mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH A MINING RIGHT

SUBMITTED FOR AN ENVIRONMENTAL AUTHORISATION LODGED IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT No 107 OF 1998 READ WITH REGULATION 19 OF THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 FOR MINING AND RELATED INFRASTRUCTURAL ACTIVITIES ON PORTIONS 31 AND PORTION 32 OF THE FARM KLIPFONTEIN 400KT, THABA CHWEU LOCAL MUNICIPALITY, MPUMALANGA PROVINCE

NAME OF APPLICANT: IMERYS REFRACTORY MINERALS SOUTH AFRICA, KRUGERSPOST MINE

FILE REFERENCE NUMBER SAMRAD: MP 30/5/1/2/3/2/1(196) EM

APPLICATION PROPERTY: Portions 31 and Portion 32 of the Farm Klipfontein 400KT

October 2020

BECS Environmental (Pty) Ltd
In association with BECS Services (Pty) Ltd

IMERYS
Refractory Minerals

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IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act no 28 of 2002 (as amended) (MPRDA), 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 (EA) can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme Report (EIAR/EMP) in terms of the National Environmental Management Act no 107 of 1998 (as amended) (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 Environmental Impact Assessment (EIA) Regulations, GN 982 of 2014 (as amended) in terms of the NEMA, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority (CA) and in terms of section 17(1)(c) the CA 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 EIAR/EMP required in respect of applications for an EA 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.

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

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT

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

a. determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
b. describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
c. identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified

development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

d. determine the—-
    i. nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    ii. degree to which these impacts—
        aa. can be reversed;
        bb. may cause irreplaceable loss of resources, and
        cc. can be avoided, managed or mitigated;
e. identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
f. identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
g. identify suitable measures to manage, avoid or mitigate identified impacts; and
h. identify residual risks that need to be managed and monitored.

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ABBREVIATIONS

AEL	Air emission licence
AMD	Acid mine drainage
AP	Acid Generating Potential
ARC	Agricultural Research Council
BECS	BECS Services
CA	Competent Authority
CBA	Critical Biodiversity Areas
CV	Curriculum Vitae
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DMS	Dense Media Separation
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental authorisation
EAP	Environment Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
EC	Electrical Conductivity
ECA	Environmental Conservation Act No 73 of 1989 (as amended)
EIA	Environmental Impact Assessment

EIA/EMP	Environmental Impact Assessment/ Environmental management programme
EIAR	Environmental Impact Assessment Report
EIA Regulations	Environmental Impact Assessment Regulations, GN 982 of 2014 i.t.o. the National Environmental Management Act No 107 of 1998
ELCA	Environmental Legal Compliance Assessment
ELWU	Existing Lawful Water Use
EMP	Environmental Management Programme
ESA	Ecological Support Areas
ESR	Environmental Scoping Report
GA	General authorisations
GDP	Gross Domestic Product
HD	Horizontal Dipole
HIA	Heritage Impact Assessment
HOD	Head of Department
I&APs	Interested and affected parties
IAIAsa	International Association for Impact Assessment
IDP	Integrated Development Plan
Imerys & IRMS	Imerys Refractory Minerals South Africa (Pty) Ltd
IWUL	Integrated Water Use License
IWULA	Integrated Water Use License Application
LDV	Light Duty Vehicle
LED	Local Economic Development
LoM	Life of Mine
MA	Minerals Act No 50 of 1991
MAR	Mean Annual Runoff
mamsl	meters above mean sea level
MHSA	Mine Health and Safety Act No 29 of 1996 (as amended)
MPRDA	Mineral and Petroleum Resources Development Act No 28 of 2002 (as amended)
MPRDR	Mineral and Petroleum Resources Development Regulations, GN 527 of 2004 (as amended) i.t.o. the Mineral and Petroleum Resources Development Act No 28 of 2002
MWP	Mining works programme
NAAQS	South Africa's National Ambient Air Quality Standards
NAFCOC	National Federated Chamber of Commerce and Industry
NDCR	National Dust Control Regulations
NDEA	National Department of Environmental Affairs
NEMA	National Environmental Management Act No 107 of 1998 (as amended)
NEMAQA	National Environmental Management Air Quality Act No 39 of 2004 (as amended)
NEMBA	National Environmental Management Biodiversity Act No 10 of 2004 (as amended)
NEMWA	National Environmental Management Waste Act 59 of 2009 (as amended)

NFA	National Forest Act No 84 of 1998
NGA	National Groundwater Archive
NHRA	National Heritage Resources Act No 25 of 1999
NNP	Net Neutralising Potential
NP	Neutralising Potential
NPR	Neutralising Potential Ratio
NPI	National Pollutant Inventory
NWA	National Water Act No 36 of 1998 (as amended)
PES	Present Ecological Score
PPE	Personal Protective Equipment
PPP	Public participation process
RoD	Record of decision
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SANAS	South African National Accreditation System
SANS	South African National Standards
SWMP	Storm Water Management Plan
TCLM	Thaba Chweu Local Municipality
TSP	Total Suspended Particulates
VD	Vertical Dipole
WHO	World Health Organisation
WRC	Water Research Commission
WMA	Water Management Area

Executive summary

Applicant

BECS Environmental has been appointed by Imerys Refractory Minerals South Africa (Pty) Ltd: Krugerspost Mine to apply for an environmental impact assessment (EIA), and an Integrated Water Use License Application (IWULA).

Krugerspost Mine has been mining for over 35 years and has an existing mining right for the mining of andalusite on portions 31, 32, 36 and the remaining extent of portion 1 of the farm Klipfontein 400 KT in Thaba Chweu Local Municipality, Mpumalanga Province. The mine is in the B42E quaternary catchment of the Olifants Water Management Area and the Central Transvaal (Bushveld) Basin. Krugerspost is located at S24°56'13.20" and E30°26'9.60" (central coordinates). Approximately 978ha on the farm Klipfontein is used for the Krugerspost mining operations. The Spekboom River runs approximately 3km to the south west from the current mining activities.

Table 1: Description of the applicant

Project applicant	Imerys Refractory Minerals South Africa (Pty) Ltd – Krugerspost Mine
Contact person	Hendrik Jones
Designation	Operational Director
Telephone number	+27 12 643 5940
E-mail address	Hendrik.Jones@imerys.com

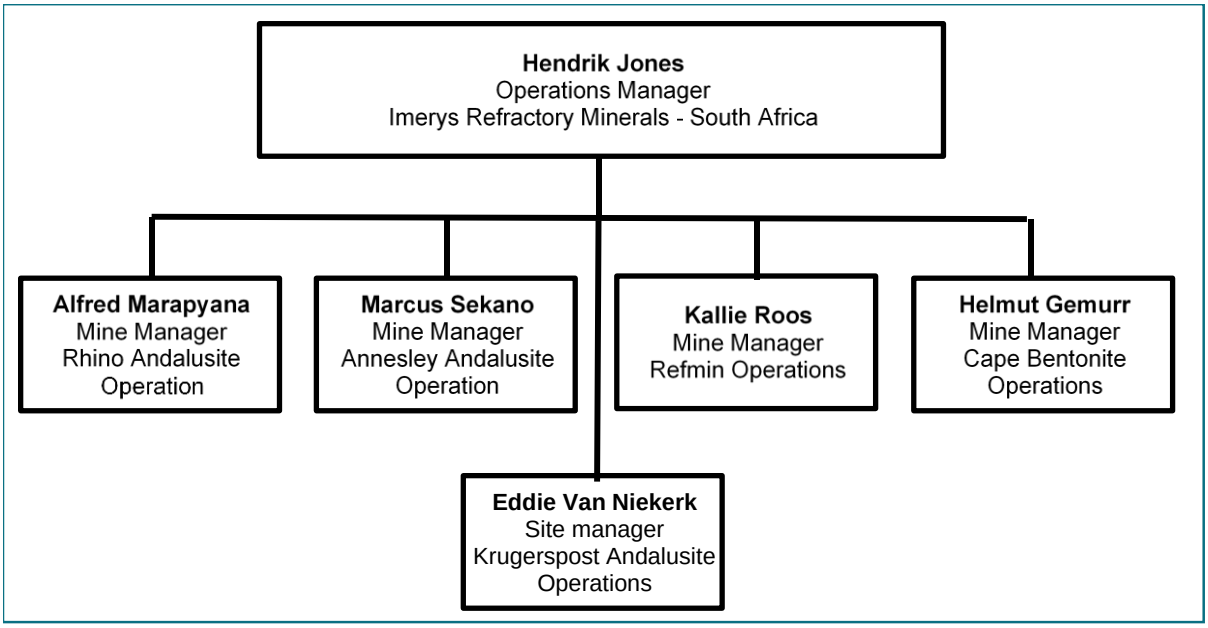


Figure 1: Krugerspost Mine organogram

Project description

Imerys has since decided to re-establish a beneficiation plant on Krugerspost Mine, located closer to the currently mined quarries. This plant will be located on an already disturbed area, adjacent to the existing quarry. Imerys has subsequently applied for a section 102 amendment under the MPRDA to include this beneficiation plant. This application is still underway, and this EIA is submitted as part of the process. The application form was acknowledged on 10 February 2020 by the Mpumalanga DMR. The Environmental Scoping Report (ESR) was accepted on the 30th of September 2020 which allowed the compilation of the EIA.

The proposed listed activities included in this application are as follows:

- Activity 6 of GN 984 (as amended by GN 325 of 2017) under NEMA for the storing of water from in Quarry 6. This water will be abstracted from Klipplaatdrift Mine quarries. This activity is also triggered since the mine needs to apply for an AEL for the plant.

Note: The DMR stated that a Category B(11) waste license in terms of GN 921 (as amended by GN 633 of 2015) under NEMWA for the backfilling of mine residue in to Quarry 6 (this includes slimes and waste rock) is not necessary and that a closure plan can be submitted instead to demonstrate the rehabilitation of the quarry. It was confirmed by the DMR that the mine is not applying for closure and that no closure application will need to be lodged as the purpose of the closure plan is to demonstrate the rehabilitation of Quarry 6. This closure plan is attached to the EIA as an addendum.

Summary of impacts

- **Soil, surface water, and groundwater pollution**
  - Backfilling, the storage of water in the quarry and the construction of the plant can lead to soil, surface water, and groundwater due to the pollution from hydrocarbons. Spillages and the generation of waste can also lead to contamination.
- **Soil erosion and sedimentation**
  - Backfilling and sloping may lead to soil erosion and sedimentation. Run off from mine residue and sloped soil may also occur. The mine has combatted this by storing water in the quarry to reduce the potential of erosion and surface water run-off.
- **Land capability and visual aspects**
  - Rehabilitation efforts will change the topography to a more natural state which will positively impact the visual aspect of the region. This will also positively impact the drainage patterns and the land use will be returned to what it was prior to mining.
- **Alien vegetation establishment**
  - Alien vegetation may establish on areas that have been backfilled if they are not managed appropriately.

- **Groundwater pollution**
    - Backfilling poses a risk of groundwater pollution post-closure. This is due to the long-term release and accumulation of low risk elements. However, rainwater shall ensure that it is diluted. No sulphidic minerals are present in the ore or overburden that could result in acidity of drainage or mine water.
- **Air quality pollution and noise generation**
    - Activities associated with the backfilling of quarry 6 with mine residue can generate dust and noise. The new plant can also lead to air pollution.

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

a) Details of the environmental assessment practitioner

BECS Environmental was appointed as an independent Environment Assessment Practitioner (EAP) to meet the requirements as set out in regulation 13 of the EIA Regulations. Refer to Table 2 below for a description of the EAP and refer to Addendum 2 for a detailed CV of the EAP, which includes the expertise, qualifications, and experience.

Table 2: Description of the EAP

Name of company	BECS Environmental
Postal address	PO Box 72960, Lynnwood Ridge, 0040
Telephone number	012 361 9970
Cell phone number	072 191 6074
Facsimile number	012 361 0645
E-mail address	salome@becsenv.co.za
Name of responsible EAP	Salome Beeslaar
Expertise of EAP	B.Sc Environmental Science (UP[1]), B.Sc Honours Geography (UP), M.Sc Geography (UP), member of the IAIAsa[2] with membership number: 5853, Professional Scientist (Environmental Science) with SACNASP[3] number 400385/14, Registered EAP[4] with EAPASA[5], number 2020/846
Name of second responsible EAP	Deshree Pillay
Expertise of EAP	B.Sc Environmental Science (UP), B.Sc Honours Geography & Environmental Science (UP), M.Sc Environment and Society (UP), member of the IAIA with membership number: 6186, Candidate Scientist (Environmental Science) with SACNASP number 123140, Candidate EAP with EAPASA number 2019/947

[1] University of Pretoria
[2] International Association for Impact Assessment South Africa
[3] South African Council for Natural Scientific Professions
[4] Environmental Assessment Practitioner
[5] Environmental Assessment Practitioners Association of South Africa

b) The location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report

Refer to Table 3 below for a description of the property. A locality map of Krugerspost Mine is provided below in Figure 2. Refer to Addendum 1 for all maps and plans.

Table 3: Farm names, 21-Digit Surveyor General codes, and coordinates

	Portion 31 of the farm Klipfontein 400 KT	**Portion 32 of the farm Klipfontein 400 KT**
Title deed number	T17811/1996	T17811/1996
Deeds office	Pretoria	Pretoria
Property owner	Samrec	Samrec
Property size	215.0467ha	231.2068ha
21-digit Surveyor General Code for each farm portion	T0KT00000000040000031	T0KT00000000040000032
Coordinates	S24°54'43.08", E30°27'4.51" S24°55'11.65", E30°27'34.58" S24°55'45.30", E30°27'18.25" S24°55'21.33", E30°26'17.76"	S24°56'4.12", E30°26'3.27" S24°56'20.98", E30°27'1.06" S24°55'45.12", E30°27'18.38" S24°55'20.52", E30°26'17.63"

c) A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale

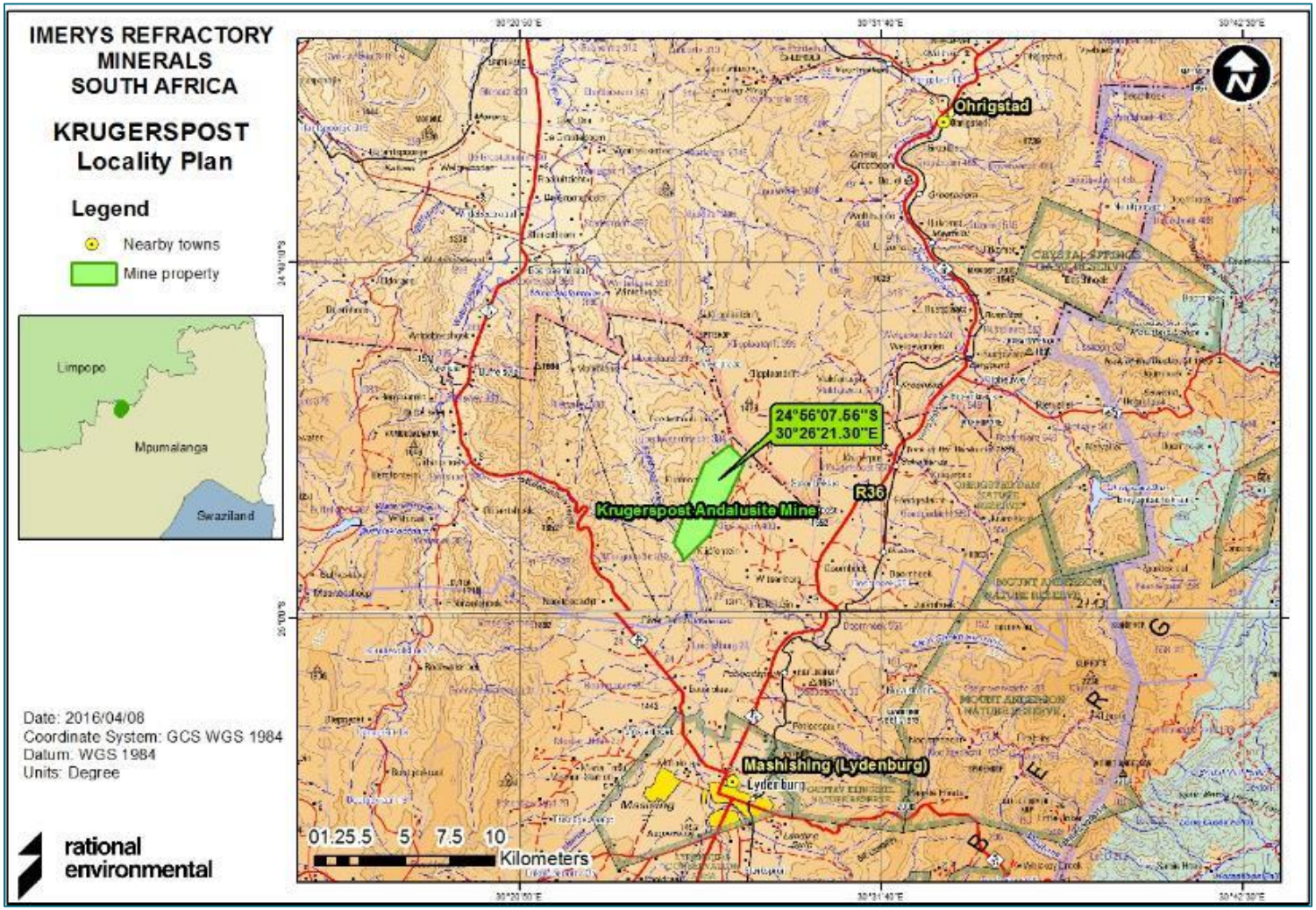


Figure 2: Locality map of Krugerspost Mine (Rational Environmental, 2016)

d) Description of the scope of the proposed overall activity

Krugerspost Mine obtained a mining licence in 1999 with mining licence number 22/99, issued in terms of the old Minerals Act No 50 of 1991 (MA). This licence was issued for Samrec (Pty) Ltd (Samrec). The mining licence was converted to a mining right under the Mineral and Petroleum Resources Development Act No 28 of 2002 (MPRDA), executed on 4 May 2020, with reference number MP30/5/1/2/3/2/1(196) MR. The converted mining right was also issued for Samrec. A Section 11 application was submitted to the Department of Mineral Resources (DMR) to change the mining right holder from Samrec to Imerys.

Krugerspost Mine has an approved Environmental Management Programme (EMP), which was still approved under the MA in 1999. The main activities approved in this EMP are as follow:

- The mining of Andalusite ore in a northerly direction, parallel to the strike of the ore body until the reserve is depleted. *The ore body is almost depleted, with final removal of ore in the most north-eastern part of the mining right area.*
- The placement of overburden adjacent to the quarries.
- Mineral beneficiation. *The plant has since then been removed and no beneficiation is currently taking place on site.*
- Slimes was pumped to two slimes dams. *Both are now non-operational because the beneficiation process has stopped.*
- Dry in-pit crushing and screening discard is deposited directly into the quarry where it serves to backfill the worked out area.
- Various dams associated with the mining activities. *Most of these dams have been removed, with the two settling dams, still in place.*
- Workshops, storage areas, offices, etc. *This has all been removed with only a few offices still remaining.*

Imerys has since decided to re-establish a beneficiation plant on Krugerspost Mine, located closer to the currently mined quarries. This plant will be located on an already disturbed area, adjacent to the existing quarry. Imerys has subsequently applied for a section 102 amendment under the MPRDA to include this beneficiation plant. This application is still underway, and an environmental scoping report was submitted on 24 March 2020 to DMR. The application form was acknowledged on 10 February 2020 by the DMR. The proposed listed activities included in this application are as follow:

- Activity 6 of GN 984 (as amended by GN 325 of 2017) under the National Environmental Management Act No 107 of 1998 (NEMA) for the storing of water from in Quarry 6. This water will be abstracted from Klipplaatdrift Mine quarries. This activity is also triggered due to the fact that

the mine needs to apply for an Air Emission Licence (AEL) under the National Environmental Management Air Quality Act No 39 of 2004 (NEMAQA) for the plant.

Krugerspost Mine applied for an integrated water use licence (IWUL) under the National Water Act No 36 of 1998 (NWA), which was issued 27 November 2010 by the Department of Water and Sanitation (DWS) of the Olifants Water Management Area (WMA), via its Mashishing offices, with licence number 24009412. This IWUL includes the following water uses:

- Section 21a and j water uses under the NWA. The abstraction of water from Quarry 6, and storage thereof in dams on site.
- Section 21b water uses under the NWA. The storage of wastewater in various dams.
- Section 21g water uses under the NWA. The disposal of slimes on a slimes dam. Please note, at this time, the original slimes dam was already non-operational and completely rehabilitated. For this reason, no wate ruse was required for this slimes dam.
- Section 21g water uses under the NWA. The disposal of slimes into quarries 2 and 3. These quarries have since, been filled with mine residue, as also approved under the EMP.

This application is for an EIA application. In addition to this application, the mine is also applying for an IWULA. Refer below to Table 4 for all listed activities. Refer to Figure 4 below for a Master plan of the entire mining right area (MP30/5/1/2/3/2/1(196) MR) and Figure 3 for a layout indicating the activities applied for. Included as well for reference is Figure 5 which is a Master plan with all activities on MP30/5/1/2/3/2/1 (196) MR and LP30/5/1/2/3/2/1(10006) MR.

(i) Listed and specified activities triggered and being applied for

Refer below to Table 4 below for all listed activities being applied for. These activities will form part of an existing mine. see Part A, section (d)(ii) for a detailed description of all activities which includes then the listed activities being applied for.

Table 4: All listed activities for this application

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice
The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.	Quarry 6: 30ha	6	GN 984 (as amended by GN 325 of 2017)

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice
Storing of process water in quarry 6. The application for an AEL for a dryer as part of the plant.			

(ii) Description of the activities to be undertaken

The mine is currently in the process of mining Quarry 6. However, all other activities have ceased. It was an opencast rip-and-doze operation along the gentle scarp slope of a range of low hills. The mine is proposing to backfill Quarry 6 with mine residue as part of its rehabilitation. Due to the size of the quarry, water pumped from the new quarry on Klipplaatdrift, will be stored in Quarry 6, an IWULA was made for this.

The mine will also erect a new plant on already disturbed soil. Concept Design includes a full scale plant essentially including a primary crushing & screening with first stage Dense Media Separation (DMS) followed by a 3 stage processing plant, dryer, and mag plant.

Figure 3: Site layout plan for listed activities on MP 30/5/1/2/3/2/1(196) MR

Figure 4: Master plan with all activities on MP30/5/1/2/3/2/1(196)MR

Figure 5: Master plan with all activities on MP 30/5/1/2/3/2/1(196) MR and LP30/5/1/2/3/2/1 (10006) MR

e) Policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context

This section only includes policy and legislative context directly related to the authorisations of the mine. For a complete description of al legislation, guidelines and policies, a detailed Environmental Legal Compliance Assessment (ELCA) must be done.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
MPRDA	According to the MPRDA, Krugerspost Mine must have a mining right as well as an approved EMP. Due to changes from the MA to the MPRDA in 2002, all mining rights had to be converted in 2009 from the old MA to the new MPRDA. Any mining right application submitted after 8 December 2014 must be done in terms of NEMA and not MPRDA. This application will include the listed activities pertaining to mining (i.e. Activity 17 of GN 984 of the EIA Regulations). These applications are still submitted to DMR.	Addendum 5A: Mining right	The mine has a converted mining right that commenced on the 4th of May 2010 and will end on the 3rd of May 2020 with reference number MP 30/5/1/2/2/196 MR. The mine has an EMP that was regulated under section 39 of the MPRDA and was approved in 1999/10/12 for the mining of andalusite on portions 31, 32, 36 and the R/E of portion 1 of the farm Klipfontein 400 KT. This EA application is submitted in terms of NEMA to ensure all applicable listed activities are authorised.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	Any changes in the mining right, EMP, mining works programme (MWP), or EA, must be authorised through a Section 102 (in terms of the MPRDA) amendment.	N/A	This application is done parallel with a section 102 amendment.
NEMA and the Environmental Conservation Act 73 of 1989 as amended (ECA)	The first listed activities which required an EA (referred to as a record of decision (RoD) in the past) commenced in 1998. These activities were published in the EIA Regulations of 1998 (GN1183). In 2006, the ECA activities and EIA Regulations were replaced by the first NEMA EIA Regulations. The second set of NEMA EIA activities replaced the first set of NEMA EIA activities in 2010. The ECA activities as well as the first and second NEMA EIA activities excluded the application for an EIA when applying for a mining right; however, there are various other activities that could potentially trigger an EIA. The third set of NEMA EIA activities commenced on 8 December 2014. According to these listings, an	Addendum 5C: Proof of submission of EIA application form	The mine is in the process to apply for an EA This EA application includes a listed activity under NEMA. No EA for the application of a mining right is necessary because it is an existing mining right.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	applicant must apply for both a mining right as well as an EA for any new mine, and a prospecting right as well as an EA for any new prospecting activities.		
NEMWA	Waste management permits for certain waste activities were required from 1989 i.t.o. the ECA. These permits were repealed by the publishing of the first listed waste management activities licensing in 2009 (GN 718 of 2009 i.t.o. NEMWA). These listings were replaced by new listings in 2013 (GN 921 of 2013 i.t.o. NEMWA). If a site has a permit under ECA, this is still applicable until the National Department of Environmental Affairs (NDEA) requests an update under the new legislation (NEMWA). In 2015, the Regulations were amended with GN 633 to include the requirement for a waste licence for the establishment of mine residue.	N/A	According to the DMR, a waste license is not required in terms of this regulation for the backfilling of quarry 6 with mine residue (slimes and waste rock). A closure plan must thus be submitted in place of a waste license application to demonstrate rehabilitation of Quarry 6.
NWA	Section 21 of the NWA sets out the water uses for which a general authorisation (GA) or IWUL is required. These water uses commenced in 1 October 1998, and include permissible water uses (water uses for which no licencing or registration is necessary), general authorisations (GA) (water uses for which registration only is required), and IWULs (water used for which both	Addendums 5D & 5E: Krugerspost Integrated Water Use Licence & Correspondence with the Department of Water and Sanitation regarding the Integrated Water Use License	The mine has already applied for an IWUL. The IWULA was submitted and the Department of Water and Sanitation have until the 10th of December 2020 to provide feedback on this application. The following water uses were included in this IWULA for Krugerspost.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	registration and licencing is required). An existing lawful water use (ELWU) is any water use that commenced 2 years or more prior to the NWA and authorised under the old Water Act no 54 of 1956. These water uses are deemed lawful.		• Section 21(g) of the NWA: Storage of water from pit in Quarry 6 • Section 21(g) of the NWA: Roll-over mining into Quarry 6 • Section 21(g) of the NWA: Backfilling Quarry 6 • Section 21(g) of the NWA: Septic tanks
National Heritage Resources Act no 25 of 1999 (NHRA)	All required permits as per the NHRA.	Part(h)(v)	A Heritage Impact Assessment (HIA) was done as part of the original mining right application in November 2011. This report will be attached to the EIAR/EMP. All impacts and management measures from the HIA are included in this EIA.
National Forest Act No 84 of 1998 (NFA)	No person may cut, disturb, damage or destroy any protected tree; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except under a licence granted by the Minister.	Part(h)(v)	Activities at the mine do not include the cutting, disturbance, destruction, collection, removal, transportation, selling or export of any protected tree, or any forest product derived from a protected tree.

f) Motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report

As per the Guideline on Needs and Desirability in terms of the EIA Regulations (published 20 October 2014), the following table has been compiled:

Table 5: Need and desirability of the proposed project

Guideline requirement	Comments on requirement
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?	
1.1 How were the following ecological integrity considerations taken into account?	
1.1.1 Threatened Ecosystems,	The site does not fall in a threatened ecosystem.
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,	A part of the northern quarry falls within and area characterised as heavily modified terrestrial and freshwater area. The backfilling of this quarry over time will help to reduce this effect of the area. It must also be noted that the Mpumalanga Biodiversity Sector Plan of 2014 indicates the quarry area as 'mining' and the adjacent land as old lands (meaning old crops).
1.1.3 CBAs and Ecological Support Areas (ESAs),	A large part of the quarry falls within an ESA. It must be noted that the site is an existing quarry. Backfilling thereof will help to ensure rehabilitation of the area.
1.1.4 Conservation targets,	*Thaba Chweu Local Municipality Integrated Development Plan (IDP) (Cllr S Mashigo-Sekgobela and team, 2017-2022):* The Thaba Chweu Local Municipality has an environmental profile that consists of nature reserves and environmentally sensitive areas. This includes natural heritage and archaeological or historical sites. It is the goal of the municipality to ensure that these regions remain undisturbed and preserved.
1.1.5 Ecological drivers of the ecosystem,	

Guideline requirement	Comments on requirement
	The eventual backfilling will help to achieve an improve 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.).	*Mpumalanga Spatial Development Framework (Data World Pty Ltd, 2019).* One of the strategic focus areas in terms of the spatial developmental strategy of Mpumalanga is Thaba Chweu. One of the main concerns addressed in this document is the need for growth in agriculture and related activities, mining and mineral beneficiation, manufacturing and trade. The municipality aims to put in place environmental management systems to protect other natural resources (water, ecosystems, agricultural land) from adverse effects of mining. As South Africa is a signatory of the Ramsar Convention for the conservation of important wetlands, we are committed to the conservation of all our wetlands. The Convention on Wetlands came into force for South Africa on 21 December 1975. South Africa presently has 21 sites designated as Wetlands of International Importance, with a surface area of 554,136 hectares (www.ramsar.org). There are no RAMSAR sites near the study area. However, the mine still takes care to avoid the pollution water resources. Further objectives include the implementation of the Mpumalanga Biodiversity Sector Plans and Environmental Management Frameworks and the evaluation of all land use applications in terms of the District/Local Environmental Management Frameworks.
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	Refer to impact assessment for the impact of the development on the biological diversity and mitigation measures thereof.

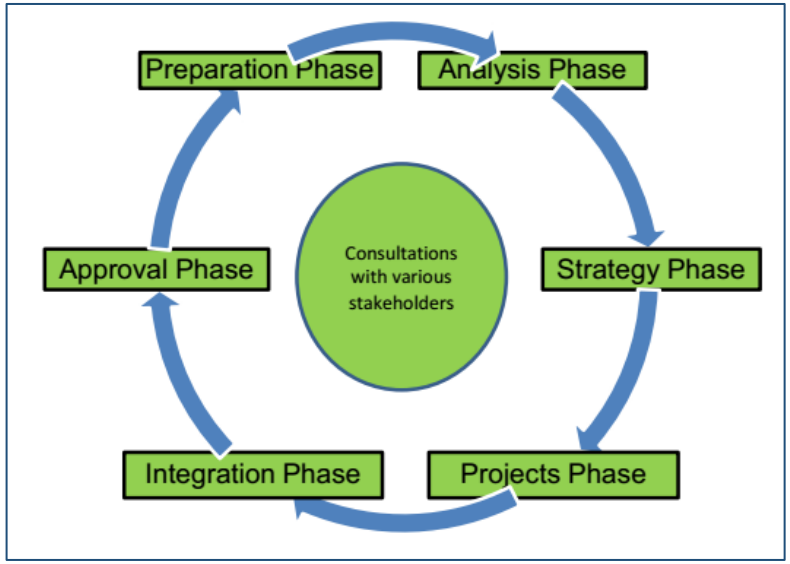
Guideline requirement	Comments on requirement
offsetting) the impacts? What measures were explored to enhance positive impacts?	
1.3 How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	
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?	This application will assist the management of waste. A waste license is not required for the backfilling of quarry 6 with mine residue (slimes and waste rock). A closure plan must thus be submitted in place of a waste license application to demonstrate rehabilitation of Quarry 6. Backfilling of wastes do pose several advantages compared to surface storage and include: • No erosion and therefore sedimentation risks towards the receiving environment. • Vertical seepage will dominate during the operational phase due to the high hydraulic conductivity of fines thereby reducing horizontal seepage risks towards the matrix and receiving environment. Seepage loads from the slimes and tailings wastes will, therefore, most probably remain isolated during the operational phases. As per the IWULA pre-application meeting that took place on the 1st of July, the following was established: (a) the mine residue is not from a Category A mine; (b) the disposal is in accordance with Government Notice No. 704 of 4 June 1999 as amended from time to time; [Regulation 4c of GN 704: No person in control of a mine or activity may place or dispose of any residue or

Guideline requirement	Comments on requirement
	substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation]. • A Waste characterisation was done, and it was found that it is a Rock type III – not acid forming. (c) The disposal will be done in accordance with SANS 10286: 1998, as amended from time to time. Therefore, various specialist studies are underway to conform to the conditions stipulated in the legislative requirements.
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?	*Cultural Heritage Resources Impact Assessment on Mine at Krugerpos (African Heritage Consultants cc, 2011):* The heritage report undertaken previously has reference: "the 2003 Google Earth image shows that the area was used for agriculture and therefore totally disturbed. From 2010 Google Earth images to the east and west of this disturbed area it is clear though that a continuous archaeological Later Iron Age site existed here."
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 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?	The area is underlain by greenish grey/dark grey laminated graphitic shale (hornfels) and fine-grained greenish dark grey biotite quartz – feldspar (hard) hornfels representing the Lydenburg Member of the Silverton Formation (Pretoria Group). This sequence is underlain by fine-grained dense dark grey to black quartzitic shale (hornfels) and fine-grained tuff and basic lava with coarse micaceous sandstone lenses locally, together representing the Machadodorp and Boven Members of the Silverton Formation. Actions required as part of backfilling: • Construct safety berms • It is recommended that a surveyor ensure these quarries have been sloped to the angle as indicated in the closure plan • Backfilling might take place if the correct licences are in place.
1.7 How will this development use and/or impact on renewable natural resources and the ecosystem of which	

Guideline requirement	Comments on requirement
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?	Positive outcomes: • Enhanced draining of water • Enhanced vegetative growth • Community and livestock safety The current mine operation at Krugerspost Andalusite Mine have been operating for over 35 years. Therefore, there is no anticipated increased dependency on resources as the proposed activity is in an already existing mining area. The proposed location, type and scale of development thus promotes a reduced dependency on resources.
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?)	

Guideline requirement	Comments on requirement
1.7.3 Do the proposed location, type and scale of development promote a reduced dependency on resources?	
1.8 How were a risk-averse and cautious approach applied in terms of ecological impacts?	Specialist studies were undertaken and included into this process.
1.8.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Once the specialist studies are complete, the limits of current knowledge, gaps, uncertainties and assumptions will be included and submitted as part of the final report.
1.8.2 What is the level of risk associated with the limits of current knowledge?	Specialist studies were undertaken and included into this process. All the limits of current knowledge, gaps, uncertainties, and assumptions were included and is appended to this report. The subsequent level of risk is also included.
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?	A risk assessment based on Appendix 3 (Minimum Content of an Environmental Risk Assessment Report) of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, 2019 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended), and regulation 60 of the Minerals and Petroleum Resources Development Regulations, GN 527 of 2004 (as amended) i.t.o. the Minerals and Petroleum Resources Development Act No 28 of 2002 was compiled for the mine in line with the annual rehabilitation plan. All risks identified will be dealt with the suggested mitigation measures as well as suggestions from the various specialist studies. A risk-averse cautious approach will be followed.
1.9 How will the ecological impacts resulting from this development impact on people's environmental right in terms following	Refer to impact assessment for a comprehensive analysis of all potential impacts.
1.9.1 Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air	Impact identification and prediction includes a stepwise procedure to identify the direct, indirect and cumulative impacts (relating to both positive and negative impacts) for which a proposed activity and its alternatives will have on the environment as well as the community.

Guideline requirement	Comments on requirement
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?	This is undertaken by determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity aspects of sites and locations as well as the risk of impact of the proposed activity. Refer to part A(h)(iv) for a complete description of these environmental attributes. Sources of data to be used for gathering data on the environmental attributes as well as the impacts include; monitoring / sampling data collected and stored, assumptions and actual measurements, published data available from the departments or other stakeholders in the area as well as specialist studies. Likely impacts are described qualitatively and then studied separately in detail. This provides consistent and systematic basis for the comparison and application of judgements.
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?	
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.)?	
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?	
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?	There is no alternative to the pumping of water from Quarry 6 and Quarry 7 or the backfilling of Quarry 6 with mine residue (slimes and waste rock). This is the best rehabilitation activities that were proposed for the mine and various specialist studies were undertaken based on this.

Guideline requirement	Comments on requirement
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?	Refer to the cumulative impact assessment.
2.1 What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	Refer to Section 2(h)(iv)(15) for the socio-economic context of the area.
2.1.1 The Integrated Development Plan (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 Local Economic Development Strategy (LED Strategy).	Phases of the IDP process can be seen in the figure above. Strategies to promote Local Economic Development (LED) are aligned to national imperatives by the municipality and can be seen in the figure below.

Guideline requirement	Comments on requirement
	
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?	The mine ensures that employment opportunities will be made available. The mine is employing 45 people of which 3 are white males, 30 are black males and 12 are black females to ensure just and equitable transformation for activities on Klipplaatdrift. This will also include the backfilling of quarry 6 on Klipfontein and the pumping of water from quarry 6 and quarry 7.
2.2.1 Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	Refer to impact assessment and Social and Labour Plan for further details.

Guideline requirement	Comments on requirement
2.3 How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	
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?	
2.5 (Not applicable)	
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)?	
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?	
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	

Guideline requirement	Comments on requirement
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?	
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 socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to impact assessment. The development aims to backfill mine residue into quarry 6. This creates jobs opportunities for the community while ensuring that the environment is rehabilitated. Backfilling will ensure that there is no erosion and therefore sedimentation risks towards the receiving environment. Vertical seepage will dominate during the operational phase due to the high hydraulic conductivity of fines thereby reducing horizontal seepage risks towards the matrix and receiving environment. Seepage loads from the slimes and tailings wastes will, therefore, most probably remain isolated during the operational phases. Backfilling will assist this process.
2.9 What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	Refer to the impact assessment in Part(2)(h)(v) which includes the environmental objective to be achieved, the phase applicable to management measure, management tools, management timeframe and schedule, monitoring programmes, responsibilities for implementation and long-term maintenance, financial provision for long-term maintenance and/or environmental costs and the mitigation hierarchy.
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?	

Guideline requirement	Comments on requirement
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?	
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?	
2.13 What measures were taken to:	
2.13.1 ensure the participation of all I&APs,	The process followed adheres to the National Environmental Management Act 107-1998 - National guideline on minimum information (20180209-GGN-41432-00086) and the 2012, IEM Guideline Series 7, Public participation, GN 807. Below is a summary of the announcement. <u>Formal announcement of the project:</u> The notices as mentioned below include all requirements as per the EIA Regulations. <u>Advertisement:</u> An advertisement was published in the local newspaper "Steelburger" on 6th March 2020. Refer to Addendum 4B for a copy and proof of this advertisement. <u>Site notice:</u> One site notice was placed at the entrance to the road from the R36 towards the mining right area. Refer to Addendum 4C for a copy and proof of this site notice as well as a map indicating location of the site notice.
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 I&APs were taken into account, and that adequate	

Guideline requirement	Comments on requirement
recognition were given to all forms of knowledge, including traditional and ordinary knowledge, and	Letters: Letters were sent to all stakeholders as well landowners to the site. Addendum 4D for a copy and proof of these letters sent. Refer to Addendum 4E for comments received and responded to. Public meeting: A public meeting will be held on 14th April 2020 at 10h00. The venue will be confirmed closer to the date depending on the number of people to attend. It will be either at the already existing mine or in Lydenburg. This EIA is simultaneously sent to DMR, the registered I&APs and stakeholder. All issues raised are included in this EIA/EMP before submission to DMR. All registered I&APs are given the opportunity to comment on the EIA. This includes any issues that they have with the proposed activity and that they believe may be of significance in the consideration of the application.
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 be promoted	
2.14 Considering the interests, needs and values of all the I&APs, 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)?	
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?	All contractors, sub-contractors and workers will attend compulsory environmental awareness training and inductions. This training will highlight the dangers associated with the workplace. Procedures relating to environmental risks will also be put in place and will be regularly updated.
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,	Additional jobs will be created, and employees will be sourced. Refer to the Social and Labour Plan for further information.

Guideline requirement	Comments on requirement
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.).	
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	Refer to section 2(i)(vii)
2.17.2 that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	
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?	

Guideline requirement	Comments on requirement
2.19 Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Refer to impact assessment mitigation measures and further refer to the rehabilitation plan.
2.20 What measures were taken to ensure that the 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?	The mine updates its financial provision on an annual basis to include all measures that must be taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment.
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?	There is no alternative to the pumping of water from Quarry 6 and Quarry 7 or the backfilling of Quarry 6 with mine residue (slimes and waste rock). This is the best rehabilitation activities that were proposed for the mine and various specialist studies were undertaken based on this.
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 the cumulative impact assessment.

g) Motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report

There is no alternative to the pumping of water from Quarry 6 and Quarry 7 or the backfilling of Quarry 6 with mine residue (slimes and waste rock). This is the best rehabilitation activities that were proposed for the mine and various specialist studies were undertaken based on this. The final decommissioning and rehabilitation will be discussed with the community. Furthermore, all activities will be planned with the aid of a specialist

.

h) Full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report

Various specialist studies were conducted as part of the EIA process. This EIA and any further documents will be made available to the stakeholders and I&APs for comments. The preferred alternative was finalised using information from both the specialists as well as the comments received.

i) Details of the development footprint alternatives considered

The following definition of "alternatives" is given in the EIA Regulations: *"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -*

(a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity; and

(f) includes the option of not implementing the activity;"

Please note the term preferred alternative is the preferred activity whereby the second alternative is the alternative to the preferred alternative.

1 The property on which or location where it is proposed to undertake the activity

No alternatives are applied for.

2 The type of activity to be undertaken

No alternatives are applied for.

3 The design or layout of the activity

There is no site layout alternative. The design or layout of the activity is as described above.

4 The technology to be used in the activity

No alternatives are applied for.

5 The operational aspects of the activity

No alternatives are applied for.

6 The option of not implementing the activity

In the case of the no go option being implemented, mining will cease once the already approved area is mined out. This will then lead to the loss of employment.

ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs

According to the Publication of Participation Guideline (NEMA), an I&AP is:

"(a) any person, group or persons or organisations interested in or affected by an activity, and (b) any organ of state that may have jurisdiction over any aspect of the activity".

This definition is more detailed in the Guideline for consultation with communities and I&APs (MPRDA):

"I&APs include, but are not limited to; (i) Host Communities, (ii) Landowners (Traditional and Title Deed owners), (iii) Traditional Authority, (iv) Land Claimants, (v) Lawful land occupier, (vi) The Department of Land Affairs, (vii) Any other person (including on adjacent and non-adjacent properties) whose socio-economic conditions may be directly affected by the proposed prospecting or mining operation (viii) The Local Municipality, (ix) The relevant Government Departments, agencies and institutions responsible for the various aspects of the environment and for infrastructure which may be affected by the proposed project."

1 Identification of interested and affected parties

Refer to Table 6 below for all I&APs and stakeholders identified. Refer to Addendum 4A for the entire database of all I&APs as well as stakeholder, and map indicating adjacent properties.

Table 6: I&APs and stakeholders identified

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Action plan forward to incorporate comments and section in this EIA	Registered I&AP or stakeholder
Affected parties				
Landowner/s or lawful occupier/s of the land and adjacent land				
Portion 36 of the farm Klipfontein 400 KT Samrec Pty Ltd	No comments received	N/A	N/A	N/A
Portion 2 of the farm Klipfontein 400 KT Axlewood Trading & Inv 104 Pty Ltd- T424/2019	No comments received	N/A	N/A	N/A
Portion 15 of the farm Klipplaatdrift 339 KT Imerys Refractory Minerals SA	No comments received	N/A	N/A	N/A
RE of the farm Klipplaatdrift 399 KT Steenekamp Jacobus Christoffel	No comments received	N/A	N/A	N/A

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Action plan forward to incorporate comments and section in this EIA	Registered I&AP or stakeholder
RE of the farm Goedvooruitzicht 394 KT Batau Ba Ga Mabelane Communal Prop Association	No comments received	N/A	N/A	N/A
Municipal councillor – ward 4				
Ms Khulumile Elizabeth Maziya	No comments received	N/A	N/A	N/A
Thaba Chweu Local Municipality				
Ms Puleng Mapheto	No comments received	N/A	N/A	N/A
Ehlanzeni District Municipality				
Mr Thapelo Shabangu	No comments received	N/A	N/A	N/A
Organs of state				
DWS Mpumalanga – Lydenburg/Mashishing Office Portia Munyai	1 July 2019 Pre-application meeting for the IWULA took place whereby the IWULA was discussed.	4 July 2019 Minutes of pre-application meeting sent to DWS.	The IWULA is finalised. The EAP will follow up with the DWS on the IWULA.	Stakeholder
Department of Agriculture Forestry and Fisheries	No comments received.	N/A	N/A	N/A

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Action plan forward to incorporate comments and section in this EIA	Registered I&AP or stakeholder
Zinzile Mtotywa/ Andrew Tshivhase				
Department of Rural Development and Land Reform David Maraba	No comments received	N/A	N/A	N/A
South African Heritage Resources Agency Nokukhanya Khumalo	12th March 2020 Nokukhanya stated that she is the case officer for developments in Mpumalanga and Limpopo. She asked if a case was created for the proposed development. 24th March 2020 Nokukhanya thanked the EAP for notifying her that a case has been created for this development and stated that she is working from home but will assign herself to this case.	The EAP sent the proof of submission of the Environmental Scoping Report to the SAHRA official. The EAP also stated that a case was created on SAHRA for the development.	Upload the final EIA onto SAHRA.	Stakeholder.
	30th of April 2020 A letter was sent to the applicant from SAHRA. It stated that the Heritage Impact Assessment (HIA) is more than 5 years and	The EAP stated that the activities being applied for on this site is to backfill an already disturbed quarry with no resources occurring. The plant to be constructed is also on top of mine residue, therefore, no	Upload the final EIA onto SAHRA.	Stakeholder.

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Action plan forward to incorporate comments and section in this EIA	Registered I&AP or stakeholder
	may be outdated. Therefore, an archaeologist must be out to site to review the HIA which must be submitted for comment. A palaeontological resources assessment must be conducted by a palaeontologist due to the high palaeontological sensitivity. This must be submitted for commenting.	heritage resources can occur on this residue and respectfully requested that a heritage and paleontological study will only be necessary, if the mine, with mining right MP196MR extents to undisturbed areas.		
Communities and traditional leaders				
Mabelane Communal Prop Association	No comments received	N/A	N/A	N/A
Historical disadvantaged communities				
None identified	N/A	N/A	N/A	N/A
Land claimants				
See above regarding land claims	N/A	N/A	N/A	N/A
Interested and affected parties				
National Federated Chamber of Commerce and Industry	10th March 2020 Edward Mobogoane, NAFCOC chairperson under NAFCOC mining sector Mpumalanga stated that they fully support the application and are willing to be part of this project as going on.	The EAP called NFCOC and discussed the matter telephonically. The EAP stated that they will provide NAFCOC with the venue of the public meeting closer to the time. The EAP further stated that they will be provided with the Environmental Scoping Report once complete.	NFCOC was registered as an I&AP and received all communication regarding the project.	I&AP

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Action plan forward to incorporate comments and section in this EIA	Registered I&AP or stakeholder
Ladwin Moraba	25th March 2020 Ladwin stated that they are an interested party over an SMS.	The EAP stated that Ladwin has now been registered as an I&AP and will receive communication henceforth.	All communication regarding the project was sent to the I&AP.	I&AP

2 Formal announcements of the project

An advertisement was published in the local newspaper, the "Steelburger" on the 6thof March 2020. Refer to Addendum 4B for a copy of the advertisement. One site notice was placed at the entrance to the road from the R36 towards the mining right area. Refer to Addendum 4C for a copy and proof of this site notice as well as a map indicating location of the site notice. Letters were sent to all stakeholders as well landowners to the site. Addendum 4D for a copy and proof of these letters sent.

A public meeting was supposed to be held on 14th April 2020 at 10h00. However, due to Covid-19 and a restriction on the number of guests at a venue, the public meeting did not take place.

A public participation plan was compiled in line with the Covid -19 regulations stating the full plan for public participation. This was then accepted by the case official. Therefore, no public meeting has taken or will take place.

3 Environmental Scoping Report and Environmental Impact Assessment Report and EMP

The ESR was sent to all stakeholders and registered I&APs. All comments that were received were included in this report. Refer to Addendum 4G for proof of the EIA sent to all stakeholders and registered I&APs.

The EIAR/EMP will be sent to all stakeholders and registered I&APs. The competent authority will also receive a copy of the EIA/EMP.

All I&APs are given the opportunity to comment on the final report if they are registered. This includes any issues that they have with the proposed activity and that they believe may be of significance in the consideration of the application. These comments need to be submitted within the specified timeframe.

The submission of the comments is received by the EAP. The organs of state have 40 days to comment (failing to do so will be taken as no comment) The DWS has 60 days in which to comment. If there are no comments within this time, then it will be regarded as no comments given to the Competent Authority (CA).

4 Decision making announcement to stakeholders and I&APs

Within 12 days of the date of decision taken by DMR, all stakeholders and registered I&APs should be notified. They should also be notified that an appeal may be lodged.

iii) Summary of issues raised by interested and affected parties and an indication of the manner in which the issues were incorporated, or the reasons for not including them

Nokukhanya Khumalo from SAHRA wanted to know if a case was created for the development as she assigned herself as the case official. NAFCOC did not raise any concerns, they wanted to be registered as I&AP and stated that they are willing to be part of the project. Ladwin stated that they would just like to also be listed as an I&AP and no further concerns were raised.

Refer to Addendum 4E for all comments received and responded to.

iv) The Environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects

1 Geology

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014):

The Rustenburg Layered Suite (Bushveld Complex) covers Gauteng, Limpopo and Mpumalanga Province as seen in Figure 6 below. The aluminous shales of the Pretoria Group within the thermal metamorphic aureole of the Bushveld Complex were metamorphosed to andalusite hornfels. The Krugerspost andalusite deposit occurs in the Magaliesburg Subgroup of the Pretoria Group, and its extent is largely defined by the subsurface weathering profile of the andalusite host rock.

Additional information was sourced from the originally approved Environmental Management Programme (author unknown, 1999).as seen below.

Karoo age dolerite intrusive dykes strike N-S, parallel to the ore body and are rarely evident within the ore zone. The associated minerology is biotite, chlorite, quartz, and sericite. No associated sulphide mineralisation occurs within the Krugerspost deposit. Orthorhombic andalusite crystals occur speckled throughout the ore body and show no preferred orientation. The crystals vary in size from less than 0,5mm to 3mm in cross section. The andalusite releases readily from the weathered host rock due to the retrogressive formation of secrete along the crystal margins.

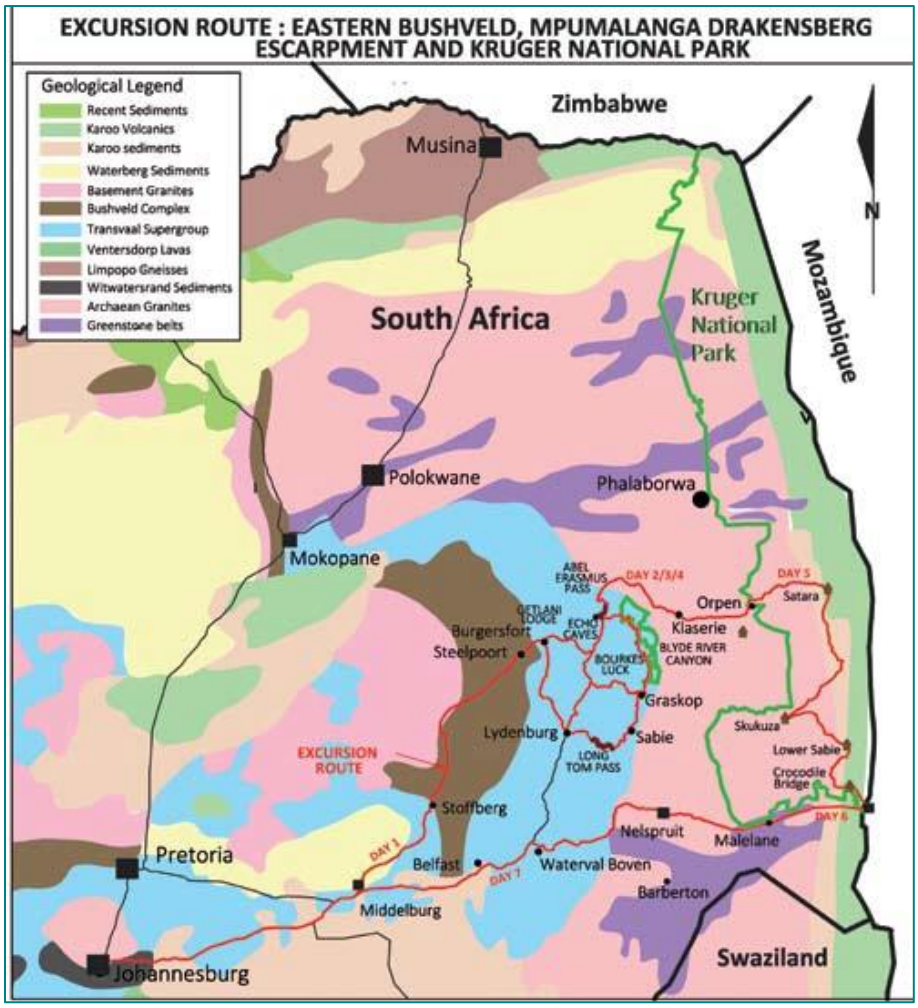


Figure 6: Bushveld complex (35th International Geological Congress, 2016)

2 Climate

The following information has been extracted from the Air Quality Impact Assessment for the Environmental Impact Assessment on Klipplaatdrift Mine (Tikotech, 2019). The information below represents the general climate of the region.

The MM5 meteorological data from 2016 to 2018 shows the average monthly temperature ranges between approximately 20°C in the summer months to 10°C in the winter months, reaching highs of 32°C and lows of 3°C. Day temperatures are higher than night temperatures, temperatures increase from around 7:00 and start to decrease again after 16:00 (Refer to Figure 7, Figure 8 and Figure 9).

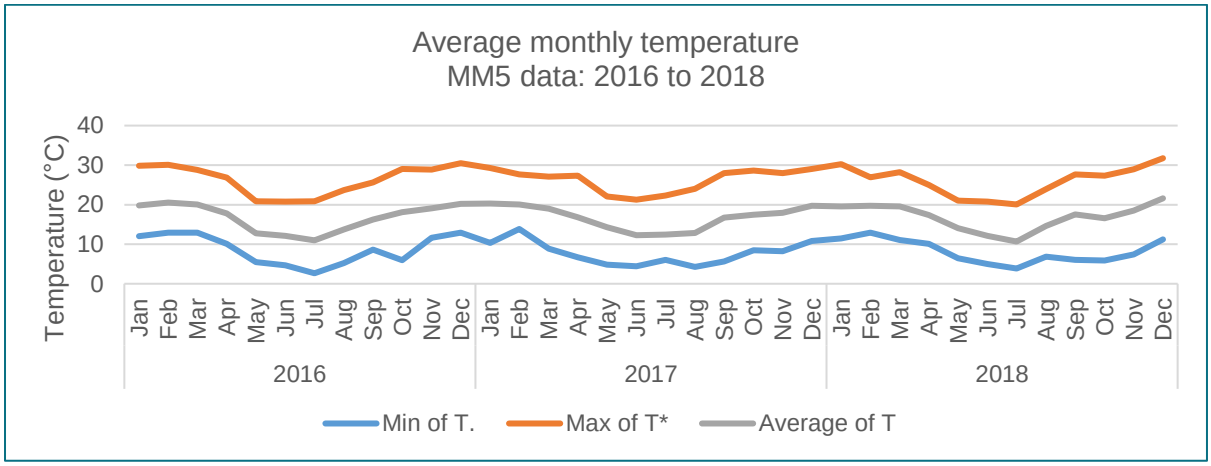


Figure 7: Average monthly temperature.

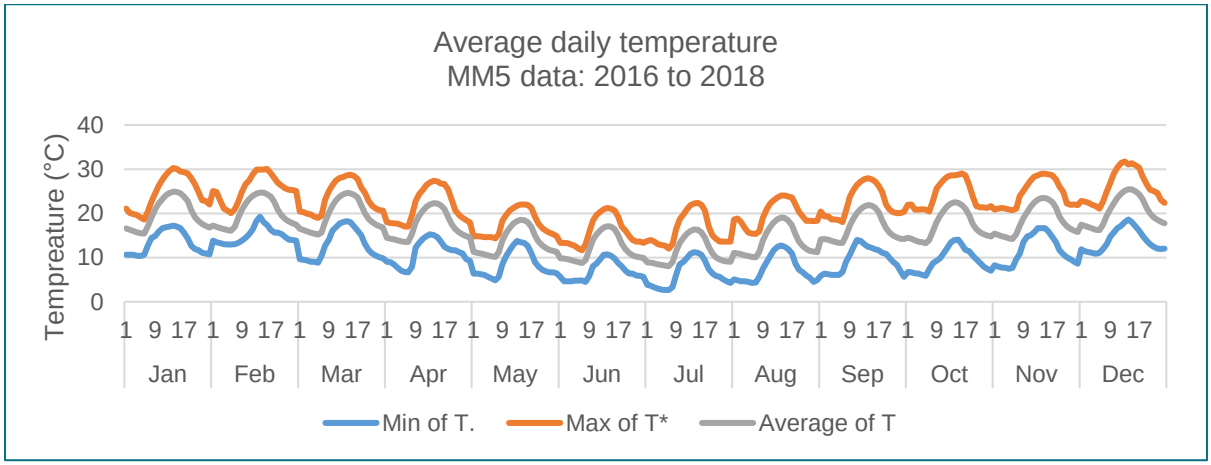


Figure 8: Average daily temperature.

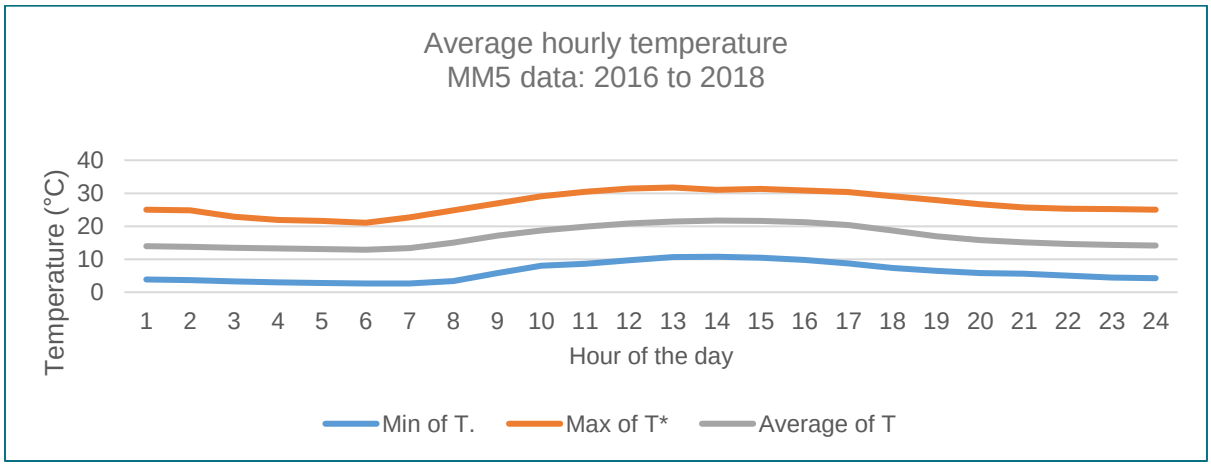


Figure 9: Average hourly temperature.

Annual rainfall in the Lydenburg thornveld grassland unit (580-810mm) and the Ohrigstad mountain bushveld unit (500-800mm) is generally lower than in surrounding areas (Mucina et al., 2006). The MM5 data shows the average annual precipitation for the site is approximately 673.89 mm/year. Precipitation is higher during the spring and summer months (Refer to Figure 10, Figure 11, and Figure 12).

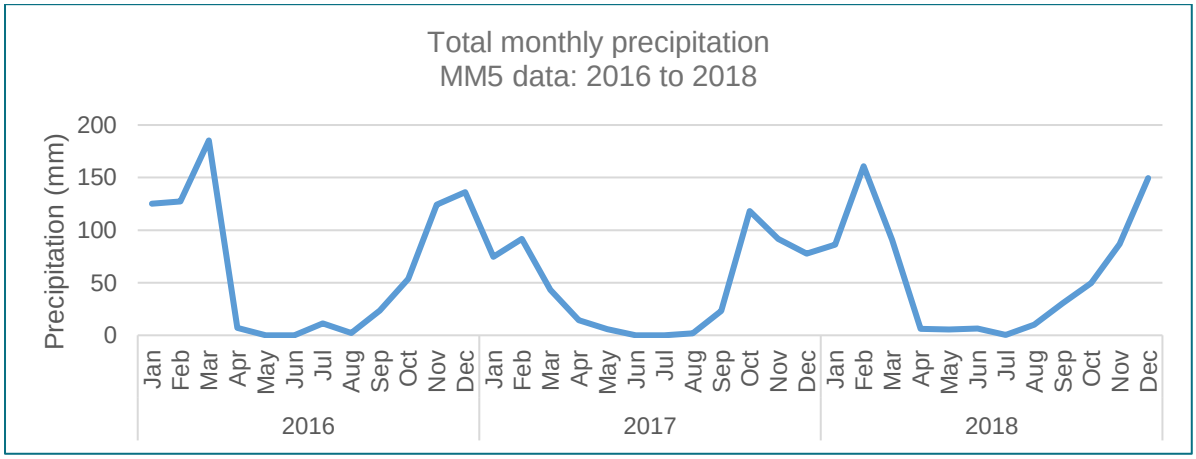


Figure 10: Total monthly precipitation

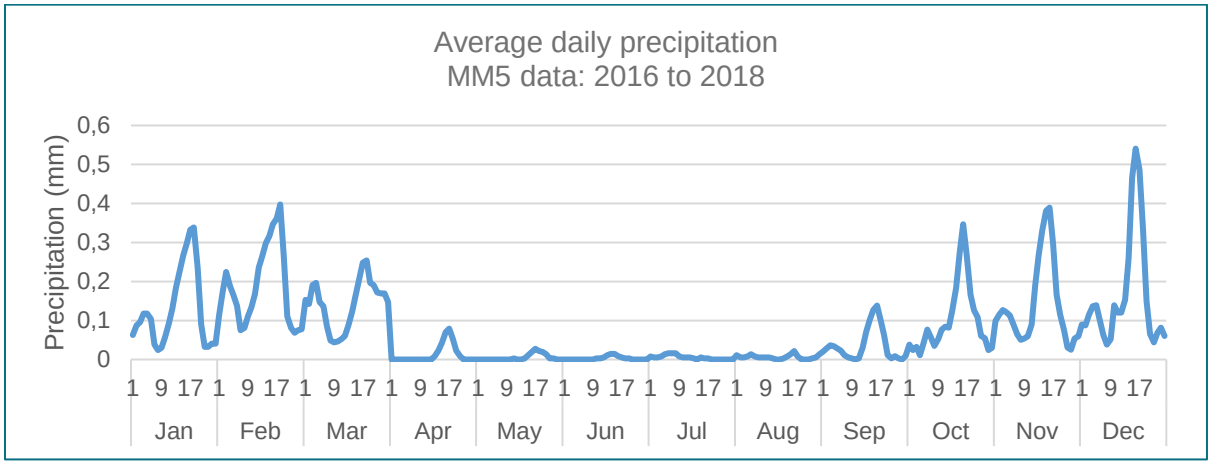


Figure 11: Average daily precipitation

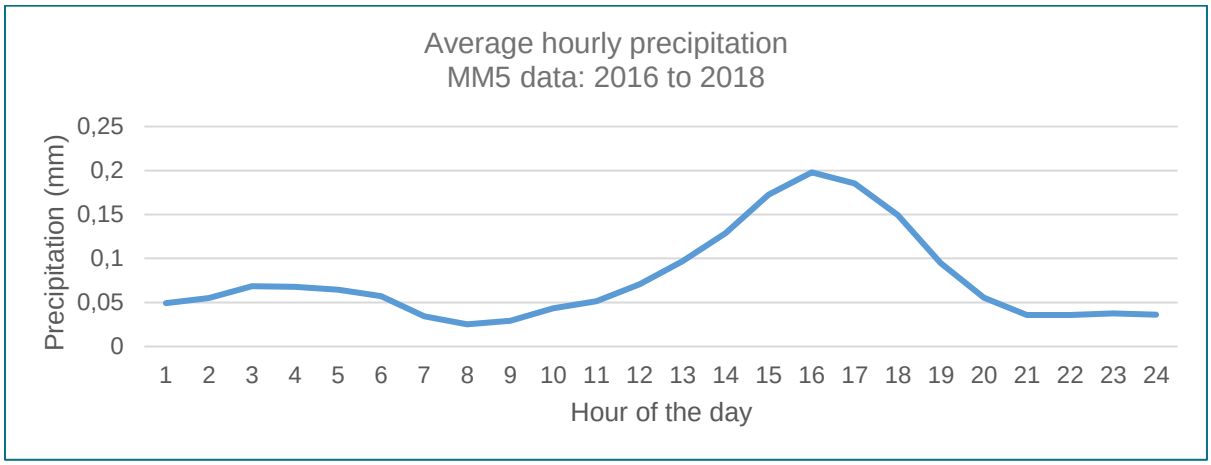
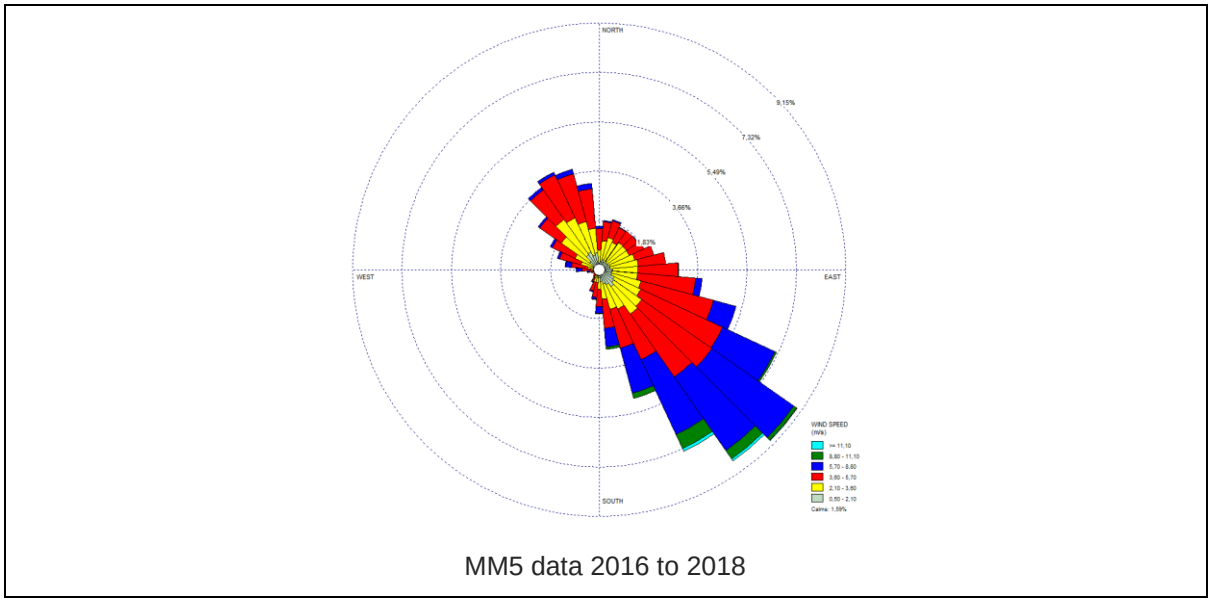
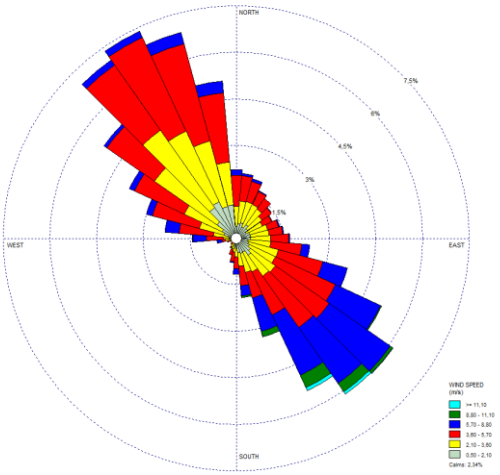


Figure 12: Average hourly precipitation

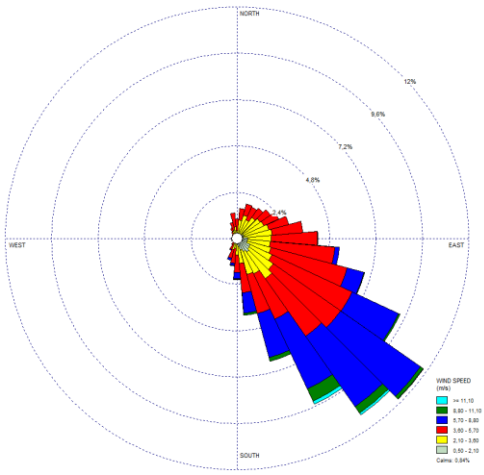
The MM5 data shows the prevailing wind direction from an east south easterly direction (104°) and an average annual wind speed of 3.87m/s. Winds of this speed can be described as a gentle breeze, characterised by leaves and small twigs in constant motion (SEPA, 2010). The dominant, stronger winds are primarily from the south east. Wind rarely blows from the north east and the south west. Calm winds (<0.5m/s) are expected approximately 1.59% of the time. Calm winds are more prevalent during the day (2.34% from 06:00 to 17:00 and 0.84% from 18:00 to 05:00). The average wind speeds are greater during the night (4.16m/s) than the day (3.58m/s) and wind speeds are on average higher than during the winter (4.14m/s) than the rest of the year (3.77m/s in spring, 3.82m/s in summer and 3.74m/s in autumn) (Refer to Figure 13 and Figure 14).



MM5 data 2016 to 2018

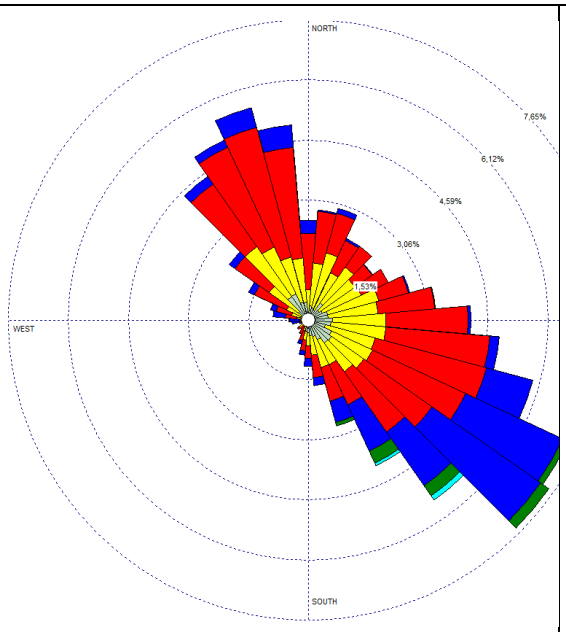


MM5 data 2016 to 2018 – Day (06:00 to 17:00)

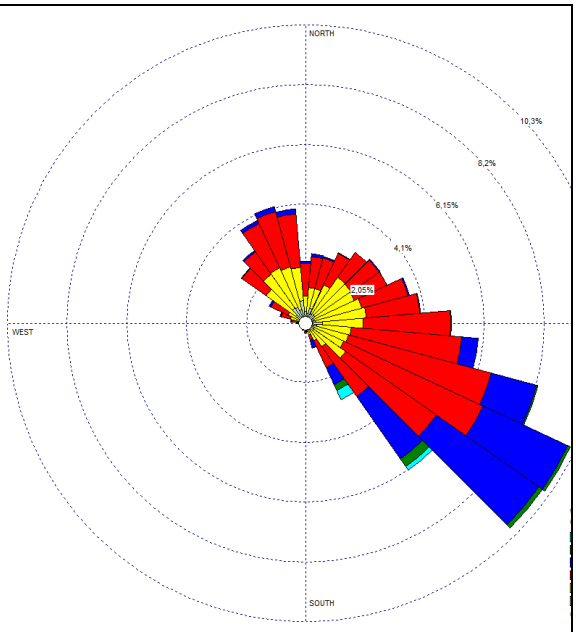


MM5 data 2016 to 2018 – Night (18:00 to 5:00)

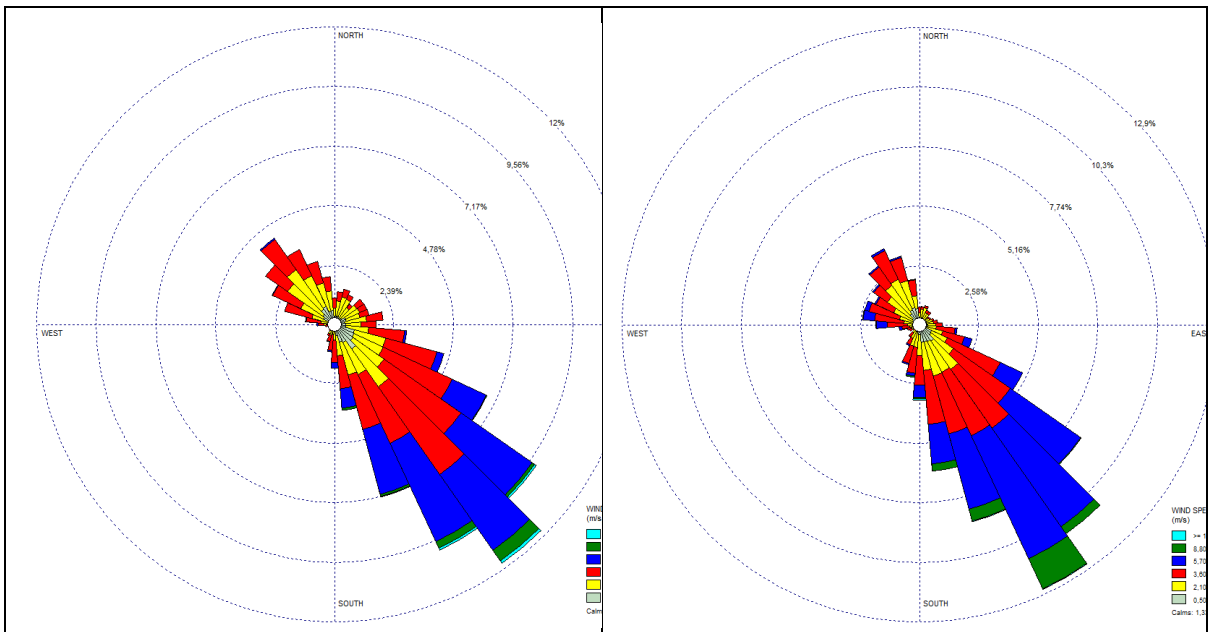
Figure 13: Wind roses (Annual and diurnal)



MM5 data 2016 to 2018 – Spring (Sep to Nov)



MM5 data 2016 to 2018 – Summer (Dec, Jan & Feb)



MM5 data 2016 to 2018 – Autumn (Mar to May)

MM5 data 2016 to 2018 – Winter (Jun to Aug)

Figure 14: Wind roses (Seasonal)

3 Topography

Information for this section was extracted from the Klipplaatdrift Stormwater Management Plan (SWMP) (Rational Environmental (Pty) Ltd, 2019):

The site is located along a flat regional area with a slight drainage to the East. Most of the surroundings are naturally vegetated bushveld. The site has a slight drainage towards the North East. Drainage within the site is uniform with clean runoff will be diverted around the operations, while internal runoff will be collected within the quarry and dewatering discharged into the adjacent quarry. There is no surface water exiting the site. According to Figure 15 below, the topography of the site ranges from 1400m to 1450m.

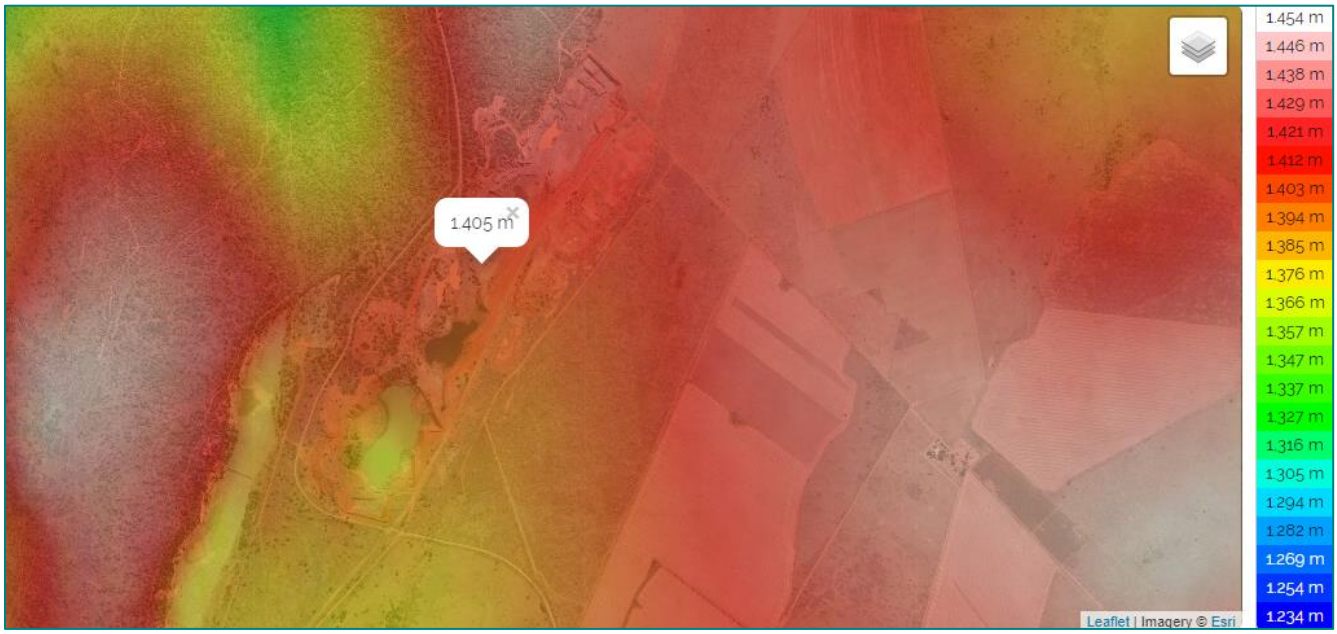


Figure 15: Topography of Quarry 6 (https://en-za.topographic-map.com/maps/jmbz/Mashishing-Lydenburg/)

4 Soil, land capability, and pre-mining land use

The following information is extracted from the approved Environmental Management Programme (author unknown, 1999).

In the north-eastern sector, approximately 25% of the mining area was relatively good arable land. To the north, west and south of the mined area clay, boulder rich soils suitable for only grazing occurred. Approximately in the middle of the mined area, deep lowlands-type arable soils occurred. These soils were of poor quality due to the high silt content and moderate blocky structure.

To the north, west and south of the mined area, and probably underlying the southern dump of transported materials, red, clayley soils of variable depth, containing 10 to 60% surface boukders occur. These soils are situated to grazing only due to rockiness and/steep slopes. They are slightly acid, with high exchangeable magnesium and high silt content.

Approximately in the middle of the mined area, deep, red-brown, structured, lowland-type soils occur. These soils are arable. Their quality is, however, negatively affected by high silt content and moderate block structure. Much of the land originally constituted by these soils is now covered by the eastern, levelled, dumps.

The dumps of dark coloured, coarse sand contain very little, if any, fine material. It has a high cation exchange capacity, which is almost fully occupied by magnesium. The material is slightly acid.

Phosphate is released in places. This material is not suitable as reclamation material on its own, due to very low water holding capacity and susceptibility to wind and water erosion.
No mention is made of the residual impacts on the soil in any of the specialist studies. It is, however, assumed that the residual impacts on the soil will be significant. Very little topsoil was stockpiled during the mining activities. Topsoil is mixed with overburden and shows signs of erosion. Until such time that revegetation is completed, these areas will be prone to soil erosion.

5 Vegetation

The following information is extracted from the approved Environmental Management Programme (author unknown, 1999).

The area as described by Acocks is mixed bushveld, which is very mixed bush and may be characterised as "*Acacia nigresens* veld". The hill slopes are well wooded with a large variety of medium species of trees as well as shrubs and aloes. No endangered or rare species have been found. No invader species were identified prior to mining. The dominant grass species found in undisturbed areas are Aristida scrabrivalus and Enneapoga centroides. The following species of trees occur on the area of the ore body; Acacia nigrescence (Knob thorn), Acacia Tortillas (Umbrella thron), Acacia sieberana (Paperbark acacia), Acacia permixta (Slender thorn), Acacia senegalis (Three hook thorn), Commiphora chimperi (Glossy-leaved Commiphora), Kerkil wilmsii (Mountain seringa). There have been no endangered or rare species found on site as well as invader species. However, it must be noted that these were identified a while ago, an updated study must be conducted for current site conditions.

6 Animal life

Information for this section was extracted from the Aquatic ecosystem delineation, fauna and flora assessment for the proposed expansion of the Krugerspost mine, Mpumalanga (Limnology, 2019):

The local occurrences of mammals are closely dependent on broadly defined habitat types: terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. From a mammal habitat perspective, it was established that all four major habitats are naturally present on Klipplaatdrift, namely terrestrial, arboreal, rupicolous and wetlands.

No moribund termitaria were recorded on Klipplaatdrift. These structures are good indicators of the occurrence of small mammals. Accordingly, it is estimated that the mammal population density for Klipplaatdrift is lower. At the time of the site visit the basal cover was good in many places and would provide adequate nourishment and cover for small terrestrial mammals.

Rupicolous habitats were found in some areas on the Klipplaatdrift. Good manmade rupicolous habitat for small mammals exists in the form of loose stones along the gravel road of Klipplaatdrift. These rupicolous habitats offer nooks and crannies as refuge for most rupicolous mammals.
Natural arboreal habitat is also present on Klipplaatdrift especially north of Klipplaatdrift. The larger trees may offer refuge for arboreal mammals. There are several dead logs, which would provide shelter and food for mammals.

The site does not have any caves suitable for cave-dwelling bats. The buildings near the site may act as substitute daytime roosts. The Echo caves are situated some distance to the north of the site. It is likely that common bats commute from roosting sites elsewhere to hawk for insects over the wetlands on the study site.

- Connectivity is very good with areas around the study site. Real opportunities for migration exist along the drainage line and ridges.
- Sight records were also used to compile this mammal report.

From a herpetological habitat perspective, it was established that all four major habitats are naturally present on Klipplaatdrift, namely terrestrial, arboreal, rupicolous and wetland-associated vegetation cover.

Most of Klipplaatdrift consists of secondary grassland. The natural grassland has been transformed in some parts for agricultural purposes like old fields and grazing by cattle. Other anthropogenic influences such as roads, fences and invasive plants have also altered parts of the site. Klipplaatdrift is thus ecologically disturbed in places. No moribund termitaria were recorded. These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the reptile and amphibian population density for Klipplaatdrift is lower. At the time of the site visit, the basal cover was good in most places, despite grazing by cattle, and would provide adequate cover for small terrestrial herpetofauna. The grasslands on Klipplaatdrift have not been severely transformed and prey is probably widely distributed, so foraging grounds would not need to be very extensive to support the different populations of herpetofauna.

Five (5) major avifaunal habitat systems were identified within Klipplaatdrift. These habitat systems are as follow:

- Acacia dominated mountain bushveld
- Acacia dominated woodland savanna
- Cultivated and fallow fields
- Man-made impoundments and water filled quarries
- Disturbed and transformed area

Of the 291 avifaunal species recorded for the 2430CD q.d.g.c. during the current SABA2 period, 101 are likely to occur on Klipplaatdrift and 64 of these avifaunal species were actually observed within Klipplaatdrift during the time of the survey.

7 Surface water

Information for this section was extracted from the Aquatic ecosystem delineation, fauna and flora assessment for the proposed expansion of the Krugerspost mine, Mpumalanga (Limnology, 2019):

Krugerspost falls in the Eastern Bankenveld (no 7) as described in the Level 1 Ecoregions by the Department of Water Affairs and Forestry (DWAF, 2005).

Primary boundary determinants are closed hills and mountains with moderate and high relief together with North-eastern Mountain Grassland and Mixed Bushveld are definitive of the region. Distinctive escarpments occur along the eastern boundary. Large rivers that traverse the area are the Olifants, Elands and Steelpoort with perennial tributaries in the region contributing to their flow. The Crocodile River (East) has many of its sources in this area.

- Mean annual precipitation: Moderate to moderately high.
- Coefficient of variation of annual precipitation: Low to moderate.
- Drainage density: Predominantly medium.
- Stream frequency: Medium/high but low/medium in limited areas.
- Slopes <5%: <20%, 20-50% in limited areas.
- Median annual simulated runoff: Mostly moderate but moderately high in areas.
- Mean annual temperature: Mostly moderate

The mine is in the B42E quaternary catchment of the Olifants Water Management Area and the Central Transvaal (Bushveld) Basin. The Spekboom River runs approximately 3km to the south west from the current mining activities.

8 Groundwater

The following was extracted from the Geohydrological impact assessment for the quarry operations at Klipplaatdrift and Klipfontein (Shangoni Aquascience, 2019):

A desk study was conducted to gather all relevant environmental information, including topographical, hydrological and geohydrological data. Data/information was also gathered from previous relevant studies conducted for Krugerspost Mine as well as data published in the public domain National Groundwater Archive (NGA) hydrocensus.

The aquifer classification system used to classify South African aquifers is the National Aquifer Classification System developed by 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 suggested that aquifer classification forms a very useful planning tool that can be used to guide the management of groundwater issues.

8.1 Aquifer classification

The South African Aquifer System Management Classification is presented by five major classes listed below and defined in Table 7:

- Sole Source Aquifer System
- Major Aquifer System
- Minor Aquifer System
- Non-Aquifer System
- Special Aquifer System

Table 7*:* Aquifer classification scheme *(Parsons, 1995)*

Aquifer system	Defined by Parsons (1995)	Defined by DWA minimum requirements (DWAF, 1998)
Sole source aquifer	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.	An aquifer, which is used to supply 50% or more of urban domestic water for a given area for which there are no reasonably available alternative sources should this aquifer be impacted upon or depleted.
Major aquifer	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.	High yielding aquifer (5-20l/s) of acceptable water quality.
Minor aquifer	These can be fractured or potentially fractured rocks that do not have a high primary hydraulic conductivity, or other formations of variable hydraulic conductivity. 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.	Moderately yielding aquifer (1-5l/s) of acceptable quality or high yielding aquifer (5-20l/s) of poor quality water.
Non-aquifer	These are formations with negligible hydraulic conductivity 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.	Insignificantly yielding aquifer (< 1l/s) of good quality water or moderately yielding aquifer (1-5l/s) of poor quality or aquifer which will never be utilised for water supply and which will not contaminate other aquifers.

Aquifer system	Defined by Parsons (1995)	Defined by DWA minimum requirements (DWAF, 1998)
Special aquifer	An aquifer designated as such by the Minister of Water Affairs, after due process.	

8.2 Aquifer vulnerability

Groundwater plays an important role in supplying water to many regions of Southern Africa due to its low annual average precipitation of 460mm, which is well below the world average of 860mm. The quality of groundwater resources in South Africa has therefore received considerable focus and attention on the need for a proactive approach to protect these sources from contamination (Lynch *et. al*., 1994). Groundwater protection needs to be prioritised based upon the susceptibility of an aquifer towards pollution. This can be done in two ways, namely i) pollution risk assessments and ii) aquifer vulnerability. Pollution risk assessments consider the characteristics of a specific pollutant, including source and loading while aquifer vulnerability considers the characteristics of the aquifer itself or parts of the aquifer in terms of its sensitivity to being adversely affected by a contaminant should it be released.

The DRASTIC model concept developed for the USA (Aller *et. al*., 1987) is well suited for producing a groundwater vulnerability evaluation for South African aquifers. The DRASTIC evaluates the intrinsic vulnerability (*IV*) of an aquifer by considering factors including **D**epth to water table, natural **R**echarge rates, **A**quifer media, **S**oil media, **T**opographic aspect, **I**mpact of vadose zone media, and hydraulic **C**onductivity. Different ratings are assigned to each factor and then summed together with respective constant weights to obtain a numerical value to quantify the vulnerability:

$$\text{DRASTIC Index } (IV) = DrDw + RrRw + ArAw + SrSw + TrTw + IrIw + CrCw$$

Where *D*, *R*, *A*, *S*, *T*, *I*, and *C* are the parameters, *r* is the rating value, and *w* the constant weight assigned to each parameter (Lynch *et al*, 1994). The scores associated with the vulnerability of South African aquifers are shown in Table 8.

Table 8: South African National Groundwater Vulnerability Index to Pollution (Lynch et al, 1994)

Score	Vulnerability
50-87	Least susceptible
87 - 109	Moderate susceptible
109 - 226	Most susceptible

The concept of DRASTIC in vulnerability assessments is based on:

- A contaminant is introduced at the surface of the earth or just below it (such as in backfilling).
- A contaminant is flushed into the groundwater by precipitation.
- A contaminant has the mobility of water.
- The area evaluated is 0.4km^2 or larger.

The weighting for each parameter is constant. The minimum value for the DRASTIC index that one can calculate (assuming all seven factors were used in the calculation) is therefore 24 with the maximum value being 226. The higher the DRASTIC index the greater the vulnerability and possibility of the aquifer to become polluted if a pollutant is introduced at the surface or just below it.

8.3 Hydrocensus

A hydrocensus was performed on and around the study areas to identify groundwater users, groundwater potential and baseline data. The survey was conducted in June 2019. A previous hydrocensus was conducted in May 2013 during a hydrogeological study for Krugerspost (Shangoni, 2013). In addition to these boreholes being re-surveyed new boreholes were also included in the hydrocensus.

During the hydrocensus, all available details of boreholes and borehole-owners were collected and recorded. Where possible, information was collected on water use, water levels and yields of boreholes, etc. This information was used to assess the potential risk posed by the mining activities on the groundwater regime and users thereof. The following parameters were captured during the hydrocensus:

- XYZ Coordinates
- Existing equipment
- Current use
- Future use
- Yield
- Drill depth
- Static/dynamic water level
- Water quality
- Photograph

The hydrochemical data generated from this phase should be used as baseline quality to enable impact quantification by means of long-term monitoring.

8.4 Geophysical survey and results

8.4.1 Methodology followed

A geophysical survey was conducted to site suitable locations for drilling of monitoring and/ or characterisation boreholes. Two geophysical techniques were employed in this study, namely the electromagnetic and magnetic method. Four (4) geophysical traverses equalling 2km in total length (Figure 16) were conducted on the 19^{h} of June 2019.

- Traverse 1 targeted a linear feature as indicated on the 1: 250 000 (2430 Pilgrims Rest) geological map.
- Traverse 2 targeted a dolerite dyke that was indicated on the geological map.

- Traverses 3 and 5 targeted the linear feature north of traverse 1 and west of the study area.

The Magnetic method attempts to differentiate between lateral differences in the earth's magnetic field. These differences or anomalies indicate different types of underlying rock formations and/or variations in depth of these different formations. The magnetic surveys are normally done in a linear traverse and are normally applied in the following situations:

- Tracing of intrusive dolerite or diabase dykes or sills,
- Tracing of contact zones between different formations, and
- Tracing of possible fault zones.

The Electromagnetic method attempts to measure the conductivity of rock. The application in ground water exploration can be found in the fact that there is a relationship between the conductivity of a formation and the porosity thereof, the connection between pores, the volume of water in the pore and the conductivity of the water in the pore. The method can be used to do lateral profiling of strata and is applied in the following situations:

- Identification of thin linear zones of conductivity, in particular fracture zones, fault zones, weathered dykes and contact zones of different hydrological regimes; and
- The identification of contamination plumes.

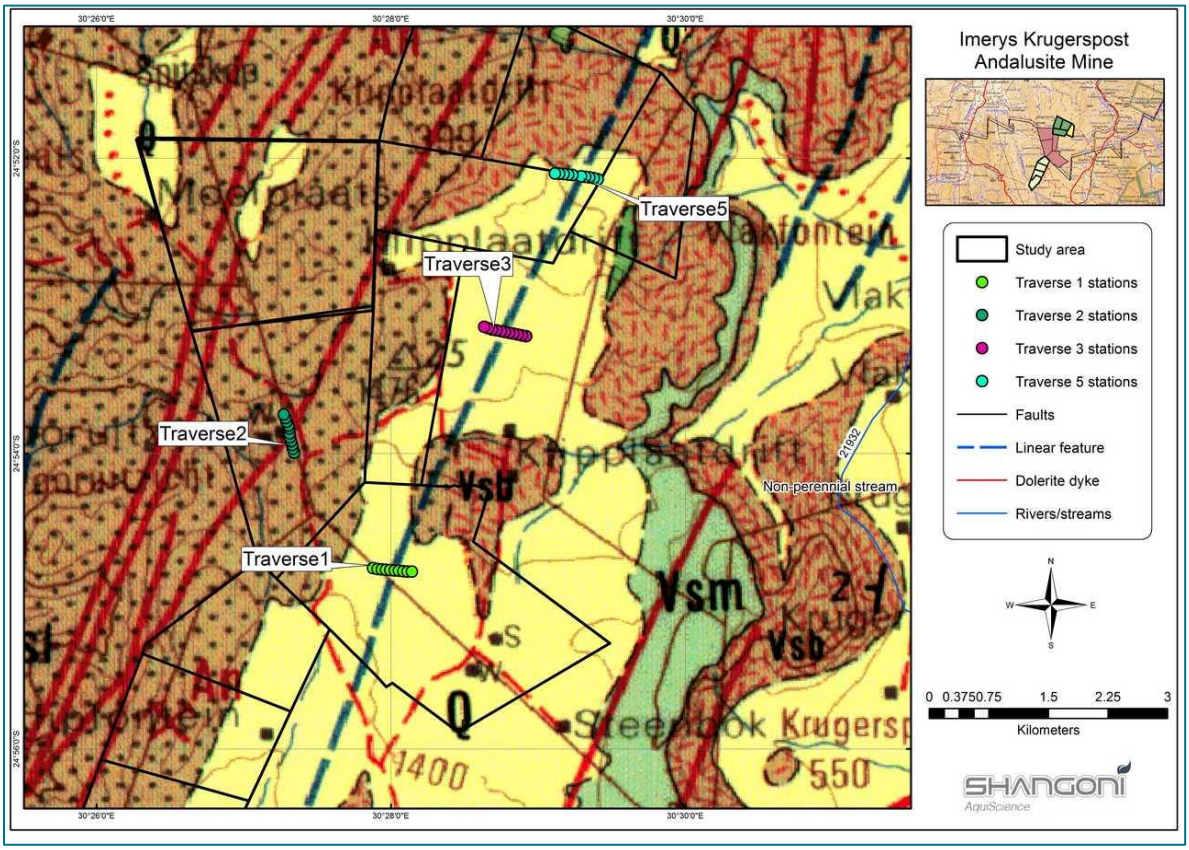


Figure 16: Electro-magnetic (EM) and magnetic geophysical traverses conducted at Krugerspost

8.4.2 Geophysical Results

As discussed above, magnetic and electro-magnetic investigations were carried out on suspected geological anomalies. The results can be viewed in Appendix A. To summarise the findings the following:

Traverse 1:

A spike in the magnetic data, indicative of a dolerite dyke, was recorded at stations 255 and 260m. The EM data indicate areas of increased weathering in the vicinity of the suspected dyke.

Traverse 2:

The magnetic data was inconclusive to suggest the presence of a linear dolerite dyke, although a small spike is visible at station 280m. The EM data does show increasing low vertical dipole (VD) and increasing horizontal dipole (HD) readings at station 290m, which could indicate an area of weathering or increased mineralisation.

Traverse 3:

A magnetic anomaly was recorded at station 340m. The EM data also indicate areas of weathering in this area, indicating the presence of a dolerite dyke.

Traverse 5:

The magnetic data shows no significant anomaly, although a magnetic high was recorded at the beginning of the traverse at station 5m. VD readings do show high but erratic readings and could indicate areas of shallow weathering or mineralisation.

8.4.3 Drilling and siting of boreholes

No new boreholes were drilled as part of this study. However, based on the geophysical investigation, additional monitoring and/ or characterisation boreholes should be drilled in the vicinity of geophysical anomalies identified on traverses 1 and 2 during the geophysical investigation.

Table 9: Positions of recommended monitoring and characterisation boreholes

Traverse No	Station No.	Coordinates	
1	230	S24.913181	E30.466837
2	250	S24.897710	30.455172

8.5 Aquifer testing

8.5.1 Falling Head Aquifer Tests

Falling head tests were conducted on five (5) monitoring boreholes to determine the hydraulic conductivity (K) of the aquifer. A falling head test is a quick and easy method that can be used to predict the yield of the borehole and the aquifer characteristics by measuring the rate of recovery of the water level after a sudden change in pressure. The test was performed by suddenly raising the static water level in the borehole with the aid of a certain volume of water being introduced into the borehole. The

water replaces its volume in the borehole, thus increasing the pressure in the borehole. The equilibrium in the water level is thus changed and it will recover or stabilise to its initial level. By measuring the rate of recovery or recession of the water level (time taken to recover), the permeability of the aquifer can be measured. The rate of water level change is a function of the K of the formation and the geometry of the well or screened interval. The recovery of the water table was measured over time using a pressure transducer. The data gathered were analysed by means of the Bouwer and Rice method (Bouwer and Rice, 1976) using the software programme FC-Excel as developed by the Institute for Groundwater Studies, University of the Free State.

8.5.2 Double Ring Soil Infiltration tests

The double ring infiltration test (Bouwer, 1966) is a widely used method of infiltration test to determine the saturated hydraulic conductivity (K_{fs}) of the soil. Field-saturated hydraulic conductivity is the hydraulic conductivity of the soil when it has been brought to a near-saturated state by water applied abundantly at the land surface, typically by processes such as ponded infiltration or copious rainfall or irrigation. This type of wetting normally traps air in a significant fraction of the pores, both large and small and the conductance of channels with trapped air is much less than it would be if the channels were completely water saturated.

The testing device consists of two concentric metal rings, which are driven into the soil, and of a perforated metal plate. The rings are partially inserted into the soil and filled with water, after which the speed of infiltration is measured. The double ring limits the lateral spread of water after infiltration. Examples of soil types based on values of saturated hydraulic conductivity K, are given in Table 10.

Table 10: Soil classification table based on values of saturated hydraulic conductivity K

Soil (according the relative permeability)	Range of saturated hydraulic conductivity (m/s)	Examples of soil types
Highly impermeable	$< 10^{-10}$	Clays with low and medium plasticity, clays with high and extremely high plasticity
Impermeable	from 10^{-8} to 10^{-10}	Gravel loams, gravel clays and sandy clays, loams with low and medium plasticity
Lowly (poorly) permeable	from 10^{-6} to 10^{-8}	Sandy loams, loamy sands and clayey sands, loamy gravels and clayey gravels
Permeable	from 10^{-4} to 10^{-6}	Sands and gravels, containing fine-grained fraction (5 – 15 %)
Highly permeable	$>10^{-4}$	Sands and gravels without or with very low fine-grained fraction (<5%)

8.6 Sampling and chemical analysis

Ground- and surface water samples were taken during the hydrocensus that was conducted in June 2019. Samples were taken using relevant and industry standards and all samples were delivered to a

South African National Standards (SANAS) accredited water laboratory. The results are presented and discussed in Section 5.6 of the geohydrological study.

8.7 Acid generation capacity

A variety of mining wastes, most notably tailings, overburden and slimes contain sulphidic material (mostly pyrite) which may oxidise to produce acid mine drainage (AMD). The result is sulphuric acid generation which acidifies water it comes in contact with. This has several negative consequences and most notably includes the solubilisation of a variety of trace metals and metalloids. A number of factors control the generation of AMD, but the most important are the relative abundance of acid producing minerals (generally the sulphides) and acid consuming minerals (generally carbonates), moisture content/ ingress and exposure to air. As AMD has the potential to impact significantly on surface and groundwater quality, it is necessary to also quantify the potential of waste to generate acid.

Acid-Base Accounting is a straightforward test to determine the acid potential of rock. The total acid generating potential (AP) is calculated from the total sulphur content of the rock material. The neutralising potential (NP) of minerals in the material is measured by reacting a finely ground sample of the test material with a measured excess of hydrochloric acid and back-titrating to a selected pH endpoint between 6.0 and 8.3 (to differentiate between the actions of carbonates and silicates). The balance between the potentially acid consuming and potentially acid generating minerals in the sample is expressed as the net neutralising potential (NNP).

The ABA analysis conducted for residue waste indicates that the mine residue generated is non-acid producing (Table 11). The total sulphur (S) percentage analysed and the resultant AP are very low. The NP and NNP are relatively high indicating an abundance of neutralising minerals such as carbonates and silicates. The waste would therefore have the potential to neutralise any acidity *in situ* should it be produced.

Table 11: Acid base accounting results for Krugerspost mining waste

Acid – Base Accounting Modified Sobek (EPA-600)	**Sample Identification**	
	Waste Rock	
Paste pH	6.1	6.0
Total Sulphur (%) (LECO)	0.01	0.01
Acid Potential (AP) (kg/t)	0.31	0.31
Neutralization Potential (NP)	3.96	4.71
Nett Neutralization Potential (NNP)	3.65	4.39
Neutralising Potential Ratio (NPR) (NP : AP)	12.7	15.1
Rock Type	**III**	**III**

If NNP (NP – AP) < 0, the sample has the potential to generate acid

If NNP (NP – AP) > 0, the sample has the potential to neutralise acid produced

As a result of the low acid forming potential, it is unlikely that significant acid (if any) will be generated from the waste. The pH is likely to be neutral to slightly alkaline and heavy metal solubilisation will therefore be minimal. The rock type can therefore be classified as a ***Type III*** which is defined as "***non-acid*" forming** (Table 12).

Table 12: Rock Classification

TYPE I	Potentially Acid Forming	Total S(%) > 0.25% and NP:AP ratio 1:1 or less
TYPE II	Intermediate	Total S(%) > 0.25% and NP:AP ratio 1:3 or less
TYPE III	Non-Acid Forming	Total S(%) < 0.25% and NP:AP ratio 1:3 or greater

8.8 Hydrogeology

8.8.1 Unsaturated zone (vadose zone)

The characteristics of vadose zone vulnerability dominating factors are closely related to the migration and transformation mechanisms of contaminants in the vadose zone, which directly affect the state of the contaminants percolating to the groundwater. The permeability and thickness of the unsaturated zone are some of the main factors determining the infiltration rate, the amount of runoff and consequently the effective recharge percentage of rainfall to the aquifer. The type of material forming the unsaturated zone as well as the permeability and texture will significantly influence the mass transport of surface contamination to the underlying aquifer(s). Factors like ion exchange, retardation, biodegradation and dispersion all play a role in the unsaturated zone.

The thickness of the unsaturated zone was determined by subtracting the undisturbed static water levels in the study area from the topography. Water level measurements showed that the depth to water level, and thus the unsaturated zone, generally varies between 3 and 27 meters below ground level.

The permeability of this zone was determined by double-ring infiltration tests. The results are displayed in Table 13. These results indicate that the soils range from sandy loams, loamy sands and clayey sands, loamy gravels and clayey gravels to sands and gravels, containing fine-grained fractions (5 – 15%).

Table 13: Soil permeability results

Site ID	Latitude	Longitude	Minimum (m/s)	Maximum (m/s)	Average (m/s)
DT 01	-24.87182	30.47807	$5.4x10^{-6}$	$1.3x10^{-5}$	$8.4x10^{-6}$
DT 02	-24.88788	30.46746	$1.3x10^{-5}$	$3.6x10^{-5}$	$1.8x10^{-5}$
DT 03	-24.91223	30.46889	$5.4x10^{-6}$	$3.9x10^{-5}$	$1.3x10^{-5}$

8.8.2 Saturated zone

Lithologies and geological features that are potentially water bearing in the study area include alluvium, weathered and fractured rock of the Silverton Formation that comprise mainly of shales. Groundwater occurrence favours weathered shale, brecciated or jointed zones and especially the contact zone between intrusive dolerite dykes and shale. The following types of natural groundwater bearing horizons can be found:

i. Seasonal perched aquifer also sometimes associated with wetlands (unconfirmed).
ii. Weathered horizon (secondary, semi-confined with moderate aquifer potential).
iii. Regional fractured horizon (secondary, confined/semi-confined & moderate aquifer potential).

Weathered horizon

The weathered zone hosts the unconfined or semi-confined shallow weathered aquifer or hydro-stratigraphic zone. The zone is on average 15 – 20m thick and water levels are often shallow (few meters below ground level). Due to direct rainfall recharge and dynamic groundwater flow through the unconfined aquifer in weathered sediments, the water quality is generally good, but also vulnerable to pollution. A weathered water bearing horizon is defined as groundwater saturated strata which possesses a secondary porosity associated with weathering of rock strata. The weathered water bearing horizon may or may not be hydraulically connected with the regional fractured water bearing horizon, depending on the presence, thickness and weathering of confining layers (typically horizontal sills or shale layers). Water intersections in the weathered aquifer are mostly above or at the interface to fresh bedrock, where less permeable layers of weathering products and capillary forces limit the vertical percolation of water and promote lateral water movement. Groundwater daylights as springs (contact springs) where the flow path is obstructed by palaeo-topographic highs of the basement rocks or more often in the area of interest where the surface topography cuts into the groundwater level at e.g. drainage lines (free draining springs).

The weathered horizon is typically not regarded as good aquifers but suitable for household supply, with yields ranging between 0.1 and 1.0l/s but typically less than 0.5 l/s. Where the weathered aquifer does become significant is from a pollution transport perspective. This aquifer is not considered to be a significant aquifer in terms of yields.

Fractured horizon

A fractured water bearing horizon is defined as a groundwater saturated stratum displaying secondary porosity due to fracturing. Fractured horizons are common in shaly host rock of the Silverton Group of the Transvaal Sequence of rocks. The permeability within the shale rocks is extremely low and the matrix is not expected to allow any significant groundwater flow. Therefore, groundwater flow in the sedimentary rocks is expected only along weathered zones and fractures.

The fractured horizon is confined but may be semi-confining at places of extreme weathering. The aquifer depth extends from a depth of ±20-100mbs with limited yields at depth, indicating the absence of major water bearing fractures and low permeability at depth. Aquifer tests within the study area also confirmed this low permeable groundwater zones. The aquifer can be regarded as heterogeneous having a moderate fracture network formed in the consolidated and mostly impervious matrix because of tectonic and depositional stresses. Movement of groundwater is mostly restricted to fracture and aperture flow although the shale matrix may also contribute as seepage, albeit very little.

The fractured rock aquifer is a more reliable source of groundwater compared to the weathered zone aquifer although salinity may be somewhat higher due to longer exposure times of the water with the rock. Typical characteristics of the fractured flow aquifer are:

- They are present as either confined or semi-confined aquifers. In the former instance, the aquifer is overlain by sediments or rock of a confining nature, thus limiting direct recharge from rainfall.
- Aquifers in the study area typically have a low hydraulic conductivity, but are known to be highly heterogeneous with yields ranging from 0.5 up to 5L/s.
- Higher yields are typically associated with higher hydraulic conductivities along contact zones with intrusive rocks.
- The contact zones of dolerite dykes with the host rock provide preferential flow paths, while the dolerite itself is rather impermeable or semi-permeable (hydraulic conductivity of 0.00086m/d or $1x10^{-8}$m/s). This setting promotes groundwater flow along, but not across the dykes or sills.
- Depending on the residence time of the water in the aquifer, groundwater quality can be good to moderate.
- Recharge from rainfall is generally low and averages between 2.5 to 5% of the annual rainfall.
- Characteristics of the aquifer vary greatly over short distances.
- Contaminant transport through fracture flow aquifers is comparatively fast.
- There is hardly any attenuation of pollutants in the fractures.

8.8.3 Hydraulic conductivity

Five (5) borehole were subjected to aquifer falling head tests to determine the Hydraulic conductivity (K) of the aquifer in vicinity of the study area. The methodology used is discussed in detail under Section 4.5.1 of the geohydrological study. The results are displayed in Table 14 below and falling head curves can be viewed in Appendix B of the specialist study.

The K-values determined indicate that the aquifer/s in the vicinity have relatively low permeabilities with average values ranging between 0.02 and 0.18m/d.

Table 14: Borehole information and aquifer test results

Model	Borehole ID (June 2019)	Borehole ID (April 2012)	Latitude	Longitude	Water Level (m)	SWL (mbch)	Borehole Depth (m)	K-Value (m/d)	Late K-Value (m/d)
Aqtesolv Method	HBH 06	House 05	-24.94902	30.43942	7.79	7.79	50	0.12	
Aqtesolv Method	HBH 07	KRBH 01	-24.94345	30.43678	10.33	9.83	80	0.36	0.08
Aqtesolv Method	HBH 22	New	-24.90151	30.45173	14.25	13.88	59	0.176	
Aqtesolv Method	HBH 23	New	-24.88689	30.46333	26.79	26.35	98	0.12	
Aqtesolv Method	HBH 24	New	-24.92570	30.45061	9.10	8.90	39	0.35	0.090
Minimum								0.031	0.020
Maximum								0.18	0.090
Average								0.11	0.066

8.9 Groundwater levels

Groundwater levels were measured during the hydrocensus survey conducted. Groundwater levels including other details captured can be viewed in Table 15 below.

Twenty-three (23) boreholes were surveyed during June 2019, including five (5) mine pits and two (2) dams. Most of the in-use boreholes are utilised for domestic and livestock watering while some are not currently used.

Borehole water levels recorded range between 3.1 and 26.4 meters below surface (mbs) with an average of 11.20mbs.

A map showing the positions of the localities surveyed can be viewed in Figure 17.

8.10 Groundwater potential contaminants

An Acid Rain leaching procedure was performed on mine residue to assess the potential of harmful substances to be released if exposed to weakly acidic solutions (Shangoni, 2012). Because the waste rock does not have any acid potential, the results as shown in Table 16 are based on a worst-case scenario.

The results of the acid leach indicate a high prevalence of alkalinity/ $CaCO_3$ and lower than detection limits of major elements including sulphate (SO_4), chloride (Cl), fluoride (F) and nitrate (NO_3) (Table 15). The end pH value of 6.8 including the high prevalence of $CaCO_3$ and absence of SO_4 corresponds to the low AP and relatively high NP and NNP of the sample as recorded for the ABA analyses. Trace elements including metalloids recorded in the acid rain leach can be viewed in Appendix C of the geohydrological study.

Table 15: Hydrocensus information

Borehole ID	Coordinates		Farm name	Type	SWL (m)	Application	Owner	Sampling method
H/BH20	-24.886260	30.463970	Klipplaatdrift	Borehole	25.34	Livestock	Mine Property	
H/BH10	-24.953510	30.449990	Klipfontein	Borehole	3.08	Domestic	GT Roth	Tank
H/BH11	-24.962370	30.442130	Klipfontein	Borehole	11.47	Domestic	GT Roth	Tank
H/BH15	-24.907900	30.471740	Klipplaatdrift	Borehole	7.04	Domestic & Livestock	J Stenekamp	Pumping
H/BH16	-24.904710	30.469550	Klipplaatdrift	Borehole	5.78	Livestock	J Stenekamp	Tank
H/BH17	-24.901330	30.470830	Klipplaatdrift	Borehole	7.58	Domestic & Livestock	J Stenekamp	Tank
H/BH18	-24.899400	30.471550	Klipplaatdrift	Borehole	4.94	Livestock	J Stenekamp	Pumping
H/BH13	-24.910470	30.465440	Klipplaatdrift	Borehole	24.10	Domestic	J Stenekamp	Tank
H/BH12	-24.910560	30.465800	Klipplaatdrift	Borehole	23.60	Domestic	J Stenekamp	-
H/BH04	-24.935950	30.444640	Klipfontein	Borehole	11.89	Domestic & Livestock	Mine Property	Tank
H/BH02	-24.940360	30.445440	Klipfontein	Borehole	5.52	Domestic	Mine Property	Tank
H/BH01	-24.941520	30.449170	Klipfontein	Borehole	15.17	Not in use	Mine Property / GT Roth	Bailer
H/BH05	-24.942960	30.440160	Klipfontein	Borehole	5.08	Not in use	Mine Property	Bailer
H/BH06	-24.949020	30.439420	Klipfontein	Borehole	7.79	Not in use	Mine Property	Bailer
H/BH08	-24.944360	30.436310	Klipfontein	Borehole	8.77	Not in use	Mine Property	Bailer
H/BH21	-24.940070	30.439540	Klipplaatdrift	Borehole	5.97	Not in use	Mine Property	Bailer
H/BH07	-24.943450	30.436780	Klipfontein	Borehole	9.83	Not in use	Mine Property	Bailer
H/BH22	-24.901510	30.451730	Klipplaatdrift	Borehole	13.88	Not in use	Mine Property	Bailer
H/BH23	-24.886890	30.463330	Klipplaatdrift	Borehole	26.35	Not in use	Mine Property	Bailer
H/BH24	-24.925700	30.450610	Klipfontein	Borehole	8.90	Not in use	Mine Property	Bailer
-	-24.944580	30.447300	Klipfontein	Borehole	25.34	Not in use	-	-
-	-24.908570	30.471810	Klipplaatdrift	Borehole	3.08	Not in use	-	-
-	-24.903320	30.471420	Klipplaatdrift	Borehole	11.47	Not in use	-	-
SW 01	-24.917260	30.452700	Klipfontein	Pit	7.04	Not in use	Mine Property	Grab
SW 02	-24.918470	30.451460	Klipfontein	Pit	5.78	Not in use	Mine Property	Grab

Borehole ID	Coordinates		Farm name	Type	SWL (m)	Application	Owner	Sampling method
SW 03	-24.919530	30.450390	Klipfontein	Pit	7.58	Not in use	Mine Property	Grab
SW 04	-24.923670	30.449090	Klipfontein	Pit	4.94	Not in use	Mine Property	Grab
SW 05	-24.924610	30.448490	Klipfontein	Pit	24.10	Not in use	Mine Property	Grab
SW 06	-24.952990	30.449510	Klipfontein	Dam	23.60	Irrigation	GT Roth	Grab
SW 07	-24.950530	30.440630	Klipfontein	Dam	11.89	Not in use	Mine Property	Grab

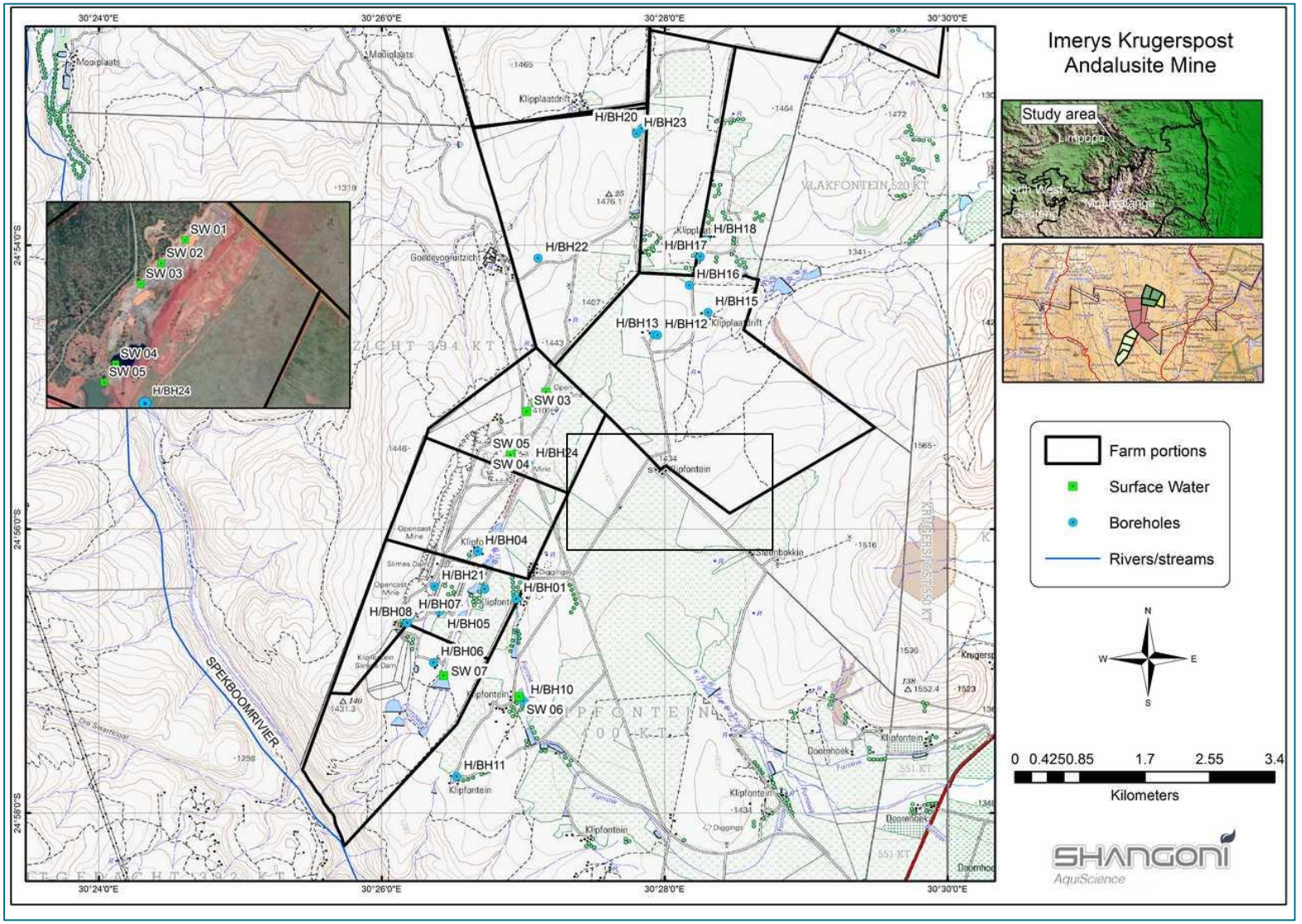


Figure 17: Hydrocensus map

Table 16: Results of the Acid Rain leach

Analyses	**Sample Identification**	
	Waste Rock	
Sample number	3128	
TCLP / Acid Rain / Distilled Water / H_2O_2	Acid Rain	
Dry Mass Used (g)	50	
Volume Used (mℓ)	1000	
pH Value at 25˚C	6.8	
Electrical Conductivity in mS/m at 25˚C	5.7	
Units	mg/ℓ	mg/kg
Alkalinity as $CaCO_3$	28	560
Chloride as Cl	<5	<100
Sulphate as SO_4	<5	<100
Nitrate as N	<0.2	<4.0
Fluoride as F	<0.2	<4.0
ICP-OES Scan	Appendix B	

As indicated by the values highlighted in the ICP-OES table as in Appendix C, traces of aluminium (Al), iron (Fe), magnesium (Mg), potassium (K) and silica (Si) were solubilised under the mildly acidic conditions of the Acid Rain leach. Based on the information above, it can be determined that the **waste present a slight/ low risk** to the environment posed by the backfilling material in the pits. Despite the low risk it is nevertheless recommended that a monitoring programme be implemented to monitor the ongoing performance.

8.11 Groundwater Quality

During the hydrocensus, samples were taken from surveyed boreholes and analysed for hydrochemical quality. The hydrochemical data are displayed in Tables 17 and 18 while interpretation based on hydrogeochemical Stiff diagrams and a Piper diagram can be viewed in Figures 18 and 19, respectively.

Table 17: Groundwater quality for Krugerspost hydrocensus boreholes

Locality / Guideline Parameter	Unit	Domestic use SANS 241(1)[a]	H/BH01	H/BH02	H/BH04	H/BH05	H/BH06	H/BH07	H/BH08	H/BH10	H/BH11
pH	-	5 - 9.7	6.81	7.05	7.04	7.16	7.05	7.3	6.66	7.2	7.29
EC	mS/m	≤170	34.9	36.6	26	41.4	44.6	23	17.8	33.4	26.8
TDS	mg/l	1200	174	193	131	209	198	113	80	159	123
Calcium (Ca)	mg/l		18.9	18.9	12.1	22.4	14.7	11.73	9.8	10.43	9.56
Magnesium (Mg)	mg/l	-	26.2	21.2	12.9	21.3	26.3	9.69	7.66	34.5	25.4
Sodium (Na)	mg/l	200	7.46	21.9	18.1	28.7	21.8	15.2	6.36	1.96	0.93
Potassium (K)	mg/l	-	0.89	0.69	1.78	2.84	1.3	2.57	2.8	0.32	0.46
Total alkalinity (MALK)	mg/l	-	155	151	110	187	149	104	77	161	120
Chloride (Cl)	mg/l	300	5.6	8.48	6.16	6.61	11.1	5.25	3.65	2.48	3.2
Sulphate (SO_4)	mg/l	500	9.42	5.15	<0.5	8.12	23.8	3.87	1.35	5.06	4.84
Nitrate as N (NO_3-N)	mg/l	11	2.73	5.64	3.12	1.43	2.1	<0.35	<0.35	1.78	1.5
Total ammonia (NH_3-N + NH_4-N)	mg/l	1.5	<0.45	<0.45	<0.45	<0.45	<0.45	1.31	1.8	<0.45	<0.45
Ortho-phosphate (PO_4)	mg/l	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Fluoride (F)	mg/l	1.5	0.29	0.21	0.2	0.21	0.24	0.19	0.18	0.2	0.31
Aluminium (Al)	mg/l	0.3	<0.01	0.31	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron (Fe)	mg/l	2	<0.01	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese (Mn)	mg/l	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Hardness	mg/l	-	155	134	83	144	145	69	56	168	128
[a] SANS 241: 2011											

Table 18: Groundwater quality for Krugerspost hydrocensus boreholes

Locality / Guideline Parameter	Unit	Domestic use SANS 241(1)[a]	H/BH13	H/BH15	H/BH16	H/BH17	H/BH18	H/BH21	H/BH22	H/BH23	H/BH24
pH	-	5 - 9.7	7.82	7.25	7.47	7.49	7.47	7.21	7.35	6.97	7.27
EC	mS/m	≤170	40.7	75.3	55.3	61.6	66	46.5	41.4	28.8	38.2
TDS	mg/l	1200	221	398	288	324	339	244	213	148	199
Calcium (Ca)	mg/l		23.2	58.8	31.2	31.4	34.4	27.1	16.7	9.23	21.7
Magnesium (Mg)	mg/l	-	25.3	45.6	41.3	46.4	49.7	23	18.7	9.21	21.1
Sodium (Na)	mg/l	200	20.2	24.7	20.2	26.2	26.3	26.3	36.6	27	19
Potassium (K)	mg/l	-	4.06	1.26	2.59	2.5	3.96	4.1	6.17	7.63	1.74
Total alkalinity (MALK)	mg/l	-	173	290	270	301	320	238	196	102	156
Chloride (Cl)	mg/l	300	8.63	45.3	8.56	10.9	10.4	11.5	10	12.1	9
Sulphate (SO_4)	mg/l	500	4.79	13.2	1.69	12.7	3.94	0.51	4.01	<0.5	0.64
Nitrate as N (NO_3-N)	mg/l	11	7.07	7.99	4.63	2.81	4.11	0.41	0.5	4.94	7.31
Total ammonia (NH_3-N + NH_4-N)	mg/l	1.5	<0.45	<0.45	<0.45	<0.45	<0.45	4.98	<0.45	<0.45	<0.45
Ortho-phosphate (PO_4)	mg/l	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Fluoride (F)	mg/l	1.5	0.19	0.15	0.18	0.43	0.14	0.84	0.57	0.17	0.12
Aluminium (Al)	mg/l	0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron (Fe)	mg/l	2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24	<0.01	<0.01
Manganese (Mn)	mg/l	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	0.66	<0.01	<0.01
Total Hardness	mg/l	-	162	335	248	269	291	162	119	61	141
[a] SANS 241: 2011											

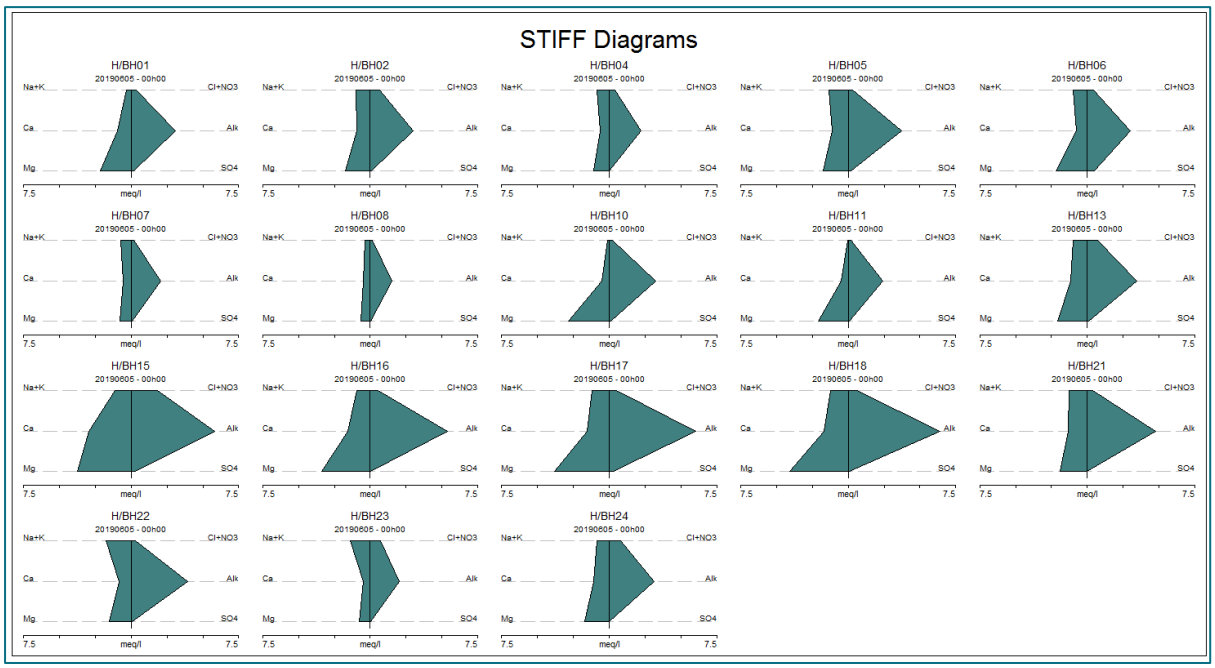


Figure 18: Stiff Diagrams based on meq/l

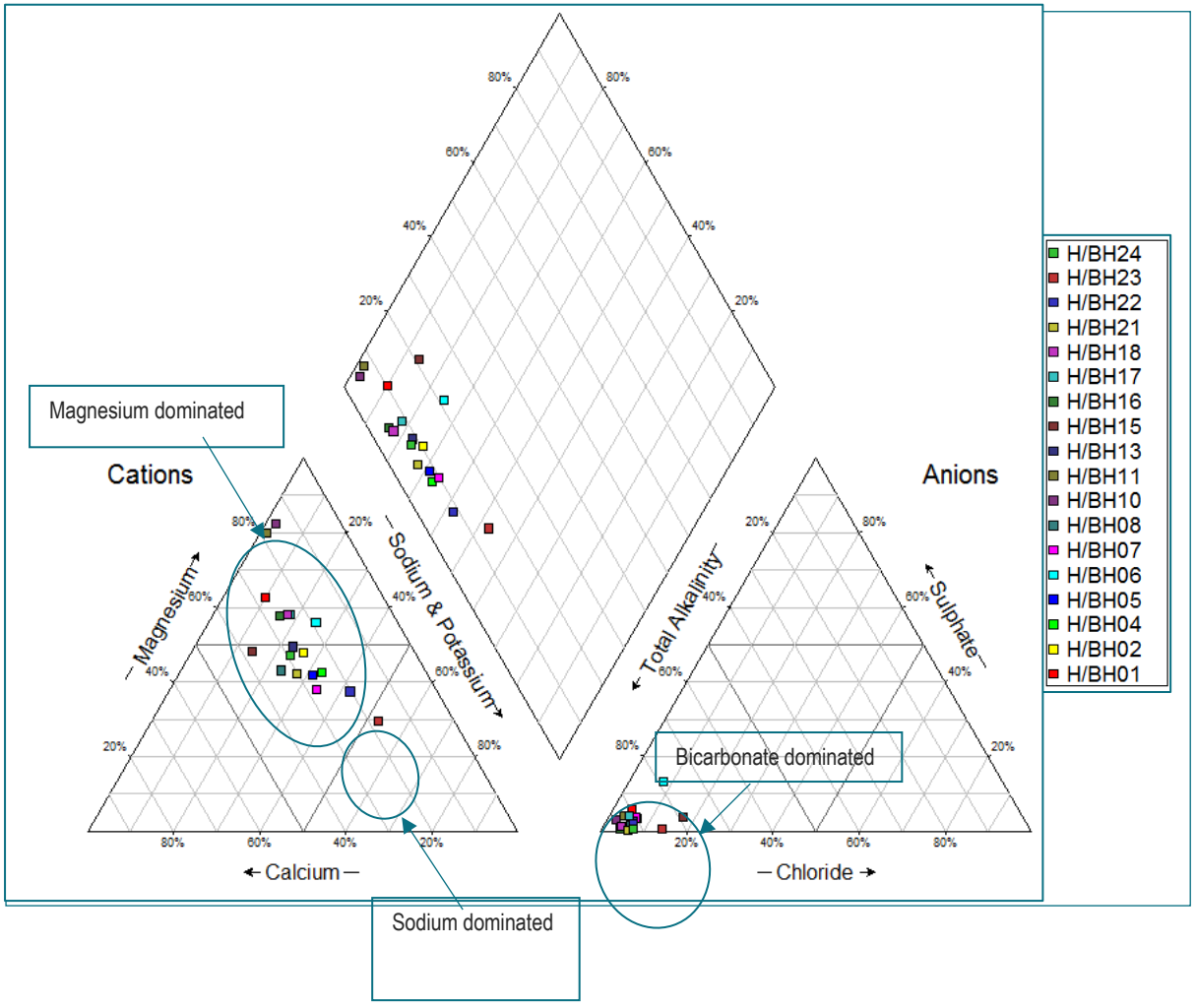


Figure 19: Piper diagram based on relative meq/l

Based on the data in Tables 17 and 18, the following:

- The pH levels of groundwater from the boreholes are circum-neutral ranging between 6.66 and 7.82 with an average of 7.21.
- In terms of salinity the quality can be described as Ideal (class 0) to Good (Class 1) in terms of the potable standards proposed by the DWS (WRC, 1998) with EC ranging between 17.8 and 75.3mS/m with an average of 41.0mS/m.
- Groundwater range between moderately soft and very hard with the majority of hardness contributed to by the Mg cation. Total hardness levels vary between 56 and 335mg/l with an average of 160mg/l. At the high end of the scale, scaling of hot water appliances may expected.
- Nitrate (NO_3) concentrations range between Ideal (class 0) to Good (Class 1) with concentrations between <0.35 and 7.99mgN/l with an average of 3.19mgN/l.
- Total ammonia (NH_3 + NH_4) levels range between low to relatively high ranging between <0.45 and 4.98mgN/l. The ammonium cation (NH_4^+) is the reduced form of nitrogen and high values indicate reducing conditions, which could either be natural or due to organic breakdown. It is not uncommon for groundwater to be in a reducing state due to low oxygen conditions but at the high end of the spectrum, organic pollution is the most likely cause.
- Trace metals recorded in low to very low concentrations.
- All parameters except for total ammonia in H/BH07, H/BH08 and H/BH21, are well within the SANS:241 drinking water quality guidelines.

Based on the hydrogeochemical diagrams, the following:

- Two distinct groundwater types can be distinguished, namely Mg-HCO_3 types and Na-HCO_3 types.
- The majority of samples are Mg-HCO_3 types representing fresh, clean, relatively young groundwater that has started to undergo Mg ion exchange.
- Only one sample, H/BH23 is a Na-HCO_3 type representing fresh, clean, relatively young groundwater that has undergone sodium (Na) ion exchange typically found in Na enriched granites or other felsic rocks.

9 Air quality

Information for this section was extracted from the “Air Quality Impact Assessment” (Tikotech, 2019):

9.1 Ambient air quality background

The mine falls outside South Africa’s declared airshed priority areas (the Vaal Triangle Airshed Priority Area, the Highveld Priority Area; and the Waterberg Bojanala Priority Area). Emission sources within a 50km radius of the mine include: agriculture, mining, smelting, incineration (Tswelopele funeral services), commercial and industrial industries associated with the towns and settlements, domestic fuel burning (an example is open cooking areas in Burgersfort), forest burning, burning at landfill sites and vehicles on roads and rails.

No local dustfall monitoring or hourly ambient air quality monitoring data was available at the time of the assessment. For an understanding of the ambient particulate air pollution, reference was made to the WHO's global ambient air pollution. The interactive map showed the modelled annual mean ambient PM2.5 for the year 2016 to range between 16 and 25µg/m3 for the assessment area. Refer to the table below for the modelled annual mean PM2.5 and PM10 for the Waterberg area in the Limpopo province and the Emalahleni, Middleburg, Sekunda and Ermelo area in the Mpumalanga province (based on updated information in 2018).

Table 19: Mean PM10 and PM2.5 ambient air pollution (WHO).

Area	Province	Priority area	PM2.5 (µg/m^3)	PM10 (µg/m^3)
Waterberg	Limpopo	Waterberg Bojanala Priority Area	18	37
Witbank (Emalahleni)	Mpumalanga	Highveld Priority Area	16	30
Middleburg	Mpumalanga	Highveld Priority Area	13	24
Sekunda	Mpumalanga	Highveld Priority Area	26	54
Ermelo	Mpumalanga	Highveld Priority Area	16	33

9.2 Standards and critical levels

South Africa's National Ambient Air Quality Standards (NAAQS) and National Dust Control Regulation' (NDCR) standards are targets set for air quality management to prevent the deterioration of air quality and to ensure that levels of air pollution are not harmful to human health or well-being. Table 20 and Table 21 provides South Africa's national ambient air quality standards for particulate matter and its national dust control standards. Refer to Table 22 for the Department of Environmental Affairs' (DEA) categorisation of dust deposition rates.

Table 20: PM10 and PM2.5 National ambient air quality standards

Pollutant	Averaging Period	Concentration (at 25°C and 101,3 kPa)	Frequency of Exceedance	Compliance Date
PM10	24 hours	75 µg/m^3	4	1 January 2015
	1 year	40 µg/m^3	0	1 January 2015
PM2.5	24 hours	40 µg/m^3	4	1 January 2016 - 31 December 2029
	1 year	20 µg/m^3	0	
	24 hours	25 µg/m^3	4	1 January 2030
	1 year	15 µg/m^3	0	

Table 21: National dust control standards

Restriction Areas	Dustfall rate (D) (mg/m^2/day, 30 days average)	Permitted frequency of exceeding dustfall rate
Residential area	D<600	Two within a year, not sequential months.
Non-residential area	600<D<1200	Two within a year, not sequential months.

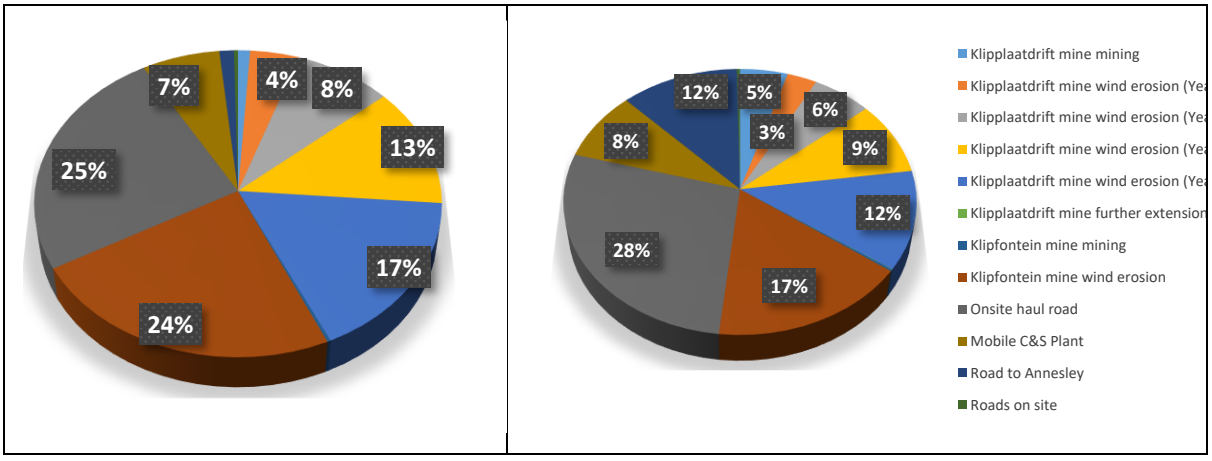
Table 22: DEA categories of dust deposition rates

Group	Deposition rate	Description
Slight	< 250 mg/m^2/day	Barely visible to the naked eye.
Moderate	250–500 mg/m^2/day	
Heavy	500–1 200 mg/m^2/day	A fine layer of dust on a surface.
Very Heavy	1 200 mg/m^2/day	Easily visible when a surface is not cleaned for a few days.
	>2 000 mg/m^2/day	Characterised by a layer of dust thick enough to allow a person to 'write' words in the dust with their fingers.

9.3 Point source maximum emission rates (start-up, maintenance and or shut down)

The planned mining operation's fugitive TSP and PM10 emissions were estimated based on default emission factors taken from the National Pollutant Inventory's (NPI) emission estimation technique manual for mining (2012) and the NPI's emission estimation technique manual for aggregated emissions from paved and unpaved roads (1999). No PM2.5 emission factors were available at the time of the assessment.

The emission inventory shows wind erosion, hauling, mining and crushing and screening to be the most significant sources of dust and PM10 air pollution (Refer Figure 20 and to Table 21). The section applicable to Klipfontein can be found in green in Table 23 below.



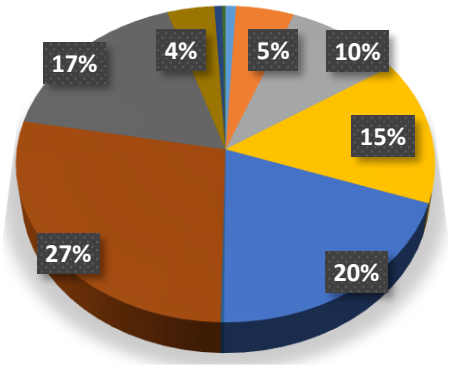
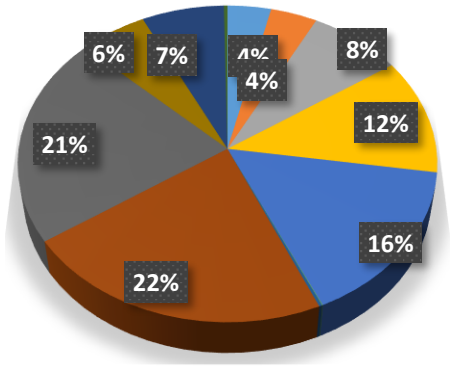
Average annual TSP emissions	Average daily TSP emissions
	
Average annual PM10 emissions	Average daily PM10 emissions

Figure 20: Average emission source apportionment

Table 23: Emission inventory

Source	Activity	Emission Factors				Activity data		Emissions (tonne/year)	
		TSP	PM 10	Units	EF R[6]	Activity	Unit	TSP	PM10
Klipfontein mining	Run of mine removed by excavators and placed on tipper trucks.	0,025	0,012	kg/tonne	U	144	tonne/day	0,78	0,37
	Rehabilitation (Filling quarries with slimes, OB and waste rock, dumped with trucks from mobile C&S Plant).	0,012	0,0043	kg/tonne	U	1137	tonne/day	4,25	1,52
Klipfontein mine wind erosion	Wind erosion from exposed areas, stockpiles and dumps.	0,4	0,2	kg/ha/hr	U	24	hr/day	475,84	237,92
Onsite haul road	Tipper trucks transporting run of mine to the C&S Plant.	4,23	1,25	kg/VKT	B	46	VKT/day	39,78	11,76
	Tipper trucks transporting slimes and overburden to the quarry.	4,23	1,25	kg/VKT	B	346	VKT/day	448,46	132,53
	P1 transported by road trucks on the onsite haul road.	4,23	1,25	kg/VKT	B	115,98	VKT/day	13,40	3,96
	P1 transported from mobile C&S Plant to Annesley by road trucks on paved portion of road.	0,34	0,06	kg/VKT	Unknown	1939,8	VKT/day	17,81	3,41
LDVs and grader on internal roads	LDVs traveling on internal roads.	0,94	0,33	kg/VKT	B	20	VKT/day	6,77	2,38
	Grader levelling roads.	0,19	0,085	kg/VKT	B	30	VKT/day	0,27	0,12

[6] NPI Emission factor rating (ERF) system: A – Excellent, B - Above Average, C – Average, D - Below Average, E – Poor, U – Unrated.

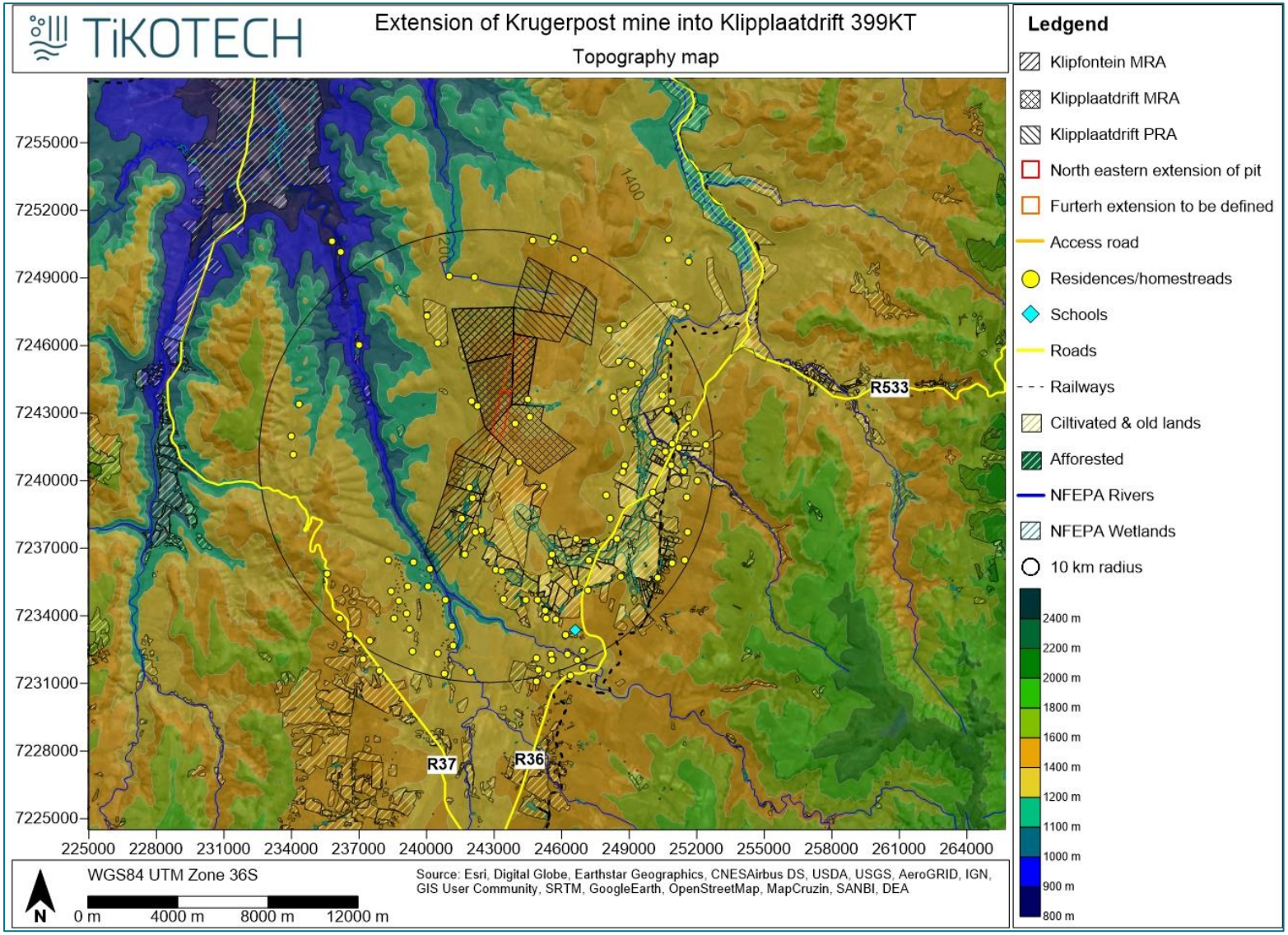


Figure 21: Topography map.

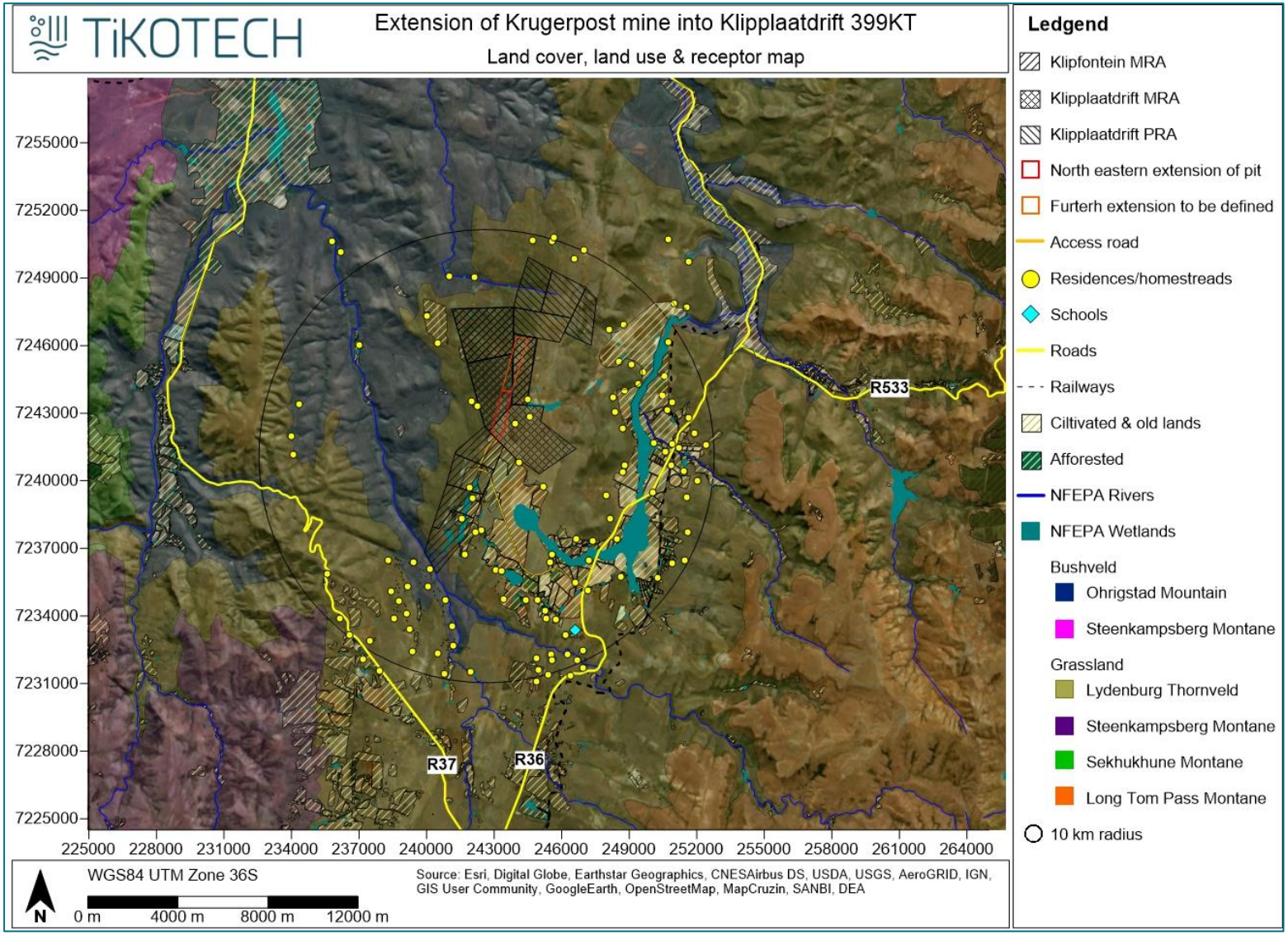


Figure 22: Land cover, land use and receptor map

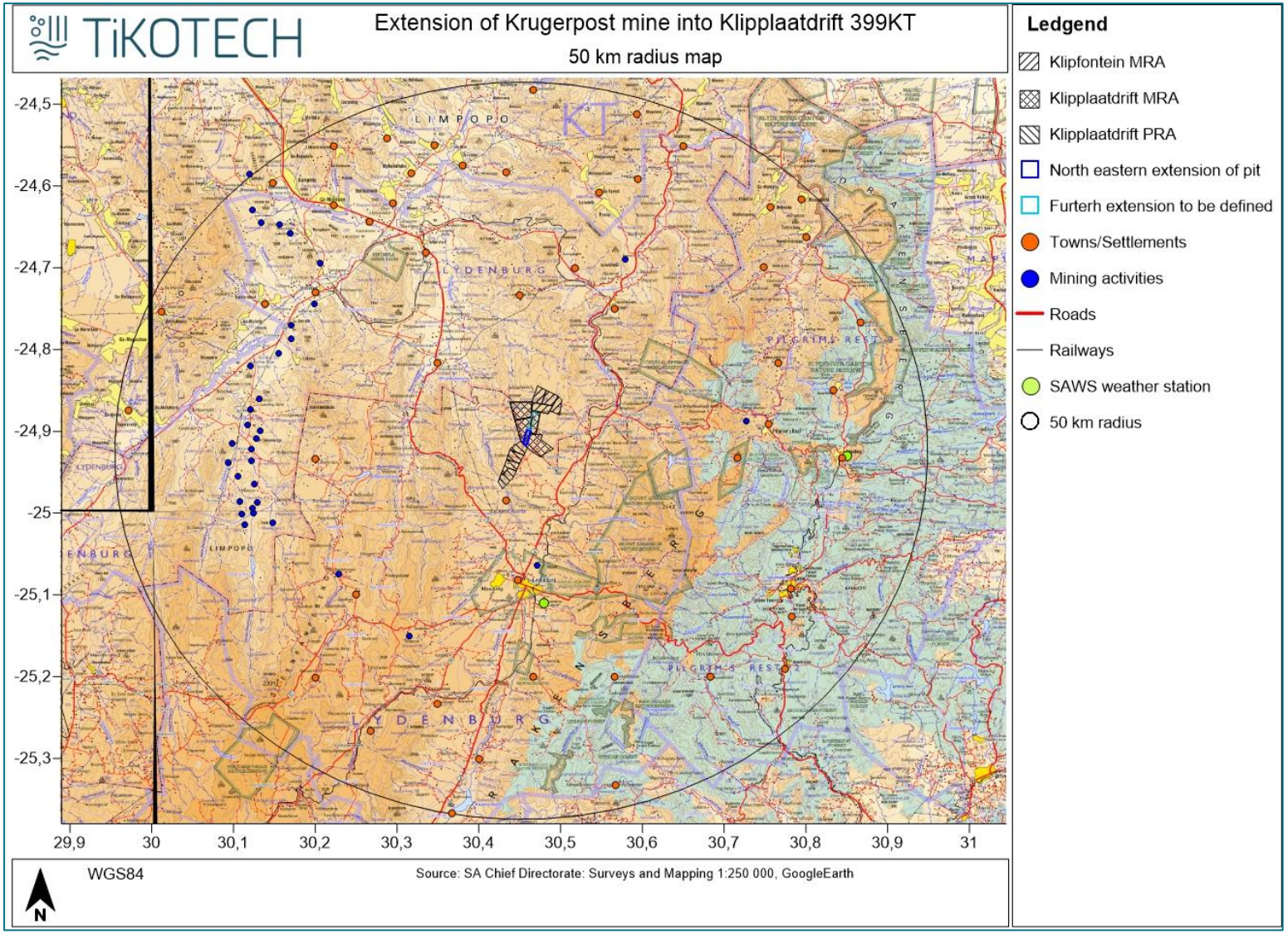


Figure 23: 50km radius map

10 Environmental noise

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014):

Noise pollution and vibrations caused by existing mining machinery and vehicles. The noise level is only significant in the immediate vicinity of the source, with no impact beyond the boundaries of the site. There are no notable sources of the noise from the surrounding area.

11 Visual aspects

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014):

The mining area is somewhat visible from JC Steenekamp, landowner of the remainder of Klipplaatdrift 399KT. The residence on the remainder of the farm Klipplaatdrift 399 KT is approximately 2.4km away from the proposed new mining right activities. The existing mine pits on the adjacent mine are visible from the R36 from approximately 7km outside of Mashishing for approximately 2km.

12 Cultural and heritage resources

Information for this section was extracted from the Cultural Heritage Resources Impact Assessment on Mine at Krugerpos (African Heritage Consultants cc, 2011).

The present mining plan used in this report is 'estimated' from information given by the mine manager, David Bellicini.

The fact that 'stone circles' were identified and could not be found on site during the site visit was illuminated by the correct application of the Google Earth technology. This image is dated to 2010 although the present author misinterpreted the image as dating to 2003. When the 2003 image was acquired the original suspicion that the fields were cleared for agriculture was confirmed, with not a single stone wall in site.

The question that now confronted the investigator was 'where did the stone walling in the 2010 image come from?'

In retrospect the answer is rather straightforward. While the walling was originally in place, the walls acted as collectors for biological material such as vegetation, ash and water. This altered the chemical composition of the soils under the walls, with the result that with the removal of the stones that formed the walls some time prior to 2003 by the farmer it created zones of preference for different pioneer grass species. From the stand of pioneer acacia species on the fields now in 2011 it is clear that the fields were

not used for possibly more than a couple of years so that ploughing could not really influence the change in chemicals that were deposited under the walls.

It is therefore the re-habitation of a pioneer grass in the 'footprints' of the walls that show up in the 2010 Google Earth images that appears to be 'stone walls'

For purposes of the heritage report therefore the 2003 Google Earth image shows that the area was used for agriculture and therefore totally disturbed. From 2010 Google Earth images to the east and west of this disturbed area it is clear though that a continuous archaeological Later Iron Age site existed here.

This was then also confirmed on site by the identification of a large collection of rocks in the direct vicinity of the cleared area. Amongst these rocks the investigative team also identified lower grinding stone. A bored stone and a hammer stone used for breaking marula pipes to extract the kernels.

13 Sensitive landscapes

A screening tool report was generated for the site and found that the site does have a very high agricultural sensitivity and terrestrial biodiversity as seen in the maps below. The area falls within Critical Biodiversity Area 2, Ecological Support Area 1 and 2 as well as focus areas for land-based protected areas expansion. It must be noted that the site is an existing quarry. Backfilling thereof will help to ensure rehabilitation of the area.

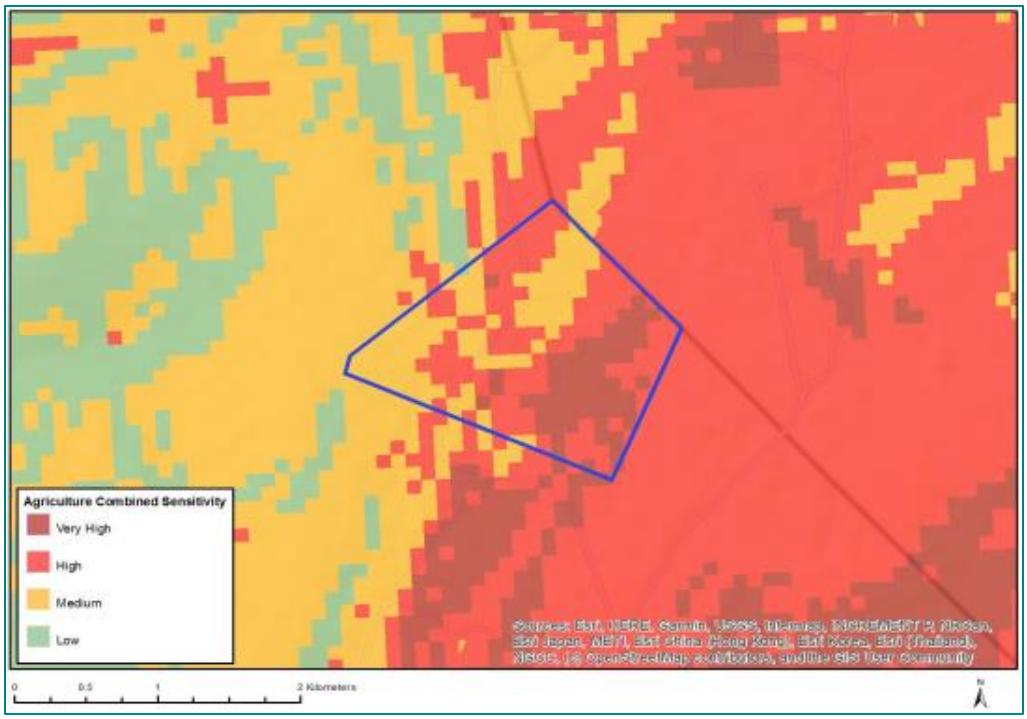


Figure 24: Map of relative agricultural sensitivity

Figure 25: Map of terrestrial biodiversity

14 Regional socio-economic aspects

Information for this section was extracted from the Thaba Chweu Local Municipality IDP (Cllr S Mashigo-Sekgobela and team, 2017-2022):

According to the Census results of Statss SA the population size in 1996 was at 65909, 2001 it stood at 81681 and in 2011 it was 98387 as at 2016 we are sitting at 101895 and it is projected that by 2030 we will be around 113920. According to this statistic there has been an increase in population size from 1996 to 2016. This statistical information becomes important in TCLM planning in order to accurately determine the service demand and focus areas for basic service improvement from all pieces of municipal sector plans and policies. In simple terms this becomes a key directive for planning and budgeting within the municipality.

The population of Thaba Chweu municipality shows a typical age structure of a different age group distribution in the year 2011. There is a high proportion of the age group of between 25-29 to be highest and 0-4 to be the second highest of both female and male. The number decreases as the age goes up. The age group of 80+ has the lowest proportion compared to the rest of the other groups. In terms of gender balance, the females have the highest proportion in almost all the age groups. Despite this population distribution by sex and age, the population of the municipality has concentration of younger age groups.

Race and ethnic group

Blacks/black people are the most dominant in the year 1996, 2001 and 2011 followed by whites/white people. This means that the municipal planning in terms of socioeconomic related up-liftment"s programmes and projects must target groups or speak or respond to the race with the highest percentage. Amongst all the three groups the one that has hit a peak in the years (1996, 2001 and 2011) is the age group of 15-64 which sat at a percentage 64,49 in 1996, 67,16 in 2001 and 69,91 in 2011. The lowest age group is 65+ in the years (1996, 2001 and 2011) whereas the age group 0-14 years had a percentage ranging from 25,17 to 29,21.

Gender

In terms of gender there has been not much change in the years 1996, 2001 and 2011. The percentage of males and females fairly remained the same, in the year 1996, the number of males went down to 49 percent while the number of females was at 50 percent in the year 2001 at least higher than the males, and in the 2011 there has been a slight change in the number females at least this time males were higher by 1% to the females.

Employment

The general unemployment of TCLM population comprises of classified persons i.e People with disabilities, Women and Youth. It has been observed that a large number of employment opportunities come from the mining sector followed by community services and then agriculture. Trade is also contributing a better percentage in employment. Manufacturing, trade and private household share almost the same percentage in terms employment whereas finance, utilities and transport contribute the least in absorbing labour.

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

This section includes the impact management for the preferred layout plan. Refer to Part A, section h)(vii) for a comparison with the alternative layout plan.

It must be noted that the following impacts are only for the backfilling of Quarry 6. This area is already disturbed and will be rehabilitated. Therefore, there is no impact on heritage resources as the area has already been disturbed.

1 Soil, surface water, and groundwater pollution from hydrocarbons.

Activity, nature and consequence of impact:

During backfilling as well as the storage of water in the quarry and construction of plant, activities using hydrocarbons as well as the generation of waste, take place. These activities can lead to the pollution of soil, surface water, and to a lesser extent, groundwater, if these materials are not managed correctly, leading to wastes and spills and unauthorised disposal of contaminated substances. This is a negative impact on soil, surface water and groundwater.

Cumulative impacts:

Adjacent to the existing mine, is another andalusite mine. The area is surrounded by agricultural land uses that can all lead to soil, surface water and groundwater pollution.

Assumptions, uncertainties, and gaps in knowledge

Impacts and management were extracted from the 1999 approved EMP for Krugerspost, as well as the Geohydrological impact assessment for the quarry operations at Klipplaatdrift and Klipfontein (Shangoni Aquiscience, 2019). The significance rating on these reports, differ from this report, and has been amended to fit into the current report. It is assumed that no other types of hazardous substances than hydrocarbons will be used on site.

	Soil quality	Surface water quality	Groundwater quality
Intensity and magnitude	1. The volume of hydrocarbons or waste on site is small.		
Duration	1. Hydrocarbons will dissipate in a short time span.		

	Soil quality	Surface water quality	Groundwater quality
Extent or spatial scale	1: The pollution of soil will be activity specific.	2. The pollution of surface water will be site specific.	2. The pollution of surface water will be site specific.
Probability	2. It is probable for soil and surface water pollution to take place.		1. It is unlikely for hydrocarbon pollution to seep down to groundwater level.
Significance	5: Low	6: Low	5: Low
Degree to which impact can be reversed	1: Completely reversible: If spillages of hydrocarbons do occur, it can be completely removed.		
Degree to which impact may cause irreplaceable loss of resources	1: The type of hazardous substances will be limited to hydrocarbons and no other types of hazardous substances which are more severe.		
Degree to which impact can be avoided, managed or mitigated	1: The correct management will avoid impacts. Also, of an impact does occur in the form of spillage, it can be completely mitigated.		
Significance with mitigation	8: Low	9: Low	8: Low

Environmental objective

To ensure that no soil pollution occurs.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
Drip trays must be used during equipment maintenance. These should be emptied regularly into secondary containers.	Operational until closure.	Inspection checklists.	Mine-wide inspections.	When necessary.	Mine manager	In house – no budget necessary.	Avoid.
If refuelling on site or from drums, the ground must be protected, and proper dispensing equipment is to be used i.e. hand pumps and	Operational until closure.	Inspection checklists.	Mine-wide inspections.	When necessary.	Mine manager	In house – no budget necessary.	Avoid.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
funnels. Drums may not be tipped to dispense fuel.							
Implement spill handling procedure if spillage of hazardous materials occurs. Ensure that such contaminated material arising from spill clean-up is disposed of as a hazardous waste at a registered landfill site.	Operational until closure.	Spill handling procedure, spill kits.	Mine-wide inspections, auditing of procedure.	When necessary.	Mine manager	In house – no budget necessary.	Minimise.
All waste must be stored and disposed of in terms of all relevant waste legislation.	Operational until closure	Waste management procedures, all waste documents associated with waste management procedure.	Mine-wide inspections, auditing of procedure.	When necessary.	Mine manager	In house – no budget necessary.	Avoid.

Stakeholder expectations and / or comments
None received.
Residual and latent risks
If effective management takes place, there should not be residual impacts. No latent impacts foreseen.

2 Soil erosion and sedimentation of surface water sources

Activity, nature and consequence of impact:

After backfilling is finished, some degree of sloping will be done. This may lead to soil erosion. It can further lead to sedimentation of surface water sources due to run-off from the mine residue or sloped soil. It should be noted that backfilling and storage of water will take place in a quarry, which will reduce the potential of erosion as well as surface wate run-off. This is a negative impact on the soil and surface water.

Cumulative impacts:

Adjacent to the existing mine, is another andalusite mine. The area is surrounded by agricultural land uses that can contribute to soil erosion, sedimentation as well as land degradation.

Assumptions, uncertainties and gaps in knowledge

Impacts and management were extracted from the 1999 approved EMP for Krugerspost, as well as the Geohydrological impact assessment for the quarry operations at Klipplaatdrift and Klipfontein (Shangoni Aquiscience, 2019). The significance rating on these reports, differ from this report, and has been amended to fit into the current report. The impacts are only based on the backfilling of the quarry and storage of the water. All other already existing activities, which are not part of the activities described in this report, are not currently included here.

	Soil pollution	**Surface water pollution**
Intensity and magnitude	2: Soil erosion can affect the soil and surface water functions; however, these functions can still continue in a modified	2. The pollution of surface water will be site specific.
Duration	2: Soil erosion and surface water sedimentation will last for the entire operational life of the mine but will be mitigated thereafter.	
Extent or spatial scale	1: The erosion of soil will be activity specific.	2. The sedimentation of surface water will be site specific.
Probability	2. Soil erosion is evident on old mine residue dumps; and can therefore potentially take place.	
Significance	7: Medium	8: Medium
Degree to which impact can be reversed	1: With correct management, the impacts can be reversed.	
Degree to which impact may cause irreplaceable loss of resources	2: The loss of soil can somewhat be replaced.	1: The loss of surface water quality due to sedimentation can be completely replaced.

	Soil pollution	Surface water pollution
Degree to which impact can be avoided, managed or mitigated	1: With the correct management in place, the impact can be completely avoided.	
Significance with mitigation	11: Low	11: Low

Environmental objective

To ensure that no soil erosion and surface water sedimentation takes place.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
Ensure correct rehabilitation takes place, which should include erosion preventative measures.	Operational until 5 years after closure.	Rehabilitation plan.	Erosion monitoring.	Erosion removal as necessary. Erosion monitoring monthly	Mine manager.	See financial provision.	Rehabilitation.
Surface water monitoring as per IWUL.	Operational until 5years after closure.	Water monitoring programme.	Surface water monitoring as per IWUL.	Monthly.	Specialist.	Included in the costs of the mine.	Minimise or prevent
The mine will adhere to the SWMP as well as GN 704 requirements.	Operational until 5years after closure.	Inspection checklists, GN 704 Regulations, SWMP.	Mine-wide inspections, GN 704 and SWMP audits.	Inspections monthly, audits annually.	Mine manager	In house – no budget necessary.	Avoid.

Stakeholder expectations and / or comments

None received.

Residual and latent risks

If effective rehabilitation takes place, there should not be residual impacts. No latent impacts foreseen.

3 Returning the land capability to final land use and restoring visual aspects

Activity, nature and consequence of impact:

The topography of the mine residue areas will be changed to a more natural topography. This will further also have a positive impact on the drainage patterns as well as the visual aspects. The land capability will also be returned to the end land use. This is a positive impact on surface water, visual aspects and land capability.

Cumulative impacts:

Adjacent to the existing mine, is another andalusite mine. The area is surrounded by agricultural land uses that can cause the alteration of land capability.

Assumptions, uncertainties and gaps in knowledge

Impacts and management were extracted from the 1999 approved EMP for Krugerspost, as well as various specialist studies undertaken in line with the Section 102 application for Klipplaatdrift Mine. The significance rating on these reports, differ from this report, and has been amended to fit into the current report. The impacts are only based on the backfilling of the quarry and storage of the water. All other already existing activities, which are not part of the activities described in this report, are not currently included here.

	Drainage patterns	**Visual aspects**	**Land capability**
Intensity and magnitude	2. All environmental components will be mostly return to its natural state.		
Duration	3. The return of topography to its natural state will be permanent.		
Extent or spatial scale	3: The impact on the drainage patterns as well as visual aspects will be local.		1. The impact will be site specific.
Probability	3. With correct backfilling and sloping, the environmental components will definitely return to its natural state.		
Significance	11: High	11: High	9: High

Environmental objective
To return the topography to such a state that the drainage patterns, visual aspects and land capability is returned to its natural state.

Management measures to be applied	Phase applicable to management measure	Management tools	Management timeframe and schedule	Monitoring programmes	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
The area should be shaped to fit in with the current sloping and contours of the area	Rehabilitation and closure.	Rehabilitation plan.	Only during rehabilitation.	Rehabilitation plan	Mine surveyor and mine manager.	Refer to the financial provision.	Rehabilitation
Backfilling and sloping as per rehabilitation plan must be implemented.	Operational until closure.	Rehabilitation plan.	Topographical reshaping.	Correct sloping must be ongoing. Monitoring of sloping once after reshaping.	Mine surveyor and mine manager.		Rehabilitation.
Revegetation as per the rehabilitation plan must be implemented.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager.		Rehabilitation.

Stakeholder expectations and / or comments
None received.
Residual and latent risks
The backfilling of quarries with mine residue will lessen this residual impact. No latent impacts are envisaged.

4 Alien vegetation establishment

Activity, nature and consequence of impact:

The establishment of alien vegetation on recently backfilled areas is prone to take place. This is a negative impact on vegetation.

Cumulative impacts:

Adjacent to the existing mine, is another andalusite mine that may cause the distribution of alien vegetation. The area is also surrounded by agricultural land uses which can cause the establishment of alien vegetation.

Assumptions, uncertainties and gaps in knowledge

Impacts and management were extracted from the 1999 approved EMP for Krugerspost, as well as various specialist studies undertaken in line with the Section 102 application for Klipplaatdrift Mine. The significance rating on these reports, differ from this report, and has been amended to fit into the current report. The impacts are only based on the backfilling of the quarry and storage of the water. All other already existing activities, which are not part of the activities described in this report, are not currently included here.

	Natural vegetation
Intensity and magnitude	2. Alien vegetation can moderately affect processes or functions of the natural vegetation.
Duration	3. If not removed, alien vegetation can be permanent.
Extent or spatial scale	3: The impact can spread to the surrounding areas.
Probability	2. Without proper mitigation, it is probable for alien vegetation establishment to take place.
Significance	10: High
Degree to which impact can be reversed	1. Impact can be in its entirety be reversed.
Degree to which impact may cause irreplaceable loss of resources	1. With correct management, the impact will not cause irreplaceable loss of resources.
Degree to which impact can be avoided, managed or mitigated	1. Impact can be avoided if correctly managed.
Significance with mitigation	13. Medium

Environmental objective
To eradicate alien and invader vegetation.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
All alien vegetation will be removed.	Operational until closure	Alien eradication plan	Site inspections	As per eradication plan	Mine manager	As part of financial provision	Prevent

Stakeholder expectations and / or comments
None received.
Residual and latent risks
If effective rehabilitation takes place, there should not be residual impacts. No latent impacts foreseen.

5 Groundwater pollution

Activity, nature and consequence of impact:

The rehabilitation strategy of pit backfilling poses the greatest potential risk on post-closure groundwater quality. However, none of the reactions or contaminants associated with coal or gold mining applies to the Krugerspost mining environment. Geochemical studies have shown the in-situ ore and host rock to be chemically inert and ion exchange and accompanying groundwater contamination do not occur. While low risk elements such as Si and Fe and some ions such as Ca, Mg and K could be released, it is expected to be in relatively low concentrations. Long-term, qualities will start to improve due to dilution of rainwater. Minor groundwater quality impacts are therefore expected, but the surrounding groundwater users should not be affected. This is a negative impact on groundwater quality.

Risk of AMD: No sulphidic minerals are present in the ore or overburden that could result in acidity of drainage or mine water. Leach data indicates that the overburden and slimes material do not leach elements in substantial quantities. Status quo groundwater qualities in vicinity of the potential pollution sources and current mining activities also indicate that no historic impacts on groundwater quality have occurred. The only water quality impacts that might occur result from the physical mining operation itself and from seepage or accidental spills of hazardous substances imported into the mining area for a variety of uses like fuel, lubricants, cleaning agents and solvents. However, the mine is not in the operational phase. Therefore, this impact is insignificant.

Cumulative impacts:

Mining activities from the adjacent mine may also lead to groundwater pollution. Agricultural activities in the region can also lead to the pollution of groundwater.

Assumptions, uncertainties and gaps in knowledge

Impacts and management were extracted from the Geohydrological impact assessment for the quarry operations at Klipplaatdrift and Klipfontein (Shangoni Aquiscience, 2019). This report was amended to include the groundwater pollution model for Quarry 6 as well. The significance rating on these reports, differ from this report, and has been amended to fit into the current report. The impacts are only based on the backfilling of the quarry and storage of the water. All other already existing activities, which are not part of the activities described in this report, are not currently included here.

	Groundwater quality
Intensity and magnitude	1. As described in full detail in the specialist report, the intensity is indicated as a low.
Duration	2. Pollution will be medium-term.
Extent or spatial scale	2: The impact can be site specific.
Probability	1. As described in full detail in the specialist report, the probability is low.
Significance	6: Low
Degree to which impact can be reversed	1. Impact can be in its entirety be reversed.
Degree to which impact may cause irreplaceable loss of resources	1. With correct management, the impact will not cause irreplaceable loss of resources.
Degree to which impact can be avoided, managed or mitigated	1. Impact can be avoided if correctly managed.
Significance with mitigation	9. Low

Environmental objective
To reduce any groundwater pollution that may occur.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
Minimise recharge of rainwater into the rehabilitated pit by creating free draining slopes and capping with low permeable material.	Operational until closure	Stormwater management plan	Groundwater quality and erosion monitoring		Mine manger		Minimise
Ponding should be prevented on rehabilitated surfaces.	Operational until rehabilitation	Stormwater management plan	Groundwater quality and erosion monitoring		Mine manger		Minimise

Stakeholder expectations and / or comments
None.
Residual and latent risks
Depending on the results of further monitoring, the risk of potential pollution (excluding AMD) will be a residual risk. The potential for AMD becoming a latent impact is not probable.

6 Air quality pollution and noise generation

Activity, nature and consequence of impact:

Backfilling of quarry 6 with mine residue can lead to dust and noise generation. This is a negative impact on air quality and environmental noise. The new plant can also lead to air pollution.

Cumulative impacts:

Activities from the adjacent mine can lead to air pollution.

Assumptions, uncertainties and gaps in knowledge

Impacts and management were extracted from various specialist studies undertaken in line with the Section 102 integrated environmental authorisation as well as the 2014 approved EMP for Klipplaatdrift Mine. The significance rating on these reports, differ from this report, and has been amended to fit into the current report. The impacts are only based on the backfilling of the quarry and storage of the water. All other already existing activities, which are not part of the activities described in this report, are not currently included here.

	Air quality	**Environmental noise**
Intensity and magnitude	1. Dust generation and environmental noise will have a low intensity.	
Duration	2. This impact will take place during the LoM.	
Extent or spatial scale	2: The impact can be site specific.	
Probability	2. There is a probability of dust generation to take place.	3. Environmental noise will take place.
Significance	7: Medium	8: Medium
Degree to which impact can be reversed	1. Impact can be in its entirety be reversed.	
Degree to which impact may cause irreplaceable loss of resources	1. With correct management, the impact will not cause irreplaceable loss of resources.	
Degree to which impact can be avoided, managed or mitigated	1. Impact can be avoided if correctly managed.	
Significance with mitigation	10. Low	11. Low

Environmental objective

To minimise the generation of dustfall and particulate emissions.

To reduce or avoid environmental noise.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
Dust suppression on unpaved roads (depending on the availability of water).	All phases	Water bowser	Keep record of water used for dust suppression	When road is in use	Mine manager	Costs for monitoring	Minimise
Set speed limits at ≤ 40km/hr.	All phases	Signage Agreement with contractors	Site inspections.	When road is in use	Mine manager	No additional costs. This forms part of the operating costs	Minimise
All vehicles and machinery must be maintained to prevent excessive noise.	Operation and decommissioning phase	Maintenance register	Maintenance register	As per schedule of maintenance register	Mine manager	No additional costs. This forms part of the operating costs	Avoid.
Working hours are limited to nine hours a day for six days per week. Maintenance will be carried out during weekend periods	Operational	None	Site inspections	Continuous	Mine manager.	No additional costs.	Minimise.

Stakeholder expectations and / or comments

None received

Residual and latent risks

Wind erosion presents a residual risk on air quality. No residual risks on environmental noise. No latent impacts were identified at this stage.

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

Impact assessment

The methodology used to assess the significance of an impact is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA for Mining Activities that Require EA, of 2018, GN 86 in terms of NEMA. The impact significance methodology described below also complies to Appendix B of the Operational Guideline to Integrated Water and Waste Management of 2010 in terms of the NWA. In the event of any Section 21c&i water uses in terms of the NWA being assessed, Appendix A of the General Authorisations of 2016, GN 509 in terms of the NWA will be used to construct a risk matrix. Regulation 3(b) of the General Authorisations of 2016, GN 509 in terms of the NWA states that a suitably qualified SACNASP professional member must determine risks associated with this risk matrix.

Impact identification and prediction means forecasting the change of environmental parameters due to developmental patterns. These parameters may also be changing due to climate change and should be included.

Method of assessment: Impact identification and prediction is a stepwise procedure to identify the direct, indirect and cumulative impacts (relating to both positive and negative impacts) for which a proposed activity and its alternatives will have on the environment as well as the community. This should be undertaken by determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity aspects of sites and locations as well as the risk of impact of the proposed activity. Refer to part A(h)(iv) for a complete description of these environmental attributes. Sources of data to be used for gathering data on the environmental attributes as well as the impacts include; monitoring / sampling data collected and stored, assumptions and actual measurements, published data available from the departments or other stakeholders in the area as well as specialist studies. Likely impacts should be described qualitatively and then studied separately in detail. This provides consistent and systematic basis for the comparison and application of judgements.

Significance rating: Ratings should then be assigned to each criterion. Significance of impacts should be determined for each phase of the mining lifecycle this includes; preconstruction, construction, operational, closure (including decommissioning) and post closure phases. The significance of impacts should further be assessed both with and without mitigation action. The description of significance is largely judgemental, subjective and variable. However, generic criteria can be used systematically to identify, predict, evaluate and determine the significance of impacts resulting from project construction, operation and

decommissioning. The process of determining impact magnitude and significance should never become mechanistic. Impact magnitude is determined by empirical prediction, while impact significance should ideally involve a process of determining the acceptability of a predicted impact to society. Making the process of determining the significance of impacts more explicit, open to comment and public input would be an improvement of environmental assessment practice. Impact magnitude and significance should as far as possible be determined by reference to either legal requirements (accepted scientific standards) or social acceptability. If no legislation or scientific standards are available, the EAP can evaluate impact magnitude based on clearly described criteria. A matrix selection process is the most common methodology used in determining and ranking the site sensitivities:

- The consequence: includes the nature / intensity / severity of the impact, spatial extent of the impact, and duration of the impact.
    - The nature / intensity / severity of the impact: An evaluation of the effect of the impact related to the proposed development on the receiving environment. The impact can be either positive or negative. A description should be provided as to whether the intensity of the impact is high, medium, or low or has no impact in terms of its potential for causing negative or positive effects. Cognisance should be given to climate change which may intensify impacts.
    - The spatial extent of the impact: Indication of the zone of influence of the impact: A description should be provided as to whether impacts are either limited in extent or affect a wide area or group of people. Cumulative impacts must also be considered as the extent of the impact as may increase over time.
    - The duration of the impact: It should be determined whether the duration of an impact will be short-term, medium term, long term or permanent. Cumulative impacts must also be considered as the duration of the impact as it may increase over time.
- The likelihood: includes the probability of the potential occurrence of the impact, and frequency of the potential occurrence of the impact
    - The probability of the impact: The probability is the quality or condition of being probable or likely. The probability must include the degree to which these impacts can be reversed; may cause irreplaceable loss of resources; and can be avoided, managed or mitigated
    - The frequency of the potential occurrence of the impact.
- The significance: This is worst case scenario without any management measures. See below how significance is determined: Impact that may have a notable effect on one or more aspects of the environment or may result in noncompliance 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. Mitigation measures should be provided with evidence or motivation of its effectiveness

Example of significance rating:

Prior to mitigation	Intensity and magnitude	1 - Low: natural processes or functions are not affected.	2 - Medium: affected environment is altered but function and process continue in a modified manner.	3 - High: function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
		1 – Low: the positive impact will only not adequately return processes or functions to its natural state.	2 – Medium: the positive impact will mostly but not entirely return processes or functions to its natural state.	3 – High: the positive impact will entirely return processes or functions to its natural state.
	Duration	1 – Short term: dissipation of impact through active or natural mitigation in a time span shorter than the LoM.	2 – Life of mine: the impact will last for the entire operational life of the mine but will be mitigated thereafter.	3 – Permanent: the impact will not cease after LoM ceases.
	Extent or spatial scale	1 - Activity specific: impact will only occur where the activity takes place.	2 – Site specific: impact will only occur within the site.	3 – Local or regional: impact can occur outside the site.
	Probability	1 – Improbably: it is unlikely that the impact will occur.	2 – Probable: it is likely for the impact to occur.	3 – Definitely: the impact will occur.
	Significance	None or low If the sum of the above ranking equal or less than 6 and no ranking equals 3.	Medium If the sum of the above ranking is equal or between 7 and 9.	High If the sum of the above ranking is above 9.
With mitigation	Degree to which impact can be reversed	1 – Completely reversible: with correct management, the impact can be completely revered.	2 – Somewhat reversible: after proper management, the impact may persist but can be reversed to some degree.	3 – Not reversible: with proper management, the impact cannot be reversed.
	Degree to which impact may cause irreplaceable loss of resources	1 – Replaceable: loss of resource can be completely replaced	2 – Somewhat replaceable: loss of resource can somewhat be replaced	3 – Not replaceable: resources will be completely lost.
	Degree to which impact can be avoided, managed or mitigated	1 – Impact can be completely avoided, managed or mitigated	2 – Impact can somewhat be completely avoided, managed or mitigated	3 – Impact cannot be completely avoided, managed or mitigated

	Significance with mitigation	None or low If the sum of the first significance and the sum of the rankings with mitigation is equal less than 11 and no ranking equals 3.	Medium If the sum of the first significance and the sum of the rankings with mitigation is equal or between 12 and 17.	High If the sum of the first significance and the sum of the rankings with mitigation is equal to or more than 18.

Mitigation and management

Management methodology is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA for Mining Activities that Require EA, of 2018, GN 86 in terms of NEMA; and the Mining and Biodiversity Guideline (Mainstreaming Biodiversity into the Mining Sector) IDB of 2013 in terms of the MPRDA.

Management statements detail the processes, procedures and practices required to achieve an impact management outcome. A hierarchy of management tools used can also be used as seen below.

Mitigation should include measures in the following order of priority. The aim is to prevent adverse impacts from happening or, where this is unavoidable, to limit their significance to an acceptable level.

Avoiding or preventing impacts

If the biodiversity (an ecosystem, habitat for threatened species, ecological corridor or area that provides essential ecosystem services) is of conservation value or importance, it is best to plan to avoid or prevent impacts altogether by changing the location, siting, method or processes of the mining activities and related infrastructure.

Minimising impacts

Minimising impacts of mining is a mitigation measure that deals with the environment in general. In areas where the biodiversity is to be affected is of conservational value or importance, then every effort should be made to minimise those impacts that cannot be avoided or prevented. Mining companies should strive to minimise impacts on biodiversity to ensure environmental protection. Section 2 of NEMA contains environmental management principles that resonates with minimising the impact rather than stopping at mitigation, this is imperative in the mining sector.

Rehabilitating impacted areas

Rehabilitation is the measures that are undertaken to “as far as it is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which aligns to the generally accepted principle of sustainable development. A closure plan is an

essential part of rehabilitation and must be developed based on the establishment of the closure objectives and criteria.

Biodiversity offsets

Biodiversity offsets are measurable conservation gains that help to balance any significant biodiversity losses that remain after actions to avoid, minimise and restore negative impacts have been taken. They are the last stage of mitigation and should be considered after appropriate avoidance, minimisation, and rehabilitation/restoration measures have been applied already.

When dealing with management, impact management outcomes must:

- be set for the expected activity-based impacts;
- describe the desired outcome of the management measure/s prescribed or the standard to be achieved (environmental objective);
- be clearly documented and identified per project phase as in the impact identification and significance rating process (this must be aligned to the mines closure objectives, and must therefore include predicted long-term result of the applied management measures);
- be measurable to determine compliance, which includes time frames and schedule for the implementation of the management measures; responsibilities for implementation and long-term maintenance of the management measures; financial provision for long-term maintenance; and monitoring programmes to be implemented;
- be informed by stakeholder expectations; and
- ensure legal compliance;

Finally, the impact assessment must refer to the residual and latent impact after successful implementation of the management measures.

vii) 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

As part of this development, no alternatives have been applied for.

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

Refer to Part A, section (h)(v) for all mitigation measures that could be applied and the level of risk.

ix) Motivation where no alternative sites were considered

There is no alternative. The activity is to backfill to aid in rehabilitation.

x) Statement motivating the preferred site

The rehabilitation of Quarry 6 was chosen because the site is already disturbed and needed rehabilitation. This activity was planned with the aid of specialist. The final decommissioning and rehabilitation will be discussed with the community.

i) Full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity

Refer to Part A(g)(v & vi) above for a 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.

j) Assessment of each identified potentially significant impact and risk

Refer to Part A(g)(v & vi) above for a full description of all impacts as well as their significance. This includes potentially significant impact and risks.

k) Summary of specialist reports complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report

- An air quality impact assessment was conducted in 2019 and the following aspects were noted. Emission sources within a 50 km radius of the Krugerpost mine include: agriculture, mining, smelting, incineration (Tswelopele funeral services), commercial and industrial industries associated with the towns and settlements, domestic fuel burning (an example is open cooking areas in Burgersfort), forest burning, burning at landfill sites and vehicles on roads and rails. No local dustfall monitoring or hourly ambient air quality data was available at the time of the assessment. For an understanding of the ambient particulate air pollution, reference was made to the WHO's global ambient air pollution. The interactive map showed the modelled annual mean ambient PM2.5 for the year 2016 to range between 16 and 25 µg/m3 for the assessment area. Refer to Table 11 in the AIA for the modelled annual mean PM2.5 and PM10 for the Waterberg area in the Limpopo province and the Emalahleni, Middleburg, Sekunda and Ermelo area in the Mpumalanga province (based on updated information in 2018).
- Geohydrological impact assessment for the quarry operations at Klipplaatdrift and Klipfontein was conducted in 2019 and the following was noted: The specialist groundwater investigation relating to this application concluded and recommended the following:
    - No substantial groundwater related impacts, quality and quantity, are foreseen during construction, operation or post-closure phases.

- There are shortcomings with regards to current monitoring and surface water and groundwater monitoring should be implemented as recommended in this report.
- Monitoring should include quality and water level monitoring with regular interpretation of results by a qualified and professional geohydrologist.
- Decommissioning of the facilities should entail final rehabilitation, i.e. re-shaping to enhance free drainage / surface run-off, top soiling and seeding.
- Monitoring and management of the natural surface water environment should also receive priority. Degradation of these natural systems should be avoided.
- Discharge or seepage of affected water into the natural surface water environment should be avoided.

l) Environmental impact statement

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

The topography of the area will be impacted in a positive manner as further sloping and rehabilitation on is planned for the near future.

Soils, land capability, surrounding land use and landscape character will be impacted further by the project. If soil pollution does occur, it will be mitigated through the various management measures set out in the impact assessment. Once rehabilitation is complete, the end land-use will be grazing and game farming.

Vegetation and animal life will be disturbed during rehabilitation activities. This could lead to the establishment of alien and invasive species.

Surface water pollution due to run-off from already existing mine residue will have a negative impact on the environment. However, the approved water monitoring programme will ensure that this does not occur, and the adequate operational measures are taken.

Seepage from already existing mine residue can potentially lead to groundwater pollution. Vertical seepage will dominate during the operational phase and will most probably remain isolated during the operational phases. Management measures will ensure that the impact after management is reduced and groundwater monitoring takes place.

Environmental noise may affect the community within the vicinity, the mine will mitigate this through the maintenance of vehicles and machinery to ensure they are functioning optimally. The mine will further ensure that the safety aspect is also included, and protection devices are provided to workers.

The safety of the community due to an increase in traffic may be a risk for the community. However, the mine is fenced, and all vehicles drive within the stipulated speed limits of the mine.

(ii) Final Site Map

Refer to Addendum 1 for all the maps.

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

There is no alternative to the opening of a quarry, placement of overburden, construction of haul roads, construction of a crushing a screening plant and a dryer or the backfilling of mine residue.

Environmental component	Negative implications	Positive implications
Geology	There will be no negative impact	There will be no positive impact
Topography	There will be no negative impact	The project will have a positive impact on topography as the topography of the mine residue areas will be changed to a more natural topography. This will further also have a positive impact on the drainage patterns as well as the visual aspects.
Soils, land capability, surrounding land use and landscape character	The project will have a negative impact on the soil as soil pollution from spillages of mine residue or hydrocarbons may occur.	There will be no positive impact
Vegetation and animal life	There will be no negative impact	There will be no positive impact
Surface water	The project may have negative implications on surface water resources as receptors may be influenced by the rehabilitation activities.	There will be no positive impact
Groundwater	The project will negatively impact groundwater resources as vertical seepage from the already existing mine residue during the operational phase may occur.	There will be no positive impact
Air quality	Air pollution due to dust from backfilling and rehabilitation activities has the negative potential to reduce the air quality without proper air quality management measures as per the air emissions license.	There will be no positive impact
Environmental noise	Environmental noise from backfilling has the potential to negatively impact receptors within the area.	There will be no positive impact
Archaeological, historical and cultural aspects	There will be no negative impact as already existing infrastructure to be used therefore no impact on archaeological, historical and cultural aspects.	There will be no positive impact as already existing infrastructure to be used therefore no impact on archaeological, historical and cultural aspects.
Socioeconomic	The project will have a negative impact on the mine as increased traffic leading	The project will have a positive impact on the community as locals will be employed by the mine.

Environmental component	Negative implications	Positive implications
	to the area will endanger the people walking in the vicinity.	

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

Refer to Part A(g)(v) for all Proposed impact management objectives and the impact management outcomes for inclusion in the EIA/EMP Part B.

n) Final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment

There is no alternative to the pumping of water from Quarry 6 and Quarry 7 or the backfilling of Quarry 6 with mine residue (slimes and waste rock). This is the best rehabilitation activities that were proposed for the mine and various specialist studies were undertaken based on this.

o) Any aspects which were conditional to the findings of the assessment which are to be included as conditions of authorisation

All management measures set out in this EIA/EMP must be complied with. The mine must further comply with any conditions set out under other authorisations such as the IWUL.

p) Description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed

Various specialist studies were conducted as part of the application. All impact assessments and management measures are based on either the new specialist studies conducted, previous studies or on acceptable general standards.

q) Reasoned opinion as to whether the proposed activity should or should not be authorised and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation

i) Reasons why the activity should be authorised or not

The proposed activity should be authorised as it will contribute largely to the production of andalusite which can contribute largely to South Africa's Gross Domestic Product (GDP). The project will also ensure that locals are involved and will create opportunities for skill transfer between the mine and locals.

ii) Conditions that must be included in the authorisation

The mine must update the water monitoring requirements as soon as DWS has issued an IWUL.

r) Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised

Krugerspost is an existing andalusite mine with a Life of Mine (LoM) of up to 3 May 2020. The mine is in the process of extending the mining right period. Assuming an 'average' (may differ from year to year due to in situ grades and yield variations) consumption of 35,000 tons Krugerite per annum until the current reserve runs out, the expected life of mine (LoM) is until the year 2026. This means that the currently LoM is 6 years and the period for the EA is therefore approximately 8 years.

s) Undertaking under oath or affirmation by the environmental assessment practitioner in relation

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 ☒

d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed ☒

I, Deshree Pillay (9505080248080), hereby declare that I have no conflict of interest related to the work of this report. Specially, I declare that I have no business, personal, or financial interests in the property and/or mining right being assessed in this report, and that I have no personal or financial connections to the relevant property owners, or mine. I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise and that there are no circumstances that may compromise my objectivity in performing such work.

The EIA/EMP will, should it comply with the provisions of section 24N of NEMA as well as the applicable EIA Regulations i.t.o. NEMA, be approved, become an obligation in terms of the approved EIA/EMP and mining right issued.

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the, and confirm that the above EIA & EMP compiled in accordance with Appendices 3 & 4 of the EIA Regulations.

Full Names and Surname	Deshree Pillay
Identity Number	9505080248080
Designation	EAP
Signature	

t) Details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts

(i) Annual forecasted financial provision calculation

The CES Group was contracted by Shangoni to acquire rates for demolition and rehabilitation of mining activities. Procurement of budget pricing approached by identifying reputable demolition companies, various sites of varying sizes at various locations and identifying local companies in the study area with ability to work on similar scale project. A bill of quantities (BoQ) was distributed to the various companies. The table below indicates the number of contractors to which the BoQ was distributed and the number of tenders received afterwards.

Table 24: Results of rate acquisition process

Area	Number of contractors identified	Tenders received
National	6	1
North West	6	3
Free State	5	1
Northern Cape	7	2
Limpopo	5	3 (One joint venture with national based company)
Total	29	10

The prices received from contractors were reviewed by the CES Group, after which average and meridian rates were drawn rates to correctly establish a baseline rate. The following methods to establish the baseline rates were followed:

Price A - Average if priced – across the board average of rates received per category;

Price B - Median pricing – “middle” rate of all rates in series per category;

Price C - Average between Price A & B;

Price D - Average rate excluding top and bottom rates per category.

Price D - rate category that was used in the closure cost calculation, unless otherwise indicated in the closure cost spreadsheet “Rate” sheet.

The above-mentioned method was utilised to establish the baseline rates. Shangoni updated the bill of quantities in 2018 with rates acquired form a demolition and rehabilitation contractor that operates nationally. BECS updated the 2018 to 2019 rates using the CPI inflation index. The rates / tariffs used during the closure cost calculation is indicated in the table below.

The closure budget consists of the following areas:

- Physical - Demolition of infrastructure where infrastructure does not form part of end land use. Potential to transfer to third party was identified.
- Biophysical - Actions to safeguard (making safe and stable) and re-establish the biophysical to ensure a sustainable landform and mitigate identified risks. This includes levelling of the dumps, seeding of the trees and grass.

Table 25: Tariffs used for quantum determination

List reference	Unit	Rates (2018)	Rates (2019)	Rate used
800mm concrete structures	m³	R 598.21	R 624.41	National
400mm concrete structure	m³	R 532.71	R 556.04	National
250mm concrete structure	m³	R 416.86	R435.12	Northern Cape
340mm concrete structures	m³	R 476.41	R 497.28	Northern Cape
Single storey double brick building	m²	R 532.71	R 558.28	National
Multi-level double brick building	m³	R 518.09	R 542.96	Limpopo
Excavating foundations	m³	R 381.13	R 399.42	North West
Light steel	m²	R 63.28	R 66.32	National
Medium steel	m²	R 345.39	R 361.97	Limpopo
Heavy steel	m³	R 174.39	R 182. 76	Lowest ave (converted from R/t to R/m3 - R/t:7.85t/m3)
Infrastructure: Railway lines	m	R 95.28	R 99. 85	North West
Infrastructure: Pipelines <400mm	m	R 44.89	R 47.04	Lowest quote (National)
Infrastructure: Pipelines >400mm	m	R 80.87	R 84.75	Lowest quote (National)
Dismantling fences 1.2m	m	R 14.29	R 14.98	North West
Dismantling fences 1.8m Mesh	m	R 14.29	R 14.98	North West
Dismantling fences 1.8m Security	m	R 16.08	R 16.85	North West
Dismantling fences 1.m Steel pallisade	m	R 26.20	R 27.46	National
Dismantling fences 1.8m Pallisade & concrete	m	R 26.20	R 27.46	National
Dismantling fences 2.1m Elec.	m	R 26.20	R 27.46	National
Dismantling fences 2.4m Diamond mesh	m	R 26.20	R 27.46	National
Dismantling fences 1.8m Pre-cast	m	R 26.20	R 27.46	National
Erecting fences	m	R 158.18	R 165.77	Quote from fencing company
Infrastructure: Powerlines	m	R 53.60	R 56.17	Northern Cape
Silos	m³	R 89.77	R 94.08	(Lowest quote, National - 2018 actual quote)

List reference	Unit	Rates (2018)	Rates (2019)	Rate used
Infrastructure: Sub-stations	no	R 31 978.78	R 33 513.76	North West
Infrastructure: Transformers	no	R 12 600.95	R 13 205.80	North West
Fuel pumps & tanks	m³	R 1 012.36	R 1060.95	North West
Workshop cranes	no	R 7 741.60	R 8113.20	Limpopo
French drain	no	R 7 842.84	R 8219.30	North West
Soakaway toilet	no	R 7 842.84	R 8219.30	North West
Water tanks	m³	R 535.96	R 561.69	Limpopo
Underground fuel tanks	m³	R 1 361.00	R 1426.33	(Lowest quote, National - 2018 actual quote)
Conveyor belts	m	R 643.15	R 674.01	Northern Cape
Earth dams	m³	R 46.00	R 48.21	(Lowest quote, National - 2018 actual quote)
Temporary office 6m	no	R 1 786.52	R 1872.27	North West
Temporary office 12m	no	R 1 786.52	R 1872.27	North West
Temporary office 9.6m	no	R 1 786.52	R 1872.27	North West
Maintenance	ha	R 11 361.43	R 11 906.78	Mine rate
Ripping	m²	R 20.00	R 20.96	(Lowest quote, National - 2018 actual quote)
Tar road ripping	m²	R 28.00	R 29.34	(Lowest quote, National - 2018 actual quote)
Tar removal	m²	R 40.17	R 42.10	National
Paving removal: Bricks	m²	R 58.00	R 60.78	(Lowest quote, National - 2018 actual quote)
Paving removal: Concrete	m²	R 52.00	R 54.50	(Lowest quote, National - 2018 actual quote)
Weigh bridges	m³	R 1 195.27	R 1252.64	Lowest ave (top and bottom removed)
Pumps & pump rooms	no	R 2 150.68	R 2253.91	National
Return water dams	m²	R 25.00	R 26.2	(Lowest quote, National - 2018 actual quote)
Fresh water earth dams	m³	R 46.00	R 48.21	(Lowest quote, National - 2018 actual quote)
Dump levelling: Bulldozer	m³	R 36.86	R 38.63	National
Dump levelling: Grader	m³	R 36.42	R 38.17	National
Planting trees 20l	no	R 178.65	R 187.26	Northern Cape

List reference	Unit	Rates (2018)	Rates (2019)	Rate used
Planting trees 50l	no	R 357.30	R 374.45	Northern Cape
Planting trees 100l	no	R 535.96	R 561.69	Northern Cape
Seeding	m²	R 4.00	R 4.19	National
Planting grass	m²	R 43.55	R 45.64	Lowest ave (top and bottom removed)
Backfilling of pit	m³	R 9.14	R 9.58	QS rate
Enviroberm	m	R 25.48	R 26.70	Quote from specialist
Hydro-seeding/mulching	m²	R 32.80	R 34.37	Lowest ave (top and bottom removed)

The following table contains a summary of the calculations made for the premature closure cost.

Table 26: Summary of the closure cost calculation

Item	Size or number of years	Rate	Final cost	Comment
Removal of pipelines	1	R36 000.00	R36 000.00	Estimated costs
Seeding Office dam	262 000	R4.19	R1 097 780.00	
Seeding Quarry 1	100 000	R4.19	R419 000.00	
Seeding Quarries 2 & 3	139 700	R4.19	R585 343.00	
Seeding Hostel Quarry	24 600	R4.19	R103 074.00	
Removal of Ericson Dam	500	R561.69	R280 845.00	
Seeding of Skatkis Quarry / Quarry 6	242 500	R4.19	R1 016 075.00	
Removal of alien vegetation	5	R50 000.00	R250 000.00	Estimated costs for 5 years
Soil erosion, vegetation growth, and alien vegetation monitoring	5	R30 000.00	R150 000.00	Estimated costs for 5 years
Groundwater monitoring	20	R30 000.00	R600 000.00	Quarterly for 5 years
Sub-total			R4 538 117.00	
P&G (13.5%)			R612 645.80	
Contingency (10%)			R453 811.70	
Total			**R5 604 574.50**	

(ii) Confirmation of the amount that will be provided should the right be granted

The mine has financial provision in place for the mine residue. This will be updated once DMR requests such an update.

(iii) Method of providing financial provision contemplated in regulation 53

This amount will be provided using a bank guarantee.

(iv) Capacity to manage and rehabilitate the environment

Refer to the tables in Part A(g)(v) for a description of the environmental budget. Financial provision update was submitted to the DMR for the existing mine and will be relevant for a period of 1 year.

u) Indication of any deviation from the approved scoping report, including the plan of study

All specialist studies with their impacts and management have been included. From this the maps and plans have been updated.

v) Any specific information that may be required by the competent authority

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

Refer to Part A(g)(v) above.

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

Refer to Part A(g)(v) above.

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

24 (4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment-	
(a) must ensure, with respect to every application for an EA-	
i. Coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state;	DMR is the only applicable authority for the proposed integrated EA and thus the only organ of state. DWS is, however the competent authority for the IWULA. All other organs of state and stakeholders received the ESR and will receive the EIA/EMP for review.
ii. That the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project;	All the findings from investigations have been included in this EIA/EMP.
iii. That a description of the environment likely to be significantly affected by the proposed activity is contained in such application;	Environmental baseline information, based on specialist studies, has been included in this EIA/EMP.
iv. Investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and	Investigation of impact on the environment and assessment of the significance of the potential impacts have been done by specialists.

v. Public information and participation procedures which provide all I&APs, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and	Refer to Section 2(h)(ii) for the PPP.
(b) must include, with respect to every application for an EA and where applicable-	
i. Investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;	Investigation of impact on the environment and assessment of the significance of the potential impacts have been done by specialists.
ii. Investigation of mitigation measures to keep adverse consequences or impacts to a minimum;	Investigation of mitigation measures were done by the specialists.
iii. Investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;	Refer to Section 2(h)(v)(13)
iv. Reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;	All gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information will be included in the EIA/EMP.
v. Investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation;	A monitoring plan is included in the EIA/EMP.
vi. Consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and	Environmental attributes identified were taken into consideration during the process.
vii. Provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question.	Refer to Section 2(e) for adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

a) Details of the Environmental Assessment Practitioner

Refer to Part A(a) for the requirement for the provision of the details and expertise of the EAP.

b) Detailed description of the aspects of the activity that are covered by the EMP as identified by the project description

The requirement to describe the aspects of the activity that are covered by the draft EMP is already included in Part A(1)(h), and (g)(v) herein as required.

c) Map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers

Refer to Part A, section h)(iv)(13).

d) Description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development

i) Planning and design

Refer to part A(h)(v) above for all impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. Refer to part A(e) above for the policy and legislative context in which the development will take place. Planning and design takes cognisance of sustainable development principles: Section 2(3 & 4), of NEMA, section 2, 2(a)(ii), 22(2)(d) of NWA, GN 527 of 2004 i.t.o. MPRDA, section 37 of MPRDA, section 2(a)(ii) of Section 2(3 & 4) of NEMA, section 2 of NWA, section of, and section of NWA. This ensures that mining will take place in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of mining in order to ensure that exploitation of mineral resources serves present and future generations. The mine has also ensured that all authorisation applications have taken place prior to mining in terms of the MPRDA, NWA and NEMA.

ii) Pre-construction activities

Refer to part A(h)(v) above for all impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. Mining plans and surveying takes place in accordance with GN 447 of 2011 i.t.o. the Mine Health and Safety Act No 29 of 1996 (as amended). Refer to part A(e) above for the policy and legislative context in which site clearing and pre-construction activities take place. Pre-construction activities will only take place once the mine has been granted the relevant authorisations to go ahead with mining.

iii) Construction activities

Refer to part A(h)(v) above for all impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. Refer to part A(e) above for the policy and legislative context in which site clearing and construction activities take place.

iv) Rehabilitation of the environment after construction and closure

Rehabilitation and closure will take place in accordance with Section 24R of NEMA, Appendix 5 of the EIA Regulations, sections 43, 56, 61 of MPRDA. A closure plan will be submitted with this EIA. Closure objectives form part of the draft EMP, and must identify the key objectives for mine closure to guide the project design, development and management of environmental impacts; provide broad future land use objective(s) for the site; and provide proposed closure costs. Imerys must ensure that details of rehabilitation of the residue deposit are provided in the EMP.

1 End land use

The end land-use has been identified as grazing and game farming. Water accumulating within the remaining quarries will be utilised and optimised to compliment the end land-use. Sloping should be at a safe angle for cattle and other animals to graze on site and provide easy access to the water. Sloping should allow for free drainage and prevent siltation of the water resources.

2 Residual impacts

2.1 Geology

The removal of andalusite and hence geology will be permanent and therefore the impact will be permanent and therefore a residual risk.

2.2 Soil, pre-mining land capability and land use

Erosion of rehabilitated areas and erosion of final void edges will occur along with safety risks caused by water filling the final void.

2.3 Vegetation and animal life

Alien vegetation establishing on areas that have not been rehabilitated in a residual risk. This will be mitigated through vegetation monitoring.

2.4 Surface water

A natural depression will remain post-closure where surface water will likely accumulate.

2.5 Groundwater

The groundwater quality is not expected be affected in terms of quality and the water level will recover post closure. Therefore no/little residual impacts are expected if effective practices are in place during mining.

3 Closure objectives

According to the Approved Environmental Management Programme for Krugerspost Andalusite Mine, 196 MR, approved 1999:

Key closure objectives are necessary for mine closure, to guide the project design, development and management of environmental impacts. The closure objectives for the mine are as follow:

1. To rehabilitate the land to a level where natural topography, vegetation and land use approach the original state as closely as possible.
2. That stormwater control is permanent in view of the large volumes of fine erodible materials that have been created.
3. That the water quality and catchment yield return to the original state as closely as possible.

The rehabilitation of Krugerspost will focus on sloping of quarries and sloping and levelling of any additional overburden; removal of alien vegetation and establishment of natural vegetation on all disturbed areas to also prevent erosion; adequate stormwater control to prevent siltation and pollution of the Spekboom River; and removal of all old infrastructure. The rehabilitation plan will, therefore, be compatible with the closure objectives.

4 Rehabilitation process

Re-vegetation, alien control, sloping and earthworks

When considering which vegetation to use in rehabilitation, it is important to consider the natural vegetation of the site before mining (if known) and the natural and/or indigenous vegetation of the surrounding properties. This will guide the selection of vegetation species to ensure that vegetation used in rehabilitation is similar to that of the original vegetation and / or similar to surrounding properties. By using species indigenous to the area in which the mine is located, it will also facilitate the creation of habitats similar to those that should occur on the mining site. This will facilitate the re-colonisation of the site by indigenous fauna.

4.1 Veld types

Veld types were delineated per Mucina & Rutherford's "The Vegetation of South Africa, Lesotho and Swaziland". The area is situated within the Lydenburg Thornveld vegetation unit. This vegetation type includes specific species compositions and vegetation structure. Seeds obtained from the mining area can be used for revegetation of the slimes dam as well as the quarries, however, please note, it is unclear whether these seeds will germinate and whether these seeds are all natural vegetation species. It is therefore suggested that seeds are planted using either a rehabilitation (revegetation) specialist or the species described in **section 4.2** below.

4.2 Grass species

The selection of grass species to be used in the rehabilitation of the mining area has been compiled using the information from Mucina & Rutherford's "The Vegetation of South Africa, Lesotho and Swaziland' and the Grab-a-Grass Dial provided by the Agricultural Research Council (ARC) with the supporting document 'Rehabilitation Recommendations after Alien Plant Control' (Campbell, 2001). This dial provides guidance with regards to the selection of grass species based on the characteristics of the grass species, the conditions in which they would be planted and the purpose of the vegetation

cover (in this case for soil stability and soil cover). Per Mucina & Rutherford these vegetation types include grass cover; therefore, rehabilitation will focus on the establishment of grass cover, with the species selected being determined by several factors. Based on the information provided on the Grab-a-Grass Dial, selection criteria have been identified for use in the selection of grass species. The list provided below gives the selection criteria.

1. The first step is to decide on the final land use of the area. This includes the type of soil-binding the grass provides.
2. It is important to know how easily the grass can establish together with the lifespan of the grass, whether it is annual or perennial grass species. This may enhance the establishment of a grass species and help reduce the invasiveness of a grass species.
3. The third step is to consider whether the grass is indigenous and the invasiveness of non-indigenous grasses.
4. The climatic conditions of the site
    I. What is the minimum MAR needed for successful grass establishment?
    II. Is the grass tolerant to drought?
    III. Is the grass tolerant to frost?
5. Soil types where vegetation will be planted.
    I. What type of soil fertility is needed for the grass to grow?
    II. What type of texture is the soil?
    III. Is the grass tolerant to water logging?
6. What type of planting method should be used?
7. What is the planting time of the grass species?

The grass species suitable for use in rehabilitation in this area and the characteristics of each species have been extracted from the reference material (the Grab-a-Grass Dial). Commercial grasses are commercially available species. No commercial grasses were identified using the Grab-a-Grass Dial. Veld grasses are not usually commercially available and are harvested from the veld. Therefore, only small amounts are available. Veld seeds are also usually dormant that requires a period of after-ripening or has a low percentage viability. These grasses are more difficult to establish. It is also important to note that in the veld, grasses do not occur isolated, but are mixed with other seeds. To reduce the chances of mixing the selected seeds with other seeds, choose patches that are dominated by the chosen grass for seeds. All grass seeds bought should be accompanied by a certificate. Livestock should be excluded from rehabilitation site as far as possible.

4.2.1 End land use aims

It is necessary to decide what the end land use will be after rehabilitation. The end land-use has been identified as grazing and game farming. At present, the aim is to control soil erosion, and obtain a vegetation cover. For the controlling of soil erosion, creepers are better than tufts, however, creepers are usually invasive. No creepers were identified to be used. A species that establish easily is *Melinis*

repens. *Hyparrhenia hirta* establish medium well, and *Setaria sphacelata* establish with difficulty. These species occur within the area and are therefore included in the grasses to be used. *Hyparrhenia hirta* and *Setaria sphacelata* have a high grazing value. These grasses will be suitable for grazing as part of end land use. *Melinis repens* has a low grazing value and should be used on area such as the Office Slimes Dam to prevent grazing as much as possible.

4.2.2 Tolerance to local climate

The MAR of the area is about 663mm. All three species need less rainfall and will therefore not be affected by this. As South Africa is prone to drought and the site is situated within a drought prone area, the ability of selected species to endure drought periods is very important. *Melinis repens* can tolerate drought, whereas *Hyparrhenia hirta* and *Setaria sphacelata* can tolerate drought on a medium level.

4.2.3 Tolerance to soil characteristics

Topsoil is minimal and in many areas, absent. Topsoil that does occur will have low soil fertility. *Melinis repens* and *Hyparrhenia hirta* can grow on soil with low soil fertility and *Setaria sphacelata* in soil with medium fertility. Soils are mostly clayey and all three grasses can grow in this texture. None of these species can easily grow in water-logged areas. This might pose a problem in some of the quarries if the overburden being backfilled becomes waterlogged. The quarries being backfilled might only have stony substrate with minimal to no topsoil. *Melinis repens* can grow on stony areas.

4.2.4 Indigenous and invasiveness

All grasses are indigenous with low invasive status except *Hyparrhenia hirta* with high invasive status.

4.2.5 Seed harvesting of veld grasses

The following is extracted from Agri-Facts (Brooks et al., nd).

Grasses need 20-30 days after flowering for seeds to properly mature. This will vary because the period of flowering and seed development lasts from several days to two weeks. Thus, seed heads emerge at different times, which cause uneven ripening. Hot, dry weather shortens the ripening time. The ideal time to swath is when seed is at the medium to hard dough stage and still firmly attached. Moisture testing of the entire seed head (35-50%) is also a useful indicator of when to swath. Most grasses will hold their seed for 10-15 days, but the time from medium dough to seed shatter can be as short as three or four days. Seed shattering will depend on the grass species, stage of maturity, the variety, the degree of lodging, and wind, rain or hail.

Table 27: Grass species to be used not in mixture

Scientific name	Soil binding	Use	Grazing value	Establish easily?	Life span	Indigenous	Invasive	MAR required	Tolerance to drought	Tolerance to frost	Tolerance to water logging	Soil fertility needed	Soil texture	Planting method	Planting time
Melinis repens	Tuft	None	Low	Yes	Ann	Yes	Low	350+	Yes	Yes	No	Low	S-C, stony	S, P	Spring
Hyparrhenia hirta	Tuft	P, B	Med	No	Per	Yes	High	500+	Med	Yes	No	Low	S-C	Th, P	Spring – Autumn
Setaria sphacelata	Tuft	P	Med	Med	Per	Yes	Low	350+	Med	Med	Med	Med	S-C	S, T	Spring

Soil texture: NA = non-acidic; S = sand; SL = sandy loam; L = loam; LC = loamy clay; C = clay

Life span: Ann = annual (lives 1 year), Per = perennial (lives many years)

Planting time:

Planting method = S = seeds; P = plugs; T = tufts; Th = thatch

Use: P = pasture; B = barrier line

Planting time: Spring = Spring+ Summer (Plant after first reliable rains); Spring/Autumn = Plant during Spring+ Summer+ Autumn

Check fields often to determine when the crop is ready to harvest. A crop is ready to harvest when seed is at the medium to hard dough stage (moderate to hard pressure with a thumbnail will dent the seed of large-seeded species). Swath when 75% of the seed heads have matured. Grass seed heads generally ripen from the top down. When the tips begin to shatter, the crop is ready to harvest. Harvest immediately if seed heads shatter when gently struck against the palm. A crop is ready to swath if seed heads shatter when roughly struck against the palm.

In most cases, a conventional grain combine can be used to harvest either a standing or swathed grass crop. Adjust the combine as recommended by the manufacturer and thoroughly clean the combine before harvest. Air intake should be based on seed weight. Shut off the air intake when harvesting light chaffy seed, such as orchard grass. For heavier seeds air intake can be increased slightly. It is important that an even continuous flow of material is fed into the combine. Be careful to prevent seed being carried through the combine in the straw and chaff.

Swath easily shattered grasses in the early morning or in the evening when air humidity is higher. Under low humidity, drying in the swath from 5 to 10 days will usually allow the seed to dry enough for harvest and safe storage.

4.2.6 Time of sowing

Moisture is the most important factor for germination of seed. Seed should be planted after the first reliable rains. All the grasses should be planted in spring. The first rains in the area occur in September; therefore, grass seeds would most likely be planted in September after the first rains. Seed must not be planted in December or January, as this time of the year is too hot for the germination of seeds. *Hyparrhenia hirta* can also be planted in autumn. This must be done at least ten weeks before the expected frost. When grasses are established vegetatively, planting should be done from spring to mid-summer preferably soon after the soils are wetted by good rains. Planting should be done directly after removal of alien plants. Bare soil may lead to erosion, etc. It is also important to keep on with alien control.

Most indigenous grasses have a dormancy period before seeds germinate. Seeds should usually be left to rest for a whole season if obtained from the veld. Seeds purchased from a seed merchant can usually be sowed immediately. Seed should not be stored for more than three years. Seed should be stored in a cool dry place below 25°C away from direct sunlight.

4.2.7 Planting Methods

There are different types of planting methods and plant uses. As the Grab-a-Grass Dial include many types of planting and uses; which has no reference to the grass species chosen, only those relevant to the grasses to be used will be described.

Seeds

Melinis repens and *Setaria sphacelata* can be planted by using this method. When planting grasses using seed, the seeds should be mixed with river sand or lime to make it bulkier. Lime also acts as a marker to indicate where sowing has taken place. The type of sowing depends on the terrain. The bulking of seeds is also advantageous of sowing rate is low or if seed is easily blown by wind. Generally, all seeds must be covered with a thin layer of soil. This will not be possible on the mine residues. Sowing should take place to a depth of 0.5cm. Compaction results in the close contact between seeds and soil. This leads to maximum moisture retaining and optimal seedling establishment.

Broadcast Sowing

This type of sowing is suitable for flat ground and gentle slopes of 0% to 10%. This type of sowing involves the evenly spreading of seeds over and area. Steps to take for sowing:

1. Spread either by hand or cyclone seeder.
2. To ensure that the seed is evenly applied, the seed must be divided into two even portions.
3. Two seeders (seeders being by hand or cyclone seeder) move in the opposite direction with seeds.
4. Areas where indigenous grasses are already established, seed should only be applied to bare soil patches.
5. Control the depth of the seeds by using hand tools. The back of garden rakes can be used to cover seeds or by sweeping with small branches.

Row Sowing

This type of sowing is suitable for shorter, gentle to steep slopes. Sharp-pointed hoes or forks must be used to make shallow furrows. Rows of grass seed will help trap silt and therefore help stabilize the area. The furrows must be space approximately 30-50cm apart on the natural contours. Please be advised, contours should be made parallel with the horizon and not vertical.

1. Seed must be divided into two equal portions.
2. Cover all furrows with each of these portions. Short sticks should be used to cover the seed. Rows can also be scuffed with the shoe.
3. As with broadcast sowing, only sow in bare areas.

Hydroseeding

The mixture is prepared by mixing the mulch, seed, fertiliser, pigment and water in the specified proportions. All ingredients shall be thoroughly mixed to form a homogenous slurry. Seed must be uniformly sown over all areas to be planted.

Thatching

Hyparrhenia hirta can be planted be means of thatching. The stalks provided by the thatch make mulching material and helps with seeding establishment. This method is labour intensive and seeding establishment is difficult. This type of planting method should only be tried on small areas at a time. Steps to be taken for thatching:

1. Lightly rake the bare soil if the soil crust is smooth or hard.
2. Spread the seed heads of the thatch evenly over the area.
3. Thatch should not be too deep – only 5cm of thatch is needed.
4. Hold thatch down with small amounts of soil, rocks or small branches.
5. Thatch can also be tied into small bundles and placed in the direction of water flow. These bundles of thatch also help with the trapping of soil to accumulate seed and stop soil erosion.

Plugs

Grass plugs can be purchased from nurseries. Plugs are re-planted. It is an expensive planting method. Growth rate is rapid and success rate is high. *Melinis repens* and *Hyparrhenia hirta* can be planted using plugs.

Tufts

Setaria sphacelata can be planted using tufts. Always plant the tufts at the beginning of the wet season to ensure that they get the full benefit of the rains. For successful establishment, watering by rain or irrigation is essential for 1 month after planting. Water from the mining area is suitable for the irrigation of pastures. Make a furrow or hole for each grass tuft. Holes should be spaced 5-10 cm apart (one fist width). Soak the tufts in a solution of fertilizer for 1 hour immediately before planting. Push the tuft into the hole, taking care not to bend the roots upward. Push the soil back into the hole, making sure that the root crown is covered with soil. Trample the soil gently to ensure good contact between soil and grass roots. Use cut leaf material as a mulch to help retain water.

4.2.8 Sowing rates

It is important to note; sowing rates should be doubled where possible since many of the seeds do not germinate.

Row sowing rate

Seeds are sown in furrows spaced 30-50cm apart. The seeds are sown over 1ha e.g. 3kg/ha is sown in rows over and area of 100m X 100m.

Broadcast sowing rate

The row sowing rate must be multiplied by 1.5 to give the broadcast sowing rate e.g. 3kg/ha (if row sowing) will be 4.5kg/ha (to convert to broadcast sowing rate).

Barrier lines

Barrier lines are necessary on slopes. This is to prevent soil loss due to water flow. The aim is not to divert water flow but to merely slow it. There are two types of barrier lines that can be used. The first is using loose non-vegetative material and secondly, planting of vegetation. Stumps form invasive plants can be used as vegetation barrier lines. This should be sowed in three lines of 15cm apart. This is followed by 3 rows of another indigenous grass species also sowed 15cm apart. Barrier lines should be established horizontally as with contour lines. The following type of material can be used for non-vegetative barrier line:

- Brushwood;
- Branches;
- Thatch; or
- Stones.

Barrier lines using non-vegetative material depend on the slope of the area and the length of the slope. The following calculations must be done to find the slope percentage:

1. Measure the length of the slope from the top to the bottom (a).
2. Measure the difference in altitude from the top to the bottom (b).
3. Divide (a) into (b) and multiply by 100. This will be the slope percentage.

Refer to Figure 26 for the calculations of barrier lines.

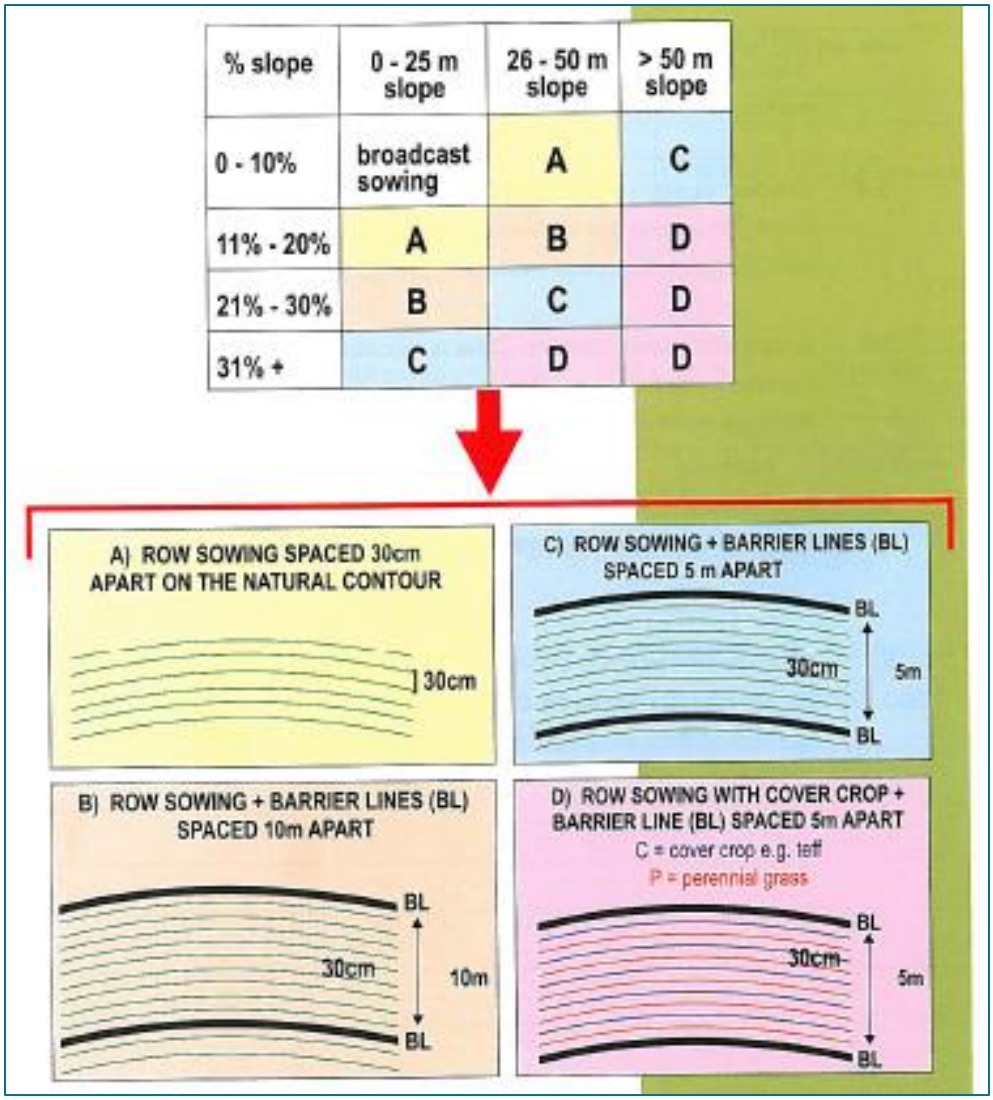


Figure 26: Calculating barrier spacing (Taken by Campbell, 2001)

Brushwood

Brushwood helps to prevent the loss of topsoil and seeds after heavy rains or during strong winds. The area is characterised with hot summers and late afternoon showers during this period. Wind is mild, except for short periods during thunderstorms when strong winds may occur. Therefore, brushwood is necessary on the site. Brushwood also breaks down and helps add organic carbon to the soil. Steps to take in placing brushwood on site:

1. Brushwood; which is twigs and small branches should be cut and placed evenly over the area.
2. The brushwood should be trampled to get good contact with the soil. Please be advised not to disturb seeds or soil covering the seeds.

3. Brushwood should be approximately 0.5-1m high. Too large heaps of brushwood will kill seeds.
4. As the placement of brushwood is labour intensive, only use it in areas where practical.

When placing branches against a slope to control erosion, the broad end of the branches (crown part) must be put uphill. This wider area of twigs and leaves will ensure that more soil and silt will be trapped. Steps to take on steep slopes:

1. Place brushwood horizontal with soil (parallel with natural contours).
2. Fasten brushwood with iron pegs or stabilize by using big rocks and branches.

4.3 Alien control

Information for this section was obtained from 'Rehabilitation Recommendations after Alien Plant Control' (Campbell, 2001) as well as from Bromilow (2010). The control of alien plants is a very important part of the rehabilitation of the site. Alien control should take place before and during the establishment of vegetation on site. There are three phases included in the control of alien plants. These phases are as follow:

1. The initial control. This is a very drastic reduction or eradication of the existing alien plant species on site.
2. The follow-up control. This phase will take place during the planting of vegetation. Alien vegetation seedlings, root suckers and coppice regrowth must be removed.
3. Maintenance control. This phase occurs when re-vegetation has already take place and alien infestation will no longer be a significant problem. This phase will take place two to three times each year during spring, mid-summer and autumn.

<u>Alien vegetation control methods</u>

Control strategies depend on different factor. These factors are:

1. The type of alien plant species;
2. The growth habit of these alien species;
3. The density of alien plants;
4. The terrain;
5. The rehabilitation requirements;
6. The availability of resources; and
7. The urgency / speed of alien control necessary.

Alien species observed on the site are given below. Please note, this list will be extended once rehabilitation is underway.

Table 28: Alien species occurring on site

Scientific name	Common name	Plant type	NEMBA Category*
Acacia mearnsii	Black Wattle	Tree	2
Verbena bonariensis	Wild verbena	Herb	1b
Tamarix ramosissima	Pink tamarisk	Tree	1b
Ricinus communis	Castorbean	Shrub	2
Pseudognaphalium luteo-album	Jersey cudweed	Herb	N/a
Hypochaeris radicata	Hairy wild lettuce	Herbs	N/a
Schinus molle	Pepper tree	Tree	N/a
Eucalyptus globulus or grandis	Blue gum	Tree	*grandis* – 1b

1b – Spreading or allowing to spread prohibited

2 – Permit required for spreading or allowing to spread

Table 29: Alien vegetation control methods

Alien Species Description	Method of Eradication
Acacia mearnsii Fast-growing, extremely invasive leguminous tree. As a pioneer plant, it quickly binds the erosion-prone soil. A round or shapeless tree growing to 15 m in height. It is an unarmed, evergreen tree with shallowly ridged branchlets. All parts are finely hairy. The trunk often bends when trees are grown outside plantations. The bark is smooth, grey, becoming black and fissured; and splits to give a resinous gum (http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Acacia_mearnsii_(Black_Wattle).htm).	Plants should not be felled, bulldozed or burnt without immediate follow-up with herbicides. Mechanical control can include handpull, stripbark, and fire. Registered herbicides: • Foliar spray- Garlon 4, Roundup, Stirrup, Tordon 101, Touchdown, Touchdown Plus, Tumbleweed • Control stumps: Access, Chopper, Timbrel, Tordon 101, Tordon Super • Basal bark: Garlon 4, Tordon Super • Frill: Access, Chopper, Tordon 101 Soil applied: Bromacil WP, Bushwacker, Grazer, Hyvar X, Savana SC, Velpar
Eucalyptus globulus or grandis Varied in form, occurring as a stunted shrub or a medium to very tall (up to 70 m) evergreen tree, with a trunk diameter up to 2 m. The bark at the base of the tree is rough and persistent but peels to reveal long strips of the smooth, pale grey, white or yellowish trunk for most of its height. The petioles (leaf stalks) are winged and somewhat square in cross-section.	Eucalyptus trees can be handpulled, strip-barked, or ring-barked. Registered herbicides: • Foliar spray: Brush-off, Chopper, Garlon 4, Tordon 101. • Stump control: Access, Brush-off, Chopper, Ecoplug, Garlon 4, Roundup, Timbrel, Tordon 101, Touchdown. • Frill control: Chopper, Tordon 101. Soil application: Molopo, Grazer.

Alien Species Description	Method of Eradication
http://www.kew.org/science-conservation/plants-fungi/eucalyptus-globulus-tasmanian-blue-gum	
Ricinus communis An evergreen herbaceous or semi-woody large shrub or small tree that reaches 5 meters tall and 4.5 m wide. This is a fast-growing plant that tends to grow straight up at first, and then develops branches later. The leaves are palmate, with 5-11 deeply incised lobes. They are glossy, green to purplish or reddish-green and 30 to 75 cm across, with long petioles (leaf stems). The stems are green to reddish-purple in colour and have hollow internodes. The inflorescence (not particularly showy) has greenish yellow flowers that are borne in spikes up to 30 cm long near the tops of the stems. http://ntbg.org/plants/plant_details.php?plantid=11833	The only mechanical control is handpull or to dig out. Large plants can easily be controlled by chopping or uprooting them. Registered herbicides: Basal bark: Chopper and Bromoxynil
Schinus molle It is an evergreen tree 8-15m in height with graceful hanging branches and foliage. Leaves are downy when young greyish or light green in colour. Fruits emit a peppery scent when crushed. Flowers are creamy-white about 2mm long male and female flowers are on separate trees.	Seedlings can be hand pulled. There is no registered herbicide currently.
Tamarix ramosissima It is an evergreen shrub or trees 3-6m high. The bark is reddish-brown and branches are feathery. Leaves are minute and scale-like, deep green, greyish or bluish-green. Flowers are pale to purplish pink in racemes 15-70mm long at the end of long thin twigs. Fruits are papery capsules, 3-4mm long.	These plants should be bull dozed or handpulled.
Verbena bonariensis Tall verbena is a flowering herb with erect stems up to 2m tall which are noticeably square in cross-section and rough. Leaves are stalkless and clasping the stem at the base, thick textured,	When young it can easily be controlled by usual broadleaf weed herbicides. The mature plant, however, is tough and more tolerant to herbicides. Small infestations can be cleared by hand pulling and digging. Larger infestations can be treated with herbicide.

Alien Species Description	Method of Eradication
strongly veined beneath and the margins are sharply toothed. Flowers are purple, appearing in congested terminal spikes. http://www.invasives.org.za/legislation/item/836-tall-verbena-verbena-bonariensis	http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Verbena_bonariensis_(Purple_Top).htm Registered herbicides: Imazapyr, 2,4-D, Metribuzin, Chlorimuron-ethyl, Diuron, Simazine
Pseudognaphalium luteo-album Erect, greyish white woolly annual herb to 45 cm high; branching from the base (but often corymbosely branched above). It grows as an erect herb up to 70 centimetres high, branching from the base. Flowers are cream, yellow, white, or pink. http://bie.ala.org.au/species/Helichrysum+luteoalbum	Use herbicides: Metribuzin, Amicarbazone, Chlorimuron-ethyl, Diuron, Glufosinate-ammonium, Glyphosate http://www.efekto.co.za/wp-content/uploads/mixing_labels/A%20List%20of%20Weeds%20and%20their%20Control.pdf
Hypochaeris radicata The leaves, which may grow up to eight inches (20 cm) tall, are lobed and covered in fine hairs, forming a low-lying rosette around a central taproot. Forked stems carry bright yellow flower heads, and when mature these form seeds attached to windborne "parachutes". All parts of the plant exude a milky sap when cut. https://en.wikipedia.org/wiki/Hypochaeris_radicata	Use herbicides: 2,4-D, Cynazine, Glyphosate, Simazine, Isoxaflutole, Tebuthiuron http://www.efekto.co.za/wp-content/uploads/mixing_labels/A%20List%20of%20Weeds%20and%20their%20Control.pdf

Disposal of alien vegetation

Small amounts of cut material can be left on the site to and adds to organic material provision, however, please note, if seeds are left with the cut material, infestation will occur. Most of the plant material will be used as part of mulching of the Office Slimes Dam.

Follow-Up Control

It is very important to do a follow-up control after the initial alien control programme as alien vegetation will re-establish very easily. For the follow-up control the re-establishment must be evaluated to see if there is a dense regrowth or low-medium dense regrowth. Dense regrowth is usually in the form of seedlings, root suckers or stump coppice.

Chemical Control – Foliar Applications

Use knapsack sprayers with flat fan nozzles if the regrowth is uniform and less than 1m tall. This must be done as quickly as possible with enough people. If there are large assessable areas, a tractor-mounted tractor can be used. See, if there are indigenous species occurring in the same area, use selective registered herbicides only.

Mechanical Control

If plants are uprooted, it will result in soil erosion. It is advised to cut the plant so that coppice growth can take place. The coppice growth can then be sprayed with herbicides. Plant grass after the area has been cleared of alien plants to prevent more regrowth.

Areas that only have a low-medium dense regrowth must be high priority to control. If such areas are left uncontrolled, high dense regrowth will take place.

Chemical Control

Plant cut and control: Plants should be cut to a height of less than 15cm tall. Herbicide should be applied to the stumps by using hand sprayers, paint brushes or knapsack sprayers. Dye the stumps that are sprayed. This way it is easy to see what plants have been treated. Please note the herbicide should be applied to the cut area of the stump and not on the sides of the stump. Spray on coppice regrowth: Regrowth can be sprayed to a height of 1m tall. Use knapsack sprayers.

Mechanical Control

Hand pull of seedling can take place in wet soils. Please ensure that workers wear gloves for protection as some of the plants are irritants or poisonous.

4.4 Avoidance of sensitive area

People assigned/contracted to work on the rehabilitation in this area need to take cognisance of the conservation sensitivity of the environment, particularly in and near the conservation land as laid out in the agreement with Kudu Game Range. As per the agreement KPNR has with neighbouring landowners regarding the conservation land, the fences and gates will continue to be maintained and monitored by KPNR. This includes maintaining fire breaks along the fences and controlling gate access. Any destruction or disturbance of the habitat will be avoided that could endanger:

- the unique and extremely rare leopard species, the Red or Erythristic Leopard, found in the area, currently being studied and the data deficient Golden Mole (*Amblysomus hottentotus meesteri*);

- the rare birds that are breeding in the area – the Verrauxs Eagle (Black Eagle), African-Crowned Eagle, Cape Vulture, Denhams Bustard (Stanley's Bustard), Black-Bellied Bustard, White-Bellied Korhaan and Black Stork; and
- Cussonia transvaalensis, which is endemic to South Africa and *Argyrolobium wilmsii*, which is endemic to Mpumalanga and *Scilla natalensis*.

The following principles are used in the sloping and earth moving component of the rehabilitation strategy, listed in the hierarchy of importance:

1. Safety
2. End land-use
3. Functional slope for rehabilitation objectives
4. Optimal cut/fill operation

Safety

The excavated areas are located at the foot of a hill creating high walls with steep benches. These benches are a safety risk for both humans and animals moving on site. It is, therefore, the first main objective to safeguard high walls and where possible reslope to a safe gradient.

End Land-use

The end land-use has been identified as grazing and game farming. Water accumulating within the remaining quarries will be utilised and optimised to compliment the end land-use. Sloping should be at a safe angle for cattle and other animals to graze on site and provide easy access to the water. Sloping should allow for free drainage and prevent siltation of the water resources.

Functional slope for rehabilitation objectives

The functionality of the slope is largely determined by the local precipitation, soil type, and vegetation to be used during rehabilitation. The slope should allow for vegetation growth and minimise the risk of erosion caused by accelerated runoff. Evidence on site suggests that vegetation can grow naturally on very steep slopes. However, there are clear signs of erosion on un-rehabilitated side slopes of the slime's dams and overburden.

A functional slope of 18 degrees has been identified as an acceptable angle for rehabilitation of this site. All earth moving operations will, therefore, be aimed to reach at least 18 degrees. It should be noted that a flatter slope does not necessarily constitute more successful rehabilitation as it will increase the footprint of

disturbance. A well-balanced rehabilitation is proposed to optimise topography with the least disturbance of the surrounding natural habitat.

Optimise cut/ fill operation

Rehabilitation in general, and specifically earth moving activities are expensive and should be planned properly. Ideally, the rehabilitation strategy should allow for making use of the material on site to reshape the desired topography. In order to avoid the need to bring in more material, an optimised cut and fill strategy is proposed where an equal amount of material is "cut" from the top and "filled" into the depressions.

4.5 Sloping Strategy

Along the high walls of remaining quarries, it is proposed to combine a trench and berm that will discourage humans and animals from getting close to the edge. This method also allows making use of the material from the trench and placing it directly next to it for the berm. This can be done with an excavator digging one bucket width causing a minimum disturbance. Volumes are estimated based on a 1m x 1m trench.

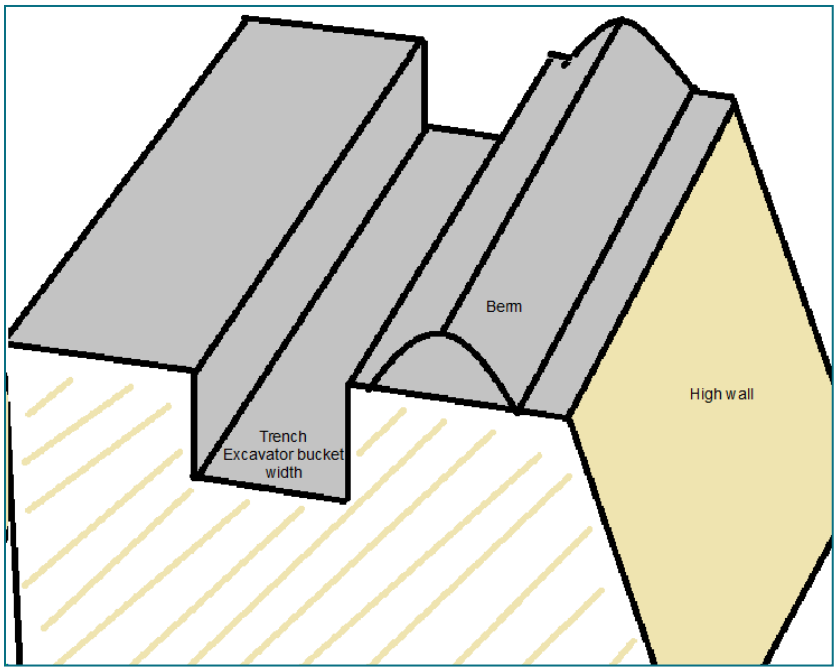
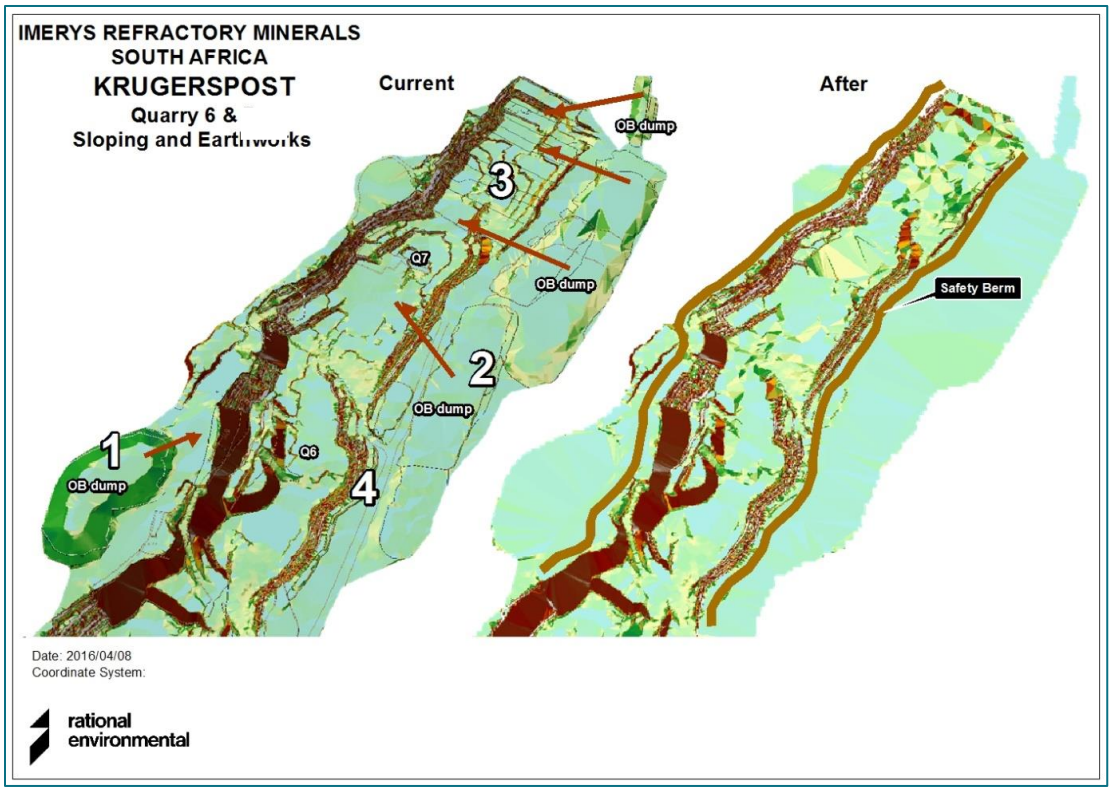


Figure 27: Proposed safety berm

Where possible all areas should be free draining and follow the natural topography of the area. Storm water control measures should be in place to prevent erosion of newly disturbed areas.

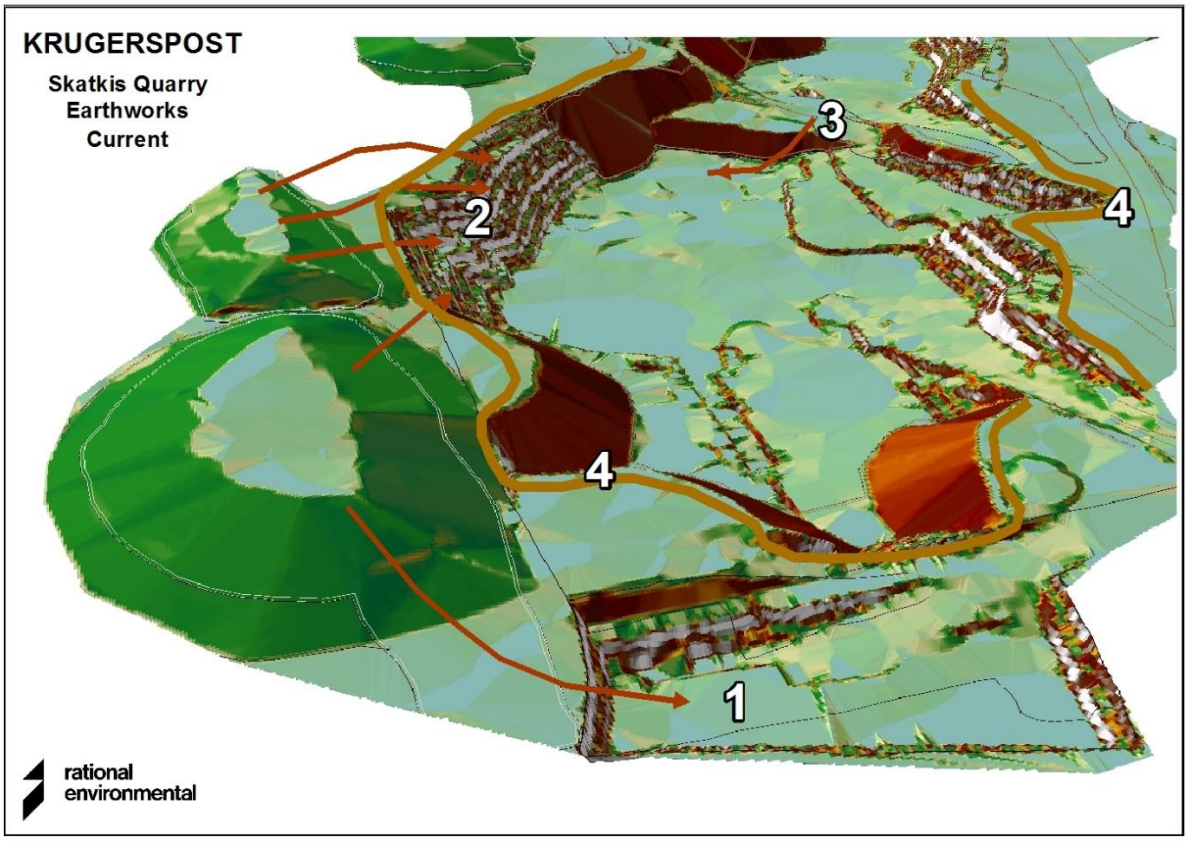
4.6 Quarry 6 / Skatkis Quarry

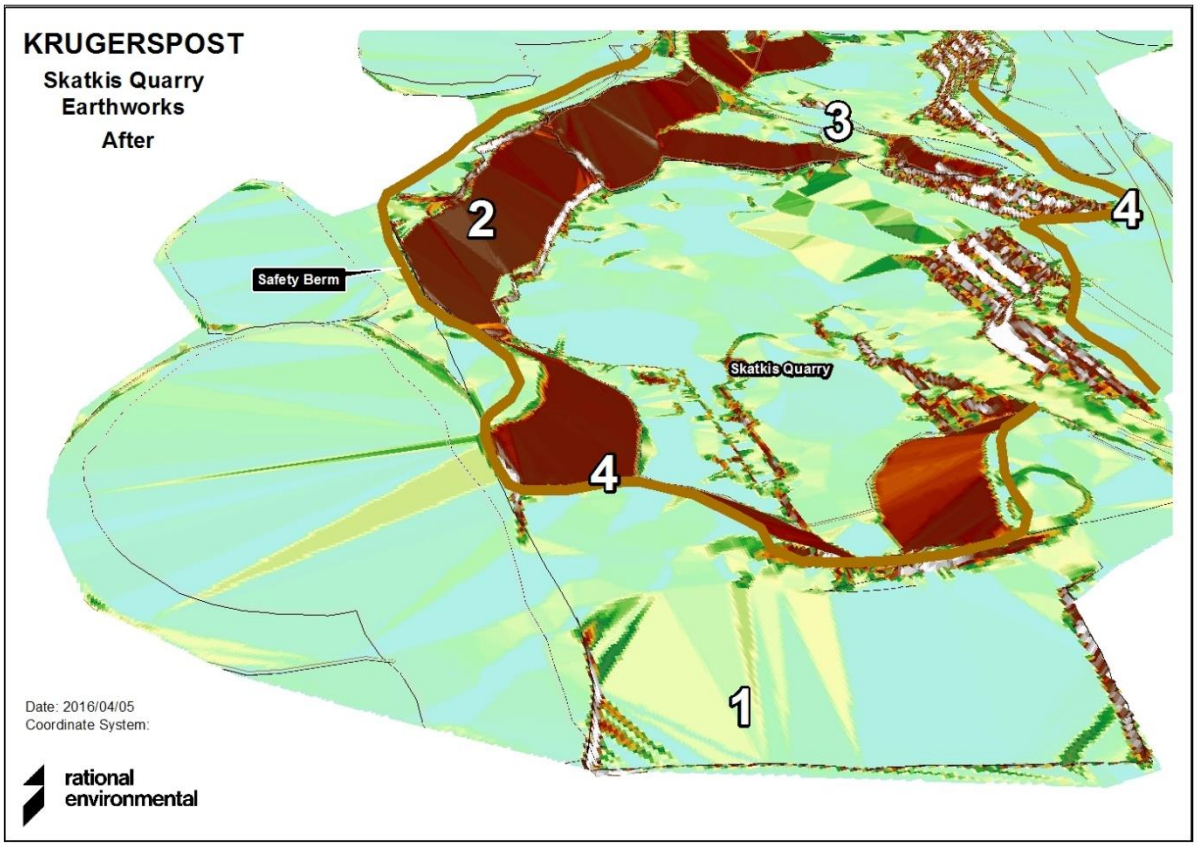
Please note that Skatkis Quarry and Quarry 6 are the same quarry. The western section is called Skatkis Quarry and the eastern part is called Quarry 6. The strategy is to safeguard the remaining high walls while access to the Skatkis area (dam area) from the east will remain intact. Quarry 6 will be filled in with some material to the western benches to allow vegetation growth. These overburden dumps shall be sloped and grassed as part of rehabilitation. The end land use for Skatkis quarry is to become a drinking point and recreational dam. The water level is slowly rising and is already showing a positive attribute. The box cut quarry to the south will be filled and the rest of overburden will be used to create a gradual slope along the high wall to the west.



No	Description
1	Use OB on the west to fill benches on the high wall for a more natural gradient. An estimated **134 256m³** is to be moved from this stockpile.
2	Use OB from the east to fill and gradually slope the northern floor of Hostel quarry to produce a gradual contour within the quarry. This should provide free drainage to the south of the quarry with less ponding. The total estimated OB to be moved from the east into the quarry is **245 000m³.**

No	Description
	Note that there are no detailed survey data available for the calculation of the volume above. Only the footprints of the OB stockpiles are available. The volume is calculated based on the natural angle of repose for the OB in the area together with a predetermined height of four metres.
3	Together with the gradual sloping using OB, the remaining benches within the quarry should also be flattened to produce a more natural surface for vegetation.
4	Construct a safety berm along remaining high walls.





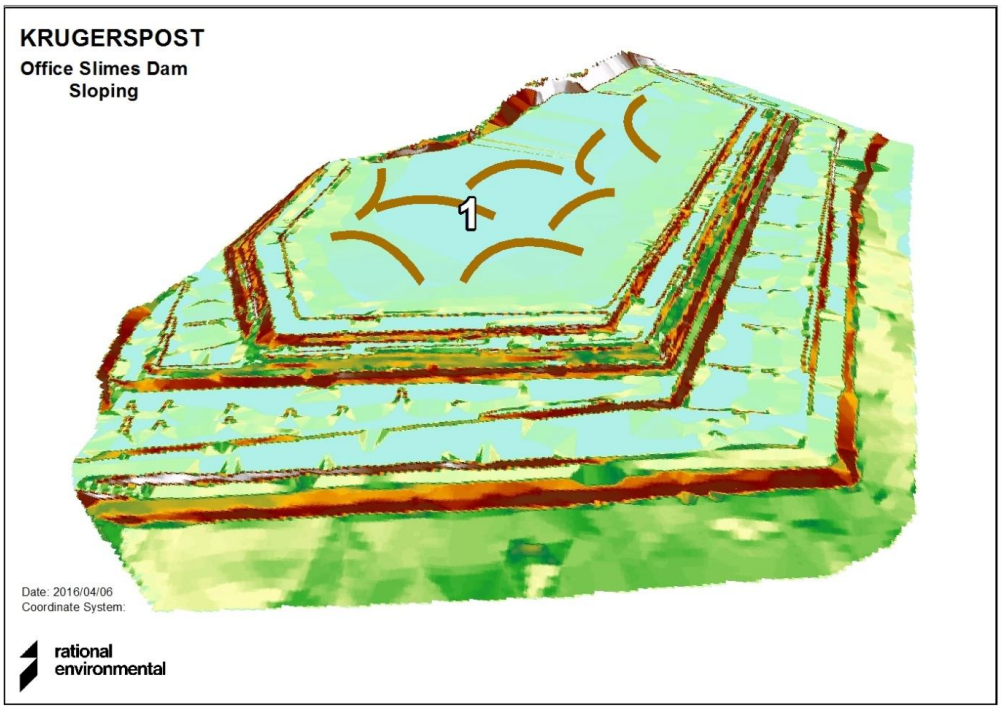
No	Description
1	Slope the overburden to a natural angle and grass the overburden dumps as part of rehabilitation.
2	Use remainder of OB to fill in Skatkis quarry from the west to create a natural gradient over benches. The two OB stockpiles on the west is **164 301m³** combined.
3	Dig open separation wall between Skatkis quarry and Hostel quarry to allow free flowing of surface water between quarries as it gradually rises.
4	Use remainder of OB together with the proposed trench berm concept to construct safety berms along steep slopes.

4.7 Quarries 1, 2 & 3

These quarries have been backfilled fairly flat with the natural topography on the eastern side. No major sloping is proposed. Only paddocks on the top surface are proposed similar to Quarry 2 to promote even vegetation growth. Paddocks on Quarry 3 should not commence without the approval of the responsible engineer as the dam is still draining through the penstock.

4.8 Office Slimes Dam

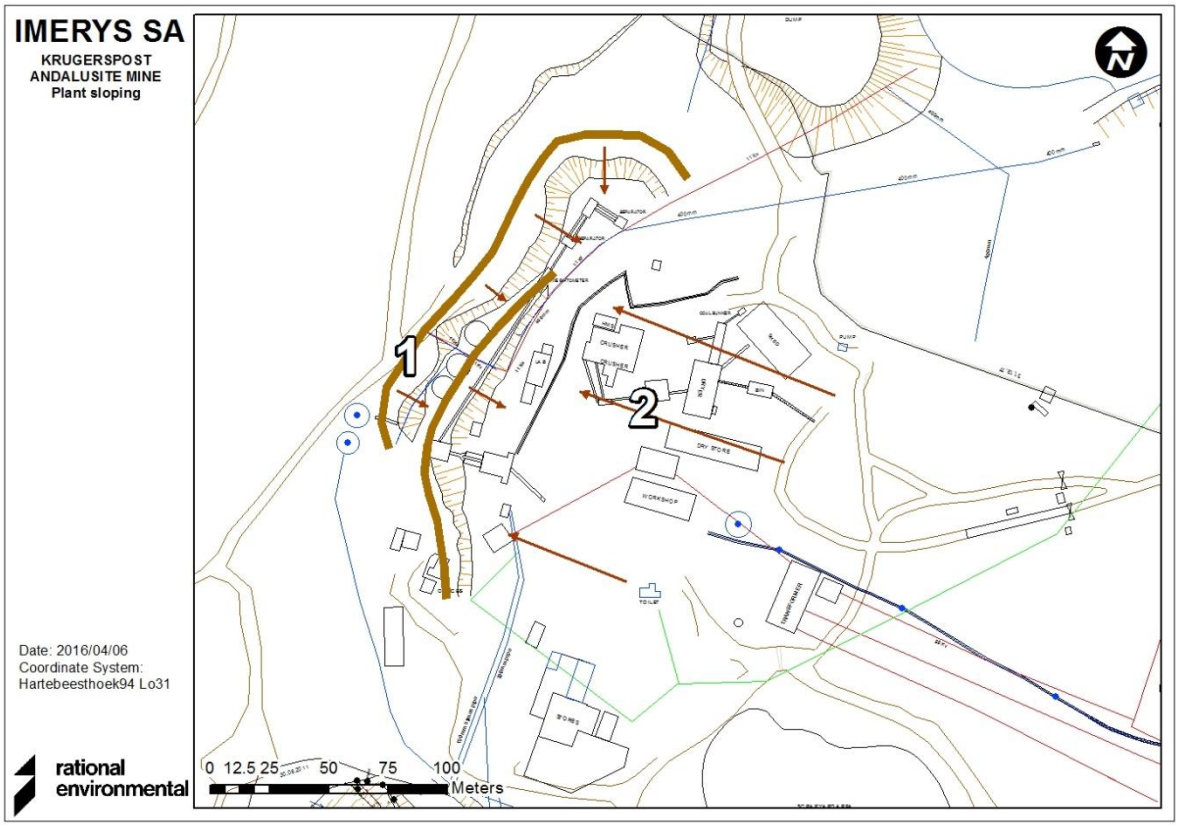
The office slimes dam has not been in use for a long time and vegetation growth is already established in some areas. It is proposed to have this area rehabilitated to a wilderness. The required benches will remain intact with only some paddocks to be made on the top to evenly distribute surface runoff and prevent ponding at the sealed penstock.



No	Description
1	The office slimes dam has some vegetation already established on parts of the sidewalls. It will not be beneficial to disturb the slimes dam along the sidewalls. It is recommended to construct small berms on the top to allow even distribution of runoff to assist vegetation growth and prevent ponding at the sealed penstock.

4.9 Plant area

It should be noted that no detailed elevation data was provided for this area to determine expected volumes to be moved. Some sloping will be required after all the infrastructure is removed. This should be done in such a way that final drainage will be to the south east.



No	Description
1	Once all remaining infrastructure is removed the sloping can be done with the aim to keep the existing terraces with only minor cut and fill operations by pushing the edges of the high wall down.
2	Sloping of the floor is recommended to be done towards the terraces to allow a gradual drainage to the east.

v) Operation activities

Refer to part A(h)(v) above for all impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. The mine will ensure that operational activities take place in accordance with Regulation 73 of the MPRDR (GN 349 of 2011 i.t.o. MPRDA) and GN 632 of 2015 i.t.o. NEMWA. Mine residue management will also take place in accordance with Regulations 9(1)(d-f)&(2) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA. Refer to part b(g) below for monitoring that will take place. Mine wide inspections will ensure that mine residue is managed appropriately. Non-mining waste will be handled in accordance with GN 634

of 2013 (Waste Classification and Management Regulations) under NEMWA. This will ensure that non-mining waste produced will be disposed of and managed in accordance with legislative requirements. Water management will take place in accordance with GN 527 of 2004 i.t.o. MPRDA. An IWULA has been lodged and an IWWMP has been submitted which contains an assessment of impacts relating to water management and pollution control at mining operations. Refer to Addendum 3 for mitigation measures included in this EMP for surface and groundwater management. Dust control will take place in accordance with Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA. An atmospheric impact report and air dispersion modelling was conducted and can be found in Addendum 3 which is compiled according to GN 747 of 2013 (Regulations Prescribing the Format of the Atmospheric Impact Report) & GN 533 of 2014 (Regulations Regarding Air Dispersion Modelling) under NEMAQA. Soil will be managed in accordance with GN 527 of 2004 i.t.o. MPRDA, and sections 35-41 of NEMWA.

f) Description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable

Refer to Part A(g)(v) as well as Part A(i) of this report.

(g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f)

Baseline monitoring is required to establish existing conditions that will help to define the requirements for site restoration and provide a basis for comparison of effects during the operation. Compliance monitoring should be carried out during the operation to ensure that the specified target limits are being met. The following environmental monitoring will be conducted at Krugerspost.

Only monitoring applicable to this project is included, all additional monitoring is found in prior environmental documents.

i) Monitoring of impact management actions

All impacts identified in the impact assessment must be monitored to ensure the correct management thereof takes place.

1 Topography

Mechanism for monitoring compliance:

- After reshaping the resultant topography must be surveyed to determine the degree to which the final topography meets planned objectives
- Surface drainage and slope must meet land capability objectives, a surveyor must assess this
- Deviations from plan must be documented, and the final reshaped surface should be signed off by the responsible person prior to the replacement of topsoil.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
Visual aspect. Change in topography	Once after reshaping	Mine manager / site geologist and surveyor.

2 Soil pollution and change in landscape

Mechanism for monitoring compliance:

Monitoring will take place in accordance to the rehabilitation plan.

- Maintenance as per maintenance register.
- Inspections of routes for any pollution.
- Inspections of pipeline routes.
- Inspections of plant and infrastructure area.
- Inspection of road routes.
- Erosion monitoring.
- Surface water quality monitoring; groundwater quality monitoring; and monitoring of surface water drainage systems in accordance to the water monitoring programme
- Spill handling procedures should be adopted in the event of a spillage.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• Soils, land capability, surrounding land use and landscape character. Pollution of topsoil • Environmental noise from vehicles and machinery that is not maintained • Surface and groundwater: Runoff or infiltration of spillages	Weekly basis.	Mine manager / site geologist.

3 Surface water monitoring

Mechanism for monitoring compliance:

Surface water monitoring will take place as per the water monitoring programme. The water monitoring programme was compiled in line with the stipulated conditions as per the IWUL. The various parameters can be seen in Table 28 and 29 below. It is the responsibility of the specialist to ensure these parameters are monitored.

The following information is extracted from the Water Monitoring Programme (BECS Environmental, 2019).

Parameters to be monitored

3.1 Surface water quantity

Table 30: Section 21a water uses - Taking water from a water resource quantities

Name	Description of point	Water use description	Coordinates
BH01	Borehole at house 1	Abstracting water for domestic purposes	S 24°56'9.52" E 30°26'40.55"
BH02	Borehole at house 2	Abstracting water for domestic purposes	S 24°56'25.26" E 30°26'43.53"
Q06	Dewatering at Quarry 6	Abstracting water for industrial purposes	S 24°55'17.83" E 30°27'0.02"
SBR01	Abstraction from Spekboom River	Abstracting water for industrial purposes	

Table 31: Section 21a water uses - Taking water from a water resource quantities

Name	Maximum volume annually (m^3)	Metering frequency	Recording frequency	Reporting frequency
BH01	3,600	Daily	Monthly	Biannually
BH02	1,800			
Q06	620,000			

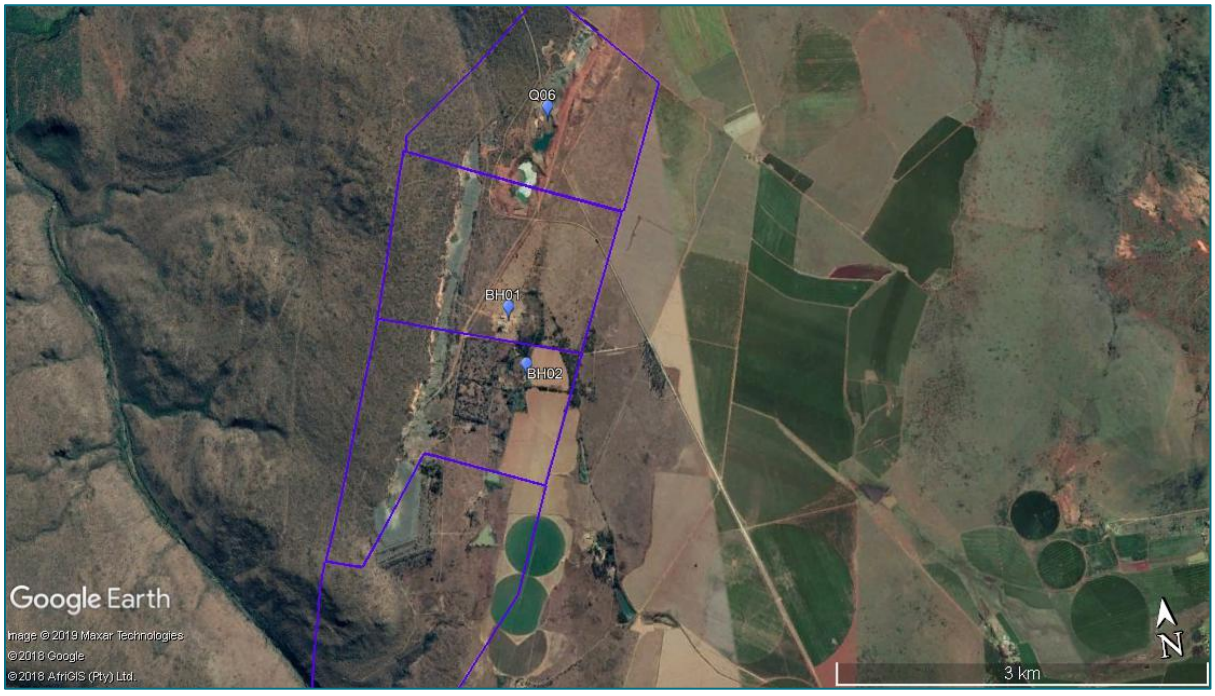


Figure 28: Water quantities abstracted

3.2 Surface water quality

Table 32: Section 21g water uses – Surface water qualities

Name	Description of point	Coordinates
SW01	Upstream in the Spekboom River	S 25° 0'33.84" E 30°30'0.36"
SW02	Downstream in the Spekboom River	S 24°57'20.70" E 30°26'3.42"

Table 33: Section 21g water uses – Surface water qualities

SW01, SW02			
Variable	**Limit (Domestic use: TWQG)**	**Monitoring frequency**	**Reporting frequency**
pH	6.0-9.0	Monthly	Quarterly
EC in mS/m	≤70		
TDS in mg/l	≤450		
Ca in mg/l	≤32		
Mg in mg/l	≤30		
Na in mg/l	≤100		
K in mg/l	≤50		
Cl in mg/l	≤100		
SO_4 in mg/l	≤200		
T-Alk (HCO_3^-/CO_3^-)			
Fe in mg/l	≤0.1		
Al in mg/l	≤0.15		
Mn in mg/l	≤0.05		
Si in mg/l			
F in mg/l	≤1.0		
PO_4^-	≤2.5		
NO_3^-	≤6		
NH_4^+	≤1.0		

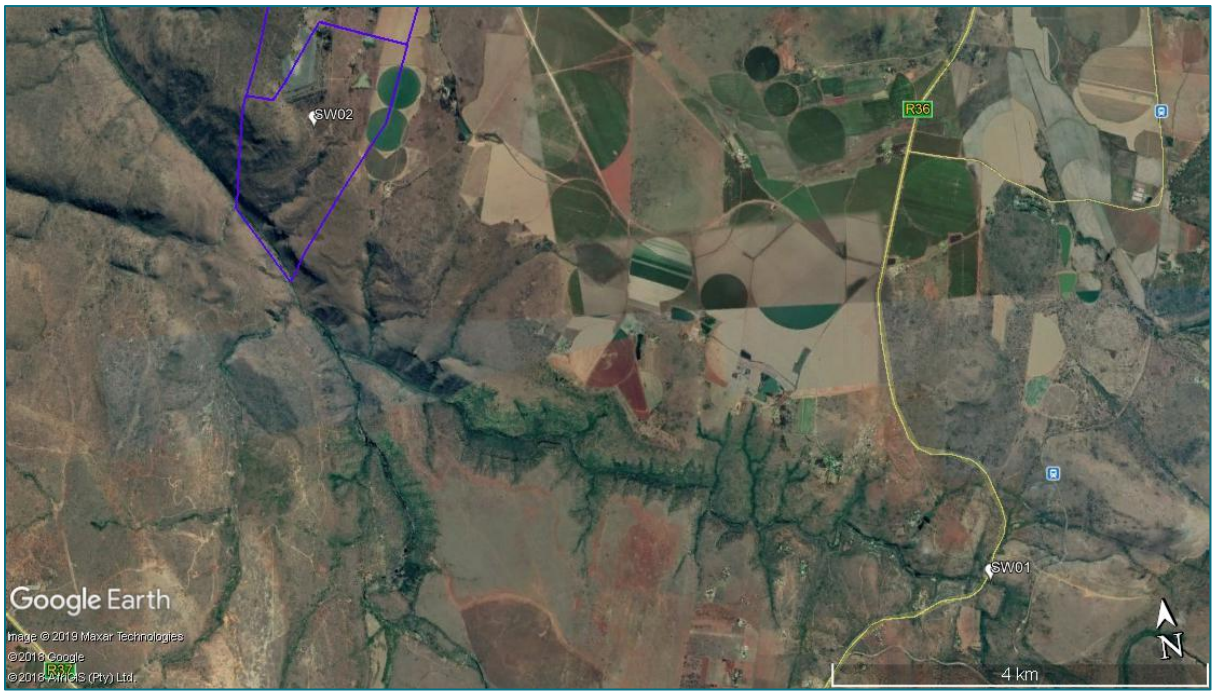


Figure 29: Surface water qualities

3.3 Biomonitoring

Table 34: Section 21g water uses – Biomonitoring

Name	Description of point	Coordinates
BM01	Upstream in the Spekboom River	S 25° 0'33.84" E 30°30'0.36"
BM02	Downstream in the Spekboom River	S 24°57'20.70" E 30°26'3.42"

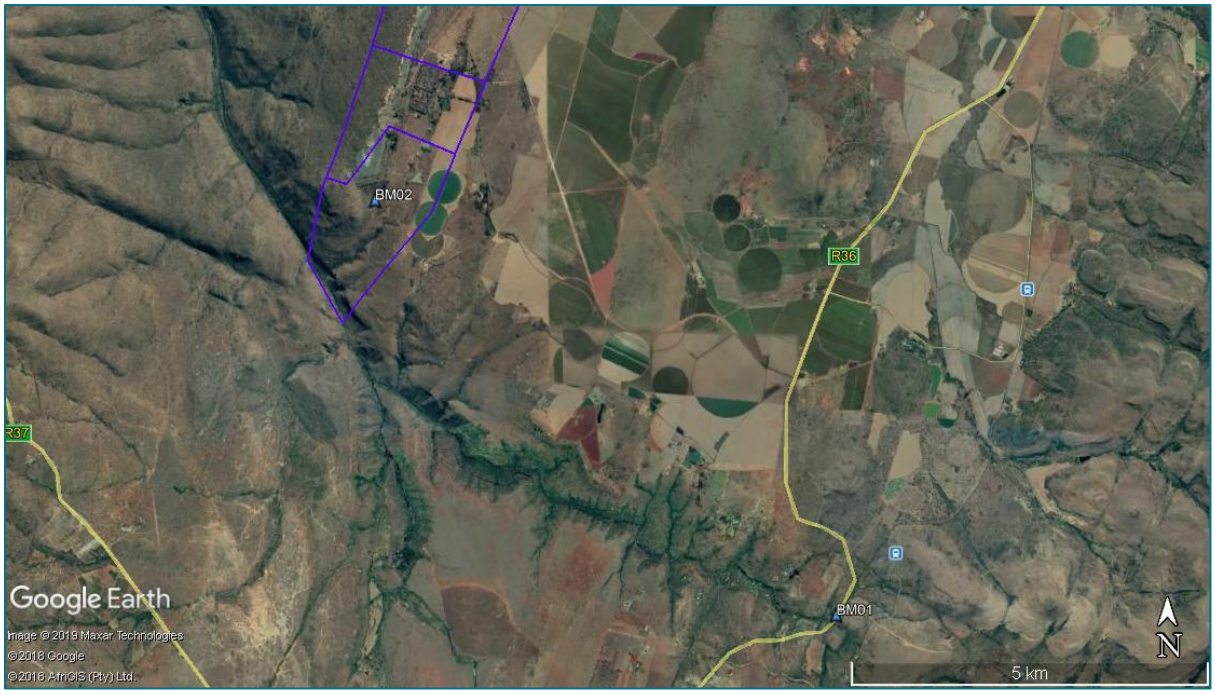


Figure 30: Biomonitoring

3.4 Wastewater qualities

Table 35: Section 21g water uses – Wastewater qualities

Name	Description of point	Origin of water / description	Comment	Owner	Coordinates
WW01	Skatkis	Quarry dam & slimes. Waste backfilling. Gravity fed to barge dam & back to process	No active waste backfilling.	Imerys	S 24°55'37.63" E 30°26'50.06"
	~~Quarry 2-3~~	~~Slimes / waste pumped from mine & separated water back to plant~~	Quarry 2-3 rehabilitated. No water in quarries except during rainy events.	~~Imerys~~	N/A
	~~Barge Dam~~	~~Return water~~	Removed. Now only a wetland area.	~~Imerys~~	N/A

Name	Description of point	Origin of water / description	Comment	Owner	Coordinates
	~~Ericsson dams~~	~~Water from Ericsson Dams~~	Three have been removed with last two remaining completely empty and non-operational	~~Imerys~~	N/A
	~~HMS Plant~~	~~Process water~~	No plant on site.	~~Imerys~~	N/A
	~~Plant~~	~~Ground Water from the plant~~	Not included in the Desktop Hydrogeological Study, 2013	~~Imerys~~	N/A
	~~Office slimes dam~~	~~Slimes disposal~~	No active disposal of slimes; therefore, no wastewater.	~~Imerys~~	N/A
WW02	Settling dam 1	Water from Office slimes dam.	Still in use	Imerys	S 24°57'14.21" E 30°26'5.19"
WW03	Settling dam 2	Water from Settling dam 1	Still in use	Imerys	S 24°57'19.41" E 30°26'6.61"
	~~Botha Dam~~	~~Stormwater dam~~	~~Dam is in general empty~~	Imerys	S 24°56'25.58" E 30°26'36.71"
	~~Surprise Dam 1~~	~~Water from Botha Dam & excess water from Barge Dam (RWD)~~	~~Dam is in general empty~~	Imerys	S 24°56'42.32" E 30°26'30.12"
WW04	Surprise Dam 2 (Enos)	Water from Surprise Dam 1	Used as farm dam	Imerys	S 24°56'49.96" E 30°26'27.89"
WW05	Percy Dam 1-3	Water received from Surprise Dam to settling Dams	Used as farm dam	Imerys	S 24°57'7.63" E 30°26'26.12"

Table 36: Section 21g water uses – Wastewater qualities

WW01, WW02, WW03, WW04, WW05			
Substance / parameter	**Limit (IWUL)**	**Monitoring frequency**	**Reporting frequency**
pH	6.34-6.98	Quarterly	Quarterly
EC in mS/m	34		
TDS in mg/l	250		
Cl in mg/l	15		
SO4 in mg/l	60		
Na in mg/l	24		

Figure 31: Wastewater qualities

4 Groundwater monitoring

Mechanism for monitoring compliance:

Ground water monitoring will take place as per the water monitoring programme. The water monitoring programme was compiled in line with the stipulated conditions as per the IWUL. The various parameters can be seen in Table 37 below. It is the responsibility of the specialist to ensure these parameters are monitored.

The following information is extracted from the Water Monitoring Programme (BECS Environmental, 2019).

Parameters to be monitored

4.1 Groundwater qualities for potable

Table 37: Section 21g water uses - Groundwater qualities for potable water

Name	Description of point	Origin of water / description	Comments	Owner	Coordinates
	KRBH01	No use	Potable, pollution & receptor monitoring	Imerys	S 24°56'36.56" E 30°26'12.30"
	KRBH02	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'10.61"
	House#2	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'43.66"
	House#3	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'40.67"
	House#4	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'24.36"
	House#5	Domestic borehole		Imerys	S 24°56'56.58" E 30°26'21.80"
	House#1	Domestic borehole	Potable monitoring	Imerys	S 24°56'51.28" E 30°26'56.94"

Figure 32: Groundwater qualities for potable

Table 38: Section 21g water uses - Groundwater monitoring for potable

KRBH01, KRBH02, House#2, House#3, House#4, House#5, House#1			
Variable	**Limit (TWQG)**	**Monitoring frequency**	**Reporting frequency**
pH	6.0-9.0	Monthly	Quarterly
EC in mS/m	≤70		
TDS in mg/l	≤450		
Ca in mg/l	≤32		
Mg in mg/l	≤30		
Na in mg/l	≤100		
K in mg/l	≤50		
Cl in mg/l	≤100		
SO_4 in mg/l	≤200		
T-Alk (HCO_3^- /CO_3^-)			
Fe in mg/l	≤0.1		
Al in mg/l	≤0.15		
Mn in mg/l	≤0.05		
Si in mg/l			
F in mg/l	≤1.0		
PO_4^-	≤2.5		
NO_3^-	≤6		
NH_4^+	≤1.0		
Total coliforms	≤5.0		
E.coli			

4.2 Groundwater qualities for pollution, receptor, zone of influence & background monitoring

Table 39: Section 21g water uses - Groundwater qualities for pollution, receptor, zone of influence & background monitoring

Name	Origin of water / description	Comments	Owner	Coordinates
KRBH01	No use	Potable, pollution & receptor monitoring	Imerys	S 24°56'36.56" E 30°26'12.30"
KRBH02	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'10.61"
House#2	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'43.66"
House#3	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'40.67
House#4	Domestic borehole		Imerys	S 24°56'28.96"

Name	Origin of water / description	Comments	Owner	Coordinates
				E 30°26'24.36"
House#5	Domestic borehole		Imerys	S 24°56'56.58" E 30°26'21.80"
KRBH07	Domestic, garden & irrigation borehole	Zone of influence & receptor monitoring	Steenekamp	S 24°54'37.76" E 30°27'55.30"
KRBH08	Livestock borehole		Steenekamp	S 24°56'39.34" E 30°28'18.23"
KRBH10	Domestic borehole		Steenekamp	S 24°54'17.17" E 30°28'10.24"
KRBH13	Domestic borehole		Steenekamp	S 24°56'39.34" E 30°28'17.11"
KRBH03	No use	Background monitoring	Roth	S 24°56'40.49" E 30°26'50.75"
KRBH04	Domestic & garden borehole		Roth	S 24°56'39.34" E 30°26'59.64"
KRBH05	Domestic & garden borehole		Roth	S 24°56'41.52" E 30°26'21.80"
KRBH12	Livestock borehole		Steenekamp	S 24°56'41.52" E 30°28'17.58"

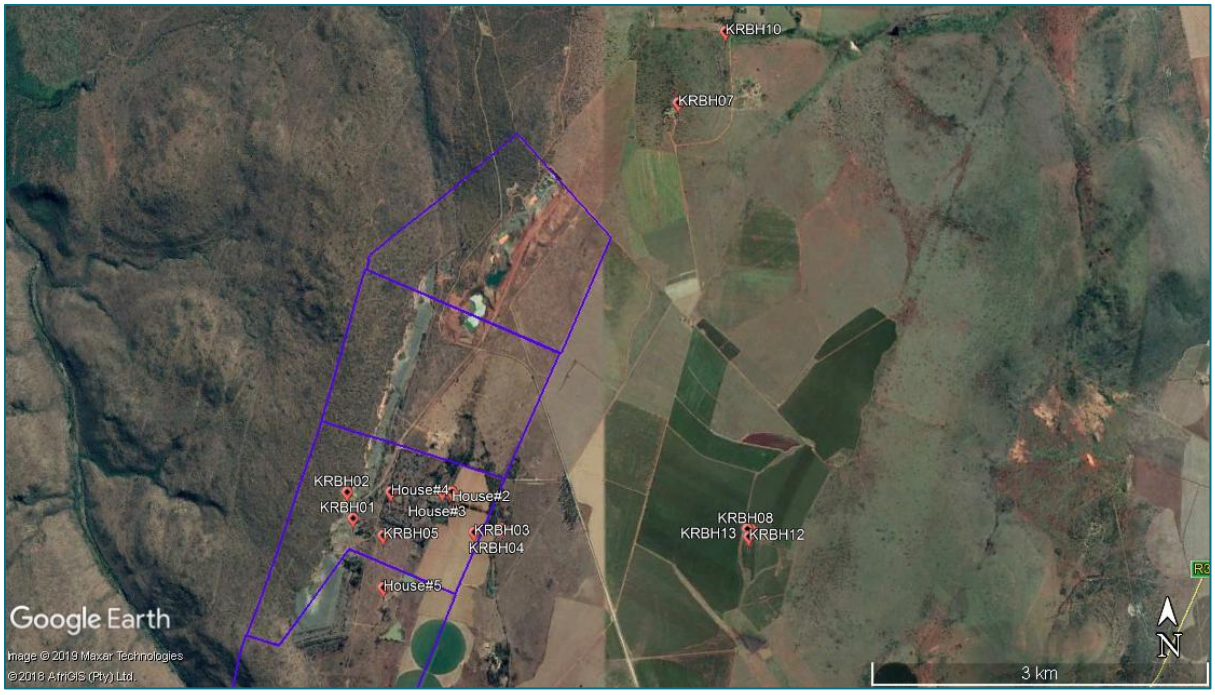


Figure 33: Groundwater qualities for pollution, receptor, zone of influence & background monitoring

Table 40: Section 21g water uses - Groundwater monitoring for pollution, receptor, zone of influence & background monitoring

KRBH01, KRBH02, House#2, House#3, House#4, House#5, KRBH07, KRBH08, KRBH10, KRBH13, KRBH03, KRBH04, KRBH05, KRBH12			
Variable	**Limit (IWUL)**	**Monitoring frequency**	**Reporting frequency**
pH	6-8.6	Quarterly	Quarterly
EC in mS/m	32.89		
TDS in mg/l	450		
Ca in mg/l	23.1		
Mg in mg/l	13.53		
Na in mg/l	24.31		
K in mg/l	50		
Cl in mg/l	5.94		
SO_4 in mg/l	4.51		
T-Alk (HCO_3^-/CO_3^-)	50		
Fe in mg/l	0.1		
Al in mg/l	0.15		
Mn in mg/l	0.02		
Si in mg/l			
F in mg/l	0.33		
PO_4^-			
NO_3^-	0.41		
NH_4^+			

4.3 Groundwater levels

Table 41: Section 21j water uses – Groundwater levels

Name	**Origin of water / description**	**Comments**	**Owner**	**Coordinates**
KRBH01	No use	Potable, pollution & receptor monitoring	Imerys	S 24°56'36.56" E 30°26'12.30"
KRBH02	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'10.61"
House#2	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'43.66"
House#3	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'40.67
House#4	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'24.36"
House#5	Domestic borehole		Imerys	S 24°56'56.58"

Name	Origin of water / description	Comments	Owner	Coordinates
				E 30°26'21.80"
KRBH07	Domestic, garden & irrigation borehole	Zone of influence & receptor monitoring	Steenekamp	S 24°54'37.76" E 30°27'55.30"
KRBH08	Livestock borehole		Steenekamp	S 24°56'39.34" E 30°28'18.23"
KRBH10	Domestic borehole		Steenekamp	S 24°54'17.17" E 30°28'10.24"
KRBH13	Domestic borehole		Steenekamp	S 24°56'39.34" E 30°28'17.11"
House#1	Domestic borehole	Potable monitoring	Imerys	S 24°56'51.28" E 30°26'56.94"

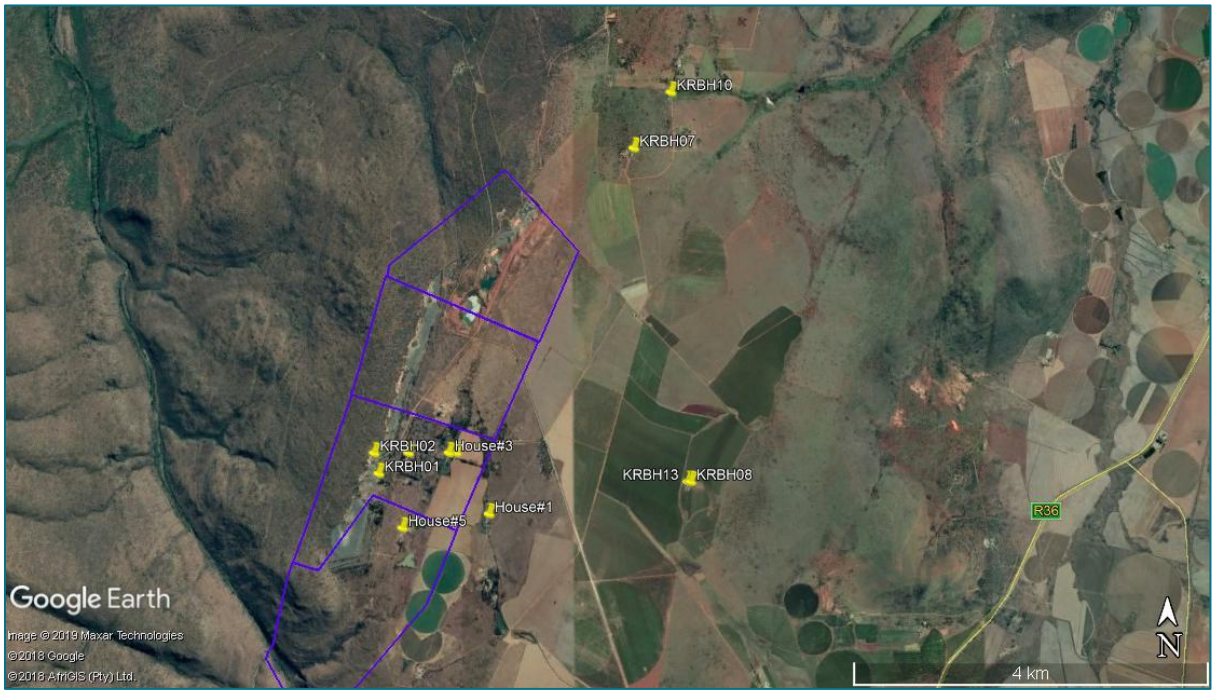


Figure 34: Groundwater levels

KRBH01, KRBH02, House#2, House#3, House#4, House#5, KRBH07, KRBH08, KRBH10, KRBH13, House#1		
Levels	**Monitoring frequency**	**Reporting frequency**
Compare against previous results	Biannually (once in the beginning of the dry season and once in the beginning of the wet season).	Biannually

5 Fall out dust

Mechanism for monitoring compliance:

Method:

- Determine the contribution of dustfall in residential and non-residential areas in the vicinity of the mine; and
- To establish the baseline dustfall at the mine
- Maintain a complaint register
  - The complaints register should be kept with security at the entrance to the site;
  - The complaints register should provide space for the following information: complainant name, complaint, physical address, telephone number, date and the time when the complaint was registered; and
  - All air quality related complaints should be investigated, and remedial steps taken.

The monthly dustfall monitoring reports will comply with Regulation 5(a) of the National Dustfall Control Regulations. Regulation 5 (a) requires a dustfall monitoring report to provide:

a) Information on the location of sampling sites, including latitudinal and longitudinal coordinates, and a position indicator on a topographic map;
b) Classification of the area where samplers are located, in terms of residential and non-residential, and identification of sensitive receptors;
c) Reference to the standard methods used for site selection, sampling and analysis, and any methods/laboratory accreditation, if applicable;
d) The dustfall monitoring results including a comparison of current year and historical results (if any) for each site, and including a tabular summary of compliance with the dustfall standard set out in regulation 3; and
e) Meteorological data (wind speed and direction, rainfall) for the sampling area; and any other relevant data that might influence the results.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• Dust generation on air quality	Monthly monitoring.	Mine manager / site geologist.

6 Job creation and community safety

Mechanism for monitoring compliance:

- Monitor and evaluate the Social and labour plan.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• Socio-economic aspects. Job creation.	Continuous monitor. Annually reporting.	Site manager.

7 Mine wide inspections

Mechanism for monitoring compliance:

- Extract all inspection requirements from environmental documents and make a list of inspections as well as the frequency of inspections.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• All environmental components.	Continuous monitoring as and when necessary. Annually reporting.	Site manager.

8 Noise monitoring

From an occupational perspective the mining workers should be protected through standards and procedures and monitored as requires through Section 12 of the MHSA. No environmental noise monitoring has been proposed by the specialist.

(h) The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f)

Refer to Part B, section (g)(i) above.

(i) An indication of the persons who will be responsible for the implementation of the impact management actions

Refer to Part B, section (g)(i) above.

(j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented

Refer to Part B, section (g)(i) above.

(k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f)

Refer to Part B, section (g)(i) above.

l) Program for reporting on compliance, taking into account the requirements as prescribed by the Regulations

The performance of the EIA/EMP will be assessed every two years. A financial provision will accompany the EIA/EMP which will be updated on an annual basis. This financial provision update will be accompanied by a report on rehabilitation that has taken place. An audit on the Integrated Water Use License will also be done to ensure compliance in all water uses and activities taking place on the mine if the license is granted.

m) Environmental awareness plan

This section includes:

1. Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
2. Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment.

The following was extracted from the Environmental training procedure (BECS Environmental, 2016).

i) Induction training

1. Induction training is relevant to all new employees and contractors (including any employee and/or contractor that has not yet been trained on the environmental induction material) as well as all visitors to the mine.
2. Training will be repeated every 18 months.

3. Induction training will include the following:
    a. Relevant impacts and management as per the approved and operational EMP of Krugerspost Mine (these will be site- and job specific);
    b. Environmental procedures; and
    c. Environmental emergency procedure.
4. The trainee will after completion of induction:
    a. Sign the necessary induction form/book; and
    b. Have all relevant PPE necessary for the specific job.

ii) General environmental awareness training

1. Management will identify environmental awareness needs and related environmental topics.
2. The environmental awareness will include:

a. The significant environmental impacts, actual or potential, of their work activities and the benefits of improved personal performance; and
b. The potential consequences of departure from specified operating procedures.

3. Environmental awareness training will form part of the safety talks prior to each shift.
4. Visual aids will be used, where applicable to help with awareness training. These could be in the form of posters displayed at specific work areas after training was done.

iii) Competency training

1. Management will identify job-related training needs for all employees who have or can have a significant impact on the environment.
2. A training needs matrix will be completed for Krugerspost Mine.
3. Job specific training will convey the importance of conformance with the environmental procedures. Simplified summaries of these procedures may be used to ensure better understanding at lower levels of the organisation.

4. Management will identify specialised training needs. for personnel performing tasks, which can cause significant environmental impacts, or personnel who needs specialised environmental knowledge for areas of responsibility. These courses will be sourced externally.

5. Management will undergo legal training from time to time. A summary of this training will also be given to employees of Krugerspost Mine.

iv) Development of training material

1. The Health and Safety Officer will develop and maintain training material for induction training, general environmental awareness and competency training. This excludes specialised competency training which will be externally sourced.
2. This training material will be based on the approved and operational EMP as well as environmental procedures. Additional topics will also be included for general environmental awareness.
3. Training material will be reviewed using results from audits, changes to plant/operation, competency assessments and new significant aspects.

v) Scheduling of training

1. Once training topics and material have been compiled, the Health and Safety Officer will ensure employees are scheduled according to the needs identified.

vi) Training records

1. Upon completion of training, a training record will be completed. This may be in the following formats:
   a. Attendance registers;
   b. Sign off on procedure to demonstrate understanding of procedure; and/or
   c. Certificates of attendance / completion.

2. All training records will be kept for the period of employment plus an additional 5 years.

vii) Reconciliation to determine gaps in attendance

1. All employees and contractors must undergo all training as identified (as per training needs analysis). Reconciliation will be done on all training attendance registers, against the training schedules, to identify any shortcomings in training performed and reschedule if necessary.

viii) Competency assessment

1. An evaluation will be conducted on all employees and contractors. The aim is to identify both the effectiveness of training as well as the competence in performing the job.
2. Competency evaluation records will be completed by the approved training assessor and will be included with the attendance records.

n) Specific information required by the competent authority

1 Financial provision

The financial provision will be reviewed on an annual basis.

2 Procedures for environmentally related emergencies and remediation

The following was extracted from the Environmental emergency's procedure (BECS Environmental, 2016).

2.1 List of environmental incidents

There have been no environmental incidents noted to date.

2.2 Major spillages onto soil or spillages into water resources

1. Krugerspost Mine will as soon as reasonably practicable after obtaining knowledge of the incident, report through the most effective means reasonably available:
   a. the nature of the incident;
   b. any risks posed by the incident to public health, safety and property;
   c. the toxicity of substances or by-products released by the incident; and
   d. any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to:
      i. the DWS and/or the Mpumalanga Department of Economic Development, Environment, and Tourism;
      ii. the South African Police Services and the relevant fire prevention service;
      iii. the relevant head of municipality; and
      iv. all persons whose health may be affected by the incident.

2. Krugerspost Mine will, as soon as reasonably practicable after knowledge of the incident:
   a. take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
   b. undertake clean-up procedures;
   c. remedy the effects of the incident;
   d. assess the immediate and long-term effects of the incident on the environment and public health; and
   e. and take such measures as the catchment management agency may either verbally or in writing direct within the time specified by such institution.

3. Steps to be taken to contain, minimise and clean-up are as follow:
   a. Isolate and evacuate the affected area to prevent unauthorised access;
   b. If safe to do so, isolate source of leak or spillage to prevent further losses;
   c. Use appropriate PPE;
   d. Protect stormwater drains around the affected area by sealing them off:
   - Construct berm walls cross-stream using soil if pollution has escaped into drainage ditches; and
   - If possible construct temporary retention dams across stream using soil, and divert flow into them.
   e. Transfer any residual contents and contaminated absorbents to suitable temporary storage containers;
   f. Obtain specialist advice on decontamination of surfaces, drains and interceptors;
   g. Remove any retention berms/temporary retention dams only when authorised; and
   h. Dispose of contaminated material as hazardous waste (see Waste Management Procedure: AAM-EP-01).

4. Krugerspost Mine will, within 14 days of the incident, report to the DWS, and/or the CA, and relevant head of municipality such information as is available to enable an initial evaluation of the incident, including:
   a. the nature of the incident;
   b. the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;
   c. initial measures taken to minimise impacts;
   d. causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and
   e. measures taken and to be taken to avoid a recurrence of such incident.

2.3 Drills

1. Emergency drills of above incidents will be held at least biannually.
2. The emergency drill should be a practical exercise where practicable or as a minimum, a desktop exercise.
3. A realistic scenario will be created, e.g. water can be spilled from an oil drum in order to test the reaction of personnel in line with the emergency procedure.
4. The emergency drill report should be completed.
5. It is advisable that photographs or videos should be taken for review after the drill has been conducted.
6. A debriefing session should be held after each drill to discuss any non-conformances or areas for improvement identified during the drill.

2.4 Veldfires

1. The observer shall as soon as possible verbally report the occurrence to his Head of Department (HOD).
2. In the case of a fire on Imerys land or adjacent land which may endanger life, property, or the environment, the owners of adjoining land and the relevant fire protection association shall be notified.
3. Imerys may enter an adjacent land in order to prevent a fire from spreading or to extinguish it if it is believed that a fire may endanger life, property, or the environment.

-END-

References

African Heritage Consultants, 2011: Cultural Heritage Resources Impact Assessment on Mine at Krugerspos

Bouwer and Rice, 1976

Bromilow, 2010

Brooks et al., nd: Agri-Facts

Campbell, 2001: Rehabilitation Recommendations after Alien Plant Control

Cllr S Mashigo-Sekgobela and team, 2017-2022: Thaba Chweu Local Municipality Integrated Development Plan

DWAF, 1998

DWAF, 2005

https://en-za.topographic-map.com/maps/jmbz/Mashishing-Lydenburg/

International Geological Congress, 2016

Limnology, 2019: Aquatic ecosystem delineation, fauna and flora assessment for the proposed expansion of the Krugerspost mine, Mpumalanga

Lynch et. al., 1994

Parsons, 1995: Parsons Classification system

Rational Environmental, 2019: Klipplaatdrift Stormwater Management Plan

Screening tool, 2020

SEPA, 2010: Wind speeds

Shangoni Aquascience, 2019: Geohydrological impact assessment for the quarry operations at Klipplaatdrift and Klipfontein

Shangoni, 2012: Groundwater potential contaminants

Shangoni Management Services, 2013: Hydrogeological study for Krugerspost

Shangoni Management Services (Pty) Ltd, 2014: Klipplaatdrift Mine Environmental Management Plan

Tikotech, 2019: Air Quality Impact Assessment for the Environmental Impact Assessment on Klipplaatdrift Mine

Unknown, 1999: Environmental Management Programme

Department of Environmental Affairs, 2013: Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector

Environmental Conservation Act No 73 of 1989 (as amended)

Environmental Impact Assessment Regulations, GN 982 of 2014 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended): Guideline on Needs and Desirability

Environmental Impact Assessment Regulations: Listing Notice 2, GN 984 of 2014 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended)

Financial Provisioning Regulations, GN 1147 of 2015 i.t.o. National Environmental Management Act No 107 of 1998 (as amended)

Mine Health and Safety Act No 29 of 1996 (as amended)

Minerals Act No 50 of 1991

Mineral and Petroleum Resources Development Act No 28 of 2002 (as amended)

Mineral and Petroleum Resources Development Regulations, GN 527 of 2004 (as amended) i.t.o. the Mineral and Petroleum Resources Development Act No 28 of 2002 (as amended)

National Environmental Management Act No 107 of 1998 (as amended)

National Environmental Management Air Quality Act No 39 of 2004 (as amended)

National Environmental Management Biodiversity Act No 10 of 2004 (as amended)

National Environmental Management Waste Act 59 of 2009 (as amended)

National Dust Control Regulation'

National Forest Act No 84 of 1998

National Heritage Resources Act No 25 of 1999

National Water Act No 36 of 1998 (as amended)