# IMERYS REFRACTORY MINERALS SOUTH AFRICA (PTY) LTD – KLIPPLAATDRIFT MINE

## Annual Rehabilitation Plan and Annual Financial Provision

**Based on Appendix 3 (Minimum Content of An Annual Rehabilitation Plan) of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, 2015 9(GN 1147) (as amended) i.t.o. the National Environmental Management Act No 107 of 1998 (as amended).**

**DMR mining right ref: 30/5/1/1/2/10006 MR**

**Location: Portions 13, 14, 15 and the remaining extent of the farm Klipplaatdrift 399 KT, Mashishing Local Municipality, Limpopo**

**July 2018**

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

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## MINIMUM CONTENT OF AN ANNUAL REHABILITATION PLAN

The annual rehabilitation plan will form a component of the environmental management programme to be submitted in terms of section 24N of the Act and the Environmental Impact Assessment Regulations, 2014 and will be subject to the same requirements of the environmental management programme with regards opportunities for stakeholder review and comment as well as auditing.

Objective of the annual rehabilitation plan

The objective of the annual rehabilitation plan is to:

a. review concurrent rehabilitation and remediation activities already implemented;
b. establish rehabilitation and remediation goals and outcomes for the forthcoming 12 months, which contribute to the gradual achievement of the post-mining land use, closure vision and objectives identified in the holder's final rehabilitation, decommissioning and mine closure plan;
c. establish a plan, schedule and budget for rehabilitation for the forthcoming 12 months;
d. identify and address shortcomings experienced in the preceding 12 months of rehabilitation; and
e. Evaluate and update the cost of rehabilitation for the 12-month period and for closure, for purposes of supplementing the financial provision guarantee or another financial provision instrument.

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## ABBREVIATIONS

| | |
|---|---|
| DWS | Department of Water and Sanitation |
| EAP | Environmental assessment practitioner |
| EMP | Environmental Management Programme |
| GN 1147 | Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production, GN 1147 of 2015 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended) |
| MAR | Mean annual runoff |
| MHSA | Mine Health and Safety Act, 1996 (Act No. 29 of 1996) |
| MPRDA | Minerals and Petroleum Resources Development Act (Act 28 of 2002 as amended) |
| MPRDR | 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 |
| MWP | Mine works programme |
| NEMA | National Environmental Management Act No 107 of 1998 (as amended) |

## DISCLAIMER

The views expressed in this annual rehabilitation report are based on the information supplied to BECS Environmental by Imerys Refractory Minerals. BECS has ensured all due care in reviewing the supplied information. BECS has compared key supplied data with predictable values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. BECS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of BECS investigations, and those reasonably probable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which BECS had no prior knowledge nor had the opportunity to evaluate.

## EXECUTIVE SUMMARY

Imerys Refractory Minerals South Africa (Pty) Ltd has a mining right for the mining of andalusite on Portions 13, 14, 15 and the remaining extent of the farm Klipplaatdrift 399 KT, Mashishing Local Municipality, Limpopo. The purpose of this document is to provide sufficient information for the annual rehabilitation of the mine.

Information regarding the background to the mine was taken from various documents including the approved Environmental Management Programme (EMP). A site visit was held on 28 February 2018 to gather any additional information.

**Requirements of the annual rehabilitation plan**

The annual rehabilitation plan will be relevant for a period of 1 year, after which the plan will be updated by the holder of the right to reflect progress relating to rehabilitation and remediation activities in the preceding 12 months and to establish a plan, schedule and budget for the forthcoming 12 months. The annual rehabilitation plan must contain information that defines concurrent rehabilitation and remediation activities for the forthcoming 12 months and how these relate to the operations' closure vision, as detailed in the final rehabilitation, decommissioning and mine closure plan, must indicate what closure objectives and criteria are being achieved through the implementation of the plan, must be measurable and auditable and must include the following contents as seen in Table 1.

Table 1: Contents of an annual rehabilitation plan in terms of Appendix 4 of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production, (GN 1147) of 2015 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended) (NEMA)

| Appendix nr | Description | Section in this report |
|---|---|---|
| 3(a)(i) | details of the person or persons that prepared the plan | 1.2 |
| 3(a)(ii) | details of the professional registrations and experience of the person or persons; | 1.2 |

| Appendix nr | Description | Section in this report |
|---|---|---|
| 3(a)(iii) | details of the timeframes of implementation of the current, and review of the previous rehabilitation activities; | 4.6 |
| 3(b) | the pertinent environmental and project context relating directly to the planned annual rehabilitation and remediation activity; | 3 |
| 3(c) | results of monitoring of risks identified in the final rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities; | 4.2 |
| 3(d) | an identification of shortcomings experienced in the preceding 12 months; | 4.3 |
| 3(e) | details of the planned annual rehabilitation and remediation activities or measures for the forthcoming 12 months, including those which will address the shortcomings contemplated in (d) above or which were identified from monitoring in the preceding 12 months, and including | 4.4 |
| 3(e)(i) | if no areas are available for annual rehabilitation and remediation concurrent with mining, an indication to that effect and motivation why no annual rehabilitation or remediation can be undertaken; | 4.4.1 |
| 3(e)(ii) | where areas are available for annual rehabilitation and remediation concurrent with mining, annual rehabilitation and remediation activities related to previous disturbance or expected planned impacts and disturbance, as per the mine works programme (MWP), in the period under consideration, which should be tabulated and must indicate, but not necessarily be limited to | 4.4.2 |
| 3(e)(ii)(aa) | nature or type of activity and associated infrastructure; | 4.4.2.1 |
| 3(e)(ii)(bb) | planned remaining life of the activity under consideration; | 4.4.2.1 |
| 3(e)(ii)(cc) | area already disturbed or planned to be disturbed in the period of review; | 4.4.2.1 |
| 3(e)(ii)(dd) | percentage of the already disturbed or planned to be disturbed area available for concurrent rehabilitation and remediation activities; | 4.4.2.1 |
| 3(e)(ii)(ee) | percentage of the already disturbed or planned to be disturbed area available as per (dd) and on which concurrent rehabilitation and remediation can be undertaken; | 4.4.2.1 |
| 3(e)(ii)(ff) | notes to indicate why total available or planned to be available area differs from area already disturbed or planned to be disturbed; | 4.4.2.1 |
| 3(e)(ii)(gg) | notes to indicate why concurrent rehabilitation will not be undertaken on the full available or planned to be available area; | 4.4.2.1 |
| 3(e)(ii)(hh) | details of rehabilitation activity planned on this area for the period of review; | 4.4.2.1 |
| 3(e)(ii)(ii) | the pertinent closure objectives and performance targets that will be addressed in the forthcoming year, which objectives and targets are aligned to the final rehabilitation, decommissioning and mine closure plan; | 4.4.2.1 |
| 3(e)(ii)(jj) | description of the relevant closure design criteria adopted in the annual rehabilitation and remediation activities and the expected final land use once all rehabilitation and remediation activities are complete for the activity or aspect; and | 4.4.2.1 |
| 3e(iii) | a site plan indicating at least the total area disturbed, area available for rehabilitation and remediation and the area to be rehabilitated or remediated per aspect or activity; | 4.4.3 |
| 3(f) | a review of the previous year's annual rehabilitation and remediation activities, indicating a comparison between activities planned in the previous year's annual | 4.5 |

| Appendix nr | Description | Section in this report |
|---|---|---|
| | rehabilitation and remediation plan and actual rehabilitation and remediation implemented, which should be tabulated and as a minimum contain: | |
| 3(f)(aa) | area planned to be rehabilitated and remediated during the plan under review; | 4.5 |
| 3(f)(bb) | actual area rehabilitation or remediated; and | 4.5 |
| 3(f)(cc) | if the variance between planned and actual exceeds 15%, motivation indicating reasons for the inability to rehabilitate or remediate the full area; and | 4.5 |
| 3(g) | costing, including; | 6 |
| 3(g)(i) | an explanation of the closure cost and methodology, | 6.1 |
| 3(g)(ii) | auditable calculations of costs per activity or infrastructure, | 6.2 |
| 3(g)(iii) | cost assumptions; and | 6.4 |
| 3(g)(iv) | monitoring and maintenance costs likely to be incurred both during the period of the annual rehabilitation plan and those that will extend past the period of the final rehabilitation, decommissioning and mine closure plan, on condition that the monitoring and maintenance costs included in previous annual rehabilitation plans must be accumulated into subsequent versions of the annual rehabilitation plan until such time as the monitoring and maintenance obligation is discharged | 6.3 |

Attached as **Addendum 1** is the Environmental Risk Assessment Report in line with the requirements of the Minerals and Petroleum Resources Development Act (Act 28 of 2002 as amended) (MPRDA) as stipulated in 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 (MPRDR); regulations 6(c), 11(1)(c) & 12(3) & Appendix 5 of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production, GN 1147 of 2015 i.t.o. NEMA.

Attached as **Addendum 2** to this report is the EMP Performance Assessment, 2017, as stipulated in regulation 55(9) of the MPRDR. See Section 6 for the Annual Updated Financial Provision report is as stipulated in regulation 6 of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production, GN 1147 of 2015 i.t.o. NEMA.

No transfer of environmental liabilities and responsibilities will take place, Imerys will rehabilitate the mine.

The total financial provision costs for the year 2018 is R 1,975,082.80.

# SECTION 1: INTRODUCTION

## 1.1 Details of applicant

Refer to Table 2 below for a description of the applicant.

Table 2: Description of the applicant

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

## 1.2 Details of Environmental assessment practitioner

This section includes (a) details of the person or persons that prepared the plan and (b) details of the professional registrations and experience of the person or persons.

Refer to Table 3 below for a description of the environmental assessment practitioner (EAP).

Table 3: Description of the environmental assessment practitioner

| | |
|---|---|
| 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), B.Sc Honours Geography (UP), M.Sc Geography (UP), Professional Scientist (Environmental Science) , member of the International Associated of Impact Assessments South Africa. |
| Name of second responsible EAP | Deshree Pillay |
| Expertise of EAP | B. Sc Environmental Science (UP), B. Sc Honours Geography & Environmental Science (UP) |

I, Salome Beeslaar (8310190032081), 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.

_____

Salome Beeslaar
MSc – Geography, SACNASP (400385/14), IAIAsa (5853)
2 July 2018

## 1.3 Background on locality

Klipplaatdrift Mine is located on portions 13, 14 and 15 and the remaining extent of the farm Klipplaatdrift 399 KT in Thaba Cheuw Local Municipality in the Limpopo Province. The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place.

The mine is located within the Olifants River Catchment in the B4 and B6 secondary catchment areas. The site falls within three quaternary catchment areas. To the south-west is the B42G quaternary catchment area, to the north-west is the B42H quaternary catchment area and to the east is the B60F quaternary catchment area. The approximate co-ordinates of the mine are 24º56.054984' S 30º26.476061' E. The mine is situated approximately 10km west of the R36 tarred road that links Mashishing and Ohrigstad. The closest railway station is at Schalksrus situated approximately 15km north-east of the mine. The station is equipped with handling facilities. Refer to Figure 1 for a locality map.

## 1.4 Description of the property

There is currently no mining infrastructure on the site except for a small farm dam on portion 14 of the farm Klipplaatdrift. A very small area of topsoil, overburden and ore has been removed on the Re Ext of the farm Klipplaatdrift. There are dirt roads from farming activities traversing the site.

The adjacent, existing mine operation is the Krugerspost Andalusite Mine, and has been operating for over 35 years. Klipplaatdrift is the northern extension of the ore-body.

## 1.5 Land ownership of adjacent land and servitudes

Imerys is the owner of portions 13 & 15 of the farm Klipplaatdrift 399 KT. The Mabelane Communal Prop Association is the owner of portion 14 of the farm Klipplaatdrift 399 KT. Jacobus Christoffel Steenekamp is the owner of the Re Ext of the farm Klipplaatdrift 399 KT. Refer to Figure 2 and Table 4 below for all landowners.

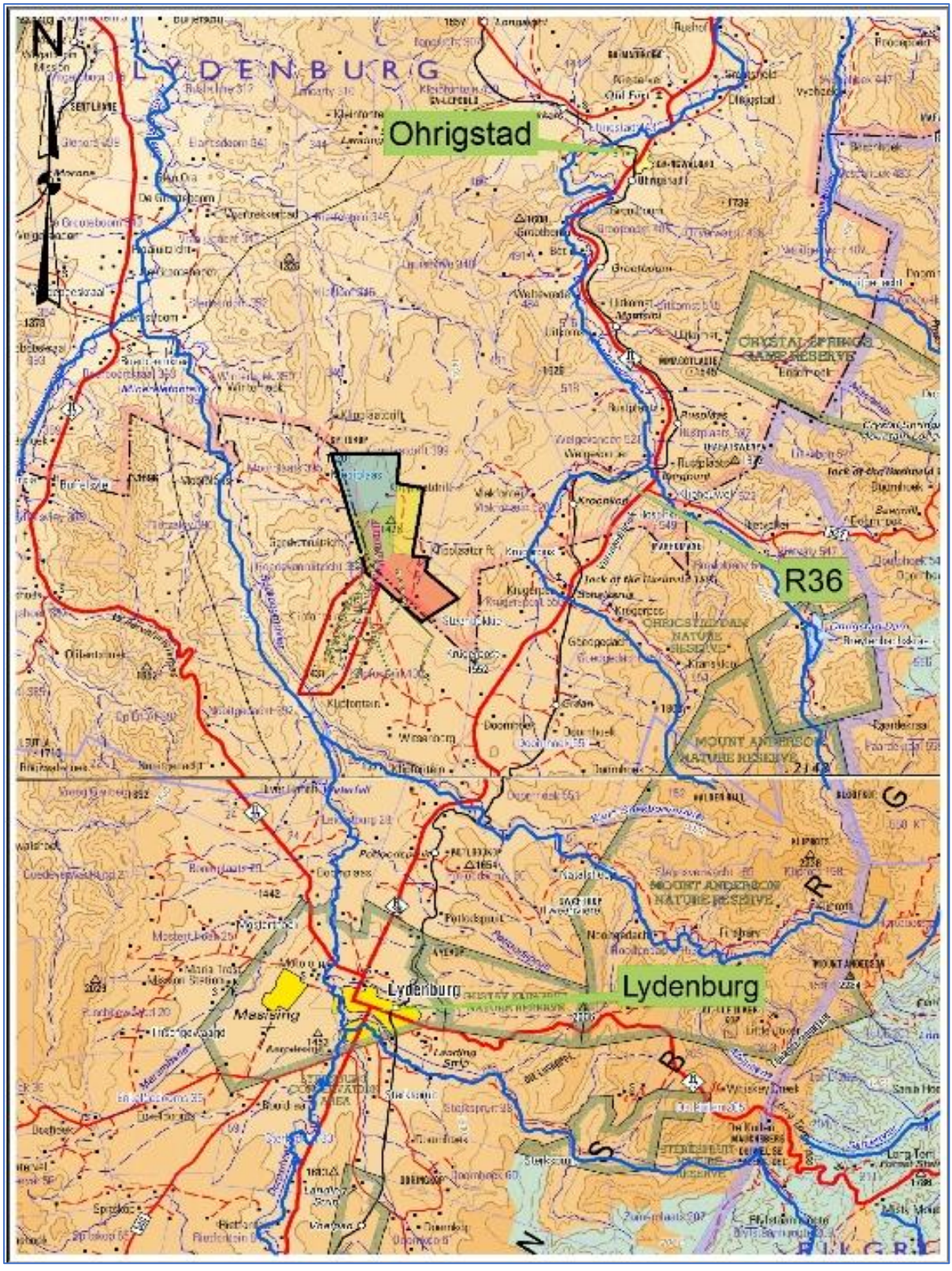



Figure 1: Locality Map of Klipplaatdrift Mining Right

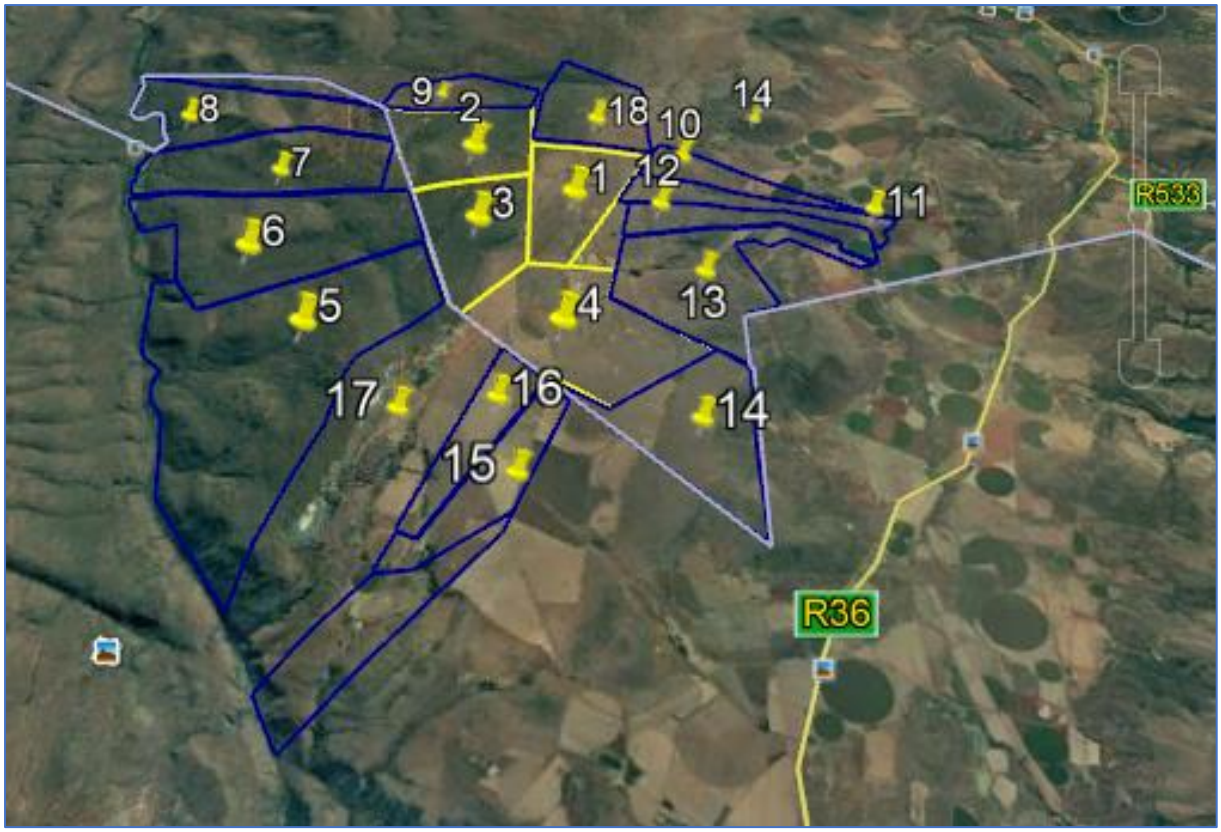



Figure 2: Google earth image of all landowners

Table 4: Landowners

| Number | Physical address | Adjacent Landowner | Institution | Land Use |
|---|---|---|---|---|
| 1. | Ptn 13 of Klipplaatdrift 399 KT | Hendrik Jones | Imerys | Mining |
| 2. | Ptn 14 Klipplaatdrift 399 KT | Mapoko Mabelane | Mabelane Communal Prop Association | Vacant land |
| 3. | Ptn 15 Klipplaatdrift 399 KT | Hendrik Jones | Imerys | Mining |
| 4. | RE Klipplaatdrift 399 KT | Jacobus Christoffel Steenekamp | Private | Agriculture |
| 5. | Goedevooruitzicht 394 KT | Mapoko Mabelane | Mabelane Communal Prop Association | Vacant land |
| 6. | Ptn 1 Goedeverooruitzicht 394 KT | Mapoko Mabelane | Mabelane Communal Prop Association | Vacant land |
| 7. | RE Mooiplaats 395 KT | Mapoko Mabelane | Mabelane Communal Prop Association | Vacant land |
| 8. | Ptn 1 Mooiplaats 395 KT | Mapoko Mabelane | Mabelane Communal Prop Association | Vacant land |
| 9. | Ptn 7 Klipplaatdrift 399 KT | Mapoko Mabelane | Mabelane Communal Prop Association | Vacant land |
| 10. | Ptn 1 Vlakfontein 520 KT | Willem Petrus Smith | Private | Agriculture |

| Number | Physical address | Adjacent Landowner | Institution | Land Use |
|---|---|---|---|---|
| 11. | Ptn 15 Vlakfontein 520 KT | Jacobus Theodorus Van Heerden | Private | Agriculture |
| 12. | Ptn 16 Vlakfontein 520 KT | Jacobus Theodorus Van Heerden | Private | Agriculture |
| 13. | Ptn 21 Vlakfontein 520 KT | Johannes Jacobus Steenekamp | Hanus Boerdery Pty Ltd | Agriculture |
| 14. | Ptn 6 Klipplaatdrift 399 KT | Elizabeth Susanna Stiles | Private | Vacant land |
| 15. | Ptn 13 Klipfontein 400 KT | Hendrik Jones | Imerys | Mining |
| 16. | Ptn 2 Klipfontein 400 KT | Hendrik Jones | Imerys | Mining |
| 17. | Ptn 31 Klipfontein 400 KT | Hendrik Jones | Imerys | Mining |
| 18. | Ptn 10 Klipplaatdrift 399 KT | Hendrik Jones | Imerys | Mining |

There is a power line servitude occurring across the mining area.

## SECTION 2: LEGISLATION AND GUIDELINES APPLICABLE

Table 5: Legislation and interpretation of these requirements for the closure design principles

| Legislation | Requirements | Interpretation of these requirements for the closure design principles |
|---|---|---|
| Regulation 56 of MPRDR | In accordance with applicable legislative requirements for mine closure, the holder of a mining right must ensure that -<br>a) the closure of a mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation;<br>b) risks pertaining to environmental impacts must be quantified and managed proactively, which includes the gathering of relevant information throughout the life of a mining operation;<br>c) the safety and health requirements in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) are complied with;<br>d) residual and possible latent environmental impacts are identified and quantified;<br>e) the land is rehabilitated, as far as is practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms with the concept of sustainable development; and<br>f) mining operations are closed efficiently and cost effectively. | The EMP of 2012 describes the environment on site and the potential impacts during each phase of the project. Rehabilitation of the mine includes all phases of the project from construction to decommissioning. The environmental scoping report includes all information pertaining to risks, residual and possible latent risks. Various specialist studies were carried out to assess the impact or potential impact on the land and used to help formulate rehabilitation. Closure of the mine will incorporate any necessary safety and health requirements in terms of the MHSA. The residual and possible latent environmental impacts are identified and quantified in this Closure Plan. The end land use is discussed in Section 4.1 of this Annual Rehabilitation Plan. |
| Regulation 61 of MPRDR | Closure objectives form part of the draft environmental management programme and must -<br>a) identify the key objectives for mine closure to guide the project design, development and management of environmental impacts; | The pertinent closure objectives and performance targets that will be addressed in the forthcoming year, which objectives and targets are aligned to the final rehabilitation, decommissioning and mine closure plan can be found in section 4.4.2.1 in this report. This includes closure costs which in total is R**1 975 082.80** |

| Legislation | Requirements | Interpretation of these requirements for the closure design principles |
|---|---|---|
| | b) provide broad future land use objective(s) for the site; and<br>c) provide proposed closure costs. | |
| Regulations 6(a) of GN 1147 | An applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for annual rehabilitation, as reflected in an annual rehabilitation plan | The financial provision is included in Section 6 of this Annual Rehabilitation Plan which includes the financial provision methodology, auditable calculations of financial provision per activity or infrastructure financial provision estimation and assumption on the financial provision. |
| Regulations 11(1)(a) of GN 1147 | The holder of a right or permit must ensure that a review is undertaken of the requirements for annual rehabilitation, as reflected in an annual rehabilitation plan | Rehabilitation commitments will be assessed and reviewed upon approval of the annual rehabilitation plan. |
| Regulations 11(2) of GN 1147 | The holder of a right or permit must, on completion of the actions contemplated in subregulation (1), ensure that the adequacy of the financial provision is assessed and any adjustments that need to be made to the financial provision are identified. | The adjustments to the financial provision are included in section 6 of this Annual Rehabilitation Plan. Note the transitional period for these Regulations. |
| Regulations 12(1) of GN 1147 | The annual rehabilitation plan must contain all information set out in Appendix 3 to these Regulations | This Annual Rehabilitation Plan is based on the requirements of the MPRDA, as well as Appendix 3 of GN 1147 pertaining to the minimum content of a rehabilitation plan. |

# SECTION 3: THE PERTINENT ENVIRONMENTAL AND PROJECT CONTEXT RELATING DIRECTLY TO THE PLANNED ANNUAL REHABILITATION AND REMEDIATION ACTIVITY

## 3.1 Environmental context

### 3.1.1 Geology

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

#### 3.1.1.1 Regional geology

The Rustenburg Layered Suite (Bushveld Complex) covers Gauteng, Limpopo and Mpumalanga Province. 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. (Refer to Figure 3 below).


Figure 3: Geology associated with the proposed mining area *(Shangoni, 2014)*

#### 3.1.1.2 Site specific geology

3.1.1.2.1 Mine pit and immediate surroundings

The associated mineralogy is biotite, chlorite, quartz and sericite. No associated sulphide mineralization occurs with the Krugerspost andalusite 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 crystals release readily from the weathered rock due to the retrogressive formation of sericite along the crystal boundaries.

3.1.1.2.2 Dykes, sills and faults

Karoo age dolerite intrusive dykes strike north to south, parallel to the ore body and are rarely evident within the ore zone.

### 3.1.2 Climate

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

3.1.2.1 Regional climate

The climate is typical of the Transvaal Middleveld, with warm to hot summers and cool winters. Most rainfall occurs in the summer months from September to February in the form of thunderstorms. The area has a moderate rainfall.

3.1.2.2 Rainfall and evaporation

Mean annual rainfall amounts to ±663mm per annum. The 1:50year 24-hour storm average is 133mm and the 1:100year 24hour storm average is 154mm. The mean monthly evaporation for Krugerspost Andalusite Mine is 2140 mm.

3.1.2.3 Temperature

Table 7 below indicates the mean monthly maximum and minimum temperatures for Krugerspost Andalusite Mine. January is generally the warmest month of the year with a mean temperature of 25.4ºC and June is generally the coldest month of the year with a mean temperature of 18.3ºC.

3.1.2.4 Wind

Table 6 indicates the hourly wind speed for the area. Wind frequency, direction and speed for Lydenburg is illustrated in Figure 4 below. Refer to Figure 4 below for the seasonal wind roses for the year 2012.

Table 6: Hourly wind speed analysis (% frequency per speed category)

| Month | 0 TO 1. | 1 TO 1.5 | 1.6 TO 3.5 | 3.6 TO 5.5 | > 8.0 |
|---|---|---|---|---|---|
| January | 24.4 | 17.8 | 47.9 | 9.6 | 0.4 |
| February | 26.9 | 16.6 | 48 | 8.3 | 0.2 |
| March | 30.1 | 17.2 | 45.4 | 7.2 | 0.1 |
| April | 34.5 | 15.3 | 42.8 | 7.1 | 0.3 |
| May | 32.8 | 16.6 | 43.3 | 6.8 | 0.5 |
| June | 30.3 | 15.1 | 47.4 | 6.9 | 0.3 |
| July | 26 | 14 | 44.9 | 10.5 | 0.4 |
| August | 30 | 13.3 | 42 | 13.5 | 1.1 |
| September | 32.6 | 11.7 | 37 | 17 | 1.7 |
| October | 26 | 11.6 | 40.7 | 19 | 2.8 |
| November | 26.3 | 15 | 43.5 | 13.9 | 1.3 |
| December | 25.1 | 16.8 | 47.7 | 10.1 | 0.3 |
| Year | 28.9 | 15 | 44.1 | 10.9 | 0.8 |

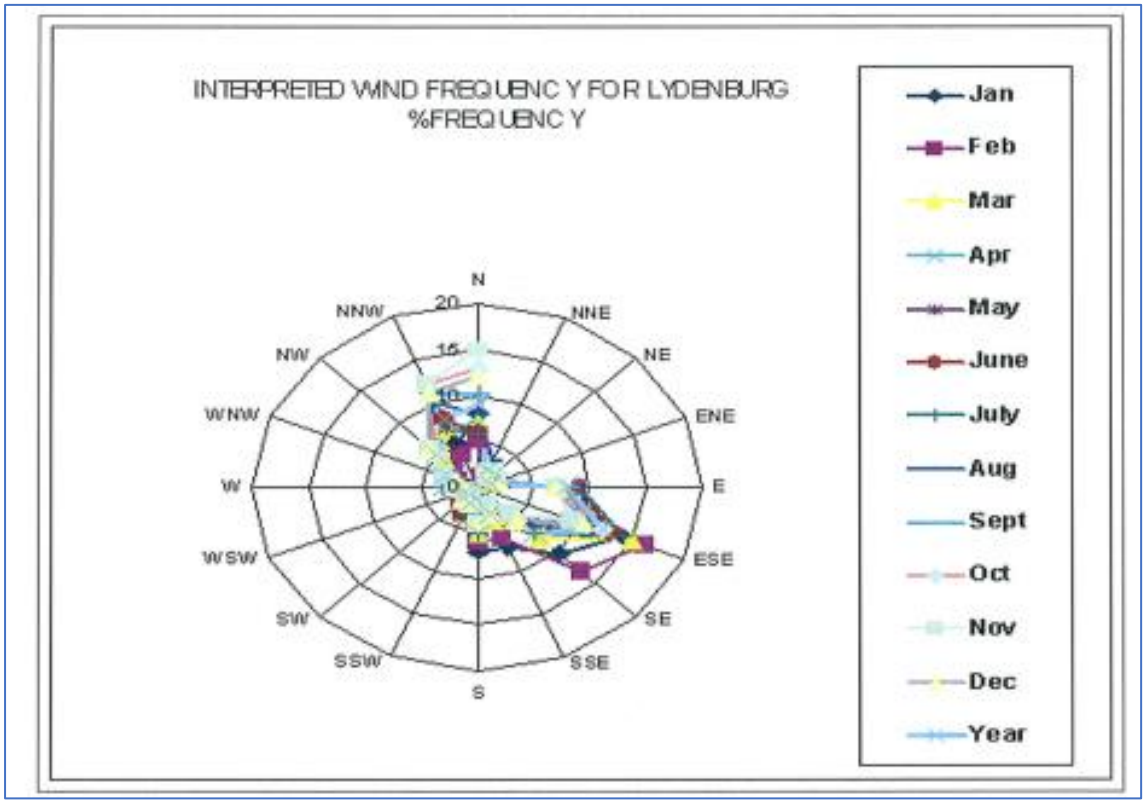



Figure 4: Wind direction and frequency

### 3.1.3 Topography

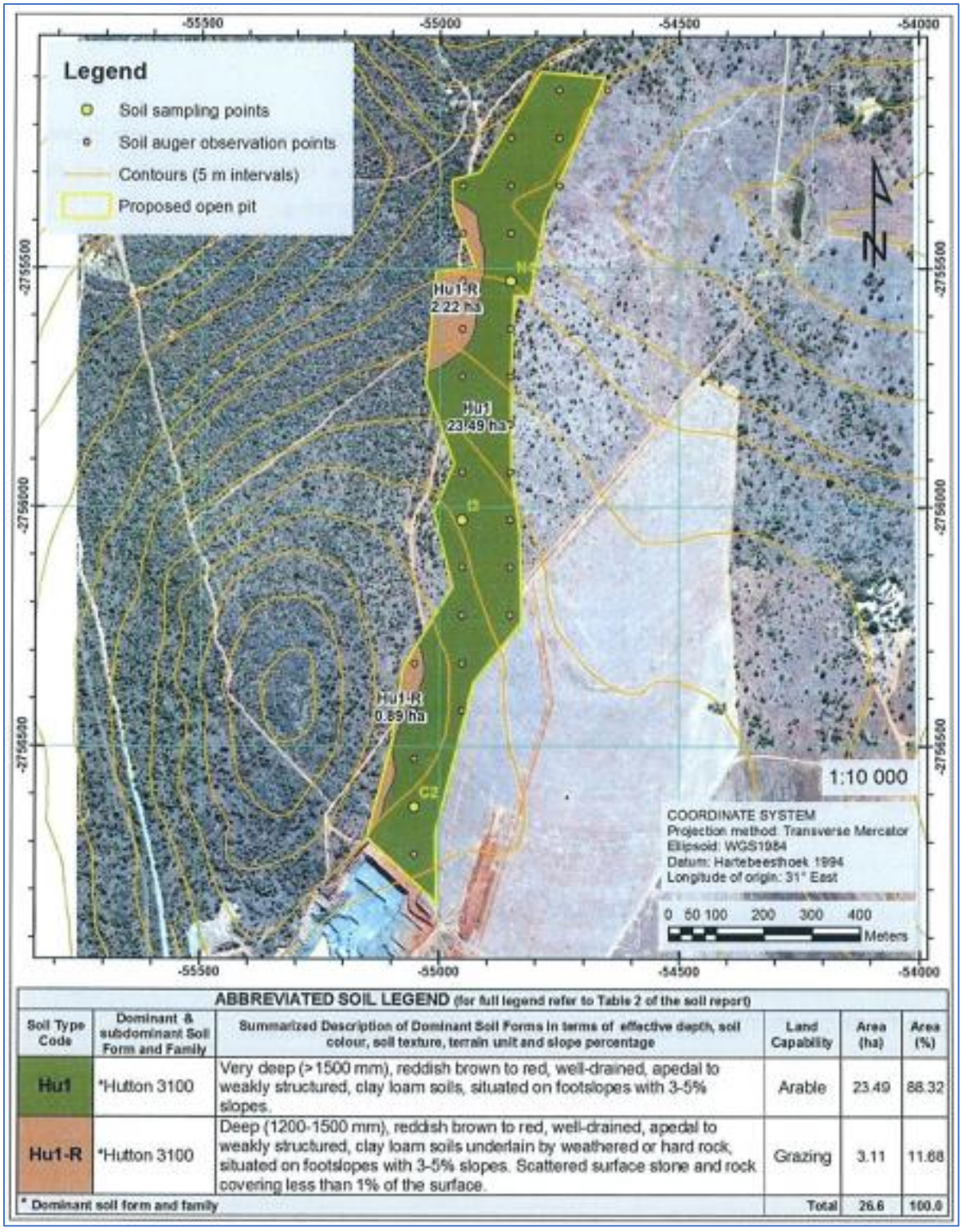
Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014): The mine is situated on the east slope of a low hill which comprises mainly hornfelsic rock. Slope class is 3-5% of most part of the area where activities will take place. Therefore, convex slope will erode most rapidly, yield most sediment and tend to change shape fastest. Figure 5 below represents a 3-dimesnional view of the topography of the area within a 10km radius. The region

is fairly mountainous with rocky outcrops and ridges in places. The Lydenburg area falls within the Mountain Region catchment of the Olifants River. The tertiary catchments include the Steelpoort and Spekboom Rivers. The Krugerspost Andalusite Mine is situated on the eastern slope of a north/south water divide. Surface flow from the mine will therefore be in a south-eastern direction towards the natural drainage line and dams to the east which also acts as the mine surface water system.


Figure 5: Topography within a 10km radius of the site *(Shangoni, 2014)*

### 3.1.4 Soil

The following information was taken from the report titled: “Soil, land capability and land use assessment of the proposed open pit area of the Krugerspost Andalusite Mine north of Lydenburg, Limpopo Province” dated 26 October 2014 and compiled by Rehab Green Environmental and Rehabilitation Monitoring cc (Rehab green, 2014). The soil forms identified were Hut and Hul-R. The soil forms can be described as being deep to very deep, reddish brown to red in nature and are well drained. The soils are situated on foot slopes with a steepness of 3-5% and are apedal to weakly structured. The Hu 1 -R soils are however underlain by weathered or hard rock and consist of scattered surface stone and rock covering less than 1% of the surface area, the dominant soil type is the Hut as it occupies approximately 23.49 Ha (88.32% of the total surface area of the proposed open pit) (refer also to Figure 6 below).




**ABBREVIATED SOIL LEGEND** (for full legend refer to Table 2 of the soil report)

| Soil Type Code | Dominant & subdominant Soil Form and Family | Summarized Description of Dominant Soil Forms in terms of effective depth, soil colour, soil texture, terrain unit and slope percentage | Land Capability | Area (ha) | Area (%) |
|---|---|---|---|---|---|
| Hu1 | *Hutton 3100 | Very deep (>1500 mm), reddish brown to red, well-drained, apedal to weakly structured, clay loam soils, situated on footslopes with 3-5% slopes. | Arable | 23.49 | 88.32 |
| Hu1-R | *Hutton 3100 | Deep (1200-1500 mm), reddish brown to red, well-drained, apedal to weakly structured, clay loam soils underlain by weathered or hard rock, situated on footslopes with 3-5% slopes. Scattered surface stone and rock covering less than 1% of the surface. | Grazing | 3.11 | 11.68 |
| * Dominant soil form and family | | | Total | 26.6 | 100.0 |

Figure 6: Soil map of proposed new open pit area

### 3.1.5 Pre-mining land capability, land use and existing infrastructure

The following information was taken from the report titled: “Soil, land capability and land use assessment of the proposed open pit area of the Krugerspost Andalusite Mine north of Lydenburg, Limpopo Province” dated 26 October 2014 and compiled by Rehab Green Environmental and Rehabilitation Monitoring cc (Rehab green, 2014). The location and extent of the land capability within

the proposed open pit area can be seen to directly correlate with the fertility and the soil forms identified. As described in Table 7 below, the land capability of Hu 1 is that of arable and the land capability of Hu1-R is that of grazing.

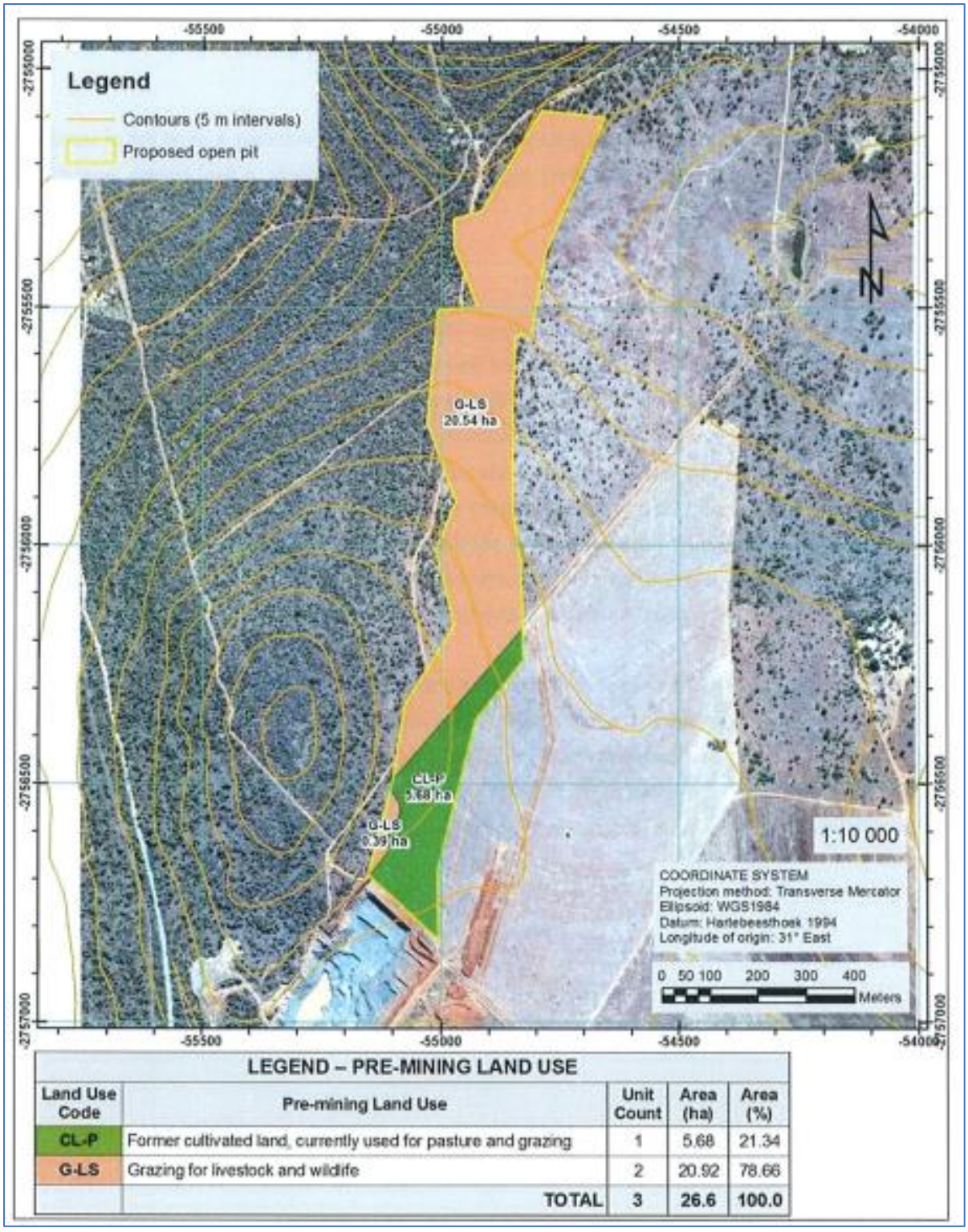
Table 7: Description of the land capability classes *(Rehab Green, 2014)*

| Land Capability Code | Land Capability Class | Soil Types | Broad Soil Description | Unit Count | Area (ha) | Area (%) |
|---|---|---|---|---|---|---|
| A | Arable | Hu1 | Very deep (1500mm), mm, reddish brown to red, well drained, apedal to weakly structured clay loam soils, soils situated on footslopes with 3-5% slopes. | 1 | 23,49 | 88,32 |
| G | Grazing | Hu1-R | Deep (1200-1500 mm), reddish brown to red well drained, apedal to weakly structured clay loam soils, soils situated on footslopes with 3-5% slopes. Scattered surface stone and rock covering 1% of the surface. | 2 | 3,11 | 11,68 |
| W | Wetland | - | - | 0 | 0 | 0 |
| WD | Wilderness | - | - | 0 | 0 | 0 |
| **Total** | | | | **3** | **26,6** | **100,0** |

The land use within the proposed new open pit area can be described as being predominantly grazing of livestock and wild life (20,92 ha). The land use of the remaining area (5,68 ha) is that of former cultivated lands that are currently used for pasture and grazing. Refer to Table 8 and Figure 7 below for the pre-mining land uses.

Table 8: Pre-mining land uses *(Rehab Green, 2014)*

| Pre-mining Land Use | Unit Count | Area (ha) | Area (%) |
|---|---|---|---|
| Former cultivated land currently used for pasture and grazing | 1 | 5,68 | 21,34 |
| Grazing for livestock | 2 | 20,92 | 78,66 |
| **TOTAL** | **3** | **26,6** | **100,0** |




LEGEND – PRE-MINING LAND USE

| Land Use Code | Pre-mining Land Use | Unit Count | Area (ha) | Area (%) |
|---|---|---|---|---|
| CL-P | Former cultivated land, currently used for pasture and grazing | 1 | 5.68 | 21.34 |
| G-LS | Grazing for livestock and wildlife | 2 | 20.92 | 78.66 |
| | TOTAL | 3 | 26.6 | 100.0 |

Figure 7: Pre-mining land use map

### 3.1.6 Vegetation

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

the proposed mining area is situated within the Grassland and Savanna Biome of South Africa. Summer rainfall combined with dry winters and frost with marked diurnal temperature variations in the Grassland Biome are unfavourable to tree growth and therefore grasslands comprise mainly of grasses and plants with perennial underground storage organs, for example bulbs and tubers and less trees. However, the site is situated within Mesic Highveld grassland where the surface topography (e.g. rocky hills and protected valleys) creates habitats that are favourable to shrublands and trees (Dimela, 2014). Generally, the higher the surface rock cover, the higher the occurrence of woody vegetation such as trees and shrubs, relative to herbaceous vegetation (Mucina & Rutherford, 2006).

The Grassland Biome consists of various different vegetation types, of which the Lydenburg Thornveld dominates the study area (refer to Figure 8 below). This vegetation type, in its natural and undisturbed state, comprised open, frost hardy woodland especially on rocky outcrops, while the frost sensitive valleys and plains include less trees and contain mainly Acacia karroo and woody suffrutexes (plants which aerial parts die back to an underground rootstock during winter) (Dimela, 2014).

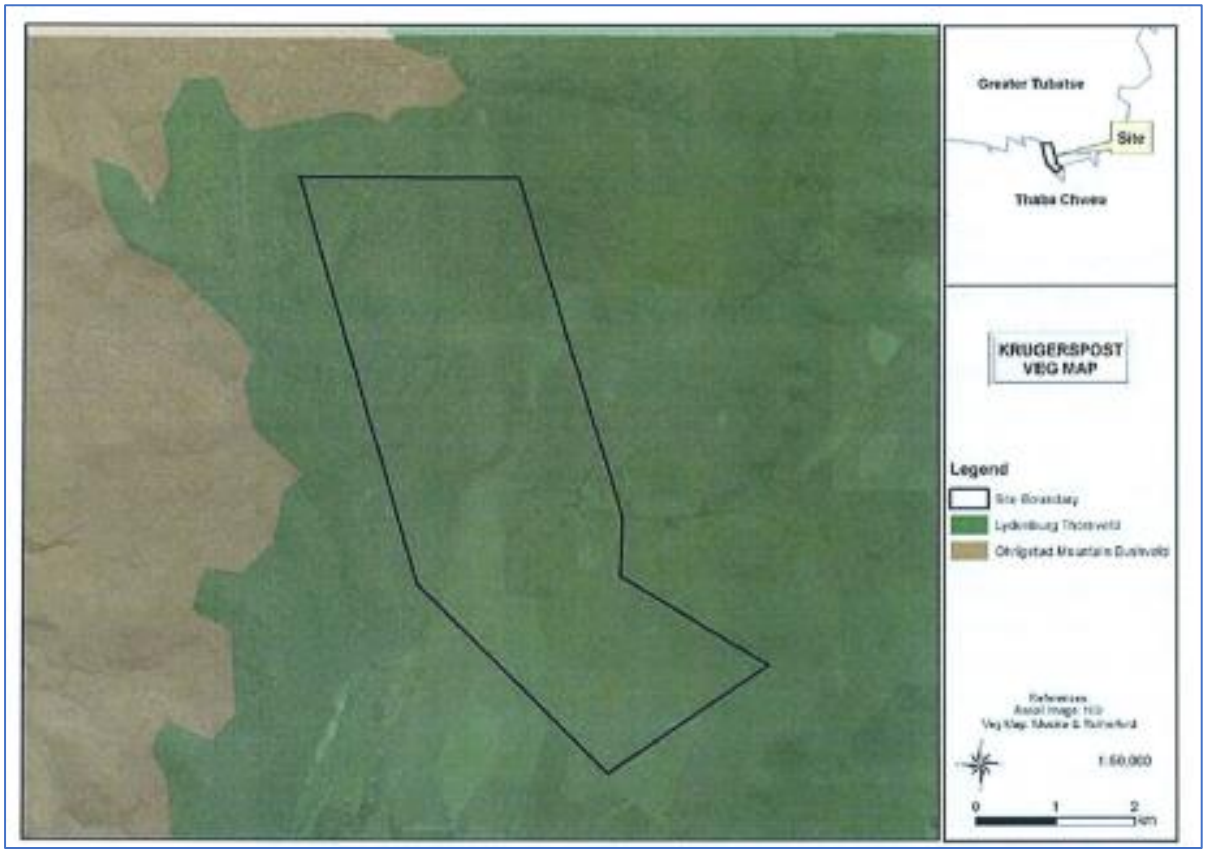



Figure 8: Krugerspost vegetation map

The conservation status of the Lydenburg Thornveld is classified as 'Vulnerable' as much of its extent are transformed by agriculture and mining. Therefore, areas where this vegetation remains in its natural state should be conserved in order to reach the national conservation target of this vegetation type.

The site is in close proximity to the Ohrigstad Mountain Bushveld, which falls within the Savannah Biome (refer to Figure 12 above). It must be noted that the National Vegetation Map is a broad scale assessment based on amongst others, geology, soil and climate. Therefore, the site may also exhibit species composition characteristic to the Ohrigstad Mountain Bushveld, which is classified as 'Least Threatened'.

#### 3.1.6.1 Site specific

The vegetation in the mine area is categorised into the following four (4) broad vegetation groupings (refer to Figure 9 below):

1. Grazed grassland
2. Secondary grassland
3. Natural open woodland
4. Vegetation associated with watercourses:
    - Moist grasslands; and
    - Riparian vegetation


Figure 9: Krugerspost vegetation categories

##### 3.1.6.1.1 Grazed Grassland

This grassland was characterised by a diversity of Increaser II and III grasses (grass species that increase in over utilised/overgrazed veld) and a high number of a shrubby *Berkheya* species and

*Senecio microglossus* which seemingly increase in overgrazed veld. Although these areas were not ploughed in the recent past, continuous grazing pressure reduced palatable grasses and subsequently changed the species composition from what is expected in natural Lydenburg Thornveld (Dimela, 2014). This vegetation is not representative of the Lydenburg Thornveld and although some mutual grass species and forbs were present, the typical open woody layer is absent, except for encroachment of the pioneer trees *Acacia karroo* (Sweet Thorn) and *Lopholaena coriifolia* (Pl uisbossie).

Although the grazed grassland includes a number of species, these are mostly associated with overgrazing and species that could be recognised included patchy occurrences of *Hyparrhenia hirta* (Common Thatching Grass), *Cynodon dactylon* (Couch Grass), *Melinis repens* (Natal Red Top), Eragrostis curvula (Weeping Love Grass) and *Aristide diffusa* (Iron Grass). The forb layer was limited in species diversity, although this could be attributed to the assessment being undertaken during winter. Forbs and shrubs observed included *Hermannia depressa* (Creeping Hermannia), *Helichrysum rugulosum, Haplocarpa scaposa, Asparagus species, Polygala species an Argyrolobium species and Macledium zeyhen.*

3.1.6.1.2 Natural and open woodland

Much of the northern section of the mine area comprised natural bushveld vegetation (northern portion of portion 14, portion 13 & 14), while open woodland was observed through the centre and towards the eastern corner of the site.

The vegetation through the centre and eastern border, as well as the south-eastern corner comprised open woodland dominated by a grass layer and were found to be representative of Lydenburg Thornveld. Although the grass layer was dry, the following species could be recognised: *Heteropogon contortus* (Spear Grass), *Themeda triandra* (Red Grass), *Hyparrhenia hirta* (Common Thatching Grass), *Melinis repens* and a *Tristachya* species. The tree layer was dominated by Acacia karroo, A. *caffra, A. ataxacantha* (Flame Thorn), *Dombeya rotundifofia*, *Cussonia transvaalensis*, *Euclea crispa* and the climber *Clematis matee* (Traveller's Joy). Herbaceous species included *Polygala mate* and *Lippea javanica.*

The centre portion of the site also included a rocky hill where the woody layer was more dense and additional species that grew here included *Gymnosporia buxifolia*, *Rhamnus prionokles* (Dogwood), *Acacia gerradii* (Red Thorn), *Diospyros whyteana* (Bladder-nut), *Euclea cripsa* (Blue Guarrie), the fern *Pellaea calomelanos*, the herbaceous *Athrixia arachnoidea*, a *Thesium* species, and the succulent Aloe marlothfi (Mountain Aloe). The area was grazed and a high number of *Senecio microglossus* was observed.

The northern section of site (specifically portion 14 and the most northern section of portion 15) comprised mountainous areas with a denser vegetation and a higher species diversity. The most northern section (portion 14) is situated on deeper sand with valleys, giving rise to denser woody layer.

In addition to the aforementioned species, additional species characteristic of the Ohrigstad Mountain Bushveld was observed and included trees such as *Boscia foetida subsp rehmanniana* (Stink Shepard's Tree), *Combretum molle* (Velvet Bushwillow), *Pelthophorum africanurn* (African Wattle), *Faurea saligna Commiphora* 'yogis (Velvet Corkwood), Croton *gratissimus* (Lavender Fever Berry) and tall growing *Aloe marlothii* and *Cussonia paniculata* (Cabbage Tree). Herbaceous species included Gerbera *cf piloselloides*, *Anthospermum rigidum*, an *Argyrolobium* species and *Schistostephiurn crateegifolium* (Berg kruie).

3.1.6.1.3 Vegetation associated with watercourses

The site included riparian areas and non-perennial drainage lines in the northern section of the site, as well as moist grasslands or wetland areas in the south-eastern section of the site.

Riparian areas and drainage lines

Riparian habitat refers to the extent of a river's footprint and includes the physical structure, as well as the vegetation associated with the river or drainage line. The interaction between land and water in the riparian zone provides a range of micro-habitats that support a diverse range of flora and fauna. Highly fertile soils and moist conditions increase the establishment and growth of a diverse range of plant species (Land for Wildlife, 2002), Although vegetation associated with non-perennial drainage lines have much the same species composition and structure of surrounding vegetation, the vegetation is highly functional in preventing soil erosion and degradation of surrounding vegetation, as well as downstream watercourses. A sample plot on the western boundary of the site, within riparian habitat, revealed a more vigorous and dense woody layer and the following species not observed within the surrounding vegetation: Ilex mites, *Olea europea subsp rmatee, Ziziphus mucronata, Syzigium corclatum* (Waterberry) and the herbs *Abutilon sonneratianum* and *Chaetacanthus cf setiger*. At the time of the site visit, a dirt road was being constructed through the riparian area resulting in some destruction of riparian vegetation.

Moist grasslands

Moist grasslands were classified as the grassland areas where the vegetation comprised of species that are adapted to grow in permanently or periodically saturated areas. These areas also included plants with an affinity for growing near water, but not within saturated soils. These areas therefore comprised of hydrophytic vegetation which is an indicator of permanent and temporary wetland conditions. The moist grassland areas where partly dammed and some showed signs of grazing pressure. Typical plants included *Haplocarpa scaposa* (near moist areas), *Imperata cylindrical* (Cotton Wool Grass) in periodically saturated areas and sedges such as *Cyperus sexangularis and Juncus effuses* (Soft Rush). Grass species in and around the wetland areas included *Hyperrhenia tamba* (Blue Thatching Grass), a *Cymbopogon species, Themeda triandre* (Red Grass) and *Aristide cf junciformis* (Gongoni Three-awn).

3.1.6.2 Limpopo Biodiversity Assessment and Conservation Plan

The Limpopo Province assessed the biodiversity in the province and classified the province in terms of Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESA's), as well as Protected Areas and areas where No Natural Habitat remain (refer to Appendix E8). Critical Biodiversity Areas (CBAs) are the sites that are required to meet the region's biodiversity targets and need to be maintained in a natural condition to safeguard identified biodiversity features.

Ecological Support Areas (ESAs) are classified as areas that are important for ensuring persistence and to provide intact mega-pathways for long-term biological movement, and they are selected primarily along river lines and altitude gradients in order to provide for the natural retreat and advance of plants and animals in response to environmental change.

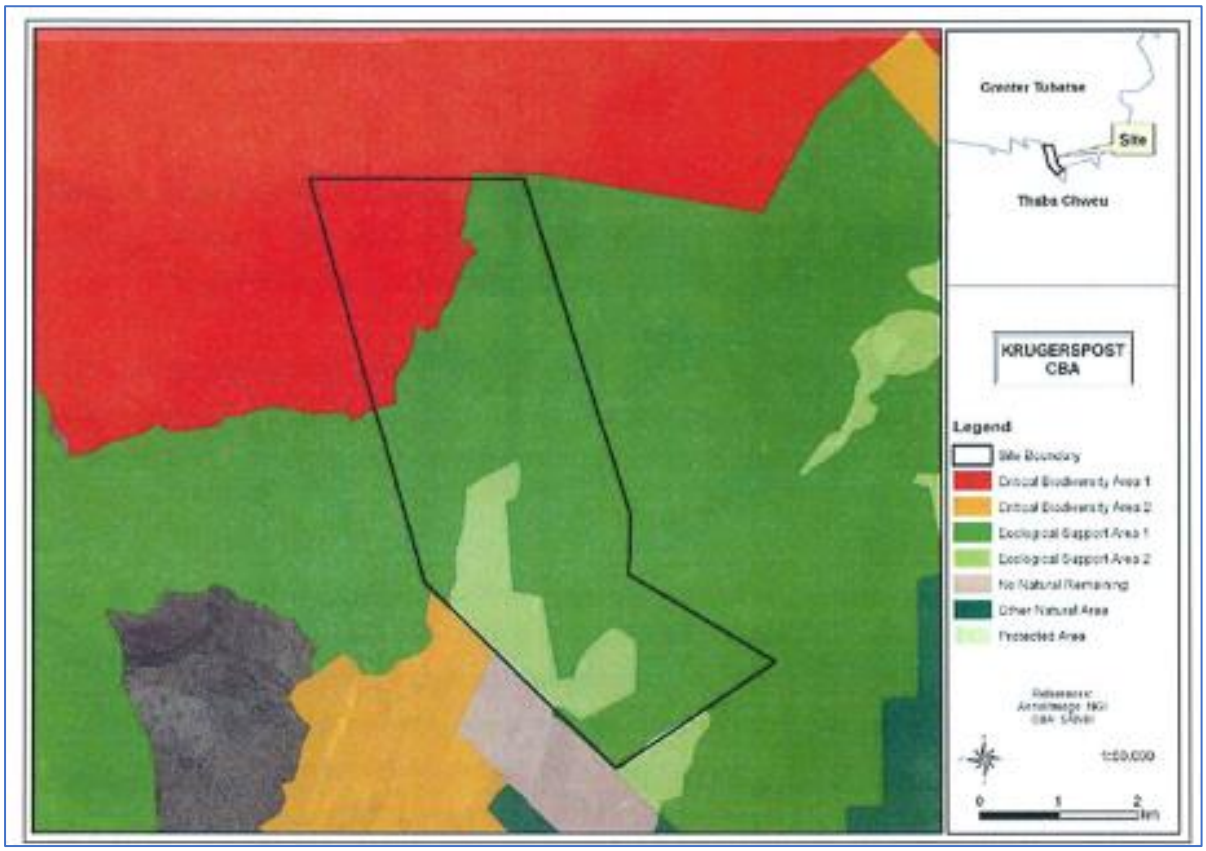



Figure 10: The Klipplaatdrift 399 KT area in relation to the Limpopo C-Plan

The CBAs have been split into CBA 1 and CBA 2. The majority of the CBAs in the province are CBA 1 which can be considered "irreplaceable" in that there is little choice in terms of areas available to meet conservation targets. If CBA 1 areas are not maintained in a natural state, then targets cannot be achieved. CBA 2's represent areas where there are spatial options for achieving targets and the selected sites are the ones that best achieve targets within the landscape design objectives of the plan.

ESAs has also been split on the basis of land-cover into ESA 1 and ESA 2, with ESA 1 being in a largely natural state, while ESA 2 areas are no longer intact but potentially retain significant importance from a

process perspective (e.g. maintaining landscape connectivity). As indicated in Figure 10, the northern portion of the site is situated within a CBA1, while the majority of the site is situated in an ESA1 and a small portion within an ESA2. The area where the existing but abandoned open pit mining took place south of the site, is situated within a CBA2.

#### 3.1.6.3 Invader species

Grazed grassland

The invasive plant *Cirsium vulgare* (Scotch Thistle) was observed within the grazed grassland, in proximity to moist grasslands. This species is a declared category 1 b invader.

Natural vegetation open-woodland

The invasive succulent *Opuntia* species (Prickle Pear) was observed within the natural woodland in the northern portion of the site. This species is a declared category 1, as described in Appendix E2. A *Cotoneaster* and *Rubus* species were observed around the centre of the site.

Vegetation associated with watercourses

The invasive herbaceous plants *Cirsium vulgare* (Scotch Thistle) and *Verbena bonariensis* (Wild Verbena) were observed within the moist grasslands. These species are a declared category 1 invader.

### 3.1.7 Animal life

The following information was taken from the document titled: "Faunal Assessment Report, SAMREC: Krugerspost Andalusite Mine, Limpopo Province", dated August 2014 and compiled by Classic Environmental Management Services (CEMS, 2014).

The majority of mammals, reptiles and amphibians are nocturnal by nature and birds are highly mobile. The presence of suitable habitats was used to determine the status, and presence, of these species through various field guides and atlases.

#### 3.1.7.1 General

The proposed mining area is situated within the Grassland and Savanna Biome of South Africa and as described above, the presence of suitable habitats was used to identify the possible presence of faunal species. The vegetation in the mine area is categorised into the following four (4) broad vegetation groupings:

1. Grazed Grassland
2. Secondary Grassland
3. Natural open woodland
4. Vegetation associated with watercourses
    - Moist grasslands
    - Riparian vegetation

### 3.1.7.2 Site specific

3.1.7.2.1 Amphibians

No frog species were identified during the site assessment although those expected to occur in the area are widespread and common throughout the thornveld, bushveld and grassland environments. Table 9 below provides a list of species of amphibians which have previously been identified in the Mashishing area.

Table 9: Species of amphibians previously identified within the Mashishing area

| Common name | Scientific name |
|---|---|
| African Bullfrog | *Pyxicephalus edulis* |
| Southern Ornate Frog | *Hildebrandtia ornate* |
| Tremolo Sand Frog | *Tomopterna cryptotis* |
| Russet-backed Sand Frog | *Tomopterna mamorata* |
| Natal Sand Frog | *Tomopterna natalensis* |
| Common Caco | *Cacostemum boettgeri* |
| Bronze Caco | *Cacostemum nanum* |
| Bubbling Kassina | *Kassino senegalensis* |
| Brown-backed Tree frog | *Leptopelis mossambicus* |
| Southern Foam nest frog | *Chiromantis xerampelina* |
| Red Toad | *Schismaderma carens* |
| Eastern Olive toad | *Ametiophyrnus (Bufo) garmani* |
| Guttural toad | *Metiophyrnus (Bufo) gutturalis* |
| Raucous toad | *Bufo rangeri* |
| Northern Pygmy toad | *Bufo fenoulheti* |
| Tropical Platanna | *Xenopus muelleri* |
| Common River frog | *Xenopus laevis* |
| Banded Rubber frog | *Phrynomantis bifasciatus* |
| Dwarf Puddle frog | *Phyrnobatrachys mababiensis* |
| Snoring Puddle frog | *Phyrnobatrachys natalensis* |
| Plain grass frog | *Ptychadena anchietae* |
| Broad-banded grass frog | *Ptychadena mossambica* |
| Sharp-nosed grass frog | *Ptychadena oxyrhynchus* |
| Bushveld rain frog | *Breviceps adspersus* |
| Mozambique rain frog | *Breviceps mossambicus* |
| Painted reed frog | *Hyperolius mamoratus* |
| Water lily frog | *Yperolius pusillus* |

3.1.7.2.2 Reptiles

As reptiles are elusive, secretive and particularly difficult to observe during site assessments, the identification of the species of reptiles present in the area was based on the vegetation and topography present on site as well as in the surrounding areas. The open and closed thornveld as well as the rocky

mountainous areas may provide suitable habitat for the following species of reptiles listed in Table 10 below.

Table 10: List of reptile species for the Mashishing area

| Common name | Scientific name |
|---|---|
| Flap-necked chameleon | *Chamaeleo dilepis* |
| Boomslang | *Dispolidus typus* |
| Spotted bush snake | *Philothamnus variegatus* |
| Southern tree agama | *Acanthocercis atricolis* |
| Common dwarf gecko | *Lygodactylus capensis* |
| Wahlbergs snake-eyed skink | *Panaspis walbergii* |
| Yellow throated plated lizard | *Gerrhosaurus flavigularis* |
| Giant plated lizard | *Gerrhosaurus Validus montane* |
| Speckled skink | *Trachylepis (Mavuya) punctatissima* |
| Variable skink | *Trachylepis (Mavuya) varia* |
| Southern rock agama | *Agama atra* |
| Ground agama | *Agama matee Sekhukune* |
| Flat lizard | *Platysaurus orientalis* |
| Common flat lizard | *Platysaurus intermedius itermedius* |
| Common crag lizard | *Pseudocordylus melanotus* |
| Transvaal girdled lizard | *Cordylus vittifer* |
| Transvaal thick toed gecko | *Pacydactylus affinis* |
| South African python | *Python natalensis* |
| Breyers long tailed seps | *Tertadactylus breyeri* |
| Yellow bellied house snake | *Lamprophis fuscus S* |
| Triped harlequin snake | *Homoroselaps dorsalis* |
| Puff adder | *Britis arietans* |
| Crossed sand snake | *Psammophis crucifer* |
| Sundevals sand snake | *Mochlus sundevalli holubs* |
| Sandveld lizard | *Nucras holubi* |
| Ornate scrub llizard | *Nucras nnate* |
| Spotted bush snake | *Philothamus semivariegatus* |
| Sekukhune flat lizard | *Platysaurus orientalis* |
| Stigmochelys pardalis | *Stigmochelys pardalis* |
| Cape centipede eater | *Aparallactus carpensis* |
| Sundevalls garter snake | *Elapsoidea sundevallii media* |
| Adlers worm snake | *Leptotyphlops jacobsonii* |
| Cape thread snake | *Leptotyphlops scutifrons conjunctus* |
| Black spotted dwarf gecko | *Lygodactylus nigropunctatus* |
| Oscillated dwarf gecko | *Lygodactylus ocellatus* |

#### 3.1.7.2.3 Avifauna (birds)

The identification of the presence of avifauna species on site relied upon vegetation assessments, direct sightings, bird calls and presence of nests. However, during the site assessment, a lack of avifaunal species was identified, and no roosting sites could be located. Therefore, the list of conservation important bird species (according to quarter degree grid 2430CD) was obtained from the Mpumalanga Tourism and Parks Agency. This list and their likelihood of occurrence were assessed, and the species are presented in Table 11 below.

Table 11: List of bird species of conservation concern from quarter degree (2430CD)

| Scientific name | Common name | Conservation status | Likelihood of occurrence |
|---|---|---|---|
| *Gyps coprotheres* | Cape Vulture | Vulnerable | Low- This species requires cliff faced ledges for roosting and breeding. This habitat type does not occur within the study area or immediate surrounds. |

#### 3.1.7.2.4 Mammals

The identification of possible mammal species, present on the site, relied upon assessment of the vegetation and confirmed by spoors/ dropping. During the site assessment, signs of mammal presence were seen and included burrows, droppings and spoor. The list of mammals occurring on site is presented in Table 12. It was identified that two (2) of the species which occur or are likely to occur are listed as species of conservation concern and are presented below in Table 13.

Table 12: List of mammals occurring on site

| Common name | Scientific name |
|---|---|
| Leopard | *Panther pardus* |
| Steenbok | *Raphicerus campestris* |
| Common duiker | *Sylvicapra grimmia* |
| Kudu | *Tragelaphus strepsiceros* |
| Warthog | *Phacochoerus africanus* |
| Black-Backed jackal | *Canis mesomelas* |
| Common Molerat | *Cryptomys hottentotus* |
| Yellow Mongoose | *Cynictus penicillate* |
| Small grey Mongoose | *Galerella pulverulenta* |
| Shrub hare | *Lepus saxatillis* |
| Multimammate mouse | *Mastomys coucha* |
| Multimammate mouse | *Mastomys natalensis* |
| Slender mongoose | *Galerella sanguinea* |
| Highveld gerbil | *Gerbilliscus brantsii* |
| Cape porcupine | *Hystrix africaeustralis* |
| Tree squirrel | *Paraserus cepapi* |
| Vervet monkey | *Chlorobcebus pygerythrus* |
| Bushbuck | *Tragelaphus scriputs* |

| Common name | Scientific name |
|---|---|
| Eastern elephant shrew | *Elephantulus myurus* |
| Smiths red rock rabbit | *Pronolagus rupestris* |
| Jamesons red rock rabbit | *Pronolagus radensis* |
| Rock dormouse | *Graphiurus platyops* |
| Aardvark | *Orycteropus afer* |
| Grey rhebok | *Pelea capreolus* |
| Mountain reed buck | *Redunca fulvorufula* |
| Chacma baboon | *Papio hamadryas* |
| Large spotted genet | *Genetta maculate* |
| Side striped jackal | *Canis adustus* |
| Honey badger | *Mellivora capensis* |
| Impala | *Aepyceros melampus* |
| Red hartebeest | *Alcelaphus buselaphus* |
| Springhare | *Pedetes capensis* |

Table 13: Mammal species of conservation concern

| Scientific name | Common name | Conservation status | Likelihood of occurrence |
|---|---|---|---|
| Panthera pardus | Leopard | Lc but in mpumalanga and limpopo near threatened | High- through personal communication with the caretaker it was confirmed that the leopard is common in the area |
| Mellivora capensis | Honey badger | Near threatened | High- through personal communication with the caretaker it was confirmed that the leopard is common in the area |

### 3.1.8 Surface water

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014), The following information relating to surface water was obtained from the document titled: "Hydrological analysis and determination of floodlines for the Krugerspost Andalusite Mine (Pty) Ltd., located in the Magisterial District of Lydenburg, Mpumalanga Province", dated September 2007, compiled by GCS (Pty) Ltd, SWMP (SWMP, Shangoni 2014) as well as the document titled "SAMREC (Pty) Ltd. — Krugerspost Andalusite Mine: Integrated Water and Waste Management Plan" dated May 2013 and compiled by Shangoni Management Services (Pty) Ltd IWWMP, Shangoni 2013).

#### 3.1.8.1 Regional description

Water quality monitoring was done in August 2016 (BECS Environmental, 2016). Refer below for the results.

The region in which the Krugerspost Andalusite Mine (including the new proposed mining area) is situated is fairly mountainous with rocky outcrops and ridges in places. The Lydenburg area falls within

the Mountain Region catchment of the Olifants River. The tertiary catchments include the Steelpoort- and Spekboom Rivers. The Spekboom River is located approximately 2 km to the west of Krugerspost which drain in a northerly direction.

Krugerspost Andalusite Mine is located in the Olifants River Catchment in the 134 and 136 secondary catchment areas. The site falls within three quaternary catchment areas. To the south-west is the B42G quaternary catchment area, to the north-west is the B42H quaternary catchment area and to the east is the B6OF quaternary catchment area. The construction of the proposed quarry will take place within portions 13, 14 and 15 of the farm Klipplaatdrift 399 KT. There is no naturally occurring accumulation of surface water within the mining vicinity except for the accumulation of rainfall and surface runoff within Quarry 6. The area is drained by a number on non-perennial drainage lines towards the Spekboom River. A number of linked process dams are utilised by the mine. Dewatering from Quarry 6 is discharged into the linked process dams. Surface water users outside of the mining boundary is mainly farmers utilising clean water dams for irrigation.

Krugerspost Mine is situated on the eastern slope of north/south water divide. Surface flow from the mine will therefore be on a south-eastern direction towards the natural drainage line and dams to the east which also acts as the mine surface water system. This water flows down south-west towards the north draining Spekboom River. Any storm water emanating from the mine will therefore report to this natural drainage line.

#### 3.1.8.2 Surface water quality

There is no naturally occurring accumulation of surface water within the mining area. The area is drained by several dry watercourses. The area is not a high-water yield area.

##### 3.1.8.2.1 Catchment hydrology

Portions 13, 14 and 15 of the Farm Klipplaatdrift 399 KT fall within four quaternary catchment areas. Only the most southern tip of this area falls within the B6OG quaternary area. The proposed Mining Right does not occur within this quaternary catchment. The eastern part of portion 13 and the remainder falls within the B6OF quaternary catchment area. The Kranskloof Spruit flows to the east of the mine and drains the B6OG quaternary catchment area. This spruit flows into the Ohrigstad River. Ohrigstad River is located in Mpumalanga, South Africa. The Ohrigstad River joins the Blyde River at the Blyde Rivier Poort Dam in the Blyde River Canyon Nature Reserve. Like the Blyde, it has its ultimate origin at around 2 000m altitude to the south, on the verge of the Hartebeesvlakte conservation area, but follows a more westerly course.

The south-western side of portions 13, 14 and 15 of the Farm Klipplaatdrift 399 KT fall within B42E and the north-western side B42H quaternary catchment. The Spekboom River flows approximately 3km to the south of the mining area and drains the B42E and B42H quaternary catchment areas.

Characteristics of the total catchment can be summarised as follows:

- Area = 12.1 km2.
- Time of concentration = 0.545 hours.
- Peak flow 1:50 = 99 m3/s.
- Peak flow 1:100 = 199 m3/s.

3.1.8.2.2 Dry weather flow

No dry weather flow is anticipated

3.1.8.2.3 Mean annual runoff

The mean annual run-off for the quaternary catchments ranges between 10X106m$^3$ and 40X106m$^3$. Table 14 below was adapted from the Storm Water Management Plan (SWMP, Shangoni 2014) and presents a guidance to the expected runoff volumes that may accumulate within the quarries during a 1:50 year flood event to be used as a water reserve for plant operations.

Table 14: Expected runoff volumes for 1:50 year 24-hour flood

| **Runoff volumes** | **Quarry 6** | **Proposed new quarry** |
|---|---|---|
| Design rainfall depth (mm) | 118 | 118 |
| Receiving catchment size (ha) | 42,183 | 25,599 |
| Runoff coefficient (%) | 51,8 | 51,8 |
| **Effective runoff volume (m3)** | **25 783** | **16 258** |

3.1.8.2.4 Surface water quality

The water quality results dated 23 July 2013 for Krugerspost Mine is presented in Table 17 below. Drinking water for Krugerspost Mine is sourced from two boreholes (Borehole No. 1 and Borehole No. 2) on site. The quality thereof and suitability for the use is described as follows:

- The "Office Drinking Water" can be described as neutral, non-saline and moderately hard. Major cations and anions and trace metals recorded in the low or un-detected levels. Total coliforms and Faecal coliforms recorded below detection limits (<1 counts/100 ml) and the risk of microbial infection is therefore negligible. Total viable organisms (heterotrophic plate count) recorded a count of 61 /1 ml but should not pose any risks of infection in the absence of coliforms and *E. coli*. The presence of heterotrophic bacteria is natural and ubiquitous in the natural environment and is mostly included in the testing of treated potable supplies to monitor the treatment / disinfection process. The water is moderately hard (mostly contributed by magnesium Mg) and scaling of hot water appliances and / or soap lathering may be the only risks. The water quality for the Office Drinking Water is well within South African domestic water use guidelines (SANS 241: 2011; DWAF, 1998) and can be classified as an Ideal/Class 0 water type suitable for lifetime use.

The quality of the storm water / pollution control dams is described as follows:

- The water within the pollution control dams and storm water dams at Krugerspost Mine can be described as neutral, non-saline and hard to moderately hard with medium to high levels of suspended matter and turbidity. Stiff diagrams (Figure 11) indicate domination of the magnesium cation and bicarbonate anion and is indicative of the inertness of the ore and geology. The electrical conductivity recorded between 22.8 mS/m and 28.8 mS/m and major cation and anions, trace elements and nutrients are in the low to undetected ranges. Feacal coliforms were detected in Quarry 2-3, Barge Dam, HMS Plant, the Office Slimes Dam and Settling Dam 2 and should be handled with care and should be not ingested as the risk of microbial infection is high. The water quality of the surface dams is well within Livestock watering guidelines but the Barge Dam, Ericsson Dams, HMS Plant, Plant and Office Slimes Dam suspended solid levels exceed the General Limit guidelines for wastewater discharge.

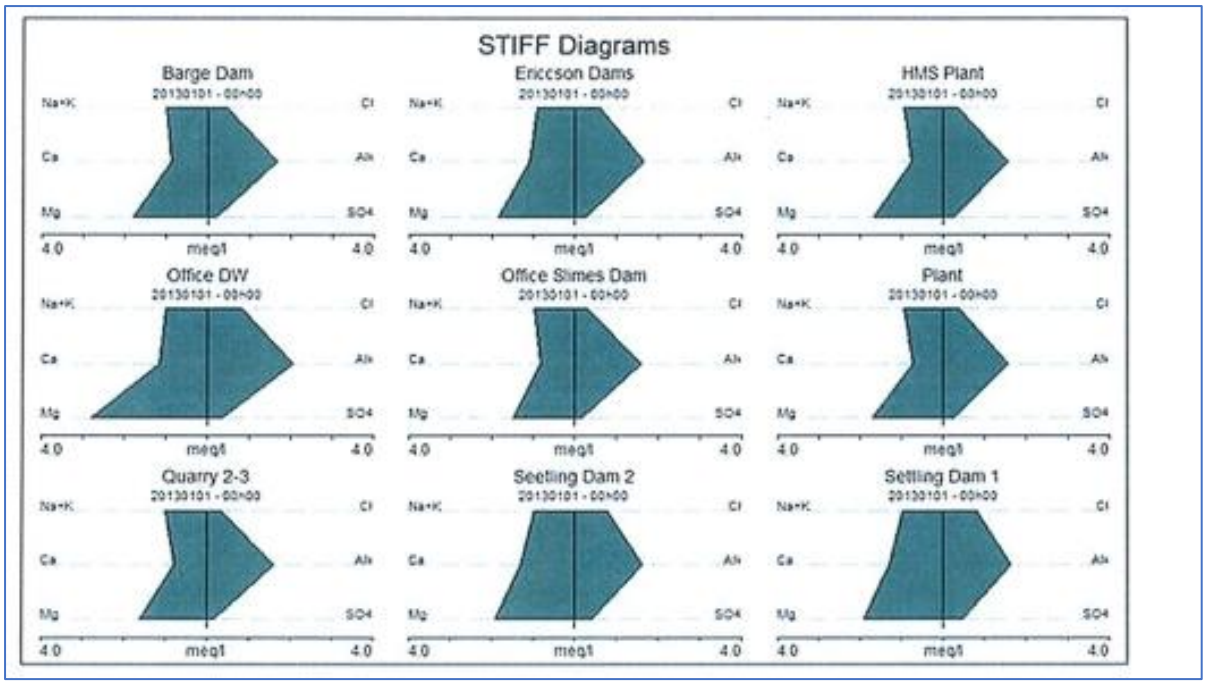



Figure 11: STIFF diagrams showing dominant cations and anions (in meg/l) for the water quality at Krugerspost Mine.

Surface water quality monitoring takes place at office drinking water, quarry 2-3, barge dam, Ericsson dams, HMS plant, plant, slimes dam, settling dam 1, settling dam 2, and the Spekboom River. The surface water quality information is presented in Table 15 below.

Table 15: Surface water quality

| Sample ID | Units | KP 1 | KP 2 | KP 3 | KP 4 | KP 5 | KP 6 |
|---|---|---|---|---|---|---|---|
| pH | | 7.6 | 7.08 | 6.59 | 6.81 | 7.61 | 7.08 |
| Conductivity | mS/m | 33.5 | 16.3 | 22.5 | 25.6 | 22.4 | 22.9 |
| TDS | mg/l | 232 | 118 | 152 | 180 | 149 | 160 |
| Fluoride | mg/l | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Chloride | mg/l | 23.0 | 16.4 | 11.6 | 18.1 | 11.3 | 13.2 |
| Nitrate N | mg/l | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Phosphate P | mg/l | 0.03 | 0.01 | 0.02 | 0.03 | 0.06 | 0.05 |
| Sulphate | mg/l | 16.0 | 5.0 | 9.0 | 12.0 | 8.0 | 9.0 |
| p-Alkalinity | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| m-Alkalinity | | 107.7 | 55.9 | 78.2 | 80.0 | 78.9 | 79.0 |
| Carbonate | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Bicarbonate | | 131..3 | 68.1 | 95.4 | 97.5 | 96.2 | 96.3 |
| Total hardness | | 179.2 | 79.8 | 119.3 | 131.6 | 118.1 | 121.8 |
| Calcium hardness | | 46.9 | 59.8 | 33.8 | 40.2 | 32.8 | 35.8 |
| Magnesium hardness | | 132.3 | 20.0 | 85.5 | 91.4 | 85.3 | 86.0 |
| Calcium | mg/l | 18.8 | 24.0 | 13.5 | 16.1 | 13.2 | 14.3 |
| Magnesium | mg/l | 32.1 | 4.9 | 20.8 | 22.2 | 20.7 | 20.9 |
| Sodium dissolved | mg/l | 25.3 | 19.5 | 18.4 | 19.9 | 18.5 | 18.8 |
| Potassium dissolved | mg/l | 3.68 | 4.11 | 2.98 | 2.96 | 3.45 | 2.86 |
| Iron dissolved | mg/l | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Manganese dissolved | mg/l | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Sum cation | me/l | 4.78 | 2.55 | 3.26 | 3.57 | 3.25 | 3.32 |
| Sum anion | me/l | 4.80 | 2.57 | 3.27 | 3.60 | 3.26 | 3.34 |
| Turbidity | Ntu | 3.11 | 108.4 | 66.82 | 43.91 | 202.72 | 91.20 |
| Suspended solids | mg/l | 8 | 139 | 84 | 51 | 496 | 111 |
| COD | mg/l | 21.4 | 9.4 | 18.3 | 14.6 | 11.6 | 17.4 |

#### 3.1.8.2.5 Surface water use

Within the mine catchment area, the water users are mainly farmers using the clean water dams for irrigation.

There are no surface water users along the route of the affected watercourses down to the receiving water body of the Spekboom River. According to the integrated water and waste management programme (IWWWMP) of 2007, the Mine currently utilises water pumped from the Spekboom River for plant processing purposes; however, it is not known if there are water users along the Kranskloof Spruit.

#### 3.1.8.2.6 Wetlands

An un-channelled valley bottom wetland (to the east of the site boundary area) and four (4) riparian areas have been identified.

3.1.8.2.7 Water management area

The mine is situated within the lower Olifants Management area, within the Steelpoort Sub-management area.

### 3.1.9 Groundwater

The following groundwater information was extracted from the approved EMP of Krugerspost Andalusite Mine, dated October 1999, the IWWMP and the desktop hydrogeological study titled: "SAMREC Krugerspost Andalusite Mine: Desktop Hydrogeological Study" dated May 2013 and compiled by Shangoni Management Services (Pty) Ltd. (Shagoni, 2013)

3.1.9.1 Depth of water tables

During the desktop hydrocensus for the Krugerspost Andalusite Mine, conducted by Shangoni (2013), 18 boreholes and 1 spring were located within a 5 km radius of the Krugerspost Andalusite Mine. According to the desktop hydrogeological study (Shangoni, 2013) and data obtained from NGA South Africa, the water levels in the study area varied between Om and 14.32m below ground level with an average of 5.87 m. The mining depth in the mining pits is deeper than the groundwater level, the fact that little to no seepage of groundwater into the mining pits occur and no active dewatering takes place, is evident of the impervious nature of the rock and the assumption can be made that groundwater flow in the occurring aquifers will be relatively slow.

3.1.9.2 Groundwater zones

Water compartments are defined by north-south striking dykes. The area is not a high groundwater recharge area.

The South African Aquifer System Management Classification is presented by five major classes:

- Sole Source Aquifer System.
- Major Aquifer System.
- Minor Aquifer System.
- On-Aquifer System.
- Special Aquifer System.

Krugerspost Mine is directly underlain by rocks of the Lydenburg Member occurring in the Pretoria Group of the Transvaal sequence of rocks. The Lydenburg Member consists predominantly of laminated shales with interbedded carbonate layers and hornfels in places. The hydrogeology can be summarised as follows:

- Laminated shales with interbedded carbonate layers and hornfels in places.
- Large scale abstractions for irrigational use occur to the north of Krugerspost Mine.
- Aquifer yields are typically between 0.5 lfs and 2.0 ifs with relatively good water quality and is classified as a d3 intergranular and fractured aquifer.
- According to the Parsons aquifer classification system, the aquifer can be regarded as a minor aquifer.

3.1.9.3 Groundwater use

Three (3) boreholes, located outside the mining area, are utilized by the Mine for domestic purposes, the cleaning of trucks and for dust suppression.

The Krugerspost Andalusite Mine is currently in possession of a Water Use Licence (WUL), with Licence No. 24009412, for which the abstraction of water from two boreholes (Borehole 1 and borehole 2) for domestic purposes is included.

As described in table 19 of the hydrogeological assessment, the majority of the boreholes, within a 5 km radius of the Krugerspost Andalusite Mine, are utilised for domestic purposes and livestock watering.

3.1.9.4 Groundwater quality

Groundwater samples were collected for chemical analysis during the hydrocensus from existing boreholes during the geohydrological evaluation in July 2010. Refer to Table 11 below for the groundwater qualities.

According to a geohydrological evaluation conducted in July 2010, no chemical other than FeSi are being used in the process and no sulphides, heavy metals or leachates are present in the plant discard or final product. Therefore, it is unlikely that the mining operation will have any negative effect on the groundwater conditions in future.

Table 16: Chemical parameters compared to SANS 241:2006 (edition 6.1) drinking water standards

| **Sample nr** | **BHW1** | **BHW2** | **BHW3** | **BHW4** | **BHW5** | **BHW6** | **BHW7** | **BHW8** | **BHW9** | **Class I** | **Class II** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ca | 20.77 | 25.88 | 18.92 | 22.02 | 9.35 | 11.12 | 12.82 | 25.70 | 35.31 | 150 | 300 |
| Mg | 19.06 | 22.56 | 16.46 | 25.83 | 21.31 | 34.38 | 14.46 | 24.15 | 29.97 | 70 | 100 |
| Na | 26.59 | 35.46 | 23.05 | 29.78 | 8.09 | 9.47 | 22.57 | 25.85 | 48.26 | 200 | 400 |
| K | 3.88 | 3.61 | 3.70 | 2.69 | .077 | 0.70 | 2.85 | 2.89 | 5.76 | 50 | 100 |
| Mn | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.1 | 1 |
| Fe | 0.02 | 0.03 | 0.02 | 0.04 | 0.06 | 0.02 | 0.03 | 0.02 | 0.03 | 0.2 | 2 |
| F | 0.50 | 0.34 | 0.29 | 0.42 | 0.23 | 0.32 | 0.20 | 0 | 0.30 | 1 | 1.5 |
| NO3 – N | 3.92 | 3.88 | 0 | 3.11 | 0.27 | 1.49 | 1.79 | 5.89 | 0.36 | 10 | 20 |
| NH4 – N | 0.00 | 0.04 | 0.08 | 0 | 0.02 | 0.03 | 0.03 | 0.06 | 0.04 | 0.94 | 1.87 |
| Al | 0 | 0 | 0 | 0 | 0.0007 | 0 | 0 | 0 | 0 | 0.3 | 0.5 |
| Cl | 8 | 6 | 7 | 16 | 3 | 3 | 14 | 6 | 7 | 200 | 600 |
| SO4 | 5 | 2 | 4 | 14 | 4 | 3 | 0 | 0 | 15 | 400 | 600 |
| pH | 7.27 | 7.77 | 7.17 | 7.64 | 7.48 | 7.44 | 7.40 | 7.41 | 7.21 | 5.0-9.5 | 4.0-10.0 |
| EC | 41 | 47 | 32 | 47 | 25 | 35 | 29 | 44 | 62 | 150 | 370 |

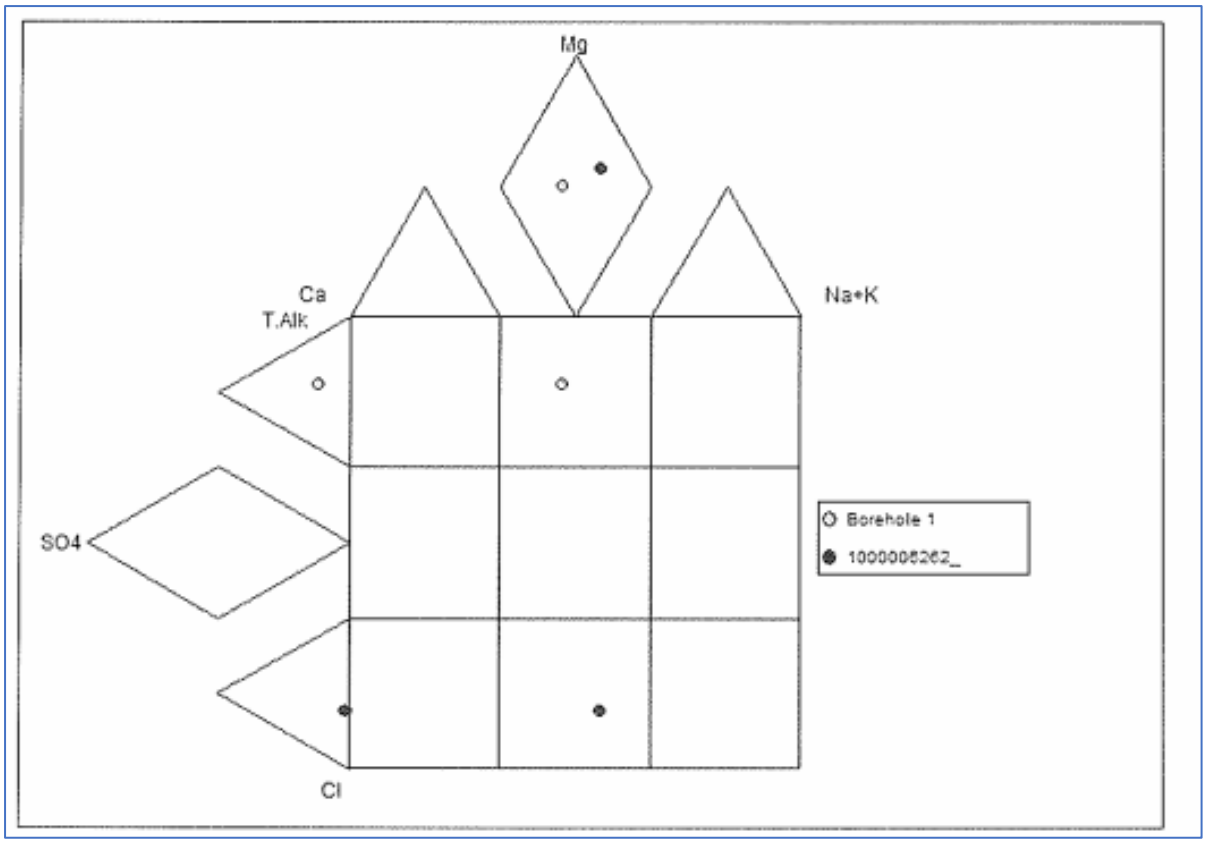



Figure 12: Expanded Durov diagram for groundwater quality in B42E quaternary catchment

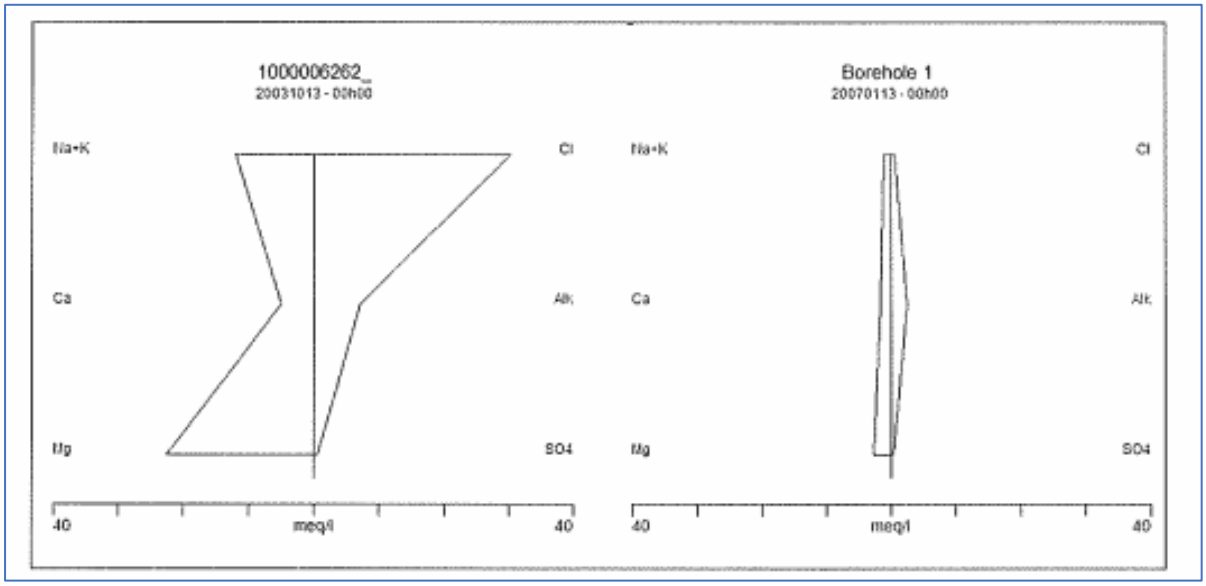



Figure 13: STIFF diagram showing dominant cations and anions (in meg/l) for groundwater in B42E quaternary catchment

### 3.1.10 Air quality

An air quality impact assessment was conducted in October 2014 for the Krugerspost Andalusite Mine and the proposed new Mining Right area. The document titled "An atmospheric impact assessment of

SAMREC: Krugerspost Andalusite Mine's proposed mine on the Farm Klipplaatdrift 399KT dated October 2014 and compiled by Shangoni and the findings summarised below.

#### 3.1.10.1 General

No ambient air quality monitoring station were identified within a 50 km radius of the proposed new Mining Right area (refer to AIA Shangoni, 2014). The closest ambient air quality monitoring station is located more 100 km away from the site and can thus not be seen as representative of the area. As a result of this and the fact that no dust fall-out monitoring is currently conducted, information relating to PM10 and dust fall out levels are not available

The proposed new Mining Right area falls outside of the Highveld, Waterberg and VAAL triangle airshed priority areas and there are also no industrial and / or metropolitan areas within a 50 km radius of the site. Therefore, the current opencast mining area of the Krugerspost Andalusite Mine is the most likely source to cumulatively contribute to the particulate matter in the atmosphere of the area.

#### 3.1.10.2 Site specific

As part of the air quality impact assessment, the 10-year Life of Mine of the proposed new open pit was divided into three phases, namely:

- Phase 1: Year 1 to Year 3.
- Phase 2: Year 4 to Year 6.
- Phase 3: Year 7 to Year 10.

The average emissions for each of the above phases were modelled to illustrate the movement of the plume as the open pit develops. It was further established through the modelling of each phase that the most emissions will be generated during the first year.

##### 3.1.10.2.1 Dust fall-out rates

Simulated dust fallout rates for the three phases were compared against the National Dust Control Standards. It was found that the simulated dustfall rates were below the standards for non-residential areas. The highest simulated dust fallout levels up to 350 mg/m2/day whereas the standard for non-residential is that of 600<dustfall rate<1200. The reason for the highest simulated dustfall rates being below the standards for non-residential areas can be explained by the fact that 50pm particles generally fallout within 1-2 km of the site. The low to moderate wind speeds experienced throughout the area through the year, may also influence the below standard dustfall rates. The simulated dustfall rates are therefore considered to not be of any nuisance to the surrounding residences as well as not pose a threat to the moderate to high sensitivity vegetation in the area. The figure below presents the modelled dustfall rates for phases 1 through 3 under both controlled and uncontrolled conditions.

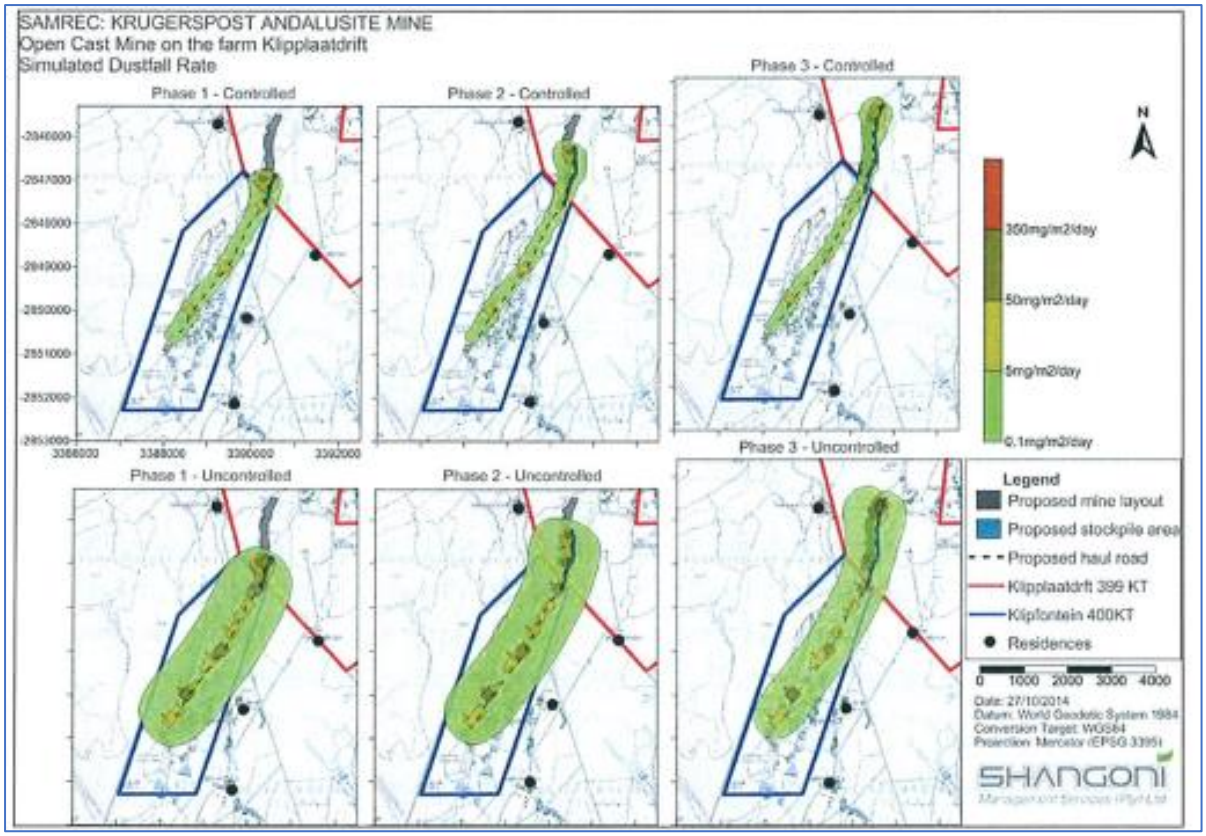



Figure 14: Simulated dust-fall rate

3.1.10.2.2 Criteria pollutants in terms of the National ambient Air Quality Standards (NAAQS)

Criteria pollutants in terms of the National Ambient Air Quality Standards (NAAQS) Ground level concentrations for Particulate matter (PM 10) were modelled for Phase 1, 2 and 3 for the proposed operations of the proposed new Mining Right area. Both uncontrolled and controlled emissions were modelled, however it is important to note that the model outputs may be exaggerated and overstate ground concentrations under assumed worst case scenario

<u>Uncontrolled emissions</u>

The Simulated ground level concentrations of PM10 as well as the frequency of allowable exceedance for both annual and daily averages (under uncontrolled conditions) were found to be above the NAAQS, outside of the proposed mine boundary area. The exceedance of the concentration threshold for PM 10 were simulated over two (2) sensitive receptors (the Mabaso and Motlolo primary schools) and in close proximity to a third sensitive receptor (the Goedgedacht primary school).

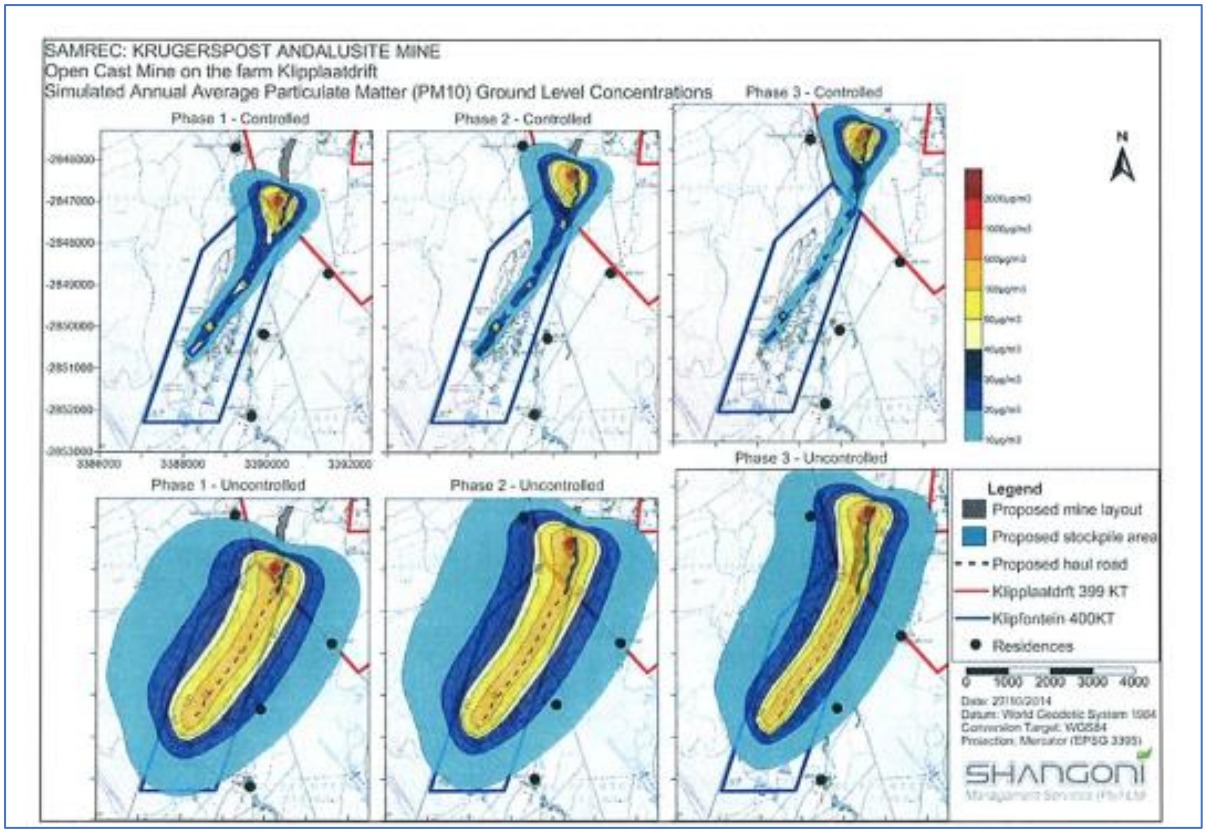



Figure 15: Simulated annual average PM10 ground level concentrations

Controlled emissions

The Simulated ground level concentrations of PM10 for both annual and daily averages (under controlled conditions) were found to be above the NAAQS, within the proposed mine boundary area. The frequency of allowable exceedance of the concentration threshold for PM10 for both the annual averaging period and the daily averaging period were exceeded outside the mine boundary.

Figure 15 and 16 present the simulated annual PM10 concentrations, simulated exceedance of annual average PM10, simulated daily PM10 concentrations, simulated exceedance of highest daily PM 10 respectively.

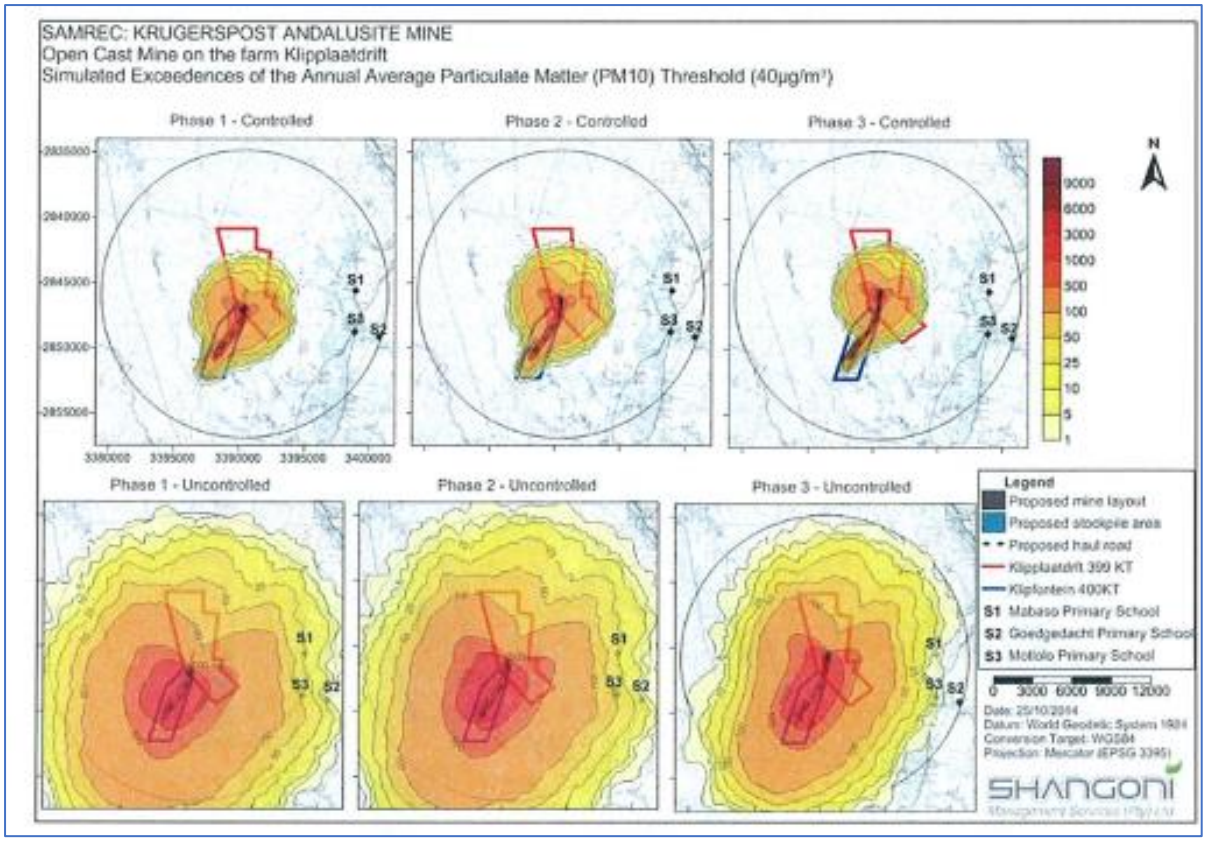



Figure 16: Simulated exceedance of highest daily PM10

### 3.1.11 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. The potential causes of noise are:

- Percussion drilling for pre-exploitation
- Ore loading and handling
- Ore screening

The variety of noise levels are:

- Haul truck uphill - 85dBA
- Haul truck downhill - 80dBA
- Screening plant - 96dBA

There are no notable sources of the noise from the surrounding area.

### 3.1.12 Visual aspects

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2012):

The proposed new 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.

### 3.1.13 Cultural and heritage resources

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2012):

During the first assessment a Google Earth image from 2010 was used. On this image ‘stone circles’ were identified on the site. Using an image of 2003, these ‘stone circles’ were not visible. During a site visit, it was confirmed that the fields were cleared for agriculture, with not a single stone wall in site. The reason for the ‘stone circles’ showing on a 2010 image and not the 2003 image is explained below:

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 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 then also identified a lower grinding stone, a bored stone and a hammer stone used for breaking marula pips to extract the kernels. In the premises of JC Steenekamp ±600m from this point there is a collection of one hundred of these bored stones that was recovered while he was clearing fields for agriculture. They now serve as garden furniture.

It is estimated that the mining area will mainly influence the cleared fields, but it will also affect portions of undisturbed Later Iron Age sites.

It was agreed upon by all parties that a second phase study will be undertaken in the area of greatest contact by means of mapping the stone walls and limited excavation. This will be followed by an application for a demolition permit that ought to be obtained in lieu of the abundance of similar sites in the region and their preservation owing to the ruggedness of the terrain.

Owing to the environment of Krugerspost, it has been a preferred place of settlement of people from early times to the historical period. During the investigation of the main site Iron Age sites were also identified outside the immediate impact area that may be influenced by the mining operations.

Similarly, the area adjacent to the impact area is rich in a unique type of rock art, only found in the Lydenburg valley. If any of these are found to be located inside the impact area, one may assume that a demolition permit will not be obtainable from South African Heritage Resources Agency (SAHRA) even if the correct second phase procedures are followed.

It is suggested that the impact area, as well as a corridor of ‘secondary’ impact, be surveyed for the engravings mentioned above.

### 3.1.14 Sensitive features

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

#### 3.1.14.1 Wetlands

The information in this section is taken from the document titled: "Mining Application for portion 15 of the Farm Klipplaatdrift 399 KT, Lydenburg (Limpopo Province): Wetland/Riparian delineation and functional assessment", dated June 2014 and compiled by Limosella Consulting (Limosella, 2014).

Wetlands are delineated based on scientifically sound methods (Limosella, 2014) and utilises a tool from the Department of Water Affairs (DWA) titled "A practical field procedure for the identification and delineation of wetlands and riparian areas" (DWAF, 2008). Wetlands are identified based on one or more of the following characteristic:

- The terrain unit indicator.
- The presence of plants adapted to saturated soils.
- Wetland soils.
- A high-water table that results in saturation near or on the surface

In order to delineate wetlands and riparian areas, the delineation methods described in the following documents were utilised during the field survey (Limosella, 2014):

• Updated manual for the identification and delineations of wetlands and riparian areas, DWAF (2008).
• Minimum requirements for biodiversity assessments, GDACE (2012).
• Classification system for wetlands and other Aquatic ecosystems in South Africa. User manual: Inland Systems, Ollis et al (2013).

3.1.14.1.1 Site specific

Site specific During the field survey, four (4) riparian areas and one (1) wetland area were delineated on the study area (Limosella, 2014). Refer to Figure 17 below for an indication of the position of delineated wetland and riparian areas.

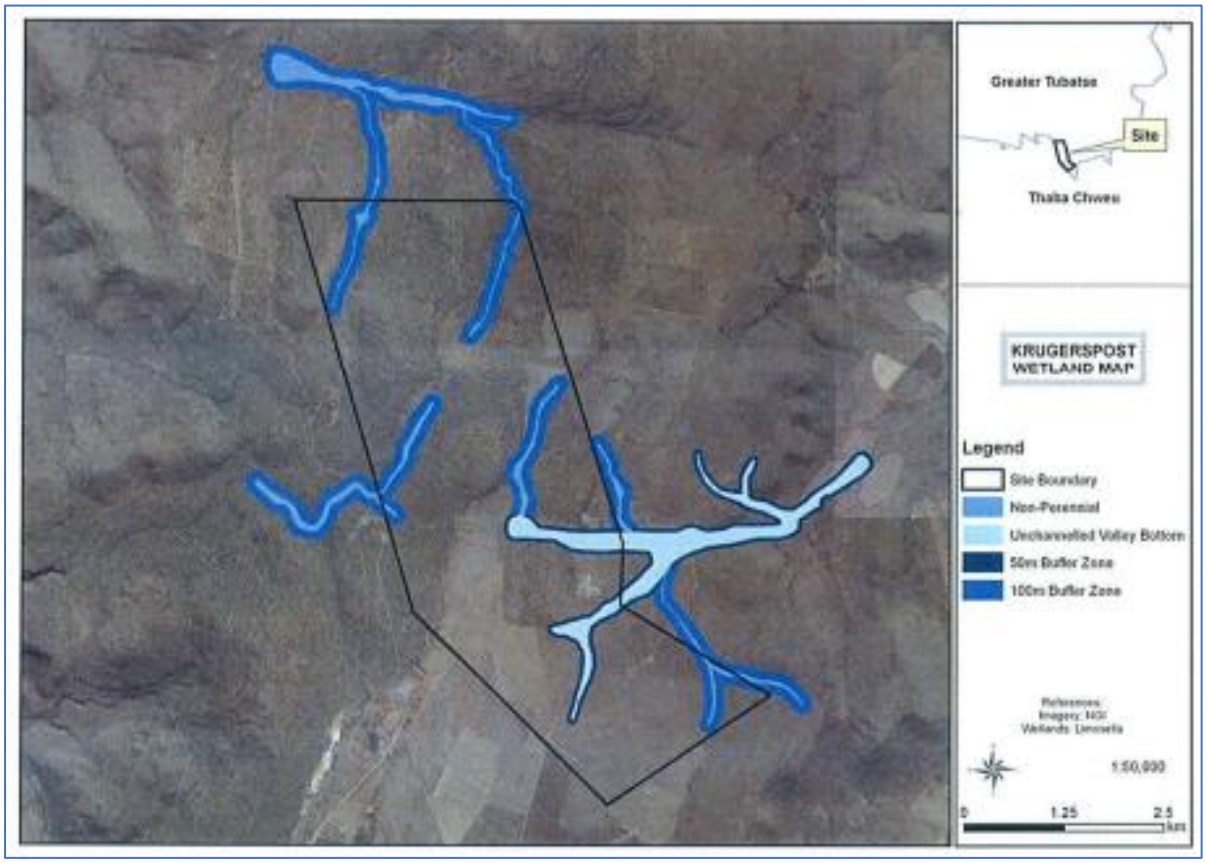



Figure 17: Map indicating the position of the delineated wetlands and riparian areas in relation to the study area

All four of the riparian areas were classified as episodic riparian areas. These episodic riparian areas are characterised by rivers that occur high in their respective catchments and only flow in response to extreme rainfall events (refer to Appendix E8). Due to the episodic nature of the riparian areas, landscape was utilised as the primary delineation indicator. Two of the delineated riparian areas are connected to and flow into an unchannelled valley bottom wetland on the eastern side of the study area. This unchannelled valley bottom wetland reflected some hydrophytic vegetation growth, however it is likely that some vegetation was over looked as the field survey was conducted during winter (dry season).

The EIS of the unchannelled valley bottom wetland are presented below in Table 17.

Table 17: EIS scores obtained for the valley bottom wetland

| Wetland importance and sensitivity | Importance | Confidence |
|---|---|---|
| Ecological importance and sensitivty | 2,7 | 3,0 |
| Hydro-functional importance | 1,9 | 3,0 |
| Direct human benefits | 2,1 | 3,0 |
| Overall score | 2,2 | |

During the wetland delineation and functional assessment field survey, it was identified that the unchanneled valley bottom wetland and the riparian areas had been impacted upon. Table 18 below presents the identified Present Ecological Status (PES), Quick Habitat Integrity (QHI) and the Riparian Vegetation Response Assessment Index (VEGRAI) ratings as well as the current impacts.

Table 18: PES, QHI, VEGRAI and current impacts associated with the unchanneled valley bottom wetland as well as the riparian areas

| Area | Current impacts | PES score | QHI score | VEGRAI score |
|---|---|---|---|---|
| Unchanneled valley bottom | The greatest impact on the wetland is historical and current farming within and surrounding the wetland. Although the infrastructure within and surrounding the wetland is limited to a few dirt road wetland they impact on the wetland to some degree | C | N/A | N/A |
| Non- perennial streams (Episodic) | The riparian areas are located high in their catchments and the impacts are limited due to the dry nature of the streams in numerous sections within the streams thus blocking water from reaching the surrounding wetland or river systems during rainfall events | N/A | C | C |

Formal and informal land-based protected areas occur some distance south and east of the mine. The formal protected areas layer was used in the National Protected Area Expansion Strategy 2008 (NPAES). Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The mine falls within the north-east great escarpment national protected area.

The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The ecosystems listed make up 9.5% of the country, with critically endangered and endangered ecosystems together accounting for 2.7% and vulnerable ecosystems a further 6.8%. The National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011 has listed a map showing remaining protected ecosystems.

According to this map many endangered areas occur south to east some distance away from the mine. Some distance to south-east of the mine is a protected area namely the Mauchesburg Alpine Grassland.

The already existing mine and proposed new mining area falls just outside a Freshwater Ecosystem Priority Areas (FEPA). River FEPAs achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species and were identified in rivers that are currently in a good condition (A or B ecological category. Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources. It is important to note that river FEPAs currently in an A or B ecological category may still require some rehabilitation effort, e.g. clearing of invasive alien plants and/or rehabilitation of river banks.

Fish sanctuaries are rivers that are essential for protecting threatened and near-threatened freshwater fish that are indigenous to South Africa. A goal of National Freshwater Ecosystem Priority Areas (NFEPA) is to keep further freshwater species from becoming threatened and to prevent those fish species that are already threatened from going extinct. In order to achieve this, there should be no further deterioration in river condition in fish sanctuaries and no new permits should be issued for stocking invasive alien fish in farm dams in the associated sub-quaternary catchment. The mine falls just outside of a fish sanctuary area.

3.1.14.1.2 Listed ecosystems

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing threatened or protected ecosystems in one of four categories: critically endangered (CR), endangered (EN), Vulnerable (VU) or Protected (Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Government Gazette 34809, Government Notice 1002, 9 December 2011)). The ecosystem status is based on the percentage of original area remaining untransformed (by croplands, mining, urban development & roads) in relation to the biodiversity target and a threshold for ecosystem functioning. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction, this includes preventing further degradation and loss of structure, function and composition of threatened ecosystems.

Neither the Lydenburg Thornveld nor the Ohrigstad Mountain Bushveld is situated within a listed ecosystem.

### 3.1.15 Regional socio-economic aspects

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2012):

The proposed mine is located in a rural farming area of Mpumalanga where the population density is low, population growth small and the population is centred on farmsteads. A part of the mine major economic activity of the area is agriculture.

As the people staying in the immediate area either works in mining or in agriculture, the unemployment level is low.

Mine employees are housed either in a hostel on site or in the nearby town of Lydenburg. To see current and future dwelling conditions refer to Table 19 and Table 20. All information below was taken from Social and Labour Plan (SLP) of Krugerspost Andalusite Mine.

Table 19: Current status of available dwelling for employees

| Type | Mark (x) | Percentage |
|---|---|---|
| **Hostels** | | 0% |
| **Own houses** | X | 23% |
| **Rentals** | X | 26% |
| **Other (specify)** | X (Informal) | 51% |

Table 20: Housing and living conditions plan

| Type of accommodation | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|
| | Baseline | 25% | 50% | 75% | 100% |
| **Hostels** | 0% | 0% | 0% | 0% | 0% |
| **Own houses** | 15% | 23% | 35% | 45% | 55% |
| **Rentals** | 20% | 26% | 30% | 30% | 30% |
| **Other (Informal)** | 75% | 51% | 35% | 25% | 15% |

The social infrastructure is centred in Mashishing which has a Magistrates Court, schools, a hospital, recreation facilities, shops and a police station.

3.1.15.1 Demographic Profile

3.1.15.1.1 Population and population distribution

According to the Census of 2001 for the TCLM, the total population consisted of 81 236 people of whom 86% are African, 2% are Coloured, 0.37% are Indian and 11.66% are White. The population group for TCLM is indicated in Table 21 below.

Table 21: The population group according to the census (2001 and 1996) for TCLM

| Population group for TCLM (2001) | | | | Total population |
|---|---|---|---|---|
| **African** | **Coloured** | **Indian** | **White** | |
| 69 848 | 1 609 | 300 | 9 479 | 81 236 |

3.1.15.1.2 Age, gender and households

The 2001 Census recorded the age and gender of people living in the TCLM area. The different ages of the two genders are indicated in Table 22 below.

Table 22: Age and gender of people living in the TCLM area during the 2001 census

| PERSONS | 2001 |
|---|---|
| Males - 0 to 4 | 3 917 |
| Males - 5 to 14 | 7 596 |
| Males - 15 to 34 | 15 409 |
| Males - 35 to 64 | 12 059 |
| Males - Over 65 | 1 467 |
| Females - 0 to 4 | 3 809 |
| Females - 5 to 14 | 7 788 |
| Females - 15 to 34 | 15 250 |
| Females - 35 to 64 | 11 808 |
| Females - Over 65 | 2 132 |
| Males - Total | 40 448 |
| Females - Total | 40 787 |

The composition of households was also determined during the 2001 Census. The types of dwelling (Table 23), household sizes (Table 24) and household incomes (Table 25) are indicated in the tables below. 65% of people taken up in the Census have a formal dwelling and 9% make use of a traditional dwelling. Approximately 47% of households consist of one household and approximately 2% consist of 10 or more households. 1 % of households have no income, while 31.53% has an annual income of R4 801–R9 600. Only 0.08% of households have an income of over R 2 457 600.

Table 23: Type of dwelling (census 2001)

| Formal | Informal | Traditional | Other |
|---|---|---|---|
| 14 556 | 4 533 | 1 894 | 91 |

Table 24: Household size (census 2001)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 and over |
|---|---|---|---|---|---|---|---|---|---|
| 5782 | 4267 | 3090 | 2784 | 1925 | 1293 | 722 | 489 | 309 | 412 |

Table 25: Annual household income (Census 2001)

| Households | 2001 |
|---|---|
| None | 3 792 |
| R 1 – 4 800 | 2 733 |
| R 4 801 – 9 600 | 6 645 |
| R 9 601 – 19 200 | 6 138 |
| R 19 201 – 38 400 | 3 501 |
| R 38 401 – 76 800 | 1 831 |
| R 76 801 – 153 600 | 1 179 |
| R 153 601 – 307 200 | 509 |
| R 307 201 – 614 400 | 128 |
| R 614 401 – 1 228 800 | 41 |

| Households | 2001 |
|---|---|
| R 1 228 801 - 2457600 | 46 |
| Over R 2 457 600 | 18 |

3.1.15.2 Education Profile

The Education Profile of the people living in the TCLM area as it was recorded in the Census 2001 is indicated in Table 26. According to the Census (2001), only 3.2% of individuals between the ages of 5 and 24 do not attend an educational institution. 63.36% of individuals in the same age group attend school and only a limited number of individuals attend tertiary educational institutions. The highest education levels attained by over 20-year olds are stipulated in Table 27. A mere 2% have had no schooling and the largest percentage of people has some secondary education (29.37%).

Table 26: Education institutions being attended by 5 to 24-year olds

| Persons | 2001 |
|---|---|
| None | 9 930 |
| Pre - school | 1 101 |
| School | 19 481 |
| College | 90 |
| Technikon | 39 |
| University | 37 |
| Adult Education Centre | 26 |
| Other | 40 |

Table 27: Highest education levels attained by over 20-year olds

| Persons | 2001 |
|---|---|
| No schooling | 10 441 |
| Some primary | 9 298 |
| Complete primary | 3 494 |
| Secondary | 14 813 |
| Grade 12 | 9 329 |
| Higher | 3 058 |

3.1.15.3 Economic Profile

3.1.15.3.1 Industries

Farming is an important economic resource in the TCLM, which stretches from the Olifants River, north of the Strydom Tunnel to 35km south of Mashishing and from Ohrigstad to Steelpoort Park. A wide range of products are cultivated owing to the good soil conditions, the sub-tropical climate and reasonable access to water. The products that are produced are fruit, vegetables, grain, cotton, citrus, maize, tobacco and meat.

The main sources of natural water that encourage and are essential for present and long-term irrigation are the Olifants-, Steelpoort- and Spekboom Rivers. Due to the high number of unskilled labour, this area also unfortunately has the highest potential for desertion due to overgrazing and the inability to plan ahead.

Except for the expansion of citrus orchids, very little expansion has taken place in the agricultural sector. The Tswelopele Agricultural Scheme in the Steelpoort River Valley in the vicinity of Bothashoek was launched and production has begun.

#### 3.1.15.3.2 Unemployment

In the Census (2001) of the TCLM area, the total labour force was 37 114 of which 75% individuals were employed. 17 753 individuals were not economically active and not included in the Total Labour force. The results are indicated in Table 28 below.

Table 28: Labour force of the TCLM according to the census in 2001

| **Persons** | **2001** |
|---|---|
| Employed | 27 802 |
| Unemployed | 9 312 |
| Not economically active | 17 753 |
| Total labour force | 37 114 |

According to the Reviewed IDP (2004 / 2005) of the GTLM, unemployment is becoming an increasing concern as the number of people exceeds the number of job opportunities. The high demand for unskilled labour, due to the low levels of literacy, also increases unemployment.

#### 3.1.15.4 Community, social and personal services

Krugerspost Mine employees are housed in the nearby town of Mashishing. The social infrastructure is centred in Mashishing which has a Magistrates Court, schools, a hospital, recreation facilities, shops and a police station.

## 3.2 Project context

The mining right commenced on the 27th July 2016 and will continue to be in force for a period of 15 years ending on 26 July 2031. The predicted 'average' (may differ from year to year due to in situ grades and yield variations) consumption of 35 000t Krugerite per annum until the current reserve runs out will result in the expected life of mine (LoM) being 15 years (this timeline excludes the possible future transfer from resources to reserves, as well as further optimization of both pit and plant parameters). Imerys Refractory Minerals South Africa (Pty) Ltd has a prospecting right for prospecting andalusite on Portions 10, 11, 12, 13, 14, 15 of the farm Klipplaatdrift 399KT and portion 3 of the farm Vlakfontein 520KT, Mashishing Local Municipality, Limpopo. The 2005 approved EMP for a prospecting right application stated that prospecting will occur for 6-12 months, a renewal of the prospecting right has

been applied for since then and the life span of the prospecting right will be updated. The mine has been operating for more than 15 years. Only open pit construction and the access road are included in construction phase. No additional buildings will be constructed.

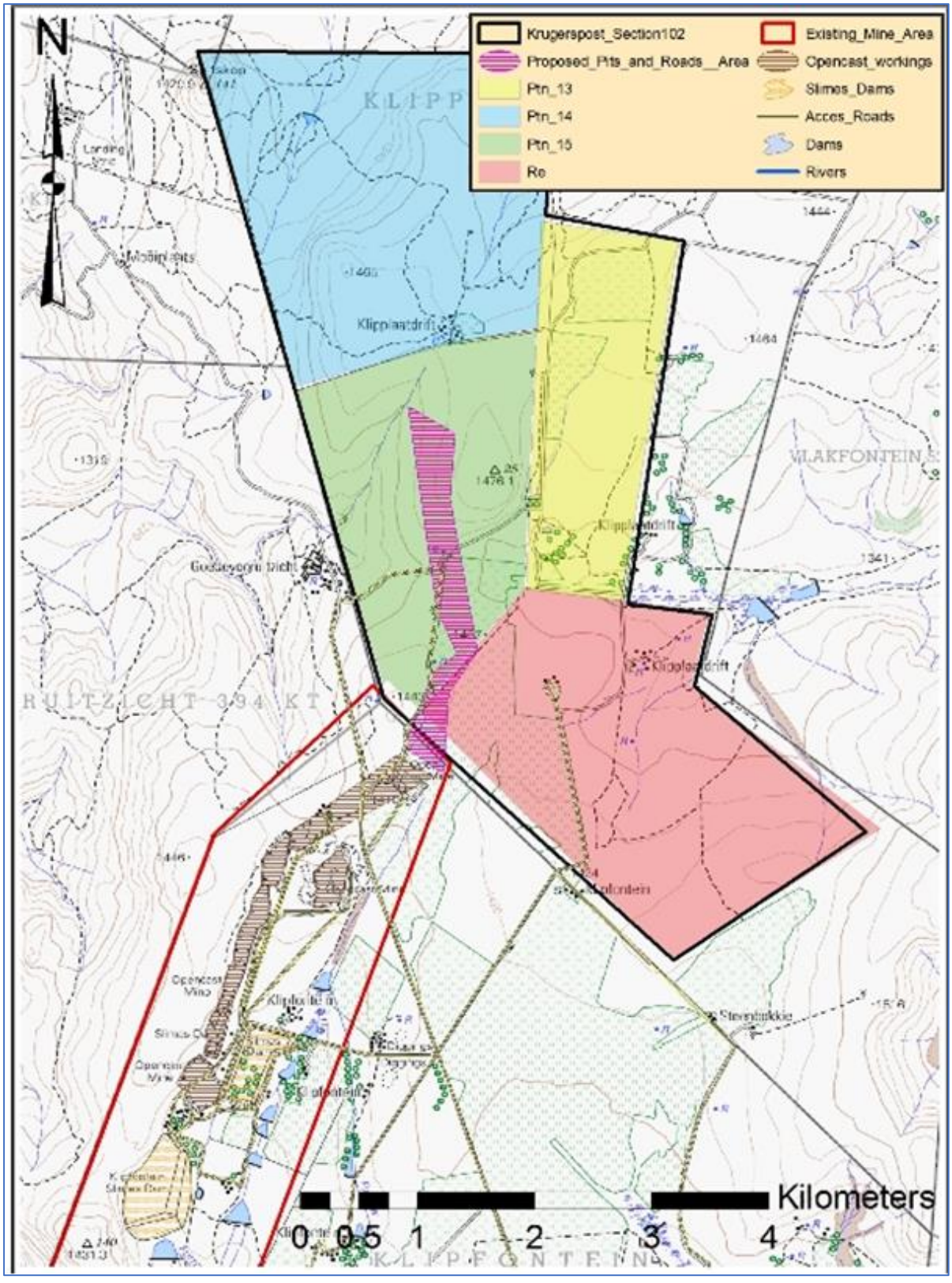



Figure 18: Site layout plan

## 3.3 Zone of influence

Since mining has just begun, the zone of influence will be the soil which is not impacted greatly as yet. As mining continues, the zone of influence will expand as the impact on the environment grows.

### 3.3.1 Geology

The construction and progressive development of the open pit will lead to the destruction of the geological sequence in the project area. Therefore, the zone of influence is restricted to the project area.

### 3.3.2 Climate

There is no zone of influence for the climatology of the region

### 3.3.3 Topography

The potential zone of influence of topography will be in the vicinity of the project as the topography of the area will be altered as a result of the mining and mining related activities. The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place.

### 3.3.4 Soil

The potential impacts on soil relate to the depletion of topsoil and potential contamination of the soil with hydrocarbons and other chemicals spilled. Soil erosion may occur if adequate soil management structures to control storm water run-off are not implemented and maintained. Soil contamination is limited to the vehicles driving on the dirt roads. Surface water can cause erosion on the area disturbed. The impact on the soil will however be localised and will not transverse the boundaries of the mine. Siltation of surrounding areas can occur when soil is washed across the boundaries of the mine e.g. Klipplaatdrift. This may continue after closure if the mitigation measures are not well implemented and maintained.

### 3.3.5 Pre-mining capability, land use and existing infrastructure

The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place to impact the zone of influence. However once mining extends, the construction and utilisation of the access and haul roads, topsoil and the progressive development of the opencast pit will cause the current land capability to cease within the area of mining.

### 3.3.6 Vegetation

The zone of influence on flora can extend outside the current mining licence area in the event that invader plants migrate from the mine to the surrounding farms. This can be minimised through an invader plant control programme. Once mining has ceased the influence will be prevented by continuing with the implementation of such a plan.

### 3.3.7 Animal life

The zone of influence with regards to fauna will be limited to the mining area and will not extend outside the mining area during the life of mine. The end land-use has been identified as grazing and cattle farming. If exotic species are introduced the zone of influence can extend further than the mine. This can be managed through a land management plan and the biodiversity action plan.

### 3.3.8 Surface water

The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place to impact the zone of influence. However, once mining commences, operations may contribute to surface water pollution by means of adding pollutants to the surface water in the form of e.g. hydrocarbons, metals, and suspended solids. This will continue after mining has ceased due to historical pollution and erosion of e.g. waste rock dumps. Surface water retention will also take place in the open pit areas. The zone of influence can reach the Spekboom River.

### 3.3.9 Groundwater

The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place to impact the zone of influence. However, the potential zone of influence on groundwater is affected by the use thereof, the potential pollution thereof and the possible ingression of ground water into the Klipplaatdrift pit. It is assumed the zone of influence will be limited to the pit area in such instances.

### 3.3.10 Air quality

The only potential sources of post closure air pollution would be dust generated from the waste rock dumps and other disturbed areas. The effective rehabilitation will minimise this impact but, in the event, of this happening the zone of influence will not extend very far outside the boundaries of the mine. This is due to the weight of the particles that settle very quickly.

### 3.3.11 Environmental noise

The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place. There for there is no zone of influence for environmental noise as yet. However, once mining begins, the generation of noise from the mining and mining related activities may disturb surrounding landowners, communities and frighten animal life.

### 3.3.12 Visual aspects

The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place. There for there is no zone of influence for environmental noise as yet. The zone of influence can extend to the surrounding land owners once mining begins. Activities such as dust generation, lighting and noise will occur. It is

however important to note that the mining at the adjacent Krugerspost Andalusite Mine commenced over 35 years ago and therefore locals and regular visitors to the area are likely to be desensitised to the mining activities in the area.

3.3.13 Cultural and heritage resources

The zone of influence on heritage resources is limited to the direct surrounding where the heritage resource occurs. The destruction on these resources will cease once mining operations stop. The impact after closure will be on preserving the resources for future generations. The closure objectives reflect the intentions in this regard.

3.3.14 Sensitive features

The mine has only recently received its mining right and therefore construction phase has just commenced and there are no noteworthy activities yet taking place. However, one of the important sensitive features is the wetland. Once mining begins, contaminated or silt lade surface water runoff may reach the watercourse and moist grassland area, which can affect the ecological functioning of the riparian and moist grassland area. This causes the zone of influence to extend further than the area being mined.

3.3.15 Regional socio-economic aspects

The zone of influence from a social economic point of view can extend further than the boundaries of the mine.

# SECTION 4: ANNUAL REHABILITATION PLAN

## 4.1 Proposed final post-mining land use

The end land-use has been identified as grazing and cattle 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.

## 4.2 Results of monitoring of risks identified in the annual rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities

Refer to the Environmental Risk Assessment Report, attached as **Addendum 1** for a complete description of all the risks identified in the final rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities.

## 4.3 An identification of shortcomings experienced in the preceding 12 months

This is the first annual rehabilitation plan to be submitted. The rehabilitation can only commence once the EMP has been approved and mining was executed in 2016.

## 4.4 Details of the planned annual rehabilitation and remediation activities or measures for the forthcoming 12 months, including those which will address the shortcomings contemplated in Section 4.2 above or which were identified from monitoring in the preceding 12 months

### 4.4.1 If no areas are available for annual rehabilitation and remediation concurrent with mining

Mining has only recently commenced. An area of 3,214m² has been stripped and mined. Overburden has been placed on an area of 10,338m² along a dirt road on the boundary of the Re Ext of Klipplaatdrift. This area cannot yet be rehabilitated for final land use. Refer to Figure 19 below for a GoogleEarth image of this area. The management of topsoil on this area can be managed as part of rehabilitation and is discussed below in Section 4.4.2.

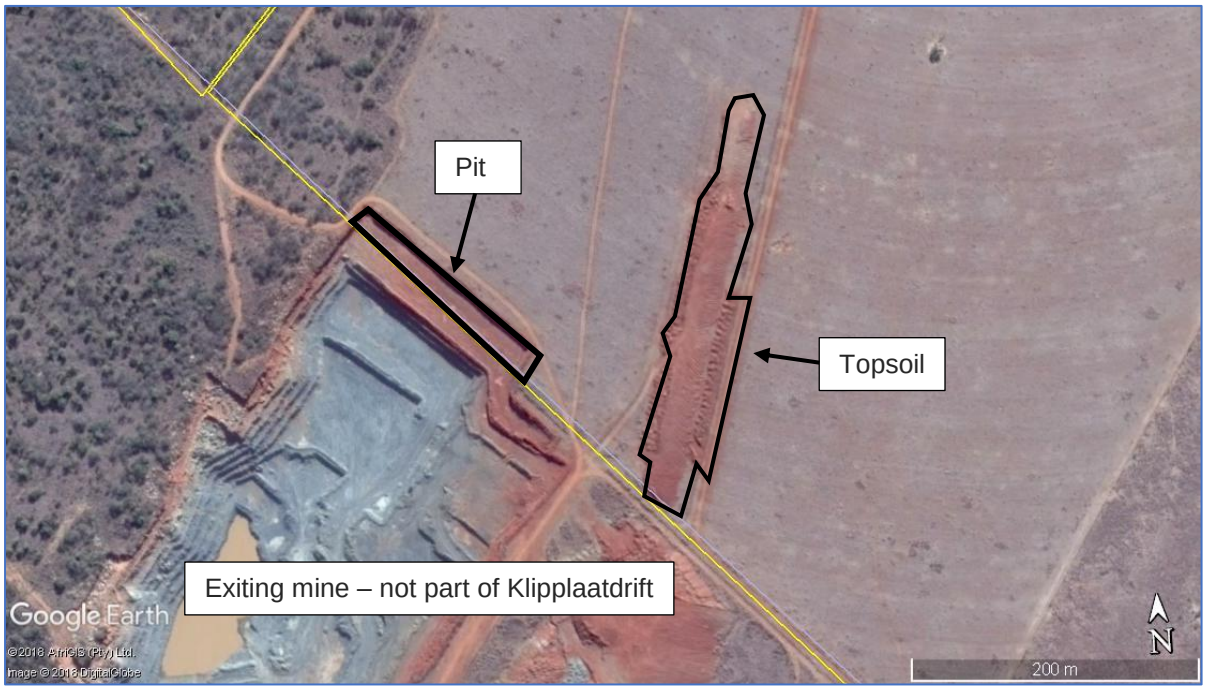



Figure 19: Pit and topsoil stockpile on Klipplaatdrift

### 4.4.2 If areas are available for annual rehabilitation and remediation concurrent with mining

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2012):

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 has been created.
3. That the water quality and catchment yield return to the original state as closely as possible.

The rehabilitation of Klipplaatdrift will focus on backfilling of quarries as far as possible 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 storm water control to prevent siltation and pollution of any rivers and streams; and removal of all old infrastructure. The rehabilitation plan will therefore be compatible with the closure objectives.

#### 4.4.2.1 Soil

| **Description** | **Comment** |
|---|---|
| Nature or type of activity and associated infrastructure. | Stripping of topsoil for commencement of quarry |
| Planned remaining life of activity under consideration. | Until 2031 |
| Surface area of already disturbed area. | 13,552m²: |
| Planned-to-be-disturbed area. | 521,338m² |
| Area already disturbed* in percentage of planned-to-be-disturbed area, available for concurrent rehabilitation and remediation activities. | 0.6% |
| Notes to indicate why total available or planned to be available area differs from area already disturbed or planned to be disturbed. | N/A |
| Notes to indicate why concurrent rehabilitation will not be undertaken on the full available or planned to be available area. | N/A |
| Details of rehabilitation activity planned on this area for the period of review; | Compaction is the most significant problem with stripping of topsoil. Compaction must be minimised by using the right equipment. Too heavy machinery must not be used to strip the soil. Rather use a dozer than a grader. Soils should also only be moved when it is dry to minimise soil compaction. Please note this may then lead to wind erosion or dust generation. Care must be taken to prevent wind blowing the placed topsoil away. |
| The pertinent closure objectives and performance targets that will be addressed in the forthcoming year, which objectives and targets are aligned to the final rehabilitation, decommissioning and mine closure plan; | To adequately remove topsoil and store topsoil for the use as part of rehabilitation. |

| Description | Comment |
|---|---|
| Description of the relevant closure design criteria adopted in the annual rehabilitation and remediation activities and the expected final land use once all rehabilitation and remediation activities are complete for the activity or aspect | Not necessary. No design criteria needed for the stripping of topsoil. |

* This disturbed area refers only to the area disturbed by the soil, and not the entire area of the Operation.

#### 4.4.3 A site plan indicating at least the total area disturbed, area available for rehabilitation and remediation and the area to be rehabilitated or remediated per aspect or activity

Refer to Figure 19 indicating the area that has already been disturbed. Only topsoil stockpiling can currently be undertaken as part of rehabilitation.

### 4.5 A review of the previous year's annual rehabilitation and remediation activities, indicating a comparison between activities planned in the previous year's annual rehabilitation and remediation plan and actual rehabilitation and remediation implemented

This is the first annual rehabilitation report, mining has just commenced, therefore, no review available of the previous year's annual rehabilitation and remediation activities.

### 4.6 Details of the timeframes of implementation of the current, and review of the previous rehabilitation activities

Nothing has commenced therefore no details on the timeframes yet. Topsoil must be adequately removed and stockpiled concurrently with opening of pit and placement of overburden.

## SECTION 5: POST REHABILITATION ACTIVTIES

Information for this section was taken from 'Rehabilitation Recommendations after Alien Plant Control' (Campbell, 2001). Post rehabilitation will take place after closure of the mine. These activities will be in the form of maintenance and monitoring. This section will form part of the closure plan to be compiled when closure of mine is neared. If, during monitoring it is noticed that re-vegetation or removal of plants is necessary, or if during maintenance re-vegetation or removal of plants must be done.

### 5.1 Monitoring plan

Monitoring of any rehabilitation is absolutely necessary to ensure that the integrity and performance of the rehabilitation method are still in line with the original objectives and purposes of the method. It is very important that monitoring takes place continuously throughout and after rehabilitation. The main goals behind a monitoring program are (van Deventer, 2009):

1. To meet legal requirements. In the EMP, a description of methods to be followed to monitor compliance of the approved rehabilitation plan is included. Closure application should also be substantiated with adequate monitoring data. Closure objectives must be specified upfront and accepted by all parties. Objectives must be prescribed for at least the following:
    - Topographical reshaping
    - Erosion (surface stability);
    - Vegetation cover (species diversity, abundance);
    - Mine residue characteristics with respect to plant growth (soil quality)

2. Evaluating mine residue and vegetation quality. Dynamic assessment requires a monitoring system to provide a regular surveillance of mine residue and vegetation quality attributes or indicators.
3. Land management. The annual results of the monitoring program will determine the actions to be taken for the following year to ensure the site is improving in the direction of the stipulated end result.
4. Improving our understanding of new ecosystems. For the new ecosystem, the biological productivity, stocks and exchange of nutrients, and the regulation of other ecological processes need to be characterized, quantified, and modelled.

Refer below for the parameters of monitoring. This includes an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities.

Please note, rehabilitation is currently only focusing on the correct removal and storage of topsoil.

Table 29: Monitoring plan

| Parameters to be monitored | Frequency of monitoring | Period of monitoring | Responsible person | Explanation of the approach that will be taken to address and close out audit results and schedule |
|---|---|---|---|---|
| **Erosion monitoring** | | | | |
| The primary objective of closure of any sloped area is to create a rehabilitated surface and topography that has the capacity to be stabilised under all environmental conditions e.g. severe rain events, veld fires, droughts etc. Erosion status of the rehabilitated land should be monitored and zones with excessive erosion should be identified for remedial action. Erosion can be quantified by insertion of marked stakes into the rehabilitated profile and recording the rate at which the stakes are uncovered. However, the norm is simply the recording of the existence of erosion in a particular location. Key objectives to improve surface stability are;<br>• Minimisation of surface erosion (wind and water)<br>• Establishment of a plant community that is self-sustaining or any other cover material which comply to surface stability<br><br>Achievement of these objectives should be demonstrated by monitoring of the rehabilitated areas. The key objective of surface stability monitoring lies in being able to demonstrate in a quantified manner the stability of surface rehabilitation works. The | Monthly | From start until five years after rehabilitation | Mine manager | It is much simpler, and cheaper, to treat this type of erosion in the early stages of formation than to try repair the damage once a deep gulley has formed. Small ruts that are just starting to open up can be easily controlled by filling them with brush, straw, manure or even stones.<br><br>Treatments should be concentrated in areas of clearly active soil erosion, rather than relatively stable (vegetated) gulleys).<br><br>An extremely important principle with any soil erosion control method is that when natural materials are gathered for use in control structures, care must be taken to ensure that the removal (for example, of stones) does not become the cause of a new erosion problem at the source of the material. Stones, for example, should only be collected along roads, where they are displaced during road-making, or from piles of stones cleared off irrigation lands. Similarly, natural vegetation should not be destroyed by vehicles collecting or delivering materials for gulley control.<br>(http://www.ostrichsa.co.za/downloads/bio_diversity/rehabilitation.pdf) |

| Parameters to be monitored | Frequency of monitoring | Period of monitoring | Responsible person | Explanation of the approach that will be taken to address and close out audit results and schedule |
|---|---|---|---|---|
| monitoring programme should be developed such that loss of soil can be quantified and the stability of the vegetated areas be assessed. | | | | |
| **Soil pollution** | | | | |
| The area should be surveyed for soil pollution. | Once every quarter | From start until after rehabilitation. | Mine manager | Any signs of pollution must be removed as hazardous waste. |

## 5.2 Internal, external and legislated audits of the monitoring plan

The monitoring plan will be audited to ensure effective implementation.

### 5.2.1 Person responsible for undertaking the audit

Mine Manager for internal audits and consultant for external audits.

### 5.2.2 Planned date of audit and frequency of audit

Annually.

### 5.2.3 An explanation of the approach that will be taken to address and close out audit results and schedule

Refer to the monitoring plan in section 5.1 for approach that will be taken to address and close out audit results and schedule.

### 5.2.4 Disclosure of updates of the plan to stakeholders

The audit report will be sent to DMR and Department of Water and Sanitation (DWS) once finalised, therefore on an annual basis.

# SECTION 6: ANNUAL UPDATED FINANCIAL PROVISION

This section is the annual updated financial provision for Klipplaatdrift Mine. This section includes

i. an explanation of the closure cost and methodology,
ii. auditable calculations of costs per activity or infrastructure,
iii. cost assumptions;
iv. and monitoring and maintenance costs likely to be incurred both during the period of the annual rehabilitation plan and those that will extend past the period of the final rehabilitation, decommissioning and mine closure plan, on condition that the monitoring and maintenance costs included in previous annual rehabilitation plans must be accumulated into subsequent versions of the annual rehabilitation plan until such time as the monitoring and maintenance obligation is discharged

## 6.1 Financial provision methodology

The following is extracted from the Annesley Andalusite Mine Closure Liability Update (Shangoni Management Services, 2016):

The CES Group was contracted by Shangoni to acquire rates for demolition and rehabilitation of mining activities (**Table 31**). 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 the 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 30: 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 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.

## 6.2 Auditable calculations of financial provision per activity or infrastructure

The monitoring and maintenance costs likely to be incurred both during the period of the annual rehabilitation plan and those that will extend past the period of the final rehabilitation, decommissioning and mine closure plan, on condition that the monitoring and maintenance costs included in previous annual rehabilitation plans must be accumulated into subsequent versions of the annual rehabilitation plan until such time as the monitoring and maintenance obligation is discharged are included in the table below.

Table 31: Tariffs used for quantum determination

| Rehabilitation and Demolition | Unit | Rates |
|---|---|---|
| Earthworks, break-up and level | $m^3$ | R 40.01 |

| Rehabilitation and Demolition | Unit | Rates |
|---|---|---|
| Traditional seeding | $m^2$ | R 3.36 |
| Backfilling of open pit | $m^3$ | R 8.09 |
| Sloping and replacement of topsoil | $m^3$ | R8.89 |

## 6.3 Financial provision estimation

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

Table 32: Summary of the closure cost calculation of actual disturbance

| Item | Size (m / m² / m³) | Rate | Final cost | Comment | Percentage of total costs |
|---|---|---|---|---|---|
| Physical rehabilitation | | | | | |
| Backfilling of open pit | 156 831.00 | R8.09 | R1 268 762.79 | Less than 10% of year 1 surface indicated in EMP has been mined. Volume overburden in year 1 is 313,661m³. Adjusted to 50% of year 1. | |
| Sloping and replacement of topsoil | 3 626.00 | R8.89 | R32 235.14 | Soil year 1 is 7,252m³. Adjusted to 50% of year 1. No additional sloping necessary. | |
| Earthworks, break-up and level | 2 067.60 | R40.01 | R82 724.68 | 200mm under actual overburden footprint. | |
| *Physical rehabilitation sub total* | | | *R1 383 722.61* | | 86.52% |
| Vegetation | | | | | |
| Traditional seeding | 13 552.00 | R3.36 | R45 534.72 | Actual footprint of area | |
| *Vegetation sub total* | | | *R45 534.72* | | 2.85% |
| Monitoring | | | | | |
| Soil erosion, vegetation growth, and alien vegetation monitoring | Year 1 | R50 000.00 | R50 000.00 | | |
| Groundwater monitoring | Quarterly for year 1 | R30 000.00 | R120 000.00 | | |
| *Monitoring sub total* | | | *R170 000.00* | | 10.63% |

| Item | Size (m / m² / m³) | Rate | Final cost | Comment | Percentage of total costs |
|---|---|---|---|---|---|
| | | | | | |
| Sub-total | | | R 1 599 257.33 | | 100.00% |
| P&G (13.5%) | | | R 215 899.74 | | |
| Contingency (10%) | | | R 159 925.73 | | |
| **Total** | | | **R 1 975 082.80** | | |

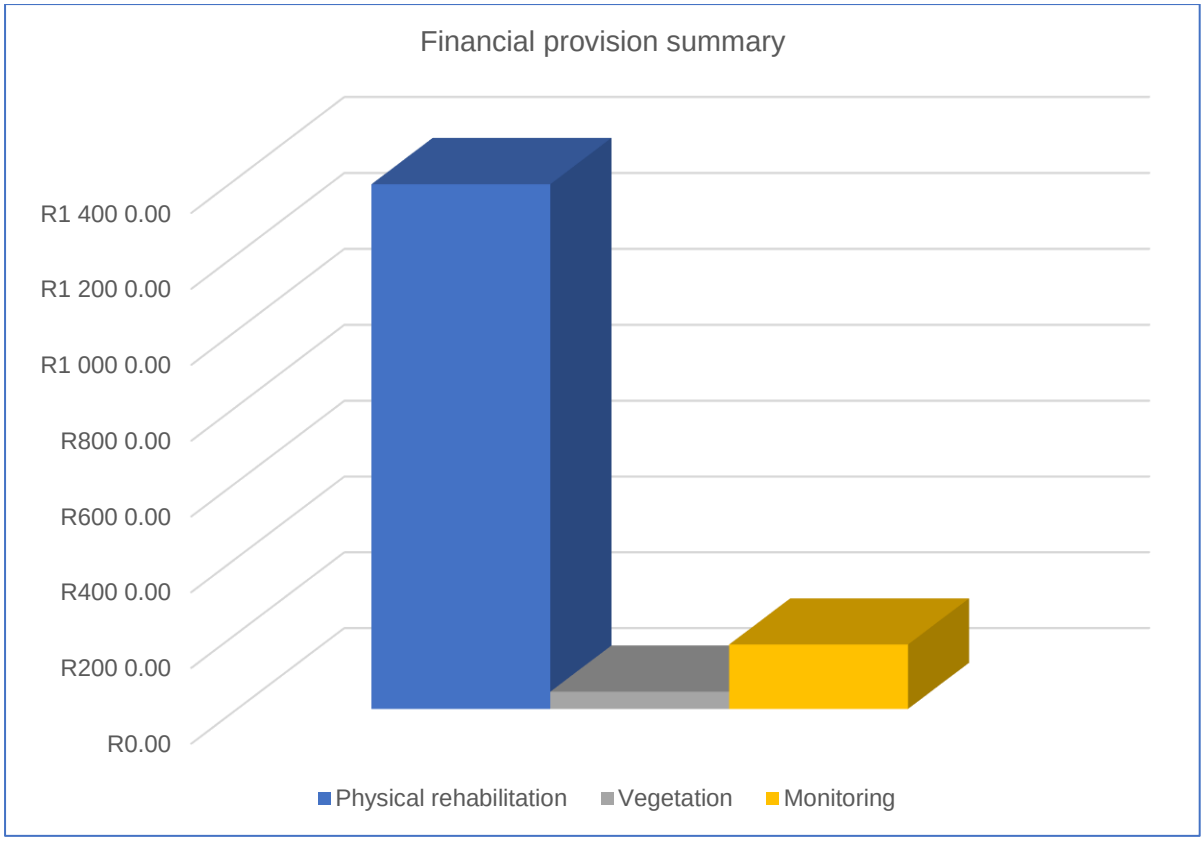



Figure 20: Financial provision summary

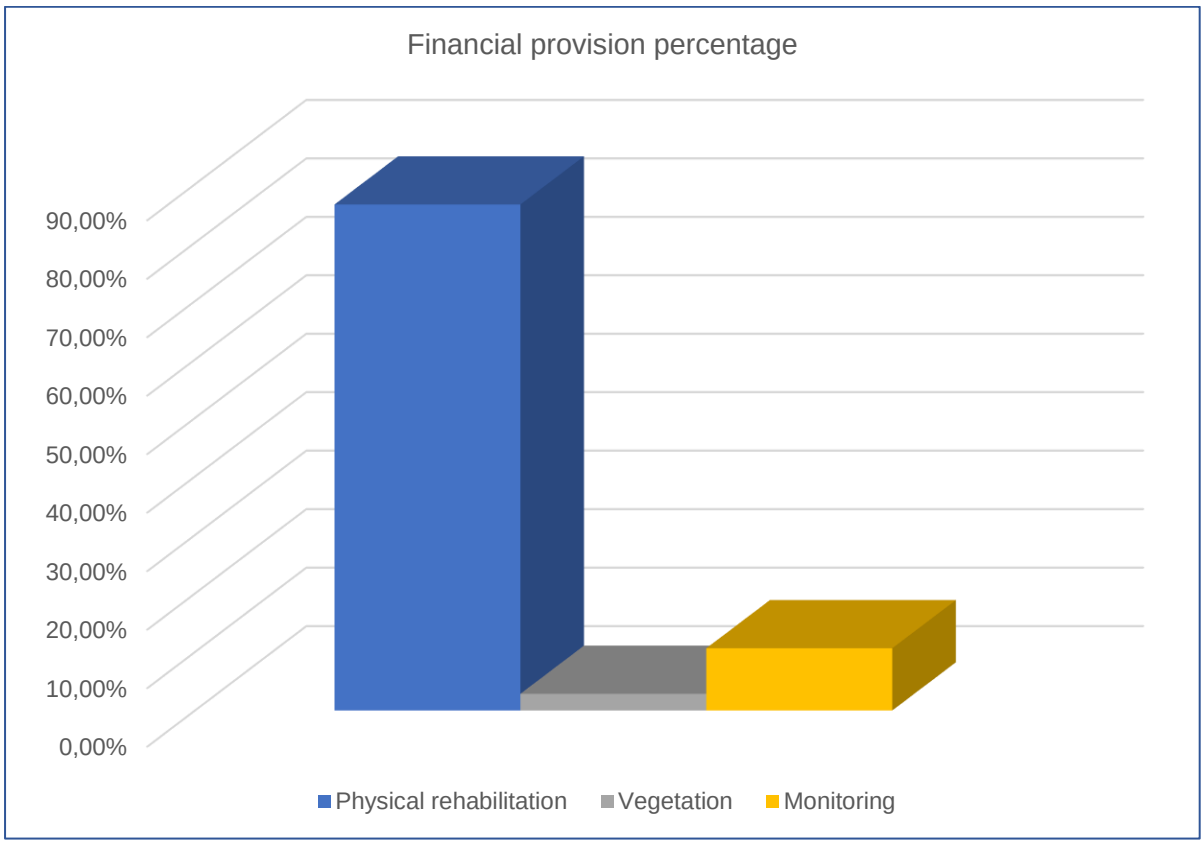



Figure 21: Percentage of financial provision

Referring to **Figures 20 and 21** above, it is evident that physical rehabilitation will be almost 87% of the entire financial provision.

### 6.4 Financial provision assumptions

Less than 10% of year 1 surface indicated in EMP has been mined.

## SECTION 7: CONCLUSION AND GAP ANALYSIS

The objective of the annual rehabilitation plan will be ensuring the post-closure land capability goals are achieved, in accordance with the overall closure objectives. The monitoring programme was designed to collect information to demonstrate the criteria that was used. This report is the first annual rehabilitation plan compiled and an explanation of motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps will only become applicable in subsequent updates.

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