BASIC ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED SECTION 102 APPLICATION FOR THE AMENDMENT OF THE MINING RIGHT OF WITKOP FLUORSPAR (PTY)LTD, BRITS QUARRY ON PORTION 95 (A PORTION OF PORTION 5) OF THE FARM ZANDFONTEIN 447JQ, MAGISTERIAL DISTRICT BRITS, NORTH WEST PROVINCE.

DMR REF. NW30/5/1/2/2/441MR

Submitted to:
Department of Mineral Resources
Gauteng Region
Johannesburg

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

BASIC ASSESSMENT REPORT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

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: Witkop Fluorspar Mine (Pty) Ltd, Brits Quarry

Contact Person: Mr. Johan Heyl

TEL NO: 082 492 7696

FAX NO: 086 660 7687

POSTAL ADDRESS: P. O. Box 1451, Brits, 0250

PHYSICAL ADDRESS: Remaining Extent of Portion 95 (a portion of portion 5), and a portion of portion 129, of the farm Zandfontein 447 JQ, R104 Rustenburg Road, Brits district

FILE REFERENCE NUMBER SAMRAD:

- **NW30/5/1/2/2/441MR**

DOCUMENT CONTROL	
Document Title	BASIC ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED SECTION 102 APPLICATION FOR THE WITKOP FLUORSPAR (PTY) LTD, BRITS QUARRY ON PORTION 95 (A PORTION OF PORTION 5) OF THE FARM ZANDFONTEIN 447JQ, MAGESTERIAL DISTRICT BRITS, NORTH WEST PROVINCE.
Report Number	NEMA BA-REP- Witkop Fluorspar 102
Version	**DRAFT FOR PUBLIC REVIEW**
Date	Nov 2021
Submitted to	Contact Person: Johan Meyer Position: Mine Manager Email: johan.meyer@sallies.co.za
Distribution	1X Witkop Fluorspar (Pty) Ltd 1X Retief Environmental 3X Department of Mineral Resources (Gauteng Region)
QUALITY CONTROL	
	Originated By
Name	Corrie Retief
Designation	Environmental Assessment Practitioner
Signature	
Date	2021/09/15
DISCLAIMER	

EXECUTIVE SUMMARY

Retief Environmental as independent environmental consultant was appointed by Witkop Fluorspar (Pty) Ltd (hereafter referred to as Witkop Fluorspar (Pty) Ltd, Brits Quarry) to undertake the Environmental Authorisation and Section 102 Application process for the Witkop Fluorspar (Pty) Ltd, Brits Quarry. Witkop Fluorspar (Pty) Ltd, Brits Quarry in a process to update its mine planning for the next 20 years. The aim of Witkop Fluorspar (Pty) Ltd, Brits Quarry is to decrease its current mining area and to add a small strip of property to be mined on the western side of the existing mining area. The current mining area will be mined with a view to be rehabilitated and the additional new area will then be mined whereafter this new additional area will be rehabilitated and closed. The affected properties include the following:

RIGHT NUMBER	Properties
NW30/5/1/2/2/441MR	A Portion of Portion 95
This Amendment Application to Include	A Portion of Portion 129

Legislative Requirements

The most important legislation applicable to the proposed project are listed below:

- **National Environmental Management Act (No. 107 of 1998) [as amended]**
  Section 28: Duty of Care and responsibilities to minimise and remediate environmental degradation.
- **EIA Regulations, 2014 (Government Notices 982) [as amended]**
  The EIA regulations prescribe the manner and content of the Basic Assessment and Public Participation Processes to be followed.
- **Minerals and Petroleum Resources Development Act (Act No. 28 of 2002) [as amended]**
  In order to apply for a mining right, an application was submitted on the Department of Mineral Resources' SAMRAD online application system.

Need and Desirability

As described in the Needs and Desirability section of this report, the proposed extension, although not perfectly aligned with the objectives of the municipal Spatial Development Framework (SDF), it will not compromise the integrity of these respective forward planning documents. Unemployment within the Madibeng Municipality is high, according to the SDF of Madibeng Municipality. The Witkop Fluorspar (Pty) Ltd, Brits Quarry operations will have a positive impact on the socio-

economic conditions of the local communities involved, should the results of the mining show that feasible reserves are present to mine and a mining right is applied for.

The approval of this Section 102 application will not compromise the integrity of the existing environmental management priorities of the area as defined in the SDF, provided that sensitive areas as indicated by the specialist are avoided and the mitigation measures as recommended in this report and in the EMPr (refer to Part B of this report), are implemented.

The geology of the area is known for sand resources, and from a mining perspective is ideal for the type of land use. However, in terms of the environment, the location has several sensitive aspects as identified by specialist studies which impacts will be managed by the EMPR.

Prevention and mitigation measures as recommended by the specialists, were included in this Basic Assessment Report (BAR) and the Environmental Management Programme (EMPR) (please refer to Part B) Mitigation Measures (the EMPR section). The implementation of the EMPR will ensure that the environment is affected to the minimum. The potential cumulative impacts were also assessed and found not to be of high significance after mitigation for the mining period.

Alternatives

An assessment of the alternatives was conducted in in this report. The alternatives focused on the amendment application and the no-go alternative.

1. The Amendment Alternative : Reducing current mining site and expanding the mining site by adding a section of property to be mined on the western boundary of the site. This was identified as to not mine further through the Maggaliesberg as the current mining right allows.
2. The No-Go alternative entail the mining of the current mining area through the Maggaliesbeg to the other side. This alyternative would have a significant impact on the visual landscape and on the Maglliesberg protected area.

After assessing the alternative, it was conducted that the amendment application is the best alternative option than the No-Go alternative.

Public Participation

A Public Participation Process is undertaken for the Environmental Authorisation for mining. The process is undertaken to ensure compliance with regard to the requirements in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) [as amended] (MPRDA) and the Environmental Impact Assessment Regulations (2014) [as amended].

Tasks undertaken for the Public Participation Process (PPP):

- Identification of key interested and affected parties (affected and adjacent landowners) and other stakeholders (organs of state and other parties).

Interested and Affected parties (I&APs) representing the following sectors of society has been identified:

- National, provincial and local government.
- Agriculture, including local landowners (affected and adjacent).
- Community Based Organisations.
- Non-Governmental Organisations.
- Water bodies.
- Tourism.
- Industry and mining.
- Commerce; and
- Other stakeholders.

Formal notification of the application to interested and affected parties (including all affected and adjacent landowners) and other stakeholders:

- Publication of media advertisement (English) in the BritsPos on 12 Nov 2021.
- Site notices will be erected on site and at visible locations close to the site on 12 Nov 2021.
- I&AP's and other key stakeholders, who included the above-mentioned sectors, will be directly informed of the proposed development by e-mail on 12 Nov 2021.

I&APs were given 30 days to comment and / or raise issues of concern regarding the proposed development. The commenting period is from 12th of Nov 2021 to 12th of Dec 2021:

- Consultation and correspondence with I&APs and stakeholders.

All I&AP registrations and comments that are received from stakeholders will be formally recorded in the Comments and Responses Report. The Draft BAR and EMPr will be released for a period of 30 days from 12 Nov 2021 to 12 Dec 2021. Hardcopies of the Draft BAR and EMPR will also be submitted to all organs of state and relevant authorities. In addition, copies are placed at the Madibeng Local Library and can be obtained from Retief Environmental on request.

Next phases of the public participation process

All comments received from I&APs and organs of state and responses sent will be included in the final BAR and EMPR to be submitted to the Competent Authority (CA).

Specialist studies

In accordance with the Screening Tool the following specialist studies have been identified. As presented in the Table a number of the specialist studies identified by the Screening tool is not applicable to the site and thus have not been undertaken.

	Study Included	**Existing Study**	**Motivation not to include**
Agriculture Theme			**X**
Animal Species Theme	**X**		
Aquatic Biodiversity Theme			**X**
Archaeological and Cultural Heritage Theme		**X**	
Civil Aviation Theme			**X**
Paleontological Theme			**X**
Plant Species Theme	**X**		
Terrestrial Biodiversity Theme	**X**		
Additional Studies			
Rehabilitation Plan		**X**	
Closure Plan and Cost Assessment – GN 1147	**X**		

The main objective of the specialist studies is to provide independent scientifically sound information on issues of concern relating to the project proposal.

The findings and recommendations identified by the various specialist studies undertaken, were incorporated into the Basic Impact Assessment.

- **<u>Ecological and Biodiversity Assessment</u>**

When viewed in the larger context, the study site forms part of a very important conservation corridor and the Magaliesberg Protected Environment, also overlapping with the Magaliesberg Important Bird and Biodiversity Area (IBA). The southern section of the study site is also classed as Critical Biodiversity Area 2 (CBA2). The following was found for the fauna and flora assessment:

The Marula Tree (*Sclerocarya birrea*), a Protected Tree species of South Africa, was recorded on site. Though not threatened, *Sclerocarya birrea* is a protected tree species under the National Forests Act No. 84 of 1998. In terms of a part of section 51(1) of Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister. Several Alien and Invasive Vegetation Species were recorded on site, especially in disturbed areas and the areas surrounding the Pollution Control Dam. Several avifaunal species protected under the

Threatened and Protected Species list (ToPS, 2013), which is enforceable under the National Environmental Management: Biodiversity Act, 2004, is likely to occur on site. All Amphibian and reptile species are of Least Concern (LC), except for the Giant Bullfrog (*Pyxicephalus adspersus*) and the African Rock Python (*Python natalensis*) which is of special conservation concern according to the North-West Biodiversity Sector Plan (2015) and protected under NEMBA.

Overall, the area should be regarded as moderate sensitivity. It is however unlikely that there will be a loss of flora or faunal species of known conservation concern if the site is developed, and proper mitigation measures are implemented. Various potential negative impacts are associated with the activities and are discussed in the impact assessment scores derived according to the amended EIA Regulations (2017).

- **Cultural heritage desktop assessment**

Although there was no archaeological material that was noted within the proposed area, an informal graveyard was noted, this graveyard is on the buffer zone. If not harnessed, it can be endangered by the proposed development. Conversely, it is important to note that, it is close to an informal road. Thus, the informal road, is about -60cm from the graves. If one considers that Meyers (2012) espoused that over time the original context of the burial will change, and as the body decomposes it will shift its position under the ground. It is possible that the informal road might be transverse on the content of the grave, though unintentional. The coordinates for the noted graves: S25°72969; E27°79085.

From an archaeological and cultural heritage resources perspective, we have no objections to the proposed project, as such we recommend South African Heritage Resource Agency (SAHRA) to approve the project to proceed with the suggested mitigation measure.

- **Rehabilitation Plan and Closure Plan**

The current mining area will be mined with a view to close. The current section will be mined up to the same level as the stormwater dam that is adjacent to the site. On completion of mining the current section will be flooded and an artificial dam will be created, Slopes will be profiled and covered with the stored topsoil on site. The slopes will be revegetated with indigenous plant species. Designs will be submitted of the old mining area and proposed rehabilitated layout 180 days before the start of rehabilitation works. This area is characterised by higher, steeper slopes and some vertical rock faces due to quarrying activities. Therefore, geotechnical stability, soil erosion and visual mitigation are very important. The existing. Rehabilitation Plan deals extensively with these issues, however, the following should receive special attention:

- Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable fencing or a strong wall/bund structure to prevent people or animals from falling down.

- Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations.
- Placement of stored topsoil on rehabilitated areas where possible.
- Utilise the lowest area with the current stormwater dam as an artificial dam. This dam can be stocked with local species of fish.
- Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column titled "Suitability to rehabilitate higher, steeper areas" in the table below to identify species most suitable for this specific area and purposes.
- Visual, dust and sound screening on lower, less steep areas Larger and structurally denser trees needs to be planted on the lower parts of the site to provide direct visual, dust and sound screening. The northern, eastern, western and central parts of the existing Mining Right area to be rehabilitated, and in future the entire newly proposed Mining Right expansion area, needs to be rehabilitated this way. Use the second last column titled "Suitability to rehabilitate lower, less steep areas" in the table below to identify species most suitable for this specific area.
- Visual, dust and sound screening along the site boundary using a tree corridor There is a need to plant a tree corridor (boundary planting or hedgerow) along the lower, more visible parts of the site. Such a corridor of trees, even if just two trees wide on average, could play a very important role in visual, dust and noise mitigation. Use the last column titled "Suitability to use in boundary planting / tree corridor" in the table below to identify species most suitable for this specific area.

Reasoned Opinion of the EAP

Based on the findings of the basic impact assessment, the EAP is of the opinion that the proposed amendment be approved, due to the potential positive social and economic impacts it will have on the local and regional communities and the short term, temporary and local impacts associated with mining. The potential negative impacts can be mitigated to levels of low and very low significance, provided that the mitigation measures are strictly implemented and monitored. It is, however, recommended, that the sensitive areas as identified by the specialist studies and as indicted in the sensitivity map must be excluded from the mining activities, due to the sensitive nature of the habitat and the potential impact on biodiversity. The remaining portions may be utilised for mining purposes provided, that all the recommendations of the specialists and mitigation measures provided in the Environmental Management Programme (PART B of this report) are adhered to.

Recommendations

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through physical measures, the recommendations from the basic assessment report are included within the Environmental Management Programme (EMPr). The EMPr is based on all the information contained within this report as well as all the specialists' reports.

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ABBREVIATIONS

CA	Competent Authority
CBA	Critical Biodiversity Area
CoJ	City of Johannesburg
CoT	City of Tshwane
CSA	Constitution of South Africa (Act No. 108 of 1996)
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DTM	Dimensional Terrain Modelling
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESM	Environmental Site Manager
GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
GEMF	Gauteng Environmental Management Framework
GN	Government Notice
GIS	Geographic Information System
GPS	Global Positioning System
GVA	Gross Value Added
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
Mamsl	Metres above mean sea level
MHSA	Mine Health and Safety Act (Act No. 29 of 1996) [as amended]
MPRDA	Minerals and Petroleum Resources Development Act (Act No. 28 of 2002) (as amended)
NEMA	National Environmental Management Act, 1998 (Act no 107 of 1998) (as amended)
NEMAQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004) (as amended)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMWA	National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)

NHRA	National Heritage Resource Act, 1999 (Act No. 25 of 1999)
NVFFA	National Veld and Forest Fire Act (Act No. 101 of 1998)
NWA	National Water Act, 1998 (Act No. 36 of 1998) (as amended)
PGMs	Platinum Group Metals
PM	Public Meeting
PPE	Personal Protective Equipment
PPP	Public Participation Process
ROM	Run of Mine
RWD	Return Water Dam
SAHRA	South African Heritage Resources Agency
SANS	South African National Standards
SAWS	South African Weather Service
SDF	Spatial Development Framework
SLP	Social and Labour Plan
SM	Site Manager
tpm	tonne per month
VAC	Visual Absorption Capacity

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 a 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 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.

Objective of the basic assessment process

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

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

(b) identify the alternatives considered, including the activity, location, and technology alternatives.

(c) describe the need and desirability of the proposed alternatives,

(d) through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine:

(i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and

(ii) the degree to which these impacts—

(aa) can be reversed.

(bb) may cause irreplaceable loss of resources; and

(cc) can be managed, avoided or mitigated.

(e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—

(i) identify and motivate a preferred site, activity and technology alternative.

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

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

PART A

SCOPE OF ASSESSMENT AND BASIC ASSESSMENT REPORT

1. Contact Person and correspondence address

a) Details of:

i) The EAP who prepared the report

Name of The Practitioner: Corrie Retief

Cell : 0828522134
e-mail address: corrieretief2@gmail.com

Corrie Retief was contracted as an Independent Environmental Practitioner by Witkop Fluorspar (Pty) Ltd, Brits Quarry.

ii) Expertise of the EAP

(1) The qualifications of the EAP

*(With evidence attached as **Appendix 1**)*

- University of South Africa, BA Hons Geography - 2007
- University of South Africa, BA Environmental - 2005
- Registerd EAP with EAPASA
- Pri.Sci.Nat Registerd with SACNASP

(2) Summary of the EAP's past experience.

*(Attach the EAP's curriculum vitae as **Appendix 2**)*

Corrie Retief is an Environmental Scientist with more than 16 years of experience in applying the principles of Integrated Environmental Management, and in applying the Environmental Legislation to a number of development projects and initiatives in Southern Africa. He has co-ordinated and managed a number of diverse projects and programs related to the Environment and Waste within both the public and private sectors for national, multi-national and international companies. His interpersonal and organisational skills have enabled him to efficiently direct these projects from initiation to implementation. Furthermore his training in sustainability and sustainable project delivery has helped him to deliver profitable sustainability into customers operations throughout the asset lifecycle.

A significant element of public participation is required throughout the life cycle of an EIA process. Corrie has successfully liaised with interested and affected parties, ensuring that all communication procedures and dialogues are open and transparent, and that capacity building is conducted where necessary. His proficient report-writing skills have been utilised for the compilation of a wide variety of reports, which include but is not limited to Basic Assessment Reports, Scoping and Environmental Impact Assessment Reports, Environmental Management Plans (Planning, Construction, Operation and Closure), Environmental Audit Reports, Opportunities and Constraints Analyses, Feasibility studies, Waste License Applications, Water-Use Application Reports and Mining Right Applications.

The EAP has experience in the following disciplines:

- Environmental risk assessments;
- Environmental site screening, investigation and evaluations;
- Environmental legal screenings;
- Environmental feasibility studies;
- Environmental impact assessments;
- Basic assessments;
- Environmental compliance auditing;
- Compilation, implementation and monitoring of environmental management plans;
- Waste Management;
- Waste Disposal site selection screenings;
- Waste license applications;
- Water-Use License Applications;
- Mining Right applications; and
- Managing and facilitating public participation.

2. Location of the overall Activity

Table 1: Location of the Overall Activity

Farm Name:	A Portion of Portion 95 of the Farm Zandfontein 447 JQ A Portion of Portion 129 of the Farm Zandfontein 447 JQ	
Mining Right	NW30/5/1/2/2/441MR	
Application area (Ha)	Reduction Area - 6.96 Ha Expansion Area - 5.85Ha	
Magisterial district:	Madibeng District	
Distance and direction from nearest town	10 km south of the town of Brits and 8 km west of the town of Hartbeespoort	
21-digit Surveyor General Code for each farm portion	**Farm Portion**	**SG Code**
	A Portion of Portion 95 of the Farm Zandfontein 447 JQ	T0JQ00000000044700095
	A Portion of Portion 129 of the Farm Zandfontein 447 JQ	T0JQ00000000044700129

3. Locality map

(show nearest town, scale not smaller than 1:250000)

Refer to **Appendix 3** for the locality map.

4. Description of the scope of the proposed overall activity

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site.

(i) Listed and specified activities

Table 2: Listed and specified activities

NAME OF ACTIVITY (All activities including activities not listed)	Aerial extent of the Activity Ha or m²	LISTED ACTIVITY Mark with an X where applicable or affected.	APPLICABLE LISTING NOTICE (*GNR 983, GNR 984 or GNR 985 /NOT LISTED*	WASTE MANAGEMENT AUTHORISATION (Indicate whether an authorisation is required in terms of the Waste Management Act)
OPERATIONAL PHASE				
Decreasing Current Mining Area	6.96 Ha	X	GNR 517 of 11 June 2021 Activity 21D - Any activity including the operation of that activity which requires an amendment or variation to a right or perm it in terms of section 102 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity contained in this Listing Notice or in Listing Notice 3 of 2014, required for such amendment	NOT LISTED
Expansion of Mining are	5.85Ha	X		NOT LISTED
Clearing of vegetation and topsoil on new mining area.	5.85Ha	X	GNR 983 amended by GNR 326 of 7 April 2017 - Listing Notice 1 Activity 27 The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	NOT LISTED

(ii) Description of the activities to be undertaken

(Describe Methodology or technology to be employed, including the type of commodity to be prospected/mined and for a linear activity, a description of the route of the activity)

Background

Witkop Fluorspar (Pty) Ltd, Brits Quarry is applying for an amendment of their existing mining right for the reduction of the current mining area on portion 95 of the Farm Zandfontein 447 JQ and the expansion of the proposed mining area on a section of Portion 102 of the Farm 447 JQ.

The area demarcated for areas for the reduction and expansion is as follow :

Table 3: Property name & coordinates

Property	Portion	Coordinates	Extent (ha)
ZANDFONTEIN 447 JQ	95	**CURRENT MINING AREA (REDUCTION)** C1 S25° 43.667' E27° 47.548' C2 S25° 43.662' E27° 47.624' C3 S25° 43.747' E27° 47.651' C4 S25° 43.766' E27° 47.655' C5 S25° 43.784' E27° 47.656' C6 S25° 43.818' E27° 47.656' C7 S25° 43.911' E27° 47.652' C8 S25° 43.970' E27° 47.587' C9 S25° 43.949' E27° 47.575' C10 S25° 43.666' E27° 47.545'	6.96 Ha
	129	**NEW MINING AREA (EXPANSION)** E1 S25° 43.947' E27° 47.575' E2 S25° 43.654' E27° 47.545' E3 S25° 43.653' E27° 47.440' E4 S25° 43.776' E27° 47.462' E5 S25° 43.790' E27° 47.470' E6 S25° 43.948' E27° 47.574'	5.85Ha

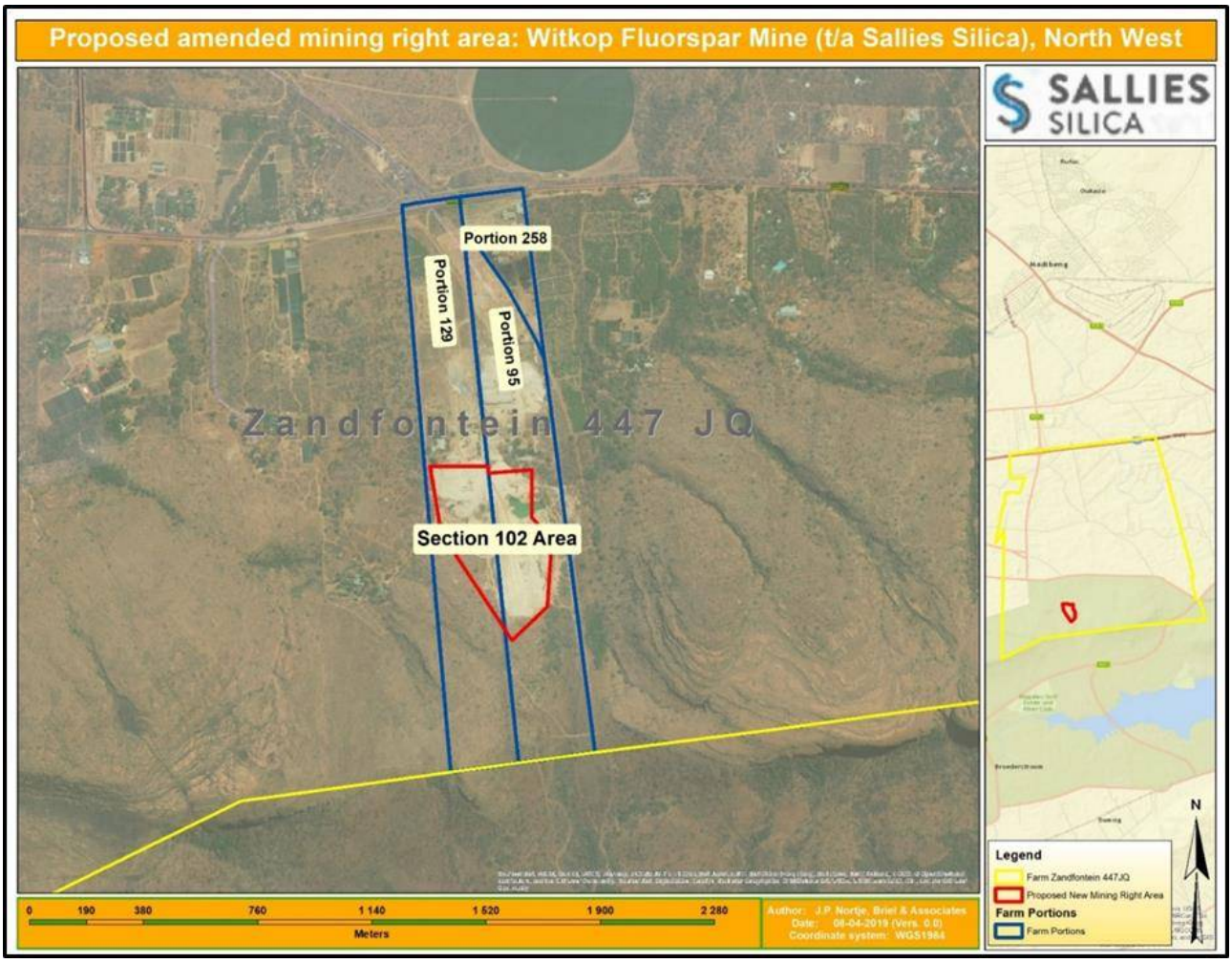


Figure 1: Farm Portions of the Study Area

BASIC OVERVIEW OF ACTIVITIES

CURRENT MINING SITE

MINE DEVELOPMENT, PRODUCTION BUILD-UP & DECLINE

The mine has been in operation since 1975 and therefore no explanation of timeframes is provided to develop the mine and commence with production. This amended Mining Works Programme relates to a Section 102 application in terms of the MPRDA. As soon as the new application is granted, the mine intends to move its existing operation directly west to the new approved mining area and continue with normal mining practices, including stripping and removal of topsoil, storage, and re-use of the same, followed by drilling, blasting, and hauling to remove the quartz mineral. The primary processed material will be transported elsewhere outside of the new mining right area, where further beneficiation will be performed.

PRODUCTION FORECAST

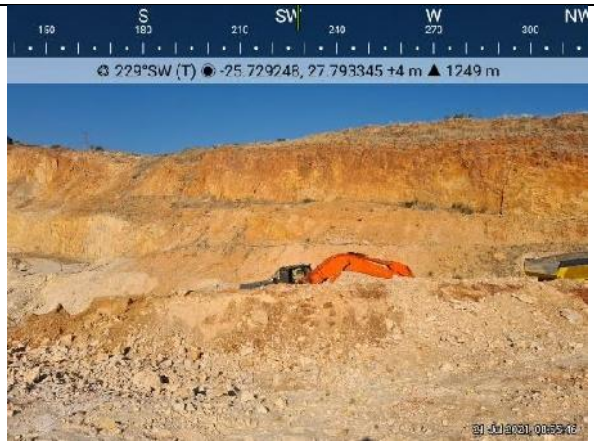
As indicated by the exploration data, the quality of crystalline quartz is expected to be maintained at the current level of >99% as SiO2. The addition of the new portion, co`mbined with the mining activities on the existing portion, will result in stable mine production output and quality for a minimum of another 20 years till 2040. The mine produces an average saleable volume of goods amounting to 19 640 ton per month. Production runs at full capacity during the months of February to November. During December and January, production drops to 50% of output capacity as a result of annual shut-down and plant maintenance.

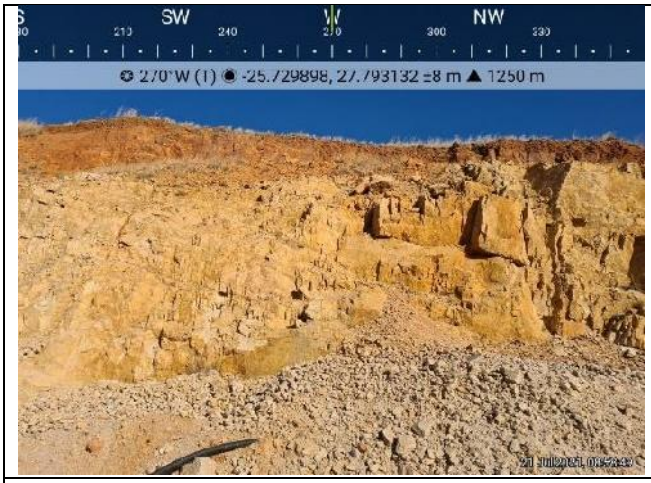
Year	Saleable Tons Total	Tons Graded Silica	Tons Quartz & Aggregates	Revenue Graded Silica	Revenue Quartz & Aggregates	Total Revenue
Y1	216,000	41,853	174,147	R24,306,104	R18,592,708	R42,898,812
Y2	216,000	41,853	174,147	R25,521,409	R19,522,343	R45,043,753
Y3	216,000	41,853	174,147	R26,797,480	R20,498,461	R47,295,940
Y4	216,000	41,853	174,147	R28,137,354	R21,523,384	R49,660,737
Y5	216,000	41,853	174,147	R29,544,221	R22,599,553	R52,143,774
Y6	216,000	41,853	174,147	R31,021,432	R23,729,530	R54,750,963
Y7	216,000	41,853	174,147	R32,572,504	R24,916,007	R57,488,511
Y8	216,000	41,853	174,147	R34,201,129	R26,161,807	R60,362,936
Y9	216,000	41,853	174,147	R35,911,186	R27,469,898	R63,381,083
Y10	216,000	41,853	174,147	R37,706,745	R28,843,392	R66,550,137
Y11	216,000	41,853	174,147	R39,592,082	R30,285,562	R69,877,644
Y12	216,000	41,853	174,147	R41,571,686	R31,799,840	R73,371,527
Y13	216,000	41,853	174,147	R43,650,271	R33,389,832	R77,040,103
Y14	216,000	41,853	174,147	R45,832,784	R35,059,324	R80,892,108
Y15	216,000	41,853	174,147	R48,124,423	R36,812,290	R84,936,713
Y16	216,000	41,853	174,147	R50,530,645	R38,652,904	R89,183,549
Y17	216,000	41,853	174,147	R53,057,177	R40,585,550	R93,642,727
Y18	216,000	41,853	174,147	R55,710,036	R42,614,827	R98,324,863
Y19	216,000	41,853	174,147	R58,495,537	R44,745,569	R103,241,106
Y20	216,000	41,853	174,147	R61,420,314	R46,982,847	R108,403,161
Cumulative	**4,320,000**	**837,064**	**3,482,936**	**R 803,704,520**	**R 614,785,628**	**R 1,418,490,148**

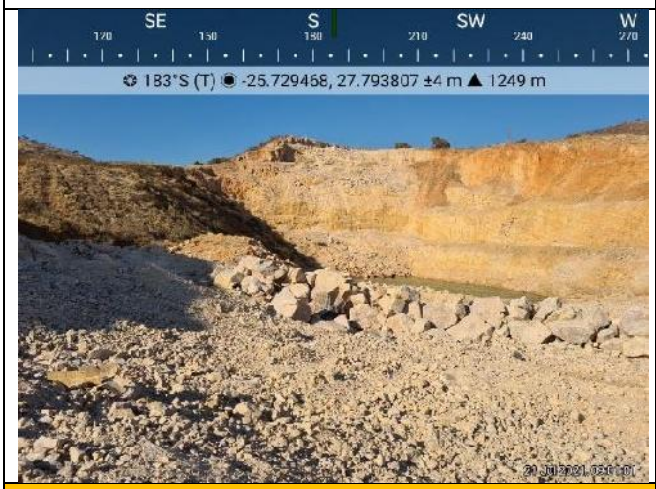
The current Witkop Fluorspar (Pty) Ltd, Brits Quarry is an operational mine that consist of the following infrastructure :

- Mining Area
- Slurry Dam (Quarry 1) / Stormwater Dam
- Crushing and washing Plant
- Offices and Workshops
- Product Stockpile Area
- Plant (Drying and Packaging

CURRENT MINING AREA



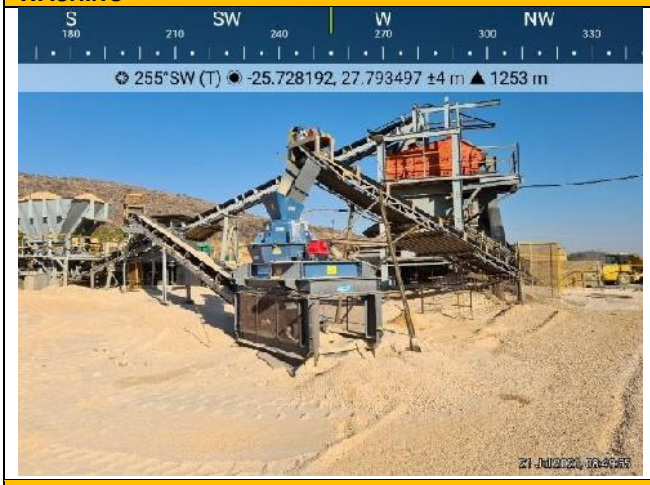




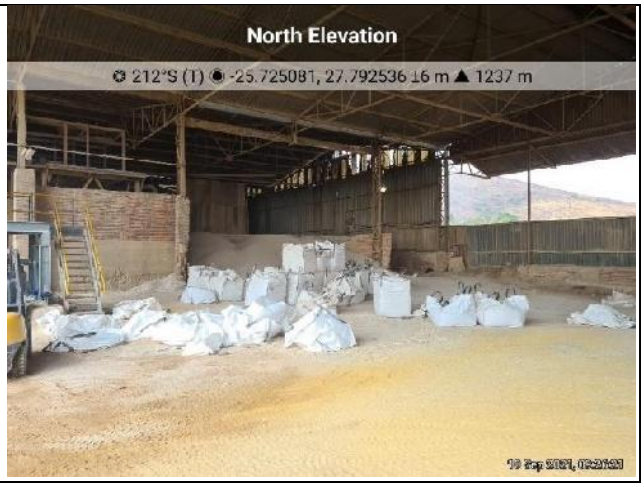
SLURRY DAM/ STORMWATER DAM

STOCKPILE AREA

WASHING **CRUSHING**



PLANT



THE MINING METHOD OF CURRENT AND NEW SECTION

Blasting and related activities take place as part of the removal of the silica. A blast consists of a quantity of explosives placed into a series of blast holes drilled into the rock mass to a seam depth of 10m. A boom-drilling machine is utilized for create the blast hole. The blast hole is created for the full length of the intended blast depth of pull. The burden and spacing dimensions of the blast grid is 3.3M x 3.8M staged pattern. The blast holes are 8.9 cm in diameter.

The series of blast holes are detonated one at a time in a controlled sequence as to control the burden and spacing dimensions between the adjacent holes. Blasting takes place as required, normally once per month and is done by a blasting contractor under the supervision of internally qualified employees. All blasting occurs during daylight hours from 15h30 to 16h30 during weekdays. Blasting is conducted within a 500-meter radius from surface infrastructure as permitted by special blasting authorisation already in place.

Simple opencast mining methods are employed. Mining is conducted in one of two areas in the same pit the opencast method of mining employed by Witkop Fluorspar (Pty) Ltd, Brits Quarry involves opening up the seam and following the seam to a depth of up to 30 meters. Almost no topsoil is available for removal and storage and is removed with the mineral and processed. The silica is excavated and loaded with an excavator and hauled to the primary crusher of the plant. Access to the opencast workings is by way of temporary constructed ramps. Vehicles access the seams directly via these ramps, which progress with the workings along strike. The surface disturbance thus takes place along the seam over a width of 150 metres.

After blasting, the mineral is loaded onto articulated dump trucks by an excavator. Material is then transported by these trucks along a haul road between the pit and the Primary Crusher Plant for further processing.

Run of mine is crushed in a TELSMITH 25” x 36” JAW CRUSHER set at a 90mm gap to reduce the ore fragments lo less than 90mm in size, after which it is fed onto a primary double-deck screen with a 45mm top and 24mm bottom deck. Oversize material is recycled into a 3” SYMONS CONE CRUSHER with a minimum closed-side setting of 34mm to reduce

fragments quantitatively to less than 45 mm. The middle-fraction from the screen i.e., sized at 20 – 40mm material is stockpiled and sold as metallurgical aggregate. The underflow from the screen is fed onto a secondary double-deck screen with a 16mm top and 5mm bottom deck. The fraction above 16mm and the middle-cut i.e., the 5 – 16mm fractions are combined onto a 5 – 20mm stockpile for further processing in the washing section. The crusher sand finer than 5mm is collected on another stockpile and sold as unwashed silica quartz sand.

The 5 – 20mm stockpile of high purity silica quartz proceeds to the washing section where it is fed onto a double-deck screen fitted with a 7mm top and 3.5mm bottom deck. The oversize from the top deck is recycled into an HSI-1006 to reduce all fragments to less than 8mm. The middle-cut from the screen may be stockpiled as a 4 – 9mm product, which finds application in epoxy resins and related construction mortars. However, since the latter is a limited market, the middle-cut is mostly recycled to the HSI together with the oversize fraction to facilitate maximal production output of the <4mm fraction. The underflow from the bottom deck screen is then fed onto a wet double-deck screen fitted with a 3.15mm top and 0.8mm bottom deck. Three washed products are derived from this washing step i.e., a 2 – 5mm washed product from the oversize of the top deck, a 0.8 – 2mm washed product stockpile from the middle-cut and a less than 0.8mm washed powder, collected after a cyclone, which separates the product from the wash water. The 2 – 5mm washed product finds application as filler in the brickmaking and fertilizer industries. The 0.8 – 2mm and <0.8mm washed products are sold off to be further processed in a drying and high-frequency separation and bagging plant outside of the mining area.

Figure 2 below provide an overview of the mining process.

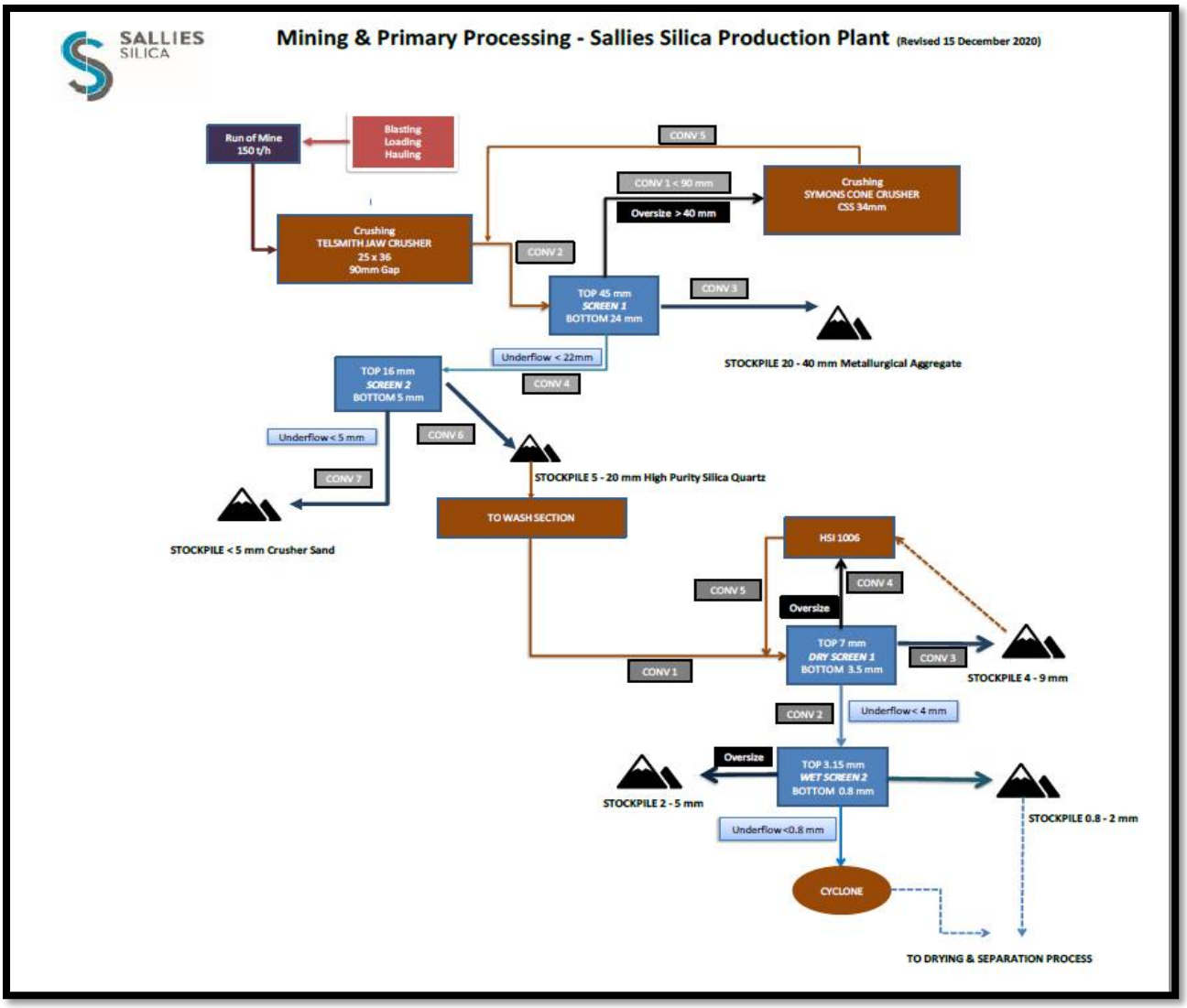


Figure 2: Mining Process

THE PROPOSED EXPANSION SITE

The proposed expansion site is on the western side of the current mining site and is a strip that runs along the current mining site and a powerline. Currently the site is natural veld with an existing road that runs from the bottom to the top of the site.

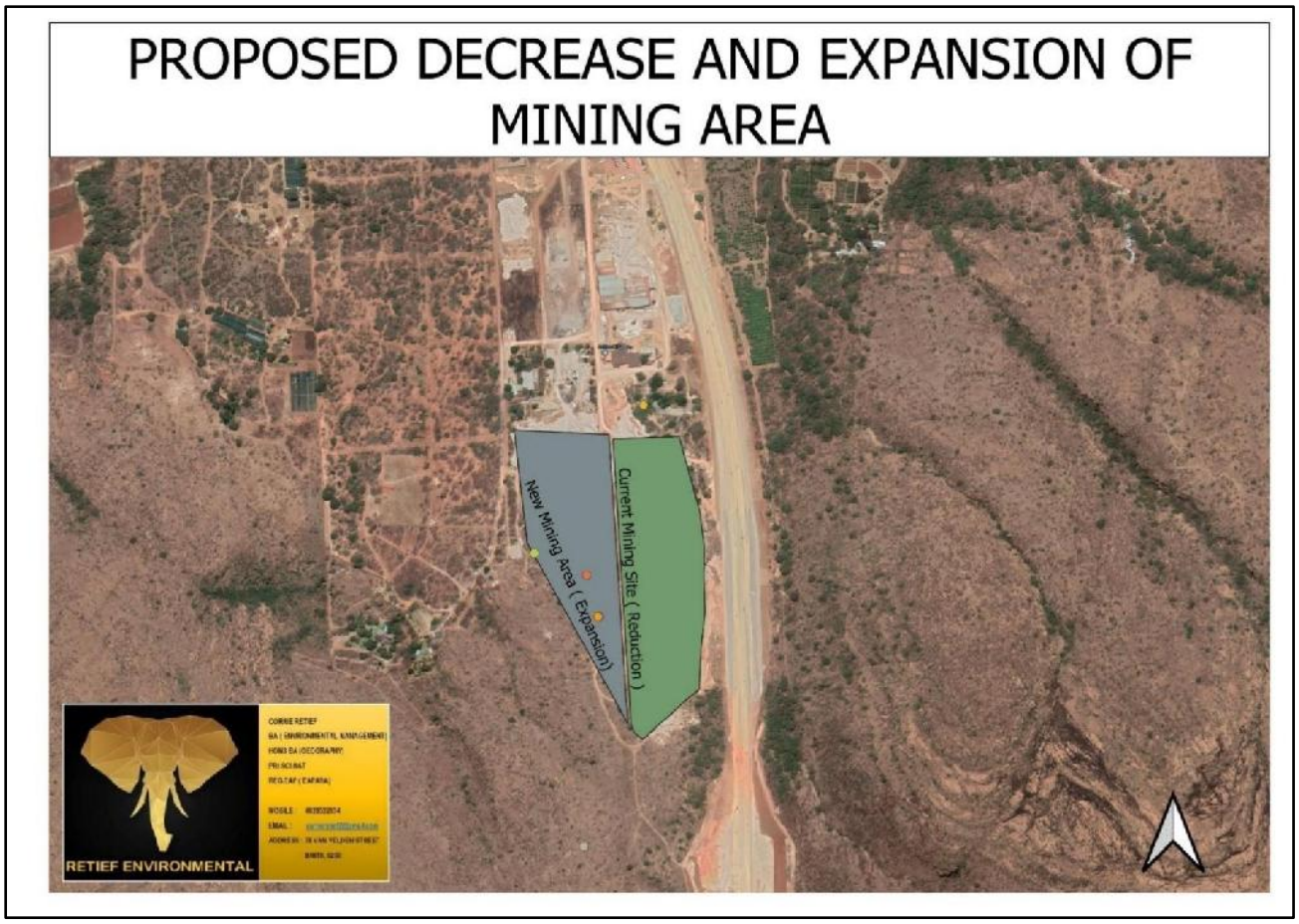


Figure 3: Layout of Current and Expansion Areas

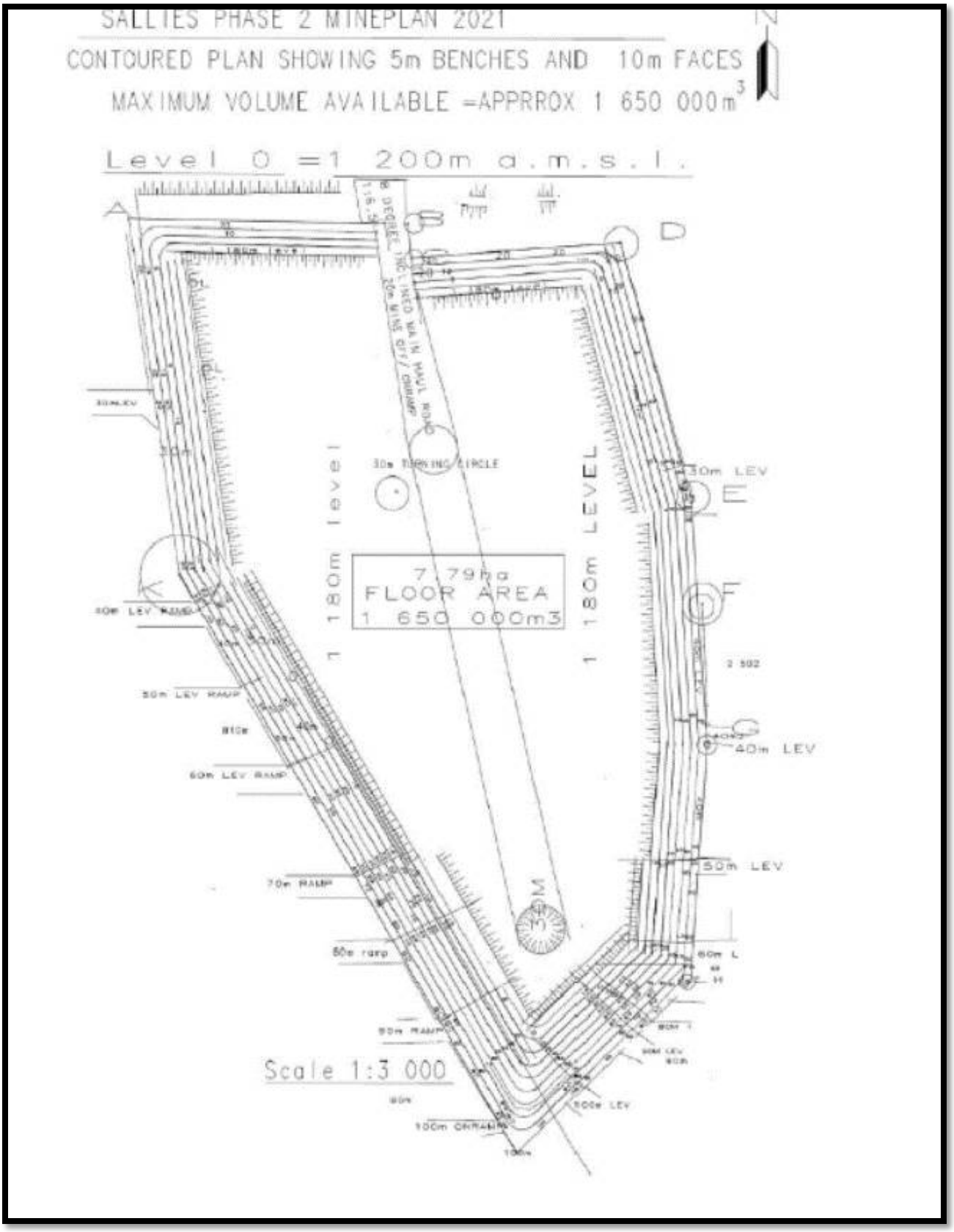
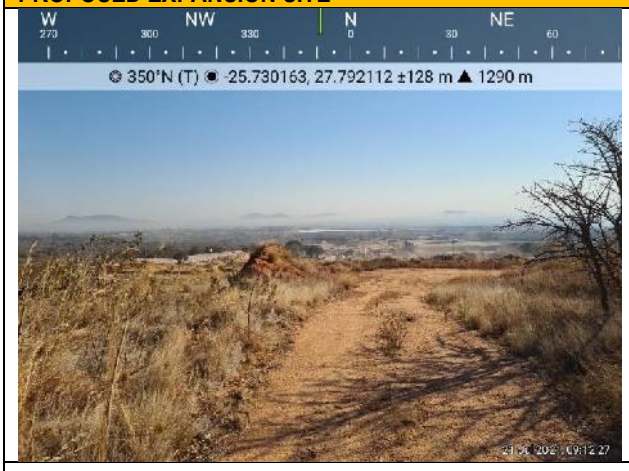


Figure 4 Mine Design

The table below provides photographs of the proposed expansion area

PROPOSED EXPANSION SITE	
	
	
	

THE REHABILITATION METHOD OF CURRENT MINING AREA

The current mining area will be mined with a view to close. The current section will be mined up to the same level as the stormwater dam that is adjacent to the site. On completion of mining the current section will be flooded and an artificial dam will be created, Slopes will be profiled and covered with the stored topsoil on site. The slopes will be revegetated with indigenous plant species. Designs will be submitted of the old mining area and proposed rehabilitated layout 180 days before the start of rehabilitation works. This area is characterised by higher, steeper slopes and some vertical rock faces due to quarrying activities. Therefore, geotechnical stability, soil erosion and visual mitigation are very important. The existing. Rehabilitation Plan deals extensively with these issues; however, the following should receive special attention:

- Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable fencing or a strong wall/bund structure to prevent people or animals from falling down.
- Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations.
- Placement of stored topsoil on rehabilitated areas where possible.
- Utilise the lowest area with the current stormwater dam as an artificial dam. This dam can be stocked with local species of fish.
- Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column titled “Suitability to rehabilitate higher, steeper areas” in the table below to identify species most suitable for this specific area and purposes.
- Visual, dust and sound screening on lower, less steep areas Larger and structurally denser trees needs to be planted on the lower parts of the site to provide direct visual, dust and sound screening. The northern, eastern, western and central parts of the existing Mining Right area to be rehabilitated, and in future the entire newly

proposed Mining Right expansion area, needs to be rehabilitated this way. Use the second last column titled "Suitability to rehabilitate lower, less steep areas" in the table below to identify species most suitable for this specific area.

- Visual, dust and sound screening along the site boundary using a tree corridor There is a need to plant a tree corridor (boundary planting or hedgerow) along the lower, more visible parts of the site. Such a corridor of trees, even if just two trees wide on average, could play a very important role in visual, dust and noise mitigation. Use the last column titled "Suitability to use in boundary planting / tree corridor" in the table below to identify species most suitable for this specific area.

Table 4: Tree and grass species selection matrix

Specie	Is this specie indigenous to this specific vegetation and ecological unit?	Does this specie occur on the site and/or properties directly adjacent to the site in the exact same biophysical conditions, especially soil and aspect?	Succession status	Forage, habitat provision & economic value	Visual, dust and noise screening value (also consider if evergreen)	Soil stabilisation value	Rock stabilisation value	Ease of establishment and care	Suitability to rehabilitate higher, steeper areas	Suitability to rehabilitate lower, less steep areas	Suitability to use in boundary planting / tree corridor
Trees											
Acacia caffra (Common Hook-thorn)	Yes	Yes	Sub-climax	High	Moderate	Low	High	High	High	High	Moderate
Combretum zeyheri (Raasblaar; Large-fruited bush-willow)	Yes	Yes	Sub-climax	Moderate	Moderate	Low	Moderate	High	Moderate	Moderate	High
Englerophytum magalismontanum	Yes	Yes	Sub-climax	High	High	Low	High	High	High	Moderate	Low
Ficus abutilifolia (Large-leaved Rock Fig)	Yes	Yes	Sub-climax	Low	Moderate	Moderate	High	High	High	Moderate	Low
Ficus ingens (Rooiblaarrotsvy; Red-leaved rock fig)	Yes	Yes	Sub-climax	Moderate	High	Low	High	High	High	Moderate	Low
Mimusops zeyheri (Moepel)	Yes	Yes	Sub-climax	High	High	Low	High	High	High	High	High
Pappea capensis (Jacket-plum)	Yes	Yes	Climax	High	High	Low	Moderate	High	Moderate	High	High
Sclerocarya birrea	Yes	Yes	Sub-climax	Moderate	Moderate	Low	Moderate	High	Moderate	Moderate	High
Ximenia caffra (Sourplum)	Yes	Yes	Sub-climax	Moderate	Low	Low	High	High	High	Low	Low
Ziziphus mucronata (Buffalo-thorn)	Yes	Yes	Climax	High	High	Low	Low	High	Low	High	High

Other species including: Acacia karoo; Acacia robusta; Ochna Pulchra; Rhus lancea; Bequaertiodendron magalismontanum; Burkea Africana; Combretum molle	Yes	Only some.	Sub-climax	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Grasses											
Dactyloctenium aegyptium (Common Crowfoot)	Yes	No	Pioneer	Moderate	Low	Low	Low	High	High	High	Low
Dactyloctenium giganteum (Giant Crowfoot)	Yes	No	Pioneer	High	High	High	Low	High	High	High	Low
Cenchrus ciliaris (Foxtail Buffalo	Yes	Yes	Sub-climax	High	High	High	Moderate	High	High	High	Low
Grass)			& climax								
Digitaria eriantha (Common Finger Grass)	Yes	Yes	Sub-climax & climax	High	Low	High	Low	High	Moderate	Moderate	Low
Eragrostis chloromelas	Yes	Yes	Sub-climax & climax	Moderate	Low	Moderate	Low	High	Moderate	Moderate	Low
Heteropogon contortus	Yes	Yes	Sub-climax	Moderate	Low	Low	Low	High	Moderate	Low	Low
Hyparrhenia hirta (Common Thatching Grass)	Yes	Yes	Sub-climax & climax	Moderate	High	High	High	High	High	High	Low
Panicum maximum (Guinea Grass) [prefer more humid microclimates]	Yes	Yes	Sub-climax & climax	High	High	High	Low	High	Moderate	High	Low
Setaria sphacelata var. sphacelata (Common Bristle Grass)	Yes	Yes	Climax	High	Low	High	Low	High	Moderate	High	Low
Themeda triandra	Yes	Yes	Climax	High	Moderate	Moderate	Low	High	Moderate	High	Low
Tragus berteronianus (Carrot-seed Grass)	Yes	Yes	Pioneer	Low	Low	Low	Low	High	High	High	Low
Trichoneura grandiglumis (Small Rolling Grass)	Yes	Yes	Sub-climax	Low	Low	Low	Low	High	High	Moderate	Low
Urochloa mosambicensis (Bushveld Signal Grass)	Yes	Yes	Sub-climax	High	Low	Low	Low	High	Moderate	Moderate	Low

Other: Setaria flabellate; Setaria nigirostris; Eragrostis racemosa; Eragrostis capensis; Eragrostis gummiflua; Aristida aequiglumis; Rhynchelytrum nerviglume; Cymbopogon excavates; Trachypogon spicatus; Tristachya leucotrix; Panicum natalense; Diheteropogon amplectens; Monocyrnbium ceressiiforme; Digitaria monodactyula; Digitaria tricholaedoides.	Yes	No	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies

Initial seeding should contain more pioneer grass species

Pioneer grasses are the first species that should be established because only these species are:

- Adapted to bare soil conditions. (In case sub-climax or climax species are sown too early, they are likely not to grow or if they grow, to die off as soon as unfavourable weather conditions prevail because the soil and other biophysical conditions are not ready yet).
- Capable to prepare soil and other biophysical conditions to become more favourable for more diverse sub-climax and climax species to establish at a later stage. Therefore sequencing, or sowing/planting the mix of different species in the correct order, is important. After an initial planting of pioneer species successfully established, it is needed to do follow up seeding or planting of sub-climax and climax species as discussed next. Use the column titled “Succession status” in the table below to identify lower successive stage (i.e. pioneer and to a lesser extent sub-climax) species.

Follow-up seeding/planting

Even though it may seem that vegetation establishment is going well, it does not necessary mean that the correct species composition is present. To facilitate smooth transfer from an early successive state (i.e. pioneer condition) to a higher successive state (i.e. sub-climax and climax state) it may be needed to do some follow up planting of trees and sowing of grass seeds. The reason is because natural succession where subclimax and climax species will eventually take over, may take too long and if it takes too long, gaps exist for alien invasive plants to establish. Use the column titled “Succession status” in the table below to identify higher successive stage (i.e. climax and to a lesser extent sub-climax) species

Use of a properly diverse mix of species

Each batch of seeding or planting material should contain a diverse mix of species to reduce risk of vegetation establishment failure. As mentioned above, initial sowings/plantings should contain more pioneer and less subclimax and even less climax species while follow-up sowings/plantings should contain more sub-climax and climax species and less pioneer species. Species that occupies a variety of niche conditions, tolerate various levels of draught or cold spells etc, should be included in each sowing/planting.

There is a need to make use of more trees in rehabilitation work because well selected tree species will perform better in terms of dust, noise and visual screening, will stabilise slopes better with its more extensive root system, and will provide for a more diverse wildlife habitat. However, over-use of trees should also be avoided since grasses play an important role in early succession stage stabilisation of soil. As a general guide, keep the ratio of tree cover to grass cover the same as in adjacent undisturbed natural vegetation.

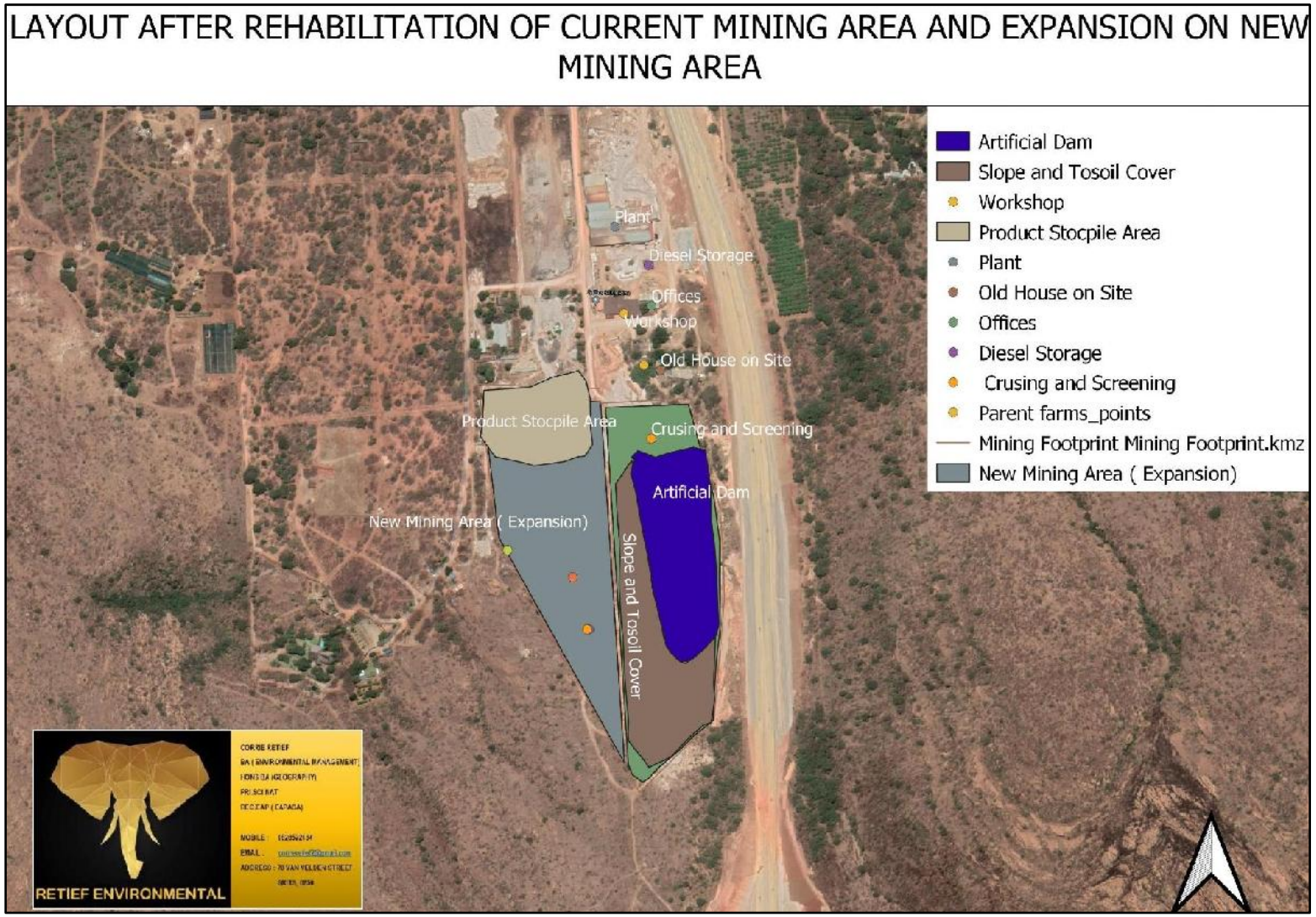


Figure 5: Representation of mine layout after rehabilitation of current site and expansion.

5. Existing Authorisations

A water use licence was approved on 18-09-2018 for Portions 95 of the Farm Zandfontein 447 JQ (Licence No: 07/A21J/AGJ/7962) and a Mining Right was issued on 09-10-2012 for Portion 95 (a Portion of Portion 5) of the Farm Zandfontein 447 JQ (NW30/5/2/2/441MR). This mining right was ceded from the previous owner to Witkop Fluorspar (Pty) Ltd (t/a Witkop Fluorspar (Pty) Ltd, Brits Quarry) on 30-11-2018 (Ref. No: NW-00086-MR/11). Existing mining right is attached **Appendix 4**

6. Policy and Legislative Context

Table 5: Policy and Legislative Context

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)*	**REFERENCE WHERE APPLIED**
Constitution of South Africa, 1996 (Act No. 108 of 1996) [as amended] • *Section 24* *Environment. -Everyone has the right-* *(a) to an environment that is not harmful to their health or well-being; and* *(b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that-* *i) prevent pollution and ecological degradation.* *ii) promote conservation; and* *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*	The proposed activity has the potential to harm the environment and poses a risk to the health and wellbeing of people. The Applicant has the overall responsibility to ensure that the rights of people in terms of Section 24 of the Constitution is protected in terms of the proposed prospecting activity.
National Environmental Management Act (No. 107 of 1998) [as amended] • *Section 24* *Environmental Authorisations* • *Section 28 (1)* *Duty of Care and responsibilities to minimise and remediate environmental degradation.*	The proposed activity is a listed activity in terms of the EIA Regulations and requires environmental authorisation. Overall responsibility of the mining rests with the Applicant, especially in terms of liabilities associated with the operational phase.
EIA Regulations, 2014 (Government Notices 982 and 984) [as amended in 2021] *Chapter 2: Timeframes for EIA processes* *Chapter 3: Duties of proponent*	The EIA Regulations, 2014 [as amended] prescribes *inter alia*: the manner in which public participation needs to be conducted as well as the requirements of a basic assessment process and content

<table>
<tr><th>APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT
(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)</th><th>REFERENCE WHERE APPLIED</th></tr>
<tr><td>Chapter 4: Application for Environmental Authorisation: Part 2: Basic Assessment
Part 4: Environmental Authorisation
Chapter 6: Regulation 39 to 44: Public Participation
Appendix 1: Basic Assessment Report
Appendix 4: Environmental Management Programme
Appendix 6: Specialist Reports</td><td>of a basic assessment report, Environmental Management Programme and specialist reports.</td></tr>
<tr><td>Screening Tool
On 5 July 2019, the Minister of Environmental Forestry and Fisheries published a notice requiring that when submitting an application for environmental authorisation in terms of regulation 19 and 21 of the Environmental impact Assessment Regulations, 2014 (as amended) (the EIA regulations), the applicant must submit the report generated by the National Web Base Screening Tool (“The Screening Tool”) with the application.</td><td>In accordance with the Screening tool the following sensitivities was identified:
Agriculture Theme – Very High Sensitive
Animal Species Theme – High Sensitive
Aquatic Biodiversity Theme - Very High Sensitive
Archaeological and Cultural Heritage Theme - High Sensitive
Civil Aviation Theme - High Sensitive
Paleontological Theme - Very High Sensitive
Plant Species Theme – Medium Sensitivity
Terrestrial Biodiversity Theme - Very High Sensitive
The Screening Report is attached as Appendix 5
<table><tr><th></th><th>Study Included</th><th>Existing Study</th><th>Motivation not to include</th></tr><tr><td>Agriculture Theme</td><td></td><td></td><td>X</td></tr><tr><td>Animal Species Theme</td><td>X</td><td></td><td></td></tr><tr><td>Aquatic Biodiversity Theme</td><td></td><td></td><td>X</td></tr></table></td></tr>
</table>

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)*	**REFERENCE WHERE APPLIED**
	Archaeological and Cultural Heritage Theme: X Civil Aviation Theme: X Paleontological Theme: X Plant Species Theme: X Terrestrial Biodiversity Theme: X **Additional Studies** Rehabilitation Plan: X Closure Plan and Cost Assessment – GN 1147: X
Mineral and Petroleum Resources Development Act, 2002 (Act. 28 of 2002) [as amended]: *Chapter 2 (5): Legal nature of a prospecting right;* *Chapter 4: Mineral and Environmental Regulation* *(9) Order of processing of applications* *(10) Consultation with Interested and Affected Parties;* *(16 – 19) Prospecting right application.* *(37) Environmental Management Principles*	The application is for an amendment to an existing right and therefore all regulations pertaining to the Section 102 application process and environmental management is application to this application.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) [as amended] • *Section 16* *General duty in respect of waste management.* • *Section 17.* *Reduction, re-use, recycling and recovery of waste.* • *Section 21*	The mining activities will produce general and hazardous waste which need to be managed and disposed of according to best practices such as recycling, safe storage, etc.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)*	**REFERENCE WHERE APPLIED**
General requirements for storage of hazardous and general waste.	
National Water Act, 1998 (Act No. 36 of 1998) [as amended] • *Section 3* *Regulation of flow and control of all water* • *Section 19* *Prevention of pollution to watercourses*	Stormwater need to be managed properly in order to achieve prevention of pollution and hazards.
Mine Health and Safety Act, 1996 (Act No. 29 of 1996) [as amended] and associated regulations • *Chapter 2, Sections 2 – 4* *Responsibilities of owner* • *Chapter 2, Sections 5 – 13* *Responsibilities of manager.* • *Chapter 2, Sections 14 – 18.* *Documentation requirements.* • *Chapter 2, Section 19 – 20 and 22 to 24* *Employee's rights and duties; and* • *Chapter 2, Section 21* *Manufacturers and supplier's duty for health and safety*.	The development activities will create an environment that may not be safe and healthy for workers on and visitors to the site. The act provides for measures to prevent threats to the health and safety of humans in the development area.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) • *Section 38* *Statutory Comments to be obtained from the South African Heritage Resources Agency (SAHRA)* • *Section 44 (1).* *Preservation and protection of heritage resources.* • *Section 3 Types and ranges of heritage resources (i) (i).* *Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens*.	Protection of indigenous heritage resources that may potentially occur on the property. A cultural heritage desktop assessment was conducted in 2013 by Holistic Environmental Services. The specialist concluded that no archaeological or heritage sites will be impacted by the development. Only one site of archaeological significance was found but it is out of proposed expansion site boundary. Comments to be obtained from SAHRA on the Draft BAR and EMPr and cultural heritage desktop assessment.
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) [as amended] • *Section 32* *Control of dust* • *Section 34* *Control of noise*	Impacts on surrounding landowners need to be managed through dust and noise monitoring and mitigation measures.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)*	**REFERENCE WHERE APPLIED**
National Dust Control Regulations, 2013 (Government Notice 827 of 2013) • *Section 3* *Dust fall standard* • *Section 4* *Dust falls monitoring program* • *Section 6* *Measures for control of dust* • *Section 7* *Ambient air quality monitoring (PM10)* • *Section 8* *Offences* • *Section 9* *Penalties*	Dust fallout need to be monitored in accordance to the standards set out in the monitoring programme with the specified measures. This is a result of the Applicant being liable to offences and penalties associated with non-conformance to dust which may influence employees and surrounding landowners.
Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) [as amended] • *Section 12 (1)* *Duty of the landowner to prevent fire from spreading to neighbouring properties.*	Cautionary steps in avoiding the spread of fires to and from neighbouring properties.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) [as amended] • *Section 9* *Norms and standards* • *Section 27* *Delegation of power and duties* • *Section 30* *Financial accountability* • *Section 43* *Biodiversity management plans.*	Indigenous vegetation need to be protected and managed in accordance with management measures set out in the management plans developed for the proposed activity. The Applicant need to ensure he is aware of and covers his liabilities.
(Government Notice 609 of 2017) Notice of the List of Protected Tree Species under the National Forests Act, 1998 (Act No. 84 of 1998).	It is the responsibility of the Applicant to avoid unnecessary removal of protected tree species. Should protected tree species need to be removed, a permit must be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF).
Alien and Invasive Species Regulations (Government Notice 598 of 2014) and Alien and Invasive Species List, 2016 in terms of NEMBA (Government Notice 864 of 2016)	It is the responsibility of the Applicant to ensure that all prohibited plant and animal species are eradicated as far as possible.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)*	**REFERENCE WHERE APPLIED**
• *Notice 2* *Exempted Alien Species in terms of Section 66 (1)* • *Notice 3* *National Lists of Invasive Species in terms of Section 70(1) – List 1, 3-6 8 & 11* • *Notice 4* *Prohibited Alien Species in terms of Section 67 (1) – List 1, 3-6, 9 & 12*	
Conservation of Agricultural Resources Act (no. 43 of 1983) • *Section 5* *Prohibition of spreading of weeds* • *Section 12* *Maintenance of soil conservation works and maintenance of certain states of affairs* • *Section 16* *Regional Conservation Committees*	Listed invader/alien plants occurring on site which requires management measures to be implemented to strive to maintain the status quo environment, especially through the guidelines provided by the Regional Conservation Committee.
Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] • *Section 2* *Declaration of grouped hazardous substances.* • *Section 4* *Licensing.* • *Section 16* *Liability of employer or principle* • *Section 9 (1)* *Storage and handling of hazardous chemical substances* • *Section 18* *Offences*	The Applicant must ensure the safety of people working with hazardous chemicals (specifically fuels), as well as safe storage, use and disposal of containers during the on-site operational phase together with the associated liability should non-compliance be at the order of the day.
Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) • *Section 4* *Duties of persons who may be exposed to hazardous chemical substances* • *Section 9A (1)* *Penalties*	Hazardous substances will be stored and utilised on the site and non-compliance to management measures will result in prosecution of the Applicant in terms of his liabilities to the socio-economic environment.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)*	**REFERENCE WHERE APPLIED**
NEMA: Government Notice. 805 Companion Guideline on the Implantation of the Environmental Impact Assessment Regulations, 2010, October 2012.	The application for Environmental Authorisation is submitted in terms of the EIA Regulations.
NEMA: GN. 807 Public Participation Guideline, October 2012	Consultation with Interested and Affected Parties and Communities.
Public Participation guideline in terms of NEMA EIA Regulations, Department of Environmental Affairs, 2017	This guideline has informed the public participation process for the project. Public Participation for the project has been undertaken in terms of the guideline and other relevant requirements.
Guideline on the Need and Desirability, Department of Environmental Affairs, 2017	This guideline has been taken into account as part of project planning. The 2017 Guideline has been used within this process. The Need and Desirability of the project is motivated based on the requirements of the guideline.
National Development Plan 2030 (2012)	Land uses
National Framework for Sustainable Development (2008)	Land uses
National Strategy for Sustainable Development and Action Plan 2011 – 2014 (NSSD 1) (2011)	Land uses
Madibeng Local Municipality (SDF)	Land uses
Department of Mineral Resources Guidelines for the compilation of a Scoping Report with due regard to consultation with communities and Interested and Affected Parties.	Consultation with Interested and Affected Parties and Communities.
Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector (2013) (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute.	The Guideline provides guidance on the impacts on biodiversity typically associated with mining as well as mitigation measures and strategies. The guideline is taken into consideration in this EIA and the development of the Environmental Management Programme.
Magaliesberg Biosphere Proposed Management Plan	Guidelines for activities and land uses within the biosphere.
Magaliesberg Protected Environment: Environmental Management Framework and Plan	Guidelines for activities and land uses within the biosphere.
SANS 10103:2008 The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication.	Impacts on surrounding landowners need to be managed through noise mitigation measures.
SANS 1929: Ambient Air Quality – Limits for Common Pollutants	Impacts on surrounding landowners need to be managed through dust mitigation measures.
SANS 1137: Standard test method for the collection and measurement of dust fall (settleable particulate matter).	Impacts on surrounding landowners need to be managed through dust mitigation measures.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)*	**REFERENCE WHERE APPLIED**
SANS 10234: 2008 Globally Harmonised Systems of classification and labelling of chemicals (GHS) Government Notice 634. August 2013: Waste Classification	All dangerous goods on site need to be managed according to these standards.
SANS 10228:2006 The Identification and Classification of Dangerous Goods for Transport	All dangerous goods to be transported to and from the site need to be managed according to these standards.
ASTM d 1739, 1970 or equivalent approved protocol for dust monitoring.	Impacts on surrounding landowners need to be managed through dust mitigation measures.
All other relevant national, provincial, district and local municipality legislation and guidelines that may be applicable to the application.	

7. Need and desirability of the proposed activities

(Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location).

According to DEA (2017), Guideline on Need and Desirability, Department of Environmental Affairs, to describe the need for a development, it must be determined whether it is the right time for locating the type of land use and/or activity being proposed. To describe the desirability for a development, it must be determined, whether it is the right place for locating the type of land use and/or activity being proposed. Need and desirability can be equated to the concept of wise use of land which can be determined through asking the question: "what is the most sustainable use of land?"

Considering the above, the need and desirability of an application must be addressed separately and in detail answering inter alia the questions as indicated in Table 6.

Table 6: Need and desirability considerations

Securing ecological sustainable development and use of natural resources		
1. 1.1	How will this development (and its separate elements/aspects) impact on the ecological integrity of the area? How were the following ecological integrity considerations taken into account? 1.1.1 Threatened Ecosystems, 1.1.2 Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure, 1.1.3 Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs"), 1.1.4 Conservation targets, 1.1.5 Ecological drivers of the ecosystem, 1.1.6 Environmental Management Framework, 1.1.7 Spatial Development Framework, and 1.1.8 Global and international responsibilities relating to the environment (e.g., RAMSAR sites, Climate Change, etc.).	Threatened Ecosystems Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver et al. 2011). Datasets have been developed by SANBI (2016) in order to outline threatened ecosystems, with the primary objective of limiting the rate of ecosystem extinctions. Four established categories group these ecosystems namely: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Protected. No threatened ecosystems overlap with the study site (NBA 2018). **Protected Areas** Formally protected areas are protected either by national or provincial legislation. Based on the SANBI (2010) Protected Areas Map and the North-West Biodiversity Sector Plan (2015), the southern section of the study site overlaps with the formally protected Magaliesberg Protected Natural Environment which forms one of the core zones of the Magaliesberg Biosphere .It is a declared formal protected area under the National Environmental Management Protected Areas Act, 2003. Environmental Impact Assessment The southern section of the study site is classed as Critical Biodiversity Area 2 (CBA2) in terms of the NWBSP. This is possibly due to the site overlapping with the Magaliesberg Protected Natural Environment and the Magaliesberg IBA. The study site overlaps with the Magaliesberg IBA , previously known as the Magaliesberg and Witwatersberg IBA, this IBA consists mainly of the Magaliesberg range, which extends in an arc from just north-west of Rustenburg in the west to the N1 in the east near Pretoria. To the south, the Witwatersberg range runs parallel to the Magaliesberg, extending from the town of Magaliesberg in the west to Hartbeespoort Dam in the east. The most important trigger species in the IBA is the globally threatened Cape Vulture. The number of breeding pairs in the Skeerpoort colony seems to be stable at 200–250. The Secretarybird is the other globally threatened species in the IBA. Regionally threatened species are the Lanner Falcon (*Falco biarmicus*), Half-collared Kingfisher (*Alcedo semitorquata*), African Grass Owl (*Tyto capensis*), African

		Finfoot (*Podica senegalensis*) and Verreauxs' Eagle (*Aquila verreauxii*). Biome-restricted species include White-bellied Sunbird (*Cinnyris talatala*), Kurrichane Thrush (*Turdus libonyanus*), White-throated Robin-chat (*Cossypha humeralis*), Kalahari Scrub Robin (*Erythropygia paena*) and Barred Wren-Warbler (*Calamonastes fasciolatus*). All forms of development will have an immediate effect on the natural environment. It is therefore of utmost importance to provide information on the environmental consequences these activities will have and to inform the decision-makers thereof. When viewed in the larger context, the study site forms part of a very important conservation corridor and the Magaliesberg Protected Environment, also overlapping with the Magaliesberg Important Bird and Biodiversity Area (IBA). The southern section of the study site is also classed as Critical Biodiversity Area 2 (CBA2). The following was found for the fauna and flora assessment: The Marula Tree (Sclerocarya birrea), a Protected Tree species of South Africa, was recorded on site. Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. In terms of a part of section 51(1) of Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister. Several Alien and Invasive Vegetation Species were recorded on site, especially in disturbed areas and the areas surrounding the Pollution Control Dam. Several avifaunal species protected under the Threatened and Protected Species list (ToPS, 2013), which is enforceable under the National Environmental Management: Biodiversity Act, 2004, is likely to occur on site. All Amphibian and reptile species are of Least Concern (LC), except for the Giant Bullfrog (Pyxicephalus adspersus) and the African Rock Python (Python natalensis) which is of special conservation concern according to the North-West Biodiversity Sector Plan (2015) and protected under NEMBA. A biodiversity assessment has been completed for the proposed extension of the mining area. No protected plants have been identified within the proposed extension area. Overall, the area should be regarded as moderate sensitivity. It is however unlikely that there will be a loss of flora or faunal species of known conservation concern if the site is developed, and proper mitigation measures are implemented. Various potential negative impacts are associated with the activities and are discussed in the impact assessment scores derived according to the amended EIA Regulations (2017)

		The impacts associated with the activities range from Medium-Low to Medium-High prior to mitigation taking place. With mitigation fully implemented, the significance of most impacts can be reduced to Very Low or Low
1.2	How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Overall, the area should be regarded as moderate sensitivity. It is however unlikely that there will be a loss of flora or faunal species of known conservation concern if the site is developed, and proper mitigation measures are implemented. Various potential negative impacts are associated with the activities and are discussed in the impact assessment scores derived according to the amended EIA Regulations (2021) General impacts, such as dust, noise, etc. have been covered within the Environmental management programme Report (EMPr) proposed for the mining activities. Several mitigation and management measures and monitoring features have been included in the EMPr to ensure minimal and managed operation of the footprint area designed for the prospecting area.
1.3	How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Mitigation and Management measures prescribed will aid to avoid and lower any possible impacts that may result from the mining activities. The existing Surface infrastructure will be used. Final rehabilitation of mined areas will restore Land capability
1.4	What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	General waste, Hazardous waste and litter will be generated during the prospecting operation and these should be kept in designated areas and disposed of to a licensed landfill facility. Other wastes that may cause soil contamination are from the use of vehicles during the mining process, which may lead to hydrocarbon spills. Regulations for soil clean-up and management have been prescribed in the EMPr. Portable toilets during mining are recommended for the operation and a contractor will be required for the maintenance and service of these systems.
1.5	How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	A specialist heritage study was conducted for the project and these findings have been included in the application. The findings have resulted in the one sensitive site to be delineated and this site will be excluded from the active mining area. All other relevant specialist investigations have been incorporated
1.6	How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been	It is noted that due to the nature of this project (silica mining), will not significantly deplete any natural resource as the mining activity is very limited. Through implementing good practice environmental

	considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	management measures and mitigation measures, it will ensure that both human and environment are not negatively affected by the development.
1.7	How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts? 1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e., de-materialised growth)? (note sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life). 1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e., what are the opportunity costs of using these resources this the proposed development alternative?) 1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?	Renewable natural resources may include the use of water to a limited amount on-site. Stormwater management infrastructure will be required during the development and operation phase Also refer to the impact assessment and mitigation methods in Section 10 of this report. As the project will make use of existing infrastructure in the mining right area, no additional / new infrastructure will be required,
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts? 1.8.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)? 1.8.2 What is the level of risk associated with the limits of current knowledge? 1.8.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The Environmental risk assessment for all environmental features has been included within Section 10. Ecological (Fauna, Flora and Avifaunal), and Heritage specialist study (including many other specialist investigations as incorporated within this document) was completed for the project to ensure the impacts of these aspects have been properly assessed and will be catered for within the Environmental Management Programme (EMP). Other specialist investigations were also undertaken, and these are relevant for the specific project and adherence to these management measures will mitigate and manage impacts predicted. The level of risk has been informed by these specialist studies and feedback from the I&APs to date. A section regarding limitations of the studies has been included in the EIA/EMP format and will be available for the competent authorities to consider as well.

1.9	How will the ecological impacts resulting from this development impact on people's environmental right in terms following. 1.9.1 Negative impacts: e.g., access to resources, opportunity costs, loss of amenity (e.g., open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts? 1.9.2 Positive impacts: e.g., improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	Noise, dust and visual pollution can increase if not managed correctly. Possibly water pollution, if impacts are not managed effectively, but with the proper mitigation and good practice environmental management measures, it will result in minimal impacts. These impacts have been assessed and detailed prevention and mitigation measures have been recommended (refer to Table 18 to Table 19)
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g., on livelihoods, loss of heritage site, opportunity costs, etc.)?	Ecological aspects and specialist impact assessments have been included in the document and risk assessments utilised to guide the Environmental Management Program.
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	The Environmental risk assessment for all environmental features has been assessed and included in the BAR/EMPr.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Ecological and Heritage specialist studies have been undertaken for the project to ensure the impacts of these aspects have been properly assessed and have been catered for within the Environmental Management Programme (EMP). The studies have assisted with the development of a management plan to secure ecological integrity and a healthy biophysical environment.
1.13	Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	The loss and fragmentation of habitat are two of the more serious cumulative impacts in terms of fauna and flora. Given the largely natural state of the Magaliesberg Natural Environment in the surrounding landscape, the characteristics and sensitivity of the affected area, the nature of the proposed development, and the potential for cumulative impacts are expected to be moderate as the activities and thus the impacts will increase. It was not realistically possible or very difficult to perform an impact assessment for the cumulative impacts based on the available information. However, the implementation of the mitigation measures and management measures are applied, cumulative negative impacts as a result of the mining will be managed optimally.
"Promoting justifiable economic and social development"		
2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	The project is not completely aligned with the objectives of the municipal Spatial Development Framework (SDF) and Integrated Development Plan (IDP); however, it will not compromise the integrity of these respective forward planning documents, due to the relatively short-term period of the mining activities.

	2.1.1 The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area, 2.1.2 Spatial priorities and desired spatial patterns (e.g., need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.), 2.1.3 Spatial characteristics (e.g., existing land uses, planned land uses, cultural landscapes, etc.), and 2.1.4 Municipal Economic Development Strategy ("LED Strategy").	The approval of this application will not compromise the integrity of the existing environmental management priorities of the area as defined in the Madibeng EMF, provided that sensitive areas and vegetation as indicated by the specialists are avoided and the mitigation measures as recommended in this report and in the EMPr (refer to Part B of this report), are implemented.
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area? 2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	Also refer to the comments made above. .
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Refer to comments made above. All aspects and comments received from I&APs during the process will be reasonably addressed and incorporated into the final BAR/EMPr submitted to the DMRE. Local economic growth and work opportunities will be main benefits from the project if approved and may address some of the physical, psychological, development, cultural and social needs. Main benefits from the mining, which may possibly address community needs are mentioned below (also refer next comment) and is in-line with the local municipality and national goals of development and transformation.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	The main benefits of the proposed mining operation are: • Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the continued spending power of employees. • Implementation of the proposed project will result in continued skills development associated with coal mining. • It contributes to the economic welfare of the surrounding community by creating working opportunities. • It contributes to the upliftment of living standards and the health and safety of the local community. • The project will result in economic mining of a known resource. • The net benefit to South Africa is a product produced for the world and specifically the local commodity market, as it is noted in background information that the coal will be utilised by Eskom and exported. The project is aligned with the objectives of the MPRDA (Act 28 of 2002) • To promote economic growth and mineral development in the Republic

		• To promote employment and advance the social and economic welfare of all South Africans.
2.5	In terms of location, describe how the placement of the proposed development will. 2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other, 2.5.2. reduce the need for transport of people and goods, 2.5.3. result in access to public transport or enable non-motorised and pedestrian transport (e.g., will the development result in densification and the achievement of thresholds in terms public transport), 2.5.4. compliment other uses in the area, 2.5.5. be in line with the planning for the area, 2.5.6. for urban related development, make use of underutilised land available with the urban edge, 2.5.7. optimise the use of existing resources and infrastructure, 2.5.8. opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g., not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement), 2.5.9. discourage "urban sprawl" and contribute to compaction/densification, 2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs, 2.5.11. encourage environmentally sustainable land development practices and processes 2.5.12. take into account special locational factors that might favour the specific location (e.g., the location of a strategic mineral resource, access to the port, access to rail, etc.), 2.5.13. the investment in the settlement or area in question will generate the highest socio-economic returns (i.e., an area with high economic potential), 2.5.14. impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and 2.5.15. in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	Alternatives have been assessed during the BAR phase, the findings of the specialist studies, comments from I&APs to date and resources studies have been taking into consideration to determine alternatives for the proposed project. All additional comments from I&APs will be taken into consideration in the final report to be submitted to the competent authority for adjudication.
2.6	How were a risk-averse and cautious approach applied in terms of socio-economic impacts? 2.6.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Gaps and limits in knowledge have been given within the BAR/EMPR document and where appropriate a pre-cautionary approach has been applied. Gaps and limitations have been properly assessed and addressed.

	2.6.2. What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge? 2.6.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The level of risk is low as the project is not expected to have far reaching negative impacts on socio-economic conditions. In fact, the mining will have a positive impact in terms of employment for the mining period. The gaps in knowledge related to fine tuning of precises mining locations but this will be confirmed once the mining right is granted.
2.7	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following: 2.7.1. Negative impacts: e.g., health (e.g., HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts? 2.7.2. Positive impacts. What measures were taken to enhance positive impacts?	Refer to all other aspects regarding the Socio-Economic environment, benefits and disadvantages. All of the relevant aspects have also been addressed within the BAR/EMPR and may be viewed within the Impact Assessment, Management and Mitigation tables as contained within this document.
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g., over utilisation of natural resources, etc.)?	The area where the mining right is proposed, is currently utilised for a number of uses including tourism, agriculture and grazing. The Land Use and Capability has been described within this document. Refer to the baseline environment section (Section 9).
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	Health and Safety considerations have been included in the measures taken to pursue the best practicable environmental options in terms of socio-economic considerations, such as implementation of the mitigation measures such as dust, noise and visual management and mitigation. No other socio-economic considerations are relevant, except for work creation for local communities within the area, but these will be same for any footprint chosen on the farms. The environmental features and impacts, known resource and financial restraints associated with mining (specific resource) were the deciding factors concerning the best suited option. Also refer to the impact assessment and mitigation measures in **Error! Reference source not found.**
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Refer to the impact assessment and mitigation measures in **Error! Reference source not found.** of this BAR. The mine will be in line with the regulatory requirements, provide financial provision to ensure that the mitigation measures proposed can be carried out. All alternative scenarios have been discussed in this BAR and EMPR.
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	The main benefits of the proposed mining operation are: • Direct economic benefits will be derived from wages

		• Indirect economic benefits will be derived from the procurement of goods and services and the spending power of employees. • Implementation of the proposed project will result in skills development associated with mining. • It contributes to the economic welfare of the surrounding community by creating working opportunities. • It contributes to the upliftment of living standards and the health and safety of the local community. • The project will result in the estimation if mining is feasible in the proposed mining area. The project is aligned with the objectives of the MPRDA (Act 28 of 2002) • To promote economic growth and mineral development in the Republic; and • To promote employment and advance the social and economic welfare of all South Africans. By conducting a Basic Assessment Process, the applicant ensures that equitable access has been considered. Refer to the impact assessment and mitigation measures in **Error! Reference source not found.** of this BAR and EMPR.
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	Disturbances in terms of Noise, Dust, Waste and Health and Safety have been assessed according to a Risk Matrix and included within this report. Mitigation and Management measures are prescribed for every possible impact which may result from the mining right being granted.
2.13	What measures were taken to: 2.13.1. ensure the participation of all interested and affected parties, 2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, 2.13.3. ensure participation by vulnerable and disadvantaged persons, 2.13.4. promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means, 2.13.5. ensure openness and transparency, and access to information in terms of the process, 2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge, and 2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were promoted?	Public Participation will be and has been conducted in accordance with the guidelines and regulations. All comments received during the BAR phase will be included in the Final BAR.

2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g., a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	Refer to comments made above and Refer to Section **Error! Reference source not found.** of this BAR, describing the public participation process that has been implemented for the proposed project.
2.15	What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	The mining Right holder will need to draft an Environmental Policy and a Health and Safety Policy, along with Standard Operational Procedures (SOPs) which will regulate activities on the mining area. All workers and contractors will need to abide to the policies and framework as specified. It is not anticipated that any new jobs will be created; rather, existing jobs will be maintained for a longer period of time.
2.16	Describe how the development will impact on job creation in terms of, amongst other aspects: 2.16.1. the number of temporary versus permanent jobs that will be created, 2.16.2. whether the labour available in the area will be able to take up the job opportunities (i.e., do the required skills match the skills available in the area), 2.16.3. the distance from where labourers will have to travel, 2.16.4. the location of jobs opportunities versus the location of impacts (i.e., equitable distribution of costs and benefits), and 2.16.5. the opportunity costs in terms of job creation (e.g., a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	Refer to comments made above. As the application is for a mining Right, it is a long-term project, and the appropriate areas will be rehabilitated afterwards to match the pre-mining land use (or alternatively the approved land use).
2.17	What measures were taken to ensure: 2.17.1. that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and 2.17.2. that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	The applicant is in the process of applying for the following aspects across different legislation requirements: • Mining right (this application – Environmental Authorisation). • All legislation which has been incorporated within these processed were discussed within Section regarding Policy and Legislative Content above.
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Refer to comment above as these aspects have already been addressed within previous discussions.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Yes, for a sensitive environment (which is almost always associated with mining) all impacts have been addressed optimally as best possible.
2.20	What measures were taken to ensure that he costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	Mitigation and management measures have been described for all environmental aspects identified and is incorporated into the EMPr.

2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Alternatives and analysis have already been addressed above, refer to comments made.
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to comments made above regarding positive and negative socio-economic impacts. Cumulative impacts have been discussed where relevant and are not easily accurately quantifiable.

8. Details of the development footprint alternatives considered

The following alternatives were investigated as feasible alternatives. Analysis of the alternatives are presented below in Table 7-1. A full description is presented below.

Table 7: Alternative Analysis

TYPE OF ALTERNATIVE: Location	**ALTERNATIVE EXPLANATION:** ***Develop on an alternative property*** ***Develop on alternative sites on the same property/properties***
No location alternatives have been identified or are assessed as part of this application.	
TYPE OF ALTERNATIVE: Activity	**ALTERNATIVE EXPLANATION:** ***Develop an alternative activity e.g., Incineration of waste vs. landfill disposal, abstraction of water vs. re-use/recycling of water.***
The mine is an already operational mine. No other development alternatives have been assessed.	
TYPE OF ALTERNATIVE: Design	**ALTERNATIVE EXPLANATION:** ***Adapt architectural and/or engineering designs.***
No design alternatives have been identified or are assessed as part of this application.	
TYPE OF ALTERNATIVE: Layout	**ALTERNATIVE EXPLANATION:** ***Adapt spatial configurations of an activity on any particular site e.g., Locate manure dams away from water resources.***
Layout alternatives have been identified and assessed. The no-go areas have been identified by the specialist studies. • In terms of alternatives Witkop Fluorspar (Pty) Ltd, Brits Quarry weight the option of : o Mining their complete current mining site which means mining south through the Magaliesberg Mountains. The option was assessed and Witkop Fluorspar decided as this option would have significant impacts in the visual landscape of the Magaliesberg they need to find a different mining footprint. This would also have significant impact on the Magaliesberg Protected Area. o Witkop Fluorspar (Pty) Ltd, Brits Quarry identified a section of land adjacent to the current active mining area. This area would be suitable for their mining activities would would not have the significant visual impact. • No other footprint alternatives were therefore assessed.	
TYPE OF ALTERNATIVE: Technological	**ALTERNATIVE EXPLANATION:** ***Adapt methods or processes that can be implemented to achieve the same goal e.g., Introduction of bacteria rather than chemicals to wastewater.***
No other process alternatives have been identified	
TYPE OF ALTERNATIVE: Demand	**ALTERNATIVE EXPLANATION:** ***The demand for products and/or services can be met by other means e.g. The demand for paper can be met through deforestation or rather by efficient and viable recycling.***

No alternatives to meet demand were identified or are assessed in this application.

TYPE OF ALTERNATIVE:	**ALTERNATIVE EXPLANATION:**
Input	***Implement different input materials and/or sources e.g., Utilisation of woodchips for fuelling boilers rather than electricity.***

No input alternatives were identified or are assessed in this application.

TYPE OF ALTERNATIVE:	**ALTERNATIVE EXPLANATION:**
Routing	***Implement alternative routes for linear developments such as power line servitudes, transportation, and pipeline routes e.g., Elongate and divert a railway line to exclude a sensitive environment.***

No Routing alternatives has been identified in this assessment as this not linier activity,

TYPE OF ALTERNATIVE:	**ALTERNATIVE EXPLANATION:**
Transport	***Method of transportation of product or ore.***

No Transport alternatives were identified or are assessed in this application. The equipment that will be utilised on site are limited to current mine vehicles.

TYPE OF ALTERNATIVE:	**ALTERNATIVE EXPLANATION:**
Scheduling and Timing	***Adapt the order and/or scheduling of a number of measures which plays a part in a program as it will influence the overall effectiveness of the end result.***

The mining will only take place during daylight hours and will not be a 24-hour operation.

TYPE OF ALTERNATIVE:	**ALTERNATIVE EXPLANATION:**
Scale	***Adapt the scale of an activity ex. 15 vs. 35 housing units, 12m² vs. 0.5km².*** ***P.S. Scale and magnitude is interrelated.***

This amendment application is the:

- Reduction of the current mining area with 6.96 Ha
- And expanding the mine site with the addition of 5.85 Ha

The scale pf the expansion and reduction have been assed. By keeping the area to be reduced almost same size as the area to be mined the impact is kept the same as the current mining activities.

TYPE OF ALTERNATIVE:	**ALTERNATIVE EXPLANATION:**
Magnitude	***Adapt the magnitude which is directly related to the extent of an activity.*** ***P.S. Scale and magnitude is interrelated. An activity may be very small scale but can pose an extensive magnitude ex. Destroying an extremely sensitive wetland on a very small scale could result in a magnitude of such as destroying the whole wetland and/or ecological system.***

This amendment application is the:

- Reduction of the current mining area with 6.96 Ha
- And expanding the mine site with the addition of 5.85 Ha

The scale pf the expansion and reduction have been assed. By keeping the area to be reduced almost same size as the area to be mined the impact is kept the same as the current mining activities. . All of these alternatives will reduce the extent and intensity of the proposed impact.

TYPE OF ALTERNATIVE: **No-Go**	**ALTERNATIVE EXPLANATION:** ***The option of not undertaking and implementing the activity at all.***
See section below for no-go alternative	

The alternatives will be weighted in the table below using a scale of 1 to 3 where 1 is most significant potential impact to 3 least potential impact.

Table 8: Alternative Analysis

Aspect/Impact	Amendment	No-Go	Discussion
Surface disturbance - extent and intensity	3	2	Both options have the potential of surface disturbance to occur. Current mining operation can continue but will have to utilize the section of property that runs through the Magaliesberg. This will create significant surface disturbance.
Visual impact	3	2	Both options have the potential of surface disturbance to occur. Current mining operation can continue but will have to utilize the section of property that runs through the Magaliesberg. This will create significant visual disturbance.
Loss of soil and land capability through removal, erosion, compaction, and contamination	2	1	mining will result in some loss of soil and land capability. The locality of the mining activity will have minimal impact on soil and land capability.
Physical loss and/or general disturbance of terrestrial and aquatic biodiversity (including wetlands)	3	2	Sensitive vegetation was identified by the specialist and the no go areas identified. The no-go option would however have significant impact on the Magaliesberg Protected area if mining is conducted through the Magaliesberg,
Reduction in water quantity and quality affecting third party users	1	3	No mining activities should impact on any water resources.
Ground water regime and impacts on downstream users	3	3	Both options assumed to be similar in terms of the type of underlying aquifer. No impact is anticipated on the groundwater regime.
Decrease in air quality from project emissions	2	2	Both options assumed to be similar in terms expected impacts on air quality.
Effect on roads due to project related traffic	3	3	Both options have the very low potential to contribute to increased traffic. No change in traffic flow is anticipated.
Loss or damage to heritage and/or paleontological resources	3	3	No mining to take place in close proximity to heritage and/or paleontological resources
Positive and negative socioeconomic impacts	2	2	Both options have the potential to have positive and/or negative socio-economic impacts. There is no relative score difference.
Impact on surrounding land uses	2	2	Both options have the very low potential to contribute to impact on land uses.
Total	27	25	Amendment is the preferred alternative

i) Details of the Public Participation Process Followed

(Describe the process undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public

meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land)

A joint Public Participation Process will be undertaken for the proposed mining. The process is undertaken to ensure compliance with regard to the requirements in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) [as amended] (MPRDA), the National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA).

Tasks undertaken for the Public Participation Process (PPP)

This section of the report provides an overview of the tasks undertaken for the PPP to date. All PPP undertaken is in accordance with the requirements of the NEMA requirements and EIA Regulations (2014) [as amended]. It further provides an outline of the next steps in the PPP and makes recommendations for tasks to be undertaken during the environmental assessment phase of the environmental authorisation process.

The PPP tasks conducted for the proposed new plant development project to date includes:

IDENTIFICATION OF KEY INTERESTED AND AFFECTED PARTIES (AFFECTED AND ADJACENT LANDOWNERS) AND OTHER STAKEHOLDERS (ORGANS OF STATE AND OTHER PARTIES)

Public Participation is the involvement of all parties who are either potentially interested and / or affected by the proposed development. The principal objective of public participation is to inform and enrich decision-making. This is also its key role in this BA process.

Interested and Affected parties (I&APs) representing the following sectors of society has been identified:

- National, provincial and local government.
- Agriculture, including local landowners (affected and adjacent).
- Community Based Organisations.
- Non-Governmental Organisations.
- Water bodies.
- Tourism.
- Industry and mining.
- Commerce; and
- Other stakeholders.

FORMAL NOTIFICATION OF THE APPLICATION TO INTERESTED AND AFFECTED PARTIES (INCLUDING ALL AFFECTED AND ADJACENT LANDOWNERS) AND OTHER STAKEHOLDERS

The project was announced as follows:

- Newspaper advertisement

Publication of media advertisement (English) in the BritsPos on **12 November 2021**. *Proof will be attached in the final BAR that will be submitted.*

- Site notice placement

In order to inform surrounding communities, affected and adjacent landowners of the proposed development, site notices will be erected on site and at visible locations close to the site on 12 November 2021. *Proof will be attached in the final BAR that will be submitted.*

- Written notification

I&AP's and other key stakeholders, who included the above-mentioned sectors, will be directly informed of the proposed development by e-mail on 12 November 2021. I&APs will be given 30 days to comment and / or raise issues of concern regarding the proposed development. The commenting period will expire on the 12th of December 2021. *Proof will be attached in the final BAR that will be submitted.*

CONSULTATION AND CORRESPONDENCE WITH I&AP'S AND STAKEHOLDERS

All I&AP registrations and comments that are received from stakeholders will be formally recorded in the Comments and Responses Report. *Proof will be attached in the final BAR that will be submitted.*

Draft Basic Assessment Report (BAR) and Environmental Management Programme (EMPr)

The Draft BAR and EMPr are herewith released for a period of 30 days from 12 November 2021 to 12 December 2021.

Hardcopies of the Draft BAR and EMPR are herewith submitted to all organs of state and relevant authorities. In addition, copies are placed at Madibeng Library. Proof will be attached in the final BAR that will be submitted.

NEXT PHASES OF THE PUBLIC PARTICIPATION PROCESS

All comments received from I&APs and organs of state and responses sent will be included in the final BAR and EMPR to be submitted to the Competent Authority (CA).

Once the BAR and EMPr are submitted, the CA will have 107 days to reach a decision on the application. Thereafter the registered I&APs will be notified of the CA's decision.

- **Summary of issues raised by I&Aps**

Table will be completed after the Public Participation Process is completed.

Table 9: Summary of issues raised

Interested and Affected Parties List the names of persons consulted in this column and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc)
AFFECTED PARTIES					
Landowner/s					
Lawful occupier/s of the land					
Landowners or lawful occupiers on adjacent properties					
Municipal councillor					
Local Municipality – Mogale Local Metropolitan Municipality					
District Municipality – N/A					
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWS etc.					
Communities					

Interested and Affected Parties List the names of persons consulted in this column and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc)
Dept. Land Affairs					
.					
Traditional Leaders					
Dept. Environmental Affairs					
Other Competent Authorities affected					
<u>OTHER AFFECTED PARTIES</u>					

9. The Environmental attributes associated with the alternatives

(The environmental attributes described must include socio-economic, social, heritage, cultural, geographical, physical and biological aspects)

Baseline Environment

(1) Baseline Environment

The study area falls within the jurisdiction of the Madibeng Local Municipality, part of Bojanala District Municipality, in the North West Province. The site is located approximately 9 km south of Brits, adjacent to the R104 Rustenburg-Hartbeespoort dam Road near the R512 Brits Road intersection, at the following coordinates in the centre of the property:

Latitude: 25°43'38.83"S Longitude:27°47'33.33"E

.

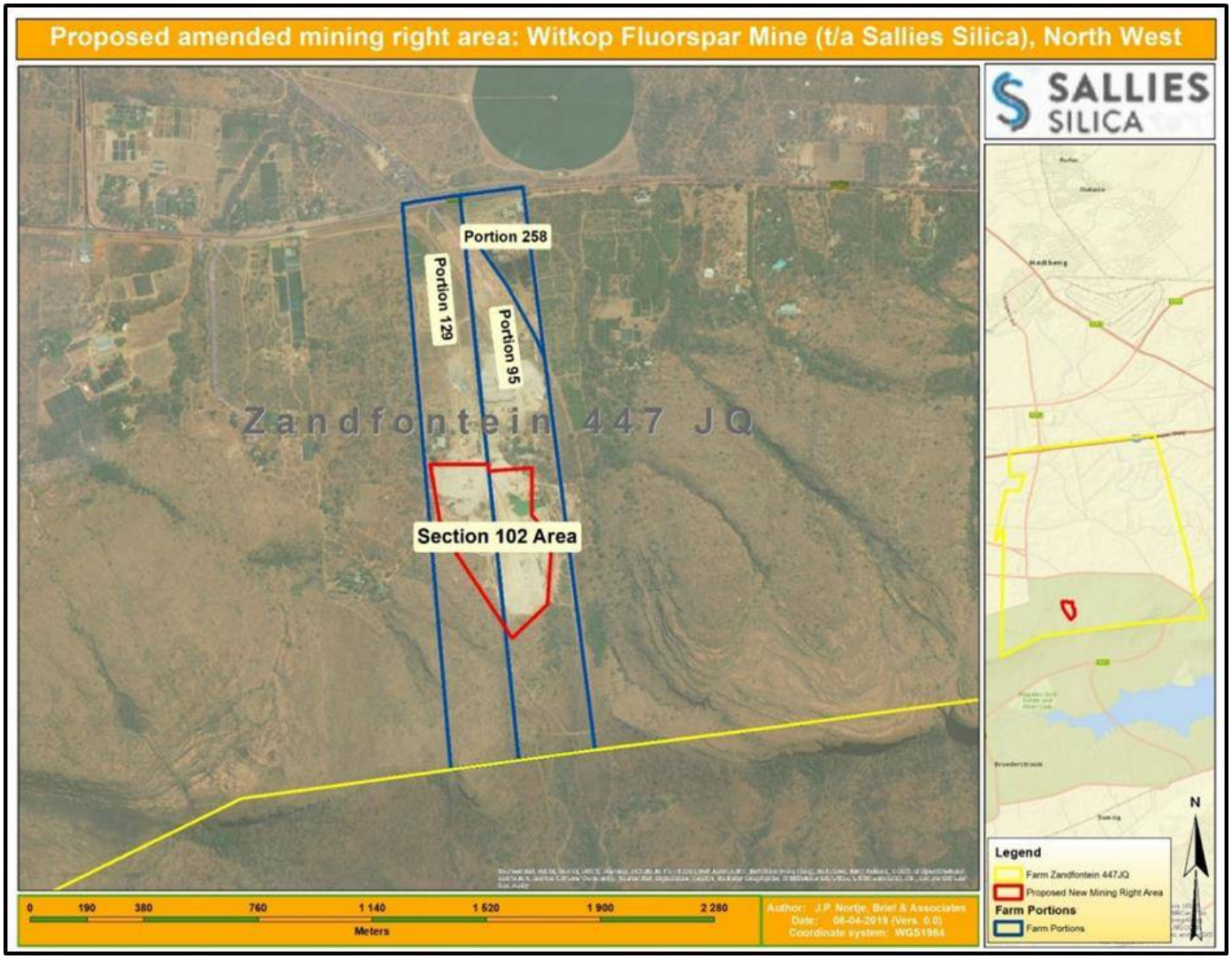


Figure 6: Regional Locality Map of the Study Area

(a) Type of environment affected by the proposed activity.

(Its current geographical, physical, biological, socio- economic, and cultural character)

Gradient and landscape context

Most of the site is located within an area classified as a flat plain, while the southern tip of the site, i.e. the area proposed as the new mining right area, is situated on the footslope of a ridge. Localised ponding of water will only occur in undrained quarry depths because the natural topography of the site allows for proper drainage. The lowest point is located in the south-western corner of the site at an elevation of approximately 1 218 m above mean sea level (mamsl), with the highest point occurring in the north-east at an elevation of approximately 1270 mamsl.

Figure 7 – Figure 13 below provides an overview of the site's topography

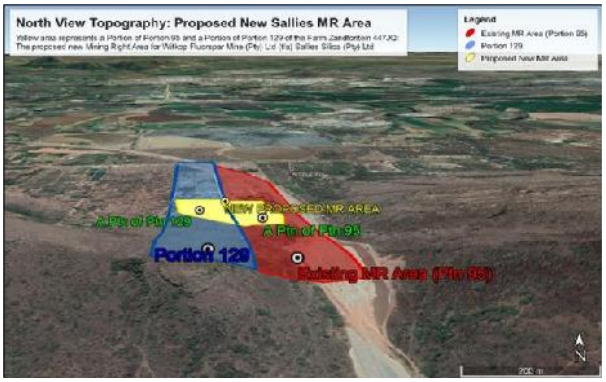


Figure 7 : View of the area's topography from a northern vantage point.

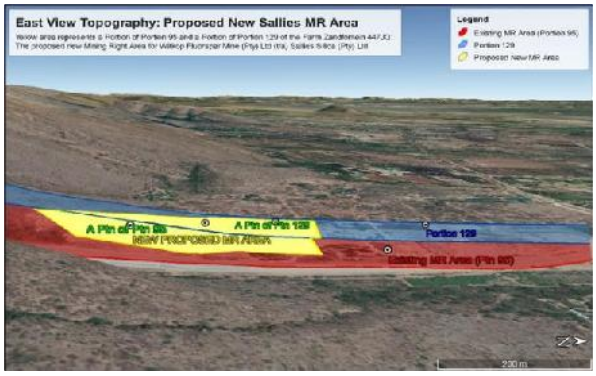
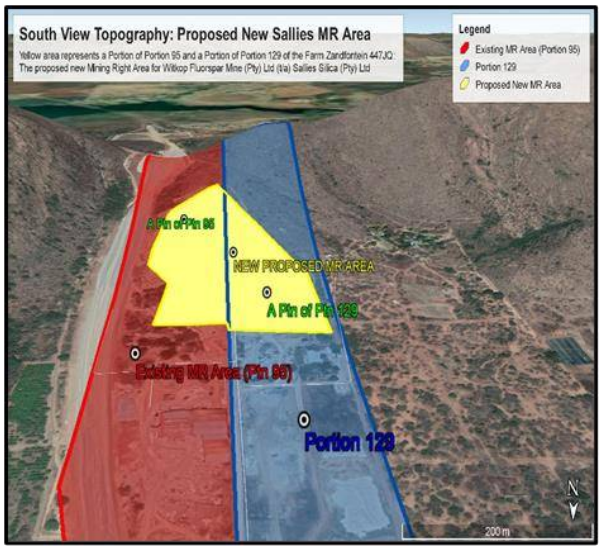


Figure 8 : View of the area's topography from a western perspective (to the east).



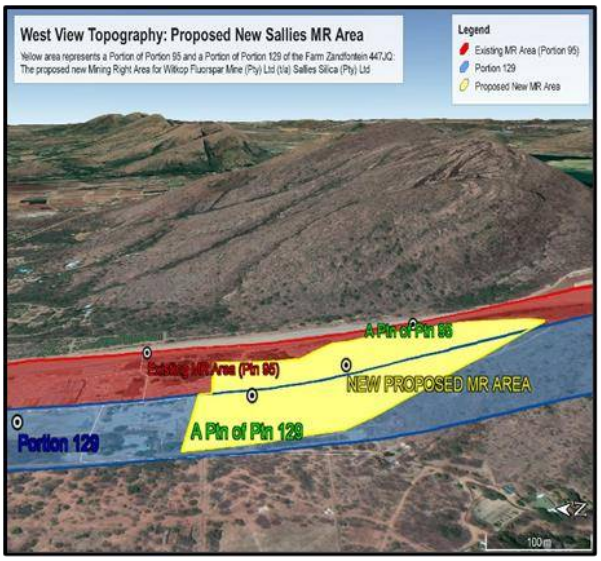


Figure 9 : Topography of the area from a southern vantage point.

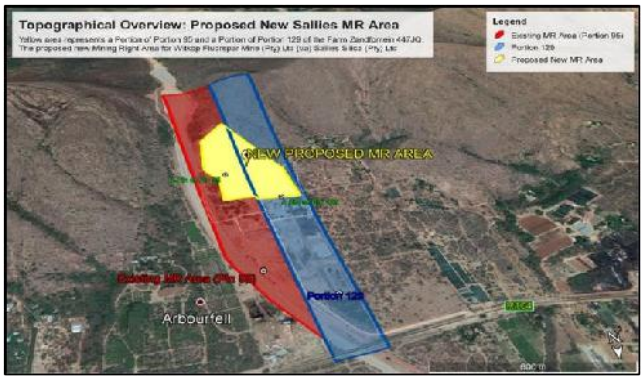


Figure 10 : Topography of the area from the east (looking toward the west).

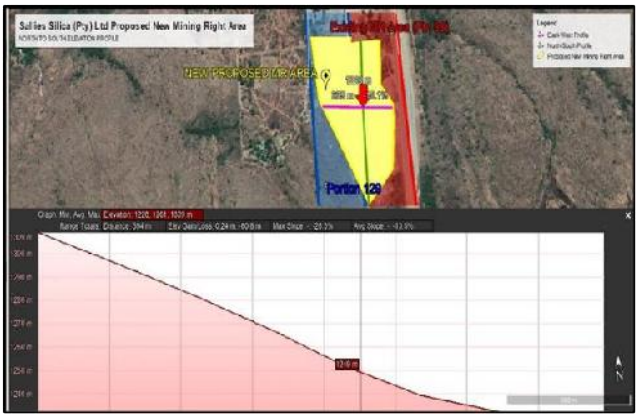


Figure 11 : An overview of the entire site and its topography

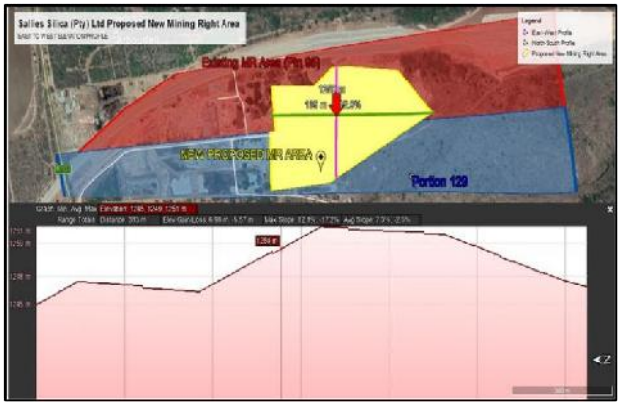


Figure 12 : North to South Profile

Figure 13 : profile of the area from east to west: Average slope of 7.3%

Geology and Soils

The following were sourced from the geological report titled “The Geological Appraisal and Mineral Resources Study of the Eggo Silica/Sand Deposit, Brits area” dated 7th September 1998, conducted by SB Gain:

The rock body on the site is a major quartzite deposit, found within a quartzite close to the top of the Pretoria Group of the Transvaal Sequence which forms the direct footwall of the overlying mafic rocks of the Bushveld Complex. The mafic rocks of the Bushveld Complex was formed from the cooling of hot magmas which contained and supplied the heat to thermally metamorphose and recrystallise the quartzites which are currently being mine.

The deposit is located in the Magaliesberg Quartzite Formation of the Pretoria Group. This formation is composed of quartzite, feldspathic quartzite, shale (hornfels) and gritty quartzite. The site is underlain by two quartzite units, separated by a thin unit of hornfels. The southerly quartzite layer, which forms the foothills of the Magaliesberg ridge, is being quarried at the present time. On outcrop the texture of the quartzite's ranges from fine crystalline to coarse crystalline with crystal sized ranging from 0.5 – 12mm.

Climate

Climate refers to the summation of the daily, weekly and monthly changes of weather over a long period and it is influenced by latitude, altitude, direction and intensity of wind and the presence of large bodies of water such as the ocean, lakes, dams and rivers.

The site falls within the summer rainfall region. The study area receives an average rainfall amount of 618mm with most rainfall occurring during the summer month of January (105mm) and the lowest rainfall in June (0mm).

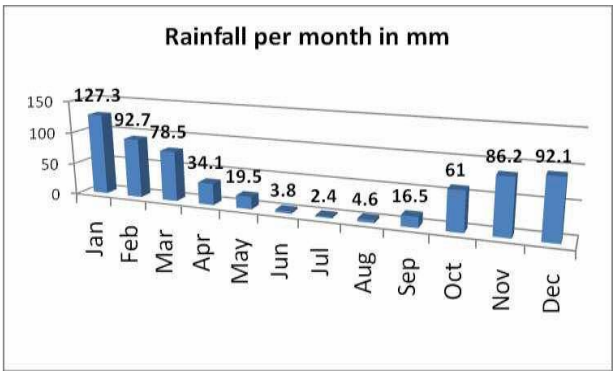


Figure 14 : Rainfall Per Month

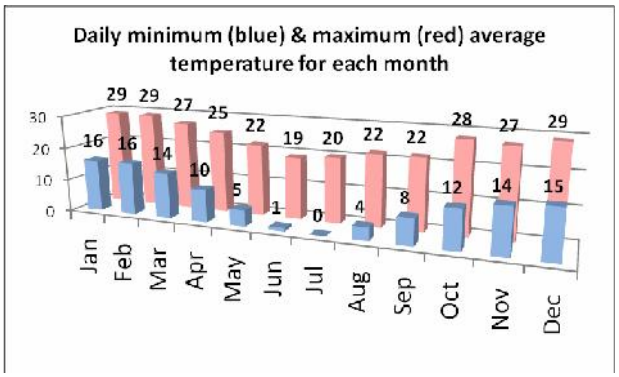


Figure 15 : Average Min and Max Temperature

The monthly distribution of average daily maximum temperatures indicates an average midday temperature range of between 19°C in June to 29C in December, January and February. The region is the coldest during July when the temperature averages 0°C during the night.

The main wind direction is from the North West and the average wind speed is 2.3m/s.

The relative humidity of the study area at 14h00 fluctuates between 31% in July and 46% in February.

Mean annual evaporation is 2055 mm. Due to the fact that evaporation is much higher than precipitation, and because the site is situated on a north facing slope, the climate of the site can be considered semi- arid, even more so than the surrounding landscape. It also reduces its agricultural potential significantly.

Groundwater

Geo-Pollution Technologies (Pty) Ltd was appointed to conduct an Geohydrological Baseline study in 2011.

The Rolfes Silica deposit is located in the Magaliesberg Quartzite Formation of the Pretoria Group. This formation is composed of quartzite, feldspathic quartzite, shale, hornfels and quartzite typically associated with hard rock fractured aquifers.

From the hydrocensus data an average borehole yield of between 1 and 2 l/s was calculated for the area under investigation which fall within the regional estimated range of 0.5 to 2 l/s.

Through qualified guesses a realistic average recharge of ~ 4.3% of the rainfall is estimated which corresponds well to the average of the Crocodile West and Marico Water Management Area (4%).

Water levels and Chemical Analysis

A total of 33 hydrocensus boreholes were found located in a 1-2 km radius around the site. Groundwater is predominantly used for potable water, irrigation, livestock watering, aqua farming and also used for small scale irrigation (garden).

Water levels could be measured in 25 boreholes. The average depth to water level is ~ 12 m bgl and a good correlation between the surface topography and the water levels (84.3%) was found for the boreholes measured during the hydrocensus.

The overall water quality is good and most of the borehole samples analysed was found to comply with the DWAF water quality guidelines for domestic use. Slightly elevated NO3 concentrations were detected in BH1 (borehole A on the premises of Witkop Fluorspar (Pty) Ltd, Brits Quarry), BH9 and BH14 which is related to agricultural activities. PO4 was also found in the water sample of BH1 which supports the above statement that it is related to agricultural activities. The pH value in BH8 (4.75) was found to be slightly low but no potential health risks are expected.

It was only in BH8 (pH) and BH14 (NO3) that chemical parameters show potential health risks, none of which is related to mining activities at Witkop Fluorspar (Pty) Ltd, Brits Quarry.

No chemicals are involved in the mining processes at Witkop Fluorspar (Pty) Ltd, Brits Quarry and therefore no significant chemical contamination is expected. Currently there is no contaminant impact on the groundwater.

Due to the nature of the inert characteristics of quartzite, no primary plume emanating from Witkop Fluorspar (Pty) Ltd, Brits Quarry could be reasonably expected. At most, secondary plumes emanating from secondary sources such as ablution facilities at the office block could be expected

Geohydrological Study attached as **Appendix 7**

Surface Water

Please note that no surface water features e.g. wetlands, rivers, streams, pans etc., occurs on or adjacent to the site. The nearest river is the Crocodile River 5 km to the east-northeast. The nearest dam is the Hartebeespoort Dam occurring 3 km to the south-east, however, the site is completely isolated from the dam by the Magaliesberg ridge which forms an impenetrable watershed.

The full catchment classification for the site is as follows: Primary Catchment: A; Secondary Catchment: A2; Tertiary Catchment: A21; Quaternary Catchment: A21J. The A21J quaternary catchment falls within the Crocodile (West) and Marico Water Management Area with the Crocodile (West) and Marico as main rivers draining the A primary catchment.

The site drains mainly by means of surface run-off (i.e.: sheetwash) with surface water flowing along the internal road infrastructure towards distant drainage features located further beyond the site to the south-east.

The flat terrain (in the northern part of the site) and mining activities occurring on site will cause localised ponding of water after precipitation events, however, most of the site, including the proposed new extended part, are well drained due to a moderate slope and sandy soil texture. A proper surface storm water management system is already in place to prevent ponding. Table 4 and **Figure 16** below provides and overview of the freshwater resources

Table 4: Desktop data relating to the freshwater resources

Ecoregion (Figure 19**)**	Western Bankenveld
Quaternary Catchment (Figure 16)	A21J
WMA (Figure 16)	Limpopo Water Management Area
Ecoregion Characteristics (Kleynhans et al. 2007)	
Dominant primary terrain morphology	Lowlands; Hills and Mountains; Moderate and High Relief Open Hills; Lowlands; Mountains; Moderate to High Relief Closed Hills; Mountains; Moderate and High Relief
Dominant primary vegetation types	Waterberg Moist Mountain Bushveld; Mixed Bushveld;
Altitude (m a.m.s.l)	900-1700

MAP (mm)	400 to 700
Coefficient of Variation (% of MAP)	20 to 35
Rainfall concentration index	60 to >65
Rainfall seasonality	Early to Mid-summer
Mean annual temp. (°C)	14 to 22
Winter temperature (July)	14 to 24
Summer temperature (Feb)	24 to 32
Median annual simulated runoff	20 to 80, 80 to 100 (limited)
National Freshwater Ecosystem Priority Area (NFEPA) (2011) Database	
NFEPA Rivers	According to the NFEPA database, no rivers or tributaries occur on the study site.
Wetlands	According to the National Wetland Map (NWM) database (2018) the study area does not overlap with any wetlands - Figure 6.

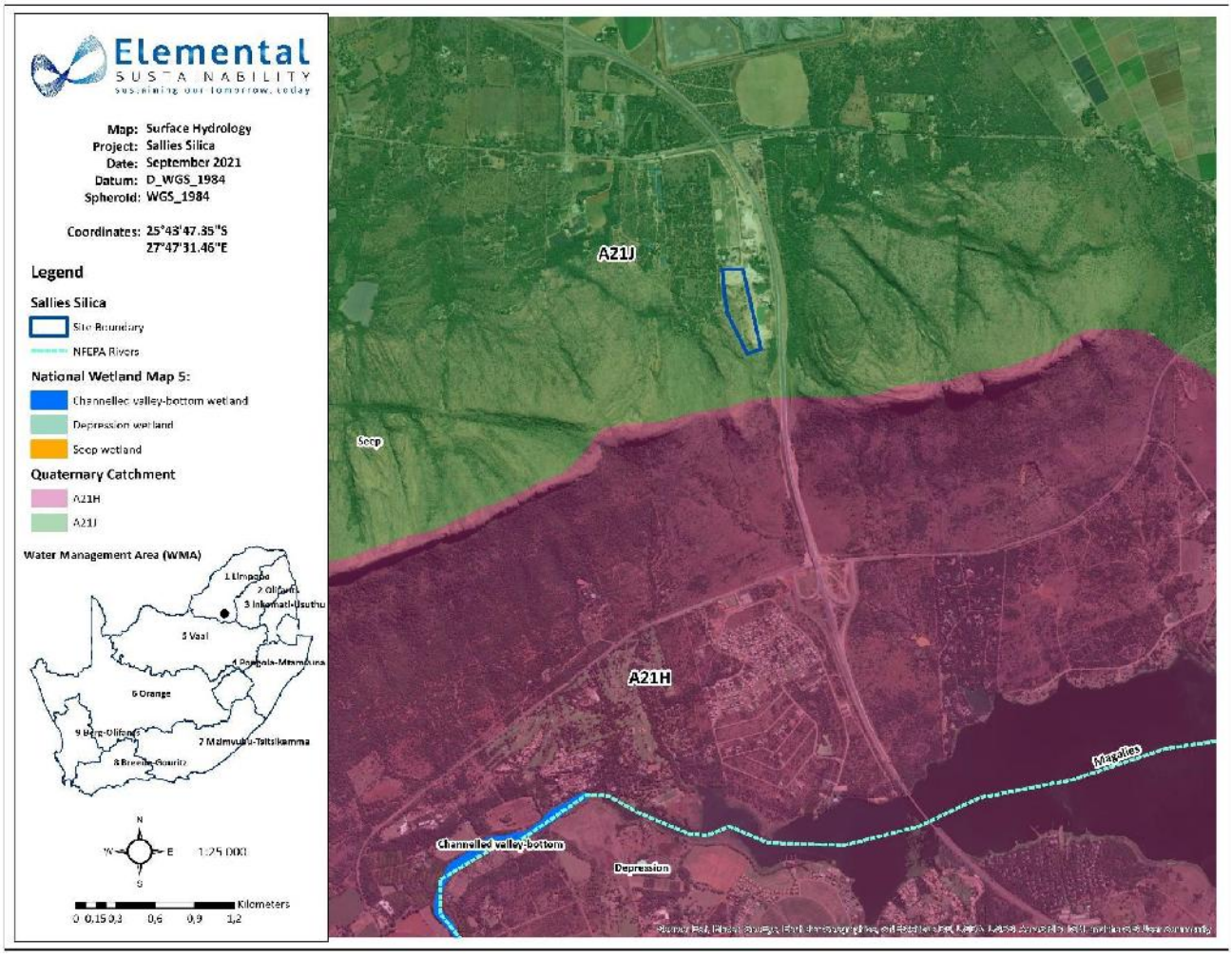


Figure 16: The study area is situated in Quaternary Catchment A21J and forms part of the Limpopo Water Management Area

Biodiversity

Elemental Sustainability was appointed by Retief Environmental to undertake an ecological assessment for the study area.

The study site falls within the Savanna Biome (Mucina & Rutherford 2006), dominated by grass species, shrub layers and well-developed trees. Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The study area is situated within the Central Bushveld Bioregion and overlaps with two vegetation types, namely the Moot Plains Bushveld (SVcb8) and the Gold Reef Mountain Bushveld (SVcb9) (Figure 17).

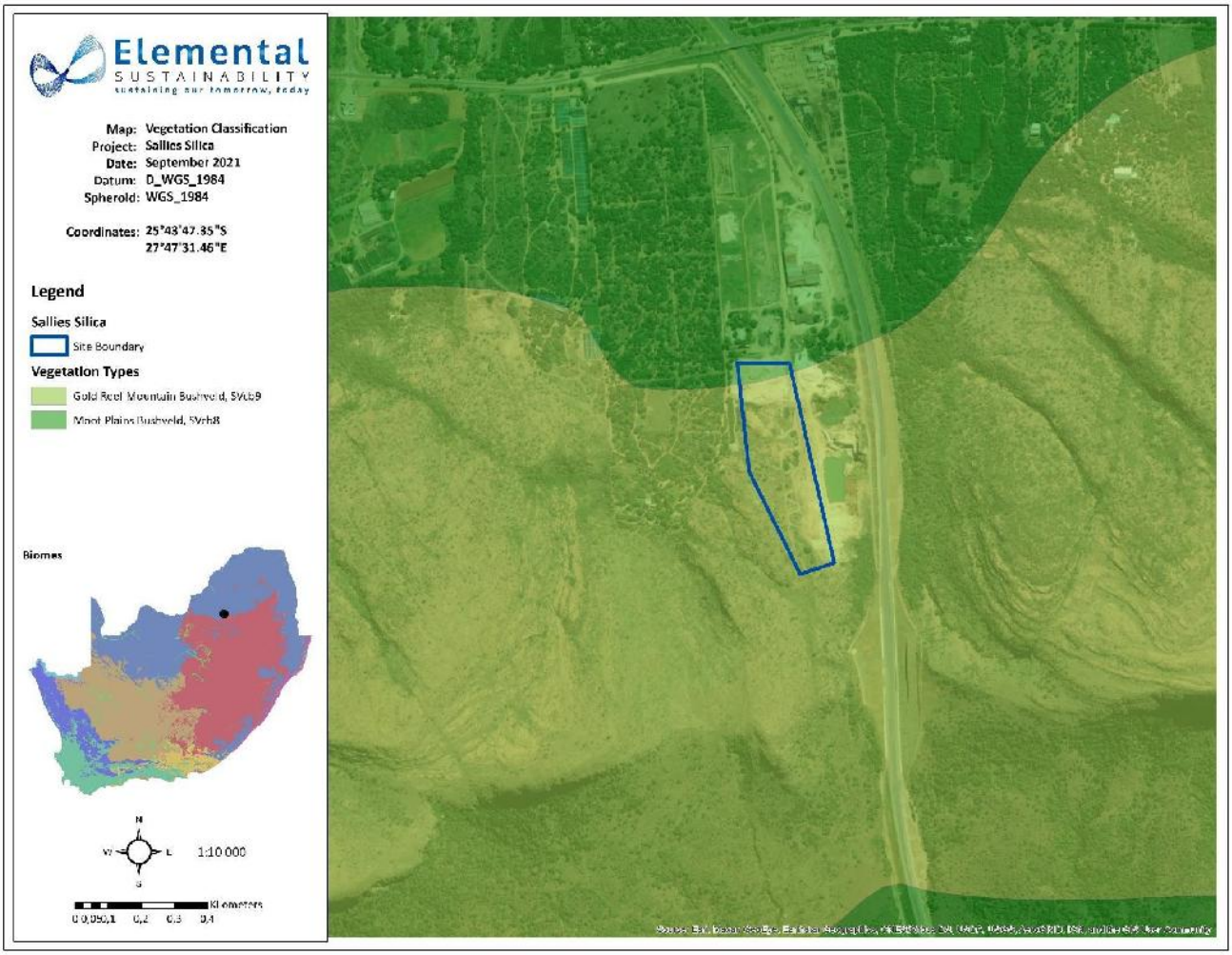


Figure 17: Vegetation Map

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver et al. 2011). Datasets have been developed by SANBI (2016) in order to outline threatened ecosystems, with the primary objective of limiting the rate of ecosystem extinctions. Four established categories group these ecosystems namely: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Protected.

No threatened ecosystems overlap with the study site (NBA 2018).

Protected Areas

Formally protected areas are protected either by national or provincial legislation. Based on the SANBI (2010) Protected Areas Map and the North-West Biodiversity Sector Plan (2015), the southern section of the study site overlaps with the formally protected Magaliesberg Protected Natural Environment which forms one of the core zones of the Magaliesberg Biosphere (Figure 18). It is a declared formal protected area under the National Environmental Management Protected Areas Act, 2003.

North West Biodiversity Sector Plan (NWBSP, 2015)

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of high biodiversity value that need to be conserved and maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services (MTPA, 2014). The North-West Biodiversity Sector Plan (2015) focusses on the mapping and the management of biodiversity priority areas within the North-West Province. This conservation plan consists of Protected Areas, Critical Biodiversity Areas, Ecological Support Areas, Other Natural Areas and Areas with No Natural Habitat Remaining based on their biodiversity attributes, spatial configuration, and requirement for meeting targets for both biodiversity pattern and ecological processes (NWBSP, 2015).

According to the National Environmental Management Act (NEMA) (Act no. 107 of 1998) certain activities have strict guidelines or are prohibited within CBAs and ESAs. Refer to the listed activities under the NEMA: Environmental Impact Assessment Regulations of 2014 (GNR 982) as promulgated in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) [as amended] for a comprehensive breakdown.

The southern section of the study site is classed as Critical Biodiversity Area 2 (CBA2) in terms of the NWBSP (Figure 18). This is possibly due to the site overlapping with the Magaliesberg Protected Natural Environment and the Magaliesberg IBA.

Important and Biodiversity Areas (IBA)

Important Bird and Biodiversity Areas (IBAs) are a network of sites that are significant for the long-term viability of naturally occurring bird populations (Birdlife 2019). Many sites are also important for other forms of biodiversity; therefore, the conservation of Important Bird & Biodiversity Areas ensures the survival of a correspondingly large number of other animals and plants.

The study site overlaps with the Magaliesberg IBA (Figure 18), previously known as the Magaliesberg and Witwatersberg IBA, this IBA consists mainly of the Magaliesberg range, which extends in an arc from just north-west of Rustenburg in the west to the N1 in the east near Pretoria. To the south, the Witwatersberg range runs parallel to the Magaliesberg, extending from the town of Magaliesberg in the west to Hartbeespoort Dam in the east.

The most important trigger species in the IBA is the globally threatened Cape Vulture. The number of breeding pairs in the Skeerpoort colony seems to be stable at 200–250. The Secretarybird is the other globally threatened species in the IBA. Regionally threatened species are the Lanner Falcon (Falco biarmicus), Half-collared Kingfisher (Alcedo semitorquata), African Grass Owl (Tyto capensis), African Finfoot (Podica senegalensis) and Verreauxs' Eagle (Aquila verreauxii). Biome-restricted species include White-bellied Sunbird (Cinnyris talatala), Kurrichane Thrush (Turdus libonyanus), White-throated Robin-chat (Cossypha humeralis), Kalahari Scrub Robin (Erythropygia paena) and Barred Wren-Warbler (Calamonastes fasciolatus).

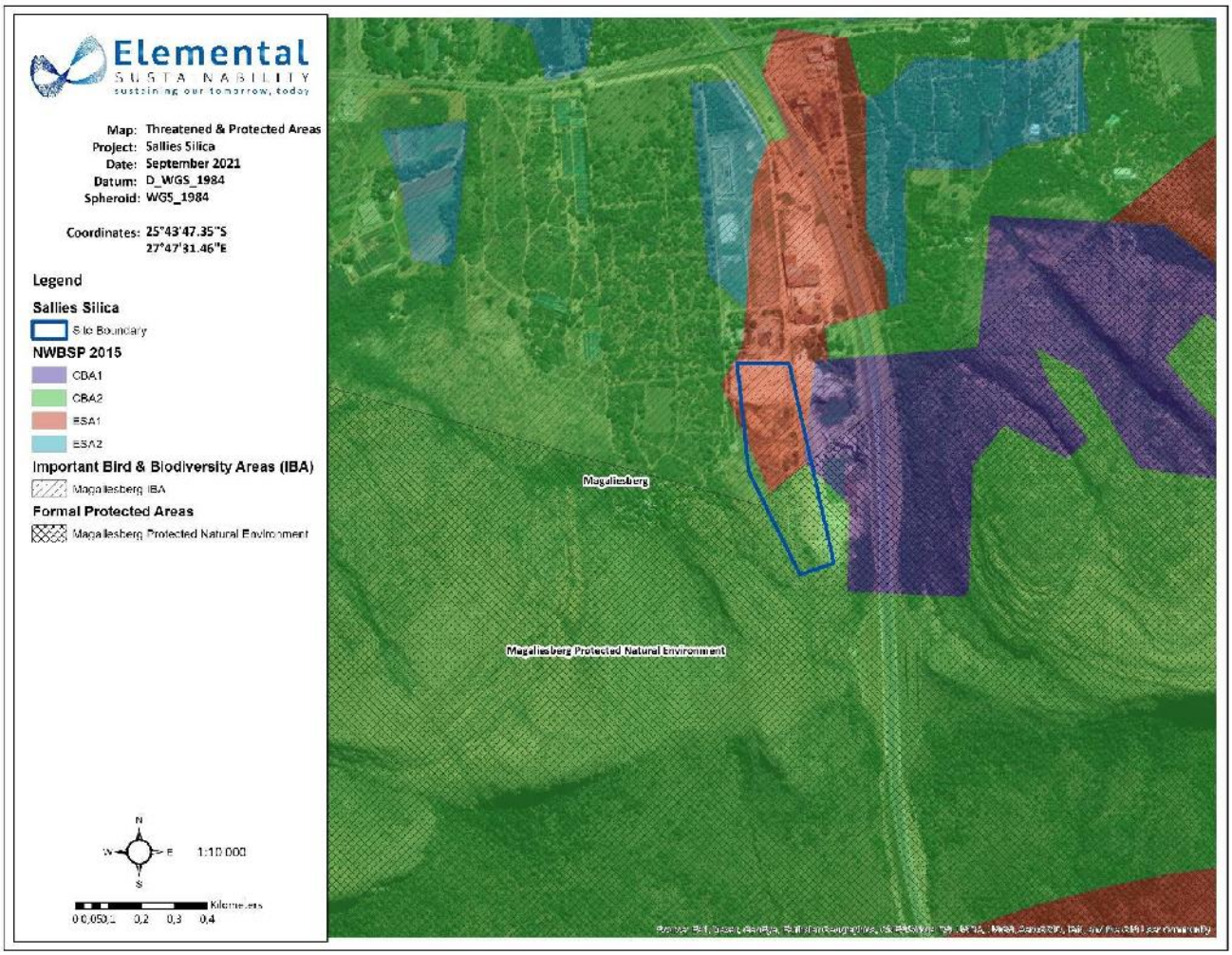


Figure 18 : Important and Biodiversity Areas

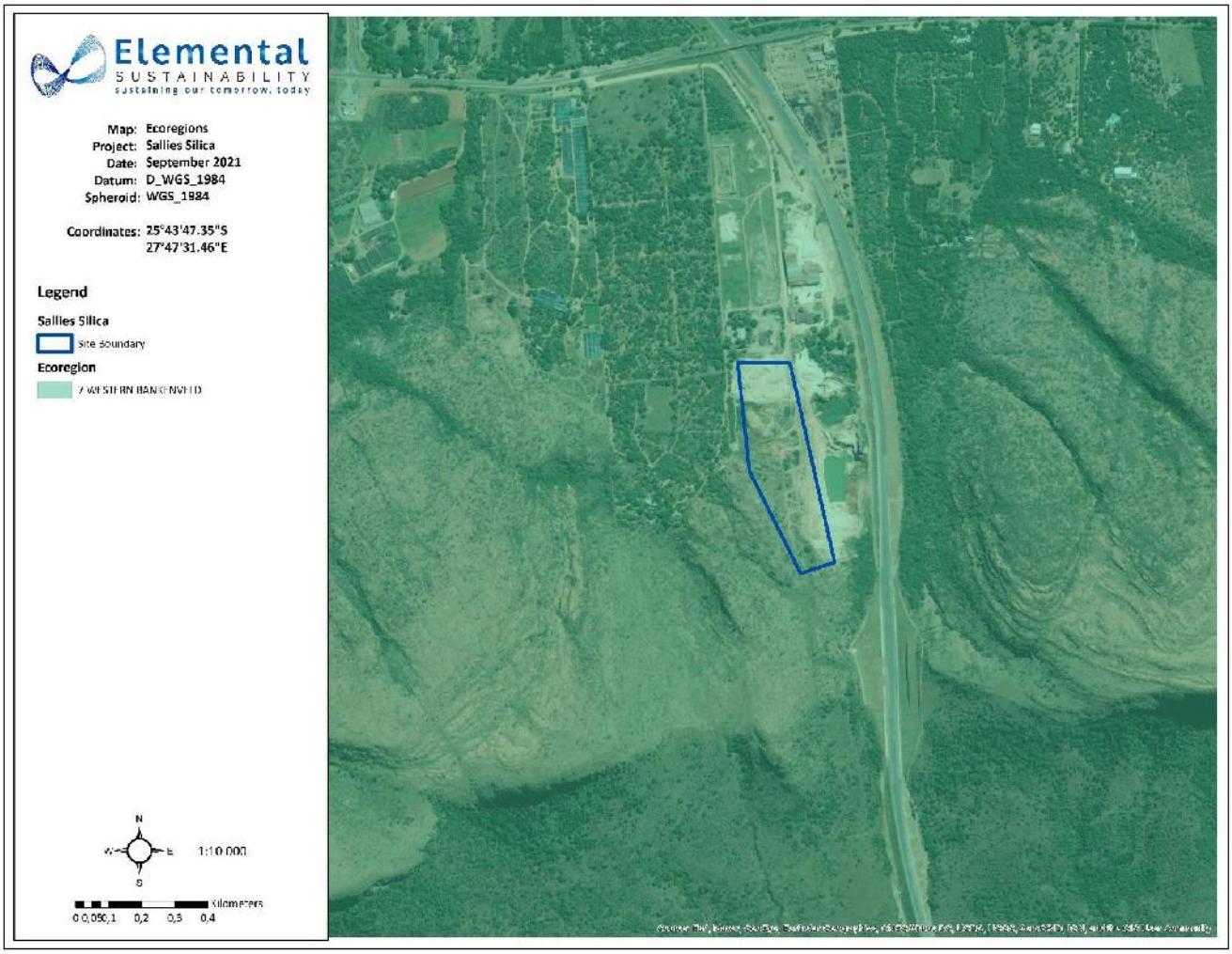


Figure 19: Ecoregions associated with the study area

When viewed in the larger context, the study site forms part of a very important conservation corridor and the Magaliesberg Protected Environment, also overlapping with the Magaliesberg Important Bird and Biodiversity Area (IBA). The southern section of the study site is also classed as Critical Biodiversity Area 2 (CBA2). The following was found for the fauna and flora assessment:

The Marula Tree (Sclerocarya birrea), a Protected Tree species of South Africa, was recorded on site. Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. In terms of a part of section 51(1) of Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister. Several Alien and Invasive Vegetation Species were recorded on site, especially in disturbed areas and the areas surrounding the Pollution Control Dam. Several avifaunal species protected under the Threatened and Protected Species list (ToPS, 2013), which is enforceable under the National Environmental Management: Biodiversity Act, 2004, is likely to occur on site. All Amphibian and reptile species are of Least Concern (LC), except for the

Giant Bullfrog (Pyxicephalus adspersus) and the African Rock Python (Python natalensis) which is of special conservation concern according to the North-West Biodiversity Sector Plan (2015) and protected under NEMBA.

Overall, the area should be regarded as moderate sensitivity. It is however unlikely that there will be a loss of flora or faunal species of known conservation concern if the site is developed, and proper mitigation measures are implemented. Various potential negative impacts are associated with the activities and are discussed in the impact assessment scores derived according to the amended EIA Regulations (2017). The important factors relevant to the project are summarised in the table below.

Biodiversity Assessment attached as **Appendix 8**

Land Capability

Pre-Mining Land Capability

Land to the south of the quarry on the relatively steep slope has a thin topsoil cover, underlain by a predominating rock formation with practically no underground. This area was never suitable for arable land. As the steepness of the slope decreases, the thickness of the topsoil cover and the depth of the underground increases. At the point where it levels off the soil quality was such that the land was arable. The arable land amounted to about half of the total area of the land. Very little of the southern portion of the land that used to be arable was used for quarrying activities as quarrying took place from about where the arable land ended. About one third of the total area of arable land to the south were used for erection of structures such as office buildings, production facilities etc and for the stockpiling of production material and topsoil.

The area could be used for low carrying grazing purposes but only in the late summer as the field has a tendency to carry the Poison Leaf (Dichapetalum cymosum), which is poisonous to animals in the spring and early summer.

Should agricultural activities have occurred on this area, the soil that is to be disturbed would be classified as follows:

- Workable soil: not applicable
- Grazing: not applicable
- Marshland: 0Ha
- Wilderness: 39Ha
- TOTAL: 39Ha

Pre-mining Land Use:

The land has been subject to mining practice for approximately 36 years. No record exists of agricultural practise on the property during the recent past except for citrus planted in 1960 to the north of the office area, away from the mining area.

It may be assumed that the land, to the extent that it was otherwise used for farming purposes, was used for grazing prior to the subdivision of the farm and the commencement of mining.

Land use Map attached as **Appendix 9**

Cultural and Heritage

Regarding the original Mining Right area, the only resource found was the remains of an old, degraded redoubt (soldier's refuge made of rocks) with low significance. In addition, this site falls outside of the mining footprint and better yet, it falls within the area that this Mining Right Amendment application aims to exclude.

Regarding the proposed new extension area, an archaeological assessment of the site was conducted by Mr. Magoma from Holistic Environmental Services Cc on 8 February 2013. During his reconnaissance no heritage resource sites or finds of any value or significant were identified within the area of proposed mining footprint, however a gravesite was found outside the development footprint, on the boundary of the property. The current development proposal could therefore be supported. The following indicates the location of the grave site and the redoubt

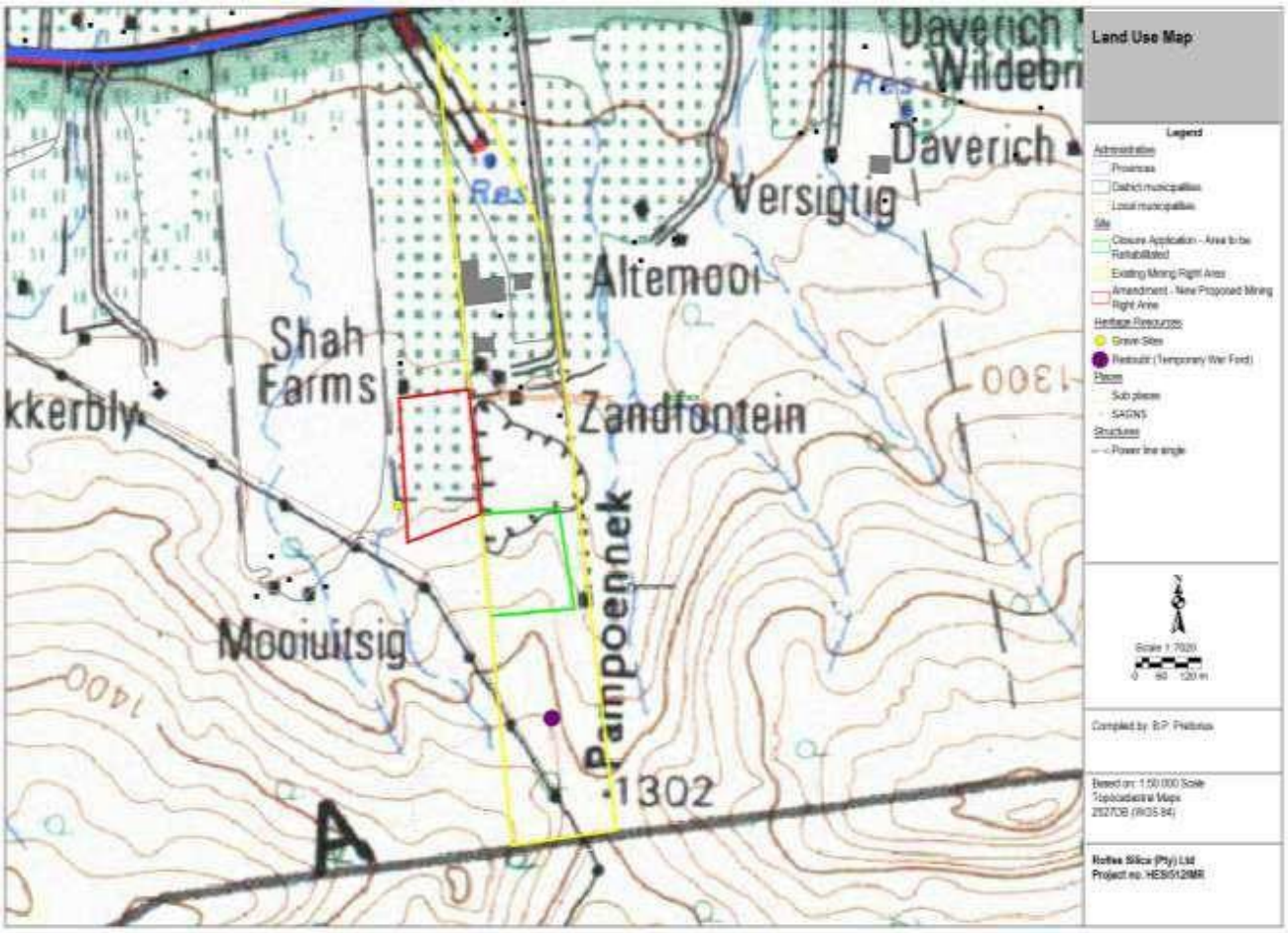


Figure 20: Heritage Sites

Overall, recommendations were as follows:

The gravesite and redoubt should be marked (preferably fenced) so that it is clear where people and activities should not trespass.

No mining or other activities should be allowed within a 20-meter buffer zone from the gravesite and redoubt.

Workers and any contractors or visitors should be made aware to avoid the gravesite and redoubt.

Workers and any contractors doing earth work or site clearance should be made aware to recognise possible heritage resources or artefacts, and should be clearly informed to stop further activities until further notice, and where to report such a finding.

It was recommended to South African Heritage Resources Agency (SAHRA) to approve the project to proceed as planned. See attached Phase 1 Heritage Report for both the original and proposed new Mining Right extension area attached in **Appendix 10.**

Noise and Dust Sources

Noise sources and baseline

Mining and associated activities often emit significant noise levels which can become a nuisance or health risk when not properly managed. This impact may affect not only to the mining area, but also to the surrounding land users and occupiers. The most sensitive receptors identified for the project area is the landowners and lawful occupiers of the study area itself, surrounding communities including land users, mine workers, industry, residential areas and permanent small holding homesteads and settlements. The local area is predominantly occupied by sand mining, agricultural and residential land uses.

The main noise generation activities of the proposed activities during all phases are:

Operational phase:

- Rehabilitation works on existing mine site
- Vegetation Clearing
- Drilling and Blasting
- Transportation of materials.
- Loading and off-loading of equipment and materials.

Closure or care and maintenance phase:

- Limited number of vehicles moving around the site; and
- Decommissioning of temporary infrastructure.

Noise generation can be expected on the proposed site due to various activities and actions as indicated above. Noise levels may possibly exceed allowed limits for noise as indicated in SANS 10103: 2008. The closest sensitive receptor is the homesteads on and immediately adjacent to the study area. Due to the close proximity of the homesteads to mining activities, mitigation measures are required to be implemented to reduce this impact. Mitigation measures may include keeping noisy activities to normal working hours and not over weekends or public holidays and maintaining machinery and vehicles in order to avoid unnecessary excessive noise emanating. It is also recommended that consultations be held with affected parties in order to establish an acceptable schedule of noisy activities.

Dust Sources and baseline

The following sensitive receptors of dust have been identified and it is expected that these receptors may be affected by dust fallout and other air pollutants, resulting from the proposed mining activities:

- Landowners and lawful occupiers of the properties adjacent to the study area.
- Surrounding communities including land users, mine workers, industry, residential areas and permanent agricultural holding homesteads and settlements

Aesthetic Quality

It is important to bear in mind that determining a visual resource in absolute terms is not achievable. Evaluating a landscape's visual quality is both complex and challenging, as many quality standards apply and it is largely subjective, with individuals basing evaluations on experiences, their social level and their cultural background. Furthermore, natural features are inherently variable. Climate, season, atmospheric conditions, region and sub-region all affect the attributes that comprise the landscape.

Visual Absorption Capacity (VAC) can be described as the ability of an area to absorb physical modifications. Factors affecting VAC include *inter alia*, vegetation, the built environment, existing infrastructure and topography. In terms of these factors the receiving environment is perceived to have a low to medium VAC.

Opencast mining will modify the physical characteristics of the study area significantly and will have a significant effect on the visual quality of the local area.

This is an existing and operational quarry. The following pictures **Figure 21** - **Figure 24** illustrate the visual impact of the existing quarry on the surrounding view shed, i.e. the view of the site from the perspective of people in the surrounding area. The main visual sensitive observers are travellers along the R104 Road. The pictures also illustrate the visual impact on travellers along this road. It is clear that the visual impact is minimal, and will even be less when the lower, proposed new section is mined and the higher, more visible section is rehabilitated, as applied for in this application.

Figure 21 : View from R104 Road, travelling towards Pretoria

Figure 22 : View from R104 Road, travelling towards Mooinooi

Figure 23: View from R104 Road, travelling towards Mooinooi

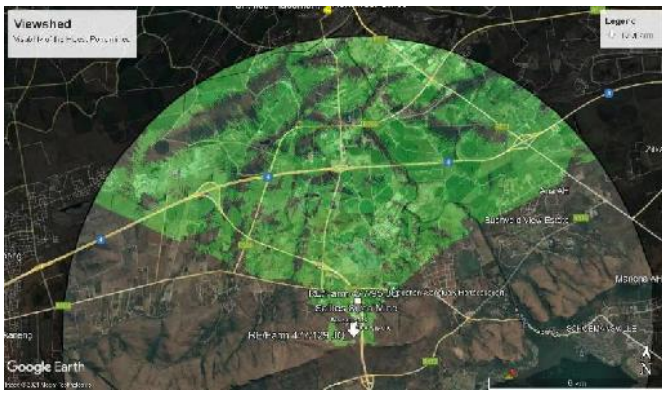


Figure 24 : Viewshed Calculation : Highest point mined would be visible from the areas in green.

Socio-Economic Environment

The population of the Madibeng Local Municipality is estimated, by the 2011 population census (Source: http://www.localgovernment.co.za/locals/demographics/188/Madibeng-Local-Municipality), to be 477 381. The population of the Bojanala Platinum District Municipality (Source: http://www.localgovernment.co.za/districts/demographics/39/Bojanala-Platinum-District-Municipality) is estimated to be 1 507 505. The Madibeng Local Municipality have an annual growth of 3.17 %, implying the projected population of the local municipality to be 492 514 in 2014.

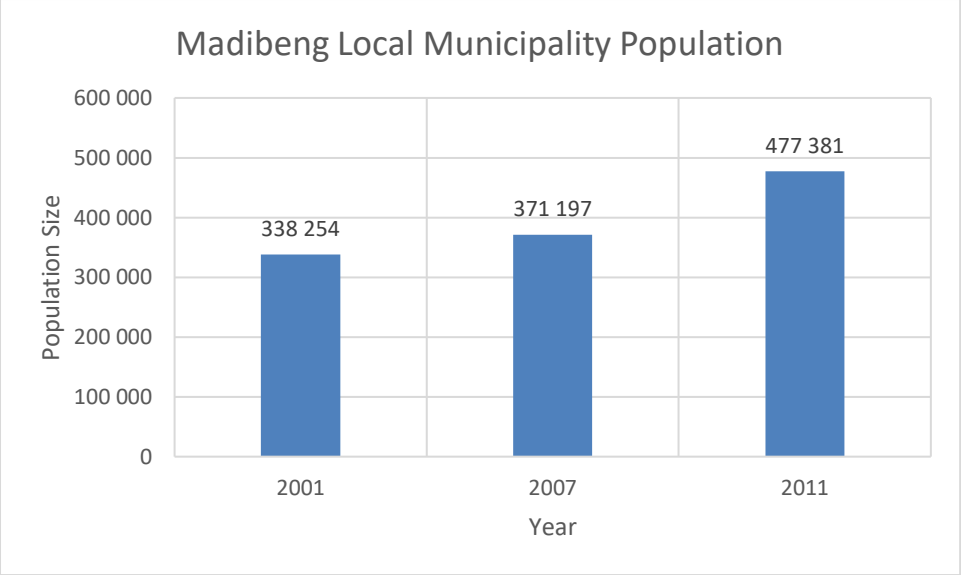


Figure 25: Population Growth (Source: Census 2011 Municipal Fact Sheet, published by Statistics South Africa)

Age Distribution

It is evident that the Madibeng Local Municipality (MLM) and the Bojanala Platinum District Municipality (BPDM) shows a typical age structure of a very young population distribution. The youth (15-34 years) unemployment rate of the MLM, is estimated by Census 2011 to be 38.20 % of the 30.40% unemployed population. At the time of Census 2011, 72 743 males within the age bracket of 20 to 24 years, - the group with the highest percentage of the general population within BPDM - and 58 860 females - between the ages of 20 and 24 years - were counted. These figures indicated an increase in this age group. From this information, it can be deduced that the main contributor of the increase in the population growth in the bracket between 20 and 24 years, was inward migration of people to the district in search of employment. The evident increase in the population that are eligible for the labour market, suggests that there is a pronounced need for development within the municipality in order to provide employment.

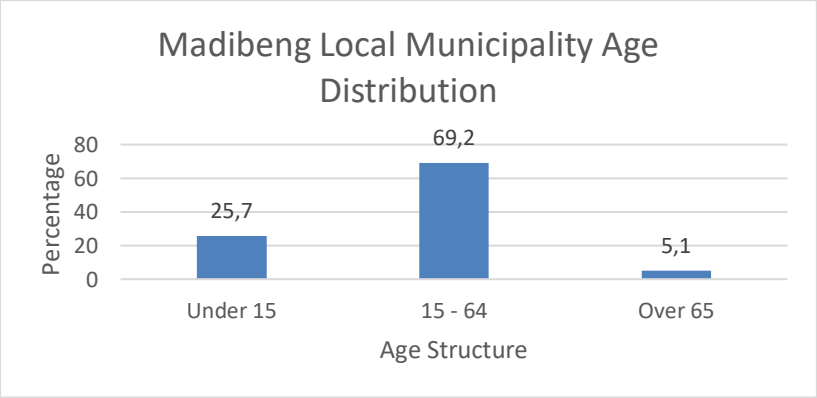


Figure 26: Age Distribution MLM (Source: Census 2011 Municipal Fact Sheet, published by Statistics South Africa)

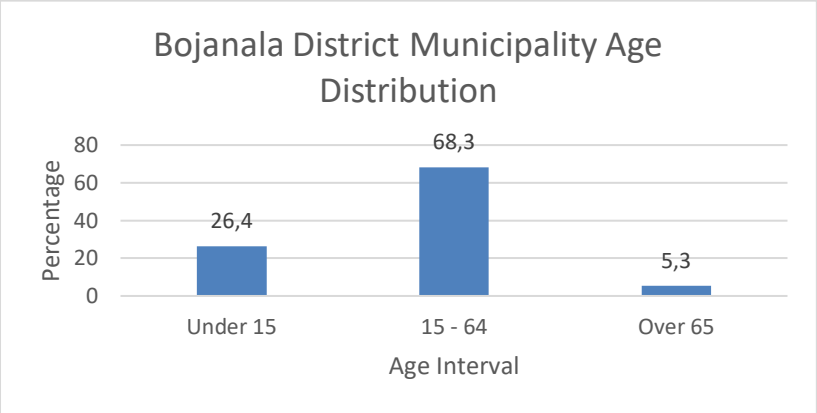


Figure 27: Age Distribution BPDM (Source: Census 2011 Municipal Fact Sheet, published by Statistics South Africa)

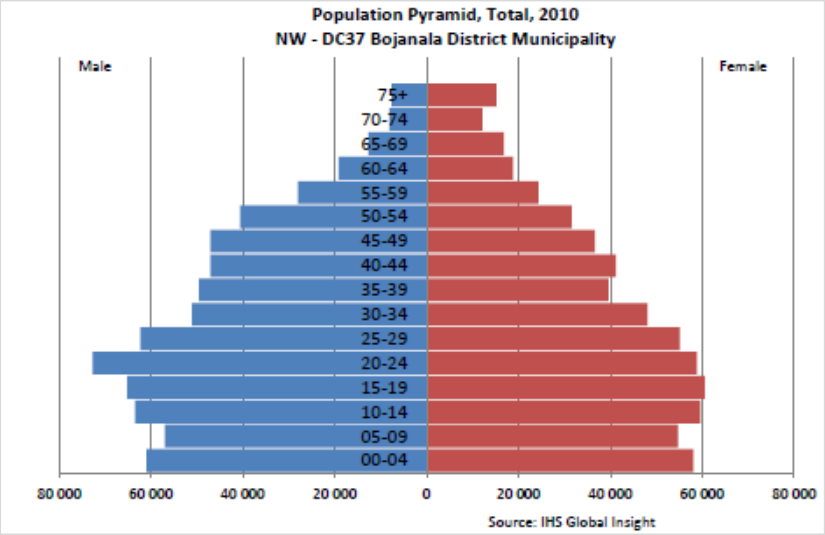


Figure 28: Sex and Age Distribution BPDM for 2010 (BPDM IDP) (Source: Census 2011 Municipal Fact Sheet, published by Statistics South Africa)

Education Levels

As can be seen from the Figure below, a very low percentage of the population of the Madibeng Local Municipality have higher education qualifications and only approximately 15% of the population completed secondary schooling.

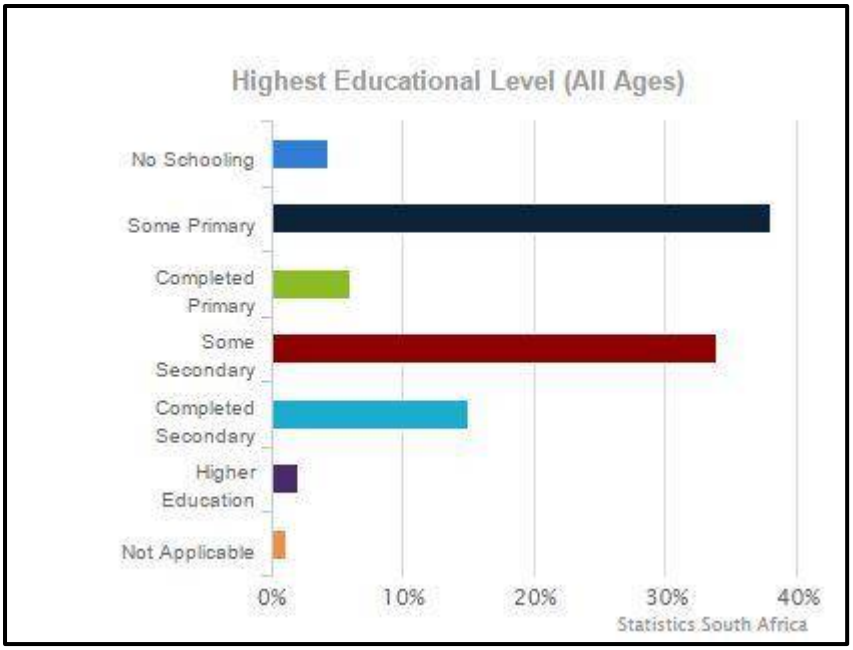


Figure 29: Highest Education Levels (All Ages) (MLM) (Source: Census 2011 Municipal Fact Sheet, published by Statistics South Africa)

Employment Status

Madibeng Local Municipality (MLM) is characterised by high levels of unemployment. In Madibeng, the unemployment rate for those aged 15 to 24 is 38,2%, 10% higher than the overall unemployment rate.

In 2010, the North West Province population showed the 10-19 years age group, comprised 20% of the population. This indicates that these 782 700 job seekers will have to migrate to other provinces in search of employment if new employment opportunities are not yet available within the North West Province. In 2011, it was estimated that within the next 12 years (2011 – 2022), more than 70 000 young people from Madibeng will enter the job market.

Table 10: Employment status of the MLM 2001 and 2011 (Source: Census 2011 Municipal Fact Sheet, published by Statistics South Africa)

	2001	**2011**
Unemployment rate	**41.9 %**	**30.40 %**
Employment rate	**56 %**	**69.60 %**

Table 11: Youth employment status of the MLM 2001 and 2011 (Source: Census 2011 Municipal Fact Sheet, published by Statistics South Africa)

	2001	**2011**

Youth unemployment rate	**52.90 %**	**38.20 %**
Youth employment rate	**47.10 %**	**61.80 %**

Agricultural Potential

The study area has generally very high agricultural potential. It is thus very important to note that the high agricultural potential can contribute to the much-needed employment and food security in the area. There is also much land that is not used for agricultural purposes.

The study site however is against mountainous terrain and would make crop production impossible. The size of the proposed expansion is also very small and would make agricultural production on this portion uneconomical.

(b) Description of the current land uses

The site is currently an existing mining operation. See attached Plan.

(c) Description of specific environmental features and infrastructure on the site

Environmental Features

The major sensitive features within the study area include:

- Houses and residents on the small holdings.
- Potential heritage objects or buildings.

Environmental and current land use map

(Show all environmental, and current land use features)

Refer to Figure 30

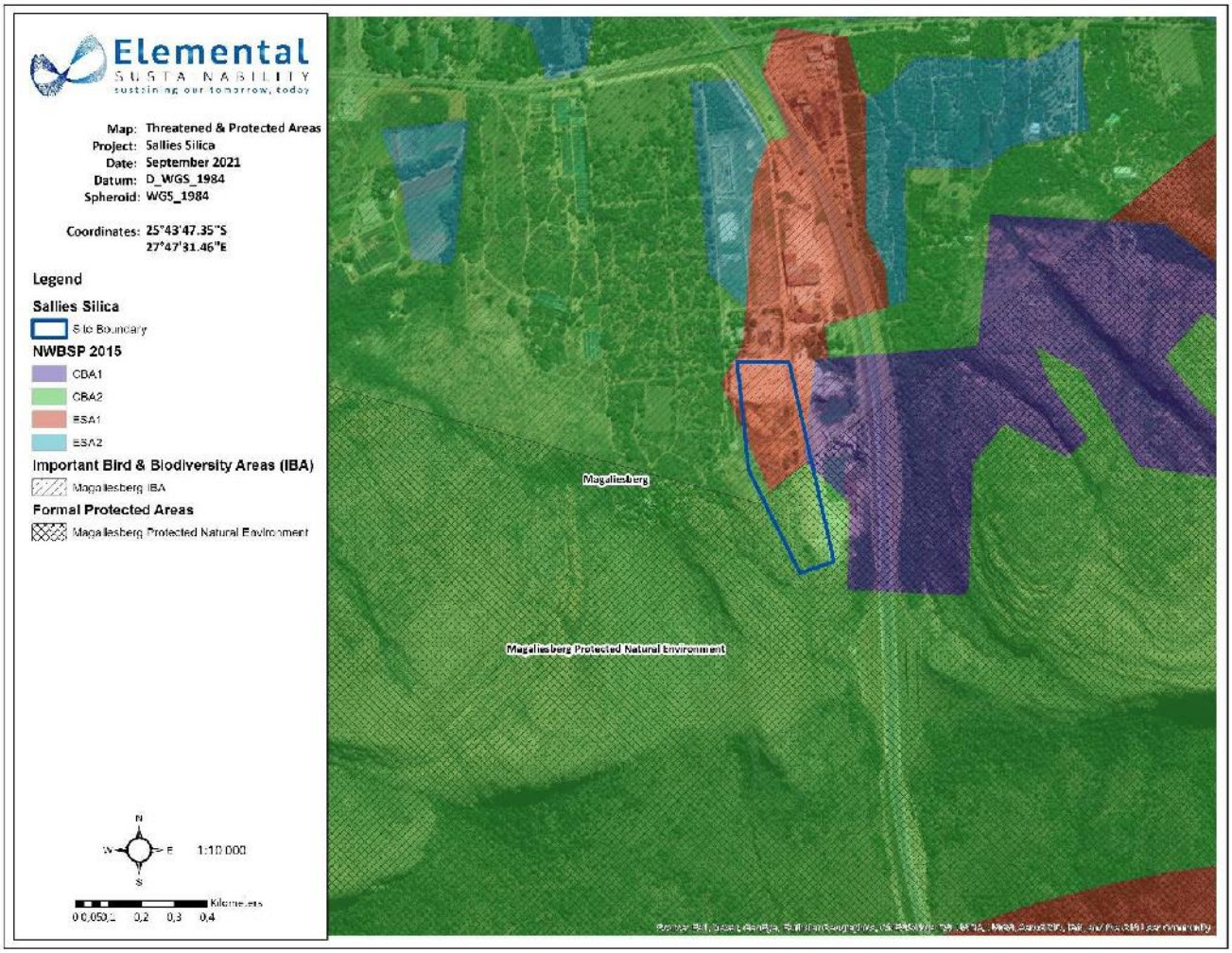


Figure 30: Sensitivity Maps of the Study Area - Ecological

10. Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated).

Table 12: EXPANSION : Impact Significance Calculation –Construction and Operational

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
TOPOGRAPHY	Mining of the area could have an impact on the visible topography of the mining site.	Construction and Operation	–	3	2	5	2	12	5	**60**	**Medium**	**36**	**Certain**	Very Low
GEOLOGY AND SOILS	Minor loss and disturbance to topsoil as a result of clearing of vegetation for mining. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils causes compaction of soils and reduces the soil's ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	Construction and Operation	–	**3**	**2**	**1**	**2**	**8**	**5**	**40**	**Medium**	**24**	**Certain**	**Very Low**

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	Hydrocarbon spills on soils can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	Construction and Operation	–	**3**	**2**	**1**	**3**	**9**	**2**	**18**	**High**	**3.6**	**Sure**	**Very Low**
HYDROLOGY GROUNDWATER SURFACE WATER	Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality.	Construction and Operation	–	**3**	**3**	**1**	**3**	**10**	**3**	**30**	**Medium**	**18**	**Sure**	**Very Low**
	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery.	Construction and Operation	–	**4**	**2**	**4**	**3**	**13**	**3**	**18**	**Low-Medium**	**3.6**	**Sure**	**Very Low**
BIODIVERSITY	Loss and disturbance of terrestrial habitat. The proposed site has sections which are moderately degraded, and habitat has been transformed for mining related activities and infrastructure. The onset of additional activities might result in impacts to the natural environment due to increased movement, traffic and large machinery to the area. Heavy machinery and vehicles might result in compaction of the soil and destruction of vegetation habitat which in	Construction and Operation	–	4	2	4	3	13	4	**52**	**Medium**	**31.2**	Certain	Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	turn will also impact on the animals that use the area as habitat.													
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	Construction and Operation	–	4	2	4	3	13	4	52	Medium	31,2	Sure	Low
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	Construction and Operation	–	3	3	1	3	10	4	40	Medium	24	Sure	Low
	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	Construction and Operation	–	3	3	1	3	10	4	40	Medium	24	Sure	Low
ARCHAEOLOGICAL/ HERITAGE RESOURCES	Alteration of archaeological, historical and palaeontological resources that may be discovered during mining.	Construction and Operation	–	2	1	5	5	13	2	26	Low-Medium	15.6	Sure	Very Low
VISUAL AND SENSE OF PLACE	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	Construction and Operation	–	3	3	1	1	8	5	40	High	8	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
NOISE AND VIBRATION	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Construction and Operation	–	4	3	1	2	10	5	50	High	10	Sure	Very Low
AIR QUALITY	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and miningg.	Construction and Operation	–	4	3	1	2	10	5	50	High	10	Sure	Very Low
	Increased dust pollution due to loading and hauling of sand	Operation	–	3	3	1	2	9	5	45	Medium	27	Sure	Very Low
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	Construction and Operation	–	3	3	1	3	10	5	50	Medium	30	Sure	Very Low
WASTE	Generation of additional general waste, litter and building rubble and hazardous waste from mining operation.	Construction and Operation	–	3	3	1	5	12	5	60	Medium	36	Certain	Very Low
SERVICES	Minor impact caused by need for services i.e., water, electricity and sewerage systems during the mining phase causing additional strain on natural resources and service infrastructure.	Construction and Operation	–	2	2	1	3	8	3	24	Medium	14,4	Certain	Very Low
TRAFFIC	Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	Construction and Operation	–	2	3	4	1	7	4	28	Medium-High	11.2	Sure	Very Low
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	Construction and Operation	–	5	3	4	5	18	3	54	Medium	32.4	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
HEALTH AND SAFETY	Possibility of mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Construction and Operation	–	3	2	4	5	19	3	57	Medium - High	22.8	Sure	Very Low
SOCIO-ECONOMIC	Potential creation of very limited extent short term employment opportunities for the local community, during the mining phase.	Construction and Operation	+	3	3	1	1	8	5	40	N/A	40	Certain	Very Low
	Multiplier effects on local economy will be positive, but very limited in extent.	Construction and Operation	+	2	3	1	1	7	5	35	N/A	35	Certain	Very Low
TOURISM	The posable impact on the visual aspect, senses of place and the noise and dust could have an impact on tourism facilities in close vicinity to the mining.	Construction and Operation	–	2	3	1	1	7	5	35	Medium High	14	Sure	Very Low

Table 13: EXPANSION : Impact Significance Calculation –Rehabilitation

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
TOPOGRAPHY	Sloping and contouring the site for rehabilitation.	**Rehabilitation**	**+**	_	3	2	1	2	8	**16**	**High**	**3.2**	**Certain**	**Very Low**
GEOLOGY AND SOILS	Replacement of topsoil for revegetation. Topsoil will be placed on sloped areas for revegetation.	**Rehabilitation**	_	**3**	**2**	**1**	**2**	**8**	**5**	**40**	**Medium**	**24**	**Certain**	**Very Low**
	Hydrocarbon spills on soils can occur where heavy machinery and vehicles are used during rehabilitation works.	Rehabilitation	_	**3**	**2**	**1**	**3**	**9**	**2**	**18**	**High**	**3.6**	**Sure**	**Very Low**
HYDROLOGY GROUNDWATER SURFACE WATER	Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality during rehabilitation.	Rehabilitation	_	**3**	**3**	**1**	**3**	**10**	**3**	**30**	**Medium**	**18**	**Sure**	**Very Low**
	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery during rehabilitation works	Rehabilitation	_	**4**	**2**	**4**	**3**	**13**	**3**	**18**	**High**	**3,6**	**Sure**	**Very Low**
BIODIVERSITY	Loss and disturbance of terrestrial habitat. The proposed site has sections which are moderately degraded, and habitat has been transformed for mining related activities and infrastructure. The	Rehabilitation	_	2	2	2	3	9	3	36	Medium	**7.2**	Certain	Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	onset of additional activities might result in impacts to the natural environment due to increased movement, traffic and large machinery to the area. Heavy machinery and vehicles might result in compaction of the soil and destruction of vegetation habitat which in turn will also impact on the animals that use the area as habitat.													
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	Rehabilitation	_	2	2	2	3	9	3	36	Medium	7.2	Certain	Low
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	Rehabilitation	_	**3**	**3**	**1**	**3**	**10**	**4**	40	High	8	**Sure**	**Low**

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	Rehabilitation	_	3	3	1	3	10	4	40	High	8	Sure	Low
ARCHAEOLOGICAL/ HERITAGE RESOURCES	Alteration of archaeological, historical and palaeontological resources that may be discovered during mining.	Rehabilitation	_	2	1	5	5	13	2	26	Medium	15.6	Sure	Very Low
VISUAL AND SENSE OF PLACE	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	Rehabilitation	_	3	3	1	1	8	5	40	Low-Medium	20	Sure	Very Low
NOISE AND VIBRATION	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Rehabilitation	_	3	3	1	2	9	3	27	High	5,4	Sure	Very Low
AIR QUALITY	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and blasting	Rehabilitation	_	4	3	1	2	10	5	50	Medium	30	Sure	Very Low
	Increased dust pollution due to loading and hauling of topsoil to the site	Rehabilitation	_	3	3	1	2	9	4	36	Medium	30	Sure	Very Low
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	Rehabilitation	_	3	3	1	3	10	5	50	Low-Medium	40	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
WASTE	Generation of additional general waste, litter and building rubble and hazardous waste from mining operation.	Rehabilitation	_	3	3	1	5	12	5	60	Medium	36	Certain	Very Low
HEALTH AND SAFETY	Possibility of mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Rehabilitation	_	3	2	4	5	19	3	57	Medium - High	22.8	Sure	Very Low
SOCIO-ECONOMIC	Potential creation of very limited extent short term employment opportunities for the local community, during the closure phase.	Rehabilitation	+	3	3	1	1	8	5	40	N/A	40	Certain	Very Low
	Multiplier effects on local economy will be negative, but very limited in extent.	Rehabilitation	-	2	3	1	1	7	5	35	N/A	35	Certain	Very Low

Table 14: REDUCTION : Impact Significance Calculation –Rehabilitation

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
TOPOGRAPHY	Sloping and contouring the site for rehabilitation.	Rehabilitation	+	_	3	2	1	2	8	16	Medium	9,6	24	Certain
GEOLOGY AND SOILS	Replacement of topsoil for revegetation. Topsoil will be placed on sloped areas for revegetation.	**Rehabilitation**	_	**3**	**2**	**1**	**2**	**8**	**5**	**40**	**Medium**	**24**	**Certain**	**Very Low**
	Hydrocarbon spills on soils can occur where heavy machinery and vehicles are used during rehabilitation works.	Rehabilitation	_	**3**	**2**	**1**	**3**	**9**	**2**	**18**	**High**	**3.6**	**Sure**	**Very Low**
HYDROLOGY GROUNDWATER SURFACE WATER	Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality during rehabilitation.	Rehabilitation	_	**3**	**3**	**1**	**3**	**10**	**3**	**30**	**Medium**	**18**	**Sure**	**Very Low**
	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery during rehabilitation works	Rehabilitation	_	**4**	**2**	**4**	**3**	**13**	**3**	**18**	**High**	**3.6**	**Sure**	**Very Low**
BIODIVERSITY	Loss and disturbance of terrestrial habitat. The proposed site has sections which are moderately degraded, and habitat has been transformed for mining related activities and infrastructure. The onset of additional activities might result in impacts to the natural environment due to	Rehabilitation	_	2	2	2	3	9	3	36	Medium High	**14,4**	Certain	Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	increased movement, traffic and large machinery to the area. Heavy machinery and vehicles might result in compaction of the soil and destruction of vegetation habitat which in turn will also impact on the animals that use the area as habitat.													
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	Rehabilitation	_	2	2	2	3	9	3	36	Medium	7.2	Certain	Low
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	Rehabilitation	_	**3**	**3**	**1**	**3**	**10**	**4**	40	High	8	**Sure**	**Low**
	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	Rehabilitation	_	**3**	**3**	**1**	**3**	**10**	**4**	40	High	8	**Sure**	**Low**

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
ARCHAEOLOGICAL/ HERITAGE RESOURCES	Alteration of archaeological, historical and palaeontological resources that may be discovered during mining	Construction and Operation	–	2	1	5	5	13	2	26	Medium	15.6	Sure	Very Low
VISUAL AND SENSE OF PLACE	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	Construction and Operation	–	3	3	1	1	8	5	40	Low-Medium	32	Sure	Very Low
NOISE AND VIBRATION	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Construction and Operation	–	3	3	1	2	9	3	27	High	5,4	Sure	Very Low
AIR QUALITY	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and blasting	Construction and Operation	–	4	3	1	2	10	5	50	Medium	30	Sure	Very Low
	Increased dust pollution due to loading and hauling of topsoil to the site	Operation	–	3	3	1	2	9	4	36	Medium	30	Sure	Very Low
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	Construction and Operation	–	3	3	1	3	10	5	50	Low	40	Sure	Very Low
WASTE	Generation of additional general waste, litter and building rubble and hazardous waste from mining operation.	Construction and Operation	–	3	3	1	5	12	5	60	Medium	36	Certain	Very Low
HEALTH AND SAFETY	Possibility of mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Construction and Operation	–	3	2	4	5	19	3	57	Medium - High	22.8	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
SOCIO-ECONOMIC	Potential creation of very limited extent short term employment opportunities for the local community, during the closure phase.	Construction and Operation	+	3	3	1	1	8	5	40	N/A	40	Certain	Very Low
	Multiplier effects on local economy will be negative, but very limited in extent.	Construction and Operation	-	2	3	1	1	7	5	35	N/A	35	Certain	Very Low

Table 15: No-Go Impact Significance Calculation

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
TOPOGRAPHY	Mining of the area could have an impact on the visible topography of the mining site.	Construction and Operation	–	4	**3**	5	2	14	5	**70**	**Medium**	**42**	**Certain**	Very Low
GEOLOGY AND SOILS	Minor loss and disturbance to topsoil as a result of clearing of vegetation for mining. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils causes compaction of soils and reduces the soil's ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	Construction and Operation	–	**3**	**2**	**1**	**2**	**8**	**5**	**40**	**Medium**	**24**	**Certain**	**Very Low**

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	Hydrocarbon spills on soils can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	Construction and Operation	–	3	2	1	3	9	2	18	High	3.6	Sure	Very Low
HYDROLOGY GROUNDWATER SURFACE WATER	Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality.	Construction and Operation	–	3	3	1	3	10	3	30	Medium	18	Sure	Very Low
	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery.	Construction and Operation	–	4	2	4	3	13	3	18	Low-Medium	3.6	Sure	Very Low
BIODIVERSITY	Loss and disturbance of terrestrial habitat. The proposed site has sections which are moderately degraded, and habitat has been transformed for mining related activities and infrastructure. The onset of additional activities might result in impacts to the natural environment due to increased movement, traffic and large machinery to the area. Heavy machinery and vehicles might result in compaction of the soil and destruction of vegetation habitat which in	Construction and Operation	–	4	2	4	3	13	4	52	Medium	31.2	Certain	Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	turn will also impact on the animals that use the area as habitat.													
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	Construction and Operation	–	4	2	4	3	13	4	52	Medium	31,2	Sure	Low
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	Construction and Operation	–	3	3	1	3	10	4	40	Medium	24	Sure	Low
	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	Construction and Operation	–	3	3	1	3	10	4	40	Medium	24	Sure	Low
ARCHAEOLOGICAL/ HERITAGE RESOURCES	Alteration of archaeological, historical and palaeontological resources that may be discovered during mining.	Construction and Operation	–	2	1	5	5	13	2	26	Low-Medium	15.6	Sure	Very Low
VISUAL AND SENSE OF PLACE	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	Construction and Operation	–	3	3	5	1	12	5	60	High	12	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
NOISE AND VIBRATION	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Construction and Operation	–	4	3	1	2	10	5	50	High	10	Sure	Very Low
AIR QUALITY	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and miningg.	Construction and Operation	–	4	3	1	2	10	5	50	High	10	Sure	Very Low
	Increased dust pollution due to loading and hauling of sand	Operation	–	3	3	1	2	9	5	45	Medium	27	Sure	Very Low
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	Construction and Operation	–	3	3	1	3	10	5	50	Medium	30	Sure	Very Low
WASTE	Generation of additional general waste, litter and building rubble and hazardous waste from mining operation.	Construction and Operation	–	3	3	1	5	12	5	60	Medium	36	Certain	Very Low
SERVICES	Minor impact caused by need for services i.e., water, electricity and sewerage systems during the mining phase causing additional strain on natural resources and service infrastructure.	Construction and Operation	–	2	2	1	3	8	3	24	Medium	14,4	Certain	Very Low
TRAFFIC	Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	Construction and Operation	–	2	3	4	1	7	4	28	Medium-High	11.2	Sure	Very Low
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	Construction and Operation	–	5	3	4	5	18	3	54	Medium	32.4	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	PHASE	IMPACT STATUS	INTENSITY	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
HEALTH AND SAFETY	Possibility of mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Construction and Operation	–	3	2	4	5	19	3	57	Medium - High	22.8	Sure	Very Low
SOCIO-ECONOMIC	Potential creation of very limited extent short term employment opportunities for the local community, during the mining phase.	Construction and Operation	+	3	3	1	1	8	5	40	N/A	40	Certain	Very Low
	Multiplier effects on local economy will be positive, but very limited in extent.	Construction and Operation	+	2	3	1	1	7	5	35	N/A	35	Certain	Very Low
TOURISM	The posable impact on the visual aspect, senses of place and the noise and dust could have an impact on tourism facilities in close vicinity to the mining.	Construction and Operation	–	2	3	1	1	7	5	35	Medium High	14	Sure	Very Low

11. Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision).

A "significant impact" is defined as it is defined in the EIA Regulations (2014) (as amended): "an impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence". The objective of this EIA methodology is to serve as framework for accurately evaluating impacts associated with current or proposed activities in the biophysical, social and socio-economical spheres. It aims to ensure that all legal requirements and environmental considerations are met in order to have a complete and integrated environmental framework for impact evaluations.

The process of determining impacts to be assessed is one of the most important parts of the environmental impact assessment process. It is of such high importance because the environmental impacts identified can and are often linked to the same impact stream. In this method all impacts on the biophysical environment are assessed in terms of the overall integrity of ecosystems, habitats, populations and individuals affected. For example, the removal of groundcover for the sloping or scraping of an embankment, can lead to higher amounts of water runoff which increases the rate of erosion. Further down in the river the amount of sediment increases because of the increased erosion. A number of fish species cannot endure the high amount of sediment and moves off. The habitat is thus changed or in the process of changing. Thus, one needs to understand that the root of the problem (removal of groundcover) is assessed in terms of the degree of change in the health of the environment and/or components in relation to their conservation value. Thus, if the impact of removal of groundcover of a definable system is high and the conservation value is also high then the impact of removal of groundcover is highly significant.

Environmental Impact Assessment (EIA) Regulations, 2014 requirements (as amended)

The Environmental Impact Assessment (EIA) 2014 Regulations promulgated in terms of Sections 24 (5), 24M and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA), requires that all identified potential impacts associated with the proposed project be assessed in terms of their overall potential significance on the natural, social and economic environments. The criteria identified in the EIA Regulations (2014) include the following:

- Nature of the impact.
- Extent of the impact.
- Duration of the impact
- Probability of the impact occurring.

- Degree to which impact can be reversed.
- Degree to which impact may cause irreplaceable loss of resources.
- Degree to which the impact can be mitigated; and
- Cumulative impacts.

ELEMENTAL SUSTAINABILITY has developed an impact assessment methodology (as defined below) whereby the Significance of a potential impact is determined through the assessment of the relevant temporal and spatial scales determined of the Extent, Magnitude and Duration criteria associated with a particular impact. This method does not explicitly define each of the criteria but rather combines them and results in an indication of the overall significance.

Impact Assessment Methodology

By considering the root cause of the issue in this way, the probability that the activity undertaken does or may result in an impact, can be determined. The associated impact can then be assessed in order to determine its significance and to define mitigation measures or management measures to address the impact.

The following definitions therefore apply:

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation.
- An environmental aspect is an 'element of an organisation's activities, products and services which can interact with the environment. The interaction of an aspect with the environment may result in an impact.
- Environmental impacts are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality.
- Receptors can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and palaeontology. Impacts on the environment can lead to changes in existing conditions; the impacts can be direct, indirect or cumulative.
- Direct impacts refer to changes in environmental components that result from direct cause-effect consequences of interactions between the environment and project activities. Indirect impacts result from cause-effect consequences of interactions between the environment and direct impacts; and
- Cumulative impacts refer to the accumulation of changes to the environment caused by human activities.

Assessment of Impact Significance

The accumulated knowledge and the findings of the environmental investigations form the basis for the prediction of impacts. Once a potential impact has been determined, it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important

for evaluating the significance of the impact, and for defining mitigation and monitoring strategies. The impact assessment methodology used to determine the significance of impacts prior and after mitigation is presented below.

Extent of the impact

The EXTENT of an impact is the physical extent/area of impact or influence.

Score	Extent	Description
1	Footprint	The impacted area extends only as far as the actual footprint of the activity.
2	Site	The impact will affect the entire or substantial portion of the site/property.
3	Local	The impact could affect the area including neighbouring properties and transport routes.
4	Region	Impact could be widespread with regional implication.
5	National	Impact could have a widespread national level implication.

Duration of the impact

The DURATION of an impact is the expected period of time the impact will have an effect.

Score	Duration	Description
1	Short term	The impact is quickly reversible within a period of less than 2 years, or limited t the construction phase, or immediate upon the commencement of floods.
2	Short to medium term	The impact will have a short term lifespan (2–5 years).
3	Medium term	The impact will have a medium term lifespan (6 – 10 years)
4	Long term	The impact will have a medium term lifespan (10 – 25 years)
5	Permanent	The impact will be permanent beyond the lifespan of the development

Intensity of the impact

The INTENSITY of an impact is the expected amplitude of the impact.

Score	Intensity	Description
1	Minor	The activity will only have a minor impact on the affected environment in such a way that the natural processes or functions are not affected.
2	Low	The activity will have a low impact on the affected environment.
3	Medium	The activity will have a medium impact on the affected environment, but function and process continue, albeit in a modified way.
4	High	The activity will have a high impact on the affected environment which may be disturbed to the extent where it temporarily or permanently ceases.
5	Very High	The activity will have a very high impact on the affected environment which may be disturbed to the extent where it temporarily or permanently ceases.

Reversibility of the impact

The REVERSIBILITY of an impact is the severity of the impact on the ecosystem structure

Score	Reversibility	Description
1	Completely reversible	The impact is reversible without any mitigation measures and management measures
2	Nearly completely reversible	The impact is reversible without any significant mitigation and management measures. Some time and resources required.
3	Partly reversible	The impact is only reversible with the implantation of mitigation and managemer measures. Substantial time and resources required.
4	Nearly irreversible	The impact is can only marginally be reversed with the implantation of significan mitigation and management measures. Significant time and resources required t ensure impact is on a controllable level.
5	Irreversible	The impact is irreversible.

Probability of the impact

The PROBABILITY of an impact is the severity of the impact on the ecosystem structure

Score	Probability	Description
1	Improbable	The possibility of the impact occurring is highly improbable (less than 5% of impact occurring).
2	Low	The possibility of the impact occurring is very low, due either to the circumstances, design or experience (5% to 30% of impact occurring).
3	Medium	There is a possibility that the impact will occur to the extent that provision must be made therefore (30% to 60% of impact occurring).
4	High	There is a high possibility that the impact will occur to the extent that provision must be made therefore (60% to 90% of impact occurring).
5	Definite	The impact will definitely take place regardless of any prevention plans, and there can only be relied on migratory actions or contingency plans to contain the effect (90% to 100% of impact occurring).

Calculation of Impacts – Significance Rating of Impact

Significance is determined through a synthesis of the various impact characteristics and represents the combined effect of the Irreplaceability (Magnitude, Extent, Duration, and Intensity) multiplied by the Probability of the impact. The significance of an impact is rated according the scores a presented below:

Equation 1:

Significance = Irreplaceability (Reversibility + Intensity + Duration + Extent) X Probability

Significance Rating

Score	Significance	Colour Code
1 to 20	Very low	
21 to 40	Low	
41 to 60	Medium	
61 to 80	High	
81 to 100	Very high	

Mitigation Efficiency	
Degree to which the impact can be mitigated: *The effect of mitigation measures on the impact and its degree of effectiveness:* *Equation 2:* *Significance Rating = Significance x Mitigation Efficiency*	
High	0,2
Medium to High	0,4
Medium	0,6
Low to Medium	0,8
Low	1,0

Confidence rating: *Level of certainty of the impact occurring*.

- **Certain**
- **Sure**
- **Unsure**

Cumulative impacts: *The effect the combination of past, present and "reasonably foreseeable" future actions have on aspects.*

- Very Low cumulative impact
- Low cumulative impact
- Medium cumulative impact
- High cumulative impact

The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties).

This section will be completed once comments have been received from interested and affected parties.

The possible mitigation measures that could be applied and the level of risk.

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ discussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered).

This section will be completed once comments have been received from interested and affected parties.

Motivation where no alternative sites were considered

Mining is conducted in phases, where the activities and location of mining is dependent on the previous phase. The overall mining area is indicated in Figure 1. Areas to be avoided in terms of sensitivities are also indicated on the sensitivity maps in this report. Positioning of invasive mining planned should be conducted with a suitably qualified ecologist in order to avoid or minimise the destruction of any sensitive vegetation or habitats occurring in these areas.

The site is; therefore, the preferred site and alternative sites are not considered.

- **Statement motivating the alternative development location within the overall site**

(Provide a statement motivating the final site layout that is proposed)

The specific locations of intrusive activities is provided in Appendix 13. All infrastructure to be is existing. The specialist, however, provide recommendations for minimising the potential impact.

b) Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout plan) 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).

- **Approach to the EIA**

An Environmental Impact Assessment (EIA) is a good planning tool. It identifies the environmental impacts of a proposed development and assists in ensuring that a project will be environmentally acceptable and integrated into the surrounding environment in a sustainable way.

The Basic Impact Assessment for this project complies with the National Environmental Management Act (1998) (as amended) and the NEMA EIA Regulations (2014) and guidelines of the Department of Environmental Affairs (DEA). The guiding principles of an EIA are listed below.

- **Guiding principles for an EIA**

The EIA must take an open participatory approach throughout. This means that there should be no hidden agendas, no restrictions on the information collected during the process and an open-door policy by the proponent. Technical information must be communicated to stakeholders in a way that is understood by them and that enables them to meaningfully comment on the project.

There should be ongoing consultation with interested and affected parties representing all walks of life. Sufficient time for comment must be allowed. The opportunity for comment should be announced on an on-going basis. There should be opportunities for input by specialists and members of the public. Their contributions and issues should be considered when technical specialist studies are conducted and when decisions are made

- **Information gathering**

Early in the Basic Assessment process, the Environmental Assessment Practitioner (EAP) identified the information that would be required for the impact assessment and the relevant data were obtained. In addition, available information about the receiving environment was gathered from reliable sources, interested and affected parties, previous documented studies in the area and previous EIA Reports. The project team visited the site to gain first-hand information and an understanding of the existing operations and the proposed project.

- **Specialist Assessments**

The following specialist studies have been conducted:

- Ecological and Biodiversity Assessment
- Cultural heritage desktop assessment (Existing)
- Closure Cost Assessment
- Rehabilitation Plan (Existing)
- Geohydrological Study (Existing)

The main objective of the specialist studies is to provide independent scientifically sound information on issues of concern relating to the project proposal.

The findings and recommendations identified by the various specialist studies undertaken, were incorporated into the Basic Impact Assessment.

- **Legislative Framework**

The legal requirements were described and assessed in detail.

- **Alternatives**

Various site alternatives and layouts have been assessed to determine the best socio-economical and biophysical option.

- **Description and assessment of impacts identified**

A comprehensive list of all potential impacts of the mining as identified by the EAP and the specialists, are provided and are assessed.

- **Environmental management programme**

An Environmental Management Programme containing mitigation, management and monitoring measures and specifying roles and responsibilities was compiled with specialist input and are included in this report.

- **Stakeholder engagement**

Registered interested and affected parties including relevant organs of state, are consulted with during the process. All their comments will be formally responded to and incorporated into the Basic Assessment Report and Environmental Management Programme that will be submitted to the competent authority.

c) Assessment of each identified potentially significant impact and risk

(This section of the report must consider all the known typical impacts of each of the activities (including those that could or should have been identified by knowledgeable persons) and not only those that were raised by registered interested and affected parties)

Potential impacts that may be caused by the proposed development will be identified using input from the following:

- Views of I&APs.
- Existing information.
- Specialist investigations.
- Site visit with the project team; and
- Legislation.

The following potential major direct, indirect and cumulative impacts were identified:

Direct and Indirect Impacts

- Contamination and compaction of soils.
- Erosion.
- Contamination of ground- and surface water quality and decline in quantity.

- Impacts on biodiversity.
- Loss and displacement of fauna.
- Impacts on existing land use of the study and surrounding area.
- Decreased aesthetic value and impact on "Sense of Place".
- Poor air quality and decreased visibility due to dust pollution.
- Increased noise levels.
- Waste generation.
- Increased demand on service infrastructure and resources.
- Slight increase in traffic and need for maintenance of road infrastructure.
- Potential injury and loss of health and life of humans; and
- Altered Socio-Economic Environment (Positive or negative).

Cumulative Impacts

In terms of cumulate impacts, the activity entails the decrease of mining area on the one side with increase mining area on the other side. One section will therefore be rehabilitated and the other section mined. The cumulative impact can therefore be said to be neutral or the same as the current activity

The most significant impact is potentially on biodiversity. The loss and fragmentation of habitat are two of the more serious cumulative impacts in terms of fauna and flora. Given the largely natural state of the Magaliesberg Natural Environment in the surrounding landscape, the characteristics and sensitivity of the affected area, the nature of the proposed development, and the potential for cumulative impacts are expected to be moderate as the activities and thus the impacts will increase.

It was not realistically possible or very difficult to perform an impact assessment for the cumulative impacts based on the available information.

Table 16: Assessment of each identified potentially significant impact and risk – Proposed Expansion

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	Mining could result in change of site topography	Topography	Construction and Operation	**Medium (-)**	• maximize access to aggregate resources on the site, • use all unique deposit features created by the mining operation in shaping new landscapes, • employ non-aggregate earth materials such as overburden, clay deposits, and mine waste in building and shaping land forms, • use available earth moving equipment and earth moving procedures efficiently for reclaiming the mine site, without interfering with ongoing mining operations, • develop a coordinated and sequential program of mining, earth moving, land shaping, and landscaping to ensure that lands are prepared for development as mining progresses through the deposit • Conduct concurrent rehabilitation during the operational phase. • Keep Photographic record of the mine site for restoration purposes.	**Low(-)**

: Clearing of vegetation from mining footprints; Blasting, ;loading and Hauling Material to crushing, screening and washing Drying and Packaging minerals at plant	Loss and disturbance to topsoil as a result of clearing of vegetation for mining. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils causes compaction of soils and reduces the soil's ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	Soil	Construction and Operation	**Low (-)**	**Prevent and reduce through management measures.** • Demarcation of mining area: • Areas to be prospected must be clearly demarcated • Detailed mining plan must be developed and updated on month to month basis **Stripping of topsoil:** • Clearing of areas to take place a maximum of one month prior to mining. • Stripping of topsoil will not take place during rain or excessive wind; and • The top 30 cm of vegetation and topsoil is to be stripped from the area to be mined. **Storage of topsoil / overburden:** • Topsoil (top 30cm) is to be stored in predetermined topsoil berms, (+/- 5m) inside the boundary of the specific area; and • Topsoil stockpiles will be restricted to 1.5 to 2m in height. • Topsoil stockpiles must be protected from erosion • A topsoil stripping and storage procedure must be developed and stored on site.	**Low (-)**
	Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	Soil	Construction and Operation	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and • The approved Integrated Water and Waste Management Plan to be implemented. ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	**Very Low (-)**
	Stormwater, erosion and siltation impacts due to a lack of implementing measures to	Surface water	Construction and Operation	**Low (-)**	**Prevent and reduce and remedy through management measures.** • A generic Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur.	**Very Low (-)**

	manage stormwater run-off quantity and quality.				• The existing Stormwater management systems (such as existing stormwater dam) will be used to prevent stormwater from entering or exiting the area where mining will occur, which could result in silt laden surface water from draining into natural drainage lines • The slopes of the area where mining activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). Slopes must be developed with a qualified mining engineer to ensure safety. • If necessary, temporary diversion channels should be constructed ahead of the stockpiles (if relevant) to intercept clean run-off and divert it around disturbed areas into the natural drainage system downstream (down gradient) of the mining area. • Existing vegetation must be retained as far as possible to minimise erosion problems. • Rehabilitation of the mining area shall be planned and completed (after conclusion of the mining activities) in such a way that the run-off water (if any) will not cause erosion. • Visual inspections shall be done on a weekly basis with regard to the stability of the temporary water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams. • No river or surface water may be affected by silt emanating from the mining area • No wastewater may run freely into any of the surrounding naturally vegetated areas.	

	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	Surface water and ground water resources	Construction and Operation	**Very Low (-)**	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated. • Contain any dirty water within a system; and • Prevent the contamination of clean water. In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that that potential stormwater impacts are kept to a minimum: • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained and treated. • All storm water infrastructure (if any) on-site shall be maintained and kept clean throughout the ining period. • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented. • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e., Spill kits) must be placed throughout the site. • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory. • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited. • Stormwater leaving the site must in no way be contaminated. • Ensure good housekeeping practices. • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance with relevant specifications. • All chemicals and fuels to be stored in the designated chemical storage area on site • Refuelling must be conducted at the diesel storage area where possible. • Should diesel bowsers be used for refuelling drip trays must be used during refuelling. • Chemical storage procedures must be developed by the on-site environmental officer and kept on site	**Very Low (-)**

					• Refuelling procedures must be developed by the site environmental officer and kept on file on site.	

	Loss and disturbance of terrestrial habitat. The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection during construction activities. Permanent changes to water flows and loss of important habitat may occur during the operational phase	Biodiversity	Construction and Operation	**Medium(-)**	**Reduce through management measures.** • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site clearing activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Adhere to all management and mitigation measures as prescribed within other specialist reports and Environmental Management Programme (EMPr). • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Continuous rehabilitation of the area should occur, immediate closure and rehabilitation. This will entail the spreading of topsoil, revegetation and management of invasive species. • It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon (including fencing off the defined project area) and preventing movement of workers into natural areas. • Rehabilitation measures that are implemented must be continually monitored for a minimum period of four years to ensure that proper succession has occurred and that there is no erosion occurring. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.	**Low (-)**
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of	Biodiversity	Construction and Operation	**Medium (-)**	**Reduce through management measures.** • Relocate conservation-worthy species under the supervision of a vegetation or horticultural specialist.	**Low (-)**

	the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.				• Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority.	
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	Biodiversity	Construction and Operation	**Low (-)**	**Reduce through management measures.** • Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation, and rehabilitation activities, a suitably qualified specialist should be consulted, and the necessary permits obtained and only the these species should be relocated to natural areas in the vicinity. • No hunting, trapping, or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area. • Noise must be kept to an absolute minimum at night to minimise all possible disturbances to amphibian species and nocturnal mammals.	**Low (-)**

	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	Biodiversity	Construction and Operation	**Low (-)**	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas.	**Low (-)**
	Alteration of archaeological, historical and palaeontological resources that may be discovered during earthworks and mining.	Cultural Heritage	Construction and Operation	**Low (-)**	**Protect heritage resources through developing and implementing procedures.** • It is recommended that the areas associated with the identified sites be avoided by the mining activities. Should this not be possible, a qualified archaeologist must be present on-site during mining in order to limit potential impact on heritage resources • It is advised that a qualified archaeologist be contacted whenever uncertainty regarding potential heritage remains are encountered. • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the mining phase, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed, all activities must be suspended, and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).	**Very Low (-)**
	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	Aesthetic quality and sense of place	Construction and Operation	**Low (-)**	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution. • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna.	**Very Low (-)**

					• Install temporary lights that will not create a night sky glow. • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards. • Housekeeping on site should be enforced. • Rehabilitation measures such as re-vegetation and plan to be implemented. • Reduce the mining period through careful planning and productive implementation of resources. • Plan the placement of lay-down areas and any potential temporary mining camps in order to minimise vegetation clearing. • Restrict the activities and movement of workers and vehicles to the immediate mining site and existing access roads. • Ensure that rubble, litter and issued materials are managed and removed regularly. • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and Reduce and control dust through the use of approved dust suppression techniques.	
	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Health of landowners and occupiers Biodiversity	Construction and Operation	**Medium (-)**	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded. • Silencers will be utilised where possible. • Heavy vehicle traffic should be routed away from noise sensitive areas where possible. • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies. • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities. • The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance.	**Very Low (-)**

					• Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity. • No noisy activities to occur on Sundays or public holidays. • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory. Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.	
	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and mining.	Aesthetic environment Sense of Place Air quality Biodiversity	Construction and Operation	**Medium (-)**	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions. • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater. • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present. • Ensure that the shortest routes are used for material transport. • Ensure that stockpile height is kept to a minimum. • Minimise travel speed on unpaved roads. • Implement and actively monitor dust fallout generated in the 8 major wind directions on the borders of the site. • Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed. • Spray areas to be cleared with water. • Ensure minimum travel distance between working areas and stockpiles. • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation. • Ensure graded areas are sprayed with water. • Minimise the number of graded areas. • Ensure that shortest routes are used for material transport. Load and offload material, as far as possible, downwind of topsoil stockpiles.	**Very Low (-)**
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	Health of landowners and occupiers	Construction and Operation	**Medium (-)**	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	**Low (-)**

	Generation of additional general waste, litter and building rubble and hazardous waste.	Biodiversity Health and safety Soil Surface water systems	Construction and Operation	**Medium (-)**	**Control through management measures.** • The central waste storage and transition area shall be surfaced and demarcated appropriately. • Portable wheelie bins shall be placed throughout the site at all working areas in the field. • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended. • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up. • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM. • Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	**Low (-)**
	Minor impact caused by need for services i.e., water, electricity and sewerage systems during the mining phase causing additional strain on natural resources and service infrastructure.	Natural resources including water and energy resources	Construction and Operation	**Low (-)**	**Reduce through controlling management measures.** • Energy savings measures to be implemented at the site e.g.: ➢ No lights to be switched on unnecessarily. ➢ Only security lights to be switched on at night. • Energy saving bulbs to be installed; and • Water should be recycled as far as possible to avoid any additional water usage. • Water meters must be placed on all pipes to monitor usage of clean water	**Very Low (-)**
	Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	Traffic	Construction and Operation	**Low (-)**	**Reduce through controlling management measures.** • Where feasible heavy vehicles should not operate on public roads during peak hours; and • Heavy vehicles should adhere to the speed limit of the road.	**Very Low (-)**
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	Safety of workers, contractors and landowners and occupiers	Construction and Operation	**Medium (-)**	**Prevent through controlling management measures.** • Drivers will be enforced to keep setting speed limits. • Trucks will be in a road-worthy condition. • Roads and intersections will be signposted clearly. Only main roads should be used. • Where feasible vehicles should not operate on public roads during peak hours.	**Low (-)**

					• Vehicles should adhere to the speed limit of the road. • Heavy vehicles should always travel with their head lights switched on. • Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the site will be allowed. • Single directional traffic shall be controlled through a stop-go system or any other appropriate traffic control method. • Witkop Flourspar (Pty) Ltd shall be responsible for ensuring that suitable access is maintained for public traffic to all relevant businesses and properties; and • All traffic accommodation measures are to conform to the latest edition of the South African Road Signs Manual.	
	Possibility of mining activities workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Biodiversity Health and safety of landowners, occupiers, visitors and workers	Construction and Operation	**Low (-)**	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire. • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets. • The Applicant shall ensure that the basic fire-fighting equipment is available on the site. • Extinguishers should be located outside hazardous materials and chemicals storage containers. • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' • Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	**Very Low (-)**
	Potential creation of very limited extent employment opportunities for the local community, during the mining phase.	Socio-economic	Construction and Operation	**Low (+)**	• Local labour to be sourced where possible.	**Low (+)**
	Multiplier effects on local economy will be positive, but very limited in extent and only short term.	Socio-economic	Construction and Operation	**Low (+)**	• Supplies to be bought locally as far as possible.	**Low (+)**

The impact for and mitigation for the rehabilitation will be the same for the current mine site (Reduction) and the area for expansion. The Table below provides the mitigation measures.

Table 17: Assessment of each identified potentially significant impact and risk – Reduction and Expansion Site

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
: • Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable fencing or a strong wall/bund structure to prevent people or animals from falling down. • Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or	Sloping and profiling topography of mined out areas.	Topography	Rehabilitation	**Very Low (-)**	**Prevent and reduce through management measures.** • A detailed mine closure design must be compiled by a qualified mining engineer. • Topography of the end landform must blend in with surrounding topography, • The final landform topography must be safe and where posable not promote erosion. • Photographic evidence must be kept of pre and post mining topography	**Very Low (-)**
	Erosion of newly placed topsoil on rehabilitated areas.	Soil	Rehabilitation	**Low (-)**	**Prevent and reduce through management measures.** • Areas to be profiled and rehabilitated must be clearly demarcated • Access to rehabilitation areas must be limited • Rehabilitated areas where topsoil are placed must be revegetated as soon as posable. • Areas where topsoil are placed should be inspected weekly for signs of erosion	**Very Low (-)**
	Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	Soil	Rehabilitation	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and • The approved Integrated Water and Waste Management Plan to be implemented. ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	**Very Low (-)**
	Stormwater, erosion and siltation impacts due to a lack of implementing	Surface water	Rehabilitation	**Medium(-)**	**Prevent and reduce and remedy through management measures.**	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations. • Placement of stored topsoil on rehabilitated areas where possible. • Utilise the lowest area with the current stormwater dam as an artificial dam. This dam can be stocked with local species of fish. • Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column	measures to manage stormwater run-off quantity and quality.				• A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The stormwater management plan must include a surface water monitoring and groundwater monitoring plan for implementation during closure and rehabilitation. • The existing Stormwater management systems (such as existing stormwater dam) will be used to prevent stormwater from entering or exiting the area where mining will occur, which could result in silt laden surface water from draining into natural drainage lines • The slopes of the area where rehabilitation activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). Slopes must be developed with a qualified mining engineer to ensure safety. • Existing vegetation must be retained as far as possible to minimise erosion problems. • Rehabilitation of the mining area shall be planned and completed (after conclusion of the mining activities) in such a way that the run-off water (if any) will not cause erosion. • Visual inspections shall be done on a weekly basis with regard to the stability of the water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams. • No river or surface water may be affected by silt emanating from the mining area • No wastewater may run freely into any of the surrounding naturally vegetated areas.	
	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	Surface water and ground water resources	Rehabilitation	**Very Low (-)**	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated. • Contain any dirty water within a system; and • Prevent the contamination of clean water.	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
titled "Suitability to rehabilitate higher, steeper areas" in the table below to identify species most suitable for this specific area and purposes. • Visual, dust and sound screening on lower, less steep areas Larger and structurally denser trees needs to be planted on the lower parts of the site to provide direct visual, dust and sound screening. The northern, eastern, western and central parts of the existing Mining Right area to be rehabilitated, and in future the entire newly proposed Mining Right expansion area, needs to be rehabilitated this way. Use the second last column titled "Suitability to rehabilitate lower, less steep areas" in					In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that that potential stormwater impacts are kept to a minimum: • A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The stormwater management plan must include surface and groundwater monitoring. • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained and treated on site. • All storm water infrastructure (if any) on-site shall be maintained and kept clean throughout the ining period. • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented. • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e., Spill kits) must be placed throughout the site. • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory. • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited. • Stormwater leaving the site must in no way be contaminated. • Ensure good housekeeping practices. • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance with relevant specifications. • All chemicals and fuels to be stored in the designated chemical storage area on site • Refuelling must be conducted at the diesel storage area where possible. • Should diesel bowsers be used for refuelling drip trays must be used during refuelling.	

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
the table below to identify species most suitable for this specific area.					• Chemical storage procedures must be developed by the on-site environmental officer and kept on site • Any dams, stormwater dams or water bodies that wil remain after rehabilitation will be stocked with indigenous fish species	

Visual, dust and sound screening along the site boundary using a tree corridor There is a need to plant a tree corridor (boundary planting or hedgerow) along the lower, more visible parts of the site. Such a corridor of trees, even if just two trees wide on average, could play a very important role in visual, dust and noise mitigation. Use the last column titled "Suitability to use in boundary planting / tree corridor" in the table below to identify species most suitable for this specific area	Loss and disturbance of terrestrial habitat. Permanent changes to water flows and loss of important habitat may occur during the rehabilitation phase	Biodiversity	Rehabilitation	**Low (-)**	**Reduce through management measures.** • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site rehabilitation activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Adhere to all management and mitigation measures as prescribed within other specialist reports and Environmental Management Programme (EMPr). • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Continuous rehabilitation of the area should occur, immediate closure and rehabilitation. This will entail the spreading of topsoil, revegetation and management of invasive species. • Rehabilitation measures that are implemented must be continually monitored for a minimum period of four years to ensure that proper succession has occurred and that there is no erosion occurring. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	Biodiversity	Rehabilitation	**Low (-)**	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority.	**Very Low (-)**
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	Biodiversity	Rehabilitation	**Low (-)**	**Reduce through management measures.** • Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation, and rehabilitation activities, a suitably qualified specialist should be consulted, and the necessary permits obtained and only the these species should be relocated to natural areas in the vicinity. • No hunting, trapping, or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance.	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area. • Noise must be kept to an absolute minimum at night to minimise all possible disturbances to amphibian species and nocturnal mammals.	
	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	Biodiversity	Rehabilitation	**Low (-)**	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • Rehabilitated areas should be inspected by a Biodiversity specialist on a bi-Annually basis	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	Aesthetic quality and sense of place	Rehabilitation	**Low (-)**	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution. • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna. • Install temporary lights that will not create a night sky glow. • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards. • Housekeeping on site should be enforced. • Rehabilitation measures such as re-vegetation and plan to be implemented. • Reduce the mining period through careful planning and productive implementation of resources. • Plan the placement of lay-down areas and any potential temporary mining camps in order to minimise vegetation clearing. • Restrict the activities and movement of workers and vehicles to the immediate mining site and existing access roads. • Ensure that rubble, litter and issued materials are managed and removed regularly. • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and Reduce and control dust through the use of approved dust suppression techniques.	**Very Low (-)**
	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Health of landowners and occupiers Biodiversity	Rehabilitation	**Low (-)**	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded. • Silencers will be utilised where possible. • Heavy vehicle traffic should be routed away from noise sensitive areas where possible. • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of	**Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies. • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities. • The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance. • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity. • No noisy activities to occur on Sundays or public holidays. • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory. Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.	
	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and mining.	Aesthetic environment Sense of Place Air quality Biodiversity	Rehabilitation	**Medium (-)**	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions. • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater. • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present. • Ensure that the shortest routes are used for material transport. • Ensure that stockpile height is kept to a minimum. • Minimise travel speed on unpaved roads. • Implement and actively monitor dust fallout generated in the 8 major wind directions on the borders of the site.	**Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed. • Spray areas to be cleared with water. • Ensure minimum travel distance between working areas and stockpiles. • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation. • Ensure graded areas are sprayed with water. • Minimise the number of graded areas. • Ensure that shortest routes are used for material transport. • Load and offload material, as far as possible, downwind of topsoil stockpiles.	
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	Health of landowners and occupiers	Rehabilitation	**Medium (-)**	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	**Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	Generation of additional general waste, litter and building rubble and hazardous waste.	Biodiversity Health and safety Soil Surface water systems	Rehabilitation	**Medium (-)**	**Control through management measures.** • The central waste storage and transition area shall be surfaced and demarcated appropriately. • Portable wheelie bins shall be placed throughout the site at all working areas in the field. • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended. • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up. • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM. • Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	**Low (-)**
	Health and safety risks caused by rehabilitation activities	Safety of workers, contractors and landowners and occupiers	Rehabilitation	**Medium (-)**	**Prevent through controlling management measures.** • Strict access control to the site must be implemented • Rehabilitation areas must be clearly demarcated • Finale slopes will be determined by mining engineer and inspected for safety at intervals to be determined by the mining engineer. • All stormwater dams will be fenced with required safety signage and safety devices as required by the mine health and safety act	**Low (-)**
	Possibility of Mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Biodiversity Health and safety of landowners, occupiers, visitors and workers	Rehabilitation	**Medium (-)**	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire. • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets. • The Applicant shall ensure that the basic fire-fighting equipment is available on the site. • Extinguishers should be located outside hazardous materials and chemicals storage containers.	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' • Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	
	Potential creation of very limited extent short term employment opportunities for the local community, during the mining phase.	Socio-economic	Rehabilitation	**Low (+)**	• Local labour to be sourced where possible.	**Low (+)**
	Multiplier effects on local economy will be positive, but very limited in extent	Socio-economic	Rehabilitation	**Low (+)**	• Supplies to be bought locally as far as possible.	**Low (+)**

d) Summary of specialist reports

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form): -

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Ecological and Biodiversity Assessment Elemental Sustainability (Pty) Ltd 2021	• When viewed in the larger context, the study site forms part of a very important conservation corridor and the Magaliesberg Protected Environment, also overlapping with the Magaliesberg Important Bird and Biodiversity Area (IBA). The southern section of the study site is also classed as Critical Biodiversity Area 2 (CBA2). The following was found for the fauna and flora assessment: • The Marula Tree (Sclerocarya birrea), a Protected Tree species of South Africa, was recorded on site. Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. In terms of a part of section 51(1) of Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister. Several Alien and Invasive Vegetation Species were recorded on site, especially in disturbed areas and the areas surrounding the Pollution Control Dam. Several avifaunal species protected under the Threatened and Protected Species list (ToPS, 2013), which is enforceable under the National Environmental Management: Biodiversity Act, 2004, is likely to occur on site. All Amphibian and reptile species are of Least Concern (LC), except for the Giant Bullfrog (Pyxicephalus adspersus) and the African Rock Python (Python natalensis) which is of special conservation concern according to the North-West Biodiversity Sector Plan (2015) and protected under NEMBA.	X	Basic Assessment Report and EMPR Part B (EMPR)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• The impacts associated with the activities range from Medium-Low to Medium-High prior to mitigation taking place. With mitigation fully implemented, the significance of most impacts can be reduced to Very Low or Low.		
Cultural heritage assessment Holistic Environmental Services 2013	The Phase 1 Archaeological Impact Assessments for the proposed project revealed no archaeological/ or heritage resources within the footprint of the proposed area. The area is vastly disturbed by past and current activities related to mining. Nonetheless, an informal grave-yard was noted. However, this grave-yard is about 80m from the proposed site. As such, it can be argued that this grave-yard is on the buffer-zone. In consideration of the nature of the proposed development, it is important to comment about these graves, although they would not be directly impacted. These graves appear to be over 60 years of age, as such, they have high archaeological value. In total they are seven, and they are marked by stone cairns. Key Recommendations: • No stone robbing or removal of any material is allowed. Any disturbance or alteration on these sites (informal-graveyards) would be illegal and punishable by law, under section 36 (3) of the National Heritage Resources Act NHRA of 1999 (Act 25 of 1999). • Maintain a reasonable buffer zone around the identified graves (approximately 20-25m). No dumping of construction material is allowed within this buffer zone and no alteration or damage on these sites may occur. • The graves should be marked by a visible tape i.e., danger tape, for the duration of the project, and workers should be notified about these graves.	X	Basic Assessment Report and EMPR Part B (EMPR)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Note that it is the responsibility of the developer to notify contractors and workers that archaeological material (e.g. pottery, remains of stone-walling, graves, etc) and fossils are often located underground. The developer is made aware that archaeological material (e.g. pottery, remains of stone-walling, graves, etc) and fossils are often located underground. Thus, unavailability of archaeological material on the footprint of the proposed area does not mean absentee, archaeological material might be hidden underground, as such the client is reminded to take precautions during the mining activities.		
Geohydrological Study Geo Pollution Technologies – Gauteng (Pty) Ltd 2011	No chemicals are involved in the mining processes at Witkop Fluorspar (Pty) Ltd, Brits Quarry and therefore no chemical contamination is expected. Currently there is no contaminant impact on the groundwater. Due to the nature of the inert characteristics of quartzite, no primary plume emanating from Witkop Fluorspar (Pty) Ltd, Brits Quarry could be reasonably expected. At most, secondary plumes emanating from secondary sources such as ablution facilities at the office block could be expected. It is further recommended that the groundwater be managed in a sustainable manner. The groundwater management plan and a groundwater monitoring program should be established at the proposed development. • Prevention of contamination in source areas as listed under section 8.1. • Any discharge or storm water runoff from site should be prevented. • Water levels should be measured on a frequent basis around the active quarry and the amount of water removed monitored. • Groundwater quality should be monitored bi-annually. Water samples must be taken from all the monitoring boreholes using approved sampling techniques and adhering to recognised sampling procedures. Further recommendations can be made regarding the sampling frequency after the first year. • Monitoring parameters should include E.coli and total faecal coliforms as well as hydrocarbons.	X	Basic Assessment Report and EMPR Part B (EMPR)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• The monitoring data should be evaluated by a competent hydrogeologist to identify trends and modify groundwater monitoring network if necessary.		
Closure Cost Assessment Elemental Sustainability (Pty) Ltd 2021	This closure plan was compiled in alignment to the NEMA GNR.1147 Regulations, the NEMA Appendix 5 (Closure Plan) and based on information provided by client, and specialist work. It is recommended that the next update of this closure plan be annually after commencement of the activities. Closure and rehabilitation are a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. Rehabilitation and closure objectives have been tailored to the project at hand with the objective of assisting for Witkop Fluorspar (Pty) Ltd – Witkop Fluorspar (Pty) Ltd, Brits Quarry in carrying out successful rehabilitation. Witkop Fluorspar (Pty) Ltd would need to provide adequate financial assurance through the required financial instrument to provide for their decommissioning and closure liability cost. The cost should be for the first 10 years of the planned operations.	X	Basic Assessment Report and EMPR Part B (EMPR)
Rehabilitation Plan Holistic Environmental Services 2013	**Final rehabilitation of the area to be excluded from the current Mining Right area** This area is characterised by higher, steeper slopes and some vertical rock faces due to quarrying activities. Therefore geotechnical stability, soil erosion and visual mitigation are very important. The existing Rehabilitation Plan deals extensively with these issues, however, the following should receive special attention: • Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-	X	Basic Assessment Report and EMPR Part B (EMPR)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable fencing or a strong wall/bund structure to prevent people or animals from falling down. • Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations. • Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column titled "Suitability to rehabilitate higher, steeper areas" in the table below to identify species most suitable for this specific area and purposes.		

Attach copies of Specialist Reports as appendices (Please refer to ***Appendix 7 – 15)***

e) Environmental impact statement

(i) Summary of the key findings of the environmental impact assessment.

Table 18: Summary of the Possible Construction and Operation Impacts Associated with the Proposed – Proposed Expansion

Description of Impact	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
Mining of the area could have an impact on the visible topography of the mining site.	**Medium (-)**	**Prevent and reduce through management measures.** • maximize access to aggregate resources on the site, • use all unique deposit features created by the mining operation in shaping new landscapes,	**Low (-)**

		• employ non-aggregate earth materials such as overburden, clay deposits, and mine waste in building and shaping land forms, • use available earth moving equipment and earth moving procedures efficiently for reclaiming the mine site, without interfering with ongoing mining operations, • develop a coordinated and sequential program of mining, earth moving, land shaping, and landscaping to ensure that lands are prepared for development as mining progresses through the deposit • Conduct concurrent rehabilitation during the operational phase. Keep Photographic record of the mine site for restoration purposes	
Loss and disturbance to topsoil as a result of clearing of vegetation for mining. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils causes compaction of soils and reduces the soil's ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	**Low (-)**	**Prevent and reduce through management measures.** • Demarcation of mining area: • Areas to be prospected must be clearly demarcated • Detailed mining plan must be developed and updated on month to month basis **Stripping of topsoil:** • Clearing of areas to take place a maximum of one month prior to mining. • Stripping of topsoil will not take place during rain or excessive wind; and • The top 30 cm of vegetation and topsoil is to be stripped from the area to be mined. **Storage of topsoil / overburden:** • Topsoil (top 30cm) is to be stored in predetermined topsoil berms, (+/- 5m) inside the boundary of the specific area; and • Topsoil stockpiles will be restricted to 1.5 to 2m in height. • Topsoil stockpiles must be protected from erosion • A topsoil stripping and storage procedure must be developed and stored on site.	**Very Low (-)**
Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.	**Very Low (-)**

		• All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and • The approved Integrated Water and Waste Management Plan to be implemented. ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	
Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality.	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • A generic Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The existing Stormwater management systems (such as existing stormwater dam) will be used to prevent stormwater from entering or exiting the area where mining will occur, which could result in silt laden surface water from draining into natural drainage lines • The slopes of the area where mining activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). Slopes must be developed with a qualified mining engineer to ensure safety. • If necessary, temporary diversion channels should be constructed ahead of the stockpiles (if relevant) to intercept clean run-off and divert it around disturbed areas into the natural drainage system downstream (down gradient) of the mining area. • Existing vegetation must be retained as far as possible to minimise erosion problems. • Rehabilitation of the mining area shall be planned and completed (after conclusion of the mining activities) in such a way that the run-off water (if any) will not cause erosion. • Visual inspections shall be done on a weekly basis with regard to the stability of the temporary water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams.	**Very Low (-)**

		• No river or surface water may be affected by silt emanating from the mining area • No wastewater may run freely into any of the surrounding naturally vegetated areas.	

Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	**Very Low (-)**	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated. • Contain any dirty water within a system; and • Prevent the contamination of clean water. In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that that potential stormwater impacts are kept to a minimum: • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained and treated on site. • All storm water infrastructure (if any) on-site shall be maintained and kept clean throughout the ining period. • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented. • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e., Spill kits) must be placed throughout the site. • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory. • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited. • Stormwater leaving the site must in no way be contaminated. • Ensure good housekeeping practices. • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance with relevant specifications. • All chemicals and fuels to be stored in the designated chemical storage area on site • Refuelling must be conducted at the diesel storage area where possible. • Should diesel bowsers be used for refuelling drip trays must be used during refuelling. • Chemical storage procedures must be developed by the on-site environmental officer and kept on site	**Very Low (-)**

		• Refuelling procedures must be developed by the site environmental officer and kept on file on site.	

Loss and disturbance of terrestrial habitat. The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection during construction activities. Permanent changes to water flows and loss of important habitat may occur during the operational phase	**Medium(-)**	**Reduce through management measures.** • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site clearing activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Adhere to all management and mitigation measures as prescribed within other specialist reports and Environmental Management Programme (EMPr). • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Continuous rehabilitation of the area should occur, immediate closure and rehabilitation. This will entail the spreading of topsoil, revegetation and management of invasive species. • It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon (including fencing off the defined project area) and preventing movement of workers into natural areas. • Rehabilitation measures that are implemented must be continually monitored for a minimum period of four years to ensure that proper succession has occurred and that there is no erosion occurring. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.	**Low (-)**
Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	**Medium (-)**	**Reduce through management measures.** • Relocate conservation-worthy species under the supervision of a vegetation or horticultural specialist. • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien	**Low (-)**

		invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority.	
Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	**Medium (-)**	**Reduce through management measures.** • Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation, and rehabilitation activities, a suitably qualified specialist should be consulted, and the necessary permits obtained and only the these species should be relocated to natural areas in the vicinity. • No hunting, trapping, or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area. • Noise must be kept to an absolute minimum at night to minimise all possible disturbances to amphibian species and nocturnal mammals.	**Low (-)**

Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	**Medium (-)**	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas.	**Low (-)**
Alteration of archaeological, historical and palaeontological resources that may be discovered during earthworks and mining.	**Very Low (-)**	**Protect heritage resources through developing and implementing procedures.** • It is recommended that the areas associated with the identified sites be avoided by the mining activities. Should this not be possible, a qualified archaeologist must be present on-site during mining in order to limit potential impact on heritage resources • It is advised that a qualified archaeologist be contacted whenever uncertainty regarding potential heritage remains are encountered. • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the mining phase, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed, all activities must be suspended, and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).	**Very Low (-)**
Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	**Medium (-)**	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution. • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna.	**Low (-)**

		• Install temporary lights that will not create a night sky glow. • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards. • Housekeeping on site should be enforced. • Rehabilitation measures such as re-vegetation and plan to be implemented. • Reduce the mining period through careful planning and productive implementation of resources. • Plan the placement of lay-down areas and any potential temporary mining camps in order to minimise vegetation clearing. • Restrict the activities and movement of workers and vehicles to the immediate mining site and existing access roads. • Ensure that rubble, litter and issued materials are managed and removed regularly. • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and • Reduce and control dust through the use of approved dust suppression techniques.	
Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	**Medium (-)**	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded. • Silencers will be utilised where possible. • Heavy vehicle traffic should be routed away from noise sensitive areas where possible. • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies. • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities.	**Low (-)**

		• The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance. • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity. • No noisy activities to occur on Sundays or public holidays. • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory. • Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.	
Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and mining.	**Medium (-)**	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions. • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater. • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present. • Ensure that the shortest routes are used for material transport. • Ensure that stockpile height is kept to a minimum. • Minimise travel speed on unpaved roads. • Implement and actively monitor dust fallout generated in the 8 major wind directions on the borders of the site. • Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed. • Spray areas to be cleared with water. • Ensure minimum travel distance between working areas and stockpiles. • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation. • Ensure graded areas are sprayed with water. • Minimise the number of graded areas. • Ensure that shortest routes are used for material transport. • Load and offload material, as far as possible, downwind of topsoil stockpiles.	**Low (-)**

Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	**Medium (-)**	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	**Low (-)**
Generation of additional general waste, litter and building rubble and hazardous waste.	**Medium (-)**	**Control through management measures.** • The central waste storage and transition area shall be surfaced and demarcated appropriately. • Portable wheelie bins shall be placed throughout the site at all working areas in the field. • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended. • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up. • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM. • Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	**Low (-)**
Minor impact caused by need for services i.e., water, electricity and sewerage systems during the mining phase causing additional strain on natural resources and service infrastructure.	**Low (-)**	**Reduce through controlling management measures.** • Energy savings measures to be implemented at the site e.g.: ➢ No lights to be switched on unnecessarily. ➢ Only security lights to be switched on at night. • Energy saving bulbs to be installed; and • Water should be recycled as far as possible to avoid any additional water usage. • Water meters must be placed on all pipes to monitor usage of clean water	**Very Low (-)**
Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	**Low (-)**	**Reduce through controlling management measures.** • Where feasible heavy vehicles should not operate on public roads during peak hours; and	**Very Low (-)**

		• Heavy vehicles should adhere to the speed limit of the road.	
Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	**Medium (-)**	**Prevent through controlling management measures.** • Drivers will be enforced to keep setting speed limits. • Trucks will be in a road-worthy condition. • Roads and intersections will be signposted clearly. Only main roads should be used. • Where feasible vehicles should not operate on public roads during peak hours. • Vehicles should adhere to the speed limit of the road. • Heavy vehicles should always travel with their head lights switched on. • Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the site will be allowed. • Single directional traffic shall be controlled through a stop-go system or any other appropriate traffic control method. • Witkop Flourspar (Pty) Ltd shall be responsible for ensuring that suitable access is maintained for public traffic to all relevant businesses and properties; and • All traffic accommodation measures are to conform to the latest edition of the South African Road Signs Manual.	**Low (-)**
Possibility of Mininga ctivities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	**Medium (-)**	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire. • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets. • The Applicant shall ensure that the basic fire-fighting equipment is available on the site. • Extinguishers should be located outside hazardous materials and chemicals storage containers. • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' • Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	**Very Low (-)**
Potential creation of very limited extent employment opportunities for the local community, during the mining phase.	**Low (+)**	• Local labour to be sourced where possible.	**Low (+)**
Multiplier effects on local economy will be positive, but very limited in extent and only short term.	**Low (+)**	• Supplies to be bought locally as far as possible.	**Low (+)**

The impact for and mitigation for the rehabilitation will be the same for the current mine site (Reduction) and the area for expansion. The Table below provides the mitigation measures.

Table 19: Summary of the Possible Rehabilitation Impacts Associated with the Proposed – Reduction and Expansion Site

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
Sloping and profiling topography of mined out areas.	**Low (-)**	**Prevent and reduce through management measures.** • A detailed mine closure design must be compiled by a qualified mining engineer. • Topography of the end landform must blend in with surrounding topography, • The final landform topography must be safe and where posable not promote erosion. • Photographic evidence must be kept of pre and post mining topography	**Very Low (-)**
Erosion of newly placed topsoil on rehabilitated areas.	**Low (-)**	**Prevent and reduce through management measures.** • Areas to be profiled and rehabilitated must be clearly demarcated • Access to rehabilitation areas must be limited • Rehabilitated areas where topsoil are placed must be revegetated as soon as posable. • Areas where topsoil are placed should be inspected weekly for signs of erosion	**Very Low (-)**
Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and • The approved Integrated Water and Waste Management Plan to be implemented. ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and	**Very Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
		• All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	
Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality.	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The stormwater management plan must include a surface water monitoring and groundwater monitoring plan for implementation during closure and rehabilitation. • The existing Stormwater management systems (such as existing stormwater dam) will be used to prevent stormwater from entering or exiting the area where mining will occur, which could result in silt laden surface water from draining into natural drainage lines • The slopes of the area where rehabilitation activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). Slopes must be developed with a qualified mining engineer to ensure safety. • Existing vegetation must be retained as far as possible to minimise erosion problems. • Rehabilitation of the mining area shall be planned and completed (after conclusion of the mining activities) in such a way that the run-off water (if any) will not cause erosion. • Visual inspections shall be done on a weekly basis with regard to the stability of the water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams. • No river or surface water may be affected by silt emanating from the mining area • No wastewater may run freely into any of the surrounding naturally vegetated areas.	**Very Low (-)**
Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	**Very Low (-)**	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated. • Contain any dirty water within a system; and	**Very Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
		• Prevent the contamination of clean water. In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that that potential stormwater impacts are kept to a minimum: • A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The stormwater management plan must include surface and groundwater monitoring. • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained and treated on site. • All storm water infrastructure (if any) on-site shall be maintained and kept clean throughout the ining period. • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented. • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e., Spill kits) must be placed throughout the site. • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory. • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited. • Stormwater leaving the site must in no way be contaminated. • Ensure good housekeeping practices. • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance with relevant specifications. • All chemicals and fuels to be stored in the designated chemical storage area on site • Refuelling must be conducted at the diesel storage area where possible.	

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
		• Should diesel bowsers be used for refuelling drip trays must be used during refuelling. • Chemical storage procedures must be developed by the on-site environmental officer and kept on site • Any dams, stormwater dams or water bodies that wil remain after rehabilitation will be stocked with indigenous fish species	

Loss and disturbance of terrestrial habitat. Permanent changes to water flows and loss of important habitat may occur during the rehabilitation phase	**Low (-)**	**Reduce through management measures.** • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site rehabilitation activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Adhere to all management and mitigation measures as prescribed within other specialist reports and Environmental Management Programme (EMPr). • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Continuous rehabilitation of the area should occur, immediate closure and rehabilitation. This will entail the spreading of topsoil, revegetation and management of invasive species. • Rehabilitation measures that are implemented must be continually monitored for a minimum period of four years to ensure that proper succession has occurred and that there is no erosion occurring. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.	**Very Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	**Low (-)**	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority.	**Very Low (-)**
Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	**Low (-)**	**Reduce through management measures.** • Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation, and rehabilitation activities, a suitably qualified specialist should be consulted, and the necessary permits obtained and only the these species should be relocated to natural areas in the vicinity. • No hunting, trapping, or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area.	**Very Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
		• Noise must be kept to an absolute minimum at night to minimise all possible disturbances to amphibian species and nocturnal mammals.	
Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	**Low (-)**	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • **Rehabilitated areas should be inspected by a Biodiversity specialist on a bi-annual basis**	**Very Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	**Low (-)**	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution. • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna. • Install temporary lights that will not create a night sky glow. • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards. • Housekeeping on site should be enforced. • Rehabilitation measures such as re-vegetation and plan to be implemented. • Reduce the mining period through careful planning and productive implementation of resources. • Plan the placement of lay-down areas and any potential temporary mining camps in order to minimise vegetation clearing. • Restrict the activities and movement of workers and vehicles to the immediate mining site and existing access roads. • Ensure that rubble, litter and issued materials are managed and removed regularly. • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and Reduce and control dust through the use of approved dust suppression techniques.	**Very Low (-)**
Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	**Low (-)**	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded. • Silencers will be utilised where possible. • Heavy vehicle traffic should be routed away from noise sensitive areas where possible. • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No	**Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
		pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies. • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities. • The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance. • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity. • No noisy activities to occur on Sundays or public holidays. • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory. Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.	
Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and mining.	**Medium (-)**	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions. • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater. • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present. • Ensure that the shortest routes are used for material transport. • Ensure that stockpile height is kept to a minimum. • Minimise travel speed on unpaved roads. • Implement and actively monitor dust fallout generated in the 8 major wind directions on the borders of the site. • Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed.	**Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
		• Spray areas to be cleared with water. • Ensure minimum travel distance between working areas and stockpiles. • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation. • Ensure graded areas are sprayed with water. • Minimise the number of graded areas. • Ensure that shortest routes are used for material transport. Load and offload material, as far as possible, downwind of topsoil stockpiles.	
Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	**Medium (-)**	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	**Low (-)**
Generation of additional general waste, litter and building rubble and hazardous waste.	**Medium (-)**	**Control through management measures.** • The central waste storage and transition area shall be surfaced and demarcated appropriately. • Portable wheelie bins shall be placed throughout the site at all working areas in the field. • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended. • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up. • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM. • Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	**Low (-)**
Health and safety risks caused by rehabilitation activities	**Medium (-)**	**Prevent through controlling management measures.** • Strict access control to the site must be implemented • Rehabilitation areas must be clearly demarcated	**Low (-)**

Description of Impact	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**	**SIGNIFICANCE** if mitigated
		• Finale slopes will be determined by mining engineer and inspected for safety at intervals to be determined by the mining engineer. • All stormwater dams will be fenced with required safety signage and safety devices as required by the mine health and safety act	
Possibility of Mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	**Medium (-)**	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire. • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets. • The Applicant shall ensure that the basic fire-fighting equipment is available on the site. • Extinguishers should be located outside hazardous materials and chemicals storage containers. • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' • Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	**Very Low (-)**
Potential creation of very limited extent short term employment opportunities for the local community, during the mining phase.	**Low (+)**	• Local labour to be sourced where possible.	**Low (+)**
Multiplier effects on local economy will be positive, but very limited in extent	**Low (+)**	• Supplies to be bought locally as far as possible.	**Low (+)**

(ii) Final Site Map

*(Provide a map at an appropriate scale which superimposes the proposed overall activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers. Attach as **Appendix 11**)*

Attached as Appendix 11

(iii) Summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.

Please refer to Table 12 to Table 14

f) Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr.

(Based on the assessment and where applicable the recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation).

The following management objectives and impact management outcomes are recommended for inclusion in the EMPR:

- Biodiversity: Prevent and / or restrict the loss of indigenous fauna and flora as far as possible.
- Physical aspects: Prevent and / or restrict the impact on soils and surface water.
- Social Aspects: Ensure the health and safety of employees of Witkop Flourspar (Pty) Ltd and any contractors associated with the development and operation of the proposed activity as well as the surrounding community and visitors.
- Heritage: Ensure the protection of any potential heritage features or objects that may be excavated during the proposed development.

g) Aspects for inclusion as conditions of Authorisation

(Any aspects which must be made conditions of the Environmental Authorisation)

The following aspects are recommended to be included as conditions in the Environmental Authorisation:

- The EMPR is a contractual document and must be implemented at all times during the mining phase.
- An independent environmental control officer (ECO) must be appointed to monitor the implementation of the EMPR and audit reports to be kept by the applicant.
- All contractors and employees of Witkop Flourspar (Pty) Ltd must be made aware of the EMPR and its requirements as well as the impact of not implementing the measures of the EMPR.

- Copies of the EMPR, Integrated Environmental Authorisation and any emergency procedures and method statements, must be kept on site and be available on request of the Competent Authority.

h) Description of any assumptions, uncertainties and gaps in knowledge.

(Which relate to the assessment and mitigation measures proposed)

- All information provided to the environmental team by the applicant and I&APs was correct and valid at the time that it was provided.
- The investigations undertaken by specialists during the BA process, indicate the development site as suitable and technically acceptable, except for the northern portions, which are sensitive and recommended to be excluded from mining.
- It is not always possible to involve all I&APs individually, however, every effort has been made to involve as many affected stakeholders as possible.
- The information provided by the applicant and specialists was accurate and unbiased; and
- The scope of this investigation is limited to assessing the environmental impacts associated with the construction, operation and closure phases of the proposed activity.

i) Reasoned opinion as to whether the proposed activity should or should not be authorised

i) Reasons why the activity should be authorised or not

In general, it is recognised that the proposed mining activities have the potential to pose various risks to the environment as well as to the residents or businesses in the surrounding area. However, based on the findings of this BAR documented in this report, all impacts can be mitigated to insignificant levels.

This report shows that the proposed development has the potential to provide socio-economic benefits to the local and regional communities. The EAP therefore recommends that the proposed activities be approved on condition that the EMPR is strictly implemented and monitored for compliance and that the northern portions of the study area are excluded from mining.

Not implementing the mining activities will result in a loss of information of mineral reserves present on the study area. Should economically feasible reserves exist on the study area and the applicant cannot prospect, the opportunity to utilise the reserves for future mining will be lost, i.e., the minerals will be sterilised, and resultant socio-economic benefits will be lost.

The proposed mining activities has the potential to have a negative impact on the ecological environment as well as the social environment of the area. These impacts, however, can potentially be prevented, minimised, mitigated and managed to low and very low levels, as shown through the impact assessment.

ii) Conditions that must be included in the authorisation

- The EMPR is a contractual document and must be implemented at all times during the mining phase.
- An independent environmental control officer (ECO) must be appointed to monitor the implementation of the EMPR and audit reports to be kept by the applicant.
- All contractors and employees of Witkop Flourspar (Pty) Ltd must be made aware of the EMPR and its requirements as well as the impact of not implementing the measures of the EMPR.
- Copies of the EMPR, Integrated Environmental Authorisation and any emergency procedures and method statements, must be kept on site and be available on request of the Competent Authority.

12. Period for which the Environmental Authorisation is required.

This Environmental Authorisation is therefore required for a period 20 years.

13. Undertaking

(Confirm that the undertaking required to meet the requirements of this section is provided at the end of the EMPr and is applicable to both the Basic assessment report and the Environmental Management Programme report).

Please refer to the EMPR in Part B of this document.

14. Financial Provision

(State the amount that is required to both manage and rehabilitate the environment in respect of rehabilitation).

The closure cost assessment has been developed based on the GNR 1147 regulations and is included as Appendix 12

iii) Explain how the aforesaid amount was derived

The financial provision amount will be calculated utilising the methodology as prescribed by the Have been developed based on the GNR 1147 regulations.

iv) Confirm that this amount can be provided for from operating expenditure

(*Confirm that the amount, is anticipated to be an operating cost and is provided for as such in the Mining work programme, Financial and Technical Competence Report or Mining Work Programme as the case may be).*

The applicant submits that it is a mining company and is able to fund the planned mining from its operational budget. It is confirmed that the amount for financial provision is anticipated to be an operating cost and is provided for as such in the Mining Work Programme.

15. Specific Information required by the competent Authority

v) Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998). the EIA report must include the: -

(1) Impact on the socio-economic conditions of any directly affected person

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond mining on any directly affected person including the landowner, lawful occupier, or, where applicable, potential beneficiaries of any land restitution claim, attach the investigation report as an Appendix).

Potential impacts on landowners, land occupiers, communities or individuals or competing land uses in the area include:

- Potential soil pollution which may result from any hydrocarbon spills where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.
- Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.
- Visual impacts: Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.
- Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.
- Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and mining.
- Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.
- Generation of additional general waste, litter and building rubble and hazardous waste.
- Minor impact caused by need for services i.e., water, electricity and sewerage systems during the mining phase causing additional strain on natural resources and service infrastructure.
- Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.
- Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.
- Possibility of mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.
- Potential creation of very limited extent short term employment opportunities for the local community, during the mining phase.
- Multiplier effects on local economy will be positive, but very limited in extent

Mitigation measures are included in this report, as well as the EMPR.

(2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond mining on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act, attach the investigation report as Appendix 2.19.2 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

From this previous research records conducted in the area; the specialist concluded there is only one significant archaeological site on the property but the site is a distance from the mining activities and would not be affected in any way.

16. Other matters required in terms of sections 24(4)(a) and (b) of the Act

(the EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 22(2)(h), exist. The EAP must attach such motivation as Appendix 4).

The EAP included all aspects as required by the EIA regulations, 2014 for the EIA and EMPr as described in the Executive Summary of this report. Please refer to Part A Section 3 (g).

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

1. Draft environmental management programme

a) Details of the EAP

(Confirm that the requirement for the provision of the details and expertise of the EAP are already included in PART A, section 1(a) herein as required).

Herewith, it is confirmed that the requirement for the provision of the details and expertise of the EAP are already included in PART A, Section 1(a) of this report.

b) Description of the Aspects of the Activity

(Confirm that the requirement to describe the aspects of the activity that are covered by the draft environmental management programme is already included in PART A, section (1) (h) herein as required).

Herewith, it is confirmed that the requirement to describe the aspects of the activity that are covered by the draft environmental management programme is already included in PART A, section (1) (h) herein as required.

c) Composite Map

(Provide a map (Attached as an Appendix) at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers).

Refer to Appendix 13.

d) Description of Impact management objectives including management statements

i) Determination of closure objectives

(Ensure that the closure objectives are informed by the type of environment described).

The assignment was interpreted as follows: Compile a Rehabilitation Plan for the existing activities that will be conducted on site with clear objectives and possible methods for restoring the environment. Specific objectives include:

- To ensure that the site is safe and secure;
- To remove any sources of pollution from the site and rehabilitate and restore the soils;

 To control erosion by establishing a vegetative cover;

 To re-establish a plant community with specified indigenous species;

 Where feasible maintain or increase the biological diversity of species in the vicinity;

 To rehabilitate the site to a state that is suitable for other land uses; and

 To rehabilitate the site that it facilitates compliance with current environmental quality objectives.

It purpose of this plan is to outline the actions that will be undertaken during the rehabilitation and re-vegetation of the site. The plan will highlight the general rehabilitation and re-vegetation actions that will be adopted.

ii) Volumes and rate of water use required for the operation

Water for mining will require 81 480 m³ per Month for the total operation.

iii) **Has a water use licence been applied for?**

The operation is in possession of an Approved Water use license (07/A21J/AGJ/7962) issued in 18 September 2018. The license authorises the following water uses :

Table 20 : Water Use License Activities

Activities	Property	Purpose/Description	Total Volume (m^3/a)	Co-ordinates
21 (a)Taking water from a water resource				
Abstraction of water from borehole H	Portion 95 of the Farm Zandfontein 447 JQ	Domestic purposes	1 800	S 25°43'37.1" E 27°47'36.73"
Abstraction of water from borehole A & B	Portion 95 of the Farm Zandfontein 447 JQ	For process purposes, and for the process make-up water within the sand washing plant	9 600	S 25°43'37.00" E 27°4 7'34. 76"
Abstraction of water quarry	Portion 95 of the Farm Zandfontein 447 JQ	for process purposes, and for the process make-up water within the sand washing plant	70 080	S 25°43'49.89" E 27°47'35.80"
21 (g) Disposing of waste in a manner which may detrimentally impact on a water resource				

Slimes into Dam Quarry no 1	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of slimes into a quarry, this quarry also acts as the return water dam.	36 500	S25°43'43.67" E 27°47'36.90"
Operational Quarry No 2	Portion 95 of the Farm Zandfontein 447 JQ	Mined and seepage water	40 000	S 25°43'48.95" E 27°47'36.90"
Dust Suppression on haul roads	Portion 95 of the Farm Zandfontein 447 JQ	To suppression dust	18 000	Haul Road S 25°43'36.99" E 27°47'32.16"
Stock pile	Portion 95 of the Farm Zandfontein 447 JQ	Stock pile	9 450	S 25°43'29.82" E 27°47'33.84"
Septic Tank A	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of waste water in septic tank A at the main office	634	S 25°43'38.4" E 27°47'37.66"
Septic Tank B	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of waste water in septic tank B at the residential units	634	S 25°43'38.4" E 27°47'37.8"
Septic Tank C	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of waste water in septic tank C at the workers compound	792 mJ/a	S 25°43'38.6" E 27°47'37.9"
21 (j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or the safety of people				
Section 21 U)	Portion 95 of the Farm Zandfontein 447 JQ	Dewatering from Operational Quarry I continuation of mining activity.	27 000	S 25°43'48.95" E 27°47'36.90"

Copy of the Water Use License is attached as **Appendix 14**

iv) Impacts to be mitigated in their respective phases

e) Measures to rehabilitate the environment affected by the undertaking of any listed activity

ACTIVITIES	PHASE	SIZE AND SCALE of disturbance	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
Please refer to **Error! Reference source not found.** for the above requested information.					

f) Impact Management Outcomes

(A description of impact management outcomes, identifying the standard of impact management required for the aspects contemplated in paragraph ().

Table 21: Measures to rehabilitate the environment affected by the undertaking of any listed activity, impact management outcomes, and impact management actions for Construction and Operation - Expansion

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
: Clearing of vegetation from mining footprints; Blasting, ;loading and Hauling Material to crushing, screening and washing Drying and Packaging minerals at plant	Loss and disturbance to topsoil as a result of clearing of vegetation for minngi. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils causes compaction of soils and reduces the soil's ability to be penetrated by root	Prevent and reduce through management measures. • Demarcation of mining area: • Areas to be prospected must be clearly demarcated • Detailed mining plan must be developed and updated on month to month basis Stripping of topsoil: • Clearing of areas to take place a maximum of one month prior to mining.	Impact avoided. All topsoil used in concurrent rehabilitation. Rehabilitation objectives and standards	Rehabilitation objectives and standards	Construction and Operation

	growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	• Stripping of topsoil will not take place during rain or excessive wind; and • The top 30 cm of vegetation and topsoil is to be stripped from the area to be mined. Storage of topsoil / overburden: • Topsoil (top 30cm) is to be stored in predetermined topsoil berms, (+/- 5m) inside the boundary of the specific area; and • Topsoil stockpiles will be restricted to 1.5 to 2m in height. • Topsoil stockpiles must be protected from erosion • A topsoil stripping and storage procedure must be developed and stored on site.			
	Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	Prevent and reduce and remedy through management measures. • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and • The approved Integrated Water and Waste Management Plan to be implemented. *Hydrocarbons and hazardous waste* • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination. Meet rehabilitation objectives and standards.	Rehabilitation objectives and standards Spill procedure Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] - Section 2 - Declaration of grouped hazardous substances. - Section 9 (1) - Storage and handling of hazardous chemical substances - Section 18 - Offences	Construction and Operation

				Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) - Section 4 - Duties of persons who may be exposed to hazardous chemical substances SANS 10234: 2008: Globally Harmonized System of classification and labelling of chemicals (GHS)	
	Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality.	Prevent and reduce and remedy through management measures. • A generic Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The existing Stormwater management systems (such as existing stormwater dam) will be used to prevent stormwater from entering or exiting the area where mining will occur, which could result in silt laden surface water from draining into natural drainage lines • The slopes of the area where mining activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). Slopes must be developed with a qualified mining engineer to ensure safety. • If necessary, temporary diversion channels should be constructed ahead of the stockpiles (if relevant) to intercept clean run-off and divert it around disturbed areas into the natural drainage system downstream (down gradient) of the mining area. • Existing vegetation must be retained as far as possible to minimise erosion problems.	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination. Meet rehabilitation objectives and standards	Rehabilitation objectives and standards Spill procedure GN704 Regulations in terms of the National Water Act, 1998 (Act No 36 of 1998) Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] Section 2 • Declaration of grouped hazardous substances. Section 9 (1)	Construction and Operation

		• Rehabilitation of the mining area shall be planned and completed (after conclusion of the mining activities) in such a way that the run-off water (if any) will not cause erosion. • Visual inspections shall be done on a weekly basis with regard to the stability of the temporary water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams. • No river or surface water may be affected by silt emanating from the mining area • No wastewater may run freely into any of the surrounding naturally vegetated areas.		• Storage and handling of hazardous chemical substances Section 18 • Offences • Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) Section 4 • Duties of persons who may be exposed to hazardous chemical substances • SANS 10234: 2008: Globally Harmonized System of classification and labelling of chemicals (GHS)	

	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	Prevent and reduce through management measures. In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated. • Contain any dirty water within a system; and • Prevent the contamination of clean water. In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that that potential stormwater impacts are kept to a minimum: • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained. • All storm water infrastructure (if any) on-site shall be maintained and kept clean throughout the ining period. • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented. • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e., Spill kits) must be placed throughout the site. • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory. • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited. • Stormwater leaving the site must in no way be contaminated. • Ensure good housekeeping practices. • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance with relevant specifications. • All chemicals and fuels to be stored in the designated chemical storage area on site • Refuelling must be conducted at the diesel storage area where possible. • Should diesel bowsers be used for refuelling drip trays must be used during refuelling. • Chemical storage procedures must be developed by the on-site environmental officer and kept on site	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination. Meet rehabilitation objectives and standards.	Rehabilitation objectives and standards Spill procedure GN704 Regulations in terms of the National Water Act, 1998 (Act No 36 of 1998) Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] - Section 2 - Declaration of grouped hazardous substances. - Section 9 (1) - Storage and handling of hazardous chemical substances - Section 18 - Offences Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) Section 4 - Duties of persons who may be exposed to hazardous chemical substances SANS 10234: 2008: Globally Harmonized System of classification	Construction and Operation

		• Refuelling procedures must be developed by the site environmental officer and kept on file on site.		and labelling of chemicals (GHS)	

	Loss and disturbance of terrestrial habitat. The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection during construction activities. Permanent changes to water flows and loss of important habitat may occur during the operational phase	Reduce through management measures. • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site clearing activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Adhere to all management and mitigation measures as prescribed within other specialist reports and Environmental Management Programme (EMPr). • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Continuous rehabilitation of the area should occur, immediate closure and rehabilitation. This will entail the spreading of topsoil, revegetation and management of invasive species. • It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon (including fencing off the defined project area) and preventing movement of workers into natural areas. • Rehabilitation measures that are implemented must be continually monitored for a minimum period of four years to ensure that proper succession has occurred and that there is no erosion occurring. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.	Meet rehabilitation objectives and standards.	As set out in Report: Biodiversity Assessment, Elemental Sustainability 2021	Construction and Operation
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of	Reduce through management measures. • Relocate conservation-worthy species under the supervision of a vegetation or horticultural specialist. • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive			

	conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority.			
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	Reduce through management measures. • Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation, and rehabilitation activities, a suitably qualified specialist should be consulted, and the necessary permits obtained and only the these species should be relocated to natural areas in the vicinity. • No hunting, trapping, or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area. • Noise must be kept to an absolute minimum at night to minimise all possible disturbances to amphibian species and nocturnal mammals.			

	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	Reduce through management measures. • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas.			
	Alteration of archaeological, historical and palaeontological resources that may be discovered during earthworks and mining.	Protect heritage resources through developing and implementing procedures. • It is recommended that the areas associated with the identified sites be avoided by the mining activities. Should this not be possible, a qualified archaeologist must be present on-site during mining in order to limit potential impact on heritage resources • It is advised that a qualified archaeologist be contacted whenever uncertainty regarding potential heritage remains are encountered. • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the mining phase, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed, all activities must be suspended, and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).	No loss of newly discovered material.	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations. • South African Heritage Resources Agency Guidelines	Construction and Operation
	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	Reduce through controlling management measures. • Unnecessary lights should be switched off during the day and / or night to avoid light pollution. • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna. • Install temporary lights that will not create a night sky glow.	Rehabilitation objectives and standards	Rehabilitation objectives and standards	Construction and Operation

		• Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards. • Housekeeping on site should be enforced. • Rehabilitation measures such as re-vegetation and plan to be implemented. • Reduce the mining period through careful planning and productive implementation of resources. • Plan the placement of lay-down areas and any potential temporary mining camps in order to minimise vegetation clearing. • Restrict the activities and movement of workers and vehicles to the immediate mining site and existing access roads. • Ensure that rubble, litter and issued materials are managed and removed regularly. • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and Reduce and control dust through the use of approved dust suppression techniques.			
	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Reduce through controlling measures. • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded. • Silencers will be utilised where possible. • Heavy vehicle traffic should be routed away from noise sensitive areas where possible. • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies. • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities.	Impact reduced. Records of service of all operational vehicles. Silencers utilised where applicable. All employees wear PPE where required.	Meet the South African National Standard SANS 10103:2008 Meet South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. Meet the requirements of the Mine Health and Safety Act (Act 29 of 1996)	Construction and Operation

		• The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance. • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity. • No noisy activities to occur on Sundays or public holidays. • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory. Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.			
	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and mining.	Reduce through controlling measures. • Dust suppression shall be implemented during dry periods and windy conditions. • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater. • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present. • Ensure that the shortest routes are used for material transport. • Ensure that stockpile height is kept to a minimum. • Minimise travel speed on unpaved roads. • Implement and actively monitor dust fallout generated in the 8 major wind directions on the borders of the site. • Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed. • Spray areas to be cleared with water. • Ensure minimum travel distance between working areas and stockpiles. • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation. • Ensure graded areas are sprayed with water. • Minimise the number of graded areas. • Ensure that shortest routes are used for material transport. Load and offload material, as far as possible, downwind of topsoil stockpiles.	Impact reduced. Speed limit roads signs, complying with the South African Road Signs Manual on site. Dust fall monitoring programme should be implemented. Dust fallout and Particulate Matter (PM) levels may not exceed the limits as set out in the Dust Control Regulations above. Monitoring dust stands occurring on site.	South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution Meet the requirements of the National Dust Control regulations, 2013, as published in the Government Gazette (No. 36974) of 1 November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004	Construction and Operation

	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	Rehabilitation objectives and standards	Rehabilitation objectives and standards	Construction and Operation
	Generation of additional general waste, litter and building rubble and hazardous waste.	Control through management measures. • The central waste storage and transition area shall be surfaced and demarcated appropriately. • Portable wheelie bins shall be placed throughout the site at all working areas in the field. • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended. • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up. • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM. • Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	Waste management on site visible.	Waste management on site visible. Waste Classification and Management Regulations and Norms and Standards for the assessment of for landfill disposal and for disposal of waste to landfill, 2013 (Government Notice 634 – 635 of 2013) promulgated in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) [as amended] and: Regulations regarding the planning and management of residue stockpiles and residue deposits from a mining, mining, exploration or production operation (GN R. 632 of 2015) SANS 10234: 2008: Globally Harmonized	Construction and Operation

				System of classification and labelling of • chemicals (GHS)	
	Minor impact caused by need for services i.e., water, electricity and sewerage systems during the mining phase causing additional strain on natural resources and service infrastructure.	Reduce through controlling management measures. • Energy savings measures to be implemented at the site e.g.: ➢ No lights to be switched on unnecessarily. ➢ Only security lights to be switched on at night. • Energy saving bulbs to be installed; and • Water should be recycled as far as possible to avoid any additional water usage. • Water meters must be placed on all pipes to monitor usage of clean water	Impact avoided. Recycling of used and contaminated water through wastewater and sewage treatment and reuse.		Construction and Operation
	Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	Reduce through controlling management measures. • Where feasible heavy vehicles should not operate on public roads during peak hours; and • Heavy vehicles should adhere to the speed limit of the road.	Impact reduced. Speed limit roads signs, complying with the South African Road Signs Manual on site.	Reduce through controlling measures Set Speed Limits South African Road Signs Manual	Construction and Operation
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	Prevent through controlling management measures. • Drivers will be enforced to keep setting speed limits. • Trucks will be in a road-worthy condition. • Roads and intersections will be signposted clearly. Only main roads should be used. • Where feasible vehicles should not operate on public roads during peak hours. • Vehicles should adhere to the speed limit of the road. • Heavy vehicles should always travel with their head lights switched on. • Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the site will be allowed. • Single directional traffic shall be controlled through a stop-go system or any other appropriate traffic control method. • Witkop Flourspar (Pty) Ltd shall be responsible for ensuring that suitable access is maintained for public traffic to all relevant businesses and properties; and	Impact reduced. Speed limit roads signs, complying with the South African Road Signs Manual on site. South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution Meet the requirements of the National Dust Control regulations, 2013, as published in the Government Gazette	Reduce through controlling measures Set Speed Limits South African Road Signs Manual South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution National Dust Control regulations, 2013, as published in the	Construction and Operation

		• All traffic accommodation measures are to conform to the latest edition of the South African Road Signs Manual.	(No. 36974) of 1 November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004 Dust fall monitoring programme should be implemented. Dust fallout and Particulate Matter (PM) levels may not exceed the limits as set out in the Dust Control Regulations above. Monitoring dust stands occurring on site.	Government Gazette (No. 36974) of 1 November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004 Approved dust fall out monitoring programme	
	Possibility of Mininga ctivities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Prevent through controlling management measures. • All workers will be sensitised to the risk of fire. • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets. • The Applicant shall ensure that the basic fire-fighting equipment is available on the site. • Extinguishers should be located outside hazardous materials and chemicals storage containers. • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' • Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	Mine Health and Safety Act (Act 29 of 1996) An Emergency Plan (including Fire Protection, Response and Evacuation Plan) Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) [as amended] - Section 12 (1) Duty of the landowner to prevent fire from	Impact avoided. No incidents of fires occurring on site. No one smoking in unauthorised areas. Proof / records of training in terms of the risk of fire and of the emergency management plan.	

			spreading to neighbouring properties.	Basic fire-fighting equipment located in the correct locations on site.	
	Potential creation of very limited extent employment opportunities for the local community, during the mining phase.	• Local labour to be sourced where possible.	Local labour to be sourced where possible.	• -	Construction and Operation
	Multiplier effects on local economy will be positive, but very limited in extent and only short term.	• Supplies to be bought locally as far as possible.	•	•	• Construction and Operation

Table 22: Measures to rehabilitate the environment affected by the undertaking of any listed activity, impact management outcomes, and impact management actions for Reduction Site -Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
: • Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable fencing or a strong wall/bund	Sloping and profiling topography of mined out areas.	**Prevent and reduce through management measures.** • A detailed mine closure design must be compiled by a qualified mining engineer. • Topography of the end landform must blend in with surrounding topography, • The final landform topography must be safe and where posable not promote erosion. • Photographic evidence must be kept of pre and post mining topography	Report - REHABILITATION PLAN - AMENDMENT OF A CONVERTED MINING RIGHT IN TERMS OF SECTION 102 OF MPRDA: PORTION OF PORTION 129 OF THE FARM ZANDFONTEIN 447 JQ, BRITS, Holistic Environmental Services, 2013	Rehabilitation objectives and standards	Rehabilitation
	Erosion of newly placed topsoil on rehabilitated areas.	**Prevent and reduce through management measures.** • Areas to be profiled and rehabilitated must be clearly demarcated • Access to rehabilitation areas must be limited • Rehabilitated areas where topsoil are placed must be revegetated as soon as posable.			

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
structure to prevent people or animals from falling down. • Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations. • Placement of stored topsoil on rehabilitated areas where possible. • Utilise the lowest area with the current stormwater dam as an artificial dam. This dam can be stocked with local species of fish. • Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column titled "Suitability to		• Areas where topsoil are placed should be inspected weekly for signs of erosion			
	Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and • The approved Integrated Water and Waste Management Plan to be implemented. ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination. Meet rehabilitation objectives and standards.	Rehabilitation objectives and standards Spill procedure Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] Section 2 Declaration of grouped hazardous substances. Section 9 (1) Storage and handling of hazardous chemical substances Section 18 Offences Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) - Section 4 Duties of persons who may be exposed to hazardous chemical substances	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
rehabilitate higher, steeper areas" in the table below to identify species most suitable for this specific area and purposes. • Visual, dust and sound screening on lower, less steep areas Larger and structurally denser trees needs to be planted on the lower parts of the site to provide direct visual, dust and sound screening. The northern, eastern, western and central parts of the existing Mining Right area to be rehabilitated, and in future the entire newly proposed Mining Right expansion area, needs to be rehabilitated this way. Use the second last column titled "Suitability to rehabilitate lower, less steep areas" in the table below to identify species most suitable for this specific area. Visual, dust and sound screening along the site boundary using a tree corridor There is a need to plant a tree corridor (boundary planting or hedgerow) along the lower, more visible parts of the site. Such a corridor of trees, even if just two trees wide on average, could				SANS 10234: 2008: Globally Harmonized System of classification and labelling of chemicals (GHS)	
	Stormwater, erosion and siltation impacts due to a lack of implementing measures to manage stormwater run-off quantity and quality.	**Prevent and reduce and remedy through management measures.** • A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The stormwater management plan must include a surface water monitoring and groundwater monitoring plan for implementation during closure and rehabilitation. • The existing Stormwater management systems (such as existing stormwater dam) will be used to prevent stormwater from entering or exiting the area where mining will occur, which could result in silt laden surface water from draining into natural drainage lines • The slopes of the area where rehabilitation activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). Slopes must be developed with a qualified mining engineer to ensure safety. • Existing vegetation must be retained as far as possible to minimise erosion problems. • Rehabilitation of the mining area shall be planned and completed (after conclusion of the mining activities) in such a way that the run-off water (if any) will not cause erosion. • Visual inspections shall be done on a weekly basis with regard to the stability of the water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams. • No river or surface water may be affected by silt emanating from the mining area	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination.	Rehabilitation objectives and standards Spill procedure GN704 Regulations in terms of the National Water Act, 1998 (Act No 36 of 1998) Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] - Section 2 Declaration of grouped hazardous substances. Section 9 (1) Storage and handling of hazardous chemical substances - Section 18 Offences	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
play a very important role in visual, dust and noise mitigation. Use the last column titled "Suitability to use in boundary planting / tree corridor" in the table below to identify species most suitable for this specific area		• No wastewater may run freely into any of the surrounding naturally vegetated areas.		Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) Section 4 Duties of persons who may be exposed to hazardous chemical substances SANS 10234: 2008: Globally Harmonized System of classification and labelling of chemicals (GHS)	
	Contamination of stormwater runoff and ground water, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated. • Contain any dirty water within a system; and • Prevent the contamination of clean water. In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that that potential stormwater impacts are kept to a minimum: • A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur. • The stormwater management plan must include surface and groundwater monitoring.	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination. Meet rehabilitation objectives and standards.	Rehabilitation objectives and standards Spill procedure GN704 Regulations in terms of the National Water Act, 1998 (Act No 36 of 1998) Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] - Section 2	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained and treated on site. • All storm water infrastructure (if any) on-site shall be maintained and kept clean throughout the ining period. • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented. • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e., Spill kits) must be placed throughout the site. • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory. • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited. • Stormwater leaving the site must in no way be contaminated. • Ensure good housekeeping practices. • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance with relevant specifications. • All chemicals and fuels to be stored in the designated chemical storage area on site • Refuelling must be conducted at the diesel storage area where possible. • Should diesel bowsers be used for refuelling drip trays must be used during refuelling. • Chemical storage procedures must be developed by the on-site environmental officer and kept on site • Any dams, stormwater dams or water bodies that wil remain after rehabilitation will be stocked with indigenous fish species		Declaration of grouped hazardous substances. - Section 9 (1) Storage and handling of hazardous chemical substances - Section 18 Offences Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) - Section 4 Duties of persons who may be exposed to hazardous chemical substances SANS 10234: 2008: Globally Harmonized System of classification and labelling of • chemicals (GHS)	

	Loss and disturbance of terrestrial habitat. Permanent changes to water flows and loss of important habitat may occur during the rehabilitation phase	**Reduce through management measures.** • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site rehabilitation activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed. • As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. • Adhere to all management and mitigation measures as prescribed within other specialist reports and Environmental Management Programme (EMPr). • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Continuous rehabilitation of the area should occur, immediate closure and rehabilitation. This will entail the spreading of topsoil, revegetation and management of invasive species. • Rehabilitation measures that are implemented must be continually monitored for a minimum period of four years to ensure that proper succession has occurred and that there is no erosion occurring. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.	Meet rehabilitation objectives and standards.	As set out in Reports: Biodiversity Assessment, Elemental Sustainability 2021 Report - REHABILITATION PLAN - AMENDMENT OF A CONVERTED MINING RIGHT IN TERMS OF SECTION 102 OF MPRDA: PORTION OF PORTION 129 OF THE FARM ZANDFONTEIN 447 JQ, BRITS, Holistic Environmental Services, 2013	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
	Loss and disturbance of terrestrial Flora. Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some Sclerocarya birrea (Marula Tree). Though not threatened, Sclerocarya birrea is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate Sclerocarya birrea from site.	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. A revegetation Plan will be developed for the rehabilitation areas by a qualified specialist, • Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority.			
	Loss and disturbance of terrestrial Fauna. Construction and operational related activities may lead to the loss of faunal species of conservation concern.	**Reduce through management measures.** • Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation, and rehabilitation activities, a suitably qualified specialist should be consulted, and the necessary permits obtained and only the these species should be relocated to natural areas in the vicinity.			

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• No hunting, trapping, or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area. • Noise must be kept to an absolute minimum at night to minimise all possible disturbances to amphibian species and nocturnal mammals.			
	Introduction and spread of alien vegetation impact ratings. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.	**Reduce through management measures.** • Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond. • An alien invasive vegetation management plan should be developed and implemented. • Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species. • Rehabilitate or revegetate disturbed areas. • **Rehabilitated areas should be inspected by a Biodiversity specialist on a bi-monthly basis**			

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
	Visibility from sensitive receptors / visual scarring of the landscape as a result of the mining activities.	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution. • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna. • Install temporary lights that will not create a night sky glow. • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards. • Housekeeping on site should be enforced. • Rehabilitation measures such as re-vegetation and plan to be implemented. • Reduce the mining period through careful planning and productive implementation of resources. • Plan the placement of lay-down areas and any potential temporary mining camps in order to minimise vegetation clearing. • Restrict the activities and movement of workers and vehicles to the immediate mining site and existing access roads. • Ensure that rubble, litter and issued materials are managed and removed regularly. • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and Reduce and control dust through the use of approved dust suppression techniques.	Rehabilitation objectives and standards	Rehabilitation objectives and standards	Rehabilitation
	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded. • Silencers will be utilised where possible.	Impact reduced. Records of service of all operational vehicles.	Meet the South African National Standard SANS 10103:2008	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
	associated with the operation of vehicles, machinery and equipment.	• Heavy vehicle traffic should be routed away from noise sensitive areas where possible. • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies. • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities. • The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance. • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity. • No noisy activities to occur on Sundays or public holidays. • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory. Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.	Silencers utilised where applicable. All employees wear PPE where required	Meet South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. Meet the requirements of the Mine Health and Safety Act (Act 29 of 1996)	
	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and mining.	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions. • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater.	Impact reduced. Speed limit roads signs, complying with the South African Road Signs Manual on site.	South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present. • Ensure that the shortest routes are used for material transport. • Ensure that stockpile height is kept to a minimum. • Minimise travel speed on unpaved roads. • Implement and actively monitor dust fallout generated in the 8 major wind directions on the borders of the site. • Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed. • Spray areas to be cleared with water. • Ensure minimum travel distance between working areas and stockpiles. • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation. • Ensure graded areas are sprayed with water. • Minimise the number of graded areas. • Ensure that shortest routes are used for material transport. Load and offload material, as far as possible, downwind of topsoil stockpiles.	Dust fall monitoring programme should be implemented. Dust fallout and Particulate Matter (PM) levels may not exceed the limits as set out in the Dust Control Regulations above. Monitoring dust stands occurring on site.	Meet the requirements of the National Dust Control regulations, 2013, as published in the Government Gazette (No. 36974) of 1 November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004 • •Rehabilitation objectives and standards	
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	Rehabilitation objectives and standards	Rehabilitation objectives and standards	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
	Generation of additional general waste, litter and building rubble and hazardous waste.	**Control through management measures.** • The central waste storage and transition area shall be surfaced and demarcated appropriately. • Portable wheelie bins shall be placed throughout the site at all working areas in the field. • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended. • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up. • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM. • Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	Waste management on site visible.	Waste management on site visible. Waste Classification and Management Regulations and Norms and Standards for the assessment of for landfill disposal and for disposal of waste to landfill, 2013 (Government Notice 634 – 635 of 2013) promulgated in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) [as amended] and: Regulations regarding the planning and management of residue stockpiles and residue deposits from a mining, mining, exploration or production operation (GN R. 632 of 2015)	

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
				SANS 10234: 2008: Globally Harmonized System of classification and labelling of chemicals (GHS)	
	Health and safety risks caused by rehabilitation activities	**Prevent through controlling management measures.** • Strict access control to the site must be implemented • Rehabilitation areas must be clearly demarcated • Finale slopes will be determined by mining engineer and inspected for safety at intervals to be determined by the mining engineer. • All stormwater dams will be fenced with required safety signage and safety devices as required by the mine health and safety act	Prevent through controlling management measures. Drivers will be enforced to keep setting speed limits. Trucks will be in a road-worthy condition.	African Road Signs Manual on site. South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution Meet the requirements of the National Dust Control regulations, 2013, as published in the Government	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
			Roads and intersections will be signposted clearly. Only main roads should be used. Where feasible vehicles should not operate on public roads during peak hours. Vehicles should adhere to the speed limit of the road. Heavy vehicles should always travel with their head lights switched on. Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the site will be allowed. Single directional traffic shall be controlled through a stop-go system or any other	Gazette (No. 36974) of 1 November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004 Dust fall monitoring programme should be implemented. Dust fallout and Particulate Matter (PM) levels may not exceed the limits as set out in the Dust Control Regulations above. Monitoring dust stands occurring on site.	

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
			appropriate traffic control method. Witkop Flourspar (Pty) Ltd shall be responsible for ensuring that suitable access is maintained for public traffic to all relevant businesses and properties; and All traffic accommodation measures are to conform to the latest edition of the South African Road Signs Manual.		
	Possibility of Mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire. • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets. • The Applicant shall ensure that the basic fire-fighting equipment is available on the site. • Extinguishers should be located outside hazardous materials and chemicals storage containers. • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' • Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	Mine Health and Safety Act (Act 29 of 1996) An Emergency Plan (including Fire Protection, Response and Evacuation Plan) Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) [as amended] - Section 12 (1) Duty of the landowner to prevent fire from spreading to	Impact avoided. No incidents of fires occurring on site. No one smoking in unauthorised areas. Proof / records of training in terms of the risk of fire and of the emergency management plan. • Basic fire-fighting equipment	Rehabilitation

Activity Including Size/ scale	Aspects and potential impacts	MITIGATION TYPE	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
			neighbouring properties.	located in the correct locations on site.	
	Potential creation of very limited extent short term employment opportunities for the local community, during the mining phase.	• Local labour to be sourced where possible.	• Rehabilitation objectives and standards	• Rehabilitation objectives and standards	• Rehabilitation
	Multiplier effects on local economy will be positive, but very limited in extent	• Supplies to be bought locally as far as possible.	• Rehabilitation objectives and standards	• Rehabilitation objectives and standards	• Rehabilitation

g) Impact Management Actions

(A description of impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (c) and (d) will be achieved)

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE	TIME PERIOD FOR IMPLEMENTATION	COMPLIANCE WITH STANDARDS
Please refer to Table 21 to Table 22 for the above requested information.				

i) Financial Provision

(1) Determination of the amount of Financial Provision

(a) Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under the Regulation

Mining activities are to be undertaken in a manner which facilitates site rehabilitation and the restoration of existing land capabilities. The primary objectives for rehabilitation include:

To ensure that the site is safe and secure;

- To remove any sources of pollution from the site and rehabilitate and restore the soils;
- To control erosion by establishing a vegetative cover;
- To re-establish a plant community with specified indigenous species;
- Where feasible maintain or increase the biological diversity of species in the vicinity;
- To rehabilitate the site to a state that is suitable for other land uses; and
- To rehabilitate the site that it facilitates compliance with current environmental quality objectives.

(b) Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

This Basic Assessment Report and Environmental Management Programme will be subjected to a public consultation period, whereby I&APs are given 30 days to comment.

(c) Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

The current mining area will be mined with a view to close. The current section will be mined up to the same level as the stormwater dam that is adjacent to the site. On completion of mining the current section will be flooded and an artificial dam will be created, Slopes will be profiled and covered with the stored topsoil on site. The slopes will be revegetated with indigenous plant species. Designs will be submitted of the old mining area and proposed rehabilitated layout 180 days before the start of rehabilitation works. This area is characterised by higher, steeper slopes and some vertical rock faces

due to quarrying activities. Therefore geotechnical stability, soil erosion and visual mitigation are very important. The existing. Rehabilitation Plan deals extensively with these issues, however, the following should receive special attention:

- Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable fencing or a strong wall/bund structure to prevent people or animals from falling down.
- Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations.
- Placement of stored topsoil on rehabilitated areas where possible.
- Utilise the lowest area with the current stormwater dam as an artificial dam. This dam can be stocked with local species of fish.
- Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column titled “Suitability to rehabilitate higher, steeper areas” in the table below to identify species most suitable for this specific area and purposes.
- Visual, dust and sound screening on lower, less steep areas Larger and structurally denser trees needs to be planted on the lower parts of the site to provide direct visual, dust and sound screening. The northern, eastern, western and central parts of the existing Mining Right area to be rehabilitated, and in future the entire newly proposed Mining Right expansion area, needs to be rehabilitated this way. Use the second last column titled “Suitability to rehabilitate lower, less steep areas” in the table below to identify species most suitable for this specific area.
- Visual, dust and sound screening along the site boundary using a tree corridor There is a need to plant a tree corridor (boundary planting or hedgerow) along the lower, more visible parts of the site. Such a corridor of trees, even if just two trees wide on average, could play a very important role in visual, dust and noise mitigation. Use the last column titled “Suitability to use in boundary planting / tree corridor” in the table below to identify species most suitable for this specific area.

Table 23 Tree and grass species selection matrix

Specie	Is this specie indigenous to this specific vegetation and ecological unit?	Does this specie occur on the site and/or properties directly adjacent to the site in the exact same biophysical conditions, especially soil and aspect?	Succession status	Forage, habitat provision & economic value	Visual, dust and noise screening value (also consider if evergreen)	Soil stabilisation value	Rock stabilisation value	Ease of establishment and care	Suitability to rehabilitate higher, steeper areas	Suitability to rehabilitate lower, less steep areas	Suitability to use in boundary planting / tree corridor
Trees											
Acacia caffra (Common Hook-thorn)	Yes	Yes	Sub-climax	High	Moderate	Low	High	High	High	High	Moderate
Combretum zeyheri (Raasblaar; Large-fruited bush-willow)	Yes	Yes	Sub-climax	Moderate	Moderate	Low	Moderate	High	Moderate	Moderate	High
Englerophytum magalismontanum	Yes	Yes	Sub-climax	High	High	Low	High	High	High	Moderate	Low
Ficus abutilifolia (Large-leaved Rock Fig)	Yes	Yes	Sub-climax	Low	Moderate	Moderate	High	High	High	Moderate	Low
Ficus ingens (Rooiblaarrotsvy; Red-leaved rock fig)	Yes	Yes	Sub-climax	Moderate	High	Low	High	High	High	Moderate	Low
Mimusops zeyheri (Moepel)	Yes	Yes	Sub-climax	High	High	Low	High	High	High	High	High
Pappea capensis (Jacket-plum)	Yes	Yes	Climax	High	High	Low	Moderate	High	Moderate	High	High
Sclerocarya birrea	Yes	Yes	Sub-climax	Moderate	Moderate	Low	Moderate	High	Moderate	Moderate	High
Ximenia caffra (Sourplum)	Yes	Yes	Sub-climax	Moderate	Low	Low	High	High	High	Low	Low
Ziziphus mucronata (Buffalo-thorn)	Yes	Yes	Climax	High	High	Low	Low	High	Low	High	High
Other species including: Acacia karoo; Acacia robusta; Ochna Pulchra; Rhus lancea; Bequaertiodendron magalismontanum; Burkea Africana; Combretum molle	Yes	Only some.	Sub-climax	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Grasses											
Dactyloctenium aegyptium (Common Crowfoot)	Yes	No	Pioneer	Moderate	Low	Low	Low	High	High	High	Low

Dactyloctenium giganteum (Giant Crowfoot)	Yes	No	Pioneer	High	High	High	Low	High	High	High	Low
Cenchrus ciliaris (Foxtail Buffalo Grass)	Yes	Yes	Sub-climax & climax	High	High	High	Moderate	High	High	High	Low
Digitaria eriantha (Common Finger Grass)	Yes	Yes	Sub-climax & climax	High	Low	High	Low	High	Moderate	Moderate	Low
Eragrostis chloromelas	Yes	Yes	Sub-climax & climax	Moderate	Low	Moderate	Low	High	Moderate	Moderate	Low
Heteropogon contortus	Yes	Yes	Sub-climax	Moderate	Low	Low	Low	High	Moderate	Low	Low
Hyparrhenia hirta (Common Thatching Grass)	Yes	Yes	Sub-climax & climax	Moderate	High	High	High	High	High	High	Low
Panicum maximum (Guinea Grass) [prefer more humid microclimates]	Yes	Yes	Sub-climax & climax	High	High	High	Low	High	Moderate	High	Low
Setaria sphacelata var. sphacelata (Common Bristle Grass)	Yes	Yes	Climax	High	Low	High	Low	High	Moderate	High	Low
Themeda triandra	Yes	Yes	Climax	High	Moderate	Moderate	Low	High	Moderate	High	Low
Tragus berteronianus (Carrot-seed Grass)	Yes	Yes	Pioneer	Low	Low	Low	Low	High	High	High	Low
Trichoneura grandiglumis (Small Rolling Grass)	Yes	Yes	Sub-climax	Low	Low	Low	Low	High	High	Moderate	Low
Urochloa mosambicensis (Bushveld Signal Grass)	Yes	Yes	Sub-climax	High	Low	Low	Low	High	Moderate	Moderate	Low
Other: Setaria flabellate; Setaria nigirostris; Eragrostis racemosa; Eragrostis capensis; Eragrostis gummiflua; Aristida aequiglumis; Rhynchelytrum nerviglume; Cymbopogon excavates; Trachypogon spicatus; Tristachya leucotrix; Panicum natalense; Diheteropogon amplectens; Monocyrnbium ceressiiforme; Digitaria monodactyula; Digitaria tricholaedoides.	Yes	No	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies

The Rehabilitation Plan is attached as **Appendix 15**

(d) Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

. Rehabilitation will be conducted concurrently and will include sloping and re-vegetation. Detailed mitigation measures are provided in the EMPR to ensure the closure objectives are met.

(e) Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

The closure cost assessment was conducted, and it was determined that an amount of R1 115 353,32 for the Expansion would be required for the closure and rehabilitation. The full Closure Cost Assessment is attached in this BAR as Appendix 12

Table 24: Closure Cost

Closure Component		Note	Unscheduled Closure			
			Quantity	Unit	Unit Rate	Total Cost
1.	Roads					
1.1	Removal of Internal Roads	Removal of pollution and dozing of topsoil berms	0,0	ha	R135 072,00	R0,00
1.2	Removal of Haul Roads	Removal of pollution and dozing of topsoil berms - High compaction	0,0	ha	R178 415,00	R0,00
Sub-total for Roads						R0,00
2.	Stockpiles and Overburdens					
2.1	Hard Overburden	Slope dozing and surface rehabilitation	0	ha	R90 125,00	R0,00
2.2	Soft - Overburden	General surface rehabilitation	0	ha	R119 106,90	R0,00
2.3	Topsoil Stockpile	General surface rehabilitation	0	ha	R119 106,90	R0,00
Sub-total for Stockpiles and Overburdens						R0,00
3.	Clean and Dirty water management					
3.1	Removal of Clean water Channels and Berm	General surface rehabilitation	0	ha	R119 106,90	R0,00
3.2	Removal of Dirty water Channels	Concrete removal and general surface rehabilitation	0	m2	R114,52	R0,00
3.3	Rehabilitation of PCD's	Liner, concrete removal slope removal and General surface rehab	0	ha	R141 573,04	R0,00
Sub-total for Clean and Dirty water management						R0,00
4.	Mining Areas					
4.1	Surface Rehabilitation					
4.1.1	Slope and Bench establishment	Dozing of slopes and bench establishment	2,9	ha	R148 883,63	R435 484,62
4.1.2	General surface rehabilitation	Truck from stockpile and shovel back.	2,9	ha	R119 106,90	R348 387,68
Sub-total for Surface Rehabilitation including final voids, ramps						R783 872,30
					Subtotal 1:	R783 872,30
5.	P&G's, Contingencies and Additional Allowances					
5.1	Preliminaries and general		7,5	/sum	R58 790,42	R58 790,42
5.2	Contingencies		7,5	/sum	R58 790,42	R58 790,42
5.3	Specialist Studies	Rock Stability Assessment	1	/sum	R75 430,00	R75 430,00
					Subtotal 2:	R193 010,85

6.	Pre-Site Relinquishment Monitoring and Aftercare					
6.1	Surface Water Quality Monitoring and Reporting	3 year period - below 2 surface samples - quarterly with annual report	3	/yr	R31 950,00	R95 850,00
6.3	Aftercare and Maintenance	Footprint area - 3 year period (Vegetation, soil, land capacity and erosion)	2,9	/yr/ha	R4 857,00	R42 620,18
					Subtotal 3:	R138 470,18
					Grand Total Excl. Vat. (or Subtotal 1+2+3)	R1 115 353,32

(f) Confirm that the financial provision will be provided as determined.

The financial provision will be provided as determined.

The applicant submits that it is a mining company and is able to fund the planned mining from its operational budget. It is confirmed that the amount for financial provision is anticipated to be an operating cost and is provided for as such in the Closure Cost Asessment.

Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including

h) Monitoring of Impact Management Actions
i) Monitoring and reporting frequency
j) Responsible persons
k) Time period for implementing impact management actions
l) Mechanism for monitoring compliance

Table 25 : Expansion Site

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
Construction, Operation PHASE				
Clearing of vegetation from mining footprints; Blasting, ;loading and Hauling Material to crushing, screening and washing Drying and Packaging minerals at plant	Surface Water	• A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur, and should include the management of stormwater during excavation, as well as the installation of stormwater and erosion control measures during mining, followed up by rehabilitation of the area. This Stormwater Management Plan to be monitored for implementation. • Visual inspections shall be done on a weekly basis with regard to the stability of the water control structures, erosion and siltation.	• Applicant • Engineer	After rain / storm events; and Monthly
	Dust and air quality pollution	Dust shall be controlled in accordance with the requirements of the National Dust Control Regulations (GN 827, November 2013). This shall include compliance with regards to: A: Dust fall out standards- (b) 1200 mg/m^2/day averaged over 30	• Applicant • Environmental Specialist	Monthly

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
		days in areas other than residential and light commercial areas measured using reference method ASTM 01739. • A Gravimetric Dust Monitoring program must be implemented on the site as stipulated in section 4 of GN 827 – National Dust Control Regulations, in terms of section 53(o), read with section 32 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004). • A minimum of eight dust buckets must be erected around the site in the eight main wind directions. Monthly air quality report will be required as per the regulations to: • Ensure that the environmental mitigation and control measures are implemented. • Monitor environmental performance of the mining operations. • Tracking of progress due to pollution control measure implementation. • Verify compliance with all relevant legal and statutory requirements. • Promote environmental education and protection; and • Determine sources of significant pollution.		
	Ecological Monitoring and management	Specialist monitoring on Faunal and Floral aspects include the monitoring of effects operational processes have on vegetation and accompanied animal life within the immediate or surrounding areas of the operations.	• Environmental Specialist	Visual inspections during rehabilitation

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
		• Alien vegetation control and management. • Habitat and vegetation management. • Rehabilitation services include the rehabilitation of operational disturbed areas and hydrocarbon spill areas. • Sloping and re-vegetation of disturbed area to surrounding landscape; and • Remediation of soil at spill sites.		
	Groundwater Monitoring	Groundwater Monitoring to be implemented in accordance with approved Water Use License	• ECO	Monthly

Table 26 : Reduction Site

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
Rehabilitation PHASE				

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
• Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable	Topography	• A rehabilitation Design must be developed by qualified engineer and updated annually	• Applicant • Engineer	Annaly

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
fencing or a strong wall/bund structure to prevent people or animals from falling down. • Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations. • Placement of stored topsoil on rehabilitated areas where possible. • Utilise the lowest area with the current stormwater dam as an	Surface Water	• A Stormwater Management Plan (SMP) to be developed for the collective area where mining and rehabilitation will occur, and should include the management of stormwater during excavation, as well as the installation of stormwater and erosion control measures during mining, followed up by rehabilitation of the area. This Stormwater Management Plan to be monitored for implementation. • Visual inspections shall be done on a weekly basis with regard to the stability of the water control structures, erosion and siltation.	• Applicant • Engineer	After rain / storm events; and Monthly
	Dust and air quality pollution	Dust shall be controlled in accordance with the requirements of the National Dust Control Regulations (GN 827, November 2013). This shall include compliance with regards to: A: Dust fall out standards- (b) 1200 mg/m^2/day averaged over 30 days in areas other than residential and light commercial areas measured using reference method ASTM 01739. • A Gravimetric Dust Monitoring program must be implemented on the site as stipulated in section 4 of GN 827 – National Dust Control Regulations, in terms of section 53(o), read with section 32 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).	• Applicant • Environmental Specialist	Monthly

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
artificial dam. This dam can be stocked with local species of fish. • Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column titled "Suitability to rehabilitate higher, steeper areas" in the table below to identify species most suitable for this specific area and purposes. • Visual, dust and sound screening on lower, less steep areas Larger and structurally denser trees needs to be planted on the lower parts of the site to provide direct visual, dust and sound screening. The northern, eastern, western and central parts of the existing Mining Right		• A minimum of eight dust buckets must be erected around the site in the eight main wind directions. Monthly air quality report will be required as per the regulations to: • Ensure that the environmental mitigation and control measures are implemented. • Monitor environmental performance of the mining operations. • Tracking of progress due to pollution control measure implementation. • Verify compliance with all relevant legal and statutory requirements. • Promote environmental education and protection; and • Determine sources of significant pollution.		
	Ecological Monitoring and management	Specialist monitoring on Faunal and Floral aspects include the monitoring of effects operational processes have on vegetation and accompanied animal life within the immediate or surrounding areas of the operations. • Alien vegetation control and management. • Habitat and vegetation management. • Rehabilitation services include the rehabilitation of operational disturbed areas and hydrocarbon spill areas. • Sloping and re-vegetation of disturbed area to surrounding landscape; and • Remediation of soil at spill sites.	• Environmental Specialist	Visual inspections during rehabilitation
	Groundwater Monitoring	Groundwater Monitoring to be implemented in accordance with approved Water Use License	• ECO	Monthly

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
area to be rehabilitated, and in future the entire newly proposed Mining Right expansion area, needs to be rehabilitated this way. Use the second last column titled "Suitability to rehabilitate lower, less steep areas" in the table below to identify species most suitable for this specific area. • Visual, dust and sound screening along the site boundary using a tree corridor There is a need to plant a tree corridor (boundary planting or hedgerow) along the lower, more visible parts of the site. Such a corridor of trees, even if just two trees wide on average, could play a very important role in visual, dust and noise mitigation. Use the last column titled "Suitability				

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
to use in boundary planting / tree corridor" in the table below to identify species most suitable for this specific area				

m) Indicate the frequency of the submission of the performance assessment/ environmental audit report.

A Performance Assessment Review of the EMPR should be conducted annually and the environmental audit report will be submitted annually.

n) Environmental Awareness Plan

(1) Manner in which the applicant intends to inform his or her employees of any the environmental risk which may result from their work

The environmental awareness plan will include the following:

- Induction of all staff and workers.
- Monthly 'toolbox' talks (awareness talks).
- Risk assessments for specific tasks with supervisors and staff involved in the task on a daily basis, or as often as the task is taking place.

The following principles and training will apply to the Environmental Awareness Plan (safety, health and environmental (SHE) training and the Environmental Management System (EMS) training):

- All personnel, including contactors will as a minimum undergo general, SHE induction and awareness training.
- The Safety, Health, Environmental and Quality (SHEQ) Manager will identify the SHE is training requirements for all personnel and contractors. The training requirements will be recorded in a training needs matrix indicating particular training that must be undertaken by identified personnel and contractors. The training matrix will be administered by the Training Department; and Development of the Training Programme, which will include:
    - Job specific training – training for personnel performing tasks which could cause potentially significant environmental impacts.
    - Assessment of extent to which personnel are equipped to manage environmental impacts.
    - Basic environmental training.
    - EMS training.
    - Comprehensive training – on emergency response, spill management, etc.
    - Specialised skills.
    - Training verification and record keeping; and
    - Periodic re-assessment of training needs, with specific reference to new developments, newly identified issues and impacts and associated mitigation measures.

General Awareness Training

- The HR Manager, together with the SHEQ Manager, will be responsible for the development of, or facilitating the development of, the required general SHE induction and awareness training. A general environmental awareness training module will be developed and integrated into the general induction programme. The general awareness training must include the Environmental Policy, a description of the environmental impacts and aspects and the importance of conformance to requirements, general responsibilities of personnel and contractors with regard to the environmental requirements and a review of the emergency procedures and corrective actions; and
- A Training Practitioner will conduct the general awareness training. The training presenter will keep a record of the details of all persons attending general awareness training. Such attendance registers shall indicate the names of attendants and their organisations, the date and the type of training received.

Specific Environmental Training

- Specific environmental training will be in line with the requirements identified in the training matrix; and
- Personnel whose work tasks can impact on the environment will be made aware of the requirements of appropriate procedures/work instructions. The SHEQ Manager will communicate training requirements to responsible supervisors to ensure that personnel and contractors are trained accordingly.

Training Evaluation and Re-training

- Effectiveness of the environmental training will be reflected by the degree of conformance to EMPr requirements, the result of internal audits and the general environmental performance achieved.
- Incidents and non-conformances will be assessed through the Internal Incident Investigation and Reporting System, to determine the root cause, including the possible lack of awareness/training.
- Should it be evident that re-training is required, the SHEQ Manager will inform the managers of the need and take the appropriate actions.
- General awareness training of all personnel shall be repeated every year; and
- The re-induction shall take into consideration changes made in the EMPr, changes in legislation, current levels of environmental performance and areas of improvement.

Emergency Procedures

- Emergency procedures, as relevant to this project, shall be implemented.
- The SHEQ Manager shall define emergency reporting procedures for the project.
- All personnel shall be made aware of emergency reporting procedures and their responsibilities.
- Any spills will be cleaned up immediately in accordance with relevant legislation; and

- Telephone numbers of emergency services, including the local firefighting service, shall be conspicuously displayed.

(2) Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

The procedure for dealing with environmental risk including the objectives, identification and calculation of environmental risks is described in the existing approved EMPR. A spill procedure should be developed and implemented by the applicant.

o) Specific information required by the Competent Authority

(Among others, confirm that the financial provision will be reviewed annually)

No specific information has been required by the Competent Authority at this point in time.

2) UNDERTAKING

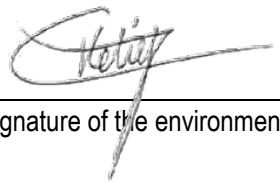
The EAP herewith confirms

a) the correctness of the information provided in the reports ☒

b) the inclusion of comments and inputs from stakeholders and I&APs; ☒

c) the inclusion of inputs and recommendations from the specialist reports where relevant; ☒; and

d) that the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein. ☒



Signature of the environmental assessment practitioner:

Retief Environmental

Name of company:

2021 – 11 - 04

Date:

-END-

REFERENCES

Madibeng Local Municipality Spatial Development Framework 2015, Madibeng,

Rolfes Silica (Pty) Ltd, Remaining Extent of Portion 95 (a portion of portion 5) of the farm Zandfontein 447JQ, Integrated Waste and Water Management Plan, Shangoni, 2011

Phase 1 Archaeological Impact Assessment, Holistic Environmental Services, 2013

Rehabilitation Plan- Amendment of a Converted Mining Right in Terms of Section 102 of MPRDA: Portion of Portion 129 of the Farm Zandfontein 447 JQ, Brits, Holistic Environmental Services, 2013

Water Use License 07/A21J/AGJ/7962

Mining Right NW/30/5/1/2/2/441 MR

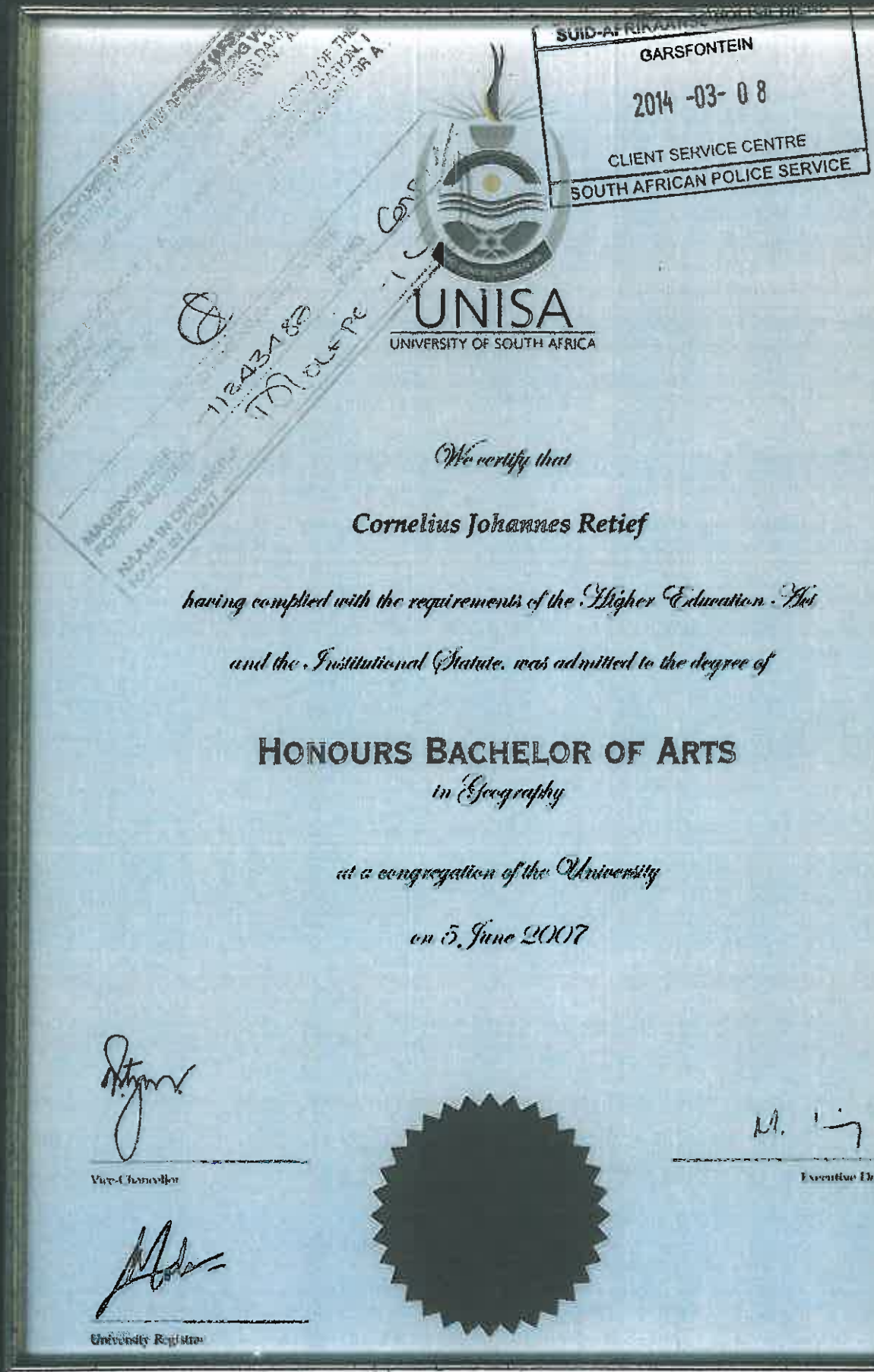
Baseline Hydrogeological Study for Rolfes Silica (PTY) LTD, Geo-Polution Technologies, 2011

Mine Work Programme, Briel and Associates, 2021

Biodiversity Assessment, Elemental Sustainability, 2021

Closure Cost Assessment Report, Elemental Sustainability, 2021

Appendix 1 : The qualifications of the EAP



SUID-AFRIKAANSE POLISIEDIENS
GARSFONTEIN
2014 -03- 08
CLIENT SERVICE CENTRE
SOUTH AFRICAN POLICE SERVICE

UNISA
UNIVERSITY OF SOUTH AFRICA

We certify that

Cornelius Johannes Retief

having complied with the requirements of the Higher Education Act and the Institutional Statute, was admitted to the degree of

HONOURS BACHELOR OF ARTS
in Geography

at a congregation of the University

on 5 June 2007

Vice-Chancellor

Executive Dean

University Registrar

UNISA
UNIVERSITY OF SOUTH AFRICA

Ons verklaar dat

Cornelius Johannes Retief

op 10 Mei 2005

by 'n kongregasie van die Universiteit

toegelaat is tot die graad

BACCALAUREUS ARTIUM

met spesialisering in Omgewingsbestuur

aangesien aan die Wet op Hoër Onderwys

en die Institusionele Statuut voldoen is

Visekanselier

Uitvoerende Dekaan

Registrateur (Akademies)

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Cornelius Johannes Retief

Registration Number: 113960

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Environmental Science (Professional Natural Scientist)

Effective **9 March 2016** Expires **31 March 2022**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

EAPASA
Unit 19 Oxford Office Park
3 Bauhinia Street
Highveld Techno Park
Centurion
0157
Tel. (+27) 12 880 2154

Email: registrar@eapasa.org / Website: www.eapasa.org

Environmental Assessment Practitioners Association of South Africa
Advancing environmental assessment practice in South Africa

Mr Cornelius Retief
78 Van Velden Street
Britr
0250

Sent by email to: corrieretief2@gmail.com

Dear Mr Retief

Registered Environmental Assessment Practitioner: Number 2019/1513
Cornelius Johannes Retief : South African ID 8208245014080

The Environmental Assessment Practitioners Association of South Africa (EAPASA) herewith certifies that Cornelius Johannes Retief is a Registered Environmental Assessment Practitioner (EAP) in accordance with the prescribed criteria of Regulation 15.(1) of the Section 24H Registration Authority Regulations (Regulation No. 849, Gazette No. 40154 of 22 July 2016, of the National Environmental Management Act (NEMA), Act No. 107 of 1998, as amended).

Your registration is duly authorised by EAPASA as the single Registration Authority for EAPs in South Africa (appointed as per Regulation No. 104, Gazette No. 41434 of 8 February 2018, in terms of section 24H(3)(a) of the NEMA). Your status as a Registered EAP is displayed in the 'EAP Register' - please find your name and contact email address at

https://registration.eapasa.org/registered-practitioners

Your registration is effective for a period of five years from 24 January 2020, and expires on 24 January 2025. The renewal of your registration in 2025 will be contingent on you having met the requirements of EAPASA's Continuing Professional Development (CPD) policy during each year of registration.

As a Registered EAP you are required to uphold the EAPASA Code of Ethical Conduct and Practice in your professional endeavours, towards the goal of quality assurance in environmental assessment practice.

Please accept my congratulations on your registration.

Best regards

Dr Richard Hill
Registrar
Date: 24 January 2020

Appendix 2 : EAP's curriculum vitae

CURRICULUM VITAE

CORNELIUS JOHANNES RETIEF
(Known as Corrie)

1. INTRODUCTION

I am a SACNASP registered Environmental Scientist and an EAPASA Registered EAP with a Bachelor degree specialising in environmental management and an Honours Bachelors in Geography. I have been working for more than 16 years on a number of diverse projects relating to the Environmental and Waste Management for mining, local government and for the private sector.

I have successfully and profitably managed projects through all project phases from inception through completion within targeted cost, schedule, and compliance parameters. Sustaining a high environmental performance reputation, maintaining quality standards, and minimizing corporate costs and liability have been a consistent result of my professional commitment. In addition, I have solid organizational leadership and decision-making skills that can make an immediate contribution to any organisation's environmental performance. I have provided compliance auditing as well as independent environmental control officer services to various large and medium, privately owned and listed companies throughout South Africa. My training in sustainability and sustainable project delivery has furthermore helped me to deliver profitable sustainability into customers operations throughout the asset lifecycle.

I am known for my clear communication, my attention to detail, my resourceful approach to problem-solving, as well as my strong relationship management and consulting skills. I have the ability to convey information clearly to everyone from my colleagues to management, stakeholders and government regulators. A significant element of public participation is required throughout the life cycle of an Environmental Authorisation process. I have successfully liaised with interested and affected parties, ensuring that all communication procedures and dialogues are open and transparent, and that capacity building is conducted where necessary.

I maintain an excellent knowledge of environmental systems and practices, in addition to a working knowledge of environmental regulations and best practice standards. I am committed to my work and have a passion for the environment combined with a firm dedication to organisational goals.

2. PERSONAL DETAILS

Name	Cornelius Johannes Retief
Date of Birth	24/08/1982
Identity Number	8208245014080
Driver's License	Code EB (Own Vehicle)
Criminal Record	None
Health	Excellent
Nationality	South African
Physical Address	78 Van Velden Street, Brits, 0250
Postal Address	PO Box 1096, Brits, 0250
Cell Number	+27 82 852 2134
Email	corrieretief2@gmail.com

3. ACADEMIC QUALIFICATIONS

2007 Honours BA (Geography) (Unisa)

2005	BA Specialising in Environmental Management (Unisa)
2000	Grade 12 (High School Brits)

4. COURSES, SEMINARS AND WORKSHOPS

4.1 COURSES, SEMINARS AND WORKSHOPS ATTENDED

2021	Environmental Law Update (Inlexso)
2017	Course in Integrated Waste Management (Northwest University: Centre for Environmental Management)
2017	Environmental Legal Update Training (MacRobert Attorneys)
2016	Environmental Law Workshop (IMBEWU / ENVASS)
2015	Innovative Management of Tailings, Mine Waste And Heap Leaching (Melrose Training)
2014	Short Course in Environmental Management and Regulation (University of Pretoria)
2013	SEAL Sustainable Design Lead Practitioner Course (WorleyParsons RSA)
2013	Short Course in Environmental Compliance (University of Pretoria)
2009	ISO 14001:2004 Requirements Course (TIQMS)
2009	ISO 14001:2004 Internal Auditors Course (TIQMS)
2001	ICDL Computer Diploma (Unisa)

5. PROFESSIONAL REGISTRATION AND ASSOCIATIONS

South African Council for Natural Scientific Professions	Professional Natural Scientist (113960)
EAPASA	Environmental Assessment Practitioner (2019/1513)

6. EMPLOYMENT EXPERIENCE

August 2020- Current **Retief Environmental**

Freelance Environmental Consultant

Responsibilities and Duties:

- Project management
- Compilation and submission of tenders and quotations
- Liaising with clients
- Liaising with relevant authorities
- Procurement and management of Sub-consultants
- Ensure Health and Safety Compliance of project teams
- Environmental Management and Authorisations
    - Environmental site screening, investigation and evaluations
    - Environmental legal screenings
    - Conducting Environmental risk assessments
    - Environmental feasibility studies
    - Environmental impact assessments

    - Basic assessments
    - Mining Rights and Permits
    - Section 102 Applications
- Environmental compliance and auditing
    - Waste License Audits
    - Water Use License Audits
    - Environmental Management Programme (EMPR) Performance Assessments
    - Legal Compliance Audits
    - GN704 Audits
    - AEL Audits
    - Due Diligence Audits for Transaction Advisory Projects
- Monitoring of environmental management aspects in accordance with EMPr (Water Quality, Dust, Noise, Biodiversity)
    - Compilation of Monitoring Plans
    - Implementation Monitoring Plans
    - Interpretation of Monitoring Results
- Waste Management
    - Waste Disposal site selection screenings
    - Waste license applications
    - Waste Classification and Assessments
    - Assessing the storage and removal Hazardous Waste
    - Contaminated Land Assessments
    - Waste Management Plans
- Water-Use License Applications
    - Completion of Application Process
    - Integrated Water Use License Application Reports
    - Integrated Waste and Water Management Plans
    - Section 27 Motivational Reports
    - Rehabilitation Strategy Implementation Plans
- Managing and facilitating public participation
- Sustainability and Sustainable project delivery

May 2015 – July 2020 **Environmental Assurance (Pty) Ltd**

Business Unit Head: Authorisations and Waste

Responsibilities and Duties:

- Project management
- Compilation and submission of tenders and quotations
- Liaising with clients
- Liaising with relevant authorities
- Procurement and management of Sub-consultants
- Ensure Health and Safety Compliance of project teams
- Environmental Management and Authorisations
    - Environmental site screening, investigation and evaluations
    - Environmental legal screenings
    - Conducting Environmental risk assessments
    - Environmental feasibility studies
    - Environmental impact assessments
    - Basic assessments
    - Mining Rights and Permits
    - Air Emission License (AEL) Applications
    - GNR 1147 Closure Cost Assessments
- Environmental compliance and auditing
    - Waste License Audits
    - Water Use License Audits
    - Environmental Management Programme (EMPR)
    - Legal Compliance Audits
    - GN704 Audits
    - AEL Audits

    - Due Diligence Audits
- Compilation, implementation and monitoring of environmental management plans.
- Waste Management
    - Waste Disposal site selection screenings
    - Waste license applications
    - Waste Classification and Assessments
    - Assessing the storage and removal Hazardous Waste
    - Contaminated Land Assessments
- Water-Use License Applications
    - Completion of Application Process
    - Integrated Water Use License Application Reports
    - Integrated Waste and Water Management Plans
    - Section 27 Motivational Reports
    - Rehabilitation Strategy Implementation Plans
- ISO14001 Environmental Management System
- Provide training in Environmental aspects
- Managing and facilitating public participation
- Sustainability and Sustainable project delivery

Jan 2011 – April 2015 **WorleyParsons RSA (Pty) Ltd**

(WorleyParsons acquired 70% of the shareholding of KV3 Engineers on 14 January 2011. As a result of the acquisition KV3 Engineers changed its name to WorleyParsons RSA (Pty) Ltd.)

Environmental Scientist

Responsibilities and Duties:

- Project management
- Financial management
- Business development
- Compilation and submission of tenders and quotations
- Liaising with clients
- Liaising with relevant authorities
- Procurement and management of Sub-consultants
- Ensure Health and Safety Compliance of project teams
- Conducting Environmental risk assessments
- Environmental site screening, investigation and evaluations
- Environmental legal screenings
- Environmental feasibility studies
- Environmental impact assessments
- Basic assessments
- Environmental compliance auditing
- Compilation, implementation and monitoring of environmental management plans.
- Waste Management
- Waste Disposal site selection screenings
- Waste license applications
- Water-Use License Applications
- Mining Right applications
- Managing and facilitating public participation
- Sustainability and Sustainable project delivery

Nov 2009 – Jan 2011 **Kwezi V3 Engineers (Pty) Ltd**

Environmental Scientist

Responsibilities and Duties:

- Project management
- Business development
- Financial Management
- Compilation and submission of tenders and quotations
- Liaising with clients
- Liaising with relevant authorities
- Procurement and management of Sub-consultants
- Conducting Environmental risk assessments
- Environmental site screening, investigation and evaluations
- Environmental legal screening
- Waste Management
- Waste license applications
- Basic assessments
- Mining right applications
- Environmental impact assessments
- Ensure Health and Safety Compliance of project teams
- Managing and facilitating public participation processes
- Environmental auditing and monitoring
- Environmental feasibility studies
- Compilation and implementation of environmental management plans.
- Sustainable Project Delivery

Nov 2004 – Nov 2009 **Retief Environmental Consultants**

Private Environmental Consultant

Responsibilities and Duties:

- Project management
- Financial Management
- Business Development
- Client liaison
- Site screening and investigation
- Mining applications
- Environmental legal screening
- Basic assessments
- Environmental impact assessments
- Public participation
- Environmental auditing and monitoring
- Environmental feasibility studies and the
- Compilation of environmental management plans.
- Tendering and compilation of quotations

7. PROJECT EXPERIENCE

I have conducted numerous projects in the environmental management field for a number of clients. My most notable projects include the following:

CLIENT	PROJECT DESCRIPTION
Tronox Mineral Sands 2018 - 2020	Application for Environmental Authorisation and Water Use License Application for the expansion of the Tronox Namakwa Sands Mine, Brand se Baai, Western Cape
Rhodium Reefs 2016 - 2017	Waste Management License applications for the Spitskop, Kennedy's Vale and Mareesburg Mines, Steelpoort, Limpopo

Eastern Platinum Limited 2015 - 2017	Application for a Water Use License for the Crocodile River, Morulabuldt and Crocette mine sections, Brits, Northwest
Harmony Gold 2016 - 2016	GN704 Audit for the Harmony Kusasalethu and Deelkraal Mines, Randfontein, Gauteng
Ilangabi Coal 2016 - 2018	EIA, Waste License and Water Use License for the proposed Grootfontein Coal Mine, Nigel, Gauteng
Bombela Concession Company (Gautrain) 2015 – 2018	Independent environmental consultant responsible for monthly compliance audits and the annual yearly compliance audits which included: 2015- Gautrain Annual EMP Follow Up Audit 2016- Gautrain Annual EMP Audit 2016- Gautrain Annual EMP Follow-Up Audit 2017- Gautrain Annual EMP Audit 2017- Gautrain Annual Follow-Up Audit
Gelncore Rhovan 2017 - 2017	External EMPr Audit for the Rhovan Mine, Brits, Northwest
ArcelorMittal BOF Slag Disposal Facility 2010 - 2012	EIA and Waste Management License for the closure of the historic ArcelorMittal BOF Slag disposal facility and the identification and licensing of a new BOF slag disposal facility, ArcelorMittal Newcastle Works, Newcastle, KZN
SolarReserve South Africa 2010 - 2015	EIA, Waste License and Water use license for the establishment of a Solar power park consisting of a 100MW concentrated solar power plant and three 75MW photovoltaic solar power developments, Upington, Northern Cape
Naledi Local Municipality 2009 - 2010	EIA and Waste Management License for the closure of the old Naledi Landfill and the identification and licensing of a New Landfill.
Department of Public Works 2013 - 2014	The EIA, Waste Management License and AEL of the new Goedemoed Prison farm landfill and incinerator
Dr Ruthe S Mompati District Municipality 2011 - 2014	Kagisano Landfills: The Identification, EIA and Waste Management License for new general waste disposal facilities for the towns of Piet Plessis,
	Molopo Landfills: The Identification, EIA and Waste Management License for new regional waste disposal facilities for the towns of Tosca, Bray and Pomfret
Mpumalanga Department Economic Development, Environment and Tourism 2009 - 2014	Project entailed the identification of a new regional landfill for the Nkangala District Municipality by means of a site selection process, the Environmental Impact Process.
Department of Water Affairs 2014 - 2015	Environmental inputs for the Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply Systems.

The detailed list of my project experience is included in **Appendix A**

8. LANGUAGE PROFICIENCY

	Speak	Read	Write
Afrikaans	Excellent	Excellent	Excellent
English	Excellent	Excellent	Excellent

9. COMPUTER SKILLS

I am highly competent in the use of IT. I have an advanced working knowledge of the following software:

- Microsoft Office
- Microsoft Projects
- Geographical Information Systems (ARCGIS, QGIS, GRASS, IDRISI)
- TEAMS Sustainability Software

Appendix A

Detailed Project Experience List

PROJECT EXPERIENCE WITH RETIEF ENVIROMENTAL (AUGUST 2020-CURRENT):

PROJECT DETAIL	
Project Name:	**Die Oog Water Use License**
Client	**Elemental Sustainability**
Project Summary:	**The water use license application for die Oog Development**
Involvement:	**October 2021 – Current**
Location:	**Nylstroom, Limpopo, SA**
Project Name:	**Sallies Silica Mine Section 102**
Client	**Salles Silica Mine**
Project Summary:	Basic Assessment and Section 102 Application for the expansion of the mine.
Involvement:	March 2021 – Current
Location:	Brits, Northwest, SA
Project Name:	**Cold Gold Prospecting**
Client	**Elemental Sustainability (Pty) Ltd**
Project Summary:	Application for prospecting for gold on various portions around Magaliesburg
Involvement:	Feb 2021– June 2021
Location:	Magaliesburg, Gauteng, SA
Project Name:	**Jaggersfontein Mine**
Client	**Jagersfontein Developments**
Project Summary:	Interpretation of Water Quality Results for the Jaggersfontein Mine
Involvement:	August 2020 – December 2020
Location:	Jaggersfontein, Free State, SA
Project Name:	**Jaggersfontein Mine**
Client	**Jagersfontein Developments**
Project Summary:	Assistance in compilation of SWMP and total Water Management Strategy for Jaggersfontein Mine
Involvement:	August 2020 – December 2020
Location:	Jaggersfontein, Free State, SA
Project Name:	**Country Gardens Estate**
Client	**MaxxLiving (Pty) Ltd**
Project Summary:	Monthly ECO inspections for the construction of Phase 1A
Involvement:	Nov 2020 – Current
Location:	Kempton Park, Gauteng, SA
Project Name:	**Country Gardens Estate**
Client	**MaxxLiving (Pty) Ltd**
Project Summary:	Water Use License Update to add the abstraction of water form boreholes and the construction of a water crossing.
Involvement:	Nov 2020 – Current
Location:	Kempton Park, Gauteng, SA
Project Name:	**Talama Engineering Standard EMP**
Client	**Talama Construction and Engineering**
Project Summary:	Compilation of generic EMP for construction operations.
Involvement:	March 2021– March 2021
Location:	Postmasburg, Northern Cape, SA
Project Name:	**2 Seam Water Use License**
Client	**Elemental Sustainability**
Project Summary:	The water use license application and river diversion for the expansion of the existing coal mine
Involvement:	August 2020 – November 2020
Location:	Middelburg, Mpumalanga, SA
Project Name:	**Lohatlha Mine WUL Audit**
Client	**Northern Cape Mining**
Project Summary:	Water use License Audit for the Lohatlha Mine
Involvement:	August 2020 - Current
Location:	Postmansburg, Northern Cape, SA
Project Name:	**Lohatlha Mine IWWMP Update**
Client	**Northern Cape Mining**
Project Summary:	Update of the IWWMP for the Lohatlha Mine
Involvement:	August 2020 - Current

Location:	Postmansburg, Northern Cape, SA
Project Name:	**Lohatlha Mine RSIP Update**
Client	**Northern Cape Mining**
Project Summary:	RSIP update for the Lohatlha Mine
Involvement:	August 2020 - Current
Location:	Postmansburg, Northern Cape, SA
Project Name:	**Lohatlha Mine Water Conservation and Demand Management Plan**
Client	**Northern Cape Mining**
Project Summary:	Compilation of a WC/WD Management Plan for the Lohatlha Mine
Involvement:	August 2020 - Current
Location:	Postmansburg, Northern Cape, SA

PROJECT EXPERIENCE WITH ENVIRONMENTAL ASSURANCE (PTY) LTD (MAY 2015-JULY 2020):

PROJECT DETAIL	
Project Name:	**Tronox Mining Footprint Expansion**
Client	**Tronox Namakwa Sands**
Project Summary:	EIA for the expansion of the mining footprint.
Involvement:	2018 - 2020
Location:	Brand Se Baai, Western Cape, SA
Project Name:	**Brikor Plant 1 WULA**
Client	**Brikor Limited**
Project Summary:	Water Use License for Brikor Plant 1
Involvement:	2018 - 2020
Location:	Nigel, Gauteng, SA
Project Name:	**Brikor Plant 3 WULA**
Client	**Brikor Limited**
Project Summary:	Water Use License for Brikor Plant 3
Involvement:	2018 - 2020
Location:	Nigel, Gauteng, SA
Project Name:	**Dwarsrivier Mine Authorisation Amendment**
Client	**Dwarsrivier Chrome Mine**
Project Summary:	Amendment of 5 authorisations to change company name.
Involvement:	2018 - 2019
Location:	Steelpoort, Limpopo, SA
Project Name:	**Mareesburg Haul Road**
Client	**Lions Head Platinum**
Project Summary:	Water Use License and Basic Assessment for the proposed Haul Road
Involvement:	2018 - 2019
Location:	Nigel, Gauteng, SA
Project Name:	**WCM Sewage Sludge Classification**
Client	**Samancor Western Chrome Mines**
Project Summary:	Classification of sewage sludge of the WWTW of the mines
Involvement:	2018 - 2018
Location:	Mooinooi, Northwest Province, SA
Project Name:	**Tubatse Chrome BA**
Client	**Tubatse Chrome**
Project Summary:	BA for expansion of dangerous good storage facility
Involvement:	2017 - 2018
Location:	Steelpoort, Limpopo Province, SA
Project Name:	**Bokone Gas Site Risk Assessment**
Client	**Bokone Gas (Pty) Ltd**
Project Summary:	Environmental Risk Assessment of proposed development site
Involvement:	2017 - 2017
Location:	Pretoria, Gauteng Province, SA
Project Name:	**Swartkops Sea Salt EMPr Update**
Client	**Swartkops Sea Salt (Pty) Ltd**
Project Summary:	Update of the existing EMPr
Involvement:	2017 - 2018
Location:	Port Elizabeth, Eastern Cape Province, SA

Project Name:	**SABRIX Prospecting**
Client	**SABRIX**
Project Summary:	Application for a Prospecting Right to mine sand and clay.
Involvement:	2017 - 2018
Location:	Pretoria, Gauteng Province, SA
Project Name:	**Grootfontein Coal Mine**
Client	**Ilangabi Coal**
Project Summary:	Application for a Mining Right to mine sand coal and clay.
Involvement:	2016 - 2018
Location:	Nigel, Gauteng Province, SA
Project Name:	**Glencore Rhovan Mine EMPr Audit**
Client	**Glencore Rhovan**
Project Summary:	External EMPr Audit for the Rhovan Mine
Involvement:	2017 - 2017
Location:	Brits, Northwest Province, SA
Project Name:	**Afrisam Springvalley EMPr Audit**
Client	**Afrisam**
Project Summary:	Externa EMPr Springvalley Mine Audit
Involvement:	2017 - 2017
Location:	Lichtenburg, Northwest Province, SA
Project Name:	**Afrisam Dudfield WULA Audit**
Client	**Afrisam**
Project Summary:	External Water Use License Audit for the Dudfield Factory
Involvement:	2017 - 2017
Location:	Lichtenburg, Northwest Province, SA
Project Name:	**Sedgman Recycler Vendor Evaluation Sheet**
Client	**Sedgman SA**
Project Summary:	Compilation of evaluation process to evaluate recycling vendors for appointments at Head office and construction sites.
Involvement:	2017 - 2017
Location:	Centurion, Gauteng Province, SA
Project Name:	**Marprozep Manufacturing Plant**
Client	**Marprozp (Pty) Ltd**
Project Summary:	Environmental risk assessment for underground diesel storage tanks
Involvement:	2017 – 2017
Location:	Edenvale, Gauteng Province, SA
Project Name:	**Lomoteng Specialist Studies**
Client	**Lomoteng Mine**
Project Summary:	Rehabilitation Strategy and Implementation Plan (RSIP) and Update of Integrated Waste and Water Management Plan (IWWMP).
Involvement:	2017- 2018
Location:	Postmasburg, Northern Cape Province, SA
Project Name:	**Evraz Vametco**
Client	**Evraz**
Project Summary:	EMPr Performance Assessment for Evraz Vametco Mine
Involvement:	2017- 2017
Location:	Brits, Northwest Province, SA
Project Name:	**Black Chrome Mine**
Client	**Sail Minerals (Pty) Ltd**
Project Summary:	EMPr Performance Assessment for Black Chrome Mine
Involvement:	2017- 2017
Location:	Burgersfort, Limpopo Province, SA
Project Name:	**Eastplats Crocodile River Mine Tailings Storage Facility GN704 Audit**
Client:	**Barplats Limited**
Project Summary:	GN704 Audit if the Crocodile River Mine Tailings Storage Facility
Involvement:	2016- 2016
Location:	Brits, Northwest Province, SA
Project Name:	**Harmony Kusasalethu and Deelkraal Mines GN704 Audit**
Client:	**Harmony Gold**
Project Summary:	GN704 Audit of the Kusasalethu and Deelkraal Mines
Involvement:	2016- 2016

Location:	Carletonville, Gauteng, Republic of SA
Project Name:	**Mogalakwena Oxidation Ponds**
Client:	**Aurecon**
Project Summary:	Waste Classification and Closure Plan for the closure of the Masodi and Sekgakgapeng Oxidation Ponds
Involvement:	2016- 2017
Location:	Mokopane, Limpopo, Republic of SA
Project Name:	**Amandelbult Mine Complex EMPR and ROD Audit**
Client:	**Anglo Platinum**
Project Summary:	EMPR Performance assessment and ROD compliance audit of the Amandelbult mining complex
Involvement:	2016- 2016
Location:	Northam, Limpopo, SA
Project Name:	**Union Mine EMPR Performance Assessment**
Client:	**Anglo Platinum**
Project Summary:	EMPR Performance assessment Union Mine Complex
Involvement:	2016- 2016
Location:	Northam, Limpopo, SA
Project Name:	**Gautrain Independent Environmental Consultant**
Client:	**Bombela Concession Company**
Project Summary:	Independent Environmental Consultant for the Gautrain Rapid Rail System
Role and Responsibilities:	Independent environmental consultant responsible monthly compliance audits and the annual yearly compliance audits. Projects include : 2015- Gautrain Annual EMP Follow Up Audit 2016- Gautrain Annual EMP Audit 2016- Gautrain Annual EMP Follow-Up Audit 2017- Gautrain Annual EMP Audit 2017- Gautrain Annual Follow-Up Audit
Involvement:	2015- 2019
Location:	Johannesburg/Pretoria, SA
Project Name:	**Hudson Rubber Contaminated Land Assessment**
Client:	**Hudson Rubber**
Project Summary:	Contaminated Land Assessment of Hudson Rubber Plant
Role and Responsibilities:	Contaminated Land Assessment and Overall Project Management
Involvement:	2016- 2016
Location:	Pretoria, Gauteng, SA
Project Name:	**Paling Mine Waste Assessment**
Client:	**PMG (Pty) Ltd**
Project Summary:	Waste Assessment for the proposed Paling Mine Waste Rock Dumps.
Role and Responsibilities:	Responsible for the Waste Assessment of waste rock samples
Involvement:	2016- 2016
Location:	Postmansburg, Northern Cape, SA
Project Name:	**Paling Mine WULA**
Client	**PMG (Pty) Ltd**
Project Summary:	Water use license application for the proposed Paling Mine.
Role and Responsibilities:	Responsible for the water use license application and overall project management.
Involvement:	2015- 2017
Location:	Postmansburg, Northern Cape, SA
Project Name:	**Rhodium Reefs Waste Management License**
Client:	**Rhodium Reefs**
Project Summary:	Waste License application for the Mareesburg, Kennedy's Vale and Spitskop Mines
Role and Responsibilities:	Responsible for the waste license application process and overall project management.
Involvement:	2016- 2017
Location:	Steelpoort, Limpopo Province, SA
Project Name:	**Eastplats Waste Classification**
Client:	**Eastern Platinum Limited**

Project Summary:	Waste Classification of all waste facilities for the Zandfontein, Crocette and Maroelabuilt mine sections.
Role and Responsibilities:	Responsible for the waste classification and overall project management.
Involvement:	2015- 2015
Location:	Brits, Northwest Province, SA
Project Name:	**Milsell Tailings Facility**
Client:	**SAMANCOR Chrome Limited**
Project Summary:	EIA, waste license and water-use license for the expansion of the Millsell Tailings facility.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2017
Location :	Marikana, Northwest Province , SA
Project Name:	**De Beers Voorspoed Diamond Mine**
Client:	**De Beers**
Project Summary:	Internal ISO14001 Audit for the Voorspoed Diamond Mine.
Role and Responsibilities:	Co-Auditor for internal ISO14001 compliance audit.
Involvement:	2015-2015
Location:	Kroonstad, Free State Province, SA
Project Name:	**Mamatwan EIA**
Client:	**ENRC Africa**
Project Summary:	Environmental Impact Assessment for a new manganese mine section.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2018
Location:	Near Hotazel, Gauteng, SA
Project Name:	**Elansdrif WULA**
Client:	**SAMANCOR Chrome Limited**
Project Summary:	Integrated water-use license for a new opencast mine section.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2020
Location:	Marikana, Northwest Province, SA
Project Name:	**Kongoni WULA**
Client:	**ENRC Africa**
Project Summary:	Integrated water-use license application for new proposed manganese mine.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2017
Location:	Near Hotazel, Northern Cape Province, SA
Project Name:	**Lynca Meats EIA**
Client:	**Lynca Meats**
Project Summary:	Environmental Impact Assessment for the expansion of abattoir facility.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2016
Location:	Meyerton, Gauteng, SA
Project Name:	**Blinkpan Compliance Audits**
Client:	**Makoya Group**
Project Summary:	Quarterly legal and compliance audits for Highveld and Blinkpan coal sidings.
Role and Responsibilities:	Responsible for the quarterly environmental compliance audits.
Involvement:	2015- 2018
Location:	Near Hendrina, Mpumalanga, SA
Project Name:	**Blinkpan Siding**
Client	**Makoya Group**
Project Summary:	Basic Assessment and water-use licence for Coal Siding.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2016
Location:	Near Hendrina, Mpumalanga , SA
Project Name:	**Argent Siding**
Client	**Canyon Resources**
Project Summary:	Basic Assessment and water-use license for a new proposed Coal Siding.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2016
Location:	Delmas, Mpumalanga, SA

Project Name:	**Eastplats WULA**
Client:	**Eastern Platinum Limited**
Project Summary:	Integrated water-use licensing for the Zandfontein, Crocette and Maroelabuilt mine sections.
Role and Responsibilities:	Responsible for the overall project management.
Involvement:	2015- 2017
Location:	Brits, Northwest Province, SA

PROJECT EXPERIENCE WITH WORLEYPARSONS RSA (KV3) (2009- 2015)

PROJECT	
Project Name:	**Uitvalfontein Landfill Audit**
Client:	**Randfontein Local Municipality**
Project Summary:	Compliance Audit of the Uitvalfontein landfill.
Role and Responsibilities:	Assisted on the compliance audit.
Involvement:	2014- 2014
Location:	Randfontein, Gauteng, SA
Project Name:	**Luvuvu Letaba Water Scheme**
Client	**Department of Water Affairs**
Project Summary:	Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply Systems.
Role and Responsibilities:	Responsible for Environmental feasibility studies.
Involvement:	2014- 2015
Location:	Limpopo, SA
Project Name:	**Assmang Chrome Machadodorp ECO**
Client:	**Assmang Chrome**
Project Summary:	ECO Audits for the Relocation of the Baghouse Dust Disposal Facility to the Existing Licensed slag disposal facility.
Role and Responsibilities:	Responsible for the monthly environmental compliance audits for the construction.
Involvement:	2014- 2015
Location:	Machadodorp, Mpumalanga, SA
Project Name:	**Syferbult WULA**
Client:	**Rustenburg Local Municipality**
Project Summary:	Water-use License Application (WULA) for the construction of water supply network.
Role and Responsibilities:	Responsible for the WULA application of the project.
Involvement:	2014 - 2015
Location:	Rustenburg, Northewest, SA
Project Name:	**Zeekoegat Waste Water Treatment Construction Audit**
Client:	**Bigen Africa**
Project Summary:	Construction compliance audits for the Zeekoeigat phase 2 WWTW construction.
Role and Responsibilities:	Responsible for the monthly environmental compliance audits for the construction phase.
Involvement:	2013 - 2015
Location:	Pretoria, Gauteng, SA
Project Name:	**Basic Assessment Apex Benoni**
Client:	**Halewood International South Africa (Pty) Ltd**
Project Summary:	Basic Assessment for the rezoning and establishment of additional parking.
Role and Responsibilities:	Responsible for the Basic Assessment application of the project.
Involvement:	2014 - 2014
Location:	Benoni, Gauteng, SA
Project Name:	**Water-use License SA Bank Note Company**
Client:	**SA Bank Note**
Project Summary:	Water-use License Application for new stormwater culvert.
Role and Responsibilities:	Responsible for the water-use application of the project.
Involvement:	2014 - 2015
Location:	Pretoria, Gauteng, SA
Project Name:	**Basic Assessment Transnet Tug Jetty**
Client:	**Transnet**

Project Summary:	Basic Assessment for the establishment of new Tug Jetty at Durban Harbour.
Role and Responsibilities:	Responsible for the Basic Assessment application of the project.
Involvement:	2013 - 2015
Location :	Durban, KZN, SA
Project Name:	**Jupiter B Substation WULA**
Client:	**Eskom**
Project Summary:	Water-use License Application (WULA) for the construction of the Jupiter B Substation.
Role and Responsibilities:	Responsible for the WULA application of the project.
Involvement:	2013 - 2014
Location:	Johannesburg, Gauteng, SA
Project Name:	**Environmental Management Plan (EMP) Update for Jupiter B Substation**
Client:	**Eskom**
Project Summary:	Update of the EMP for the construction of the Jupiter B Substation.
Role and Responsibilities:	Responsible for the update and approval of the EMP for the project.
Involvement:	2013 - 2014
Location:	Johannesburg, Gauteng, SA
Project Name:	**Taung Road Upgrade**
Client:	**Northwest Department Public Works, Roads and Transport**
Project Summary:	Application for environmental authorisation for the Upgrade of the Road D221 from Road P25/1 Via Maphoitsile to end of Tar Magogong.
Role and Responsibilities:	Compilation of detailed environmental management plan for the authorisation of the project.
Involvement:	2013 - 2014
Location:	Taung, Northwest, SA
Project Name:	**Goeboegoeboe Salt Mine**
Client:	**Geoboegoeboe Salt Works**
Project Summary:	Mining Right application for salt mining.
Role and Responsibilities:	Responsible for the mining right application of the project.
Involvement:	2013- 2015
Location :	Upington, Northern Cape, SA
Project Name:	**Assmang Chrome Machadodorp**
Client	**Assmang Chrome**
Project Summary:	Compilation of EMP for the rehabilitation works on the hazardous H:H waste facility.
Role and Responsibilities:	Responsible for the compilation of the EMP and audit documentation.
Involvement:	2013- 2013
Location:	Machadodorp, Mpumalanga, SA
Project Name:	**ArcelorMittal Newcastle Works – GSB Rehab EMP**
Client:	**ArcelorMittal SA**
Project Summary:	Compilation of EMP for the rehabilitation works on the GSB waste facility.
Role and Responsibilities:	Responsible for the compilation of an EMP and Audit documentation.
Involvement:	2012- 2012
Location:	Newcastle, KZN, SA
Project Name:	**DR George Mukhari Hospital**
Client:	**Driver Group**
Project Summary:	Private Public Partnership project for the establishment of the new Dr George Mukhari Hospital.
Role and Responsibilities:	Responsible for the environmental screening and fatal flaw analysis.
Involvement:	2011- 2012
Location:	Ga-Rankuwa, Gauteng, SA
Project Name:	**Molopo Landfills**
Client:	**Dr Ruth Segomotso Mompati District Municipality**
Project Summary:	The Identification and licencing of new regional waste disposal facility for the towns of Tosca, Bray and Pomfret.
Role and Responsibilities:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement:	2011- 2014
Location:	Tosca, Northwest, SA

Project Name:	**Kagisano Landfills**
Client:	**Dr Ruth Segomotso Mompati District Municipality**
Project Summary:	The Identification and licencing of new general waste disposal facilities for the towns of Piet Plessis, Ganyesa, Thlakgameng and Morokweng.
Role and Responsibilities:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement:	2011- 2014
Location :	Ganyesa, Thlakgameng, Morokweng and Piet Plessis, Northwest, SA
Project Name:	**Lephalale Landfills**
Client:	**Lephalale Local Municipality**
Project Summary:	The Identification and licencing of a new general waste disposal facility for the Lephalale Local Municipality.
Role and Responsibilities:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement:	2011- 2014
Location:	Lephalale, Limpopo, SA
Project Name:	**Rooipunt Solar Power Project**
Client:	**SolarReserve South Africa**
Project Summary:	Establishment of a Solar power park consisting of a 100MW concentrated solar power plant and three 75MW photovoltaic solar power developments.
Role and Responsibilities:	Responsible for the Environmental impact assessment, Water-use Licensing and Waste Licensing process of the project.
Involvement:	2010- 2015
Location:	Upington, Northern Cape, SA
Project Name:	**ArcelorMittal Newcastle Works – Basic Oxygen Furnace (BOF) Slag Dump Design and EIA**
Client:	**ArcelorMittal SA**
Project Summary:	The closure of the existing hazardous BOF slag disposal facility and establishment of a new hazardous BOF slag disposal facility.
Role and Responsibilities:	Responsible for the environmental impact assessment and waste licensing process for the project.
Involvement:	2010- 2012
Location:	Newcastle, KZN, SA
Project Name:	**Environmental Assessment Sebenza Substation**
Client:	**Johannesburg City Power**
Project Summary:	The establishment of a 1,000 MVA substation.
Role and Responsibilities:	Responsible for the Basic assessment process.
Involvement:	2009- 2012
Location:	Johannesburg, Gauteng, SA
Project Name:	**Goedemoed Prison Farm Landfill and Incinerator**
Client	**Department of Public Works**
Project Summary:	Identify, design, environmental impact assessment for closure of existing landfill and establishment of new landfill and Incinerator.
Role and Responsibilities:	Responsible for the environmental impact assessment, waste licensing and Air Emission licensing process.
Involvement:	2009- 2011
Location:	Aliwal North, Free State, SA
Project Name:	**Nkangala Regional Landfill**
Client	**Mpumalanga Department Economic Development, Environment and Tourism**
Project Summary:	Project entails the identification of a new landfill by means of a site selection process, the Environmental Impact Process and the design of the landfill including the design of a transfer station.
Role and Responsibilities:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement:	2009- 2014
Location:	Middelburg, Mpumalanga, SA
Project Name:	**Naledi Landfills**
Client:	**Naledi Local Municipality**
Project Summary:	Identify, design and licensing of new municipal landfill site.
Role and Responsibilities:	Responsible for the environmental impact assessment process for the new site and a basic assessment process for the closure of the old site.

Involvement:	2009- 2010
Location:	Vryburg, Northwest , SA

PROJECT EXPERIENCE WITH RETIEF ENVIRONMENTAL CONSULTANTS (NOVEMBER 2004- NOVEMBER 2009):

PROJECT	
Project Name:	**Sodwana Bay Boat Lockers EMP**
Client:	**Sodwana Bay Boat Lockers**
Project Summary:	The establishment of a boat locker facility to store 30 boats.
Role and Responsibilities:	Project Leader and responsible for the compilation of an environmental management plan for the boat locker facility.
Involvement:	2009- 2009
Location:	Durban, KZN, SA
Project Name:	**Steenkamp Broiler Farms**
Client:	**Steenkamp Farms**
Project Summary:	The establishment of a broiler farming operation consi sting of six broiler houses and associated infrastructure.
Role and Responsibilities:	Project Leader, and responsible for public participation, data gathering and the compilation of the basic assessment for the establishment of the broiler farm.
Involvement:	2008- 2009
Location:	Brits, Northwest, SA
Project Name :	**Dos Ramos Broiler Farm**
Client:	**Dos Ramos Farms**
Project Summary:	The establishment of a broiler farming operation consisting of four broiler houses.
Role and Responsibilities:	Project Leader and responsible for public participation, completion of basic assessment and application for water-use license.
Involvement:	2005- 2006
Location:	Brits, Northwest, SA
Project Name:	**Glowing Autumn Sand Quarries**
Client	**GCL Construction Sand**
Project Summary:	Mining permits application for the establishment of a sand quarry.
Role and Responsibilities:	Project Leader, public participation, compilation of an environmental management plan for the establishment of the mining operation.
Involvement:	2006- 2007
Location:	Rustenburg, Northwest , SA
Project Name :	**Grand Palace Granite Mine**
Client:	**Grand Palace Trading (Pty) Ltd**
Project Summary:	The establishment of a granite mining operation.
Role and Responsibilities:	Responsible for the amendment and completions of the environmental impact assessment and the establishment of a social and labour plan for the mining operation.
Involvement:	2004- 2005
Location:	Brits, North West Province, SA

Appendix 3 : Locality Map

SALLIES SILICA

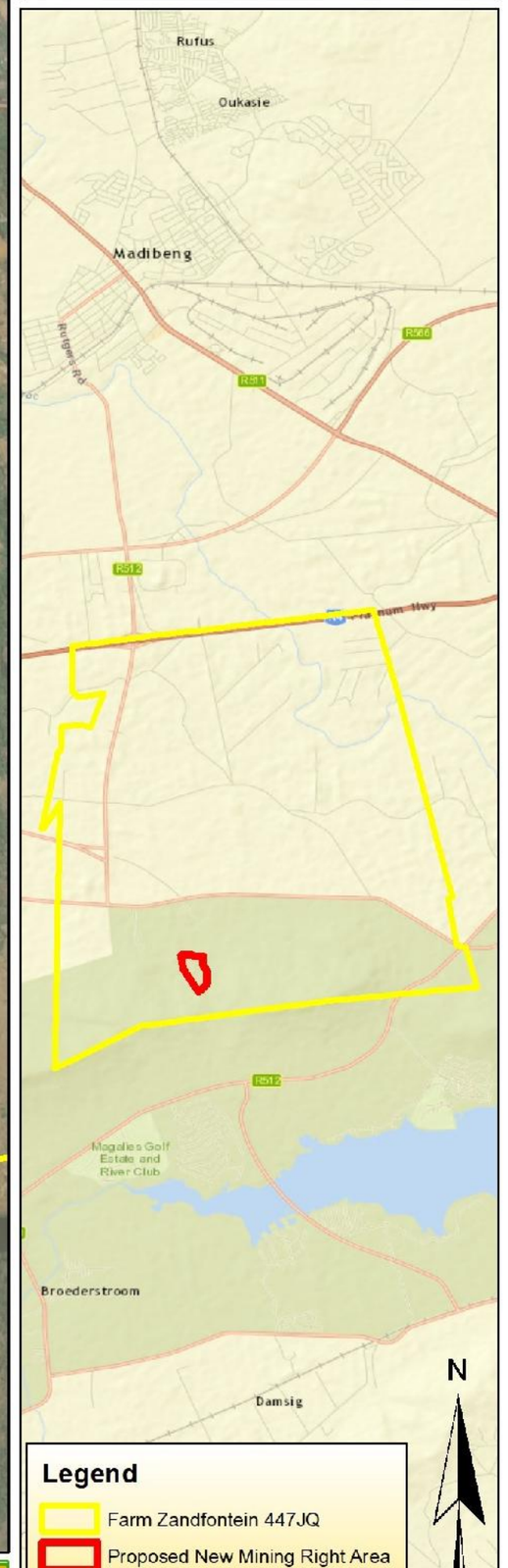
Portion 258

Portion 129

Portion 95

Zandfontein 447 JQ

Section 102 Area



Legend

Farm Zandfontein 447JQ

Proposed New Mining Right Area

Farm Portions

0 190 380 760 1 140 1 520 1 900 2 280

Author: J.P. Nortje, Briel & Associates

Appendix 4 : Copy of Existing Mining Right

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Directorate: Mineral Regulation: North West Region,
Private Bag A1, Klerksdorp, 2570 Cnr Margaretha Prinsloo & Voortrekker Streets
Vaal University of Technology Building, Klerksdorp, 2571
Enquiries: Gladys Mushome **Tel:** (018) 487 4300 **Fax:** (018) 487 4350
E-Mail: Ntanganedzeni.Mushome@dmr.gov.za **Ref:** **NW 30/5/1/2/3/2/1/441 EM**

The Manager
Witkop Fluorspar Mine (Pty) Ltd
P.O. Box 1315
Zeerust
2865

Dear Sir/Madam

AMENDMENT LODGED IN TERMS OF REGULATION 29 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (NEMA): ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS (EIA REGULATIONS), 2014 AS AMENDED TO TRANSFER THE MINING RIGHT FROM ROLFES SILICA (PTY) LTD TO WITKOP FLUORSPAR MINE (PTY) LTD IN RESPECT OF THE REMAINING EXTENT OF PORTION 95 (A PORTION OF PORTION 5) OF THE FARM ZANDFONTEIN 447 JQ, SITUATED IN THE MAGISTERIAL DISTRICT OF BRITS: NORTH WEST REGION.

1. Your application for the amendment of an Environmental Authorisation (EA) lodged in this office on the 04 December 2018 in terms of Regulation 29 of the NEMA: EIA Regulations, 2014 as amended refers.

2. The Department considered your application and hereby amend the Environmental Authorisation (EA) issued to Witkop Fluorspar Mine (Pty) Ltd with the following changes:

2.1 Brief description of the activity:

To transfer the existing Environmental Authorization (EA) from Rolfes Silica (Pty) Ltd (~~RMDC~~) to Witkop Fluorspar (Pty) Ltd.

2.2 Brief description of the amendment to read as follow:

The Environmental Authorisation (EA) to read as Witkop Fluorspar Mine (Pty) Ltd.

3. This Environmental Authorisation (EA) amendment will serve as addendum to the approved Environmental Management Programme on behalf of **Rolfes Silica (Pty) Ltd**, all other conditions specified and stipulated in the issued Environmental Authorisation (EA) must be complied with and all the legislation administering environmental issues.

4. The amendment does not change the scope of the valid Environmental Authorisation (EA).

Should you wish to appeal any aspect of the decision, you must submit the appeal to the Minister of Environmental Affairs and a copy of such appeal to the Department of Mineral Resources (North West Regional Office), within 20 days from the date of notification, and such appeal must be lodged as prescribed in by Chapter 2 of the National Appeal Regulations of 2014 as amended.

Should you need further information and/or clarity, please do not hesitate to contact this Department.

Yours Faithfully

.....

CHIEF DIRECTOR
MINERAL REGULATION
WESTERN REGIONS
DATE: 22/02/2019

NOTARIAL CESSION OF A MINING RIGHT

NW 30|5|1|2|2|441MR

ROLFES SILICA (PTY) LTD

1977|002739|07

AND

WITKOP FLUORSPAR MINE (PTY) LTD

1972|006392|07

CEDED IN FAVOUR OF WITKOP FLUORSPAR MINE (PTY) LTD

ON 19 MARCH 2019

UNDER MPT NO 11|2019

NOTARIAL CESSION OF A MINING RIGHT

CERTIFICATE

I, the undersigned,

NADINE SUSAN LOMBARD

a Notary, practising at Pretoria, in the Province of Gauteng, Republic of South Africa, duly admitted and sworn, do hereby certify and attest unto all whom it may concern that the

NOTARIAL CESSION OF A MINING RIGHT PROTOCOL NO 237

Attached hereto is a true and correct copy of the original document examined by me.

SIGNED AT PRETORIA ON 23 January 2019

NOTARY

REGISTERED IN THE MINERAL & PETROLEUM TITLES REGISTRATION OFFICE: PRETORIA

In the register of Cessions

On the 19th day of MARCH 20 19

Under MPT No.: 11/2019

pp DIRECTOR-GENERAL: MINERAL RESOURCES

PROTOCOL NO: 237

NOTARIAL CESSION OF MINING RIGHT

BE IT HEREBY MADE KNOWN:

THAT on this the 23rd day of January in the year Two Thousand and ~~Eighteen~~ Nineteen before me,

NADINE SUSAN LOMBARD,

Notary Public, duly admitted and sworn, residing and practising at Pretoria in the Province of Gauteng, Republic of South Africa, and in the presence of the undersigned witnesses personally came and appeared

CHRISTIE BRIEL

an attorney of attorneys Christie Briel of Pretoria and as such in her capacity as the duly authorised Attorney and agent of:

ROLFES SILICA (PTY) LTD

(REGISTRATION NUMBER: 1977/002739/07)

(hereinafter together with its successors in title and assigns referred to as "the Cedent")

She, the said Appearer being duly authorised hereto under and by virtue of a Power of Attorney signed at Pretoria on this **21ST day of DECEMBER 2018** and granted to her by **RICHARD BUTTLE** in his capacity as a Director of the Cedent, he being duly authorised thereto under and by virtue of a Resolution of the Directors of the Cedent passed at PRETORIA on 21 DECEMBER 2018.

AND

WITKOP FLUORSPAR MINE (PTY) LTD

REGISTRATION NUMBER: 1972/006392/07)

(hereinafter together with its successors in title and assigns referred to as "the Cessionary")

She, the said Appearer being duly authorised hereto under and by virtue of a Power of Attorney signed at Pretoria on this **21ST day of DECEMBER 2018** and granted to her by **JOHAN HEŸL** in his capacity as a Director of the Cessionary, he being duly authorised thereto under and by virtue of a Resolution of the Directors of the Cessionary passed at PRETORIA on 21 DECEMBER 2018.

which Power of Attorney and certified copies of the Resolutions have today been exhibited to me the Notary and reside in my Protocol with the minute hereof.

AND THE APPEARER DECLARED THAT:

NOW THEREFORE THESE PRESENTS WITNESS:

1. The Cedent hereby, with effect from the date of execution hereof, cedes and assigns all of its rights and obligations under the Mining Right to the Cessionary.

2. The Cessionary hereby accepts the cession and assignment referred to in clause 1 above

3. it is recorded that the causa for this cession is the Agreement referred to in preamble B above, it is being recorded that the consideration is an amount of R7 500 000,00 (SEVEN MILLION FIVE HUNDRED THOUSAND RAND), which price included the Business of the Cedent, and which was sold as a going concern and thus zero-rated for purposes of value-added tax.

4. The costs and incidental to this cession shall be borne and paid by the Cessionary.

THUS DONE AND EXECUTED AT PRETORIA ON the day and in the month and year hereinbefore written in the presence of the undersigned witnesses.

AS WITNESSES:

1. _____

2. _____

(1) _____ q.q

(2) _____ q.q

QUOD ATTESTOR

_____

NOTARY PUBLIC

DMR 40

DEPARTMENT: MINERAL RESOURCES

REPUBLIC OF SOUTH AFRICA

CONVERTED MINING RIGHT

Converted in terms of Item 7 of Schedule II of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)

TABLE OF CONTENTS

MARIZA SLABBERT NOTARY PUBLIC GAUTENG

Ceded in favour of. Witkop Emerspan Mine (PTY) Ltd
Registration No: 1972/006392/07
MPT No: 11/2019
pp Director General: Mineral Resources
Date: 19/03/2019

3

REGISTERED IN THE MINERAL & PETROLEUM TITLES
IN THE REGISTER OF Mining Right
ON THE 01 DAY OF FEBRUARY 2013
UNDER MPT NO: 11/2013
PP DIRECTOR - GENERAL: MINERAL RESOURCES

Protocol No: 59 /2012
File Ref No NW30/5/1/2/2/441MR
Application No J2009/03/18/001

LET IT HEREBY BE MADE KNOWN:

THAT on this **09th** day of **October** in the year **2012**, before me, **Mariza Slabbert** a Notary Public, duly sworn and admitted, residing and practising at **Pretoria**, in the **Gauteng** Province of South Africa, and in the presence of the subscribing competent witnesses, personally came and appeared:

Pieter Frederik Swart, Regional Manager, **North West** Region of the Department of Mineral Resources, and as such in his / her capacity as the duly authorised representative of:

THE MINISTER OF MINERAL RESOURCES

The said Regional Manager, being duly authorised thereto under and by virtue of a Power of Attorney granted by the **DEPUTY DIRECTOR-GENERAL: MINERAL REGULATION** of the Department of Mineral Resources on the **02nd** day of **August** in the year **2012** in terms of the powers delegated by the Minister on the 12th day of May 2004 in terms of section 103 (1) of the Act.

MARIZA SLABBERT NOTARY PUBLIC GAUTENG

AND

Cornel Scheepers in his capacity as the duly authorised representative of Rolfes Silica (Proprietary) Limited ,Registration number:

1	9	7	7	/	0	0	2	7	3	9	/	0	7	

(Hereinafter together with his/her/its successors in title and assigns referred to as "the Holder", he, the said representative, being duly authorised thereto under and by virtue of a resolution of directors of the Holder, signed or passed at Boksburg on the 23rd day of August in the year 2012 which a certified copy of a resolution has this day been exhibited to me, the notary, and remain filed of record in my protocol with the minutes hereof.)

AND THE MINISTER AND HOLDER DECLARED THAT:

WHEREAS The State is the custodian of the Nation's mineral and petroleum resources in terms of section 3 of the Act.

AND WHEREAS The Holder has applied for conversion of an old order mining right in terms of Item 7 of Schedule 2 to the Act,

AND WHEREAS The **DEPUTY DIRECTOR-GENERAL: MINERAL REGULATION** of the Department of Mineral Resources has by virtue of powers delegated to him, converted the Holder's old order, mining right in terms of Item 7 of the Schedule to the Act.

NOW THEREFORE THE MINISTER CONVERTS THE HOLDER'S OLD ORDER MINING RIGHT SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS:

MARIZA SLABBERT NOTARIAL PUBLIC GAUTENG

Definitions

In this mining right, the following words and expressions shall have the following meanings:

`***Act'*** means the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) and includes the Regulations, guidelines, circulars, directives and orders made in terms of that Act;

'Environmental Management Programme' is as defined in the Act and includes any other Environmental Management Programme approved in terms of the previous mining legislation;

`***Financial year'*** means a complete financial year of the Holder which, at the time of the granting of this mining right, commences on **09th** day of **October** in the year **2012**; and ends on **28th** day of **February** in the year **2013**;

`***Holder'*** is as defined in the Act, and specifically in relation to this right, it means **Rolfes Silica (Proprietary) Limited**, Registration No/Identification No **197700273907**;

`***Mineral'*** is as defined in the Act, and specifically in relation to this right means **Silica, sand and stone**;

`***Mining Area'*** is as defined in the Act and includes any additional area of environmental liability as may be reflected on the Environmental Management Programme relating to this right;

'Mining right' is as defined in the Act and includes all the Annexures to it, agreements and inclusions by reference;

'Mining Work Programme' is as defined in the Act and as reflected in the attached **Annexure B** to this mining right;

'Minister' means the Minister of Mineral Resources and includes the successors in title, the assignee or any person duly authorised to act in the Minister's place and stead;

'Old order mining right' is as defined in the Schedule to the Act.

`**Regional *Manager'*** is as defined in the Act and specifically in relation to this right means the Regional Manager for the **North West** Region of the Department of Mineral Resources;

***'Social and Labour Plan'*,** is as contemplated in regulation 46 of the Regulations to the Act and is as reflected in the attached **Annexure C** to this mining right; and

MARIZA SNABBERT NOTARIS PUBLIC GAUTENG

1. Description of the Mining Area

The Mining Area shall comprise the following:

Certain: **Remaining extent of portion 95 (a portion of portion 5) of the farm Zandfontein 447 JQ**

Situated: **North West** Magisterial/Administrative District of **Brits**

Measuring: **39,8416** hectares in extent.

(In the case of various farms being involved, a list can be attached and referred to as **Annexure**);

Which Mining Area is described in detail on the attached Diagram/plan marked **AnnexureA**.

2. Conversion of Old Order Mining Right

Without detracting from the provisions of Item 7 of the schedule to the Act, sections 5 and 25 of the Act, the Minister converts the holder's old order right and grants to the Holder the sole and exclusive right to mine, and recover the mineral/s in, on and under the mining area for the Holder's own benefit and account, and to deal with, remove and sell or otherwise dispose of the mineral/s, subject to the terms and conditions of this mining right, the provisions of the Act and any other relevant law in force for the duration of this right.

3. Commencement, Duration and Renewal

3.1. This mining right shall commence on **09th October 2012** and, unless cancelled or suspended in terms of clause 13 of this right and or section 47 of the Act, will continue to be in force for a period of **twenty (20)** years ending on **08th October 2032**.

3.2. The Holder must continue to conduct mining operations failing which this right may be cancelled or suspended.

3.3. Any application for renewal must be submitted to the Regional Manger not later than 60 working days prior to the date of expiry of this right.

4. Amendments, Variation and Abandonment

4.1. The terms of this right (including by extension of the area covered by it or by the addition of minerals or a share or shares or seams, mineralized bodies, or strata, which are not at the time the subject thereof) may not be amended or varied without the written consent of the Minister.

4.2. The Holder shall be entitled to abandon or relinquish the right or the area covered by the right entirely or in part. Upon abandonment or relinquishment of the mining area or any portion thereof, the Holder must:

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4.2.1. Furnish the Regional Manager with all prospecting and /or mining results and/or information, as well as the general evaluation of the geological, geophysical and borehole data in respect of such abandoned area in so far as it applies to the mineral or any other mineral/s obtained in respect of this right and,

4.2.2. Apply for a closure certificate in terms of section 43 (3) of the Act.

4.3 With effect from the date the Holder has abandoned or relinquished a portion or portions of the mining area, and subject to section 43 of the Act, the Minister is entitled to grant any right, permit, or permission referred to in the Act in, on, or under the portion/s, so abandoned or relinquished, to any person/s.

5. Payment of Royalties and other Monies

5.1. The Holder shall as contemplated in section 25 (2) (g) pay to the State throughout the duration of this mining right, any royalties payable in terms of any Act or Amendment to an Act of Parliament implemented.

5.2. If, prior to the commencement of the Act, the Holder of this right paid any royalties, levies, fees, or consideration to the state, the Holder shall continue to pay same applicable to such old order mining right until such time a relevant Act of parliament is implemented.

6. Payment of Interest

If mining fees, any fees, any levy, royalties or consideration referred to in clause 5 are not paid punctually, the Holder shall be in mora and shall pay interest thereon at the rate prescribed in terms of section 80 of the Public Finance Management Act, 1999(Act 1 of 1999) reckoned from the date on which payment is due and payable, to the date of actual payment.

7. Restrictions and Obligations Imposed on the Holder

7.1 The Holder is entitled to the rights referred to in section 5(2), (3) and section 25 of the Act, and such other rights as may be contained in this mining right or such other right as may be granted to, acquired by or conferred upon the Holder by any other applicable law.

7.2 Mining operations in the mining area must be conducted in accordance with the Mining Work Programme and any amendment to such Mining Work Programme and an approved Environmental Management Plan.

7.3 The Holder shall not trespass or enter into any homestead, house or its curtilage nor interfere with or prejudice the interests of the occupiers and/or owners of the surface of the Mining Area except to the extent to which such interference or prejudice is necessary for the purposes of enabling the Holder to properly exercise the Holder's rights under this mining right.

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8. Conditions on disposal of Minerals and/ or Products Derived from Mining

It is a condition of the conversion of this old order mining right that the Holder shall dispose of all minerals and/ or products derived from the exploitation of the mineral at competitive market prices which shall mean in all cases, non-discriminatory prices or non-export parity prices. If the minerals are sold to any entity, which is an affiliate or non-affiliated agent or subsidiary of the Holder, or is directly or indirectly controlled by the Holder, such purchaser must unconditionally undertake in writing to dispose of the minerals and any products produced from the minerals, at competitive market prices.

9. Mortgage, Cession, Transfer, and Alienation

This mining right, a shareholding, an equity, an interest or participation in the right or joint venture, or a controlling interest in a company, close corporation or joint venture, may not be encumbered, ceded, transferred, mortgaged, let, sublet, assigned, alienated or otherwise disposed of without the written consent of the Minister, except in the case of a change of controlling interest in listed companies.

10. Protection of Boreholes, Shafts, Adits and Openings.

All boreholes, shafts, Adits, excavations, and openings sunk or made, by the Holder during the currency of this mining right shall be sealed, closed, fenced, made safe by the Holder in accordance with the approved Environmental Management Programme, the Mine Health and Safety Act, 1996 or any other applicable laws and Regulations.

11. Holder's Liability for payment of Compensation for Loss or Damage

11.1. Subject to section 43 of the Act, the Holder shall, during the tenure of this right while carrying out the mining operations under this right, take all such necessary and reasonable steps to adequately safeguard and protect the environment, the mining area and any person/s using or entitled to use the surface of the mining area from any possible damage or injury associated with any activities on the mining area.

11.2. Should holder fail to take reasonable steps referred to above, and to the extent that there is legal liability, the holder shall compensate such person or persons for any damage or losses, including but not limited to damage to the surface, to any crops or improvements, which such person or persons may suffer as a result of, arising from or in connection with the exercise of his/her rights under this mining right or of any act or omission in connection therewith.

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12. Inspection of Mining Area

The Minister and/or any person duly authorised thereto in writing by the Minister shall be entitled to inspect the mining area, the Holder's mining operations and the execution of the approved Environmental Management Programme on the Mining Area as provided for in the Act, and any instruction conveyed in writing by the Minister to the Holder requiring the proper performance by the Holder of the Holder's obligations under this mining right shall be put into effect by the Holder in terms of the Act.

13. Cancellation or Suspension

13.1 Subject to section 47 of the Act, this mining right may be cancelled or suspended if the Holder:

13.1.I Submits inaccurate, incorrect and or misleading information in connection with any matter required to be submitted under the Act;

13.1.2 Fails to honour or carry out any agreement, arrangement, or undertaking, including the undertaking made by the Holder in terms of the Broad Based Socio Economic Empowerment Charter and Social and Labour plan, on which the Minister relied for the conversion of this right;

13.1.3 Breaches any material term and condition of this mining right;

13.1.4 Conducts mining operations in contravention of the provisions of the Act;

13.1.5 Contravenes the requirement of the approved Environmental Management Programme; or

13.1.6 Contravenes any provisions of this Act in any other manner.

13.2 Before the Minister cancels or suspends this right, the Minister shall:

13.2.I Give written notice to the Holder indicating the intention to suspend or cancel this right;

13.2.2 Give reason/s why the Minister is considering the suspension or cancellation of this right;

13.2.3 Give the Holder 30 days to show reasons why the right should not be suspended or cancelled;

13.2.4 Notify, the mortgagee [if any], of the intention to suspend or cancel this right; and

13.2.5 Direct the Holder, where it is possible to remedy any contravention, breach or failure, to comply or to take such specified measures to remedy any contravention, breach or failure to comply.

13.3 If the Holder does not take the measures as specified by the Minister to remedy a contravention, breach or failure, the Minister may cancel or suspend this right after considering representations made by the Holder in terms of clause 13.2.3.

14. Records and Returns

14.1. The Holder shall maintain all such books, plans and records in regard to mining on the Mining Area as may be required by the Act and shall furnish to the office of the Regional Manager such reports and documents as may be relevant under this right.

14.2. The Holder shall furnish to the Regional Manager all such monthly returns contemplated in section 28 (2) A of the Act not later than the 15th day of the month following the month in respect of which it was reported.

14.3 The Holder shall furthermore at the end of each year following commencement of this mining right, inform the Regional Manager in writing of any new developments and of the future mining activities planned in connection with the exploitation/mining of the minerals on the Mining Area.

15. Minister's liability for Payment of Compensation

The Minister shall not at any time be liable or responsible for the payment of compensation of whatever nature to the Holder, the Holder's successors-in-title or assignee, or any person whomsoever as a result of the conversion of this right.

16. Compliance with the Laws of the Republic of South Africa

The conversion of this Right, does not exempt the Holder and its successors in title and/or assigns from complying with the relevant provisions of the Mine Health and Safety Act, (Act No.29 of 1996) and any other law in force in the Republic of South Africa.

17. Provisions relating to section 2(d) and (f) of the Act

In the furthering of the objects of this Act, the Holder is bound by the provisions of an agreement or arrangement dated **17th May 2007** entered into between the Holder/ empowering partner and **Vuwa Investments (Proprietary) Limited (see Annexure D)** (the empowerment partner) which agreement or arrangement was taken into consideration for purposes of compliance with the requirements of the Act and or Broad Based Economic Empowerment Charter developed in terms of the Act and such agreement shall form part of this right.

18. Social and Labour Plan

18.1 The holder must annually, not later than three months before the end of its financial year, submit a detailed implementation plan to give effect to Regulation 46(e) (i), (ii) and (iii) in line with the Social and Labour Plan.

18.2 The holder must annually, not later than three months after finalisation of its audited annual report, submit a detailed report on the implementation of the previous year's social and labour plan.

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19. Severability

Notwithstanding anything to the contrary, any provision of this mining right which is contrary to any provision of the Act or which is otherwise ultra vires, null and void, voidable, or unenforceable, shall be severable from the rest of this right, such rest thus being and remaining of full force, effect and enforceable.

20. Domicilia citandi et executandi

20.1. The parties hereto choose the following addresses as their *domicilia citandi et executandi* and for all purposes arising from this mining right, in particular for the purposes of serving of any notice in terms of this mining right, and any notice properly addressed to the under mentioned postal addresses of the parties shall be deemed to have been received by the addressee within 14 days if given in writing and posted by prepaid registered post addressed to the addressee at the relevant postal address:

20.1.1. In the case of the ***Minister***:

Physical Address	Postal Address
Cnr Margaretha Prinsloo & Voortrkker Streets **Old Vaal University of Technology Building** **KLERKSDORP** Code **2570** Tel **(018) 487 9830** Fax **(018) 487 9831**	**Private Bag A1** **KLERKSDORP** **2570** **(018) 487 9830** **(018) 487 9831**

20.1.2. In the case of the ***Holder***:

Physical Address	Postal Address
Plot 95 **Old Rustenburg Road** **Brits** Code **0251** Tel **(012) 258 0123** Fax **(012) 258 0402**	**P O Box 1451** **Brits** **0251** **(012) 258 0123** **(012) 258 0402**

20.2. Notwithstanding anything to the contrary herein contained, a written notice or communication actually received by a party at any place other than the chosen *domicilia citandi et executandi*

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shall constitute adequate notice or communication to the party notwithstanding that it was not sent to or delivered at such party's chosen *domicilium citandi et executandi.*

20.3 Either party shall be entitled from time to time to change the *domicilia citandi et executandi* or postal address furnished above after giving at least 14 days prior written notice of such change to the other party, failing which the above mentioned addresses will remain in force.

20.4. Any written notice or communication contemplated in this clause which is forwarded by one party to the other by registered post will be presumed to have been received by the addressee on the fourteenth day following the date of posting from an address within the Republic of South Africa to the addressee at the postal address of the addressee for the time being as determined in accordance with the provisions of this clause.

21. Costs

The Holder shall pay all costs and charges incurred in connection with the execution and registration of this prospecting right.

Thus done and signed at **Klerksdorp** on the **09th** day of **October** in the year **2012** in the presence of the undersigned witnesses:

AS WITNESS:

AS WITNESS:

For and on behalf of the **Minister**

For and on behalf of the **Holder**

MARIZA SLABBERT NOTARY PUBLIC GAUTENG

Notary Public

Appendix 5 : EIA Screening Report

SCREENING REPORT FOR AN ENVIRONMENTAL AUTHORIZATION AS REQUIRED BY THE 2014 EIA REGULATIONS – PROPOSED SITE ENVIRONMENTAL SENSITIVITY

EIA Reference number: NW30/5/1/2/2/441MR

Project name: Section 102 Sallies Silica

Project title: The Amendmand of the Mining Right to decrease and increase mining area

Date screening report generated: 21/10/2021 13:25:18

Applicant: Witkop Fluorspar Mine (Pty) Ltd

Compiler: Retief Environmental

Compiler signature: .....

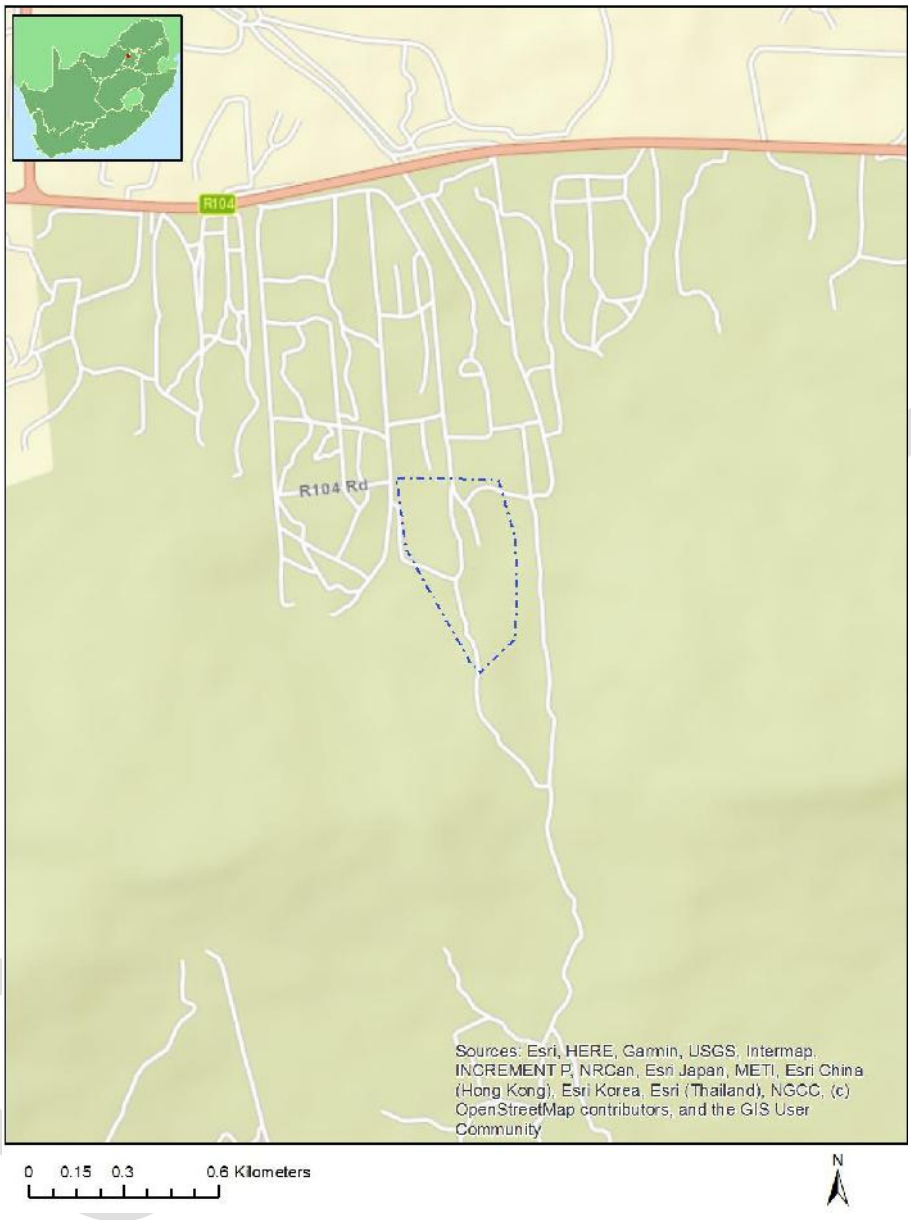
Application Category: Mining|Mining Right

Table of Contents

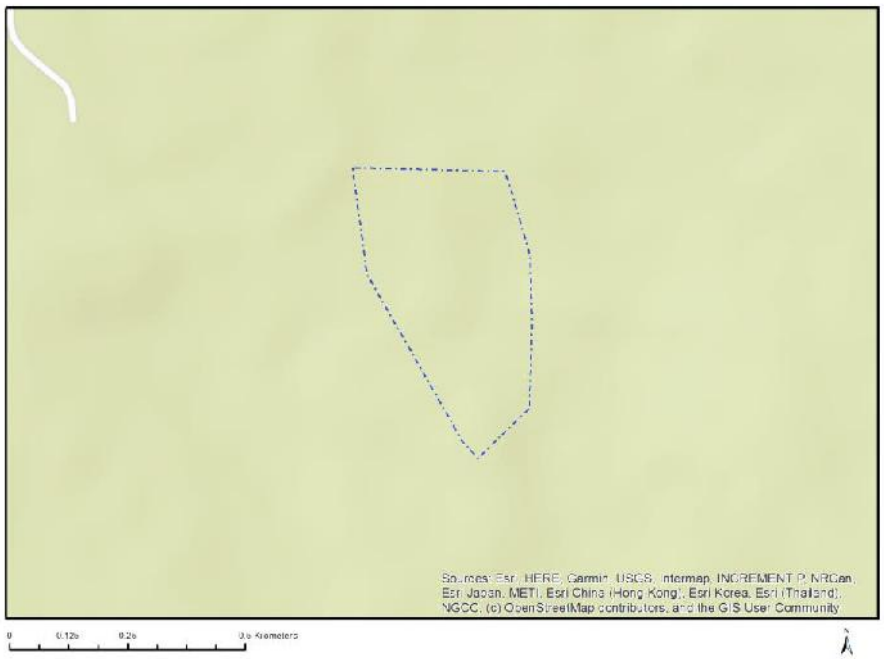
Proposed Project Location

Orientation map 1: General location

General Orientation: Section 102 Sallies Silica



Map of proposed site and relevant area(s)



Cadastral details of the proposed site

Property details:

No	Farm Name	Farm/ Erf No	Portion	Latitude	Longitude	Property Type
1	ZANDFONTEIN	447	0	25°42'36.6S	27°47'56.94E	Farm
2	ZANDFONTEIN	447	129	25°43'45.9S	27°47'29.79E	Farm Portion
3	ZANDFONTEIN	447	95	25°43'43.35S	27°47'35.59E	Farm Portion

Development footprint[1] vertices:
No development footprint(s) specified.

Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No	EIA Reference No	Classification	Status of application	Distance from proposed area (km)
1	14/12/16/3/3/1/1297	Solar PV	Approved	18.4
2	14/12/16/3/3/1/491	Solar PV	Approved	25
3	14/12/16/3/3/1/492	Solar PV	Approved	25
4	12/12/20/2172	Solar PV	Approved	20.9

[1] "development footprint", means the area within the site on which the development will take place and incudes all ancillary developments for example roads, power lines, boundary walls, paving etc. which require vegetation clearance or which will be disturbed and for which the application has been submitted.

Environmental Management Frameworks relevant to the application

No intersections with EMF areas found.

Environmental screening results and assessment outcomes

The following sections contain a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development site as well as the most environmental sensitive features on the site based on the site sensitivity screening results for the application classification that was selected. The application classification selected for this report is: **Mining|Mining Right**.

Relevant development incentives, restrictions, exclusions or prohibitions

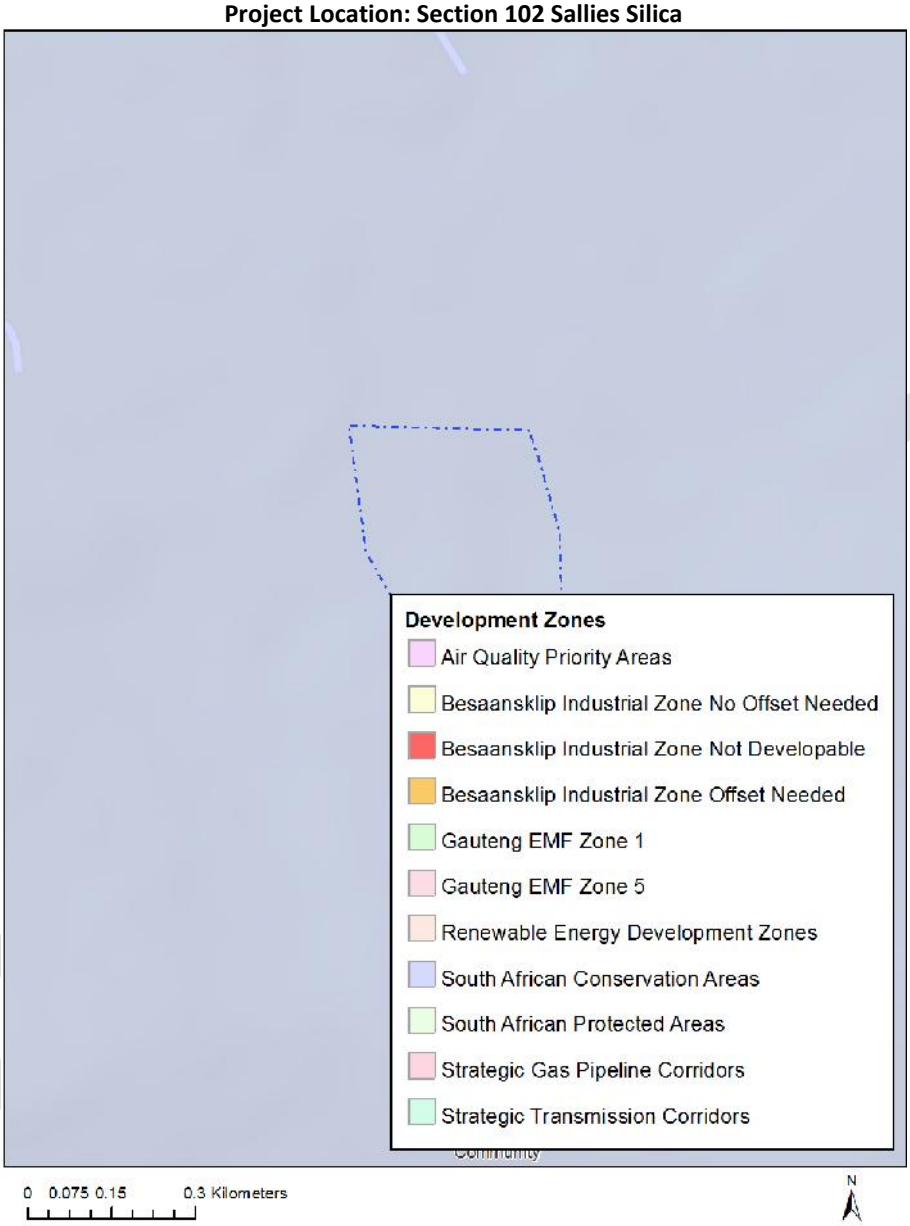
The following development incentives, restrictions, exclusions or prohibitions and their implications that apply to this site are indicated below.

Incentive, restriction or prohibition	Implication
Strategic Transmission Corridor-Central corridor	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/Combined_EGI.pdf
Air Quality-Waterberg-Bojanala Priority Area	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/gg39489_nn1207a.pdf
Strategic Gas Pipeline Corridors -Phase 3: Richards Bay to Gauteng	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/Combined_GAS.pdf
South African Protected Areas	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/SAPAD_OR_2021_Q1_Metadata.pdf
South African Conservation	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/SACAD_OR_2021_Q1_Metadata.pdf

Areas	

Map indicating proposed development footprint within applicable development incentive, restriction, exclusion or prohibition zones

Project Location: Section 102 Sallies Silica



Proposed Development Area Environmental Sensitivity

The following summary of the development site environmental sensitivities is identified. Only the highest environmental sensitivity is indicated. The footprint environmental sensitivities for the proposed development footprint as identified, are indicative only and must be verified on site by a suitably qualified person before the specialist assessments identified below can be confirmed.

Theme	Very High	High	Medium	Low

	sensitivity	sensitivity	sensitivity	sensitivity
Agriculture Theme		X		
Animal Species Theme			X	
Aquatic Biodiversity Theme	X			
Archaeological and Cultural Heritage Theme				X
Civil Aviation Theme		X		
Defence Theme				X
Paleontology Theme		X		
Plant Species Theme			X	
Terrestrial Biodiversity Theme	X			

Specialist assessments identified

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report. It is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the site situation.

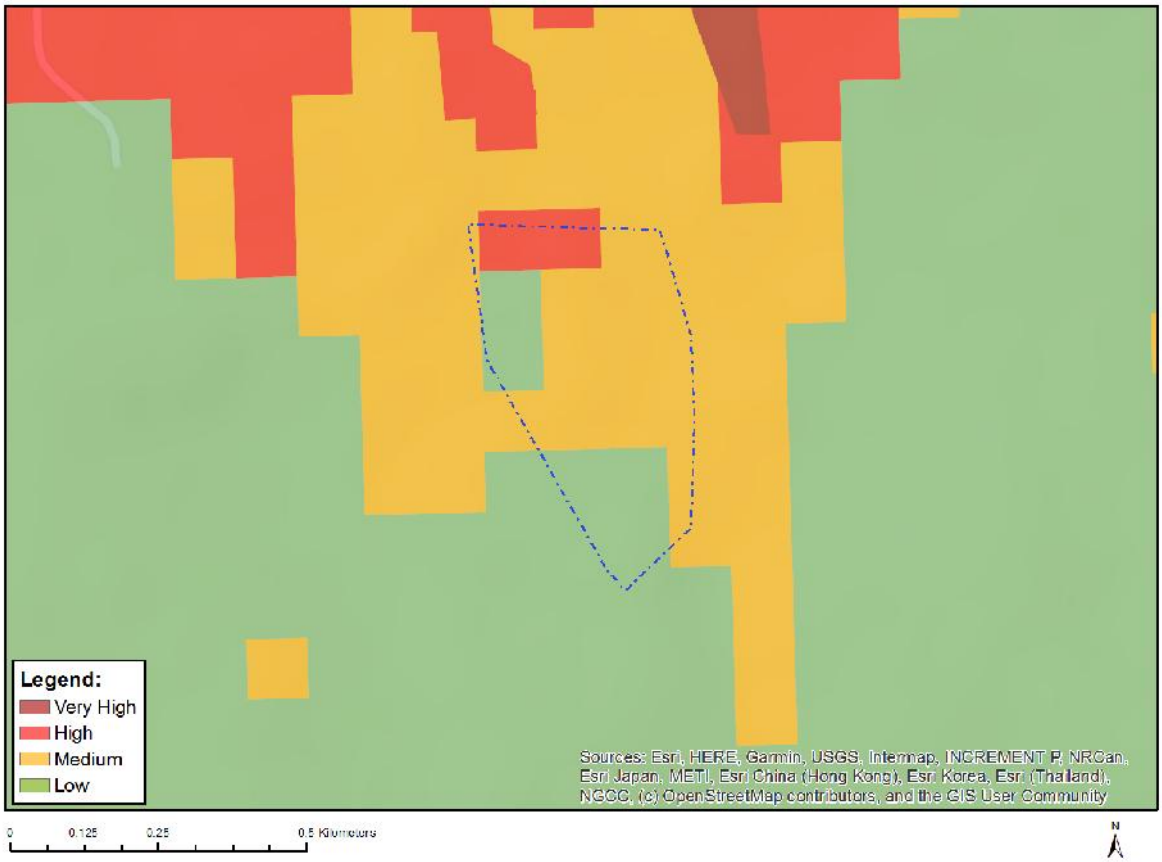
No	Specialist assessment	Assessment Protocol
1	Agricultural Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Agriculture_Assessment_Protocols.pdf
2	Landscape/Visual Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
3	Archaeological and Cultural Heritage Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
4	Palaeontology Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
5	Terrestrial Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf
6	Aquatic Biodiversity Impact	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Aquatic_Biodiversity_Assessment_Protocols.pdf

	Assessment	
7	Hydrology Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
8	Noise Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Noise_Impacts_Assessment_Protocol.pdf
9	Radioactivity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
10	Traffic Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
11	Geotechnical Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
12	Climate Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
13	Health Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
14	Socio-Economic Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
15	Ambient Air Quality Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
16	Seismicity Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
17	Plant Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Plant_Species_Assessment_Protocols.pdf
18	Animal Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Animal_Species_Assessment_Protocols.pdf

Results of the environmental sensitivity of the proposed area.

The following section represents the results of the screening for environmental sensitivity of the proposed site for relevant environmental themes associated with the project classification. It is the duty of the EAP to ensure that the environmental themes provided by the screening tool are comprehensive and complete for the project. Refer to the disclaimer.

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY

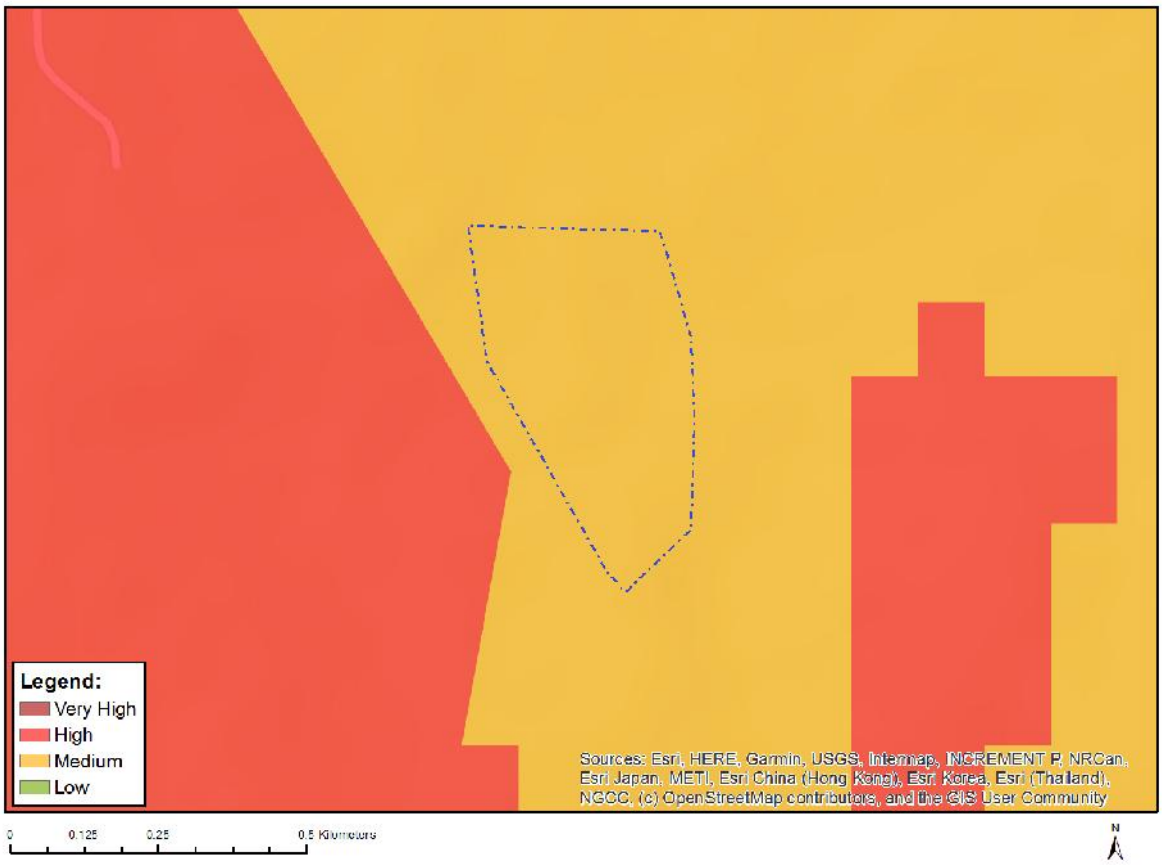


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Land capability;09. Moderate-High/10. Moderate-High
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Dasymys robertsii
Medium	Sensitive species 12

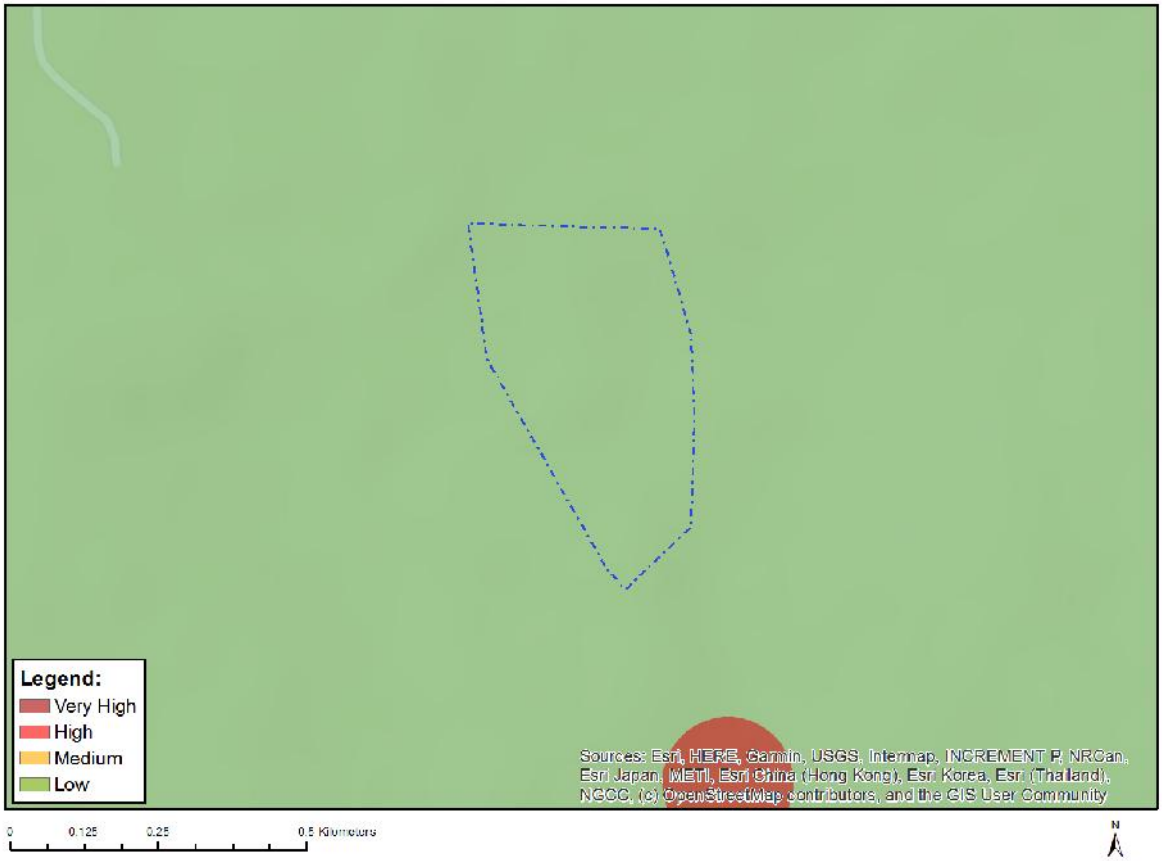
MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Aquatic CBAs

MAP OF RELATIVE ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME SENSITIVITY

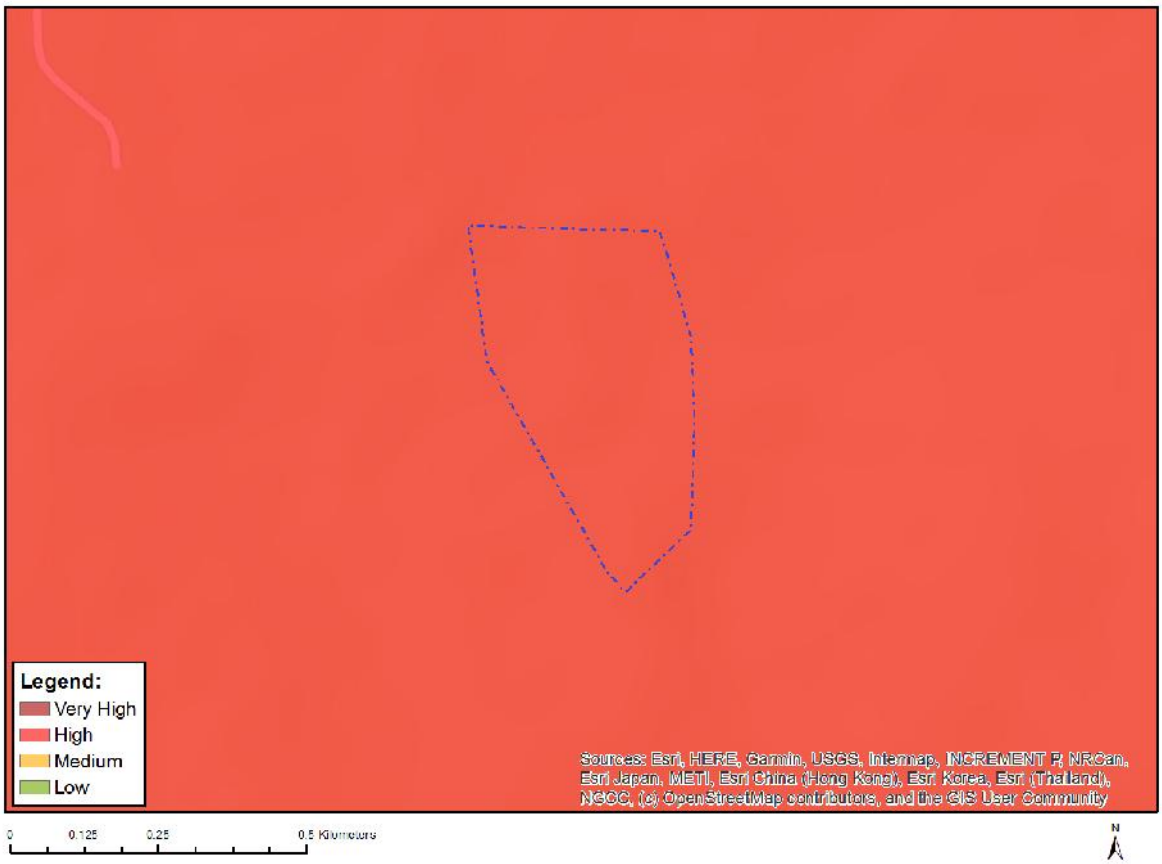


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

MAP OF RELATIVE CIVIL AVIATION THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 8 km of other civil aviation aerodrome
Medium	Between 15 and 35 km from a major civil aviation aerodrome

MAP OF RELATIVE DEFENCE THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

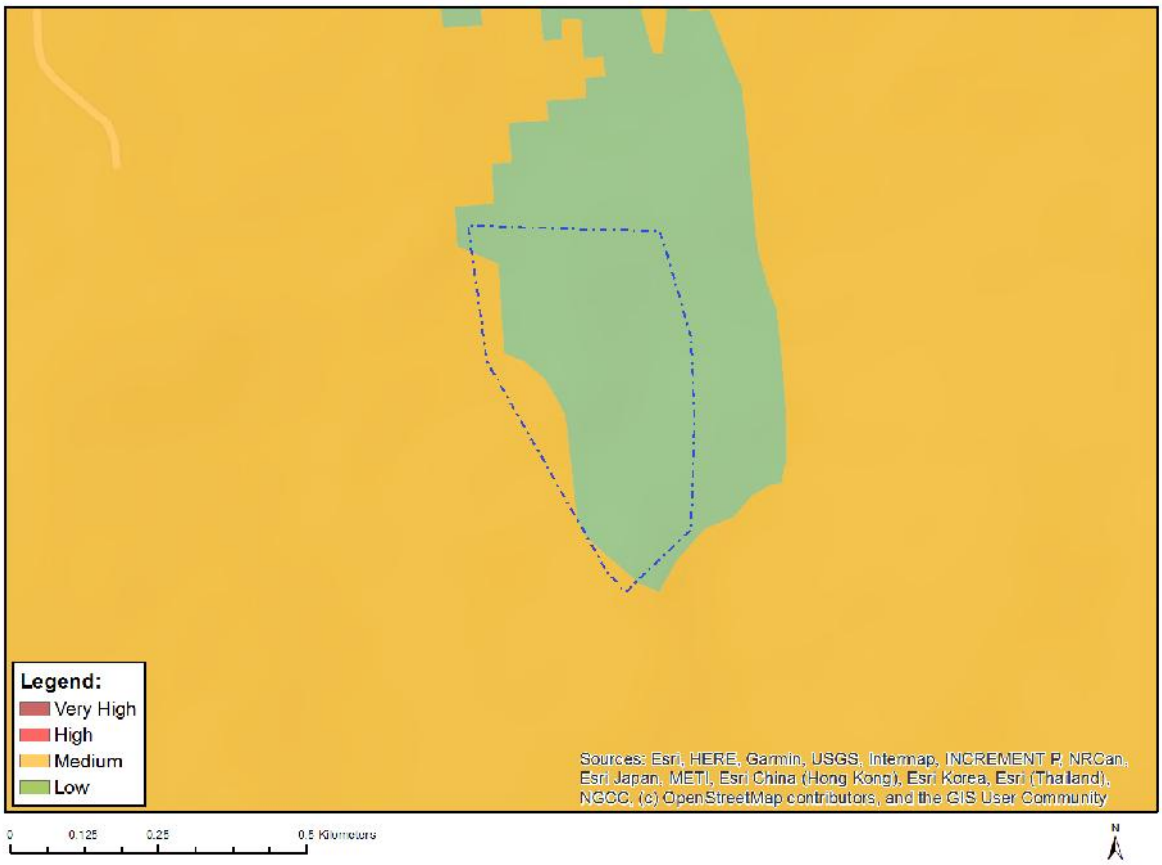
MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Features with a High paleontological sensitivity
Medium	Features with a Medium paleontological sensitivity

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Sensitive species 733
Medium	Dicliptera magaliesbergensis
Medium	Xerophyta adendorffii
Medium	Brachycorythis conica subsp. transvaalensis
Medium	Sensitive species 1248
Medium	Prunus africana

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Critical biodiveristy area 1
Very High	Critical biodiveristy area 2
Very High	Ecological support area 1
Very High	Magaliesberg Protected Natural Environment
Very High	Protected Areas Expansion Strategy

Appendix 6 : Public Participation

Appendix 7 : Geohydrological Study

BASELINE HYDROGEOLOGICAL STUDY

FOR

ROLFES SILICA (PTY) LTD

GPT Reference Number: SHRS-11-302
Version: Final Version 1.0
Date: November 2011

Compiled for:

Shangoni Management Services (Pty) Ltd

Compiled by:

Geo Pollution Technologies – Gauteng (Pty) Ltd

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Tel: *+27 (0)12 804 8120*
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Report Type:	Hydrogeological Investigation Report
Project Title:	Baseline Hydrogeological Investigation for Rolfes Silica (Pty) Ltd
Site Location:	Brits, North West Province.
Compiled For:	Shangoni Management Services (Pty) Ltd
Compiled By:	A. Freysen; (B.Sc., Hons)
Reviewed By:	G.J. du Toit; (D.Sc.,Pr.Sci.Nat)
GPT Reference:	SHRS-11-302
Version:	Final Version 2.0
Date:	November 2011
Distribution List (Current Version):	Word and PDF to Nico Brits of Shangoni

Disclaimer:

The results and conclusions of this report are limited to the Scope of Work agreed between GPT and the Client for whom this investigation has been conducted. All assumptions made and all information contained within this report and its attachments depend on the accessibility to and reliability of relevant information, including maps, previous reports and word-of-mouth, from the Client and Contractors. All work conducted by GPT is done in accordance with the GPT Standard Operating Procedures. GPT has successfully obtained ISO 9001:2008 accreditations.

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Declaration:

I hereby declare:

1. I have no vested interest (present or prospective) in the project that is the subject of this report as well as its attachments. I have no personal interest with respect to the parties involved in this project.
2. I have no bias with regard to this project or towards the various stakeholders involved in this project.
3. I have not received, nor have I been offered, any significant form of inappropriate reward for compiling this report.

A. Freysen; B.Sc. Hons
Geo Pollution Technologies – Gauteng (Pty) Ltd

Quality Control:

This report was checked by:

G.J. du Toit; D.Sc.,Pr.Sci.Nat
Professional Natural Scientist (No 400043/86)
Geo Pollution Technologies – Gauteng (Pty) Ltd

Customer Satisfaction:

Feedback regarding the technical quality of this report (i.e. methodology used, results discussed and recommendations made), as well as other aspects, such as timeous completion of project and value of services rendered, can be posted onto GPT's website at www.gptglobal.com.

EXECUTIVE SUMMARY

The objective of this study is to fulfil the requirements of an Integrated Water Use License Application (IWULA) and was requested by the Department of Water Affairs and Forestry (DWAF) namely; to characterise the prevailing groundwater regime, assess groundwater quantity impacts, delineate any groundwater pollution plume(s) and assess whether mitigation and / or remediation is required, if required by the DWA.

Hydrogeology

The Rolfes Silica deposit is located in the Magaliesberg Quartzite Formation of the Pretoria Group. This formation is composed of quartzite, feldspathic quartzite, shale, hornfels and quartzite typically associated with hard rock fractured aquifers.

From the hydrocensus data an average borehole yield of between 1 and 2 l/s was calculated for the area under investigation which fall within the regional estimated range of 0.5 to 2 l/s. Through qualified guesses a realistic average recharge of ~ 4.3% of the rainfall is estimated which corresponds well to the average of the Crocodile West and Marico Water Management Area (4%).

Water levels and Chemical Analysis

A total of 33 hydrocensus boreholes were found located in a 1-2 km radius around the site. Groundwater is predominantly used for potable water, irrigation, livestock watering, aqua farming and also used for small scale irrigation (garden).

Water levels could be measured in 25 boreholes. The average depth to water level is ~ 12 m bgl and a good correleation between the surface topography and the water levels (84.3%) was found for the boreholes measured during the hydrocensus.

The overall water quality is good and most of the borehole samples analysed was found to comply with the DWAF water quality guidelines for domestic use. Slightly elevated NO_3 concentrations were detected in BH1 (borehole A on the premises of Rolfes Silica), BH9 and BH14 which is related to agricultural activities. PO_4 was also found in the water sample of BH1 which supports the above statement that it is related to agricultural activities. The pH value in BH8 (4.75) was found to be slightly low but no potential health risks are expected.
It was only in BH8 (pH) and BH14 (NO_3) that chemical parameters show potential health risks, none of which is related to mining activities at Rolfes Silica.

No chemicals are involved in the mining processes at Rolfes Silica and therefore no chemical contamination is expected. Currently there is no contaminant impact on the groundwater.

Due to the nature of the inert characteristics of quartzite, no primary plume emanating from Rolfes Silica could be reasonably expected. At most, secondary plumes emanating from secondary sources such as ablution facilities at the office block could be expected.

Recommendations

It is further recommended that the groundwater be managed in a sustainable manner. The groundwater management plan and a groundwater monitoring program should be established at the proposed development.

- Prevention of contamination in source areas as listed under section 8.1.
- Any discharge or storm water runoff from site should be prevented.
- Water levels should be measured on a frequent basis around the active quarry and the amount of water removed monitored.
- Groundwater quality should be monitored bi-annually. Water samples must be taken from all the monitoring boreholes using approved sampling techniques and adhering to recognised sampling procedures. Further recommendations can be made regarding the sampling frequency after the first year.
- Monitoring parameters should include E.coli and total faecal coliforms as well as hydrocarbons.
- The monitoring data should be evaluated by a competent hydrogeologist to identify trends and modify groundwater monitoring network if necessary.

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1 INTRODUCTION

Geo Pollution Technologies (GPT) – Gauteng (Pty) Ltd was appointed by Shangoni Management Services (Pty) Ltd as an independent groundwater consultancy to conduct a baseline study for Rolfes Silica (Pty) Ltd, and its surroundings. The specialist hydrogeological study is to fulfil the requirements of an Integrated Water Use License Application (IWULA) and was requested by the Department of Water Affairs and Forestry (DWAF) namely; to characterise the prevailing groundwater regime, assess groundwater quantity impacts, delineate any groundwater pollution plume(s) and assess whether mitigation and / or remediation is required.

2 SCOPE OF THE STUDY

The following was done as part of the investigation:

- Site inspection, mapping of relevant geohydrological features and gathering of existing information from topographical maps, ortho-photos, geological maps, hydrological information, meteorological information, etc
- A borehole / spring hydrocensus was conducted in a 1-2km radius around the area under investigation to assess groundwater utilisation on neighbouring properties.
- Water samples were collected from selected hydrocensus boreholes for laboratory analysis to establish the background water quality of the area and any deviations in quality that might exist. The results of analysis were compared to both DWAF standards.
- The groundwater recharge of the property was estimated using appropriate techniques, viz. the Cl-Method.
- The vulnerability of the aquifer to potential pollution was assessed. The aquifer was also classified according to the Parsons aquifer classification methodology.
- A groundwater monitoring network was recommended and standard operational procedures for groundwater monitoring and management advised.
- Results of the investigation was summarised in a report.

3 METHODOLOGY

3.1 DESK STUDY

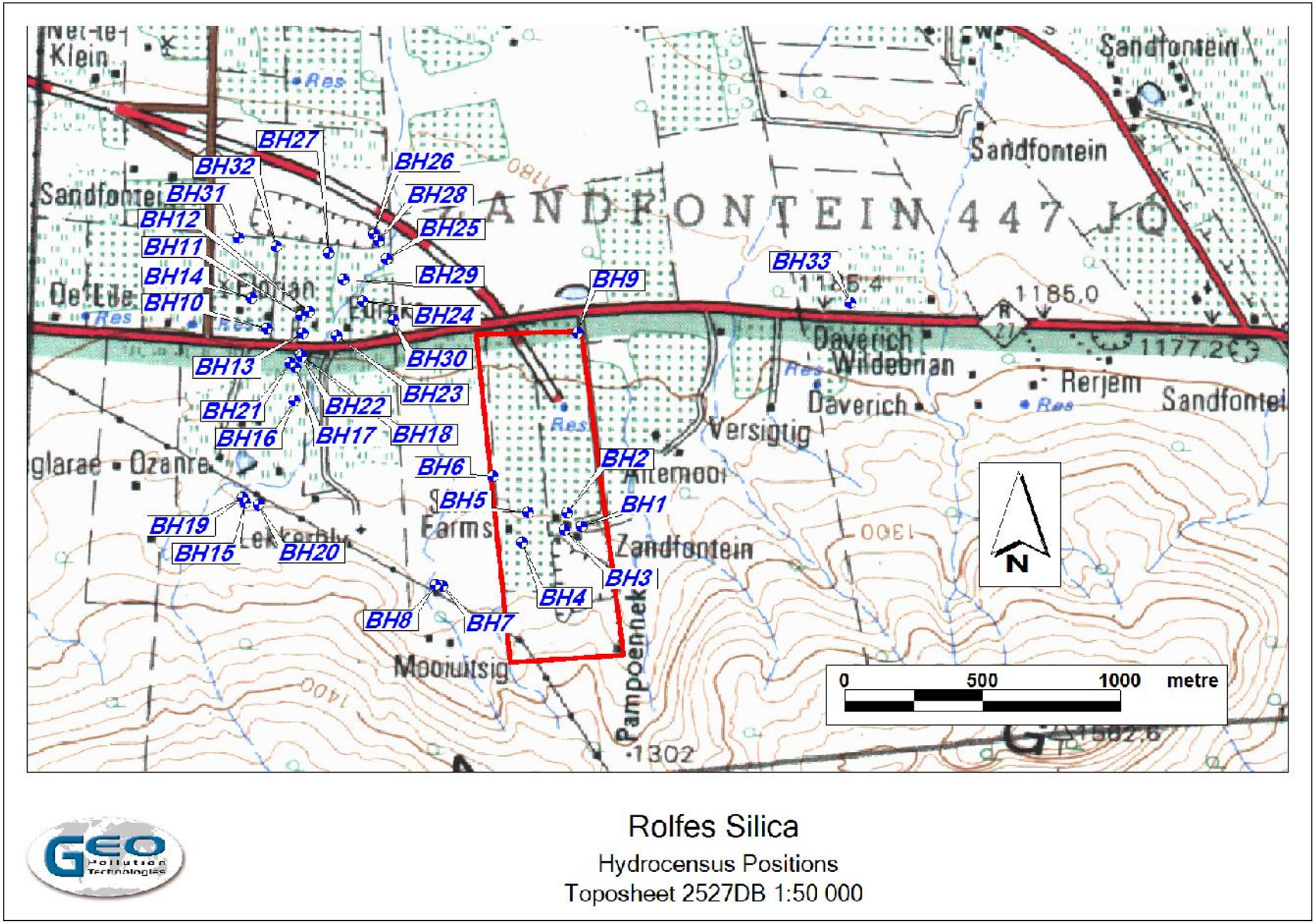
A complete desk study was conducted, entailing the gathering of information from the relevant topographical maps (1:50 000 2527DB Brits Topographic Sheet), geological map (1:250 000 sheet 2526 Pretoria) and hydrogeological map (1:500 000 2526 Johannesburg). In addition to site specific geohydrological data (water levels, hydro chemical data etc.) gathered during the hydrocensus and obtained from reports (scoping report, etc), hydrogeological data was sourced from literature. The following literature was reviewed:

- Barnard H.C (2000). An explanation of the 1:500 000 General Hydrogeological Map, Johannesburg 2526. DWAF.

3.2 HYDROCENSUS

A detailed hydrocensus was conducted in a 1 to 2 kilometre radius on and around the site to obtain a representative population of the boreholes in the area (Figure 1). Permission to conduct the hydrocensus was obtained from most of the borehole owners. During the hydrocensus, all available details of boreholes and borehole owners were collected and included in the hydrocensus forms. Water samples were collected from boreholes as described in the relevant paragraph below. Information was collected where possible on the use of the boreholes in the area, the water levels and yields of boreholes, etc. This information can be used to assess the risk which potential groundwater pollution poses to groundwater users. The following parameters were captured during the hydrocensus:

- GPS position
- Owner details
- Existing equipment
- Current use
- Reported yield
- Reported or measured depth
- Static water level
- Photograph



Rolfes Silica

Hydrocensus Positions

Toposheet 2527DB 1:50 000

Figure 1: Hydrocensus positions

3.3 WATER SAMPLING AND QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Groundwater was sampled on 29 September and 4 October 2011 according to the GPT Standard Operating Procedure for groundwater sampling by bailing [1]. Geo Pollution Technologies (Pty) Ltd, incorporating our subsidiaries and regional offices, commits to comply with the Quality Management System and the requirements of ISO 9001:2008. On request of the Client, GPT can supply Chain of Custody forms, field notes as well as standard operating procedures outlining the methodology followed for groundwater monitoring.

The water samples were collected in one litre plastic bottles. All samples were kept on ice or in a refrigerator until delivered to a laboratory. During the sample collection all relevant field information was logged. Chain-of-custody documents were prepared as part of the QA/QC and submitted to the laboratory to allow tracking of the samples through the process. The groundwater samples were submitted to UIS Analytical Services in Pretoria for major cation/anion analyses.

All monitoring data related to groundwater were interpreted by GPT using EnviroInsite version 7.0.0.20 software. The chemical data were compared with the maximum recommended concentrations for domestic use as defined by the DWAF Water Quality Guidelines.

In interpreting the data and deciding on appropriate action, a Risk Based Approach was used which requires an understanding of the groundwater in terms of the primary and secondary sources of contamination, the pathways thereof and the receptor on which the contamination can impact.

3.4 GROUNDWATER RECHARGE ESTIMATION

The groundwater recharge was estimated using the RECHARGE program[2], which includes using qualified guesses as guided by various schematic maps. The following methods/sources were used to estimate the recharge:

- Soil information
- Geology
- Groundwater Recharge Map (Vegter)
- Acru Recharge Map (Schulze)

[1] Available on request from amelia@gptglobal.com

[2] Gerrit van Tonder, Yongxin Xu: RECHARGE program to Estimate Groundwater Recharge, June 2000. Institute for Groundwater Studies, Bloemfontein RSA.

- Harvest Potential Map
- Chloride (Cl) method

The above-mentioned programme incorporates all the different methods to calculate recharge. The following assumptions are necessary for successful application of the Cl Method:

- There is no source of chloride in the soil moisture or groundwater other than that from precipitation
- Chloride is conservative in the system
- Steady-state conditions are maintained with respect to long-term precipitation and chloride concentration in that precipitation, and in the case of the unsaturated zone
- A piston flow regime, which is defined as downward vertical diffuse flow of soil moisture, is assumed.

4 DESCRIPTION OF THE ENVIRONMENT

4.1 TOPOGRAPHY, CLIMATE AND DRAINAGE

Rolfes Silica is located approximately 11km south of Brits along the R104 on the farm Zandfontein 447 JQ, North West Province. The site is located on the steep slopes of the Magaliesberg at an average elevation of 1210 to 1300 mamsl (metres above mean sea level). The land use around the site is dominated by agriculture with a number of nurseries in the vicinity.

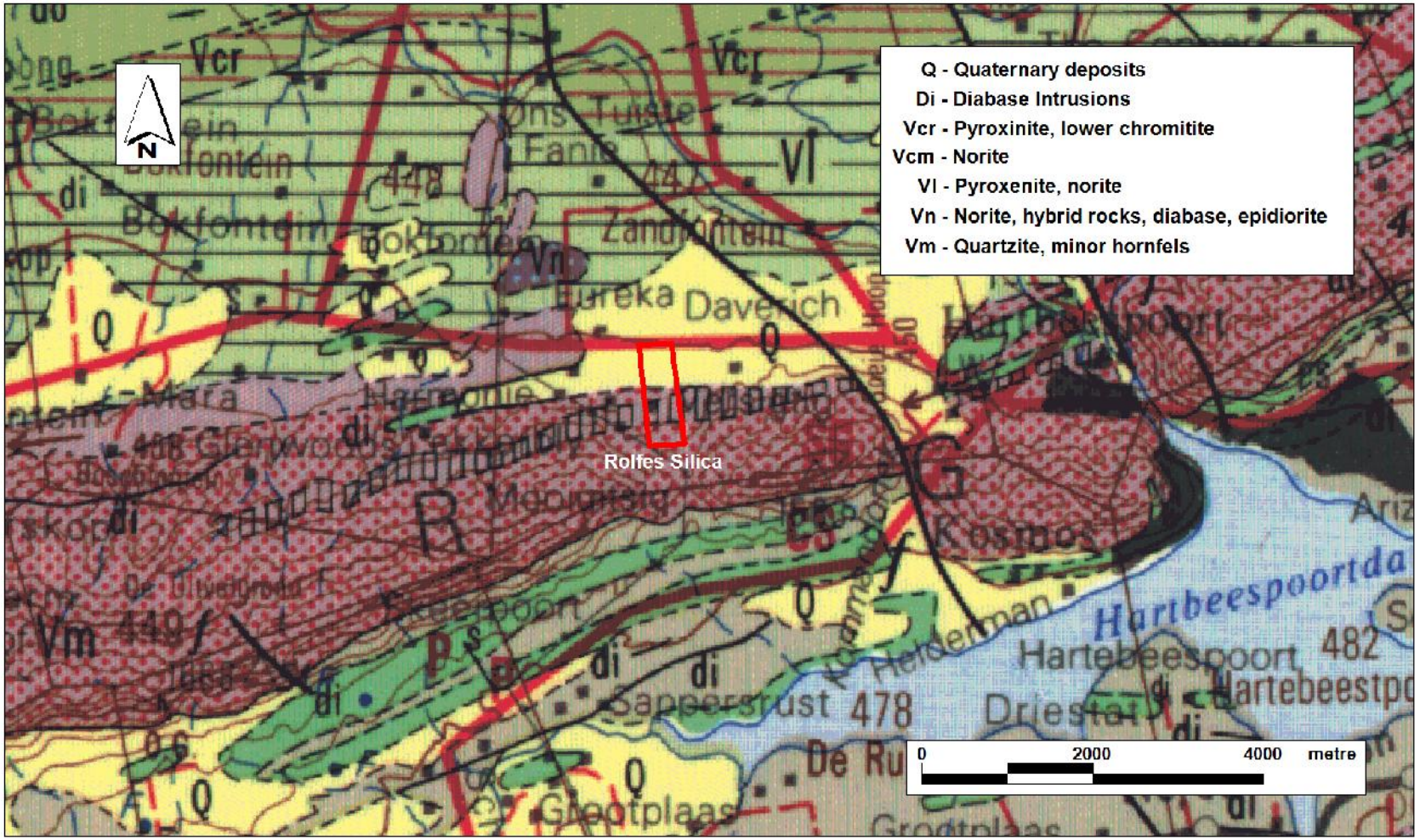
The maximum rainfall occurs generally during summer (October-April), while the minimum rainfall months are during winter from May to September. Rainfall is mainly in the form of heavy summer thunderstorms; with an approximate mean annual rainfall of 660mm.

Numerous steep-sided gullies are found along the slope of the Magaliesburg draining in a northern direction toward the Crocodile River.

4.2 REGIONAL GEOLOGY

The 2528 Pretoria 1:250 000 geological series map indicates that the investigated area is underlain by the Magaliesberg Formation of the Pretoria Group which forms part of the Transvaal Supergroup (Figure 2).

The Magaliesberg Quartzite Formation is composed of quartzite, feldspathic quartzite, shale and hornfels occurring in alternating layers and dipping in a northern direction at an average angle of 20°. This geology is overlain by quaternary sand deposits on the northern part downgradient of the site. According to the geological map no major fractures are identified at surface in the vicinity of Rolfes Silica. Diabase intrusions occur at depth on the northern part of Rolfes Silica dipping with the stratigraphy 20° north.



Rolfes Silica
Geological Map
2526 Pretoria 1:250 000

Figure 2: Geological Map

4.3 REGIONAL HYDROGEOLOGY

On regional scale the area is characterised by a typical fractured aquifer overlain by an alluvial/weathered aquifer. Groundwater flow in the fractured aquifer is associated with the fractures, joints, contact zones (with diabase intrusions) and faults, although not all these fractures may be water bearing. Hard-rock fractured aquifer can be considered to be the main aquifer and source of water for abstraction in the area.

According to the 1:500 000 Johannesburg 2526 Hydrogeological Map borehole yields associated with the Magaliesberg formation range between 0.5 and 2 l/s, (Barnard, 2000)[3]. From the hydrocensus data an average borehole yield of between 1 and 2 l/s was calculated for the area under investigation.

Both the porosity[4] and the hydraulic conductivity[5] of quartzite are known to be low. Expected values of porosity and permeability would be ~3 % (porosity) and $1x10^{-5}$ m/d (hydraulic conductivity) respectively (Kruseman & de Ridder, 1994). Movement of groundwater will preferentially be in secondary openings formed by fractures and diabase intrusions.

The site is part of the Crocodile West and Marico Water Management Area where the groundwater recharge is estimated as ~ 4% of the mean annual rainfall *(Groundwater resources of the Republic of South Africa, Water Research Commission, 1995).*

The water level in close proximity to the mine workings was measured at ~ 11 mbgl. The depth of the active quarry (Quarry no 2) is currently 30 m and the ultimate planned depth is 100 m. Mining has therefore already extended below the water level and it is expected that a hydraulic gradient will exist around the active quarry resulting in an inflow of water into the quarry. Excess water will be pumped out of the active quarry into the slimes dam (Quarry no 1) in order to maintain dry and safe mining conditions. Water from the slimes dam is then used in mining processes, mainly in the sand wash process.

[3] Barnard, H.C (2000). An explanation of the 1:500 000 General Hydrogeological Map. Johannesburg 2526. DWAF.

[4] The ratio of the volume of void space to the total volume of the rock or earth material.

[5] Measure of the ease with which water will pass through the earth's material; defined as the rate of flow through a cross-section of one square metre under a unit hydraulic gradient at right angles to the direction of flow (m/d).

4.3.1 GROUNDWATER RECHARGE ESTIMATION

The groundwater recharge was estimated using the RECHARGE program[6] (van Tonder, et al., 2000), which includes using qualified guesses as guided by various schematic maps and equations[6]. Due to limited chemical data it was not possible to estimate recharge accurately using the Cl method. The following methods/sources were used to estimate the recharge:

- Soil information
- Geology
- Groundwater Recharge Map (Vegter)
- Acru Recharge Map (Schulze)
- Harvest Potential Map

According to the rainfall data, the average rainfall of the area is 660 mm/year, measured at the Brits / Hartebeespoort Dam measuring station. The A21J catchment has a total area of 1150.2 km^2. The result of the estimations can be seen in Table 1 below. Through qualified guesses a realistic average recharge of ~ 4.3% of the rainfall is estimated which corresponds well to the average of the water management area (4%).

Table 1: Recharge Estimation

Recharge Estimation			
Method	**mm/a**	**% of rainfall**	**Certainty (Very High=5 ; Low=1)**
Qualified Guesses			
Chloride Method	31.9	4.8	4
Soil	26.4	4.0	3
Geology	23.9	3.6	3
Vegter	32.0	4.8	3
Acru	30.0	4.5	3
Harvest Potential	25.0	3.8	3
Annual Rainfall= 660 mm per annum			

[6] Van Tonder, G.; Xu, Y. 2000. RECHARGE program to Estimate Groundwater Recharge. Bloemfontein: Institute for Groundwater Studies, 2000.

5 RESULTS OF INVESTIGATION

The impacts on the groundwater regime normally associated with mining, is dewatering of the aquifer during mining and contamination of the groundwater during or following mine closure. Both these aspect are addressed in this report.

5.1 HYDROCENSUS

A total of 33 hydrocensus boreholes were found located in a 1-2 km radius around the site (Figure 1). The results of the hydrocensus are summarised in Table 2 below. Groundwater is predominantly used for potable water, irrigation, livestock watering, aqua farming (RSBH10) and also used for small scale irrigation (garden), although not widespread. Hydrocensus forms can be seen in Appendix A.

5.2 WATER LEVELS

Water levels could be measured in 25 boreholes. Some of the boreholes were equipped with pumps thus preventing access to measure the water levels. The water levels ranged from 2.81 to 28.55 m bgl. The average depth to water level is ~ 12 m bgl.

Usually a good correlation between topography and static groundwater level is found. Since groundwater follows the topography to a large degree the groundwater level is generally deeper in higher lying areas and shallower near drainage areas like the local streams etc. This relationship can be used to distinguish between boreholes with water levels at rest, and boreholes with anomalous groundwater levels due to disturbances such as pumping or local geohydrological heterogeneities. A good correleation (84.3%) was found for the boreholes measured during the hydrocensus. Some outliers (due to frequent abstraction by pumping) with water levels below the rest water level are RSBH8 are RSBH10.

In Figure 4 the static water contours and drainage gradient confirms that there is currently no cone of depression around the quarries of Rolfes Silica due to dewatering. The groundwater flow as previously stated from the correlation graph follows the topography in a northern direction away from the site and not towards the quarries. Currently dewatering only takes place during the wet season to remove rainwater and groundwater seeping into the quarry. The water removed from the quarry is pumped into the slimes dam (Quarry 1) and re-used in plant processes.

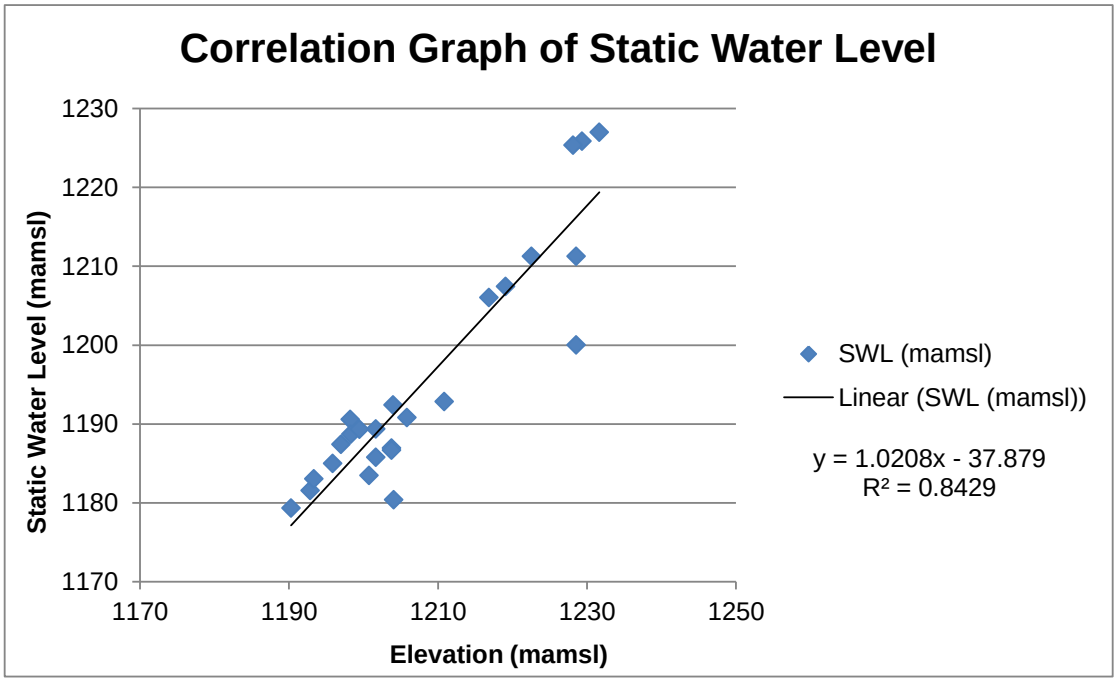


Figure 3: Water level correlation graph

Table 2: Hydrocensus information

BH ID	Owner	Y	X	SWL	Use
RSBH1	Rolfes Silica	-25.72677	27.7936	11.3	Domestic
RSBH2	Rolfes Silica	-25.72632	27.79308	11.66	Not in use
RSBH3	Rolfes Silica	-25.72688	27.79299	No access	Domestic - not for drinking
RSBH4	Rolfes Silica	-25.72729	27.79146	No access	Domestic, plant
RSBH5	Rolfes Silica	-25.72631	27.79167	No access	Domestic, plant
RSBH6	Rolfes Silica	-25.72513	27.79039	10.85	Not in use
RSBH7	Chris Hattingh	-25.72874	27.78859	17.28	Garden, game
RSBH8	Chris Hattingh	-25.72871	27.78834	28.55	Garden, livestock, domestic
RSBH9	J. Hattingh (Brits pale)	-25.72041	27.79342	7.67	Domestic, plant
RSBH10	J. C van Dyk	-25.72032	27.78218	23.69	Aqua farming, nursery, domestic
RSBH11	J. C van Dyk	-25.7199	27.78342	17.29	Garden, domestic
RSBH12	J. C van Dyk	-25.71977	27.78371	15.89	Garden
RSBH13	J. C van Dyk	-25.71977	27.78371	12.33	Not in use
RSBH14	Cock & Bull Restaurant	-25.71933	27.78162	No access	Domestic
RSBH15	Dan Man Boerdery	-25.72605	27.78114	4.69	Irrigation, domestic
RSBH16	Dan Man Boerdery	-25.72269	27.78319	18.02	Irrigation, domestic
RSBH17	Dan Man Boerdery	-25.7216	27.78323	15.05	Irrigation, domestic
RSBH18	Dan Man Boerdery	-25.72118	27.7834	16.84	Irrigation, domestic
RSBH19	Dan Man Boerdery	-25.72588	27.78135	3.5	Not in use
RSBH20	Dan Man Boerdery	-25.726107	27.78192	2.81	Not in use
RSBH21	Dan Man Boerdery	-25.72144	27.78303	Dry	Not in use
RSBH22	Dan Man Boerdery	-25.72125	27.78345	17.1	Not in use
RSBH23	Mr. Claasen	-25.72055	27.78471	11.62	Domestic, irrigation
RSBH24	Mr. Claasen	-25.71942	27.78565	9.62	Irrigation
RSBH25	Mr. Claasen	-25.71802	27.7865	10.87	Irrigation
RSBH26	Mr. Claasen	-25.71721	27.78603	10.96	Irrigation
RSBH27	Mr. Claasen	-25.71784	27.7844	11.31	Irrigation
RSBH28	Mr. Claasen	-25.71744	27.78621	10.32	Not in use
RSBH29	Mr. Claasen	-25.71871	27.78494	9.59	Not in use
RSBH30	Mr. C Hattingh (tropical garden & lodge)	-25.72003	27.78677	10.18	Domestic
RSBH31	Mr. J Steenkamp	-25.71736	27.78114	No access	Nursery
RSBH32	Mr. J Steenkamp	-25.71763	27.7825	No access	Garden, domestic
RSBH33	Mr. B N van der Westhuizen	-25.71937	27.80328	No access	Domestic

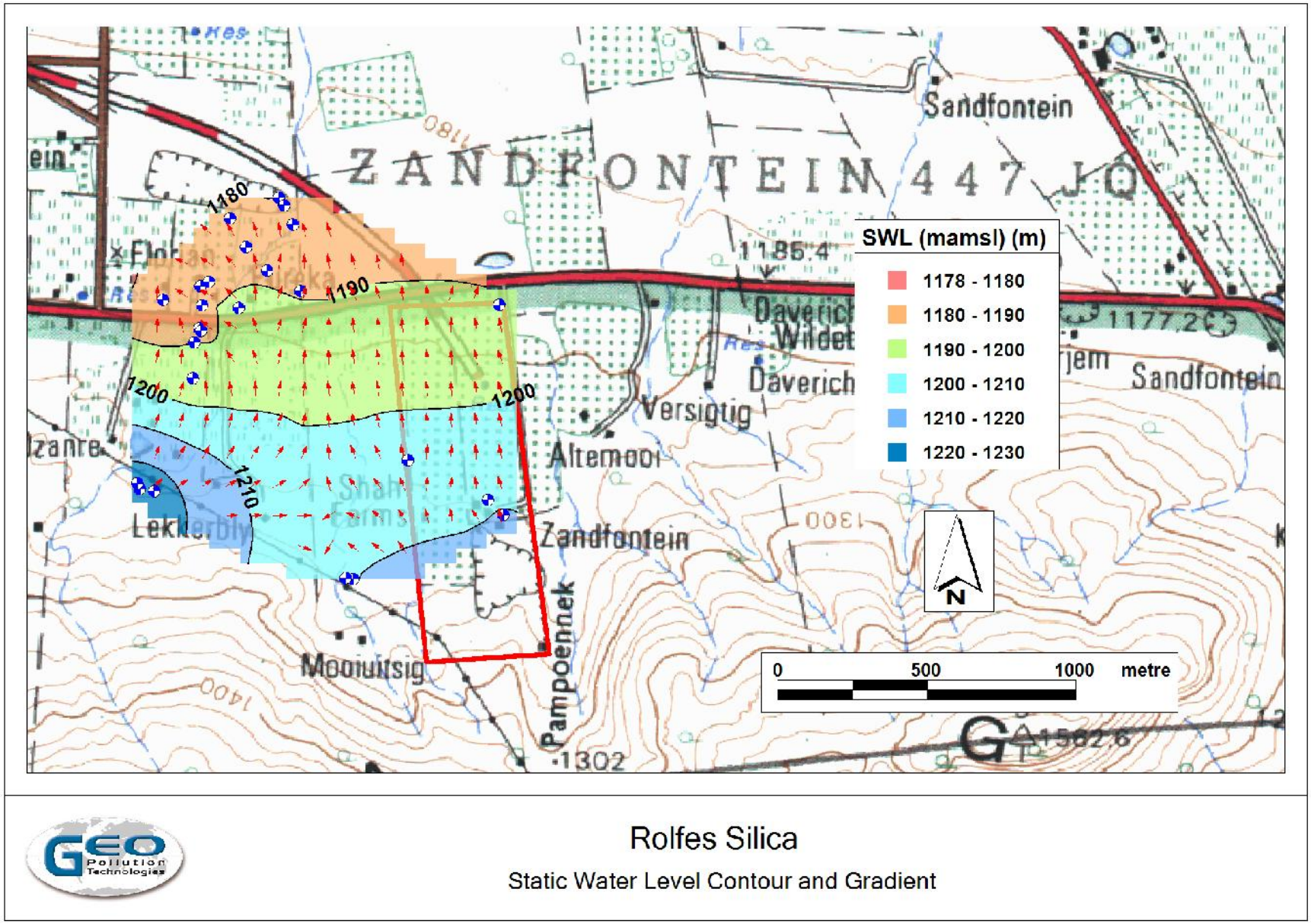


Figure 4: Contour map of static water level (mamsl) with groundwater flow gradient

5.3 WATER QUALITY

A total number of 10 borehole samples collected during the hydrocensus were sent in for chemical analyses. The water sampling results can be seen in Table 3 compared with the maximum recommended concentrations for domestic[7] use as defined by the DWAF Water Quality Guidelines. The guidelines for domestic water quality classify the water quality as follows:

- Class 0 which is ideal concentrations.
- Class I which is considered as acceptable.
- Class II which stipulates the maximum allowable concentration of the water constituent, which can be tolerated only for a limited period. For all chemicals of concern in this paragraph, the relevant period is generally seven years

The overall water quality is good and most of the borehole samples analysed was found to comply with the DWAF water quality guidelines for domestic use.

Slightly elevated NO_3 concentrations were detected in BH1 (borehole A on the premises of Rolfes Silica), BH9 and BH14 which is related to agricultural activities. The threshold for allowable NO_3 concentrations above which water pose a definite health risk is 44 mg/l, especially in infants causing methaemoglobinaemia, also known as the blue baby syndrome. NO_3 is converted to nitrite in the body. The latter combines with the oxygen-carrying red blood pigment, haemoglobin, to form methaemoglobin, which is incapable of carrying oxygen (DWAF, 1996). Mucous membrane irritation may occur in adults.

PO_4 was also found in the water sample of BH1 which supports the above statement that it is related to agricultural activities. PO_4 tend to adsorb to soil particles and is therefore rarely detected in the groundwater chemistry at any significant distance from its source.

The pH value in BH8 (4.75) was found to be slightly low. An alkalinity and HCO3 value of zero is evidence of buffering reactions in the subsurface. Possible health risks which may occur at low pH are associated with dissolved metals. However, no elevated metal concentrations were found and a slightly sour taste is the only aesthetic effect expected. The pH and PO4 concentration in BH8 is not chemically related to mining activities at Rolfes Silica, and furthermore BH8 is not located downstream of Rolfes Silica as the drainage direction is north.

Due to the nature of the inert characteristics of quartzite, no primary plume emanating from Rolfes Silica could be reasonably expected. At most, secondary plumes emanating from secondary sources such as ablution facilities at the office block could be expected. However, no evidence of such sources could be found from the boreholes sampled in this study.

[7] DWAF 1996, South African water Quality Guidelines,Volume 1, Domestic Use 2nd Ed.

Table 3: Results of the chemical analysis compared with the Guidelines for Domestic Use (October 2011).

Sample Nr.	RSBH1	RSBH8	RSBH9	RSBH11	RSBH14	RSBH18	RSBH23	RSBH30	RSBH32	RSBH33	Class 0 (ideal)	Class I (acceptable)	Class II (maximum)
Ca	6.63	2.38	12.60	19.80	30.80	22.00	9.64	7.85	26.50	26.50	< 80	80 - 150	150 - 300
Mg	7.09	2.25	12.40	17.30	26.20	17.60	10.40	7.12	12.70	19.80	< 30	30 - 70	70 - 100
Na	7.72	4.26	10.80	9.36	14.70	7.12	9.04	8.10	12.50	4.53	< 100	100 - 200	200 - 400
K	1.06	0.66	2.80	2.97	2.76	2.68	3.66	2.99	2.37	2.48	< 25	25 - 50	50 - 100
Mn	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	< 0.1	0.1 - 1.0	1.0 - 2.0
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	< 0.1	0.1 - 0.2	0.2 - 2
F	0.16	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	< 1.0	1.0 - 1.5	1.5 - 3.5
NO_3	28.70	9.27	25.00	18.30	44.50	9.51	12.10	15.10	14.30	2.35	< 25	25 - 44	44 - 88
NH_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	< 1	1.0 - 2.0	2.0 - 10.0
Al	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	< 0.15	0.15 - 0.5	-
Zn	0.08	0.10	0.06	0.00	0.74	0.00	0.08	0.05	0.00	0.15	< 3	3.0 - 5.0	5.0 - 10.0
PO_4	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-
HCO_3	18.05	0.00	44.27	89.85	118.02	107.36	36.10	28.42	98.21	118.87	-	-	-
Cl	7.96	4.38	6.07	9.14	27.90	5.22	3.15	3.93	4.50	4.98	< 100	100 - 200	200 - 600
SO_4	2.55	2.02	2.20	4.68	8.36	3.29	1.87	2.22	2.67	4.80	< 200	200 - 400	400 - 600
TDS by sum	78.00	32.50	97.50	143.00	247.00	137.00	65.00	58.50	137.00	143.00	< 450	450 - 1000	1000 - 2400
M-Alk($CaCO_3$)	14.80	0.00	36.30	73.70	96.80	88.20	29.60	23.30	80.70	97.50	-	-	-
pH	6.00	4.75	6.50	6.87	6.80	7.35	6.47	6.47	7.39	6.83	6.0 - 9.0	5.0 - 9.5	4.0 - 10.0
EC	12.00	5.00	15.00	22.00	38.00	21.00	10.00	9.00	21.00	22.00	70	70 - 150	150 - 370
Cat/An Bal. %	-6.51	-14.70	-4.31	-2.78	-2.99	-2.67	-3.97	-5.49	-3.18	-1.91	-	-	-

Notes:
Class 0: Ideal quality
Class I: Target quality
Class II: Moderate effects
Exceeding maximum allowable concentration - adverse effects
All concentrations are presented in mg/l, EC is presented in mS/m
0 = below detection limit of analytical technique

5.3.1 Spatial Analysis

The results from the chemical analyses were plotted as a Piper diagram (Figure 5), Pie diagrams (circular graphs as in Figure 6) and Stiff diagrams (Figure 7). The laboratory certificate of analyses and monitoring data can be seen attached as a separate Appendix B.

The pie diagrams show both the individual ions present in a water sample as a presentation of the total ion concentrations. The scale for the radius of the circle represents the total ion concentrations, while the subdivisions represent the individual ions. It is very useful in making quick comparisons between waters from different sources and presents the data in a convenient manner for visual inspection.

A Stiff pattern is basically a polygon created from four horizontal axes using the equivalent charge concentrations (meq/L) of cations and anions. The cations are plotted on the left of the vertical zero axis and the anions are plotted on the right. Stiff diagrams are very useful in making quick comparisons between waters from different sources.[8]

Piper diagrams are normally subdivided in four quadrants, corresponding to the four major hydrochemical types of groundwater. These quadri- and trilinear diagrams show the relative concentrations of the major cations and anions on four and three axes respectively. The number on the side of the diagram indicates the percentage of specific ion(s) in the sample. Fresh recently recharged groundwater, containing only small amounts of soluble minerals and bi-carbonate, plots in the left quadrant. In contrast, groundwater that has accumulated higher amounts of solutes, either through percolation through the aquifer or pollution, plots in the rightmost quadrant. The top and bottom quadrants are representative of intermediate states.

From the pie and stiff diagrams the major constituents in the water chemistry are identified as Ca, Mg, Na, Cl and HCO_3. The spatial distribution of chemical constituents is fairly uniform in all boreholes with NO_3 and HCO_3 (BH8) varying in proportion in some boreholes. The major water type characteristic of the background water type is Mg/Ca-HCO_3 while that of BH8 is Mg/Cl-HCO_3.

Most of the borehole samples plot in the left quadrant (freshly recharged) of the piper diagram indicative of the background water quality. It is only BH8 which plots in the top quadrant (intermediate state) due to a lack of HCO_3 as previously mentioned.

[8] EAS 44600 Groundwater Hydrology, Lecture 14: Water chemistry 1, Dr Pengfei Zhang

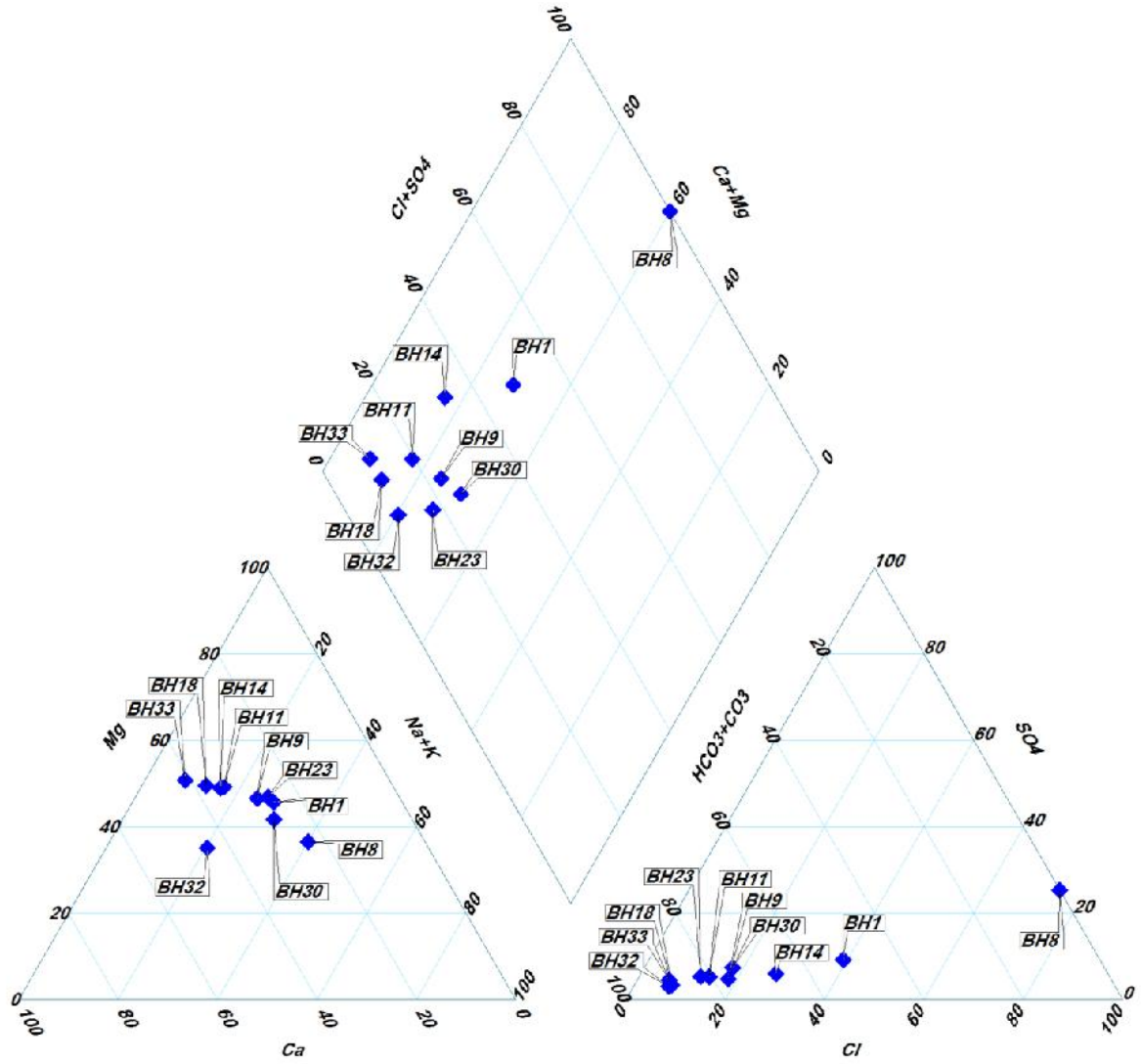


Figure 5: Piper diagram

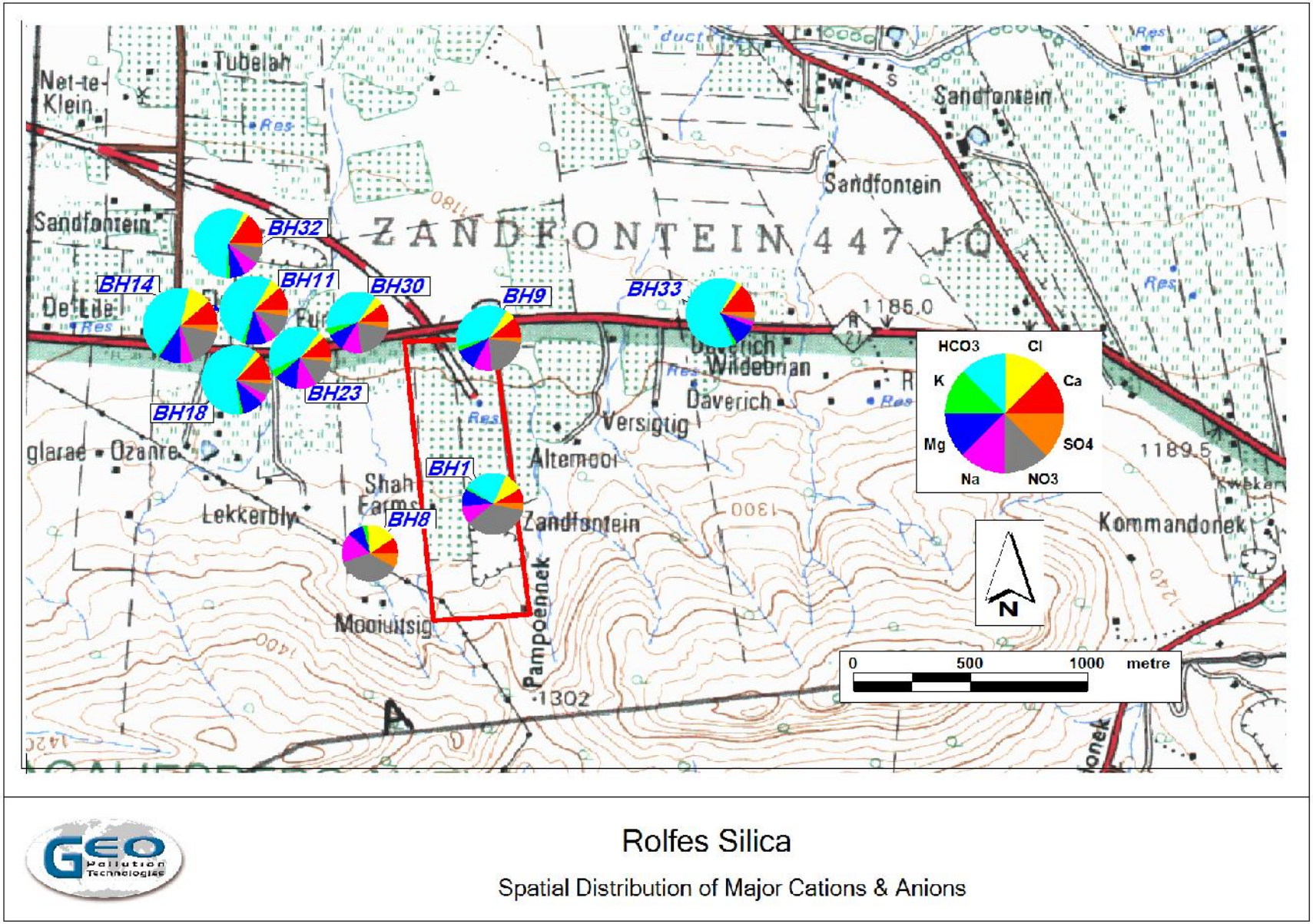
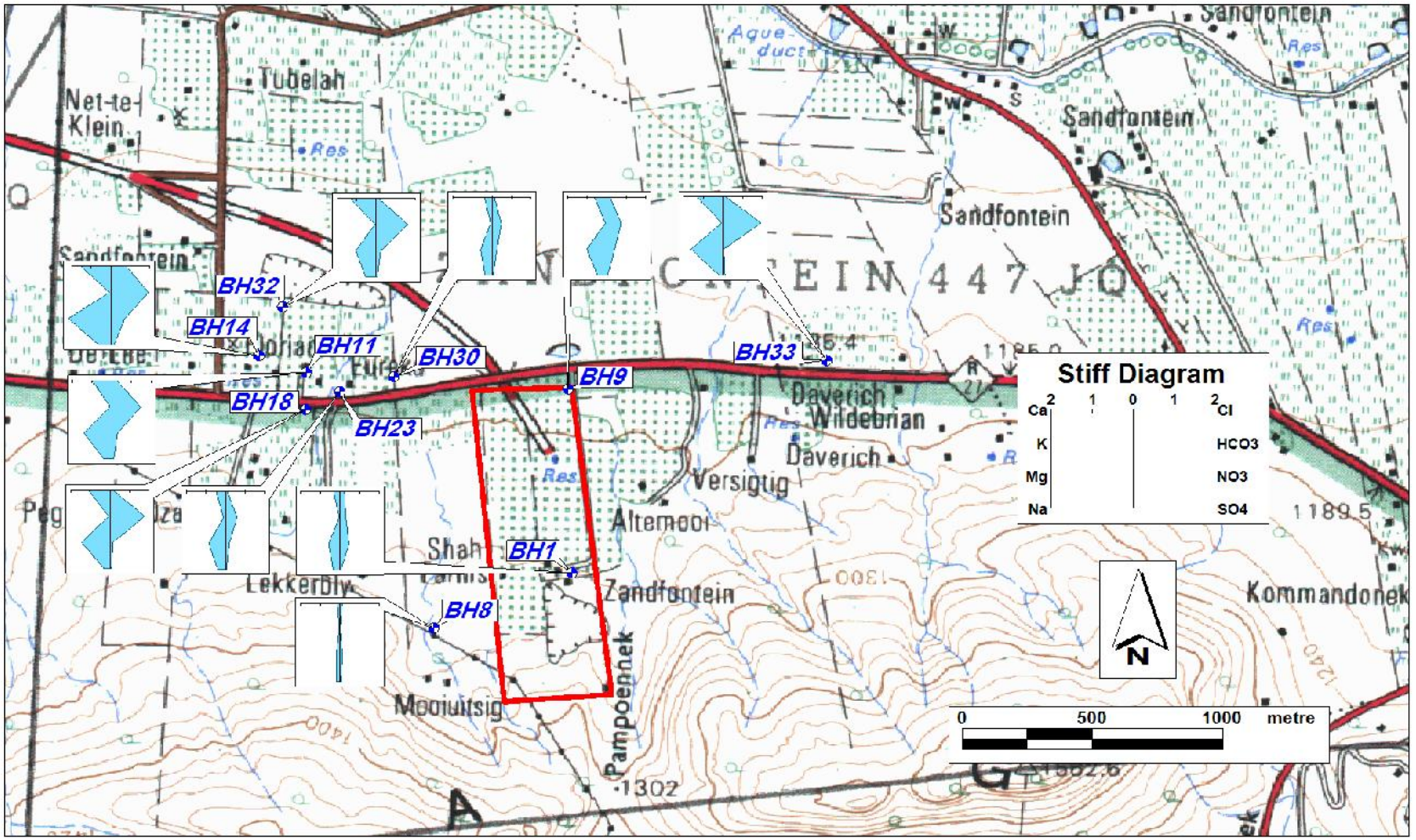


Figure 6: Pie diagrams



Rolfes Silica

Stiff Diagrams of Major Cations & Anions

Figure 7: Stiff diagrams

6 HEALTH RISK SCREENING ASSESSMENT

From the chemistry analysis of the water samples collected the general water quality was good and no health risks exist. It was only in BH8 (pH) and BH14 (NO_3) that chemical parameters show potential health risks, none of which is related to mining activities at Rolfes Silica.

The low pH in BH8 (4.75) is usually associated with the mobilisation of metals which can be a health risk. The metal concentrations in this sample however were found to be acceptably low and most of the metal concentrations even below the detection limit of the analysis method. This serves as a proof of the purity of the quartzite in the area.

The slightly elevated NO_3 concentration found in BH14 is generally well tolerated. It will rarely cause methaemoglobinaemia (blue baby syndrome) in infants. Nitrate is converted to nitrite in the body. The latter combines with the oxygen-carrying red blood pigment, haemoglobin, to form methaemoglobin, which is incapable of carrying oxygen (DWAF, 1996).

7 AQUIFER CLASSIFICATION

An aquifer classification system provides a framework and objective basis for identifying and setting appropriate levels of groundwater resource protection. Other uses could include:

- Defining levels of investigation required for decision making.
- Setting of monitoring requirements.
- Allocation of manpower resources for contamination control functions.

The aquifer classification system used to classify the aquifers is the proposed National Aquifer Classification System of Parsons (1995). This system has a certain amount of flexibility and can be linked to second classifications such as a vulnerability or usage classification. Parsons suggests that aquifer classification forms a very useful planning tool that can be used to guide the management of groundwater issues. He also suggests that some level of flexibility should be incorporated when using such a classification system.

The South African Aquifer System Management Classification is presented by five major classes:

- Sole Source Aquifer System.
- Major Aquifer System.
- Minor Aquifer System.
- Non- Aquifer System.
- Special Aquifer System.

The following definitions are taken from Parsons (1995)[9] and applied as an aquifer classification system:

Sole source aquifer system:

*"*An aquifer that is used to supply 50% or more of domestic water for a given area, and for which there are no reasonable alternative sources should the aquifer become depleted or impacted upon. Aquifer yields and natural water quality are immaterial".

Major aquifer system:

"Highly permeable formations, 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".

[9] Parsons, R.P., (1995), A South African aquifer system management classification. WRC Report No. 77/95, Water Research Commission, Pretoria.

Minor aquifer system:

*"*These can be fractured or potentially fractured rocks that do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are both important for local supplies 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 does occur, although imperceptible, and needs to be considered when assessing risk associated with persistent pollutants".

Special aquifer system:

*"*An aquifer designated as such by the Minister of Water Affairs, after due process".

7.1 AQUIFER CLASSIFICATION

Considering the geology and hydrogeology characteristics as well as the information collected during the hydrocensus, the aquifer directly underlying Rolfes Silica is the most probable to be affected by potential contamination and can be classified as a **"Minor aquifer system".** This was based on the following:

- Quartsite is known to have a very low permeability with water occurring mostly in fractures and along contact zones within the rock. Boreholes are not usually high yielding.
- Due to the fractured nature of the rock the extent of the aquifer is limited and compartments of water bearing aquifers is characteristic of the geology.

In order to achieve the Aquifer System Management and Second Variable Classifications, as well as the Groundwater Quality Management Index, a points scoring system as presented in Table 4 and Table 5 was used.

Table 4: Ratings - Aquifer System Management and Second Variable Classifications

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 – 6	
Second Variable Classification (Weathering/Fracturing)		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

Table 5: Ratings - Groundwater Quality Management (GQM) Classification System

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 - 6	
Aquifer Vulnerability Classification		
Class	Points	Study area
High:	3	
Medium:	2	
Low:	1	1

As part of the aquifer classification, a Groundwater Quality Management (GQM) Index is used to define the level of groundwater protection required. The GQM Index is obtained by multiplying the rating of the aquifer system management and the aquifer vulnerability. The GQM index for the study area is presented in Table 6.

The vulnerability, tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above mentioned, is classified as **low level**.

The level of groundwater protection based on the Groundwater Quality Management Classification:

GQM Index = Aquifer System Management x Aquifer Vulnerability
= 2 X 1 = 2

Table 6: GQM index for the study area

GQM Index	Level of Protection	Study Area
<1	Limited	
1 - 3	Low Level	2
3 - 6	Medium Level	
6 - 10	High Level	
>10	Strictly Non-Degradation	

7.2 AQUIFER PROTECTION CLASSIFICATION

A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a **low level groundwater protection** is required for the aquifers. Reasonable and sound groundwater protection measures are recommended to ensure that no cumulative pollution affects the aquifer, even in the long term.

DWA's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that if any potential risk exists, measures must be taken to limit the risk to the environment, which in this case is:

- The protection of the underlying aquifer
- Downstream areas affected by surface water drainage

8 SITE CONCEPTUAL MODEL

The site conceptual model was developed using a risk based approach, whereby contaminant source areas are identified, pathways are characterised and potential receptors identified.

From a hydrogeological point of view it is expected that the potential contaminants will be mobilised by surface and groundwater from the contaminant sources. Thereafter the contaminants will move from surface into the sub-surface through the unsaturated (vadose) zone and into the saturated zone. Once the groundwater is in the upper weathered aquifer it will follow the surface topography in a northern direction. There also exists a possibility that movement is from the upper weathered or perched aquifer into the underlying fractured aquifer.

8.1 CONTAMINANT SOURCES

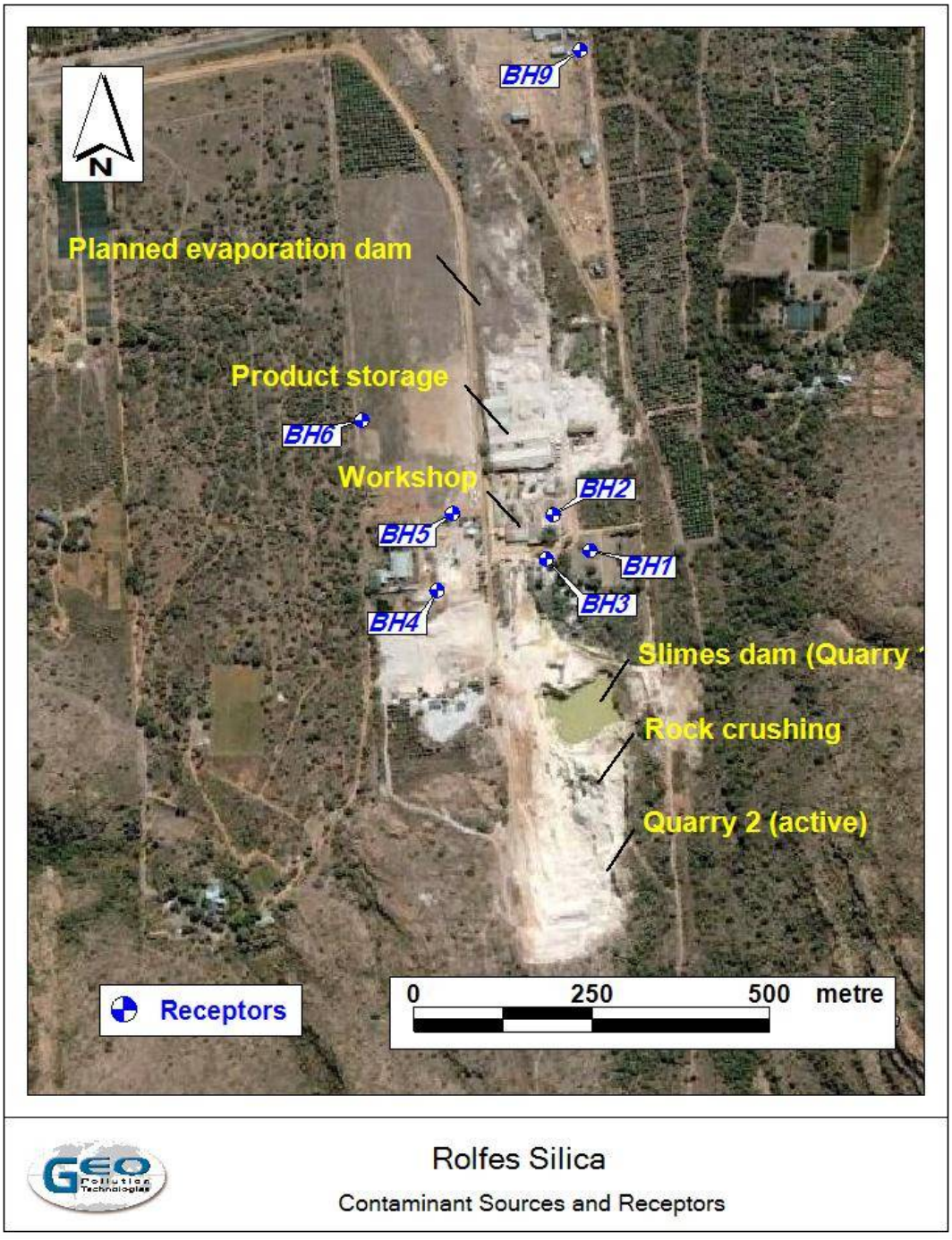
The relevant potential contaminant source areas were identified as the following:

- Workshops and petroleum storage tanks
- Machinery leaking oil and fuel
- Septic tanks / French drains
- General waste facilities
- Suspended solid as a result of mining

The hydraulic characteristics of the source and the geochemical properties of the subsurface will determine the behaviour of the contaminants emanating from the source. In addition, the location and extent of the pollution source will have an effect on the extent of the contaminant plume.

Workshops, fuel dispensing areas, septic tanks, oil fired kilns and waste disposal sites (above and under the ground) may contribute to the contamination potential of the mine. Hydrocarbons may be found in elevated levels in the soil, groundwater and surface water in the areas of the mine where they are handled (workshops and fuel dispensing areas). Hydrocarbon contamination poses the largest risk to the environment. A spill handling procedure is currently in place and hazardous waste is collected by Oilkol. Also, daily dip readings are taken in the diesel and petrol storage tanks.

Although temporary waste disposal sites and septic tanks do not contribute largely to the potential contaminant load of the mine, they may impact in localised areas around the sites. The potential impacts include groundwater, surface water and soil. Currently sewage is being removed by a certified company.



Waste disposal is likely to be minimal especially if the waste is collected for disposal at a municipal waste facility. Waste management procedures are currently in place and waste is removed on a weekly basis.

Suspended solids in the slimes dam may be the only aesthetic impact which the physical mining of the sand may have on the surface water environment. No chemicals are involved in the mining processes at Rolfes Silica and therefore no chemical contamination is expected. Currently there is no contaminant impact on the groundwater.

8.2 PATHWAYS

Pathways along which contaminants may be mobilized and migrate toward groundwater receptors include:

- The vadose zone (unsaturated zone)
- Groundwater (fractured aquifers)
- Surface runoff in storm water or water courses (rivers and streams)
- Airborne contaminants as dust

Seepage from surface hydrocarbon spills or septic tanks into the vadose zone and fracture systems of deeper aquifers can lead to the contamination of groundwater and consequently water supply boreholes. For accurate prediction of the behaviour of a contaminant plume along pathways it is critical that the monitoring and field measurements are representative of the physical environment. It is also important to keep seasonal and annual trends in mind as it effects on the water quality at the receptor. Wind may act as a pathway for contaminants as dust particles settle on surface water resources.

The aquifer is classified as a minor aquifer, while a low level of groundwater protection is required for the aquifer.

8.3 RECEPTORS

Any user of a groundwater or surface water resource that is affected by pollution from any of the above mentioned sources is defined as a receptor. Furthermore, a borehole or river may also be a receptor of deterioration in groundwater quantity and quality. The following receptors may be found:

- Groundwater users by means of borehole abstraction
- Water courses: water users, fauna and flora.

No groundwater users outside the mine properties are likely to be negatively affected by mining activities. Given the water level in the area (~11 mbgl) it is unlikely that groundwater and interflow contributes to the base flow of the surface water streams in the vicinity. Although no downstream receptors are deemed likely to be impacted, it should be verified by monitoring.

9 GROUNDWATER MONITORING SYSTEM

An effective groundwater management plan should include a sound groundwater monitoring network. The reason for a groundwater monitoring network is to manage the impact of the source (Rolfes Silica), has on the surrounding groundwater pathways and potential receptors.

9.1 GROUNDWATER MONITORING NETWORK

A groundwater monitoring system has to adhere to the criteria mentioned below. As a result the system should be developed accordingly.

Source, plume, impact and background monitoring

A groundwater monitoring network should contain monitoring positions which can assess the groundwater status at certain areas. The boreholes can be grouped classification according to the following purposes:

- **Source monitoring** – monitoring boreholes are placed close to or in the source of contamination to evaluate the impact thereof on the groundwater chemistry. **BH1, BH2 and BH3 (Boreholes A, B and C on site) comply with this requirement.**
- **Plume monitoring** – monitoring boreholes are placed in the primary groundwater plume's migration path to evaluate the migration rates and chemical changes along the pathway. **BH5, BH6, BH7, BH8 and BH9 comply with this requirement**.
- **Impact monitoring** – monitoring of possible impacts of contaminated groundwater on sensitive ecosystems or other receptors. These monitoring points are also installed as early warning systems for contamination break-through at areas of concern. **BH1, BH2, BH3, BH4, BH5**, **BH7, BH8 and BH9**
- **Background monitoring** – background groundwater quality is essential to evaluate the impact of a specific action/pollution source on the groundwater chemistry. **Any of the following boreholes comply with this requirement: BH18, BH30, BH32 and BH33.**
- **Surface water monitoring –** As groundwater is unlikely to contribute to the base flow of tributaries, the only surface water quality monitoring required is in the **slimes dam** (source)**.**

9.1.1 System response monitoring network

Groundwater levels – the response of water levels to abstraction are monitored. Static water levels are also used to determine the flow direction and hydraulic gradient within an aquifer. Where possible all of the above mentioned borehole's water levels need to be recorded during each monitoring event.

9.1.2 Monitoring frequency

Water quality monitoring should to take place bi-annually before and after the wet season, i.e. during September and March. It is important to note that a groundwater-monitoring network should also be dynamic. This means that the network should be extended over time to accommodate the migration of potential contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources.

9.2 MONITORING PARAMETERS

The identification of the monitoring parameters is crucial and depends on the chemistry of possible pollution sources. They comprise a set of physical and/or chemical parameters (e.g. groundwater levels and predetermined organic and inorganic chemical constituents). Once a pollution indicator has been identified it can be used as a substitute to full analysis and therefore save costs. The use of pollution indicators should be validated on a regular basis in the different sample position.

9.2.1 Abbreviated analysis (pollution indicators)

Physical Parameters:

- Groundwater levels

Chemical Parameters:

- Field measurements:
  - pH, EC
- Laboratory analyses:
  - Major anions and cations (Ca, Na, Cl, SO4)
  - Other parameters (EC)

9.2.2 Full analysis

Physical Parameters:

- Groundwater levels

Chemical Parameters:

- Field measurements:
  - pH, EC
- Laboratory analyses:
  - Anions and cations (Ca, Mg, Na, K, NO_3, Cl, SO_4, F, Fe, Mn, Al, & Alkalinity)
- Other parameters (pH, EC, TDS)
- Petroleum hydrocarbon contaminants (where applicable, near workshops and petroleum

handling facilities)

- Sewage related contaminants (E.Coli, Faecal Coliforms and Total Coliforms) in boreholes in proximity to septic tanks or French drains.

10 CONCLUSIONS

- The land use around Rolfes Silica is dominated by agriculture with a number of nurseries in the vicinity. Numerous steep-sided gullies are found along the slope of the Magaliesburg draining in a northern direction toward the Crocodile River.
- The Rolfes Silica deposit is located in the Magaliesberg Quartzite Formation of the Pretoria Group. This formation is composed of quartzite, feldspathic quartzite, shale, hornfels and quartzite typically associated with hard rock fractured aquifers.
- From the hydrocensus data an average borehole yield of between 1 and 2 l/s was calculated for the area under investigation which fall within the regional estimated range of 0.5 to 2 l/s.
- Through qualified guesses a realistic average recharge of ~ 4.3% of the rainfall is estimated which corresponds well to the average of the Crocodile West and Marico Water Management Area (4%).The site is part of the where the groundwater recharge is estimated as ~ 4% of the mean annual rainfall.
- A total of 33 hydrocensus boreholes were found located in a 1-2 km radius around the site. Groundwater is predominantly used for potable water, irrigation, livestock watering, aqua farming and also used for small scale irrigation (garden).
- Water levels could be measured in 25 boreholes. The average depth to water level is ~ 12 m bgl and a good correleation between the surface topography and the water levels (84.3%) was found for the boreholes measured during the hydrocensus.
- The overall water quality is good and most of the borehole samples analysed was found to comply with the DWAF water quality guidelines for domestic use. Slightly elevated NO_3 concentrations were detected in BH1 (borehole A on the premises of Rolfes Silica), BH9 and BH14 which is related to agricultural activities. PO_4 was also found in the water sample of BH1 which supports the above statement that it is related to agricultural activities. The pH value in BH8 (4.75) was found to be slightly low but no potential health risks are expected.
- The major constituents in the water chemistry are identified as Ca, Mg, Na, Cl and HCO_3. The spatial distribution of chemical constituents is fairly uniform in all boreholes with NO_3 and HCO_3 (BH8) varying in proportion in some boreholes. The major water type characteristic of the background water type is Mg/Ca-HCO_3 while that of BH8 is Mg/Cl-HCO_3.
- It was only in BH8 (pH) and BH14 (NO_3) that chemical parameters show potential health risks, none of which is related to mining activities at Rolfes Silica.

- No contamination plumes are thus found to be present in the vicinity of or emanating from Rolfes Silica.
- Considering the geology and hydrogeology characteristics as well as the information collected during the hydrocensus, the aquifer directly underlying Rolfes Silica is the most probable to be affected by potential contamination and can be classified as a **"Minor aquifer system"**
- The vulnerability, tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer is classified as **low level**.
- Workshops, fuel dispensing areas, septic tanks, oil fired kilns and waste disposal sites (above and under the ground) may contribute to the contamination potential of the mine. No chemicals are involved in the mining processes at Rolfes Silica and therefore no chemical contamination is expected. Currently there is no contaminant impact on the groundwater
- Water quality monitoring should to take place bi-annually before and after the wet season, i.e. during September and March. Monitoring paramenters should include hydrocarbons and biological parameters.

11 RECOMMENDATIONS

It is further recommended that the groundwater be managed in a sustainable manner. The groundwater management plan and a groundwater monitoring program should be established at the proposed development.

- Prevention of contamination in source areas as listed under section 8.1.
- Any discharge or storm water runoff from site should be prevented.
- Water levels should be measured on a frequent basis around the active quarry and the amount of water removed monitored.
- Groundwater quality should be monitored bi-annually. Water samples must be taken from all the monitoring boreholes using approved sampling techniques and adhering to recognised sampling procedures. Further recommendations can be made regarding the sampling frequency after the first year.
- Monitoring parameters should include E.coli and total faecal coliforms as well as hydrocarbons.
- The monitoring data should be evaluated by a competent hydrogeologist to identify trends and modify groundwater monitoring network if necessary.

APPENDIX A

HYDROCENSUS FORMS

GEO Pollution Technologies Gauteng

HYDROCENSUS of GROUNDWATER

GEO POLLUTION TECHNOLOGIES
CONSULTING SCIENTISTS
TEL (012) 804 8120, FAX (012) 804 8140
PO BOX 38384, GARSFONTEIN EAST, 0060

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Rolfes Silica**		
Address:		Tel:	**012 258 9912**
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 1**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.72677**						When last pumped:	Hours	**1**	Days		Currently		N/A					
X-coordinate: (East)	**27.7936**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1211**	mamsl					Depth to water table (SWL):	**11.35**	mbgl	No access									
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes	**X**	No									
Collar height:	Level		**50**	mm			Float/pumped sample:	Float		Pump	**X**	Tank							

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households								No. of people	**201 (drinking water)**												
Other uses:	**Kitchen for office, purifier installed on separate tap**																					
Possible future use:																						

Additional Borehole Information

Date drilled:	**±1990**		Un		Depth of water strikes:												Un	**X**	
Depth drilled:			Un	**X**	Pump size:								**2.2**	kW	Un				
Casing type:	Steel		Un	**X**	Yield:		Gal		**6000**	l/h	Un								
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**	No			Vol.								
Depth of casing:		m	Un	**X**	How often pumped:	As needed					Daily	**X**							
Length of perforated casing:		m	Un	**X**		Auto level control													

Notes

Pumped 4 hrs per day to 2 5000 l tanks

Un = Unknown

Photo

HYDROCENSUS of GROUNDWATER

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Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Rolfes Silica**		
Address:		Tel:	**012 258 9912**
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 2**						In use:	Yes				No	**X**						
Y-coordinate: (South)	**-25.72632**						When last pumped:	Hours		Days		Currently		N/A	**X**				
X-coordinate: (East)	**27.79308**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1207**	mamsl					Depth to water table (SWL):	**11.86**	mbgl	No access									
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes		No	**X**								
Collar height:	Level		**200**	mm			Float/pumped sample:	Float		Pump		Tank							

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households						No. of people															
Other uses:																						
Possible future use:																						

Additional Borehole Information

Date drilled:	**±1990**			Un		Depth of water strikes:										Un	**X**		
Depth drilled:				Un	**X**	Pump size:									kW	Un	**X**		
Casing type:	Steel			Un	**X**	Yield:			Gal						l/h	Un	**X**		
	Plastic			Un	**X**	Pump to reservoir:	Yes			No		**X**				Vol.			
Depth of casing:			m	Un	**X**	How often pumped:	As needed									Daily			
Length of perforated casing:			m	Un	**X**		Auto level control												

Notes

Pump was broken at the time of hydrocensus.

Un = Unknown

Photo

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HYDROCENSUS of GROUNDWATER

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Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Rolfes Silica**		
Address:		Tel:	**012 258 9912**
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 3**				In use:	Yes	X	No			
Y-coordinate: (South)	**-25.72688**				When last pumped:	Hours		Days		Currently	X	N/A	
X-coordinate: (East)	**27.79299**				Pump type:	Sub	X	Wind		Mono		None	
Z-coordinate:		**1224**	mamsl		Depth to water table (SWL):		mbgl	No access	X		
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes		No	X	
Collar height:	Level		**200**	mm	Float/pumped sample:	Float		Pump		Tank	

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households						No. of people									
Other uses:	**For sanitation and household, not for drinking**															
Possible future use:																

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:				Un	X
Depth drilled:			Un	X	Pump size:		**2.2**	kW	Un	
Casing type:	Steel		Un	X	Yield:	Gal	**6000**	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes	X	No	Vol.	**5 kL**
Depth of casing:		m	Un	X	How often pumped:		As needed		Daily	X
Length of perforated casing:		m	Un	X			Auto level control			

Notes

Pumped 4 hrs per day. This borehole was originally pumped at 10 kL/h, but the pump size was reduced and it now pumps about 6 kL/h.

Un = Unknown

Photo

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of
GROUNDWATER

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PO BOX 38384, GARSFONTEIN EAST, 0060

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Rolfes Silica (currently rented out to HRM - Tony Hebden)**		
Address:		Tel:	**012 258 9912**
		Fax:	
		Cell:	**082 923 2490**

Borehole / Monitoring Well Info

Borehole number:	**BH / 4**					In use:	Yes	X		No			
Y-coordinate: (South)	**-25.72729**					When last pumped:	Hours		Days		Currently		N/A X
X-coordinate: (East)	**27.79146**					Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:				**1226**	mamsl	Depth to water table (SWL):				mbgl	No access		X
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes				No	X	
Collar height:	Level	X			mm	Float/pumped sample:	Float				Pump		Tank

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households						No. of people	**10**								
Other uses:	**Plant processes**															
Possible future use:																

Additional Borehole Information

Date drilled:	**2006**		Un		Depth of water strikes:			Un	X
Depth drilled:			Un	X	Pump size:	**2.2**	kW	Un	
Casing type:	Steel		Un	X	Yield:	Gal	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes X	No	Vol.	
Depth of casing:		m	Un	X	How often pumped:	As needed		Daily	
Length of perforated casing:		m	Un	X		Auto level control			X

Notes

The pump was broken at the time of the hydrocensus, waiting to be fixed by an electrician. BH5 is in use as back-up.

This borehole is used to fill 3X10kL tanks.

Un = Unknown

Photo

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HYDROCENSUS of GROUNDWATER

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Rolfes Silica (currently rented out to HRM - Tony Hebden)**		
Address:		Tel:	**012 258 9912**
		Fax:	
		Cell:	**082 923 2490**

Borehole / Monitoring Well Info

Borehole number:	**BH / 5**				In use:	Yes	X		No		
Y-coordinate: (South)	**-25.72631**				When last pumped:	Hours		Days		Currently	X	N/A	
X-coordinate: (East)	**27.79167**				Pump type:	Sub	X	Wind		Mono		None	
Z-coordinate:			**1217**	mamsl	Depth to water table (SWL):		mbgl	No access		X
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes	X	No		
Collar height:	Level		**150**	mm	Float/pumped sample:	Float		Pump	X	Tank	

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households						No. of people	**10**								
Other uses:	**Plant processes**															
Possible future use:																

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:				Un	X
Depth drilled:			Un	X	Pump size:	**2.2**	kW		Un	
Casing type:	Steel		Un	X	Yield:		Gal	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes	X	No		Vol.
Depth of casing:		m	Un	X	How often pumped:	As needed	X	Daily		
Length of perforated casing:		m	Un	X		Auto level control				

Notes

This borehole is used to fill 3X10kL tanks. It is pumped for 5 hours per day.

Un = Unknown

Photo

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HYDROCENSUS of GROUNDWATER

FF 02 rev 02 | Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Rolfes Silica**		
Address:		Tel:	**012 258 9912**
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 6**				In use:	Yes				No	X		
Y-coordinate: (South)	**-25.72513**				When last pumped:	Hours		Days		Currently		N/A	X
X-coordinate: (East)	**27.79039**				Pump type:	Sub		Wind		Mono		None	X
Z-coordinate:			**1217**	mamsl	Depth to water table (SWL):	**11.08**	mbgl	No access					X
Diameter:	165mm		225mm	X	mm	Sample taken:	Yes		No	X			
Collar height:	Level		**230**	mm	Float/pumped sample:	Float		Pump		Tank			

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households				No. of people											
Other uses:																
Possible future use:																

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:				Un	X
Depth drilled:	**30 m**		Un		Pump size:		**2.2**	kW	Un	
Casing type:	Steel		Un	X	Yield:	Gal		l/h	Un	X
	Plastic		Un	X	Pump to reservoir:	Yes	No	X	Vol.	
Depth of casing:		m	Un	X	How often pumped:	As needed			Daily	
Length of perforated casing:		m	Un	X		Auto level control				

Notes

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. C Hattingh**		
Address:	**Portion 5 Zandfontein**	Tel:	
		Fax:	
		Cell:	**082 653 4756**

Borehole / Monitoring Well Info

Borehole number:	**BH / 7**						In use:	Yes				No	**X**						
Y-coordinate: (South)	**-25.72874**						When last pumped:	Hours		Days		Currently		N/A	**X**				
X-coordinate: (East)	**27.78859**						Pump type:	Sub		Wind		Mono		None	**X**				
Z-coordinate:	**1229**	mamsl					Depth to water table (SWL):	**17.5**	mbgl	No access									
Diameter:	165mm		225mm	**X**		mm	Sample taken:	Yes		No	**X**								
Collar height:	Level		**220**	mm			Float/pumped sample:	Float		Pump		Tank							

Water Application

Garden/Landscape:	Garden	**X**	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game	**X**	Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households						No. of people															
Other uses:																						
Possible future use:																						

Additional Borehole Information

Date drilled:	**1997**		Un		Depth of water strikes:	**40 - 42 m**							Un		
Depth drilled:	**50 m**		Un		Pump size:							kW	Un	**X**	
Casing type:	Steel		Un	**X**	Yield:		Gal	**20 000**				l/h	Un		
	Plastic		Un	**X**	Pump to reservoir:	Yes		No					Vol.		
Depth of casing:	**6**	m	Un		How often pumped:	As needed							Daily		
Length of perforated casing:		m	Un	**X**		Auto level control									

Notes

Pump was stolen, to be replaced. Used for irrigation.

Un = Unknown

Photo

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Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. C Hattingh**		
Address:	**Portion 5 Zandfontein**	Tel:	
		Fax:	
		Cell:	**082 653 4756**

Borehole / Monitoring Well Info

Borehole number:	**BH / 8**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.72871**						When last pumped:	Hours		Days		Currently	**X**	N/A					
X-coordinate: (East)	**27.78834**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1229**	mamsl					Depth to water table (SWL):	**28.8**	mbgl	No access									
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes	**X**	No									
Collar height:	Level		**250**	mm			Float/pumped sample:	Float		Pump	**X**	Tank							

Water Application

Garden/Landscape:	Garden	**X**	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle	**X**	Game	**X**	Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households						No. of people	**15**														
Other uses:																						
Possible future use:																						

Additional Borehole Information

Date drilled:	**1993**		Un		Depth of water strikes:	**40 m**							Un		
Depth drilled:	**45 m**		Un		Pump size:							kW	Un	**X**	
Casing type:	Steel		Un	**X**	Yield:		Gal	**4 500**	l/h	Un					
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**	No		Vol.					
Depth of casing:	**6**	m	Un		How often pumped:	As needed				Daily	**X**				
Length of perforated casing:		m	Un	**X**		Auto level control									

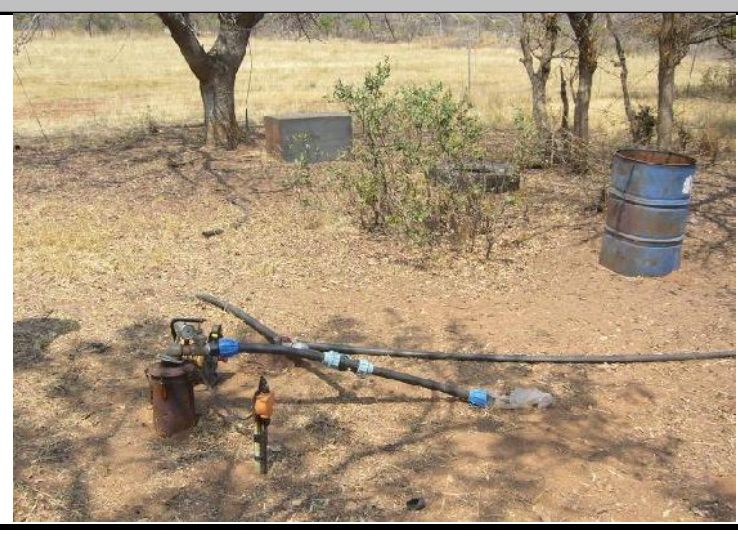
Notes

Borehole is pumped for 6 hours per day to fill 6 x 5 kL tanks

and a dam.

Un = Unknown

Photo



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HYDROCENSUS of GROUNDWATER

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. J. Hattingh (Brits pale)**		
Address:		Tel:	
		Fax:	
		Cell:	**083 377 6464**

Borehole / Monitoring Well Info

Borehole number:	**BH / 9**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.72041**						When last pumped:	Hours	**X**	Days		Currently		N/A					
X-coordinate: (East)	**27.79342**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1199**	mamsl					Depth to water table (SWL):	**8**	mbgl	No access									
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes	**X**	No									
Collar height:	Level		**330**	mm			Float/pumped sample:	Float		Pump	**X**	Tank							

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households						No. of people	**20**														
Other uses:	**water use at plant**																					
Possible future use:																						

Additional Borehole Information

Date drilled:	**1993**		Un		Depth of water strikes:							Un	**X**		
Depth drilled:			Un	**X**	Pump size:						kW	Un	**X**		
Casing type:	Steel		Un	**X**	Yield:		Gal	**3 500**	l/h	Un					
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**	No		Vol.					
Depth of casing:		m	Un	**X**	How often pumped:	As needed				Daily	**X**				
Length of perforated casing:		m	Un	**X**		Auto level control									

Notes

Borehole is pumped for 4 hours per day to fill 1 x 5 kL tank

Un = Unknown

Photo

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HYDROCENSUS of GROUNDWATER

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. J. C van Dyk (Serenity plant park)**		
Address:	**Portion 22 Zandfontein**	Tel:	
		Fax:	
		Cell:	**082 444 1270**

Borehole / Monitoring Well Info

Borehole number:	**BH / 10**				In use:	Yes	X		No			
Y-coordinate: (South)	**-25.72032**				When last pumped:	Hours	X	Days		Currently		N/A
X-coordinate: (East)	**27.78218**				Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:			**1204**	mamsl	Depth to water table (SWL):	**23.92**	mbgl	No access				
Diameter:	165mm		225mm	X	mm	Sample taken:	Yes		No	X		
Collar height:	Level		**230**	mm	Float/pumped sample:	Float		Pump	X	Tank		

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	X
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes	X	No		Volume and no. of tanks:	**1 x 5000 L**										
Domestic:	No. of households				No. of people	**5**										
Other uses:	**Nursery**															
Possible future use:																

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:					Un	X
Depth drilled:	**60 m**		Un		Pump size:			**2.2**	kW	Un	
Casing type:	Steel		Un	X	Yield:		Gal	**3 000**	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes	X	No		Vol.	
Depth of casing:		m	Un	X	How often pumped:			As needed		Daily	X
Length of perforated casing:		m	Un	X					Auto level control		

Notes

Borehole is pumped for 6 hours per day to fill a dam.

Dam: 1.7 x 9 m.

Un = Unknown

Photo

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HYDROCENSUS of GROUNDWATER

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. J. C van Dyk (Serenity plant park)**		
Address:	**Portion 22 Zandfontein**	Tel:	
		Fax:	
		Cell:	**082 444 1270**

Borehole / Monitoring Well Info

Borehole number:	**BH / 11**			In use:	Yes	X		No			
Y-coordinate: (South)	**-25.7199**			When last pumped:	Hours	X	Days		Currently		N/A
X-coordinate: (East)	**27.78342**			Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:	**1201**	mamsl		Depth to water table (SWL):	**17.47**	mbgl	No access				
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes	X	No		
Collar height:	Level		**180**	mm	Float/pumped sample:	Float		Pump	X	Tank	

Water Application

Garden/Landscape:	Garden	X	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	X
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households	**2**			No. of people	**15**										
Other uses:																
Possible future use:																

Additional Borehole Information

Date drilled:		Un	X	Depth of water strikes:				Un	X
Depth drilled:	**150 m**	Un		Pump size:		**2.2**	kW	Un	
Casing type: Steel		Un	X	Yield:	Gal	**3 000**	l/h	Un	
Casing type: Plastic		Un	X	Pump to reservoir:	Yes	X	No	Vol.	
Depth of casing:	m	Un	X	How often pumped:	As needed		Daily	X	
Length of perforated casing:	m	Un	X		Auto level control				

Notes

Borehole is pumped for 5 hours per day to fill 2 x 10 kL tanks.

Un = Unknown

Photo

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HYDROCENSUS of GROUNDWATER

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Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. J. C van Dyk (Serenity plant park)**		
Address:	**Portion 22 Zandfontein**	Tel:	
		Fax:	
		Cell:	**082 444 1270**

Borehole / Monitoring Well Info

Borehole number:	**BH / 12**					In use:	Yes	X		No			
Y-coordinate: (South)	**-25.71977**					When last pumped:	Hours	X	Days		Currently		N/A
X-coordinate: (East)	**27.78371**					Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:	**1201**				mamsl	Depth to water table (SWL):	**16.13**	mbgl	No access				
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes		No	X			
Collar height:	Level		**240**		mm	Float/pumped sample:	Float		Pump		Tank		

Water Application

Garden/Landscape:	Garden	X	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other		
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha	
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other		
No of:																	
Aqua Farming:	Yes		No	X	Volume and no. of tanks:												
Domestic:	No. of households						No. of people										
Other uses:	**swimming pool**																
Possible future use:																	

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:			Un	X
Depth drilled:	**50 m**		Un		Pump size:	**2.2**	kW	Un	
Casing type:	Steel		Un	X	Yield:	Gal	**3 000** l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes	No X	Vol.	
Depth of casing:		m	Un	X	How often pumped:	As needed	X	Daily	
Length of perforated casing:		m	Un	X		Auto level control			

Notes

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. J. C van Dyk (Serenity plant park)**		
Address:	**Portion 22 Zandfontein**	Tel:	
		Fax:	
		Cell:	**082 444 1270**

Borehole / Monitoring Well Info

Borehole number:	**BH / 13**			In use:	Yes			No	X		
Y-coordinate: (South)	**-25.72048**			When last pumped:	Hours		Days		Currently		N/A X
X-coordinate: (East)	**27.78348**			Pump type:	Sub		Wind		Mono		None X
Z-coordinate:	**1201**		mamsl	Depth to water table (SWL):	**12.41**	mbgl	No access				
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes		No	X	
Collar height:	Level				mm	Float/pumped sample:	Float		Pump		Tank

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households						No. of people									
Other uses:																
Possible future use:																

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:					Un	X
Depth drilled:			Un	X	Pump size:				kW	Un	X
Casing type:	Steel		Un	X	Yield:		Gal		l/h	Un	X
	Plastic		Un	X	Pump to reservoir:	Yes		No	X	Vol.	
Depth of casing:		m	Un	X	How often pumped:		As needed			Daily	
Length of perforated casing:		m	Un	X			Auto level control				

Notes	Photo
	No photograph available.
Un = Unknown	

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HYDROCENSUS of GROUNDWATER

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TEL (012) 804 8120, FAX (012) 804 8140
PO BOX 38384, GARSFONTEIN EAST, 0060

FF 02 rev 02 | Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**29/09/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Cock & Bull Restaurant**		
Address:		Tel:	
		Fax:	
		Cell:	**072 026 6143**

Borehole / Monitoring Well Info

Borehole number:	**BH / 14**			In use:	Yes	X		No			
Y-coordinate: (South)	**-25.71933**			When last pumped:	Hours	X	Days		Currently		N/A
X-coordinate: (East)	**27.78162**			Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:	**1200**	mamsl		Depth to water table (SWL):		mbgl	No access		X		
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes	X	No		
Collar height:	Level	X		mm		Float/pumped sample:	Float		Pump	X	Tank

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other		
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha	
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other		
No of:																	
Aqua Farming:	Yes		No	X	Volume and no. of tanks:												
Domestic:	No. of households				No. of people	**30**											
Other uses:	**Clients of the restaurant**																
Possible future use:																	

Additional Borehole Information

Date drilled:		Un	X	Depth of water strikes:			Un	X
Depth drilled:		Un	X	Pump size:	**2.2**	kW	Un	
Casing type: Steel		Un	X	Yield:	Gal	l/h	Un	X
Casing type: Plastic		Un	X	Pump to reservoir:	Yes X	No	Vol.	
Depth of casing:	m	Un	X	How often pumped:	As needed		Daily	
Length of perforated casing:	m	Un	X		Auto level control			X

Notes

3 boreholes pumped to fill 2 x 10 kL tanks.

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Moolman (Dan Man Boerdery)**		
Address:		Tel:	
		Fax:	
		Cell:	**082 823 6803**

Borehole / Monitoring Well Info

Borehole number:	**BH / 15**				In use:	Yes	X		No			
Y-coordinate: (South)	**-25.72605**				When last pumped:	Hours		Days		Currently	X	N/A
X-coordinate: (East)	**27.78114**				Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:			**1231**	mamsl	Depth to water table (SWL):	**5.09**	mbgl	No access				
Diameter:	165mm		225mm	X	mm	Sample taken:	Yes	X	No			
Collar height:	Level		**400**	mm	Float/pumped sample:	Float		Pump	X	Tank		

Water Application

Garden/Landscape:	Garden	X	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	
Area of garden/crop:	**5**	ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households	**6**			No. of people	**30**										
Other uses:																
Possible future use:																

Additional Borehole Information

Date drilled:	**1960**		Un		Depth of water strikes:				Un	X
Depth drilled:	**40 m**		Un		Pump size:		**2.2**	kW	Un	
Casing type:	Steel		Un	X	Yield:	**2000**	Gal	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes	X	No	Vol.	
Depth of casing:	**6**	m	Un		How often pumped:		As needed		Daily	X
Length of perforated casing:		m	Un	X			Auto level control			

Notes

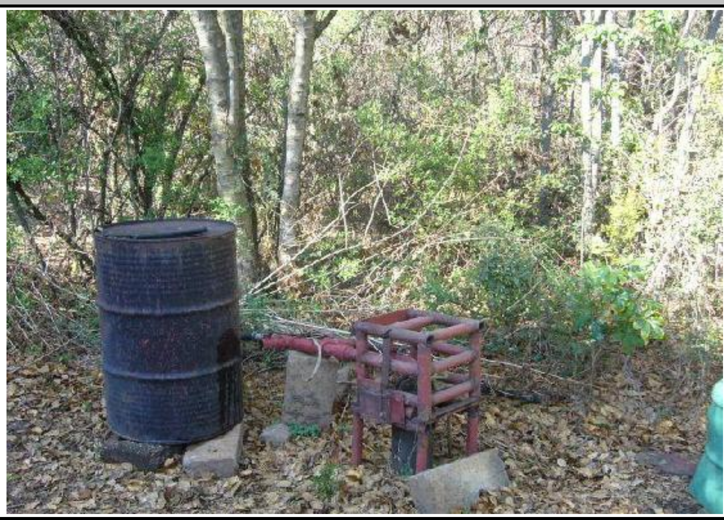
Borehole is pumped for 8 hours per day to fill 5 x 5000 L tanks

and a dam (20 X 2.5 m).

Used for irrigation of seedlings.

Un = Unknown

Photo



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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Moolman (Dan Man Boerdery)**		
Address:		Tel:	
		Fax:	
		Cell:	**082 823 6803**

Borehole / Monitoring Well Info

Borehole number:	**BH / 16**						In use:	Yes		**X**		No						
Y-coordinate: (South)	**-25.72269**						When last pumped:	Hours		Days		Currently	**X**	N/A				
X-coordinate: (East)	**27.78319**						Pump type:	Sub	**X**	Wind		Mono		None				
Z-coordinate:	**1210**	mamsl					Depth to water table (SWL):	**18.07**	mbgl	No access								
Diameter:	165mm		225mm	**X**		mm	Sample taken:	Yes		No	**X**							
Collar height:	Level		**50**	mm			Float/pumped sample:	Float		Pump		Tank						

Water Application

Garden/Landscape:	Garden	**X**	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:	**5**	ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households	**6**					No. of people	**30**														
Other uses:																						
Possible future use:	**Sasol Garage under construction at the time of the hydrocensus.**																					

Additional Borehole Information

Date drilled:	**1930**		Un		Depth of water strikes:								Un	**X**	
Depth drilled:	**45 m**		Un		Pump size:						**2.2**	kW	Un		
Casing type:	Steel		Un	**X**	Yield:	**4600**	Gal					l/h	Un		
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**	No					Vol.		
Depth of casing:	**6**	m	Un		How often pumped:	As needed							Daily	**X**	
Length of perforated casing:		m	Un	**X**		Auto level control									

Notes

Borehole is pumped for 8 hours per day to fill the same dam

as BH15 (20 X 2.5 m).

Used for irrigation of seedlings.

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Moolman (Dan Man Boerdery)**		
Address:		Tel:	
		Fax:	
		Cell:	**082 823 6803**

Borehole / Monitoring Well Info

Borehole number:	**BH / 17**				In use:	Yes	X	No					
Y-coordinate: (South)	**-25.7216**				When last pumped:	Hours	X	Days		Currently		N/A	
X-coordinate: (East)	**27.78323**				Pump type:	Sub	X	Wind		Mono		None	
Z-coordinate:			**1205**	mamsl	Depth to water table (SWL):	**15.04**	mbgl	No access					
Diameter:	165mm		225mm	X	mm	Sample taken:	Yes		No	X			
Collar height:	Level		**350**	mm	Float/pumped sample:	Float		Pump		Tank			

Water Application

Garden/Landscape:	Garden	X	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other		
Area of garden/crop:	**5**	ha		ha		ha		ha		ha		ha		ha		ha	
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other		
No of:																	
Aqua Farming:	Yes		No	X	Volume and no. of tanks:												
Domestic:	No. of households	**6**			No. of people	**30**											
Other uses:																	
Possible future use:	**Sasol Garage under construction at the time of the hydrocensus.**																

Additional Borehole Information

Date drilled:	**1980**		Un		Depth of water strikes:				Un	X
Depth drilled:	**80 m**		Un		Pump size:	**2.2**	kW		Un	
Casing type:	Steel		Un	X	Yield:	**3000**	Gal		l/h	Un
	Plastic		Un	X	Pump to reservoir:	Yes	X	No		Vol.
Depth of casing:	**6**	m	Un		How often pumped:	As needed			Daily	X
Length of perforated casing:		m	Un	X		Auto level control				

Notes	Photo
Borehole is pumped for 8 hours per day to fill the same dam	
as BH15&BH16 (20 X 2.5 m). Also fills 5 x 5000 L tanks.	
Used for irrigation of seedlings.	
Un = Unknown	

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Moolman (Dan Man Boerdery)**		
Address:		Tel:	
		Fax:	
		Cell:	**082 823 6803**

Borehole / Monitoring Well Info

Borehole number:	**BH / 18**				In use:	Yes	X	No		
Y-coordinate: (South)	**-25.72118**				When last pumped:	Hours	X	Days	Currently	N/A
X-coordinate: (East)	**27.7834**				Pump type:	Sub	X	Wind	Mono	None
Z-coordinate:	**1203**	mamsl			Depth to water table (SWL):	**17.2**	mbgl	No access		
Diameter:	165mm		225mm	X	mm	Sample taken:	Yes	X	No	
Collar height:	Level		**360**	mm	Float/pumped sample:	Float		Pump	X	Tank

Water Application

Garden/Landscape:	Garden	X	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other			
Area of garden/crop:	5	ha		ha		ha		ha		ha		ha		ha		ha		
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other			
No of:																		
Aqua Farming:	Yes		No	X	Volume and no. of tanks:													
Domestic:	No. of households	**6**	No. of people	**30**														
Other uses:																		
Possible future use:																		

Additional Borehole Information

Date drilled:	**1980**		Un		Depth of water strikes:				Un	X
Depth drilled:	**100 m**		Un		Pump size:		**13**	kW	Un	
Casing type:	Steel		Un	X	Yield:	**12000**	Gal	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes	X	No	Vol.	
Depth of casing:	**6**	m	Un		How often pumped:	As needed			Daily	X
Length of perforated casing:		m	Un	X		Auto level control				

Notes

Borehole is pumped for 8 hours per day.

Used for irrigation of seedlings.

Four additional boreholes not currently eqquiped, one is dry.

Numbered BH19 to BH22, coordinates & SWL captured in database.

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Claasen**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 23**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.72055**						When last pumped:	Hours	**X**	Days		Currently		N/A					
X-coordinate: (East)	**27.78471**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1203**	mamsl					Depth to water table (SWL):	**11.62**	mbgl	No access									
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes	**X**	No									
Collar height:	Level	**X**				mm	Float/pumped sample:	Float		Pump	**X**	Tank							

Water Application

Garden/Landscape:	Garden	**X**	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households	**1**					No. of people	**7**														
Other uses:																						
Possible future use:																						

Additional Borehole Information

Date drilled:	**1980**		Un		Depth of water strikes:						Un	**X**
Depth drilled:	**35 m**		Un		Pump size:				**1.75**	kW	Un	
Casing type:	Steel		Un	**X**	Yield:	**1000**	Gal			l/h	Un	
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**	No			Vol.	
Depth of casing:	**6**	m	Un		How often pumped:	As needed					Daily	**X**
Length of perforated casing:		m	Un	**X**		Auto level control						

Notes

Borehole is pumped for 12 hours per day to fill 1 x 5000 L tank.

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Claasen**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 24**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.71942**						When last pumped:	Hours	**X**	Days		Currently		N/A					
X-coordinate: (East)	**27.78565**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1198**	mamsl					Depth to water table (SWL):	**9.84**	mbgl	No access									
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes		No	**X**								
Collar height:	Level		**220**	mm			Float/pumped sample:	Float		Pump		Tank							

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits	**X**	Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha	**1**	ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households						No. of people															
Other uses:																						
Possible future use:																						

Additional Borehole Information

Date drilled:	**2009**			Un		Depth of water strikes:	**30 & 79 m**										Un		
Depth drilled:	**80 m**			Un		Pump size:									**2.2**	kW	Un		
Casing type:	Steel			Un	**X**	Yield:	**800**	Gal								l/h	Un		
	Plastic			Un	**X**	Pump to reservoir:	Yes		No							**X**	Vol.		
Depth of casing:	**6**	m		Un		How often pumped:	As needed									**X**	Daily		
Length of perforated casing:		m		Un	**X**		Auto level control												

Notes

Borehole is pumped for 8 hours per day for irrigation of 3000 citrus trees.

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Claasen**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 25**				In use:	Yes	**X**		No			
Y-coordinate: (South)	**-25.71802**				When last pumped:	Hours		Days	**X**	Currently		N/A
X-coordinate: (East)	**27.7865**				Pump type:	Sub	**X**	Wind		Mono		None
Z-coordinate:			**1195**	mamsl	Depth to water table (SWL):	**11**	mbgl	No access				
Diameter:	165mm	**X**	225mm	mm	Sample taken:	Yes		No	**X**			
Collar height:	Level		**130**	mm	Float/pumped sample:	Float		Pump		Tank		

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits	**X**	Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha	**1**	ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:											
Domestic:	No. of households						No. of people									
Other uses:																
Possible future use:																

Additional Borehole Information

Date drilled:			Un	**X**	Depth of water strikes:				Un	**X**
Depth drilled:	**55 m**		Un		Pump size:	**1.75**	kW		Un	
Casing type:	Steel		Un	**X**	Yield:	**800**	Gal		l/h	Un
	Plastic		Un	**X**	Pump to reservoir:	Yes		No	**X**	Vol.
Depth of casing:	**6**	m	Un		How often pumped:	As needed		Daily	**X**	
Length of perforated casing:		m	Un	**X**		Auto level control				

Notes

Borehole is pumped for 8 hours per day for irrigation of 3000 citrus trees.

Un = Unknown

Photo

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FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Claasen**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 26**				In use:	Yes	X	No				
Y-coordinate: (South)	**-25.71721**				When last pumped:	Hours		Days	X	Currently		N/A
X-coordinate: (East)	**27.78603**				Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:			**1190**	mamsl	Depth to water table (SWL):	**11.06**	mbgl	No access				
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes		No	X		
Collar height:	Level		**100**	mm	Float/pumped sample:	Float		Pump		Tank		

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits	X	Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha	**1**	ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households				No. of people											
Other uses:																
Possible future use:																

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:				Un	X
Depth drilled:	**60 m**		Un		Pump size:		**1.75**	kW	Un	
Casing type:	Steel		Un	X	Yield:	**500**	Gal	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes		No	X	Vol.
Depth of casing:	**6**	m	Un		How often pumped:	As needed		Daily	X	
Length of perforated casing:		m	Un	X		Auto level control				

Notes	Photo
Borehole is pumped for 8 hours per day for irrigation of 3000 citrus trees. Not frequently used in rainy season.	

Un = Unknown

HYDROCENSUS of GROUNDWATER

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FF 02 rev 02 — Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. Claasen**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 27**					In use:	Yes	X		No		
Y-coordinate: (South)	**-25.71784**					When last pumped:	Hours		Days	X	Currently	N/A
X-coordinate: (East)	**27.7844**					Pump type:	Sub	X	Wind		Mono	None
Z-coordinate:			**1192**	mamsl		Depth to water table (SWL):	**11.75**	mbgl	No access			
Diameter:	165mm	X	225mm		mm	Sample taken:	Yes		No	X		
Collar height:	Level		**440**	mm		Float/pumped sample:	Float		Pump		Tank	

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits	X	Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha	**0.5**	ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households						No. of people									
Other uses:																
Possible future use:																

Additional Borehole Information

Date drilled:	**2009**		Un		Depth of water strikes:				Un	X
Depth drilled:	**80 m**		Un		Pump size:	**1.75**	kW		Un	
Casing type:	Steel		Un	X	Yield:	**300**	Gal	l/h	Un	
	Plastic		Un	X	Pump to reservoir:	Yes		No	X	Vol.
Depth of casing:	**6**	m	Un		How often pumped:	As needed			Daily	X
Length of perforated casing:		m	Un	X		Auto level control				

Notes

Borehole is pumped dry within 30 minutes after pumping started. BH28 on the same property is dry after blasting at mines in area. BH29 is a backup borehole. Borehole details (coordinates & SW) are captured in the database.

Un = Unknown

Photo

HYDROCENSUS of GROUNDWATER

GEO POLLUTION TECHNOLOGIES
CONSULTING SCIENTISTS
TEL (012) 804 8120, FAX (012) 804 8140
PO BOX 38384, GARSFONTEIN EAST, 0060

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. C Hattingh (tropical garden & lodge)**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 30**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.72003**						When last pumped:	Hours		Days		Currently	**X**	N/A					
X-coordinate: (East)	**27.78677**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1199**	mamsl					Depth to water table (SWL):	**10.28**	mbgl	No access									
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes	**X**	No									
Collar height:	Level		**100**	mm			Float/pumped sample:	Float		Pump	**X**	Tank							

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households						No. of people	**10 - 20**														
Other uses:	**Lodge, 2 chalets and conference centre**																					
Possible future use:																						

Additional Borehole Information

Date drilled:			Un	**X**	Depth of water strikes:								Un	**X**
Depth drilled:	**70 m**		Un		Pump size:					**2.2**	kW		Un	
Casing type:	Steel		Un	**X**	Yield:		Gal				l/h		Un	**X**
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**	No					Vol.	
Depth of casing:	**6**	m	Un		How often pumped:	As needed							Daily	
Length of perforated casing:		m	Un	**X**		Auto level control								**X**

Notes

Borehole is pumped to fill 1 x 5000L tank

Un = Unknown

Photo

Gauteng

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of
GROUNDWATER

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CONSULTING SCIENTISTS
TEL (012) 804 8120, FAX (012) 804 8140
PO BOX 38384, GARSFONTEIN EAST, 0060

FF 02 rev 02 | Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. J Steenkamp**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 31**				In use:	Yes	X		No			
Y-coordinate: (South)	**-25.71736**				When last pumped:	Hours		Days	X	Currently		N/A
X-coordinate: (East)	**27.78114**				Pump type:	Sub	X	Wind		Mono		None
Z-coordinate:		**1194**	mamsl		Depth to water table (SWL):		mbgl	No access				X
Diameter:	165mm		225mm	X	mm	Sample taken:	Yes	X	No			
Collar height:	Level		**300**	mm	Float/pumped sample:	Float		Pump	X	Tank		

Water Application

Garden/Landscape:	Garden	X	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other	
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other	
No of:																
Aqua Farming:	Yes		No	X	Volume and no. of tanks:											
Domestic:	No. of households						No. of people									
Other uses:	**Nursery**															
Possible future use:																

Additional Borehole Information

Date drilled:			Un	X	Depth of water strikes:					Un	X
Depth drilled:	**90 m**		Un		Pump size:			**1.8**	kW	Un	
Casing type:	Steel		Un	X	Yield:		Gal	**5 300**	l/h	Un	X
	Plastic		Un	X	Pump to reservoir:	Yes	X	No		Vol.	
Depth of casing:	**6**	m	Un		How often pumped:			As needed		Daily	X
Length of perforated casing:		m	Un	X				Auto level control			

Notes

Borehole is pumped to fill 3 x 10 kL tanks.

Un = Unknown

Photo

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CONSULTING SCIENTISTS
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PO BOX 38384, GARSFONTEIN EAST, 0060

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. C Hattingh (tropical garden & lodge)**		
Address:		Tel:	
		Fax:	
		Cell:	

Borehole / Monitoring Well Info

Borehole number:	**BH / 32**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.71763**						When last pumped:	Hours		Days	**X**	Currently		N/A					
X-coordinate: (East)	**27.7825**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1195**	mamsl					Depth to water table (SWL):			mbgl		No access							**X**
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes	**X**	No									
Collar height:	Level		**300**	mm			Float/pumped sample:	Float		Pump	**X**	Tank							

Water Application

Garden/Landscape:	Garden		Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households	**5**							No. of people	**30**												
Other uses:																						
Possible future use:	**Irrigation.**																					

Additional Borehole Information

Date drilled:			Un	**X**	Depth of water strikes:								Un	**X**	
Depth drilled:	**90 m**		Un		Pump size:					**3.75**	kW		Un		
Casing type:	Steel		Un	**X**	Yield:		Gal		**5 100**		l/h		Un		
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**		No				Vol.		
Depth of casing:	**6**	m	Un		How often pumped:					As needed			Daily	**X**	
Length of perforated casing:		m	Un	**X**						Auto level control					

Notes

Borehole is pumped to fill 4 x 10 kL tanks.

Un = Unknown

Photo

GEO Pollution Technologies Gauteng

HYDROCENSUS of GROUNDWATER

GEO POLLUTION TECHNOLOGIES
CONSULTING SCIENTISTS
TEL (012) 804 8120, FAX (012) 804 8140
PO BOX 38384, GARSFONTEIN EAST, 0060

FF 02 rev 02 Effective Date: 24 May 2010

Project Name:	**Rolfes Silica**	**Project Number:**	**SHRS-11-302**
Census date:	**04/10/2011**	**Field Technician:**	**Dirk Duvenhage**

Site Information

Owner:	**Mr. B N van der Westhuizen**		
Address:	**Ikwezi Ranch, Plot 54**	Tel:	
	Zandfontein	Fax:	
		Cell:	**083 704 9976**

Borehole / Monitoring Well Info

Borehole number:	**BH / 33**						In use:	Yes		**X**		No							
Y-coordinate: (South)	**-25.71937**						When last pumped:	Hours	**X**	Days		Currently		N/A					
X-coordinate: (East)	**27.80328**						Pump type:	Sub	**X**	Wind		Mono		None					
Z-coordinate:	**1190**	mamsl					Depth to water table (SWL):			mbgl		No access							**X**
Diameter:	165mm	**X**	225mm			mm	Sample taken:	Yes	**X**	No									
Collar height:	Level					mm	Float/pumped sample:	Float		Pump	**X**	Tank							

Water Application

Garden/Landscape:	Garden	**X**	Veg.		Mix		Cotton		Fruits		Grains		Feed		Other							
Area of garden/crop:		ha		ha		ha		ha		ha		ha		ha		ha						
Livestock watering:	Horses		Poultry		Pigs		Sheep / Goats		Cattle		Game		Exotic		Other							
No of:																						
Aqua Farming:	Yes		No	**X**	Volume and no. of tanks:																	
Domestic:	No. of households						No. of people	**16**														
Other uses:	**Lodge**																					
Possible future use:																						

Additional Borehole Information

Date drilled:	**2009**		Un		Depth of water strikes:						Un	**X**
Depth drilled:			Un	**X**	Pump size:			**2.2**	kW		Un	
Casing type:	Steel		Un	**X**	Yield:		Gal	**3 000**	l/h		Un	
	Plastic		Un	**X**	Pump to reservoir:	Yes	**X**	No			Vol.	
Depth of casing:	**6**	m	Un		How often pumped:	As needed					Daily	**X**
Length of perforated casing:		m	Un	**X**		Auto level control						

Notes	Photo
Borehole is pumped to fill 1 x 2000L tanks and 2 x 5000L tanks	**No photograph available.**
Un = Unknown	

APPENDIX B

LABORATORY CERTIFICATE OF ANALYSES

UIS Analytical Services (Pty) Ltd • Reg. No. 2000/027788/07 • VAT No. 4920202969
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E-Mail : amelia@gptglobal.com

FINAL CERTIFICATE OF ANALYSIS	
Report Date	2011-10-27
Date Required	2011-10-16
Contract No	
Order/Ref No	SHRS-11-302

Rolfes Silica

SAMPLE ID	: 263512	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/1	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 1 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	6	
pH Temperature	23.6	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	12	mS/m
TC Temperature	23.6	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	78	mg/l
TDS by EC * 7	84	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	14.8	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	6.63	mg/l
Cr	<0.05	mg/l
Cu	0.05	mg/l
Fe	<0.05	mg/l
K	1.06	mg/l
Mg	7.09	mg/l
Mn	0.05	mg/l
Na	7.72	mg/l
Pb	<0.05	mg/l
Si	5.91	mg/l
Zn	0.08	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

SAMPLE ID	: 263512 (continued)	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/1	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 2 / 12
		REVISION NO	: 0

PARAMETER	**VALUE**	**UNIT**
F	0.163	mg/l
Cl	7.96	mg/l
NO3	28.7	mg/l
NO3 as N	6.47	mg/l
PO4	1.45	mg/l
SO4	2.55	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	**VALUE**	**UNIT**
Sum of Cations	1.28	me/l
Sum of Anions	1.46	me/l
Ion Balance Error	-6.51	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	**VALUE**	**UNIT**
NH4	<2.5	ppm

SAMPLE ID	: 263513	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/8	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 3 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	4.75	
pH Temperature	23.6	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	5	mS/m
TC Temperature	23.6	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	32.5	mg/l
TDS by EC * 7	35	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	<3.5	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	2.38	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	0.66	mg/l
Mg	2.25	mg/l
Mn	0.05	mg/l
Na	4.26	mg/l
Pb	<0.05	mg/l
Si	4.87	mg/l
Zn	0.1	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	4.38	mg/l
NO3	9.27	mg/l
NO3 as N	2.09	mg/l
PO4	<0.8	mg/l
SO4	2.02	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	0.51	me/l
Sum of Anions	0.69	me/l
Ion Balance Error	-14.7	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263514	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/9	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 4 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	6.5	
pH Temperature	23.6	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	15	mS/m
TC Temperature	23.6	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	97.5	mg/l
TDS by EC * 7	105	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	36.3	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	12.6	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	2.8	mg/l
Mg	12.4	mg/l
Mn	<0.05	mg/l
Na	10.8	mg/l
Pb	<0.05	mg/l
Si	16.4	mg/l
Zn	0.06	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	6.07	mg/l
NO3	25	mg/l
NO3 as N	5.65	mg/l
PO4	<0.8	mg/l
SO4	2.2	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	2.2	me/l
Sum of Anions	2.39	me/l
Ion Balance Error	-4.31	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263515	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/11	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 5 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	6.87	
pH Temperature	23.6	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	22	mS/m
TC Temperature	23.6	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	143	mg/l
TDS by EC * 7	154	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	73.7	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	19.8	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	2.97	mg/l
Mg	17.3	mg/l
Mn	<0.05	mg/l
Na	9.36	mg/l
Pb	<0.05	mg/l
Si	16.5	mg/l
Zn	<0.05	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	0.141	mg/l
Cl	9.14	mg/l
NO3	18.3	mg/l
NO3 as N	4.14	mg/l
PO4	<0.8	mg/l
SO4	4.68	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	2.9	me/l
Sum of Anions	3.06	me/l
Ion Balance Error	-2.78	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263516	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/14	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 6 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	6.8	
pH Temperature	23.8	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	38	mS/m
TC Temperature	23.8	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	247	mg/l
TDS by EC * 7	266	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	96.8	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	30.8	mg/l
Cr	<0.05	mg/l
Cu	0.09	mg/l
Fe	<0.05	mg/l
K	2.76	mg/l
Mg	26.2	mg/l
Mn	<0.05	mg/l
Na	14.7	mg/l
Pb	<0.05	mg/l
Si	19.8	mg/l
Zn	0.74	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	27.9	mg/l
NO3	44.5	mg/l
NO3 as N	10.1	mg/l
PO4	<0.8	mg/l
SO4	8.36	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	4.43	me/l
Sum of Anions	4.7	me/l
Ion Balance Error	-2.99	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263517	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/18	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 7 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	7.35	
pH Temperature	23.9	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	21	mS/m
TC Temperature	23.9	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	137	mg/l
TDS by EC * 7	147	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	88.2	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	22	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	2.68	mg/l
Mg	17.6	mg/l
Mn	<0.05	mg/l
Na	7.12	mg/l
Pb	<0.05	mg/l
Si	17.5	mg/l
Zn	<0.05	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	5.22	mg/l
NO3	9.51	mg/l
NO3 as N	2.15	mg/l
PO4	<0.8	mg/l
SO4	3.29	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	2.93	me/l
Sum of Anions	3.09	me/l
Ion Balance Error	-2.67	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263518	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/23	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 8 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	6.47	
pH Temperature	23.9	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	10	mS/m
TC Temperature	23.9	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	65	mg/l
TDS by EC * 7	70	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	29.6	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	9.64	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	3.66	mg/l
Mg	10.4	mg/l
Mn	<0.05	mg/l
Na	9.04	mg/l
Pb	<0.05	mg/l
Si	16.3	mg/l
Zn	0.08	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	3.15	mg/l
NO3	12.1	mg/l
NO3 as N	2.74	mg/l
PO4	<0.8	mg/l
SO4	1.87	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	1.83	me/l
Sum of Anions	1.98	me/l
Ion Balance Error	-3.97	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263519	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/30	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 9 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	6.47	
pH Temperature	23.9	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	9	mS/m
TC Temperature	23.9	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	58.5	mg/l
TDS by EC * 7	63	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	23.3	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	7.85	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	2.99	mg/l
Mg	7.12	mg/l
Mn	<0.05	mg/l
Na	8.1	mg/l
Pb	<0.05	mg/l
Si	11	mg/l
Zn	0.05	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	3.93	mg/l
NO3	15.1	mg/l
NO3 as N	3.41	mg/l
PO4	<0.8	mg/l
SO4	2.22	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	1.41	me/l
Sum of Anions	1.57	me/l
Ion Balance Error	-5.49	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263520	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/32	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 10 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	7.39	
pH Temperature	24	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	21	mS/m
TC Temperature	24	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	137	mg/l
TDS by EC * 7	147	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	80.7	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	26.5	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	2.37	mg/l
Mg	12.7	mg/l
Mn	<0.05	mg/l
Na	12.5	mg/l
Pb	<0.05	mg/l
Si	19.8	mg/l
Zn	<0.05	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	4.5	mg/l
NO3	14.3	mg/l
NO3 as N	3.23	mg/l
PO4	<0.8	mg/l
SO4	2.67	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	2.97	me/l
Sum of Anions	3.17	me/l
Ion Balance Error	-3.18	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263521	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/33	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 11 / 12
		REVISION NO	: 0

METHOD : pH
METHOD NO. : UIS-EA-T003 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
pH	6.83	
pH Temperature	24	Deg C

METHOD : Electrical Conductivity
METHOD NO. : UIS-EA-T001 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Total Conductivity	22	mS/m
TC Temperature	24	Deg C

METHOD : Calculated Total Dissolved Solids from EC
METHOD NO. : UIS-CP-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
TDS by EC * 6.5	143	mg/l
TDS by EC * 7	154	mg/l

METHOD : P and Total (M) Alkalinity
METHOD NO. : UIS-EA-T002 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
P Alkalinity	<0.6	mg/l CaCO3
Total (M) Alkalinity	97.5	mg/l CaCO3

METHOD : Disolved Cations in Water by ICP-OES
METHOD NO. : UIS-TEA-T001 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Al	<0.05	mg/l
As	<0.1	mg/l
Ca	26.5	mg/l
Cr	<0.05	mg/l
Cu	<0.05	mg/l
Fe	<0.05	mg/l
K	2.48	mg/l
Mg	19.8	mg/l
Mn	<0.05	mg/l
Na	4.53	mg/l
Pb	<0.05	mg/l
Si	20.2	mg/l
Zn	0.15	mg/l

METHOD : Anions by Ion Chromatography
METHOD NO. : UIS-EA-T008 (accredited) **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
F	<0.1	mg/l
Cl	4.98	mg/l
NO3	2.35	mg/l
NO3 as N	0.53	mg/l
PO4	<0.8	mg/l
SO4	4.8	mg/l

METHOD : Ion Balance Error
METHOD NO. : UIS-CP-T002 **DATE COMPLETED** : 2011-10-27

PARAMETER	VALUE	UNIT
Sum of Cations	3.22	me/l
Sum of Anions	3.34	me/l
Ion Balance Error	-1.91	%

METHOD : Ammonium by Ion Chromatography (IC)
METHOD NO. : UIS-EA-T009 (accredited) **DATE COMPLETED** : 2011-10-27

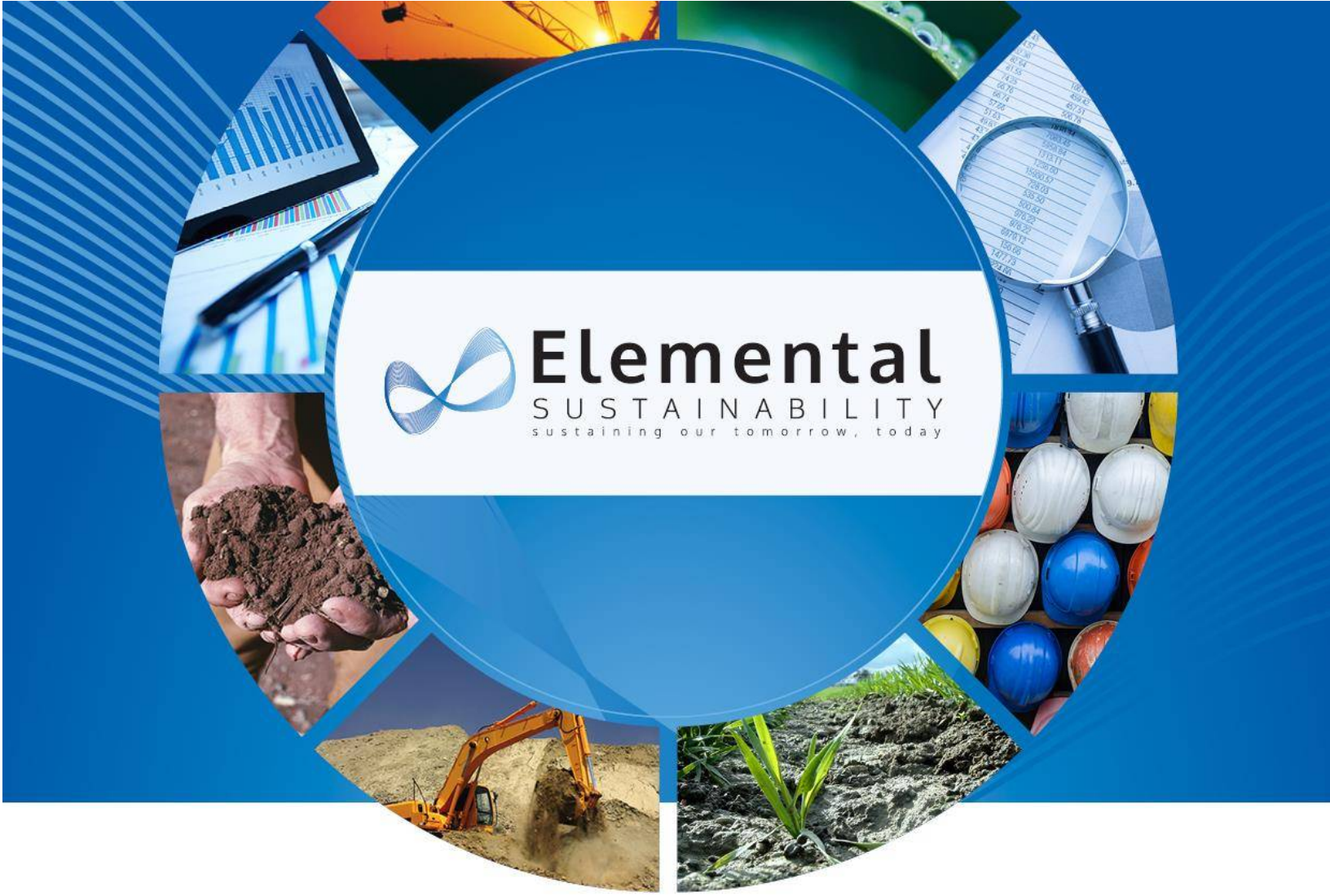
PARAMETER	VALUE	UNIT
NH4	<2.5	ppm

SAMPLE ID	: 263521 (continued)	**DATE RECEIVED**	: 2011-10-06
SAMPLE NO.	: RSBH/33	**REQUEST ID**	: 4635
SAMPLE MATRIX	: Water	**PAGE**	: 12 / 12
		REVISION NO	: 0

METHOD	: Ammonium by Ion Chromatography (IC) (continued)		
METHOD NO.	: UIS-EA-T009 (accredited)	**DATE COMPLETED**	: 2011-10-27

PARAMETER	**VALUE**	**UNIT**
TECHNICAL SIGNATORY		

Appendix 8 : Biodiversity Study



Biodiversity Assessment

Final Report

Prepared for:

Sallies Silica
A portion of Portion 129 and a portion of Portion 95 of the Farm Zandfontein 447 JQ

September 2021

PROJECT INFORMATION

DOCUMENT CONTROL

Report	Biodiversity Assessment Report		
Client	Witkop Fluorspar Mine (Trading as Sallies Silica)		
Responsible Person	Mr Corrie Retief Retief Environmental corrieretief2@gmail.com		
Report Number	SS-ECO-REP-024_21	**Report Status**	Final Report
		Report Date	9 September 2021

DOCUMENT REVIEW

Responsible person	Date	Position	Responsibility	Signature
Liezl Landman Pr.Sci.Nat. (No. 118084)	09/09/2021	Specialist	Author	
DuToit Wilken Pr.Sci.Nat. (No. 118911)	13/09/2021	Director: Senior Specialist	Reviewer	

DISCLAIMER

In addition, this report has been compiled in line with the requirements of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) and EIA regulations (2014), as amended. Information reported herein may be based on the interpretation of public domain data collected by Elemental Sustainbility (Pty) Ltd, and/or information supplied by the applicant and/or its other advisors and associates. The data has been accepted in good faith as being accurate and valid. This document may contain information of a specialised and/or highly technical nature and the reader is advised to seek clarification on any elements which may be unclear to it.

EXECUTIVE SUMMARY

Elemental Sustainability (Pty) Ltd (hereafter referred to as Elemental) was appointed to conduct a Biodiversity Assessment as part of the Basic Impact Assessment and Section 102 Amendment application processes for the Witkop Fluorspar Mine (Trading as and hereafter referred to as Sallies Silica). The application area is situated on a portion of Portion 129 and a portion of Portion 95 of the Farm Zandfontein 447 JQ, in the North West Province.

A site visit was undertaken on the 28th of July 2021 to assess the present ecological status of the area and to determine the impacts, if any, on the terrestrial biodiversity of the area. A baseline ecological desktop assessment was undertaken of all available data. The farm falls within the Topographical Quarter Degree Square of 2527DB. The location was used as guideline structure to compile species lists that may occur within these regions (similar latitude and longitude values) and those recorded on the South African National Biodiversity Institute (SANBI) Database of records. These were captured in the desktop study and represent the species that may occur on the study site. The field survey enabled comparison of these data lists and assessment of the actual habitat types and integrity.

Receiving Environment:

The site is dominated by existing mining activities and related infrastructure. Some areas consist of natural grassland and shrubland, and sections of open bush, especially on the rocky hills and slopes.

Summary of the Results:

Desktop Assessment:

- According to the North-West Biodiversity Sector Plan (2015), the southern section of the study site is classed as Critical Biodiversity Area 2 (CBA2), which are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services.
- The study site overlaps with the Magaliesberg Important Bird and Biodiversity Area (IBA) (Birdlife 2021).
- The southern section of the study site overlaps with the formally protected Magaliesberg Protected Natural Environment. It is a declared formal protected area under the National Environmental Management Protected Areas Act, 2003.
- The study site falls within the Moot Plains Bushveld (SVcb8) and the Gold Reef Mountain Bushveld (SVcb9) Vegetation types (Mucina & Rutherford, 2006/2018).
- The study site falls within the Western Bankenveld Ecoregion and Quaternary Catchment A21J.

- According to the National Wetland Map (NWM) database (2018) the study area does not overlap with any natural wetlands.

Fauna and Flora Species Desktop Analysis and Field Survey:

- Marula Tree (*Sclerocarya birrea*), a Protected Tree species of South Africa, was recorded on site. Several Alien and Invasive Vegetation Species were recorded on site, especially in the disturbed areas and the area surrounding the Pollution Control Dam.
- Several avifaunal species protected under the Threatened and Protected Species list (ToPS, 2013), which is enforceable under the National Environmental Management: Biodiversity Act, 2004, is likely to occur on site (Table 6).
- Several mammal species possibly occurring on site are protected under NEMBA, however, it is unlikely for many of these protected species to occur on site (Table 7).
- All Amphibian species are of Least Concern (LC), except for the Giant Bullfrog (*Pyxicephalus adspersus*) which is of special conservation concern according to the North-West Biodiversity Sector Plan (2015) and protected under NEMBA (Table 8).
- The African Rock Python (*Python natalensis*) is the only Protected reptile species known to possibly occur on site (Table 9).

Sensitivity and Impact Assessment:

NEMA Impact Assessment	The impacts associated with the activities range from Medium-Low to Medium-High prior to mitigation taking place. With mitigation fully implemented, the significance of most impacts can be reduced to Very Low or Low.
Mitigation Measures	Refer to Section 5.3
Does the Specialist support the Application?	Based on the findings made in the report, the impact can be mitigated to an acceptable level and the specialist can support the application if all mitigation measures provided in this report as well as general good practice, are strictly adhered to.

Impact Statement:

The activities are only supported if all mitigation measures provided in this report as well as general good practice, are strictly adhered to.

EIA REGULATIONS: SPECIALIST REPORT GUIDE

All specialist reports must be prepared in accordance with Appendix 6 of the EIA Regulations of 2014 (as amended in 2017).

NR.	CONTENT	REFERENCE
a	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix B
b	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page xii
c	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
cA	An indication of the quality and age of base data used for the specialist report;	Section 2
cB	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 4 & 5
d	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1
e	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3 & 4
g	An identification of any areas to be avoided, including buffers;	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
j	A description of the findings and potential implications of such findings on the impact of the proposed activity [including identified alternatives on the environment] or activities;	Section 5
k	Any mitigation measures for inclusion in the EMPr;	Section 5.3
l	Any conditions for inclusion in the environmental authorisation;	Section 5.3

m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 5.3
n	A reasoned opinion— i. [as to] whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 6
o	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q	Any other information requested by the competent authority.	None

CONTENT OF SPECIALIST REPORTS – GN320

On 20 March 2020 "Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the NEMA when applying for environmental authorization" was published in GN 320 (Government Gazette 43110). This was again replaced in October 2020.

It is important to note that the protocol replaces the requirements of Appendix 6 of the EIA Impact regulations as outlined above. The protocol as published are outlined below.

Site verification requirements:

NR.	CONTENT	REPORT SECTION
1	The site sensitivity verification must be undertaken by an Environmental Assessment Practitioner or a specialist.	Appendix B
2	The sensitivity verification must be undertaken through the use of: a. A desktop analyses, using satellite imagery; b. A preliminary on-site inspection; and c. Any other available and relevant information.	Section 3 & 4
3	The outcome of the site sensitivity verification must be recorded in the form of a report that:	
	a. Confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructures, the change in vegetation cover status etc.;	Section 3
	b. Contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and	Section 3
	c. Is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.	This report will be attached to the relevant assessment report as specialist scope of work

Table combined for Fauna, Floral & Terrestrial Biodiversity Minimum Requirements

Requirement	Section
1. General Information 1.1 An applicant, intending to undertake an activity as identified in the scope of this protocol on a site identified as being of "very high", "high" or "medium" sensitivity for terrestrial animal species on the national web based environmental screening tool must submit a Terrestrial Species Impact Assessment Report.	This Report
1.2 However, where the information gathered from the initial site sensitivity verification identified in section 2 of this protocol or the specialist assessment differs from the designation of "very high", "high", or "medium" terrestrial animal species sensitivity from the national web based environmental screening tool and it is found	A Specialist Report was required as sections of High sensitivity overlap with the specific farm and

Requirement	Section
to be of a "low" sensitivity, then a Terrestrial Species Impact Assessment is not required.	footprint in terms of Terrestrial Biodiversity.
1.3 Should paragraph 1.2 apply, a Terrestrial Species Compliance Statement must be submitted. An environmental assessment practitioner or a suitably qualified taxon relevant specialist, registered with the South African National Council for Natural Scientific Professionals (SACNASP), must append to the Terrestrial Species Compliance Statement a motivation and evidence (e.g. photographs) of the different terrestrial animal species sensitivity.	No Compliance statement is necessary – a full impact assessment report had been conducted (refer below)
Additional as noted for Terrestrial Biodiversity Studies specifically	
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: 2.3.1. a description of the ecological drivers or processes of the system and how the proposed development will impact these;	Section 3 & 5
2.3.2. Ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;	The site does not have specific increased value in terms of migration, pollination or other.
2.3.3. The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	The study site overlaps with the Magaliesberg Important Bird and Biodiversity Area (IBA) (Birdlife 2021). The southern section of the study site overlaps with the protected Magaliesberg Protected Natural Environment.
2.3.4. The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;	No strategic water resources (SWSA) or FEPAs occur on-site
2.3.5. a description of terrestrial biodiversity and ecosystems on the preferred site, including: a) main vegetation types; b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;	Section 3 & 4
The assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	None identified.
The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify: Terrestrial critical biodiversity areas (CBAs), including: a) the reasons why an area has been identified as a CBA;	The study area contains the following classes from the NWBSP (2015): • CBA2: Section 3

Requirement	Section
b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation; c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s); d) the impact on ecosystem threat status; e) the impact on explicit subtypes in the vegetation; f) the impact on overall species and ecosystem diversity of the site; and g) the impact on any changes to threat status of populations of species of conservation concern in the CBA; Terrestrial ecological support areas (ESAs), including: (a) the impact on the ecological processes that operate within or across the site; (b) the extent the proposed development will impact on the functionality of the ESA; and (c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;	
Protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including- a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan; b) priority areas for protected area expansion, including- (a) the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;	Section 3
SWSAs including: a) the impact(s) on the terrestrial habitat of a SWSA; and b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses); c) FEPA sub catchments, including- the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;	No Strategic Water Source Areas occur on the footprint. No FEPAs intercept with the property and no impacts are expected on these aspects.
Indigenous forests, including: a) impact on the ecological integrity of the forest; and (b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.	No indigenous forests occur on the site – confirmed during the field assessment.
2. Terrestrial Species Impact Assessment 2.1 The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	The specialists are suitably qualified, and the report was peer reviewed.
2.2 The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 3 & 4

Requirement	Section
2.3 The Terrestrial Species Impact Assessment must be undertaken in accordance with the *Species Environmental Assessment Best Practice Guidelines 3* and must identify the following: 2.3.1 The species of conservation concern which were found on site;	Section 3 (Desktop), Section 4 (Field Assessment)
2.3.2 The distribution, location, viability (ability to survive and reproduce in future) and detailed description of population size of the species of conservation concern identified on the preferred development site;	Section 4
2.3.3 The nature and the extent of the potential impact of the proposed development on the species of conservation concern on the proposed development site;	Section 5
2.3.4 The importance of the conservation of the population of the species of special concern identified on the proposed development site based on information available in national and international databases including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases;	Section 3 (Desktop), Section 4 (field Assessment). All species have been awarded with the relevant SCC within the tables presented.
2.3.5 The potential impact of the proposed development on the habitat of the species of conservation concern;	Section 5
2.3.6 Any dynamic ecological processes occurring within the site and its surrounds that might be disrupted by the proposed development and resulting impact on the identified species of conservation concern; for example, fires in fire-prone systems;	None.
2.3.7 Any potential impact of ecological connectivity (on site, and in relation to the broader landscape) and resulting impact on the identified species of conservation concern;	Section 3 & 4 No other relevant ecological connectivity
2.3.8 Buffer distances as per the *Species Environmental Assessment Best Practice Guidelines* used for the population of each species of conservation concern;	N/A
2.3.9 The likelihood of other threatened species, undescribed species or highly localised endemics, migratory species, or species of conservation concern, occurring in the vicinity; and	Section 4
2.3.10 Identify any alternative development footprints within the preferred development site which would be of "low" sensitivity as identified by the national web based environmental screening tool and verified through the initial site sensitivity verification.	N/A
3. The findings of the Terrestrial Animal Species Impact Assessment must be written up in a Terrestrial Animal Species Impact Assessment Report.	This Report
This report must include as a minimum the following information: 3.1 Contact details and curriculum vitae of the specialist including SACNASP registration number and fields of expertise;	Appendix B
3.2 A signed statement of independence by the specialist;	Page xii
3.3 Duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2
3.4 A description of the methodology used to undertake the impact assessment and site inspection, including equipment and modelling used where relevant;	Section 2

Requirement	Section
3.5 A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
3.6 Areas not suitable for development, to be avoided during construction and operation where relevant; additional environmental impacts expected from the proposed development; - any direct, indirect and cumulative impacts of the proposed development; - the degree to which impacts and risks can be mitigated; - the degree to which the impacts and risks can be reversed; - the degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 5.3
3.7 Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts; and	Section 5
3.8 Impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Section 5.3
3.9 A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not, and any conditions to which the opinion is subjected;	Section 5.3 & 6
3.10. A motivation must be provided if there were development footprints identified as per paragraph 2.3.10 above that were identified as having a “low” terrestrial animal species sensitivity and were not considered appropriate.	N/A
4. The findings of the Terrestrial Impact Assessment must be incorporated into the Basic Assessment Report (BAR) or the Environmental Impact Assessment Report (EIAR), including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr. A signed copy of the assessment must be appended to the BAR or EIAR.	N/A – Done by EAP

SPECIALIST DECLARATION

I, Liezl Landman, declare that:

- I acted as the independent specialist;
- I performed the work in an objective manner, even if the findings and conclusions are not favourable to the applicant;
- I do not have any financial interest in the undertaking of this project or projects, other than remuneration for the work performed in terms of the National Environmental Management Act 107 of 1998;
- There are no circumstances that may compromise my objectivity in performing such work;
- The contents of this report comply with the relevant legislative requirements, specifically Appendix 6 of the NEMA: EIA Regulations (2014, as amended in 2017);
- I have the relevant expertise required to conduct a specialist report of this nature in terms of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) and the National Water Act (NWA) (Act no. 36 of 1998);
- I understand that any false information published in this document is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act;
- I am a professionally registered scientist with the South African Council for Natural Scientific Professions (SACNASP);
- I have been accredited as a South African Scoring System Version 5 (SASS5) aquatic biomonitoring practitioner by the National Department of Water and Sanitation (DWS);
- I undertake to disclose and provide to the competent authority all material and information in my possession regarding this project as required in terms of National Environmental Management Act 107 of 1998; and
- Based on the information provided to me by the client and in addition to information obtained during this study, I have presented the results and conclusion regarding this project to the best of my professional ability.

Liezl Landman
Pr.Sci.Nat. (no. 118084)

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ABBREVIATIONS

ADU	Animal Demography Unit
BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
DEA	Department of Environmental Affairs
DHSWS	Department of Human Settlements, Water and Sanitation
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme / Plan
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information Systems
GPS	Global Positioning System
HGM	Hydro-Geomorphic
IBA	Important Bird and Biodiversity Areas
IAPS	Invasive Alien Plant Species
IUCN	International Union for Conservation of Nature
LC	Least Concern
MAMSL	Meters Above Mean Sea Level
MAP	Mean Annual Precipitation
MAT	Mean Annual Temperature

NA	Not Assessed
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEMPA	National Environmental Management: Protected Areas Act
NFEPA	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
PES	Present Ecological State
POSA	Plants of Southern Africa
RHP	River Health Programme
SAMBF	South African Mining and Biodiversity Forum
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Area Database
VU	Vulnerable
WMA	Water Management Area
WRC	Water Research Commission
WULA	Water Use Licence Application

1. INTRODUCTION

1.1 Activity Description

Witkop Fluorspar Mine (Trading as and hereafter referred to as Sallies Silica) appointed Elemental Sustainability (Pty) Ltd (hereafter referred to as Elemental) to conduct a Biodiversity Assessment as part of the Basic Impact Assessment and Section 102 Amendment application processes. The application area is situated on a portion of Portion 129 and a portion of Portion 95 of the Farm Zandfontein 447 JQ, in the North West Province (hereafter referred to as the "study site") (**Figure 1**).

A site visit was undertaken on the 28th of July 2021 to assess the present ecological status of the area and to determine the impacts, if any, of the activities on the receiving environment.

1.2 Scope of Work

Elemental was appointed by Sallies Silica to conduct a Biodiversity Impact Assessment for the project. The Terms of Reference (ToR) for this study included the following:

- Desktop description of the baseline receiving environment (general surrounding as well as site specific environment);
- Provide an overview of possible fauna and flora of conservation concern, and sensitive habitats;
- Identification and description of any sensitive receptors that occur in the study site, and the way these sensitive receptors may be affected by the activity;
- Site visit to verify desktop information;
- Conduct an Impact Assessment as specified by the Environmental Impact Assessment Regulations of 2014 to determine the mining impact on the biodiversity;
- Discuss appropriate mitigation and management procedures relevant to the conservation of biodiversity on the site; and
- Provide management recommendations to mitigate negative and enhance positive impacts.

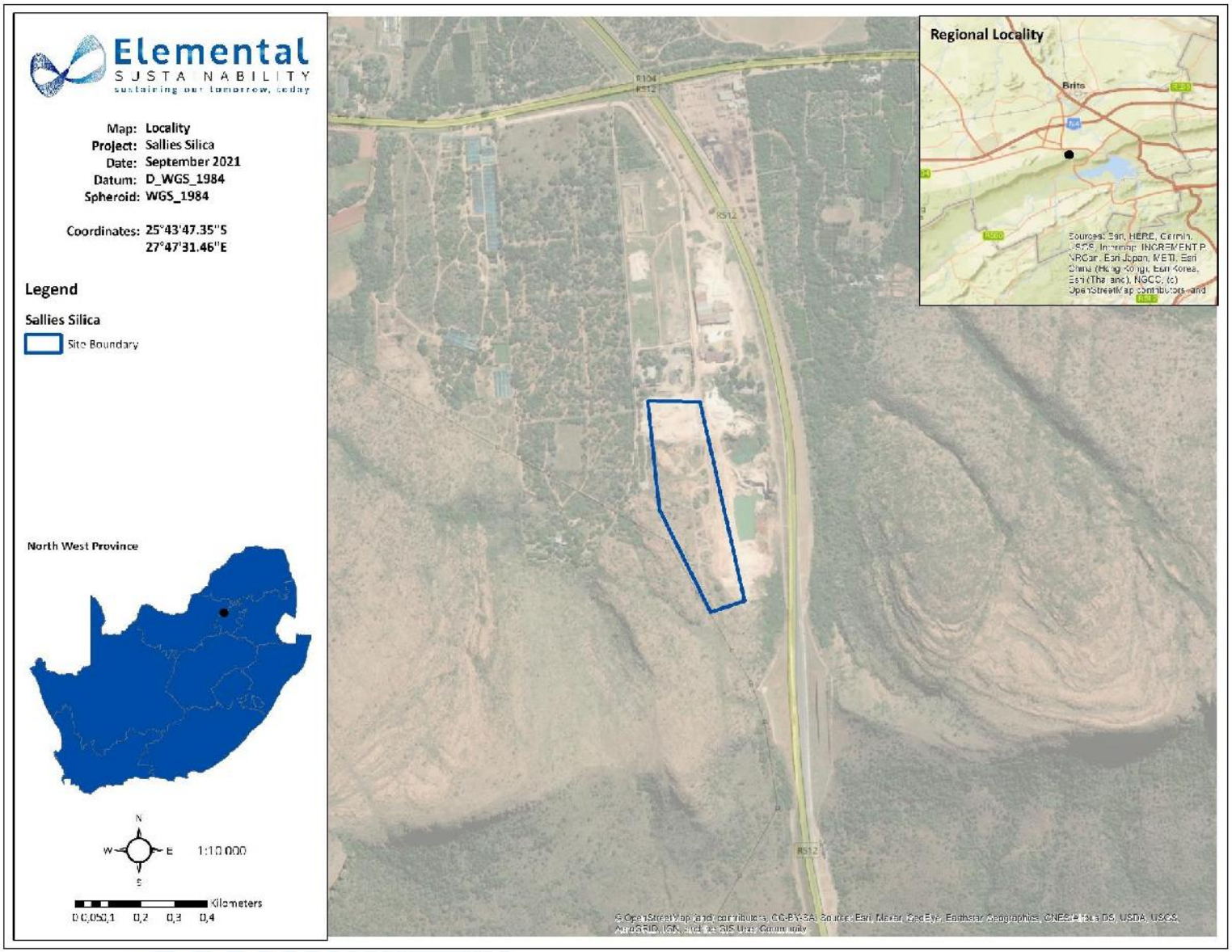

Figure 1: Locality map of the study site located within the North West Province.

1.3 Assumptions and Limitations

- The fieldwork component of the assessment comprised of one assessment only, during the dry season in July. No temporal trends for the respective seasons have been assessed.
- It is assumed that species flowering only during specific times of the year could be confused with similar species of the same genus. Plant species that bloom during other seasons or under very specific circumstances may have been missed entirely.
- Reliance is made upon the specialist input of the previous vegetation studies conducted in the area.
- Data collection in this study relied heavily on data from representative, homogenous sections of vegetation units, as well as general observations, analysis of satellite imagery from the past until the present, generic data and a desktop analysis.
- Invertebrates did not form part of this assessment.
- The assessment was conducted on the portion of the study site as originally defined by the client, any changes in the project boundary subsequent to this may negatively impact the robustness of this report.
- Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.

1.4 Legislative Requirements

The following legislative requirements apply to this study:

- Convention on Biological Diversity (Rio de Janeiro, 1992);
- The Ramsar Convention;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- The IUCN (International Union for Conservation of Nature).
- Constitution of the Republic of South Africa (Act 108 of 1996)
- National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- National Environmental Management: Protected Areas Act (NEMPA) (Act No. 57 of 2003);
- National Water Act (NWA) (Act No. 36 of 1998);
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 287 of 2002).
- National Veld and Forest Fire Act (Act No. 101 of 1998);
- Environmental Conservation Act (ECA) (Act No. 73 of 1989);
- National Forests Act (Act No. 84 of 1998), specifically with reference to Protected Tree species;

- National Heritage Resources (Act No. 25 of 1999);
- Soil Conservation Act (Act No. 76 of 1969); and
- Conservation of Agricultural Resources Act (Act No. 43 of 1983).

2. METHODOLOGY

A detailed description of the methodology is provided in the subsections below. The desktop assessment is used as the point of departure. Subsequently, a site visit was undertaken on the 28th of July 2021.

2.1 Literature Review and Desktop Assessment

A desktop assessment was undertaken of all available data. This involved the investigation of aerial photography, GIS databases, government records and previous studies, including literature reviews pertaining to the study site to determine the theoretical importance and sensitivity of the terrestrial ecosystems involved. The South African National Biodiversity Institute's online biodiversity tool, ADU (Animal Demography Unit) Virtual Museum was used to query a species list for the Quaternary Degree Square (QDS) within which the study area is situated. Information regarding species of conservation concern was obtained prior to the field investigation. The study site was mapped using Geographical Information Systems (GIS) (e.g. ArcGIS) to better understand the layout and structure of the surrounding environment.

The following data sources and GIS information provided in **Table 1** was utilised.

Table 1: Information and data sources used to comprise the desktop assessment

Data	Source	Date of Data Source
Latest and Historic Google Earth ™ imagery	Google Earth PRO™ On- line	2019
Vegetation Map of South Africa, Lesotho and Swaziland	SANBI	2018
DEA National Landcover	SANBI	2015
North West Biodiversity Sector Plan	SANBI	2015
National Wetland Classification System	SANBI	2011
National Freshwater Ecosystem Priority Area maps and database	Water Research Commission, Implementation: Manual and Maps for FEPA area / SANBI	2011
National List of Threatened Ecosystem	SANBI	2011
NBA Terrestrial Formal Protected Areas	SANBI	2011 / 2018
National Wetland Map (NWM)	SANBI	2018

The following datasets and sources were reviewed for the study:

- The Vegetation of South Africa, Lesotho & Swaziland (Mucina & Rutherford, 2006).
- The Southern Africa Bird Atlas Project (SABAP2, 2021).
- Animal Demography Unit (ADU, 2021).
- International Union for Conservation of Nature (IUCN) Red List of Threatened Species.
- The Endangered Wildlife Trust's Red List of Mammals of South Africa, Lesotho and Swaziland.
- NEMBA List of Threatened or Protected Species (TOPS List).

2.2 Field Survey

A field assessment was conducted on the 28th of July 2021. This field investigation was conducted to supplement and confirm the findings of the desktop analysis. A walkover field survey of the site verifying the presence or absence of faunal and floral species predicted to occur on the site was conducted. Verification of the possible wetlands identified, and their current status was also included. The field survey essentially consisted of the following:

a) Identification and location of rare, threatened, protected and conservation-worthy species that may be impacted;
b) The site was comprehensively assessed to determine fauna and faunal micro habitats present within the site;
c) Identify important habitats;
d) Identify areas of conservation and/or ecological importance;
e) Consider invasive alien plant status and rehabilitation potential of natural areas; and
f) An overall condition of the vegetation found in the area, including an assessment of cover and vegetation structure.

3. RECEIVING ENVIRONMENT DESCRIPTION

This section contains data accessed as part of the desktop assessment and are presented in the Sections below. This data was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance.

3.1 General Description

Table 2: Desktop data relating to the receiving environment

General Description	
GPS Coordinates	25°43'47.35" S; 27°47'31.46" E
Topography	The topography of the site is situated on gentle to moderate slopes. Rocky hills and ridges are also present.
Geology and Soils	This area consists predominantly of quartzites, conglomerates and some shale horizons of the Magaliesberg, Daspoort and Silverton Formations (Vaalian Pretoria Group) and the Hospital Hill, Turffontein and Government Subgroups (Randian Witwatersrand Supergroup). Soils are shallow, gravel lithosols of the Mispah and Glenrosa forms. Land types mainly Ib and Fb (Mucina & Rutherford 2006).
Land Use and Land Cover (Figure 2)	The site is dominated by existing mining activities and related infrastructure. Some areas consist of natural grassland and shrubland, and sections of open bush.
Rainfall	The site falls within the summer rainfall region. The study area receives an average rainfall amount of 618 mm with most rainfall occurring during the summer month of January (105 mm) and the lowest rainfall in June (0 mm).
Temperature	The monthly distribution of average daily maximum temperatures indicates an average midday temperature range of between 19°C in June to 29C in December, January and February. The region is the coldest during July when the temperature averages 0°C during the night.
Wind, Humidity and Evaporation	The main wind direction is from the North West and the average wind speed is 2.3 m/s. The relative humidity of the study area at 14h00 fluctuates between 31% in July and 46% in February. Mean annual evaporation is 2055 mm. Due to the fact that evaporation is much higher than precipitation, and because the site is situated on a north facing slope, the climate of the site can be considered semi-arid, even more so than the surrounding landscape. It also reduces its agricultural potential significantly.

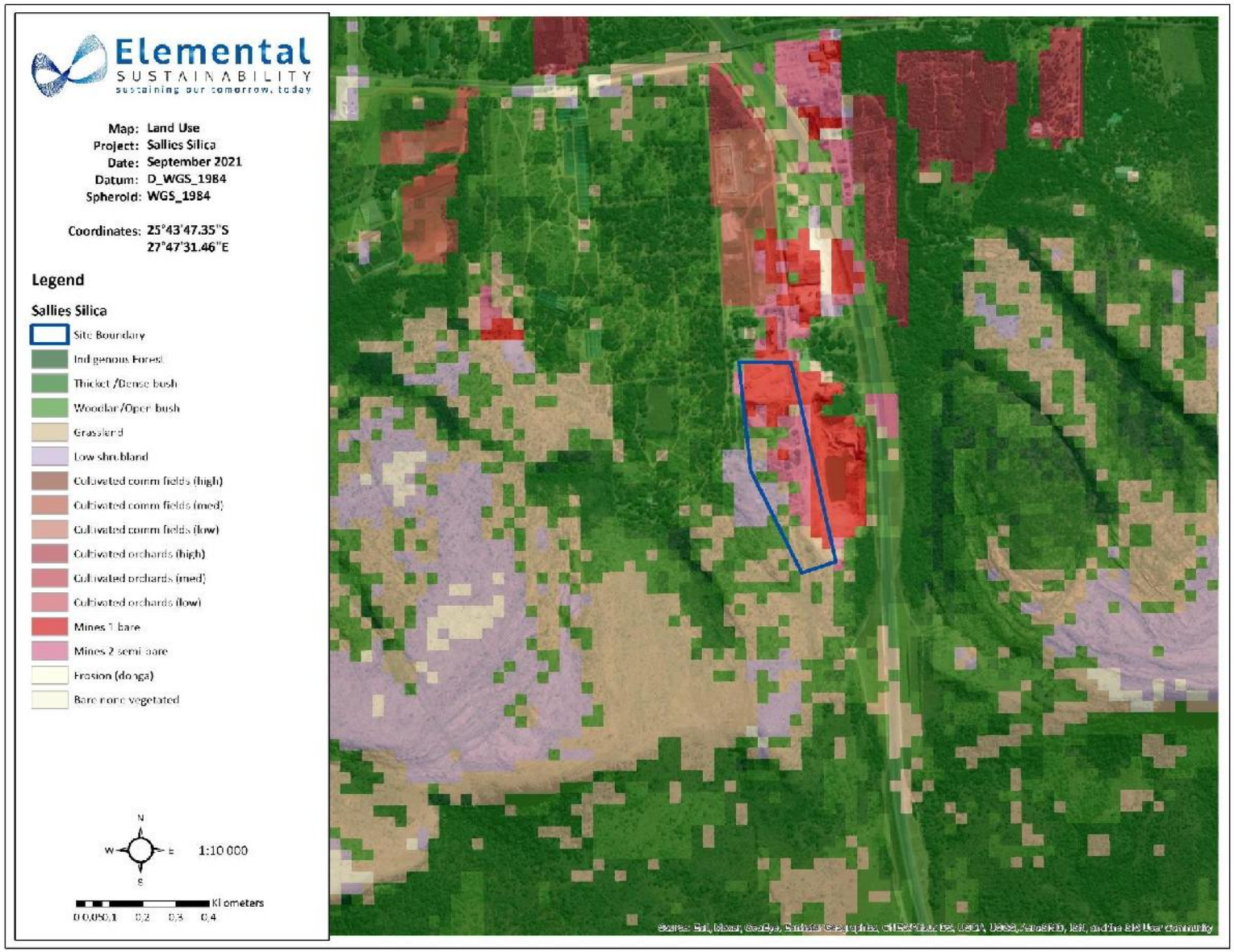

Figure 2: Current Land Use associated with the study area and surrounding environment

3.2 Regional Vegetation Assessment

The study site falls within the Savanna Biome (Mucina & Rutherford 2006), dominated by grass species, shrub layers and well-developed trees. Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The study area is situated within the Central Bushveld Bioregion and overlaps with two vegetation types, namely the Moot Plains Bushveld (SVcb8) and the Gold Reef Mountain Bushveld (SVcb9) (**Figure 3**).

Taxa associated with these vegetation types consist of the following:

Table 3: Taxa associated with the vegetation types found on site

Taxa Groups	Moot Plains Bushveld (SVcb8)	Gold Reef Mountain Bushveld (SVcb9)
Small Trees:	*Vachellia nilotica (d)* *V. tortilis* subsp. *heteracantha (d)* *Rhus lancea (d)*	*Senegalia caffra (d)* *Combretum molle (d)* *Protea caffra (d)* *Celtis Africana* *Dombeya rotundifolia* *Englerophytum magalismontanum* *Ochna pretoriensis* *Rhus leptodictya* *Vangueria infausta* *V. parvifolia* *Ziziphus mucronata*
Tall Shrubs:	*Buddleja saligna (d)* *Euclea undulata (d)* *Olea europaea* subsp. *africana (d)* *Grewia occidentalis* *Gymnosporia polyacantha* *Mystroxylon aethiopicum* subsp. *burkeanum*	*Canthium gilfillanii* *Ehretia rigida* subsp. *Rigida* *Grewia occidentalis* *Gymnosporia buxifolia* *Mystroxylon aethiopicum* subsp. *burkeanum*
Low Shrubs:	*Aptosimum elongatum* *Felicia fascicularis* *Lantana rugosa* *Teucrium trifidum*	*Athrixia elata* *Pearsonia cajanifolia* *Rhus magalismontana* subsp. *Magalismontana* *R. rigida var. rigida*
Succulent Shrub:	*Kalanchoe paniculata*	-
Woody Climber:	*Jasminum breviflorum*	*Ancylobotrys capensis*
Herbaceous Climber:	*Lotononis bainesii*	-
Graminoids:	*Heteropogon contortus (d)* *Setaria sphacelata (d)* *Themeda triandra (d)* *Aristida congesta* *Chloris virgata* *Cynodon dactylon*	*Loudetia simplex (d)* *Panicum natalense (d)* *Schizachyrium sanguineum (d)* *Trachypogon spicatus (d)* *Alloteropsis semialata* subsp. *Eckloniana* *Bewsia biflora*

	Sporobolus nitens *Tragus racemosus*	*Digitaria tricholaenoides* *Diheteropogon amplectens* *Sporobolus pectinatus* *Tristachya biseriate* *T. leucothrix*
Herbs:	*Achyropsis avicularis* *Corchorus asplenifolius* *Evolvulus alsinoides* *Helichrysum nudifolium* *H. undulatum* *Hermannia depressa* *Osteospermum muricatum* *Phyllanthus maderaspatensis*	*Helichrysum nudifolium* *H. rugulosum* *Pentanisia angustifolia* *Senecio venosus* *Xerophyta retinervis*
Geophytic Herb:	-	*Cheilanthes hirta* *Hypoxis hemerocallidea* *Pellaea calomelanos*

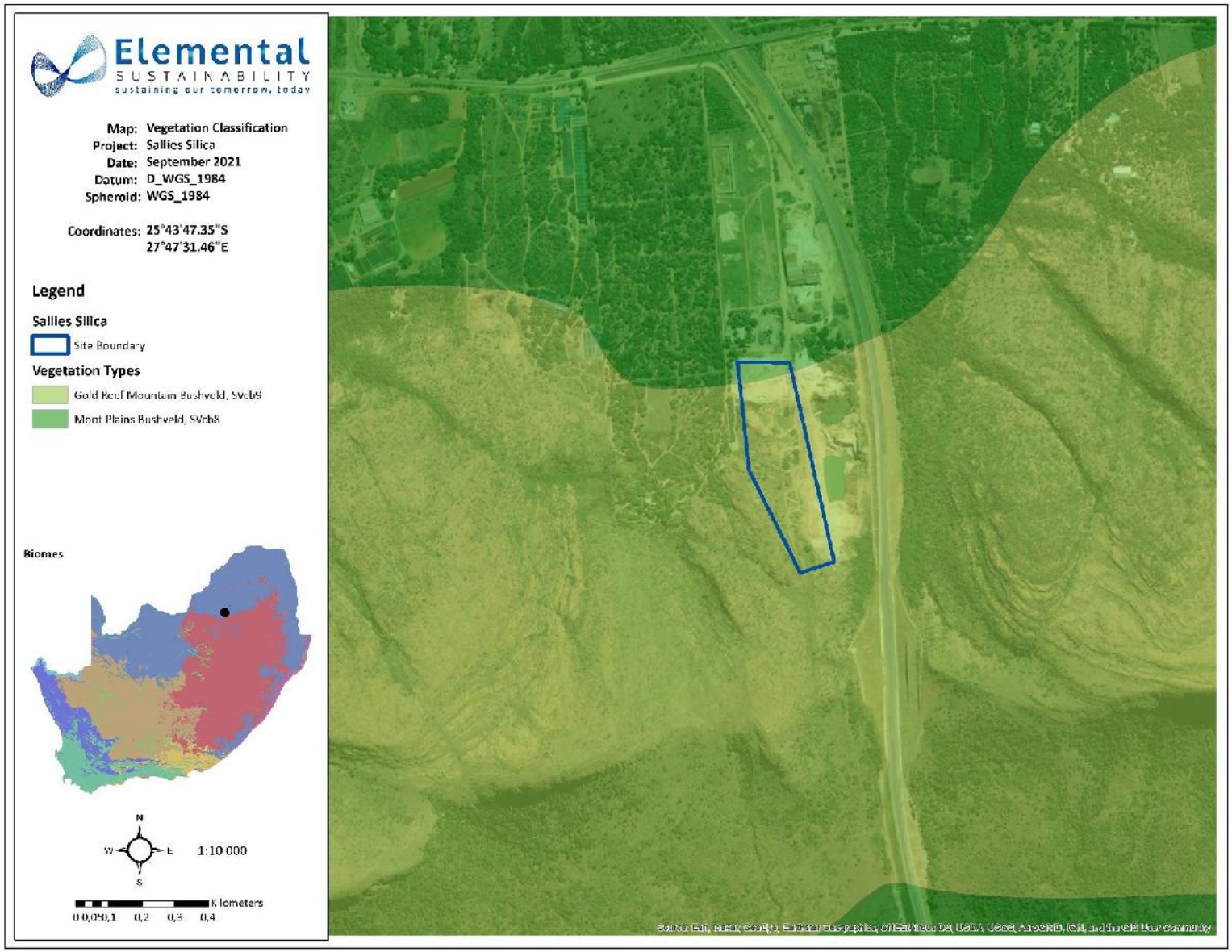

Figure 3: Vegetation Types associated with the study site situated within the Savanna Biome

3.3 Threatened Ecosystems

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver *et al*. 2011). Datasets have been developed by SANBI (2016) in order to outline threatened ecosystems, with the primary objective of limiting the rate of ecosystem extinctions. Four established categories group these ecosystems namely: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Protected.

No threatened ecosystems overlap with the study site (NBA 2018).

3.4 Protected Areas

Formally protected areas are protected either by national or provincial legislation. Based on the SANBI (2010) Protected Areas Map and the North-West Biodiversity Sector Plan (2015), the southern section of the study site overlaps with the formally protected Magaliesberg Protected Natural Environment which forms one of the core zones of the Magaliesberg Biosphere (**Figure 4**). It is a declared formal protected area under the National Environmental Management Protected Areas Act, 2003.

3.5 North West Biodiversity Sector Plan (NWBSP, 2015)

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of high biodiversity value that need to be conserved and maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services (MTPA, 2014). The North-West Biodiversity Sector Plan (2015) focusses on the mapping and the management of biodiversity priority areas within the North-West Province. This conservation plan consists of Protected Areas, Critical Biodiversity Areas, Ecological Support Areas, Other Natural Areas and Areas with No Natural Habitat Remaining based on their biodiversity attributes, spatial configuration, and requirement for meeting targets for both biodiversity pattern and ecological processes (NWBSP, 2015). Each of these are defined as follow:

- *Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.*
- *Ecological Support Areas (ESAs) are terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree*

or extent of restriction on land use and resource use in these areas may be lower than that recommended for CBAs.

- *Protected Areas are declared and formally protected under the Protected Areas Act, such as National Parks, legally declared Nature Reserves, World Heritage Sites and Protected Environments that are secured by appropriate legal mechanisms.*
- *Other Natural Areas are areas that still contain natural habitat but that are not required to meet biodiversity targets.*
- *No Natural Habitat Remaining includes areas without intact habitat remaining.*

According to the National Environmental Management Act (NEMA) (Act no. 107 of 1998) certain activities have strict guidelines or are prohibited within CBAs and ESAs. Refer to the listed activities under the NEMA: Environmental Impact Assessment Regulations of 2014 (GNR 982) as promulgated in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) [as amended] for a comprehensive breakdown.

The southern section of the study site is classed as Critical Biodiversity Area 2 (CBA2) in terms of the NWBSP (**Figure 4**). This is possibly due to the site overlapping with the Magaliesberg Protected Natural Environment and the Magaliesberg IBA.

3.6 Important and Biodiversity Areas (IBA)

Important Bird and Biodiversity Areas (IBAs) are a network of sites that are significant for the long-term viability of naturally occurring bird populations (Birdlife 2019). Many sites are also important for other forms of biodiversity; therefore, the conservation of Important Bird & Biodiversity Areas ensures the survival of a correspondingly large number of other animals and plants.

The study site overlaps with the Magaliesberg IBA (**Figure 4**), previously known as the Magaliesberg and Witwatersberg IBA, this IBA consists mainly of the Magaliesberg range, which extends in an arc from just north-west of Rustenburg in the west to the N1 in the east near Pretoria. To the south, the Witwatersberg range runs parallel to the Magaliesberg, extending from the town of Magaliesberg in the west to Hartbeespoort Dam in the east.

The most important trigger species in the IBA is the globally threatened Cape Vulture. The number of breeding pairs in the Skeerpoort colony seems to be stable at 200–250. The Secretarybird is the other globally threatened species in the IBA. Regionally threatened species are the Lanner Falcon (*Falco biarmicus*), Half-collared Kingfisher (*Alcedo semitorquata*), African Grass Owl (*Tyto capensis*), African Finfoot (*Podica senegalensis*) and Verreauxs' Eagle (*Aquila verreauxii*). Biome-restricted species include White-bellied Sunbird (*Cinnyris talatala*), Kurrichane Thrush (*Turdus libonyanus*), White-throated Robin-chat (*Cossypha humeralis*), Kalahari Scrub Robin (*Erythropygia paena*) and Barred Wren-Warbler (*Calamonastes fasciolatus*).

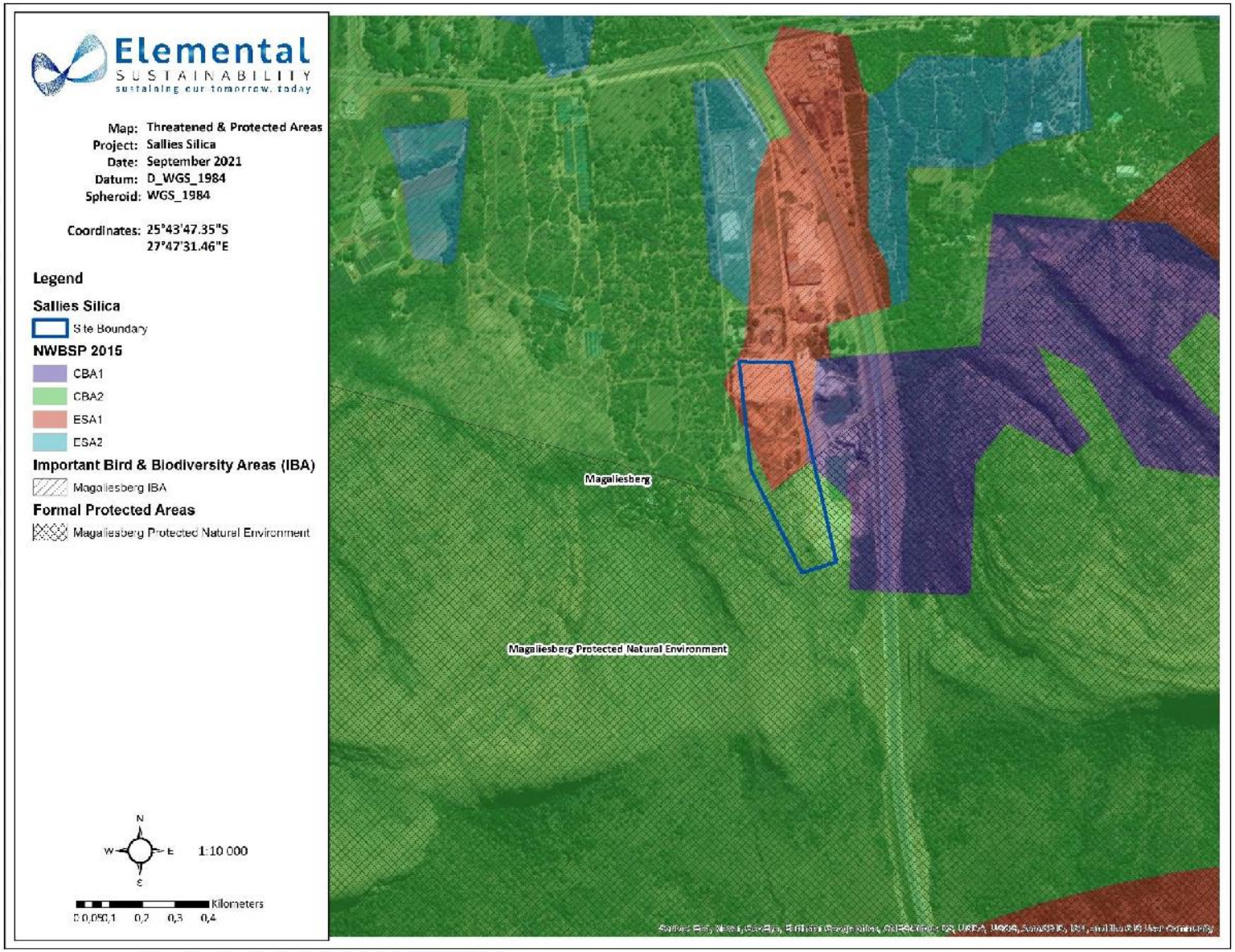

Figure 4: Threatened and Protected Areas associated with the study site

3.7 Surface Hydrology and Aquatic Classification

Table 4: Desktop data relating to the freshwater resources

Ecoregion (Figure 5)	Western Bankenveld
Quaternary Catchment (Figure 6)	A21J
WMA (Figure 6)	Limpopo Water Management Area
Ecoregion Characteristics (Kleynhans *et al.* 2007)	
Dominant primary terrain morphology	Lowlands; Hills and Mountains; Moderate and High Relief Open Hills; Lowlands; Mountains; Moderate to High Relief Closed Hills; Mountains; Moderate and High Relief
Dominant primary vegetation types	Waterberg Moist Mountain Bushveld; Mixed Bushveld;
Altitude (m a.m.s.l)	900-1700
MAP (mm)	400 to 700
Coefficient of Variation (% of MAP)	20 to 35
Rainfall concentration index	60 to >65
Rainfall seasonality	Early to Mid-summer
Mean annual temp. (°C)	14 to 22
Winter temperature (July)	14 to 24
Summer temperature (Feb)	24 to 32
Median annual simulated runoff	20 to 80, 80 to 100 (limited)
National Freshwater Ecosystem Priority Area (NFEPA) (2011) Database	
NFEPA Rivers	According to the NFEPA database, no rivers or tributaries occur on the study site.
Wetlands	According to the National Wetland Map (NWM) database (2018) the study area does not overlap with any wetlands - Figure 6.

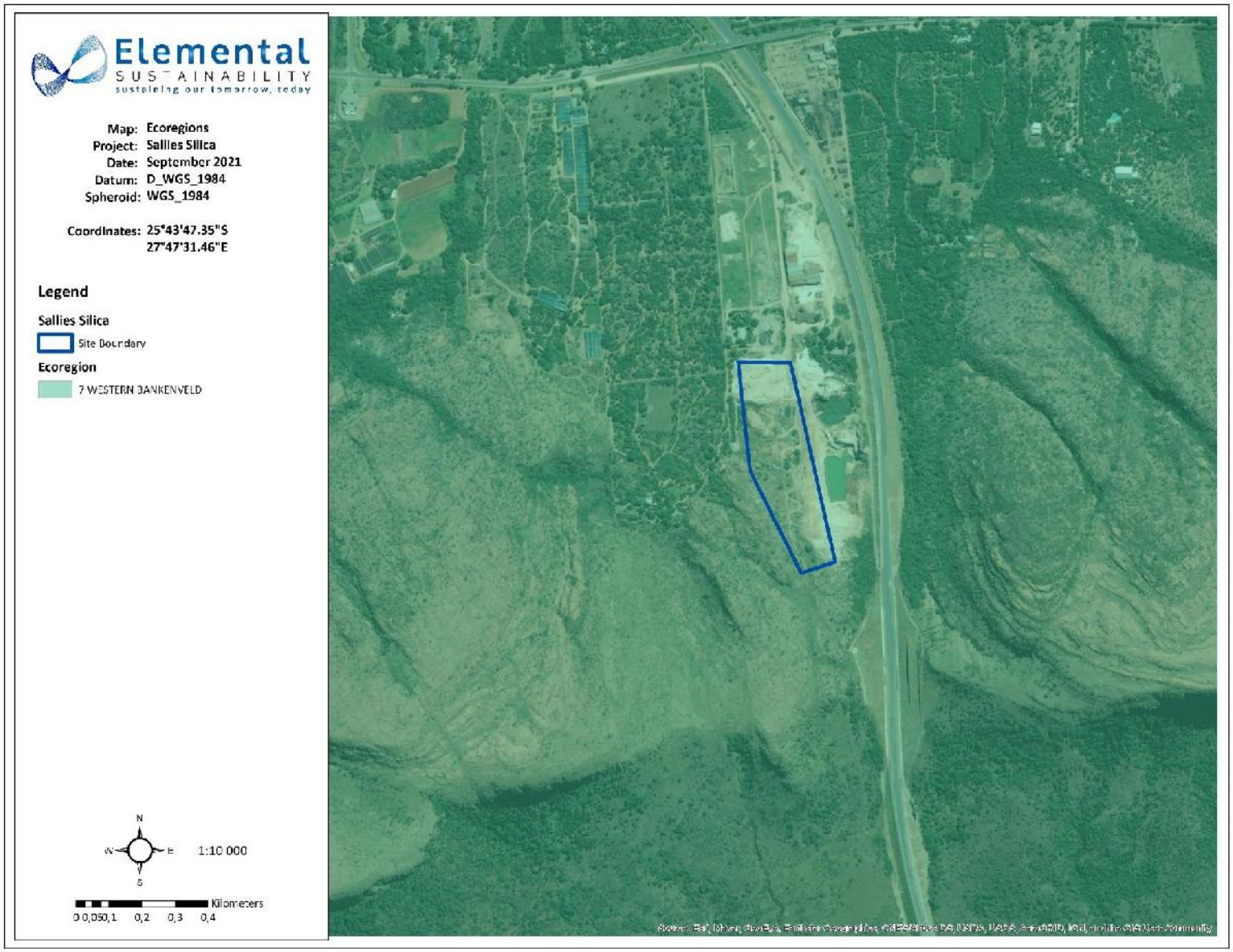

Figure 5: Ecoregions associated with the study area

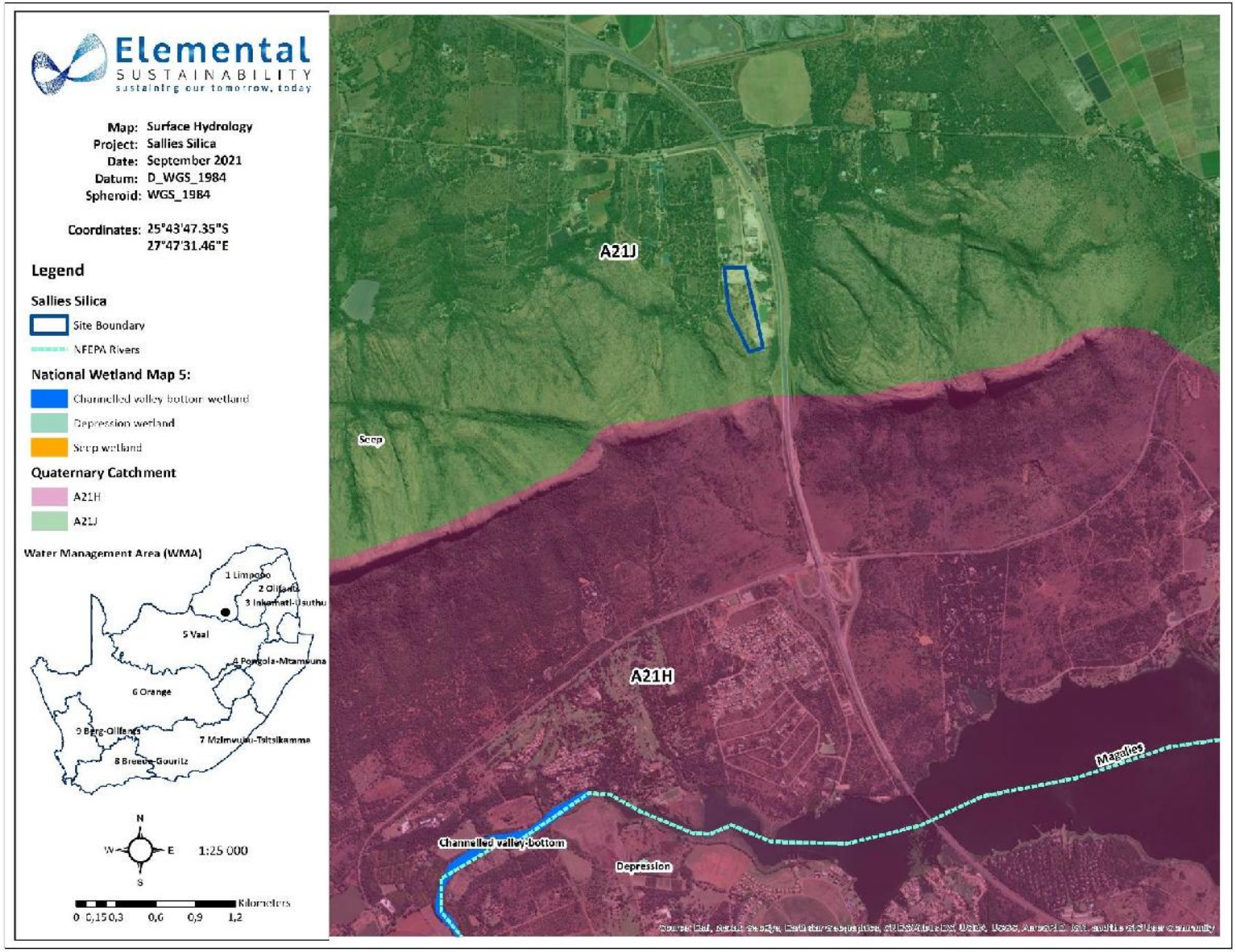

Figure 6: The study area is situated in Quaternary Catchment A21J and forms part of the Limpopo Water Management Area

3.8 Screening Tool Report Sensitivity

The following is provided in accordance with the National Screening Tool, which needs to be considered as per minimum requirements for Ecological, Terrestrial, and Aquatic Biodiversity Assessments.

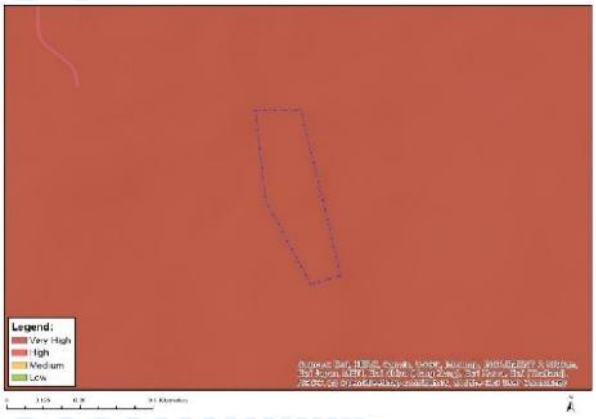

Figure 7: Aquatic Biodiversity Sensitivity – National Screening Tool.

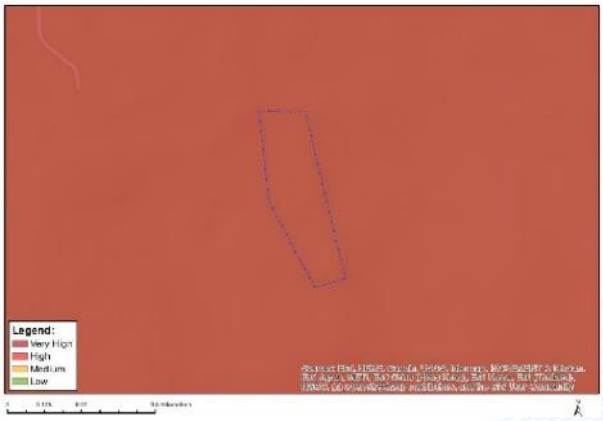

Figure 8: Terrestrial Biodiversity Sensitivity – National Screening Tool.

Figure 9: Plant Species Sensitivity – National Screening Tool.

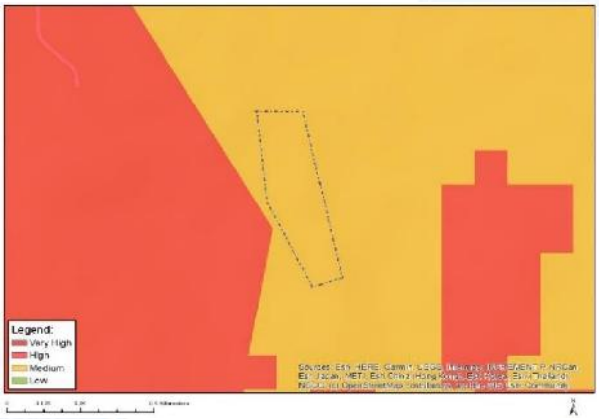

Figure 10: Animal Species Sensitivity – National Screening Tool.

4. RESULTS OF THE ASSESSMENT

4.1 Fauna and Flora Species Assessment

During the Desktop study, a list of potential flora and fauna species occurring in the area were compiled and included in this section of the document for the affected quarter degree grid cells, however, it does not mean that these do occur on-site.

4.1.1 Floral Assessment

A list of flora observed on site was compiled and their protection status indicated where relevant (**Table 5)**. The site assessment took place during the winter; therefore, several species could not be correctly identified, and reliance was made on previous studies conducted in the area. If a species is a known Alien and Invasive Species, this was also indicated. The only protected species noted on site was *Sclerocarya birrea* (Marula Tree).

Table 5: Dominant plant species observed on the study site

Trees / Shrubs	Climbers / Grasses / Graminoids / Forbs
Vachellia caffra	**Achyranthes aspera*
Ancylobotrys capensis	**Alternanthera pungens*
**Catharanthus roseus*	*Aristida transvaalensis*
Combretum molle	**Argemone ochroleuca*
Combretum zeyheri	**Bidens bipinnata*
Croton gratissimus	**Bidens pilosa*
Cyphostemma lanigerum	*Bothriochloa insculpta*
Dichrostachys cinerea	**Catharanthus roseus*
Diospyros lycioides	*Cenchrus ciliaris*
Elephantorrhiza burkei	*Ceratotheca triloba*
Englerophytum magalismontanum	*Chamaecrista mimosoides*
Euclea crispa	*Chamaesyce hirta*
Ficus abutilifolia	*Chloris virgata*
Ficus ingens	*Coleochloa setifera*
Gomphocarpus fruticosus	**Conyza bonariensis*
Indigofera melanadenia	*Cyperus rupestris*
Lannea discolor	*Cymbopogon pospischilii*
**Lantana camara*	*Cynodon dactylon*
**Melia azedarach*	*Digitaria eriantha*
Mimusops zeyheri	*Enneapogon cenchroides*
Pappea capensis	*Eragrostis chloromelas*
[P]Sclerocarya birrea	*Eragrostis curvula*
Searsia leptodyctia	*Eragrostis lehmanniana*
Searsia magalismontana	*Eragrostis superba*
**Solanum mauritianum*	*Fingerhuthia Africana*

Ximenia caffra *Ziziphus mucronata*	**Flaveria bidentis* **Gomphrena celosioides* *Heteropogon contortus* **Hibiscus trionum* *Hyparrhenia hirta* *Hyparthelia dissoluta* **Melia azedarach* *Melinis repens* *Momordica balsamina* *Panicum maximum* **Passiflora edulis* *Pogonarthria squarrosa* **Schkuhria pinnata* *Sporobolus fimbriatus* **Tagetes minuta* *Themeda triandra* **Zinnia peruviana*

[P] - **Protected Species**

* - Alien and Invasive Species

4.1.2 Faunal Assessment

4.1.2.1 Avifauna

A complete list of potential avifaunal species occurring in the relevant pentad 2540_2745 is listed in **Appendix A**. **Table 6** below lists the species of particular high conservation priority which may possibly occur on site Several species protected under the Threatened and Protected Species list (ToPS, 2013), which is enforceable under the National Environmental Management: Biodiversity Act, 2004, is likely to occur on site.

Table 6: Threatened bird species of pentad 2540_2745 in the North West Province which possibly occur on site

Scientific Name	Common Name	Provincial (NWBSP)	ToPS / NEMBA
Aegypius tracheliotos	Lappet-faced Vulture	Vulnerable	
Anthropoides paradiseus	Blue Crane	Vulnerable	**Endangered**
Aquila rapax	Tawny Eagle	Vulnerable	**Vulnerable**
Ardeotis kori	Kori Bustard	Vulnerable	**Vulnerable**
Balearica regulorum	Grey Crowned Crane	Vulnerable	**Endangered**
Botaurus stellaris	Eurasian Bittern	Critically Endangered	
Certhilauda chuana	Short-clawed Lark	Near threatened	
Charadrius pallidus	Chestnut-banded Plover	Near threatened	
Ciconia nigra	Black Stork	Near threatened	**Vulnerable**
Circus macrourus	Pallid Harrier	Near threatened	
Circus ranivorus	African Marsh- Harrier	Vulnerable	**Protected**
Crex crex	Corn Crake	Vulnerable	

Eupodotis caerulescens	Blue Korhaan	Near threatened	**Vulnerable**
Eupodotis senegalensis	White-bellied Korhaan	Vulnerable	
Falco biarmicus	Lanner Falcon	Near threatened	
Falco peregrinus	Peregrine Falcon	Near threatened	**Vulnerable**
Falco naumanni	Lesser Kestrel	Vulnerable	**Vulnerable**
Geronticus calvus	Southern Bald Ibis	Vulnerable	**Vulnerable**
Glareola nordmanni	Black-winged Pratincole	Near threatened	
Gorsachius leuconotus	White-backed Night-heron	Vulnerable	
Gypaetus barbatus	Bearded Vulture	Endangered	**Endangered**
Gyps africanus	White-backed Vulture	Vulnerable	**Endangered**
Gyps coprotheres	Cape Vulture	Vulnerable	**Endangered**
Leptoptilos crumeniferus	Marabou Stork	Near threatened	
Mirafra cheniana	Melodious lark	Near threatened	
Mycteria ibis	Yellow-billed Stork	Near threatened	
Pelecanus rufescens	Pink-backed Pelican	Vulnerable	**Endangered**
Phoenicopterus minor	Lesser Flamingo	Near threatened	
Phoenicopterus ruber	Greater Flamingo	Near threatened	
Polemaetus bellicosus	Martial Eagle	Vulnerable	**Vulnerable**
Rhynchops flavirostris	African Skimmer	Endangered	
Rostratula benghalensis	Greater Painted-snipe	Near threatened	
Sagittarius serpentarius	Secretarybird	Near threatened	
Sarothrura ayresi	White-winged Flufftail	Critically Endangered	
Sternia caspia	Caspian Tern	Near threatened	
Tyto capensis	African Grass-Owl	Vulnerable	**Vulnerable**

4.1.2.2 Mammals

The potential diversity of mammals within the study site is moderate to low due to it being a largely disturbed area with many disturbances in the surrounding area. The area does however form part of a larger ecological corridor connected to the Magaliesberg Protected Environment, which provides habitat for several species. **Table 7** below lists all the mammal species possibly occurring on the proposed site according to the Animal Demography Unit (2021) alongside the designated statuses of those species in the South African Red list of Mammals (2012) and the Threatened or Protected Species (ToPS) List (NEMBA, 10 of 2004), as well as the species listed in the North West Biodiversity Sector Plan (NWBSP). Several species possibly occurring on site are protected under NEMBA (See species in bold). During the site visit, no mammal species were observed.

Table 7: List of Mammals Possibly Occurring on Site (ADU, 2021)

Family	Scientific Name	Common Name	Red Data List Category	ToPS / NEMBA	Provincial NWBSP
Bathyergidae	*Cryptomys hottentotus*	Southern African Mole-rat	Least Concern (2016)		
Bathyergidae	*Cryptomys mahali*	Mahali's Mole-rat	Data Deficient (IUCN, 2019)		

Bovidae	*Aepyceros melampus*	Impala	Least Concern		
Bovidae	*Alcelaphus buselaphus*	Hartebeest			
Bovidae	*Connochaetes taurinus*	Blue Wildebeest	Least Concern (ver 3.1, 2017)		
Bovidae	*Connochaetes taurinus taurinus*		Least Concern (2016)		
Bovidae	*Damaliscus pygargus phillipsi*	Blesbok	Least Concern (2016)		
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*		Least Concern (2016)		
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern (2016)		
Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern (2016)		
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern (2016)		
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern (2016)		
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)		
Canidae	*Lycaon pictus*	African wild dog	Endangered (2016)	**Endangered**	Endangered
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern (2016)		
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern (2016)		
Equidae	*Equus quagga*	Plains Zebra	Least Concern (2016)		
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened (2016)	**Protected**	Vulnerable
Felidae	*Acinonyx jubatus*	Cheetah	Vulnerable (2016)	**Vulnerable**	Vulnerable
Felidae	*Caracal caracal*	Caracal	Least Concern (2016)		
Felidae	*Felis silvestris*	Wildcat	Least Concern (2016)		
Felidae	*Leptailurus serval*	Serval	Near Threatened (2016)	**Protected**	Near Threatened
Giraffidae	*Giraffa giraffa giraffa*	South African Giraffe	Least Concern (2016)		
Gliridae	*Graphiurus (Graphiurus) murinus*	Forest African Dormouse	Least Concern		
Herpestidae	*Atilax paludinosus*	Marsh Mongoose	Least Concern (2016)		
Hyaenidae	*Crocuta crocuta*	Spotted Hyaena	Near Threatened (2016)	**Protected**	Near Threatened
Hyaenidae	*Proteles cristata*	Aardwolf	Least Concern (2016)		
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern		
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern		
Leporidae	*Pronolagus sp.*	Rock-hares			
Macroscelididae	*Elephantulus myurus*	Eastern Rock Elephant Shrew	Least Concern (2016)		
Manidae	*Smutsia temminckii*	Ground Pangolin	Vulnerable (2016)	**Vulnerable**	Vulnerable

Molossidae	*Sauromys petrophilus*	Roberts's Flat-headed Bat	Least Concern (2016)		
Muridae	*Aethomys ineptus*	Tete Veld Aethomys	Least Concern (2016)		
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	Least Concern		
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	Least Concern (2016)		
Muridae	*Mus (Nannomys) minutoides*	Southern African Pygmy Mouse	Least Concern		
Muridae	*Rattus rattus*	Roof Rat	Least Concern		
Procaviidae	*Procavia capensis*	Cape Rock Hyrax	Least Concern (2016)		
Pteropodidae	*Epomophorus wahlbergi*	Wahlberg's Epauletted Fruit Bat	Least Concern (2016)		
Rhinolophidae	*Rhinolophus darlingi*	Darling's Horseshoe Bat	Least Concern (2016)		Near Threatened
Sciuridae	*Paraxerus cepapi*	Smith's Bush Squirrel	Least Concern (2016)		
Soricidae	*Crocidura fuscomurina*	Bicolored Musk Shrew	Least Concern (2016)		
Soricidae	*Suncus infinitesimus*	Least Dwarf Shrew	Least Concern (2016)		
Suidae	*Phacochoerus aethiopicus*	Desert Warthog			
Vespertilionidae	*Myotis tricolor*	Temminck's Myotis	Least Concern (2016)		
Vespertilionidae	*Scotophilus dinganii*	Yellow-bellied House Bat	Least Concern (2016)		
Viveridae	*Genetta maculata*	Common Large-spotted Genet	Least Concern		
Viverridae	*Genetta genetta*	Common Genet	Least Concern (2016)		
Viverridae	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)		

4.1.2.3 Herpetofauna

The local occurrences of reptiles and amphibians (collectively known as Herpetofauna) are closely dependent on broadly defined habitat types, terrestrial, arboreal (tree-living), rupiculous (rock dwelling) and wetland-associated vegetation cover. **Table 8** lists all species of Amphibian and **Table 9** list all species of Reptile which could possibly occur on the study site. All Amphibian species are of Least Concern (LC), except for the Giant Bullfrog (*Pyxicephalus adspersus*) which is of special conservation concern according to the North-West Biodiversity Sector Plan (2015) and protected under NEMBA. The Giant Bullfrog relies on temporary wetlands and dams in the province. The African Rock Python (*Python natalensis*) is the only Protected reptile species known to possibly occur on site.

Table 8: List of Amphibians possibly occurring on site (ADU, 2021; IUCN, 2019)

Family	Scientific Name	Common Name	Red List Category	ToPS / NEMBA	Provincial NWBSP
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern		

Bufonidae	*Schismaderma carens*	Red Toad	Least Concern		
Bufonidae	*Sclerophrys sp.*				
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern		
Bufonidae	*Sclerophrys garmani*	Olive Toad	Least Concern (IUCN, 2016)		
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern (IUCN, 2016)		
Bufonidae	*Sclerophrys poweri*	Power's Toad	Least Concern		
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern		
Microhylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	Least Concern		
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	Least Concern (IUCN, 2013)		
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern		
Ptychadenidae	*Ptychadena anchietae*	Plain Grass Frog	Least Concern		
Ptychadenidae	*Ptychadena mossambica*	Broadbanded Grass Frog	Least Concern		
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern (2017)		
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)		
Pyxicephalidae	*Amietia poyntoni*	Poynton's River Frog	Least Concern (2017)		
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern (2013)		
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bull Frog	Near Threatened	**Protected**	Near Threatened
Pyxicephalidae	*Tomopterna sp.*				
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern		
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	Least Concern		
Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog	Least Concern (2013)		

Table 9: List of Reptiles possibly occurring on site (ADU, 2021; IUCN, 2019).

Family	Scientific Name	Common Name	Red List Category	ToPS / NEMBA	Provincial NWBSP
Agamidae	*Acanthocercus atricollis*	Southern Tree Agama	Least Concern (SARCA 2014)		
Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	Least Concern (SARCA 2014)		
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern (SARCA 2014)		
Chamaeleonidae	*Chamaeleo dilepis*	Common Flap-neck Chameleon	Least Concern (SARCA 2014)		
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	Least Concern (SARCA 2014)		
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern (SARCA 2014)		

Colubridae	*Dispholidus typus viridis*	Northern Boomslang	Not evaluated		
Colubridae	*Philothamnus hoplogaster*	South Eastern Green Snake	Least Concern (SARCA 2014)		
Colubridae	*Philothamnus semivariegatus*	Spotted Bush Snake	Least Concern (SARCA 2014)		
Colubridae	*Telescopus semiannulatus semiannulatus*	Eastern Tiger Snake	Least Concern (SARCA 2014)		
Cordylidae	*Cordylus jonesii*	Jones' Girdled Lizard	Least Concern (SARCA 2014)		
Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	Least Concern (SARCA 2014)		
Elapidae	*Elapsoidea sundevallii media*	Highveld Garter Snake	Least Concern		
Elapidae	*Naja annulifera*	Snouted Cobra	Least Concern (SARCA 2014)		
Elapidae	*Naja mossambica*	Mozambique Spitting Cobra	Least Concern (SARCA 2014)		
Gekkonidae	*Chondrodactylus turneri*	Turner's Gecko	Least Concern (SARCA 2014)		
Gekkonidae	*Hemidactylus mabouia*	Common Tropical House Gecko	Least Concern (SARCA 2014)		
Gekkonidae	*Lygodactylus capensis*	Common Dwarf Gecko	Least Concern (SARCA 2014)		
Gekkonidae	*Pachydactylus affinis*	Transvaal Gecko	Least Concern (SARCA 2014)		
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern (SARCA 2014)		
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)		
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern (SARCA 2014)		
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern (SARCA 2014)		
Lamprophiidae	*Duberria lutrix lutrix*	South African Slug-eater	Least Concern (SARCA 2014)		
Lamprophiidae	*Homoroselaps dorsalis*	Striped Harlequin Snake	Near Threatened (SARCA 2014)		**Near Threatened**
Lamprophiidae	*Lamprophis aurora*	Aurora House Snake	Least Concern (SARCA 2014)		
Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	Least Concern (SARCA 2014)		
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern (SARCA 2014)		
Lamprophiidae	*Prosymna sundevallii*	Sundevall's Shovel-snout	Least Concern (SARCA 2014)		
Lamprophiidae	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern (SARCA 2014)		

Lamprophiidae	*Psammophylax tritaeniatus*	Striped Grass Snake	Least Concern (SARCA 2014)		
Leptotyphlopidae	*Leptotyphlops incognitus*	Incognito Thread Snake	Least Concern (SARCA 2014)		
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	Not evaluated		
Pythonidae	*Python natalensis*	Southern African Python	Least Concern (SARCA 2014)	**Protected**	
Scincidae	*Acontias occidentalis*	Western Legless Skink	Least Concern (SARCA 2014)		
Scincidae	*Mochlus sundevallii*	Sundevall's Writhing Skink	Least Concern (SARCA 2014)		
Scincidae	*Panaspis wahlbergii*	Wahlberg's Snake-eyed Skink	Least Concern (SARCA 2014)		
Scincidae	*Trachylepis damarana*	Damara Variable Skink	Least Concern		
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern (SARCA 2014)		
Scincidae	*Trachylepis sp. (Transvaal varia)*	Skink sp. 1			
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	Least Concern (SARCA 2014)		
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	Least Concern (SARCA 2014)		
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)		
Varanidae	*Varanus niloticus*	Water Monitor	Least Concern (SARCA 2014)		
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern (SARCA 2014)		
Viperidae	*Causus rhombeatus*	Rhombic Night Adder	Least Concern (SARCA 2014)		

5. NEMA IMPACT ASSESSMENT

All forms of development, albeit for mining, industrial, urban or residential purposes, will have an immediate effect on the natural environment. It is therefore of utmost importance to provide information on the environmental consequences these activities will have and to inform the decision-makers thereof.

5.1 Potential Impacts

The proposed activities will result in a possible disturbance of the terrestrial biodiversity during the construction and operation phases. These include:

- Loss and disturbance of terrestrial habitat
- Loss and disturbance of terrestrial Fauna
- Loss and disturbance of terrestrial Flora
- Introduction and spread of alien vegetation

5.2 Ecological Impact Assessment Methodology

Impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An environmental aspect is an ‘element of an organizations activities, products and services which can interact with the environment’. The interaction of an aspect with the environment may result in an impact.
- Environmental risks/impacts are the consequences of these aspects on environmental resources or receptors of value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.

- Receptors can comprise, but are not limited to, people or human-made systems, such as residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- Resources include components of the biophysical environment.
- Frequency of activity refers to how often the proposed activity will take place.
- Frequency of impact refers to the frequency with which a stressor (aspect) will impact on the receptor.
- Severity refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- Spatial extent refers to the geographical scale of the impact.
- Duration refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (**Table 10**). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary.

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment considers the recommended management measures required to mitigate the impacts.

The NEMA Regulations require that an impact assessment provide quantified scores indicating the expected impact, and the cumulative impact of a proposed activity. The following format was utilised during this assessment:

- *Direct impacts* - Impacts caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- *Indirect impacts* - Indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
- *Cumulative impacts* result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative

impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Risks/Impacts were assessed for the following stages of the project cycle:

- Construction;
- Operational; and
- Closure/Rehabilitation.

Table 10: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS	
Frequency of Impact	**Rating**
Almost Never / Almost Impossible	1
Very Seldom / Highly Unlikely	2
Infrequent / Unlikely / Seldom	3
Often / Regularly / Likely / Possible	4
Daily / Highly Likely / Definitely	5
Frequency of Activity / Duration of Aspect	**Rating**
Annually or less / Low	1
6 Months / Temporary	2
Monthly / Infrequent	3
Weekly / Life of Operation / Regularly / Likely	4
Daily / Permanent / High	5
CONSEQUENCE DESCRIPTORS	
Severity of Impact	**Rating**
Insignificant / Non-harmful	1
Small / Potentially Harmful	2
Significant / Slightly Harmful	3
Great / Harmful	4
Disastrous / Extremely Harmful	5
Spatial Scope of Impact	**Rating**
Activity specific	1
Site specific (within the site boundary)	2
Local area (within 5 km of the site boundary)	3
Regional	4
National	5
Duration of Impact	**Rating**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post Closure / Permanent	5

Table 11: Significance Rating Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (Probability of Impact + Sensitivity of receiving environment)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 12: Positive / Negative Mitigation Ratings

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very High	126 - 150	Critically consider the viability of proposed projects. Improve current management of existing projects significantly and immediately.	Maintain current management
High	101 - 125	Comprehensively consider the viability of proposed projects. Improve current management of existing projects significant	Maintain current management
Medium – High	76 - 100	Consider the viability of proposed projects. Improve current management of existing projects.	Maintain current management
Medium – Low	51 - 75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy.	Maintain current management and/or proposed project criteria and strive for continuous improvement.
Low	26 - 50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy.	Maintain current management and/or proposed project criteria and strive for continuous improvement.
Very Low	1 - 25	Maintain current management and/or proposed project criteria and strive for continuous improvement.	Maintain current management and/or proposed project criteria and strive for continuous improvement.

5.3 Impact Assessment Tables and Mitigation Measures

Table 13: Loss and disturbance of terrestrial habitat

Impact: The proposed site has sections which are moderately degraded, and habitat has been transformed for mining related activities and infrastructure. The onset of additional activities might result in impacts to the natural environment due to increased movement, traffic and large machinery to the area. Heavy machinery and vehicles might result in compaction of the soil and destruction of vegetation habitat which in turn will also impact on the animals that use the area as habitat.		
***Activity*:** The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection during construction activities. Permanent changes to water flows and loss of important habitat may occur during the operational phase.		
	Without Mitigation	**With Mitigation**
CONSTRUCTION & OPERATIONAL PHASE		
Frequency of Impact	Highly Likely (5)	Unlikely (3)
Frequency of Activity / Duration of Aspect	Life of Operation (4)	Life of Operation (4)
Severity	Harmful (4)	Potentially Harmful (2)
Spatial Scale	Local area (3)	Site Specific (2)
Duration	Life of operation (4)	One year to ten years (3)
Significance	**99 Medium – High**	**49 Low**
Status (positive or negative)	Negative	Negative
CLOSURE PHASE		
Frequency of Impact	Likely (4)	Highly Unlikely (2)
Frequency of Activity / Duration of Aspect	Life of Operation (4)	Temporary (2)
Severity	Slightly Harmful (3)	Insignificant (1)
Spatial Scale	Local area (3)	Activity Specific (1)
Duration	One month to one year (2)	One day to one month (1)
Significance	**64 Medium – Low**	**12 Very Low**
Status (positive or negative)	Negative	Positive
Reversibility	Low	Low
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	
Mitigation: • Ensure that erosion management and sediment controls are strictly implemented from the beginning of site clearing activities. • All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses to stabilise the loose material. Areas that are stripped during construction and operation should be re-vegetated with indigenous vegetation. • Monitor the occurrence of erosion during the rainy season and take immediate corrective action where needed.		

- As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment.
- Adhere to all management and mitigation measures as prescribed within other specialist reports and Environmental Management Programme (EMPr).
- To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.
- Continuous rehabilitation of the area should occur, immediate closure and rehabilitation. This will entail the spreading of topsoil, revegetation and management of invasive species.
- It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon (including fencing off the defined project area) and preventing movement of workers into natural areas.
- Rehabilitation measures that are implemented must be continually monitored for a minimum period of four years to ensure that proper succession has occurred and that there is no erosion occurring.
- An alien invasive vegetation management plan should be developed and implemented.
- Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.

Table 14: Loss and disturbance of terrestrial Flora

Impact: Construction and operational related activities may lead to the loss of floral species of conservation concern. None of the plant species of conservation priority occurs on the site, apart from some *Sclerocarya birrea* (Marula Tree). Though not threatened, *Sclerocarya birrea* is a protected tree species under the National Forests Act No. 84 of 1998. The necessary permits are required to remove/relocate *Sclerocarya birrea* from site.		
Activity: • Vegetation clearance • Vehicles driving through natural vegetated areas • Habitat fragmentation and destruction • Removal of Protected species		
	Without Mitigation	**With Mitigation**
CONSTRUCTION & OPERATIONAL PHASE		
Frequency of Impact	Highly Likely (5)	Unlikely (3)
Frequency of Activity / Duration of Aspect	Infrequent (3)	Temporary (2)
Severity	Slightly Harmful (3)	Potentially Harmful (2)
Spatial Scale	Local Area (3)	Site Specific (2)
Duration	Life of Operation (4)	One year to ten years (3)
Significance	**80** **Medium – High**	**35** **Low**
Status (positive or negative)	Negative	Negative
CLOSURE PHASE		
Frequency of Impact	Likely (4)	Highly Unlikely (2)
Frequency of Activity / Duration of Aspect	Life of Operation (4)	Temporary (2)
Severity	Slightly Harmful (3)	Insignificant (1)

Spatial Scale	Local area (3)	Activity Specific (1)
Duration	One month to one year (2)	One day to one month (1)
Significance	**64** **Medium – Low**	**12** **Very Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

- Relocate conservation-worthy species under the supervision of a vegetation or horticultural specialist.
- Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond.
- An alien invasive vegetation management plan should be developed and implemented.
- Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.
- Footprint areas should be kept as small as possible when removing alien plant species.
- No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species.
- Rehabilitate or revegetate disturbed areas.
- Protected trees and plants shall not be removed or damaged without prior approval, permits or licenses from the relevant authority.

Table 15: Loss and disturbance of terrestrial Fauna

Impact: Construction and operational related activities may lead to the loss of faunal species of conservation concern.

Activity:

- Vegetation loss and disturbance – clearing of vegetation
- Excessive noise disturbances
- Illegal hunting
- Habitat fragmentation and destruction
- Vehicles driving through natural vegetated areas

	Without Mitigation	**With Mitigation**
CONSTRUCTION & OPERATIONAL PHASE		
Frequency of Impact	Highly Likely (5)	Infrequent (3)
Frequency of Activity / Duration of Aspect	Infrequent (3)	Temporary (2)
Severity	Harmful (4)	Potentially Harmful (2)
Spatial Scale	Local Area (3)	Activity Specific (1)
Duration	Life of Operation (4)	One month to one year (2)
Significance	**88** **Medium – High**	**25** **Very Low**

Status (positive or negative)	Negative	Negative
CLOSURE PHASE		
Frequency of Impact	Likely (4)	Highly Unlikely (2)
Frequency of Activity / Duration of Aspect	Infrequent (3)	Temporary (2)
Severity	Harmful (4)	Potentially Harmful (2)
Spatial Scale	Local Area (3)	Activity Specific (1)
Duration	Life of Operation (4)	One month to one year (2)
Significance	**77 Medium – High**	**20 Very Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	
Mitigation: • Site clearing to take place in a phased manner (where possible) to allow for any faunal species present to move away from the study site to the surrounding open space areas. • Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery. • Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint. • Should any sensitive or Red Data animal or bird species be encountered during the construction, operation, and rehabilitation activities, a suitably qualified specialist should be consulted, and the necessary permits obtained and only the these species should be relocated to natural areas in the vicinity. • No hunting, trapping, or killing of fauna are allowed. • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area. • Noise must be kept to an absolute minimum at night to minimise all possible disturbances to amphibian species and nocturnal mammals.		

Table 16: Introduction and spread of alien vegetation impact ratings

Impact: Introduction and spread of alien vegetation.		
Activity: The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of alien vegetation seed.		
	Without Mitigation	**With Mitigation**
CONSTRUCTION & OPERATIONAL PHASE		
Frequency of Impact	Likely (4)	Unlikely (3)
Frequency of Activity / Duration of Aspect	Infrequent (3)	Temporary (2)
Severity	Harmful (4)	Potentially Harmful (2)

Spatial Scale	Local Area (3)	Site Specific (2)
Duration	Life of Operation (4)	One month to one year (2)
Significance	**77** **Medium – High**	**30** **Low**
Status (positive or negative)	Negative	Negative
CLOSURE PHASE		
Frequency of Impact	Likely (4)	Highly Unlikely (2)
Frequency of Activity / Duration of Aspect	Infrequent (3)	Temporary (2)
Severity	Harmful (4)	Potentially Harmful (2)
Spatial Scale	Local Area (3)	Activity Specific (1)
Duration	Life of Operation (4)	One month to one year (2)
Significance	**77** **Medium – High**	**20** **Very Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

- Proliferation of alien and invasive species is expected within any disturbed areas particularly as there are some alien and invasive species present within the study site. These species should be eradicated and controlled to prevent further spread beyond.
- An alien invasive vegetation management plan should be developed and implemented.
- Alien and invasive vegetation control should take place throughout all phases to prevent loss of floral habitat.
- Footprint areas should be kept as small as possible when removing alien plant species.
- No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species.
- Rehabilitate or revegetate disturbed areas.

5.4 Cumulative Impacts

The loss and fragmentation of habitat are two of the more serious cumulative impacts in terms of fauna and flora. Given the largely natural state of the Magaliesberg Natural Environment in the surrounding landscape, the characteristics and sensitivity of the affected area, the nature of the proposed development, and the potential for cumulative impacts are expected to be moderate as the activities and thus the impacts will increase.

It was not realistically possible or very difficult to perform an impact assessment for the cumulative impacts based on the available information.

6. CONCLUSION

When viewed in the larger context, the study site forms part of a very important conservation corridor and the Magaliesberg Protected Environment, also overlapping with the Magaliesberg Important Bird and Biodiversity Area (IBA). The southern section of the study site is also classed as Critical Biodiversity Area 2 (CBA2). The following was found for the fauna and flora assessment:

The Marula Tree (*Sclerocarya birrea*), a Protected Tree species of South Africa, was recorded on site. Though not threatened, *Sclerocarya birrea* is a protected tree species under the National Forests Act No. 84 of 1998. In terms of a part of section 51(1) of Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister. Several Alien and Invasive Vegetation Species were recorded on site, especially in disturbed areas and the areas surrounding the Pollution Control Dam. Several avifaunal species protected under the Threatened and Protected Species list (ToPS, 2013), which is enforceable under the National Environmental Management: Biodiversity Act, 2004, is likely to occur on site. All Amphibian and reptile species are of Least Concern (LC), except for the Giant Bullfrog (*Pyxicephalus adspersus*) and the African Rock Python (*Python natalensis*) which is of special conservation concern according to the North-West Biodiversity Sector Plan (2015) and protected under NEMBA.

Overall, the area should be regarded as moderate sensitivity. It is however unlikely that there will be a loss of flora or faunal species of known conservation concern if the site is developed, and proper mitigation measures are implemented. Various potential negative impacts are associated with the activities and are discussed in the impact assessment scores derived according to the amended EIA Regulations (2017). The important factors relevant to the project are summarised in the table below.

NEMA Impact Assessment	The impacts associated with the activities range from Medium-Low to Medium-High prior to mitigation taking place. With mitigation fully implemented, the significance of most impacts can be reduced to Very Low or Low.
Mitigation Measures	Refer to Section 5.3

It is imperative that an effective management and rehabilitation plan is implemented to ensure that all mitigation measures discussed in the report are adhered to. The activities are only supported if all the conditions, mitigation measures and environmental impact regulations are implemented.

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APPENDIX A: LIST OF BIRD SPECIES POSSIBLY TO OCCUR ON THE STUDY SITE (SABAP2, 2021)

Nr	Common Name	Scientific Name	Nr	Common Name	Scientific Name
1	Bokmakierie	*Telophorus zeylonus*	142	Lapwing, African Wattled	*Vanellus senegallus*
2	Brubru	*Nilaus afer*	143	Lapwing, Blacksmith	*Vanellus armatus*
3	Hamerkop	*Scopus umbretta*	144	Lapwing, Crowned	*Vanellus coronatus*
4	Hybrid Mallard	*Anas hybrid*	145	Lark, Eastern Long-billed	*Certhilauda semitorquata*
5	Mallard	*Anas platyrhynchos*	146	Lark, Flappet	*Mirafra rufocinnamomea*
6	Neddicky	*Cisticola fulvicapilla*	147	Lark, Red-capped	*Calandrella cinerea*
7	Shikra	*Accipiter badius*	148	Lark, Rufous-naped	*Mirafra africana*
8	Apalis, Bar-throated	*Apalis thoracica*	149	Mannikin, Bronze	*Spermestes cucullata*
9	Avocet, Pied	*Recurvirostra avosetta*	150	Martin, Brown-throated	*Riparia paludicola*
10	Babbler, Arrow-marked	*Turdoides jardineii*	151	Martin, Common House	*Delichon urbicum*
11	Barbet, Acacia Pied	*Tricholaema leucomelas*	152	Martin, Rock	*Ptyonoprogne fuligula*
12	Barbet, Black-collared	*Lybius torquatus*	153	Martin, Sand	*Riparia riparia*
13	Barbet, Crested	*Trachyphonus vaillantii*	154	Masked-weaver, Lesser	*Ploceus intermedius*
14	Batis, Chinspot	*Batis molitor*	155	Moorhen, Common	*Gallinula chloropus*
15	Bee-eater, European	*Merops apiaster*	156	Mousebird, Red-faced	*Urocolius indicus*
16	Bee-eater, Little	*Merops pusillus*	157	Mousebird, Speckled	*Colius striatus*
17	Bee-eater, White-fronted	*Merops bullockoides*	158	Mousebird, White-backed	*Colius colius*
18	Bishop, Southern Red	*Euplectes orix*	159	Myna, Common	*Acridotheres tristis*
19	Bishop, Yellow-crowned	*Euplectes afer*	160	Nightjar, Fiery-necked	*Caprimulgus pectoralis*
20	Boubou, Southern	*Laniarius ferrugineus*	161	Nightjar, Rufous-cheeked	*Caprimulgus rufigena*
21	Bulbul, African Red-eyed	*Pycnonotus nigricans*	162	Oriole, Black-headed	*Oriolus larvatus*
22	Bulbul, Dark-capped	*Pycnonotus tricolor*	163	Ostrich, Common	*Struthio camelus*
23	Bunting, Cape	*Emberiza capensis*	164	Owl, Marsh	*Asio capensis*
24	Bunting, Cinnamon-breasted	*Emberiza tahapisi*	165	Owl, Western Barn	*Tyto alba*
25	Bunting, Golden-breasted	*Emberiza flaviventris*	166	Owlet, Pearl-spotted	*Glaucidium perlatum*
26	Bushshrike, Grey-headed	*Malaconotus blanchoti*	167	Peafowl, Indian	*Pavo cristatus*
27	Bushshrike, Orange-breasted	*Chlorophoneus sulfureopectus*	168	Pigeon, African Green	*Treron calvus*
28	Buzzard, Common	*Buteo buteo*	169	Pigeon, African Olive	*Columba arquatrix*
29	Buzzard, Jackal	*Buteo rufofuscus*	170	Pigeon, Speckled	*Columba guinea*
30	Camaroptera, Grey-backed	*Camaroptera brevicaudata*	171	Pipit, African	*Anthus cinnamomeus*
31	Canary, Black-throated	*Crithagra atrogularis*	172	Pipit, Nicholson's	*Anthus nicholsoni*
32	Canary, Yellow	*Crithagra flaviventris*	173	Pipit, Striped	*Anthus lineiventris*
33	Canary, Yellow-fronted	*Crithagra mozambica*	174	Plover, Three-banded	*Charadrius tricollaris*
34	Chat, Familiar	*Oenanthe familiaris*	175	Pochard, Red-crested	*Netta rufina*
35	Chat, Mocking Cliff	*Thamnolaea cinnamomeiventris*	176	Prinia, Black-chested	*Prinia flavicans*
36	Cisticola, Desert	*Cisticola aridulus*	177	Prinia, Tawny-flanked	*Prinia subflava*
37	Cisticola, Lazy	*Cisticola aberrans*	178	Puffback, Black-backed	*Dryoscopus cubla*
38	Cisticola, Levaillant's	*Cisticola tinniens*	179	Pytilia, Green-winged	*Pytilia melba*

39	Cisticola, Rattling	*Cisticola chiniana*	180	Quelea, Red-billed	*Quelea quelea*
40	Cisticola, Wailing	*Cisticola lais*	181	Robin-Chat, Cape	*Cossypha caffra*
41	Cisticola, Wing-snapping	*Cisticola ayresii*	182	Robin-Chat, White-throated	*Cossypha humeralis*
42	Cisticola, Zitting	*Cisticola juncidis*	183	Roller, Lilac-breasted	*Coracias caudatus*
43	Coot, Red-knobbed	*Fulica cristata*	184	Sandgrouse, Yellow-throated	*Pterocles gutturalis*
44	Cormorant, Reed	*Microcarbo africanus*	185	Sandpiper, Common	*Actitis hypoleucos*
45	Cormorant, White-breasted	*Phalacrocorax lucidus*	186	Scimitarbill, Common	*Rhinopomastus cyanomelas*
46	Coucal, Burchell's	*Centropus burchellii*	187	Scrub Robin, White-browed	*Cercotrichas leucophrys*
47	Crake, Black	*Zapornia flavirostra*	188	Seedeater, Streaky-headed	*Crithagra gularis*
48	Crombec, Long-billed	*Sylvietta rufescens*	189	Shoveler, Cape	*Spatula smithii*
49	Crow, Cape	*Corvus capensis*	190	Shrike, Crimson-breasted	*Laniarius atrococcineus*
50	Crow, Pied	*Corvus albus*	191	Shrike, Lesser Grey	*Lanius minor*
51	Cuckoo, African	*Cuculus gularis*	192	Shrike, Magpie	*Urolestes melanoleucus*
52	Cuckoo, Black	*Cuculus clamosus*	193	Shrike, Red-backed	*Lanius collurio*
53	Cuckoo, Diederik	*Chrysococcyx caprius*	194	Sparrow, Cape	*Passer melanurus*
54	Cuckoo, Great Spotted	*Clamator glandarius*	195	Sparrow, Great	*Passer motitensis*
55	Cuckoo, Jacobin	*Clamator jacobinus*	196	Sparrow, House	*Passer domesticus*
56	Cuckoo, Klaas's	*Chrysococcyx klaas*	197	Sparrow, Southern Grey-headed	*Passer diffusus*
57	Cuckoo, Levaillant's	*Clamator levaillantii*	198	Sparrow, Yellow-throated Bush	*Gymnoris superciliaris*
58	Cuckoo, Red-chested	*Cuculus solitarius*	199	Sparrow-Weaver, White-browed	*Plocepasser mahali*
59	Cuckooshrike, Black	*Campephaga flava*	200	Sparrowhawk, Black	*Accipiter melanoleucus*
60	Darter, African	*Anhinga rufa*	201	Sparrowhawk, Little	*Accipiter minullus*
61	Dove, Cape Turtle	*Streptopelia capicola*	202	Sparrowhawk, Ovambo	*Accipiter ovampensis*
62	Dove, Emerald-spotted Wood	*Turtur chalcospilos*	203	Spoonbill, African	*Platalea alba*
63	Dove, Laughing	*Spilopelia senegalensis*	204	Spurfowl, Natal	*Pternistis natalensis*
64	Dove, Namaqua	*Oena capensis*	205	Spurfowl, Swainson's	*Pternistis swainsonii*
65	Dove, Red-eyed	*Streptopelia semitorquata*	206	Starling, Cape	*Lamprotornis nitens*
66	Dove, Rock	*Columba livia*	207	Starling, Red-winged	*Onychognathus morio*
67	Drongo, Fork-tailed	*Dicrurus adsimilis*	208	Starling, Violet-backed	*Cinnyricinclus leucogaster*
68	Duck, African Black	*Anas sparsa*	209	Starling, Wattled	*Creatophora cinerea*
69	Duck, Domestic	*Anas platyrhynchos*	210	Stilt, Black-winged	*Himantopus himantopus*
70	Duck, Muscovy	*Cairina moschata*	211	Stonechat, African	*Saxicola torquatus*
71	Duck, White-faced Whistling	*Dendrocygna viduata*	212	Stork, Abdim's	*Ciconia abdimii*
72	Duck, Yellow-billed	*Anas undulata*	213	Stork, Black	*Ciconia nigra*
73	Eagle, African Fish	*Haliaeetus vocifer*	214	Stork, White	*Ciconia ciconia*
74	Eagle, Black-chested Snake	*Circaetus pectoralis*	215	Stork, Yellow-billed	*Mycteria ibis*
75	Eagle, Brown Snake	*Circaetus cinereus*	216	Sunbird, Amethyst	*Chalcomitra amethystina*
76	Eagle, Verreaux's	*Aquila verreauxii*	217	Sunbird, Greater Double-collared	*Cinnyris afer*
77	Eagle, Wahlberg's	*Hieraaetus wahlbergi*	218	Sunbird, Malachite	*Nectarinia famosa*
78	Eagle-Owl, Spotted	*Bubo africanus*	219	Sunbird, Marico	*Cinnyris mariquensis*

79	Egret, Great	*Ardea alba*	220	Sunbird, White-bellied	*Cinnyris talatala*
80	Egret, Intermediate	*Ardea intermedia*	221	Swallow, Barn	*Hirundo rustica*
81	Egret, Little	*Egretta garzetta*	222	Swallow, Greater Striped	*Cecropis cucullata*
82	Egret, Western Cattle	*Bubulcus ibis*	223	Swallow, Lesser Striped	*Cecropis abyssinica*
83	Eremomela, Burnt-necked	*Eremomela usticollis*	224	Swallow, Pearl-breasted	*Hirundo dimidiata*
84	Falcon, Amur	*Falco amurensis*	225	Swallow, South African Cliff	*Petrochelidon spilodera*
85	Falcon, Lanner	*Falco biarmicus*	226	Swallow, White-throated	*Hirundo albigularis*
86	Falcon, Peregrine	*Falco peregrinus*	227	Swift, African Black	*Apus barbatus*
87	Finch, Cut-throat	*Amadina fasciata*	228	Swift, African Palm	*Cypsiurus parvus*
88	Finch, Red-headed	*Amadina erythrocephala*	229	Swift, Alpine	*Tachymarptis melba*
89	Firefinch, African	*Lagonosticta rubricata*	230	Swift, Common	*Apus apus*
90	Firefinch, Jameson's	*Lagonosticta rhodopareia*	231	Swift, Horus	*Apus horus*
91	Firefinch, Red-billed	*Lagonosticta senegala*	232	Swift, Little	*Apus affinis*
92	Fiscal, Southern	*Lanius collaris*	233	Swift, White-rumped	*Apus caffer*
93	Flamingo, Greater	*Phoenicopterus roseus*	234	Tchagra, Black-crowned	*Tchagra senegalus*
94	Flycatcher, African Paradise	*Terpsiphone viridis*	235	Tchagra, Brown-crowned	*Tchagra australis*
95	Flycatcher, Fairy	*Stenostira scita*	236	Teal, Red-billed	*Anas erythrorhyncha*
96	Flycatcher, Fiscal	*Melaenornis silens*	237	Tern, Whiskered	*Chlidonias hybrida*
97	Flycatcher, Southern Black	*Melaenornis pammelaina*	238	Tern, White-winged	*Chlidonias leucopterus*
98	Flycatcher, Spotted	*Muscicapa striata*	239	Thick-knee, Spotted	*Burhinus capensis*
99	Francolin, Crested	*Dendroperdix sephaena*	240	Thrush, Cape Rock	*Monticola rupestris*
100	Go-away-bird, Grey	*Crinifer concolor*	241	Thrush, Groundscraper	*Turdus litsitsirupa*
101	Goose, Domestic	*Anser anser*	242	Thrush, Karoo	*Turdus smithi*
102	Goose, Egyptian	*Alopochen aegyptiaca*	243	Thrush, Kurrichane	*Turdus libonyana*
103	Goose, Spur-winged	*Plectropterus gambensis*	244	Thrush, Short-toed Rock	*Monticola brevipes*
104	Goshawk, Gabar	*Micronisus gabar*	245	Tinkerbird, Yellow-fronted	*Pogoniulus chrysoconus*
105	Grassbird, Cape	*Sphenoeacus afer*	246	Tit-Flycatcher, Grey	*Myioparus plumbeus*
106	Grebe, Little	*Tachybaptus ruficollis*	247	Vulture, Cape	*Gyps coprotheres*
107	Guineafowl, Helmeted	*Numida meleagris*	248	Vulture, White-backed	*Gyps africanus*
108	Gull, Grey-headed	*Chroicocephalus cirrocephalus*	249	Wagtail, African Pied	*Motacilla aguimp*
109	Harrier-Hawk, African	*Polyboroides typus*	250	Wagtail, Cape	*Motacilla capensis*
110	Heron, Black	*Egretta ardesiaca*	251	Warbler, African Reed	*Acrocephalus baeticatus*
111	Heron, Black-crowned Night	*Nycticorax nycticorax*	252	Warbler, Chestnut-vented	*Curruca subcoerulea*
112	Heron, Black-headed	*Ardea melanocephala*	253	Warbler, Garden	*Sylvia borin*
113	Heron, Goliath	*Ardea goliath*	254	Warbler, Great Reed	*Acrocephalus arundinaceus*
114	Heron, Grey	*Ardea cinerea*	255	Warbler, Icterine	*Hippolais icterina*
115	Heron, Purple	*Ardea purpurea*	256	Warbler, Lesser Swamp	*Acrocephalus gracilirostris*
116	Heron, Squacco	*Ardeola ralloides*	257	Warbler, Little Rush	*Bradypterus baboecala*
117	Heron, Striated	*Butorides striata*	258	Warbler, Marsh	*Acrocephalus palustris*
118	Honey-buzzard, European	*Pernis apivorus*	259	Warbler, Willow	*Phylloscopus trochilus*
119	Honeybird, Brown-backed	*Prodotiscus regulus*	260	Waxbill, Black-faced	*Brunhilda erythronotos*
120	Honeyguide, Greater	*Indicator indicator*	261	Waxbill, Blue	*Uraeginthus angolensis*

121	Honeyguide, Lesser	*Indicator minor*	262	Waxbill, Common	*Estrilda astrild*
122	Hoopoe, African	*Upupa africana*	263	Waxbill, Orange-breasted	*Amandava subflava*
123	Hornbill, African Grey	*Lophoceros nasutus*	264	Weaver, Cape	*Ploceus capensis*
124	Hornbill, Southern Yellow-billed	*Tockus leucomelas*	265	Weaver, Scaly-feathered	*Sporopipes squamifrons*
125	Ibis, African Sacred	*Threskiornis aethiopicus*	266	Weaver, Southern Masked	*Ploceus velatus*
126	Ibis, Glossy	*Plegadis falcinellus*	267	Weaver, Thick-billed	*Amblyospiza albifrons*
127	Ibis, Hadada	*Bostrychia hagedash*	268	Weaver, Village	*Ploceus cucullatus*
128	Indigobird, Dusky	*Vidua funerea*	269	Wheatear, Capped	*Oenanthe pileata*
129	Indigobird, Purple	*Vidua purpurascens*	270	White-eye, Cape	*Zosterops virens*
130	Indigobird, Village	*Vidua chalybeata*	271	Whydah, Long-tailed Paradise	*Vidua paradisaea*
131	Jacana, African	*Actophilornis africanus*	272	Whydah, Pin-tailed	*Vidua macroura*
132	Kestrel, Greater	*Falco rupicoloides*	273	Whydah, Shaft-tailed	*Vidua regia*
133	Kestrel, Lesser	*Falco naumanni*	274	Widowbird, Long-tailed	*Euplectes progne*
134	Kestrel, Rock	*Falco rupicolus*	275	Widowbird, Red-collared	*Euplectes ardens*
135	Kingfisher, Brown-hooded	*Halcyon albiventris*	276	Widowbird, White-winged	*Euplectes albonotatus*
136	Kingfisher, Giant	*Megaceryle maxima*	277	Wood Hoopoe, Green	*Phoeniculus purpureus*
137	Kingfisher, Malachite	*Corythornis cristatus*	278	Woodpecker, Bearded	*Chloropicus namaquus*
138	Kingfisher, Pied	*Ceryle rudis*	279	Woodpecker, Cardinal	*Dendropicos fuscescens*
139	Kingfisher, Woodland	*Halcyon senegalensis*	280	Woodpecker, Golden-tailed	*Campethera abingoni*
140	Kite, Black-winged	*Elanus caeruleus*	281	Wryneck, Red-throated	*Jynx ruficollis*
141	Kite, Yellow-billed	*Milvus aegyptius*			

APPENDIX B: SPECIALIST CURRICULUM VITAE AND QUALIFICATIONS

PERSONAL PROFILE

Liezl Landman is an Ecological Specialist and Environmental Consultant with approximately five years of experience in the field of environmental management. Her core experience and expertise are in the mining and industrial sectors, focusing on Ecological and Biodiversity Assessments, both Terrestrial and Aquatic, along with Wetland Delineation and Functionality Assessments, Visual Impact Assessments, Water and Air Quality Assessments, GIS Mapping and SASS 5 Aquatic Biomonitoring. She has proven competence in environmental legal compliance audits (WUL, WML, EA/ROD and AEL), and EMPr Performance Assessments for various industrial and mining works. And completed several Basic Assessments (BAs), Water Use Licence Applications (WULAs), Public Participation Processes (PPPs), Air Emission Licence Applications, and have experience with the current e-WULAA online Water Use Licence Application platform.

Liezl is registered as a professional scientist in the field of ecological science and environmental science with SACNASP and a member of the IAIAsa.

CAPACITY

In her capacity as **SPECIALIST** at Elemental Sustainability (Pty) Ltd (Elemental-S), she has been exposed and worked on numerous projects. Since starting her career in the environmental field she has gained valuable experience and insight into the fields of environmental science and project management. As Specialist, the areas of responsibility at Elemental-S is set out strategically to cater for a wide range of operational and specialist requirements.

QUALIFICATIONS

EDUCATION AND QUALIFICATIONS	M.Sc. Environmental Ecology, University of Pretoria, 2021. B.Sc. Honours Wildlife Management, University of the Free State, 2011. B.Sc. Zoology, University of the Free State, 2010.		
CONTINUED PROFESSIONAL DEVELOPMENT	**COURSE**	**INSTITUTION**	**COMPLETED**
	Environmental Impact Assessment Report Writing Course	International Association for Impact Assessment (IAIAsa)	2020
	Tools for Wetland Assessment Training	Rhodes University; GroundTruth & Verdant Environmental	2020
	Introduction to Hydropedology Course	Department of Water and Sanitation (DWS) & Digital Soils Africa (DSA)	2019

	Section 21 (c) & (i) water use authorisation training	Department of Water and Sanitation (DWS)	2019
	SASS5 Aquatic Biomonitoring Training	GroundTruth	2018
	Environmental Law (Awareness) (NQF 5)	Centre for Environmental Management (CEM)	2018
	Environmental Legal Update Training	MacRobert Attorneys	2017
	Environmental Law Update Workshop	IMBEWU Sustainability Legal Specialists	2016
	ISO 14001:2004 Environmental Management Systems Training Course	SGS	2014

PROFESSIONAL STATUS	South African Council of Natural Scientific Professions - Registered Professional Natural Scientist – Environmental and Ecological Science (118084)
Registrations & Memberships	International Association for Impact Assessment (IAIA)

PROFESSIONAL EXPERIENCE

CAREER HISTORY	
Employer	**ELEMENTAL SUSTAINABILITY (PTY) LTD (ELEMENTAL-S)**
Period	November 2020 – Current
Position	**Senior Specialist and Consultant**
Employer	**MILNEX CC ENVIRONMENTAL CONSULTANTS**
Period	May 2019 – October 2020
Position	**Terrestrial and Aquatic Ecologist; Environmental Consultant**
Employer	**ENVIRONMENTAL ASSURANCE (PTY) LTD – ENVASS**
Period	February 2016 - March 2019
Position	**Environmental Consultant; Environmental Auditor; Ecologist and GIS Specialist** **Divisional Head: Environmental Audits** **Unit Manager: Audits, Mine Closures and Aquatic Biomonitoring**
Employer	**DELRON CONSULTING CC**
Period	June 2015 - October 2015 (Part-time)
Position	**Junior Environmental Assessment Practitioner**

WORK EXPERIENCE

WORK EXPERIENCE AND SKILLS	• **Project Management** - Marketing - Customer Relationship Management - Project Costing and Proposal Writing - Project Initiation, Planning and Tracking - Project Budget Management - Project Schedule Implementation - Risk Identification - Correspondence with State Departments, Local Authorities, Municipalities, Communities, and - Stakeholders - Quality Review Process - Timesheets • **Specialist Studies** - Terrestrial and Aquatic Assessments - Biodiversity Assessments and Management Plans - Wetland Delineation, Buffer Zone Determination and Functionality Assessments - C & I Water Use Risk Assessments - Ecological Desktop Assessments - Alien Invasive Management Plans - Visual Impact Assessments - Biomonitoring Assessments (SASS5) • **Environmental Compliance Audits** - Water Use Licence (WUL) - Air Emission Licence (AEL) - Waste Management Licence (WML) - Environmental Management Programme (EMPr) Performance Assessment Reviews (PAR) - Environmental Authorisations (EA) - Environmental Control Officer (ECO) • **Compliance Monitoring and Measurement** - Surface and Groundwater, Air and Noise Quality - Data Analysis and Interpretation • **Authorisations** - Environmental Impact Assessments (BA & EIA) - Public Participation Process - Air Emission Licence Applications - Water Use Licence Applications (WULA) - Environmental Management Programmes (EMPr) - National and Provincial Flora Permit and Licence Applications • **Other** - Geographic Information Systems (GIS Mapping) - Odour Zone Assessments - Waste Management Plans - Ecological Specifications

PROJECT EXPERIENCE	Refer to the summary of project experience in the section overleaf.

SUMMARY OF KEY PROJECTS

SPECIALIST STUDIES

Ecological and Biodiversity Assessments and Management Plans:	
Ecological Management Plan for the Mooiplaats Colliery	Coal of Africa
Baseline Biodiversity Assessment for the Zandfontein Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Baseline Biodiversity Assessment for the Boekenhoutkloof Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Ecological Scan for the proposed Brikor Grootfontein Mine	Brikor Limited
Baseline Ecological Assessment for a Proposed Prospecting Application	Klei Minerale (Pty) Ltd.
Ecological Fauna and Flora Assessment	Serfontein Poultry
Terrestrial Ecological Assessment	Nuco Chrome
Watercourse Delineation and Ecological Impact Assessment Report	Steinmann Groep (Pty) Ltd
Ecological and Wetland Assessment	Nendifusion (Pty) Ltd
Ecological and Wetland Assessment	Jodeo Four (Pty) Ltd
Ecological and Wetland Assessment	Miramar Trading (Pty) Ltd
Ecological and Wetland Assessment	Lolacento (Pty) Ltd
Ecological and Wetland Assessment	Johan Smit
Wetland Assessment and Delineation	Coenraad Du Toit
Ecological and Wetland Assessment	Acacia Resources (Pty) Ltd
Watercourse Delineation and Impact Assessment	DJ De Smidt
Watercourse Delineation and Impact Assessment	Britman Stene CC
Ecological and Wetland Assessment	Seal-a-Deal
Ecological and Wetland Assessment	Olievenfontein Trust
Wetland Assessment and Delineation	Rooi Lak (Pty) Ltd
Wetland Assessment and Delineation	Paul Pretorius
Ecological and Wetland Assessment	Welwitschia Holdings (Pty) Ltd
Wetland Assessment and Delineation	Prieska Diamond Mining (Pty) Ltd
Wetland Assessment and Delineation	Sanddrif Exploration (Pty) Ltd
Ecological and Wetland Assessment	GF Diamond Mining (Pty) Ltd
Ecological and Wetland Assessment	Kolver Mulke Boerdery (Pty) Ltd
Watercourse Delineation and Ecological Impact Assessment	Okapi Diamonds (Pty) Ltd

Watercourse Delineation and Ecological Impact Assessment	Bondeo 140 CC
Watercourse Delineation and Impact Assessment – Britten Mine	Oos Transvaal Kalk Verskaffers (Pty) Ltd
Watercourse Delineation and Impact Assessment – Marico Mine	Oos Transvaal Kalk Verskaffers (Pty) Ltd
Watercourse Delineation and Impact Assessment – Buhrmansdrift Mine	Oos Transvaal Kalk Verskaffers (Pty) Ltd
Several Baseline Ecological Desktop Assessments (A full list can be provided upon request)	
Biomonitoring Assessments:	
Zululand Anthracite Colliery (ZAC)	Zululand Anthracite Colliery (ZAC)
Blinkpan Siding	Makoya Supply Chain Holdings (Pty) Ltd
Phalanndwa Colliery	Canyon Resources
Alien Invasive Vegetation Management Plans:	
Kilo Sand Clay Mine	Kilo Sand CC
Zandfontein Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Boekenhoutkloof Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Farm Koppie-Alleen 221, North West Province	Namakwa Diamonds Holdings (Pty) Ltd.
Visual Impact Assessments:	
Glen Gariff Housing Development in the Eastern Cape Province	Bulugha Investments (Pty) Ltd
Vorna Valley Extension 106 Housing Development in Midrand, Gauteng Province	M&T Development
Mokopane Red Granite (Pty) Ltd Proposed Granite Mine	Elemental Sustainability (Pty) Ltd
Malekaskraal Vanadium (Pty) Ltd Proposed Open Cast Vanadium Mine	Mafanele Geo-enviro Consulting (Pty) Ltd
Other:	
Air Quality Baseline Assessment – Southern Farms	ValuMax Southern Farms
Air Quality Baseline Assessment – Mulke Farm	Kolver Mulke Boerdery (Pty) Ltd
Odour Zone Assessment - Southern Farms	LEAP Consultants

COMPLIANCE AUDITS

AEL Compliance Audits:	
Rosema Olifantsfontein	Era Stene (Pty) Ltd

Kemin Industries	Kemin Industries (Pty) Ltd.
Zandfontein Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Boekenhoutkloof Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
WUL Compliance Audits:	
Glencore Magareng Mine	Glencore Merafe Venture
Glencore Mototolo Mine	Glencore Merafe Venture
Zululand Anthracite Colliery (ZAC)	Zululand Anthracite Colliery (ZAC)
Dooren Kuilen	Kariba Minerals (Pty) Ltd
Kadgame Diamond Mine	Kadgame Mining (Pty) Ltd
Wouterspan Delwery	Wouterspan Boerdery (Pty) Ltd
WML Compliance Audits:	
AfriSam Dudfield Site	AfriSam South Africa (Pty) Ltd.
Infrabuild Cement	Infrabuild Cement Pty Ltd
MPRDA EMPr Performance Assessment:	
Kilo Sand Clay Mine	Kilo Sand CC
Hernic – Bokone Site	Hernic Ferrochrome
Evraz	EVRAZ Vametco Holdings (Pty) Ltd.
Zandfontein Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Boekenhoutkloof Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Infrabuild Cement	Infrabuild Cement Pty Ltd
PPC Beestekraal Operations	PPC Cement
EA/ROD Compliance Audits:	
AfriSam Dudfield Site	AfriSam South Africa (Pty) Ltd.
Infrabuild Cement	Infrabuild Cement Pty Ltd
Environmental Compliance Officer (ECO):	
Construction of Flammable Store	Freightpak
Victoria Clay Mine and Brick Making Plant	Victoria Bricks

AUTHORISATIONS

Basic Assessment for The Proposed Development Of 150 Housing Units: Williston	CoGHSTA
Environmental Management Programme (EMPr) Marina Salt	Swartkops Sea Salt (Pty) Ltd

Water Use Licence Application (WULA) for SABrix Zandfontein	Klei Minerale (Pty) Ltd.
Water Use Licence Application (WULA) for SABrix Boekenhoutkloof	Klei Minerale (Pty) Ltd.
Water Use Licence Application (WULA) for Britman Stene	Britman Stene CC
Air Emission Licence (AEL) Renewal SABrix ZF	Klei Minerale (Pty) Ltd.
Air Emission Licence (AEL) Renewal SABrix BK	Klei Minerale (Pty) Ltd.
Air Emission Licence (AEL) Amendment Kemin	Kemin Industries (Pty) Ltd.
Air Emission Licence (AEL) Application Pika Brick	Henque 4052 CC
Flora Removal Permit and Licence Application – Farm Nooitgedacht	Morgenson Mining (Pty) Ltd.
Flora Removal Permit and Licence Application – Farm Lanyon Vale	Morgenson Mining (Pty) Ltd.
Flora Removal Permit and Licence Application	Okapi Diamonds (Pty) Ltd.
Flora Removal Permit and Licence Application	Bondeo 140 CC

COMPLIANCE MONITORING

Air Quality:	
Mooinooi Mine	Samancor WCM
Millsell Mine	Samancor WCM
Waterkloof Mine	Samancor WCM
Buffelsfontein Mine	Samancor WCM
Boekenhoutkloof Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Zandfontein Clay Mine and Brick Making Plant	Klei Minerale (Pty) Ltd.
Rosema Olifantsfontein Clay Mine and Brick Making Plant	Era Stene (Pty) Ltd
LockSand Sand Mine	LockSand
Sterkfontein Clay Mine and Brick Making Plant	Sterkfontein Bricks
Highveld Siding	Makoya Supply Chain Holdings (Pty) Ltd
Delmas Clay Mine	Era Stene
Olifantsfontein Clay Mine and Brick Making Plant	Era Stene
Victoria Bricks	Victoria Bricks
Kilo Sand Clay Mine	Kilo Sand CC
Sublime	Sublime Technologies
Blinkpan Siding	Makoya Supply Chain Holdings (Pty) Ltd

Water Quality:	
Annual Water Quality Monitoring: Evraz	EVRAZ Vametco Holdings (Pty) Ltd.
Victoria Clay Mine and Brick Making Plant	Victoria Bricks
Kilo Sand Clay Mine	Kilo Sand CC
Sublime	Sublime Technologies

Blinkpan Siding	Makoya Supply Chain Holdings (Pty) Ltd
Noise Assessments:	
Quarterly Noise Assessment LockSand Sand Mine	LockSand
OTHER:	
Waste Management Plan for the Everite Site	Everite Building Products (Pty) Ltd
Gautrain Ecological Specification	Bombela Concession Company Pty Ltd
Mine Closure Plan for the Delmas Clay Mine	Era Stene (Pty) Ltd

REFERENCES	CONTACT NAME	COMPANY	CONTACT NR
	Mr. D. Wilken *Current Employer*	Director Elemental Sustainability (Pty) Ltd.	084 588 2322 dutoit@elemental-s.co.za
	Mr. C. Retief *Former Colleague*	Senior Environmental Consultant Freelance Consultant	082 852 2134 corrieretief2@gmail.com
	Mr. Marco Morelli *Former Colleague*	Department Head – Water Milnex CC	071 365 2474 marco@milnex-sa.co.za
	Dr. Wika Esterhuizen *Client*	Safety, Health and Environmental Advisor Kei Minerale (Pty) Ltd	082 695 9386 wika@sabrix.co.za

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Liezl Taylor

Registration Number: 118084

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Environmental Science (Professional Natural Scientist)
Ecological Science (Professional Natural Scientist)

Effective **13 September 2017** Expires **31 March 2022**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

CERTIFICATION

I, Liezl Landman, declare that, to the best of my knowledge, all the information contained herein is true.

Signature:

Date: 21 September 2021

Appendix 9 : Land Use Map

Elemental SUSTAINABILITY
sustaining our tomorrow, today

Map: Land Use
Project: Sallies Silica
Date: September 2021
Datum: D_WGS_1984
Spheroid: WGS_1984

Coordinates: 25°43'47.35"S
27°47'31.46"E

Legend

Sallies Silica

- Site Boundary
- Indigenous Forest
- Thicket /Dense bush
- Woodlar/Open bush
- Grassland
- Low shrubland
- Cultivated comm fields (high)
- Cultivated comm fields (med)
- Cultivated comm fields (low)
- Cultivated orchards (high)
- Cultivated orchards (med)
- Cultivated orchards (low)
- Mines 1 bare
- Mines 2 semi-bare
- Erosion (donga)
- Bare none vegetated

N
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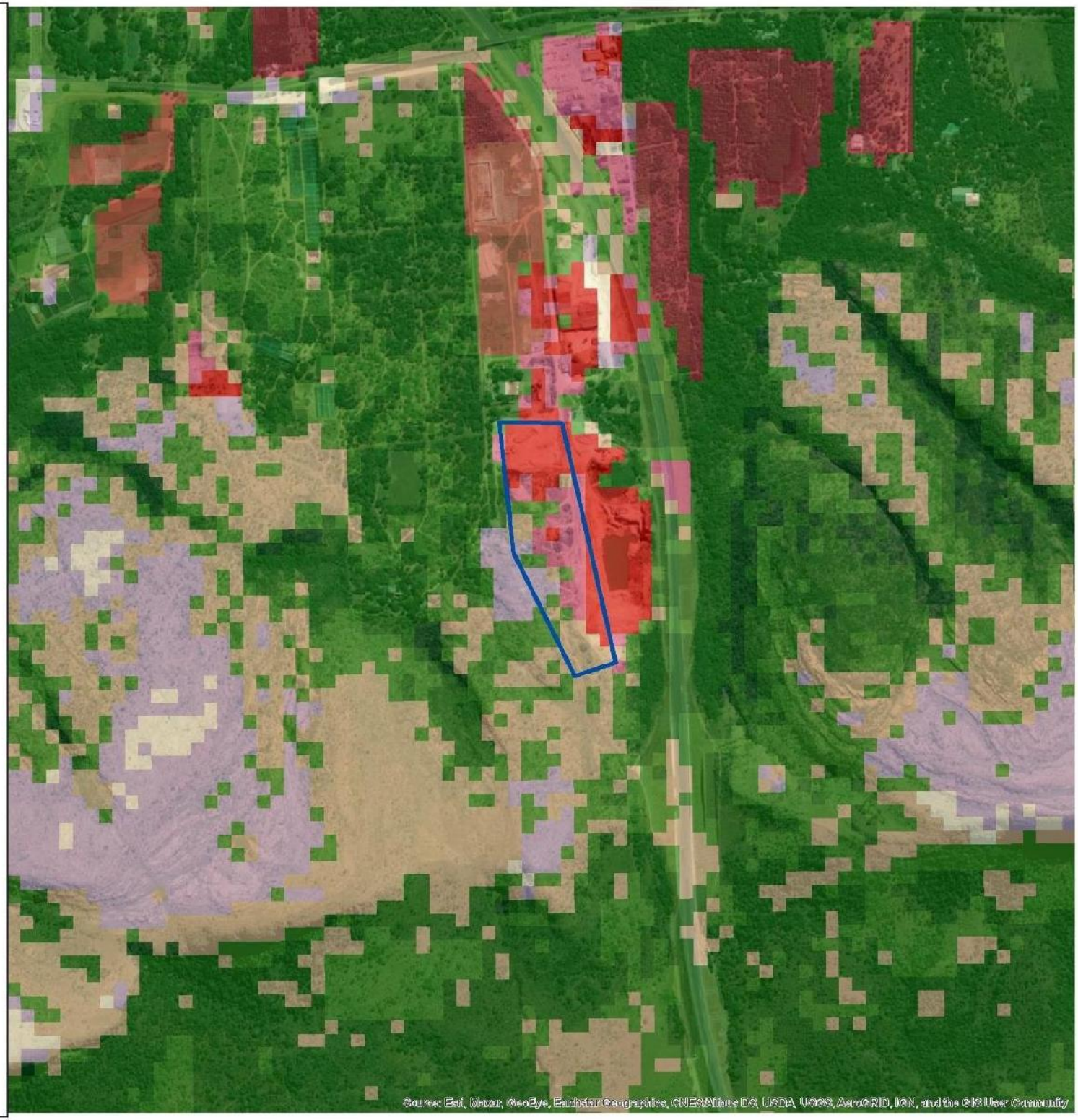
Kilometers
0 0,05 0,1 0,2 0,3 0,4



Appendix 10 Archaeological Assessment

PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT:

PREPARED BY:

Holistic Environmental Services

P.O. Box 679

Thornhill Plaza

Polokwane

0882

DOCUMENT VERSION 1.0 – Draft

THE PROPOSED MINING RIGHT AMENDMENT APPLICATION ON A PORTION OF PORTION 129 OF THE FARM ZANDFONTEIN 447-JQ WITHIN THE JURISDICTION OF THE MADIBENG LOCAL MUNICIPALITY, MAGISTERIAL DISTRICT OF BRITS, NORTH-WEST PROVINCE

PHASE 1 ARCAEOLOGICAL IMPACT ASSESSMENT: HES/325/AIA

DOCUMENT VERSION 1.0 – Draft

THE PROPOSED MINING RIGHT AMENDMENT APPLICATION ON A PORTION OF PORTION 129 OF THE FARM ZANDFONTEIN 447-JQ WITHIN THE JURISDICTION OF THE MADIBENG LOCAL MUNICIPALITY, MAGISTERIAL DISTRICT OF BRITS, NORTH-WEST PROVINCE

AUTHOR:

PREPARED BY:

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Document History and Distribution

TITLE:	The Phase 1 Archaeological Impact Assessment for the proposed mining right amendment application on a portion of portion 129 of the farm Zandfontein 447-JQ within the jurisdiction of the Madibeng Local Municipality, Magisterial District of Brits, North-West Province.
OUR REFERENCE NO.:	HES/325/AIA

Copyright Information

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Abbreviations

EIA	Environmental Impact Assessment
EMP	Environmental Management Plan/Programme
EAP	Environmental Assessment Practitioner
I&AP	Interested and Affected Party
LIA	Late Iron Age
LIHRA	Limpopo Heritage Resources Authorities
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
SAHRA	South Africa Heritage Resource Agency

Glossary

Archaeological sites ; a) Material remains resulting from human activity which are in a state of disuse and are in or on and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;

b) Rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area whinging 10 m of such representation;

c) Features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

Biodiversity : The variety of life and its processes; including the variety of living organisms the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting.

Clearing : The clearing and removal of vegetation, whether partially or in whole, including trees and shrubs, as specified.

Environment : The surroundings within which humans exist and that is made up of:

a) The land, water and atmosphere of the earth;

b) Micro-organisms, plant and animal life;

c) Any part or combination of a) and b) and the interrelationships among and between them; and

d) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being (*i.e.* the social environment).

Habitat	:	A dynamic system of plant, animals and micro-organism communities and their non-living environment interacting as a functional unit.
Heritage resource	:	All those heritage resources that are of cultural significance or other special value for present and future generations, and which are accordingly considered part of the National Estate. In this regard, the National Estate includes those items identified in terms of Section 2 of the National Heritage Resources Act (No 25 of 1999).
Natural vegetation	:	The existing vegetation species, indigenous or otherwise, of trees, shrubs, groundcover, grasses and all other plants found growing on the site.
Site	:	The piece of land and any other place on, under, over, in or through which the development activity are to be executed or carried out. The site shall include the activity area, internal roads and access route.
Weeds and invader plants	:	Weeds and invader plants, as defined under Section 1 of the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) and Government Notice R1048 of 25 May 1984 Part 2, or any list of invaders identified by the Agricultural Research Council and the Plant Protection Research Institute (Handbook No.5 – Plant Invaders of Southern Africa).

Executive Summary

HES was appointed to undertake a archaeological impact assessment of the proposed mining right amendment application on a portion of portion 129 of the farm Zandfontein 447-JQ within the jurisdiction of the Madibeng Local Municipality, Magisterial District of Brits, North-West Province., in terms of the National Heritage Resources Act No. 25 of 1999. The study was undertaken on the 8th of February 2013.

The Phase 1 Archaeological Impact Assessments for the proposed project revealed no archaeological/ or heritage resources within the footprint of the proposed area. The area is vastly disturbed by past and current activities related to mining. Nonetheless, an informal grave-yard was noted. However, this grave-yard is about 80m from the proposed site. As such, it can be argued that this grave-yard is on the buffer-zone. In consideration of the nature of the proposed development, it is important to comment about these graves, although they would not be directly impacted. These graves appear to be over 60 years of age, as such, they have high archaeological value. In total they are seven, and they are marked by stone cairns.

Key Recommendations:

- No stone robbing or removal of any material is allowed. Any disturbance or alteration on these sites (informal-graveyards) would be illegal and punishable by law, under section 36 (3) of the National Heritage Resources Act NHRA of 1999 (Act 25 of 1999).
- Maintain a reasonable buffer zone around the identified graves (approximately 20-25m). No dumping of construction material is allowed within this buffer zone and no alteration or damage on these sites may occur.
- The graves should be marked by a visible tape i.e., danger tape, for the duration of the project, and workers should be notified about these graves.
- Note that it is the responsibility of the developer to notify contractors and workers that archaeological material (e.g. pottery, remains of stone-walling, graves, etc) and fossils are often located underground.

The developer is made aware that archaeological material (e.g. pottery, remains of stone-walling, graves, etc) and fossils are often located underground. Thus, unavailability of archaeological material on the footprint of the proposed area does not mean absentee, archaeological material might be hidden underground, as such the client is reminded to take precautions during the mining activities.

Should any archaeological material be unearthed accidentally during the course of construction, SAHRA should be alerted immediately and construction activities stopped.

We recommend to South African Heritage Resources Agency (SAHRA) to approve the project to continue with recommended archaeological mitigation.

1 Introduction

Holistic Environmental Services Cc was appointed by Restigen (Pty) Ltd on behalf of Rolfes Silica (Pty) Ltd to conduct the mining right amendment application which will include an additional property (6 ha) to an existing mining right for the mining of sand and silica as contemplated in section 102 of the Mineral and Petroleum Resource Development Act (MPRDA), (Act 28 of 2002). The appointment was to conduct the Phase 1 Archaeological Impact Assessment (AIA). This study is often commissioned as part of the heritage component of an Environmental Impact Assessment (EIA) process. The proposed development constitutes an activity, which may be harmful to the heritage resources that could occur in the demarcated area. The management and protection of heritage resources is a requirement of the National Environmental Management Act No.107 of 1998 (NEMA) as amended in terms of the NEMA 2010 regulations and Section 38 of the National Heritage Resources Act (NHRA - Act No. 25 of 1999).

The purpose of the HIA procedures is to identify and describe the following:

- Description of the activity and its location;
- Description of affected environment;
- Identify heritage sites;
- Identify archaeological sites;
- Determine whether the heritage or archaeological remains will be affected by the proposed development;
- Methods used to asses risk;
- Summary of heritage risk assessment;
- Mitigation and/or precautionary measures.

The purpose of the report is to inform the applicant/client about the heritage resources and their significance, while making appropriate recommendations with regard to the management thereof. It is also essential in that it provides South African Heritage Resource Agency (SAHRA) with the necessary information regarding for them to make an informed decision regarding the following:

- Whether it has objections with regard to the development;
- The conditions upon which such developments might proceed;
- The sites to which permits for destruction is required;
- Whether the sites require mitigation and what it should comprise of;
- The measures that should/can be put in place to protect sites that should be conserved.

1.1 Project objective and scope

The purpose of the study was to conduct a detailed site survey and have a holistic understanding of the sensitivity of the proposed area for a mining. From a cultural heritage point of view this survey which for the purpose of this report will be referred to as *archaeological impact assessment* is used to integrate cultural heritage management with the impact of planning proposals prepared to provide a detailed and holistic framework for decision making, and for the implementation of a coherent set of appropriate actions for the conservation of cultural heritage sites if found. Impact assessments highlight the many issues facing sites in terms of site management, conservation, monitoring and maintenance and the environment in and around the site.

2 Archaeological Impact Assessment Report

This Phase 1 archaeological report fulfils the requirement of the NHRA of 1999 (Act 25 of 1999). The structure of this report has been based on section 38 of the NHRA of 1999, which clearly specifies the required content of a Phase 1 HIA (or AIA) report.

2.1 Full Particulars of Heritage Specialist

Company:	Holistic Environmental Services Cc
Heritage Assessment Practitioner:	Mr. Munyadziwa Magoma
Qualifications:	BA (UNISA). Hons (UNIVEN). Archaeology: [ASAPA CRM Member].
Experience in Heritage Assessments:	7 Years
Telephone number:	+27 (0) 15 298 8035
Fax number:	086 538 9453
Postal address:	P.O. Box 679; Thornhill Plaza; Polokwane; 0882
Email address:	consult@holistic-services.co.za
Web:	www.holistic-services.co.za

2.2 The Relevant Authorities

As the proposed activity will take place within the jurisdiction of the North-West Province, the relevant agency in this case is:

South African Heritage Resources Agency (SAHRA)
Ms. K. Smuts
The Chief Executive Officer
111 Harrington Street
Cape Town
8001
Tel: (021) 462 4502
Fax: (021) 462 4509
E-mail: ksmuts@sahra.org.za

3 Methodology

- A desktop study was first undertaken to better understand the nature of the activity, this study involve the investigation of the history of the area through internet search and consultation with relevant authorities. In addition, SAHRA inventory was searched to very what other researcher have found in the area. More so, a library at the University of Pretoria was consulted to help with further understanding the area around the proposed site.
- The area was inspected on **08th of February 2013**
- To make solid defensible judgment a ground survey through acceptable archaeological standard was undertaken with no attempt to alter with the environment, the survey lasted approximately two and a half hour. It requires a detailed foot survey of the proposed area, area that could yield information were given a closer look. In addition a reasonable buffer area was given attention.
- Photographs were taken with a 10.1 mega-pixel Sony Cybershot Digital Camera and co-ordinates were taken with a handheld Garmin etrex Venture HC.
- The visibility of the soil was moderate; it is important to note that there was no research which was undertaken on the subsurface, since a permit is required from SAHRA to tamper with a site.
- The client is reminded that heritage material might be hidden underground and the Act requires that a developer cease all work immediately and notify relevant heritage resource agency (**in this case SAHRA**).

4 Proposed Activity

4.1 Locality

The proposed area for development is approximately 6ha. This site is located south of the town of Britz (North-West) and about 40km north of Krugersdorp (Gauteng). The site can be characterised as undulating with rolling hills, while certain section of the area is fairly flat. Rocky outcrop and few small shrubs define the area. Currently the area is vacant of any activity. Nonetheless, certain section of the activity was in the past used as a dumping area of faulty machinery.

- Oral interview was conducted with the manager of the area, he pointed out that, except for the graves, he is not aware of any material of heritage within the area. Ccoordinates of the site is the following: S25°72969; E27°79085.

Figure 1: Locality Map

4.2 Description of Activity

The proposed amendment is to include an additional mining area (6 ha) to the existing mining right obtained for portion 95 (±33 ha) of the farm Zandfontein 447-JQ. The existing mining right on the said property is for the mining of sand and silica. According to the Mineral and Petroleum Resources Development Act (MPRDA) no person may remove, or mine for, any mineral without an environmental management plan and a license issued by the same department. This public participation process is being undertaken to meet the requirements of the MPRDA.

The additional mining area will be marked along the boundaries with suitable material for public safety. The top 200-300 mm soil will be removed and stored for use during rehabilitation in areas where it will not be disturbed by the progress of gravel excavation and removal. A grader will be used to clear and dig up the area to loosen topsoil and a front loader will load the material into trucks for storage. Water trucks will be used to water the area before and during the mining operation depending on dust. Following the extraction of the gravel, the mine will be rehabilitated. The walls of the mine will be sloped to minimise water run-off and increase the ability of the soil to retain water. Coarse material incapable of supporting vegetation will be covered with finer material and topsoil. The area will be landscaped on all sides to speed up establishment of grasses and shrubs.

Figure 2: View of the noted graves

Figure 3: An overview of the graves, note the distance from the informal-road as indicated by the red mark.

Figure 4: Note the malfunction machinery that have been dumped in the area proposed for development, as indicated by the arrow.

Figure 5: View of the eastern section proposed for development.

Figure 6: View of the southern section.

Figure 7: View of the northwest section of the proposed area.

Figure 8: View of operation currently taking place. This area is adjacent to the proposed site.

5 Legal Requirements

The activity is listed under Section 38 (1) of the National Heritage Resources Act NHRA of 1999 (Act 25 of 1999) and therefore requires a Phase 1 HIA (AIA) to be conducted. The following activities are listed under the Act and require a HIA (AIA) to be conducted:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50 m in length; and

(c) any development or other activity which will change the character of an area of land, or water -

- *(i) exceeding 5 000 m² in extent;*
- *(ii) involving three or more existing erven or subdivisions thereof; or*
- *(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or*
- *(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a Provincial Heritage Resources Authority;*

(d) the re-zoning of a site exceeding 10 000 m² in extent; or

(e) any other category of development provided for in regulations by SAHRA or a Provincial Heritage Resources Authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Section 3 of the national heritage resource Act (25 of 1999) lists a wide range of national resources that qualify as part of South Africa national estate. When conducting a Heritage Impact Assessment (HIA) the following heritage resources had to be identified:

(a) Places, buildings structures and equipment of cultural significance

(b) Places to which oral traditions are attached or which are associated with living heritage

(c) Historical settlements and townscapes

(d) Landscapes and natural features of cultural significance

(e) Geological sites of scientific or cultural importance

(f) Archaeological and paleontological sites

(g) Graves and burial grounds including-

(i) ancestral graves

(ii) royal graves and graves of traditional leaders

(iii) graves of victims of conflict

(iv) graves of individuals designated by the Minister by notice in the Gazette

(v) historical graves and cemeteries; and

(vi) other human remains which are not covered by in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983)

(h) Sites of significance relating to the history of slavery in South Africa

(i) moveable objects, including -

(i) objects recovered from the soil or waters of South Africa, including archaeological and paleontological objects and material, meteorites and rare geological specimens

(ii) objects to which oral traditions are attached or which are associated with living heritage

(iii) ethnographic art and objects

(iv) military objects

(v) objects of decorative or fine art

(vi) objects of scientific or technological interest; and

(vii) books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1 of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

Other sections of the Act with relevance are the following:

Section 34(1) *No person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.*

Section 35(4) *No person may, without a permit issued by the responsible heritage resources authority:*

- *destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite*

Section 36 (3) *No person may, without a permit issued by SAHRA or a provincial heritage resources authority:*

- *destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside formal cemetery administered by a local authority; or*

- *bring onto or use at a burial ground or grave any excavation equipment, or any equipment which assists in detection or recovery of metals.*

Other relevant legislation includes:

- The Constitution of South Africa Act of 1996 (Act No. 108 of 1996);
- Limpopo Environmental Management Act of 2003 (Act No. 7 of 2003);
- The National Environmental Management Biodiversity Act of 2004 (Act No. 10 of 2004);
- The National Environmental Management Act of 1998 (Act No. 107 of 1998);
- The National Environmental Management Biodiversity Act of 2004 (Act No. 10 of 2004) and the regulations and lists regarding threatened and protected species ;
- White Paper on Integrated Pollution and Waste Management for South Africa.

6 Site Significance

The *significance* of the sites and artefacts are determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

(a) Historic value

(i) Is it important in the community, or pattern of history?

(ii) Does it have strong or special association with the life or work of a person, group or organisation of importance in history?

(iii) Does it have significance relating to the history of slavery?

(b) Aesthetic value

Is it important in exhibiting particular aesthetic characteristics valued by a community or cultural group?

(c) Scientific value

(i) Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage?

(ii) Is it important in demonstrating a high degree of creative or technical achievement at a particular period?

(d) Social value

Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons?

(e) Rarity

Does it possess uncommon, rare or endangered aspects of natural or cultural heritage?

(f) Representivity

(i) Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects?

(ii) What is the importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class?

(iii) Is it important in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.

(g) Sphere of Significance

This category requires a broad, but detailed knowledge of the various disciplines that might be involved. Large sites, for example, may not be very important, but a small site, on the other hand, may have great significance as it is unique for the region. Such a region can transcend international boundaries.

6.1 Methodology for Assessing Significance

This category relates to the actual artefact or site in terms of its actual value as it is found today, and refers more specifically to the condition that the item is in. For example, an archaeological site may be the only one of its kind in the region, thus its regional significance is high, but there is heavy erosion of the greater part of the site, therefore its significance rating would be medium to low. Generally speaking the following are guidelines for the nature of the mitigation that must take place as Phase 2 of the project.

Table 1: Description of significant ratings

High
This is a do not touch, leave entirely alone situation. Alternative areas or routes must be sought for the project, be it a pipeline, mine, power line, road, township development or any other form in which the proposed development may be. Examples would be natural and cultural landscapes like the Mapungubwe Cultural

Landscape World Heritage Site, or the house in which Nelson Mandela grew up in.

Certain sites or features may be exceptionally important, but do not warrant leaving entirely alone. In such cases, detailed mapping of the site and all its features is imperative, as is the collection of diagnostic artefactual material on the surface of the site. Extensive excavations must be done to retrieve as much information as possible before destruction. Such excavations might cover more than half the site and would be mandatory.

In the above mentioned case study (2), it would also be advisable to negotiate with the client to see what mutual agreement in writing could be reached, whereby part of the site is left for future research.

Medium

Sites of medium significance require detailed mapping of all the features and the collection of diagnostic artefactual material from the surface of the site. A series of test trenches and test pits should be excavated to retrieve basic information before destruction.

Low

These sites require minimum or no mitigation. Minimum mitigation recommended could be a collection of all surface materials and/or detailed site mapping and documentation. No excavations would be considered to be necessary. Where no mitigation is required, then the site can be destroyed.

In all the above scenarios permits will be required from the National Heritage Resources Agency (SAHRA) as per the relevant law, namely the National Heritage Resources Act (Act 25 of 1999). Destruction of any heritage site may only take place when a permit has been issued by SAHRA or its provincial equivalent should this exist.

7 History of the area around the proposed site

The Later Stone Age is associated with the San and the knowledge of sites belonging to this period is limited in the area around Madibeng Local Municipality. However, Later Stone Age tools, rock engravings and rock painting have been documented in the Magaliesberg range (Wadley, 1998). The earliest evidence of Bantu-speaking farmers' in the region dates to between 350 to 600 AD. These sites are significant in that they provide among others the earliest solid evidence for the practice of lobola in South Africa (Huffman 2007). The Later Iron Age sites within the project area are chiefly associated with early Tswana people. The Tswana or western

Sotho are one of the three groups on which Sotho speaking people are grouped. The other two being southern Sotho (Basotho), and northern Sotho (Bapedi). The origin of the name Tswana is the subject of speculation, it has been interpreted as meaning “little offshoots”, “separatist”, and to “those who are alike” (Schapera 1962). When the first Tswana people arrived in the land we now call Botswana, they encountered the San (Sarwa), to whom it is not clear when did they enter southern Africa. However, Schapera (1952) further indicated that it was somewhere in the distant past, and at some point these people were generally populated across the southern Africa region. After been encountered, the San where either displaced and pushed to the desert were they are now found.

Although local variation in terms of dialect, social structure and other aspect of culture do occurs among the Tswana, they are a sufficient homogenous and can be classified as a single group (Schapera 1962). According to Schapera (1952) the Kgalagadi, who are believed to have originated somewhere in the vicinity of the Great-Lakes of East-Africa, were the first group of the Tswana to have encountered the San in Botswana. However, Breutz (1989) argued that since from oral tradition it is stated that they originated from the area were “the sun stood on the other side”, it means they lived north of the equator, which would probably be southern Sudan, and not Great Lakes, which is on the Equator.

The Rolong and Tlhaping group of the Tswana were the next to arrived, on arrival they absorbed the Kgalagadi and San people who were found in the area (Schapera 1652). The Tlhaping were referred to as Briqua (goat people) by the Khoi people, and they ate fish which is unusual among the Bantu-speaking people (Breutz 1989). Accordingly Breutz (1989) indicated that these groups arrived between 1200 and 1350, and at around 1350-1400 there was a large migration of another group called the Kwena-Hurutshe, this group settled in the Rustenburg and Brits area. Accordingly these migrations were without attack by tsetse fly, which made it difficult for the stock they had. Eventually, the last group entered South Africa at around fifteen or perhaps sixteenth century. They choose to settle east of Crocodile and Marico Rivers. Towards the end of the seventeenth century, a period of drought and famine made life difficult around the Rustenburg region. As such, a search of grazing and water pushed these groups into what is now Botswana.

The Magaliesberg range which is an area where most of the earliest evidence of Bantu-speaking farmers are located, was named after Mogale who was the Chief. In addition, the area was also occupied for a while by the Ndebele of Mzilikazi between 1823 and 1838. However, the capital of Mzilikazi was located on the northern side of the Magaliesberg range, and out of the boundaries of the Madibeng area (Carruthers 2007). The Madibeng area was also inhabited by the Voortrekker in the mid-1800, the Voortrekkers fought many battles against African communities including the Ndebele of Mzilikazi. By 1860, the Madibeng area was part and

parcel of the Boer Republic also known as the Zuid-Afrikaansche Republiek (ZAR). The Anglo-Boer War of 1899-1901 also reached the Madibeng area. In fact, the notorious Swartkop Commando frequented the area well into the final stages of war when commercial warfare was replaced by guerilla tactics (Carruthers 2007).

8 Findings

Although there was no archaeological material that was noted within the proposed area, an informal graveyard was noted, this graveyard is on the buffer zone. If not harnessed, it can be endangered by the proposed development. Conversely, it is important to note that, it is close to an informal road. Thus, the informal road, is about -60cm from the graves. If one considers that Meyers (2012) espoused that over time the original context of the burial will change, and as the body decomposes it will shift its position under the ground. It is possible that the informal road might be transverse on the content of the grave, though unintentional. The coordinates for the noted graves: S25°72969; E27°79085.

9 Recommendations

These graves appear to be over 60 years of age, as such, they have high archaeological value. In total they are seven, and they are all marked by stone cairns. Furthermore they are parallel and close to each other.
Key Recommendations:

- No stone robbing or removal of any material is allowed. Any disturbance or alteration on these sites (informal-graveyards) would be illegal and punishable by law, under section 36 (3) of the National Heritage Resources Act NHRA of 1999 (Act 25 of 1999).
- Maintain a reasonable buffer zone around the identified graves (approximately 20-25m). No dumping of construction material is allowed within this buffer zone and no alteration or damage on these sites may occur.
- The graves should be marked by a visible tape i.e., danger tape, for the duration of the project, and workers should be notified about this site.
- The informal road which is adjacent to the graves, and approximately 60cm from the edge of the cairns should be realigned and shifted further from these graves. There should be at-least a circumference of 20m between the graves and any road, existing or new.
- Note that it is the responsibility of the developer to notify contractors and workers that archaeological material (e.g. pottery, remains of stone-walling, graves, etc) and fossils are often located underground.
- Although no archaeological objects were observed on the footprint of the proposed area during survey, the client is reminded that these often occur underground, as such should any archaeological material

be unearthed accidentally during the course of construction, SAHRA should be alerted immediately and construction activities be halted.

10 Conclusion

From an archaeological and cultural heritage resources perspective, we have no objections to the proposed project, as such we recommend South African Heritage Resource Agency (SAHRA) to approve the project to proceed with the suggested mitigation measure.

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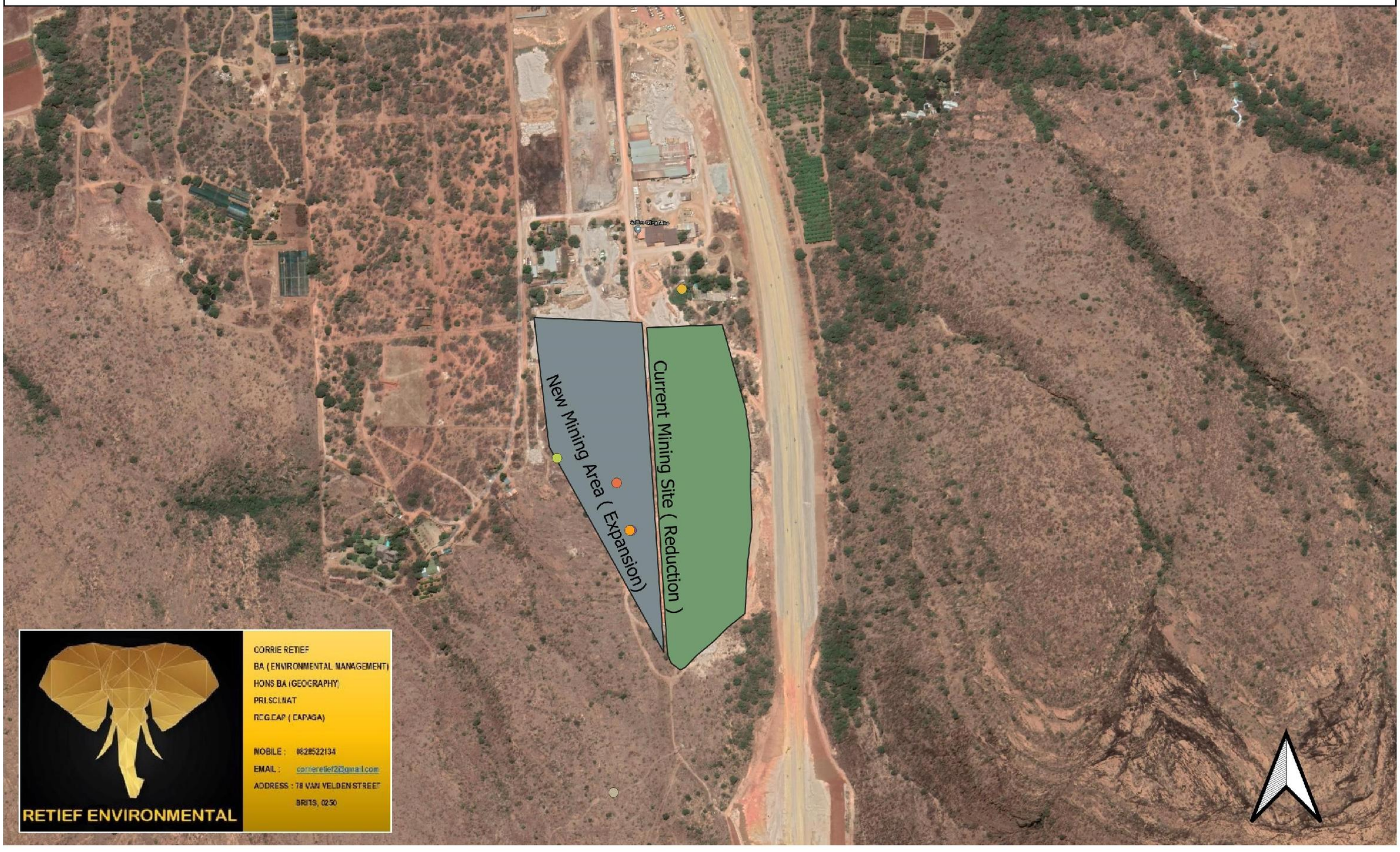
Appendix 11 : Layout

PROPOSED DECREASE AND EXPANSION OF MINING AREA



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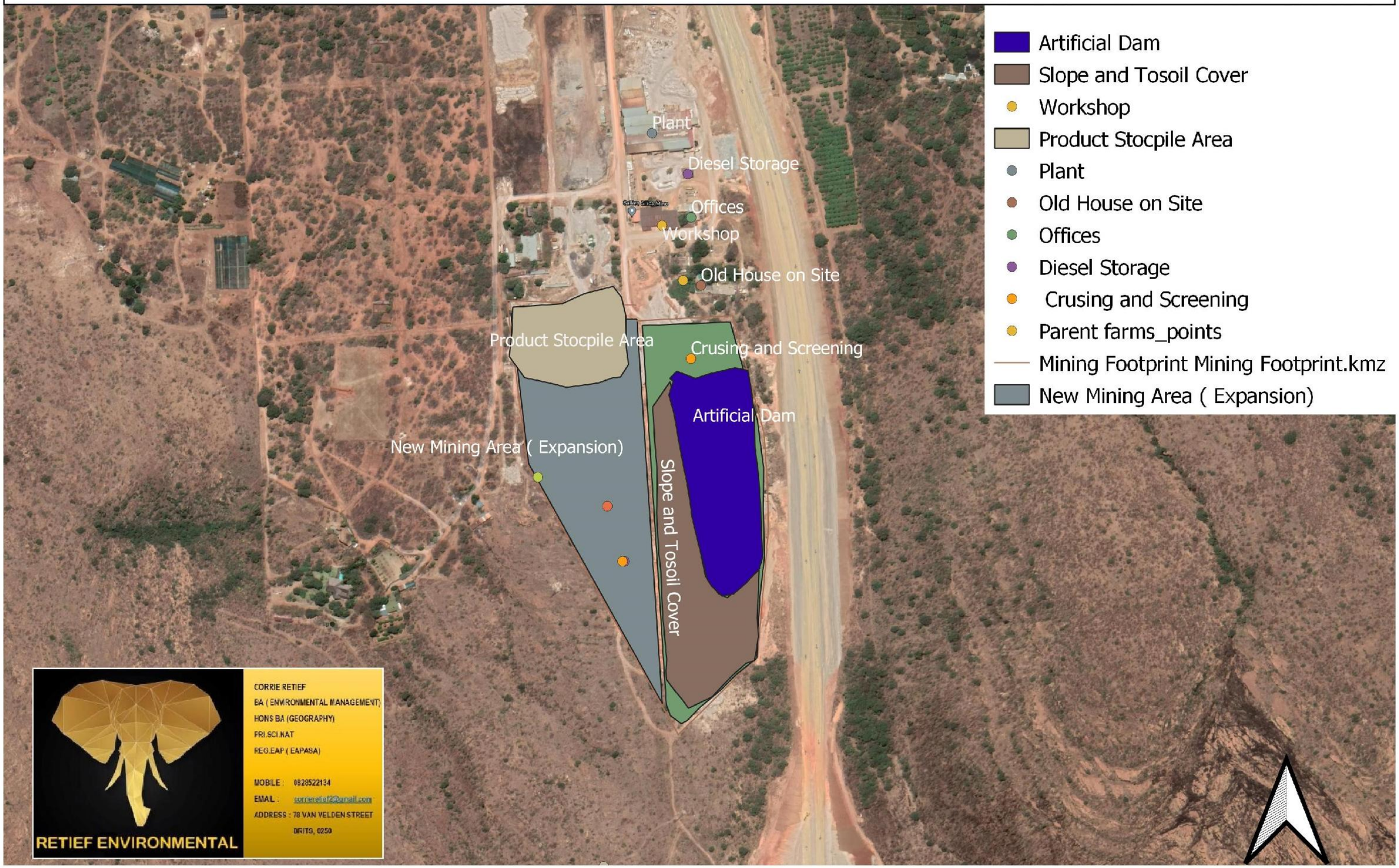
LAYOUT AFTER REHABILITATION OF CURRENT MINING AREA AND EXPANSION ON NEW MINING AREA



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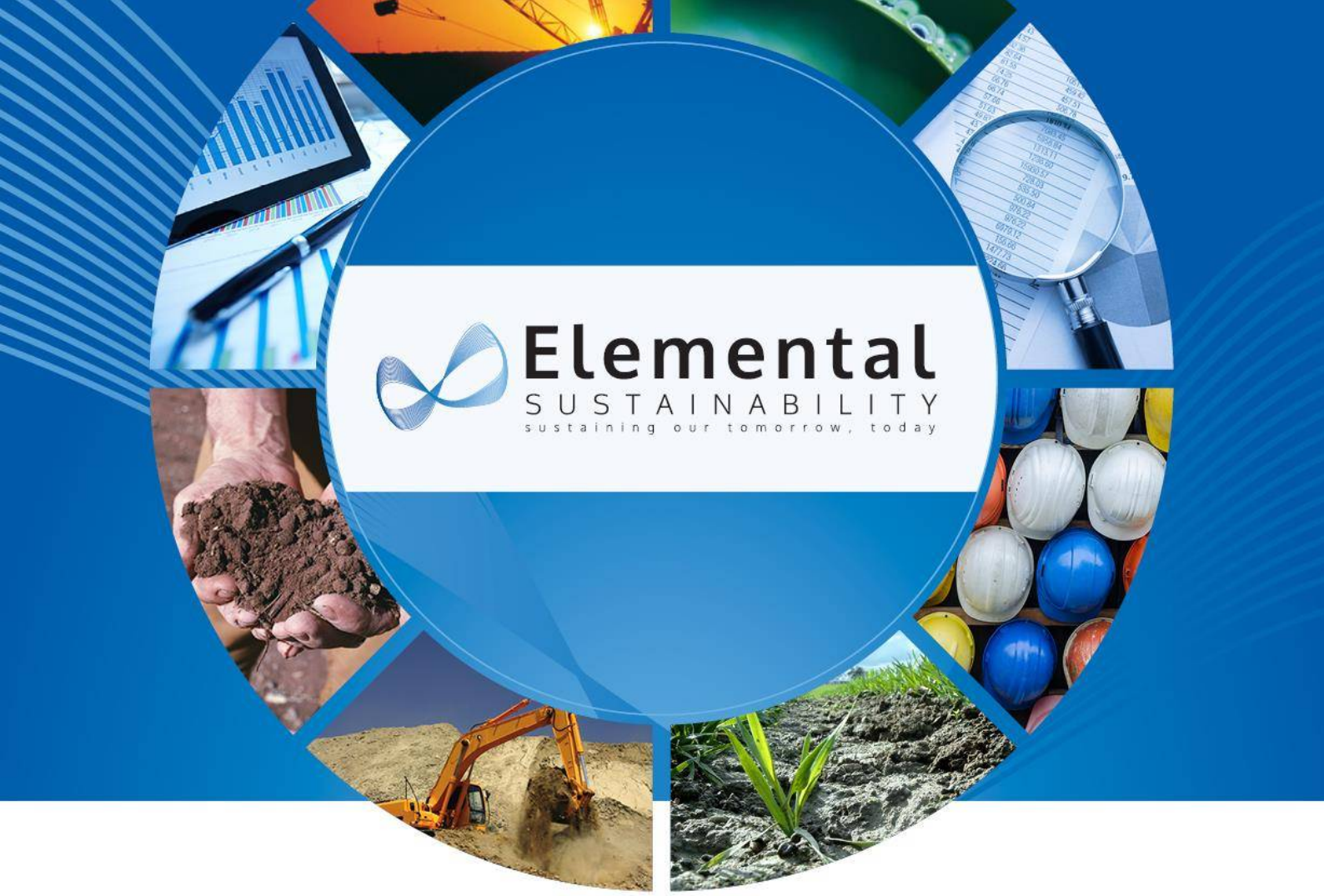
Appendix 12 : Closure Cost Assessment



PRELIMINARY CLOSURE AND FINANCIAL PROVISION ASSESSMENT FOR THE PROPOSED EXTENSION OF THE SALLIES SILICA MINE

COMPILED FOR

WITKOP FLUORSPAR MINE (PTY) LTD

DMR REF: NW 30/5/1/2/3/2/1/441 EM

DOCUMENT CONTROL

Report	Preliminary: Closure and Financial Provision Assessment – Sallies Silica		
Client	Witkop Fluorspar mine (Pty) Ltd		
Responsible Person	Corrie Retief		
Report Number	CCA_SS_024_21	**Report Status**	Final
Assessment Date	October 2021	**Report Date**	October 2021

VERIFICATION AND ACCEPTANCE

Author Verification	
Auditor Name	DuToit Wilken (Pr.Sci.Nat) -118911
Designation	Senior Specialist
Signature	
Date	31 October 2021

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ACRONYMS AND ABBREVIATIONS

ACRONYM:	DESCRIPTION:
DMRE	Department of Mineral Resources and Energy Note: Currently this Department is known as the Department of Mineral Resources and Energy, DMRE.
DWS	Department of Water and Sanitation Note: this department was formerly known as the Department of Water Affairs and Forestry, DWAF.
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EMPr	Environmental Management Program
FP Regulations	Financial Provisioning Regulations, 2015 (as amended)
Ha	Hectares
Mamsl	metres above mean sea level
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Right Area
MRDS	Mine Residue Disposal Site
NAEIS	National Atmospheric Emissions Inventory System
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
PCD	Pollution Control Dam
PPP	Public Participation Process
ROM	Run of Mine
RWD	Return Water Dam
WMA	Water Management Area

LIST OF DEFINITIONS

	DEFINITIONS
Care and maintenance	This involves the maintaining and corrective action as requires as well as conducting the required inspection and monitoring to demonstrate achievement of success of the implemented measures.
Closure	This involves the application for closure certificate and initiation of transfer of on-going care and maintenance to third parties.
Closure Planning	A process that begins during the pre-feasibility phase of a project and continues throughout the operations to closure certification. It sets clear objectives and guidelines, makes financial provision, and establishes effective stakeholder engagement leading to closure.
Contingencies	This allows for making reasonable allowance for possible oversights/omissions and possible work not foreseen at the time of compilation of the closure costs. Allowance of between 10 percent and 20 percent would usually be made based on the accuracy of the estimations. The South African Department of Mineral Resources Guideline (January 2005) requires an allowance of 10 percent.
Decommissioning	This relates to the situation after cessation of operations involving the deconstruction/removal and/or transfer of surface infrastructure and the initiation of general site rehabilitation.
Environmental Management Programme	A legal document capturing the current state of the mine, mine progress as to the agreed state and the interim arrangements made during the course of each year of the mine's operation, as contemplated in Section 39 of the MPRDA.
Financial Provision	Section 1 of the MPRDA defines financial provision as meaning the insurance, bank guarantee, trust fund or cash that applicants for or holder of a right of a right or permit must provide in terms of section 41 and 89 guaranteeing the availability of sufficient funds to undertake the agreed work programmes and to rehabilitate the prospecting, mining, reconnaissance, exploration, or production areas, as the case may be.
Life of Mine	An assessment of realistically assumed geological, mining, metallurgical, economic, marketing, legal, environmental, social, governmental, engineering, operational and all other modifying factors, which are considered in order to derive the year for which a mine can still operate economically.
Post-closure	The period of on-going care and maintenance, as per arrangement with third parties.
Preliminary and Generals (P&Gs)	This is a key cost item which is directly related to whether third party contractors are applied for site rehabilitation. This cost item comprises both fixed and time-related charges. The former makes allowance for establishment (and de-establishment) of contractors on site, as well as covering their operational requirements for their offices (electricity/water/communications),

	latrines, etc. Time-related items make allowance for the running costs of the fixed charged items for the contract period.
Reserve	The economically mineable material derived from a measured and/or indicated resource (SAMREC, 2007).
Rehabilitation:	The re-instatement of a disturbed area into a usable state (not necessarily its pre-mining state) as defined by broad land use and related performance objectives.
Remediation	To assist in the rehabilitation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions.
Scheduled closure	Closure that happens at the planned date and/or time horizon.
Site relinquishment	Receipt of closure certificate and handover to third parties for on-going care and maintenance, if required.
Unscheduled closure	Immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state.

1. INTRODUCTION

Witkop Fluorspar Mine (Pty) ltd has applied for a Section 102 to amend the Environmental Authorisation. Sallies Silica an existing mine has been operational since 1975. The application area is situated on a portion of Portion 129 and a portion of Portion 95 of the Farm Zandfontein 447 JQ, in the North West Province (hereafter referred to as the "study site") (Figure 1).

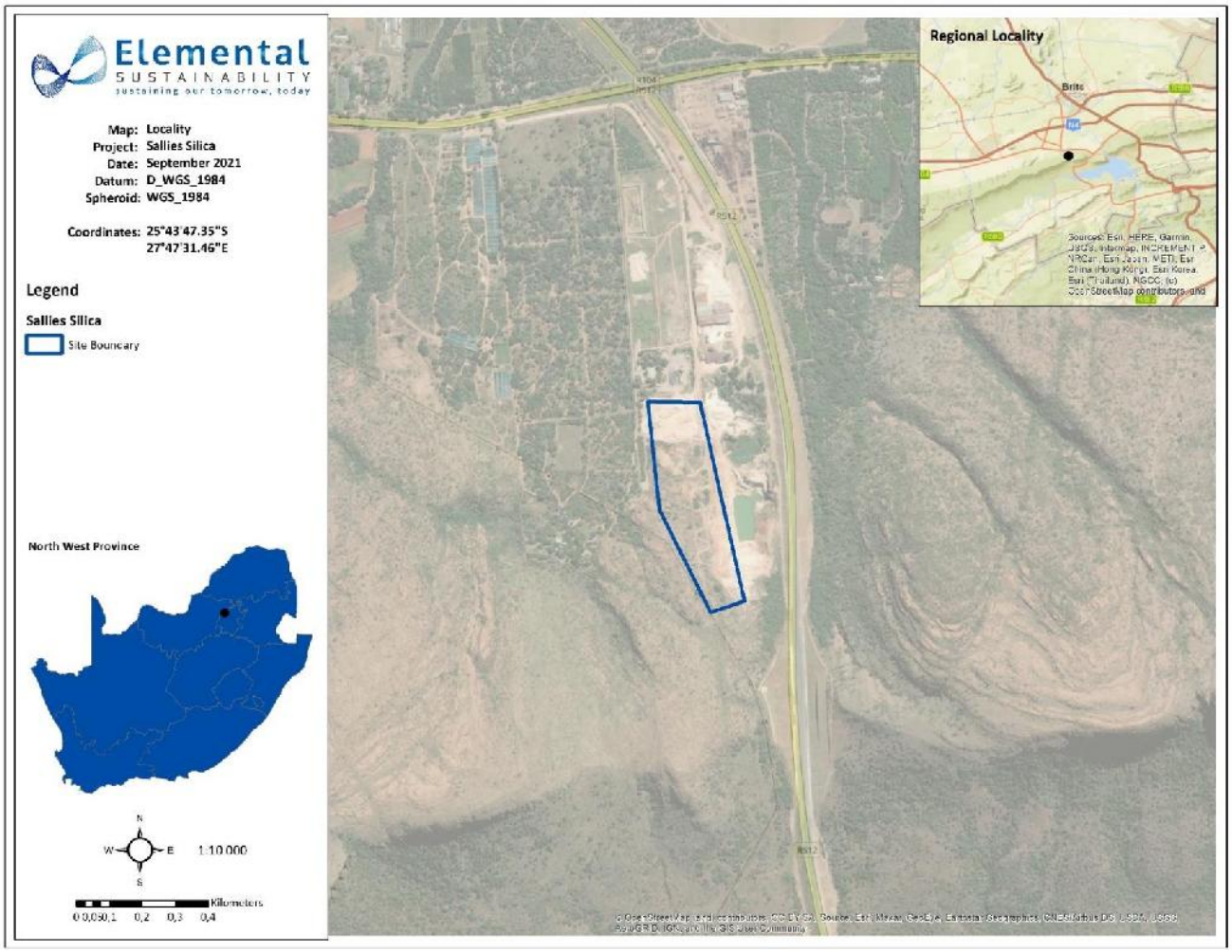


Figure 1: Regional Location of mine

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) prescribes that Mines must comply with the prescribed financial provision for the rehabilitation, closure and on-going post-decommissioning management of negative environmental impacts arising from the mining operation. This Report aims to meet the NEMA requirements and has been prepared in terms of the NEMA Financial Provisioning Regulations, 2015 (as amended).

According to the regulations, financial provision must be made for annual rehabilitation, final rehabilitation, decommissioning and closure activities at the end of prospecting, exploration, mining, or production operations; and remediation and management of latent or residual environmental impacts which may become known in the future. In order to address these

requirements this document includes an annual rehabilitation plan, a final rehabilitation, decommissioning and closure plan, and an environmental risk assessment report.

1.1. MINE CONTACT DETAILS

Table 1: Mine contact details

Name of Company	Preliminary: Closure and Financial Provision Assessment – Sallies Silica
Name of Project	Witkop Fluorspar mine (Pty) Ltd
Contact Person	Corrie Retief

1.2. CLOSURE ASSESSMENT PRATITIONER

This closure plan was compiled by Elemental Sustainability, under the technical lead of DuToit Wilken. Contact details are provided below.

Table 2: Contact details for Closure Assessment Practitioner

Name of Company	Elemental Sustainability (Pty) Ltd
Address	323 Brooks Street, Menlo Park, Pretoria, 0081
E-mail	dutoit@elemental-s.co.za
Cellular nr	084 588 2322

The specialist who contributed to the closure planning process, and the relevant professional registrations and experience, are listed in Table 3.

Table 3: Details of specialist

Specialist	**Task**	**Professional Registrations/Experience**
DuToit Wilken	Closure Plan compilation	BSc MSc – (Geography – Mine Closure) *Pr.Sci.Nat* - 12 years' experience

2. GUIDING PRINCIPLES

The following broadly accepted principles have been adopted to guide the preliminary closure planning for Witkop Fluorspar mine (Pty) Ltd – Sallies Silica:

- Providing the vision, objectives, targets and criteria for final rehabilitation, decommissioning and closure of the project;
- Outlining the design principles for closure;
- Explaining the risk assessment approach and outcomes and link closure activities to risk rehabilitation;

- Detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
- Committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure;
- Identifying knowledge gaps and how these will be addressed and filled;
- Detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed; and
- Outlining monitoring, auditing and reporting requirements;

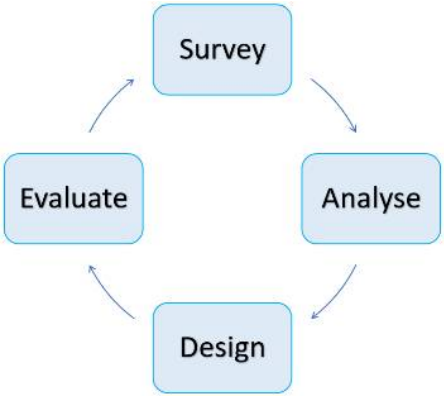
According to the NEMA GNR 1147 the objective of the final rehabilitation, decommissioning and closure plan, is to identify a post-mining land use that is feasible.

- Rehabilitation and Closure Planning must comply with relevant legislation, as well as with generally accepted good practices;
- Closure objectives must be realistic and achievable;
- Closure related rehabilitation of land disturbed by mining must be conducted to allow for pre-determined post-mining land uses, as agreed with stakeholders. In this regard, the rehabilitated areas must be safe, stable and non-polluting for integration into the existing land uses;
- Closure actions / measures conceptualised and implemented must limit the potential adverse effects of the closed mine site on the receiving environment, and thereby ensure that the quality of life of the surrounding / resident communities is not compromised after closure by possible threats to the health and safety of people and animals;
- Closure measures must be sustainable under foreseeable natural events;
- Priority must be given to the use of locally available natural materials and / or vegetation as opposed to imported / synthetic material and / or exotic vegetation. The measures provided must be appropriate for the site conditions;
- Manage activities within the study area in order to maintain and/ or improve ecological integrity of the study area;
- Maximise the service provision and ecological function of the watercourse
- The success, performance and sustainability of the closure measures must be demonstrated and confirmed by suitable monitoring and measurement for an adequate period post closure;
- A site with limited residual care-and-maintenance requirements must be sought. In this regard, proven sustainable passive measures must be favoured over measures that require ongoing maintenance and / or active care post-closure;
- Involvement of stakeholders must be undertaken in a meaningful manner to inform Closure planning by reflecting local requirements, priorities, and preferences, as well as the requirements as stipulated in local and provincial planning as well as the municipal Integrated Development Plans / frameworks; and
- Closure should be achieved as efficiently and cost effectively as possible.

3. APPROACH

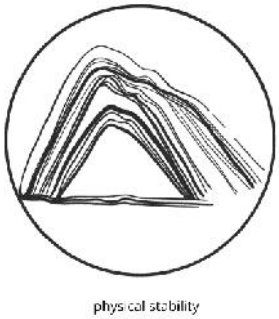
The approach adopted in undertaking closure planning for the proposed for Witkop Fluorspar mine (Pty) Ltd – Sallies Silica as further refinement to the guiding principles documented above, is based on the following key planning foci:

1. **The application of an iterative closure planning/ design process**



This iterative process underpins the principle that planning for closure should occur throughout the life of the mine, with solutions continually being evaluated through the process cycle.

2. **Key Closure Objectives**

 physical stability	To create a physically stable, safe, rehabilitated landscape that limits long term environmental degradation, erosion, and failure / collapse of unavoidably remnant mining residue which are present on the mine site post closure, thus enabling the successful establishment of the planned post-mining l and use
 environmental quality	To ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the mine site or individual facilities, as well as to sustain catchment yield as far as possible after closure

 healthy and safety	To limit the possible health and safety threats to humans and animals using the rehabilitated mine site as it becomes available
 land capability land use	To re-instate a suitable land capability over the mine site to facilitate the progressive implementation of the planned post-mining land use
 landscape viability	To create a landscape that is self-sustaining and over time will converge to the desired ecosystem structure, function, and composition
 biodiversity	To encourage, where appropriate and as aligned to the planned post-mining land use, the re-establishment of native vegetation on the rehabilitated mine site such that the terrestrial biodiversity is largely re-instated over time

	To ensure that there is constructive engagement and alignment with local communities and regulatory authorities regarding the proposed end land use

3. Tiered Risk-based Process

The application of a tiered risk-based process to allow for an understanding of the challenges and opportunities that need to be addressed and refining, abstracting, and prioritising essential issues. The structure of this report is presented below in Figure 2.

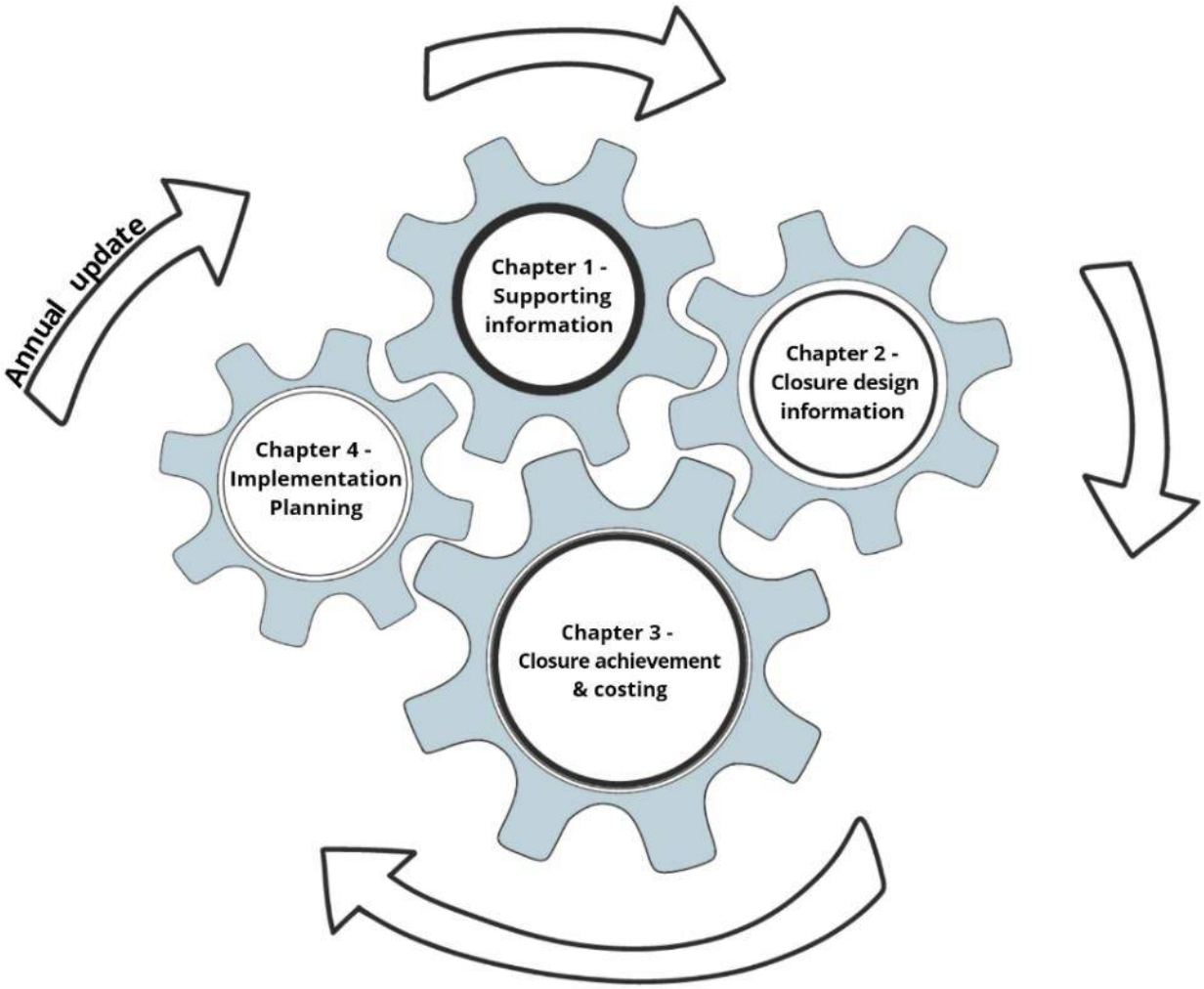
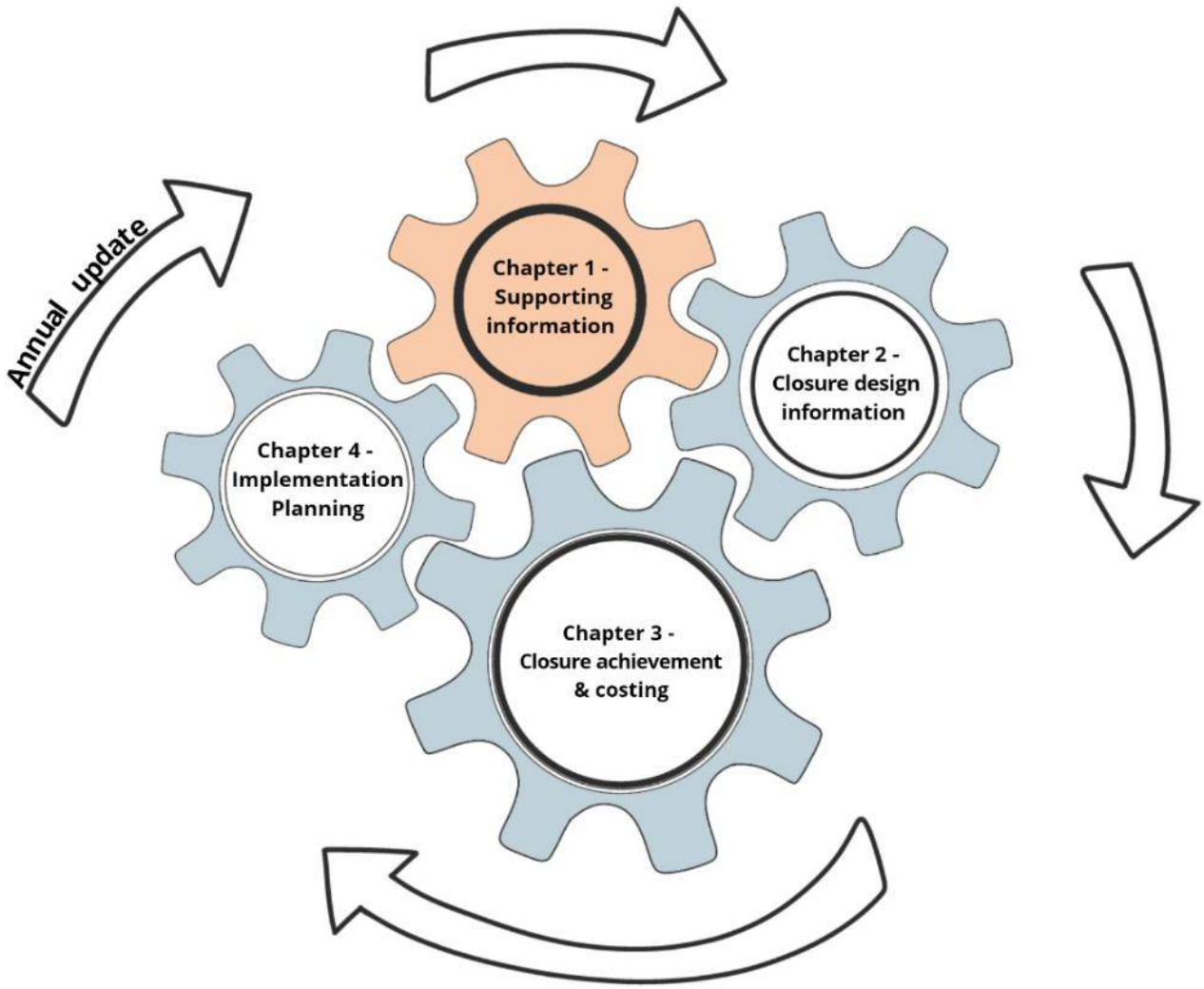


Figure 2: Approach to closure plan compilation

CHAPTER 1: SUPPORTING INFORMATION



Chapter 1: Review and documentation of relevant project information:

- A description of the mine – material information and issues that have guided the development of the plan;
- A summary of the legal and governance framework and interpretation of these requirements for the closure design principles;
- Environmental and Social Context;

4. MINE DESCRIPTION

4.1. STUDY AREA – REGIONAL SETTING

Sallies Silica (Pty) Ltd, owned and operated by Witkop Fluorspar Mine (Pty) Ltd, is an existing mining operation, which has been in production since the late 1970's. The current mining activities are located on a portion of portion 95 (a portion of portion 5) of the farm Zandfontein 447 JQ, within the Bojanala Platinum District and the Madibeng Local Municipalities. The

property is situated some 11km south of the town of Brits and some 42km west of Pretoria along the R27 route to Rustenburg and about 8km to the west of the Hartbeespoort Dam.

A section 102 application has been submitted to extent the mining right area. The application area is situated on a portion of Portion 129 and a portion of Portion 95 of the Farm Zandfontein 447 JQ

The Project Background, farm portions that fall within the project area and including details on the location of the operation is summarized in Table 4.

Table 4: Project Summary

Company Name	Witkop Fluorspar Mine (Pty) Ltd	
Reference Number	NW 30/5/1/2/3/2/1/441 EM	
Commodity:	Silica (General)	
Life of Mine	Estimated 20 years of LOM extension.	
Mining Method(s):	Opencast – surface mining	
Farm Name	Portion 129 and a portion of Portion 95 of the Farm Zandfontein 447 JQ	
Application Area (Ha)	Existing mining area – 6.96 ha Proposed extension - 5.85 ha	
Magisterial District	Bojanala Platinum District Madibeng Local Municipalities	
Distance and direction	11km south of the town of Brits 42km west of Pretoria	
21-digit Surveyor General Code	**Farm Name and Portion:**	**21 Digit Surveyor General Code**
	Zandfontein 447 JQ – Portion 95	T0JQ00000000044700095
	Zandfontein 447 JQ – Portion 129	T0JQ00000000044700129

4.2. CURRENT MINING AREA

The current Sallies Silica mine is an operational mine that consist of the following infrastructure :

- Mining Area
- Stormwater Dam
- Crushing and washing Plant
- Offices and Workshops
- Product Stockpile Area
- Plant (Drying and Packaging)

The following yellow equipment is deployed to support the mining and primary processing operation:

- 1 x 30-ton Excavator
- 1 x 25 ton Articulated Dump Truck
- 1 x 18 ton Articulated Dump Truck
- 1 x Water Bowser
- 2 x Frontend Loaders
- 1 x Light Delivery Vehicle

The following key components consuming fossil fuels, form part of the primary processing stage:

- 1 x Primary Jaw Crusher
- 1 x Secondary Cone Crusher
- 1 x Tertiary Horizontal Shaft Impactor
- 3 x Double Deck Dry Screens
- 1 x Double Deck West Screen
- 1 x Hopper with Feeder
- 1 x Wet Cyclone Separator
- Conveyor belts of various length

The mine stripping ratio is extremely favourable at less than 5% overburden and spoils produced per ton run of mine fed into the processing section i.e., RoM: Waste = 19: 1. Processing losses accounts to less than 10% of head feed to the processing plant. Overall efficiency calculates to 86%. At an annual final product output of 216 000 ton, the overburden, spoils and sludge amount to about 30 000 ton, which is used as backfill in the pit or for construction and maintenance of roads, dam walls, etc. or gets sold off as building sand.

Figure 3: Existing Mining Area

4.3. MINING METHOD

Simple opencast mining methods are employed. Mining is conducted in one of two areas in the same pit the opencast method of mining employed by Sallies Silica involves opening up the seam and following the seam to a depth of up to 30 meters. After blasting, the mineral is loaded onto articulated dump trucks by an excavator. Material is then transported by these trucks along a haul road between the pit and the Primary Crusher Plant for further processing.

The silica is excavated and loaded with an excavator and hauled to the primary crusher of the plant. Access to the opencast workings is by way of temporary constructed ramps. Vehicles access the seams directly via these ramps, which progress with the workings along strike. The surface disturbance thus takes place along the seam over a width of 150 metres.

Blast consists of a quantity of explosives placed into a series of blast holes drilled into the rock mass to a seam depth of 10m. A boom-drilling machine is utilized for create the blast hole. The blast hole is created for the full length of the intended blast depth of pull. The burden and spacing dimensions of the blast grid is 3.3M x 3.8M staged pattern. The blast holes are 8.9 cm in diameter.

The series of blast holes are detonated one at a time in a controlled sequence as to control the burden and spacing dimensions between the adjacent holes. Blasting takes place as required, normally once per month and is done by a blasting contractor under the supervision of internally qualified employees. All blasting occurs during daylight hours from 15h30 to 16h30 during weekdays. Blasting is conducted within a 500-meter radius from surface infrastructure as permitted by special blasting authorisation already in place.

4.4. MINING AND PRIMARY PROCESSING

Run of mine is crushed in a TELSMITH 25” x 36” JAW CRUSHER set at a 90mm gap to reduce the ore fragments lo less than 90mm in size, after which it is fed onto a primary double-deck screen with a 45mm top and 24mm bottom deck. Oversize material is recycled into a 3” SYMONS CONE CRUSHER with a minimum closed-side setting of 34mm to reduce fragments quantitatively to less than 45 mm. The middle-fraction from the screen i.e., sized at 20 – 40mm material is stockpiled and sold as metallurgical aggregate. The underflow from the screen is fed onto a secondary double-deck screen with a 16mm top and 5mm bottom deck. The fraction above 16mm and the middle-cut i.e., the 5 – 16mm fractions are combined onto a 5 – 20mm stockpile for further processing in the washing section. The crusher sand finer than 5mm is collected on another stockpile and sold as unwashed silica quartz sand.

The 5 – 20mm stockpile of high purity silica quartz proceeds to the washing section where it is fed onto a double-deck screen fitted with a 7mm top and 3.5mm bottom deck. The oversize from the top deck is recycled into an HSI-1006 to reduce all fragments to less than 8mm. The middle-cut from the screen may be stockpiled as a 4 – 9mm product, which finds application in epoxy resins and related construction mortars. However, since the latter is a limited market, the middle-cut is mostly recycled to the HSI together with the oversize fraction to facilitate maximal production output of the <4mm

fraction. The underflow from the bottom deck screen is then fed onto a wet double-deck screen fitted with a 3.15mm top and 0.8mm bottom deck. Three washed products are derived from this washing step i.e., a 2 – 5mm washed product from the oversize of the top deck, a 0.8 – 2mm washed product stockpile from the middle-cut and a less than 0.8mm washed powder, collected after a cyclone, which separates the product from the wash water. The 2 – 5mm washed product finds application as filler in the brickmaking and fertilizer industries. The 0.8 – 2mm and <0.8mm washed products are sold off to be further processed in a drying and high-frequency separation and bagging plant outside of the mining area.

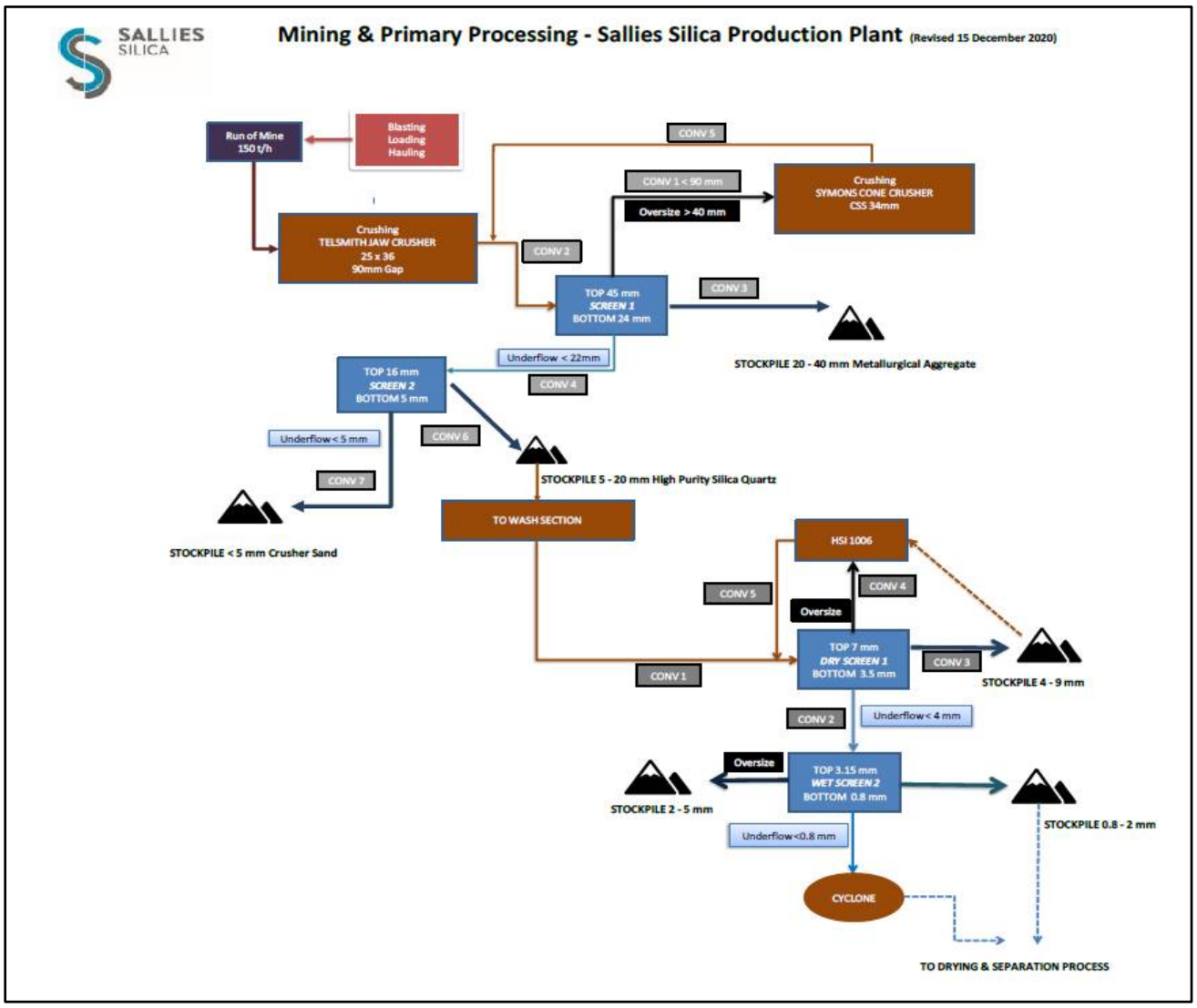


Figure 4: Mining Process

4.5. PROPOSED EXPANSION SITE

The proposed expansion site is on the western side of the current mining site and is a strip that runs along the current mining site and a powerline. Currently the site is natural veld with an existing road that runs from the bottom to the top of the site.

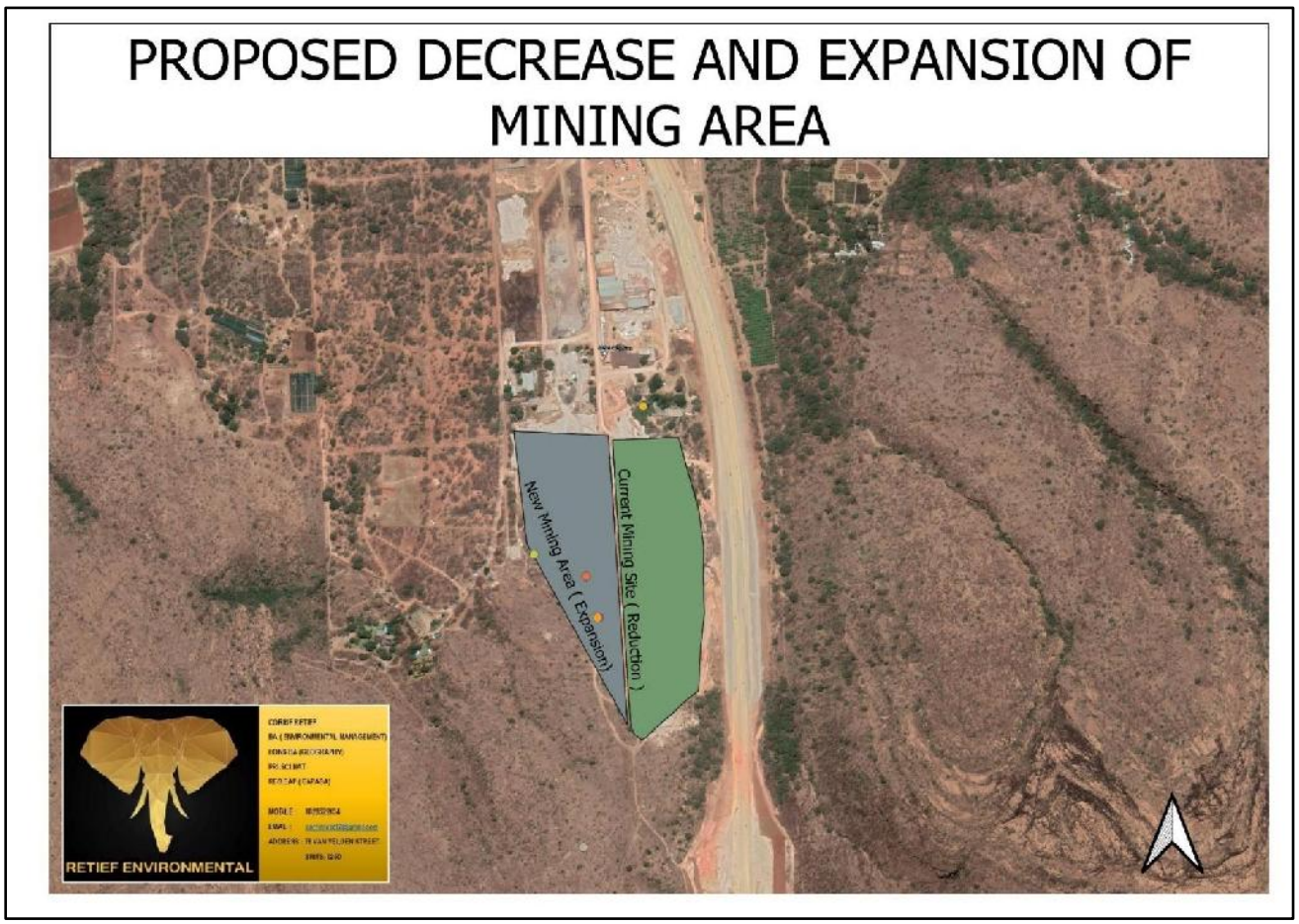


Figure 5: Layout of Current and Expansion Areas

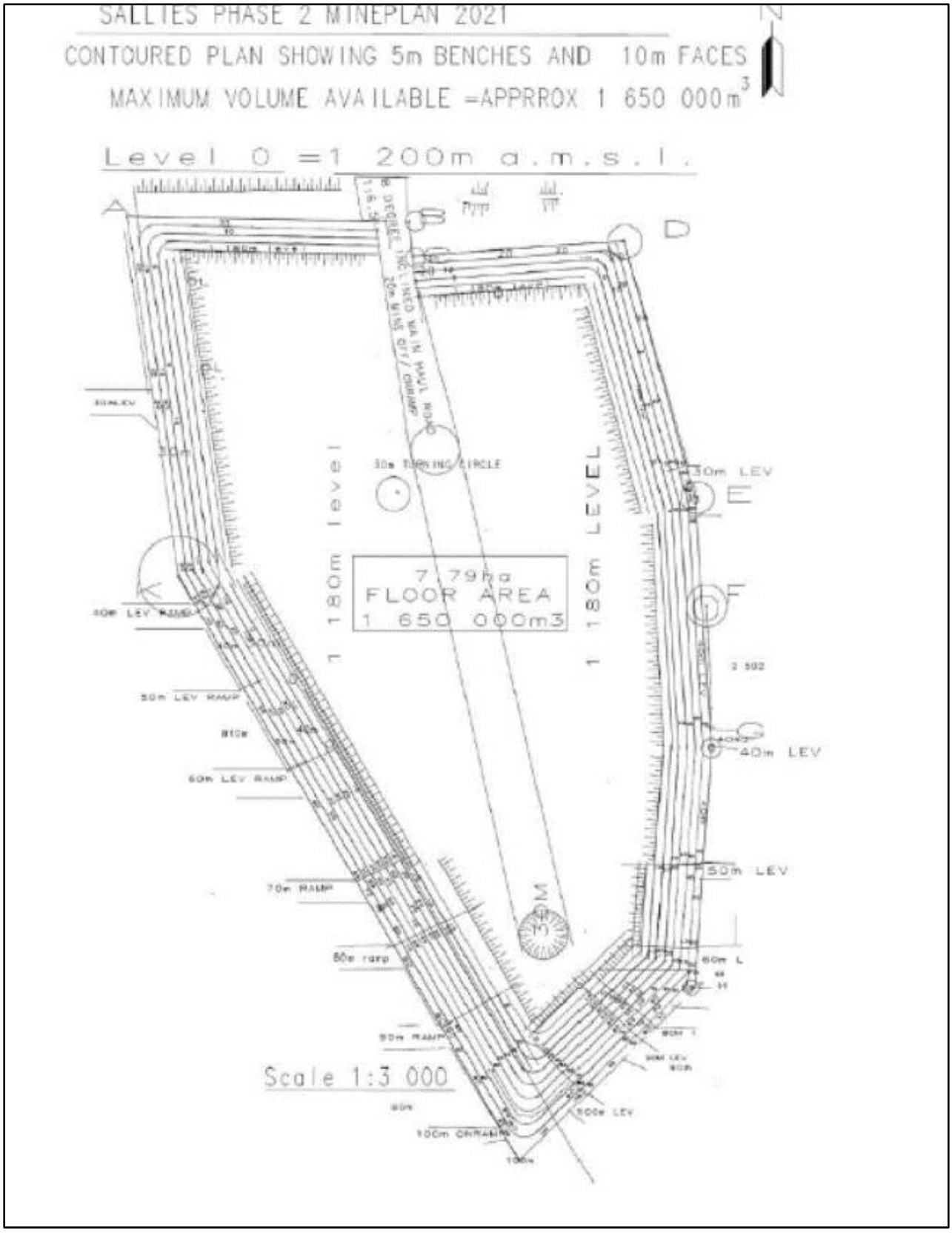


Figure 6: Mine Design

Figure 7: Proposed Mining Area

4.6. ACTIVITY DESCRIPTION

4.6.1. LIFE OF MINE

The expected Life of Mine ("LOM") for the proposed expansion area is 20-years. As indicated by the exploration data, the quality of crystalline quartz is expected to be maintained at the current level of >99% as SiO2. The addition of the new portion, combined with the mining activities on the existing portion, will result in stable mine production output and quality for a minimum of another 20 years till 2040. The mine produces an average saleable volume of goods amounting to 19 640 ton per month. Annual final product output of 216 000 ton the overburden, spoils and sludge amount to about 30 000 ton, which is used as backfill in the pit or for construction and maintenance of roads, dam walls, etc. or gets sold off as building sand. Production runs at full capacity during the months of February to November. During December and January, production drops to 50% of output capacity as a result of annual shut-down and plant maintenance.

The cost estimates for operations, from closure will be prepared as conceptual estimates with an accuracy of ± 70 per cent. The cost estimates for operations will be increased to as the life of mine is decreased.

5. REHABILITATION OF EXISTING MINING AREA

The current mining area will be mined with a view to close. The current section will be mined up to the same level as the stormwater dam that is adjacent to the site. On completion of mining the current section will be flooded and an artificial dam will be created, Slopes will be profiled and covered with the stored topsoil on site. The slopes will be revegetated with indigenous plant species. The task for rehabilitation will include the following :

- Compile detailed design of current site for rehabilitation
- Remove all viable mining material up to same depth as the stormwater dam
- Slope and profile current site walls
- Cover slopes with topsoil and revegetate
- Connect floor of current mining area with Stormwater Dam and Flood
- Conduct monitoring of rehabilitated site

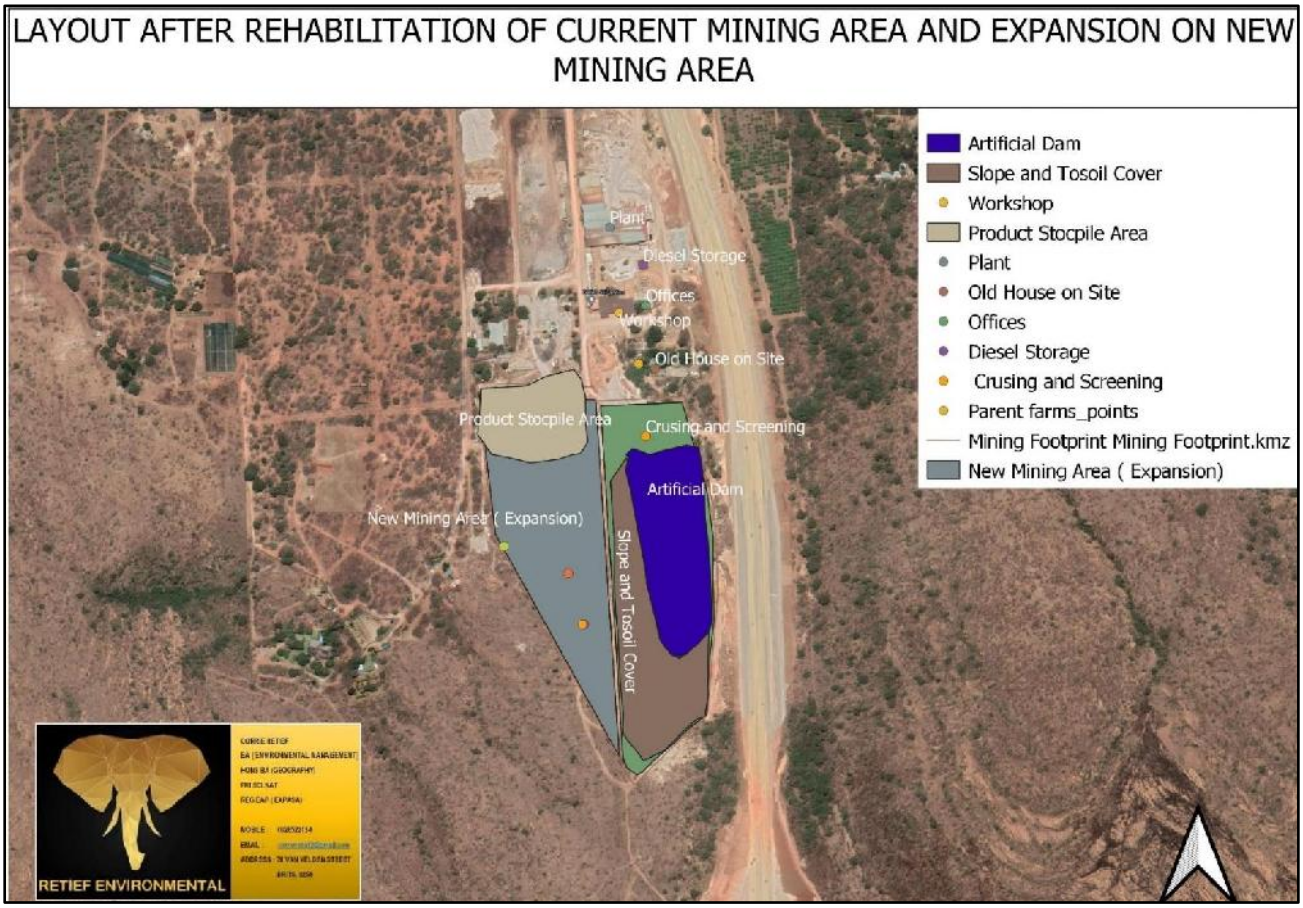


Figure 8: Representation of mine layout after rehabilitation of current site and expansion.

6. EXISTING AUTHORISATIONS

A water use licence was approved on 18-09-2018 for Portions 95 of the Farm Zandfontein 447 JQ (Licence No: 07/A21J/AGJ/7962) and a Mining Right was issued on 09-10-2012 for Portion 95 (a Portion of Portion 5) of the Farm Zandfontein 447 JQ (NW30/5/2/2/441MR). This mining right was ceded from the previous owner to Witkop Fluorspar Mine (Pty) Ltd (t/a Sallies Silica) on 30-11-2018 (Ref. No: NW-00086-MR/11).

7. LEGAL AND GOVERNANCE FRAMEWORK

NEMA Regulations GNR 1147

This closure plan will be progressively updated to comply with Appendix 4 of the NEMA Regulations (GNR. 1147), 20 November 2015. This report is aligned to the requirements pertaining to the content of the closure plan as required by Appendix 4 of GNR. 1147, with references to the sections where the given requirement is addressed in the report as presented in Table 1.

The purpose of these Regulations is to regulate the determine and making of financial provision as contemplated in the Act for the costs associated with the undertaking of management, rehabilitation, and remediation of environmental impacts from prospecting, exploration, mining or production operations through the lifespan of such operations and latent or residual environmental impacts that may become known in the future. The Regulations also include detailed descriptions of the wording required in the documentation to support the provisioning for liability using Bank Guarantees and Trust Funds. Finally, the legislation also provides detail on the information to be contained in the following plans: Annual rehabilitation plan Final rehabilitation, decommissioning and mine closure plan Environmental risk assessment report

Other National Regulations

Minerals Petroleum and Resources Development Act No. 28 2002 (MPRDA), Section 43:

A holder of a prospecting right, mining right, retention permit or mining permit remains responsible for any environmental liability, pollution or ecological degradation and the management thereof, until the Minister has issued a closure certificate to the holder concerned.

National Environmental Management Act, No. 107 of 1998 (NEMA):

If it is determined that a mine, having regard to its known ore reserves, is likely to cease mining operations within a period of five years, the owner of that mine must promptly notify the Minister in writing -

- of the likely cessation of those mining operations; and
- of any plans that are in place or in contemplation for-
- the rehabilitation of the area where the mining operations were conducted after mining operations have stopped; and
- The prevention of pollution of the atmosphere by dust after those operations have stopped.

Duty of care (Section 28 of NEMA) to take reasonable measures to prevent significant pollution or degradation of the environment from occurring, continuing, or re-occurring or where such pollution or degradation cannot be reasonably stopped or avoided, such person must take reasonable measures to minimize and rectify such pollution or degradation.

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

In terms of section 28, the mine is required to obtain authorisation by Law and to provide proof that the degradation can be rehabilitated and or remediated after mining. In terms of the Financial Provision Regulations (GNR 1147) the cost associated with environmental damages should be provided from in some form of a financial guarantee.

Environmental Impact Assessment Regulations, 2014 (as amended):

Regulation 19 (6): *"A closure plan must contain the information set out in Appendix 5 to these Regulations, and, where the application for an environmental authorisation is for prospecting, exploration, or extraction of a mineral or petroleum resource, including primary processing, or activities directly related thereto, the closure plan must address the requirements as set in the regulations, pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, exploration, mining or production operations, made in terms of the Act".*

Regulation 19(7A): *"The content of a closure plan may be combined with the relevant plan contemplated in the regulations, pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, exploration, mining or production operations, made in terms of the Act, on condition that the requirements of both those Regulations and Appendix 5, respectively, are met".*

An application for an environmental authorisation must be submitted for the decommissioning of any activity requiring -

- A closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or
- A prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.

NEMA Principles

In terms of section 38 of the MPRDA, holders of reconnaissance permissions, prospecting rights, mining rights, mining permits or retention permits must promote compliance with the principles set out in section 2 of the NEMA, which provide that -

- the disturbance of ecosystems and loss of biological diversity is avoided, or, wherever it cannot altogether be avoided, is minimised and remedied;
- pollution and degradation of the environment is avoided, or where it cannot be altogether avoided, is minimised and remedied;
- the disturbance of landscapes and sites that constitute a nations cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;
- a risk-averse and cautious approach is applied, which considers the limits of current knowledge about the consequences of decisions and actions; and
- Negative impacts on the environment and on people's environmental rights be anticipated and prevented, and when they cannot be altogether prevented, are minimised and remedied.

The National Water Act (NWA), Act No. 36 of 1998:

A duty is imposed on the owner of land, a person in control of land or a person who occupies or uses the land to take all reasonable measures to prevent the pollution of a water resource from occurring, continuing or recurring;

Regulations on the Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources, GNR R704;

Any person in control of an existing mine must notify the Department of Water and Sanitation (DWS) 14 days before the temporary or permanent cessation of the operation of the mine;

Any person in control of a mine must at temporary or permanent cessation of mining operations, ensure that -

- Any person in control of a mine or activity must at temporary or permanent cessation of operations ensure that all pollution control measures have been designed, modified, constructed, and maintained in accordance with GNR 704; and
- Any person in control of a mine or activity must ensure that the in-stream and riparian habitat of any water resource, which may be affected or altered by the mine or activity, is remedied so as to comply with GNR 704.

Provision is made for, *inter alia* -

- Regulation 4: Restrictions on locality regarding infrastructure;
- Regulation 5: Restrictions on use of material;
- Regulation 6: Capacity requirements of clean and dirty water systems; and
- Regulation 7: Protection of water resources.

Regulation 7 of GNR 704:

Every person in control of a mine or activity must take reasonable measures to -

- Prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource and must retain or collect such substance or water for use, re-use, evaporation or for purification and disposal in terms of the Act;
- Cause effective measures to minimise the flow of any surface water or floodwater into mine workings, opencast workings, other workings, or subterranean caverns, through cracked or fissured formations, subsided ground, sinkholes, outcrop excavations, adits, entrances or any other openings; and
- Prevent the erosion or leaching of materials from any residue deposit or stockpile from any area and contain such material or substances so eroded and leached in such area by providing effective suitable barrier dams, evaporative dams, or any other effective measures to prevent this material or substance from entering and polluting any water resources.

Conservation of Agricultural Resources Act No. 43 of 1983:

Regulation 15 of the Conservation of Agricultural Resources (CARA), Act No. 43 of 1983 provides a list of Category 1 plants (Weeds) and Category 2 and Category 3 plants (invaders) that must be controlled. Category 1, 2 and 3 plants may not occur on any land or inland water surface other than in biological control reserves and must be controlled by means of the methods prescribed in the regulations (unless exemption granted).

Constitution of the Republic of South Africa, Act No. 108 of 1996, Section 33:

- Everyone has the right to administrative action that is lawful, reasonable and procedurally fair;
- Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons;
- Any application for, for example, a closure certificate or an application for transfer of liabilities and responsibilities in terms of the MPRDA must be considered by the relevant authority according to the criteria contained in Section 33 of the Constitution;
- Where the relevant authority has been given a discretion that discretion must be exercised in a reasonable manner and without bias, prejudice, or any personal agenda; and
- Failure, the decision may be set aside by way of an application to court or any internal procedures prescribed by the empowering legislation.

South African good practice

The Department of Water Affairs and Sanitation (DWS) formerly known as the Department of Water Affairs and Forestry (DWAF) – commissioned a series of Best Practice Guidelines (BPG), in partnership with industry, to assist with aspects of DWAF's water management hierarchy. BPG5: Water Management Aspects for Mine Closure, includes the following principles:

- Management measures at closure should primarily be of a passive nature with minimal long-term maintenance and operating costs;
- The final landform must be sustainable, must be free-draining, must minimise erosion and avoid ponding;
- Concurrent rehabilitation must be undertaken in a manner that supports the final closure landform to ensure/avoid that rehabilitation does not need to be redone at a later stage;
- Land use plan which is directly interlinked with water management issues insofar as water is required to support the intended land use and the land use itself may have an impact on the water; and
- Biodiversity plan will address issues that are interrelated with the mine water management plan, particularly regarding the environmental water balance and the effects that mining may have thereon.

The Guidelines for the rehabilitation of mined land developed by the Chamber of Mines (updated 2007) was developed by key industry role players with focus on aspects of opencast mine rehabilitation. Pertinent aspects include:

- Stripping topsoil per a dedicated stripping plan and utilizing the correct equipment to minimise compaction, over stripping and mixing of horizons;
- Implementing concurrent rehabilitation, constructing a post mining landform free of ponding and prioritizing the live stripping and placement of topsoil where possible;
- Limiting topsoil management activities to dry seasons as increased moisture content can also increase the potential for compaction;
- Implementing effective strategies for topsoil stripping, placement and stockpiling to limit compaction; and
- Implementing a soil amelioration and revegetation strategy based on dedicated soil sampling and analysis.

Draft National Mine Closure Strategy 2021 (GN 446, 21 May 2021)

The aim of the strategy is to prevent or minimize adverse lang term environmental and social-economic impacts, and to create a self-sustaining natural ecosystem or alternate land use. The Regional closure strategy will therefore set specific standards for all mines and promote the alignment of individual mine closure plans and regional mine closure plans, including the requirements for application for closure, requirements for Environmental Management Programmes/Plans and Financial Provision. A Regional Mine Closure Strategy (RMCS) is different to a Mine Closure Plan. The regional mine closure strategy considers the various issues that are relevant to mine closure on a broader integrated level and develops a strategic framework within which individual mine-closure plans will fit. RMCS therefore do not replace a mine closure plan.

<u>The objectives of National Mine Closure Strategy are:</u>

- To manage the closure of mine in a demarcated area in an integrated and sustainable manner, hence ensuring that these mines work together to achieved self-sustaining ecosystem after closure.
- To ensure that mines do not impact negatively on the livelihood of adjacent/interconnected mines in a demarcate area.
- To promote a strategic approach to managing water at mining and minerals processing sites so that water is more efficiently managed and value and to develop a post closer mine water strategy for an area.
- To make provision for post-closure stewardship and socio-economic sustainability, to continue monitoring the implementation of individual and regional mine closure plans.
- Integrated environmental management and related closure activities with socio-economic interventions and aligning these with development of a post-closure economy, by rationalising current wasteful spending on Environmental Management Programme (EMPr), Social and Labour Plan (SLP) and Corporate Social Investment (CSI) by reducing duplication of efforts and spending and aggregating available funding for coordinated regional projects.

The identification of Mine Closure Regions

The identification of closure regions is a multi-contextual process and requires consideration of social, environmental, and economic impact geared towards sustainable post closure support for dependent communities. The initiative requires the identification of closure regions suitable for integrated development strategies. The identification of these closure regions should be made within the existing provisions of the MPRDA. The selection of logical mine closure regions will enable the aggregation of development and rehabilitation funds unto common regional economic development programmes underpinned by substantial financial capacity. This, in turn, provides the basis for collaborative regional development between mining companies, local government and other sectors. Examples of these regions are shown in the figure below.

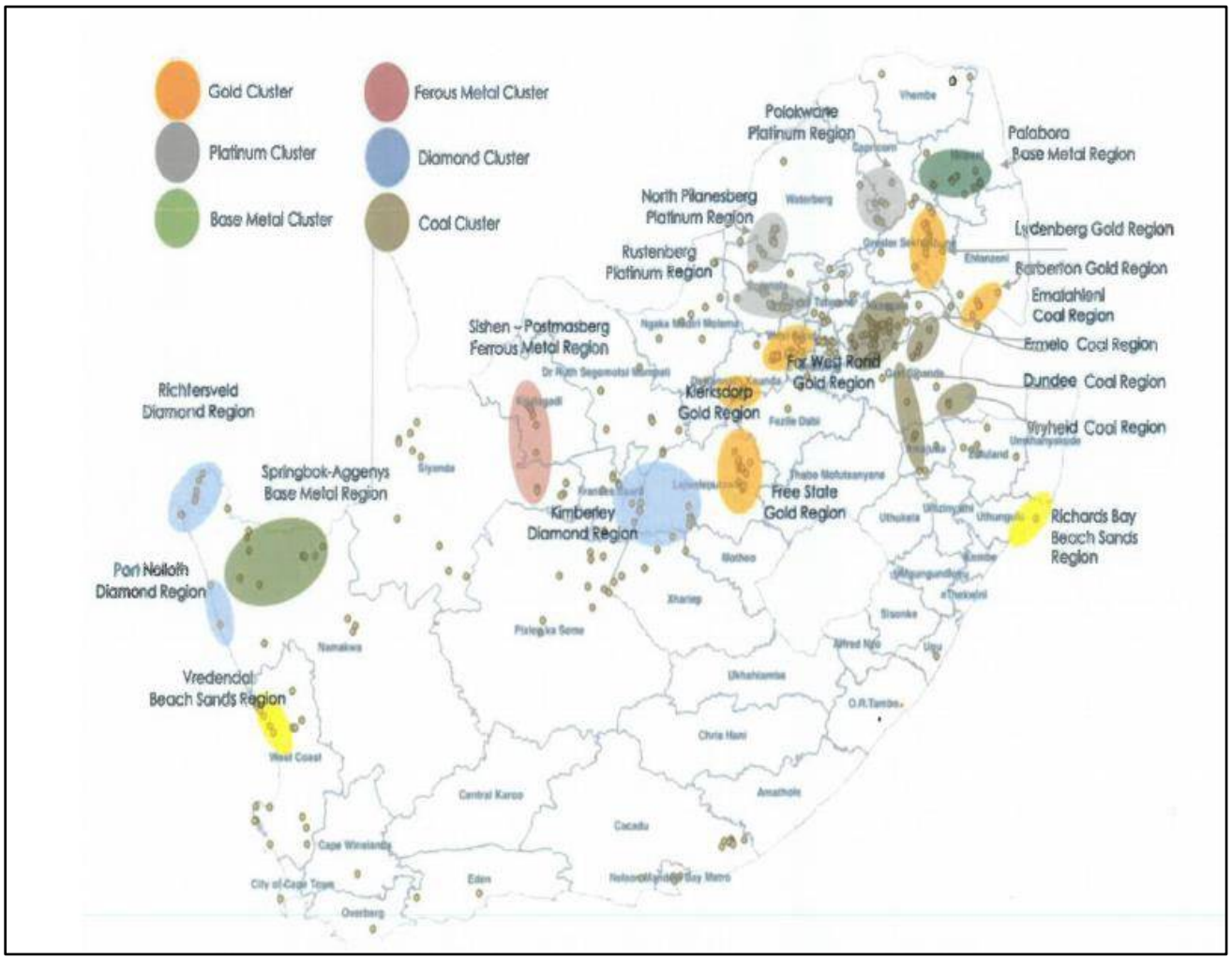


Figure 9: Regional Mine Cluster

8. ENVIRONMENTAL AND SOCIAL CONTEXT

An overview of the biophysical and socio-economic context within which closure will be implemented, is included. The summary is based on a review of the information made available for this closure plan. Several implications related to the information collected are provided along with linkages with the seven key closure objectives.

The study area falls within the jurisdiction of the Madibeng Local Municipality, part of Bojanala District Municipality, in the North West Province. The site is located approximately 9 km south of Brits, adjacent to the R104 Rustenburg-Hartbeespoort dam Road near the R512 Brits Road intersection, at the following coordinates in the centre of the property:

- Latitude: 25°43'38.83"S
- Longitude: 27°47'33.33"E

8.1. SUMMARY OF ENVIRONMENTAL AND SOCIAL CONTEXT OF THE PROJECT

The pertinent environmental and social conditions at the Site are summarised in Table 5.

Table 5: Environmental and Social Context

Aspect	Description
Climate	The site falls within the summer rainfall region. The study area receives an average rainfall amount of 618mm with most rainfall occurring during the summer month of January (105mm) and the lowest rainfall in June (0mm). The monthly distribution of average daily maximum temperatures indicates an average midday temperature range of between 19°C in June to 29C in December, January and February. The region is the coldest during July when the temperature averages 0°C during the night. The main wind direction is from the North West and the average wind speed is 2.3m/s. Mean annual evaporation is 2055 mm. Due to the fact that evaporation is much higher than precipitation, and because the site is situated on a north facing slope, the climate of the site can be considered semi- arid, even more so than the surrounding landscape. It also reduces its agricultural potential significantly.
Topography	Most of the site is located within an area classified as a flat plain, while the southern tip of the site, i.e. the area proposed as the new mining right area, is situated on the footslope of a ridge. Localised ponding of water will only occur in undrained quarry depths because the natural topography of the site allows for proper drainage. The lowest point is located in the south-western corner of the site at an elevation of approximately 1 218 m above mean sea level (mamsl), with the highest point occurring in the north-east at an elevation of approximately 1270 mamsl.
Surface Water	The full catchment classification for the site is as follows: Primary Catchment: A; Secondary Catchment: A2; Quaternary Catchment: A21J. The A21J quaternary catchment falls within the Crocodile (West) and Marico Water Management Area with the Crocodile (West) and Marico as main rivers draining the A primary catchment. No surface water features e.g. wetlands, rivers, streams, pans etc., occurs on or adjacent to the site. The nearest river is the Crocodile River 5 km to the east-northeast. The nearest dam is the Hartebeespoort Dam

	occurring 3 km to the south-east, however, the site is completely isolated from the dam by the Magaliesberg ridge which forms an impenetrable watershed.
Geology and Soils	The following were sourced from the geological report titled "The Geological Appraisal and Mineral Resources Study of the Eggo Silica/Sand Deposit, Brits area" dated 7th September 1998, conducted by SB Gain: The rock body on the site is a major quartzite deposit, found within a quartzite close to the top of the Pretoria Group of the Transvaal Sequence which forms the direct footwall of the overlying mafic rocks of the Bushveld Complex. The mafic rocks of the Bushveld Complex was formed from the cooling of hot magmas which contained and supplied the heat to thermally metamorphose and recrystallise the quartzites which are currently being mine. The deposit is located in the Magaliesberg Quartzite Formation of the Pretoria Group. This formation is composed of quartzite, feldspathic quartzite, shale (hornfels) and gritty quartzite. The site is underlain by two quartzite units, separated by a thin unit of hornfels. The southerly quartzite layer, which forms the foothills of the Magaliesberg ridge, is being quarried at the present time. On outcrop the texture of the quartzite's ranges from fine crystalline to coarse crystalline with crystal sized ranging from 0.5 – 12mm.
Agricultural Potential	The study site is against mountainous terrain and would make crop production impossible. The size of the proposed expansion is also very small and would make agricultural production on this portion uneconomical.
Biodiversity	The study site falls within the Savanna Biome (Mucina & Rutherford 2006), dominated by grass species, shrub layers and well-developed trees. Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The study area is situated within the Central Bushveld Bioregion and overlaps with two vegetation types, namely the Moot Plains Bushveld (SVcb8) and the Gold Reef Mountain Bushveld (SVcb9). Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver et al. 2011). Datasets have been developed by SANBI (2016) in order to outline threatened ecosystems, with the primary objective of limiting the rate of ecosystem extinctions. Four established categories group these ecosystems namely: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Protected. No threatened ecosystems overlap with the study site (NBA 2018). The southern section of the study site is classed as Critical Biodiversity Area 2 (CBA2) in terms of the NWBSP. This is possibly due to the site overlapping with the Magaliesberg Protected Natural Environment and the Magaliesberg IBA. The study site overlaps with the Magaliesberg IBA, previously known as the Magaliesberg and Witwatersberg IBA, this IBA consists mainly of the Magaliesberg range, which extends in an arc from just north-west of Rustenburg in the west to the N1 in the east near Pretoria. To the south, the Witwatersberg range runs parallel to the Magaliesberg, extending from the town of Magaliesberg in the west to Hartbeespoort Dam in the east.
Socio-Economic	The population of the Madibeng Local Municipality is estimated, by the 2011 population census (Source: http://www.localgovernment.co.za/locals/demographics/188/Madibeng-Local-Municipality), to be 477 381. The population of the Bojanala Platinum District Municipality (Source: http://www.localgovernment.co.za/districts/demographics/39/Bojanala-Platinum-District-Municipality) is

	estimated to be 1 507 505. The Madibeng Local Municipality have an annual growth of 3.17 %, implying the projected population of the local municipality to be 492 514 in 2014. It is evident that the Madibeng Local Municipality (MLM) and the Bojanala Platinum District Municipality (BPDM) shows a typical age structure of a very young population distribution. The youth (15-34 years) unemployment rate of the MLM, is estimateded by Census 2011 to be 38.20 % of the 30.40% unemployed population. At the time of Census 2011, 72 743 males within the age bracket of 20 to 24 years, - the group with the highest percentage of the general population within BPDM - and 58 860 females - between the ages of 20 and 24 years - were counted. A very low percentage of the population of the Madibeng Local Municipality have higher education qualifications and only approximately 15% of the population completed secondary schooling.
Heritage and Archaeology	Regarding the proposed new extension area, an archaeological assessment of the site was conducted. During his reconnaissance no heritage resource sites or finds of any value or significant were identified within the area of proposed mining footprint, however a gravesite was found outside the development footprint, on the boundary of the property. The current development proposal could therefore be supported. No sites of archaeological or cultural interest that will be impacted by the operations were identified within the project area.

9. Knowledge Gaps

The following specialist studies and investigations are proposed to address the knowledge gaps relating to the for Witkop Fluorspar mine (Pty) Ltd – Sallies Silica:

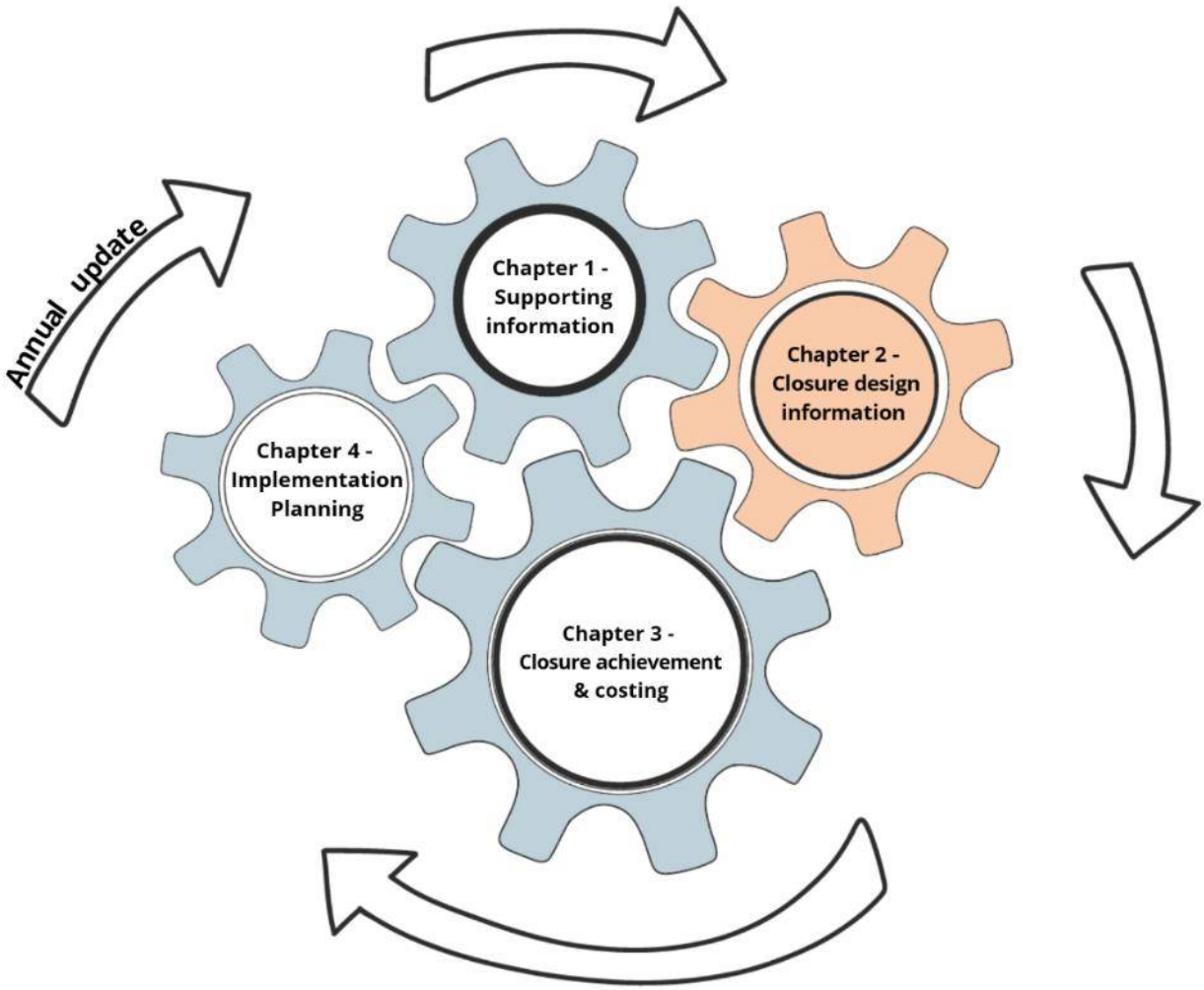
- A detail topsoil assessment, quantity and quality must be undertaken during the operational phase to establish if sufficient topsoil is available to establish the final landform.
- The steep (greater than 20%) un-protected slope will be prone to slope failure and erosion, resulting in a long period of aftercare and maintenance. The stability of the slopes and benches should be established by a rock engineer. A stability assessment must be undertaken as part of closure planning.
- The final landform must be determined based on the stability of the rock face, the health and safety requirements of the slopes and benches.
- The final landform and land-use to be determined during the operational phase.
- The Visual impact of the opencast mine will remain relatively high after rehabilitation. It should be investigated to decrease the visual impact by changing the rock colour to be more natural and in line with surrounding areas.

Further the financial provisioning regulations requires that the FRDCP be revisited, assessed, and revised on an annual basis. This annual review must aim to ensure that the gaps identified above are addressed, as applicable, and the relevant financial provisioning updated.

10. Concerns Raised by Interest and Affected Parties

The main concerns raised during the community engagement process, either through participation in public meetings or via electronic submission, are listed within the Basic Assessment. Please see the Basic Assessment for the full Public Participation Report.

CHAPTER 2: CLOSURE DESIGN INFORMANTS



Chapter 2, addresses the key closure design informants and develops the preceding survey data via analysis and synthesis. This part includes:

- The current post-mining end land use plan;
- The findings of, and commentary on, operational rehabilitation to date, as well as planned rehabilitation;
- Outcomes of closure-related stakeholder engagement, where applicable;
- An initial assessment of closure options / alternatives, along with a motivation for the preferred option and the formulation of the anticipated closure scenario and vision; and

- A summary of the environmental risk assessment undertaken in accordance with the requirements of GN. R. 1147, with a key focus on the formulation of mitigation measures which are further refined in the core section of this planning process.

11. NEXT LAND USE

11.1. Land Use Objective

The land use objective must be realistic, achievable and must be established through consultation with the landowners and I&AP's. The final land use is essential the end land use to which Sallies Silica would like to return the land affected by mining activities.

In support of achieving this post closure vision there are certain key rehabilitation, decommissioning and closure objectives. 'Well-conceptualised rehabilitation objectives will allow assessment of the risks associated with achieving these objectives and guide the setting of suitable rehabilitation actions to be taken to mitigate these risks at every stage of the mine's life.

Rehabilitation objectives describe 'what' needs to be achieved to reach the mine's rehabilitation goal. These objectives should be aligned to site-specific characteristics that are within the mine's control. Rehabilitation objectives should be as specific, measurable, achievable, and realistic as possible. They should also define a time period against which they can be measured. Driven by the closure vision and with due consideration of the project context, the closure objectives are presented below.

To progressively reinstate a post mining landscape that:

- Is physically and chemically stable and supports the pre-mining land capability of wilderness.
- Slopes are stable and non-erosive;
- The benches and rock face must be stable;
- Focus on establishing a functional post-mining landscape;
- Utilise closure strategies that promote a self-sustaining condition with little or no need for ongoing care and maintenance; and
- Comply with local, district and national regulatory requirements.

12. Closure Options

The project, from a closure perspective, has a low complexity, and most of the risks and impacts associated with the project are well understood. A preliminary best fit post closure land use option has been proposed within the context described. The rehabilitation measures proposed for this project are consistent with legislation and what is considered industry good practice in restoring the desired post mining land use. The following alternatives were considered:

12.1. Pre-mining natural ground level option

The post mining landform would be consistent with the surrounding topography instead of a modified slope. This alternative was not considered for implementation due to the following:

- Insufficient overburden available to establish the natural ground level after mining.
- Backfill material will have to be obtained from other areas.
- Bulking and settlement factors unknow of fill material.
- Chemical properties unknow of fill material to be imported.
- A long-term stable slope cannot be achieved;
- Chemical stability of the dump must be investigated during closure; and
- Long term monitoring will be required.

13. Preferred Closure Option

Based on the type of mining (opencast – Quarry) and the associated risk that could occur post closure, the following recommendations have been made as a result of the outcomes of the Environmental Risk Assessment (ERA) conducted:

The preferred option for current closure planning is:

- A stepped slope (benches) will be created to limit the length of a single slope face. Where possible a 1:3 slope will be created.
- The benches should be designed by a rock engineer and should ensure stability of the slope and comply with Mine Health and Safety requirements.
- Rocks should be utilised on the slope to prevent soil erosion and to create drainage lines.
- Replace all topsoil stripped ahead of mining;
- Backfill the open pit with all the available overburden to create a free-draining post mining landform;
- Plant naturally occurring grasses to prevent erosion, to provide a limited grazing potential.
- On completion of mining the current section will be flooded and an artificial dam will be created.

The preferred closure option will result in a stable slope with minimal erosion problem. This will create a landform that is stable and have a low risk for humans and animals. All available overburden and waste rock will be utilised to establish slopes, the foot of the slope, to shape the pit floor area and create drainage lines. Topsoil will be place on slope and erosion provision measures will be implemented to ensure that topsoil is not eroded from the slopes. Measure to include geotextile, bio-degradable synthetic mats and rock cladding.

13.1. Closure Assumptions

Information currently available will need to be supplemented during the operational phase and closure phase of the project. As additional information will be collected during operations and these assumptions will need to be reviewed and revised.

The assumptions used to prepare this report are the following:

- The closure period will commence once the last planned ore has been extracted from the area, concurrent rehabilitation forms part of the operational phase.
- The plant will only be decommissioned and removed from site after all resources have been process.
- The mine plan, design and layout have been adhered to.
- Water quality monitoring will be governed by the WUL.
- The overburden and waste rock are Classified as Type 4 waste and can be used in rehabilitation and backfill of the opencast area.
- There are limited opportunities for post closure infrastructure for community uses. All information (houses and structures) will remain after mining and will not be removed. All non-permit structures (containers and plant) will be removed during rehabilitation. The SLP will be updated to include the structures that can be hand-over to the community during closure. These items will be removed from the closure schedule.
- All demolition rubble is considered General Waste as per the definition of Demolition waste in Category B of Schedule 3 of the National Environmental Management Waste Amendment Act (NEMWAA) and based on the classification as General can therefore be incorporated into the backfill.
- The past closure land use will be wilderness. No agricultural activities will be undertaken after mining.
- The steep sections of the slopes will not be rehabilitated with topsoil, rocks will be placed on the steep section to protect the topsoil and prevent erosion.
- Drainage lines will be constructed with energy dissipaters and a rock mattress
- All hazardous and domestic waste will be transported offsite for disposal in licenced landfills.
- Some of the roads constructed to access the site will be needed for post-closure monitoring and cannot be closed as part of normal closure actions.
- The mine will align the closure plan with the regional closure strategy when the strategy for the area has been developed.
- The mine will not require long term water quality monitoring or pumping as the mine will not produce any AMD or long-term water pollution.

13.2. Closure Scenario

Leading on from the closure option analysis and the motivation of the preferred option, the closure scenario is formulated to provide the context within which decommissioning, and closure activities will occur, i.e. a "snapshot" view of the last day of operations, taking account of operational mine and rehabilitation planning.

Table 6: Closure Scenario

Aspect	Description
Mining and Mine Dumps	• Concurrent rehabilitation will be performed as mining progress, the side slopes will be shaped and rehabilitated during the LOM. • The final void will be backfilled with the overburden stockpile material to design elevations; • Topsoil will be replaced from the topsoil berm onto the backfilled and slopes. • The topsoil berms will be dozed over the roads, plant, and other areas. • The top-soiled areas will be cross ripped, to alleviate compaction, scarified and revegetated; • Contaminated soils will have been identified and addressed as they arise during operations, leaving only limited potentially contaminated soils / areas requiring clean-up at cessation of operations; and • The haul roads will be deep ripped, profiled, and vegetated. • All product will be removed from the plant and stockpiles areas. No stockpiles will remain.
Water management	• Operational storm water measures will be filled in, shaped as required and the footprint scarified and re-vegetated. • Stormwater measures will be installed on the slopes to ensure drainage. • The pit area will be flooded. • Diversion berms at the top of the slopes and benches will remain to divert water away from the opencast area.
Plant Area	• The sacrificial layer located under the plant and stockpiles areas will be excavated and will be processed by the plant. • All infrastructure from the plant area will be removed. • Cement structures will be broken up and placed in the backfill. • The plant will be relocated to another operational area. This will form part of the operational cost of the other mine.
Offices and Infrastructure	• All formal structures (houses and offices) will remain after mining and will not be removed. • All non-permit structures (containers and plant) will be removed during rehabilitation.

13.3. Closure Vision

Closure and rehabilitation are a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation.

The preliminary closure vision is proposed for the mining area, is as follows:

- To create non-contaminating, secure and physically stable landforms and rehabilitated areas that contribute to the selected land use mix, biodiversity of the area and which are aesthetically acceptable.

14. OPERATIONAL REHABILITATION

A key mine closure principle is concurrent (progressive) rehabilitation. This includes the development and implementation of rehabilitation plans aligned with mining programmes. The specific aim is to minimise closure costs and liabilities and reduce environmental risks during operation and at closure of the mine through to post mining.

As mining progresses from the existing area into the proposed new area, progressive rehabilitation (concurrent rehabilitation) will take place. The side lopes will be created, the benches will be established on the rock face and placement of topsoil will take place. The mined-out areas will be shaped to form part of the final land form.

14.1. Vision for the Operational Period

The operational period will include rehabilitation activities that have a direct impact on the quality of rehabilitation attained at closure, particularly the management of soils. A proposed vision for the development and operation of the mining area are:

- To limit the development footprint as far as possible;
- Implement stormwater measures according to GNR 704;
- Strip and store soils prior to any development;
- Implement concurrent rehabilitation as soon as possible;
- Prevent mixing of soil profiles;
- Re-vegetate topsoil stockpiles and berm to maintain soil fertility; and
- Prevent contamination of topsoil.

14.2. Planned Rehabilitation

14.2.1. Final Landform Design

In order to achieve the final landform design, the closure objectives and relinquishing criteria must be met. This will require that, slopes and surfaces will be stabilised to prevent subsequent rehabilitation and revegetation from being less effective and maintenance being prolonged.

Final landform design will take the following factors into consideration:

- Erosion potential of material on site;
- Recognition of pre-mining surface flow;
- Alignment with existing topographical features;
- Slope angles and length to be visually compatible with the surrounding area and stable under local rainfall patterns and erosion processes;
- Recognition that unconsolidated material from disturbed areas will require greater protective measures to minimise erosion;
- Drainage pattern for the overall site should be planned as part of the overall landscaping, with drainage patterns and densities monitored during the operation phase on, and near site providing a guide to site requirements.

The annual rehabilitation requirements have been established based on the production rate of the plant and the area of the that can be rehabilitated. The final landform design will be developed during the operational phase. The landform will be altered as the area can not be backfilled to original topographic levels. The visual impact must be limited during closure and rehabilitation.

14.2.2. Steps for the next year (2022-2023)

The proposed surface layout of the mine is in Figure 8. The development will consist out of four phases (i.e. Construction, operational, decommissioning and Closure). The first phase, consist out of the construction phase. During the first phase no concurrent rehabilitation can be undertaken. However, incorrect establishment of the extension of the mining will result in concurrent rehabilitation and final rehabilitation begin problematic, resulting in excessive liability. The following actions are critical for future rehabilitation to be possible:

- Stripping and stockpiling of all topsoil.
- Stripping and stockpiling of subsoil.
- Separation of topsoil and soft overburden must take place
- Topsoil stripped from roads must be used as berms (to be replaced during rehabilitation)
- Topsoil stockpiles to be re-vegetated.

Rehabilitation that can be undertaken in the existing mining area consist out of the following:

- Shaping of mined out areas.
- Establishing of Benches
- Creating slopes on mined out area
- Placement of topsoil
- Re-establishing of vegetation.

14.3. INFRASTRUCTURE AND REHABILITATION

14.3.1. ROADS

The access to the mine will be obtained from existing roads established for the existing mining area. No upgrades will be required as the production rate will not increase. Roads connecting the existing area with the new proposed extension will be in the mining area and will be mined out through time.

None of the roads constructed will be surfaced with tar or any form of hydrocarbons. For this reason, the roads will be rehabilitated by ripping and placement of topsoil.

Financial provision has been made for the existing roads and no additional road will be constructed. No additional closure liability uptake is required for roads.

14.3.2. STOCKPILES AND OVERBURDEN

Overburden and stockpiles (topsoil and subsoil) normally have a low pollution potential and hence only need to be shaped to create a stable landform. Stockpiles (Topsoil and subsoil) and overburden stockpiles are in and will be utilised. Topsoil will from the stormwater berms at the top of the slope and to act as diversion berms.

Subsoil and hard overburden will be place on the existing stockpile or will be utilised in concurrent rehabilitation. No additional closure liability uptake is required for overburdens and stockpiles.

14.3.3. CLEAN AND DIRTY WATER MANAGEMENT

The mine will construct a stormwater management system in compliance with GN704. Clean and dirty water channels will be constructed. Clean water channels will consist of s cut off trench and a berm. Energy dissipation systems will be constructed where the channels spill into the receiving environment.

A number of structures will remain after rehabilitation. The clean water channels will be rehabilitated through dozing of the berm back into the channel and re-vegetation. A clean water berm will remain at the top of the slope and surrounding the mining area to prevent water inflow. The berms will be established during the operational phase and will be re-vegetated during this phase. No additional closure liability uptake is required for clean and dirty water management.

During the monitoring and aftercare phase, erosion monitoring and water monitoring will take place. The monitoring will take place for 2-3 years after closure. The aftercare and maintenance for the site can be stopped when the relinquishment criteria is met.

14.3.4. PLANT AND PRODUCT STOCKPILES

The plant is an existing area, and no new plant or stockpiles will be created. No additional structures are required for the proposed extension of the mining area.

14.3.5. STEEL STRUCTURES, CARPORT AND WORKSHOP

The existing steel structure, carport and workshops will be utilised. No additional structures are required for the proposed extension of the mining area.

14.3.6. OPENCAST REHABILITATION

The rehabilitation of the opencast area will consist out of four area. Each of these areas will have its own requirements for rehabilitation.

1. **Mine Floor Area**

The area will be shaped and backfill material will be utilised to form the final landform. Rehabilitation of the area will consist of dozing of material and placement of topsoil.

2. **Dam Area**

The stormwater dam already in place at the existing mining area will be extended into the new proposed area. All drainage from the slopes and mining area will be directed to this area. No rehabilitation will be required.

3. **Side Slopes**

The sides of the opencast area will be sloped. The slopes will be less than 1:3. The area will be created during the operation phase and final shaping will take place during closure. Topsoil placement and topsoil protection measures will be installed on the slopes. Rocks will be utilised to create drainage lines and to limit erosion.

4. **Benches**

Benches will be created at areas where the slopes will exceed 1:3. The benches must be designed by a rock engineer and the benches must be of such a nature that no rock failures will take place. The benches will be created during the operational phase.

14.3.7. GENERAL SURFACE REHABILITATION

General surface rehabilitation will consist out of the cross ripping of all areas, placement of topsoil ripping of any compacted topsoil and seeding of topsoil. All areas impacted during mining, apart from the areas/ infrastructure that will remain after closure requires general rehabilitation.

Limited amount of topsoil is available on site. If required sub-soil can be tested and ameliorated to supplement topsoil. This can only be done on areas that will be restored to wilderness. The final landform design will be developed during the operational phase and a topsoil balance will be developed to ensure that sufficient topsoil is available.

All the disturbed and void areas that have been filled, top soiled and levelled, will be prepared for planting.

The recommended approach, for which this costing has been derived, is as follows:

- Lime and superphosphate are applied to the surface;
- These ameliorants are then incorporated by deep ripping, which penetrated 100 mm through the soil into the underlying overburden material;
- Compound (NPK + Zn) fertilizer is applied, and disced in as part of seedbed preparation;
- A grass seed mix is then planted, usually with first rains, or after rains have commenced; and
- The site is then mulched using locally obtained grass; this is to stimulate the long-term establishment of indigenous vegetation and to reduce erosion during early plant growth.

14.3.8. MAINTENANCE AND AFTERCARE

Maintenance and aftercare must be planned for 2-3 years after the land preparation and replanting of vegetation has been completed. Maintenance will specifically focus on fertilizing the rehabilitated area annually, control of alien plants and general maintenance, including rehabilitation of cracks, subsidence, and erosion gullies. Continuous erosion monitoring of rehabilitated areas and slopes should be undertaken and zones with excessive erosion should be identified.

Surface monitoring will take place as part of the aftercare and maintenance. No long-term pollution or AMD is expected from the mining area.

Table 7: Preliminary implementation plan

Year	Aspect/ Closure Activity	Size catered for in terms of quantum(s)	Actual implementation date	Percentage completed – to be updated annually	Work to be re-scheduled – to be updated annually
Phase 1: Construction phase					
Construction phase (year 1)	Stripping of topsoil	Surface area			
Construction phase (year 1)	Re-vegetation of topsoil stockpiles and berm	Stockpiles and berms			
Phase 2: Operational phase					
Operational phase (year 2 – 20)	Concurrent rehabilitation of mined out areas	Area to be determined annually			
Operational phase (year 2 – 20)	Re-vegetation of topsoil stockpiles and berm	Stockpiles and berms			
Operational phase (year 2 – 20)	Alien Vegetation Management	Based on requirement of Alien Vegetation Management plan			
Operational phase (year 2 – 20)	Erosion Control and management	Area to be determined annually			
Phase 3: Decommissioning phase					
Closure phase (year 20 – 23)	Final sloping of slopes, establishment of final benches. Shaping of floor area.	Area to be determined annually			

Year	Aspect/ Closure Activity	Size catered for in terms of quantum(s)	Actual implementation date	Percentage completed – to be updated annually	Work to be re-scheduled – to be updated annually
Closure phase (year 20 – 23)	Removal of stockpiles and product	Stockpile area			
Closure phase (year 20 – 23)	Placing of backfill and dozing of material	Area to be determined annually			
Closure phase (year 20 – 23)	Re-vegetation of topsoil stockpiles and berm	Stockpiles and berms			
Closure phase (year 20 – 23)	Alien Vegetation Management	Based on requirement of Alien Vegetation Management plan			
Phase 4: Final Rehabilitation, closure, and aftercare					
End of life of mine	Rehabilitation of roads and haul roads				
End of life of mine	Rehabilitation and removal of Stockpiles and Overburden				
End of life of mine	Clean and dirty water management system rehabilitation				
End of life of mine	Infrastructure rehabilitation – plant and stockpiles				
End of life of mine	Surface infrastructure				
End of life of mine	Waste Management Facilities				
End of life of mine	Aftercare and maintenance				

15. Operational monitoring plan

An operational monitoring plan should be developed for the mining area, this should include the requirements of the EMPR and WUL. The proposed parameters to be monitored, frequency of monitoring and period of monitoring are indicated in Table 8 below.

Table 8: Proposed operational monitoring plan

Proposed operational monitoring plan			
Aspect	**Parameters**	**Frequency**	**Responsibility**
Material Balance – Topsoil	Soil stripping depth, soil stockpiling, soil placement depth and maintaining the life of mine topsoil balance. Verifying the actual overburden bulking factor	Active daily management of operations; and A monthly survey consolidation	Site environmental manager and the surveyor
Topsoil and subsoil quality	Soil physical and chemical properties, accurate implementation of soil management practices to reduce mixing and compaction	As topsoil stripping and placement occurs; and active daily management of stripping, stockpiling and placement activities	Site environmental officer and soil scientist
Dust	Source and receptor monitoring	Monthly	Environmental Control Officer
Surface quality	Upstream and downstream of mining area. In accordance with Water Use License requirements	Quarterly	Environmental Control Officer
Post mining landform	Non-erosion slopes, correct slope to be establish	Active daily management of operations	Site environmental manager and the surveyor

16. Environmental Risk Assessment

The key to closure planning is not deferring the rehabilitation / closure costs but eliminating future closure activities through integrated closure and LOM planning. This includes a process of closure-focused risk assessment, strategic planning, and development of robust and applicable closure criteria to meet the closure vision. The objective of the risk assessment is outlined in the Financial Provisioning Regulations, 2015. The objective is to:

- Ensure timeous risk reduction through appropriate interventions;
- Identify and quantify the potential latent environmental risks related to post closure;

- Detail the approach to managing the risks;
- Quantify the potential liabilities associated with the management of the risks; and
- Outline monitoring, auditing, and reporting requirements.

16.1. Risk Screening Methodology

The approach to identifying potential risks is summarised as follows:

- High level discussions were held with regarding the prevailing conditions at the proposed site;
- A preliminary site visit was conducted to become familiarized with the site location, soil conditions, topography, vegetation and surface water bodies;
- A document review was done of available background information to inform the screening level risk assessment;
- The key potential risks were identified for relevant closure-related aspects. The focus is placed on the risk (change) and not the activity causing the risk; and
- The risks were arranged within a matrix format.

16.2. Risk Rating Methodology

The Environmental Impact Assessment (EIA) 2014 Regulations [as amended] promulgated in terms of Sections 24 (5), 24M and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA), requires that all identified potential impacts associated with the project be assessed in terms of their overall potential significance on the natural, social, and economic environments. The criteria identified in the EIA Regulations (2014) include the following:

- Nature of the impact;
- Extent of the impact;
- Duration of the impact
- Probability of the impact occurring;
- Degree to which impact can be reversed;
- Degree to which impact may cause irreplaceable loss of resources;
- Degree to which the impact can be mitigated; and
- Cumulative impacts.

The impact assessment methodology used to determine the significance of impacts prior and after mitigation is presented Appendix A.

16.3. Comparative Risk Assessment

The following steps were taken to compile a comparative risk assessment, between the pre-and post-mitigation scenarios:

- Devise measures, based on accepted industry best practice and experience, to mitigate consequences and impacts. The measures should be implemented concurrently during the LoM or at closure;
- Re-calculate the post-mitigation (residual risk), thus assuming reasonable effectiveness of the recommended measures;
- Highlight the risks that scored as highly negative or moderately negative in the pre-mitigation assessment, arrange in a table and indicate the proposed mitigation measures. This action highlights the priority measures associated with pre-emptively mitigating the risks;
- Discuss the potential post closure residual and latent risks based on the outcomes of specific specialist studies;
- Include and further develop the risks assessment findings in the Closure plan to ensure that:
    - The closure objectives have clearly defined actions to address the identified risks;
    - Feasible post-mining land uses are proposed, thus taking account of the identified risks;
    - Design principles for closure are adjusted to include uncertainties and to adequately scope potential further work to reduce the level of uncertainty; and
    - All potential risks are pro-actively managed / controlled.

Table 9: Risk Assessment

Potential Impact	Extent		Duration		Intensity		Reversibility		Irreplaceability (Extent + Duration + Intensity + Reversibility)	Probability		Significance without mitigation		Mitigation Efficiently		Significance with mitigation		Mitigation measures
Loss of topsoil through erosion at stockpiles,opencast edges and rehabilitated areas	Footprint	1	Long term	4	Medium	3	Partly reversible	3	11	Highly likely	4	Medium	44	Medium	0,6	Low	26,4	Disturbed areas must be re-vegetated as soon as possible to reduce the risk of erosion; Ensure that all stockpiles have a storm water diversion berm for protection against erosion and contamination by dirty water; Vegetate long-term soil stockpiles.
Insufficient topsoil to cover all disturbed areas during rehabilitation	Footprint	1	Long term	4	High	4	Nearly irreversible	4	13	Highly likely	4	Medium	52	Low	0,8	Medium	41.6	Optimise the limited topsoil resources available on site; Utilise the stored topsoil for the sole purpose of rehabilitation, no topsoil should be used for landscaping or construction purposes such as roads or embankments.

Ineffective soil amelioration resulting in poor vegetation establishment	Footprint	1	Long term	4	High	4	Partly reversible	3	12	Highly likely	4	Medium	48	Medium	0,6	Low	28.8	Investigate soil quality through representative sampling and specialist analysis of laboratory results; Define remediation measures and correct soil fertility prior to establishing vegetation on rehabilitated soil; Conduct follow up soil sampling and analysis to inform further remediation should it be required; Conduct regular visual inspections and preventative care and maintenance.
Deterioration of surface water quality because of runoff (siltation)	Site	2	Medium term	3	High	4	Nearly completely reversible	2	11	Possible	2	Low	22	Medium	0,6	Very Low	13.2	Based on the geohydrological report decant is not expected or any formation of AMD. Stormwater management system to be maintained. Run off water to be contained to prevent siltation of rivers.
Insufficient profiling of the topography of the mining area during rehabilitation may lead to erosion	Site	2	Medium term	3	Medium	3	Nearly irreversible	4	12	Highly likely	4	Medium	48	Low	0,8	Medium	38.4	Profiling of topography should be deigned to reduce erosion; Erosion control measures to be implemented concurrent with rehabilitation. Visual monitoring of erosion to be undertaken throughout

																	decommissioning phase until Closure Certificate is gained; Any erosion detected must be remediated and erosion control measures to be implemented where necessary.
Excessive dust/erosion from unvegetated areas	Local	3	Short term	1	Medium	3	Nearly completely reversible	2	9	Likely	3	Low	27	Medium to high	0,4	Very low	10,8	Develop and maintain dust suppression practices during the rehabilitation phase; Revegetate rehabilitated areas as soon as possible; Ensure sufficient financial provision for monitoring, care, and maintenance of rehabilitated areas.
Insufficient control of alien invasive species on rehabilitated land	Local	3	Medium term	3	Low	2	Nearly completely reversible	2	10	Highly likely	4	Medium	40	High	0,2	Very low	8	Compile AIP management plan to be implemented throughout LoM and decommissioning phase; Monitoring of AIP to be undertaken annually.
Lack of stakeholder buy-in on rehabilitated landscapes	Region	4	Long term	4	Medium	3	Nearly completely reversible	2	13	Possible	2	Low	26	Low to medium	0,8	Low	20,8	Update, audit and submit the closure plan and associated closure documentation to the regulators as prescribed by legislation; Undertake regular engagement to present the planning process and ensure alignment; Develop a post mining land use plan considering the local spatial development

																	framework (SDF) and Integrated Development Plan.
Visual impact as a result of poor rehabilitation and no landform design	Region	4	Long term	4	Medium	3	Nearly irreversible	4	15	Likely	3	Medium	45	Medium	0,6	Low	27	Final landform to be design. Slope stability to be design by rock engineer. Visual impact to be limited by blending exposed areas into the surrounding landform. The rock colour to be changed to blend into surrounding areas.
Changes in surface hydrology as a result of rehabilitation	Local	3	Medium term	3	Low	2	Nearly completely reversible	2	10	Highly likely	4	Medium	40	Medium	0,6	Low	24	Implement final landform design; Limit steep slopes; Establish free draining landscape; Re-instate drainage lines and low laying areas.
Reduction in land capability after rehabilitation.	Footprint	1	Long term	4	Medium	3	Nearly irreversible	4	12	Highly likely	4	Medium	48	Medium	0,6	Low	28,8	Optimise the limited topsoil resources available on site; Utilize the stored topsoil for the sole purpose of rehabilitation, no topsoil should be used for landscaping or construction purposes such as roads or embankments; Analysis of topsoil for fatality and apply require amelioration where required; Apply agricultural lime and fertiliser to soil profile

																		Rehabilitation to be in line with the final land-use requirements.
Uncertainty regarding the latent and residual risks due to site specific knowledge gaps	Local	3	Medium	3	High	4	Nearly irreversible	4	14	Likely	3	Medium	42	Medium	0,6	Low	25,2	No ADM will be produce by the waste material or any material on site. The stability of the rock face to be established. The benches to be design as required to ensure stability. Erosion protection will be required on steep sloped.
Potential inadequate budget for the rehabilitation of the mine	Local	3	Permanent	5	High	4	Nearly completely reversible	2	14	Low	2	Low	28	High	0.2	Very low	6	Financial liability must be provided before any mining right is approved. The Rehabilitation and Financial liability are updated annual and submitted to the Department.
Uncontrolled access during closure phase	Region	4	Permanent	5	High	4	Nearly completely reversible	2	15	Likely	3	Medium	42	Medium	0,6	Low	25.2	The mining area will be accessed through a single access point. The area will remain fenced off to prevent access to the dam area.

16.4. Proposed Mitigation Measures

The risks with pre-mitigation significance ratings of Medium are indicated in Table 10 below. The risk classification provides an insight into the key aspects requiring management and intervention during the operations and into closure.

Table 10: Proposed mitigation applied in the risk assessment

Risk	Proposed Mitigations
Insufficient topsoil quality and quantity	• Optimise the limited topsoil resources available on site; • Strip all available soils within the mining area boundary, shaft fringe (5m buffer), road footprints prior to mining and store in the berm and stockpile; and • Utilize the stored topsoil for the sole purpose of rehabilitation, no topsoil should be used for landscaping or construction purposes such as roads or embankments. • Subsoil must be tested and ameliorated, to be used as topsoil.
Ineffective soil amelioration resulting in poor vegetation establishment	• Investigate soil quality through representative sampling and specialist analysis of laboratory results; • Define remediation measures and correct soil fertility prior to establishing vegetation on rehabilitated soil; • Conduct follow up soil sampling and analysis to inform further remediation should it be required; and • Conduct regular visual inspections and preventative care and maintenance. • Subsoil must be tested and ameliorated, to be used as topsoil.
Loss of topsoil through erosion at stockpiles, opencast edges and rehabilitated areas	• Strip all available soils off the opencast fringe; and • Disturbed areas must be re-vegetated as soon as possible to reduce the risk of erosion. • Ensure that all stockpiles have a storm water diversion berm for protection against erosion and contamination by dirty water; • Vegetate long-term soil stockpiles.
Compaction and sterilization of undisturbed topsoil underneath the topsoil berm	• Limit the height of the topsoil berm to below 3.0 meters; • Limit the heavy vehicle traffic over the topsoil berm; • Upon berm removal, cross rip the footprint with an agricultural ripper and scarify to alleviate compaction; and • Revegetate the footprint.
Compaction and decline in topsoil structure during,	• Limit the traffic over in situ or stockpiled soils as far as possible; • Develop a soil stripping and placement traffic management plan to ensure that no heavy wheel-based vehicles traverse over in situ or replaced topsoil;

stripping, stockpiling and topsoil re-placement	• Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once; • Spreading of soil over far distances and repeated traversing of heavy mechanical equipment should be avoided to prevent compaction.
Excessive dust/erosion from un-vegetated areas	• Develop and maintain dust suppression practices during the rehabilitation phase; • Revegetate rehabilitated areas as soon as possible; and • Ensure sufficient financial provision for monitoring, care, and maintenance of rehabilitated areas
Reduction in land capability after rehabilitation.	• Optimise the limited topsoil resources available on site; • Strip all available soils within the boundary, opencast fringe (5m buffer), road footprints prior to mining and store in the berm and stockpile; and • Utilize the stored topsoil for the sole purpose of rehabilitation, no topsoil should be used for landscaping or construction purposes such as roads or embankments. • Analysis of topsoil for fatality and apply require amelioration where required. • Apply agricultural lime and fertiliser to soil profile. • Rehabilitate areas in line with final land use requirements.
Changes in surface hydrology as a result of rehabilitation	• Implement final land form design; • Limit steep slopes; • Establish free draining landscape; • Re-instate drainage lines and low laying areas.
Lack of stakeholder buy-in on rehabilitated landscapes	• Update, audit and submit the closure plan and associated closure documentation to the regulators as prescribed by legislation; • Undertake regular engagement to present the planning process and ensure alignment; • Develop a post mining land use plan considering the local spatial development framework (SDF) and Integrated Development Plan.
Deterioration of surface water quality	• Develop and maintain a surface monitoring program in line with the WUL requirements and specialist studies; • Maintain stormwater measures during operational phase; • Contain any runoff on the rehabilitated area to prevent siltation and contamination of surface water;
Uncertainty regarding the latent and residual risks.	• Undertake stability assessment by rock engineer • Determine design parameters for benches and slope gradients. • Determine erosion factor of soil and the design angle of slopes.

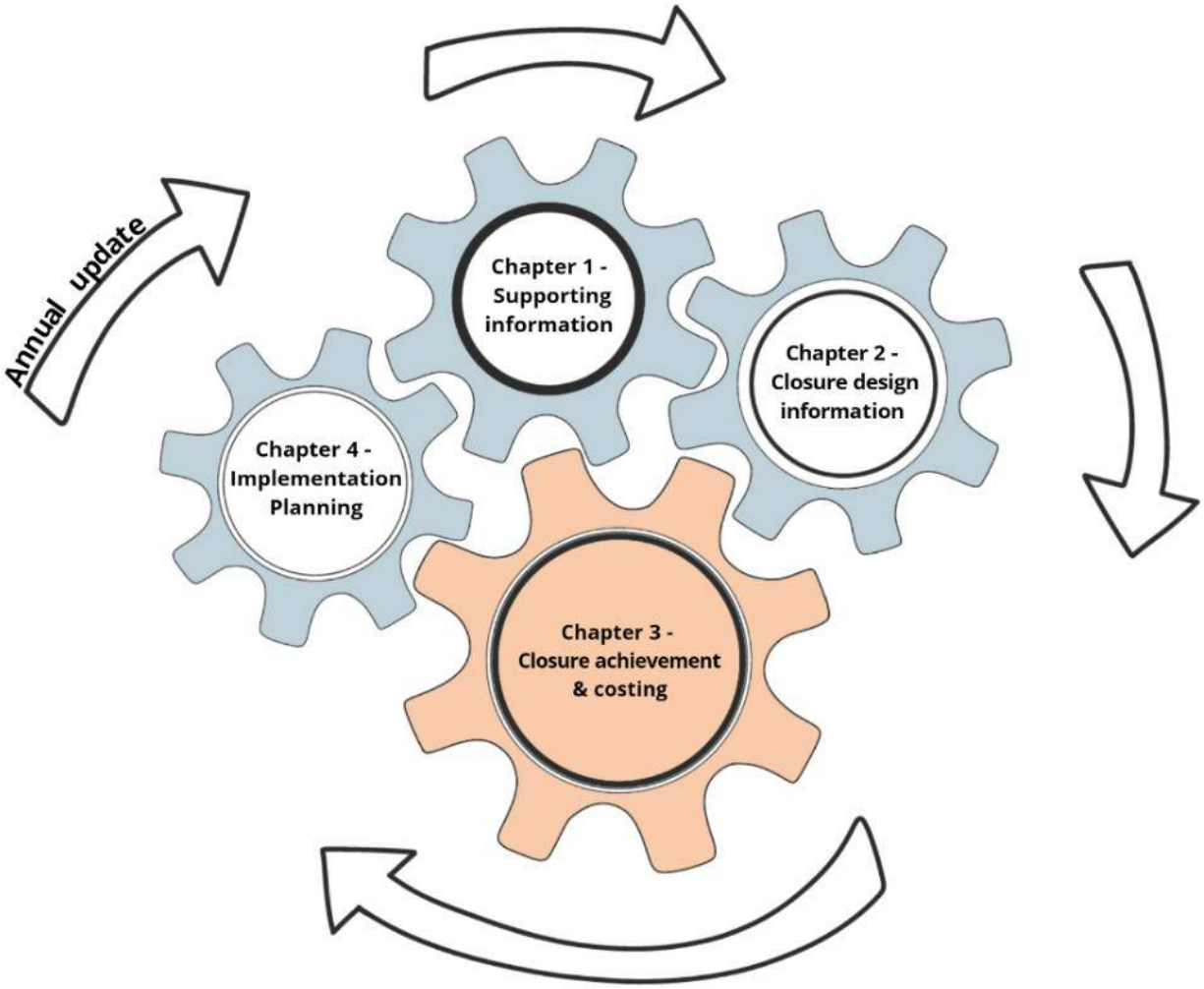
16.5. Threat Opportunities and Uncertainties

The specialist studies for this site and the knowledge gaps that exist should be taking into consideration. It is envisaged that through the operational phase of this project many further specialist studies may be required, update of studies and improvements in technology will take place and as such, it is recommended this plan be revisited and updated with these findings as an annual requirement of GNR 1147. As presented in the risk assessment, the uncertainty, indicated as having a low significance, associated with the latent and residual risks after mitigation measures have been implemented. The following have been identified, with respect to threats, opportunities, and uncertainties with respect to the compilation of this plan to define any additional work that is needed in order to reduce the level of uncertainty.

- Ongoing engagement with communities surrounding the area, with respect to the closure vision of the mine and tacking these issues into account when closure is being considered;
- Final landform and land use to be determined during the operational phase.
- Rock stability assessment to be undertaken;
- Slope stability assessment to be undertaken;
- Erosion potential of soil and slope angle to be determined.
- Adopting closure recommendations as identified in the respective specialist reports, with particular emphasis on social, water and biodiversity related aspects; and

Further update and review of the rehabilitation, decommissioning and closure plan based on new information may highlight further gaps in the plan, however, this plan includes information available at present.

CHAPTER 3: CLSOURE ACTIONS AND COSTING



Chapter 3 is the combination of the findings of Chapter 1 and 2 and forms the core of the plan:

- The general closure actions (measures) aimed at achieving the seven key objectives;
- Refined into the specific closure actions for infrastructure, mining areas, general surface rehabilitation and post-closure aftercare and monitoring; and
- The closure cost determination based on the specific closure actions.

17. CLOSURE ENVIRONMENTAL MANAGEMENT PLAN

The main aim in developing the Final Rehabilitation, Decommissioning and Mine Closure Plan is to minimise and mitigate the impacts caused by mining and industrial activities and to restore land back to a satisfactory standard. It is best practice to develop the Plan as early as possible so as to ensure the optimal management of rehabilitation and closure issues that may arise. It is critical that a mine's Final Rehabilitation, Decommissioning and Mine Closure Plan is defined and understood

from before mining progresses and is complimentary to the objectives and goals set. Rehabilitation and closure objectives need to be tailored to the project at hand and be aligned with the Environmental Management Program (EMPr).

The Final Rehabilitation, Decommissioning and Mine Closure Plan aims to inform on the actions required to rehabilitate the project to ensure that the area is socially and environmentally safely and sustainably closed. Importantly, the Rehabilitation Plan consists of direct activities associated with rehabilitation of various infrastructure components. This EMP should inform how the mine infrastructure is either handed over legally or removed from site. During the operational phase it is recommended that an assessment be undertaken of the infrastructure to determine if some of the infrastructure can be utilised post closure.

The rehabilitation and closure actions for the particular infrastructure are detailed below and separated into phases. Although concurrent rehabilitation occurs during the operational phase, it has been included in this section as it directly impacts on final rehabilitation and closure.

17.1. Closure Actions

The conceptual mitigations proposed in the initial risk assessment is refined into a specific rehabilitation approach and sequence of actions. The striping of topsoil from the area before mining or construction start if the basis of many of the general actions. If insufficient topsoil is stripped before construction additional actions, mitigation and management measures will be required. Table 11 provide the General Closure Actions for the mine.

Table 11: General Closure Actions

Aspect	Closure Action
Physical Stability	• Manage available soil carefully during the life of mine to limit the damage to an already scarce and denuded resource; • Design construct a post mining landform to specified elevations, ensuring a free draining topography; • Benches to be created in the slope to break a single continues slope. Steep sections to be protected with rocks. • Replace topsoil to specified depths on prepared areas and rip with an agricultural ripper to alleviate compaction and revegetate. • Ensure that all rehabilitated areas on the mine site are free draining. • Rock stability of the exposed rock to be ensure that no rock falls, slips or slumps do take place. • Inspection to be performed as part of closure phase and any affected area to be rehabilitated.

Environmental Quality	• Clean up sources of possible surface water contamination still present on the mine site to protect the downstream receiving environment; • Ensure that the rehabilitated project site is free-draining; • Demonstrate by means of suitable sampling and analysis that the rehabilitated area is not causing contamination; • Monitor surface against water quality limit and baseline to determine if any pollution plume is developing.
Health and Safety	• Limit dust generation on the rehabilitated mine site that could cause nuisance and / or health effects to surround communities; • Revegetate all bare areas as soon as possible; and • Demonstrate by means of suitable sampling and analysis that the threshold levels of wind-borne dust and associated contaminants are acceptable. • Ensure rock stability • Fence off dam area to prevent humans and animals from entering • The dam must have a walk out area.
Land Capability Land Use	• Ensure that the rehabilitated portions of the project sites are safe and physically and chemically stable in the long-term; • Limit the loss of topsoil by stripping all areas to be disturbed and the opencast fringes; • Replace soils to specified depths; • Define physical and chemical amelioration based on soil fertility analysis and interpretation by a suitable qualified professional; • The area will be restored to wilderness. • Conduct rehabilitation monitoring of soils and vegetation for three years; and • Conduct a post closure land use and capability assessment after year 3 to demonstrate the achieved end land use.
Landscape viability	• Establish rehabilitated slopes on post mining landform to preserve vital resources such as growth medium and nutrients, as far as possible, and stabilising disturbed areas to prevent erosion in the short- to medium-term until a suitable vegetation cover has established; • Benches to be established to limit erosion; • Replace soils to specified depths; and • Establish vegetation based on dedicated fertility sampling, analysis, and specifications. • Rocks must be treated to form part of surrounding area. Reduce visual impact.

Biodiversity	• Monitor, control, eradicate and manage declared Category 1, 2 and 3 invader plant species; • Establish a biodiversity management plan for rehabilitation; and • Establish viable self-sustaining vegetation communities that will encourage the reintroduction of local natural fauna as far as possible.
Socio-economic	• Mange the implementation and the expectations of various stakeholders throughout the process. • Update SLP to include structure that will be handed over to the community during final closure.

17.2. Specific Closure Actions

Specific rehabilitation and closure actions forming the basis of the rehabilitation and closure operations. The actions are aligned with the mitigations defined in the comparative risk assessment. These actions are planned to comply with the requirements of the vision and objectives. The closure actions form the basis for the closure liability assessment. The actions are indicated according to the following categories:

- Overburden Stockpiles, Haul Road;
- Clean and dirty water management system
- Mining area – opencast
- Topsoil Berm;
- Office Complex (change house, offices, Plant); and
- General surface rehabilitation and water management.

Topsoil forms the basis of rehabilitation and if insufficient topsoil is stripped before construction additional actions, mitigation and management measures will be required. The concurrent rehabilitation during the operations described in this report with the final rehabilitation actions.

Overburden

The overburden dump will be utilised in the backfill of the opencast area. After clearance of the overburden stockpile, the area should be shaped taking into account surface water drainage and erosion risk considerations.

- Load, haul topsoil or shovel overburden into backfilled areas;
- Load, haul topsoil from the topsoil berm, tip at the correct spacing and level to the specified depths;
- Cross rip replaced soils with an agricultural ripper to alleviate compaction and scarify the area;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and

- Establish vegetation (includes specified amelioration and seed mix application).

Haul roads

Haul roads will remain intact and be utilised during the final rehabilitation. Rehabilitation will commence after topsoil has been replaced on all areas and no more access with heigh equipment is required. The following actions will be implemented.

- Remove all signage;
- Re-establish natural drainage;
- Rip haul roads with construction equipment to a depth of at least 0.5 m, and over-rip with agricultural equipment to create suitable conditions for vegetation establishment;
- Profile to be free draining and emulate the natural surface topography;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes land preparation, specified amelioration and seed mix application).

Infrastructure

All infrastructures that cannot be removed will remain to be utilised by the landowner. Container, mobile office will be removed and the footprint rehabilitated and re-vegetated.

Closure actions as detailed in the "Guidelines for the Rehabilitation of Mined Land" include:

- All power and water services to be disconnected and certified as safe prior to commencement of any demolition works;
- Salvageable equipment will be removed and transported offsite prior to the commencement of demolition;
- All fittings, fixtures and equipment within buildings will be dismantled and removed to designated temporary disposal yards;
- All tanks, pipes and sumps containing hydrocarbons to be flushed or emptied prior to removal to ensure no hydrocarbon/ chemical residue remains;
- All above ground electrical, water and other service infrastructure and equipment to be removed and placed in designated temporary salvage yards, to be sold as scrap;
- Electrical, water and other services that are more than one metre below ground surface will remain;
- All pipes and structures deeper than one metre need to be sealed to prevent possible ingress and ponding of water;
- Non-hazardous concrete slabs and footings will be broken. This concrete (and metal) will be broken up and disposed of in the base of the mining area;

- Soils beneath the plant, storage tanks and chemical storage areas will be sampled. Any contaminated soils found will be removed for disposal;
- Sacrificial layer underplant will be removed;
- Plant and equipment will be removed from site and concert will be removed and used as backfill (be placed more than 1m under surface level); and
- All excavations resulting from demolition of plant, buildings, roads, etc. and earth structures will be left in a safe manner.

Stormwater dam

The stormwater dam will be retained during the closure period to provide water for closure activities as well as to capture any flows generated on the site. The dam will remain after closure as part of the landform. The dam must comply with the following:

- Health a safety requirement
- The dam must have a walk-in for the safety of animals and humans.
- All drainage from the site should be design to flow into the dam.

Operational storm water measures

The measures are assumed to be limited to shallow trenching and berm construction. All berms, trenches and paddocks will be flattened by backfilling the excavations or dozing the structures to a functioning topography, except where they have been positioned prevent additional water flowing onto rehabilitated area. The berms will be utilised to divert water away from the opencast area and to limit water flow. The following will be undertaken:

- Shape the area and slopes to be free-draining
- Cross rip in-situ soils with an agricultural ripper to alleviate compaction;
- Conduct fertility sampling have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes land preparation, specified amelioration and seed mix application).

General Surface Rehabilitation

The general surface rehabilitation measures for the proposed mining area are limited to the following:

- Seeding of areas with natural grasses;
- Development of free draining profile as per land form design;
- Maintaining of area to prevent erosion;
- Soils, which should have been stripped according to form, should be replaced according to a pre-existing plan;

- Compaction should be minimised by use of appropriate equipment and replacing soils to the greatest possible thickness in single lifts;
- Soils should be moved when dry to minimise compaction. If they have to be moved when wet, shovel and truck should be used as bowl scrapers create massive compaction when moving wet soils;
- Where multi-layer soil profiles are re-created, running over the lower layers with heavy equipment should be minimised;
- Minimise compaction during smoothing of replaced soils by using dozers rather than graders;
- Following placement, all soils should be ripped to full rooting depth; and
- Where natural revegetation is not possible, the soils should be tilled to produce a seed-bed suitable for the plant species selected for seeding.
- Lime and superphosphate are applied to the surface;
- These ameliorants are then incorporated by deep ripping, which penetrated 100 mm through the soil into the underlying overburden material;
- Compound (NPK + Zn) fertilizer is applied, and disced in as part of seedbed preparation;
- A grass seed mix is then planted, usually with first rains, or after rains have commenced; and
- The site is then mulched using locally obtained grass; this is to stimulate the long-term establishment of indigenous vegetation and to reduce erosion during early plant growth.

Opencast Rehabilitation

Opencast rehabilitation will consist out of four areas as described in section 14.3.6. The main rehabilitation of the opencast area will consist out of the following actions.

- Creating side slope of less than 1:3.
- Creating benches in line with the requirements of the rock engineer findings.
- Backfill and shaping of available overburden
- Profiling of opencast floor area.

As significant void will remain after mining as insufficient material is available to establish the before mining topography. The visual impact of the opencast area should be limited as far as possible, and the exposed rock should be treated to blend into the surrounding environment.

Long term water issues

No long-term water issues are anticipated as no pollution sources are present within the mining area. The material has no acid forming potential and no AMD formation will take place.

All run off water will be collected at the stormwater dam. The dam will act as n siltation trap to ensure that surrounding water sources are not impact on, through siltation.

Aftercare and Maintenance

During aftercare and maintenance, a number of actions, monitoring and audits will be required to establish if the Relinquishment Criteria for each of the aspect have been reached. The Proposed Relinquishment criteria are presented in Table 12 with the monitoring requirements.

Any corrective measures required as a result of the monitoring or audits must be implemented during this period. It is anticipated that a stable final landform will be created within a period of 2-3 years. The annual audit will be utilised to established if the relinquishment criteria have been reached or if additional measures are required.

18. PERFORMANCE MONITORING

The following preliminary measures are proposed and are to be further refined with future updates of the closure plan. It is envisaged that a two to three-year demonstration period will be required for surface water to confirm success of closure. A period of two to three years is proposed for the demonstration of successful rehabilitation. Following the completion of earthworks and vegetation establishment a visual inspection will be undertaken to inform corrective action required, if needed. Thereafter ongoing monitoring and corrective action as per Table 12 will be undertaken. The period can be extended if required if the final landform and relinquishing criteria has not been achieved.

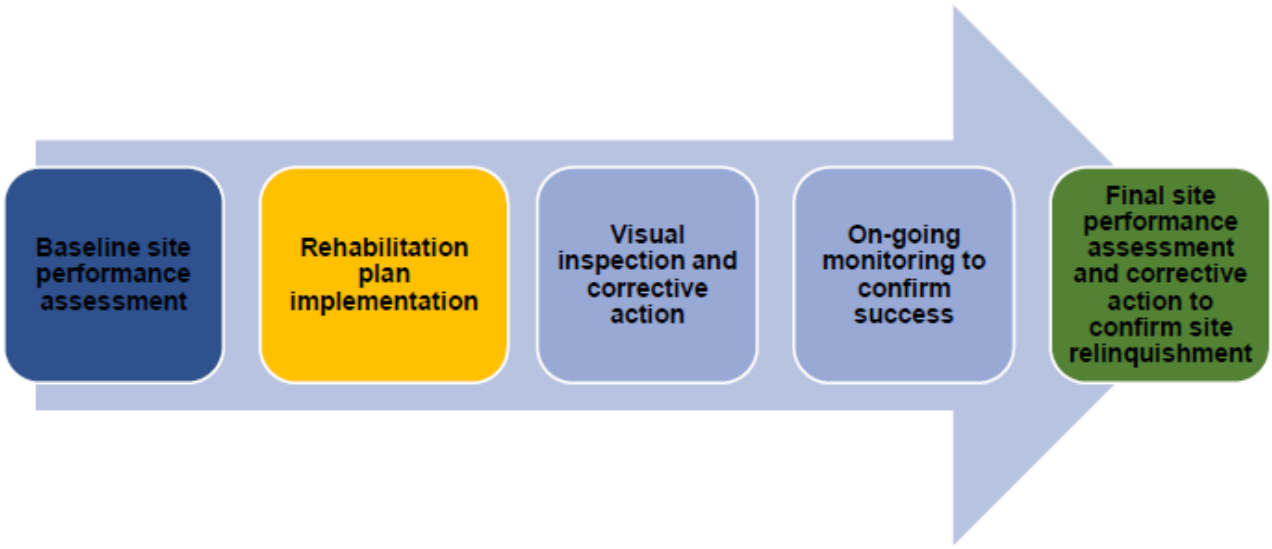


Figure 10: Final Rehabilitation plan roll out and performance monitoring

18.1. Monitoring and Closure Targets - Relinquishment Criteria

The measurable criteria indicated should be used to assess the effectiveness of the specific closure actions implemented during rehabilitation. They will also assist in determining when the standard of closure achieved is sufficient to relinquish responsibility for a specific area. The site-specific aspect, monitoring requirement, indicators and closure targets are included in the table.

The relinquishment criteria indicated in Table 12 is proposed for the mining area and is applicable to the rehabilitated areas. The criteria, indicators and reporting requirements are listed against the environmental aspect.

Table 12: Proposed Relinquishment criteria

Environmental Aspect	Closure Criteria – Relinquishment Criteria	Monitoring Requirements	Reporting Requirements
Biodiversity	Establishment of vegetation that has a basal cover of 15% and that is self-sustaining and can be measured over a 2-3-year period, indicating that natural succession has occurred. Establishment of wilderness areas.	Vegetation monitoring and rehabilitation monitoring	Monitoring Reports – Bi-annually Vegetation audits – Annually
Surface Water	Surface water quality need to comply with the qualities as stipulated in the WULA and the appropriate DWS and SANS Standards.	WUL requirements GNR 704 requirements.	Monitoring – Quarterly Reporting – Annually
Air Quality	Dust and PM10 must comply with the minimum standards and limits as set by the NEM:AQA and applicable regulations and guidelines.	GNR 827 – National Control Regulations, SANS Standards. Monthly monitoring. Compliance with the National Environmental Management Act: Air Quality (Act 39 of 2004).	Monitoring – Monthly Monitoring Reports – annually
Soil, Land Capability and Land Use	Post land use mining assessment to determine status of rehabilitated areas with respect to soil quality and that rehabilitated areas have been rehabilitated to an agreed upon land use. In addition to the above, inspections should be undertaken to identify areas of erosion and that erosion measures have been constructed. Top soiling' depth must match that of the pre-disturbance condition, as determined by the pre-mining land capability; whereby pre-disturbance capability classes must ideally in the post-disturbance/mining condition be 'top soiled' with the following depths of suitable soil material: Arable (>= 0.6m), Grazing (>= 0.3m), and Non-Grazing ('Wilderness') and Wetland (>= 0.15m). In areas where the implementation of the Grazing depth	Regular post-closure monitoring using Standard measures of vegetative cover or Landscape Function Analysis; and visual observations. Photographic record. Post-rehabilitation slope analysis mapping must be conducted immediately after re-grading (re-sloping) [before 'top soiling'] utilising an aerial photograph and generated contours. Over steep slopes must be corrected before 'top soiling'. Photographic record.	Results of soil quality report and erosion monitoring report – Annual report photographic evidence and mapping included in annual report

	standard is not possible, then these areas must be rehabilitated as per the Wilderness depth standard (>=0.3cm).	Closure and intermittent post-closure Agricultural soil fertility data (laboratory analysis) by independent consultants.	
Social - Stakeholder Engagement	Grievance mechanism to be established. The SLP should be updated, and the structures should be handed over to the community. The handover should be sustainable, and skills transfer should have taken place.	Report (and investigate) any grievance or complaints received. SLP reporting.	Annual report
Ground stability	The final mine layout and safety factors for each area to be determined. The areas of risk to be identified based on factory factors. Stability of the area to be determined based on the rock engineering report.	Monitoring of ground stability of high-risk areas. Risk to be determined based on rock engineering report. Surface investigation to be undertaken to established if cracks or failures of rock face is forming.	Annual monitoring and report

19. ORGANISATION CAPACITY

The organisational capacity of the project is detailed in the table below. As detailed, there is adequate capacity to perform the rehabilitation function during the operational phase. During final rehabilitation and closure phase of the mine, suitably skilled technical persons would need to be employed to ensure that rehabilitation works are completed correctly and successfully. These positions would include an Environmental Manager, a Rehabilitation Officer, and a Rehabilitation Superintendent, who will ensure that all work involving spoils replacement, topographical reshaping, top soiling, revegetation are done according to specification.

Table 13: Organisational Structure

CATEGORY	POSITION	REGULATION
Senior Management	Mine Manager	3.1 (a)
Professionally qualified and experienced specialists and mid-management	General Manager	4.1
	Mining Superintendent	2.14.1
	Engineering Manager	2.13.1
	Shaft Engineer	2.13.3.1
	SHE Manager	2.17.4
	Occupational Hygienist	12(1)
	Chief Safety Officer	2.17.4
	Occupational Medical Practitioner	13.3(a)i
	Senior Surveyor	17.2 (a)
Skilled technical and academically qualified workers, junior management, supervisors, foreman and superintendents	Medical Nurse	13.3(a)ii
	Shift Overseer	2.15.1
	Safety Officer	2.17.1
	Mine Surveyor	2.12.7

20. CLOSURE COST

This section provides details on the closure cost. The outlined assumptions and limitations also underpin the basis of this closure cost determination. It is important to note that the estimation is based on existing information. The closure cost calculation has been performed in accordance with NEMA GNR 1147 financial provision.

Due to the current uncertainty surrounding the change in the financial provision regulations, this report has utilised the current existing regulations but has only calculated the final rehabilitation cost and no concurrent rehabilitation cost is included based on the mine schedule. The cost is also calculated for an operational period of 10 years and not the LOM (i.e., 20 years)

Concurrent annual environmental costs will be included into the operating budget of the mine. The closure costs of the aspects linked with the project have been determined using current contractor cost.

Costing calculations refer to the specific rehabilitation actions, areas and type of disturbance that requires rehabilitation. The bill of quantities (BoQ) for each of the closure items have been developed based on information obtained from the client. The volume estimations are based on preliminary design and mining schedules provided. The method employed is deemed acceptable for the level of accuracy required in terms of the regulations.

Closure Liability Cost is only calculated for the section 102 application area. The existing area has existing financial provisioning in place and if approved this will be incorporated into the existing financial provisioning.

The costing methodology applied is summarised as follows:

- Developed an itemised plan indicating an inventory of closure aspects based on the proposed mine schedule.
- Defined specific rehabilitation actions for each, through reviewing specialist studies, impact assessment outcomes, industry guidelines, conceptual modelling, and rehabilitation experience.
- Calculated monitoring and maintenance costs; and
- Compiled a dedicated closure spreadsheet to determine the closure costs of the quantified actions through applicable rates.

A rate sheet has been developed and aligned to the specific infrastructure in the BoQ. The rates sheet has been developed using the following datasets:

- Tender and pay rates from contractors that are available.
- Rates from operations recently evaluated by Elemental Sustainability.
- Associations and industry oversight entities average rate sheets.
- DMR guidelines (2005) update with CPI to 2021.

20.1. Assumptions and Qualifications

The following qualifications and assumption were made for the assessment:

- The financial provision calculation for the proposed mine is based on the mine works program and is for a period of 10 years (year 1 – year 10). The Latent Liability Cost is based on the current closure scenario and available information.
- The cost estimates for operations, from closure will be prepared as conceptual estimates with an accuracy of ± 70 per cent.

- The closure liability calculation is only for the extension area and the existing mining area is not included in this calculation. The cost associated with the closure liability of the extension will be incorporated into the existing financial provision if approved.
- Input in this report is based on information obtained from the mine, reference documents, site visits and interviews.
- This report is based on prescribed legal methodologies and applications, the report contains interpretations and assumptions documented and contextualized to the best ability of the writer. Particularly, with relation to futuristic and predictive matters associated with scheduled closure.
- Notice is taken of changing circumstances and associated report qualifications, which at the time of the report might be different to the time of the assessment. This report therefore represents a snapshot view of the operation at the time and date of the assessment.
- This extension of the mine has not been constructed and this report and the costing is based on the proposed layout and development. The layout and development schedule may change over time and for this reason this report will be updated annually.
- No warranty is included with this report, either express or implied, that the actual described conditions will conform exactly to the assessment and results contained in this report.
- This report addresses rehabilitation costs required at closure and the post closure monitoring and maintenance in terms of the GNR 1147 regulations. This report has been completed before the proposed amendments have been finalised and thus do not take any proposed amendment to the regulations into consideration.
- The rehabilitation costs required at closure and the post closure monitoring and maintenance
- Calculations for infrastructure such as plant infrastructure, concreted areas and steel structures were based on estimates from satellite images, onsite personnel and the survey information provided.
- A contingency of 7.5% has been included to allow for unforeseen costs associated with contractors or rate increases.
- Preliminary and general of 7.5% has been included to allow for unforeseen costs associated with the project.
- It was assumed that 2-3 years is adequate for the monitoring and maintaining of vegetation after rehabilitation. After the 2-3 year period the need for additional morning and maintenance will be established.
- For post-closure monitoring, costs of surface water has been assumed to take place for a period of 2-3 years with sampling taking place as provided in this report.
- Specialist studies, professional fees and project management has been included in the closure cost;
- In this assessment the current aspects and activities will be considered to determine the environmental liability, excluding planned aspects for the next financial year which were not considered.
- Cost estimates will have an accuracy of ± 70 per cent for operations, or components of operations, 30 or less years (but more than ten years) – GNR 1147.
- At mine closure, all infrastructure will be removed from the site.
- The mining area consist out of 5.85 ha, it is anticipated that only 50% of this will be mined in the first 10 years.

20.2. Accuracy Level

Notwithstanding the above, the reflected costs provide a good indication of the costs for the current operation. Providing a sound basis for making the financial provision for the planned LoM, to an accuracy level of 70%. The cost estimates for operations, from closure will be prepared as conceptual estimates with an accuracy of ± 70 per cent. The cost estimates for operations will be increased to ± 80 per cent for operations, or components of operations ten or less years (but more than five years)

20.3. Closure Cost

The 2021 quantum for closure-related financial provision for Witkop Fluorspar mine (Pty) Ltd – Sallies Silica was undertaken by Elemental Sustainability (Pty) Ltd. The summary of the closure cost calculated for the mine is presented in the Table below.

The estimated financial provision required for the rehabilitation and closure of the Witkop Fluorspar mine (Pty) Ltd – Sallies Silica is R 1 115 353.32 (Final Closure) excl. VAT, inclusive of the Latent liability and Monitoring. Latent Liability Cost includes maintenance and re-vegetation of rehabilitated areas, estimated at R 138 470.18 excl. VAT and P&G's, and Specialist cost at R 193 010.85 excl. VAT. The closure liability is based on a 10-year requirement. The estimated final closure cost is included in Table 14.

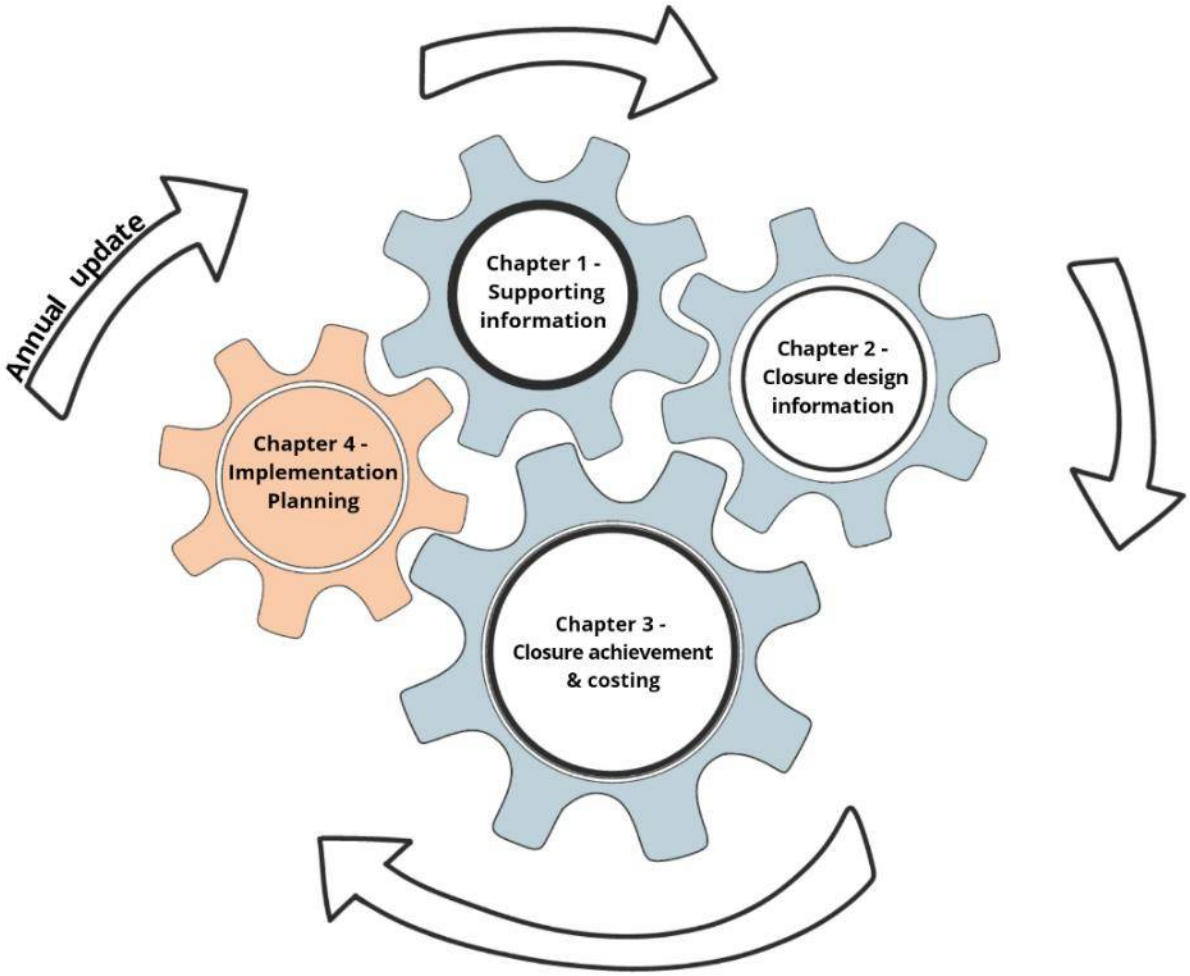
A summary of the financial provision estimates associated with the Witkop Fluorspar mine (Pty) Ltd – Sallies Silica is included in the tables below.

Table 14: Quantum of Financial Provision

Closure Component		Note	Unscheduled Closure			
			Quantity	Unit	Unit Rate	Total Cost
1.	Roads					
1.1	Removal of Internal Roads	Removal of pollution and dozing of topsoil berms	0,0	ha	R135 072,00	R0,00
1.2	Removal of Haul Roads	Removal of pollution and dozing of topsoil berms - High compaction	0,0	ha	R178 415,00	R0,00
Sub-total for Roads						R0,00
2.	Stockpiles and Overburdens					
2.1	Hard Overburden	Slope dozing and surface rehabilitation	0	ha	R90 125,00	R0,00
2.2	Soft - Overburden	General surface rehabilitation	0	ha	R119 106,90	R0,00
2.3	Topsoil Stockpile	General surface rehabilitation	0	ha	R119 106,90	R0,00
Sub-total for Stockpiles and Overburdens						R0,00
3.	Clean and Dirty water management					
3.1	Removal of Clean water Channels and Berm	General surface rehabilitation	0	ha	R119 106,90	R0,00
3.2	Removal of Dirty water Channels	Concrete removal and general surface rehabilitation	0	m2	R114,52	R0,00
3.3	Rehabilitation of PCD's	Liner, concrete removal slope removal and General surface rehab	0	ha	R141 573,04	R0,00
Sub-total for Clean and Dirty water management						R0,00
4.	Mining Areas					
4.1	Surface Rehabilitation					
4.1.1	Slope and Bench establishment	Dozing of slopes and bench establishment	2,9	ha	R148 883,63	R435 484,62
4.1.2	General surface rehabilitation	Truck from stockpile and shovel back.	2,9	ha	R119 106,90	R348 387,68
Sub-total for Surface Rehabilitation including final voids, ramps						R783 872,30
					Subtotal 1:	R783 872,30
5.	P&G's, Contingencies and Additional Allowances					
5.1	Preliminaries and general		7,5	/sum	R58 790,42	R58 790,42
5.2	Contingencies		7,5	/sum	R58 790,42	R58 790,42
5.3	Specialist Studies	Rock Stability Assessment	1	/sum	R75 430,00	R75 430,00
					Subtotal 2:	R193 010,85

6.	Pre-Site Relinquishment Monitoring and Aftercare					
6.1	Surface Water Quality Monitoring and Reporting	3 year period - below 2 surface samples - quarterly with annual report	3	/yr	R31 950,00	R95 850,00
6.3	Aftercare and Maintenance	Footprint area - 3 year period (Vegetation, soil, land capacity and erosion)	2,9	/yr/ha	R4 857,00	R42 620,18
					Subtotal 3:	R138 470,18
Grand Total Excl. Vat. (or Subtotal 1+2+3)						R1 115 353,32

CHAPTER 4: IMPLEMENTATION PLANNING



Chapter 4, contains aspects related to implementation of the closure planning during the remaining operational period, at closure and post-closure, including:

- The organisational capacity required to champion closure planning for the MRA;
- Scheduling related to the various activities to occur during the remaining operational period in preparation for closure, at closure and post-closure; and
- The closure plan evaluation, which includes a gap analysis of the current information knowledge and the way forward for improved refinement.

21. SCHEDULE

A preliminary closure schedule is proposed in Table 15 below and includes the closure and post-closure timelines. As per the above documented approach, the closure plan is a live document that should be updated regularly throughout the LoM, as solutions are continually refined, and the knowledge base is developed.

Table 15: Closure Schedule

Facility life/ phase	Activity	Timeline	Frequency
Construction phase	Stripping and stockpiling of topsoil	2022-2022	As required
Operational	Further refine / update the closure plan and closure action plan to incorporate detailed specialist assessment outcomes	2023 – 2043	As required
	Develop cash flows and related financial information for funding the implementation of the stipulated closure measures	2023 – 2043	As required
	Ongoing environmental monitoring to establish baseline conditions to benchmark the closure situation	Pre-mining and the LoM	Monthly
	Compile final closure plan	2042 – 2043	Once-off
Closure	Backfill final void, replace topsoil, prepare, and revegetate all affected areas; and General site rehabilitation	2043 - 2044	Once-off
	On-going communications with regulatory bodies and submission of required reporting and applications	To be determined	As required
Post-closure	Maintaining closure measures and conducting required inspection and monitoring to demonstrate achievement (success) of closure measures	Rehabilitation +- 3 years post-closure Surface water +- 3 years post-closure	Rehabilitation monitoring annually for 3 years; Surface water quarterly for 3 years
End state/land use	Implement agreed-upon end state/land use (requires a post mining land use and land capability assessment)	Approximately 3 years post-closure	Once-off
	Care and maintenance of rehabilitated areas	3 years post closure	Annually

22. AUDITS

The closure plan must be updated during the operation's life to reflect known developments, new regulatory requirements, and any other material developments. A preliminary schedule of monitoring, auditing, and reporting requirements which relate to the risk assessment, legal requirements, effective implementation, and knowledge gaps is proposed as follows:

- Internal operational rehabilitation audits co-ordinated by the mine and including soils, surface water, rock engineer, and closure specialists. The purpose is to review the closure plan and monitor the implementation of concurrent rehabilitation measures.

- External financial audits co-ordinated by the financial manager and the closure manager, by suitable qualified independent auditors; and
- Legal compliance audits co-ordinated by the Mine manager aligned with environmental authorisation requirements. Relevant aspects relating to closure, such as changes to the risk assessment, changes in closure options and changes in the closure provision will be reported.

23. CLOSURE PLAN REFINEMENT

23.1. Planned amendments and gaps

This preliminary closure plan, dated October 2021, is compiled in the overall approach and structure to align to Appendix 4 of GNR. 1147, namely minimum content of a final rehabilitation, decommissioning and mine closure plan. This plan also reflects an integration and consolidation of closure-related studies and specialist work. The following should be implemented to further refine the closure planning for the mining area.

- Establish the stability of the slopes and exposed rock face.
- Erosion rates and angle of slopes.
- Develop and refine the conceptual post mining landform.
- Develop and include a detailed topsoil balance.
- Utilise the improved topsoil data to accurately plan the topsoil placement depths
- Develop a detailed monitoring plan.
- Refine relinquishment criteria.
- Refine and developed a post closure water management plan.
- Refine the closure scheduling.
- Develop a closure road map during the operational phase.
- Include a revision of the closure costs to improve the accuracy running into the closure phase.
- Update latent and residual risks as risk become known.

23.2. Motivation for Amendments

No motivation for amendments to the final Rehabilitation, Decommissioning and Mine Closure Plan have been made as a result of the previous auditing period.

23.3. LIMITATIONS

This report is based on the following assumptions and limitations:

- Current information available to Elemental Sustainability was used in the development of this report.

- The information contained within this report is based on the proposed layout plans available. If there is a significant change or addition of other infrastructure areas, this report will need to be updated to cater for this change.
- Mitigation measures and recommendations provided in this report is based on the specialist studies. All specialist studies have been completed prior to this report being completed; and
- This report must be considered as a living document and will be updated as additional information becomes available, and as monitoring and rehabilitation progresses. The report has to be updated as required by legal requirements.

23.4. Research and Development

During the operational mining phase research can be completed on the following aspects:

- Stability of slope;
- Effective erosion control measures;
- Surface water (stormwater dam) post closure management plan;
- Vegetation re-establishment rates;
- Rock stability and competence.
- Vegetation re-establishment rates.

No timeframes to undertake and complete the ongoing research have been provided but consideration to amend or remove these actions need to be motivated in subsequent updates to this report.

24. CONCLUSION

This closure plan was compiled in alignment to the NEMA GNR.1147 Regulations, the NEMA Appendix 5 (Closure Plan) and based on information provided by client, and specialist work. It is recommended that the next update of this closure plan be annually after commencement of the activities. Closure and rehabilitation are a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. Rehabilitation and closure objectives have been tailored to the project at hand with the objective of assisting for Witkop Fluorspar mine (Pty) Ltd – Sallies Silica in carrying out successful rehabilitation.

Sallies would need to provide adequate financial assurance through the required financial instrument to provide for their decommissioning and closure liability cost. The cost should be for the first 10 years of the planned operations.

APPENDIX A: Environmental Risk Assessment (Methodology)

The impact assessment methodology used to determine the significance of impacts prior and after mitigation is presented below.

Extent of the impact

The EXTENT of an impact is the physical extent/area of impact or influence.

Score	Extent	Description
1	Footprint	The impacted area extends only as far as the actual footprint of the activity.
2	Site	The impact will affect the entire or substantial portion of the site/property.
3	Local	The impact could affect the area including neighbouring properties and transport routes.
4	Region	Impact could be widespread with regional implication.
5	National	Impact could have a widespread national level implication.

Duration of the impact

The DURATION of an impact is the expected period of time the impact will have an effect.

Score	Duration	Description
1	Short term	The impact is quickly reversible within a period of less than 2 years, or limited to the construction phase, or immediate upon the commencement of floods.
2	Short to medium term	The impact will have a short term lifespan (2–5 years).
3	Medium term	The impact will have a medium term lifespan (6 – 10 years)
4	Long term	The impact will have a medium term lifespan (10 – 25 years)
5	Permanent	The impact will be permanent beyond the lifespan of the development

Intensity of the impact

The INTENSITY of an impact is the expected amplitude of the impact.

Score	Intensity	Description
1	Minor	The activity will only have a minor impact on the affected environment in such a way that the natural processes or functions are not affected.
2	Low	The activity will have a low impact on the affected environment.

3	Medium	The activity will have a medium impact on the affected environment, but function and process continue, albeit in a modified way.
4	High	The activity will have a high impact on the affected environment which may be disturbed to the extent where it temporarily or permanently ceases.
5	Very High	The activity will have a very high impact on the affected environment which may be disturbed to the extent where it temporarily or permanently ceases.

Reversibility of the impact

The REVERSIBILITY of an impact is the severity of the impact on the ecosystem structure

Score	Reversibility	Description
1	Completely reversible	The impact is reversible without any mitigation measures and management measures
2	Nearly completely reversible	The impact is reversible without any significant mitigation and management measures. Some time and resources required.
3	Partly reversible	The impact is only reversible with the implantation of mitigation and management measures. Substantial time and resources required.
4	Nearly irreversible	The impact is can only marginally be reversed with the implantation of significant mitigation and management measures. Significant time and resources required to ensur impact is on a controllable level.
5	Irreversible	The impact is irreversible.

Probability of the impact

The PROBABILITY of an impact is the severity of the impact on the ecosystem structure

Score	Probability	Description
1	Improbable	The possibility of the impact occurring is highly improbable (less than 5% of impact occurring).
2	Low	The possibility of the impact occurring is very low, due either to the circumstances, design or experience (5% to 30% of impact occurring).
3	Medium	There is a possibility that the impact will occur to the extent that provision must be made therefore (30% to 60% of impact occurring).
4	High	There is a high possibility that the impact will occur to the extent that provision must be made therefore (60% to 90% of impact occurring).
5	Definite	The impact will definitely take place regardless of any prevention plans, and there can only be relied on migratory actions or contingency plans to contain the effect (90% to 100% of impact occurring).

Calculation of Impacts – Significance Rating of Impact

Significance is determined through a synthesis of the various impact characteristics and represents the combined effect of the Irreplaceability (Magnitude, Extent, Duration, and Intensity) multiplied by the Probability of the impact. The significance of an impact is rated according the scores a presented below:

Equation 1:
Significance = Irreplaceability (Reversibility + Intensity + Duration + Extent) X Probability

Significance Rating

Score	Significance	Colour Code
1 to 20	Very low	
21 to 40	Low	
41 to 60	Medium	
61 to 80	High	
81 to 100	Very high	

Mitigation Efficiency

Degree to which the impact can be mitigated: *The effect of mitigation measures on the impact and its degree of effectiveness:*

Equation 2:
Significance Rating = Significance x Mitigation Efficiency

High	0,2
Medium to High	0,4
Medium	0,6
Low to Medium	0,8
Low	1,0

Confidence rating: *Level of certainty of the impact occurring*.

- **Certain**
- **Sure**
- **Unsure**

APPENDIX B: CLOSURE COST ASSESSMENT BASE RATES

Item	Activity	Unit	Rate - 2021
Earth Moving	Spoils volume levelling m^3 (Truck and shovel)	m3	R35,80
	Cost per m^3 to Dozer within 90m	m3	R15,24
	Cost per m^3 (Truck and shovel) to fill within 90m	m3	R35,80
	Cost per m^3 (Truck and shovel) to profile within 1km	m3	R41,25
	Cost per m^3 Excavation	m3	R35,80
	Cost per m^3 Trenching	m3	R105,38
	Replace topsoil	ha	R85 400,00
	Ripping 300mm if necessary	ha	R14 225,00
	Scarification & Hydroseeding	ha	R19 481,90
	From prescribed stock piles on site	m3	R49,90
	Backfilling to trenches, holes, etc	m3	R345,90
	Backfill of declines	m3	R126,11
	Backfill Adit Entrance	m3	15.34
	Sealing of vent shafts with concrete structure	sum	R258 855,24
	Earth Works - Sloping and Bench establishment	ha	R148 883,63
	General surface rehabilitation	ha	R119 106,90
Post Closure	Surface Water Quality Monitoring	per year	R31 950,00
	Aftercare and Maintenance (Vegetation, soil, land capacity and erosion)	per ha	R4 857,00

APPENDIX C: CV's

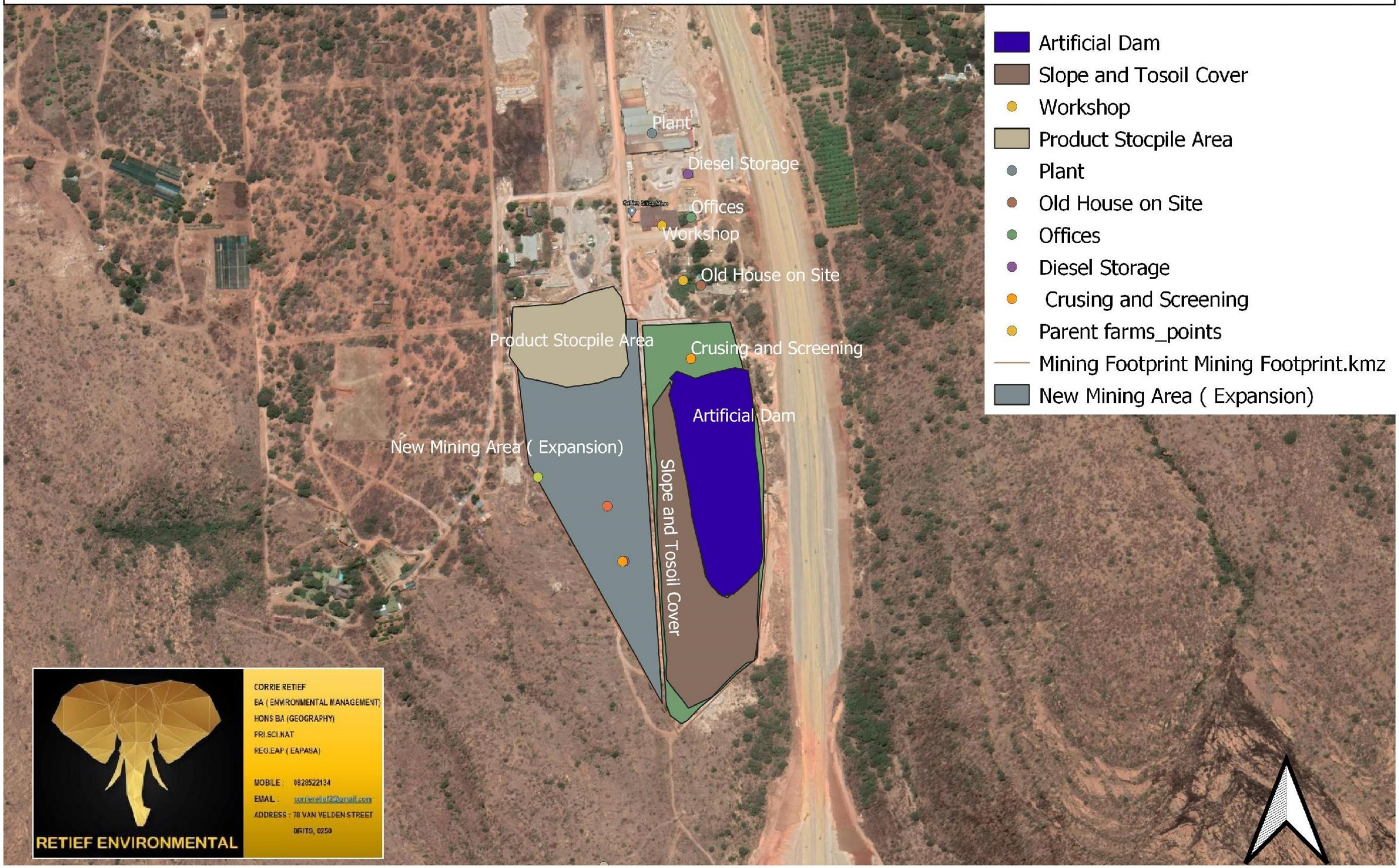
DuToit Wilken

<table>
<tr><td>EDUCATION AND QUALIFICATIONS</td><td>Masters MSc. Environmental Science – 2015 - University of Pretoria;
- MSc Research Thesis: Value of classified class F fly ash as an ameliorant for degraded surface coal mine soils.
Honours BSc. Environmental Science – 2009 - University of Pretoria;
Degree BSc. Environmental Science – 2008 - University of Pretoria;</td></tr>
<tr><td>CONTINUED PROFESSIONAL DEVELOPMENT</td><td>
<table>
<tr><th>COURSE</th><th>INSTITUTION</th><th>COMPLETED</th></tr>
<tr><td>Environmental Law Workshop</td><td>MacRobert</td><td>2017</td></tr>
<tr><td>Mine Closure and Rehabilitation</td><td>South Africa Asset Management Association</td><td>2017</td></tr>
<tr><td>Environmental Law Workshop</td><td>IMBEWU Sustainability Legal Specialists</td><td>2016</td></tr>
<tr><td>ISO 14001 Training SAATCA Registered</td><td>Centre for Environmental Management (CEM)</td><td>2014</td></tr>
<tr><td>Water Law in South Africa Workshop</td><td>IMBEWU Sustainability Legal Specialists</td><td>2013</td></tr>
<tr><td>Mining Law in South Africa Workshop</td><td>IMBEWU Sustainability Legal Specialists</td><td>2013</td></tr>
<tr><td>Post – Decision Environmental Monitoring and Enforcement</td><td>Centre for Environmental Management (CEM)</td><td>2012</td></tr>
<tr><td>Environmental Law for Environmental Managers</td><td>Centre for Environmental Management (CEM)</td><td>2011</td></tr>
<tr><td>Environmental Law (EMI)</td><td>University of Pretoria</td><td>2009</td></tr>
<tr><td>Arc GIS 10</td><td>University of Pretoria</td><td>2009</td></tr>
</table>
</td></tr>
<tr><td>PROFESSIONAL STATUS</td><td>South African Council of Natural Scientific Professions - Registered Professional Scientist – <u>Environmental Science (118911)</u></td></tr>
<tr><td>WORK HISTORY
Employer
Period
Position
Responsibilities</td><td>ELEMENTAL SUSTAINABILITY (Pty) LTD
January 2018 – Current
Senior Specialist and Director
Senior Specialist and Director. Responsible for the management of all operations and projects. Senior specialist for Environmental authorisations projects (EIA, BAR, WULA, WML and AEL's), Mine Closure (Closure Cost and Rehabilitations plans), Audit (Environmental Authorisations), Compliance Monitoring and Specialist divisions (Bio monitoring, Wetlands and Biodiversity). Responsible for the development of Project plans and schedules, implementations of plans and budget planning. Risk identification and management of risk for each of the projects.</td></tr>
<tr><td>Employer
Period
Position</td><td>ENVIRONMENTAL ASSURANCE (PTY) LTD
October 2010– January 2018
SENIOR OPERATIONS MANAGER & MINE CLOSURE</td></tr>
</table>

<table>
<tr><td>Responsibilities</td><td colspan="3">Senior operations manager and mine closure specialist: Responsible for the management of all operations and projects. Senior project manager of the EIA, Mine Closure, Audit, Compliance Monitoring and Specialist divisions. Development of Project plans and schedules, budget planning and review of reports. Day to day tasks include, Compliance audits, reporting, Mine Closures, Closure Plans, Specialist work, tender documents and marketing, risk management, client interaction and development of new products.</td></tr>
<tr><td>Employer
Period
Position
Responsibilities</td><td colspan="3">BOKAMOSO (PTY) LTD
2009 -2010
ENVIRONMENTAL CONSULTANT
Environmental Consultant responsible for the Environmental Authorisation Applications in terms of NEMA and SEMA’s. Management of specialist and ensuring timely delivery of specialist reports.</td></tr>
<tr><td>WORK EXPERIENCE AND SKILLS</td><td colspan="3">Development of Mine closure cost assessments in accordance with MPRDA regulations. Mine closure risk assessments, annual plans and final rehabilitation plans in terms of GNR 1147. Development of project plans, delivery schedules and budget planning. Project risk management. Development of audit protocol, conducting of audits. Environmental due diligences, WUL audits, EMPR PAR’s and ROD audits. Specialist studies: Noise & Dust Baselines, EMP Performance Reviews, Air Emission Licenses (AEL), Visual Impact Assessment. Compilation of Scoping EIA, EIA, BAR and Environmental Management Plans for mines, industrial developments, and residential developments. Development of RSIP, IWWMP and Closure Plans. Application for Mining rights and prospecting rights. Development and implementation of various monitoring programs for water quality and air quality monitoring for mining and other industries. The use of fly ash for the rehabilitation of coal mine disturbed areas. Environmental legislation interpretation, recommendations, and implementation. Mentoring of Professional Natural Science in training towards professional registration.</td></tr>
<tr><td>PROJECT EXPERIENCE</td><td>Client</td><td>Mining Area</td><td>Work Completed and Year</td></tr>
<tr><td></td><td>CiM International</td><td>Sand Mine</td><td>Closure Report in terms of GNR 1147 - 2018</td></tr>
<tr><td></td><td>Onicalite</td><td>Onicalite Colliery</td><td>Closure Report in terms of GNR 1147 -2019</td></tr>
<tr><td></td><td>Vandaspark</td><td>Rondevly Colliery</td><td>Closure Report in terms of GNR 1147 -2019</td></tr>
<tr><td></td><td>Tronox Mining</td><td>Eastern Mines</td><td>Closure Report in terms of GNR 1147 -2017</td></tr>
<tr><td></td><td>MC Mining</td><td>Mooiplaats</td><td>Closure Cost Assessment – 2012 to 2016</td></tr>
<tr><td></td><td>Limpopo Coal</td><td>Vele Colliery</td><td>Closure Cost Assessment – 2015 to 2019</td></tr>
<tr><td></td><td>Samancor WCM</td><td>Mooinooi, Elandsdrift, Buffelsfontein and Millsell Waterkloof</td><td>Closure Cost Assessment – 2012 to 2017</td></tr>
<tr><td></td><td>SABRIX</td><td>Zandfontein and Boekenhoutkloof</td><td>Closure Cost Assessment – 2011 to 2017</td></tr>
<tr><td></td><td>KILO SAND</td><td>Kilo Sand</td><td>Closure Cost Assessment – 2011 to 2019</td></tr>
<tr><td></td><td>Eastplats</td><td>Kenndy’s Vale, Spitzkop</td><td>Closure Cost Assessment – 2014 to 2017</td></tr>
<tr><td></td><td>Barplats Limited</td><td>Zandfontein, Crocette and Maroelabult</td><td>Closure Cost Assessment – 2014 to 2017</td></tr>
</table>

Appendix 13 Layout Map

LAYOUT AFTER REHABILITATION OF CURRENT MINING AREA AND EXPANSION ON NEW MINING AREA



RETIEF ENVIRONMENTAL

CORRIE RETIEF
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HONS BA (GEOGRAPHY)
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REG.EAP (EAPASA)

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Appendix 14 Water Use License

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Private Bag X313, Pretoria, 0001, Sedibeng Building, 185 Francis Baard Street. Pretoria,
Tel: (012) 336-7500, Fax: (012) 326-4472/ (012) 326-2715

LICENCE IN TERMS OF CHAPTER 4 OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) (THE ACT)

I, ***Trevor Balzer,*** in my capacity as Deputy Director-General: Special Projects in the Department of Water and Sanitation: and acting under authority of the powers sub- delegated to me by the Acting Director- General of Water and Sanitation, hereby authorizes the following water uses in respect of this licence.

SIGNED: _____

DATE: 18/09/2018

FILE NO: 27/2/2/A921/34/1
LICENCE NO: 07/A21J/AGJ/7962

1. Licensee — **Rolfes Silica (Pty) Ltd**

Postal Address — P.O. Box 1451
Brits
0250

2. Water uses

2.1 Section 21(a) of the Act: Taking water from a water resource, subject to the conditions set out in Appendices I and II

2.2 Section 21(g) of the Act: Disposing of waste in a manner which may detrimentally impact on a water resource subject to the conditions set out in Appendices I and III.

2.3 Section 21(j) of the Act: Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people subject to the conditions set out in Appendices I and IV

3. Property and owners in respect of which this licence is issued

3.1 Portions 95 of the Farm Zandfontein 447 JQ

4. Registered owner of the Properties

4.1 Rolfes Silica (Pty) Ltd

5. Licence and Review Period

B 08041

5.1 This licence is valid for a period of fourteen (14) years, from the date of issuance and it may be reviewed at the interval of five (5) years.

6. Definitions

Any terms, words and expressions as defined in the National Water Act, 1998 (Act 36 of 1998) shall bear the same meaning when used in this licence.

"Minister"	means the Minister of Water and Sanitation.
"Department"	means the Department of Water and Sanitation.
"Deputy Director-General: Special Projects"	means the Deputy Director-General: Special Projects: Water and Sanitation.
"Regional Head"	means the Head of Region: North West, Department of Water and Sanitation, Private Bag X05, Mmabatho, 2735.

"Responsible Authority" means Department of Water and Sanitation or Catchment Management Agency

7. Description of activity

The licence authorises Rolfes Silica (Pty) Ltd for the proposed activity entails the abstraction of a maximum volume of 81 480 m^3/a water from three (3) boreholes for domestic and mine processing purposes. Water will be used for washing process at the sand washing plant and for dust suppression in the quarry and internal road.

Currently hazardous waste generated by the mine is collected by a waste contractor (Oilkol) and disposed of at an appropriate licensed waste facility. A safe disposal certificate is provided to the mine upon the disposal of the waste at a licensed facility.

Residue in a form of waste rock and overburden produced during the cleaning of the quarry area is stored along the western property boundary as a berm alongside the quarry for future use as backfilling during the construction of ramps or for levelling and grading slopes

The slimes produced during the sand washing are deposited in the existing slimes dam (Quarry no1) immediately south of the plant and stock dumps. The slimes contain no contaminants for no chemicals are used within Rolfes Silica's process activities. Mine residue deposits, including slimes from the crushing plant will be re-used as a saleable product in the form of powder.

There are three (3) septic tanks on site one at the main office serve 20 people, one at the residents units serve 20 people, and one at the workers compound serve 25 people on site. All sewage are removed by honey sucker from a certified company and properly disposed of at a licensed water treatment facility

The mining operation is located on Portion 95 of the farm Zandfontein 447 JQ. The area falls in Bojanala Platinum District in North West Province. The Water Management Area is the Limpopo, in quaternary catchment A21J.

APPENDIX I

GENERAL CONDITIONS FOR THE LICENCE

1. This licence is subject to all applicable provisions of the National Water Act, 1998 (Act 36 of 1998).
2. The responsibility for complying with the provisions of the licence is vested in the Licensee and not any other person or body.
3. The Licensee must immediately inform the Regional Head of any change of name, address, premises and/or legal status.
4. If the property in respect of which this licence is issued is subdivided or consolidated, the Licensee must provide full details of all changes in respect of the property to the Regional Head within 60 days of the said change taking place.
5. The Licensee shall be responsible for any water use charges and/or levies imposed by a Regional Head.
6. While effect must be given to the Reserve as determined in terms of the Act, where a lower confidence determination of the Reserve has been used in issuance of this licence, the licence conditions may be amended should a higher confidence reserve be conducted.
7. The licence shall not be construed as exempting the Licensee from compliance with the provisions of any other applicable Act, Ordinance, Regulation or By-law.
8. The licence and amendment of this licence are also subject to all the applicable procedural requirements and other provisions of the Act, as amended from time to time.
9. The Licensee must conduct an annual internal audit on compliance with the conditions of this licence. A report on the audit shall be submitted to the Regional Head within one month of the finalisation of the audit.
10. The Licensee must appoint an independent external auditor to conduct an annual audit on compliance with the conditions of this licence. The first audit must be conducted within 3 (three) months of issuance date of this licence and a report on the audit shall be submitted to the Regional Head within one month of finalisation of the report.
11. Any incident that causes or may cause water pollution must be reported to the Regional Head or his/her designated representative within 24 hours.
12. If the water use described in this licence is not exercised within 3 years of the date of the licence, the authorisation will be withdrawn. Upon commencement of the water use, the Licensee must inform the Regional Head in writing.
13. Notices prohibiting unauthorized persons from entering water use premises must be displayed.
14. The Department accepts no liability for any damage, loss or inconvenience, of whatever nature, suffered as a result of / amongst other things.
    - 14.1 Inundation of flood;
    - 14.2 Any *force majeure* event;
    - 14.3 Siltation of the river or dam basin.

APPENDIX II

Section 21(a) of the Act: Taking water from a water resource

1.1 This licence authorises Rolfes Silica (Pty) Ltd to abstract the borehole and quarry for domestic purpose and processing plant as shown in Table 2.

Table 2: Volume of water to be abstracted

Activities	Property	Purpose/Description	Total Volume (m^3/a)	Co-ordinates
Section 21 (a)				
Abstraction of water from borehole H	Portion 95 of the Farm Zandfontein 447 JQ	Domestic purposes	1 800 m^3/ a	S 25°43'37.10" E 27°47'36.73"
Abstraction of water from borehole A & B	Portion 95 of the Farm Zandfontein 447 JQ	for process purposes, and for the process make-up water within the sand washing plant	9 600 m^3/a	S 25°43'37.00" E 27°47'34.76"
Abstraction of water quarry	Portion 95 of the Farm Zandfontein 447 JQ	for process purposes, and for the process make-up water within the sand washing plant	70 080 m^3/a	S 25°43'49.89" E 27°47'35.80"

1.2 The quantity of water authorised to be taken in terms of this licence may not be exceeded.

1.3 This licence does not imply any guarantee that the said quantities and qualities of water will be available at present or at any time in the future.

1.4 Groundwater monitoring data shall be evaluated bi-annually by a qualified geohydrologist. The groundwater flow model shall be developed and updated on an annual basis.

1.5 The above mentioned volume may be reduced when the licence is reviewed.

1.6 The Licensee must continually investigate new and emerging technologies and put into practice water efficient devices or apply technique for the re-use of water containing waste, in an endeavour to conserve water at all times.

1.7 The Licensee must install an appropriate water measuring device to measure the amount of water abstracted. The Licensee must ensure that all measuring devices are properly maintained and in good working condition and must be easily accessible. This shall include a program of checking; calibration, and/or renewal of measuring devises recorded and reported. All water taken from the resource shall be measured as follows:

1.7.1 The daily quantity of water taken must be metered or gauged and the total recorded at the last day of each month;

1.7.2 The water level measurement must be taken and recorded on a monthly basis and the date, time, borehole number and geographical location should be recorded; and

1.8 No water taken permissible in this licence may be pumped, stored, diverted, or alienated for purposes other than intended in this licence, without written approval by the Minister or his or her delegated nominee.

1.9 The Licensee must ensure that all measuring devices are properly maintained and in good working order and it must be easily accessible. This shall include a programme of checking, calibration, and/or renewal of measuring devices.

1.10 Notices prohibiting unauthorised persons from entering the certain areas, as well as internationally acceptable signs indicating the risks involved in case of an unauthorised entry must be displayed along the boundary fence of these areas.

1.11 The Licensee shall establish a programme of formal Information Management System, which maintains a database on water supply, distribution and delivery infrastructure.

APPENDIX III

Section 21(g) of the Act: Disposing of waste in a manner which may detrimentally impact on a water resource

1. QUANTITY OF WASTE TO BE DISPOSED

1.1 This Licensee is authorised to dispose treated wastewater in terms of water uses activities detailed in Table 3.

Table 3: Water use activities

Activities	Property	Purpose/Description	Total Volume (m^3/a)	Co-ordinates
Section 21 (g)				
Slimes into Dam Quarry no 1	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of slimes into a quarry, this quarry also acts as the return water dam.	36 500 m^3/a	S 25°43'43.67" E 27°47'36.90"
Operational Quarry No 2	Portion 95 of the Farm Zandfontein 447 JQ	Mined and seepage water	40 000 m^3/a	S 25°43'48.95" E 27°47'36.90"
Dust Suppression on haul roads	Portion 95 of the Farm Zandfontein 447 JQ	To suppression dust	18 000 m^3/a	Haul Road S 25°43'36.99" E 27°47'32.16"
Stock pile	Portion 95 of the Farm Zandfontein 447 JQ	Stock pile	9 450 m^3	S 25°43'29.82" E 27°47'33.84"
Septic Tank A	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of waste water in septic tank A at the main office	634 m^3/a	S 25°43'38.4" E 27°47'37.66"
Septic Tank B	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of waste water in septic tank B at the residential units	634 m^3/a	S 25°43'38.4" E 27°47'37.8"
Septic Tank C	Portion 95 of the Farm Zandfontein 447 JQ	Disposal of waste water in septic tank C at the workers compound	792 m^3/a	S 25°43'38.6" E 27°47'37.9"

1.2 The quantity of waste authorised to be disposed in terms of this licence must not be exceeded.

1.3 No water containing waste must be disposed of or stored onto any land, into any pond, dam or any other structure whatsoever, except for the disposal as authorised in the conditions specified in this Licence.

1.4 The quantities and composition of the waste or wastewater and other waste authorised to be disposed of in terms of this Licence may not be changed without prior authorisation from the Department.

1.5 The water level of all dirty water containment facilities, specifically dams used to store water containing waste for re-use or disposal must be recorded weekly.

1.6 All facilities constructed to manage clean and dirty stormwater, seepage and or process water shall be constructed as per the proposed designs reflected in the Report.

2. MONITORING

2.1 Groundwater monitoring

2.1.1 The Licensee must carried out the hydro census in out to ascertain the presence or absence of groundwater users in the area.

2.2.2 The groundwater quality monitoring must conducted on a quarterly on site and in the surrounding groundwater users. The monitoring points should be at the site and downstream show in Table 4

Table 4 Groundwater Monitoring Points

Borehole No	Coordinates		Groundwater level frequency	Groundwater quality frequency
Borehole A	(S) 25.72680	(E) 27. 79360	Monthly	Quarterly
Borehole B	(S) 25.72630	(E) 27. 79310		
Borehole C	(S) 25.71950	(E) 27. 77420		
SRBH 08	(S) 25.72871	(E) 27. 78834	Quarterly	
SRBH 07	(S) 25.72874	(E) 27. 78859		
SRBH 06	(S) 25.72513	(E) 27. 79039		
SRBH 05	(S) 25.72631	(E) 27. 79167		
SRBH 09	(S) 25.72041	(E) 27. 79342		
SRBH 33	(S) 25.71937	(E) 27. 80328		
SRBH 30	(S) 25.72003	(E) 27. 78677		

2.2.2.1 Groundwater monitoring network should be reviewed annually by competent geo-hydrologists and the report should be submitted to the Department for evaluation.

2.2.2.2 Groundwater flow and transport models should be updated annually by competent geo-hydrologists and submitted to the Department.

2.2.3 If ground water pollution have occurred or may possibly occur, the Licensee must conduct necessary investigation and implement additional monitoring and rehabilitation measures which must be to the satisfaction of the Regional Head.

2.2.4 There must be an annual inspection on the Septic tank. The groundwater model must be calibrated to quantify the pollution plume migration rate and direction.

2.2.5 A monitoring programme should be put in place to monitor water quality on a quarterly basis and water levels on a monthly basis.

2.2.6 Should the monitoring data prove that the activity is negatively impacting boreholes of other users in any significant way, then the applicant should provide alternative water supply to these affected parties.

2.2.7 If ground water pollution have occurred or may possibly occur, the Licensee must conduct necessary investigation and implement additional monitoring and rehabilitation measures which must be to the satisfaction of the Regional Head.

APPENDIX IV

Section 21(j) of the Act: Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or the safety of people

1. Dewatering

1.1 This licence authorises Rolfes Silica (Pty) Ltd for the dewatering of a maximum quantity of twenty seven thousand (27 000 m^3/a) cubic metres of water per annum from pit as shown in Table 5:

Table 5: Volume of water to be abstracted

Activities	Property	Purpose/Description	Total Volume (m^3/a)	Co-ordinates
Section 21 (j)				
Section 21 (j)	Portion 95 of the Farm Zandfontein 447 JQ	Dewatering from Operational Quarry / continuation of mining activity.	27 000 m^3/a	S 25º43'48.95" E 27º47'36.90"

2. METHOD OF ANALYSIS

2.1 Analysis must be carried out in accordance with methods prescribed by and obtainable from the South African National Standard (SANS), in terms of the Standards Act, 1982 (Act 30 of 1982).

2.2 Any laboratory used for monitoring or analytical work must take steps to ensure method validation e.g. participate in inter-laboratory testing.

2.3 The methods of analysis must not be changed without prior notification to and written approval by the Department.

3 Flow

3.1 Flow metering, recording and integrating devices must be maintained in a sound state of repair and calibrated by a competent person at intervals of not more than two years. Calibration certificates must be available for inspection by the Regional Head or his/her representative upon request.

3.2 The date, time and monitoring point in respect of each sample taken must be recorded together with the results of the analysis.

4 OTHER WATER USERS

4.1 The Licensee must attempt to prevent adverse effect on other water users. All complaints must be investigated by a suitable qualified person and if investigations prove that the Licensee has impaired the rights of other water users, the Licensee must initiate suitable compensative measures.

5. POLLUTION PREVENTION, INCIDENTS AND MALFUNCTIONS

5.1 If surface and/or groundwater pollution has occurred or may possibly occur, the Licensee must conduct, and/or appoint specialists to conduct the necessary investigations and implement additional monitoring, pollution prevention and remediation measures to the satisfaction of the Regional Head.

5.2 The Licensee shall keep all records relating to the compliance or non-compliance with the conditions of this licence in good order. Such records shall be made available to the Regional Head within 14 (fourteen) days of receipt of a written request by the Department for such records.

5.3 The Licensee shall keep an incident report and complaints register, which must be made available to any external auditors and the Department.

6. BUDGETARY PROVISIONS

6.1 The Licensee must ensure that there is a budget sufficient to complete and maintain the water use and for successful implementation of the rehabilitation programme as set out in this licence.

6.2 The Department may at any stage of the process request proof of budgetary provisions for rehabilitation and closure of project.

[END OF LICENCE]

Appendix 15 Rehabilitation Plan

REHABILITATION PLAN: **NW 30/5/1/2/2/441**

APPLICANT:
Rolfes Silica (Pty) Ltd
P.O.Box 1451
Brits
0250

PREPARED BY:
Holistic Environmental Services
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Thornhill Plaza
Polokwane
0882

DOCUMENT VERSION 1.0 – Draft

ADDENDUM TO AN AMENDMENT OF A CONVERTED MINING RIGHT IN TERMS OF SECTION 102 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, ACT 128 OF 2002 (MPRDA): CERTAIN PORTION OF PORTION 129 OF THE FARM ZANDFONTEIN 447 JQ, IN THE MAGISTERIAL DISTRICT OF BRITS

REHABILITATION PLAN: NW 30/5/1/2/2/441

DOCUMENT VERSION 1.0 – Draft

ADDENDUM TO AN AMENDMENT OF A CONVERTED MINING RIGHT IN TERMS OF SECTION 102 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, ACT 128 OF 2002 (MPRDA): CERTAIN PORTION OF PORTION 129 OF THE FARM ZANDFONTEIN 447 JQ, IN THE MAGISTERIAL DISTRICT OF BRITS

CONDUCTED ON BEHALF OF:
Rolfes Silica (Pty) Ltd
P.O.Box 1451
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PREPARED BY:

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DOCUMENT HISTORY

Title:	APPLICATION FOR AN AMENDMENT OF A CONVERTED MINING RIGHT IN TERMS OF SECTION 102 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, ACT 128 OF 2002 (MPRDA): CERTAIN PORTION OF PORTION 129 OF THE FARM ZANDFONTEIN 447 JQ, IN THE MAGISTERIAL DISTRICT OF BRITS
Our Project No:	HES/512/MR
DMR Ref No:	**NW 30/5/1/2/2/441**

DOCUMENT DISTRIBUTION

Name	Institution	Date	Version	Status
Regional Manager	Department of Mineral Resources	12 March 2013	1.0	Draft

Copyright Information

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Glossary

Biodiversity : The variety of life and its processes; including the variety of living organisms the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting.

Clearing : The clearing and removal of vegetation, whether partially or in whole, including trees and shrubs, as specified.

Environment : The surroundings within which humans exist and that is made up of:

a) The land, water and atmosphere of the earth;

b) Micro-organisms, plant and animal life;

c) Any part or combination of a) and b) and the interrelationships among and between them; and

d) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being (*i.e.* the social environment).

Erosion control : The act of reducing or eliminating on–going erosion caused by natural or man-made processes.

Herbicide : A chemical substance or cultured biological organism used to control, suppress or kill plants, or severely interrupt their normal growth processes.

Natural vegetation : The existing vegetation species, indigenous or otherwise, of trees, shrubs, groundcover, grasses and all other plants found growing on the site.

Pollution : Any change in the environment caused by –

(a) substances; or
(b) noise, odours, dust or heat, emitted from any activity associated with the clearance or rehabilitation phases, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed eco-systems, or on materials useful to people, or will have such an effect in the future.

Rehabilitation : The return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at re-vegetation of a disturbed area and the insurance of a stable land surface. Re-vegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.

Solid waste : All solid waste, chemical waste, wrapping materials, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Weeds and invader plants : Weeds and invader plants, as defined under Section 1 of the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) and Government Notice R1048 of 25 May 1984 Part 2, or any list of invaders identified by the Agricultural Research Council and the Plant Protection Research Institute (Handbook No.5 – Plant Invaders of Southern Africa).

Topsoil

The layer of soil covering the earth which-
(a) provides a suitable environment for the germination of seed;
(b) allows the penetration of water;
(c) is a source of micro-organisms, plant nutrients and in some cases seed; and
(d) is not of a depth of more than 0,5 metres or such depth as the Minister may prescribe for a specific prospecting or exploration area or mining area.

Trench

A type of excavation usually made by digging in a line towards a mechanical excavator and not pivoting the boom – a large, U-shaped hole in the ground, with vertical sides and about 6 – 8 metres in length. Also a prospecting trench.

DWAF	The Department of Water Affairs and Forestry – both national office and their various regional offices, which are divided across the country on the basis of water catchment areas.
MPRDA	**T**he Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)

1 Introduction

The demand for reclamation or rehabilitation has increased during the last few decades as resource firms become increasingly conscious about the environment and the relevant environmental laws. Ecological areas which have or would be impacted upon by mining activities are often in need, or would be, of remediation. There are three major types of remediation: reclamation, rehabilitation and restoration.

Reclamation: First level – stabilization of a terrain (mined area), aesthetic improvement and return of land to a useful purpose. The whole landscape will benefit.

Rehabilitation: Second level – the reparation of ecosystem processes, productivity and service and reintroduction of certain ecosystem functioning. Make landscape more "natural", but increase in indigenous biodiversity limited.

Restoration: Third and most ambitious level – construction of prior ecosystem, i.e. former function, characteristic species and structure. Re-establishment of the pre-existing, historical biotic integrity in terms of species composition and assemblage structure. According to the Society for Ecological Restoration International ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (SER International Primer on Ecological Restoration; www.ser.org).

2 Background

Holistic Environmental Services (HES) Cc was appointed by Restigen (Pty) Ltd on behalf of Rolfes Silica (Pty) Ltd to develop the EMP for the amendment of a converted mining right in terms of section 102 of MPRDA: portion of portion 129 of the farm Zandfontein 447 JQ, Brits district.

It is recognised that mining is a temporary land use that should and will be followed by, other forms of land use. The rehabilitation of mining areas will be aimed towards a clearly defined future land use for the affected areas.

This is **only an addendum to the existing Rehabilitation Plan** developed by Shangoni Management Services. The purpose is to add a number of additional best practices and emphasise the use of certain grass and tree species more, and to smoothen the proposed process of withdrawal and final rehabilitation of the southern part of the existing Mining Right area, and to facilitate the eventual rehabilitation of the proposed new expansion area directly adjacent to the west. Therefore the existing/original Rehabilitation Plan remains the guiding document, while this document only provides additional guidance to apply where needed.

2.1 Project objective and scope

The assignment was interpreted as follows: Compile a Rehabilitation Plan for the existing activities that will be conducted on site with clear objectives and possible methods for restoring the environment. Specific objectives include:

- To ensure that the site is safe and secure;
- To remove any sources of pollution from the site and rehabilitate and restore the soils;
- To control erosion by establishing a vegetative cover;
- To re-establish a plant community with specified indigenous species;
- Where feasible maintain or increase the biological diversity of species in the vicinity;
- To rehabilitate the site to a state that is suitable for other land uses; and
- To rehabilitate the site that it facilitates compliance with current environmental quality objectives.

It purpose of this plan is to outline the actions that will be undertaken during the rehabilitation and re-vegetation of the site. The plan will highlight the general rehabilitation and re-vegetation actions that will be adopted.

3 Rehabilitation Plan (Addendum)

3.1 Initial seeding should contain more pioneer grass species

Pioneer grasses are the first species that should be established because only these species are:

- Adapted to bare soil conditions. (In case sub-climax or climax species are sown too early, they are likely not to grow or if they grow, to die off as soon as unfavourable weather conditions prevail because the soil and other biophysical conditions are not ready yet).
- Capable to prepare soil and other biophysical conditions to become more favourable for more diverse sub-climax and climax species to establish at a later stage.

Therefore sequencing, or sowing/planting the mix of different species in the correct order, is important. After an initial planting of pioneer species successfully established, it is needed to do follow up seeding or planting of sub-climax and climax species as discussed next. Use the column titled “Succession status” in the table below to identify lower successive stage (i.e. pioneer and to a lesser extent sub-climax) species.

3.2 Follow-up seeding/planting

Even though it may seem that vegetation establishment is going well, it does not necessary mean that the correct species composition are present. To facilitate smooth transfer from an early successive state (i.e. pioneer condition) to a higher successive state (i.e. sub-climax and climax state) it may be needed to do some follow up planting of trees and sowing of grass seeds. The reason is because natural succession where sub-climax and climax species will eventually take over, may take too long and if it takes too long, gaps exist for alien invasive plants to establish. Use the column titled “Succession status” in the table below to identify higher successive stage (i.e. climax and to a lesser extent sub-climax) species

3.3 Use of a properly diverse mix of species

Each batch of seeding or planting material should contain a diverse mix of species to reduce risk of vegetation establishment failure. As mentioned above, initial sowings/plantings should contain more pioneer and less sub-climax and even less climax species while follow-up sowings/plantings should contain more sub-climax and climax species and less pioneer species. Species that occupies a variety of niche conditions, tolerate various levels of draught or cold spells etc, should be included in each sowing/planting.

There is a **need to make use of more trees** in rehabilitation work because well selected tree species will perform better in terms of dust, noise and visual screening, will stabilise slopes better with its more extensive root system, and will provide for a more diverse wildlife habitat. However, over-use of trees should also be avoided since grasses play an important role in early succession stage stabilisation of soil. As a general guide, keep the ratio of tree cover to grass cover the same as in adjacent undisturbed natural vegetation.

3.4 Final rehabilitation of the area to be excluded from the current Mining Right area

This area is characterised by higher, steeper slopes and some vertical rock faces due to quarrying activities. Therefore geotechnical stability, soil erosion and visual mitigation are very important. The existing Rehabilitation Plan deals extensively with these issues, however, the following should receive special attention:

- Grading of steep rock faces: Steep and especially vertical rock faces are dangerous and should be graded to preferably 18° or a maximum of 35°. Where such grading are not practical (i.e. when too much land up-slope need to be graded down therefore causing unnecessary habitat loss) steeper slopes should be cordoned using durable fencing or a strong wall/bund structure to prevent people or animals from falling down.
- Exposed rock, especially where the rocks or finer material did not start to weather fast enough since it was blasted or excavated, needs to be treated with ferrous chloride or a similar approved, legal and safe product to accelerate rock oxidation so that it can adopt the colour of naturally weathered rock and thereby visually blend in with the surrounding rock formations.
- Vegetation should be wisely utilised to optimally facilitate visual screening, habitat regeneration and soil stabilisation on these higher, steeper areas. Use the third last column titled “Suitability to rehabilitate higher, steeper areas” in the table below to identify species most suitable for this specific area and purposes.

3.5 Visual, dust and sound screening on lower, less steep areas

Larger and structurally denser trees needs to be planted on the lower parts of the site to provide direct visual, dust and sound screening. The northern, eastern, western and central parts of the existing Mining Right area to be rehabilitated, and in future the entire newly proposed Mining Right expansion area, needs to be rehabilitated this way. Use the second last column titled “Suitability to rehabilitate lower, less steep areas” in the table below to identify species most suitable for this specific area.

3.6 Visual, dust and sound screening along the site boundary using a tree corridor

There is a need to plant a tree corridor (boundary planting or hedgerow) along the lower, more visible parts of the site. Such a corridor of trees, even if just two trees wide on average, could play a very important role in visual, dust and noise mitigation. Use the last column titled “Suitability to use in boundary planting / tree corridor” in the table below to identify species most suitable for this specific area.

Table1: Tree and grass species selection matrix

Specie	Is this specie indigenous to this specific vegetation and ecological unit?	Does this specie occur on the site and/or properties directly adjacent to the site in the exact same biophysical conditions, especially soil and aspect?	Succession status	Forage, habitat provision & economic value	Visual, dust and noise screening value (also consider if evergreen)	Soil stabilisation value	Rock stabilisation value	Ease of establishment and care	Suitability to rehabilitate higher, steeper areas	Suitability to rehabilitate lower, less steep areas	Suitability to use in boundary planting / tree corridor
Trees											
Acacia caffra (Common Hook-thorn)	Yes	Yes	Sub-climax	High	Moderate	Low	High	High	High	High	Moderate
Combretum zeyheri (Raasblaar; Large-fruited bush-willow)	Yes	Yes	Sub-climax	Moderate	Moderate	Low	Moderate	High	Moderate	Moderate	High
Englerophytum magalismontanum	Yes	Yes	Sub-climax	High	High	Low	High	High	High	Moderate	Low
Ficus abutilifolia (Large-leaved Rock Fig)	Yes	Yes	Sub-climax	Low	Moderate	Moderate	High	High	High	Moderate	Low
Ficus ingens (Rooiblaarrotsvy; Red-leaved rock fig)	Yes	Yes	Sub-climax	Moderate	High	Low	High	High	High	Moderate	Low
Mimusops zeyheri (Moepel)	Yes	Yes	Sub-climax	High	High	Low	High	High	High	High	High
Pappea capensis (Jacket-plum)	Yes	Yes	Climax	High	High	Low	Moderate	High	Moderate	High	High
Sclerocarya birrea	Yes	Yes	Sub-climax	Moderate	Moderate	Low	Moderate	High	Moderate	Moderate	High
Ximenia caffra (Sourplum)	Yes	Yes	Sub-climax	Moderate	Low	Low	High	High	High	Low	Low
Ziziphus mucronata (Buffalo-thorn)	Yes	Yes	Climax	High	High	Low	Low	High	Low	High	High
Other species including: Acacia karoo; Acacia robusta; Ochna Pulchra; Rhus lancea; Bequaertiodendron magalismontanum; Burkea Africana; Combretum molle	Yes	Only some.	Sub-climax	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Grasses											
Dactyloctenium aegyptium (Common Crowfoot)	Yes	No	Pioneer	Moderate	Low	Low	Low	High	High	High	Low
Dactyloctenium giganteum (Giant Crowfoot)	Yes	No	Pioneer	High	High	High	Low	High	High	High	Low
Cenchrus ciliaris (Foxtail Buffalo	Yes	Yes	Sub-climax	High	High	High	Moderate	High	High	High	Low

Grass)			& climax								
Digitaria eriantha (Common Finger Grass)	Yes	Yes	Sub-climax & climax	High	Low	High	Low	High	Moderate	Moderate	Low
Eragrostis chloromelas	Yes	Yes	Sub-climax & climax	Moderate	Low	Moderate	Low	High	Moderate	Moderate	Low
Heteropogon contortus	Yes	Yes	Sub-climax	Moderate	Low	Low	Low	High	Moderate	Low	Low
Hyparrhenia hirta (Common Thatching Grass)	Yes	Yes	Sub-climax & climax	Moderate	High	High	High	High	High	High	Low
Panicum maximum (Guinea Grass) [prefer more humid microclimates]	Yes	Yes	Sub-climax & climax	High	High	High	Low	High	Moderate	High	Low
Setaria sphacelata var. sphacelata (Common Bristle Grass)	Yes	Yes	Climax	High	Low	High	Low	High	Moderate	High	Low
Themeda triandra	Yes	Yes	Climax	High	Moderate	Moderate	Low	High	Moderate	High	Low
Tragus berteronianus (Carrot-seed Grass)	Yes	Yes	Pioneer	Low	Low	Low	Low	High	High	High	Low
Trichoneura grandiglumis (Small Rolling Grass)	Yes	Yes	Sub-climax	Low	Low	Low	Low	High	High	Moderate	Low
Urochloa mosambicensis (Bushveld Signal Grass)	Yes	Yes	Sub-climax	High	Low	Low	Low	High	Moderate	Moderate	Low
Other: Setaria flabellate; Setaria nigirostris; Eragrostis racemosa; Eragrostis capensis; Eragrostis gummiflua; Aristida aequiglumis; Rhynchelytrum nerviglume; Cymbopogon excavates; Trachypogon spicatus; Tristachya leucotrix; Panicum natalense; Diheteropogon amplectens; Monocyrnbium ceressiiforme; Digitaria monodactyula; Digitaria tricholaedoides.	Yes	No	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies

4 References

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