disconnect created by the road as well as the landscape setting which slope towards the east of the MRA area. The surface runoff from these soils rather flows towards the recharge soils (i.e., Hutton/Clovelly) which then infiltrates (if the soil is not under full saturation) and contributes to groundwater regime of the local area. Therefore, the project is not anticipated to impact on the wetland flow drivers. Loss of surface runoff is unavoidable, however, the hydropedological flow paths will not be significantly altered, particularly if mitigation measures are carefully implemented, particularly during all phases (SAS, 2021).

Following the quantification of percentage losses using the QSWAT+ model (Hydropedological Assessment: Appendix 4), it was concluded that the major losses at a finer scale [Hydropedological Response Unit (HRU)] are through evapotranspiration. At this scale the impact on the profile available water is decreased to -6%. From a hydropedological point of view, this will not lead to a change in the functionality and PES/EIS status of the affected wetlands.

A scientifically derived buffer was developed to ensure that appropriate consideration of the hydropedological drivers in the study area is given. The buffer was developed to minimise impact in line with the mitigation hierarchy, although no significant impact would occur if slight encroachment on the buffer was to occur.

All the important hydropedological aspects were considered, including considering the ecology of the area where hydropedological drivers were considered less significant, and the following criteria was used to determine the buffer:

- The pan wetland was protected at a catchment level to ensure that the all the runoff reports to the pan wetland. Where the catchment boundary was less than 100m; the 100m zone of regulation took precedence as a minimum to avoid edge effects as well as dust (to a degree). Thus, a 100m buffer was deemed sufficient to allow for overland flow to feed the pan wetland feature; and
- The remaining seep wetlands were afforded the minimum buffer size of 100m to avoid edge effects as well as dust (to a degree) on wetland plants due to their small catchment size as well as in the absence of hydropedologically important soils.

6.3.4.2 Surface water quality

Four surface water (aquatic) resources were assessed in respect of water quality, namely:

- An artificial impoundment associated within the western hillslope seep wetland (RK01);
- A natural depression wetland (RK02) and associated artificial impoundment (RK03) within the MRA area; and
- A depression wetland situated to the south of the MRA area which has an open water body associated with it (RK04) and is dammed because of road crossings.

Refer to Figure 36 for an indication of the position of the aquatic monitoring points.

Although the MRA area will encompass RK01, RK02 and RK03, the planned opencast pit and infrastructure area are located 100m outside of the freshwater resources and will not intersect the freshwater features.

Water quality data in 2016 were garnered from RK01 – RK03 during three sampling runs spanning different seasons, and RK04 was sampled during a single sampling run. A second baseline assessment was conducted in May 2021, and was considered supplementary to that performed in 2016, to more accurately assess current baseline water quality status. During the May 2021 assessment only two of the four sites were assessed, namely RK01 and RK04, while RK03 and RK02 were dry at the time of assessment. The data on selected water quality variables were assessed and compared to the following guidelines:

- South African Water Quality Guidelines for aquatic ecosystems, recreation, agricultural use and drinking water (DWAF, 1996);
- General and Special Limits for the discharge of wastewater into a watercourse (DWAF, 1999); and
- Resource quality objectives for the Upper Olifants River catchment (General Notice 466 of 2016) (OREWA). Please note that as none of the aquatic resources assessed had riverine characteristics, and that the most proximally linked OREWA resource unit was located ~28km to the north of the study area, OREWA was only considered as a tentative guideline for management of resources within the greater catchment.

Figure 38 presents the water quality at RK01-RK04 for the 2016 baseline assessment.

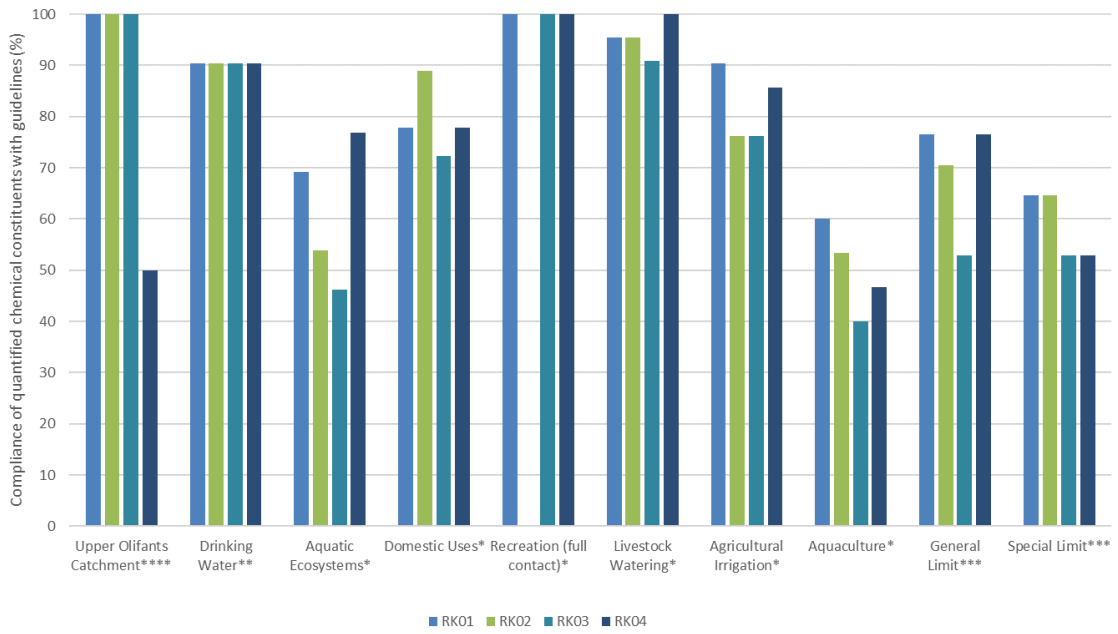


Figure 38: Compliance of the quantified parameters for each monitoring point with the stipulated guidelines

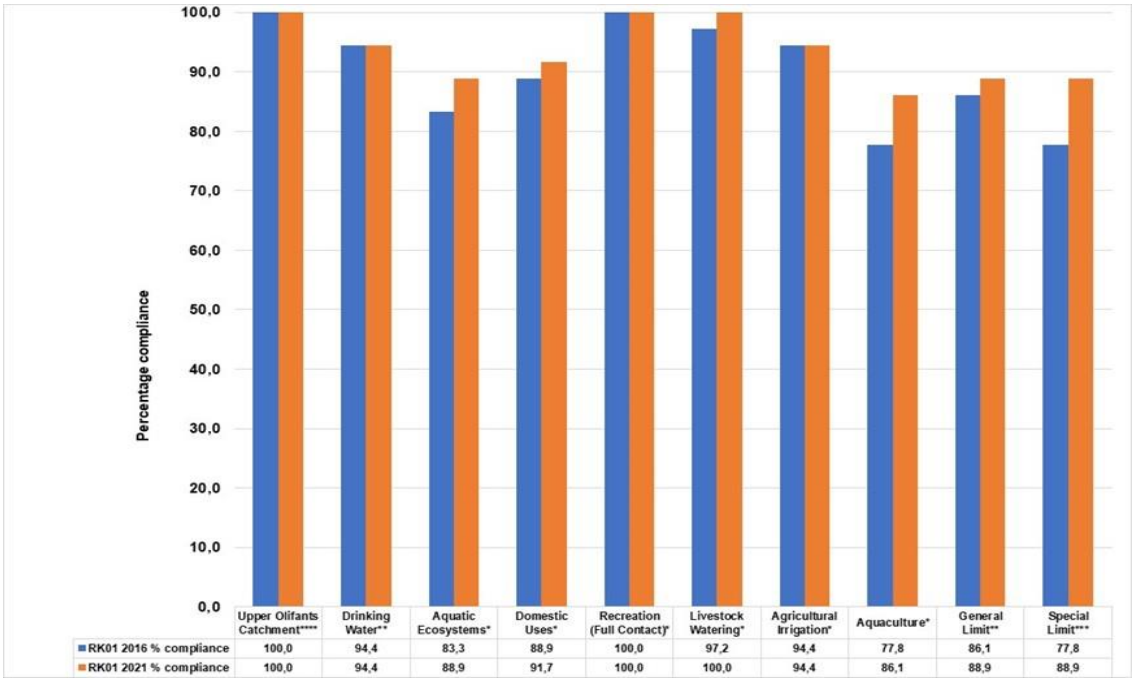
{* DWAF (1996); ** SANS 241 (2015); *** DWAF (1999); **** DWAF (2016)}

It is noted that no value is shown pertaining to the compliance of RK02 with the DWAF (1996) TWQR for recreation as a 0% compliance value was achieved.

Figure 39 and Figure 40 present the water quality at RK01 and RK04, respectively, for the 2021 baseline assessment compared to that in 2016.

The following conclusions and recommendations were made by the surface water specialist report:

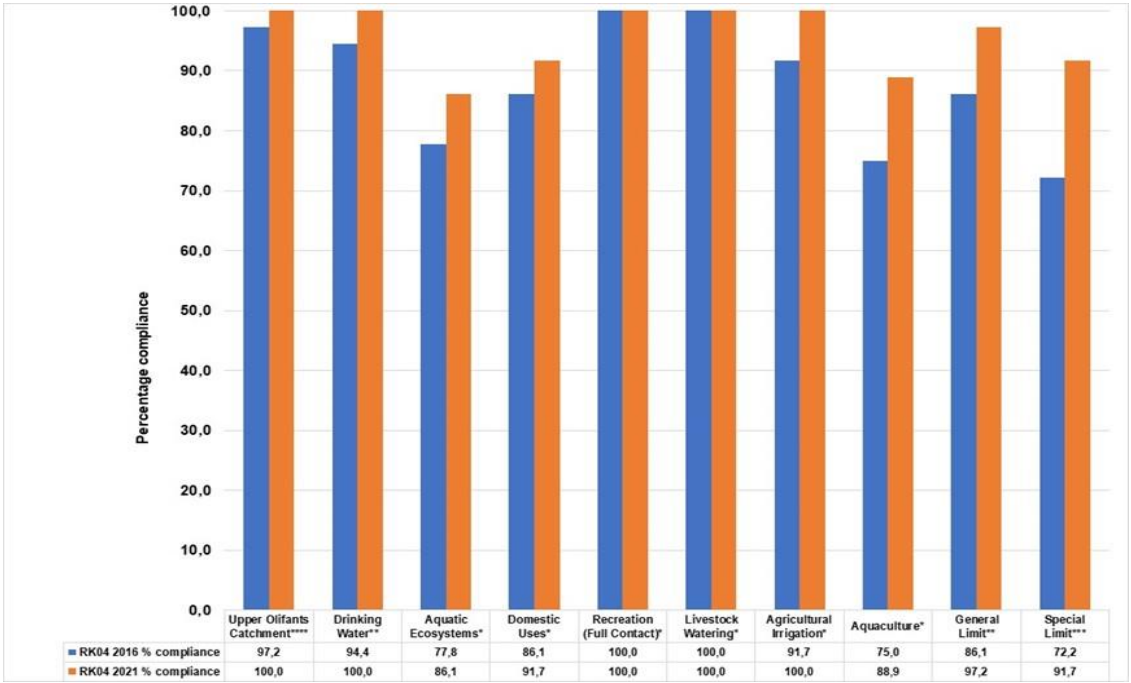
- The water quality at RK01-03 is in line with the water quality standards recommended for the Upper Olifants Catchment. However, the water quality standards for the Upper Olifants Catchment only encompass basic water quality parameters, whereas the DWAF (1996) guidelines for aquatic ecosystems are more comprehensive. The water at the monitoring points complied with between 46% (RK03) and 77% (RK04) of the Target Water Quality Range (TWQR) for aquatic ecosystems which define the acceptable percentage variance from the reference condition for a particular resource. Thus, the environmental state of the system prior to the development of the proposed Rietkol silica mine cannot be considered as pristine.



	Upper Olifants Catchment****	Drinking Water**	Aquatic Ecosystems*	Domestic Uses*	Recreation (Full Contact)*	Livestock Watering*	Agricultural Irrigation*	Aquaculture*	General Limit**	Special Limit***
RK01 2016 % compliance	100,0	94,4	83,3	88,9	100,0	97,2	94,4	77,8	86,1	77,8
RK01 2021 % compliance	100,0	94,4	88,9	91,7	100,0	100,0	94,4	86,1	88,9	88,9

Figure 39: Compliance of the quantified parameters for each monitoring point with the stipulated guidelines in the May 2021 baseline assessment compared to that in 2016 for site RK01

{* DWAF (1996); ** SANS 241 (2015); *** DWAF (1999); **** DWAF (2016)}



	Upper Olifants Catchment****	Drinking Water**	Aquatic Ecosystems*	Domestic Uses*	Recreation (Full Contact)*	Livestock Watering*	Agricultural Irrigation*	Aquaculture*	General Limit**	Special Limit***
RK04 2016 % compliance	97,2	94,4	77,8	86,1	100,0	100,0	91,7	75,0	86,1	72,2
RK04 2021 % compliance	100,0	100,0	86,1	91,7	100,0	100,0	100,0	88,9	97,2	91,7

Figure 40: Compliance of the quantified parameters for each monitoring point with the stipulated guidelines in the May 2021 baseline assessment compared to that in 2016 for site RK04

{* DWAF (1996); ** SANS 241 (2015); *** DWAF (1999); **** DWAF (2016)}

- The only water application for which RK01, 03 and 04 were suited for is full contact recreational use. Full contact recreational use includes fully submersive activities such as swimming. No monitoring point was considered 100% suitable for any other use.
- The visual assessment identified that RK01 and RK04 are likely being utilised for irrigation, and RK04 is likely also being utilised for informal domestic use. The water quality at these resources is not considered suitable for this use. The continuation of irrigation may be justifiable if cautious monitoring of crops is undertaken to determine bioaccumulation. Additionally, these constituents may accumulate in irrigated soils over time increasing the toxicological risk and this aspect should also be monitored if use continues.
- Trends in percentage of parameters that complies with the TWQR at sites RK01 and RK04 that was also assessed in May 2021, remained largely the same compared to the 2016 baseline data.
- Regarding temporal changes in individual parameter values, temporal variability [comparing May 2021 baseline data to baseline (2016) data], was evident at both sites RK01 (more pronounced) and RK04 prior to any potential impact from the proposed mining activity. Parameters for which concentrations increased at both sites were boron, EC, pH, potassium, sodium, and zinc. Ongoing monitoring of these trends should continue.

Refer to Appendix 6 for the detail water quality analyses and discussion as summarised above.

6.3.5 Groundwater

6.3.5.1 Hydrocensus

A hydrocensus/groundwater user survey was conducted in April 2016 by Aquatico Scientific within the MRA area and the immediate surrounding properties. The main aims and objectives of the hydrocensus field survey were as follow:

- To locate all IAPs with respect to groundwater – thus groundwater users;
- To collect all relevant information from the IAPs (i.e. name, telephone number, address, etc.);
- Accurately log representative boreholes on the IAPs properties; and
- To collect all relevant information regarding the logged boreholes (i.e. yield, age, depth, water level etc.) but especially the use of groundwater from the borehole.

An extended hydrocensus was conducted by Aquatico Scientific in January 2017, with a further follow-up in March 2018 to include additional boreholes not surveyed during the first two rounds.

A total of 86 boreholes, four dams and one cave were located, and their positions are indicated in Figure 41. The main finding of the hydrocensus/user survey is that groundwater is used extensively throughout the project area, especially for irrigation and domestic purposes (66% of all boreholes) – refer to Figure 42. The 2018 hydrocensus report is attached as Appendix A of the Geohydrological Report (Appendix 7).

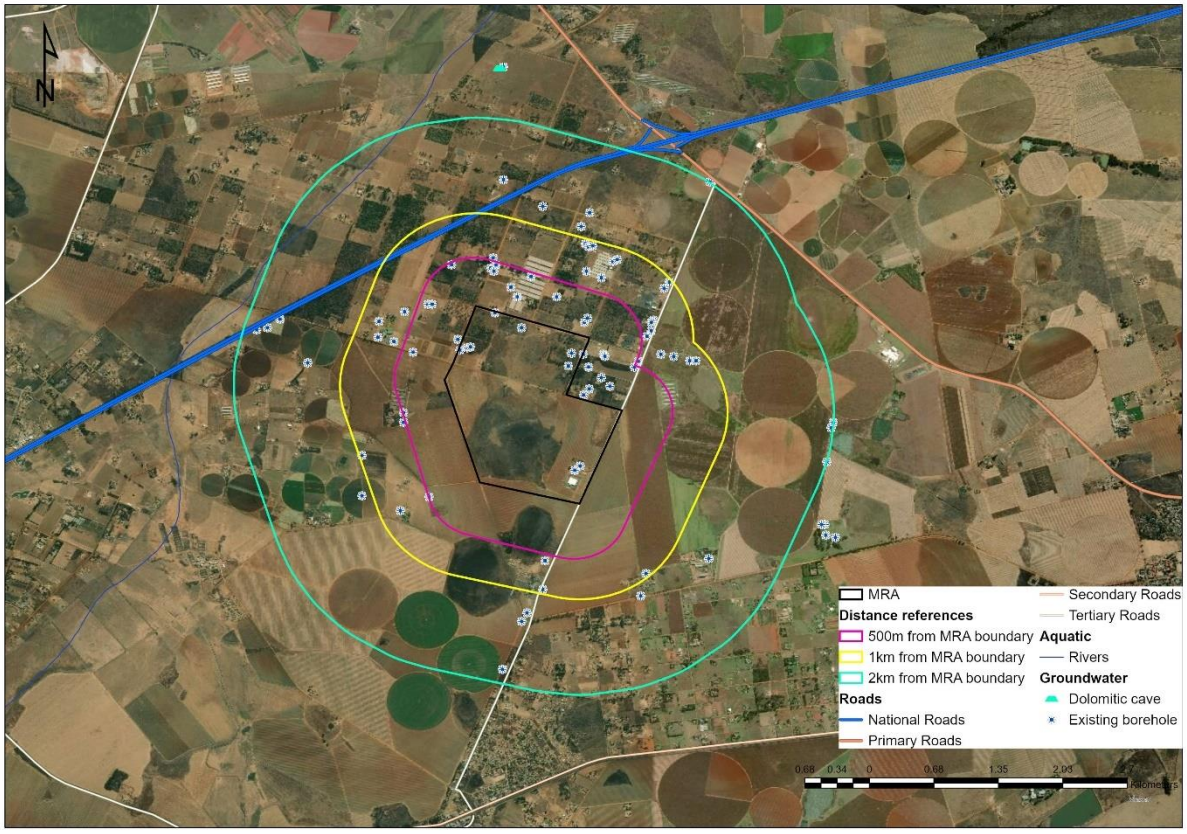


Figure 41: Position of hydrocensus recordings

An important feature from a groundwater perspective that occurs in the area is an underground cave partly filled with groundwater. The cave opening/entrance occurs on AH 138, approximately 2.5 km north of the Rietkol MRA boundary. Apart from its presence and its rest water level, very little concrete information on the cave structure and dimensions could be obtained. A borehole is drilled into the cave through its roof, and it was used until a few years ago for irrigation purposes. The water level in the borehole was measured in 2017 at 23.5 meters below surface.

The cave is recognized as an important feature in terms of environmental sensitivity as well as for heritage purposes. Although information on the cave is limited, the risk of negative impact because of the proposed Rietkol Project on the cave is very low to negligible due to:

- The cave's relative distance from the proposed project.

- The mineable reserve being slightly metamorphosed sandstone (silica) on top of an intrusive dolerite sill and not penetrating the dolomite.
- The limited impact (depth and radius) that the mining will have on the groundwater level drawdown (availability) and quality.

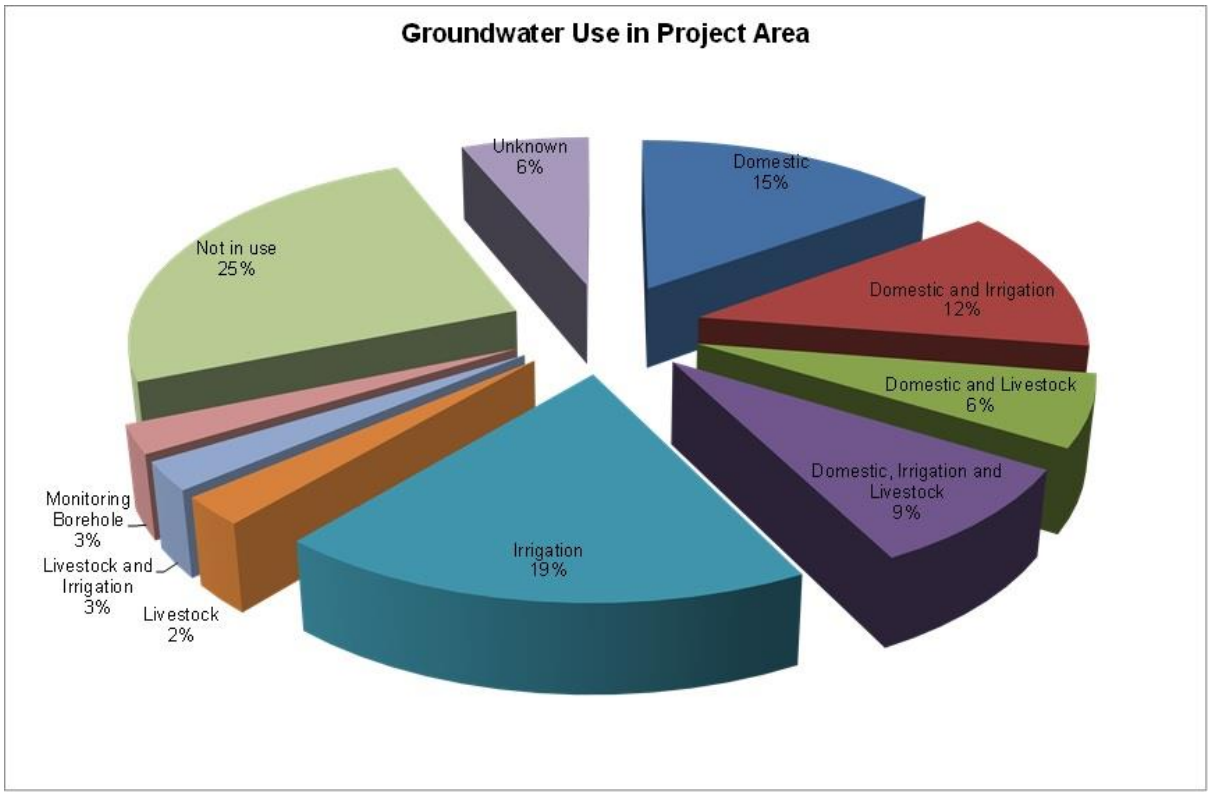


Figure 42: Groundwater use in the MRA area and surrounds

6.3.5.2 Groundwater level depth

Groundwater level information was collected during the hydrocensus/user surveys that were conducted within the MRA area and the surrounding properties. Water level measurements were also taken at the newly drilled source monitoring boreholes. A thematic contour map indicating groundwater level depths in the project area is provided in Figure 43. The blue circles indicated on the abovementioned figure represent the positions of the boreholes, while the sizes of the circles are proportional to the groundwater level depth (i.e. the largest circle represents the deepest water level).

Groundwater levels around the MRA area generally vary between ± 9 and 100 mbs, with the average being ± 42 mbs. Under ambient conditions, the deeper groundwater levels would generally be associated with the dolomite aquifer, while water levels in the Karoo aquifer/s generally do not exceed 10 mbs. Approximately 66% of all boreholes are in use (mainly for domestic and/or irrigation purposes), meaning that most groundwater levels are affected by the abstraction of groundwater. Not

all groundwater levels are therefore representative of ambient/unaffected conditions, making it difficult to distinguish between the dolomite aquifer and Karoo aquifer solely based on differing groundwater levels. The groundwater level contour map provided in Figure 43 clearly shows the groundwater depression cones resulting from the groundwater abstraction.

In conclusion, groundwater abstraction for domestic purposes and/or farming related activities has already caused a lowering of the local groundwater levels and is also believed to have affected the natural groundwater flow patterns and velocities.

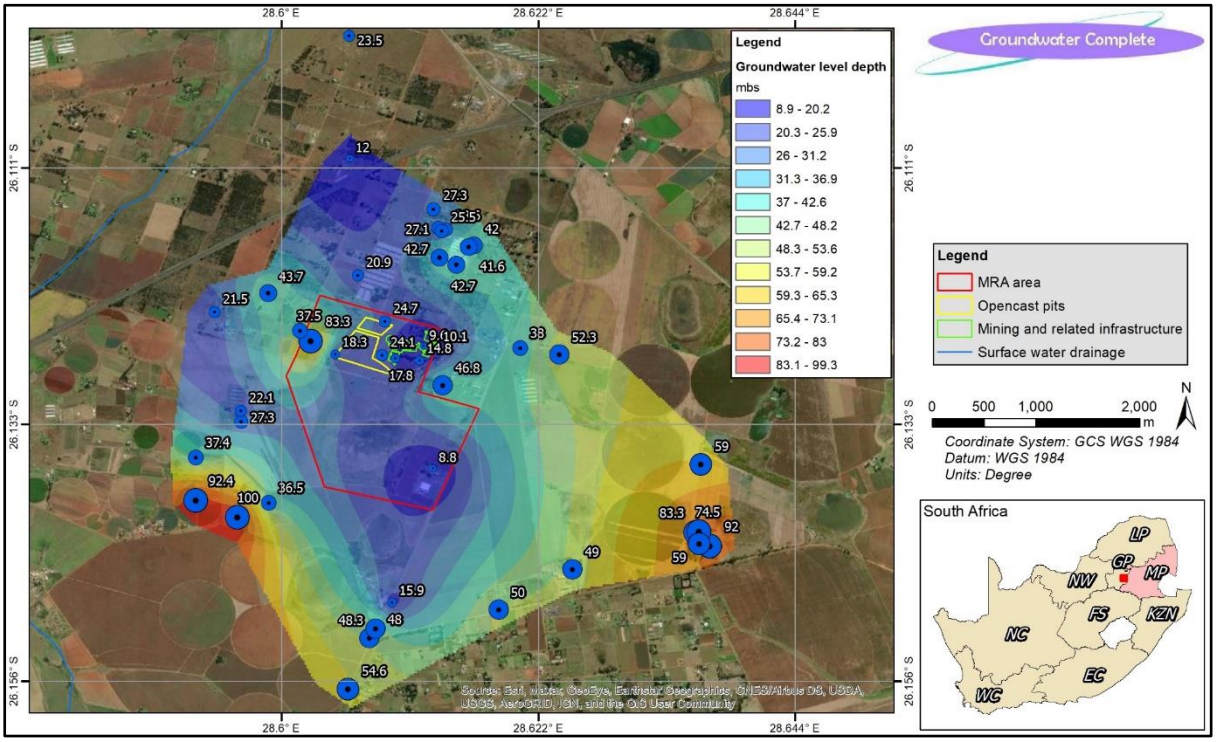


Figure 43: Thematic contour map of groundwater level depths (mbs)

6.3.5.3 Hydraulic properties and potential yields

Constant rate pumping tests were performed on four user boreholes and four purpose drilled monitoring boreholes. The positions of these eight boreholes are indicated in Figure 44.

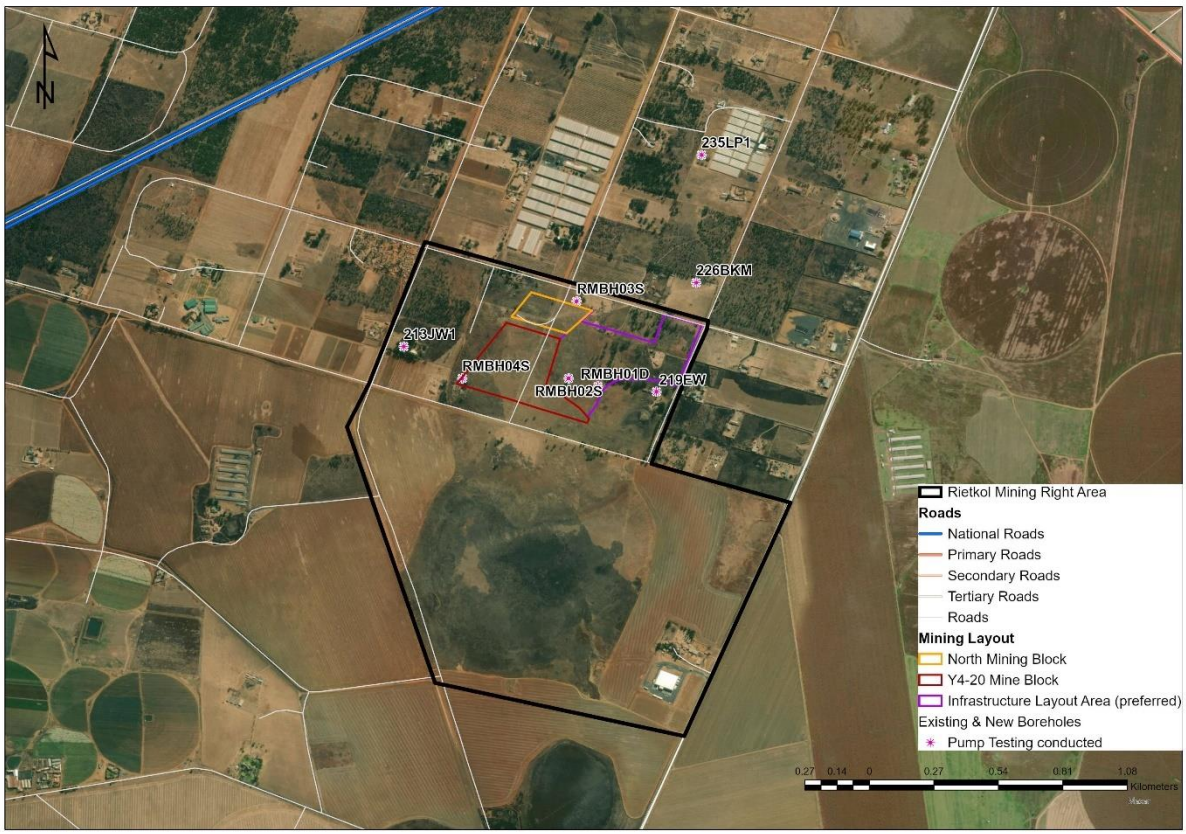


Figure 44: Positions of user boreholes on which pumping tests were performed

Based on the 1:250 000 scale geological map of the project area, boreholes 213JW1, 226BKM and 235LP1 are believed to be located within the Malmani dolomite. It follows that the average transmissivity of this dolomite aquifer is in the region of 22 m^2/d. On the other hand, borehole 219EW displayed a much lower transmissivity of nearly 6.5 m^2/d, which is believed to be representative of the fractured Karoo Supergroup aquifer. The four monitoring boreholes were drilled into the Rietkol quartzite deposit and its associated contact zones and displayed an even lower average transmissivity of approximately 0.9 m^2/d.

The potential abstraction rates from the boreholes are provided in Table 20 and are indicated as liters per second for a 24-hour pump cycle. Although the borehole yields provided were calculated with tested and proven techniques, uncertainties still exist (especially with regards to the available drawdown) and are therefore first order approximations only.

The maximum on-site water requirement at full production is expected to be 4 ℓ/s (i.e. 0.4 ℓ/s dust suppression, 0.2 ℓ/s potable water and 3.4 ℓ/s plant). Table 20 shows that the combined sustainable yield of the on-site tested boreholes is around 4 ℓ/s. The existing on-site boreholes would therefore be sufficient to supply the Rietkol operations, not taking into account groundwater influx and direct rainfall.

Table 20: Potential borehole yields

Borehole	Potential Groundwater Yield (ℓ/S)				
	No boundary	1 Boundary	2 Boundaries	Closed	Average
213JW1	5.5	2.7	1.8	1.4	2.8
219EW	1.3	0.6	0.4	0.3	0.7
226BKM	Test inconclusive				
235LP1	9.4	4.7	3.1	2.3	4.9
RMBH01D	0.9	0.5	0.3	0.2	0.5
RMBH02S	0.04	0.02	0.01	0.01	0.02
RMBH03S	Test inconclusive				
RMBH04S	0.04	0.02	0.01	0.01	0.02

6.3.5.4 Groundwater quality conditions

Groundwater quality data is available for 22 user boreholes and four dedicated source monitoring boreholes. Their positions are indicated in Figure 45 and Figure 46 respectively. The data was evaluated with the aid of diagnostic chemical diagrams and by comparing the inorganic concentrations to the South African National Standards for drinking water (SANS 241:2015). The once-off sampling data does not allow for any statistical analyses or trend identification.

6.3.5.4.1 Regional user boreholes

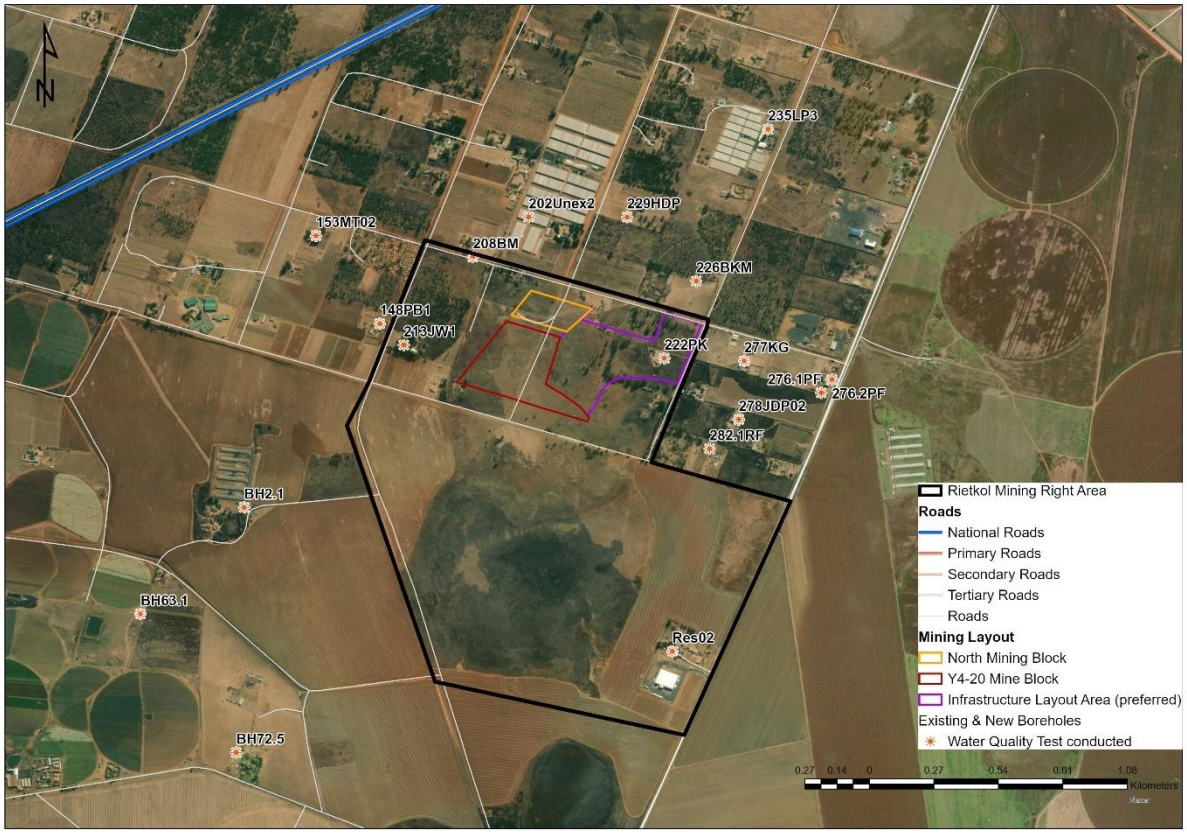


Figure 45: Distribution of regional groundwater quality data

The total dissolved solids (TDS) content of groundwater is a good indicator of the overall quality of the water, as it provides a measurement of the total amount/weight of salts that are present in solution. An increase in TDS will therefore also indicate an increase in the total inorganic content of the groundwater. Groundwater TDS concentrations of user boreholes vary between 120 mg/l and 416 mg/l, which are well below the maximum permissible SANS value of 1 200 mg/l.

The sulphate content of groundwater is low and vary from below the detection limit of 0.452 mg/l to nearly 45 mg/l, which are well below the maximum permissible SANS value of 500 mg/l.

In a farming environment, nitrate contamination is generally associated with seepage from pit latrines and animal feedlots/kraals or fertilisers, while where mining occurs the usage of nitrate-based explosives is mainly responsible for high levels of nitrate contamination. Health effects associated with high nitrate intake are impaired concentration, lack of energy and the formation of methahemoglobin in blood cells. Groundwater nitrate concentrations measured in the majority of user boreholes are well below the maximum permissible SANS value of 11 mg/l. Exceptions do however occur and a concentration of approximately 12 mg/l was measured in both boreholes 148PB1 and 202Unex2. The once-off analyses do not allow for accurate source identification, however the nitrate contamination affecting the abovementioned two boreholes is likely to originate from pit latrines and/or feedlots.

The groundwater pH conditions are neutral with values varying between 7.0 and 8.8. The neutral pH conditions restrict the mobilisation of metals, which are also sensitive to groundwater redox conditions.

User boreholes display groundwater chloride concentrations of between 2 mg/l and 85 mg/l, which are well below the maximum permissible SANS value of 300 mg/l.

Most user boreholes are dominated by fresh, clean, relatively young groundwater that has started to undergo mineralization, i.e. magnesium ion exchange. The groundwater is therefore dominated by magnesium cations, while bicarbonate alkalinity dominates the anion content. This is typical of a dolomite aquifer, which is mainly composed of calcium and magnesium carbonates.

Summary:

- Groundwater from most user boreholes is considered to be of good quality and is suitable for human consumption with regards to SANS 241:2015.

- Exceptions do however occur as the groundwater nitrate content measured in user boreholes 148PB1 and 202Unex2 exceeds the maximum permissible SANS value of 11 mg/l. The nitrate contamination is likely to originate from pit latrines or feedlots.
- The groundwater is mainly dominated by magnesium cations and bicarbonate alkalinity, which is typical of an unpolluted dolomite aquifer.

6.3.5.4.2 Site-specific monitoring boreholes

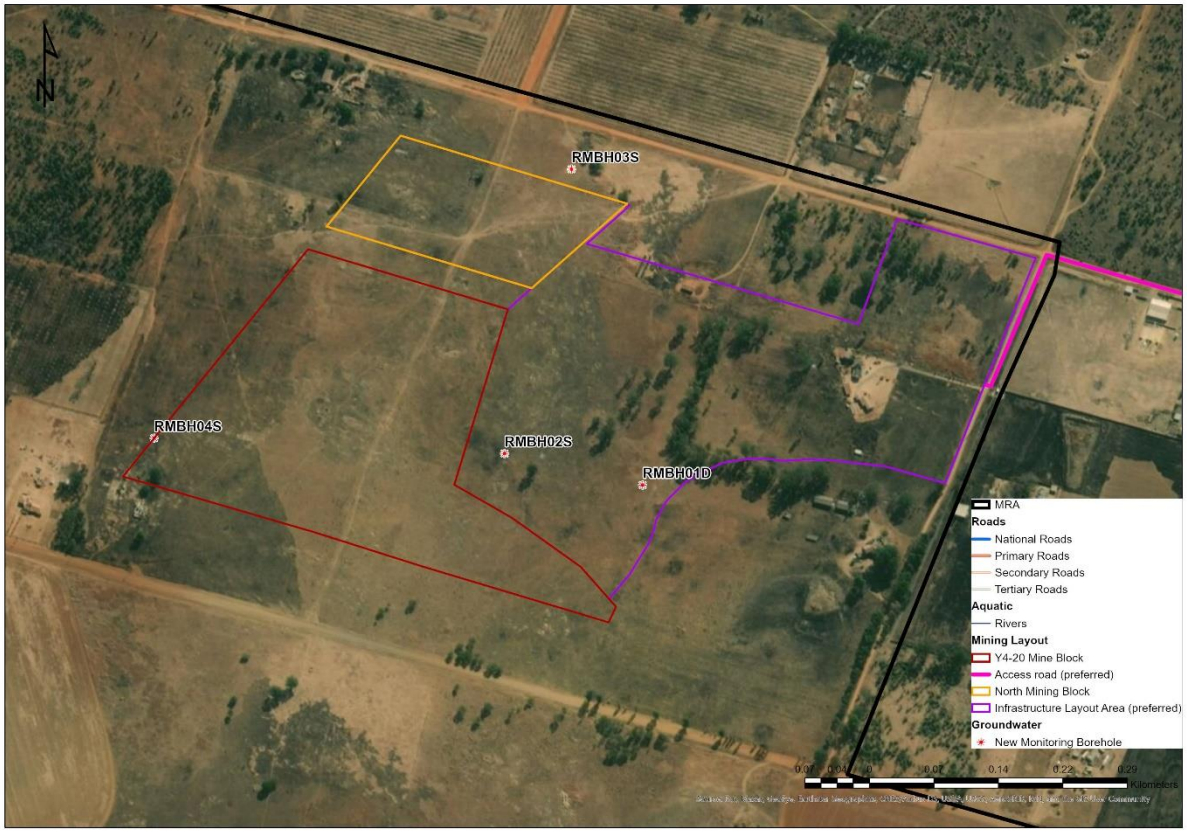


Figure 46: Distribution of site-specific groundwater quality data

Groundwater within the MRA area is of good quality according to SANS 241:2015 and also representative of the ambient or unaffected environment. The TDS content of groundwater is a very effective indicator of inorganic type contamination. Groundwater TDS concentrations vary between 20 mg/l and 84 mg/l, which are very low and perfectly suitable for human consumption.

The manganese content in borehole RMBH01D did however exceed the maximum permissible SANS value of 0.4 mg/l. The only explanation for the elevated manganese content is the fact that the borehole was drilled into the dolomite aquifer and the weathering in the borehole was very deep. The chemical weathering in dolomite terrains in South Africa often leaves a black to coffee-brown residue which is very light and is named manganese earth or wad. Since RMBH01 is the only site borehole drilled into the weathered dolomite and sampled shortly thereafter the elevated manganese in the

groundwater is likely to originate from the manganese earth. It is unlikely to be the result of any nearby farming or human related activities.

Summary:

- Groundwater from the four monitoring boreholes is of good quality and is suitable for human consumption with regards to SANS 241:2015.
- The groundwater manganese content in borehole RMBH01D did however exceed the maximum permissible SANS value of 0.4 mg/l. The elevated manganese content is expected to originate from wad formed due to weathered dolomite/chert.

6.3.5.5 Aquifer Characterisation

6.3.5.5.1 Groundwater Vulnerability

The *Groundwater Vulnerability Classification System* used in the geohydrological specialist assessment was developed as a first order assessment tool to aid in the determination of an aquifer's vulnerability/susceptibility to groundwater contamination. This system incorporates the well-known and widely used *Parsons Aquifer Classification System* (Table 24) as well as drinking water quality guidelines as stated by the DWS. This system is especially useful in situations where limited groundwater related information is available and is explained in Table 22 and Table 23. The dolomitic aquifer underlying the project area achieved a score of 9 (Table 21) and is therefore regarded as having a high vulnerability.

According to the *Aquifer Vulnerability Map of South Africa* that was first published by the CSIR in 1999, the underlying aquifer is considered to have a high vulnerability.

Table 21: Groundwater vulnerability rating for project area

	Rating
Depth to groundwater level	1
Groundwater quality	4
Aquifer type	4
Total score	**9**

Table 22: Groundwater vulnerability classification system

Rating	***4***	***3***	***2***	***1***
Depth to groundwater level	0 – 3 m	3 – 6 m	6 – 10 m	>10 m
Groundwater quality *(Domestic WQG*)*	Excellent (TDS < 450 mg/l)	Good (TDS > 450 < 1 000 mg/l)	Marginal (TDS > 1 000 < 2 400 mg/l)	Poor (TDS > 2 400 mg/l)

Rating	*4*	*3*	*2*	*1*
Aquifer type ***(Parsons Aquifer Classification)***	Sole aquifer system	Major aquifer system	Minor aquifer system	Non-aquifer system

** WQG = Water Quality Guideline.*

Table 23: Groundwater vulnerability rating

Vulnerability	Rating
Low vulnerability	≤ 4
Medium vulnerability	> 4 ≤ 8
High vulnerability	≥ 9

6.3.5.5.2 Aquifer Classification

Information from geological maps, drilling results and experience gained from numerous studies conducted in similar geohydrological environments suggest that three different types of aquifers may be present in the project area. For this study, an aquifer is defined as a geological formation or group of formations that can yield groundwater in economically useable quantities. Aquifer classification according to the Parsons Classification system is summarised in Table 24.

The first aquifer is a shallow, semi-confined or unconfined aquifer that occurs in the transitional soil and weathered bedrock zone or sub-outcrop horizon. Yields in this aquifer are generally low (less than 0.5 ℓ/s) and the aquifer is usually not fit for supplying groundwater on a sustainable basis. Consideration of the shallow aquifer system becomes important during seepage estimations from pollution sources to receiving groundwater and surface water systems. The shallow weathered zone aquifer plays the most important role in contaminant transport simulations from process and mine induced contamination sources because the lateral seepage component in the shallow weathered aquifer often dominates the flow. According to the Parsons Classification system, this aquifer is usually regarded as a minor- and in some cases a non-aquifer system.

Due to the mainly lateral flow and sometimes phreatic nature of the weathered zone aquifer, it is usually only affected by opencast mining, high extraction, or shallow underground mining where subsidence occurs and the entire roof strata above the mined area is destroyed.

The second aquifer system is the deeper secondary fractured rock aquifer that is hosted within the sedimentary rocks of the Karoo Supergroup, which underlies the southern half of the MRA area. Groundwater yields, although more heterogeneous, can be higher. This aquifer system usually displays semi-confined or confined characteristics with piezometric heads often significantly higher than the water-bearing fracture position. Fractures may occur in any of the co-existing host rocks due to different tectonic, structural, and genetic processes. According to the Parsons Classification system,

the aquifer could be regarded as a minor aquifer system, but also a sole aquifer system in some cases where groundwater is the only source of domestic water.

The third, and major aquifer system is associated with the Malmani Subgroup (Transvaal Supergroup) dolomite that underlies the northern half of the MRA area. Dolomite is generally considered to be an excellent host rock for aquifers due to the formation of solution cavities and their ability to store vast volumes of groundwater. However, water needs to penetrate the rock for any dissolution to occur, meaning that the dolomite must have undergone some significant fracturing for any significant cavities to have formed over the years. According to the Parsons Classification System, this aquifer could be regarded as a major aquifer system, but also a sole aquifer system in some cases where groundwater is the only source of domestic water.

Notes:

- Mining will technically only intersect the shallow weathered zone aquifer to gain access to the underlying Rietkol quartzite that was deposited in an ancient sinkhole structure – leaving the Karoo- and Transvaal Supergroup (i.e. Malmani dolomite) aquifers intact. The quartzite deposit may be regarded as a fourth aquifer; however, its crystalline structure and small size are characteristic of a minor, or even a non-aquifer system.
- The underlying dolomite aquifer will be separated from the overlying opencast pit by a dolerite sill of approximately 30m thick and many more meters of quartzite (i.e. Lower Quartzite band). The quartzite deposit in its entirety is expected to act as a buffer between the proposed mining activities and the surrounding and underlying dolomite.

Table 24: Parsons Aquifer Classification (Parsons, 1995)

Sole Aquifer System	An aquifer that is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
Major Aquifer System	Highly permeable formation, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (less than 150 mS/m).
Minor Aquifer System	These can be fractured or potentially fractured rocks that do not have a primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large volumes of water, they are important both for local suppliers and in supplying base flow for rivers.
Non-Aquifer System	These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although impermeable, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.
Special Aquifer System	An aquifer designated as such by the Minister of Water Affairs, after due process.

6.3.5.5.3 Aquifer Protection Classification

In 1995 Roger Parsons prepared a report for the Water Research Commission and the Department of Water and Sanitation titled, "*A South African Aquifer System Management Classification*". Amongst other things, he described how the need or importance to protect groundwater led to the development of a Groundwater Quality Management classification system, or GQM. The level of protection depends on the aquifer vulnerability (Section 6.3.5.5.1), and aquifer classification (Section 6.3.5.5.2).

Table 25: Groundwater Quality Management classification ratings

Aquifer vulnerability		**Aquifer classification**	
Class	**Points**	**Class**	**Points**
		Sole source aquifer	**6**
High	**3**	Major aquifer	4
Medium	2	Minor aquifer	2
Low	1	Non-aquifer	0
		Special aquifer	0 - 6

The GQM (or level of protection) is calculated by multiplying aquifer vulnerability with aquifer classification (Table 25) and the results can be interpreted as follows:

GQM	**Level of protection**
<1	Limited protection
1 – 3	Low protection
3 – 6	Medium protection
6 – 10	High protection
>10	**Strictly non-degradation (i.e. no impact is allowed)**

The fractured rock aquifer underlying the project area scored a GQM rating of 18, which means that no impact is allowed.

6.3.6 Air Quality

6.3.6.1 Existing sources of pollution

Although the air quality in the region can be viewed as natural (rural), local airborne pollutant sources were identified during the various site visits. These are important to consider in terms of assessing the cumulative impact potential on air quality in the region:

- Agricultural activities;
- Vehicle emissions;

- Veld and agricultural fires;
- Industrial emissions;
- Power generation;
- Mining activities; and
- Home fires.

A qualitative discussion on each of these source types is provided in the subsections which follow.

6.3.6.1.1 Agriculture

Large scale agriculture to the south and east, along with small-scale type of agriculture (small holdings) which supply a family and relatives of food within the community are common in the area, except for the high intensity flowers grown in greenhouses. The airborne pollutant associated with the farming is Particulate Matter (TSP, PM_{10}, $PM_{2.5}$, etc.) generated by animal husbandry, wind erosion of open tilled fields and planting.

Agricultural activity can be considered a significant contributor to particulate emissions, although tilling, harvesting and other activities associated with field preparation are seasonally based.

The main focus internationally with respect to emissions generated due to agricultural activity is related to animal husbandry, with special reference to malodours generated as a result of the feeding and cleaning of animal. The types of livestock assessed included pigs, sheep, goats and chickens (within close proximity to the project). Emissions assessed include ammonia and hydrogen sulphide.

Little information is available with respect to the emissions generated due to the growing of crops. The activities responsible for the release of particulates and gasses to atmosphere would however include:

- Particulate emissions generated due to wind erosion from exposed areas;
- Particulate emissions generated due to the mechanical action of equipment used for tilling and harvesting operations;
- Vehicle entrained dust on paved and unpaved road surfaces;
- Gaseous and particulate emissions due to fertilizer treatment; and
- Gaseous emissions due to the application of herbicides and pesticides.

6.3.6.1.2 Vehicles

The force of the wheels of vehicles travelling on unpaved roadways causes the pulverisation of surface material. Particles are lifted and dropped from the rotating wheels, and the road surface is exposed

to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. The quantity of dust emissions from unpaved roads varies linearly with the volume of traffic. Due to the nature of both mining and agricultural activity, road networks can often be of a temporary nature, and are thus unpaved. An unpaved road network exists in the area. Due to the volume of heavy vehicles using the roads near the site, the expected volumes of entrained dust are likely to be considerable.

Due to the proximity of the site to the N12 highway, exhaust tailpipe emissions from vehicles is a significant source of particulate emissions. Exhaust fumes contain nitrogen, oxygen, carbon monoxide, water vapour, sulphur dioxide, nitrogen oxide, volatile hydrocarbons and polyaromatic hydrocarbons (PAHs) and their derivatives, acetylaldehyde, benzene and formaldehyde, carbon particles, sulphates, aldehydes, alkanes, and alkenes.

6.3.6.1.3 Veld and agricultural burning

A veld fire or controlled agricultural burn is a large-scale natural combustion process that consumes various ages, sizes, and types of flora growing outdoors in a geographical area. Consequently, fires are potential sources of large amounts of air pollutants that should be considered when attempting to relate emissions to air quality. The size and intensity, even the occurrence, of fires depend directly on such variables as meteorological conditions, the species of vegetation involved and their moisture content, and the weight of consumable fuel per hectare (available fuel loading).

The major pollutants from burning are particulate matter, carbon monoxide and volatile organics. Nitrogen oxides are emitted at rates of from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulphur oxides are negligible. A study of biomass burning in the African savannah estimated that the annual flux of particulate carbon into the atmosphere is estimated to be of the order of 8 Tg C, which rivals particulate carbon emissions from anthropogenic activities in temperate regions.

6.3.6.1.4 Brick kiln emissions

Clay brick manufacturing face poor uptake of tunnel kiln technology, and lack of abatement on clamp kilns, particularly of particular matter and CO emissions. Tunnel kiln technology is promoted in new, regulated operations.

6.3.6.1.5 Power generation

The burning of coal for power generation can result in emissions being generated. At the power stations surrounding the ash facility, various mitigation measures have been put in place at the stations to reduce the emissions before entering the atmosphere. These include bag filters or

electrostatic precipitators (ESPs) for the removal of particulate matter and ash, scrubbers for sulphur dioxide and over air burners for oxides of nitrogen. These mitigation measures are highly efficient with up to 99% of all emissions being captured or removed.

6.3.6.1.6 Mining activities

Opencast mining should control the generation of particulate matter on mine haul roads. Water spraying is a cheap and effective means of control and should be consistently applied across mines in the Highveld Priority Area (HPA). Other studies have indicated that chemicals and re-surfacing techniques are effective. Potential sources of fugitive dust emissions (PM_{10} and dust) are released from these sources: material handling operations, vehicle entrainment by haul vehicles, windblown dust from tailings dams and oxides of nitrogen (NO_X) and carbon monoxide (CO) which are produced during mining operations. Fugitive dust emissions released during mining operations are generally only of concern within 3 - 5 km of the mine boundary.

6.3.6.1.7 Home fires

Domestic fuel burning continues partly due to poor uptake of technology, and high pace of settlement growth. Awareness and technology promotion activities are increasing, although local and provincial authorities have lacked capacity and means to ensure awareness and conversion. In the region of the mine, the housing associated with low-income housing with minimal electricity usage for heating during the colder winter months and for cooking. The open fires are made from any combustible material (usually wood or coal) and is often used to cook and to heat up the house. The associated emissions from these cooking fires differentiate from the type of material used for energy and the most common airborne pollutants are Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon monoxide (CO), Carbon dioxide (CO_2) and Particulate matter (TSP, PM_{10}, $PM_{2.5}$, etc.). During the winters cold day's inversions form over the surface of the land and cause the airborne pollutants from domestic fuel burning to be entrapped. The air movement cannot disperse the air pollutant from the region and causes the concentrations to build up. The inversion layer and domestic fuel burning takes place at the same time, which increases the severity of the situation at some locations. As the day heats up (midday) the inversion layer breaks up and the pollutants can disperse.

6.3.6.2 Baseline air quality monitoring

6.3.6.2.1 Highveld Priority Area

The Highveld Priority Area (HPA) was declared in late 2007. The Department of Environmental Affairs (DEA) now manages the priority area and is developing an air quality management plan.

Air emissions of fine particulate matter (PM_{10}) in the HPA over a year, is estimated at 279 630 tons, including:

- 89% PM_{10} from general industrial sources
- 50% PM_{10} from opencast mine haul roads dust
- 17% PM_{10} from primary metallurgical industries
- 12 % PM_{10} from coal power generation

NO_x air emission total 978 781 tons per year in the HPA, including:

- 90% NO_x from industrial sources
- 73% NO_x from coal power generation

SO_2 air emissions in the HPA total 1 622 233 tons per year, including:

- 99% SO_2 from industrial sources
- 82% SO_2 from coal power generation

6.3.6.2.2 Regional ambient air quality

Ambient air quality monitoring has been undertaken by Eskom at the Chicken Farm Site, situated approximately 30 km north-east of the Rietkol MRA area. The South African Air Quality Information System (SAAQIA) provided the following information from 1 January 2017 to 31 December 2017.

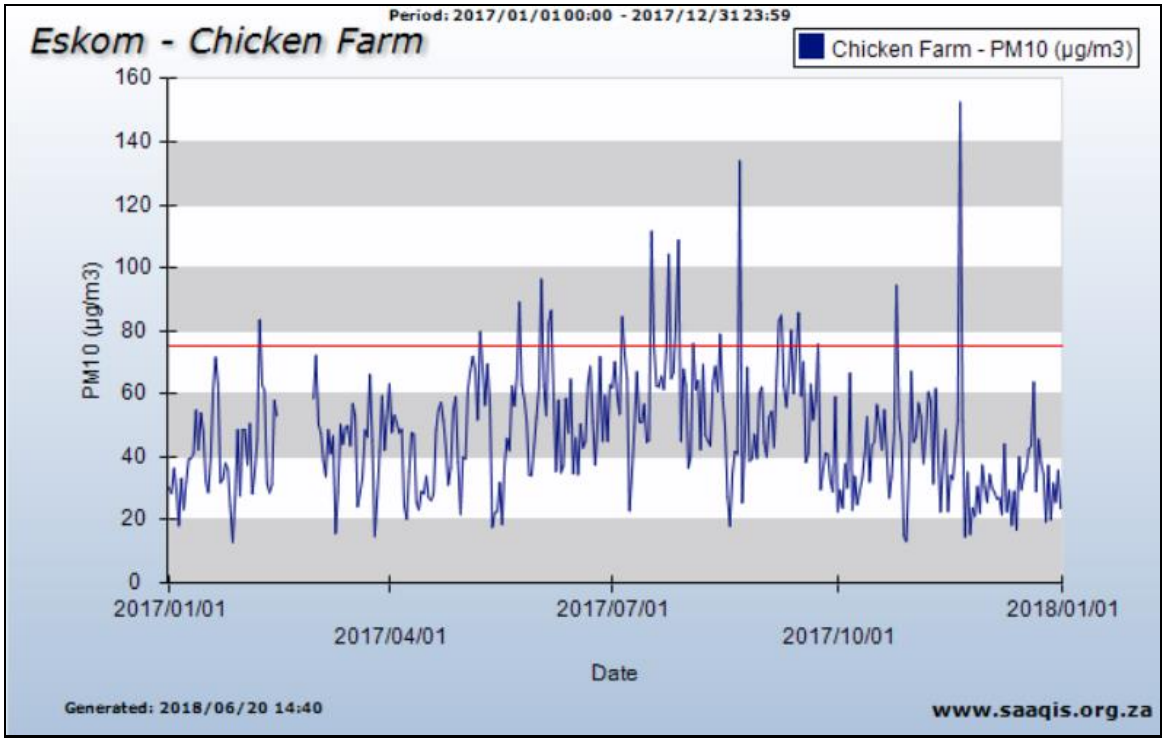


Figure 47: PM_{10} monitoring results at the Eskom Chicken Farm site (daily standard: 75 µg/m³)

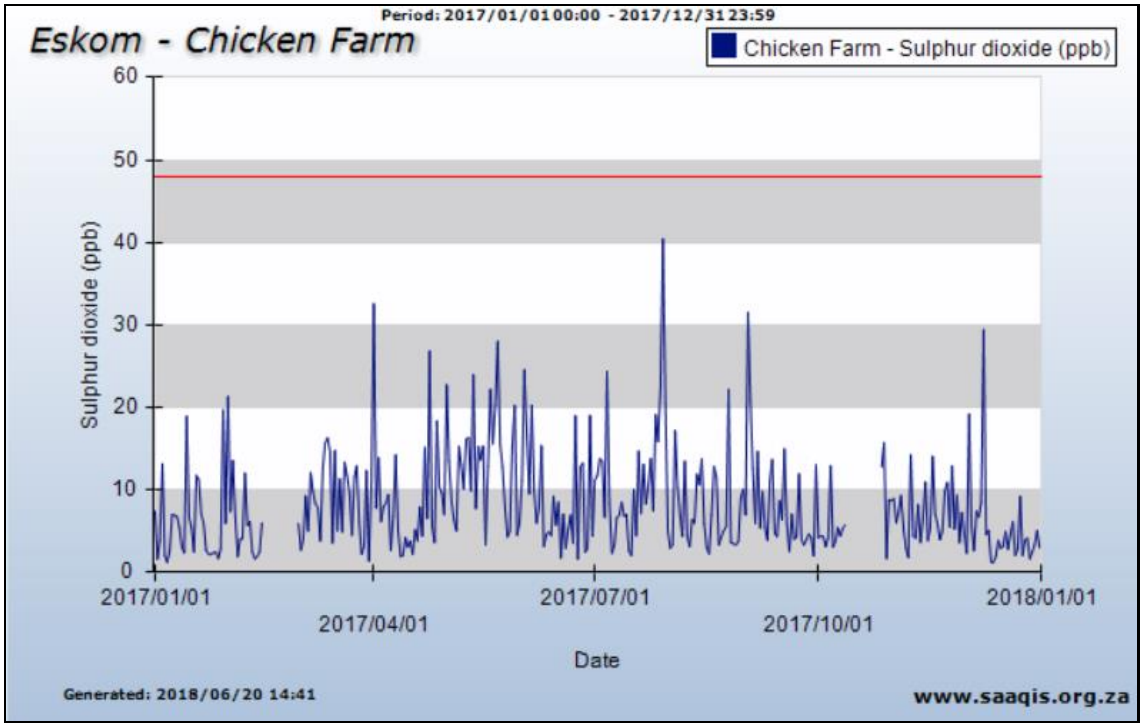


Figure 48: Sulphur Dioxide monitoring results at Eskom Chicken Farm site (daily standard: 48 ppb)

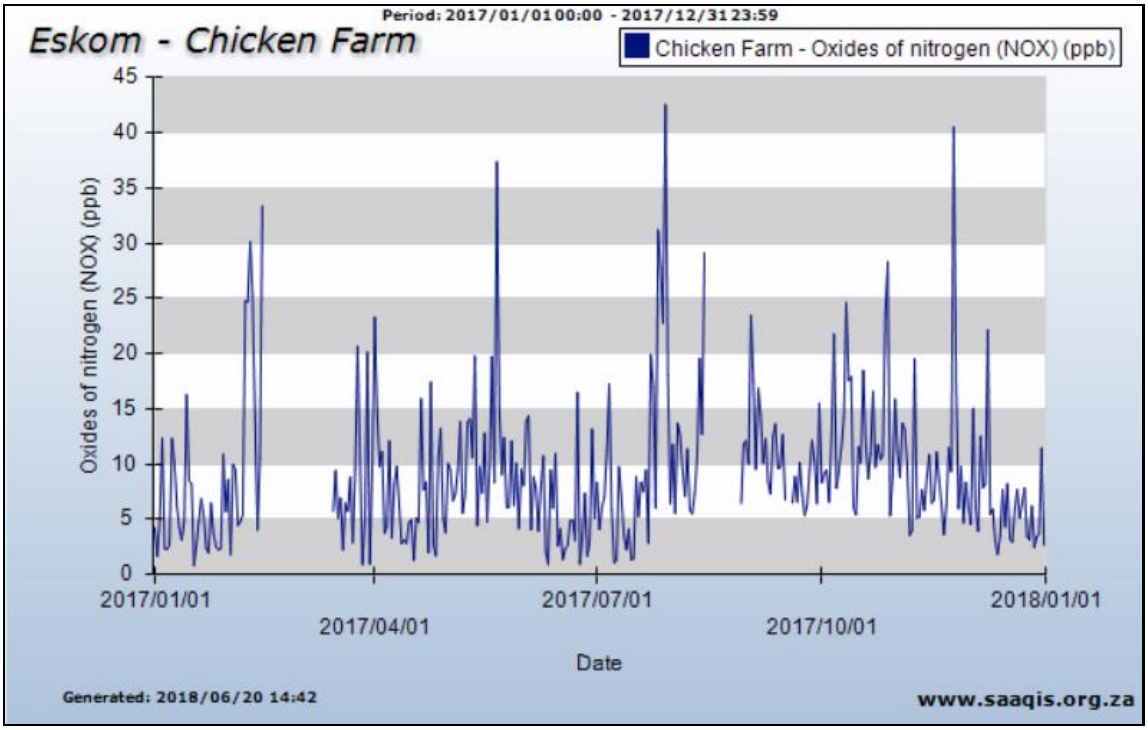


Figure 49: Oxides of Nitrogen monitoring results at Eskom Chicken Farm site (no daily standard prescribed)

6.3.6.2.3 Local ambient air quality

Ambient monitoring was undertaken by EBS Advisory as part of the baseline assessment of the Air Quality Impact Assessment. Baseline PM_{10} monitoring was conducted at eight positions, as indicated in Figure 51. The results are presented in Figure 50.

Table 26: Local PM_{10} monitoring results

Monitoring point	Ambient particulate matter (µg/m³)			
	Oct 16	Nov 16	Apr 18	Mar 21
Wocke	10.6	11.6	15.6	26.2
Burger	18.2	19.0	23.8	40.0
Van der Walt	22.7	21.9	24.1	40.5
Die Plaas	10.3	11.0	14.9	25.0
ST-PM1 (Blomme)			16.3	27.4
ST-PM2 (N12)			32.8	55.1
ST-PM3 (Rossgro)			12.5	21.0
ST-PM4 (Geluk)			17.1	28.7

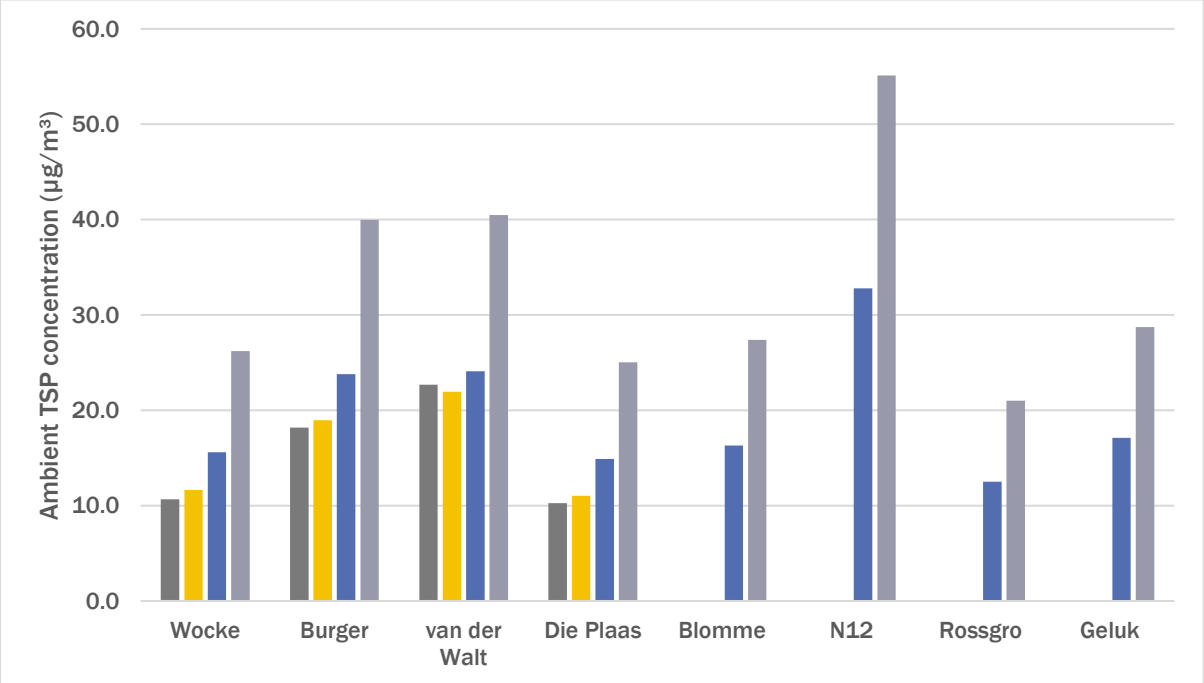


Figure 50: Local ambient PM_{10} monitoring results

The results indicate an ambient particulate load on the lower side of the ambient conditions for the HPA, and well below the National Standard PM_{10} daily average guideline of 75 µg/m^3.

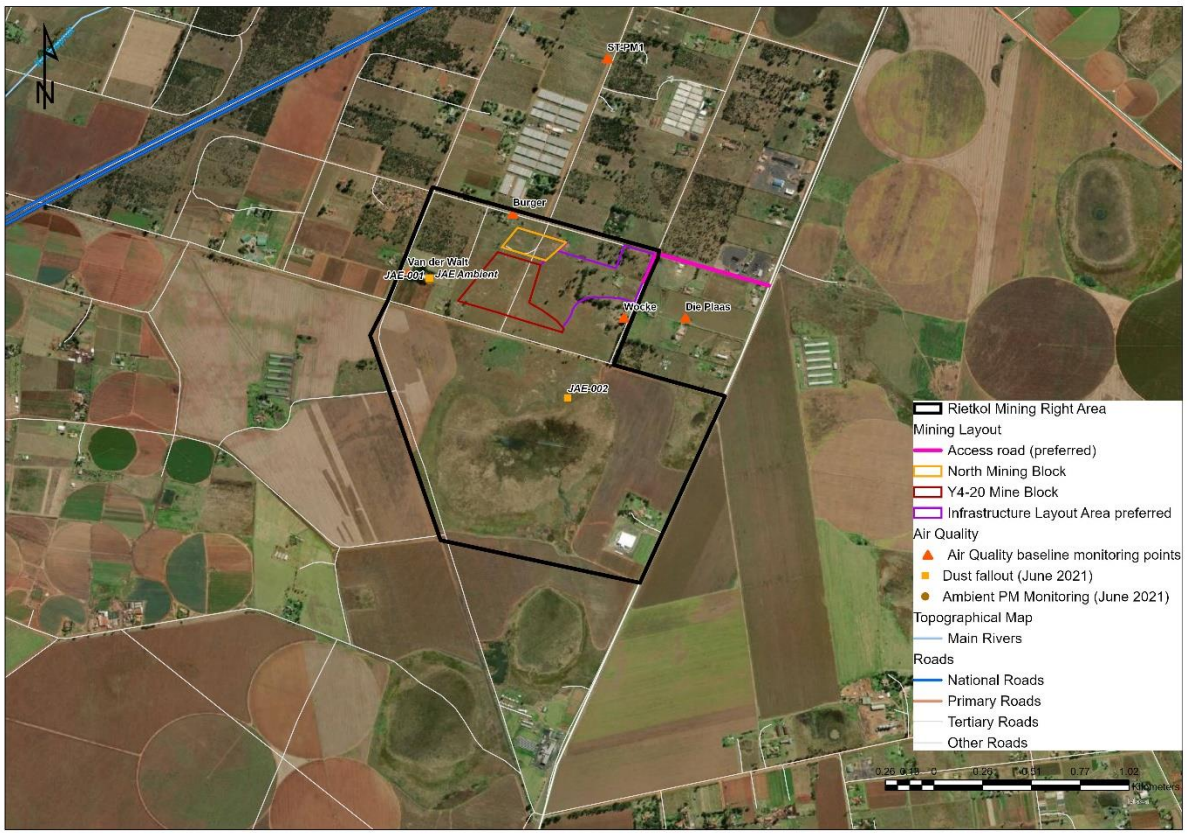


Figure 51: Baseline air quality monitoring points

In addition to the above, Rayten Engineering Solutions (Rayten) was appointed to undertake and determine the baseline dustfall and ambient particulate matter levels around the Rietkol MRA area for a 30-day period (4 June – 5 July 2021). A total of two (2) dustfall monitoring stations (JAE-001 and JAE-002) were installed at the positions indicated in Figure 51. In addition, a Beyond Wireless ambient monitoring station was installed at the van der Walt Farm and is located in close proximity to the dustfall station at JAE-001 to monitor the levels of PM_{10} as well as $PM_{2.5}$ during the monitoring period at the Rietkol site.

The dustfall rate at site JAE-001 remained below the residential area standard of 600 mg/m^2/day, recording a dustfall rate of 56.27 mg/m^2/day. The dust bucket at site JAE-002 was reported stolen and the stand vandalised, as a result a sample could not be obtained for the site.

The dustfall sample obtained from site JAE-001 was sent to an external laboratory for alpha quartz (silica) analysis. The sample was below detectable limits of the instrumentation (which is 0.013 mg), indicating that the levels of silica within the air and recorded during the monitoring period at JAE-001 were extremely low.

The PM_{10} and $PM_{2.5}$ concentrations measured for the period 04 June 2021 – 05 July 2021 are presented in Figure 52.

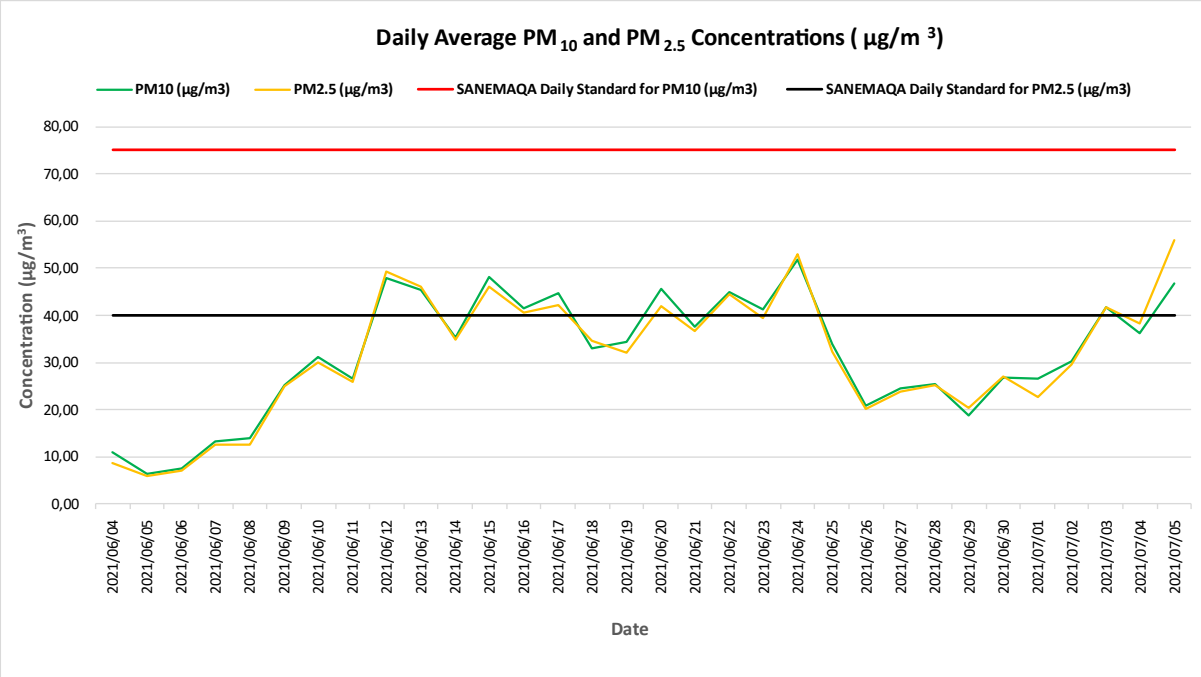


Figure 52: Daily average PM_{10} and $PM_{2.5}$ concentrations at Rietkol (04 June 2021 – 05 July 2021)

There were no exceedances of the South African National Standard of 75 µg/m^3 (i.e. average daily limit) recorded for PM_{10}; however, there were 10 exceedances of the daily limit of 40 µg/m^3 recorded for $PM_{2.5}$. A maximum daily average concentration of 51.79 µg/m^3 for PM_{10} was recorded (24 June 2021), while a maximum daily average concentration of 55.94 µg/m^3 for $PM_{2.5}$ was recorded (5 July 2021). The average daily concentration recorded for the period for PM_{10} was 31.84 µg/m^3 and 31.44 µg/m^3 for $PM_{2.5}$.

A maximum hourly average concentration of 102.90 µg/m^3 was recorded for both PM_{10} and $PM_{2.5}$ fractions at least 14 times during the monitoring period (Figure 53 and Figure 54). The high levels of PM, which can be observed in Figure 53 and Figure 54, show spikes in PM values in the late evenings (20:00 – 23:00) and early periods of the morning (06:00 – 08:00). A diurnal graph showing the fluctuations in concentration levels of PM throughout the day can be seen in Figure 55, which supports the above.

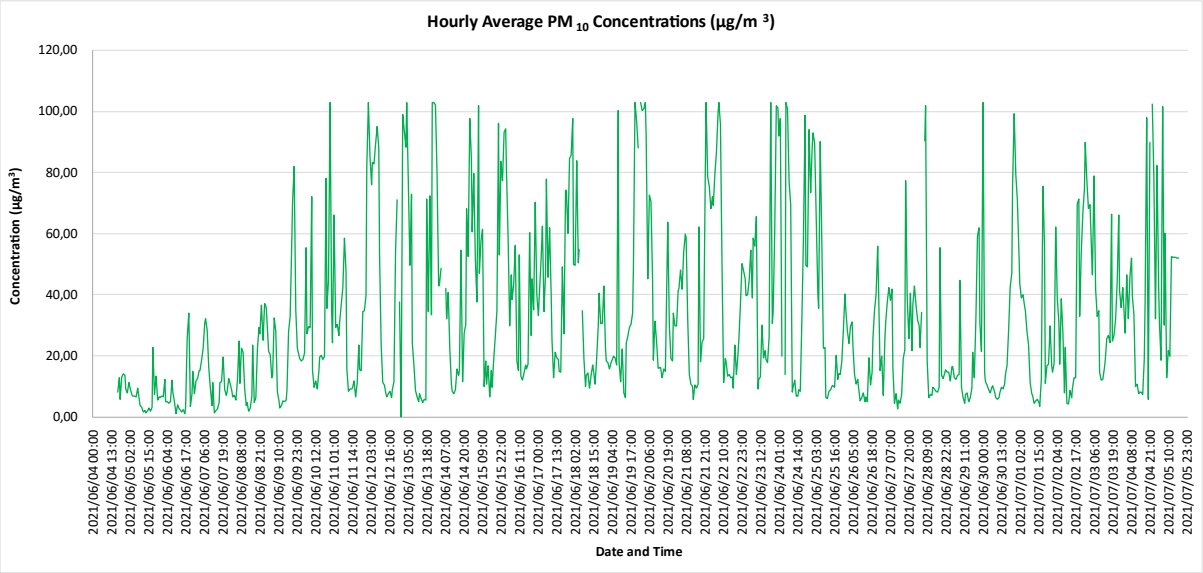


Figure 53: Hourly average PM_{10} concentrations at Rietkol (04 June 2021 – 05 July 2021)

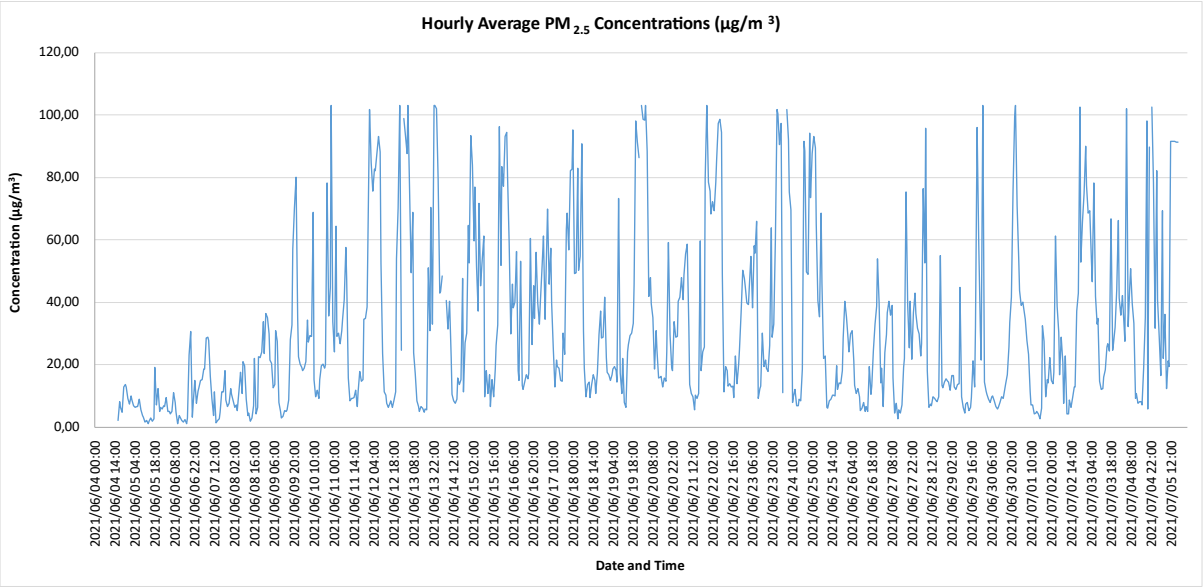


Figure 54: Hourly average $PM_{2.5}$ concentrations at Rietkol (04 June 2021 – 05 July 2021)

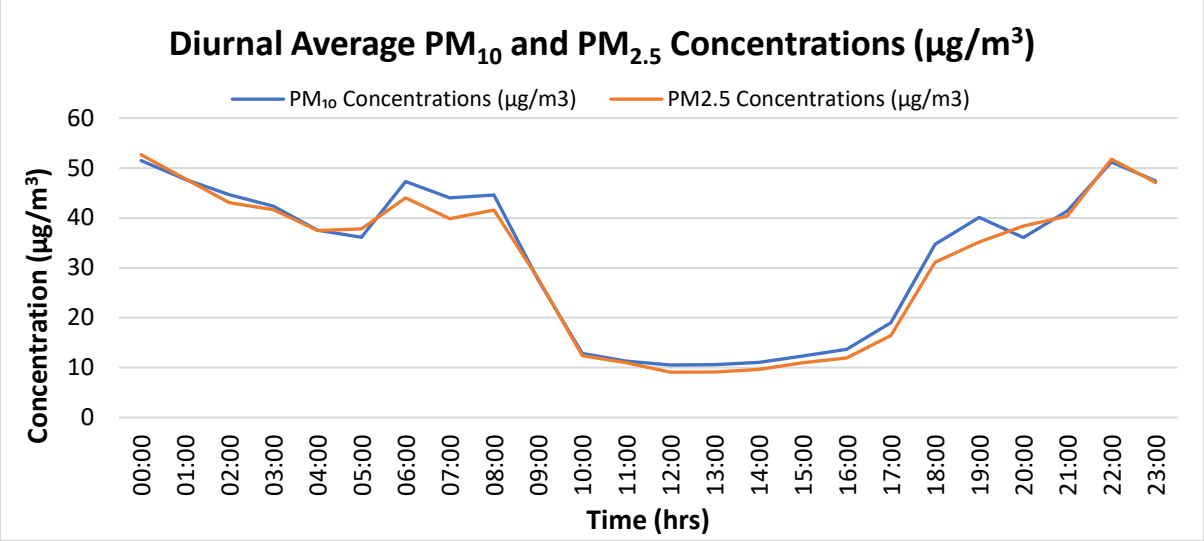


Figure 55: Diurnal average PM concentrations at Rietkol (04 June 2021 – 05 July 2021)

Such regular spikes could be caused by the cold snap in weather experienced in the area during June 2021, leading to an increased number of fires being lit at the neighbouring informal settlement to the north-west of the site, in attempts to provide warmth at night. In addition, a veld fire was reported to the south of the site during one unspecified night in June 2021, which would also have influenced the PM values recorded.

It can be seen in Figure 52 to Figure 55 that the levels of $PM_{2.5}$ and PM_{10} are very similar and in some cases the $PM_{2.5}$ levels were higher than the PM_{10} levels. From this one can deduce that there was very little PM_{10} recorded by the ambient monitoring station, with the majority of particulate matter being 2.5 microns in size or smaller. When looking at potential sources of $PM_{2.5}$ in the area, sources may include the burning of wood and/or coal (by nearby farmhouses and the squatter camp, which is located north-east of the ambient station) as a means of cooking and as a source of warmth during a reported cold snap in June 2021 (Rayten, 2021).

From the above ambient monitoring results, albeit it only for a 30-day period, it is clear that the ambient air quality in the area is not pristine, and that the $PM_{2.5}$ concentrations are in exceedance of the National Standards.

The Ambient Monitoring Report (Rayten, 2021) is attached as Appendix 20.

6.3.7 Ambient Noise

6.3.7.1 Identified noise sources

The area is exposed to low frequency noises generated by the local road traffic (especially from the N12) and some tonal characteristics from the greenhouses that can be detected in the sound spectrum. The greenhouse fan noise is continuous in nature and is more detectable during the night hours at further distances from the source.

Identified noise sources in the region include:

- National Highway (N12) travelling from Johannesburg to Witbank (eMalahleni);
- Road 50 (R50) travelling from the N12 to Delmas;
- Main tarred road travelling from the R50 south towards Eloff;
- Groupings of greenhouses (especially fans of greenhouses) north of MRA area;
- Gravel road leading from main tarred road on the southern boundary of the MRA area; and
- General gravel road network of the region.

The study area can further be described in terms of environmental components that may contribute or change the sound character in the area, as follow:

- ***Topography***: The topography in the area can be described as *"Plains and Pans"* and there are little natural features that could act as noise barriers considering practical distances at which sound propagates.
- ***Surrounding land use***: The land use near the proposed development is agricultural and residential. Activities include crop cultivation, chicken coops and flower production with scattered dwellings featuring the bulk of the land use. The fans at the Unex Roses and chicken coops operate 24/7. The fans are quite audible and a significant source of noise at night.
- ***Roads***: The most important road (in terms of calculable acoustics near a receptor's dwelling) is the N12. Based on the 2003 data, the Average Annualized Daily Traffic (AADT) volume were approximately 6,500 vehicles. With a 6.5% growth, this would equate to an AADT for approximately 16,700 vehicles per day in 2018, or 955 vehicles/hour during the day and 335 vehicles/hour at night. Traffic on tarred road D1550 (leading from the R50 to Eloff) is quite audible during passing, with around 140 vehicles/hour (traffic count Tuesday, 17 April 2018). Assuming an AADT of around 5,000 vehicles per day (RAMS), traffic volumes would be ± 300 and 100 vehicles/hour during the day and night-time periods. Traffic on the R50 is relatively high, but it is located further than 1,000 m from the project site, yet it may cumulatively contribute to noise levels in the area. Traffic volumes similar to the D1550 were assumed.

Other roads in the area do not carry sufficient traffic to warrant considering their contribution to the ambient soundscape (even though these roads do contribute to single events / during passing). The projected noise levels due to the main roads in the area are illustrated in Figure 56 and Figure 57, with the noise contours illustrated from 35 dBA upwards.

- ***Residential areas***: While there are a number of residential dwellings close to the proposed infrastructure, there are no formal residential/urban development closer than 2 000m from the proposed mine infrastructure.
- ***Other industrial and commercial processes***: There are several commercial and light industrial activities taking place on the AHs near the proposed development. A number of these activities are located close to the tar road, although based on the audible impression, the noise generating activities would be limited to daytime activities. While impulsive noises were audible, it was not considered significant.
- ***Ground conditions and vegetation***: The area falls within the Grassland biome, with the vegetation type being moist cool Highveld grassland. The natural veldt has been impacted significantly due to anthropogenic activities, with significant trees planted close the dwellings in the area. Most of the surface area is well vegetated with grasses, shrubs, sedges and trees. Taking into consideration available information it is concluded that the ground surface is sufficiently covered to assume 50% hard ground conditions for modelling purposes. It should be noted that this factor is only relevant for air-borne waves being reflected from the ground surface, with certain frequencies slightly absorbed by the vegetation.

Figure 56: Projected conceptual ambient daytime noise levels due to roads

Figure 57: Projected conceptual ambient night-time noise levels due to roads

6.3.7.2 Existing ambient sound levels

Ambient sound measurements were conducted by Jansen (2016). Additional on-site measurements were collected 16-20 April 2018 by Enviro-Acoustic Research (EAR). Further on-site measurements were conducted during April and July 2021 to supplement the previous baseline measurements. The monitoring points are indicated Figure 58.

6.3.7.2.1 Results 2016 survey

The short-term noise measured results in 2016 are presented in Table 27. The survey identified some noise sources in the region (N12, local gravel road network and natural noises) which impact on the typical expected noise levels for the region. The region is classified as a rural area; however, with the close proximity of the N12 and the busy tarred roads in the region, it is possible to classify the region as sub-urban with a major road in close proximity.

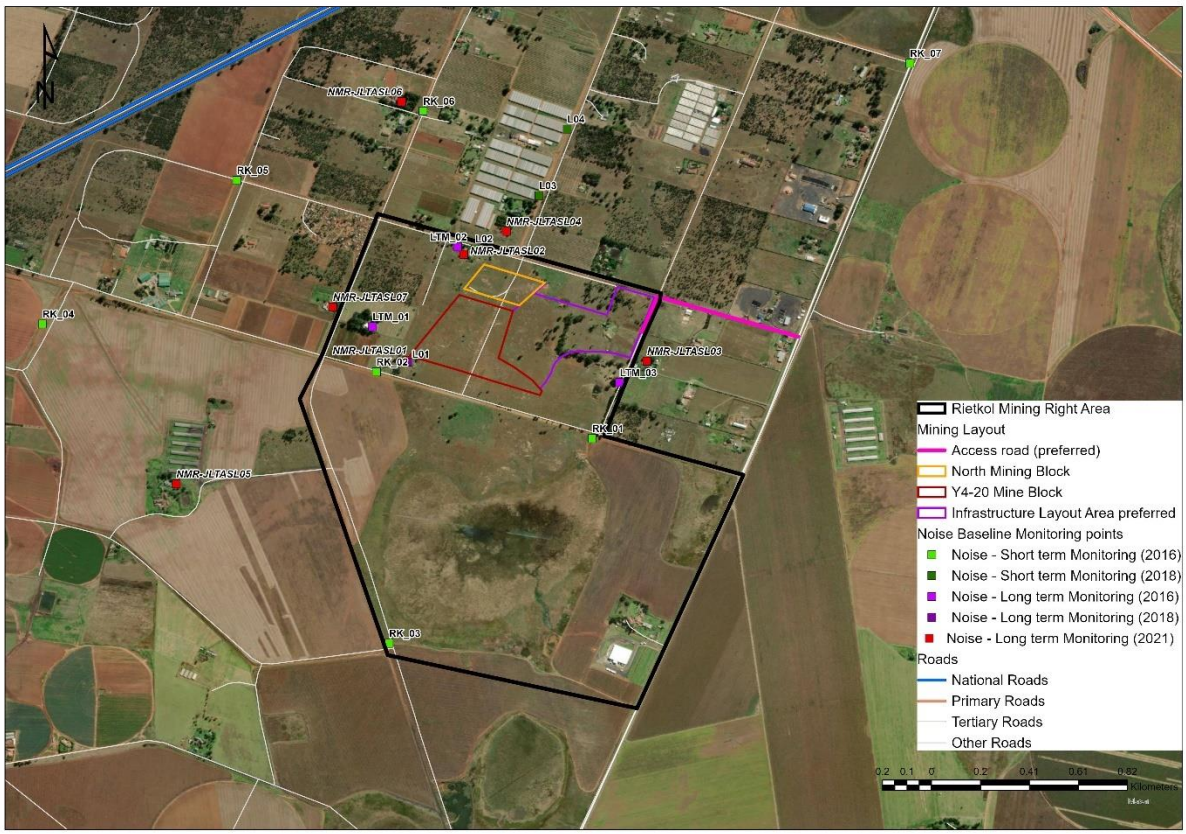


Figure 58: Baseline noise monitoring points

Table 27: Short-term noise monitoring results (2016)

ID	Name	Time	Duration (min)	L_{Aeq}	L_{ceq}	L_{A10}	L_{A90}	L_{AMIN}	L_{AMAX}
RK_01	SE corner of Site	10:48	60	50.5	64.0	51.7	36.7	32.3	82.4
RK_02	Bheki House	11:55	15	50.6	65.2	49.5	38.0	32.7	73.9
RK_03	Across the pan	12:17	15	39.7	63.4	42.9	33.0	28.6	61.4
RK_04	Highway monitoring point	12:40	15	46.3	68.5	47.4	44.5	40.7	63.6
RK_05	Highway monitoring point	13:06	15	46.8	66.1	49.7	43.8	37.8	55.1
RK_06	Agricultural Area	13:26	15	48.3	64.4	48.2	45.2	40.2	69.6
RK_07	UNEX Roses Road Side	13:50	15	68.1	76	70.3	50.2	35.2	85.2

The long-term noise measured are presented in Table 28. Jansen (2016) concluded that the area can be classified as “Urban – with major road” according to the SANS 10103:2008 type of districts, as the site is not rural in the pure aspect of a rural area.

Table 28: Long-term noise monitoring results (2016)

ID	Name	^{L}Req,daynight (dBA)	^{L}Req,day (dBA)	^{L}Req,night (dBA)
LTM_01	Van der Walt Home	57.21	54.53	50.04
LTM_02	Burger Home	55.17	52.11	48.20
LTM_03	Wocke Home	53.32	54.43	39.56
Average continuous rating levels calculating from LTM's		55.5	53.8	47.7
SANS 10103:2008 District D – Urban with Main roads		60.0	60.0	50.0

6.3.7.2.2 Results 2018 survey

Additional unattended long-term ambient (background) sound levels were measured over a 4-night time period from 16 - 20 April 2018 at monitoring point LO1 (AH216: Mthethwa) (Figure 58).

Table 29: Sound levels considering various sound level descriptors for LO1

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)	Comments
Day arithmetic average	-	53	49	41	-	-
Night arithmetic average	-	44	41	34	-	-
Day minimum	-	33	30	-	22	-
Day maximum	117	97	84	-	-	-
Night minimum	-	30	28	-	24	-
Night maximum	78	64	59	-	-	-
Day 1 equivalent	-	56	49	-	-	Late afternoon and evening
Night 1 Equivalent	-	51	47	-	-	8-hour night equivalent average
Day 2 equivalent	-	62	55	-	-	16-hour day equivalent average
Night 2 Equivalent	-	50	45	-	-	8-hour night equivalent average
Day 3 equivalent	-	57	53	-	-	16-hour day equivalent average
Night 3 Equivalent	-	54	49	-	-	8-hour night equivalent average
Day 4 equivalent	-	59	54	-	-	16-hour day equivalent average
Night 4 Equivalent	-	50	45	-	-	8-hour night equivalent average
Day 5 equivalent	-	82	69	-	-	Morning and afternoon

The statistical data ($L_{A90,f}$) indicates a location with substantial elevated noise levels both day and night, even though L_{Amin} data indicates a location with a potential to become quiet. L_{Amax} levels frequently exceeded 65 dBA at night (more than 10 times each night) with the source unknown. When sound events occur at night (where the noise level exceeds 65 dBA) this may disturb the sleep of people. It

should be noted that equivalent data shows a location where ambient sound levels are higher than the level desired for residential use at night (higher than 45 dBA).

In additional to the long-term measurement, a few single measurements were collected to gauge the noise levels from the fans located at the greenhouses (levels and spectral character). The data is presented in Table 30.

Table 30: Summary of singular noise measurements (2018)

Monitoring point	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} level (dBA90)	Comments
L02 (AH-210: Consol)	50.6	49.5	47.0	Fans from the nursery significant and dominant sound. Birds and chickens audible at times, with some wind-induced noises. Agricultural equipment active in the area and clearly audible. Sounds of grinding and other workshop related activities audible at times.
L03 (AH-Re/202: Unex Rose)	50.9	48.6	46.7	Fans from the greenhouses significant and dominant sound. Wind-induced noises due to plastic sheeting (from tunnels) occasionally flapping in the wind. Workers travelling up and down the gravel road on foot, via bicycle, tractor and a LDV. Voices audible at times. Nearby workshop related activities are taking place including grinding, use of hammers and drills etc. Wind-induced noises due to the presence of trees.
L04 (AH-3/202: Unex Rose)	50.3	48.0	45.5	Fans from the greenhouses significant and dominant sound. Wind-induced noises due to plastic sheeting (from tunnels) occasionally flapping in the wind. Workers travelling up and down the gravel road on foot, via bicycle, tractor and in LDV. Voices audible at times. Nearby workshop related activities are taking place including grinding, use of hammers and drills etc. Wind-induced noises due to the presence of trees. Road traffic noise in distance, possibly the N12 traffic.

EAR (2018) concluded that, while measured ambient sound levels were higher, considering the developmental character of the area, the acceptable zone rating level would be typical of an urban area (45 dBA at night and 55 dBA during the day) as defined in SANS 10103:2008, acceptable for residential use.

6.3.7.2.3 Results 2021 survey

Further unattended long-term ambient (background) sound levels were measured over a 2-night time period from 17 - 19 February 2021 at three locations and over a 4-night time period from 9-13 July 2021 at an additional four locations (Figure 58). The data is presented in Table 31.

Focussing on the night-time measurements at NMR-JLTASL01, NMR-JLTASL02 and NMR-JLTASL03 (April 2021), the average of the impulse-time weighted night-time equivalent rating levels (48.6 dBA)

is typical of a busy urban (with main roads, business and workshops) noise district (with acceptable rating levels of 50 dBA during the night-time period). The average of the fast-time weighted night-time equivalent rating levels (44.1 dBA) is typical of an urban noise district.

Noise levels at measurement locations NMR-JLTASL04, NMR-JLTASL05, NMR-JLTASL06 and NMR-JLTASL07 (July 2021) are quite high, and the average of the impulse-time weighted night-time equivalent rating levels (58.1 dBA) is typical of an industrial noise district (with acceptable rating levels of 60 dBA during the night-time period). The average of the fast-time weighted night-time equivalent rating levels (53.1 dBA) is typical of a central business district.

It is noted that measurement locations NMR-JLTASL04, NMR-JLTASL05, NMR-JLTASL06 and NMR-JLTASL07 are typically not locations used to measure sound levels, as proximity to the N12 road or industrial activities (such as chicken coups) would raise ambient sound levels and result in excessive rating levels (acceptable sound levels) (EAR, 2021). Therefore, although the additional noise measurements (collected during April and July 2021) highlighted high ambient sound levels, when considering the developmental character of the area, the acceptable zone rating level would be typical of an **urban area** (45 dBA at night and 55 dBA during the day) as defined in SANS 10103:2008 (acceptable for residential use) (EAR, 2021). Mining activities (calculated noise levels) should not change these proposed acceptable rating levels with more than 7 dBA (disturbing noise) and ideally with no more than 3 dBA.

Table 31: Summary of long-term noise measurements (2021)

Monitoring Point	$L_{Aeq,l}$ (dBA)		$L_{Aeq,f}$ (dBA)		$L_{A90,f}$ (dBA90)		Comments
	Day	Night	Day	Night	Day	Night	
NMR-JLTASL01 (AH-216: Mthethwa)	52.4	46.7	47.5	43.2	37.6	37.1	Daytime: sub-urban to urban noise district Nighttime: urban to busy urban (with main roads, business and workshops) noise district LA90 levels are significantly elevated for both the day- and night-time periods, indicating constant sounds that raised this statistical indicator. The source of this acoustic energy is not clearly defined but may relate to the traffic noises.
NMR-JLTASL02 (AH-210: Consol)	55.7	49.1	46.3	43.3	37.7	37.7	Daytime: urban noise district Nighttime: busy urban (with main roads, business and workshops) noise district LA90 levels are significantly elevated for both the day- and night-time periods, indicating constant sounds that raised this statistical indicator. The source of this acoustic energy is not clearly defined but may relate to the traffic noises as well as fans from the nursery.
NMR-JLTASL03 (AH-278: CPI)	57.8	50.1	54.6	45.9	39.0	35.5	Daytime: urban to busy urban (with main roads, business and workshops) noise district Nighttime: busy urban (with main roads, business and workshops) noise district LA90 levels are significantly elevated for both the day- and night-time periods, indicating constant sounds that raised this statistical indicator. The source of this acoustic energy is not clearly defined but may relate to the traffic noises.
NMR-JLTASL04 (AH-RE/202: Unex Rose farmhouse)	69.2	72.7	58.8	62.4	42.8	43.1	Daytime: industrial noise district Nighttime: industrial noise district LA90 levels are significantly elevated for both the day- and night-time periods, indicating constant sounds that raised this statistical indicator. The source of this acoustic energy is not clearly defined but may relate to fans from the nursery.
NMR-JLTASL05 (Rietkol Ptn 2: Rossgro, Rustig Broiler Farm)	58.4	57.6	57.3	57.1	54.9	54.0	Daytime: urban to busy urban (with main roads, business and workshops) noise district Nighttime: industrial noise district LA90 levels are significantly elevated for both the day- and night-time periods, indicating constant sounds that raised this statistical indicator. The source of this acoustic energy is suspected to related to fan noises from the chicken houses.
NMR-JLTASL06 (AH160: Kritzinger, Goudhoek Stud)	55.3	49.3	52.5	47.6	46.4	35.1	Daytime: urban noise district Nighttime: busy urban (with main roads, business and workshops) noise district LA90 levels are significantly elevated for both the day- and night-time periods, indicating constant sounds that raised this statistical indicator. The source of this acoustic energy is likely from traffic noises in the area.
NMR-JLTASL07 (AH148: Booyen)	58.4	52.7	51.5	45.2	41.9	35.0	Daytime: urban to busy urban (with main roads, business and workshops) noise district Nighttime: busy urban (with main roads, business and workshops) noise district LA90 levels are significantly elevated for both the day- and night-time periods, indicating constant sounds that raised this statistical indicator. The source of this acoustic energy is not clearly defined.

6.4 CULTURAL AND HERITAGE RESOURCES

6.4.1 Palaeontology

The Rietkol Project area is dominated by large areas underlain by dolomitic rocks of the Hospital Hill Formation (Witwatersrand Supergroup), the Malmani Subgroup of the Chuniespoort Group (Transvaal Supergroup) as well as a cover of Permian aged Vryheid Formation of the Ecca Group (Karoo Supergroup).

The areas underlain by Vaalian aged rocks of the Hospital Hill Formation will have a Low palaeontological significance and underlies the entire central part of the development. The overlying Malmani Subgroup is Very Highly sensitive for palaeontological heritage. It is important to note that the Malmani Subgroup contains significant karst formations and caves over its entire outcrop area, hence the high classification.

Geologically, the proposed development lies on the edge of the Vryheid Formation of the Ecca Group, which may contain plant fossils, especially in the shales above or below the coal. Bearing in mind that the terrain consists of quartzite outcrops where the sandstones have been metamorphosed, it is highly unlikely that fossils will be present in the rock. The objective of the mining is to extract sand and therefore there is no reason to penetrate the shale or coal layers.

The palaeontological sensitivity of the MRA area is indicated in Figure 59. The mining blocks are of Low sensitivity, whilst the infrastructure area is partly of Very High sensitivity and partly of Low sensitivity.

The desk-top Palaeontology Impact Assessment (PIA) concluded that no mitigation for palaeontological heritage is recommended for this project before excavations reach a depth of 1.5m. A suitably qualified palaeontologist must visit the area indicated as Very High sensitivity during the first week of excavations. If excavations expose fossils, a Phase 1 PIA must be conducted, and a "Chance Find Protocol" (CFP) document developed. The CFP document must then be included as part of the EMPr of the project, to record all unexpected fossils associated with the geological formations on site.

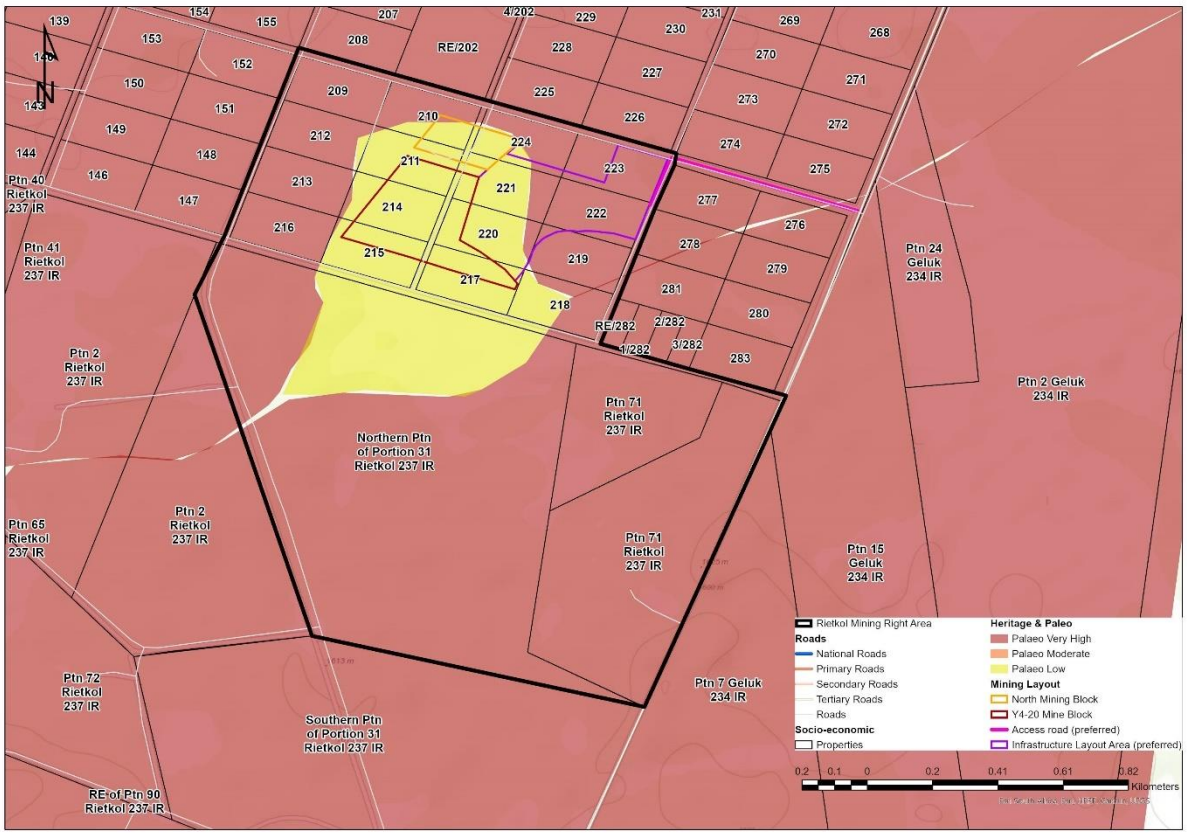


Figure 59: Palaeontological sensitivity of the area affected by the Rietkol Project

6.4.2 Stone Age

Quartz is hard and was frequently used for stone tool making. Isolated Middle Stone Age flakes were noted on the outcrop just north of the pan, but no intact primary site or stone knapping site was found, and no formal tools were observed. The terrain is not suitable for Rock Art as there are no large lose-standing boulders or rock overhangs which would facilitate rock art.

6.4.3 Iron Age

No Iron Age sites or cultural material was observed.

6.4.4 Graves and Burial Sites

An informal graveyard consisting of about 20 graves was recorded at coordinates S26°07'41.5" E28°36'32.2". Some of these graves are delineated by brick-and-mortar walls, whereas others are stone stacked. The graves are not maintained, are overgrown and some have been damaged by burrowing porcupines, while others have collapsed. Graves of both adults and children are present. None of the graves have headstones and no names could be discerned. The exact size of the graveyard and number of graves could not be determined accurately. The graves fall just outside of the mining

pit area. The proposed mining will be undertaken in this area by YR15 according to the mining schedule, at which point the activity may impact on the graves.

6.4.5 The Built Environment

Several ruins exist of the properties, numbered 1 – 6 on Figure 60. Two of the ruins were homesteads (1 & 6), while the others relate to livestock and farming activities.

1. Ruins of a house and outbuilding constructed with a combination of fired clay bricks and cement blocks. The architectural design (shape and large windows) and building materials makes it highly unlikely that the structures are older than 60 years. Significance: Low. Coordinates: S26°07'40" E28°36'37"
2. Stacked large stones in two groups, the one resembling the letter J. Probably cleared from the adjacent ploughed field. Significance: None. Coordinates: S26°07'39.4" E28°36'22.8"
3. A structure that probably was a fowl-house. Contains modern pre-fab material. Connected to recording 1. Significance: None. Coordinates: S26°07'37" E28°36'23.4"
4. A pigsty constructed with cement blocks. Connected to recording 1. Significance: None. Coordinates: S26°07'35" E28°36'25.5"
5. Water trough and livestock pen. Connected to recording 6. Significance: None. Coordinates: S26°07'31.8" E28°36'25.2"
6. Ruins of a house and outbuilding. The house was constructed with fired clay bricks and mortar and the outbuilding of stone. Aspects such as the architectural design, ventilation ports and building material makes it highly unlikely that the structure is older than 60 years. A water tank stand constructed of brick and mortar stands near the house. Significance: Low. Coordinates: S26°07'29.8" E28°36'22.4"

All other buildings on the properties are modern.

Recording 7 is an old trigonometrical beacon (No. 626). Coordinates: S26°07'35.6" E28°36'30.3". The network of trigonometrical beacons on top of mountains and tall structures and buildings is known as a passive network since the beacon merely represents the position of the co-ordinate assigned to it and plays no role in updating or monitoring its position.

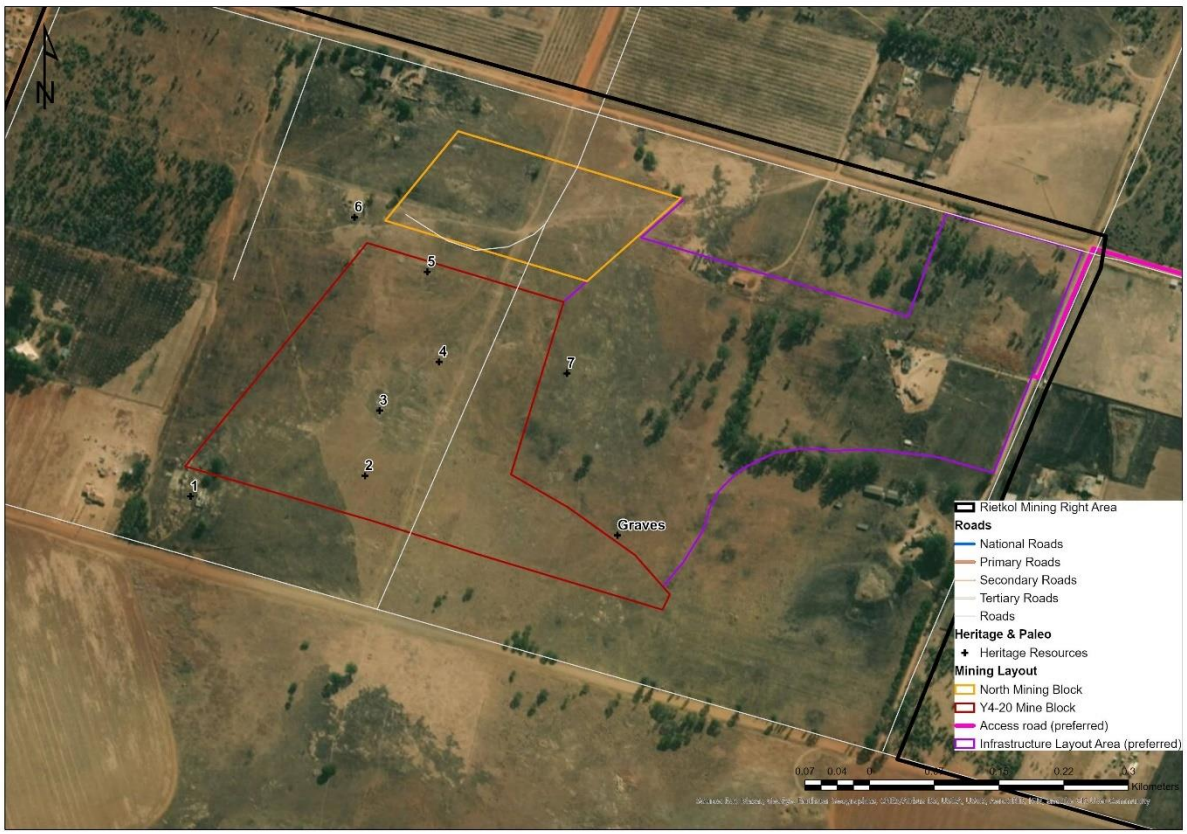


Figure 60: Heritage resources

6.5 SOCIO-ECONOMIC CHARACTER

6.5.1 Towns and Settlements

The broader project area is located amongst existing towns and settlements. The closest formal towns are (refer to Figure 61):

Table 32: Nearest towns

No	Town	Direction	Distance
1	Delmas / Botleng	East	5 km
2	Daveyton / Etwatwa	West	15 km
3	Eloff	South	3.5 km

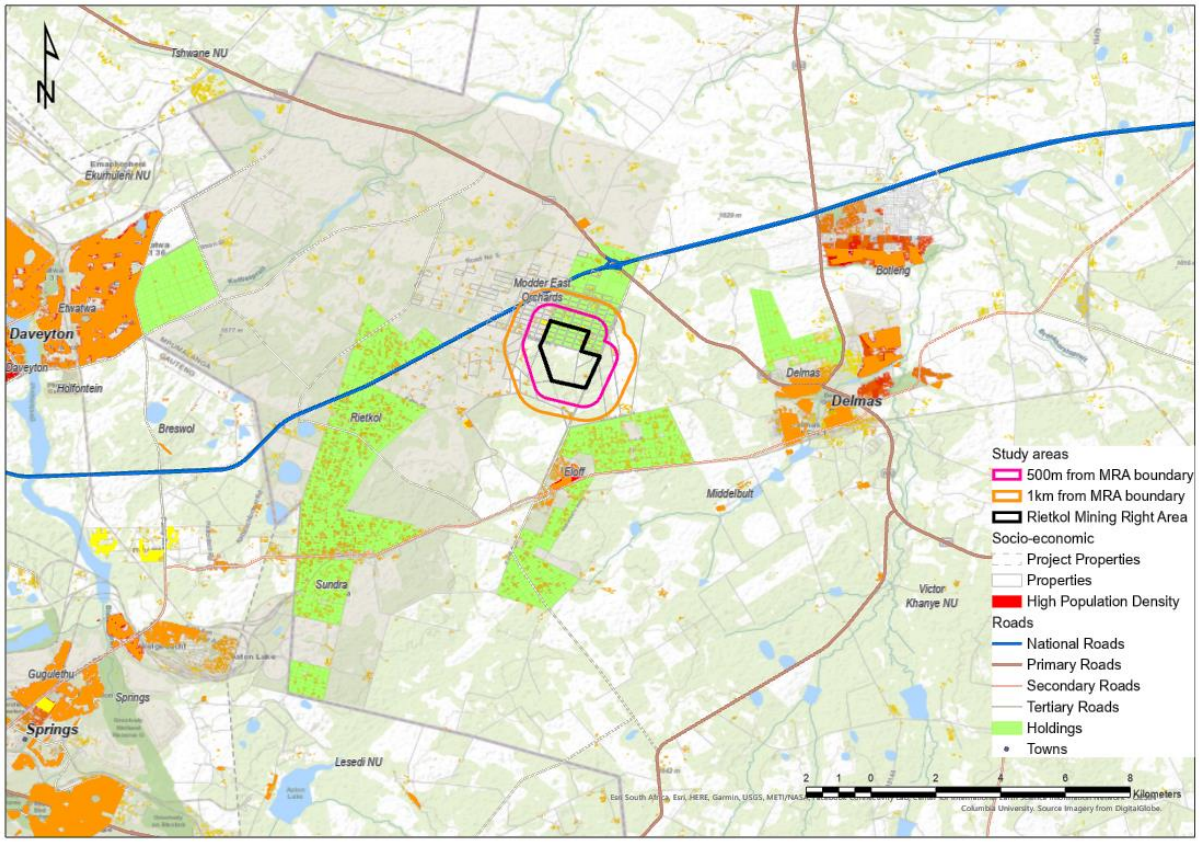


Figure 61: Towns and settlements

Some settlements and informal housing have been observed on the periphery of the formal towns. These are relevant as a risk of uncontrolled expansion in these areas due to the potential influx of jobseekers.

Within the broader project area there are no formal towns. There are, however, built-up areas and residential structures located on many of the AHs, which may constitute a rural dispersed settlement in the broader context. Figure 62 indicates residential structures and built-up areas in relation to the MRA area. In the study areas the following residential structures can be found:

Structure Type	MRA area	Within 500m of MRA area	Between 500m and 1km of the MRA area	Total
Owner / Tenant Residential Structures	12	36	28	**76**
Worker Residential Structures	13	41	13	**67**
Support Structures	22	39	27	**88**
Informal Settlement	0	63	0	**63**
Total	**47**	**179**	**68**	**294**

Apart from the land occupants or labour tenant housing located on the various properties, there are two AHs that have occupants that constitute the start of or an informal settlement. These are AH 152 spreading over to AH 151.

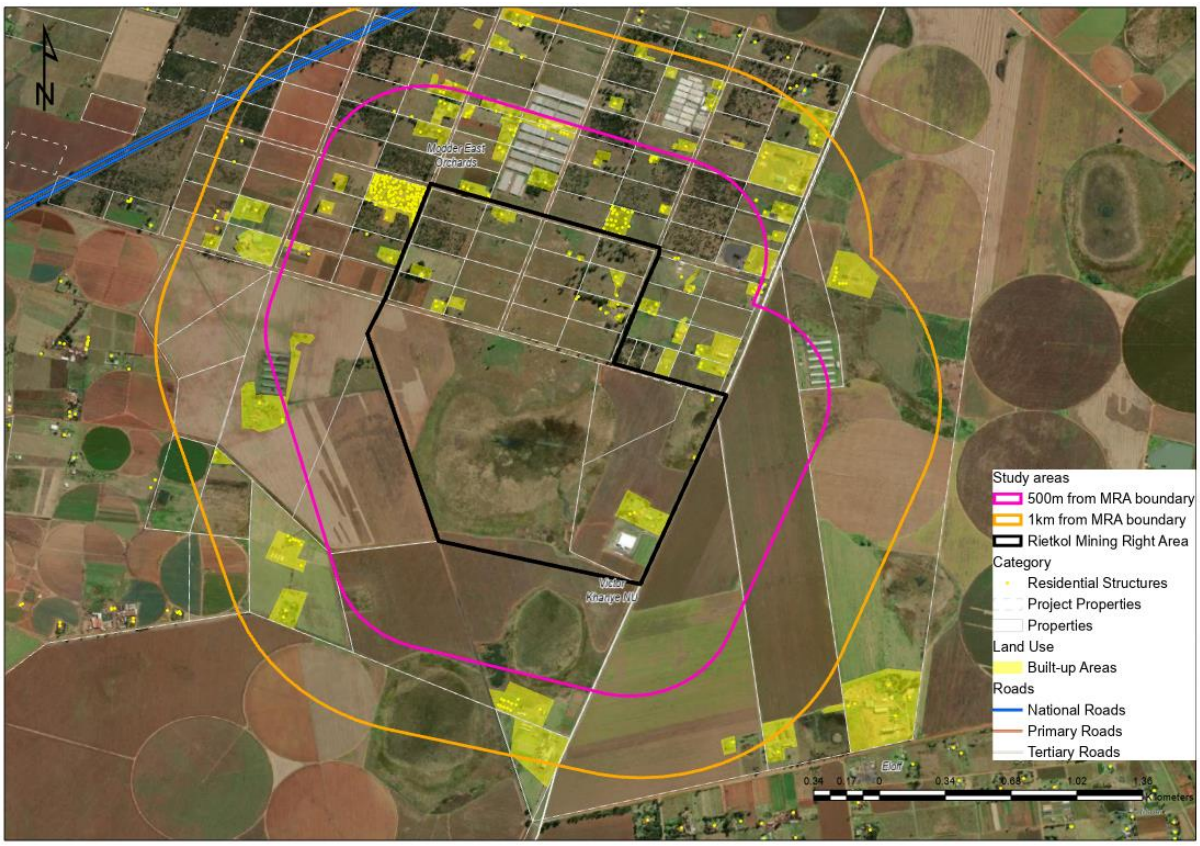


Figure 62: Residential and built-up areas

Other residential areas are less dense and are mixed with other land uses such as agriculture. In some cases, owners also use residential rent-out to generate an additional income for the household.

The Social Impact Assessment (SIA) provides an analysis of the socio-economic environment in the broader area and within the project area and the informal settlements, which is not repeated in this report.

A skills assessment conducted on the informal settlement (Emfasini) located within 500m from the MRA area revealed the following:

Table 33: Informal settlement skills assessment

Employment & skills	2018 Emfasini (151/152)	2021 Emfasini (151/152)
Economically Active Population (EAP)	89	86
% Employed	62.92%	58.14%
% Unemployed (expanded def)	37.08%	41.86%
% with formal skills	10.1%	33.7%
% with informal skills	47.2%	37.2%
% with No skills	19.1%	29.1%

The following further information was found:

- Employed: In total, 59.3% (51 of 86) of the employable workforce is currently employed or self-employed. The major employers of the people residing in these settlements are:

Employers	2018 survey		2021 survey	
Unex Roses & Prickley Pears	39.3%	22	27.5%	14
Rossgro	17.9%	10	7.8%	4
MBFi	12.5%	7	9.8%	5
Pretorius Blomme	0.0%	0	5.9%	3
Properties surrounding the MRA area as domestic & other workers	12.5%	7	3.9%	2
Parties & Companies within Eloff	1.8%	1	5.9%	3
Parties & Companies within Delmas	5.4%	3	17.6%	9
Parties & Companies within broader region	1.8%	1	3.9%	2
Self-employed	8.9%	5	17.6%	9

There has been a decrease of 4.8% in employment rates between 2018 and 2021 within the settlement, probably primarily due to those employed leaving the settlement to either reside on the properties where they work or to alternative living arrangements. There has also been some loss of employment from some of the employers.

- Formal skills: 33.7% (29 of 86) of the employable workforce have formal skills. Of the 29, 7 are currently unemployed.

Formal skills from the surveys	Total	Employed	Unemployed	Details of skills
2018 survey	10.1%	77.8%	22.2%	Formal Administration, Artisan, Construction, Mining, Safety and Security Skills
	9	7	2	
2021 survey	33.7%	75.9.2%	24.1%	
	29	22	7	

- Informal skills: 37.2% (32 of 86) of the employable workforce have informal skills. Of the 32, only 6 are currently unemployed, amongst them cleaners and agricultural workers.

Informal skills from the surveys	Total	Employed	Unemployed	Details of skills
2018 survey	47.2%	83.3%	14.3%	Cleaners and agricultural workers
	42	35	6	
2021 survey	37.2%	81.3%	18.8%	
	32	26	6	

- No specific skills: 29.1% (25 of 86) of the employable workforce have no specific skills. Of the 25, 23 are unemployed. Of the 23 currently unemployed, 1 has a Public Administration certificate, 7 have their Matric, and a further 15 is functionally literate.

No skills from the surveys	Total	Employed	Unemployed	Details of unemployed parties
2018 survey	28.1%	4.0%	96.0%	None.
	25	1	24	
2021 survey	29.1%	8.0%	92.0%	
	25	2	23	

6.5.2 Residential Investment or Commercial Development

Commercial Development within the Victor Khanye Municipality mostly surrounds primary and secondary development nodes, such as Delmas / Botleng and Eloff. In recent years agricultural holdings have been increasingly developed for commercial properties rather than agriculture.

In terms of the Victor Khanye Land Use Management plan, the Modder East AHs are to be utilized for low-density residential development, but in most cases the holdings have been developed commercial (Figure 63).

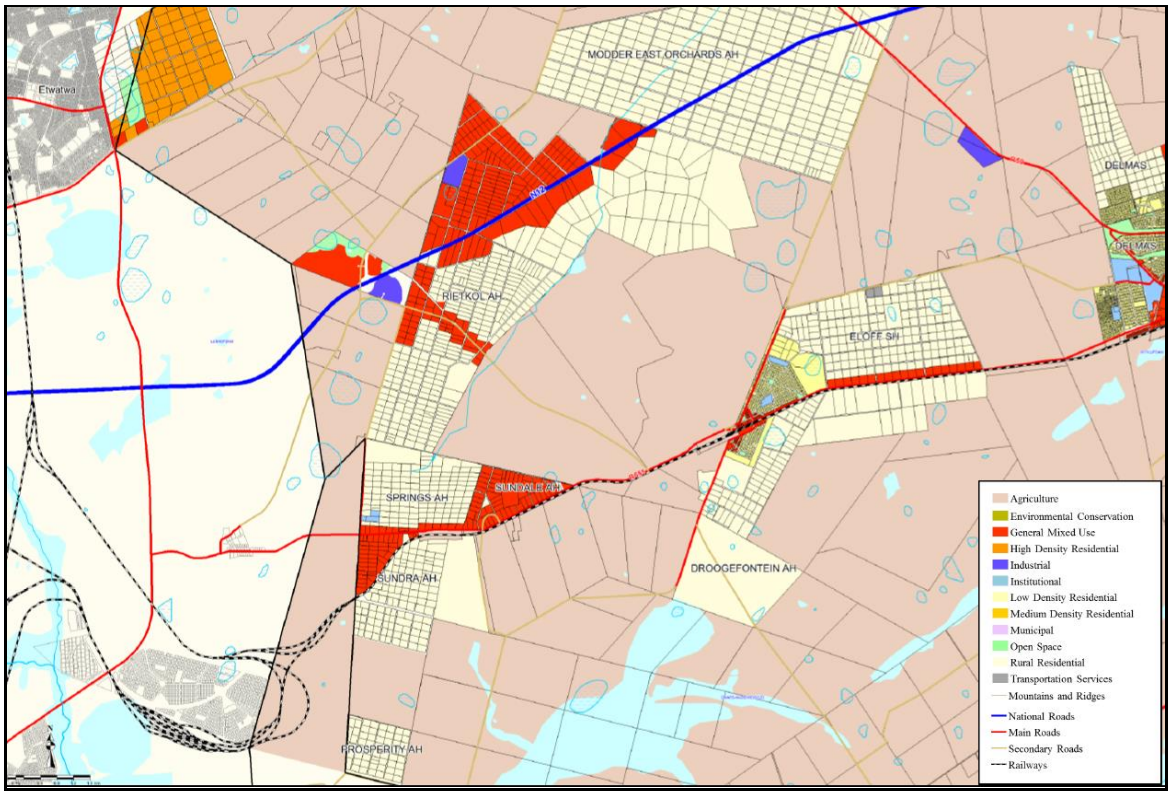


Figure 63: Victor Khanye LM land use management plan

Within the Modder East AHs, many properties have been converted from rural residential to residential investment properties (properties constructed to rent out) with more than 1 residential structure on a property and commercial development (workshops, panel beaters, offices, etc.). Commercial development has expanded from 2018 – 2021 and more properties, especially next to the

main access route, are now used for commercial activities. Figure 64 indicates the study areas and where either residential investment or commercial development was found.

Many of the commercial developments have a focus on agricultural activities such as the Rossgro Packhouse, Feedmil and the MBFi laboratory. Other commercial development is focused on the transport, construction, and mining industries.

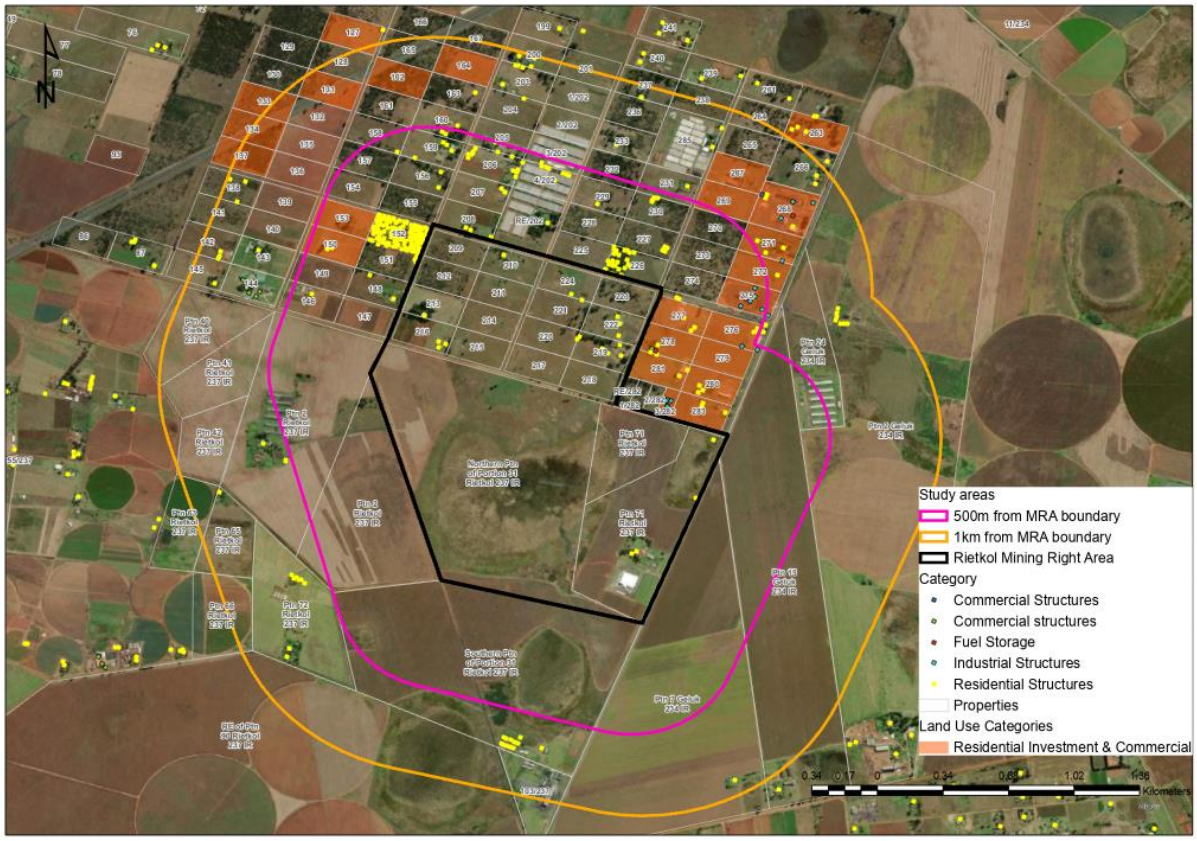


Figure 64: Residential investment or commercial development

6.5.3 Agricultural Land Use Activities

The agricultural land use in the study areas consists of a variety of agricultural businesses, i.e. pasture grass, crop cultivation grown in rain fed and pivot irrigation areas, horticulture (rose and cut flowers), poultry enterprises, livestock farming and horse training (equestrian centre). Pecan nut trees have been planted on AH 213. Pasture production includes Teff and Russian grass for livestock feed. With the good rainfall in the area, dry land production is high. Microbial Biological Fertilizers International (MBFi) also have their Fungal Department on AH 144 with experimental crops on AHs 146, 147 and 216. A large egg layer packhouse and two broiler units are present within the study zones.

The summer crops are Maize and Soya, winter crops are Cabbage, Teff and Russian grass and flower and rose production all year round. The cultivated dry land and irrigation areas were identified by

means of satellite images and the hectares determined. The project area consists of close to 59% allocated to cultivation and crop production (Maize, Soya- and Dry Beans, Teff and Russian Grass, Cactus Pears, Floriculture and Pecan Nuts) and 41% to grazing.

The agricultural activities are summarised in Table 34 as indicated in Figure 65.

Table 34: Agricultural land use activities

Activity	**Zone 1 (ha)**	**Zone 2 (ha)**	**Zone 3 (ha)**	**Total (ha)**
Economic activities				
Maize	33,04	154,65	619,75	807,44
Soya	16,52	77,33	309,87	403,72
Floriculture - Roses		7,97	-	7,97
Beef (Grazing)	98,5	107,647	164,85	370,997
Teff/Hay/Russian Grass		15,61	27,92	43,53
Cactus Pears		6,88	7,24	14,12
Pecan Nuts	3,5		-	3,5
Egg Packhouse	4,04			4,04
Poultry - Broilers		-	6,34	6,34
Floriculture - Cut Flowers			4,24	4,24
Combined Private Investigations (CPI)		12,14		12,14
Dr Greeff – House Rental		0,44		0,44
Dr Greeff – Pig Feed Experimental Unit		3,6		3,6
MBFi		8,09	12,14	20,23
Other natural areas (wetlands)	45,64	27,89	36,9	110,43
Sub-total	**201,24**	**422,25**	**1189,25**	**1 812,74**
Built-up areas				
Farm Homesteads and Outbuildings	6,89	27,07	12,86	46,82
Packhouse/Feed Mill	2,38		5,55	7,93
Informal Settlements (squatters)		3,55		3,55
Business Administration and Premises		10,29	28,39	38,68
Equestrian			2,62	2,62
Security Business		1,26		1,26
Roads	1,48	9,59	11,66	22,73
Total	**10,75**	**51,76**	**61,08**	**123,59**

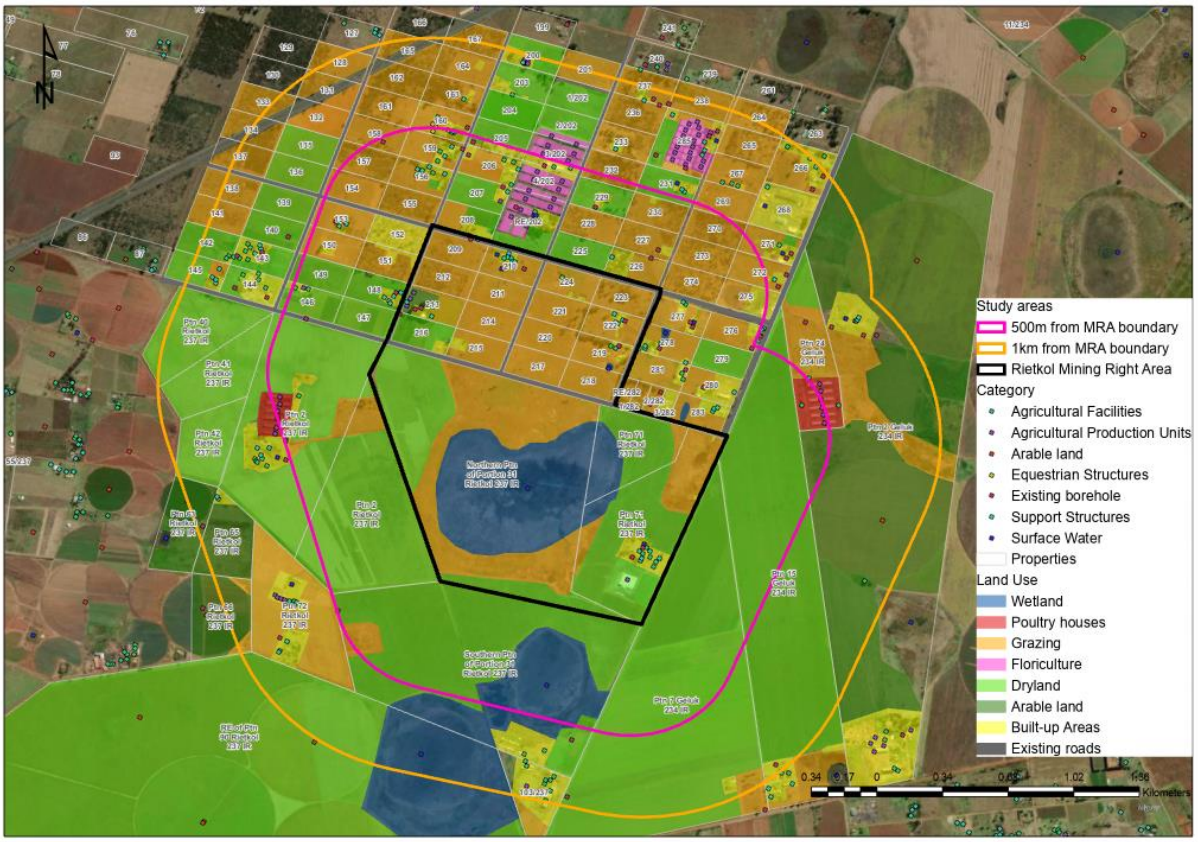


Figure 65: Agricultural activities in project area

6.5.4 Mining Activities

Figure 66 illustrates the spatial distribution of applications for mining and prospecting licenses in the municipal area (source Victor Khanye SDF). The entire eastern and southern extents of the municipal area are covered by mining license applications, while there are prospecting license applications on almost the entire remainder of the municipal area.

Also shown on Figure 66 is the footprint of existing mining activities (as per the SDF). The spatial extent of mining activities is significantly less than the area covered by the license applications. The two predominant mining areas are around Delmas, and in the far north-eastern corner of the municipal area. Mining activities recently also expanded to the west of the municipal area. Based on available information the mining activities are mostly related to coal, quarrying and/or sand mining activities.

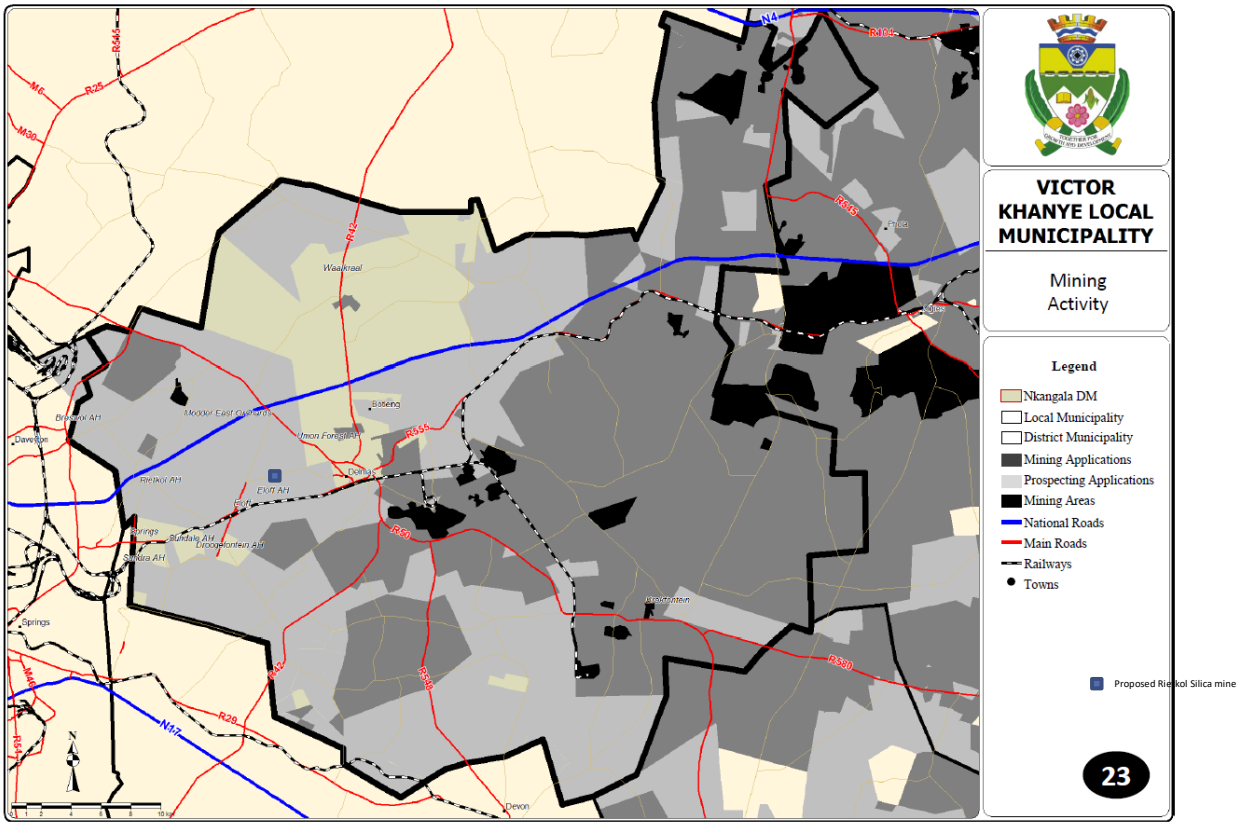


Figure 66: Prospecting, mining applications and mining areas (Victor Khanye SDF, 2015)

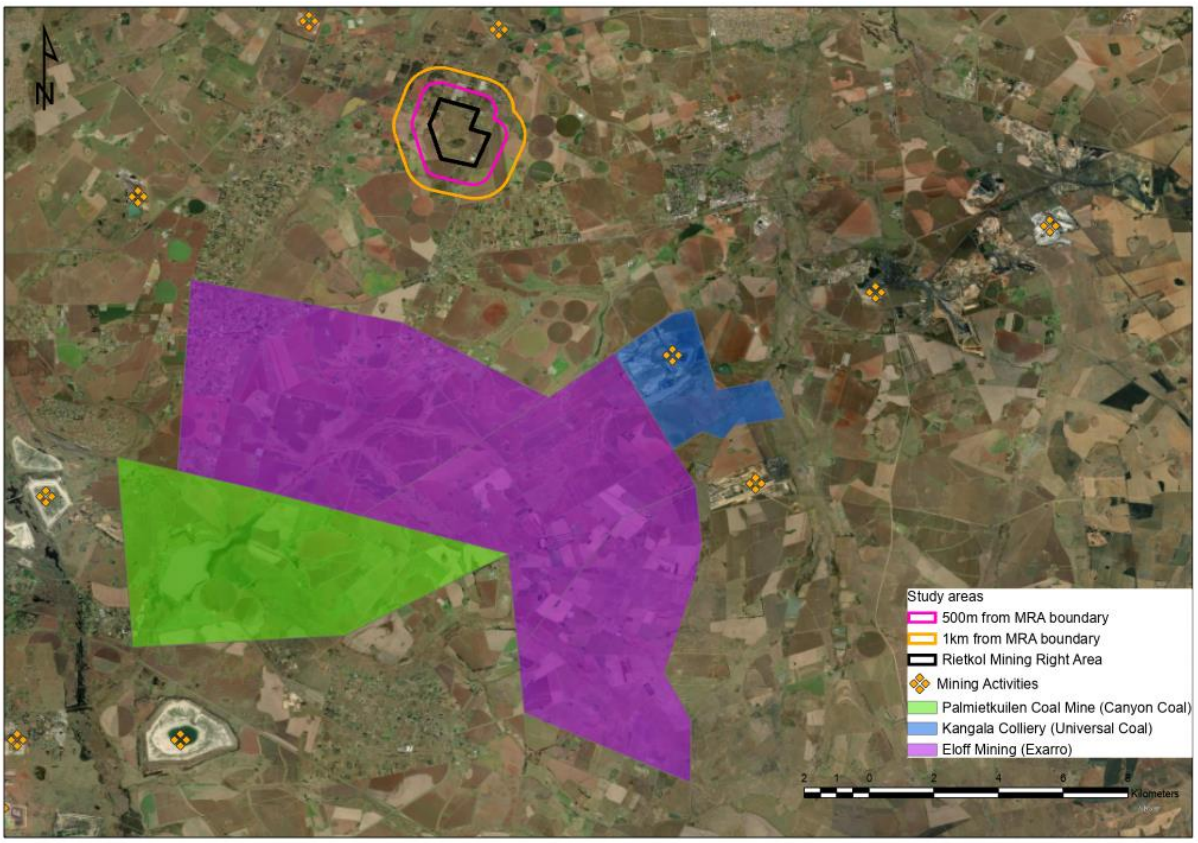


Figure 67: Mining activities near the proposed Rietkol Project

Figure 67 shows the mining activities near the proposed Rietkol Project. The Palmietkuilen Coal mine of Canyon Coal is located 11.3 km to the south, the Eloff Mining of Exxaro 5 km to the south and Kangala Colliery of Universal Coal 7 km to the south-east of the Rietkol MRA area.

6.5.5 Monetary Value of Current Activities

In the calculation of the baseline of the current economic activities in the area, the following aspects were determined:

- Economic growth, i.e. the impact on GDP;
- Employment creation, i.e. the impact on labour requirements; and
- Payments to households, i.e. low income and medium/high income.

A breakdown of the different effects of the agricultural sector multipliers used in this calculation is as follows:

- Direct Impacts: the effects occurring directly in the agriculture sector.
- Indirect Impacts: those effects occurring in the different economic sectors that link backwards to agriculture due to the supply of intermediate inputs, e.g. fertiliser, seed, professional services, transport, etc.
- Induced Impacts: the chain reaction triggered by the salaries and profits (less retained earnings) that are ploughed back into the economy in the form of private consumption expenditure.
- Total Impacts: Represents the direct, indirect and induced summed effect.

Table 35 presents the socio-economic parameters for agricultural and business results of the MRA area and surrounding area within 1 km before any mining took place. As confidentiality is important, as little as possible detail per activity is provided.

Table 35: Socio-Economic Parameters for the area within 1 km of the Rietkol MRA area (2020 Prices)

Zone	Direct GDP	Indirect and induced GDP	Total GDP	Direct jobs	Indirect and induced jobs	Total	Total household income	High & middle income	Low income
	Rand million	Rand million	Rand million	Number	Number	Number	Rand million	Rand million	Rand million
Zone 1 - MRA area	20,488	19,7851	40,2731	79	66	145	19,689	11,8711	7,8179
Zone 2	64,045	51,634	115,679	201	142	343	33,627	24,864	8,763
Zone 3	36,855	51,594	88,449	145	142	287	30,445	22,177	8,268
Total	**121,388**	**123,0131**	**244,4011**	**425**	**350**	**775**	**83,761**	**58,9121**	**24,8489**

The direct GDP is estimated at R 121.388 million with a total of R 244.4011 million if the ripple impact is taken into consideration. The total employment number is estimated 775 jobs of which 425 is direct employment and 350 indirect and induced. The main labour-intensive activities are poultry, egg packhouse, roses and cut flower production.

Total salaries and management fees paid to households, not only those working on the farms but also the indirect and induced labour, are estimated at R 83.761 million with R 24.8489 million to low-income households.

From the results it is obvious that current agricultural and other activities provide many direct jobs as well as a healthy income to households.

There are several small businesses operating on some of the AHs, such as a guest house facility, panel beaters, trucking, etc., which were not included in the calculations. No other mining activities were observed in the immediate area.

Further detail on the land use activities, the level of production, employment and agricultural structures are described in the SIA (Appendix 15) and Macro-Economic Impact Analysis (Appendix 17).

6.6 SENSITIVE RECEPTORS

Available information, orthophotos and satellite imagery was utilised to identify sensitive receptors. The following sensitive receptors have been included where applicable:

- Residential areas (towns, rural & labour houses)
- Agricultural residences and infrastructure
- Labour tenants or land occupants
- Existing mining activities and Power Stations
- Surface water and boreholes
- Heritage resources

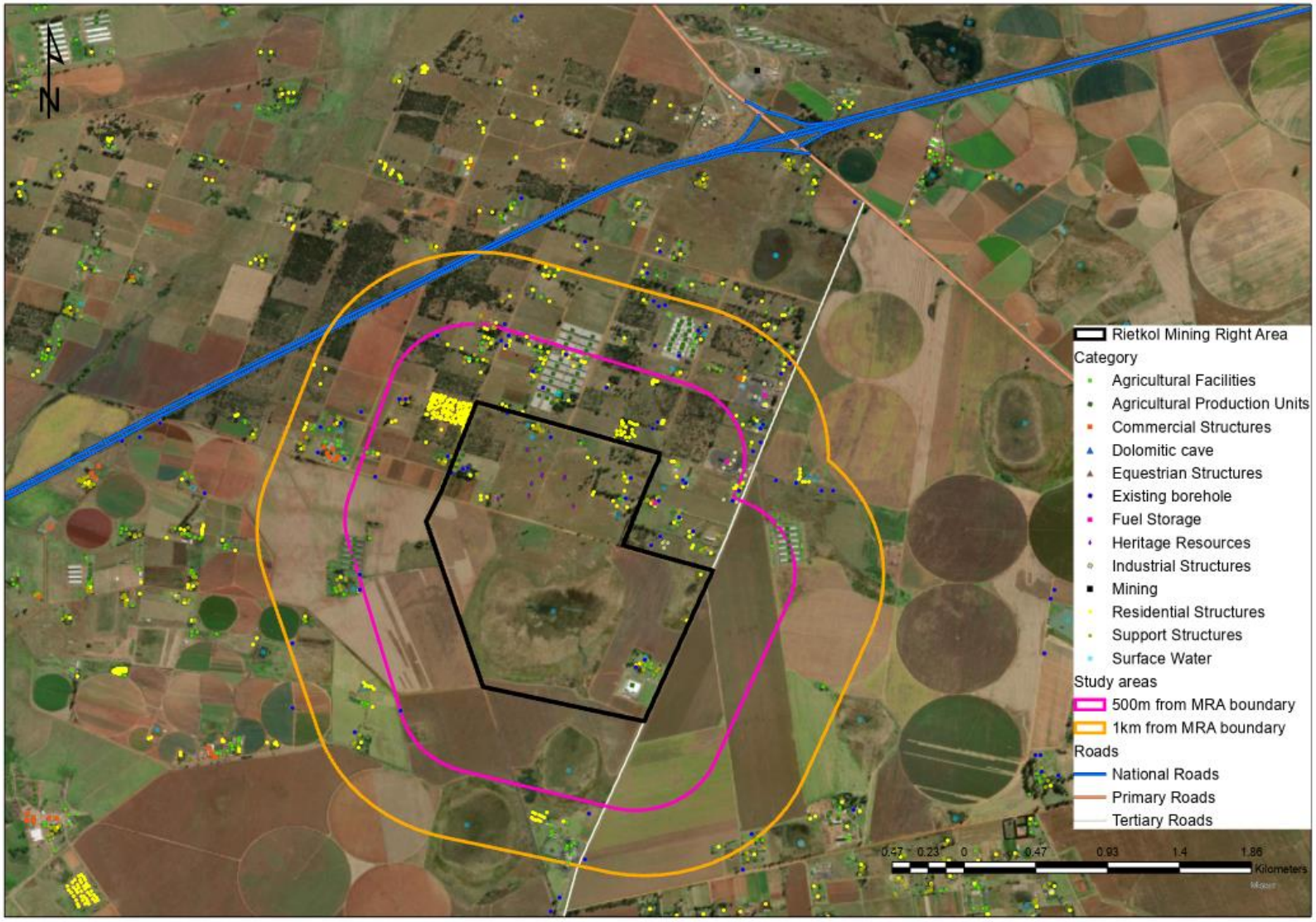


Figure 68: Sensitive receptors

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 RISK ASSESSMENT METHODOLOGY

7.1.1 Impact Significance

7.1.1.1 Nature and status

The 'nature' of the impact describes what is being affected and how. The 'status' is based on whether the impact is positive, negative or neutral.

7.1.1.2 Spatial extent

'Spatial Extent' defines the spatial or geographical scale of the impact.

Category	Rate	Descriptor
Site	1	Site of the proposed development
Local	2	Limited to site and/or immediate surrounds
District	3	Victor Khanye Local Municipal Area
Region	4	Nkangala District Municipal Area
Provincial	5	Mpumalanga Province
National	6	South Africa
International	7	Beyond South African borders

7.1.1.3 Duration

'Duration' gives the temporal scale of the impact.

Category	Rate	Descriptor
Temporary	1	0 – 1 years
Short term	2	1 – 5 years
Medium term	3	5 – 15 years
Long term	4	Where the impact will cease after the operational life of the activity either because of natural process or by human intervention.
Permanent	5	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such a time span that the impact can be considered as transient.

7.1.1.4 Probability

The 'probability' describes the likelihood of the impact actually occurring.

Category	Rate	Descriptor
Rare	1	Where the impact may occur in exceptional circumstances only.
Improbable	2	Where the possibility of the impact materialising is very low either because of design or historic experience.
Probable	3	Where there is a distinct possibility that the impact will occur.
Highly probable	4	Where it is most likely that the impact will occur.
Definite	5	Where the impact will occur regardless of any prevention measures.

7.1.1.5 Intensity

'Intensity' defines whether the impact is destructive or benign, in other words the level of impact on the environment.

Category	Rate	Descriptor
Insignificant	1	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are not affected. Localised impact and a small percentage of the population is affected.
Low	2	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are affected to a limited extent.
Medium	3	Where the affected environment is altered in terms of natural, cultural and social functions and processes continue albeit in a modified way.
High	4	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily or permanently cease.
Very High	5	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease, and it is not possible to mitigate or remedy the impact.

7.1.1.6 Ranking, weighting and scaling

The weight of significance defines the level or limit at which point an impact changes from low to medium significance, or medium to high significance. The purpose of assigning such weights serves to highlight those aspects that are considered the most critical to the various stakeholders and ensure that the element of bias is taken into account. These weights are often determined by current societal values or alternatively by scientific evidence (norms, etc.) that define what would be acceptable or unacceptable to society and may be expressed in the form of legislated standards, guidelines or objectives.

The weighting factor provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspect criteria.

Spatial Extent	Duration	Intensity / Severity	Probability	Weighting factor	Significance Rating (SR - WOM) Pre-mitigation	Mitigation Efficiency (ME)	Significance Rating (SR-WM) Post Mitigation
Site (1)	Short term (1)	Insignificant (1)	Rare (1)	Low (1)	Low (0 – 19)	High (0.2)	Low (0 – 19)
Local (2)	Short to Medium term (2)	Minor (2)	Unlikely (2)	Low to Medium (2)	Low to Medium (20 – 39)	Medium to High (0.4)	Low to Medium (20 – 39)
District (3)							
Regional (4)	Medium term (3)	Medium (3)	Possible (3)	Medium (3)	Medium (40 – 59)	Medium (0.6)	Medium (40 – 59)
Provincial (5)	Long term (4)	High (4)	Likely (4)	Medium to High (4)	Medium to High (60 – 79)	Low to Medium (0.8)	Medium to High (60 – 79)
National (6)							
International (7)	Permanent (5)	Very high (5)	Almost certain (5)	High (5)	High (80 – 110)	Low (1.0)	High (80 – 110)

7.1.1.7 Impact significance without mitigation (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:
Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

7.1.1.8 Effect of significance on decision-making

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required.

Rating	Rate	Descriptor
Negligible	0	The impact is non-existent or insignificant, is of no or little importance to decision making.
Low	1-19	The impact is limited in extent, even if the intensity is major; the probability of occurrence is low, and the impact will not have a significant influence on decision-making and is unlikely to require management intervention bearing significant costs.
Low to Medium	20 – 39	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels. The impact and proposed mitigation measures can be considered in the decision-making process.
Medium	40 – 59	The impact is significant to one or more affected stakeholder, and its intensity will be medium or high; but can be avoided or mitigated and therefore reduced to acceptable levels. The impact and mitigation proposed should have an influence on the decision.
Medium to High	60 -79	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
High	80 – 110	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor and must influence decision-making.

7.1.2 Mitigation

"Mitigation" is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures, amongst others, to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts because of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated:

- Avoid/prevent impact: can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels.
- Minimise (reduce) impact: can be done through utilisation of alternatives that will ensure that impacts on biodiversity and eco-services provision are reduced. Impact minimisation is considered an essential part of any development project.
- Rehabilitate (restore) impact is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation toll as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
    - Structural rehabilitation which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
    - Functional rehabilitation, which focuses on ensuring that the ecological functionality of the ecological resources on the subject property supports the intended post-closure land use. In this regard, special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
    - Biodiversity reinstatement that focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post-closure land uses. In this regard, special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended post-closure land use; and

- Species reinstatement that focuses on the re-introduction of any ecologically important species, which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.

- Offset impact: refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered a last resort to compensate for residual negative impacts on biodiversity.

According to the DMR (2013) "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.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity, the residual impacts should be considered to be of very high significance and when residual impacts are considered to be of very high significance, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have medium to high significance, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance, no biodiversity offset is required.

7.1.2.1 Impact significance with mitigation measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it is necessary to re-evaluate the impact.

7.1.2.2 Mitigation efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact. Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2: Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency (ME)

Mitigation Efficiency is rated out of 1 as follows:

Category	Rate	Descriptor
Not Efficient (Low)	1	Mitigation cannot make a difference to the impact.
Low to Medium	0.8	Mitigation will minimize impact slightly.
Medium	0.6	Mitigation will minimize impact to such an extent that it becomes within acceptable standards.
Medium to High	0.4	Mitigation will minimize impact to such an extent that it is below acceptable standards.
High	0.2	Mitigation will minimize impact to such an extent that it becomes insignificant.

7.1.2.3 Significance following mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account

7.2 IMPACTS AND RISKS IDENTIFIED

The detail impact assessments are contained in the specialist reports attached as appendices and are not repeated here. Table 36 provides a summary list of the potential risks (and benefits) together with the significance, probability and duration of the impacts.

Table 36: Impact Risk Matrix Summary

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
PRE-CONSTRUCTION PHASE										
1	Open Pit Mining Infrastructure area	Proposed layout of the surface infrastructure and opencast mining block areas.	• Poor planning with regards to the placement of mining related infrastructure within proximity to sensitive floral and faunal habitats. • Inadequate liaison and applications with MTPA with regards to floral SCC rescue and relocation permits. • Inadequate planning with regards to new site locations for floral SCC. • Poor planning with regards to the placement and design of infrastructure within proximity to the wetlands that could result in loss of catchment yields and surface water recharge, loss of biodiversity of the wetlands, impaired water quality and hydrological regimes of the downgradient wetlands and changes in wetland habitat.	Negative	Long Term	Site specific	Improbable	Low	Medium	Low to Medium
2	Open Pit Mining Infrastructure area	Proposed layout of the surface infrastructure and opencast mining block areas.	Visual intrusion of mining activities on sensitive receptors during the preconstruction phase, due to: • Positioning of visually intrusive infrastructure on higher lying areas where it will be visible for significant distances and within a clear line of sight from various visual receptor sites, during the planning phase. • Failure to plan for final closure and rehabilitation in the form of backfilling of opencast pits, final shaping, grading and revegetation, that may lead to further visual intrusion and receptor exposure impacts on the landscape character during later development phases.	Negative	Short Term	Site specific	Improbable	Low	Low to Medium	Low
3	All activities	Change in Land use & Cover	Displacement of agricultural residences and support infrastructure within mine footprint areas & those with a High Sensitivity Risk Rating.	Negative	Permanent	Site specific	Definite	High	Medium to High	Medium to High
4	All activities	Change in Land use & Cover	Loss of access to productive land and livelihood activities (economic displacement) within mine footprint areas & those with a High Sensitivity Risk Rating.	Negative	Permanent	Site specific	Definite	Medium	Medium	Medium
5	All activities	Change in Land use & Cover	Physical displacement of worker households and/or labour tenants through land acquisition for footprint or high cumulative impact from Environmental Impact Interactions.	Negative	Permanent	Site specific	Definite	High	High	Medium to High

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
CONSTRUCTION PHASE										
6	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related activities.	Soil erosion and dust generation during vegetation clearance activities.	Negative	Long Term	Site specific	Highly Probable	Medium	Medium	Low to Medium
7	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related activities.	Soil compaction resulting from vehicle movement during construction.	Negative	Long Term	Site specific	Probable	Medium	Medium	Low to Medium
8	Open Pit Mining Infrastructure area	Excavation and removal of topsoil from the proposed opencast mining blocks and infrastructure areas.	• Loss of natural topography, soil depth, soil volume and alteration of natural drainage pattern. • Loss of high agricultural potential soils.	Cumulative Negative	Permanent	Local	Definite	High	Medium to High	Medium to High
9	Open Pit Mining Infrastructure area	Site preparation and clearing of vegetation for mine related infrastructure, contractor's laydown sites as well as the initial opencast mining blocks.	• Loss of floral and faunal habitat. • Loss of floral and faunal species diversity. • Potential loss of floral SCC species. • Decreased faunal species habitat connectivity. • Proliferation of alien and invasive plant species in the disturbed areas.	Cumulative Negative	Long Term	Site specific	Highly Probable	High	Medium to High	Medium
10	Open Pit Mining Infrastructure area	Site preparation prior to construction of activities related to the proposed surface infrastructure and opencast mining block areas clearing, including placement of contractor laydown areas and storage facilities.	• Exposure of soils, leading to increased runoff, erosion and incision of the wetlands, and thus increased potential for sedimentation of the sensitive floral and faunal wetland habitat unit. • Increased sedimentation of the wetland habitat, leading to changes in habitat, loss in faunal and floral habitats and potentially altering surface water quality. • Decreased ecoservice provision. • Proliferation of alien vegetation because of disturbances.	Cumulative Negative	Temporary	Site specific	Probable	Medium	Medium to High	Low to Medium
11	Infrastructure area	Construction of surface infrastructure and removal of topsoil from the proposed opencast mining block areas.	Site clearing, removal of vegetation and associated disturbances to soils causing increased turbidity of surface water, sedimentation of down-gradient wetlands, smothering of vegetation and/or altered	Negative	Medium Term	Local	Highly Probable	Medium	Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
			vegetation composition, and possible fragmentation of the wetland.							
12	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related of activities.	Clearing of topsoil from footprint areas can increase infiltration rates of water to the groundwater system, ultimately leading to an increase in groundwater levels. This potential impact is not necessarily a negative one.	Positive	Short Term	Site specific	Highly Probable	Insignificant	Low	Low
13	All activities	Increased vehicle movements within the construction areas.	Indiscriminate driving through the open veld leading to the loss of sensitive floral species and increased vehicle related mortalities of faunal species.	Negative	Medium Term	District	Probable	Medium	Medium	Low to Medium
14	All activities	Waste/Hydrocarbon handling.	• Disposal/ dumping of construction related material in sensitive habitat areas such as wetlands. • Dumping of construction material in open space areas other than those demarcated for such waste, leading to increased habitat and species loss. • Accidental spills and/or leakages of hazardous chemicals and hydrocarbons resulting in soil contamination. • Poor handling of waste and the transport of building material can cause various types of spills (especially hydrocarbons) that may potentially infiltrate and contaminate the underlying groundwater system.	Negative	Medium Term	Site specific	Probable	Medium	Medium	Low to Medium
15	All activities	Increased personnel on site.	• Increased risk of veld fires leading to loss of faunal and floral species as well as alteration of plant diversity. • Trapping of faunal species using snares.	Negative	Medium Term	Site specific	Probable	Medium	Medium	Low to Medium
16	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related of activities, construction of infrastructure.	• Construction activities will generate noise, but it will mainly be limited to the project site and adjacent properties. • Several noise sensitive receptors will experience a high-level of noise impact, as identified in the NIA.	Negative	Short Term	Local	Definite	Very High	High	Medium to High
17	Access / haul roads	Removal of overlying vegetation and topsoil for the construction of haul	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction in ambient air quality in the MRA area and along the access road.	Negative	Temporary	Local	Probable	Low	Low to Medium	Low

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
		roads and upgrading of the access road.								
18	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related of activities, construction of infrastructure.	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction of ambient air quality on and adjacent to the MRA area.	Negative	Short Term	District	Probable	Medium	Medium	Low to Medium
19	Open Pit Mining Infrastructure area	Site clearing, including the removal of topsoil and vegetation within the mining and mine infrastructure footprint areas and construction of proposed mining infrastructure components and access roads.	Visual impact on the landscape character and Sense of Place associated with the MRA area and surrounding area during construction and topographic alteration of the landscape within the MRA area.	Cumulative Negative	Short Term	District	Probable	Medium	Medium	Low to Medium
20	Open Pit Mining Infrastructure area	General construction of mining infrastructure, site clearing and removal of topsoil and vegetation, increased amount of human activity, vehicles, and other equipment.	Visual intrusion of mining construction activities on visual receptors during the construction phase, vegetation damage, scarring of the terrain, and altering of landforms or contours.	Cumulative Negative	Short Term	District	Probable	Medium	Medium	Low to Medium
21	All activities	Site preparation prior to construction of activities related to the proposed surface infrastructure and opencast mining block areas.	• Built environment recordings 2-5 will be destroyed during construction. • The trigonometric beacon (recording 7) may be impacted, depending on the construction areas required. • The informal graveyard will not be impacted during construction.	Negative	Permanent	Site specific	Definite	Insignific ant	Low	Low
22	All activities	Excavation and removal of topsoil from the proposed opencast mining blocks and infrastructure areas.	Recovery of sub-surface sites during construction and/or excavation.	Negative	Permanent	Site specific	Improbable	High	Medium to High	Medium
23	All activities	Excavation and removal of topsoil / overburden	A Very High Palaeontological Sensitivity is allocated to the part of study area underlain by the Malmani	Negative	Permanent	Site specific	Highly Probable	High	Medium	Medium

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
		from the proposed opencast mining blocks and infrastructure areas.	Subgroup and the Karoo Supergroup sedimentary rocks (infrastructure footprint) and a Low sensitivity over the central part of the site underlain by quartzite (mining footprint).							
24	All activities	Change in Land use & Cover	Impacts on agricultural residences & support infrastructure surrounding mine footprint areas & those with a Moderate Sensitivity Risk Rating specifically due to a high noise impact.	Negative	Long Term	Local	Highly Probable	High	Medium	Medium
25	All activities	Change in Land use & Cover	Loss of access to productive land and livelihood activities (economic displacement) surrounding mine footprint areas & those with a Moderate Sensitivity Risk Rating due to noise impacts.	Negative	Long Term	Local	Probable	Medium	Medium to High	Medium
26	All activities	Change in Land use & Cover	Loss of access to productive land and livelihood activities (economic displacement) due to blasting / air blast impacts.	Negative	Long Term	Site specific	Highly Probable	High	Medium to High	Medium to High
27	All activities	Change in Land use & Cover	Physical displacement or impact of worker households and/or labour tenants within a moderate cumulative impact zone from Environmental Impact Interactions.	Negative	Long Term	Site specific	Highly Probable	High	Medium	Medium
28	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Creation of temporary construction employment.	Positive	Short Term	Local	Highly Probable	Medium	Medium to High	Low (Positive)
29	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Loss of employment opportunities associated with land-use activities.	Negative	Permanent	Site specific	Definite	Medium	Medium	Medium
OPERATIONAL PHASE										
30	Open Pit Mining	Blasting and removal of material from opencast pits.	Disturbance of faunal species in the vicinity of the mine leading to faunal species movement out of the MRA area as well as decreased breeding rates which will impact upon faunal diversity and abundance.	Negative	Long Term	Site specific	Highly Probable	Medium	Medium	Low to Medium
31	Open Pit Mining	Blasting and ore extraction from the opencast mining block areas.	• Dust and sediment from active mining areas may lead to the smothering of surrounding vegetation as well as increased silt loads within the nearby wetland systems. • Increased dust levels during operational activities could enter the wetlands and increase the sediment load thereof. • Sedimentation of nearby wetland habitats because of storm water runoff carrying sediment from opencast mining areas. This will lead to a loss of wetland habitat for faunal and floral species.	Negative	Long Term	Site specific	Definite	High	High	Medium to High

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
			• Loss of floral and faunal SCC and habitat. • Loss of habitat connectivity between the eastern and western portions of the MRA area. • Proliferation of alien and invasive plant species in the disturbed areas.							
32	Open Pit Mining Infrastructure area	Presence of clean and dirty separation infrastructure around the project footprint.	Loss of catchment yield due to dirty stormwater containment, leading to a reduction in volume of water entering the wetlands, leading to loss of recharge of the downgradient wetlands and altered vegetation communities due to moisture stress.	Negative	Long Term	District	Definite	Medium	Medium	Medium
33	Infrastructure area	Operation of the surface, uncontrolled runoff from infrastructure areas.	• Altered surface runoff patterns due to reduced vegetation cover and increased impermeable surfaces. • Increased flood peaks because of formalisation and concentration of surface runoff leading to erosion/incision of the wetlands due to concentration of stormwater runoff. • Potential for erosion of terrestrial areas because of the formation of preferential flow paths, leading to sedimentation of the down-gradient wetlands. • Increased water inputs to the downgradient wetlands. • Risk of contaminated stormwater runoff (e.g. hydrocarbons, sediment, originating from impermeable surfaces).	Negative	Long Term	Site specific	Improbable	Medium	Medium	Low to Medium
34	Access / haul roads	Movement of operational vehicles within and outside of the active mining areas.	• Increased risk of faunal mortality rates due to collisions with mine vehicles. • Increased risk to *Pyxicephalus adspersus* (Giant Bullfrog) moving between wetlands within the MRA area.	Cumulative Negative	Long Term	Local	Probable	High	Medium	Low to Medium
35	All activities	Increased personnel on site.	• Risk of uncontrolled fires leading to habitat modification, loss of floral and faunal species as well as impacting upon SCC. • Hunting and trapping of faunal species.	Negative	Long Term	Local	Highly Probable	High	Medium to High	Medium
36	Open Pit Mining Infrastructure area	Increased ambient lighting.	Increased lighting will result in the attraction of insects, which will inevitably attract several insectivorous predators, notably bats. This may result in increased risk of injury or mortality to such predatory species either from collision with operational machinery, infrastructure, and vehicles, or as a result of direct human conflict.	Negative	Long Term	Local	Probable	Medium	Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
37	Open Pit Mining	Opencast mining.	Opencast mining, when occurring below the water table, results in an influx of groundwater. Pit dewatering is then required to ensure dry and safe mining conditions, which ultimately leads to a lowering of the local groundwater levels.	Negative	Long Term	Local	Definite	Medium	Medium	Medium
38	Mine residue and stockpiling	Tailings disposal, waste rock and product stockpiling (plant area).	The soil and ROM material are chemically inert, meaning that any runoff / leachate originating from these stockpile areas is expected to be of acceptable quality. However, leachate from these stockpiles may contain remnants of the nitrate-based explosives used in the mining process.	Negative	Long Term	Local	Highly Probable	Low	Low to Medium	Low to Medium
39	Water management facilities	Pollution control dam, return water dam and dirty water management.	Water retaining facilities such as the planned pollution control/recycling dam are designed and constructed with the objective to prevent any poor quality water from entering the underlying aquifer and contaminating the groundwater. Poor management and maintenance of such facilities may however lead to spills and/or leakages that could contaminate the surface and groundwater resources.	Negative	Long Term	Local	Probable	High	Medium to High	Medium
40	All activities	Waste/Hydrocarbon handling.	• Disposal/ dumping of waste material in sensitive habitat areas such as wetlands. • Dumping of waste material in open space areas other than those demarcated for such waste, leading to increased habitat and species loss. • Accidental spills and/or leakages of hazardous chemicals and hydrocarbons resulting in soil contamination. • Pollution of surface and groundwater because of accidental spillages of chemicals and hazardous material. • Leachate into the groundwater because of ponding/seepage.	Negative	Long Term	Local	Probable	Medium	Medium	Low to Medium
41	All activities	Open pit mining, drilling & blasting, hauling activities, crushing, and screening, dryer operations, product transport.	Operational activities will generate noise, but it will mainly be limited to the project site and adjacent properties.	Negative	Long Term	Local	Definite	Very High	High	High
42	Open Pit Mining	Activities such as drilling and blasting, as well as the handling of materials from rock face to haul truck.	Sources of fugitive dust emissions (PM_{10} and dust) are released from material handling operations, vehicle entrainment by haul vehicles, windblown dust from tailings and oxides of nitrogen (NOX) and carbon monoxide (CO) which are produced during mining	Negative	Long Term	Site specific	Highly Probable	Medium	Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
			operations. The impact modelling indicated that the impact is confined to the MRA area, the impacts from the mine are below the ambient air quality standards beyond the MRA boundary.							
43	Access / haul roads Product transport	Materials handling (trucking) of ROM from open pit to stockpile area. Transport of product off-site.	• A large amount of dust emissions is generated by vehicle traffic over these temporary unpaved roads. Substantial secondary emissions may be emitted from material moved during regular grading of the unpaved access road. • Product transport may further lead to a decrease in the regional air quality due to wind erosion of product and spillages.	Negative	Long Term	Local	Highly Probable	Medium	Medium	Low to Medium
44	Infrastructure area	Stockpiling, crushing, and screening activities.	• Particulate matter and nuisance dust are expected from the working stockpiles, transfer and tipping points during normal operations. • The crushing & screening process (beneficiation) will further reduce the ambient air quality in and adjacent to the infrastructure area. • The impact modelling indicated that the impact is confined to the MRA area, the impacts from the mine are below the ambient air quality standards beyond the MRA boundary.	Negative	Long Term	Local	Highly Probable	High	Medium	Medium
45	Infrastructure area	Drier Plant.	The dryer is usually a fuel based rotary dryer, and so emissions from the dryer are based on the fuel burnt, in the form of sulphur dioxide and oxides of nitrogen.	Negative	Long Term	Site specific	Improbable	Low	Medium	Low to Medium
46	Open Pit Mining	Blasting operation within the open pit areas.	• Ground vibration, air blast and fly rock impact on houses and other infrastructure, including boreholes and graves within the MRA area, could lead to damage of structure and/or complaints. • With the revised blast design developed by the blast specialist the impacts are confined to the MRA area, except for the potential damage of flower tunnels directly north of the MRA area (Unex).	Negative	Medium Term	Local	Definite	High	High	Medium to High
47	Open Pit Mining	Blasting operation within the open pit areas.	• Ground vibration impact on humans and animals - safety and nuisance impacts. • Potential impact on equestrian horses and events.	Negative	Medium Term	Local	Probable	Medium	Medium	Low to Medium
48	All activities	Mining activities, drilling & blasting, processing, hauling and transport of product.	Visual impact on the landscape character and Sense of Place associated with the MRA area and surrounding area during operations, due to noise, dust, increased traffic and a change in landscape character.	Cumulative Negative	Long Term	District	Probable	High	Medium to High	Medium

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
49	All activities	Mining activities, drilling & blasting, processing, hauling and transport of product.	Visual intrusion of mining activities on visual receptors during operations, due to presence of mining infrastructure, increased traffic, and increased presence of mining vehicles on the local roads, ongoing loss of vegetation, scarring of the terrain, and alteration of landforms and contours.	Cumulative Negative	Long Term	District	Highly Probable	High	Medium to High	Medium to High
50	All activities	24-hour mining and maintenance operation, exterior lighting around buildings, parking areas, and other work areas, security, and other lighting around and on support structures and conveyors.	Visual impacts from night-time lighting impacting on receptors accustomed to a low district brightness during night-time.	Cumulative Negative	Long Term	District	Highly Probable	High	Medium to High	Medium to High
51	Product transport	Increased traffic on roads due to product transport.	• The road network, surrounding the Rietkol Project, will be able to handle the traffic, with the identified road improvements, with no detrimental impact on the traffic on any of the relevant roads. • Safety of other road users do require some intervention.	Negative	Medium Term	District	Highly Probable	Medium	Medium to High	Medium
52	Open Pit Mining	Excavation and removal of topsoil from the proposed opencast mining blocks (YR14).	Mining will be in very close proximity of the graveyard, and clean water berms may directly impact on the graveyard.	Negative	Permanent	Site specific	Highly Probable	High	High	Medium to High
53	Open Pit Mining	Excavation and removal of topsoil from the proposed opencast mining blocks.	Recovery of sub-surface sites during mining operations.	Negative	Permanent	Site specific	Improbable	High	Medium to High	Medium
54	Open Pit Mining	Excavation and mining with a depth of more than 1.5m.	The mining pits overlie a Low Palaeontological Sensitivity underlain by quartzite.	Negative	Permanent	Site specific	Improbable	Medium	Medium	Low to Medium
55	All activities	Change in Land use & Cover	Impact on property values of adjacent properties	Negative	Medium Term	Local	Probable	Medium	Medium to High	Medium
56	All activities	Resource Consumption and Ecosystem Services	Impact on livelihoods dependent on groundwater due to potential impact on groundwater quality during and after decommissioning of mining.	Negative	Long Term	Local	Highly Probable	Medium	Medium	Medium
57	All activities	Resource Consumption and Ecosystem Services	Impact on the availability of natural resources such as firewood, small mammals for hunting, medicinal plants, and subsistence grazing.	Negative	Long Term	Site specific	Highly Probable	Medium	Medium to High	Medium
58	Open Pit Mining & Processing	Potential Pollution (Air, Vibration, Noise, Visual)	Impact on health, well-being, and livelihoods of the public due to risk exposure from Potential Pollution.	Negative	Long Term	Local	Highly Probable	High	Medium	Medium

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
59	Open Pit Mining & Processing	Potential Pollution (Air, Vibration, Noise, Visual)	Impact on health and well-being of workers due to risk exposure (silica dust, occupational risks, noise).	Negative	Long Term	Site specific	Highly Probable	Very High	Medium to High	Medium to High
60	All activities	Potential Pollution (Air, Vibration, Noise, Visual)	Impact on Aesthetic Value and Sense of Place due to visual intrusions and increase nuisance noise.	Negative	Long Term	Regional	Definite	High	Medium	Medium to High
61	All activities	Goods, Staff and Product Transport	Disruption of daily living and movement patterns and safety of road users.	Negative	Medium Term	Regional	Highly Probable	High	Medium	Medium
62	Product transport	Goods, Staff and Product Transport	Impact on well-being and livelihoods due to dust generation along transport routes.	Negative	Long Term	Local	Highly Probable	Medium	Medium	Medium
63	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Influx of Job seekers and Population growth pressures.	Negative	Medium Term	Local	Definite	High	Medium to High	Medium to High
64	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Changes in Settlement & Housing Patterns.	Negative	Medium Term	Local	Probable	Medium	Medium to High	Medium
65	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Increase in Social Pathologies and Crime.	Negative	Medium Term	Local	Probable	Medium	Medium to High	Medium
66	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Creation of permanent operational employment.	Positive	Long Term	Local	Highly Probable	High	High	Medium (Positive)
67	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Opportunities in local Skills Development, Bursaries, Internships and Mentorship Programmes.	Positive	Long Term	Local	Definite	High	Medium to High	Medium (Positive)
68	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Opportunities in local SMME Development and Procurement.	Positive	Long Term	Local	Highly Probable	High	Medium	Medium (Positive)
69	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Impact on Social Development through SLP Community Development Programmes.	Positive	Long Term	Local	Definite	Medium	Medium	Medium (Positive)
70	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Generation of tax base, revenue, and GDP contribution.	Positive	Long Term	National	Definite	Medium	Medium to High	Medium (Positive)
DECOMMISSIONING & CLOSURE										

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
71	Open Pit Mining	Backfilling of opencast mining blocks.	• Proliferation of alien and invasive plant species leading to ongoing floral and faunal habitat loss. • Improper rehabilitation of opencast mining blocks and disturbed areas leading to permanent floral and faunal habitat loss. • Increased risk of erosion in disturbed areas. • Increased runoff volumes and formation of preferential surface flow paths because of compacted soils and unvegetated areas, leading to increased sedimentation, erosion, and increased water inputs to downgradient wetlands.	Cumulative Negative	Long Term	Site specific	Definite	Medium	Medium	Low to Medium
72	Infrastructure area	Decommissioning/ removal of surface infrastructure.	• Highly compacted soils limiting the re-establishment of natural vegetation. • Increased runoff volumes and formation of preferential surface flow paths because of compacted soils and unvegetated areas, leading to increased sedimentation, erosion, and increased water inputs to downgradient wetlands. • Proliferation of alien and invasive plant species leading to ongoing floral and faunal habitat loss. • Improper rehabilitation of disturbed areas leading to permanent floral and faunal habitat loss.	Cumulative Negative	Long Term	Site specific	Definite	Medium	Medium	Low to Medium
73	Open Pit Mining Infrastructure area	Backfilling of opencast mining blocks Decommissioning/removal of surface infrastructure Rehabilitation and revegetation of project footprint area	Visual intrusion of rehabilitation activities on visual receptors during the decommissioning and closure phase, due to the dismantling of infrastructure and ineffective final rehabilitation actions resulting in poor vegetation cover, erosion being present, infrastructure remaining, and opencast pits not being adequately backfilled and shaped.	Negative	Temporary	Site specific	Probable	Low	Low to Medium	Low
74	Infrastructure area	Even though all mining related surface infrastructure/areas have been removed and rehabilitated, the down-gradient movement of residual contamination will continue for some time after closure.	Migration of residual groundwater contamination plume away from rehabilitated surface source areas.	Negative	Long Term	Local	Highly Probable	Medium	Medium	Low to Medium
75	Open Pit Mining	Building rubble in the South Block is expected to be relatively inert and poses no significant	Migration of groundwater contamination plume away from rehabilitated opencast pits.	Negative	Permanent	Local	Highly Probable	Low	Low to Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential impact	Nature of impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact significance
		threat to groundwater quality. Tailings material in the North Block should also be inert, however it may contain remnants of the nitrate-based explosives used during mining. These nitrates dissolve readily in water, meaning that the migrating plume may contain nitrate.								
76	Open Pit Mining Infrastructure area	Backfilling of opencast mining blocks. Decommissioning/removal of surface infrastructure. Rehabilitation and revegetation of project footprint area.	Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take place during the day using minimal equipment. While there may be various activities, there is a very small risk for any additional noise impact.	Negative	Short Term	Local	Highly Probable	Medium	Medium	Low to Medium
77	Open Pit Mining Infrastructure area	Backfilling of opencast mining blocks. Decommissioning/removal of surface infrastructure. Rehabilitation and revegetation of project footprint area.	The decommissioning phase may result in some reduction to the ambient air quality, but to a lesser extent than the operational phase. Exposed soil is often prone to erosion by water. The erodibility of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover.	Negative	Long Term	Site specific	Definite	Medium	Medium	Low to Medium
78	All activities	Need of Human Resources, Recruitment, Suppliers and Social License to Operate	Loss of job opportunities due to downscaling of the mine employment.	Negative	Medium Term	Local	Highly Probable	Medium	Medium to High	Medium

7.3 POSSIBLE MITIGATION MEASURES AND THE LEVEL OF RESIDUAL RISK

Table 37 lists the proposed mitigation measures that could be applied to reverse, reduce, and mitigate the impacts. The residual risk level, after implementation of the mitigation measures, is also indicated.

Table 37: Proposed Mitigation Measures

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
PRE-CONSTRUCTION PHASE					
1	Open Pit Mining Infrastructure area	• Poor planning with regards to the placement of mining related infrastructure within proximity to sensitive floral and faunal habitats. • Inadequate liaison and applications with MPTA with regards to floral SCC rescue and relocation permits. • Inadequate planning with regards to new site locations for floral SCC. • Poor planning with regards to the placement and design of infrastructure within proximity to the wetlands that could result in loss of catchment yields and surface water recharge, loss of biodiversity of the wetlands, impaired water quality and hydrological regimes of the downgradient wetlands and changes in wetland habitat.	• Proposed infrastructure layouts must be optimised, ensuring that the proposed layout footprint is as small as possible. • Develop and implement a rescue and relocation plan for floral SCC and obtain relevant permits from MTPA. • Infrastructure placement must be planned outside of delineated wetlands and outside of the 100m GN704 Zone of Regulation. • Design of infrastructure should be environmentally and structurally sound and all possible precautions should be taken to prevent spillage or seepage into the down gradient wetlands. It must be ensured that the design and construction of all infrastructure prevents failure.	Medium to High	Low
2	Open Pit Mining Infrastructure area	Visual intrusion of mining activities on sensitive receptors during the preconstruction phase, due to: • Positioning of visually intrusive infrastructure on higher lying areas where it will be visible for significant distances and within a clear line of sight from various visual receptor sites, during the planning phase. • Failure to plan for final closure and rehabilitation in the form of backfilling of opencast pits, final shaping, grading and revegetation, that may lead to further visual intrusion and receptor exposure impacts on the landscape character during later development phases.	• Proposed infrastructure layouts must be optimised, ensuring that the proposed layout footprint is as small as possible. • As far as possible, surface infrastructure should be positioned in areas that have already been disturbed. • As far as possible, natural contours must be followed during infrastructure placement to minimise cut-and-fill activities. • Infrastructure heights should be designed to be a low as possible. • A lighting specialist should be consulted to assist in the planning and placement of light fixtures for the mining facility and all ancillary infrastructure to reduce visual impacts associated with glare and light trespass. • Areas cleared of natural vegetation and topsoil must be kept to a minimum. • Planning for closure and final rehabilitation must be initiated.	Medium	Low
3	All activities	Displacement of agricultural residences and support infrastructure within mine footprint areas & those with a High Sensitivity Risk Rating.	• Valuation of productive land for inclusion in the land acquisition agreement for those properties to be purchased. • Engagement with owners of the key economic activities surrounding the development should be implemented. This is to determine measures that can be implemented apart from the already stated mitigation measures against noise, air quality and blasting impacts to safeguard the existing economic activities. Any unforeseen impacts should be identified immediately or where monitoring indicates noise, air quality and blasting impacts cannot be mitigated effectively, the mine and land / business owners should agree on	Low to Medium	Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			such additional measures necessary to avoid or minimize impacts on economic activities and livelihoods. • If environmental impacts cannot be effectively mitigated, and it's determined that an adverse impact exists, then compensation for landowners affected by the mining operations must be negotiated on a fair basis. • Where possible, and if safety permits, land purchased but not required for mining infrastructure should be made available for small scale grazing to existing agricultural operators. • Implementation of noise air quality and blasting monitoring programmes with measurements taken where sensitive receptors may be at risk. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.		
4	All activities	Loss of access to productive land and livelihood activities (economic displacement) within mine footprint areas & those with a High Sensitivity Risk Rating.	• Valuation of all immovable assets for inclusion in the land acquisition agreement. • Where possible offer employment opportunities to local workers that may have lost employment due to the mine development displacement. • Implementation of noise, air quality and blasting monitoring programmes with measurements taken where sensitive receptors may be at risk. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.	Medium	Low to Medium
5	All activities	Physical displacement of worker households and/or labour tenants through land acquisition for footprint or high cumulative impact from Environmental Impact Interactions.		Medium	Medium
CONSTRUCTION PHASE					
6	Open Pit Mining Infrastructure area	Soil erosion and dust generation during vegetation clearance activities.	• The footprint of the proposed infrastructure area should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint to the minimum. • Vegetation clearance and commencement of construction activities should be scheduled (if practical) to coincide with low rainfall conditions when the erosive stormwater and wind are anticipated to be low. • Bare soils must be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast. • Disturbed areas adjacent to the infrastructure and opencast areas must be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission. • Temporary erosion control measures must be used to protect the disturbed soils during the construction phase until adequate vegetation has established.	Medium to High	Low
7	Open Pit Mining Infrastructure area	Soil compaction resulting from vehicle movement during construction.	• Vegetation clearance and commencement of construction activities should be scheduled (if practical) to coincide with low rainfall conditions when soil moisture is	Medium to High	Low

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			anticipated to be relatively low, such that the soils are less prone to compaction. • Compacted soils adjacent to the mining blocks and associated infrastructure footprint must be lightly ripped to at least 50 cm below ground surface to alleviate compaction prior to re-vegetation.		
8	Open Pit Mining Infrastructure area	• Loss of natural topography, soil depth, soil volume and alteration of natural drainage pattern. • Loss of high agricultural potential soils.	• Topsoil must be used for berms as it cannot be stored indefinitely. • Temporary berms must be installed, if necessary, around disturbed areas whilst vegetation cover has not established to avoid soil loss through erosion. • Direct surface disturbance of the identified high agricultural potential soils (i.e. Hutton and Clovelly soil forms) should be avoided where possible. • During the decommissioning phase the Rehabilitation, Decommissioning and Closure Plan should be implemented to ensure a self-sustaining post-closure land use.	Medium	Low to Medium
9	Open Pit Mining Infrastructure area	• Loss of floral and faunal habitat. • Loss of floral and faunal species diversity. • Potential loss of floral SCC species. • Decreased faunal species habitat connectivity. • Proliferation of alien and invasive plant species in the disturbed areas.	• All development footprint areas are to remain as small as possible and vegetation clearing must to be limited to what is essential. • Prior to construction/mining activities floral SCC that will be directly impacted upon need to be marked and removed to a suitable similar habitat as part of a rescue and relocation plan. • Implement an Alien and Invasive Eradication Plan. • Clearing of vegetation should take place in a phased manner so that faunal species are given the opportunity to naturally move off and relocate to the surrounding natural areas. • No indiscriminate driving through the veld may be permitted. As far as possible vehicles are to utilise the existing roads. Where this is not feasible, new roads are to be located in areas of existing high disturbance, and not encroach upon sensitive habitats. • Edge effects of all construction activities which may affect faunal and floral habitat within surrounding areas, need to be strictly managed.	Medium	Low to Medium
10	Open Pit Mining Infrastructure area	• Exposure of soils, leading to increased runoff, erosion and incision of the wetlands, and thus increased potential for sedimentation of the sensitive floral and faunal wetland habitat unit. • Increased sedimentation of the wetland habitat, leading to changes in habitat, loss in faunal and floral habitats and potentially altering surface water quality. • Decreased ecoservice provision. • Proliferation of alien vegetation because of disturbances.	• Surface infrastructure to be located outside of the 100m GN704 zone of regulation unless infrastructure is authorized. • The wetlands and the associated zones of regulation should be clearly demarcated and marked as a no-go area. • All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential. • Exposed soils to be protected by means of suitable berms, silt curtains, sandbags etc. to prevent contamination of runoff and sedimentation of the down-gradient wetlands. • Following the completion of the construction phase, areas of disturbance should be monitored at least once after an erosive rainfall for erosion arising from the	Medium	Low

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			surface which leads to concentrated flow and changes to the pattern flow and timing of water in the landscape. • Implement an Alien and Invasive Eradication Plan.		
11	Infrastructure area	Site clearing, removal of vegetation and associated disturbances to soils causing increased turbidity of surface water, sedimentation of down-gradient wetlands, smothering of vegetation and/or altered vegetation composition, and possible fragmentation of the wetland.	• Surface infrastructure to be located outside of the 100m GN704 zone of regulation unless infrastructure is authorized. • Exposed soils to be protected by means of suitable berms, silt curtains, sandbags etc. to prevent contamination of runoff and sedimentation of the down-gradient wetlands. • Flow connectivity must be retained by preventing fragmentation of the wetland habitat. • It must also be ensured that no canalisation or incision of the wetlands takes place. • Compacted soil should be ripped, profiled, and reseeded with indigenous vegetation following construction.	Medium	Low
12	Open Pit Mining Infrastructure area	Clearing of topsoil from footprint areas can increase infiltration rates of water to the groundwater system, ultimately leading to an increase in groundwater levels. This potential impact is not necessarily a negative one.	• Mitigation not possible.	Not Efficient	Low
13	All activities	Indiscriminate driving through the open veld leading to the loss of sensitive floral species and increased vehicle related mortalities of faunal species.	• No indiscriminate driving through the veld is allowed. As far as possible vehicles are to utilise the existing roads. Where this is not feasible, new roads are to be located in areas of existing high disturbance, and not encroach upon sensitive habitats. • Speed restrictions to be placed on all vehicles within the MRA area to limit faunal and vehicle collisions. • Drivers to be educated through the Environmental Awareness Programme about the presence and importance of faunal species and instructed to actively avoid collisions with faunal species, regardless of size.	Medium	Low to Medium
14	All activities	• Disposal/ dumping of construction related material in sensitive habitat areas such as wetlands. • Dumping of construction material in open space areas other than those demarcated for such waste, leading to increased habitat and species loss. • Accidental spills and/or leakages of hazardous chemicals and hydrocarbons resulting in soil contamination. • Poor handling of waste and the transport of building material can cause various types of spills (especially hydrocarbons) that may potentially infiltrate and contaminate the underlying groundwater system.	• All vehicle re-fuelling is to take place within the contractor laydown area only, within a bunded area, outside of the wetland habitat. • A Spill Management and Emergency Contingency Plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress to groundwater. • The relevant authorities should be notified in the event of a significant spill. • All construction related waste and material is to be disposed of at a registered waste facility, no waste or construction rubble is to be dumped in the wetlands or surrounding habitats. • Solid waste must either be stored on-site in an approved waste disposal area or removed by credible contractors.	Medium to High	Low
15	All activities	• Increased risk of veld fires leading to loss of faunal and floral species as well as alteration of plant diversity.	• Ensure that the sensitive wetland areas are demarcated as no-go zones for personnel and mine vehicles. • No uncontrolled or unsanctioned fires should be allowed within the MRA area. A	Medium to High	Low

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
		• Trapping of faunal species using snares.	Fire Prevention Plan should be developed in conjunction with local emergency services. • No hunting or trapping of faunal species should be allowed within the MRA area. • Implement an Environmental Awareness Programme on the mine and within the surrounding communities.		
16	Open Pit Mining Infrastructure area	• Construction activities will generate noise, but it will mainly be limited to the project site and adjacent properties. • Several noise sensitive receptors will experience a high-level of noise impact, as identified in the NIA.	• Resettlement of sensitive receptors within the MRA area (before any construction activities need to start closer than 300m from these noise sensitive receptors). • Use of smallest practical available equipment for construction purposes. • Feedback to the adjacent properties on the potential noise impact on them and the mitigation measures identified to reduce the noise impact. • Establish and implement a Complaints and Grievance Procedure.	Medium	Medium
17	Access / haul roads	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction in ambient air quality in the MRA area and along the access road.	• Set the speed limit for hauling vehicles and vehicles in general to as low a speed possible and enforce the speed limits specified. It is recommended that the speed limit be set to 40km/h on unpaved roads. • Implement a program of wet suppression of the unpaved roads with major vehicle activity. • Limit the load size of the vehicles to ensure the wind in transit does not pick up more dust than necessary.	Medium to High	Low
18	Open Pit Mining Infrastructure area	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction of ambient air quality on and adjacent to the MRA area.	• All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential. • Exposed soils to be protected by means of a suitable geotextile covering such as hessian sheeting until revegetated. • Bare soils must be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast.	Medium	Low
19	Open Pit Mining Infrastructure area	Visual impact on the landscape character and Sense of Place associated with the MRA area and surrounding area during construction and topographic alteration of the landscape within the MRA area.	• All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential. • Implement dust fallout monitoring and wet suppression during the construction phase. • Infrastructure placement must be planned outside of delineated wetlands and outside of the 100m GN704 Zone of Regulation.	Medium	Low
20	Open Pit Mining Infrastructure area	Visual intrusion of mining construction activities on visual receptors during the construction phase, vegetation damage, scarring of the terrain, and altering of landforms or contours.	• All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential. • As far as possible, existing natural vegetation around the MRA area should be maintained, with particular reference to existing tall trees along the site perimeter. The eucalyptus trees on AH 209 & 212 provide a good visual buffer between the mine and the informal settlement on AH 151 & 152, and it is proposed that these trees be retained for the duration of the mining operations. • The perimeter fence must be put in place prior to commencement of mining infrastructure within the MRA area for screening purposes.	Medium	Low

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			• Where screening of higher infrastructure components located within the direct line of site of highly sensitive visual receptors, is not possible, siting should take advantage of partial screening opportunities with specific mention of large existing or proposed new trees. • Implement good housekeeping measures for the duration of the construction phase. • Natural colours should be used in all instances and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. • The use of permanent signs and project construction signs should be minimised and visually unobtrusive.		
21	All activities	• Built environment recordings 2-5 will be destroyed during construction. • The trigonometric beacon (recording 7) may be impacted, depending on the construction areas required. • The informal graveyard will not be impacted during construction.	• The recorded ruins have no cultural significance and are judged to be less than 60 years old – they contain no intrinsic architecture design or pioneer building material and building methods that require further assessment. • The trigonometrical beacon will be impacted on, it is advised that the office of the Chief Directorate: National Geo-Spatial Information (NGI) in the Department of Rural Development and Land Reform be informed. • The informal graveyard must be demarcated (fenced off) to prevent any damage during construction.	Medium to High	Low
22	All activities	Recovery of sub-surface sites during construction and/or excavation.	• A qualified archaeologist must monitor excavation activities. • Any discovery of artifacts, graves or other remains of archaeological interest should be reported to SAHRA. • Activities must cease immediately upon any discovery of cultural or heritage resources and a qualified archaeologist informed to do further assessment and reporting. • Identified sites of cultural and heritage significance must be demarcated until such time that an instruction to resume work is provided to the contractor, following consultation with the regulating authorities.	Medium	Low to Medium
23	All activities	A Very High Palaeontological Sensitivity is allocated to the part of study area underlain by the Malmani Subgroup and the Karoo Supergroup sedimentary rocks (infrastructure footprint) and a Low sensitivity over the central part of the site underlain by quartzite (mining footprint).	• A suitably qualified palaeontologist must be appointed to assess the construction site once excavations reach a depth of 1.5 m in areas allocated a Very High sensitivity. • If fossils are recorded, the palaeontologist must do a Phase 1 PIA and develop a Chance Find Protocol (CFP). • Recommendations contained in the resultant Phase 1 PIA and CFP must be approved by the Mpumalanga Provincial Heritage Resources Authority (MPHRA) and SAHRA for inclusion in the EMPr of the project.	Medium	Low to Medium
24	All activities	Impacts on agricultural residences & support infrastructure surrounding mine footprint areas & those with a Moderate Sensitivity Risk Rating specifically due to a high noise impact.	• Valuation of productive land for inclusion in the land acquisition agreement for those properties to be purchased. • Engagement with owners of the key economic activities surrounding the development should be implemented. This is to determine measures that can be	Medium	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			implemented apart from the already stated mitigation measures against noise, air quality and blasting impacts to safeguard the existing economic activities. • Any unforeseen impacts should be identified immediately or where monitoring indicates noise, air quality and blasting impacts cannot be mitigated effectively, the mine and land / business owners should agree on such additional measures necessary to avoid or minimize impacts on economic activities and livelihoods. • If environmental impacts cannot be effectively mitigated, and it's determined that an adverse impact exists, then compensation for landowners affected by the mining operations must be negotiated on a fair basis. • Where possible, and if safety permits, land purchased but not required for mining infrastructure should be made available for small scale grazing to existing agricultural operators. • Implementation of noise air quality and blasting monitoring programmes with measurements taken where sensitive receptors may be at risk. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.		
25	All activities	Loss of access to productive land and livelihood activities (economic displacement) surrounding mine footprint areas & those with a Moderate Sensitivity Risk Rating due to noise impacts.	• Valuation of all immovable assets for inclusion in the land acquisition agreement. • Where possible offer employment opportunities to local workers that may have lost employment due to the mine development displacement. • Implementation of noise air quality and blasting monitoring programmes with measurements taken where sensitive receptors may be at risk. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.	Medium	Low to Medium
26	All activities	Loss of access to productive land and livelihood activities (economic displacement) due to blasting / air blast impacts.		Medium	Low to Medium
27	All activities	Physical displacement or impact of worker households and/or labour tenants within a moderate cumulative impact zone from Environmental Impact Interactions.		Medium	Low to Medium
28	All activities	Creation of temporary construction employment.	• Prioritize people residing in local settlements. • Establishment of a local labour recruitment committee to monitor recruitment procedures and results.	Low	Medium (Positive)
29	All activities	Loss of employment opportunities associated with land-use activities.	• During recruitment preference should be provided to unemployed job seekers, to avoid poaching workers already gainfully employed on properties not affected by the mine. • Identification of people likely to lose employment due to the impact of the mine, and dependent on their capability, assess, reskill, and employ these workers.	Medium	Low to Medium
OPERATIONAL PHASE					
30	Open Pit Mining	Disturbance of faunal species in the vicinity of the mine leading to faunal species movement out of the MRA area as well as decreased breeding rates which will impact upon faunal diversity and abundance.	• The footprint of opencast pits is to remain as small as possible whilst allowing for economical and optimal extraction of the material. • Blasting should ideally be done during mid-afternoon and not early mornings or late	Low to Medium	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			afternoon/evenings when faunal species are most active. • Investigate blasting techniques to minimise ground and air vibrations and disturbances to minimise the impacts on surrounding faunal species.		
31	Open Pit Mining	• Dust and sediment from active mining areas may lead to the smothering of surrounding vegetation as well as increased silt loads within the nearby wetland systems. • Increased dust levels during operational activities could enter the wetlands and increase the sediment load thereof. • Sedimentation of nearby wetland habitats because of storm water runoff carrying sediment from opencast mining areas. This will lead to a loss of wetland habitat for faunal and floral species. • Loss of floral and faunal SCC and habitat. • Loss of habitat connectivity between the eastern and western portions of the MRA area. • Proliferation of alien and invasive plant species in the disturbed areas.	• The footprint of opencast pits is to remain as small as possible whilst allowing for economical and optimal extraction of the material. • Water quality (surface and groundwater) need to be managed and monitored to allow for the on-going survival of the wetlands. • Reduce airborne dust through dust-suppression. • Edge effects relating to opencast blocks must be suitably managed to ensure that the surrounding habitat is not impacted upon. • A rescue and relocation plan are to be implemented with regards to floral SCC. • Implement erosion control and storm water management measures to manage water runoff and mitigate sedimentation of the surrounding habitat and wetlands. • Control alien and invasive plant species throughout the mining process. • Maintain habitat connectivity between the MRA area and surrounding areas.	Low to Medium	Medium
32	Open Pit Mining Infrastructure area	Loss of catchment yield due to dirty stormwater containment, leading to a reduction in volume of water entering the wetlands, leading to loss of recharge of the downgradient wetlands and altered vegetation communities due to moisture stress.	• Develop and implement a comprehensive stormwater management plan to separate and control clean and dirty stormwater runoff. • Clean water must be discharged into the natural environment in a non-erosive and controlled manner, and not allowed to form concentrated channels. • Biomonitoring to be implemented to determine any impacts on the wetlands (bi-annually).	Low to Medium	Low to Medium
33	Infrastructure area	• Altered surface runoff patterns due to reduced vegetation cover and increased impermeable surfaces. • Increased flood peaks because of formalisation and concentration of surface runoff leading to erosion/incision of the wetlands due to concentration of stormwater runoff. • Potential for erosion of terrestrial areas because of the formation of preferential flow paths, leading to sedimentation of the down-gradient wetlands. • Increased water inputs to the downgradient wetlands. • Risk of contaminated stormwater runoff (e.g. hydrocarbons, sediment, originating from impermeable surfaces).	• Develop and implement a comprehensive stormwater management plan to separate and control clean and dirty stormwater runoff. • Clean water must be discharged into the natural environment in a non-erosive and controlled manner, and not allowed to form concentrated channels. • Biomonitoring to be implemented to determine any impacts on the wetlands (bi-annually). • Conduct regular inspection of infrastructure to ensure functionality. • A Spill Management and Emergency Contingency Plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress to groundwater. The relevant authorities should be notified in the event of a significant spill.	Medium	Low
34	Access / haul roads	• Increased risk of faunal mortality rates due to collisions with mine vehicles. • Increased risk to *Pyxicephalus adspersus* (Giant Bullfrog) moving	• Vehicles are to utilise the existing roads. • Implement speed restrictions to be placed on all vehicles within the MRA area to limit faunal and vehicle collisions.	Medium	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
		between wetlands within the MRA area.	• The Environmental Awareness Programme must include detail on the presence of faunal species including *Pyxicephalus adspersus* (Giant Bullfrog) which is listed as Vulnerable within the Mpumalanga Province.		
35	All activities	• Risk of uncontrolled fires leading to habitat modification, loss of floral and faunal species as well as impacting upon SCC. • Hunting and trapping of faunal species.	• Ensure that the sensitive wetland areas are demarcated as no go zones for personnel and mine vehicles. • No uncontrolled or unsanctioned fires should be allowed within the MRA area. A Fire Prevention Plan should be developed in conjunction with local emergency services. • No hunting or trapping of faunal species should be allowed within the MRA area. • Implement an Environmental Awareness Programme on the mine and within the surrounding communities.	Medium to High	Low to Medium
36	Open Pit Mining Infrastructure area	Increased lighting will result in the attraction of insects, which will inevitably attract several insectivorous predators, notably bats. This may result in increased risk of injury or mortality to such predatory species either from collision with operational machinery, infrastructure, and vehicles, or because of direct human conflict.	• Downward facing lights must be installed and limited to absolutely essential areas. • Covers/light diffusers must be installed to lessen the intensity of illumination where possible. • Outside lights are to utilise bulbs of varying wave lengths that do not attract insects.	Low to Medium	Low to Medium
37	Open Pit Mining	Opencast mining, when occurring below the water table, results in an influx of groundwater. Pit dewatering is then required to ensure dry and safe mining conditions, which ultimately leads to a lowering of the local groundwater levels.	• No mitigation measures are available for when mining occurs below the local water table. Only by remaining above the water table can this impact be avoided. • Groundwater monitoring should be implemented for early detection of the lowering of groundwater levels.	Not Efficient	Medium
38	Mine residue and stockpiling	The soil and ROM material are chemically inert, meaning that any runoff / leachate originating from these stockpile areas is expected to be of acceptable quality. However, leachate from these stockpiles may contain remnants of the nitrate-based explosives used in the mining process.	• Stockpiles and dirty footprint areas should be kept as small as practically possible. • Stockpile areas should be appropriately lined to prevent potentially poor quality leachate from contaminating the underlying groundwater. • Stockpile areas should be bunded to prevent clean surface water runoff from being contaminated by dirty surface areas, in line with the Stormwater Management Plan. • Groundwater monitoring should be implemented for early detection of groundwater quality impacts.	Low to Medium	Low
39	Water management facilities	Water retaining facilities such as the planned pollution control/recycling dam are designed and constructed with the objective to prevent any poor quality water from entering the underlying aquifer and contaminating the groundwater. Poor management and maintenance of such facilities may however lead to spills and/or leakages that could contaminate the surface and groundwater resources.	• All water retaining facilities should be lined with an impervious liner to prevent dirty water from reaching the underlying aquifer and contaminating the groundwater. • Water retaining facilities should be designed in line with the requirements of GN704, for a minimum of a 1:50 year rainfall event. • Clean and dirty water separation structures must be maintained throughout the life of mine - O&M Plan. • Implement effective management of containment facilities and conduct regular inspections for leakages to ensure functionality. • Spills should be cleaned up immediately in line with the Spill Management and Emergency Contingency Plan. Authorities should be notified of significant spills.	Medium to High	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
40	All activities	• Disposal/ dumping of waste material in sensitive habitat areas such as wetlands. • Dumping of waste material in open space areas other than those demarcated for such waste, leading to increased habitat and species loss. • Accidental spills and/or leakages of hazardous chemicals and hydrocarbons resulting in soil contamination. • Pollution of surface and groundwater because of accidental spillages of chemicals and hazardous material. • Leachate into the groundwater because of ponding/seepage.	• All vehicle re-fuelling is to take place within the infrastructure area only, within a bunded area, outside of the wetland habitat. • A Spill Management and Emergency Contingency Plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress to groundwater. The relevant authorities should be notified in the event of a significant spill. • Solid waste must either be stored on-site in an approved waste disposal area or removed by credible contractors. • All waste material is to be disposed of at a registered waste facility, no waste is to be dumped in the wetlands or surrounding habitats. • Hydrocarbon storage and work areas (workshops etc.) should be bunded and runoff directed to the dirty water system. • Bulk facilities to be concrete lined and bunded to capacity of 110%. • Reclamation of soils in the event of accidental spillage.	Medium to High	Low
41	All activities	Operational activities will generate noise, but it will mainly be limited to the project site and adjacent properties.	• Feedback to the identified receptors on the potential noise impact on them and the mitigation measures identified to reduce the noise impact. • Use of smallest practical available equipment for operational purposes. • The design of the exhaust stack to minimise noise emissions (e.g. the installation of an industrial exhaust silencer, use of flow control vanes, use of sound insulation, use of diffuser or design of flue section, etc.), or not operating the drier exhaust stack at night to reduce the impact on sensitive receptors to the east of the plant. • Establish and implement a Complaints and Grievance Procedure.	Medium	Medium
42	Open Pit Mining	Sources of fugitive dust emissions (PM_{10} and dust) are released from material handling operations, vehicle entrainment by haul vehicles, windblown dust from tailings and oxides of nitrogen (NOX) and carbon monoxide (CO) which are produced during mining operations. The impact modelling indicated that the impact is confined to the MRA area, the impacts from the mine are below the ambient air quality standards beyond the MRA boundary.	• Implement a program of wet suppression of the unpaved haul roads with major vehicle activity, within the pit and at stockpile areas. • Drilling and blasting activities should not be undertaken during high wind periods to avoid excess dust being transported across to neighbouring sensitive receptors. • Development of an Air Quality Management Plan (AQMP). • Dust fallout monitoring must be implemented both on and off-site to determine potential exposure. • Samples should be analysed regularly to determine silica exposure.	Low to Medium	Low to Medium
43	Access / haul roads Product transport	• A large amount of dust emissions is generated by vehicle traffic over these temporary unpaved roads. Substantial secondary emissions may be emitted from material moved during regular grading of the unpaved access road. • Product transport may further lead to a decrease in the regional air	• Set the speed limit for hauling vehicles and vehicles in general to as low a speed possible and enforce the speed limits specified. It is recommended the speed limit be set to 40km/h on unpaved roads. • Include speedbumps to control the speed limits where appropriate. • Include a program of wet suppression of the unpaved roads with major vehicle activity and at stockpile areas.	Medium	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
		quality due to wind erosion of product and spillages.	• Limit the load size of the vehicles to ensure the wind in transit does not pick up more dust than need be. • Product transport trucks must be covered with tarpaulins, the covers must be secured. • Spillages along the product transport routes must be cleaned immediately.		
44	Infrastructure area	• Particulate matter and nuisance dust are expected from the working stockpiles, transfer and tipping points during normal operations. • The crushing & screening process (beneficiation) will further reduce the ambient air quality in and adjacent to the infrastructure area. • The impact modelling indicated that the impact is confined to the MRA area, the impacts from the mine are below the ambient air quality standards beyond the MRA boundary.	• Limit the height and slope of stockpiles to reduce wind entrainment. • Reduction in drop height to reduce the dispersion of materials being transferred. • Windshield (barriers) can be implemented on the slopes and surface of the stockpile; these barriers are typically large trees with a good foliage coverage. • During the processing of material, the material should be kept wet to ensure the dust does not escape during the processing. • Dust suppression should be installed along all conveyors and at conveyor transfer stations. • Water misters must be installed at strategic points in the crushing building to abate dust emissions. • The general vehicle traffic around the stockpile areas should be limited.	Medium	Low to Medium
45	Infrastructure area	The dryer is usually a fuel based rotary dryer, and so emissions from the dryer are based on the fuel burnt, in the form of sulphur dioxide and oxides of nitrogen.	• As part of the emission mitigation, the dryer will have its own abatement equipment included in the design. • Water misters must be installed at strategic points in the drier plant building to abate dust emissions. • Low sulphur fuel oil will be used.	Medium	Low
46	Open Pit Mining	• Ground vibration, air blast and fly rock impact on houses and other infrastructure, including boreholes and graves within the MRA area, could lead to damage of structure and/or complaints. • With the revised blast design developed by the blast specialist the impacts are confined to the MRA area, except for the potential damage of flower tunnels directly north of the MRA area (Unex).	• Re-define blast design and apply for the necessary consent and authorisation for blasting within 500m of non-mining structures. • A test blast must be done to confirm levels of ground vibration and air blast. • Implement a blast monitoring programme. Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. • Conduct pre-blast photographic surveys of infrastructure within 1200m of the mining area. • Agree compensation mechanism with Unex Roses in the event of damage to its flower tunnels due to air blast.	Medium to High	Low to Medium
47	Open Pit Mining	• Ground vibration impact on humans and animals - safety and nuisance impacts. • Potential impact on equestrian horses and events.	• Re-define blast design. • Maintain an evacuation zone of 105m, establish an evacuation procedure with the affected parties prior to blasting. • Agree to a standard blasting time with the community/affected landowners. Setup blasting notice boards at various routes around the project area that will inform the community of blasting dates and times. • No blasting to be scheduled at times during horse show events or equestrian events. Preferably horses must be in stable during blast events – at least for the initial blasts to establish reactions and levels of influence. • Monitoring of blasting should be conducted at the facilities of concern, e.g. Rossgro	Medium to High	Low

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			broilers, Goudhoek Equestrian Centre, and other sensitive receptors as identified.		
48	All activities	Visual impact on the landscape character and Sense of Place associated with the MRA area and surrounding area during operations, due to noise, dust, increased traffic, and a change in landscape character.	• North Block opencast area is to be used for in-pit tailings disposal to avoid the construction of additional surface tailings infrastructure. • Access roads must be suitably maintained to limit and prevent erosion and dust pollution. • Vehicle speed on unpaved roads must be reduced to limit dust generation. • Ongoing alien and invasive vegetation control and management should take place. • Transport of product should be optimised as far as possible to limit the number of additional vehicles on local and district roads.	Medium	Low to Medium
49	All activities	Visual intrusion of mining activities on visual receptors during operations, due to presence of mining infrastructure, increased traffic, and increased presence of mining vehicles on the local roads, ongoing loss of vegetation, scarring of the terrain, and alteration of landforms and contours.	• As far as possible, existing roads are to be utilised to limit cumulative impacts from roads and traffic. • Transport of product should be optimised as far as possible to limit the number of additional vehicles on local and district roads. • All operational facilities should be actively maintained.	Medium	Low to Medium
50	All activities	Visual impacts from night-time lighting impacting on receptors accustomed to a low district brightness during night-time.	• Transport of mined material on public roads must be limited to daylight hours only. • A lighting specialist must be consulted to assist in the planning and placement of light fixtures for the mining facility and all ancillary infrastructures to reduce visual impacts associated with glare and light trespass. • Placement of lighting outside of the MRA boundary should be limited to security lighting at the main entrance. • Outdoor lighting must be strictly controlled. • The use of high light masts and high pole top security lighting should be avoided. Any high lighting masts should be covered to reduce sky glow. • Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surrounding of the mining infrastructure. • Censored and motion lighting may be installed at office areas, workshops, and other buildings to prevent use of lights when not needed. • Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose. • The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects.	Medium	Low to Medium
51	Product transport	• The road network, surrounding the Rietkol Project, will be able to handle the traffic, with the identified road improvements, with no detrimental impact on the traffic on any of the relevant roads. • Safety of other road users do require some intervention.	• Road R50 (P36/1) require some maintenance to the road edges and shoulders. • Road D1550 is currently without any road markings and painted centre lines. • The gravel access off Road D1550 need to be upgraded to be able to accommodate the future truck movements.	Medium to High	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			• Intersection 1: Access road with Road D1550: A dedicated right-turn lane must be provided on the northern approach of Road D1550, plus a left-turn slipway from the mine access onto Road D1550. • Intersection 2: Road D1550 with Road R50 (P36/1): The right-turn lane on the north-western approach of Road R50 (P36/1) must be improved in accordance with the current standards of the provincial authority, plus a left-turn slipway from the Road D1550 onto Road R50 (P36/1) should be provided. • All proposed road upgrades and improvements are to be designed by a professional engineer and submitted for official approval, by the Mpumalanga Provincial Roads Department, prior to implementation. • Bulk product transport trucks must be covered with tarpaulins, the covers must be secured. • Speed and safety control of truck movements to be monitored.		
52	Open Pit Mining	Mining will be in very close proximity of the graveyard, and clean water berms may directly impact on the graveyard.	• The informal graveyard should be demarcated (fenced off) to prevent any damage thereto prior to relocation. • The informal graveyard should be relocated if mining or any other infrastructure is closer than 100m. • Consultation must be initiated at least 2 years prior to relocation to identify the next of kin and obtain their consent. • Implement the legal process as prescribed in the NHRA and obtain the necessary permits as prescribed by the relevant legislation.	Medium	Medium
53	Open Pit Mining	Recovery of sub-surface sites during mining operations.	• A qualified archaeologist must monitor excavation activities during topsoil stripping over the LOM. • Any discovery of artifacts, graves or other remains of archaeological interest should be reported to SAHRA. • Activities must cease immediately upon any discovery of cultural or heritage resources and a qualified archaeologist informed to do further assessment and reporting. • Identified sites of cultural and heritage significance must be demarcated until such time that an instruction to resume work is provided to the contractor, following consultation with the regulating authorities.	Medium	Low to Medium
54	Open Pit Mining	The mining pits overlie a Low Palaeontological Sensitivity underlain by quartzite.	• If any fossils are unexpectedly recorded during mining excavations a suitably qualified palaeontologist must be appointed to prepare a “Chance Find Protocol” (CFP). • This CFP report must be included into the EMPr of the project and upgraded continuously during the mining phase when excavations of deeper than 1.5m are undertaken.	Medium	Low
55	All activities	Impact on property values of adjacent properties.	• Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.	Low	Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			• Mitigate air quality through dust suppression, wet processing, wind entrainment, and windshields or barriers; noise pollution through implementation of noise abatement measures on vehicles and machinery that generates most noise and blasting impacts through blast preparation and specific stemming controls.		
56	All activities	Impact on livelihoods dependent on groundwater due to potential impact on groundwater quality during and after decommissioning of mining.	• It is acknowledged that there are processes in place to manage potential water pollution and monitor water quality. These processes should be applied continuously and post decommissioning. • Implementation of mitigation measures as proposed by the Geohydrological Impact Assessment. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.	Low	Low to Medium
57	All activities	Impact on the availability of natural resources such as firewood, small mammals for hunting, medicinal plants, and subsistence grazing.	• Allow local occupants to gather natural resources from specific areas prior to vegetation clearance. • Lease back unutilized areas for agricultural purposes (grazing) if safety permits.	Low	Medium
58	Open Pit Mining & Processing	Impact on health, well-being, and livelihoods of the public due to risk exposure from potential pollution.	• Majority of the health impacts related to pollution can be effectively mitigated by reduction of air quality impacts. Mitigate air quality impacts through dust suppression, wet processing, wind entrainment, and windshields or barriers. • Purchase of property where risk levels are above an acceptable threshold and those properties within the MRA area where a high risk in air quality pollution levels is indicated by modelled impacts. • Implementation of air quality monitoring programmes with measurements taken where sensitive receptors may be at risk. • Making available monitoring information as a measure of assurance of the measured impact, and close collaboration with large production units such as Rossgro and Unex Roses to make information available to mitigate the perception of an impact by their customers. • If impact is experienced above the predicted impacts and standards, and cannot be further mitigated, the negotiation and agreement on compensation. • Identification of a sample of local residents at risk points and implementing a health monitoring programme with identified persons. Conduct lung function testing, once every 12 months on selected members of the public, including children. • Communication Strategy to keep community informed of potential pollution risks and mitigation measures. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.	Medium	Low to Medium
59	Open Pit Mining & Processing	Impact on health and well-being of workers due to risk exposure (silica dust, occupational risks, noise).	• Implementation of Personal Protective Equipment for workers.	Medium	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			• Implementation of a Health Monitoring Programme with workers. • Compensation if risks cause health-related illnesses. • Conduct regular full risk assessment and have procedures in place to deal with emergency incidents. • Establish on-site emergency equipment and appoint safety staff.		
60	All activities	Impact on Aesthetic Value and Sense of Place due to visual intrusions and increase nuisance noise.	• Implementation of mitigation measures as contained in the Visual Impact Assessment. • Implementation of mitigation measures as contained in the Noise Impact Assessment. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.	Medium	Low to Medium
61	All activities	Disruption of daily living and movement patterns and safety of road users.	• Implementation of the recommendations and mitigation measures as contained in the Traffic Impact Assessment including speed calming measures, safety awareness campaigns and upgrades to intersections. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst landowners in influence zones.	Medium	Low to Medium
62	Product Transport	Impact on well-being and livelihoods due to dust generation along transport routes.	• Mitigate air quality impacts through dust suppression, wet processing, wind entrainment, and windshields or barriers, as appropriate. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst landowners in influence zones.	Medium	Low to Medium
63	All activities	Influx of Job seekers and Population growth pressures.	• Development and implementation of an Influx and Land use Management Plan in conjunction with the Local Municipality. Planning infrastructure, services, and utilities in collaboration with the Victor Khanye Local Municipality. • Consultations with and involvement of local communities in project planning and implementation. • Awareness-raising among local community and workers relating to recruitment processes. Contractor to hire workers through recruitment procedures and avoid hiring “at the gate” to discourage spontaneous influx of job seekers. • Prioritise employment from local communities with the development of recruitment procedures and utilizing the existing skills database compiled from the local communities. • Implementation of bursary programme and practical skills programmes as part of the Social and Labour Plan. • Use of buffer zones. • Planning worker transportation that resides in formal settlements surrounding the mine development such as Delmas and Eloff. • Effective Delivery of Project Benefits. • Increased security on mine premises: Properly constructed and secured fences can control access to mine site and implementing strict access control to the project site.	Medium	Low to Medium
64	All activities	Changes in Settlement & Housing Patterns.		Medium	Low to Medium
65	All activities	Increase in Social Pathologies and Crime.		Medium	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
			• Induction of contractors and workforce about their code of conduct in the local area. • Implement health awareness programmes for workers and communities including education programmes on sexually transmitted diseases and HIV/AIDS and other illnesses such as TB. • Workers should be urged to recognize and report suspicious activity and signs of burglary and be informed of crime prevention measures that they themselves can take. • Liaison with existing community policing forums and project security to properly secure the project area and surrounding area. • Establishment of a Complaints and Grievance Procedure and raise awareness of this procedure amongst stakeholders in influence zones.		
66	All activities	Creation of permanent operational employment.	• Prioritize people residing in local settlements. • Implementation of bursary programme and practical skills programmes as part of the SLP.	Medium	High (Positive)
67	All activities	Opportunities in local Skills Development, Bursaries, Internships and Mentorship Programmes.	• Implementation of the SLP, with a focus on local settlement residents.	Medium	High (Positive)
68	All activities	Opportunities in local SMME Development and Procurement.	• Establishment of a vendor database and assessment of business aptitude and skill. • Identification of procurement opportunities that can be ring-fenced for local businesses. • Implementation of the SLP, with a focus on local settlement residents, and businesses within the Municipal area.	Medium	Medium (Positive)
69	All activities	Impact on Social Development through SLP Community Development Programmes.	• Implementation of the SLP, with a focus on local settlement residents.	Medium	Medium (Positive)
70	All activities	Generation of tax base, revenue, and GDP contribution.	• No mitigation required.	Medium	High (Positive)
DECOMMISSIONING & CLOSURE					
71	Open Pit Mining	• Proliferation of alien and invasive plant species leading to ongoing floral and faunal habitat loss. • Improper rehabilitation of opencast mining blocks and disturbed areas leading to permanent floral and faunal habitat loss. • Increased risk of erosion in disturbed areas. • Increased runoff volumes and formation of preferential surface flow paths because of compacted soils and unvegetated areas, leading to increased sedimentation, erosion, and increased water inputs to downgradient wetlands.	• Ensure sound implementation of an Alien and Invasive Eradication Plan. • Where soils have been compacted that are to be ripped and where necessary reprofiled. Indigenous grass species are to be used for revegetation of disturbed areas and the mining blocks. • Where necessary hessian sheets (or similar products) are to be used to stabilise the soil surface until complete revegetation has occurred. • Erosion mitigation measures are to be implemented to mitigate downslope sedimentation of wetlands and the hindrance of revegetation/ rehabilitation activities. • Where possible and feasible the open pit should be filled with tailings to limit the final pit depth. • The sides of the open pits should be sloped in such a way as to create ease of access in and out for faunal species once mining activities in that block have ceased.	Medium	Low to Medium

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
72	Infrastructure area	• Highly compacted soils limiting the re-establishment of natural vegetation. • Increased runoff volumes and formation of preferential surface flow paths because of compacted soils and unvegetated areas, leading to increased sedimentation, erosion, and increased water inputs to downgradient wetlands. • Proliferation of alien and invasive plant species leading to ongoing floral and faunal habitat loss. • Improper rehabilitation of disturbed areas leading to permanent floral and faunal habitat loss.	• Ensure that soils are replaced, ripped and re-profiled post-closure, and that vegetation is restored (revegetated with indigenous vegetation species) to achieve post-mining land use objectives. • Rehabilitation measures as stipulated in the Rehabilitation, Decommissioning and Closure Plan must be implemented. Implementation must be overseen by a suitably qualified Environmental Specialist with wetland experience. • Where necessary hessian sheets (or similar products) are to be used to stabilise the soil surface until complete revegetation has occurred. • Minimum of three year's post-closure monitoring to be undertaken. • Ensure sound implementation of an Alien and Invasive Eradication Plan. • During the removal of infrastructure and waste, remediation of contamination should be carried out. Where this is not possible these soils are to be removed to an appropriate waste facility.	Medium to High	Low
73	Open Pit Mining Infrastructure area	Visual intrusion of rehabilitation activities on visual receptors during the decommissioning and closure phase, due to the dismantling of infrastructure and ineffective final rehabilitation actions resulting in poor vegetation cover, erosion being present, infrastructure remaining, and opencast pits not being adequately backfilled and shaped.	• Rehabilitation measures as stipulated in the Rehabilitation, Decommissioning and Closure Plan must be implemented.	Medium	Low
74	Infrastructure area	Migration of residual groundwater contamination plume away from rehabilitated surface source areas.	• Dedicated plume monitoring boreholes should be drilled in the down-gradient groundwater flow direction and sampled at quarterly intervals to monitor plume migration. • Should the monitoring program indicate significant plume migration, interception trenches and/or rehabilitation boreholes may be considered. • If an impact is determined on a user borehole and the source of pollution is the mine, these landowners and/or communities must be supplied with clean water, while remediating the water sources of these parties as soon as possible.	Low to Medium	Low to Medium
75	Open Pit Mining	Migration of groundwater contamination plume away from rehabilitated opencast pits.	• Dedicated plume monitoring boreholes should be drilled in the down gradient groundwater flow direction and sampled at quarterly intervals to monitor plume migration. • Should the monitoring program indicate significant plume migration, interception trenches and/or rehabilitation boreholes may be considered. • If an impact is determined on a user borehole and the source of pollution is the mine, these landowners and/or communities must be supplied with clean water, while remediating the water sources of these parties as soon as possible.	Low to Medium	Low to Medium
76	Open Pit Mining Infrastructure area	Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take place during the	• Restrict rehabilitation activities to daytime only.	Medium	Low

ID	Activity	Potential impact	Proposed mitigation measures	Mitigation efficiency	Residual Risk Level
		day using minimal equipment. While there may be various activities, there is a very small risk for any additional noise impact.			
77	Open Pit Mining Infrastructure area	The decommissioning phase may result in some reduction to the ambient air quality, but to a lesser extent than the operational phase. Exposed soil is often prone to erosion by water. The erodibility of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover.	• Implement a program of wet suppression during rehabilitation activities. • Revegetate rehabilitated areas as soon as possible for long-term dust and water erosion control.	Medium	Low to Medium
78	All activities	Loss of job opportunities due to downscaling of the mine employment	• Establish a future forum with representation from the workforce to discuss potential difficulties and solutions. • Implementation of programmes to minimize and mitigate the impact of downscaling and retrenchment. • Implementation of portable skills programmes to assist employees, especially those from the local area, to re-enter the agricultural and other sectors prevalent in the Municipal area.	Medium	Low to Medium

7.4 ASSESSMENT OF IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

Based on the outcome of the risk assessment (Table 36 and Table 37), the specialist studies conducted, and the stakeholder concerns raised during the Public Participation process, the following aspects are regarded as potentially significant impacts and/or risks:

- Groundwater impacts
- Air quality impacts
- Noise impacts
- Blasting impacts
- Health and safety impacts, including increased traffic on the roads and exposure to silicosis
- Macro-economic impacts on existing agricultural activities
- Social impacts

Below follows a brief description of the potential impacts as identified by the specialist impact assessments. For more detail, please refer to the specialist reports attached as Appendices.

7.4.1 Groundwater Impacts

7.4.1.1 Groundwater quantity

The main aim or objective of the groundwater flow model was to simulate/predict the groundwater level impacts resulting from the planned opencast mining, i.e. simulation of groundwater depression cone. Two mining scenarios were simulated, namely **Scenario 1** where the depth of the pit floor is on average 30 mbs and **Scenario 2** where the average depth of the pit floor is 50 mbs. The results of the numerical groundwater flow model simulations are summarised below:

	Scenario 1	**Scenario 2**
Simulated drawdown	20 meters at LOM	40 meters at LOM
Area affected	522 460 m^2 at LOM	724 430 m^2 at LOM
Simulated groundwater influx	90 m^3/d at LOM	240 m^3/d at LOM

The pit floor was simulated to intersect the water table from year one during both mining scenarios, resulting in groundwater flowing towards and eventually into the opencast pits, resulting in the following model simulated groundwater influx volumes:

Year	**Scenario 1**		**Scenario 2**	
	Influx (m^3/d)	**Influx (ℓ/S)**	**Influx (m^3/d)**	**Influx (ℓ/S)**
1	20	0.2	97	1.1
2	19	0.2	102	1.2
3	18	0.2	95	1.1
4	36	0.4	138	1.6
5	35	0.4	133	1.5
6	34	0.4	127	1.5
7	35	0.4	128	1.5
8	36	0.4	128	1.5
9	40	0.5	136	1.6
10	44	0.5	145	1.7
11	45	0.5	145	1.7
12	46	0.5	145	1.7
13	58	0.7	171	2.0
14	69	0.8	196	2.3
15	76	0.9	210	2.4
16	83	1.0	223	2.6
17	86	1.0	228	2.6
18	89	1.0	232	2.7
19	90	1.0	235	2.7
20	90	1.0	237	2.7

A rapid reserve determination was conducted for the MRA area that falls within the B20B quaternary catchment and forms part of the Olifants Water Management Area (WMA). The General Authorised groundwater use for this catchment is 0 m^3/ha/year (Government Gazette, No. 40243), which is the result of the underlying karst (dolomite) aquifer being under considerable stress from large scale groundwater abstraction for irrigation purposes and domestic use.

In a study conducted by Roger Parsons in 1994 for the DWS, "Groundwater Allocation" was defined as the rate at which groundwater can be withdrawn without resulting in a significant drop of regional groundwater levels in a catchment over the long-term, and without inducing a deterioration of groundwater quality or without causing any other detrimental impact on aquatic ecosystems (Parsons, 1994).

The Department of Water and Sanitation (DWS) categorises the water use in three categories based on the amount of recharge that is used by the applicant in relation to the specified property:

- Category A: Small scale abstractions (<60% recharge on property);
- Category B: Medium scale abstractions (60-100% recharge on property); and
- Category C: Large scale abstractions (>100% recharge on property).

The maximum rate at which groundwater would need to be pumped from the proposed opencast pits to ensure dry and safe mining conditions was simulated/predicted with the numerical groundwater flow model to be approximately 90 m^3/d or 240 m^3/d – depending on the final depth of the pit. Based on the above DWS classification, this water abstraction can be classified as **Category A** or **small scale**.

A summary of the model simulated water level impacts at mine closure and post-closure is provided below:

- The groundwater influx for Scenario 1 was simulated to increase from approximately 20 m^3/d at the end of YR1 to a maximum of ± 90 m^3/d at mine closure. The influx simulated for Scenario 2 increased from ± 100 m^3/d to nearly 240 m^3/d at YR20 of mining.
- An area of approximately 522 460 m^2 was simulated to be affected by the Scenario 1 pit dewatering activities, while a slightly larger area of ± 724 430 m^2 was simulated for Scenario 2. The model simulated groundwater depression cones for Scenario 1 and Scenario 2 are indicated in Figure 69 and Figure 70 respectively.
- The water level impacts do extend beyond the MRA area; however, no existing groundwater user boreholes are located within these outside affected areas.
- Groundwater levels will slowly start to recover from the impacts of pit dewatering and will tend to return to pre-mining elevations. No additional adverse impacts on groundwater quantity are therefore expected to occur. Model simulated head-time curves are provided Figure 71, which give

an indication of the time it would take groundwater levels to recover. After 50 years the groundwater level (where the impact of pit dewatering was greatest) was simulated to have recovered by ± 91% for Scenario 1, while a ± 89% recovery was simulated for Scenario 2.

- The sensitive dolomite aquifer will not be intersected by the proposed opencast pits. The sediment/sand (now quartzite after low grade metamorphism) was deposited into an ancient dolomite sinkhole. The proposed opencast pits are situated more or less in the centre of this deposit, meaning that at all time (except maybe during year 2 and 3 of mining) there will be a ± 90 to 300 m buffer, or low transmissivity quartzite between the pit and surrounding dolomite. The quartzite deposit in its entirety is expected to act as a buffer between the proposed mining activities and the surrounding and underlying dolomite.

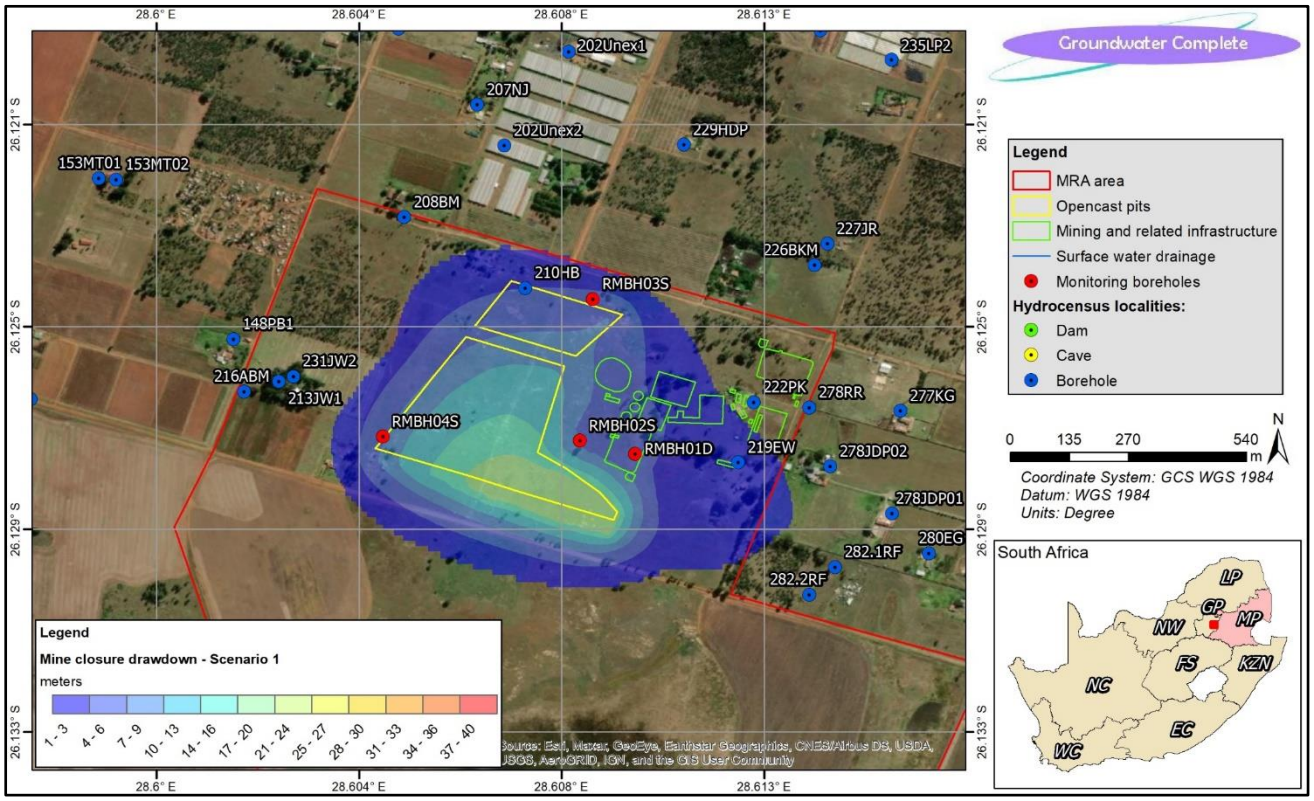


Figure 69: Groundwater drawdown cone at mine closure - Scenario 1 (30m)

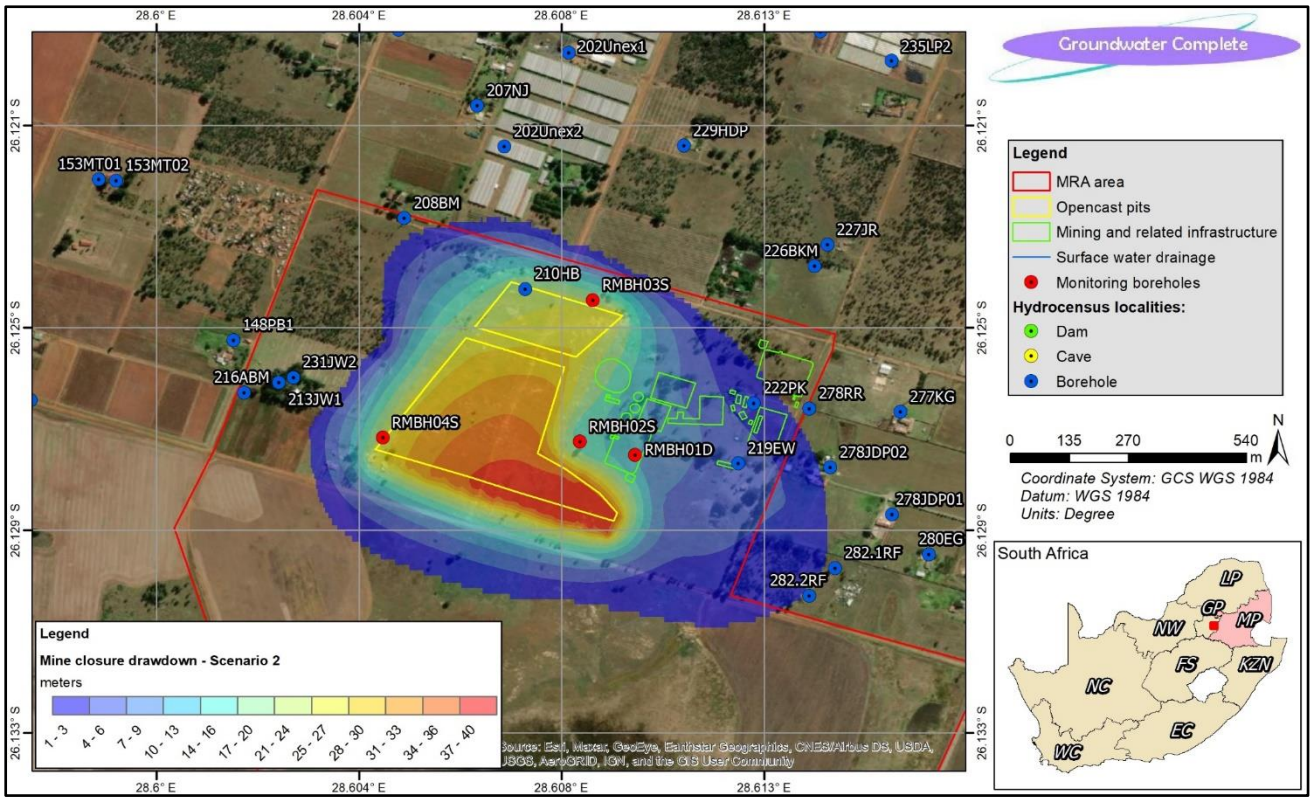


Figure 70: Groundwater drawdown cone at mine closure - Scenario 2 (50m)

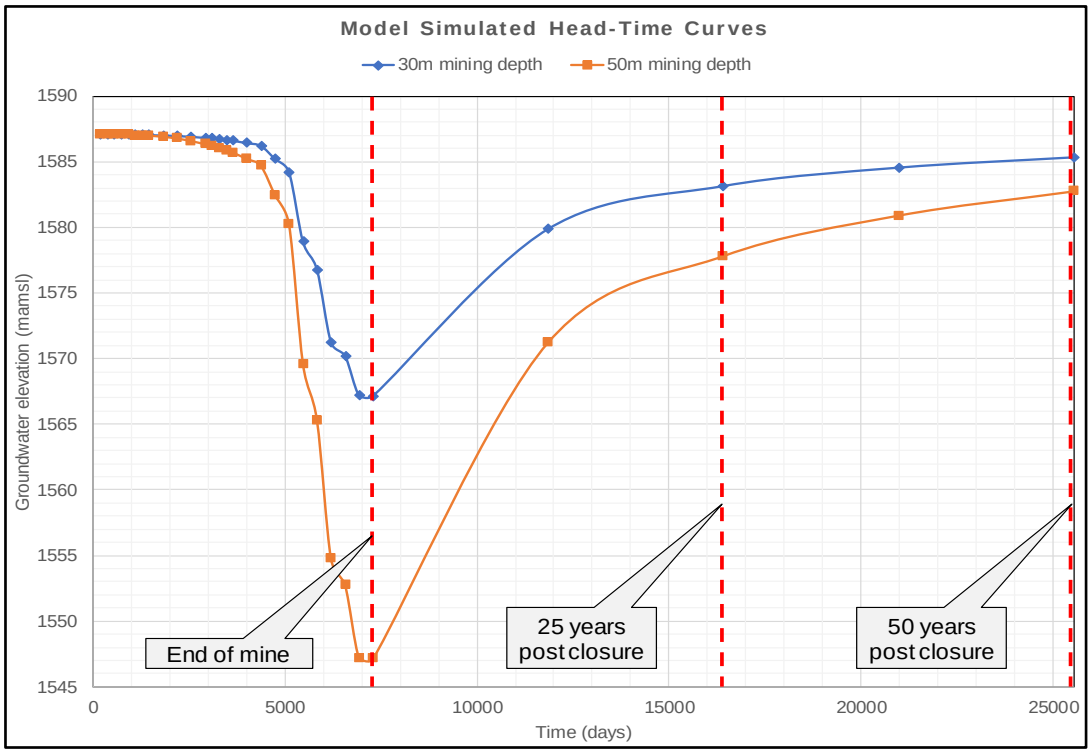


Figure 71: Groundwater level recovery after mine closure

7.4.1.2 Post-closure Decant

Tailings material from the plant will be dumped into the North Block during the operational phase of mining. This fine material will effectively "plug" the mine void, allowing for very little water infiltration and no decanting is therefore envisaged. Mining and related infrastructure will be demolished during the decommissioning phase and the resulting building rubble is planned to be disposed of into the South Block and the remainder of the void filled with water. Evaporation far exceeds rainfall in the project area and with the South Block being located on top of a local topographic high (resulting in limited surface water runoff into the pit), no decanting is expected to occur.

7.4.1.3 Groundwater Quality

The main aim or objective of the mass transport model was to simulate/predict the groundwater quality related impacts resulting from the planned mining and related activities, i.e. simulation of contaminant/plume migration. With reference to the waste classification results, it is noted that the plumes referred to below will be leachate that formed through inert quartzite material and though salinities may be slightly elevated, groundwater quality of the plume is still expected to remain within drinking water guidelines.

The proposed opencast pits were gradually included in the model simulations as source areas as mining progressed over a 20-year period, while the entire footprint of the mining and related infrastructure area was included from year one. The rehabilitated opencast pits were also included in the post closure simulations, while all mining and related infrastructure were removed after mine closure.

The results of the numerical contaminant transport model simulations are summarised below:

	Scenario 1 – Maximum pit depth of 30 meters	**Scenario 2 – Maximum pit depth of 50 meters**
Area affected at closure	338 900 m^2	268 500 m^2
Area affected at 25 years post closure	462 600 m^2	340 100 m^2
Area affected at 50 years pot closure	486 300 m^2	410 500 m^2
Plume direction	North-west	North-west
Plume migration rate at closure	5 meters per year	3 meters per year
Plume migration rate post closure	9 meters per year	7 meters per year

A summary of the simulated water quality impacts at mine closure is provided below:

- Plume migration simulated for Scenario 1 is somewhat faster than for Scenario 2, i.e. a larger area was simulated to be affected in Scenario 1.

- The deeper mining depth simulated for Scenario 2 resulted in the opencast pits acting as sinks for both groundwater and contamination, which restricted plume migration, more so than for Scenario 1. Groundwater levels around the pits would firstly need to recover from the impacts of pit dewatering before groundwater and contamination can eventually migrate away and into the down gradient groundwater flow direction.
- The contamination plumes for both Scenario 1 and Scenario 2 were simulated to migrate towards the north-west at rates of ± 5 and 3 meters per year respectively.
- At mine closure an area of approximately 338 900 m^2 was simulated to be affected by the Scenario 1 contamination plumes (Figure 72), while a slightly smaller affected area of ± 268 500 m^2 was simulated for Scenario 2 (Figure 73).
- Outside of the MRA area, only user borehole 278RR was simulated to be affected during both mining scenarios. That being said, the abovementioned borehole is located barely 25 meters east of the MRA area on Holding 278, and the plume concentration was simulated to be between 5 and 8% of the original source concentration.
- The targeted quartzite is predominantly composed of inert silica (i.e. amount of metal sulphide minerals is negligible, if any). Leachate from waste rock dumps, stockpiles and tailings is therefore expected to be of acceptable quality.
- Explosives will be used in the opencast mining process, which in all likelihood will be nitrate-based. Remnants of the explosives still contain significant amounts of nitrate and get attached to the blasted rock material. Nitrate dissolves readily in water, resulting in nitrate enriched leachate being generated whenever water is available for dissolution (usually during and directly after a rainfall event). Waste rock dumps and stockpiles are therefore regarded as potential sources of nitrate contamination and the necessary management measures during and after operations must be put in place to prevent contamination of the groundwater.

Following the mine closure simulation, the mass transport model was run for an additional 50 years to simulate/predict the post closure migration of residual contamination. A summary of the post closure mass transport model simulations is provided below:

- All the surface contaminant sources (plant area and associated infrastructure, pollution control dam and stockpiles) have been decommissioned and no longer pose a threat to the underlying groundwater.
- The only remaining sources of contamination are the two rehabilitated opencast pits. No further adverse impacts on groundwater levels are envisaged as groundwater levels will recover from the impacts of pit dewatering after the decommissioning/closure phase. After groundwater levels have

recovered and a new groundwater level equilibrium has been established, contamination from the rehabilitated pits will begin to migrate in the down-gradient groundwater flow direction.

- At 50 years post closure the Scenario 1 contamination plumes were simulated to have increased to 486 300 m^2 in size (Figure 74), while an area of 410 500 m^2 was simulated to be affected by the Scenario 2 plumes (Figure 75).
- Note that no user boreholes located outside of the MRA area were simulated to be adversely affected.
- Plume concentrations were simulated to increase over time, however natural occurring processes such as dilution and dispersion caused concentrations to only reach ± 80% after 50 years – note that the original source concentration was 100%.

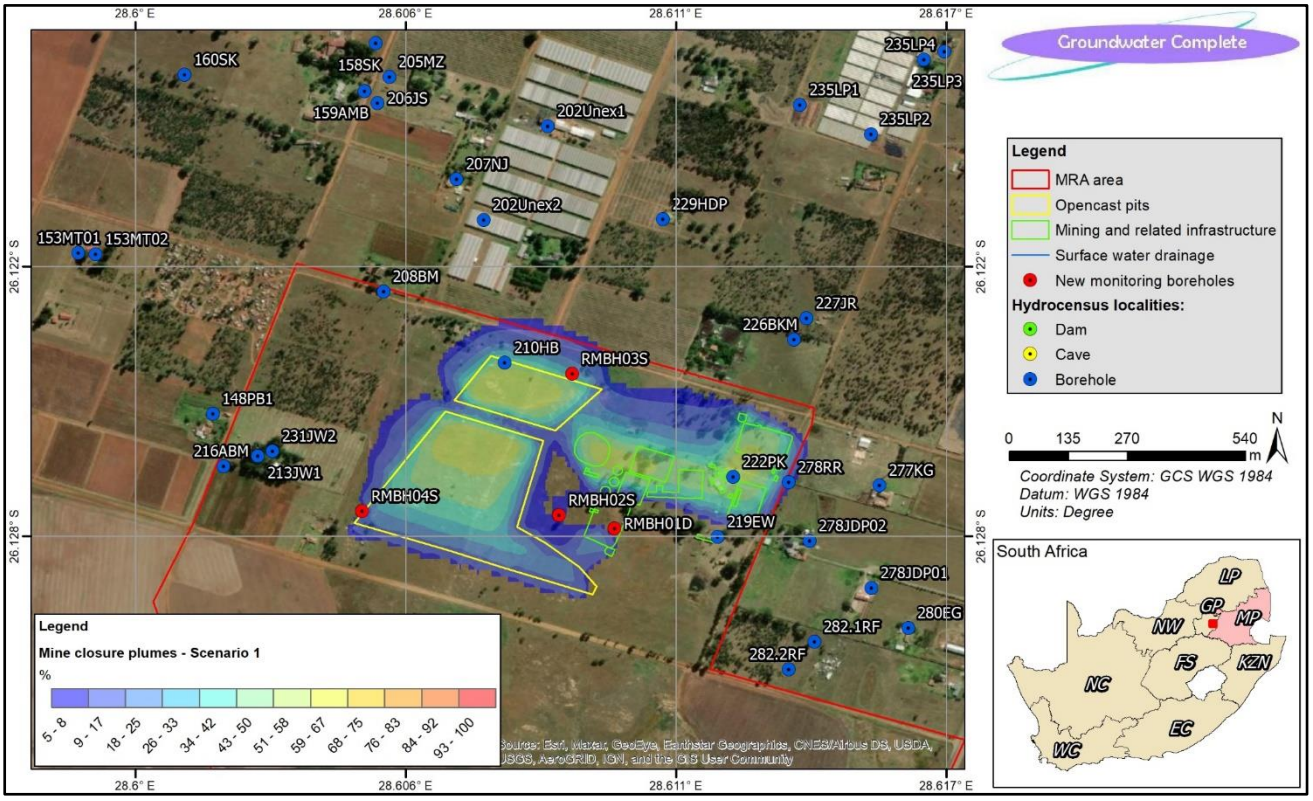


Figure 72: Groundwater contamination plumes at mine closure - Scenario 1 (% of source)

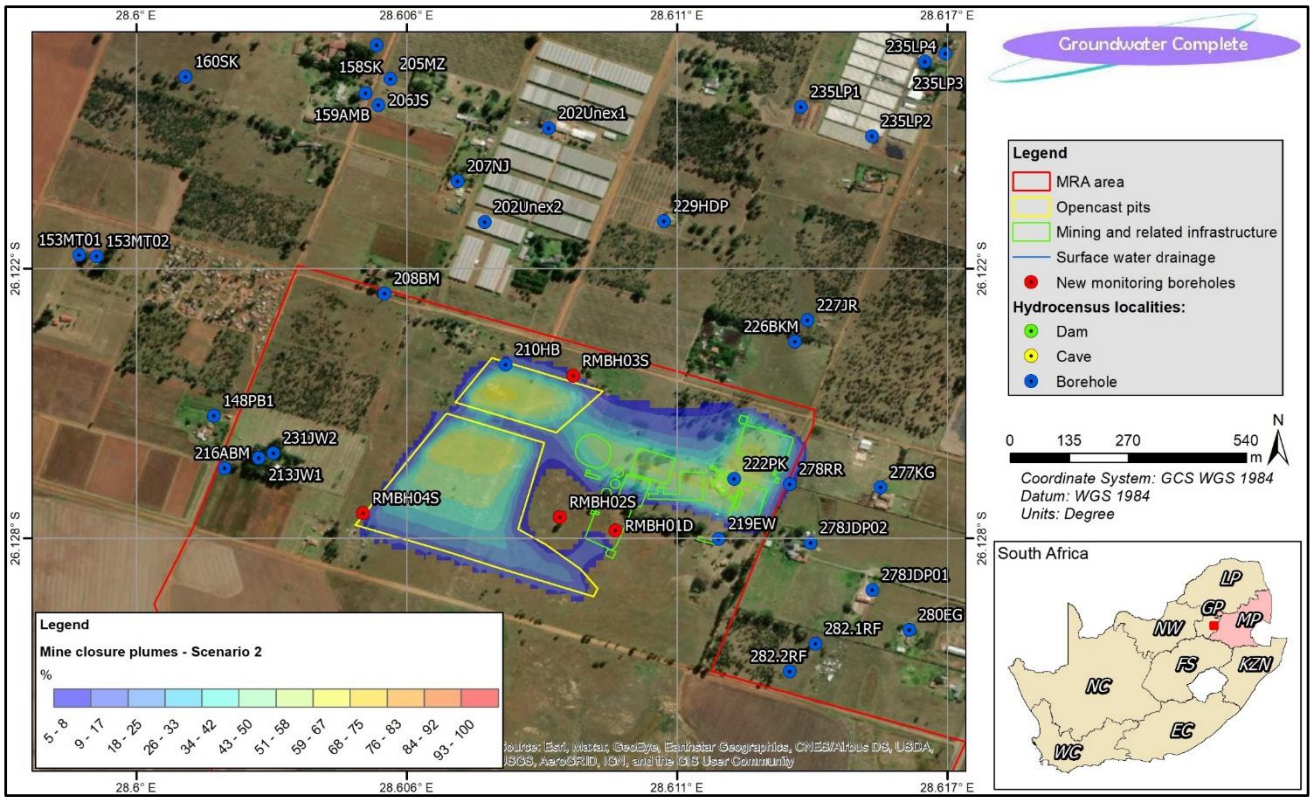


Figure 73: Groundwater contamination plumes at mine closure - Scenario 2 (% of source)

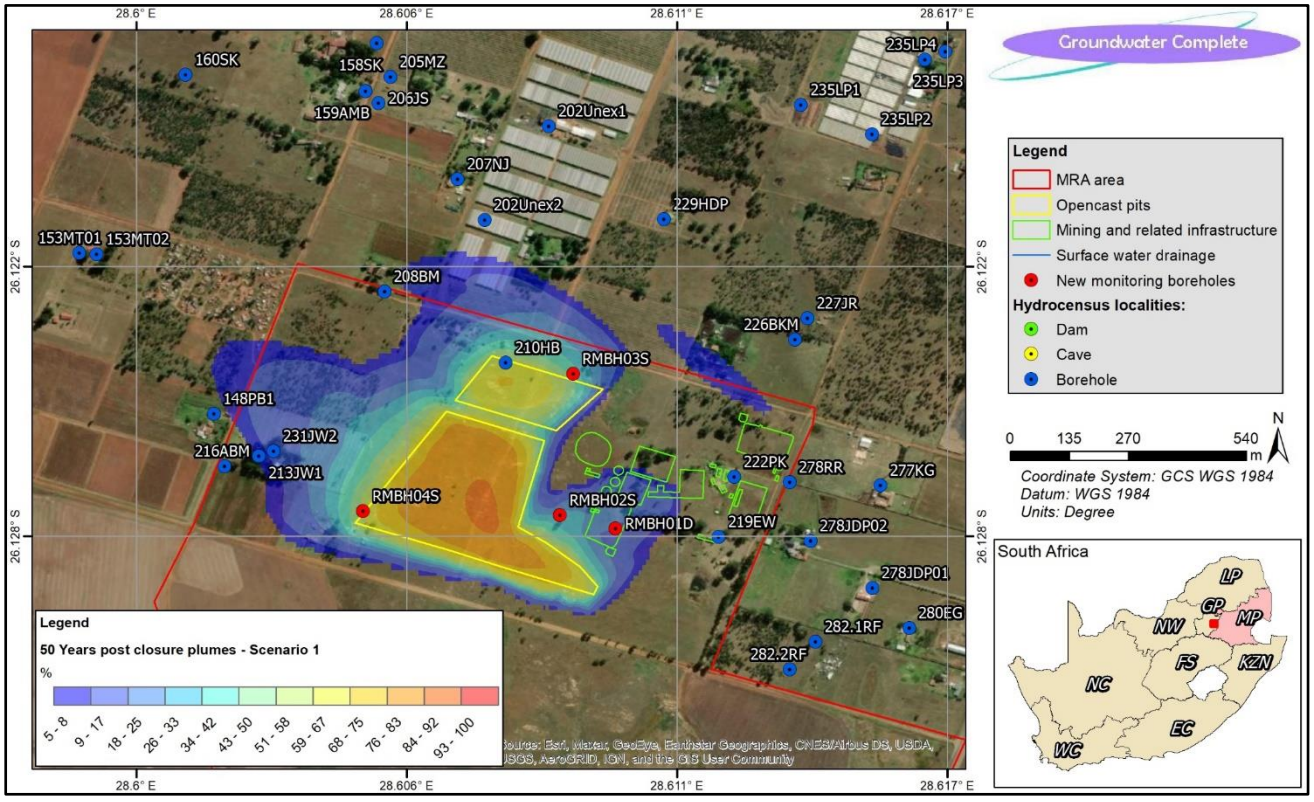


Figure 74: Groundwater contamination plumes at 50 years post closure - Scenario 1 (% of source)

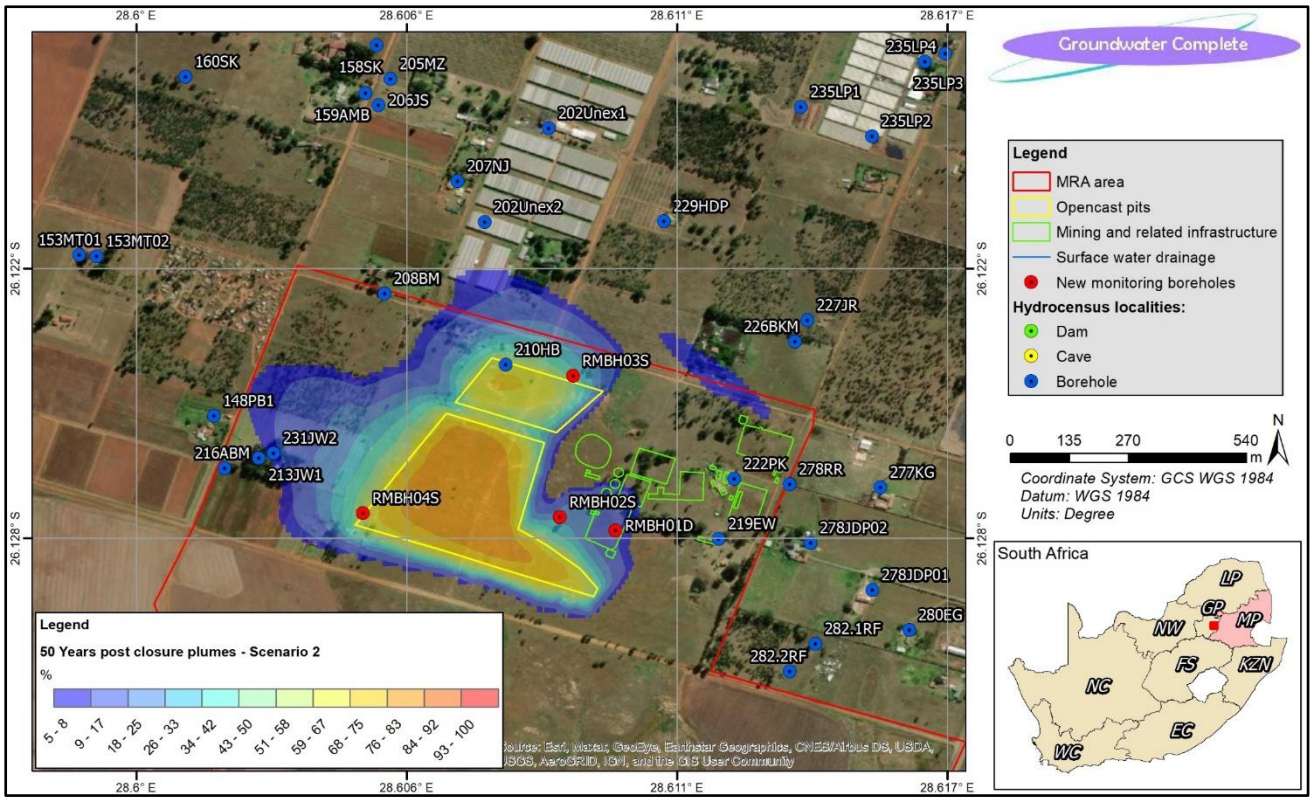


Figure 75: Groundwater contamination plumes at 50 years post closure - Scenario 2 (% of source)

7.4.1.4 Potential for acid mine drainage

Exploration drilling in the project area found that the Rietkol quartzite deposit is exceptionally pure (MWP, 2019). Both the target mineral and host rock that will be processed in the plant and then stockpiled/dumped are inert as the targeted quartzite is predominantly composed of inert silica (i.e. amount of metal sulphide minerals is negligible, if any). The material will therefore not react with oxygen and water to create poor quality leachate, i.e. acid mine/rock drainage and no acid-base accounting (ABA) was therefore deemed necessary for this investigation (GC, 2021).

In addition, a groundwater study was conducted by WSM Leshika Consulting in 2015 for Silica Quartz located approximately 20 km north-east of the Rietkol MRA area. For the investigation a sample was collected of leachate originating from the tailings dam. This water sample was analysed for a wide range of chemical and physical parameters by a SANAS accredited laboratory. The analysis revealed that the leachate is in fact of relatively good quality and also suitable for human consumption with regards to SANS 241:2015. The iron content was however slightly elevated at nearly 1.8 mg/l, but which is still below the maximum permissible SANS concentration of 2 mg/l. The Rietkol quartzite deposit is lower in iron content and any potential leachate originating from the waste rock dumps, stockpiles and tailings is expected to be of acceptable quality.

A waste classification was conducted in April of 2021 by Aquatico Scientific, and the aim was to chemically characterise the waste material that will be generated and stockpiled during the operational phase of the project. The results of the total concentration and leachable concentration analyses show no exceedances of the TCT0 and LCT0 guideline limits, and both the tailings material and waste rock can be regarded as a Type 4 or inert waste. Thus, the plumes referred to in the previous section will be leachate that formed through inert quartzite material and though salinities may be slightly elevated, groundwater quality of the plume is still expected to remain within drinking water guidelines (Groundwater Complete, 2021).

7.4.2 Air Quality Impacts

The dispersion of pollutants through the air was modelled with the AERMOD software. The physical environmental parameters, such as wind, temperature, humidity and rain, influence the concentrations over distance. The modelling software took all these parameters into account in the primary calculations, a concentration value per pollutant was calculated at each of the grid points to be able to form isopleth images for graphical presentation of the typical plume dispersion in the region.

The different modelled components are:

- Mining – This focused on the pollutants generated during mining (open pit operations).
- Crushing & Screening – This calculated the emission emitted from the crushing and screening, loading and unloading of stockpiles and the transport of product around the site.
- Dryer – This addressed the pollutants from the dryer plant.

The modelled results are presented in Table 38 and compared with the national standards. Results are a cumulative impact showing total impacts from the site. The modelled results presented in Table 38 indicate the possible worst-case future concentrations of pollutants that can be found in the region because of the proposed mining activities. The worst-case is derived from the emission sources not being mitigated and the concentration level is the second highest concentration calculated from the model. The majority of the maximum concentrations are most likely to be located either on-top of an area source or close to an area source. The concentration of the pollutant will decrease as it moves away towards the fence line (MRA boundary). The maximum concentration that enters the receiving environment, beyond the fence line is highlighted as the MRA boundary concentration.

Table 38: Dispersion Results for Rietkol Project – Worst Case Scenario

Sulphur Dioxide SO_2 (µg/m³)			
Averaging Period	Peak	MRA boundary	Standard
Hourly	70.14	29.70	350
Daily	6.47	6.45	125
Annual	2.47	2.27	50

Particulate Matter PM_{10} (µg/m³)			
Averaging Period	Peak	MRA boundary	Standard
Hourly	578.62	296.57	-
Daily	229.05	67.39	75
Annual	101.93	13.69	40
Particulate Matter $PM_{2.5}$ (µg/m³)			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	60	35	-
Daily	24	10	40
Annual	10	3	20
Oxides of Nitrogen NOx (µg/m³)			
Averaging Period	Peak	MRA boundary	Standard
Hourly	67.34	28.51	200
Daily	6.22	2.26	-
Annual	2.37	0.24	40

Graphical outputs for the annual average predicted ambient ground level concentrations of SO_2, PM_{10}, $PM_{2.5}$ and NOx are provided in Figure 76, Figure 77, Figure 78 and Figure 79, respectively.

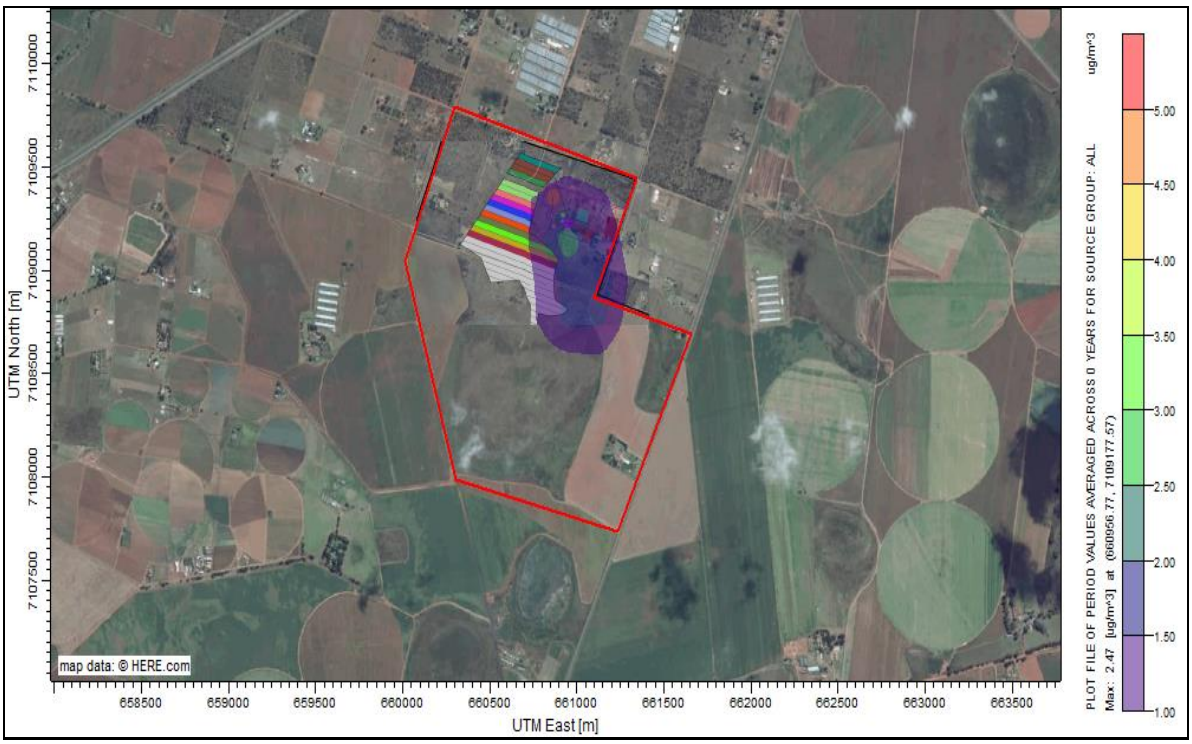


Figure 76: Annual average predicted ambient ground level concentrations (µg/m³) of Sulphur dioxide (Standard: 50 µg/m³)

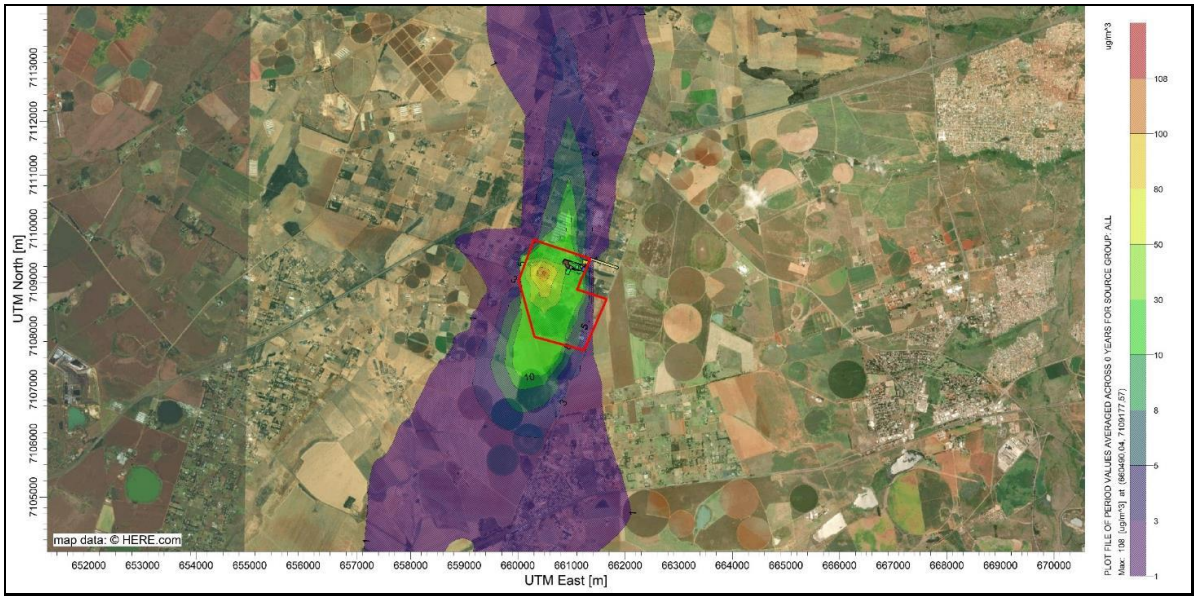


Figure 77: Annual average predicted ambient ground level concentrations (µg/m³) of Particulate Matter PM_{10} (Standard: 40 µg/m³)

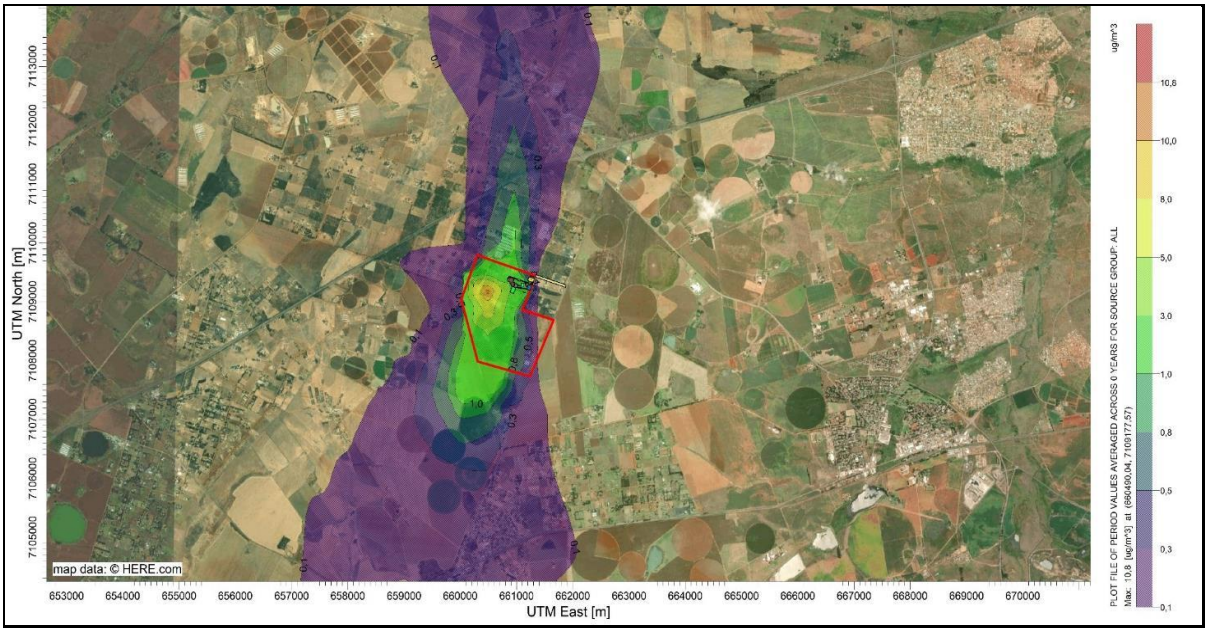


Figure 78: Annual average predicted ambient ground level concentrations (µg/m³) of Particulate Matter $PM_{2.5}$ (Standard: 20 µg/m³)

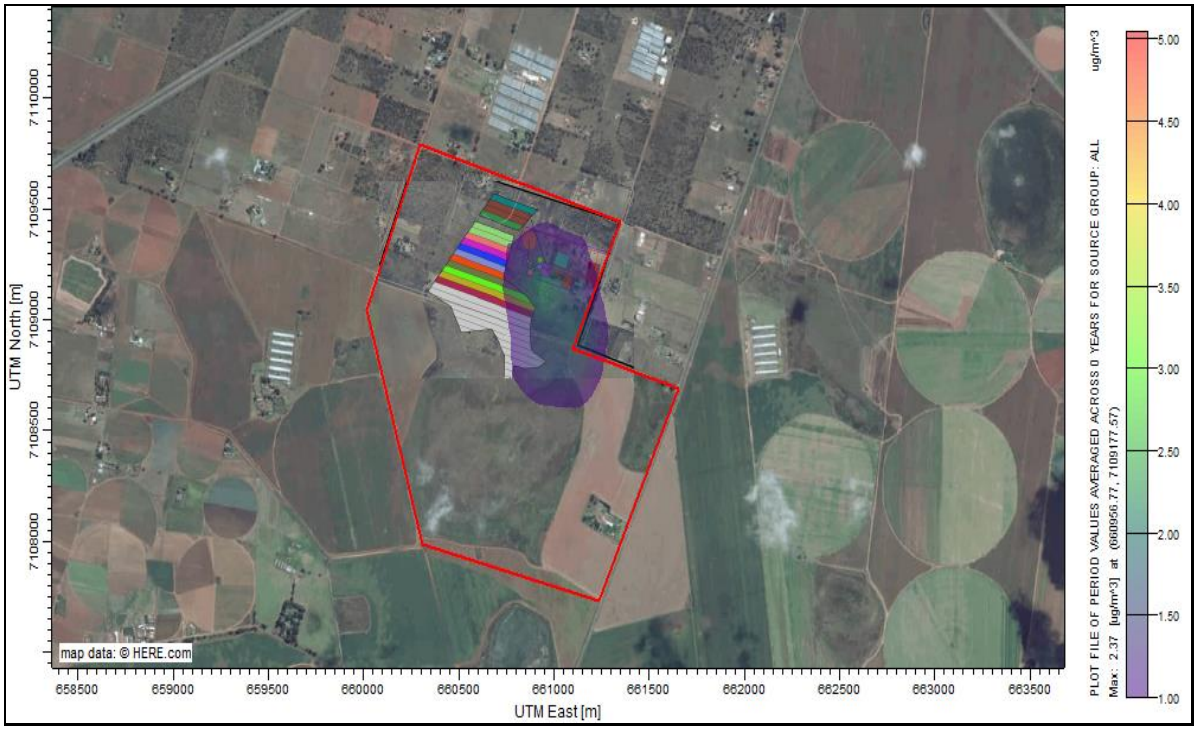


Figure 79: Annual average predicted ambient ground level concentrations (µg/m³) of Oxides of Nitrogen (Standard: 40 µg/m³)

Dust fallout modelling indicates the areas where fallout is expected to exceed the permissible limits for residential and industrial areas (Figure 80). Exceedances of both limits fall within the site boundary. It is recommended that dust fallout monitoring be undertaken to determine the effectiveness of the mitigation measures implemented.

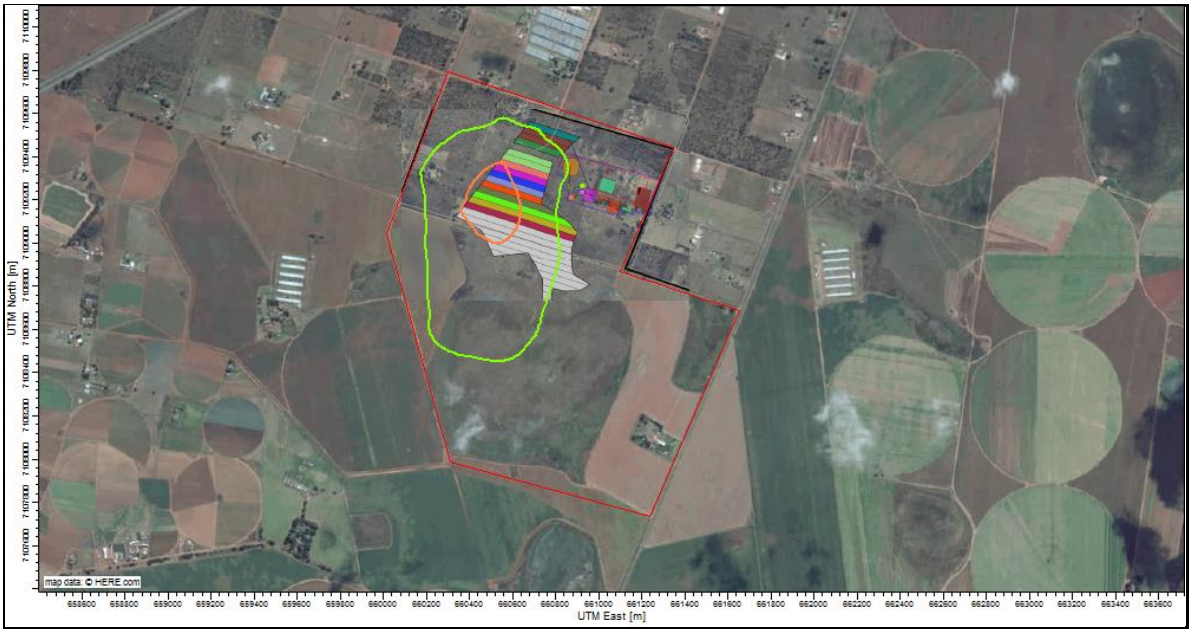


Figure 80: Predicted dust fallout impacts with the residential impact (600 mg/m²/day) in green and the industrial (1200 mg/m²/day) in orange

For the entire receptor grid modelled, beyond the MRA boundary, the impacts from the mine are below the ambient air quality standards. When combined with the current background concentrations monitored during June 2021 (Rayten, 2021), it is expected that the results will be above the national standards for ambient air quality. This is however driven by the poor quality experienced during the month of monitoring, which can be considered worst-case conditions.

While the air quality for chickens is no different to that for people, the short length of the production cycle, viz the time the broilers will be in that specific environment, will negate any possible long-term effects. Broilers are normally slaughtered between 32 and 35 days of age so each bird will only be exposed to the ambient air for 5 weeks (C4 Africa, 2021), and no impact on the broiler operations is envisaged due to reduced air quality caused by mining.

7.4.2.1 Greenhouse Gas Emissions Statement

As part of the Air Quality Impact Assessment, EBS Advisory was tasked to quantify and contextualise the project's greenhouse gas (GHG) emissions against the relevant national benchmarks. The GHG Emission Statement is attached as Appendix 21.

Table 39 shows the annual and lifetime emissions from the proposed activity as a percentage of the adjusted national carbon budget described in Appendix 21.

Table 39: Emissions for the proposed activity as a percentage of the national carbon budget

Emission category	Annual emissions (tCO_2e / year)	Lifetime emissions (over 20 years, tCO_2e)	% of SA carbon budget – annual emissions	% of SA carbon budget – lifetime
Scope 1&2	12 346	246 921	0.00028%	0.00560%
National carbon budget expenditure if approved				**0.00560%**

Based on the abovementioned calculations, the proposed project will exhaust approximately **0.00560%** of the adjusted national carbon budget if approved. The impact rating of the proposed activity's emissions is therefore '**Medium**'.

7.4.3 Noise Impacts

The potential noise rating levels were calculated using a sound propagation model. The noise emissions into the environment from the various sources as defined were calculated for the operational phase in detail, using the sound propagation model described in ISO 9613-2. The following was considered:

- The octave band sound pressure emission levels of processes and equipment;
- The distance of the receiver from the noise sources;

- The impact of atmospheric absorption;
- The operational details of the proposed project, such as projected areas where activities will be taking place;
- Topographical layout; and
- Acoustical characteristics of the ground. 50% soft ground conditions were modelled, as the area where the mining activity would be taking place is well vegetated and sufficiently uneven to allow the consideration of relatively soft ground conditions. This is because the use of hard ground conditions could represent a too precautionary situation.

The projected change in ambient sound levels during the operational phase of the proposed Rietkol Project is indicated in Figure 81 and Figure 82 for day- and night-time activities, respectively. It is noted that the modelling results indicate the worst-case scenario with numerous simultaneous operational activities.

The proposed mining activities (worst-case evaluated) will raise the noise levels at several sensitive receptors. These noises can be disturbing and may impact on the quality of living for the receptors. Mitigation is however available and if implemented would reduce the significance of the noise impact to a more acceptable medium (EAR, 2021).

Loud noise of short duration, to a level of 120dB, does not negatively affect broilers. Thunderstorms on the Highveld, accompanied by claps of thunder, have not been known to cause deaths in poultry, even though they produce noise at a level of 120dB (C4 Africa, 2021). Louder noise associated with uncontrolled blasting will result in complaints; however, with the proposed new blast design, as recommended by the blasting specialist, no impact is envisaged (C4 Africa, 2021).

According to research, continuous loud noise level of 73db – 80db (ventilation fans, a busy road) or repetitive loud noise of longer duration (chain feeders in the chicken house at 92dB), does not appear to have any negative effects on broiler and layer chicken performance (C4 Africa, 2021). The increase in noise levels due to the mining operations will be less than 3dB at the broiler farms, and well below the noise levels caused by the existing noise sources at the farms (ventilation fans, chain feeders). No impact on the production of broilers is therefore envisaged (C4 Africa, 2021). In addition, birds tend to, after showing initial signs of stress, habituate to the noise and return to their normal behaviour (C4 Africa, 2021).

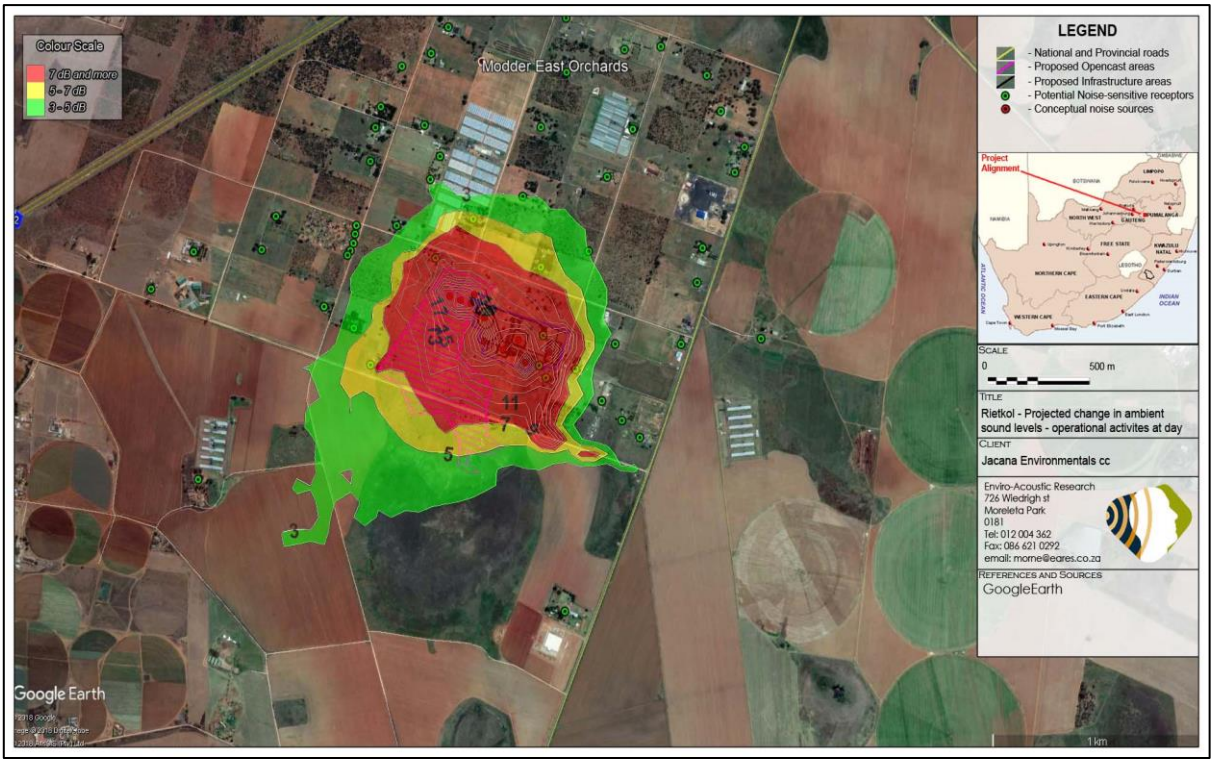


Figure 81: Projected change in ambient sound levels due to day-time operational activities

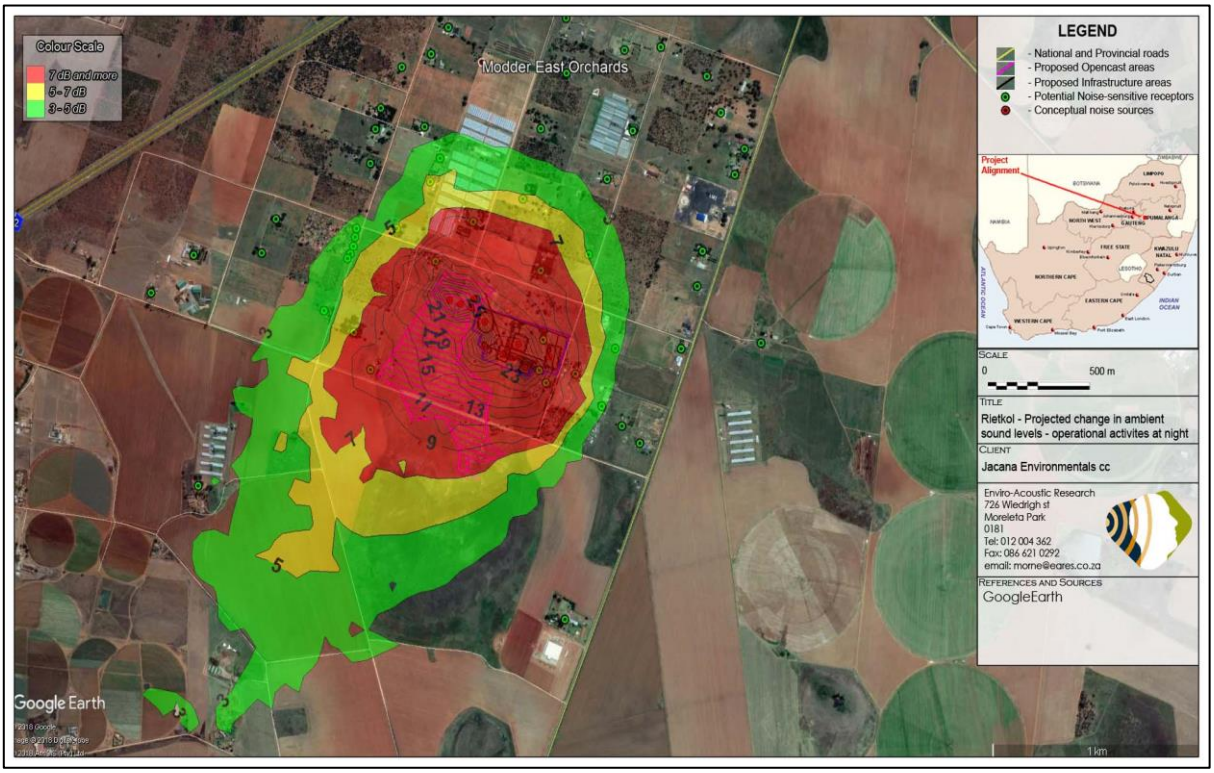


Figure 82: Projected change in ambient sound levels due to night-time operational activities

7.4.4 Blasting Impacts

The evaluation of effects yielded by blasting operations was evaluated over an area as wide as 3500 m from the MRA area. The effects of ground vibration, air blast and fly rock specifically were evaluated. Initial evaluation of ground vibration and air blast indicated that mitigation will be required for numerous surrounding structures and installations.

A specific blast design was proposed as mitigation measure to be considered – refer to Section 5.5.1. Applying the proposed design, the influence areas were reviewed. The application of the revised blast design reduces the area of influence significantly.

Figure 83 shows installations and structures that remain problematic in respect of ground vibration based on the factors of the proposed new design. These structures and installations are however all located within the MRA area and inside the pit area, most being heritage related. Levels of ground vibration at structures outside the MRA area is expected to be within acceptable limits.

In respect of air blast, the influence is reduced to only one structure (agricultural tunnel associated with Unex Roses) outside the MRA area, as indicated in Figure 84. A lower basic limit of 120 dB was applied as a standard for agricultural tunnels as there is some uncertainty at what pressure levels the sheets of plastic will get damaged.

An exclusion zone for safe blasting was also calculated based on possible fly rock travel range. The exclusion zone was established to be at least 526 m for the original design. With the implementation of the revised blast design this exclusion zone reduced to 105 m, due to the use of proper stemming lengths and stemming material. This reduction excludes all structures outside the MRA area.

No roads are negatively impacted with regards to ground vibration. The farming community around the pit areas must be considered when temporary closures of roads are required during blasting operations.

The probable influence of blasting operations on animals causing fatalities is none. Different animals will react different to the noise effect and in many cases get used to the noise. There is however concern with regards to horses and their reaction to sudden noises. The noise effect expected is rather a rumble effect and not loud instant bangs. An understanding will need to be arranged between horse owners and the mine when blasting is done so that no riding is done for that short period (BM&C, 2021).

Vibrations produced by the proposed mining operations will be well below the level of 10mm s^{-1}, reported in the literature, above which production issues in layers were observed. While there is no data on the effect on broilers, with the levels well below 10mm s^{-1}, a negative effect is unlikely (C4 Africa, 2021).

The anatomy of the chicken lung also influences the possible negative effects air blast may have. The avian lung does not have alveoli, i.e. the airways do not end in a blind ending sack where oxygen transfer to the blood occurs. Birds draw air through the lungs and into large thin-walled cavities called air sacks. When they exhale, the air is pushed through the lung tissue again and oxygen transfer then occurs. Looking at the potential negative effect of air blast, i.e. lung injury with rupture of the alveoli accompanied by hemorrhage – without blind ending alveoli the lung tissue will not be damaged (C4 Africa, 2021).

The reaction of horses and chickens are to be monitored from the onset of blasting operations at the facilities of concern to determine any impacts associated with the proposed mining (BM&C, 2021; C4 Africa, 2021).

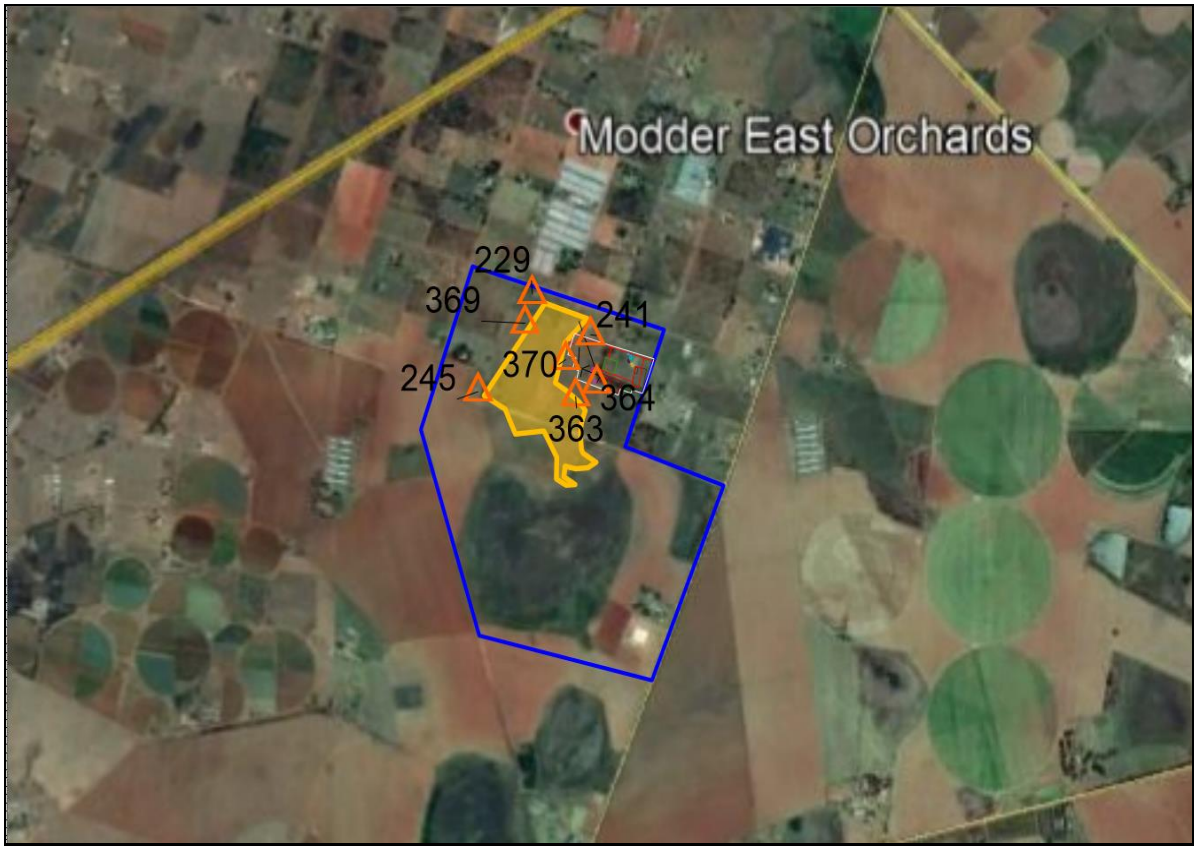


Figure 83: Structures identified with ground vibration concern after review of proposed blast design

Figure 84: Structures identified with air blast concern after review of proposed blast design

7.4.5 Health and Safety Impacts

7.4.5.1 Exposure to silicosis

Due to the potential risks associated with silica exposure, the United States Occupational Health Association has determined an acceptable exposure limit of 100 µg/m³. Figure 85 indicates the MRA area, with the US exposure limit highlighted in red (EBS Advisory, 2021).

Regarding the potential risk of silica exposure, the Occupational Health of employees/contractors working on site needs to be carefully considered; however, the risk identified for ambient environmental exposure, is below the US exposure limits.

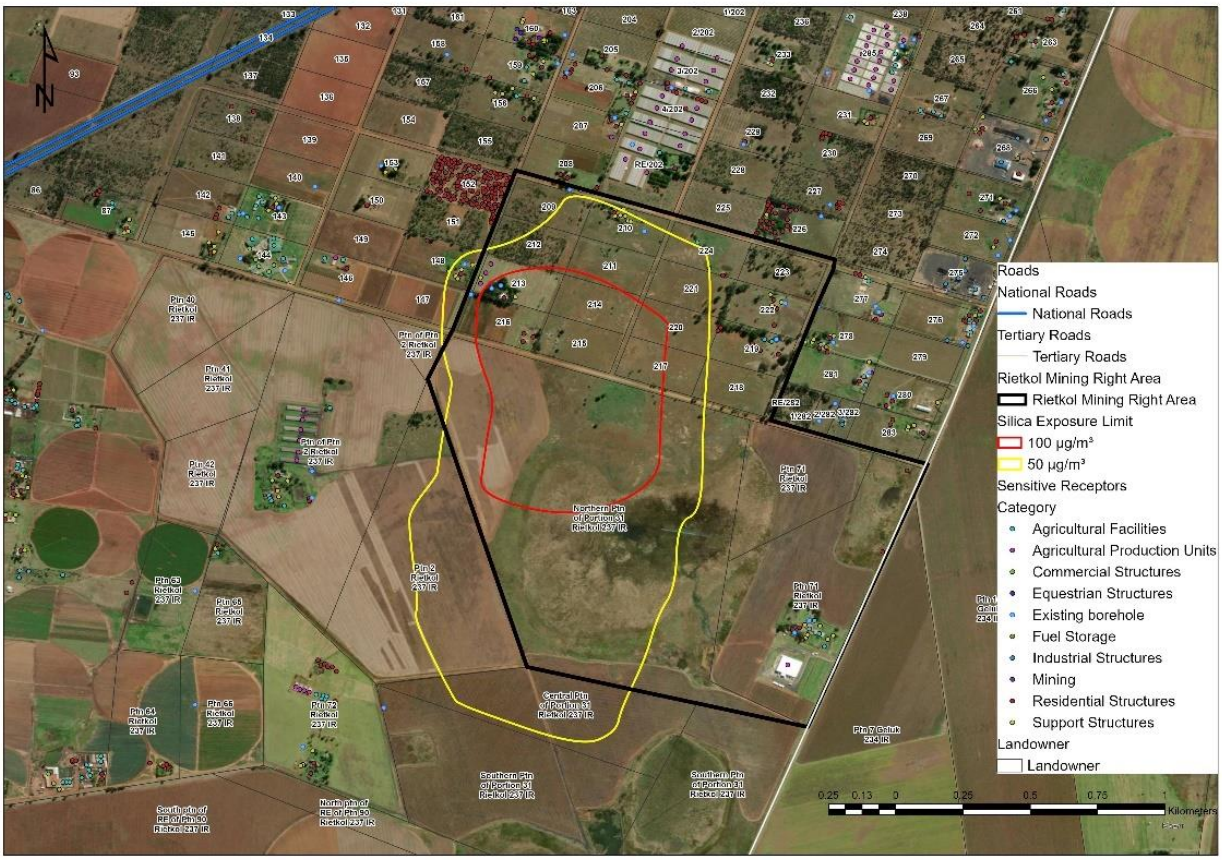


Figure 85: Silica exposure limit of 100 µg/m³ (red line)

The results of the Human Health Risk Assessment (HHRA) attached as Appendix 23 revealed the following (Oosthuizen, 2021):

- When the **acute (short-term) risks from exposure to the 24-h PM_{10}** concentrations (monitored or modelled) were assessed separately, the results indicated that it would be unlikely for individuals to develop acute health effects such as respiratory effects from neither the monitored (by Rayten, 2021), nor the modelled (by EBS Advisory, 2021) PM_{10} concentrations. When the two risks were added, a potential for adverse effects was indicated. However, it must be noted that the monitored concentration as well as the modelled concentration of PM_{10} may be considered as worst-case scenarios, i.e. adding a worst-case monitored concentration to a worst-case scenario of maximum modelled concentration with no mitigation. This is therefore likely an overestimate of the potential for adverse effects.
- **Acute short-term risks from exposure to the 24-h $PM_{2.5}$**, indicated the same as for acute PM_{10} risks, namely it would be unlikely for individuals to develop acute adverse effects from exposure to the monitored or modelled concentrations, but when adding the two worst-case scenarios, then a potential for adverse effects was indicated. Again, this is considered an over estimation of the

potential for adverse effects. In this case the risk was driven by the monitored $PM_{2.5}$ as the monitored results (by Rayten, 2021) indicated that the baseline $PM_{2.5}$ was exceeding the South African ambient standard in a winter month (when concentrations are usually higher).

- **Chronic (long-term) risks from exposure to modelled annual average PM_{10} and $PM_{2.5}$.** The risk assessment indicated chronic health effects because of exposure to the modelled annual concentrations (by EBS Advisory, 2021) would be unlikely. An annual average could not be calculated for the (monitored) baseline concentrations, due to the short monitoring period of one month. Current (baseline) chronic risks could thus not be assessed.
- **Chronic risks – crystalline silica (quartz):** Studies showed silicosis was mostly associated with exposure to crystalline silica particulates in the respirable size range over extended periods of time. Long-term respirable particulates ($PM_{2.5}$) was therefore used in this assessment. The assessment of the risk for developing silicosis from exposure to the modelled annual $PM_{2.5}$ indicated it would be unlikely under both exposure scenarios. These were as follows: **Scenario a** - exposed to the modelled annual $PM_{2.5}$ concentration with a silica content of 0.033% (Rayten, 2021) and **Scenario b -** exposed to the modelled annual $PM_{2.5}$ concentration with a silica content of 26% (AirCheck, 2017).
- **Cancer risk:** The International Agency for Research on Cancer (IARC), classified crystalline silica, inhaled in the form of quartz from occupational sources, as a confirmed human carcinogen. However, the incremental cancer risk for the general public could not be determined in this HHRA, as no approved cancer potency factor (inhalation unit risk) for silica could be found in the literature searched.

The actual concentrations of dust and silica should be verified once the mine is in operation, to determine the actual risk.

7.4.5.2 Traffic

The Traffic Impact Assessment (TIA) concluded that the road network surrounding the Rietkol Project will be able to handle the traffic, with no detrimental impact on the traffic on any of the relevant roads. Safety of other road users do require some intervention however, namely:

- Road R50 (P36/1) requires some maintenance to the road edges and shoulders.
- Road D1550 is currently without any road markings and painted centre lines.
- The gravel access off Road D1550 need to be upgraded to be able to accommodate the future truck movements.
- Intersection of access road with Road D1550: A dedicated right-turn lane must be provided on the northern approach of Road D1550, plus a left-turn slipway from the mine access onto Road D1550.

- Intersection of Road D1550 with Road R50 (P36/1): The right-turn lane on the north-western approach of Road R50 (P36/1) must be improved in accordance with the current standards of the provincial authority, plus a left-turn slipway from the Road D1550 onto Road R50 (P36/1) should be provided.

- Bulk product transport trucks should be covered with tarpaulins, and speed and safety controls to be implemented and monitored.

7.4.6 Macro-Economic Impacts

The area is an important agricultural producing area with intensive horticulture and poultry enterprises within the buffer area in which the concerns of the affected and interested parties are identified. Several other business activities are also active and contribute to economy. The area has several AHs, some of which are not

commercially very productive. Furthermore, the area is rich with underground water and irrigation pivots are a common sight.

Table 40 presents the possible negative impact of the proposed mining operation in socio-economic parameters.

Table 40: Possible Negative Impact of the Proposed Mine (2020 prices)

Zone	Direct GDP	Indirect and induced GDP	Total GDP	Direct jobs	Indirect and induced jobs	Total	Total household income	High & middle income	Low income
	Rand million	Rand million	Rand million	Number	Number	Number	Rand million	Rand million	Rand million
Zone 1-MRA	-0,385	-0,369	-0,754	-1	-2	-3	-0,404	-0,284	-0,120
Zone 2	-4,908	-3,824	-8,733	-19	-13	-32	-2,713	-2,002	-0,710
Zone 3	-0,415	-0,381	-0,796	-0	-2	-2	-0,441	-0,310	-0,132
Total	**-5,708**	**-4,574**	**-10,282**	**-20**	**-17**	**-37**	**-3,558**	**-2,596**	**-0,962**

Based on a worst-case scenario, where impacts cannot be mitigated, there is a potential risk that as many as 20 direct jobs could be lost with a further 17 indirect and induced, with a total of 37. A reduction of R5.708 million in direct GDP is anticipated, with a total R 10.28 million. The possible loss of income to low-income households is estimated at R 0.962 million per annum with a possible annual total loss of R3.558 million.

Table 41 presents a comparison between the estimated negative impact of the mine on current activities and the projected positive impact of the proposed mine together with the projected future values of the GDP, low household income and direct employment opportunities.

Table 41: Estimated Benefits Associated with the Operational Phase of the Proposed Mine

	Current Agriculture and Businesses		Mining	Net Benefit Parameter	Future Total Parameter
	Current	Estimated Loss	Projected	Projected	Projected
Direct GDP	R 121.388 mil.	R 5.708 mil.	R 35.8 mil.	R 30.092mil.	R 151.48 mil.
Direct Employment	425	20	100	80	505
Low Household Income	R 24.8489mil.	R 0.962mil.	R 13.40	R 12.438 mil.	R 37.2869 mil.

The results show that although the proposed mine will impact negatively on the current land activities, the net result is a positive improvement in benefits for the area. The total future direct GDP will increase from the current value of R 121.388 million to R 151.48 million. The number of direct employment opportunities will increase from 425 to 505 and the wages paid to low-income households from R 24.8489 million annually to R

37.2869 million. The positive economic contribution to the Mpumalanga and Gauteng economies is an additional positive factor.

The current land users are not the only parties that have an interest in the final decision, but also the users of the glass sand. Consol Glass is currently receiving quantities of glass sand from an existing mine in the Delmas area where the available product will be in short supply in the next decade. About 30% of the output of the three processing units in Gauteng at Wadeville, Clayville and Nigel, depend on glass sand. In practical terms a reasonable possibility exists that some employment opportunities can be lost if the Rietkol Project doesn't go ahead. It is estimated that about 550 people currently employed by the glass making industry will probably have to be laid off if additional glass sand resources are not secured. Thus, in addition to the direct employment opportunities, the Rietkol Project can sustain approximately 550 existing employment opportunities within the glass making industry.

The analysis of the economic feasibility of the proposed silica mine shows that there are certain risks for the enterprises near the proposed mine as an alternative land use. Currently the economic activities within the MRA area are limited and the mine will be an economic improvement.

The analysis of the economic feasibility of the proposed silica mine shows that there are certain risks for the enterprises near the proposed mine as an alternative land use. The issue in the Rietkol Project is which one of the two resource economic activities is the better land use option. Mining is the non-renewable resource user, while the current land use activities, depending on the quality of environmental management, are renewable resource activities. Currently the economic activities within the MRA area are limited and the mine will be an economic improvement. However, for the intensive horticulture, poultry and equestrian activities in the Buffer Area, the mine will pose a certain financial and economic risk which is presented in Table 40.

The CPI Security Business and Dr Jacobus Greeff are operating from buildings just outside the MRA area and will be exposed to an economic risk to the two business operations.

For Rossgro Broilers and Goudhoek Boerperd, noise from blasting could be a problem that will have to be managed in an agreement between mine management and Goudhoek. Blasting could influence the safety of competitors during equestrian events held at the equestrian centre.

Unex Roses is the activity which would probably be exposed to the highest risk, especially the two tunnels quite close to the mining site and the mine management should ensure that a good working relationship be established with Unex Roses management. Pretorius Blomme will not be exposed to additional risks. The Rossgro Egg Packhouse will not experience an additional economic risk for the first 15 years of mining, but if the mine expands in a westerly direction, they could experience an additional risk. The Rossgro broiler units should also not experience any additional economic risks.

MBFi should not experience any additional economic risk in the production areas, but the possibility exists that some risk factors can increase in the production units. However, no information was provided by the group, so it is not possible to express a solid opinion on the issues.

Another issue that causes some concern is the possible impact on property values in the area. The municipal evaluation roll shows a value of R500 000.00 per holding. According to information received from some of the owners a more common sale value was R400 000.00 per unit. Property prices is as a rule very difficult to project, but experience has shown that in the short-term values decline but tend to recover in the medium to longer term.

The macro-economic study concluded that the proposed mining project is economically feasible and will only have a low risk on the current activities, provided that all the proposed mitigation measures are implemented and adhered to (Mosaka, 2021).

7.4.7 Social Sensitivity Mapping

The specialist impact assessments that have a potential direct impact on the health and well-being and livelihoods of the sensitive receptors in the area were considered during the social sensitivity mapping exercise, namely the air quality, ambient noise, blasting and geohydrological impact assessments.

The criteria used for the sensitivity mapping were determined in conjunction with the various specialists and are based on the following:

- Legal requirements and applicable standards and/or guidelines;
- Impact modelling results as presented in the specialist reports;
- Recommendations made by the specialists in respect of mitigation; and
- Experience of the specialists involved.

In respect of air quality and noise the worst case was assumed, i.e. without the implementation of any mitigation measures. For blasting it was assumed that the revised blasting design recommended in the specialist report will be implemented and refined as monitoring data becomes available.

The results are presented below.

7.4.7.1 Air quality sensitivity mapping

The exposure to Particulate Matter with an aerodynamic diameter of less than 10 microns (PM_{10}), and specifically silica dust, is regarded as the most critical social aspect associated with the Rietkol Project as this could lead to silicosis (lung disease) with a high risk of tuberculosis (TB) as a complication.

The US Occupational Safety and Health Administration has implemented a specific exposure limit of 0.1 mg/m^3 (100 µg/m^3) for respirable silica, whilst South Africa published National Air Quality standards in respect of PM_{10} (SANS 1929:2011) which stipulates a daily (24-hour) average exposure limit of 75 µg/m^3 and an annual average exposure limit of 40 µg/m^3.

The following limits were selected for air quality:

- High Impact (silica) – Respirable silica exposure above 100 µg/m^3
- High Impact – PM_{10} daily exposure above 75 µg/m^3
- Moderate Impact – PM_{10} daily exposure between 50 µg/m^3 and 75 µg/m^3
- Low impact – PM_{10} daily exposure of between 40 µg/m^3 and 50 µg/m^3

The air quality sensitivity map is presented in Figure 86.

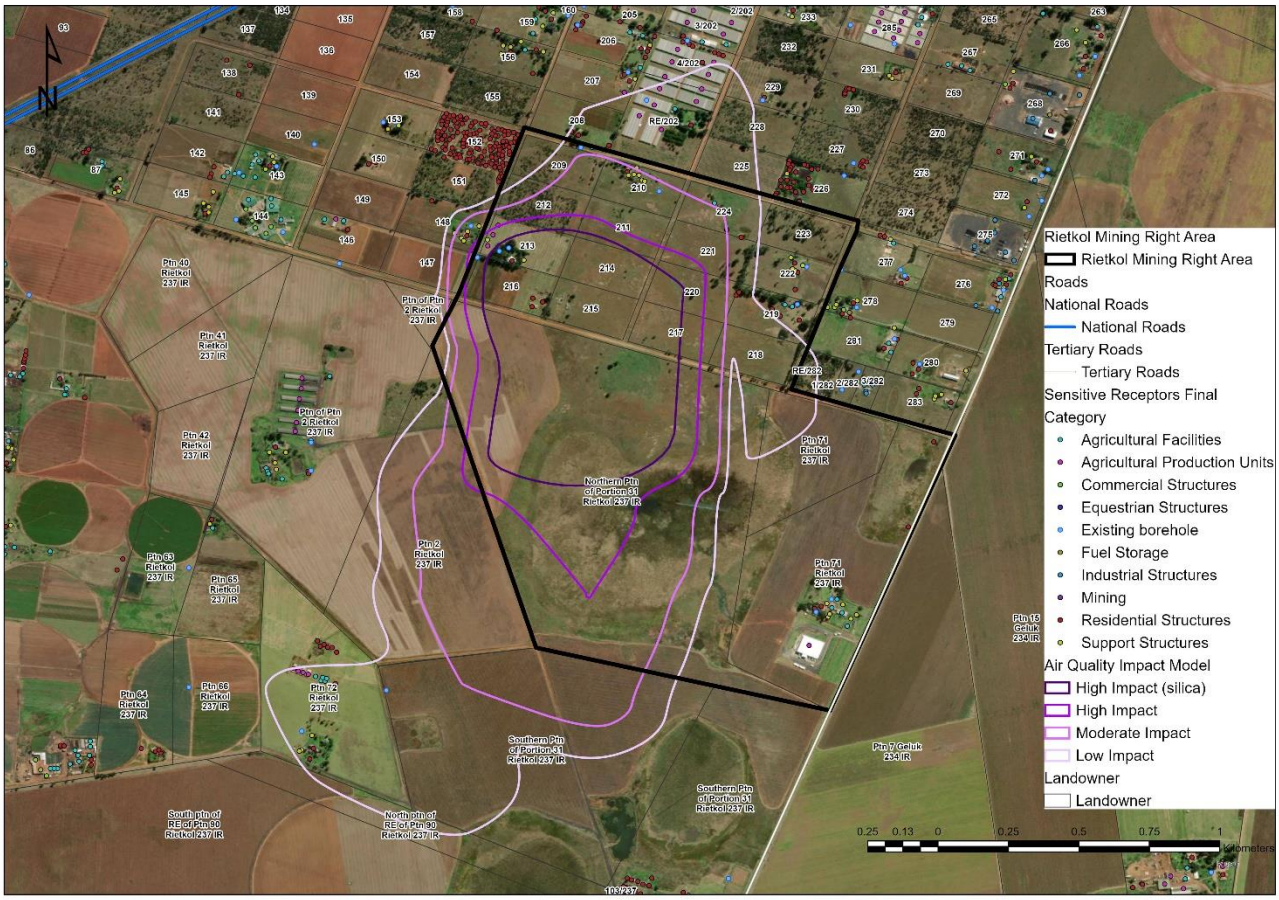


Figure 86: Air quality sensitivity map

7.4.7.2 Ambient Noise sensitivity mapping

The baseline monitoring conducted by EAR indicates that the ambient sound levels of the area are typical of an urban noise district and the acceptable zone rating level would be that of an urban area (45 dBA at night and 55 dBA during the day) as defined in SANS 10103:2008 (for residential use).

An increase (from the ambient sound level) of more than 7 dBA is defined as a disturbing noise and prohibited by National and Provincial Noise Control Regulations. Mining activities (calculated noise levels) should therefore not change the proposed acceptable rating levels with more than 7 dBA (disturbing noise) and ideally with no more than 3 dBA (World Bank guidelines). For the sensitivity mapping the nigh-time limit of 45 dBA was used which presents the worse-case scenario.

The following limits were therefore set for ambient noise:

- High Impact – Increase of 7 dBA or more
- Moderate impact – Increase of between 5 - 7 dBA
- Low impact – Increase of between 3 - 5 dBA

The noise sensitivity map is presented in Figure 87.

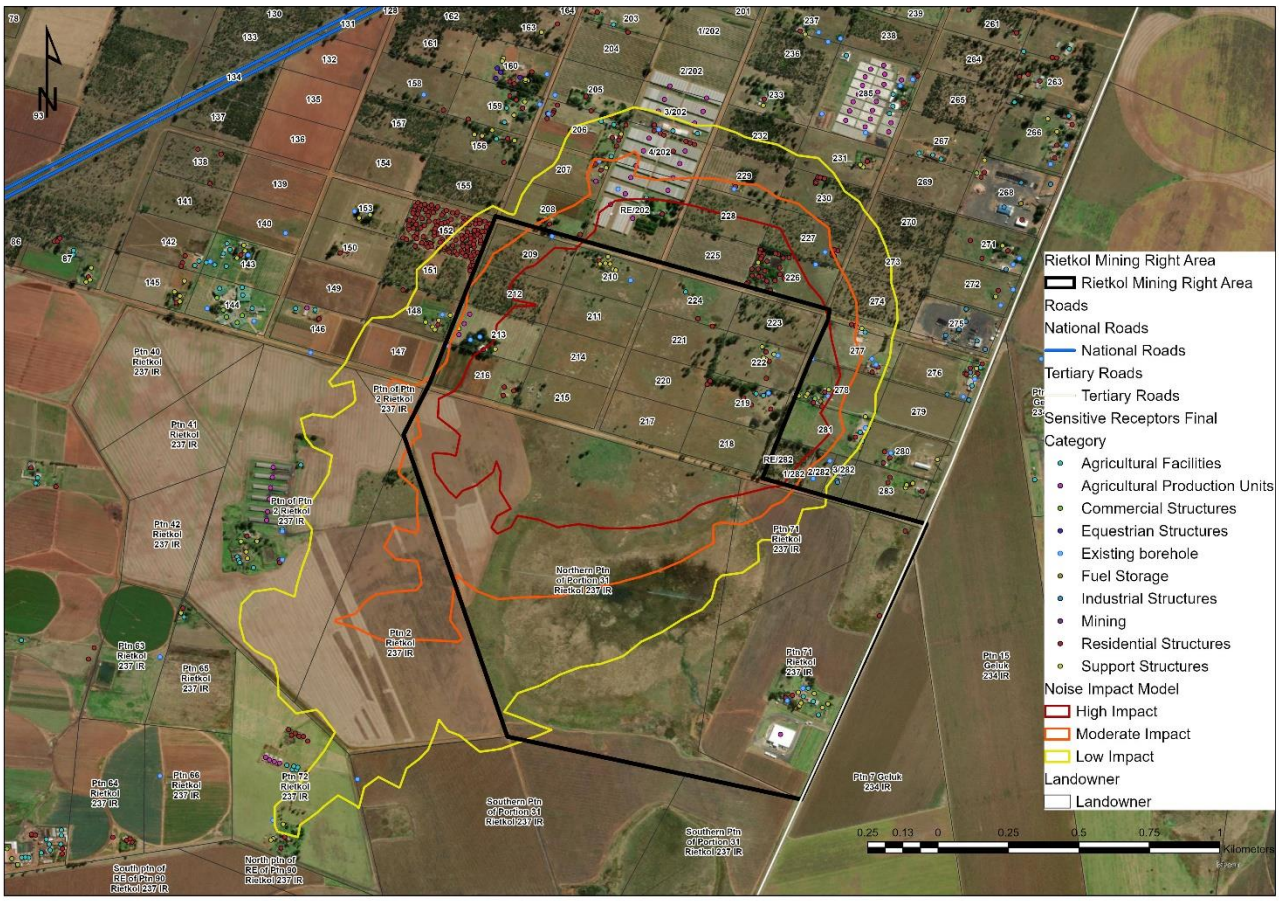


Figure 87: Noise sensitivity map

7.4.7.3 *Blasting sensitivity mapping*

The blasting impact assessment concluded that with the adoption of the revised blasting design as developed by BM&C (2021), the following impacts are envisaged:

- Ground vibration impacts will be limited to sensitive receptors situated within the MRA and pit areas.
- Air blast impacts will also be limited to the MRA area except for the potential impact on the flower tunnels situated just to the north of the MRA area due to a lower limit set for such structures.
- The exclusion zone (evacuation zone) for fly rock was calculated as 105 m from any blasting event.

The blasting sensitivity map is presented in Figure 88.

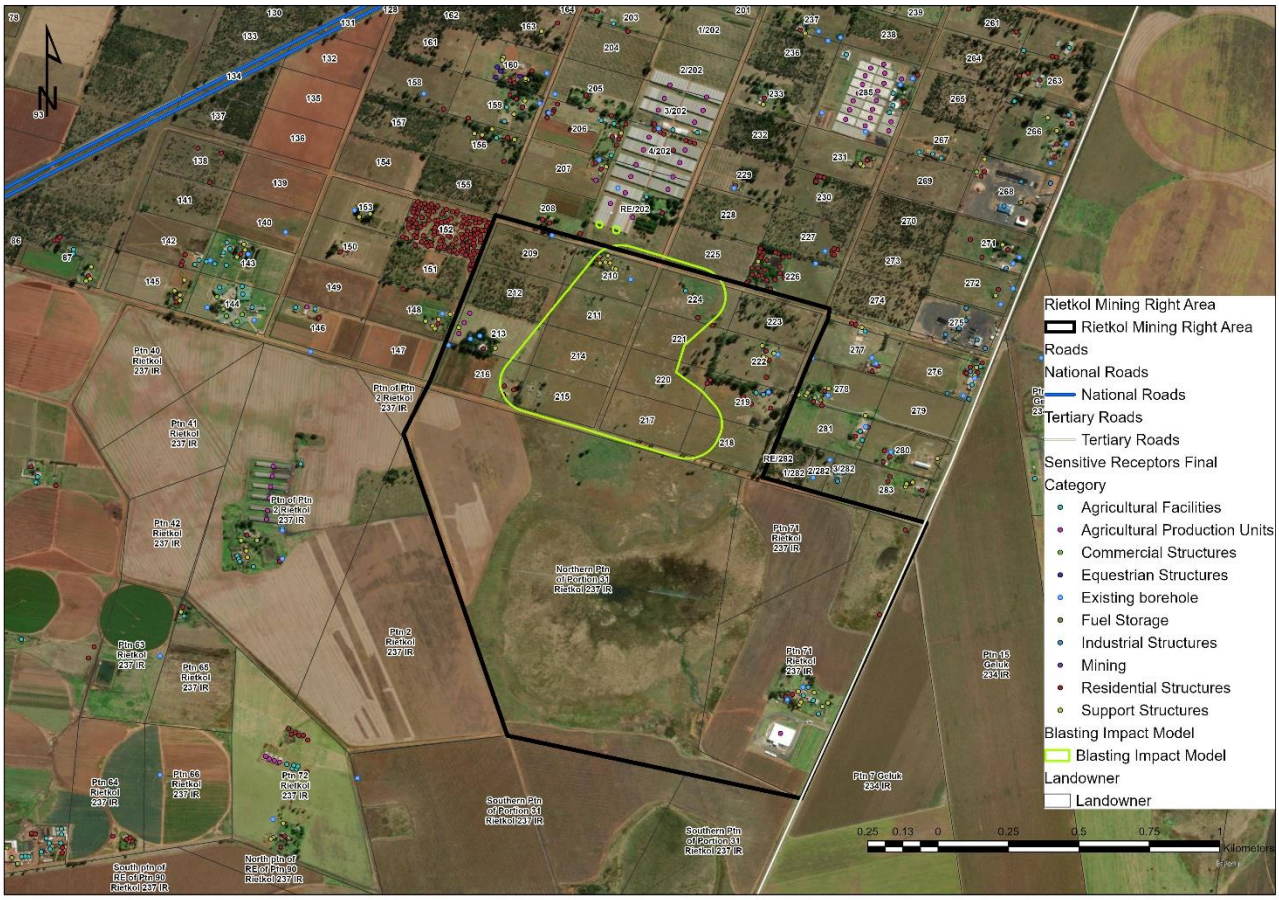


Figure 88: Blasting sensitivity map

7.4.7.4 *Groundwater sensitivity mapping*

The boreholes that may potentially be impacted by the Rietkol Project, as identified by the geohydrological impact specialist assessment conducted by GC, are indicated in Figure 89.

It is important to note that impacts on groundwater were not considered for the cumulative sensitivity mapping and property risk classification discussed in the following sections, for the following reasons:

- Boreholes that will be impacted during the operational phase all lie within the direct impact zone which must be purchased to facilitate mining.
- Impacts on the other boreholes will only manifest at mine closure and would therefore not have any impacts during the operational phase. Groundwater monitoring must be implemented to confirm the predictions of the groundwater model as mining progresses.

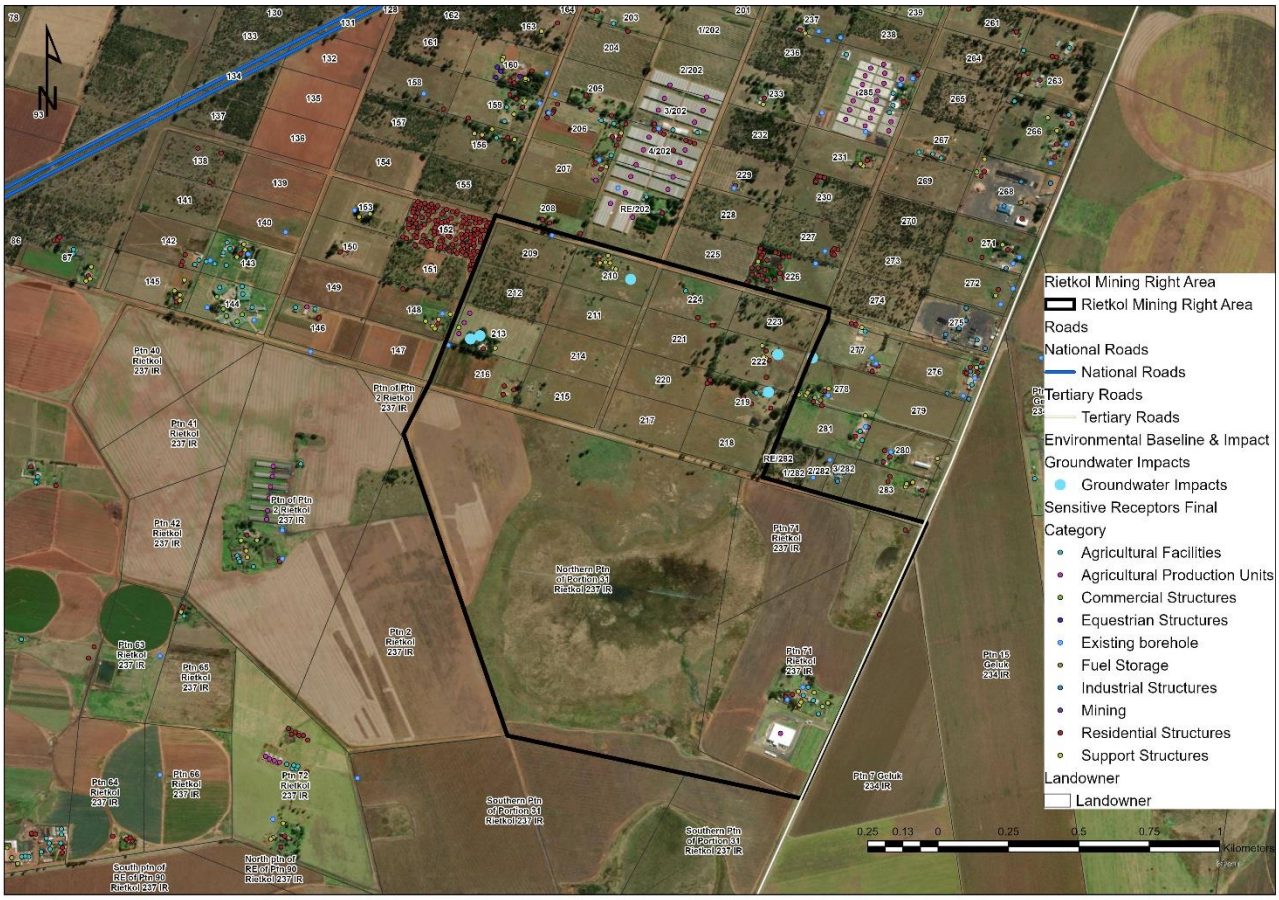


Figure 89: Groundwater sensitivity map

7.4.7.5 Property risk classification

To determine the potential socio-economic impact associated with the Rietkol Project, the properties within the overall impact zone were classified into five categories, namely:

- Direct (land take) impact zone: These properties are directly impacted by the proposed infrastructure and mining layouts and need to be purchased to facilitate mining. Existing land use on these properties will cease.

- Combined high impact zone: These properties will have a high impact during some stage of the proposed mining in respect of air quality, noise, and blasting. If appropriate mitigation measures cannot be implemented to reduce the impacts below the acceptable standards, these properties will probably have to be purchased and existing land use will cease. Monitoring must be implemented to determine the impacts over the LOM and the need for land take.
- Combined moderate to high impact zone: These properties will have a high to moderate impact in respect of air quality, noise, and blasting. No sensitive receptors occur within these zones and existing land use will be able to continue. Monitoring must be implemented to determine the impacts over the LOM.
- Combined moderate impact zone: These properties will have a moderate impact in respect of air quality and noise, with the potential for some structural damages due to uncontrolled air blast events. Land use will be able to continue. In the event of any damage, compensation should be negotiated with the mine, which may lead to a financial impact on the mine.
- Low impact zone: No detrimental social or economic impacts are expected on properties within this zone and existing land use will be able to continue. Some nuisance impacts may be experienced.

Any properties situated outside the overall impact zone should not have any risks to its health and well-being and/or livelihoods. It is important to note that this risk classification does not consider potential nuisance impacts/risks as these are considered subjective and depend on individual perceptions which cannot be scientifically substantiated at this moment. The predicted impacts should be confirmed with monitoring over the LOM and further impact modelling as appropriate.

The criteria used to determine the risk classification of individual properties are tabled below for individual aspects. If more than one aspect is applicable to a specific property, the higher risk classification was chosen.

Table 42: Criteria used for socio-economic risk classification of properties within impact zone

Air quality / Noise	**Blasting**	**Risk classification**
Property wholly or partially within **high zone**, with existing sensitive receptors within this zone	Property wholly or partially within **exclusion zone**, with existing sensitive receptors within this zone	High
Property wholly or partially within **high zone**, with no existing sensitive receptors within this zone	Property wholly or partially within **exclusion zone**, with no existing sensitive receptors within this zone	Moderate - High
Property wholly or partially within **moderate zone**, with existing residential sensitive receptors within this zone		Moderate
Property wholly or partially within **moderate zone**, with no existing residential sensitive receptors within this zone		Low
Property wholly or partially within **low (nuisance) zone**, with existing residential sensitive receptors within this zone		

Air quality / Noise	Blasting	Risk classification
Property wholly or partially within **low (nuisance) zone**, with no existing residential sensitive receptors within this zone		Insignificant

The impacted properties are indicated in Figure 90 and Table 43.

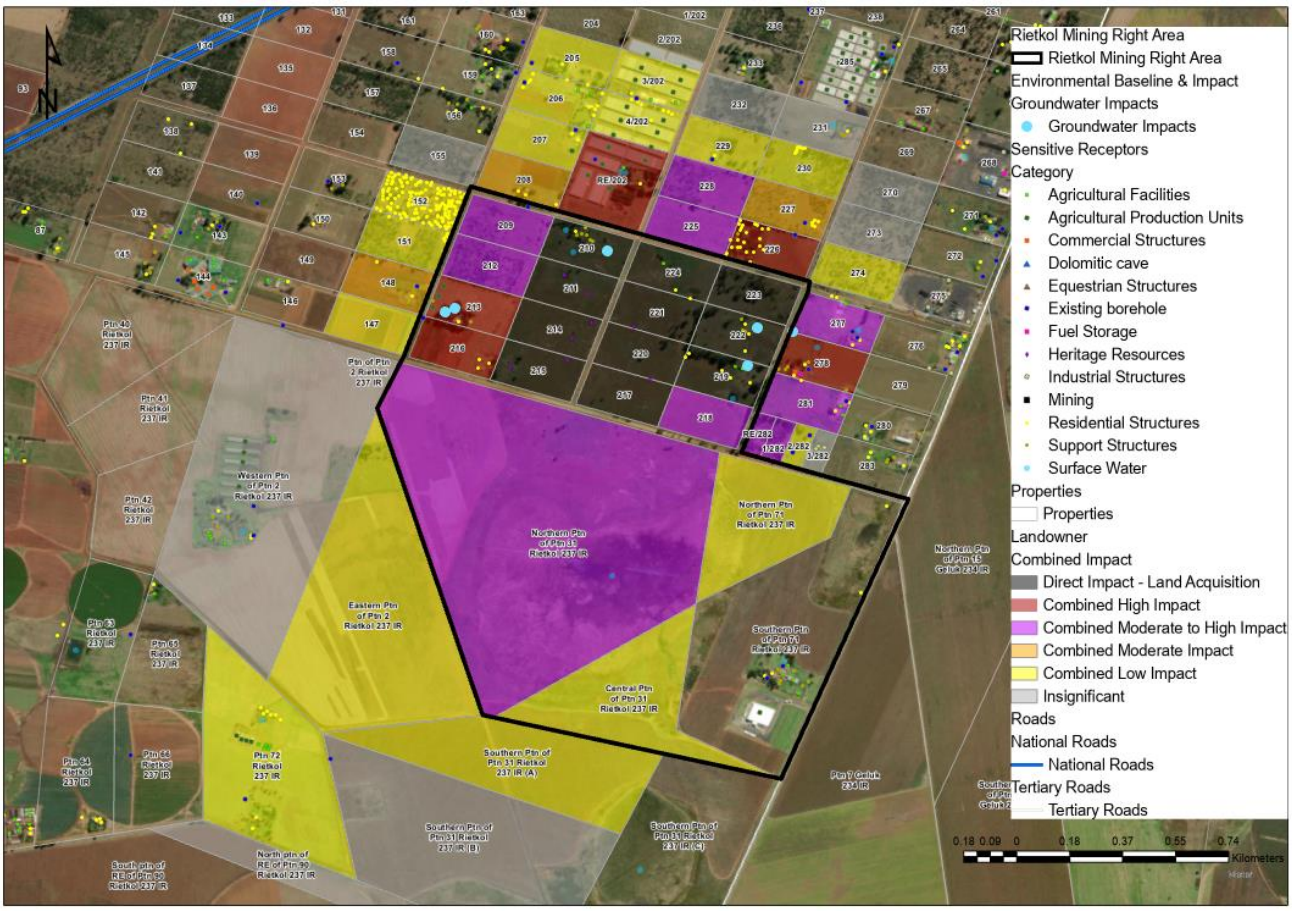


Figure 90: Property risk classification

Table 43: Property risk classification

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 210	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing, Residential	Direct Impact - Land Acquisition	High Impact	Land purchased	Moderate Impact	SR in zone	High Impact	SR in zone	High Impact	Exclusion Zone with SR	High Impact	1 borehole within direct impacted area
MODDER EAST ORCHARDS AH	Holding 211	Mining Right Application Area	Willem Christoffel Meyer	Grazing	Direct Impact - Land Acquisition	High Impact	Land purchased	High impact	No SR in zone	High Impact	No SR in zone	High Impact	Exclusion Zone with no SR	No Impact	
MODDER EAST ORCHARDS AH	Holding 214	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Direct Impact - Land Acquisition	High Impact	Land purchased	High impact	No SR in zone	High Impact	No SR in zone	High Impact	Exclusion Zone with no SR	No impact	
MODDER EAST ORCHARDS AH	Holding 215	Mining Right Application Area	Veizaj Sokol	Grazing	Direct Impact - Land Acquisition	High Impact	Land to be purchased	High impact	No SR in zone	High Impact	No SR in zone	High Impact	Exclusion Zone with no SR	No impact	
MODDER EAST ORCHARDS AH	Holding 217	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Direct Impact - Land Acquisition	High Impact	Land purchased	High impact	No SR in zone	High Impact	No SR in zone	High Impact	Exclusion Zone with no SR	No impact	
MODDER EAST ORCHARDS AH	Holding 219	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing, Residential	Direct Impact - Land Acquisition	High Impact	Land purchased	Low impact	SR in zone	High Impact	SR in zone	High Impact	Exclusion Zone with no SR	High Impact	1 borehole within direct impacted area
MODDER EAST ORCHARDS AH	Holding 220	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Direct Impact - Land Acquisition	High Impact	Land purchased	High impact	No SR in zone	High Impact	No SR in zone	High Impact	Exclusion Zone with no SR	No impact	
MODDER EAST ORCHARDS AH	Holding 221	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Direct Impact - Land Acquisition	High Impact	Land purchased	High impact	No SR in zone	High Impact	No SR in zone	High Impact	Exclusion Zone with no SR	No Impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 222	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing, Residential	Direct Impact - Land Acquisition	High Impact	Land purchased	Low impact	SR in zone	High Impact	SR in zone	No impact		High Impact	1 borehole within direct impacted area
MODDER EAST ORCHARDS AH	Holding 223	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Direct Impact - Land Acquisition	High Impact	Land purchased	No impact	No SR in zone	High Impact	No SR in zone	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 224	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing, Residential	Direct Impact - Land Acquisition	High Impact	Land purchased	Moderate Impact	SR in zone	High Impact	SR in zone	High Impact	Exclusion Zone with SR	No impact	
MODDER EAST ORCHARDS AH	Holding 213	Mining Right Application Area	Johanna Elizabeth van der Walt	Pecanut farming, Grazing, Residential	Combined High Impact	No impact	No mining or infrastructure on property	High impact	SR in zone	High Impact	SR in zone	High Impact	Exclusion Zone with no SR	High Impact	2 boreholes affected at mine closure
MODDER EAST ORCHARDS AH	Holding 216	Mining Right Application Area	Bheki Mthethwa / Lorraine Mthethwa	Crops, Grazing, Residential	Combined High Impact	No impact	No mining or infrastructure on property	High impact	SR in zone	High Impact	SR in zone	High Impact	Exclusion Zone with SR	No impact	
MODDER EAST ORCHARDS AH	Holding 209	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Combined Moderate to High Impact	No impact	Land purchased	Moderate Impact	No SR in zone	High Impact	No SR in zone	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 212	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Combined Moderate to High Impact	No impact	Land purchased	High impact	No SR in zone	High Impact	No SR in zone	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 218	Mining Right Application Area	Consol Glass (Pty) Ltd	Grazing	Combined Moderate to High Impact	No impact	Land purchased	Moderate Impact	No SR in zone	High Impact	No SR in zone	High Impact	Exclusion Zone with no SR	No impact	
RIETKOL 237 IR	Northern Ptn of Portion 31	Mining Right Application Area	Rossouw Christiaan Le Cordeur	Crops, Grazing	Combined Moderate to High Impact	No impact	No mining or infrastructure on property	High impact	No SR in zone	High Impact	No SR in zone	No impact		No impact	
RIETKOL 237 IR	Central Ptn of Portion 31	Mining Right Application Area	Rossouw Christiaan Le Cordeur	Crops, Grazing	Combined Low Impact	No impact	No mining or infrastructure on property	Moderate Impact	No SR in zone	Low impact	No SR in zone	No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
RIETKOL 237 IR	Northern Portion of Portion 71	Mining Right Application Area	Rossouw Chris	Crops, Grazing	Combined Low Impact	No impact	No mining or infrastructure on property	Low impact	No SR in zone	Moderate impact	No SR in zone	No impact		No impact	
RIETKOL 237 IR	Southern Portion of Portion 71	Mining Right Application Area	Rossouw Chris	Feed, Poultry	No Impact	No impact		No impact	SR	No impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 226	500m around Mining Right Application Area	Mabona Boy Khetile and Sarah Maditshaba	Grazing, Residential	Combined High Impact	No impact		No impact	SR	High Impact	SR	No Impact		No impact	
MODDER EAST ORCHARDS AH	Remaining Extent of Holding 202	500m around Mining Right Application Area	Uniflo Extention Eleven Pty Ltd	Roses	Combined High Impact	No impact		Low impact	SR	High Impact	SR	High Impact	Two tunnels affected by air blast	No impact	
MODDER EAST ORCHARDS AH	Holding 278	500m around Mining Right Application Area	Combined Private Investigations CC	Commercial	Combined High Impact	No impact		No impact	SR	High Impact	SR	No impact		High Impact	1 of 2 boreholes affected at mine closure
MODDER EAST ORCHARDS AH	Holding 281	500m around Mining Right Application Area	Combined Private Investigations CC	Commercial	Combined Moderate to High Impact	No impact		No impact	SR	High Impact	SR in Low	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 225	500m around Mining Right Application Area	Tinus Stols	Prickley Pears	Combined Moderate to High Impact	No impact		Low impact	No SR	High Impact	No SR	High Impact	Exclusion Zone with no SR	No impact	
MODDER EAST ORCHARDS AH	Holding 228	500m around Mining Right Application Area	Bobbins Patricia Mary	Grazing	Combined Moderate to High Impact	No impact		Low impact	No SR	High Impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Portion 1 of Holding 282	500m around Mining Right Application Area	Naidoo Krishnaswami Adimoolam	Grazing	Combined Moderate to High Impact	No impact		Low impact	No SR	High Impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Remaining Extent of Holding 282	500m around Mining Right Application Area	Lam Ying Wan	Grazing	Combined Moderate to High Impact	No impact		Low impact	No SR	High Impact	No SR	No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 277	500m around Mining Right Application Area	Greeff Jacobus, JO, Dr	Commercial - Agriculture & Property rental	Combined Moderate to High Impact	No impact		No impact	SR	High impact	SR in Low	No impact		No impact	No impact
MODDER EAST ORCHARDS AH	Holding 227	500m around Mining Right Application Area	Roux Jacobus J	Grazing	Combined Moderate Impact	No impact		No impact	SR	Moderate impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 208	500m around Mining Right Application Area	Mthethwa Amos Bheki	Maize, Residential	Combined Moderate Impact	No impact		Low impact	SR	Moderate impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 148	500m around Mining Right Application Area	Booyen Koos	Pasture, Grazing	Combined Moderate Impact	No impact		Moderate Impact	SR	Low impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 147	500m around Mining Right Application Area	Etherington Jonathan	Commercial - Agriculture, Pasture	Combined Low Impact	No impact		Moderate Impact	No SR	Low impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 151	500m around Mining Right Application Area	Killat Siegward	Grazing, Residential	Combined Low Impact	No impact		Low impact	SR	Low Impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 152	500m around Mining Right Application Area	Hardchrome Plating Co Pty Ltd	Residential, Squatters	Combined Low Impact	No impact		No impact	SR	Low impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 205	500m around Mining Right Application Area	Van Zyl Martin	Prickley Pears	Combined Low Impact	No impact		No impact	SR	Low impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 206	500m around Mining Right Application Area	Van Staden JJ & EJ	Residential	Combined Low Impact	No impact		No impact	SR	Low impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 207	500m around Mining Right Application Area	Jerome Natasha	Maize, Residential	Combined Low Impact	No impact		Low impact	SR	Moderate impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 229	500m around Mining Right Application Area	Du Plessis Hendrik Nicholaas	Teff Grass	Combined Low Impact	No impact		Low impact	No SR in zone	Moderate impact	No SR in zone	No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 230	500m around Mining Right Application Area	Mabona Boy Khetile and Sarah Maditshaba	Grazing	Combined Low Impact	No impact		No impact	SR	Low impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 274	500m around Mining Right Application Area	Heusinkveld Walter Karl Friedrich	Grazing	Combined Low Impact	No impact		No impact	No SR	Moderate impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Portion 2 of Holding 282	500m around Mining Right Application Area	Su Chung-Chien and Lam Ying Wan	Grazing	Combined Low Impact	No impact		Low impact	No SR	Moderate impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Portion 3 of Holding 202	500m around Mining Right Application Area	Uniflo Extention Eleven Pty Ltd	Roses	Combined Low Impact	No impact		No impact	SR	Low impact	SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Portion 4 of Holding 202	500m around Mining Right Application Area	Uniflo Extention Eleven Pty Ltd	Roses	Combined Low Impact	No impact		Low impact	SR	Low impact	SR	No impact		No impact	
RIETKOL 237 IR	Southern Ptn of Portion 31 (A)	500m around Mining Right Application Area	Rossouw Christiaan Le Cordeur		Combined Low Impact	No impact	No mining or infrastructure on property	Moderate Impact	No SR in zone	Low Impact	No SR in zone	No impact		No impact	
RIETKOL 237 IR	Eastern Portion of Portion 2	500m around Mining Right Application Area	Rossouw Christiaan Le Cordeur	Crops, Feed, Grazing	Combined Low Impact	No impact		Moderate Impact	No SR	Moderate impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 155	500m around Mining Right Application Area	Pickering William Edward	Grazing	Insignificant	No impact		No impact		Low impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 231	500m around Mining Right Application Area	Wentzel Annamarie Regina and Christiaan Johannes Hubertus	Maize, Grazing	Insignificant	No impact		No impact	No SR	Low impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 232	500m around Mining Right Application Area	Murray Sheilah	Grazing	Insignificant	No impact		No impact	No SR	Low impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 270	500m around Mining Right Application Area	Dawid Joubert Trust	Grazing	Insignificant	No impact		No impact	No SR	Low impact	No SR	No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 273	500m around Mining Right Application Area	Pollard Michael John Field	Grazing	Insignificant	No impact		No impact	No SR	Low impact	No SR	No impact		No impact	
MODDER EAST ORCHARDS AH	Portion 3 of Holding 282	500m around Mining Right Application Area	Fisher Riaan Henry	Commercial	Insignificant	No impact		No impact	No SR	Low impact	No SR	No impact		No impact	
RIETKOL 237 IR	Eastern Ptn of Portion 31 (B)	500m around Mining Right Application Area	Rossouw Christiaan Le Cordeur	Crops, Grazing	Insignificant	No impact	No mining or infrastructure on property	Low impact	No SR in zone	Low Impact	No SR in zone	No impact		No impact	
RIETKOL 237 IR	Western Portion of Portion 2	500m around Mining Right Application Area	Rossouw Christiaan Le Cordeur	Poultry, Feed, Residential/Office	Insignificant	No impact		No impact		Low impact		No impact		No impact	
GELUK 234 IR	Northern Portion of Portion 15	500m around Mining Right Application Area	Martinuzzi Nicolina	Crops, Feed	No Impact	No impact		No impact		No impact		No impact		No impact	
GELUK 234 IR	Portion 7	500m around Mining Right Application Area	Martinuzzi Nicolina	Crops, Feed, Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 146	500m around Mining Right Application Area	Etherington Jonathan	Commercial - Agriculture, MBFI	No Impact	No impact		No impact	SR	No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 149	500m around Mining Right Application Area	Middleditch David Garth	Pasture	No Impact	No impact		No impact	No SR	No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 150	500m around Mining Right Application Area	Thom Mike	Grazing	No Impact	No impact		No impact	SR	No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 153	500m around Mining Right Application Area	Thom Mike	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 154	500m around Mining Right Application Area	Mthetwha Amos Bheki	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 156	500m around Mining Right Application Area	Botha Daniel Erich	Grazing	No Impact	No impact		No impact	SR	No impact		No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 157	500m around Mining Right Application Area	Van Coller Hermanus Stephanus	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 158	500m around Mining Right Application Area	Serepo Masie Lucas	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 159	500m around Mining Right Application Area	Buckle Annemarie	Grazing	No Impact	No impact		No impact	SR	No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 269	500m around Mining Right Application Area	Webster Maria Elizabeth Cornelia	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 271	500m around Mining Right Application Area	Cremer Louis Frederik Jacobus	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 272	500m around Mining Right Application Area	Rudolph Johan	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 275	500m around Mining Right Application Area	Bredenkamp Pieter Dawid	Commercial	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 276	500m around Mining Right Application Area	Fourie Pieter Johannes and Fourie Johanna Hendrina	Commercial	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 279	500m around Mining Right Application Area	Combined Private Investigations CC	Commercial	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 280	500m around Mining Right Application Area	Greyling Jacobus Johannes	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 283	500m around Mining Right Application Area	Grobbelaar Alex Libion	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
RIETKOL 237 IR	Southern Ptn of Portion 31 (C)	500m around Mining Right Application Area	Rossouw Christiaan Le Cordeur	Feed, Poultry	No Impact	No impact	No mining or infrastructure on property	No impact	SR	No impact	SR	No impact		No impact	
RIETKOL 237 IR	Portion 72	500m - 1km around Mining Right Application Area	Du Plessis Maria Johanna / Ds Fanie	Vegetables	Combined Low Impact	No impact		Low impact	SR	Low impact	SR	No impact		No impact	
RIETKOL 237 IR	Northern Portion of Portion 90	500m - 1km around Mining Right Application Area	Chris Rossouw Familie Beleggings Pty	Crops, feed	Insignificant	No impact		Low impact		No impact		No impact		No impact	
GELUK 234 IR	Portion 2	500m - 1km around Mining Right Application Area	Rossouw Christiaan Le Cordeur	Crops, Feed	No Impact	No impact		No impact		No impact		No impact		No impact	
GELUK 234 IR	Portion 24	500m - 1km around Mining Right Application Area	Rossouw Christiaan Le Cordeur	Poultry	No Impact	No impact		No impact		No impact		No impact		No impact	
GELUK 234 IR	Southern Portion of Portion 15	500m - 1km around Mining Right Application Area	Martinuzzi Nicolina	Crops, Residential, Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 127	500m - 1km around Mining Right Application Area	De Jager Jacoba Alletta and De Jager Petrus Hendrik	Grazing, Residential	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 128	500m - 1km around Mining Right Application Area	De Jager Petrus Hendrik and De Jager Jacoba Alleetta	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 130	500m - 1km around Mining Right Application Area	Shein Meyer	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 131	500m - 1km around Mining Right Application Area	Suid Afrikaanse Padraad	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 132	500m - 1km around Mining Right Application Area	Voogt Dwayne	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 133	500m - 1km around Mining Right Application Area	South African National Road Agency Ltd	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 134	500m - 1km around Mining Right Application Area	South African National Road Agency Ltd	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 135	500m - 1km around Mining Right Application Area	Middleditch David Garth	Pasture, Equestrian, Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 136	500m - 1km around Mining Right Application Area	Middleditch David Garth	Pasture, Equestrian, Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 137	500m - 1km around Mining Right Application Area	South African National Road Agency Ltd	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 138	500m - 1km around Mining Right Application Area	Marais Edwin	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 139	500m - 1km around Mining Right Application Area	Middleditch David Garth	Pasture, Equestrian, Horses	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 140	500m - 1km around Mining Right Application Area	Middleditch David Garth	Pasture, Equestrian, Horses	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 141	500m - 1km around Mining Right Application Area	Middleditch Sheryl Sandra	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 142	500m - 1km around Mining Right Application Area	Middleditch Sheryl Sandra	Pasture, Equestrian	No Impact	No impact		No impact		No impact		No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 143	500m - 1km around Mining Right Application Area	Middleditch Sheryl Sandra	Equestrian, Pasture	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 144	500m - 1km around Mining Right Application Area	Etherington Jonathan	Commercial - Agriculture, MBFI	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 145	500m - 1km around Mining Right Application Area	AW De Jager	Grazing, Residential	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 160	500m - 1km around Mining Right Application Area	Kritzinger Sarel Jacob Norval	Equestrian, Grazing	No Impact	No impact		No impact	SR	No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 161	500m - 1km around Mining Right Application Area	Kritzinger Sarel Jacob Norval	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 162	500m - 1km around Mining Right Application Area	Lions Club of Durban	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 163	500m - 1km around Mining Right Application Area	Marais Hester H	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 164	500m - 1km around Mining Right Application Area	Pioneer Carpet Wholesalers Pty Ltd	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 165	500m - 1km around Mining Right Application Area	Mc Donald Ronald	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 166	500m - 1km around Mining Right Application Area	Mountifield John Robert	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 167	500m - 1km around Mining Right Application Area	Binder Aron and Epstein Joseph and Plein Aaron	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
MODDER EAST ORCHARDS AH	Holding 200	500m - 1km around Mining Right Application Area	Swart M	Maize/Veg	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 201	500m - 1km around Mining Right Application Area	Uniflo Extention Eleven Pty Ltd	Roses	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 203	500m - 1km around Mining Right Application Area	Jansen van Niewenhuizen	Teff grass	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 204	500m - 1km around Mining Right Application Area	Stols Tinus	Prickley Pears	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 233	500m - 1km around Mining Right Application Area	Van Dyk Dawid Schalk and Johanna Susanna	Grazing, Residential	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 236	500m - 1km around Mining Right Application Area	Reitmann Cornelia Huibrecht and Le Roux Hester Anette	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 237	500m - 1km around Mining Right Application Area	Viljoen Carel Johannes	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 238	500m - 1km around Mining Right Application Area	Bouwer Jacobus Christoffel	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 263	500m - 1km around Mining Right Application Area	Webster Dennis Ian Webster Maria Elizabeth	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 264	500m - 1km around Mining Right Application Area	Engelbrecht David Cornelius	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 265	500m - 1km around Mining Right Application Area	Thembeni Geluza Selby and	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
			Thembeni Christina												
MODDER EAST ORCHARDS AH	Holding 266	500m - 1km around Mining Right Application Area	African BEE Farming Pty Lyd	Bee farming	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 267	500m - 1km around Mining Right Application Area	Webster Maria Elizabeth Cornelia	Grazing	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 268	500m - 1km around Mining Right Application Area	Webster Dennis Ian	Commercial	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Holding 285	500m - 1km around Mining Right Application Area	Pretorius Petronelle Jacoba	Flowers	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Portion 1 of Holding 202	500m - 1km around Mining Right Application Area	Uniflo Extention Eleven Pty Ltd	Roses	No Impact	No impact		No impact		No impact		No impact		No impact	
MODDER EAST ORCHARDS AH	Portion 2 of Holding 202	500m - 1km around Mining Right Application Area	Uniflo Extention Eleven Pty Ltd	Prickley Pears	No Impact	No impact		No impact		No impact		No impact		No impact	
RIETKOL 237 IR	Portion 103	500m - 1km around Mining Right Application Area	Rossgro Voere Pty Ltd	Feed Production	No Impact	No impact		No impact		No impact		No impact		No impact	
RIETKOL 237 IR	Portion 40	500m - 1km around Mining Right Application Area	Rustig Landgoed Pty Ltd	Feed, Poultry	No Impact	No impact		No impact		No impact		No impact		No impact	
RIETKOL 237 IR	Portion 41	500m - 1km around Mining Right Application Area	Rustig Landgoed Pty Ltd	Feed, Poultry	No Impact	No impact		No impact		No impact		No impact		No impact	
RIETKOL 237 IR	Portion 42	500m - 1km around Mining Right Application Area	Rustig Landgoed Pty Ltd	Feed, Poultry	No Impact	No impact		No impact		No impact		No impact		No impact	
RIETKOL 237 IR	Portion 63	500m - 1km around Mining	Louman Farm Property cc	Vegetables	No Impact	No impact		No impact		No impact		No impact		No impact	

Property Name	Portion Description	Study Area	Registered Landowner	Existing Land use	Cumulative Impact	Direct (Land Take) Impact	Direct (Land Take) Impact comment	Air Quality Impact rating	Air Quality Impact comment	Noise Impact rating	Noise Impact comment	Blasting Impact rating	Blasting Impact comment	Groundwater Impact rating	Groundwater Impact comment
		Right Application Area													
RIETKOL 237 IR	Portion 65	500m - 1km around Mining Right Application Area	Scorpio Farming cc	Pasture, Residential	No Impact	No impact		No impact		No impact		No impact		No impact	
RIETKOL 237 IR	Portion 66	500m - 1km around Mining Right Application Area	Louman Farm Property cc	Vegetables	No Impact	No impact		No impact		No impact		No impact		No impact	
RIETKOL 237 IR	Southern Portion of Portion 90	500m - 1km around Mining Right Application Area	Chris Rossouw Familie Beleggings Pty	Crops, feed	No Impact	No impact		No impact		No impact		No impact		No impact	

7.5 CONCLUSIONS AND RECOMMENDATIONS OF SPECIALIST REPORTS

Table 44: Conclusions and recommendations from specialist reports

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
Soils, Land Use & Land Capability	The proposed mining activities and associated surface infrastructure are anticipated to directly impact on the land capability of the prevailing soils, particularly where the proposed mining blocks traverse through high land capability soils. This may result in long-term withdrawal of land particularly from arable agricultural production as well as potential grazing opportunities. Thus, the land capability impact assessment was undertaken on all aspects of soil and capability likely to be affected by the proposed project. The sections below present the results of the findings per identified risk/ impact for the proposed mining activities and associated surface infrastructure. Activities which are likely to negatively affect the soil and land capability have been identified, and the impacts include, but not limited to, the following: • Soil erosion and dust generation resulting from cleared and disturbed areas, leading to loss of soils for potential plant growth; • Soil compaction resulting from increased traffic of mining equipment; • Loss of soil depth and volume due to excavation associated with mining activities; • Contamination of soil resources resulting from accidental spillage of chemicals and hazardous material, leading to altered soil chemistry; and • Loss of high potential agricultural soils. From a land capability point of view, the proposed MRA area presents extensive areas of deep, well drained and well aerated soils with high agricultural potential soils, comprising just over 40% of the total MRA area. The rest of the MRA area is comprised of wetlands as well as soils not considered prime soils for agricultural production. The extent of Hutton/Clovelly soils thereof should be considered sufficient for viable cultivated small commercial farming, and thus should be avoided where feasible to minimise the loss of soil resources for current and future agricultural production. A total of 14.4 % of prime agricultural soils is anticipated to be affected by the proposed mining project, however this can be reduced if mitigation measures, and recommendations outlined in the specialist report are considered. The disturbance of prime agricultural soils is unavoidable; however, the resultant impact on these soil resources will be limited to the infrastructure footprint.	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr. It is noted that topsoil will be used for the construction of berms and rehabilitation of the construction areas. No topsoil stockpiles will be established on site as the soils cannot be stored indefinitely. Once the North Block is filled with tailings (YR16), direct placement of topsoil will be done to facilitate the rehabilitation of this area to grazing standards (proposed final end land use).

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	It is acknowledged that the grazing capacity as indicated by the Department of Agriculture, Land Reform and Rural Development (2021) [(Ref: MP 30/5/1/2/3/2/1 (10124)] is 3 ha/LSU based on the 1993 grazing capacity index, the veld has been transformed due to overgrazing and other historic anthropogenic activities. The veld is best described as a transformed rangeland. Other limitations include rocky outcrops (low productivity Mispah soils) which are not suitable for any cultivated agricultural related activities. As such, the grazing capacity livestock commercial farming is not considered ideal for this area and a grazing capacity of 3 ha/LSU is unlikely to be achieved across the majority of the proposed extent of the mining footprint.	
Hydropedology	From a hydropedological point of view, no significant impact is foreseen on the wetland systems due to proposed mining and related activities (during all phases) since the soil resources where the proposed project is to occur are not regarded as drivers of the wetland systems. Most of the opencast as well as surface infrastructure occur on shallow responsive and recharge deep soils which contribute to surface runoff and groundwater respectively. Given the above findings, the proposed project is considered acceptable from a hydropedological impact perspective and will not lead to a significant impact on the receiving freshwater resources, both locally and regionally, provided that the outcome of this study, as well as mitigation measures outlined in this document, are used as a guideline to manage water in the landscape surrounding the proposed mine. Keys, recommendations have been developed in the points below to minimise impact on hydropedological processes: • Divert surface flow away from the pit areas; • Water from the clean surfaces associated with the pits should be diverted and discharged back into the adjacent wetland systems in an attenuated manner; • Implementation of strict erosion control measures to limit loss of soil and sedimentation of the wetlands adjacent to the proposed project; • At closure, reinstate the soil the pre-mining landscape which is free draining to ensure that the surface runoff contributes to the adjacent wetlands that may be indirectly impacted during the construction and operational phase of the development; • The pits should be rehabilitated progressively (if feasible) to limit the water losses to ensure that the PES category remains unchanged;	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr. It is noted that North Block will be rehabilitated to a free draining scenario. However, as most material is removed as product, the same will not be possible for Main Block. Refer to Rehabilitation, Decommissioning and Closure Plan (Appendix 19).

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	• Excavation activities and removal of topsoil out of the demarcated areas should be avoided as far as practically possible to limit the footprint area that will be impacted; and • Following the completion of the construction phase, areas of disturbance should be monitored at least once after an erosive rainfall for erosion arising from the surface which leads to concentrated flow and changes to the pattern flow and timing of water in the landscape.	
Terrestrial & wetland ecosystems	The MRA area comprises of agricultural lands, grazing fields, houses, and wetland areas. Within the MRA area, the wetland systems are considered to be the most sensitive, providing niche habitat to floral and faunal SCC. Although the Disturbed and Rocky Grasslands have been impacted upon by various agricultural land uses, they were noted to still provide habitat to several floral SCC. The proposed mining activities will have a direct impact on the Rocky and Disturbed Grasslands. Mining in these habitat areas will result in the loss of terrestrial habitat and floral SCC. A rescue and relocation plan for earmarked floral SCC is imperative in order to mitigate the overall loss of floral SCC diversity in the MRA area. It must be ensured that the delineated boundaries of the wetlands and associated 32 m NEMA Zone of Regulation as well as the 100 m MBSP setback buffers are to be demarcated as 'no-go' areas, to prevent significant impact on the wetlands within the MRA area as a result of the proposed Rietkol project. It is worth mentioning that consultation of the hydropedological assessment of the wetlands should be undertaken in order to determine if any impacts to the wetland drivers (surface and subsurface recharge) may occur as a result of the proposed Rietkol project. Provided that all the mitigation measures as stated within the contents of the report are stringently implemented and impacts and edge effects are proactively monitored, the overall impacts on the terrestrial and freshwater ecosystems can be adequately mitigated for the life of the proposed Rietkol project. Well managed water quality monitoring of dirty water infrastructure and wetlands within the MRA must be undertaken throughout the life of the mine (including post-closure) in order to ensure the health and functioning of the wetlands and associated terrestrial ecosystems are retained. Monitoring data must be utilised to proactively manage any identified emerging issues in a well-managed and overseen Biodiversity Action Management Plan (BAMP).	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr. Terrestrial and aquatic monitoring is included in the monitoring programme – refer to Section 6 of the EMPr. A Rescue & Relocation Plan will be developed for the floral and faunal SCC. A BAMP will be developed as part of the management actions identified in the EMPr – refer to Section 5 of the EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
Water Quality Assessment	In summary, it was determined that with the implementation of the readily practicable mitigation measures during the clearing/construction phase, operational/mining and the closure phase the impact upon RK01-RK03 could be reduced to low. With mitigation the potential impact upon RK04 during the operational/mining phase and the closure phase can be reduced to low. With, and without implementation, the impacts upon water quality associated with the care and maintenance phase upon all of the monitored resources was low. Based upon the above, with the implementation of mitigation measures as is planned, the significance of the impacts upon the water quality of all resources and during all phases is anticipated to be low. Thus, from a water quality and water resource management point of view, the project can be considered favourably, however consideration must be given to the findings of the Freshwater ecological assessment. The quantified water quality baseline data, and particularly those data that exceeded the various guidelines, should be considered by the regulating authority when setting licensed limits for the mine. An impact assessment was conducted, and it was determined that with the implementation of mitigation measures as is planned, the significance of the impacts upon the water quality of all resources and during all phases will be low. Thus, the project cannot be considered as fatally flawed from a surface water resource and water quality perspective.	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr. Monthly surface monitoring is included in the monitoring programme – refer to Section 6 of the EMPr.
Groundwater	Opencast mining, when occurring below the water table, results in an influx of groundwater. Pit dewatering is then required to ensure dry and safe mining conditions, which ultimately leads to a lowering of the local groundwater levels. No mitigation measures are available for when mining occurs below the local water table. Only by remaining above the water table can this impact be avoided. The soil and ROM material are chemically inert, meaning that any leachate originating from these stockpile areas is expected to be of acceptable quality. However, leachate from these stockpiles may contain remnants of the nitrate-based explosives used in the mining process. Surface areas should be lined to prevent potentially poor quality leachate from contaminating the underlying groundwater. Surface areas should be bunded to prevent clean surface water runoff from being contaminated by dirty surface areas. Stockpiles and dirty footprint areas should be kept as small as practically possible. Water retaining facilities such as the planned pollution control/recycling dam are designed and constructed with the objective to prevent any poor quality water from	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr. Quarterly groundwater monitoring is included in the monitoring programme – refer to Section 6 of the EMPr. The WMP developed for Rietkol Project addressed the issue around lining of surface stockpile areas and water holding facilities.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	entering the underlying aquifer and contaminating the groundwater. Poor management and maintenance of such facilities may however lead to spills and/or leakages that could contaminate the groundwater. All water retaining facilities should be lined with an impervious liner to prevent dirty water from reaching the underlying aquifer and contaminating the groundwater. Spills should be cleaned up immediately. Authorities should be notified of all spills. Proper management and regular inspections for leakages are strongly recommended. Impacts on the groundwater only occur through leachate formation from dirty surface areas. Impacts thus only occur as a result of rainfall recharge or when water is introduced in some form where leachate can form that seeps to the groundwater. Organic contaminants are usually the main pollutants of concern (e.g. oil, grease, diesel, petrol, hydraulic fluid, solvents, etc.). Surface areas should be lined to prevent poor quality seepage from reaching the aquifer and contaminating the underlying groundwater. Surface areas should be bunded to prevent clean surface water runoff from being contaminated by dirty surface areas. Spills should be cleaned up immediately. Relevant authorities should be notified of all spills. After closure, the down-gradient movement of residual contamination will continue for some time after closure. Tailings material in the North Block may contain remnants of the nitrate-based explosives used during mining. These nitrates dissolve readily in water, meaning that the migrating plume may contain nitrate. Dedicated plume monitoring boreholes should be drilled in the down gradient groundwater flow direction and sampled at quarterly intervals to monitor plume migration. Should the monitoring program indicate significant plume migration, interception trenches and/or rehabilitation boreholes may be considered. Groundwater monitoring (i.e. sampling and water level measurements) should be conducted at quarterly intervals and the schedule re-assessed by a qualified geohydrologist at a later stage in terms of stability of water levels and quality. Four boreholes were drilled specifically for source monitoring purposes within the MRA area. At least four of the nearest user boreholes should also be included in the groundwater monitoring program.	
Air quality	Based on the information provided, the baseline assessment and the impact assessment and modelling results, no impacts have been identified which would result in this project having a significant impact on the environment. To this end, the mitigation measures identified need to be implemented to limit and further reduce impacts on the surrounding environment.	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	It is recommended that monthly dust fallout monitoring be conducted along the mining operations and in the surrounding community. It is proposed that a minimum of 12 monitoring points be set up, including the locations where ambient monitoring has been undertaken as part of the baseline assessment. The monitoring can be supported by additional PM monitoring be undertaken annually to determine silica exposure. It is also strongly advice that the meteorological conditions (Temperature, Humidity, Rainfall, Atmospheric Pressure, Solar Radiation, Wind Speed and Wind Direction) also be measured by an on-site meteorological station. The measured airborne concentrations can be compared with the on-site measured meteorological conditions to assess the effectiveness of mitigation measures and systems implemented at the mine.	Monthly dust fallout monitoring is included in the monitoring programme – refer to Section 6 of the EMPr. Meteorological information will be sourced from the SA Weather Bureau. An on-site meteorological station will thus not be erected.
Noise	The proposed mining activities will raise the noise levels at a number of potential noise-sensitive developments. These noises can be disturbing and may impact on the quality of living for the receptors. It is however concluded that, while this project will have a noise impact on a number of the closest noise-sensitive receptors, these impacts can be mitigated to reduce the significance. Working with these receptors, the mine could also improve on the negative perceptions and impacts. The proximity of potential noise-sensitive receptors necessitates the selection of appropriate mitigation measures and the following is recommended: • That NSDs 1, 2, 3, 5 and 7 not be used for residential purposes; • The mine must discuss the potential noise impact on NSD06 with this receptor, highlighting the magnitude as well as feasible mitigation options available that will reduce the noise levels. There should be an agreement between the developer and the receptor in writing on the noise impact as well as the selected mitigation options to be implemented; • Development of a noise barrier or similar between NSD06 and the mining area; • Minimise night-time activities within 300 m from NSD06 if mitigation measures are not implemented. If unavoidable, that the quietest equipment be used when operating within 300 m of receptors at night; • Ensure a good working relationship between mine management and all potentially noise-sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them (especially if work is to take place within 300 m from them at night). • Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr. Quarterly noise monitoring is included in the monitoring programme – refer to Section 6 of the EMPr. NSD06 (AH 213) should preferably be resettled due to high social sensitivity associated with this property. In this case none of the mitigation measures related to this sensitive receptor will be required.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised; • The operation should investigate the use of white-noise alarms instead of tonal reverse alarms on heavy vehicles operating on roads, within the mining area and at stockpile areas; • The mine must implement a line of communication (i.e. a help line where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers, or alternative means to communicate issues. The mine should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop and if valid, should be investigated; • All employees and contractors should receive induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding environment; • The development and implementation of a noise measurement programme (at NSD04, NSD06, NSD15, NSD19 preferably, if safety and security allow, a measurement location at the informal community, NSD09 – 13 should be included); and • The correct design of the exhaust stack to ensure that the design consider the minimization of noise from this source. An engineering company specialising in the design of exhaust stacks must be contracted.	
Blasting	The specialist concluded that there are specific concerns that will require detailed evaluation and changed methodologies to be applied. The project's location in relation to the surrounding areas has the greatest influence. Blasting operations can however be controlled, and it has been proven in the industry that blasting can be done in the most sensitive areas and be successful. It is a question of how the blasting operations is done and at what level the applicant is prepared to management and mitigate the concerns. The planned mining areas have structures and installations at relatively close distances to the open pit area. Blasting operations will require specific controls to manage the effects from blasting. Very conscious and sensitive negotiations with the local communities will be required to stipulate the execution of the project. The following recommendations were made:	Mitigation measures were included as appropriate – refer to refer to Table 37 and EMPr. Quarterly noise monitoring is included in the monitoring programme – refer to Section 6 of the EMPr. The revised blasting design will be adopted by the applicant.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	i) Regulatory requirements indicate specific requirements for all non-mining structures and installations within 500 m from the mining operation. POI's at both North Block and Main Block Mine Pit areas are observed within the 500 m. The mine will have to apply for the necessary authorisations as prescribed in the various acts, and specifically Mine Health and Safety Act Reg 4.16. ii) Review of the site and the planned mining areas. The Northern Pit area is closest to some of the critical points of concern. It may well be worthwhile to consider starting mining from the centre of the south pit rea. This creates more distance between the residential areas and will help alleviate some stress about blasting operations. iii) Alternative mining instead of drilling and blasting should be considered for this area. Alternative mining making use of vibrating rippers instead. iv) The new blast design must be adopted for the Rietkol Project and a test blast must be done to confirm levels of ground vibration and air blast. v) An exclusion zone for safe blasting was determined at 105 m. All people and animals within this distance must be evacuated during a blast. Note, the final blast designs that will be used will determine the final decision on safe distance to evacuate people and animals. vi) Smaller local roads that are used by the local community should be considered for closures when blasting is done, especially within the exclusion zone. vii) Photographic survey of all structures up to 1200 m from the pit areas is recommended. viii) Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. ix) A monitoring programme for recording blasting operations is recommended. Monitoring could be done using permanent installed stations. The following elements should be part of such a monitoring program: • Ground vibration and air blast results; • Blast Information summary; • Meteorological information at time of the blast; • Video Recording of the blast; • Fly rock observations.	Vibrating rippers instead of blasting is not considered viable due to high costs. The mine schedule will not be changed as proposed, as this will impact on the currently proposed tailings management strategy.
Palaeontology	The development site applicable to the application for the proposed Rietkol Project is underlain by Radian aged quartzitic rocks with a Low sensitivity for Palaeontological Heritage. The area is also underlain by Vaalian aged dolomite with a Very High	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 37 and EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	sensitivity in terms of possible Quaternary aged deposits of cave breccias that might contain Very Significant Homonin remains. A very small outcrop of Dwyka Group tillite is recorded, but it can be expected that more sediments will be exposed during mining. A group is allocated a Moderate sensitivity. The southern part of the area is underlain by Very Highly sensitive Permian to Triassic aged sandstone and mudstones with a Very High to High Palaeontological sensitivity. No significant fossils are expected in any formation at this stage of the development, and it is very important to note that a suitably qualified palaeontologist must visit all the sites indicated as High and Very Highly significant during the first week of excavations. If excavations expose fossils, it will be very important that a suitably qualified Palaeontological Specialist be appointed to do a Phase 1 PIA and to develop a "Chance Find Protocol" document. The CFP document must then be included as part of the EMPr of this project, to record all unexpected fossils associated with the geological formations on site. It is recommended that: • The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity is allocated to the part of study area underlain by the Malmani Subgroup and the Karoo Supergroup sedimentary rocks and a Low sensitivity over the central part of the site underlain by quartzite. • No further mitigation for Palaeontological Heritage is recommended for this project before excavation of deeper than 1.5m is done. • A suitably qualified palaeontologist must do a Phase 1 PIA and develop a "Chance Find Protocol" (CFP) if fossils are recorded from any formation in this area during the first week of excavations into areas with a Very High and High Palaeontological significance. • Recommendations contained in the resultant Phase 1 PIA and "Chance Find Protocol" must be approved by MPHRA and SAHRA for inclusion in the EMPr of the project. These recommendations must be included in the EMPr of this project.	A suitably qualified palaeontologist will be appointed to monitor the excavations during construction in areas allocated a Very High sensitivity.
Cultural heritage	The following mitigation measures are recommended: i) That the informal graveyard be relocated to a suitable area after consultation with the affected families. The correct legal procedures and protocols for consent and permitting must be followed.	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 37 and EMPr. A qualified archaeologist must monitor excavation activities during construction and

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	ii) That the office Chief Directorate: National Geo-spatial Information be consulted in order to establish the correct procedure for the removal of the trigonometrical beacon. i) That a suitably qualified palaeontologist be appointed should the mining activities in the open pit reach the Vryheid geological formation. ii) No action is required for the demolished structures on the properties. From a heritage resources management point of view, we have no objection with regard to the development. The discovery of undetected heritage remains must be reported to the archaeologist or the Heritage Authority.	topsoil stripping over the LOM to identify any undetected sub-surface sites.
Traffic	It is concluded that the road network, surrounding the Rietkol Project, will be able to handle the traffic, with the identified road improvements, with no detrimental impact on the traffic on any of the relevant roads. It is hereby concluded that from a traffic perspective, there are no fatal flaws with the proposed identified required road works, including the new access onto Road D1550, on condition that all improvements be constructed to the applicable standards of the provincial authority. It is recommended that specific commitments need to be included in the EMPr for the mine to address the following matters: a) Responsibility towards road maintenance, only when transport trucks serving the Rietkol Project are found to be overloaded in terms of the applicable standard and required axle loads of the specific trucks. b) Addressing and attending to possible spillage from loaded trucks between the mine area and the various destinations, such as suitable covering required for loads (tarpaulins) with a regular monitoring process. c) Speed and safety control of truck movements are necessary in line with the relevant speed limits for heavy trucks.	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 37 and EMPr.
Visual	Should it be deemed appropriate to mine the resource, mitigation measures will have to be implemented in order to minimise the visual impacts, with specific reference to the consideration of material selection, making use of screening opportunities, effective management of night-time lighting and dust, as well as implementing good housekeeping measures during the operational phase of the project. Ongoing invasive floral species management should take place throughout all project phases. Upon decommissioning, the presence of residual aboveground infrastructure should be avoided, and all cleared areas should be ripped, topsoil applied and revegetated to	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 37 and EMPr. Visual monitoring is included in the monitoring programme – refer to Section 6 of the EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	blend in with the surroundings. In the case of the main open cast pit, which will only be partially backfilled due to an expected deficit in inert backfilling material available, this feature should be rehabilitated to have a natural appearance. From a visual perspective, the project is not considered to be fatally flawed and all potential impacts have the potential to be reduced though mitigation and it is the opinion of the specialist that the project be considered favourably, from a visual resource management perspective, provided that the required mitigation and management measures be implemented in support of Integrated Environmental Management (IEM) and that it is ensured that the best long-term use of the resources in the project area will be made in support of the principle of sustainable development. Visual monitoring, to ensure that mitigation measures regarding visual impacts are put in place and maintained, should be considered throughout all development phases. Results of the monitoring activities must be taken into account during all phases of the proposed project and action must be taken to mitigate impacts as soon as unexpected negative visual effects from the proposed activities become apparent. A decommissioning/closure and final rehabilitation plan must be developed in order to ensure that the area's pre-development scenic quality and visual integrity is restored and maintained as far as possible. Important aspects addressed should include requirements on the backfilling of open cast voids, removal of all aboveground structures that the project site be re-graded and shaped, and that indigenous vegetation be re-established to be consistent with the surrounding landscape. In the case of the main opencast void, which will only be partially backfilled due to an expected deficit in available backfilling material and filled with water, the resulting water body should be shaped and vegetated to have a natural appearance.	
Social	A total of 26 social impacts were identified for the proposed project, and 6 impacts caused by interaction between social and environmental aspects. Of the 26 social impacts, 6 are positive and 20 negative. The significance ratings for negative impacts without any mitigation range from Low, Medium-to-High and High. If all mitigation measures are implemented according to the recommendations given in Section 8 of the SIA, it is anticipated that the consequence and/or probability of most negative impacts will be reduced. This is reflected in the residual or post-mitigation significance ratings assigned to negative impacts. All positive impacts are expected to be at least moderately significant after mitigation. This summary confirms that adequate mitigation measures are expected to reduce the significance of almost all negative impacts albeit not always to baseline levels, while	Mitigation measures and recommendations were included as appropriate – refer to Table 37 and EMPr. The social management plan will be implemented and reviewed on a regular basis.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	positive impacts will on average be significantly enhanced to maximise benefits to surrounding communities. Consequently, it is recommended from a social perspective that the proposed Rietkol Project proceed. This recommendation is based on the following conditions: • Mitigation measures outlined in this report will be given effect through the social management plan. • Measures to monitor and assess implementation of these mitigation measures and to take corrective action where necessary will be implemented. • Impacts pertaining to other specialist disciplines that could have indirect socio-economic repercussions (e.g. impacts on groundwater, air quality, health etc.) will be effectively addressed as per the mitigation measures recommended in those specialist reports. • Nhlabathi Minerals must also establish continuous communication channels as well as complaints and grievance procedures with the affected parties.	
Human Health Risk Assessment	Once the silica mine is operational, it may release dust (particulates) into the air. This health risk assessment aimed to identify the potential that these particulates may cause health effects in the surrounding community. Calculation of the health risks requires knowing how much of the dust and silica will be released from the mine. However, because the mine is not operational (working) yet, the concentrations could not be measured and were therefore predicted, using a mathematical model. This model calculated the highest (maximum) concentrations that could be released by the mine, which is called a “worst-case scenario”. This is done to make sure that the risk is not under-estimated, i,e., to protect people. The results of the health risk assessment showed that even if people breathe in these high concentrations predicted by the model, it is unlikely that they will develop non-cancer health effects, such as respiratory effects. This will be true for situations where a person would be exposed for a short time or a long time to these calculated dust concentrations. Measurement of the silica concentration in a dust sample from the area, found it was low (0.033%). A separate project found that the silica concentration in a dust sample from an operational mine in the district, was 26%. These two percentages of silica in dust were then used to determine the risk of developing silicosis if the fine dust concentrations predicted by the model, would be inhaled deep into the lungs. It was found that it would be unlikely for a person to develop silicosis at these concentrations.	Dust fallout monitoring will be implemented both on and off-site to determine potential exposure. Samples will be analysed regularly to determine silica exposure.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	The actual concentrations of dust and silica should be verified once the mine is in operation, to determine the actual risk.	
Poultry Impact Statement	The areas of concern are noise, blast, and ground vibration but with the recommended mitigation measures put into place, they will be reduced to manageable levels or negated entirely. Good communication lines between the mine and the farm managers of both farms will be beneficial. Monitoring of air quality, noise and blasting should be conducted at the facilities of concern i.e. the broiler farms Rustig and Geluk and the Highveld egg packing station to determine any impacts associated with the proposed mining. Due to the paucity and sometimes conflicting research results from projects carried out on poultry, we cannot say for certain that the mitigation recommendations will negate all the possible negative effects on poultry. Should there be negative effects on performance, then pre-performance data must be used to establish the financial losses on production due to the mining operation.	Monitoring programme includes air quality, noise and blasting at the facilities of concern.

7.6 ASSUMPTIONS, UNCERTAINTIES AND KNOWLEDGE GAPS

7.6.1 Socio-Economic

7.6.1.1 Assumptions

- **Strategic importance of the project and no-go option:** It is assumed that the strategic importance of the project is supported by the national and provincial government and therefore their policies.
- **Technical suitability**: It is assumed that the Rietkol Project as identified by Nhlabathi represents a technically suitable site, and the best possible location for the Silica mine based on the technical information available to them.
- **Fit with planning and policy requirements:** Legislation and policies reflect societal norms and values. The legislative and policy context therefore plays an important role in identifying and assessing the potential Social Impacts associated with a proposed development. In this regard a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. As such, if the findings of the study indicate that the proposed development in its current format does not conform to the spatial principles and guidelines contained in the relevant legislation and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported. However, the study recognizes the strategic importance of silica and the technical, spatial and land use constraints required for such facilities.

7.6.1.2 Limitations

- **Information available:** This study was carried out with the information available to the specialists at the time of executing the study, within the available timeframe and budget. The sources consulted are not exhaustive and additional information, which might strengthen arguments or contradict information in this report, might exist. Information was requested from landowners on more than one occasion, and although a number of landowners responded, some did not provide the specialist with information on their land use activities and socio-economic situation. In these cases, land use was judged on available desktop and observation records, and socio-economic information was estimated (i.e., employees, income, wages, etc.).
- **Evidence-based Approach:** The specialists did endeavour to take an evidence-based approach in the compilation of this report and did not intentionally exclude scientific information relevant to the assessment.
- **Socio-economic Sensitive Environments:** Areas that might yield socio-economic sensitivities have been identified through a desktop study utilising available Mapping, Orthophotos and Google Earth™. The areas that have been marked are the sensitive areas visible to the socio-

economic specialists at the time of the study, which are in close proximity to the proposed project location under investigation.

- **Demographic data:** The demographic data used in the study is largely based on the 2011 Census and where available the Community Survey of 2016. Census data for 2016 is not yet available from Statistics South Africa up to municipal and ward level. While this data does provide useful information on the demographic profile of the affected area, the data are dated and should be treated with care. Where possible, reference is made to the latest demographic data contained in local Integrated Development Plans and other documents. With regard to the settlements in proximity to the project, a household survey was conducted to ensure accurate and updated data.
- **Sense of Place:** Assessment of the impact on sense of place is based on the specialist's opinion as sense of place is a very personal experience and is not easily measurable. Information from the visual impact assessment was utilized to determine the impact.
- **Decommissioning Impacts**: Socio-economic impacts associated with the eventual decommissioning of the mine at the end of its life are briefly discussed but are not subject to detail assessment. This omission is motivated by the fact that predictions concerning the characteristics of the receiving socio-economic environment at the time of decommissioning are subject to a large margin of error, thus significantly reducing the accuracy of the impact assessment.

7.6.2 Soils, Land Use and Land Capability

- The soil survey conducted as part of the land capability assessment was restricted to the study area, which is considered adequate for the purpose of this investigation.
- Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and land capability may have been overlooked in this assessment. However, it is the opinion of the professional specialist that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the EAP and the regulating authorities to make an informed decision regarding the proposed mining activities.
- Land Capability was classified according to current soil restrictions, with respect to prevailing climatic conditions on site; however, it is virtually impossible to achieve 100% purity in soil mapping, the delineated soil map units could include other soil type(s) as the boundaries between the mapped soils are not absolute but rather form a continuum and gradually change from one type to another. Soil mapping and the findings of this assessment were therefore inferred from extrapolations from individual observation points.

- Since soils occur in a continuum with infinite variances, it is often problematic to classify any given soils as one form, or another. For this reason, the classifications presented in this report are based on the "best fit" to the soil classification system of South Africa.
- Soil fertility status was not considered a limitation, seeing as inherent nutrient deficiencies and/or toxicities would be rectified by appropriate liming and/or fertilization prior to cultivation.

7.6.3 Hydropedological Assessment

- The SWAT model mainly models surface processes and does not entail processes relating to ground water recharge. Impacts on groundwater need to be considered on the broader landscape and drainage regime by a suitably qualified geohydrologist.
- The main limitation of the model is the spatial representation of the Hydrological Response Units (HRUs) within each subcatchment. This approach ignores flow and pollutants routing between the HRUs. Thus, the results presented at HRU scale may have inaccuracies however, they are considered sufficient to guide the decision-making process.
- It should be noted that the “streams and channels” presented in the report (Figures 5-7) were generated based on the Digital Elevation Model (DEM) for modelling purposes and do not represent freshwater systems that truly occur in the field as defined in the freshwater report compiled by SAS (2021). The generated lines should therefore only be considered as indicative of the position of preferential flow paths in the landscape.
- Weather generator data (Obtained from the online sources) in the absence of measured weather data is not 100% accurate especially with respect to precipitation data thus inaccuracies can be expected.
- Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and hydropedological characteristics may have been overlooked in this assessment. However, it is the opinion of the professional study team that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the EAP and the regulating authorities to make an informed decision regarding the proposed activity.
- The effects climate change dynamics were not considered as part this assessment; however, it is acknowledged that this might exacerbate the anticipated impacts associated with a reduction in water inputs and the resultant hydrological function of the remaining wetlands beyond the extent of the proposed development.

7.6.4 Faunal, Floral and Freshwater Assessment

- The detail ecological assessment and field work is confined to the MRA area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment.
- The Department of Environmental Affairs screening tool provides names of sensitive species likely to be present within the study area and its surrounds. Within the screening tool outcome, the names of some species are not provided, and these species are rather assigned a number keeping them unidentifiable (e.g., Sensitive species 1). This procedure is attributed to the vulnerability of the species to threats such as illegal harvesting and overexploitation. According to the best practise guidelines provided by South African National Biodiversity Institute (SANBI), the name of sensitive species **may not appear** in the final EIA report **nor any of the specialist reports** released into the public domain. However, the conservation threat status of the species has been provided.
- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations are compared with literature studies where necessary.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal and floral communities have been accurately assessed and considered.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the study area may have been missed during the assessment.
- The freshwater assessment is confined to the MRA area and resources within 500m of the MRA area. The general surroundings including freshwater resources within 500 m of the MRA area that may potentially be affected by the proposed mining activity were however considered in the desktop assessment of the study area.
- The freshwater delineation as presented in this report is regarded as a best estimate of the freshwater boundary based on the site conditions present at the time of the assessment.
- Limitations in the accuracy of the freshwater ecosystem delineation was experienced due to anthropogenic disturbances such as infilling, canalisation as well as extensive grazing and trampling are deemed possible.
- Wetland and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species. Within the transition zone some variation of opinion on the wetland boundary may occur,

however if the Department of Water Affairs (DWAF), 2005 and 2008 method is followed, all assessors should get largely similar results.

7.6.5 Baseline Water Quality Assessment

- Aquatic, wetland and riparian ecosystems are dynamic and complex. Some aspects of the ecology of these systems, some of which may be important, may have been overlooked. For instance, findings relating to RK04 were largely based on a single site visit during the initial 2016 baseline assessment. A more reliable assessment would have required that seasonal assessments take place with at least one assessment in the low flow season also undertaken. Only a single assessment was initially conducted taken at RK04, as RK04 was only included in the monitoring program when the extent of the MRA area was revised (which took place after the second 2016) site visit. Findings relating to RK01 to RK03 do not have this seasonal limitation, as three replicates were taken during the initial 2016 baseline assessment, with means calculated to provide a more accurate reflection. However, with a subsequent baseline visit again performed in 2021 at sites RK01 and RK04, additional data has been generated that allows for further temporal comparison.
- The precise concentration of several parameters could not be quantified and were recorded as being below the detection limit (e.g. <0.01 mg/l). In some cases, the detection limit (as specified for each element/compound by the analysing laboratory and dependent on instrument specifications) was above the guidelines which they were being compared to, meaning that it was not possible to determine compliance. In such cases the precautionary principle was applied, and it was assumed that the value exceeded the guideline. These instances are, however, specifically identified in the data and in the text.
- Given that the proposed open cast mine will descend to a depth of 30-50m and is located outside the 100m zone of regulation of wetland resources, it was confirmed that de-watering of the pit will be required.

7.6.6 Groundwater

- The numerical groundwater model, despite all efforts and advances in software and algorithms, remains a very simplified representation of the very complex and heterogeneous interacting aquifer systems underlying the project area. The integrity of a numerical model depends strongly on the formulation of a sound conceptual model and the quality and quantity (distribution, length of records etc.) of input data. Nonetheless, a numerical model can still be used quite successfully to assess the effectiveness of various management and remediation options/techniques, especially if the shortcomings in information and

assumptions made in the construction and calibration of the model are clearly listed and kept in mind during modelling.

- The main purpose is thus not to try and predict what the exact groundwater level or concentration of a certain element will be at a certain position at a specific moment in future. The heterogeneity of the natural groundwater system, especially the secondary fractured rock aquifer environment underlying the project area, is simply too great to accurately incorporate and simulate accurately in the model. The purpose is therefore to rather evaluate what the relative magnitude or contribution of certain impacts or different pollution sources will be on the larger groundwater regime and then to determine which remediation options would have the most beneficial effects.
- Although relatively good borehole coverage occurs in many parts of the modelled area, the significant heterogeneity of the aquifer still makes the assigning of representative geohydrological flow or mass transport parameters to the entire model grid problematic.
- No detailed structural geological information was available at the time of submission of this report, therefore modelling (i.e. updating of the model) should be an ongoing process as new information becomes available over time. Because the aquifer underlying the project area is of a secondary fractured rock type, groundwater flow and contaminant migration are fully restricted to open fractures and discontinuities associated with geological structures. These structures therefore have the ability to significantly affect the outcome of a model.

7.6.7 Air Quality

- As no long term on-site meteorological data was available during the current investigation, it was decided to make use of measured data from the SA Weather Services Springs Meteorological Station to describe the micro meteorological aspects of the area.
- Ambient air quality monitoring has been undertaken by Eskom at the Chicken Farm Site, which due to its distance from urban areas, is the closest representative site to Delmas, approximately 30km northeast, with the South African Air Quality Information System (SAAQIA) providing the information from 1 January 2017 to 31 December 2017.
- All information provided in regard to mining rates, infrastructure layouts and mining methodology is assumed to be correct.

7.6.8 Noise

While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise levels at a receptor from any operation.

The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. The assumptions include the following:

- That octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of these processes and equipment.
- The determination of octave sound power levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results.
- Sound power emission levels from processes and equipment changes depending on the load the process and equipment is subject to. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load (work required from the engine or motor to perform action). Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worst-case scenario.
- As it is unknown which processes and equipment will be operational (when and for how long), modelling considers a scenario where processes and equipment are under full load for a set time period. Modelling assumptions complies with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would be likely over-estimated.
- Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor.
- The XYZ topographical information is derived from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM data, a product of Japan's Ministry of Economy, Trade, and Industry (METI) and the National Aeronautical and Space Administration (NASA). There are known inaccuracies and artefacts in the data set, yet this is still one of the most accurate data sets to obtain 3D-topographical information.
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify.
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Fifty percent (50%) soft ground conditions will be modelled as the area where the construction activities are proposed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

7.6.9 Blasting

- The project is a greenfields project with no drilling and blasting operations currently active.
- The anticipated levels of influence estimated in this report are calculated using standard accepted methodology according to international and local regulations.
- The assumption is made that the predictions are a good estimate with significant safety factors to ensure that expected levels are based on worst case scenarios. These will have to be confirmed with actual measurements once the operation is active.
- The limitation is that no data is available from this operation for a confirmation of the predicted values as it is a greenfields site with no current blasting activities.
- Blast Management & Consulting was not involved in the blast design. The information on blast design applied was provided by the client.
- The work done is based on the author's knowledge and information provided by the project applicant.

7.6.10 Heritage

No limitations were experienced. It must be noted that most archaeological and palaeotological remains are subterranean and there is always a chance that such material may be exposed during earthworks.

7.6.11 Palaeontology

The key assumption for the PIA is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there; or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed

by weathering or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc.).

It must be noted that most palaeotological remains are subterranean and there is always a chance that such material may be exposed during earthworks.

7.6.12 Visual

- No specific national legal requirements for VIAs currently exist in South Africa. However, the assessment of visual impacts is required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed project indicate that visibility and aesthetics are likely to be significant issues and that visual input is required.
- Due to a lack of visual specialist guidelines within the Mpumalanga Province, the “Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process”, prepared for the Western Cape Department of Environmental Affairs & Development Planning was used.
- All information relating to the proposed project as referred to in this report, inclusive of the proposed infrastructure layout, infrastructure height, mining techniques and sequences, etc., is assumed to be the latest available information. No detailed information about building styles, colours and finishes and lighting types and positioning, etc. were available prior to completion of the assessment, and assumptions have been made regarding these elements taking industry standards and best practice guidelines into consideration.
- Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable.
- The viewsheds developed for the Rietkol Project indicate the areas from which the proposed project is likely to be visible and does not take local undulations and variations in topography, vegetation and man-made structures into account. Potential sensitive receptor sites, indicated to fall within the viewsheds, have therefore been ground-truthed during the field assessment.

7.6.13 Human Health Risk Assessment

- Valid monitored and modelled concentrations of the pollutants were provided to the health risk assessor.

- The study was limited to dust (PM and silica), and biological and physical agents were not included.
- Occupational health and safety risks were excluded from this assessment.
- The background/baseline concentrations were not modelled but were based on limited (one month) monitoring, although this was done during a winter month (4 June to 5 July 2021), which may be considered a worst case.

7.7 ANY DEVIATIONS FROM APPROVED SCOPING REPORT

No deviations are noted from the approved Scoping Report.

8 DETAILS OF PUBLIC PARTICIPATION PROCESS

The Public Participation Report is attached as Appendix 1 and reflects the Public Participation conducted as part of the Announcement and Scoping Phases. The process forms part of a re-application and therefore comments made in the previous application from 2016 – 2018 have been included to ensure all comments are taken into consideration.

It should be noted that the Public Participation Process has not yet been concluded and will be further implemented in line with legislative requirements for the EIA and Decision-making Phases. An updated report will be provided with the final EIAR/EMPr.

8.1 PUBLIC PARTICIPATION TO DATE

Below a summary of the Public Participation Process to date.

8.1.1 Register of Interested and Affected Parties

A list of potential IAPs were compiled at the onset of the Public Participation Process in January 2016 and updated in 2021. The register includes all relevant Government Departments and other agencies, landowners, neighbouring landowners and communities, and Environmental Interest Groups / NGO's. The following Government Departments are included due to their relevancy to the project:

- Mpumalanga Department of Mineral Resources and Energy (DMRE)
- Mpumalanga Department of Agriculture, Rural Development, Land Reform, Environmental Affairs (MDARDLEA)
- Mpumalanga Department of Water and Sanitation (DWS)
- Mpumalanga Department of Rural Development and Land Reform (DRDLR): Regional Land Claims Commissioner
- Mpumalanga Department of Agriculture, Forestry and Fisheries (DoA & DAFF)
- Department of Forestry, Fisheries and the Environment (DFFE)
- Mpumalanga Department of Roads and Transport
- Nkangala District Municipality
- Victor Khanye Local Municipality

Additional Authorities and Agencies included in the IAP register are:

- South African Heritage Resource Agency (SAHRA)
- Mpumalanga Tourism and Parks Agency (MTPA)
- Environmental NGO's and Advocacy Groups

The IAP register is maintained and updated throughout the process as required by the NEMA and 2014 EIA Regulations. Refer to Appendix 1-1 for a copy of the IAP Register.

8.1.2 Project Notifications

Project Notifications are sent via:

- Email, where email addresses exist and are available,
- Fax, where a fax number exists
- Post, if neither an email nor a fax is available, but a postal address is available
- Sms, where a cell number is available

This ensures all parties are aware of the notification. The following notifications have been sent to potential IAPs:

- Project Announcement (notification of intended applications) and Background Information Document (BID) on 12 February 2021 (refer to Appendix 1-2 for the notification letter and Appendix 1-3 for a copy of the BID in English and isiZulu).
- Letter to the Mpumalanga Land Claims Commissioner sent on 20 January 2017 with follow-up emails and responses on 22 March 2018 (refer to Appendix 1-7).

The following table provides detail on stakeholder groups and method of notification:

Table 45: Notifications Table

Interested & Affected Party	Method of Notification	Date of Notification
AFFECTED PARTIES		
MRA Landowner		
Landowners within the MRA area	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Response to specific comments Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021 April 2021 6 May 2021 23 August 2021
Traditional Leaders, Communities, Settlements		
Traditional Leader	*Not applicable*	
Lawful Occupier, Community / Settlement	*Not applicable*	
Land Claimants		
Land Claims Commissioner	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Notification of the availability of the DSR emailed Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 18 Mar 2021 6 May 2021 23 August 2021
Land Claimant	*Not applicable*	

Interested & Affected Party	Method of Notification	Date of Notification
Municipalities		
District and Local Municipalities	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Notification of the availability of the DSR emailed Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 18 Mar 2021 6 May 2021 23 August 2021
Organs of State		
Relevant Authorities	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Notification of the availability of the DSR emailed Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 18 Mar 2021 6 May 2021 23 August 2021
OTHER AFFECTED PARTIES		
Other landowners		
Direct neighbours	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Response to specific comments Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021 May 2021 6 May 2021 23 August 2021
Landowners within a 1km radius	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Response to specific comments Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021 May 2021 6 May 2021 23 August 2021
Neighbouring land occupants, settlements or communities		
Adjacent Traditional Leaders	*Not applicable*	
Neighbouring land occupants, settlements or communities	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021 6 May 2021 23 August 2021
INTERESTED PARTIES		
Regional Landowners	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021 6 May 2021 23 August 2021
Environmental NGO's / Conservation Organisations	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021 6 May 2021 23 August 2021
Other, as registered	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021

Interested & Affected Party	Method of Notification	Date of Notification
	Notification of the availability of the FSR emailed Notification of acceptance of FSR emailed	6 May 2021 23 August 2021

8.1.3 Advertisements and On-Site Notifications

The following advertisements (Appendix 1-4) were placed to announce the project and application:

Table 46: Advertisement Table

Type of Media	Name of Media	Distribution	Date of Placement
Newspaper	Streek Nuus	Local Delmas area	12 Feb 2021

The following on-site notifications (Appendix 1-4) were placed to announce the project and application:

Table 47: On-Site Notices Table

Location of Notice	Name of Location	Coordinate of Placement	Date of Placement
Project Property Boundary	Main road to Eloff, entrance to Emafentsini	S26°07.609 E028°37.131	12 Feb 2021
Plot 152	Mafensini Tuck Shop	S26°07.521 E028°36.120	12 Feb 2021
Delmas	Victor Khanye Local Municipality	S26°08.979 E028°40.762	12 Feb 2021
Delmas	Willow Corner Center Shoprite	S26°09.058 E028°40.947	12 Feb 2021
Delmas	Pick and Pay Center	S26°08.405 E028°40.560	12 Feb 2021

8.1.4 Availability of Project Documentation

The following documents were made available throughout the process:

Table 48: Public Documents Table

Document	Timeframe	Date of Availability	Date of Comment Closure
Background Information Document (attached as Appendix 1-3)	Ongoing	12 February 2021	Not applicable
Draft Scoping Report	30 days (excl. public holidays)	18 Mar 2021	26 Apr 2021
Final Scoping Report		6 May 2021	Not applicable

8.1.5 Translation of Project Notices and Documents

The on-site notices, the BID and the Non-Technical Summary are translated into the predominant local language, which in this case is isiZulu, for distribution.

8.1.6 Engagement with IAPs

Engagements for the current process is planned as per the Public Participation Plan approved as part of the Scoping Report; however, engagements held with landowners, land occupants and the municipality during the previous application are included to ensure all relevant issues raised in the previous process is retained and addressed in the re-application process.

Appendix 1-5 contains the minutes of meetings held in the previous process:

- Victor Khanye Local Municipality Meeting held on 9 March 2018
- Landowner / Occupant Meeting (English) held on 9 March 2018
- Land Occupant, labourers, and local communities Meeting (isiZulu) held on 10 March 2018

During May 2021, several Focus Group meetings were held with the larger business activities and their representatives. For confidentiality reasons the minutes of these meetings will not be made public.

Table 49: Engagement with IAPs table

Meeting held with	Contact person	Date	Time	Place
CPI	Jan du Plooy	5 May 2021	09h00	AH 278, Die Plaas
Dr J Greeff	Dr J Greeff	5 May 2021	12h00	Greeff Residence, Eloff
P van der Walt	P v d Walt	5 Mei 2021	15h00	AH 213
Rossgro	Naude Rossouw	6 May 2021	8h30	Virtual Teams Meeting
MBFi	Izak du Toit (lawyer)	10 May 2021	11h00	Casa Kaya Guesthouse, Pretoria
Pretorius Blomme	Leon Pretorius	11 May 2021	11h00	AH 285
Unex Rose	Wally Lewis	11 May 2021	12h30	Unex Rose Office

8.2 SUMMARY OF ISSUES RAISED BY IAPS

The comments and response report includes comments from both the current and previous processes to ensure any comments made in terms of potential impacts are included in the process.

Table 50: Comments and Response Summary

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
AFFECTED PARTIES					
MRA Landowners					
Landowners within the MRA area	X	Feb 2016 March 2016 Nov 2016 Feb 2021 Apr 2021	Impact on water, air quality (silica), health, noise, economic livelihoods and security. Cumulative impacts of other existing and planned mining operations.	The process will be conducted through two phases (the Scoping and EIA Phases) where opportunity will be provided to the public for participation, input and provision of information regarding the various specialist studies.	Not finalised
Landowners within the MRA area	X	Apr 2021	Inclusion of specific studies such as a Medical Research study and Poultry Impact Assessment to determine the impact on human health and on poultry production of the nearby broiler and packhouse businesses.	The health risks and medical conditions associated with silicosis have been well researched for many years, specifically WHO and US Occupational Safety and Health Administration who have set standards based on their research, 40 and 100 µg/m^3 respectively. The potential for silica dust-fallout will be addressed in the Air Quality Impact Assessment, which will provide an indication of the risk to not only employees, but also the general public adjacent to the proposed mine. In addition, Nhlabathi has committed to undertake a Medical Research Study. The specialist studies do address the potential impacts on mammals / poultry to the extent that data is available in this regard. Very limited data is however available.	Not finalised
Landowners within the MRA area	X	March 2018 Feb 2021 April 2021	Concerns raised regarding the impacts on: Groundwater – quality and quantity including the effect blasting & vibrations may have on groundwater. Air quality and its associated health risks, with specific reference to silicosis as well as the impact it would have on the agriculture businesses (crops, livestock, etc). Security and the increase in crime.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The potential impact on the economic activities of MRA landowners will be assessed as part of the macro-economic impact assessment.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Noise and blasting impacts. Economic impact on businesses due to above impacts. Cumulative impacts considering the existing baseline and planned other developments.	Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects.	
Landowners within the MRA area	X	Feb 2021	Relocation of packing stores will have a very serious financial and logistical impact on business.	The potential impact on the economic activities and business activities will be assessed as part of the macro-economic impact assessment, including impacts on GDP and employment.	Not finalised
		Apr 2021	Concerns of irreparable loss and damages that will be suffered because of the proposed mining.	The socio- and macro-economic specialists have secured several meetings with stakeholders that have raised concerns and objections, to discuss their concerns and include these in the impact assessment process.	Not finalised
Traditional Leaders, Communities, Settlements					
Traditional Leader			*Not applicable*		
Lawful Occupier, Community / Settlement			*Not applicable*		
Land Claimants					
Land Claims Commissioner	X	March 2018	No land claims registered on the MRA properties.		Consensus
Land Claimants			*Not applicable*		
Municipalities					
District Municipality			*No comments received to date*		
Local Municipality	X	Oct 2016 Nov 2016	The area is an eco-sensitive area with an underground lake that supplies the town with water. Also, the area is underlain by dolomitic geology. 800m buffer zone between the residential area and the proposed mine. The intended mine is within the urban edge of Delmas and falls within the residential component of the farms of Modder East Orchards. The area is agricultural zoned. The proposed mine is not in line with the SDF of Delmas.	Noted, further engagement with the municipality will be arranged as part of the EIA process. The information was forwarded to the groundwater specialist who made further enquiries in this regard. Full details will be provided in the geohydrological impact assessment.	Not finalised
Local Municipality	X	March 2018	Impact on local roads – need for coordination with the municipality. Impact and monitoring of groundwater – quality & quantity.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Influx and management of informal settlements. Blasting impact on groundwater.	The municipality will be kept up to date as more information becomes available.	
Ward Councillors	X	March 2018	Management of influx and the impact on the informal settlement neighbouring the planned mining area.	Once all specialist studies are complete, a cumulative impact zone will be determined, and only at that time will we be able to determine if resettlement is required. At this stage, the first approach will be to avoid resettlement.	Not finalised
Organs of State					
DMRE	X	August 2021	Acceptance of Scoping Report and Plan of Study. Requirements for EIAR: • Activities to be described and impacts assessed • Impact management objectives and mitigation measures for risks that need to be managed • Feasible and reasonable alternatives to be assessed • PP must be transparent, all comments to be included • Proof of correspondence with stakeholders to be included • All IAP comments must be adequately addressed • Motivation for need and desirability	This report adheres to the requirements stipulated in the NEMA and the recently published EIA Regulations, 2014 (as amended). The DMRE guidelines were used as framework. All aspects raised by DMRE was addressed within this report. Stakeholder consultation records and proof of correspondence are included in the PP Report (Appendix 1).	Not finalised
MDARDLEA			*No comments received to date*		
DoA	X	March 2018	Aspects to be considered during the EIA is current land use, grazing capacity, land capability and a detailed soil study.	These aspects will be addressed in the Soils, Land Use and Land Capability specialist assessment and in the EIAR.	Not finalised
DALRRD	X	Feb 2021 May 2021	Soils and land use investigations. Weeds and alien invader plant management plan. Land capability class and grazing capacity. Sensitive areas and wetlands not to be disturbed.	These aspects will be addressed in the Soils, Land Use and Land Capability specialist assessment and in the EIAR.	Not finalised
		April 2021	Land capability is II high potential arable land. According to the 1993 grazing capacity index this area is regarded as having a 3 ha/LSU demarcation making it suited for grazing. DALRRD does not support the environmental authorisation on the farm Rietkol 237 IR – land must be protected for food security purposes.	The concerns raised are noted. These aspects will be addressed in the Soils, Land Use and Land Capability specialist assessment and in the EIAR.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
SAHRA	X	March 2018	Mitigation for the conservation of historical structures. MRA underlain Very High palaeontological sensitive rocks, as seen by the SAHRIS palaeomap. All reports and appendices to be uploaded to the SAHRIS system.	This section of the report will be rephrased and clarified. It is unlikely that the structures are older than 60 years and not regarded as significant. No mitigation measures are recommended. The area falls in the BLUE category of SAHRA's Palaeontological Sensitivity Map because of the underlying Vryheid formation. Blue is low in sensitivity and no palaeontological studies are required; however, a protocol for finds is required. A palaeontological study will be conducted, to the level proposed by the professional palaeontologist.	Not finalised
		May 2021	The SAHRA Archaeology, Palaeontology and Meteorites (APM) notes the submission of the HIA and PIA report however further comments will only be issued once the draft EIA report is submitted to the case during the public review period.	The draft EIA report will be uploaded onto the SAHRIS system, together with all specialist reports.	Not finalised
MTPA	X	March 2018	No objection. Aspects to be addressed in the EIA include terrestrial assessment, freshwater assessment, critically endangered terrestrial orchid. Recommendations include a detail flora study, wetland delineation, if orchid is found inform MTPA, plans for active water purification.	We take note of your comments, which will be addressed in the relevant specialist reports and EIAR/EMPr.	Not finalised
		August 2021	MTPA requests that you send a hard copy of the Draft EIAR and EMPr once available.	A hard copy of the draft EIAR and EMPr will be submitted to MTPA for their comments.	Not finalised
Roads and Transport	X	Feb 2021	Concerned how roads will be affected – access and building line	The potential impact on roads will be addressed in the Traffic Impact Assessment. Further consultation will be initiated with the Dept.	Not finalised
DFFE	X	June 2021	It is required that after the issuance of the Environmental Authorisation the facility must apply and be in the possession of a Provincial Atmospheric Emission Licence (PAEL) issued by the Minister of DFFE for all proposed activities that are listed in terms of section 21 of NEM:AQA before operation.	The need for a AEL was identified – refer to Section 3.2 of this report. The application for an AEL will follow once the mining right is granted, prior to construction of the dryer plant.	Not finalised
OTHER AFFECTED PARTIES					
Other landowners					

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
Direct Neighbours	X	March 2018 Feb 2021 April 2021	Concerns raised regarding the impacts on: Groundwater – quality and quantity including the effect blasting & vibrations may have on groundwater. Damage to property due to drilling & blasting. Heavy motor vehicles on the access road. Air quality and its associated health risks, with specific reference to silicosis as well as the impact it would have on the agriculture businesses (crops, livestock, etc). Biodiversity impacts, visual impacts and sense of place. Increased noise and traffic. Economic impact on businesses due to above impacts, including property value. Cumulative impacts taking into account the existing baseline and planned other developments. Monitoring programmes and feedback to landowners on the results.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The potential impact on the economic activities in the area will be assessed as part of the macro-economic impact assessment. Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects. The specialist studies will recommend the type, method and frequency of monitoring required.	Not finalised
		Apr 2021	This cumulative impact from an economic, social and environmental perspective should be investigated and included as part of the specialized environmental studies.	Cumulative effects will be investigated as far as it is practical and relevant. It is noted that the closest operational mine to the proposed Rietkol Project is more than 8 km away (Kangala Coal). Once all specialist studies are complete, a cumulative impact zone will be determined based on the impact modelling by the specialists.	Not finalised
Landowners within a 1km radius	X	Feb 2016 March 2016 April 2016 March 2018 April 2021	Concerns raised regarding the impacts on: Groundwater – quality and quantity including the effect blasting & vibrations may have on the dolomitic aquifer and groundwater in general, formation of sinkholes. Air quality and its associated health risks, with specific reference to silicosis as well as the impact it would have on the agriculture businesses (crops, livestock, greenhouses etc). Biodiversity impacts (including specie movement). Visual impacts and sense of place. Increased noise and traffic. Blasting effects on structures and animals especially horses.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The concerns raised will be forwarded to the specialists for consideration during their assessments. Impact of blasting on infrastructure and animals (horses) will be addressed as part of the blasting impact assessment. The structures and structure types will be identified as best possible and evaluation done accordingly. Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Economic impact on businesses due to above impacts including property value and method/procedure to address damages and compensation to be paid. Cumulative impacts taking into account the existing baseline and planned other developments. Monitoring programmes and feedback to landowners on the results. Job creation and losses.	The specialist studies will recommend the type, method and frequency of monitoring required. The potential impact on the existing economic activities and the benefits of the proposed mining activity will be assessed as part of the macro-economic impact assessment, including impacts/benefits on GDP and employment.	
Neighbouring land occupants, settlements or communities					
Adjacent Traditional Leaders			*Not applicable*		
Neighbouring land occupants, settlements or communities	X	March 2016 Feb 2021	Will the project require resettlement? In support as the mine as it will generate job opportunities and skills development. Impact on water, air quality and health.	Your comments will be considered during the social impact assessment that addresses both impacts and benefits to the community. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase. A cumulative impact zone will be determined around the proposed mining activities to understand the need for resettlement.	Not finalised
Neighbouring land occupants, settlements or communities	X	March 2018 Feb 2021	Concerns raised regarding: Resettlement. Graves and ancestral beliefs. Limited employment opportunities.	The specialist studies (specifically Air Quality, Noise and Blasting), that will determine the likely impacts on the communities, are still underway. Once these studies are complete, we will be able, at the next meeting, to explain to you what those impacts will be, as well as what we propose the mine does to protect the community. The families (next of kin) of any grave sites affected will be consulted. With employment, for every person employed in a family, up to 5 dependents may be uplifted. At a mine there are skilled and unskilled opportunities, but those that are unskilled can be developed through skills development. If the skills required does not exist in the local area, this can be remedied over time with skills development programmes. Also, benefits are not only focussed on employment, there are procurement and enterprise development	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
				opportunities as well as bursaries, internships and learnerships. All these programmes must be described in the 5-year SLP, which forms part of the commitment the mining company makes.	
	X	Apr 2021	Corporate Social Investment Road Infrastructure Housing Health Care Services (Clinics/Hospital) Educational Infrastructure Water Infrastructure Creation of Job opportunities to alleviate poverty preferably to local stakeholders. Black economic empowerment businesses residing in the community. Environmental management	Noted, your comments will be considered during the social impact assessment that addresses both impacts and benefits to the community.	Not finalised
INTERESTED PARTIES					
Regional Landowners (outside 1km buffer)	X	Feb 2016 March 2016	Scope of work of specialist tests. Underground lake and cave on plot 183 Impact on air quality and health Benefits to be invested locally through job creation and procurement. Concerned about mining over aquifer Impacts on groundwater, increased subsidence and incidents of sinkholes, degradation of current poorly maintained local and provincial infrastructure, increase in noise and air pollution as well as blasting and tremors, increase in socio-economic problems due to a lack of housing, crime, etc and a decline in property value and sense of place.	As described in the BID, the process will go through two phases where opportunity will be provided for you to participate, provide inputs and receive information regarding all the various specialist studies being conducted for the project. The first report that will be made available will be the draft Scoping Report, which will describe the environmental baseline (what the current status is) and the Plan of Study of the further in-depth specialist studies, only thereafter will the full EIAR be compiled and made available. Your concerns have been forwarded to our specialists for further investigation. We will keep you up to date of any further information and engagements.	Not finalised
Regional Landowners (outside 1km buffer)	X	March 2018	Groundwater – quality and quantity including the effect blasting & vibrations may have on the dolomitic aquifer and groundwater in general, formation of sinkholes. Air quality and its associated health risks, with specific reference to silicosis. Economic impact including property value. Increase in crime and safety concerns.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The concerns raised will be forwarded to the specialists for consideration during their assessments.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Blasting effects on animals especially horses. Monitoring and the reporting protocol when limits are exceeded.	Impact of blasting on infrastructure and animals (horses) will be addressed as part of the blasting impact assessment. The potential impact on the existing economic activities and the benefits of the proposed mining activity will be assessed as part of the macro-economic impact assessment, including impacts/benefits on GDP and employment.	
	X	Mar 2021	Concerns regarding dust and air quality for cattle. Negative effects on bull frogs, cranes and secretary birds. Negative effects on water levels.	Your concerns around environmental degradation are noted and will be considered during the EIA process and within the relevant specialist impact studies. Mitigation measures will be determined to deal with any of the concerns raised and impacts identified by the specialists for inclusion in the EMPr.	Not finalised
Interested Parties (Stefan Roets)	X	Feb 2018 Feb 2021	Impact on land use and zoning surrounding the mining area. Rezoning application process. Concerned about infrastructure, mainly roads.	The latest update of the SDF was supplied by Mr Steenekamp on 9 March 2018 and will be reviewed further by the EAP during the EIA Phase. Further engagement with the municipality will be conducted to discuss the land zonation as contemplated in the SDF. The rezoning process will be done after the EIA process is complete, as this application normally requires the specialist studies conducted during the EIA. They also normally require the Authorisations and Licenses. It will happen before we go on site. The potential impact on roads will be addressed in the Traffic Impact Assessment.	Not finalised
Other, as registered	X	Mar 2021	We are grateful about the report hoping for life changing opportunities.	Noted.	

A detailed Comment and Response Report (CRR) is attached as Appendix 1-6. Copies of written submissions during the current process are included in Appendix 1-7, previous written copies of comments as contained in the CCR is available on request.

9 ENVIRONMENTAL IMPACT STATEMENT

9.1 PROPOSED IMPACT MANAGEMENT OUTCOMES

The environmental and social management objectives and impact management outcomes are presented in Table 51.

Table 51: Proposed management objectives and outcomes for the Rietkol Project

Aspect	Management Objectives	Impact Management Outcomes (Performance Target)
Land capability	To re-instate suitable grazing capabilities over the reclaimed portions of the mine site	• Development of a Rehabilitation, Decommissioning and Closure Plan • Establishment of a self-sustaining, grazing land capability over the reclaimed areas
Ecology	Minimise impact on the biodiversity habitat in the area and protected species	• Limit the clearance of vegetation and topsoil to 25 ha (disturbed footprint) • Implementation of a Rescue and Relocation Plan • Implementation of a low maintenance alien and invasive eradication plan
	To re-establish an appropriate mix of grassland and other native flora species in the reclaimed areas to enable the natural re-instatement of biodiversity over time	• Establishment of a sustainable vegetation cover to facilitate the final grazing land capability requirements

Water resources	Limit the impact on the wetland systems in and around the mine site	• Maintain buffer of 100m between wetlands and mine development footprint
		• Surface water quality indicates that the surface water runoff is unpolluted
		• Biomonitoring indicates that the REC is achieved
		  ○ Hillslope wetlands: REC of D
		  ○ Pan: REC of C

	Prevent erosion and downstream siltation	• Implement SWMP to separate clean & dirty water • Erosion monitoring indicates suspended solids within RWQO for aquatic systems
	Limit the impact of the groundwater quality and yields	• Groundwater monitoring demonstrates that the surrounding groundwater users are not impacted in terms of quality or yield • Implementation of compensation strategy if the above cannot be demonstrated
Air quality	Limit the risk of dust and silica exposure to the general public	• Dust fallout < 600 mg/m^2/day on MRA boundary • PM_{10} (24-hour) < 75 µg/m^3 on MRA boundary • Silica fallout < 50 µg/m^3 on MRA boundary

Noise	Limit the noise impact on sensitive receptors	• Urban noise level
		  ○ Day: 55 dB
		  ○ Night: 45 dB

Aspect	Management Objectives	Impact Management Outcomes (Performance Target)
		• Increase in ambient noise levels (on MRA boundary) < 7 dB
Blasting	Limit the blasting impact on sensitive receptors Prevent any structural damage to infrastructure	• Air blast < 120 dB on MRA boundary • Ground vibration < 12.5 mm/s on MRA boundary • Maintain exclusion zone of 105m
Heritage / Palaeontology	Prevent any impact on heritage and palaeontological material	• No damage to heritage and palaeontological material without the necessary investigations and permits
Post-mining land use	Establish a post-mining land use that will sustain rural agricultural activities once mining is concluded, whilst providing an acceptable overall aesthetic appearance aligned to the surrounding landscape	• Establishment of a suitable final landform in the North Block and infrastructure rehabilitated areas that is free-draining and non-erosive • Establishment of a recreational area within the Main Block final void area, as per the agreement with the stakeholders and authorities
Local community / adjacent landowners	Minimise health and safety impacts on sensitive receptors	• Resettlement of sensitive receptors within Cumulative High Impact Zone (Table 43)
	Prevent vehicle and pedestrian accidents due to increase in traffic	• Implementation of road upgrades as proposed in the TIA • No fatal accidents
	Maximise social benefits (employment, procurement, etc.) to local communities	• 40% local target
	Identify and establish livelihood retention projects to create off-mine livelihoods during and post-mining	• Successful implementation of Social and Labour Plan
	Equip employees with portable skills that can be used in other sectors post-mining	• Successful implementation of Social and Labour Plan

Appropriate monitoring should be implemented to ensure compliance with the objectives and outcomes as proposed.

9.2 ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

It is essential that all the mitigation measures as listed in Table 37 be implemented. The following are considered critical to minimise the negative impacts associated with the proposed activities:

9.2.1 Pre-Construction Activities (Planning and Design)

- Infrastructure placement must be planned outside of delineated wetlands and outside of the 100m scientific buffer zone.
- Develop and implement a rescue and relocation plan for floral SCC and obtain relevant permits from MTPA.
- Infrastructure heights should be designed to be a low as possible.
- A lighting specialist should be consulted to assist in the planning and placement of light fixtures for the mining facility and all ancillary infrastructure to reduce visual impacts associated with glare and light trespass.
- Develop the Social Management and Monitoring Strategies as per the SIA related to employment, procurement, health, safety, and security.
- Implement the environmental monitoring programme.
- Develop a detail waste management procedure and obtain the necessary agreements and permissions in place.
- All proposed road upgrades and improvements are to be designed by a professional engineer and submitted for official approval, by the Mpumalanga Provincial Roads Department, prior to implementation.
- Initiate application for Atmospheric Emissions Licence (AEL).

9.2.2 Construction Phase

- Develop and implement a comprehensive stormwater management plan to separate and control clean and dirty stormwater runoff.
- Temporary erosion control measures must be used to protect the disturbed soils during the construction phase until adequate vegetation has established.
- The wetlands and the associated zones of regulation should be clearly demarcated and marked as a no-go area.
- Solid waste must either be stored on-site in an approved waste disposal area or removed by credible contractors, in line with the waste management procedure.
- Implement an Environmental Awareness Programme on the mine and within the surrounding communities.

- Conduct pre-blast surveys prior to any blasting events.
- Implement an Alien and Invasive Eradication Plan.
- A qualified archaeologist must monitor excavation activities.
- A suitably qualified palaeontologist must be appointed to assess the construction site once excavations reach a depth of 1.5 m in areas allocated a Very High sensitivity. If fossils are recorded, the palaeontologist must do a Phase 1 PIA and develop a Chance Find Protocol (CFP).
- Resettlement of sensitive receptors within Cumulative High Impact Zone in the MRA area.
- Establish and implement a Complaints and Grievance Procedure.
- Implement health awareness programmes for workers and communities
- Establishment of a local labour recruitment committee to monitor recruitment procedures and results.

9.2.3 Operational Phase

- Investigate blasting techniques to minimise ground and air vibrations and disturbances to minimise the impacts on surrounding sensitive receptors and faunal species.
- Maintain an evacuation zone of 105m, establish an evacuation procedure with the affected parties prior to blasting.
- Develop and implement a Biodiversity Action Management Plan (BAMP), including avifaunal plan.
- Ongoing eradication and control of declared weed and invader plant populations in and around the mine area and its associated infrastructure.
- Clean and dirty water separation structures must be maintained throughout the life of mine – Operations and Maintenance Plan.
- Regular assessment of erosion and sedimentation must take place. Gabion silt traps must be cleaned of silt on a regular basis, after the wet season.
- Ongoing revision of the groundwater flow and geochemical models.
- Development of an Air Quality Management Plan (AQMP).
- A qualified archaeologist must monitor excavation activities during topsoil stripping over the LOM.
- The informal graveyard should be demarcated (fenced off) to prevent any damage thereto prior to relocation. The informal graveyard should be relocated if mining or any other infrastructure is closer than 100m.

- Implementation of a Health Monitoring Programme with workers and surrounding communities.
- Ongoing implementation and review of the environmental monitoring programme.
- Ongoing implementation and monitoring of the Social Management and Monitoring Strategies.

9.3 REASONED OPINION AS TO WHETHER THE ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

To be concluded once comments are received on this Draft EIAR.

10 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

10.1 COMPLIANCE WITH THE PROVISIONS OF SECTIONS 24(4)(A) AND (B) READ WITH SECTION 24(3)(A) AND (7) OF THE NEMA

10.1.1 Impact on the Socio-Economic Conditions of any Directly Affected Person

Refer to Sections 6.5 & 7.4 and Appendices 15 & 17.

10.1.2 Impact on any National Estate referred to in Section 3(2) of the NHRA

Refer to Section 6.4 and Appendices 10 & 11.

10.2 OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

This report adheres to the requirements stipulated in the NEMA and the recently published EIA Regulations, 2014 (as amended). The DMRE guidelines were used as framework.

10.2.1 Period for which Environmental Authorisation is required

Environmental Authorisation is required for a minimum of 30 years.

10.2.2 Undertaking

The undertaking required to meet the requirements of the EIAR is provided at the end of the EMPr.

10.2.3 Financial Provision

Refer to the Rehabilitation, Decommissioning and Closure Plan (Appendix 19).

11 APPENDICES

Appendix 1	Public Participation Report and Records	
Appendix 2	Curriculum Vitae – EAP	
Appendix 3	Soil and Land Capability Assessment	Scientific Aquatic Services
Appendix 4	Hydropedological Assessment	Scientific Aquatic Services
Appendix 5	Faunal, Floral and Freshwater Assessment	Scientific Aquatic Services
Appendix 6	Baseline Water Quality Assessment	Scientific Aquatic Services
Appendix 7	Geohydrological Investigation	Groundwater Complete
Appendix 8	Air Quality Impact Assessment	EBS Advisory
Appendix 9	Environmental Noise Impact Assessment	Enviro Acoustic Research
Appendix 10	Phase 1 Heritage Impact Assessment	R&R Cultural Resource Consultants
Appendix 11	Desktop Palaeontological Assessment	ASG Geo Consultants (Pty) Ltd {Dr Gideon Groenewald}
Appendix 12	Blast Impact Assessment	Blast Management & Consulting
Appendix 13	Visual Impact Assessment	Scientific Aquatic Services
Appendix 14	Traffic Impact Assessment	Avzcons Civil Engineering Consultant
Appendix 15	Social Impact Assessment	Diphororo Development
Appendix 16	Hazard Identification and Risk Assessment	AirCheck Occupational Health, Environmental & Training Services
Appendix 17	Land Trade-off Study and Macro-Economic Impact Analysis	Mosaka Economic Consultants
Appendix 18	Surface Water Management Plan – Design Development Report	Onno Fortuin Consulting
Appendix 19	Rehabilitation, Decommissioning and Closure Plan	Jacana Environmentals
Appendix 20	Ambient Monitoring Report	Rayten Engineering Solutions
Appendix 21	Greenhouse Gas Emissions Statement	EBS Advisory
Appendix 22	Poultry Impact Statement	C4 Africa
Appendix 23	Human Health Risk Assessment	MA Oosthuizen
Appendix 24	DEA Screening Report	
Appendix 25	Site Maps and Plans	