

NEMA APPLICATION
KEBRAFIELD ROODEPOORT COLLIERY
DRAFT EIA/EMP
17/2/3N-289

25/06/2014

REPORT

REF 13_14/AUTH – 016: (Draft EIA/EMP)



2014

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ENVIRONMENTAL & PROJECT MANAGEMENT PROFESSIONALS

Roodepoort 151 IS Portion 17

Project Number:	Version:	Date:
13-009-AUTH-REP	CC	25/06/2014

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Key Project Information	
Project Title:	Kebrafield Roodepoort Colliery
Farm Description:	Roodepoort 151 IS Portion 17
SG Code:	T0IS000000000115100017
Mining Right Reference Number:	MP30/5/1/2/2/479 MR
District Municipality:	Nkangala District
Local Authority:	Steve Tshwete Local Municipality
Nearest Town:	Pullenshope
Site Midpoint Coordinates:	26° 0'25.87"S 29°34'41.21"E

Project applicant:	Kebrafield (Pty) Ltd		
Trading name (if any):	Kebrafield		
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Qualifications & relevant experience	Masters Degree specializing in Environmental Management 10 Years' experience in Environmental Consultancy		
Professional affiliation(s) (if any)	Chartered Environmental Assessment Practitioner South Africa (CEAPSA)		
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EXECUTIVE SUMMARY

i) Introduction

Eco Elementum (Pty) Ltd has been appointed by Eyethu on behalf of the applicant Kebrafield (Pty) Ltd to undertake the Scoping Environmental Impact Assessment and Water Use Licensing for all the relevant listed activities as discussed further on in this report. The mining right which has been awarded to Kebrafield (Pty) Ltd, MP30/5/1/2/2/479 MR, includes various farms and associated farm portions although for this specific project only the farm Roodepoort 151 IS portion 17 in the vicinity of the town of Pullenshope in Mpumalanga is being applied for. The project falls within the district municipality of the Nkangala District while the local authority is the Steve Tshwete Local Municipality. This report entails an application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010, and falls within the jurisdiction of the Department: Economic Development, Environment and Tourism, Mpumalanga Provincial Government.

The proposed project relate to the opencast mining of approximately 800 000tons of high grade coal over a period of approximately three years. When coal seams are near the surface, it may be economical to extract the coal using open cut (also referred to as open cast, open pit, or strip) mining methods. Open cast coal mining recovers a greater proportion of the coal deposit than underground methods, as more of the coal seams in the strata may be exploited. The activity will cover approximately 50 hectares and is situated next to the town of Pullenshope downstream of the Eskom Hendrina Power Station.

The Environmental Impact Assessment (EIA) process followed is in compliance with the National Environmental Management Act, 1998 (Act 107 of 1998), as amended and the Environmental Impact Assessment Regulations of 2010 (Government Notice No's R544, 545 and 546 in Government Gazette No. 33306 of 18 June 2010). The proposed opencast coal mining operations constitutes various listed activities which have been listed within the scheduled activities in Government Notice Regulation No 544, 545 and 546 and therefore require a full Scoping and EIA/EMP process to be followed. Prior to such a listed activity being approved, it is required that an environmental process is undertaken and a report is submitted to the relevant environmental authority for consideration.

The table below outlines the Public Participation Process (PPP) activities conducted

Table 1: PPP Activities

Consultation Phase	
Activity	Details
Identification of Stakeholders	Stakeholder database which includes I&APs from various sectors of society including directly affected and adjacent landowners.
Distribution of proposed project announcement letter	Announcement letter with comment and registration sheet was emailed and posted to stakeholders on.
Placing of advertisements	Advert was placed in the Middelburg observer (Distrubution area: Middelburg , Witbank, Belfast , Hendrina, Mines and Power Stations including Hendrina Power

	Station and the town of Pullenshope situated directly adjacent to the proposed project area.)
Placing of site notices	<p>Notices informing the public of the proposed mining activities and the Open Days to take place and inviting their input, comments and concerns were done by fixing of four notice boards at places conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is or is to be undertaken.</p> <ul style="list-style-type: none"> • Northern boundary of the proposed site • Southern boundary of the proposed site • Entrance to the town of Pullenshope • Turn-off from the main road towards the proposed site
Public participation interaction	<p>A public participation meeting was held at the proposed site on 1 November 2013 09.00am to 12.00am where the interested and affected parties were given the opportunity to register, raise their concerns and also do a site walk about with the Environmental Assessment Practitioner to give an overview of what the application for authorisation would entail.</p> <p>I&AP's and other key stakeholders were directly informed of the proposed development by e-mail. The Background Information Document (BID) and Registration and Comment sheets were also supplied to all parties. I&APs were given 40 days to comment and / or raise issues of concern regarding the proposed development. The commenting period expired on the 25 November 2013. However, comments were being received up to 21 February 2014 before the Final Scoping Report was released for a 21 day commenting period.</p> <p>The Draft Scoping Report (DSR) and Plan of Study (POS) were submitted to the Competent Authority on 16 October 2013 as per the requirements of Regulation 56 (4). The DSR and supporting documentation were subsequently released for a period of 40 days from 15 October 2013 to 25 November 2013 for public review and comment. All stakeholders and I&AP's was notified of the DSR availability for comment. Hardcopies of the DSR was submitted to all organs of state and relevant authorities. The Draft Scoping Report and supporting documentation was made available for review at the Pullenshope Public Library; and via email upon request to info@ecoelementum.co.za. However, comments were being received up to 21 February 2014 before the Final Scoping Report was released for a 21 day commenting period.</p>

ii) Legislative Requirements

National Environmental Management Act, 1998 (Act 108 of 1998) [as amended]:

The proposed development requires compliance with the EIA Regulations of 2010, promulgated in terms of the National Environmental Management Act, Act 107 of 1998 (as amended). The proposed activity requires a Scoping and EIA process as listed activities 9, 11, 13, 18, and 22 under Government Notice No R. 544 as well as listed activities 10 and 15 of Government Notice No R. 545 and also activity 13 and 14a of Government Notice No R 546 of the EIA 2010 Regulations are triggered.

National Water Act, 1998 (Act 36 of 1998):

The mine envisaged to engage in several water uses that need to be authorised in terms of section 21 of the National Water Act, 1998 (Act 36 of 1998). The water uses that need to be applied for are:

- Section 21 (a) for the taking of water from a resource (for abstraction of potable water from a borehole and use of water from pollution control dam for dust suppression). No surface water abstraction is

allowed within the quaternary catchment (under GA) as specified in Table 1.1 within Government Gazette Notice No 26187 during March 2004. The taking of groundwater is regulated in terms of quantity and rate of abstraction by Table 1.2 within the same Gazette Notice mentioned.

- Section 21 (c) and (i) in respect of the altering of water courses by mining infrastructure
- Section 21 (g) for the disposing of mine waste in a manner which may impact on a water resource (for pollution control dams and discard dumps)
- Section 21 (g) for the dirty water containment structures (PCD's)
- Section 21 (j) for removing of water from open pit operations

There are no General Authorisations applicable to this application.

Various legal references have been considered throughout the application while the following list serves as a summary;

- The Constitution of the Republic of South Africa, 1996
- The National Environmental Management Act, 1998 (Act 107 of 1998) [NEMA]
- National Heritage Resource Act, 1999 (Act No. 25 of 1999) [NHRA]
- National Water Act, 1998 (Act No.36 of 1998) [NWA]
- Integrated Environmental Management [IEM] (DEAT Guideline Series)
- National Environmental Air Quality Act (Act No 39 of 2004) [NEMAQA]
- Mineral and Petroleum Resources Development Act (Act 28 of 2002) [MPRDA]
- National Environmental Management: Waste Act (Act 59 of 2008) [NEMWA]
- Mine Health and Safety Act, 1996 (Act No. 29 of 1996) [MHSA]
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) [NEMBA]
- Conservation of Agricultural Resources Act (Act 43 of 1983) [CARA]
- Occupational Health and Safety Act (Act 85 of 1993)[OSHAct]

iii) Environmental Consultants

Kebrafield (Pty) Ltd appointed Eco Elementum (Pty) Ltd as independent environmental consultants to investigate the environmental, socio-economic and cultural aspects of the Kebrafield Roodepoort Colliery Project. Table III provides the contact details of the environmental consultants.

Company Name:	Eco Elementum (Pty) Ltd		
EAP:	Ilze Ueckermann for Eco Elementum (Pty) Ltd		
Contact person:	Henno Engelbrecht (Project Manager)		
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E-mail:	henno@ecoelementum.co.za / info@ecoelementum.co.za		
Qualifications & relevant experience	Masters Degree specializing in Environmental Management 10 Years' experience in Environmental Consultancy		
Professional affiliation(s) (if any)	Chartered Environmental Assessment Practitioner South Africa (CEAPSA)		

iv) Purpose of this Report

The purpose of this Draft EIA/EMP report is to present the results of the EIA phase for the proposed project.

The main objectives are to:

- Describe the methodology applied to undertaking the EIA phase for the proposed Roodepoort Colliery Project, including consultation with identified stakeholders;
- Identify feasible alternatives for the proposed Roodepoort Colliery Project;
- Describe the existing baseline environmental conditions of the proposed project area prior to the proposed Roodepoort Colliery Project;
- Present findings of the PPP undertaken to identify salient issues and concerns raised during the previous Scoping Phase and the current EIA phase of the proposed Roodepoort Colliery Project; and
- Provide an assessment of the anticipated environmental, social and cultural impacts of the proposed Roodepoort Colliery Project, including cumulative impacts.

Specialist Studies Conducted as Part of this EIA Report included:

- ANNEXURE 3 – Geohydrological Specialist Report
- ANNEXURE 4 – Hydrological/Surface Water Specialist Report
- ANNEXURE 5 –Wetland Specialist Report
- ANNEXURE 6 – Biomonitoring/River Health Specialist Report
- ANNEXURE 7 – Civil Engineering and Stormwater Specialist Report
- ANNEXURE 8 – Baseline Air Quality Assessment
- ANNEXURE 9 – Baseline Noise Assessment
- ANNEXURE 10 – Soils and Land Capability Specialist Report
- ANNEXURE 11 – Visual Impact Assessment
- ANNEXURE 12 – Traffic Impact Specialist Report
- ANNEXURE 13 – Heritage, Cultural and Archaeological Specialist Report
- ANNEXURE 14 – Social Impact Assessment
- ANNEXURE 15 – Blast and Vibration Risk Assessments
- ANNEXURE 16 – Ecological, Fauna and Flora Specialist Report
- ANNEXURE 17 – Paleontological Specialist Report

- ANNEXURE 18 – Social and Labour Plan

v) Public Participation Process

As part of the EIA process, the Public Participation Process (PPP) has already commenced and will be on-going throughout the process. The PPP is an important process in the development of the proposed Roodepoort Colliery Project and has the sole purpose of providing a platform to Interested and Affected Parties (I&APs) to raise issues of concern and provide comments and suggestions that will assist in the planning and design stages of the proposed project.

v) Potential Environmental Impacts Identified

Detailed Breakdown of Potential Environmental Impacts	
Ground Water Contamination	<ul style="list-style-type: none"> • During mining ground water can seep through the high walls and become contaminated in the pit when in contact with carbonaceous material • Based on the Acid Base Accounting score for the material that will be mined including the material used for backfill rehabilitation potential water contamination can occur • The drawdown effect can cause water sources in the vicinity of the opencast pit to potentially flow into the pit
Surface Water Contamination	<ul style="list-style-type: none"> • Open pit mining is associated with surface water contamination due to the leaching of stockpiles - also dependant on the characteristics of the stockpiled material • The quality of the water used for dust suppression has the potential to contaminate surface water sources • The clean and dirty water separation system could potentially contaminate surface water sources • Erosion of denuded soil surfaces could potentially increase the total dissolved solids and cause sedimentation of surface water sources
Geology, soil and land capability	<ul style="list-style-type: none"> • Opencast mining will impact the geology, soil and land capability and must be addressed during the backfill rollover rehabilitation
Socio-economic issues	<ul style="list-style-type: none"> • A potential positive impact could occur as the mine will create in excess of direct 100 jobs while many more indirect jobs will be created • The mining of the coal resource will positively impact on the economy of the country
Waste products	<ul style="list-style-type: none"> • General waste will be generated on site

	<ul style="list-style-type: none"> • Small amounts of hydrocarbon waste associated with maintenance activities will be generated on site • No washing of coal will take place on site therefore no negative impact from slurry dams
Flora and faunal displacement	<ul style="list-style-type: none"> • During opencast mining total displacement of flora and fauna will take place within the footprint of the opencast pit
Impacts on the wetlands and drainage patterns	<ul style="list-style-type: none"> • Potential impacts could arise due to mining in the vicinity of a wetland and therefore a 100m buffer must be adhered to according to specialist investigations. A WULA will however be applied for to authorise mining within the 500m radius from a wetland up and to the 100m buffer line. • Surface water drainage patterns will be altered according to the storm water management plan to ensure clean and dirty water separation.
Dust and noise impacts	<ul style="list-style-type: none"> • Mining is associated with dust and noise impacts as a result of blasting, excavation, stockpiling, crushing & screening and general vehicle movement on gravel roads.
Visual impacts	<ul style="list-style-type: none"> • Opencast mining is associated with potential visual impacts as a result of the stockpiles and waste rock dumps that is higher than the initial topography before mining
Blast & vibration impacts	<ul style="list-style-type: none"> • Blasting will be required during the opencast mining operation and potential blast and vibration impacts exist
Identified heritage sites	<ul style="list-style-type: none"> • Various graves have been identified during the initial site visits on the edge of the mining footprint (not within) that might be impacted due to mining activities
Paleontological impacts	<ul style="list-style-type: none"> • Based on the findings from the Paleontological investigation can we further determine possible impacts

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ANNEXURE 1 – Competent Authority Communication

ANNEXURE 2 – Public Participation Report

ANNEXURE 3 – Geohydrological Specialist Report

ANNEXURE 4 – Hydrological/Surface Water Specialist Report

ANNEXURE 5 –Wetland Specialist Report

ANNEXURE 6 – Biomonitoring/River Health Specialist Report

ANNEXURE 7 – Civil Engineering and Stormwater Specialist Report

ANNEXURE 8 – Baseline Air Quality Assessment

ANNEXURE 9 – Baseline Noise Assessment

ANNEXURE 10 – Soils and Land Capability Specialist Report

ANNEXURE 11 – Visual Impact Assessment

ANNEXURE 12 – Traffic Impact Specialist Report

ANNEXURE 13 – Heritage, Cultural and Archaeological Specialist Report

ANNEXURE 14 – Social Impact Assessment

ANNEXURE 15 – Blast and Vibration Risk Assessments

ANNEXURE 16 – Ecological, Fauna and Flora Specialist Report

ANNEXURE 17 – Paleontological Specialist Report

ANNEXURE 18 – Social and Labour Plan

ABBREVIATIONS

AIA - Archaeological Impact Assessment
ASAPA - Association of South African Professional Archaeologists
BID - Background Information Document
DEA - Department of Environmental Affairs
DEAT - Department of Environmental Affairs and Tourism (currently known as DEA)
DWA - Department of Water Affairs
EIA - Environmental Impact Assessment
EIR - Environmental Impact Report
EMPr - Environmental Management Programme
ENPAT - Environmental Potential Atlas
EP - Equator Principles
EPC – Engineering and Procurement Contract
EPFI - Equator Principles Financial Institutions
ESA - Early Stone Age
FGM - Focus Group Meeting
FSR - Final Scoping Report
GDP - Gross Domestic Product
GGP - Gross Geographic Product
GIS - Geographic Information System
GPS - Global Positioning System
HIA - Heritage Impact Assessment
I&APs - Interested and Affected Parties
IDP - Integrated Development Plan
IUCN - International Union for the Conservation of Nature
KSW - Key Stakeholder Workshop
LSA - Late Stone Age
LIA - Late Iron Age
LTI – Latitude Tilt Irradiation
MDEDET - Mpumalanga Department of Economic Development, Environment and Tourism
MSA - Middle Stone Age
MIA - Middle Iron Age
NEMA - National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA - National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NHRA - National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NSBA - National Spatial Biodiversity Assessment
NWA - National Water Act, 1998 (Act No. 36 of 1998)
O&M - Operations and Maintenance
PHRA - Provincial Heritage Resources Agency
PSSA - Paleontological Society of South Africa
PM - Public Meeting
PPP - Public Participation Process
ROM – Run of Mine
SADC - Southern African Development Community
SAHRA - South African Heritage Resources Agency

SALA – Subdivision of Agricultural Land of 1970
SANBI - South African National Biodiversity Institute
SAWS - South African Weather Service
SDF - Spatial Development Framework
TSF – Tailings Storage Facility
VT - Vegetation Type

GLOSSARY OF TERMS

Air pollution: any change in the composition of the air caused by smoke, soot, dust (including coal), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances.

Alien species: A plant or animal species introduced from elsewhere: neither endemic nor indigenous.

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc

Anthropogenic: Change induced by human intervention.

Applicant: Any person who applies for an authorisation to undertake an activity or undertake an Environmental Process in terms of the Environmental Impact Assessment Regulations – National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as contemplated in the scheduled activities listed in Government Notice (GN) No R. 543, 544 and 545.

Archaeological resources:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Atmospheric emission or emission: any emission or entrainment process emanating from a point, non-point or mobile source those results in air pollution.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cultural significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Cumulative impact: In relation to an activity, cumulative impact means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Ecology: The study of the interrelationships between organisms and their environments.

Environment: All physical, chemical and biological factors and conditions that influence an object.

Environmental impact assessment: In relation to an application, to which Scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application.

Environmental impact report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Programme (EMPr): The EMPr is a detailed plan for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMPr contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMPr specifies how the construction of the project is to be carried out and includes the actions required for the Post-Construction Phase to ensure that all the environmental impacts are managed for the duration of the project's life-cycle.

Heritage resources: This means any place or object of cultural significance. See also archaeological resources above.

Hyrdomorphic / hydric soil: Soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring growth and regeneration of hydrophytic vegetation. These soils are found in and associated with wetlands.

Local relief: The difference between the highest and lowest points in a landscape. For this study, it is based on 1:50 000 scale.

Particulates: comprises a mixture of organic and inorganic substances, ranging in size and shape. These can be divided into coarse and fine particulate matter. The former is called Total Suspended Particulates (TSP), whilst thoracic particles or PM10 (particulate matter with an aerodynamic diameter of less than 10 µm) fall in the finer fraction. PM10 is associated with health impacts for it represents particles of a size that would be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung. TSP, on the other hand, is usually of interest in terms of dust deposition (nuisance).

Project Manager (PM): Person/organisation appointed by the holder of the environmental authorisation to oversee the work of all consultants, sub-developers, contractors, residents and visitors for the project.

Red data species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Rehabilitation: Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was in before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement re-vegetation of a disturbed area and the insurance of a stable land surface. Re-vegetation must aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

Scoping report: An "issues-based" report which forms the first phase of an Environmental Impact Assessment process.

Soil compaction: Soil becoming dense by blows, vehicle passage or other type of loading. Wet soils compact easier than moist or dry soils.

1. Introduction

Eco Elementum (Pty) Ltd has been appointed by Eyethu on behalf of the applicant Kebrafield (Pty) Ltd to undertake the Scoping Environmental Impact Assessment and Water Use Licensing for all the relevant listed activities as discussed further on in this report. The mining right which has been awarded to Kebrafield (Pty) Ltd, MP30/5/1/2/2/479 MR, includes various farms and associated farm portions although for this specific project only the farm Roodepoort 151 IS portion 17 in the vicinity of the town of Pullenshope in Mpumalanga is being applied for. The project falls within the district municipality of the Nkangala District while the local authority is the Steve Tshwete Local Municipality. This report entails an application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010, and falls within the jurisdiction of the Department: Economic Development, Environment and Tourism, Mpumalanga Provincial Government.

The proposed project relate to the opencast mining of approximately 800 000tons of high grade coal over a period of approximately three years. When coal seams are near the surface, it may be economical to extract the coal using open cut (also referred to as open cast, open pit, or strip) mining methods. Open cast coal mining recovers a greater proportion of the coal deposit than underground methods, as more of the coal seams in the strata may be exploited. The activity will cover approximately 50 hectares and is situated next to the town of Pullenshope downstream of the Eskom Hendrina Power Station.

The Environmental Impact Assessment (EIA) process followed is in compliance with the National Environmental Management Act, 1998 (Act 107 of 1998), as amended and the Environmental Impact Assessment Regulations of 2010 (Government Notice No's R544, 545 and 546 in Government Gazette No. 33306 of 18 June 2010). The proposed opencast coal mining operations constitutes various listed activities which have been listed within the scheduled activities in Government Notice Regulation No 544, 545 and 546 and therefore require a full Scoping and EIA process to be followed. Prior to such a listed activity being approved, it is required that an environmental process is undertaken and a report is submitted to the relevant environmental authority for consideration.

A summary of the activities which are being applied for under either Government Regulations No 544, 545 or 546 (Government Gazette No. 33306 of 18 June 2010) with brief descriptions of why it is anticipated that these activities will need to be authorised in terms of the project planning are summarized in the tables below.

Table 2: Description of each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):

Number and Date of relevant Notice	Activity No	Description of listed activities with brief explanations in terms of project planning
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	S9	<p>9. Infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water -</p> <p>(i) with an internal diameter of 0,36 metres or more; or</p> <p>(ii) with a peak throughput of 120 litres per second or more, excluding where:</p> <p>a. such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.</p> <p><i>It will be required that water from the opencast mining areas that flow into the pit must be transported to the relevant pollution control facilities, in this case the pollution control dams. Stormwater which has not been contaminated will also need to be diverted away from the opencast mining area.</i></p>
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	S13	<p>13. Storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres;</p> <p><i>The storage of fuel (especially diesel) for the mining vehicles will be required. Such storage might also be required for the generator required to supply electricity.</i></p>
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	S11	<p>11. The construction of:</p> <p>(i) canals;</p> <p>(ii) channels;</p> <p>(iii) bridges;</p> <p>(iv) dams;</p> <p>(v) weirs;</p> <p>(vi) bulk storm water outlet structures;</p> <p>(vii) marinas;</p> <p>(viii) jetties exceeding 50 square metres in size;</p> <p>(ix) slipways exceeding 50 square metres in size;</p>

		<p>(x) buildings exceeding 50 square metres in size; or</p> <p>(xi) infrastructure or structures covering 50 square metres or more</p> <p>where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.</p> <p><i>The construction of canals and bulk stormwater outlet structures will be required to ensure clean and dirty water separation can take place and that stormwater can be diverted away from the opencast mining area. Dams for the control of polluted water will need to be constructed within the mining area for pollution control facilities. The distance from the watercourse will be dependent on the Water Use License Authorisation that is being applied for simultaneously to this NEMA application.</i></p>
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	S18	<p>18. The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from</p> <p>(i) a watercourse;</p> <p>(ii) the sea;</p> <p>(iii) the seashore;</p> <p>(iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater-</p> <p>but excluding where such infilling, depositing, dredging, excavation, removal or moving</p> <p>(i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or occurs behind the development setback line.</p> <p><i>The activity will be triggered should the Water Use License Authorisation allow the applicant to conduct mining activities within the watercourse (more specifically wetland) areas as defined by the wetland specialist report.</i></p>
National Environmental	S22	22. The construction of a road, outside urban areas,

Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010		<p>(i) with a reserve wider than 13,5 meters or,</p> <p>(ii) where no reserve exists where the road is wider than 8 metres, or</p> <p>for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.</p> <p><i>For the purpose of the Kebrafield Roodepoort Colliery the existing gravel road will have to be reconstructed and diverted away from the mining area to ensure a safe flow of traffic can be achieved. Roads will also need to be constructed within the mining area to ensure the mineable resource can be accessed.</i></p>
National Environmental Management Act, (Act 107 of 1998) GN.R. 545, 18 June 2010	S10	<p>10. The construction of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following:</p> <p>(i) water catchments,</p> <p>(ii) water treatment works; or</p> <p>(iii) impoundments,</p> <p>excluding treatment works where water is to be treated for drinking purposes.</p> <p><i>Water will be required to be transferred between the pollution control facilities for the safe continuation of mining. The most probable of which will be the pollution control dams.</i></p>
National Environmental Management Act, (Act 107 of 1998) GN.R. 545, 18 June 2010	S15	<p>15. Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;</p> <p>except where such physical alteration takes place for:</p> <p>(i) linear development activities; or</p> <p>agriculture or afforestation where activity 16 in this Schedule will apply.</p> <p><i>The alteration of current agricultural and grazing land is estimated to be more than 20hectares (estimated 60ha) based on the current mine planning and proposed land owner agreement. Mining is a commercial</i></p>

		<i>activity and therefore trigger this activity.</i>
National Environmental Management Act, (Act 107 of 1998) GN.R. 546, 18 June 2010	S13	<p>13. The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation,</p> <p><i>The area have been used for agricultural purposes and have been ploughed and planted to a certain extent while the remainder has been used for grazing purposes. Initial site investigations did indicate various invasive and alien plant species. A detailed ecological report has been completed and is attached to this EIA.</i></p>
National Environmental Management Act, (Act 107 of 1998) GN.R. 546, 18 June 2010	S14a	<p>14. The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for:</p> <p>purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes;</p> <p>the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list;</p> <p>the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.</p> <p><i>For mining purposes more than 5 hectares will need to be cleared. However, approximately 50% of the proposed mining layout is situated on agricultural fields which are currently being utilized for crop cultivation and not 75% indigenous vegetation. A detailed ecological report has been completed and is attached to this EIA.</i></p>

The EIA process that is being followed includes the completion of the Scoping Report as well as an Environmental Impact Assessment Report with associated Environmental Management Programme. The Scoping Report identifies and determines the issues or concerns from the relevant authorities as well as interested and/or affected parties, while an Impact Assessment Report is undertaken to determine the likely consequence of the opencast mining project entitled Kebrafield Roodepoort Colliery on the environment (whether positive or negative).

It is therefore the responsibility of Eco Elementum (Pty) Ltd as independent environmental assessment practitioners to;

- Undertake a comprehensive site evaluation facilitated by a site visit and desk top analysis;
- Advertise, requesting that Interested and Affected Parties (I&AP's) register their concerns;
- Identify and determine the possible I&AP's;
- Undertake the necessary and/or required specialist studies;
- Assess the issues, impacts and alternatives related to this project; and
- Compile a detailed Scoping Report and Environmental Impact Assessment and its submission to the relevant environmental authority.

1.1 Project Details

The proposed Kebrafield Roodepoort Colliery which is an opencast mine is situated on the farm Roodepoort 151 IS Portion 17 which currently belongs to Mr. Joseph Christiaan van Wyk (ID 7604145228088) and he is currently using a section of portion 17 for maize cultivation, and the remainder for grazing purposes.

Table 3: Project applicant details

Project applicant:	Kebrafield (Pty) Ltd		
Trading name (if any):	Kebrafield		
Contact person:	Wayne van der Burgh c/o Burgh Group Holdings (Pty) Ltd		
Physical address:	54 Guinea Fowl Str, Silver Lakes, Pretoria		
Postal address:	P.O. Box 71986, Die Wilgers		
Postal code:	0041	Cell:	
Telephone:	012 807 0229	Fax:	012 807 0339

Table 4: Details of immediate landowners and their property

Landowner:	Joseph Christiaan van Wyk - ID 7604145228088		
Contact person:	Van Wyk Attorneys, 48 Mouton Street, Hendrina, 1095		
Postal address:	PO Box 22, Hendrina		
Postal code:	1095	Cell:	
Telephone:	013 293 0505	Fax:	013 293 0530
Farm Name:	Roodepoort 151 IS Portion 17		
SG Code:	T0IS00000000115100017		
Title Deed:	T4074/2001		
Extent in ha:	409.3832		

Table 5: Details of the Environmental Assessment Practitioner

EAP:	Ilze Ueckermann for Eco Elementum (Pty) Ltd		
Contact person:	Henno Engelbrecht (Project Manager)		
Postal address:	26 Greenwood Crescent, Lynnwood Ridge, Pretoria		
Postal code:	0040	Cell:	082 690 9105
Telephone:	012 348 5214	Fax:	086 714 5399
E-mail:	henno@ecoelementum.co.za / info@ecoelementum.co.za		
Qualifications & relevant experience	Masters Degree specializing in Environmental Management 10 Years' experience in Environmental Consultancy		
Professional affiliation(s) (if any)	Chartered Environmental Assessment Practitioner South Africa (CEAPSA)		

Table 6: Project Team

Team Member	Qualification	Role
Mr. Henno Engelbrecht	B.Sc Hons Env Mgmt & Anlysis, M.Sc Project Management (final thesis)	Project Manager
Me. Ilze Ueckermann	MA Environmental Management, Registered CEAPSA	Environmental Assessment Practitioner
Mr. Morne Burger	M.Sc Hydrogeology, Pr.Sci.Nat	Geohydrology and Modelling
Dr. Giep du Toit	D.Sc, Pr.Sci.Nat	Geohydrology and Modelling
Mr. Johan Mare	M.Sc, Pr.Sci.Nat	Microbiologist, Surface Water Specialist
Dr. Petro Erasmus	Ph.D	Management Plans
Me. Nicola Gouws	M.Env.Sc	Ecology, Fauna & Flora
Mr. Ferdie Nieman	B.Sc Hons	GIS, Mapping & Field Technician
Mr. Tobias Coetzee	BA Hons	Archaeologist & Heritage Specislist
Me. Leanne George	MA	Archaeologist & Heritage Specialist
Mr. A J Smith	PrEng	Civil Engineering Works, Stormwater Management Planning, Dam Designs and Floodlines
Mr. Kas van der Merwe	B.ing (Agriculture)	Land Capability Assessment

Mr. Cobus Havenga	PrEng	Traffic Impact Assessment
Me. Phyllis Kalele	MA	Social Impact Assessment
Mr. Morne Pretorius	B Tech (Nature Conservation) COMCSC, ASANIRE	Blast Risk Assessment
Dr. Barry Millstead	PhD Geology; Pr.Sci.Nat; MGSSA	Paleontological Impact Assessment

Table 7: Brief commodity overview

Mineral Deposit:	Bituminous coal found in the coal seams of the Witbank Coal Field
Mineable Product:	Coal from a single coal seam horizon will be mined with an estimated thickness of 2.5m – 3.0m at a depth varying from 6.5m to 28m deep.
Reserves:	The estimated mineable in situ resource within the coal seam of the Kebrafield Roodepoort Colliery situated on Portion 17 of the Farm Roodepoort 151IS is 800 000tons of high grade coal.
Mining Method:	Opencast Mining following a roll-over concurrent rehabilitation methodology
Production Rate:	The entire estimated reserve of 800 000tons of high grade coal is proposed to be mined within the three year period at a rate of minimum 50 000tons per month
Planned life of mine:	Three years
Estimated Job Creation:	100 direct employment opportunities

1.2 Legislative Requirements

The following section includes a list of Acts applicable to this project and a brief description of the relevant aspect(s) of the relevant Acts. The aim of this component of the report is to provide a brief overview of the pertinent policies as well as legal and administrative requirements applicable to the proposed opencast mining project entitled Kebrafield Roodepoort Colliery. This section also summarises the policy, legal, and administrative framework applicable to the EIA that has been initiated. Further to this does this section also explain the regulatory authorities responsible for decision making related to the proposed project.

1.2.1 The Constitution of the Republic of South Africa, 1996

The legislative motivation for this project is underpinned by the Constitution of South Africa (Act No. 108 of 1996), which states that:

The State must, in compliance with Section 7(2) of the Constitution, respect, protect, promote and fulfil the rights enshrined in the Bill of Rights, which is the cornerstone of democracy in South Africa. Section 24 of the Constitution states:

24. Environment.-Everyone has the right

- (a) to an environment that is not harmful to their health or well-being; and
- (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-
 - (i) prevent pollution and ecological degradation;
 - (ii) promote conservation; and
 - (iii) secure ecologically sustainable development and use of natural resources while promoting a justifiable economic and social development.

Section 24 of the Constitution of South Africa (Act No. 108 of 1998) requires that all activities that may significantly affect the environment and require authorisation by law must be assessed prior to approval. In addition, it provides for the Minister of Environmental Affairs and Tourism or the relevant provincial ministers to identify:

- new activities that require approval;
- areas within which activities require approval; and
- existing activities that should be assessed and reported on.

Section 28(1) of the Constitution of South Africa (Act No. 108 of 1998) states that “*every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring*”. If such pollution or degradation cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution or degradation.

Appropriate measures may include:

- Assessing the impact on the environment;
- Informing and educating employees about the environmental risks of their work and ways of minimising these risks;
- Ceasing, modifying or controlling actions which cause pollution/degradation;

- Containing pollutants or preventing movement of pollutants;
- Eliminating the source of pollution or degradation; and
- Remedying the effects of the pollution or degradation.

1.2.2 The National Environmental Management Act, 1998 (Act 107 of 1998) [NEMA]

An EIA is being undertaken to comply with the requirements of the NEMA. The NEMA EIA Regulations list activities which require environmental assessment and authorisation prior to construction. These activities are known as 'listed activities', and must be authorised by the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET). The EIA was registered with MDEDET in September 2013, reference number 17/2/3N-289.

The National Environmental Management Act, 1998 (Act 107 of 1998)[NEMA] was first enacted in November 1998 and the amended Act came into effect in June 2010. The NEMA strives to legislate National Environmental Management Policy and has repealed a number of the provisions of the Environment Conservation Act, 1989 (Act 73 of 1989)[ECA]. NEMA is focussed primarily on co-operative governance, public participation and sustainable development.

NEMA makes provisions for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of the State and to provide for matters connected therewith. Section 2 of the Act establishes a set of principles, which apply to the activities of all organs of state that may significantly affect the environment. These include the following:

- Development must be sustainable;
- Pollution must be avoided or minimised and remedied;
- Waste must be avoided or minimised, reused or recycled;
- Negative impacts must be minimised and positive enhanced; and
- Responsibility for the environmental health and safety consequences of a policy, project, product or service exists throughout its entire life cycle.

These principles are taken into consideration when a Government department exercises its powers, for example, during the granting of permits and the enforcement of existing legislation or conditions of approval. The authorities may direct an industry to rectify or remedy a potential or actual pollution or degradation problem. If such a directive is not complied with, the authorities may undertake the work and recover the costs from the responsible industry.

The Environmental Impact Assessment (EIA) process followed is in compliance with the National Environmental Management Act, 1998 (Act 107 of 1998) [NEMA], as amended and the Environmental Impact Assessment Regulations of 2010 (Government Notice No's R544, 545 and 546 of 2010). The proposed development involves 'listed activities', as defined by the NEMA. Listed activities are activities, which may have potentially detrimental impacts on the environment and therefore require environmental authorisation from the relevant authorising body. The proposed development occurs in the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) is the responsible regulatory authority.

Listed activities associated with the proposed project on Portion 17 of the Farm Roodepoort 151 IS, as listed in Regulations 544, 545 and 546 of the NEMA are reflected below. A full Scoping and EIA process is required for activities listed in terms of Regulation 545. A single EIA Report and EMP document will be prepared and submitted to both the DMR and MDEDET for authorisation of the proposed project and listed activities.

NEMA (Act 107 of 1998) GNR 544 of 2010:

9. Infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water -

(i) with an internal diameter of 0,36 metres or more; or

(ii) with a peak throughput of 120 litres per second or more,

excluding where:

a. such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or

where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.

It will be required that water from the opencast mining areas that flow into the pit must be transported to the relevant pollution control facilities, in this case the pollution control dams. Stormwater which has not been contaminated will also need to be diverted away from the opencast mining area.

13. Storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres;

The storage of fuel (especially diesel) for the mining vehicles will be required. Such storage might also be required for the generator required to supply electricity.

11. The construction of:

i. canals;

ii. channels;

- iii. bridges;
- iv. dams;
- v. weirs;
- vi. bulk storm water outlet structures;
- vii. marinas;
- viii. jetties exceeding 50 square metres in size;
- ix. slipways exceeding 50 square metres in size;
- x. buildings exceeding 50 square metres in size; or
- xi. infrastructure or structures covering 50 square metres or more

where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.

The construction of canals and bulk stormwater outlet structures will be required to ensure clean and dirty water separation can take place and that stormwater can be diverted away from the opencast mining area. Dams for the control of polluted water will need to be constructed within the mining area for pollution control facilities. The distance from the watercourse will be dependent on the Water Use License Authorisation that is being applied for simultaneously to this NEMA application.

18. The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from

- i. a watercourse;
- ii. the sea;
- iii. the seashore;
- iv. the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater-

but excluding where such infilling, depositing, dredging, excavation, removal or moving is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or
occurs behind the development setback line.

The activity will be triggered should the Water Use License Authorisation allow the applicant to conduct mining activities within the watercourse (more specifically wetland) areas as defined by the wetland specialist report.

22. The construction of a road, outside urban areas,

- (i) with a reserve wider than 13,5 meters or,
- (ii) where no reserve exists where the road is wider than 8 metres, or

for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.

For the purpose of the Kebrafield Roodepoort Colliery the existing gravel road will have to be reconstructed and diverted away from the mining area to ensure a safe flow of traffic can be achieved. Roads will also need to be constructed within the mining area to ensure the mineable resource can be accessed.

NEMA (Act 107 of 1998) GNR 545 of 2010:

10. The construction of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following:

- i. water catchments,
- ii. water treatment works; or
- iii. impoundments,

excluding treatment works where water is to be treated for drinking purposes.

Water will be required to be transferred between the pollution control facilities for the safe continuation of mining. The most probable of which will be the pollution control dams.

15. Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;

except where such physical alteration takes place for:

- (i) linear development activities; or
- (ii) agriculture or afforestation where activity 16 in this Schedule will apply.

The alteration of current agricultural and grazing land is estimated to be more than 20hectares (estimated 60ha) based on the current mine planning and proposed land owner agreement. Mining is a commercial activity and therefore trigger this activity.

NEMA (Act 107 of 1998) GNR 546 of 2010:

13. The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation,

Currently only desktop ecological assessments have been conducted in support of the mining right EIA and therefore this activity is being applied for since the exact coverage of natural vegetation must still be determined by a registered professional natural scientist. The area have however been used for agricultural purposes and have been ploughed and planted to a certain extent while the remainder has been used for grazing purposes. Initial site investigations did indicate various invasive and alien plant species.

14. The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for:

purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes;

the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list;

the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.

For mining purposes more than 5 hectares will need to be cleared, but similar to the above description must the exact coverage of indigenous vegetation still be determined. However, approximately 50% of the proposed mining layout is situated on agricultural fields which are currently being utilized for crop cultivation and not 75% indigenous vegetation.

1.2.3 National Heritage Resource Act, 1999 (Act No. 25 of 1999) [NHRA]

In terms of the National Heritage Resources Act, 1999 (Act 25 of 1999), a Heritage Impact Assessment will be conducted for the site since the site is greater than 0,5 hectares (ha) in extent, currently estimated to have a footprint of approximately 60ha.

The Act makes provision for the potential destruction to existing sites, pending the archaeologist recommendations through permitting procedures. Permits are administrated by the South African Heritage Resources Agency (SAHRA).

The National Heritage Resources Act legislates the necessity for a cultural and heritage impact assessment in areas earmarked for development that complies with one of the following:

Section 38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorized as-

- (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- (b) the construction of a bridge or similar structure exceeding 50m in length;
- (c) any development or other activity which will change the character of a site-
 - (i) exceeding 5 000 m² in extent; or
 - (ii) involving three or more existing erven or subdivisions thereof; or
 - (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- (d) the re-zoning of a site exceeding 10 000 m² in extent; or
- (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Archaeological impact assessments (AIAs) are often commissioned as part of the heritage component of an Environmental Impact Assessment (EIA) and are required under Section 38(1) of the National Heritage Resources Act NHRA of 1999 (Act 25 of 1999), Section 38(8) of the National Environmental Management Act (NEMA) and the Mineral and Petroleum Resources Development Act (MPRDA).

The process of archaeological assessment usually takes the form of:

1. A scoping or initial pre-assessment phase where the archaeologist and developer's representative establish the scope of the project and terms of reference for the project;
2. A Phase 1 archaeological impact assessment;
3. A Phase 2 archaeological mitigation; and
4. A Phase 3 heritage site management plan.

Phase 1 archaeological impact assessment

Phase 1 archaeological assessments generally involve the identification and assessment of sites during a field survey of a portion of land that is going to be affected by a potentially destructive or landscape-altering activity.

The locations of the sites are recorded and the sites are described and characterised. The archaeologist assesses the significance of the sites and the potential impact of the development on the sites and makes recommendations.

It is essential that the report supply the heritage authority with sufficient information about the sites to assess, with confidence, whether or not it has any objection to a development, indicate the conditions upon which such development might proceed and assess which sites require permits for destruction, which sites require mitigation and what measures should be put in place to protect sites that should be conserved.

Minimum standards for reports, site documentation and descriptions are clearly set out by the South African Heritage Resources Agency (SAHRA) and supported by ASAPA.

The sustainable conservation of archaeological material (in situ) is always the best option for any sites that are deemed to be of importance. The report needs to indicate which sites these are, explain why they are significant and recommend management measures.

In certain kinds of developments which involve massive intervention (mining, dam construction etc), it is not possible to reach a conservation solution other than to develop a programme of mitigation which is likely to involve the total or partial “rescue” of archaeological material and its indefinite storage in a place of safety.

Phase 2: Archaeological mitigation

If a Phase 1 report finds that certain archaeological sites in a development area are of low significance, it is possible to seek permission from the heritage authority for their destruction. The final decision about this is taken by the heritage resources authority, which should give a permit or a formal letter of permission, or in the case of an EIA (in South Africa) issue a comment allowing destruction.

Phase 2 archaeological projects are primarily based on salvage or mitigation excavations preceding development that will destroy or impact on a site. This may involve collecting of artefacts from the surface, excavation of representative samples of the artefactual material to allow characterisation of the site and the collection of suitable materials for dating the sites. The purpose is to obtain a general idea of the age, significance and meaning of the site that is to be lost and to store a sample that can be consulted at a later date for research purposes. Phase 2 excavations should be done under a permit issued by SAHRA, or other appropriate heritage agency, to the appointed archaeologist. Permit conditions are prescribed by SAHRA, or other appropriate heritage agencies, and include as minimum requirements reporting back strategies to SAHRA, or other appropriate heritage agencies, and deposition of excavated material at an accredited repository.

Should further material be discovered during the course of development, this must be reported to the archaeologist or to the heritage resources authority and it may be necessary to give the archaeologist time to rescue and document the findings. In situations where the area is considered archaeologically sensitive the developer will be asked to have an archaeologist monitor earth-moving.

Phase 3: Management plan for conservation and planning, site museums and displays

On occasion, the Phase 2 may require a Phase 3 programme involving the modification of the site or the incorporation of the site into the development itself as a site museum, a special conservation area or a display. Alternatively it is often possible to re-locate or plan the development in such a way as to conserve the archaeological site or any other special heritage significance the place may have. For example in a wilderness area or open space when sites are of public interest the development of interpretative material is recommended and adds value to the development.

Permission for the development to proceed can be given only once the heritage resources authority is satisfied that measures are in place to ensure that the archaeological sites will not be damaged by the impact of the development or that they have been adequately recorded and sampled. Careful planning can minimise the impact of archaeological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

The process as explained above allows the rescue and preservation of information relating to our past heritage for future generations. It balances the requirements of developers and the conservation and protection of our cultural heritage as required of SAHRA and the provincial heritage resources authorities.

1.2.4 National Water Act, 1998 (Act No.36 of 1998) [NWA]

The National Government is responsible for the equitable allocation and use of the scarce and unevenly distributed water resources of the nation. The aim of water resource management is to ensure the sustainable use of water through the protection of the quality of water resources for the benefit of all water users. There is a need for the integrated management of all aspects of water resources and the delegation of management functions to a regional or catchment level where appropriate, to enable everyone to participate. Provision is made for sharing of certain water resources with other countries.

The preamble to the National Water Act, 1998 (Act No.36 of 1998) can be summarized as follow;

- Recognising that water is a scarce and unevenly distributed national resource which occurs in many different forms which are all part of a unitary, inter-dependent cycle;
- Recognising that while water is a natural resource that belongs to all people, the discriminatory laws and practices of the past have prevented equal access to water, and use of water resources;

- Acknowledging the National Government's overall responsibility for and authority over the nation's water resources and their use, including the equitable allocation of water for beneficial use, the redistribution of water, and international water matters;
- Recognising that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users;
- Recognising that the protection of the quality of water resources is necessary to ensure sustainability of the nation's water resources in the interests of all water users; and
- Recognising the need for the integrated management of all aspects of water resources and, where appropriate, the delegation of management functions to a regional or catchment level so as to enable everyone to participate.

The National Water Act aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level. The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways, which take into account:

- Meeting the basic human needs of present and future generation;
- Promoting equitable access to water;
- Redressing the results of past racial discrimination;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Providing for growing demand for water use;
- Protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources;
- Meeting international obligations; and
- Managing floods and droughts.

The mine envisaged to engage in several water uses that need to be authorised in terms of section 21 of the National Water Act, 1998 (Act 36 of 1998). The water uses that need to be applied for are:

- Section 21 (a) for the taking of water from a resource (for abstraction of potable water from a borehole and use of water from pollution control dam for dust suppression). No surface water abstraction is allowed within the quaternary catchment (under GA) as specified in Table 1.1 within Government Gazette Notice No 26187 during March 2004. The taking of groundwater is regulated in terms of quantity and rate of abstraction by Table 1.2 within the same Gazette Notice mentioned.
- Section 21 (c) and (i) in respect of the altering of water courses by mining infrastructure

- Section 21 (g) for the disposing of mine waste in a manner which may impact on a water resource (for pollution control dams and discard dumps)
- Section 21 (g) for the dirty water containment structures (PCD's)
- Section 21 (j) for removing of water from open pit operations

There are no General Authorisations applicable to this application.

The WULA is being undertaken as a separate process and does not fall within the scope of this environmental authorisation process under NEMA although the applications are integrated in terms of addressing the same impacts for the same proposed project.

In an attempt to assist the regulatory authority with the task of reviewing and issuing the Water Use License, the document will:

- Give a brief overview of the proposed activities of the Kebrafield Colliery Project;
- Identify the water uses as defined in Section 21 of the National Water Act, 1998 (Act 36 of 1998) applicable to the project;
- Provide all completed DW forms and legal administrative documents; and
- Provide an overview of the potential impacts on the surface water resources to assist with the decision making process.

1.2.5 Integrated Environmental Management [IEM] (DEAT Guideline Series)

Integrated Environmental Management (IEM) is a philosophy, which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process. This philosophy aims to achieve a desirable balance between conservation and development (Department of Environmental Affairs: DEAT, 1992). The IEM guidelines intend endearing a pro-active approach to sourcing, collating and presenting information at a level that can be interpreted at all levels.

A series of overview information documents on the concepts of, and approaches to, integrated environmental management (IEM) has been used during this EIA. IEM is a key instrument of South Africa's National Environmental Management Act (NEMA). South Africa's NEMA promotes the integrated environmental management of activities that may have a significant effect (positive and negative) on the environment. IEM provides the overarching framework for the integration of environmental assessment and management principles into environmental decision-making. It includes the use of several environmental assessment and management tools that are appropriate for the various levels of decision-making.

The aim of this document series is to provide general information on techniques, tools and processes for environmental assessment and management. The material in the documents draws upon experience and knowledge from South African practitioners and authorities, and published literature on international best practice.

1.2.6 National Environmental Air Quality Act (Act No 39 of 2004) [NEMAQA]

The National Environmental Management: Air Quality Act, Act No. 39 of 2004 has replaced the older Atmospheric Pollution Prevention Act (APPA), Act 45 of 1965. The Air Quality Act requires a shift from source-based air pollution control to a receiving environment, air quality management approach.

Key features of the new approach to air quality governance include:

- Decentralisation of air quality management responsibilities;
- A requirement that all significant sources be identified, quantified and addressed;
- Setting of ambient air quality targets as goals to achieve emission reductions;
- Recognition of source-based, command-and-control measures (i.e. authorities set source requirements and emission limits requiring adherence by responsible parties), in addition to alternative measures, including market incentives and disincentives, voluntary programmes, and education and awareness;
- Promotion of cost-optimised mitigation and management measures;
- Required air quality management planning by authorities and emission reduction and management planning by sources;
- Access to information and public consultation.

The new approach has significant implications for government, business and civil society.

The National Environmental Management: Air Quality Act 39 of 2004 has shifted the approach of air quality management from source-based control to receptor-based control. The Act made provision for national ambient air quality standards, however it is generally accepted that more stringent standards can be established at the Provincial and Local levels. Emissions are controlled through the listing of activities that are sources of emission and the issuing of emission licences for these listed activities. Atmospheric emission standards have been established for each of these activities and an atmospheric licence is now required to operate. The issuing of emission licences for Listed Activities will be the responsibility of the Metropolitan and District Municipalities. Municipalities are required to *'designate an air quality officer to be responsible for co-ordinating matters pertaining to air quality management in the Municipality'*. The appointed Air Quality Officer will be responsible for the issuing of atmospheric emission licences or the Air Quality Officer could delegate the responsibility to the Director of community environmental services.

Legislation for Local Government

The Local Government: Municipal Systems Act 32 of 2000, together with the Municipal Structures Act 117 of 1998, establishes local government as an autonomous sphere of government with specific powers and functions as defined by the Constitution. Section 155 of the Constitution provides for the establishment of Category A, B and C municipalities each having different levels of municipal executive and legislative authorities. According to Section 156(1) of the Constitution, a municipality has the executive authority in respect of, and has the right to, administer the local government matters (listed in Part B of Schedule 4 and Part B of Schedule 5) that deal with air pollution.

Ambient Air Quality Guidelines and Standards

Guidelines provide a basis for protecting public health from adverse effects of air pollution and for eliminating, or reducing to a minimum, those contaminants of air that are known or likely to be hazardous to human health and well-being (WHO, 2000). Once the guidelines are adopted as standards, they become legally enforceable. The South African Bureau of Standards (SABS), in collaboration with DEA, established ambient air quality standards for criteria pollutants as which will need to be adhered to during this particular project.

1.2.7 Mineral and Petroleum Resources Development Act (Act 28 of 2002) [MPRDA]

Mining operations require environmental authorisation from the DMR for the mining right application in terms of Section 22 of the MPRDA. The following issues require consideration whilst compiling the Environmental Impact Assessment Report.

- The objectives of the MPRDA include giving effect to Section 24 of the Constitution by ensuring that the Nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development. (Section 2(h) of the MPRDA);
- The principles set out in Section 2 of the National Environmental Management Act, 1998 (Act 107 of 1998)[NEMA] serve as guidelines for the interpretation, administration and implementation of the environmental requirements of the MPRDA. (Section 37(1)(b) of the MPRDA);
- Section 38(1)(a) of the MPRDA requires that effect be given to the general objectives of Integrated Environmental Management laid down in the NEMA. Integrated Environmental Management (IEM) is a philosophy, which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process in order to achieve a desirable balance between conservation and development;

- The environmental management programme to be submitted is not limited to but must *inter alia* include the requirements of regulation 51 of the MPRDA. For instance, where regulation 51(a)(ii) refers to measures for the prevention, management and remediation of each environmental impact, these clearly must be understood in the context of the NEMA where the general objectives of the IEM include ensuring that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them. This clearly requires a description of the mining project that lists each activity pertaining to the mining project, in order that each such activity can be assessed.

The MPRDA Amendment Act further states that:

- Environmental reports, as required in terms of Chapter 5 of the NEMA must be submitted to the DMR (Section 18);
- Consultation with the landowner, lawful occupier and any interested and affected party must occur in the prescribed manner and the result of the consultation must be included in the relevant environmental reports (Section 18); and
- The mining right may only be granted if the mining will not result in unacceptable pollution, ecological degradation or damage to the environment and an environmental authorisation is issued (Section 19).

1.2.8 National Environmental Management: Waste Act (Act 59 of 2008) [NEMWA]

The National Environmental Management: Waste Act (Act 59 of 2009) aims to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters. Furthermore this Act aims to provide for national norms and standards for regulating the management of waste by all spheres of government. It provides guidance for the licensing and control of waste management activities and gives regulations for the rehabilitation and remediation of contaminated land.

The NEMWA requires that all waste management activities must be licensed and that the licensing procedure must be integrated with an environmental assessment process. On 3 July 2009, GN R. 718 was published with definitions of the waste management activities that require licensing. These activities are divided into Category A (activities requiring a basic assessment) and Category B (activities requiring scoping and EIA). The basic assessment and scoping and EIA processes as described in the EIA Regulations GNR 543 should be followed.

This Act does not apply to:

- a) Radioactive waste that is regulated by the Hazardous Substances Act, 1973 (Act No. 15 of 1973), the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999), and the Nuclear Energy Act, 1999 (Act No. 46 of 1999);

- b) Residue deposits and residue stockpiles that are regulated under the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- c) The disposal of explosives that is regulated by the Explosives Act, 2003 (Act No. 15 of 2003).

Responsibilities within NEMWA include;

1. Avoid generating waste. If the company can't avoid this, reduce the harmfulness and the amount of waste generated;
2. Re-use, recycle or recover waste;
3. Ensure that the waste is treated before disposing of it in an environmentally accepted way;
4. Manage your waste in such a way that it isn't a danger to anyone's health, the environment, or causes a nuisance through noise, odour or visual impacts;
5. If at all possible, prevent any other person from contravening a provision of the *Act*; and
6. Take reasonable control measures to prevent waste from being used for an unauthorised purpose. An example of an unauthorised purpose would be using containers that previously held chemicals to store clean water.

1.2.9 Mine Health and Safety Act, 1996 (Act No. 29 of 1996) [MHSA]

The main aim of the MHSA is to provide for protection of the health and safety of employees and other persons at mines and, for that purpose-

- to promote a culture of health and safety;
- to provide for the enforcement of health and safety measures;
- to provide for appropriate systems of employee, employer and State participation in health and safety matters;
- to establish representative tripartite institutions to review legislation, promote health and enhance properly targeted research;
- to provide for effective monitoring systems and inspections, investigations and inquiries to improve health and safety;
- to promote training and human resources development;
- to regulate employers' and employees' duties to identify hazards and eliminate, control and minimise the risk to health and safety;
- to entrench the right to refuse to work in dangerous conditions; and
- to give effect to the public international law obligations of the Republic relating to mining health and safety;
- and to provide for matters connected therewith.

The Mine Health and Safety Inspectorate was established in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996), as amended, for the purpose of executing the statutory mandate of the Department of Mineral Resources to safeguard the health and safety of mine employees and communities affected by mining operations.

1.2.10 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) [NEMBA]

The overarching aim of the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA), within the framework of NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa, and of the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

The South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (inter alia) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems.

NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 8. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established.

It is also appropriate to undertake a Fauna and Flora Impact Assessment for developments in an area that is considered ecologically sensitive which require environmental authorisation in terms of NEMA, with such Assessment taking place during the EIA phase.

The NEMBA is relevant to the proposed project as removal of overburden and mining may impact negatively on biodiversity. The project proponent is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity, to obtain permits if required and to also invite SANBI to provide comments on any documentation resulting from the proposed development.

.2.11 Conservation of Agricultural Resources Act (Act 43 of 1983) [CARA]

To provide for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.

1.2.12 Occupational Health and Safety Act (Act 85 of 1993)[OSHAct]

To provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith.

In Section 8 General duties of employers and their employees it is stated that:

“Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of the employees.”

(2) The matters to those duties refer include in particular:

- a. The provision and maintenance of systems of work, plant and machinery that, as far as reasonably practicable, are safe and without risk to health;
- b. Taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety and health of employees;
- c. Making arrangement for ensuring as far as reasonably practicable, the safety and absence of risks to health in connection with the production. Processing, use, handling, storage and transport of articles or substances;
- d. Establishing, as far as reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and he shall, as far as reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures;
- e. Providing such information, instruction, training and supervision as may be necessary to ensure, as far as reasonably practicable, the health and safety of employees;
- f. As far as reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store, or transport any article or substance or to operate any plant or machinery, unless precautionary measures contemplated in paragraph (b) and (d), or any precautionary measures which may be prescribed, have been taken;

- g. Taking all necessary measures to ensure that the requirements of this Act are complied with by every person in his employment or on the premises under his control where plant and machinery is used;
- h. Enforcing such measures as may be necessary in the interest of health and safety;
- i. Ensuring that work is performed and that plant and machinery is used under the general supervision of a person trained to understand the hazards associated with it and who has the authority to ensure that precautionary measures taken by the employer are implemented; and
- j. Causing any employees to be informed regarding the scope of their authority as contemplated in Section 37(1) (b).

1.3 Administrative Framework

1.3.1 Department of Mineral Resources [DMR]



Mine environmental management forms an integral part of the management of mineral resources in South Africa. In order for the department to effectively manage it has to undertake research, develop mine environmental policies (legislation, strategies), provide strategic guidance on mine environmental management, mine rehabilitation, water ingress, mine environmental legacies and on sustainable development.

The heritage of mining which extends for over a century has left a scourge of derelict and ownerless mines which cause serious environmental and health hazards, particularly for communities living around these areas. The department has prioritised management of rehabilitation of these mines as categorised on earlier established data base; to this end a strategy has been developed and will be implemented.

The Department of Mineral Resources (DMR) through its Mineral Regulation Branch (MRB) is responsible for regulating the mining and minerals industry to achieve transformation and contribute to sustainable development. The purpose of the MRB is to administer the MPRDA and other applicable legislation. Its objectives are to ensure the granting of prospecting and mining rights in terms of the Act and to promote mineral development, urban renewal, rural development and black economic empowerment. It is responsible for co-ordinating and liaising with national, provincial and local government structures for efficient governance. It is also tasked with addressing past legacies with regard to derelict and ownerless mines and enforcing legislation regarding mine rehabilitation. The DMR through its MRB is responsible for authorising the EMP amendment in terms of the MPRDA and liaising with MDEDET in terms of the NEMA EIA authorisation process.

1.3.2 Mpumalanga Department of Economic Development, Environment and Tourism [MDEDET]



The Department of Economic Development, Environment and Tourism were formed after the split of the then Department of Finance and Economic Affairs in 2005. They are the premier Department tasked with the responsibility to drive all economic development and planning initiatives in the province of Mpumalanga. The Department provides oversight role on the work of three agencies which are: Mpumalanga Economic Growth Agency (MEGA), Mpumalanga Gambling Authority and Mpumalanga Tourism and Parks Agency.

The Department of Economic Development, Environment and Tourism is mandated to steer provincial economic growth activities and ensure the preservation of the environment, in order to speed up economic growth and transform the economy to create decent work and sustainable livelihood for the people of Mpumalanga.

In South Africa, EIA is the responsibility of both national and provincial government institutions. Policy formulation and coordination takes place at national level, while approval of EIAs for most development proposals has been delegated to the provinces. In terms of the EIA Regulations of 2010 the provinces are defined as competent authorities for environmental authorisation for most of the listed activities, i.e. they are empowered to authorise development activities. Therefore, in terms of the NEMA authorisation process for the activities listed the responsibility for environmental authorisation rests with MDEDET.

1.3.3 Department of Water Affairs [DWA]



The Department of Water Affairs is the custodian of South Africa's water resources. It is primarily responsible for the formulation and implementation of policy governing this sector. It also has an overriding responsibility for water services provided by local government. While striving to ensure that all South Africans gain access to clean water and safe sanitation, the water sector also promotes effective and efficient water resources management to ensure sustainable economic and social development.

South Africa's scarce water resources are under increasing pressure. Water resources will have to be used efficiently, effectively and wisely if the country wishes to build a sustainable future. In order to do this, one needs to know how much water is used, by whom, and where. Once this is known, one will be able to measure it against how much water is actually available for use. In some areas it could be found that there is still extra water

that can be made available for use. In other areas there is already more water being used than the water resources can provide without considerable damage to the aquatic ecosystems.

The National Water Act (Act 36 of 1998) gives the Department of Water Affairs the tools to gather the information that we need for the optimal management of our water resources. The registration of water use is one of these tools. All water users who are using water for agriculture: aquaculture, agriculture: irrigation, agriculture: watering livestock, industrial, mining, power generation, recreation, urban and water supply service must register their water use. This covers the use of surface and ground water.

1.4 Project Motivation: Need and Desirability

South Africa's coal industry is at a crossroads and unless government makes the right choices, and soon, Eskom will not be able to keep the country's lights on, a new report has shown. The SA Coal Road Map, which was published after years of research into the state of SA's coal mining industry and its likely future, calls for, among other things, urgent improvements in SA's investment climate. Confirming Eskom's claims that it faces a looming coal supply crunch, the report warns that should government delay, or make poor decisions, there will be serious economic consequences. The road map was established under the auspices of the Fossil Fuel Foundation and was compiled with the support of the coal producers, Eskom and the departments of energy and mineral resources. Existing coal supply resources to Eskom are now fast running out, in part because the power stations have been run at higher utilisation rates than originally planned.

Repeated delays on bringing the new Medupi and Kusile stations on line mean that Eskom must keep the old power stations running, and they need new sources of coal to do so. The road map notes: "At present investment in SA is being deterred due to the unfavourable policy and legislative environment and labour risks and better returns in other commodities and geographies." Though some of these investors could be replaced by domestic entities, if the desirability of investing in SA coal mines declines further, this could lead to future reductions in the availability of coal for both local and export markets." During these times of difficulty it must be noted that the proposed Kebrafield Roodepoort Colliery will contribute positively to increased investment in the South African coal mining sector ensuring more coal is available for both the local and export markets.

Mining in South Africa directly contributed to the establishment of the Johannesburg Stock Exchange in the late 19th century, and today it still accounts for a third of its market capitalisation. It is clear how much mining in South Africa has shaped the country politically, culturally, and economically. The South African mining sector has provided the critical mass for a number of industries that are either suppliers to the mining industry, or users of its products. These include energy, financial services, water and engineering services, and specialist seismic geological and metallurgical services. The Kebrafield Roodepoort Colliery will not only contribute directly to the

South African economy, but will also contribute to the development and growth of other industries supporting the mining operation.

The Kebrafield Roodepoort Colliery will contribute to the South African mining sector which currently;

- contributes an average of 20% to South Africa's GDP, of which about 50% is contributed directly;
- boasts total annual income exceeding R330 billion;
- is one of the country's major employers, with more than one million people in mining-related employment;
- is the largest contributor by value to black economic empowerment in the economy.

As a coal producer, South Africa currently ranks 5th globally, producing an average of 224 million tonnes of marketable coal each year. Major coalfields are found in the Highveld and Low-veld regions of South Africa, with Witbank and Ermelo being the major mining hubs. Coal provides almost 80% of South Africa's primary energy needs. Coal mining in South Africa plays a significant role in the country's economy as it is responsible for nearly three quarters of Eskom's fuel supply. The industry is also responsible for supplying the coal-to-liquids (CTL) industry, developed by the South African fuel company, SASOL, who produces around 35% of the country's liquid fuel. The Kebrafield Roodepoort Colliery will be directly involved in growing and advancing the South African economy as a coal supplier to the existing markets.

South Africa's most abundant source of energy is coal, which is mostly of low quality with a correspondingly low heat value and high ash content. The majority of the country's coal deposits that are suitable for cheap power generation are found in eastern and south-eastern Mpumalanga and in northern KwaZulu-Natal (KZN). In Gauteng and the northern Free State it is generally found at shallow depths and in thick seams, whereas in KZN, the seams are deeper and thinner, but of a higher quality. Worldwide, coal is one of the fastest growing energy sources. Demand for coal is soaring, especially in the emerging Indian and Chinese markets. With the increase in demand, global coal prices are following the escalating oil price, making various coal reserves now economically feasible to mine. The growth in peak electricity demand in South Africa is increasing. On average, the demand for electricity in South Africa has increased by more than 3% over the last five years. The impact of the growth in demand for electricity is that all the Eskom power stations are being scheduled to operate at their optimum output, with various suppliers providing the required supply of coal.

South Africa's threatened mining sector lost 23 000 jobs in the 12 months to June 2013, and 4 000 of those were lost between April 2013 and June 2013. The Kebrafield Roodepoort Colliery will contribute to creating new direct and indirect job opportunities at this critical point in time in the mining sector where massive job losses are present. The mining sector has the potential to create hundreds of thousands of new jobs in South Africa and the rest of Africa – provided that governments, business and labour start to see eye to eye. This is imperative as with the strife currently facing the South African mining industry the enormous job creation potential of mining is being

overlooked. International research has shown that mining has a massive multiplier effect on job creation. For example, studies show that for each direct job created by the Yanacochagold mine in Peru, 14 additional jobs were indirectly created. Mines spend millions of dollars on equipment, maintenance, food and other services, either through suppliers or local contractors. This translates into many new jobs in support industries linked to the mining sector.

The need to redress past racial and gender discrimination

Kebrafield (Pty) Ltd: Roodepoort Colliery is an emerging coal company and registered as a 30% Black Empowered Company.

Kebrafield (Pty) Ltd: Roodepoort Colliery is committed to the development of the South African workforce and to the availability of the mining operations skills and competence required for the successful mining and production of this commodity.

Socio-economic impact if the proposed project is authorised

The mining activities will have a positive effect on the socio-economic structure of the region. The proposed mining activities will create new employment opportunities, thus impacting indirectly on dependents and the economic environment. Should the application be successful, it will have a positive effect.

The main positive impacts are:

- Employment to a number of people during the construction and operational phases. The numbers of jobs created are significant to the local and regional economy.
- A large capital investment and substantial offshore revenue generation.
- Capital investment in the form of the company payroll.
- Significant amounts paid to the government in the form of local, regional and national taxes and levies.
- Creation and support of service-sector jobs, the annual procurement of large quantities of consumables and the outsourcing of service provision to local service providers.
- The generated produce will go towards Eskom's Power Generation needs and therefor the electricity output needed in South Africa

The positive impacts described above can be even further enhanced in the context of the communities surrounding the project site. Further measures to enhance socio-economic opportunities should focus on the promotion and development of small and medium enterprises in the local communities, especially due to the

short timeframe expected. Larger contracts should be broken down into smaller more accessible contracts and local people should be employed where possible.

If this project does not continue, the applicant will be prevented to invest large sums of money reaching a desperate community in the form of salaries, which will have a direct impact on the local community. The presence of the mining activity, the employment of local persons and the utilisation of local services will result in an increased income for local communities and business and an increased tax base for traditional authorities and municipalities. These opportunities will be lost should the project not proceed, and will have consequences on local, regional and national.

Investments already made by the applicant

The applicant made various investments in terms of appointment of specialists to conduct environmental investigations in support of the Environmental Impact Assessment and Water Use License Application.

- A Mining Right have been obtained from the Department of Mineral Resources (Ref: MP30/5/1/2/2/479 MR);
- EMP, EIA and Geo-hydrological studies and impact assessments have been conducted. In South Africa, legislation sets out the legal framework governing mineral exploration and exploitation related activities. These include EIA, EMP and Closure Plans to be submitted with application for a mining right. This ensures adequate management for the anticipated impacts that was identified during the EIA phase;
- Water samples have been taken to determine a reference condition which must be maintained during operation of the colliery.
- Floodline Report has been compiled by Avon Engineering (Pty) Ltd
- Engineer Design drawings for Pollution Control Facilities, Stormwater Management as well as Water Balances have been determined for the Roodepoort Colliery and final lay-out of the mining infrastructure has been based on these designs.
- Wetland Delineations, Ecological Investigations (fauna and flora) have been conducted by Menco
- The Water Use License with all supporting specialist studies and documentation has been submitted to the Department of Water Affairs for evaluation and issuance
- All specialist studies as listed earlier on in the report have been completed

2. Description of the Proposed Activity

2.1 General Overview

Section 39(3)(a) of the National Environmental Management Act (Act 107 of 1998) read together with Regulation 50(a) of the MPRDA further requires a description of the proposed activity including all infrastructure and associated activities.

The Kebrafield Roodepoort Colliery will be an opencast mine producing 800 000tons of high grade Bituminous Coal found in a single coal seam (2.5 -3.0m thick) of the Witbank Coal Field at depths varying from 6.5m to 28m deep. The colliery will be covering an extent of approximately 60ha of the 410ha Portion 17 of Roodepoort 151 IS farm (approximately 15% of the farm). The extent of the mining area is predetermined by the extent of the coal seam as has been determined during the prospecting phase of the project. The mining right with reference MP30/5/1/2/2/479 MR has already been awarded to Kebrafield (Pty) Ltd and the Mining Right EIA and EMPR has been approved and stamped on 2011-06-06. An application for the Water Use License is being made concurrently with this EIA to ensure authorisation can be granted at the same time (expected authorisation end 2014) to enable the project to commence.

The larger extent of the mining right entails a life of mine of 30 years and covers various farm portions, although for this particular EIA authorisation only the first phase of the project is being applied for with an estimated life of mine of approximately three years. Future applications for the remainder of the reserve as approved in the Mining Right will be lodged with the Department as separate applications due to the size and extent of the operation making it very difficult to apply for everything at once. The scope and extent of the Kebrafield Roodepoort Colliery therefore has been limited to 60ha on Portion 17 of the Farm Roodepoort 151 IS.

Mining methods vary widely and depend on the location, type and size of mineral resources. Surface mining methods are most economical in situations where mineral deposits occur close to the surface (e.g. coal, salts and other evaporite deposits or road quarry material) or form part of surface deposits (e.g. alluvial gold and diamonds, and heavy mineral sands). For this specific project the mining of coal by means of surface mining methods are viable due to the fact that the resource is situated close enough to the surface to make it economically mineable. Typical surface mining methods include: strip mining and open pit mining, as well as dredge, placer and hydraulic mining in riverbeds, terraces and beaches. The Kebrafield Roodepoort Colliery will be mined by means of open pit or also known as opencast mining methods following a roll over rehabilitation sequence. These activities always disrupt the surface and this, in turn, affect soils, surface water and near-surface ground water, fauna, flora and all alternative types of land-use (Fuggle & Rabie, 1996; Ashton, 1999).

Besides the rate and method of mining, the location, variety and scale of mine infrastructure also influences the nature and extent of impacts. The Kebrafield Roodepoort Colliery will be mined relatively quickly in a period of one year compared to other mining operations that could last for several years and/or even decades. The fast mining sequence will ensure impact duration during mining is short. Typical mine infrastructure includes: haul roads and spoil dumps; surface facilities (e.g. offices, workshops, car parks and warehouses); tailings and waste rock disposal areas; transport and service corridors (e.g. railway lines, roads, pipelines, conveyers, power and water corridors); product stockpiles; chemicals and fuel storage and housing facilities (Australian Environmental Protection Agency, 1995-1996; Fuggle & Rabie, 1996; Ashton, 1999; Weaver & Caldwell, 1999).

The figures below give an overview of the mine planning as is currently anticipated. This layout will change as specialist investigations and studies are completed and also according to the requirements of the final Record of Decision for both the NEMA and WULA processes. The images below is one technical design drawing which was created based merely on exploration drilling results, while the second image includes an initial high level wetland study and aerial image overlay. Which can be noted already is that a section of opencast has been indicated within the wetland area to the east, although this was initial planning and will be examined by a wetland specialist team to determine the viability of this section of mining. The anticipated result is that the section of boxcut indicated to the east of the main mining layout will not be included in the mine plan as this is too close to the sensitive receptor. The wetland specialist team and ecologists has made their recommendations regarding the required buffer distances which must be adhered to when mining in proximity of sensitive receptors and therefore has been acknowledged in this EIA.

Table 8: Proposed employee structure

Occupational Category	Number of Employees
Senior Management	4
Geologist and Mine Planner	2
Survey and assistant	2
Safety, Health and Environment	5
Sub-total: Skilled	13
Bulldozer Operators	4
Hydraulic Excavator operator	4
Articulated Dump Truck Operator	10
General Operators	34
Grader Operator	5
Water Bowser	4
Overburden Drill Operator	6
Drill Assistant	4
Blaster Assistant	6
Blasting technician	2
Relief (sick) and temporarily	8
Sub-total: Contract Mining Labour	87
TOTAL	100

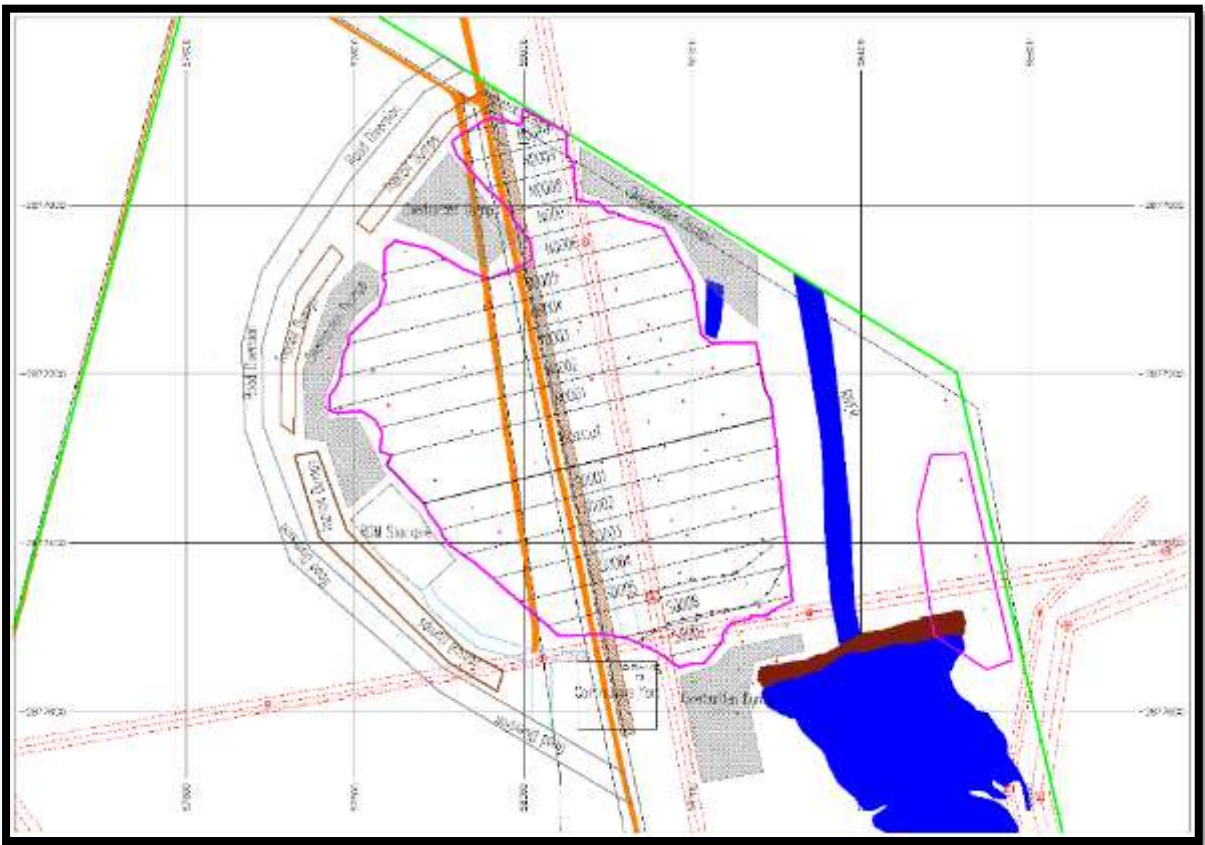


Figure 1: Mine planning layout according to the exploration drilling results

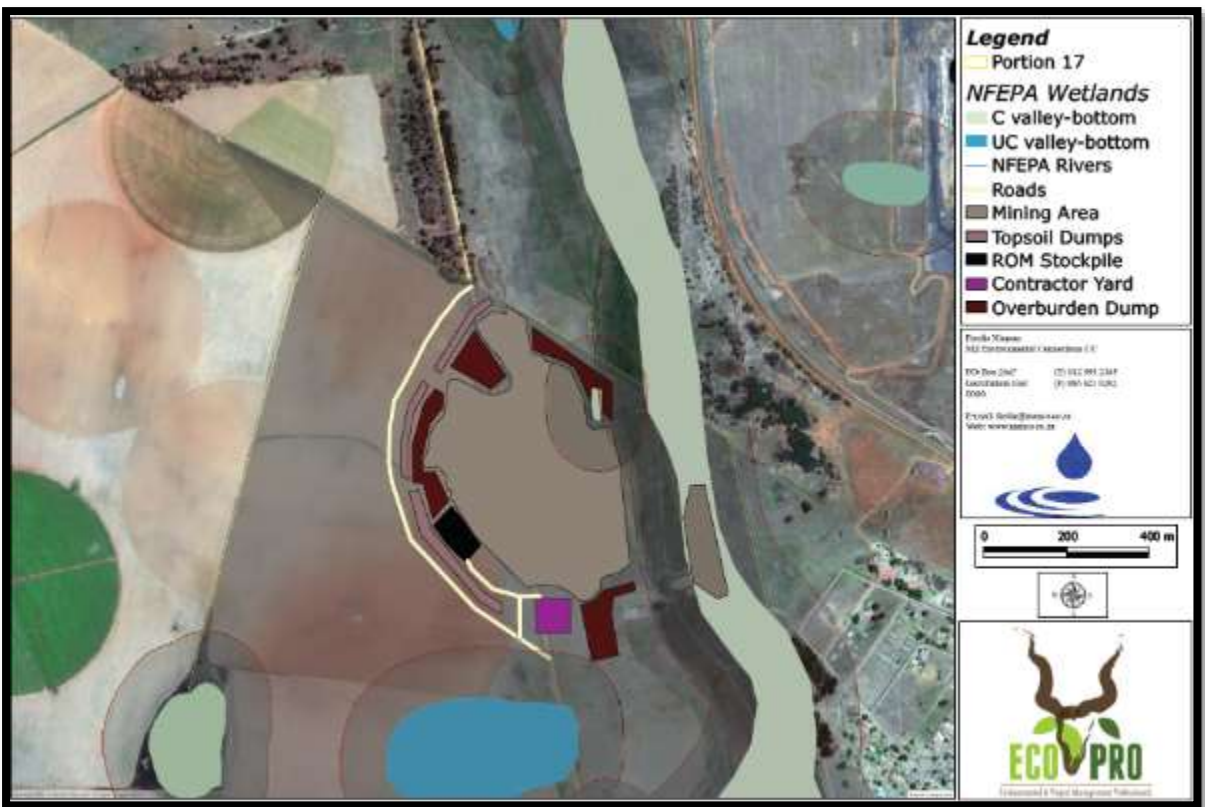


Figure 2: Mine planning layout with Aerial imagery overly

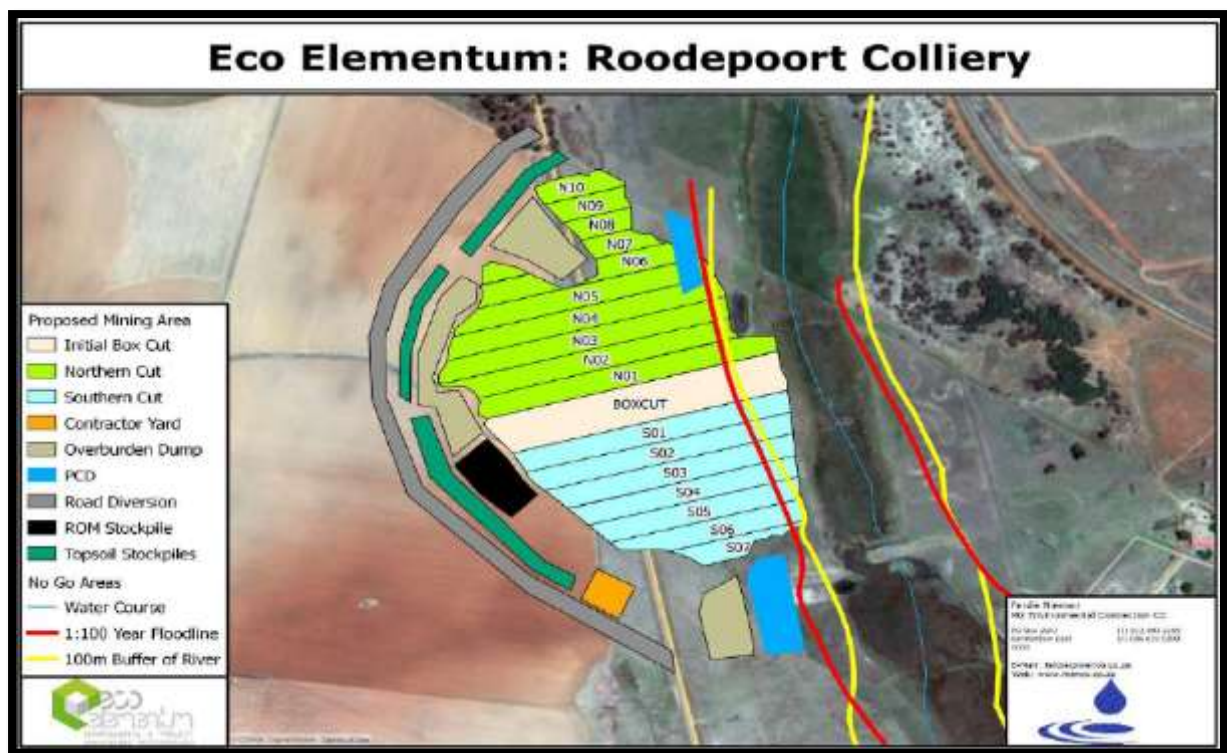


Figure 3: Mine infrastructure layout indicating boxcut sequence

As a summary the following activities will be established and are associated with the proposed Kebrafield Roodepoort Colliery;

- Site preparation;
- Box cut opencast mining with a roll over rehabilitation sequence;
- Crushing and screening of the ROM coal;
- Access road, haul road construction and road diversion of the existing road;
- Semi temporary site offices and security office;
- Semi temporary sanitation and change house;
- Stores and store yard;
- Workshop and maintenance area;
- Bulk fuel storage;
- Pollution control facility/dam(s) (evaporation and dust suppression use);
- Clean and dirty water separation system;
- Trenching;
- Fencing;
- Mine fleet hard park;
- Staff and visitors parking;
- Drilling, blasting and explosives handling;
- Topsoil, subsoil, overburden, discard and ROM stockpiles;

- Weighbridge;
- Waste management;
- Mine closure and rehabilitation.

2.2 Site Preparation

Site preparation mainly deals with the stripping and stockpiling of topsoil prior to the mining activities commencing as this might affect the quality and quantity of available valuable topsoil resources. The main objectives of soil management are to:

- provide sufficient stable topsoil material for rehabilitation (in this case concurrently as mining continues);
- optimise the preservation and recovery of topsoil for rehabilitation;
- identify soil resources and stripping guidelines;
- identify surface areas requiring stripping (to minimise over clearing);
- manage topsoil reserves so as to not degrade the resource;
- identify stockpile locations and dimensions; and
- identify soil movements for rehabilitation use.

In accordance with the objective of providing sufficient stable soil material for rehabilitation and to optimise soil recovery, the following strategies have been adopted:

- stockpiles to be located outside proposed mine disturbance areas;
- construction of stockpiles by dozers rather than scrapers to minimise structural degradation;
- construction of stockpiles with a “rough” surface condition to reduce erosion hazard, improve drainage and promote revegetation; and
- revegetation of stockpiles with appropriate fertiliser and seed in order to minimise weed infestation, maintain soil organic matter levels, soil structure and microbial activity and maximise the vegetative cover of the stockpile depending on the exposure timeframes.

Disturbance areas will be stripped progressively (ie. only as required) so as to reduce erosion and sediment generation, to reduce the extent of topsoil stockpiles and to utilise stripped topsoil as soon as possible for rehabilitation. Rehabilitation of disturbed areas (ie. roads, embankments and stripped mining footprint) will be undertaken as practicable after these structures are completed or as areas are no longer required. Soil surveys over the open cut area, beneath proposed mine waste emplacements and other infrastructure areas will determine the depth of topsoil. It should be noted that it is important that for topsoil recovered from the areas it is required that underlying material is not inadvertently collected since it is unsuitable for reuse in rehabilitation.

Based on the final void having a considerable surface area relative to the total area mined and topsoil being recovered from all areas to be mined, it is considered that a topsoil surplus over the life of mine will occur.

However, the Project topsoil budget will be reviewed following completion of topsoil recovery from the deeper profiles within the Kebrafield Roodepoort Colliery.

A general protocol for soil handling is presented below and includes soil handling measures which optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth:

- The surface of the completed stockpiles will be left in a “rough” condition to help promote water infiltration and minimise erosion prior to vegetation establishment;
- Topsoil stockpiles to have a maximum height of 3m in order to limit the potential for anerobic conditions to develop within the soil pile;
- Topsoil stockpiles to have an embankment grade of approximately 1V:4H (to limit the potential for erosion of the outer pile face);
- Topsoil stockpiles will be seeded and fertilised; and
- Soil rejuvenation practices will be undertaken if required prior to re-spreading as part of rehabilitation works.

2.3 Box Cut Opencast Mining with a Roll-over Rehabilitation Sequence

The most economical method of coal extraction from coal seams depends on the depth and quality of the seams, and also the geology and environmental factors of the area being mined. The impact of coal mining processes is generally differentiated by whether they operate on the surface or underground. In this instance the mineral will be won by means of opencast surface mining methods as indicated in the figures above. Coal is mined only where technically feasible and economically justifiable. Evaluation of technical and economic feasibility of a potential mine requires consideration of many factors: regional geologic conditions, overburden characteristics, coal seam continuity, thickness, structure, quality, and depth; strength of materials above and below the seam for roof and floor conditions; topography (especially altitude and slope); climate; land ownership as it affects the availability of land for mining and access; surface drainage patterns; ground water conditions; availability of labour and materials; coal purchaser requirements in terms of tonnage, quality, and destination; and capital investment requirements.

The Kebrafield Roodepoort Colliery operation proposes to use the rollover mining and rehabilitation method. Roll-over opencast mining is typical of small scale opencast mining operations in the Mpumalanga coal fields. The proposed mining entails only opencast methods for this stage of the project. The opencastable reserves will be mined in conventional truck and shovel mining methods using the lateral roll-over technique in a single direction. This would mean mining from the one side of the development footprint in a linear fashion towards the opposite side while backfilling and rehabilitating the area that has already been mined, thus creating the effect that the mining cuts are rolling over in a single direction. Sustainable development applied to mining works necessarily

includes rehabilitation with the aim of either restoring the land to its original use, or eliminating or reducing adverse environmental impacts to a long-term acceptable condition. The process is driven primarily by legislation which ensures that the mine owner must comply with the intention of achieving those end conditions, which are defined in broad terms by guidelines.

An initial box cut as well as an access pit ramp into the box will be constructed first. A double box cut has been planned to enable mining in both a northerly and southerly direction, thereby increasing the face length and production rates. The ramp will have a maximum slope of 12°. Topsoil from the initial box cut will be stripped, where after the subsoil and hard overburden will be drilled, blasted and removed. Topsoil, subsoil and hard overburden will each be stockpiled separately. After removal of the coal from the initial box cut, subsequent box cuts will be made and the initial void filled with the stockpiled hard overburden, subsoil and finally topsoil which will then be seeded and grasses to re-establish vegetation coverage to grazing capability.

The primary procedures that will be implemented during the mining process include;

- Removing and stockpiling of topsoil;
- Construction of the pollution control evaporation dam(s) also used for dust suppression;
- Trenching around the mining footprint to ensure storm water is diverted away from the open cast pit;
- Blasting, stripping and stockpiling of overburden;
- Excavation of the initial strip of the box-cut;
- Excavation of coal (ROM);
- Crushing, screening and stockpiling coal;
- Backfill rehabilitation concurrently as mine progress forward.

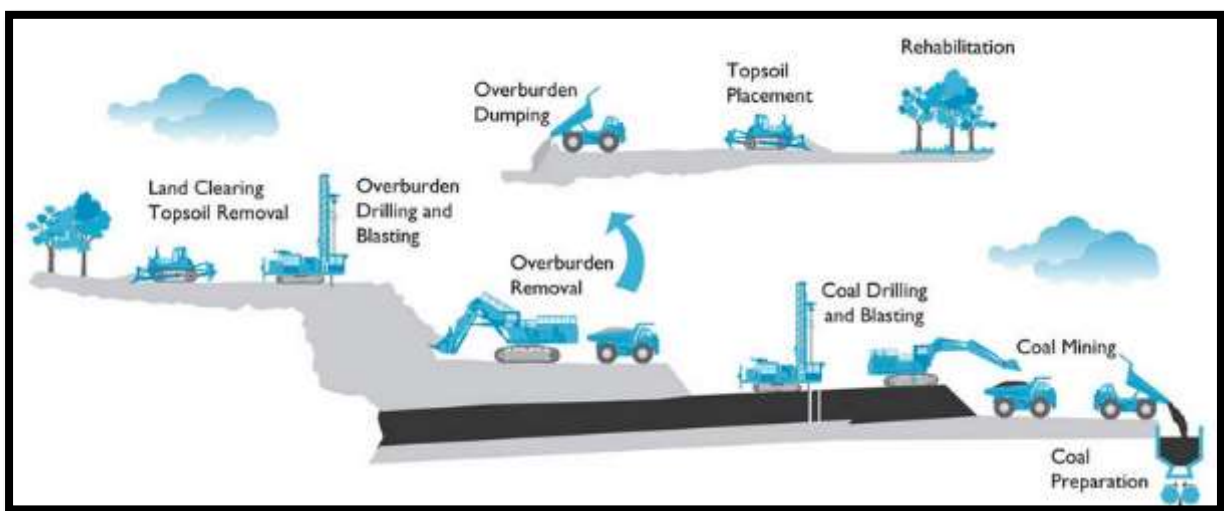


Figure 4: Typical coal surface mining opencast sequence indicating primary procedures

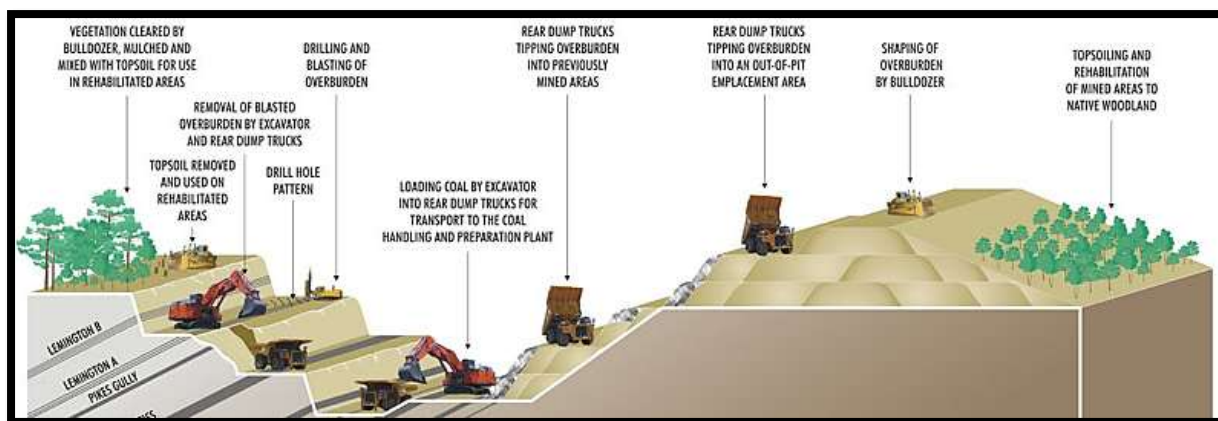


Figure 5: Typical coal surface mining opencast sequence indicating rollover backfill rehabilitation methodology

Figure 6 below indicates the typical mining sequence and can be summarized as; initial removal of the overburden which will then be stockpiled behind the mining area to ensure it can be replaced back in the initial box cut. The physical mining of the coal seam follows which is then placed into trucks to be taken to the crushing and screening facility. From here discard coal will be extracted and replaced in the bottom of the opencast pit, while the product will be taken to the weighbridge via trucks and then removed off site. The overburden is replaced back into the pit as mining progress leaving a minimum area open at a single time. The topsoil which was stripped and stockpiled separately before mining commenced is then replaced and according to the land capability specialist report prepared to the optimal composition to ensure the field can be restored to grazing land as was the pre-mining land use.

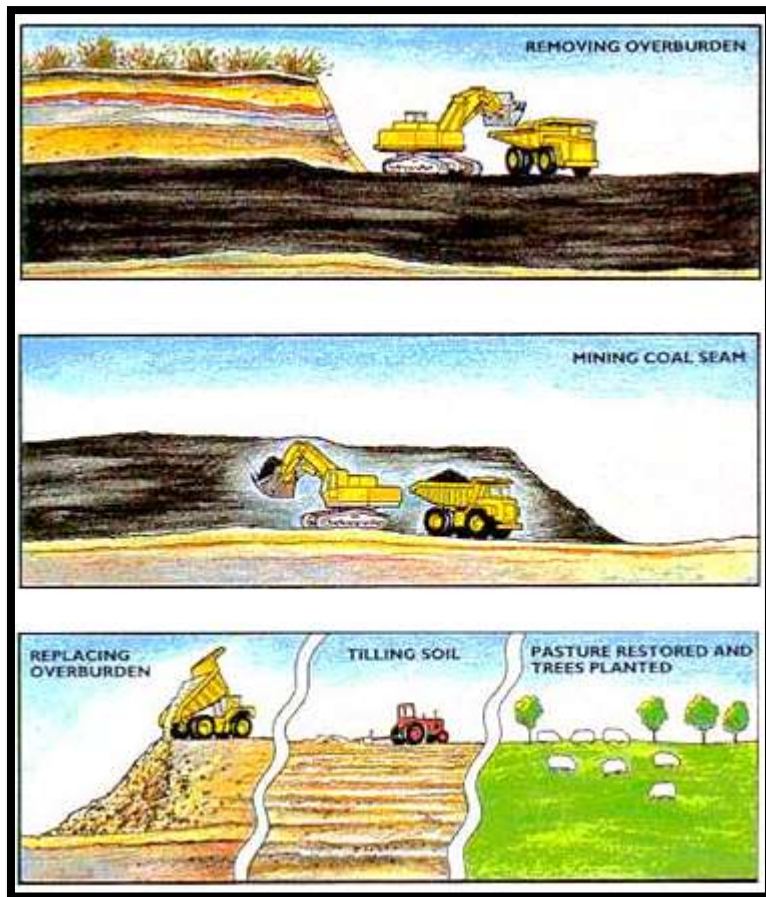


Figure 6: Opencast Coal Mining Sequence

The sequence in figure 7 can serve as a further illustration of the anticipated project. Step (1) is where the topsoil will be stripped and stockpiled separately. After this drilling takes place to enable blasting of the overburden. During step (2) the overburden is then removed by conventional truck and shovel methodology and stockpiled separately within the mining footprint. Step (3) includes the removal of underburden which is typically associated with more hard material than fine material (typical of overburden) and is usually the sandstone layer on top of the coal seam. This material is also stockpiled separately. During step (4) physical extraction of coal or winning of the mineral takes place and step (5) indicates the conventional truck and shovel methodology of removing the material.

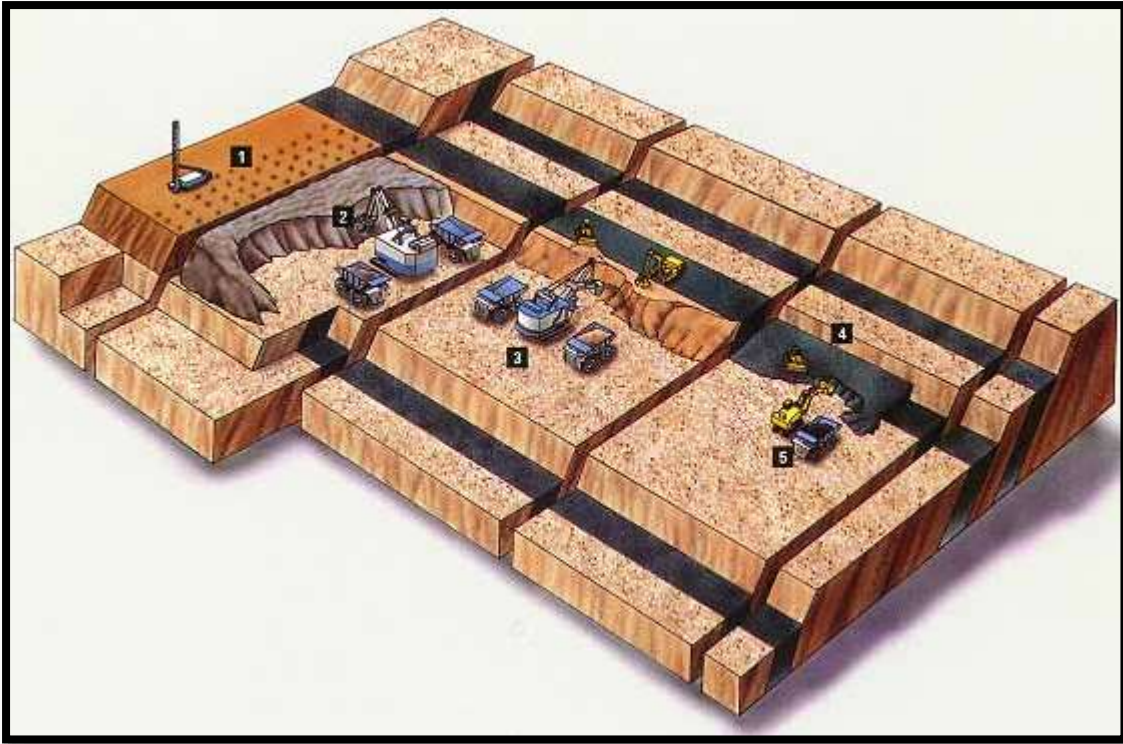


Figure 7: Opencast coal mining typical progressive steps (No 1- 5)

The following basic principles of rehabilitation form the basis of the roll-over mining methodology that entails concurrent rehabilitation as mining progress:

- Prepare a rehabilitation plan prior to the commencement of mining which includes detailed surveys of the pre-mining environment to ensure the landscape can be restored to the pre-mining environment as close as feasible;
- Agree on the long-term post - mining land use objective for the area with the relevant government departments, local government councils and private landowners. The land use must be compatible with the climate, soil, topography of the final landform and the degree of the management available after rehabilitation;
- Progressively rehabilitate the site, where possible, so that the rate of rehabilitation is similar to the rate of mining;
- Prevent the introduction of noxious weeds and alien vegetation (typical to areas of disturbance);
- Minimise the area cleared for mining and associated infrastructure to only what is ultimately required and no additional clearance of unnecessary areas;
- Reshape the land disturbed by mining operations so that it is stable, adequately drained and suitable for the desired long-term land use;
- Minimise the long-term visual impact by creating landforms which are compatible with the surrounding landscape;
- Reinststate natural drainage patterns disrupted by mining wherever possible;

- Minimise the potential for erosion by wind and water both during and following mining;
- Characterise the topsoil and retain it for use in rehabilitation. It is preferable to reuse the topsoil immediately rather than storing it in stockpiles. Only discard if it is physically or chemically undesirable, or if it contains high levels of weed seeds or plant pathogens;
- Consider spreading the cleared vegetation on disturbed areas;
- Deep rip compacted surfaces to encourage infiltration, allow plant root growth and key the topsoil to the subsoil, unless subsurface conditions dictate otherwise;
- Ensure that the surface one or two metres of soil is capable of supporting plant growth;
- If topsoil is unsuitable or absent, identify and test alternative substrates, e.g. overburden that may be a suitable substitute after addition of soil improving substances;
- Re-vegetate the area with plant species consistent with the post mining land use; and
- Monitor and manage rehabilitation areas until the vegetation is self-sustaining.

2.4 Crushing and Screening of the ROM Coal

The coal delivered from the mine that reports to the coal preparation plant (CPP) is called run-of-mine, or ROM, coal. This is the raw material for the CPP, and consists of coal, rocks, middlings, minerals and contamination. Contamination is usually introduced by the mining process and may include machine parts, used consumables and parts of ground engaging tools. ROM coal can have a large variability of moisture and maximum particle size. Crushing reduces the overall top size of the ROM coal so that it can be more easily handled and processed within the CPP. Crushing requirements are an important part of CPP design and there are a number of different types. Screens in screening plant are used to group process particles into ranges by size. These size ranges are also called grades. Screens can be static, or mechanically vibrated. Screen decks can be made from different materials such as high tensile steel, stainless steel, or polyethylene.

The proposed project entails to make use of a mobile crushing and screening facility to ensure it can be easily moved and also reduce the footprint required for rehabilitation post life of mine. No washing of coal on site is proposed as the final product from the mobile crushing and screening facility will be taken away off site, and therefore significantly reduce the environmental impacts associated with washing of coal. The image below is a typical representation of a crushing and screening plant with associated activities. Coal from the ROM stockpile is loaded into trucks and then hauled to a feed bin from where it is fed via a conveyor into the crushing and screening facility. Coal is then stockpiled according to the required top sizes from where it can be loaded transported to the weighbridge once again via truck hauling, weighed and taken off site. The process in itself is quite simple and straight forward as no washing of the coal will take place on site. During the EIA it is important to consider various aspects associated with crushing and screening which include;

-

2.5 Access Road Construction, Haul Roads and Road Diversion of the Existing Road

The current mine planning entail diversion of the current gravel road which transect the planned mine footprint. The necessary traffic impact assessment and approvals for this diversion will be undertaken prior to commencement of the activity. The road will be diverted around the western edge of the mining operation (refer

to Figure 1). In order to maintain a gravel road properly operators must clearly understand the need for three basic items:

- A crowned driving surface,
- a shoulder area that slopes directly away from the edge of the driving surface, and a
- ditch.

The shoulder area and the ditch of many gravel roads may be minimal. This is particularly true in regions with very narrow or confined right-of-ways. Regardless of the location, the basic shape of the cross section must be correct or a gravel road will not perform well, even under very low traffic. The figure below illustrates the components of a typical cross section of a gravel road that must be considered.

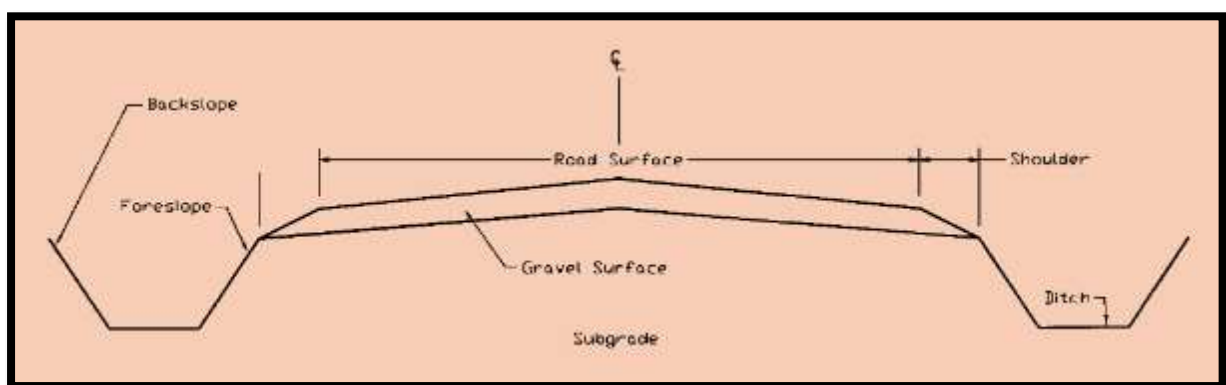


Figure 9: The components associated with a gravel road section

Gravel roads tend to rut more easily in wet weather. Traffic also tends to displace gravel from the surface to the shoulder area and even to the ditch during dry weather. Managers and equipment operators have the continual responsibility of keeping the roadway properly shaped. The shape of the road surface and the shoulder area is the equipment operator's responsibility and is classified as routine maintenance. Keeping the fore-slope and ditch established and shaped is often the maintenance operator's responsibility as well. The main aim of the design and associated maintenance is to keep water drained away from the roadway. Standing water at any place within the cross section (including the ditch) is one of the major reasons for distress and failure of a gravel road.

There is sometimes a need for specialized equipment to do major reshaping of the cross section, especially in very wet conditions. However, the operator of routine maintenance equipment must do everything possible to take care of the roadway. The recommended shape of each part of the cross section will be considered in detail during the road diversion planning stage once authorised in accordance with this EIA. When a gravel road is maintained properly, it will serve low volume traffic well. Unfortunately, most gravel roads will fail when exposed to heavy hauls even when shaped properly. This is due to weak subgrade strength and marginal gravel depths which are often problems with gravel roads. The low volume of normal traffic does not warrant reconstruction to a

higher standard. However, improper maintenance can also lead to very quick deterioration of a gravel road, especially in wet weather. The maintenance equipment operators must always work at maintaining the proper crown and shape. During mining extra maintenance and wetting of the roads to ensure minimal dust generation will be required.

This Traffic Impact Assessment was conducted by Corli Havenga Transportation Engineers as part of the Environmental Impact Assessment conducted by Eco Elementum Environmental and Project Management for the development of the Kebrafield Roodepoort Colliery near Pullen's Hope in Mpumalanga Province. The proposed opencast mine is located on Portion 17 of the Farm Roodepoort 151 IS near Pullen's Hope in Mpumalanga Province. Access to the mine can be obtained from the N11, Pullen's Hope/Hendrina Power Station intersection via Road D2274. Road D2274 is used up to the intersection with Road D2539, and then Road D2539 is taken towards the mine.

The mine is not a land use for which trip generation figures are available in the "SA Trip Data Manual". From a trip generation point of view, the mine's peak trip generation occurs around shift change times and before and after the admin office hours. The trip generation will therefore be based on employment figures and operational information provided to us for this project. The expected weekday morning peak hour trip generation is 43 trips with 35 trips towards the mine and 8 trips from the mine during the morning peak hour. The expected weekday afternoon peak hour trip generation is also 43 trips with 8 trips towards the mine and 35 trips from the mine during the morning peak hour. In terms of potential trip generation, this mine is a significant trip generator. If we summarize the peak hour trip generation at the various times during a normal weekday, the mine can generate the number of trips as depicted in the Table below.

Table 9: Expected daily trip generation for the mine

	Trips in	Trips out
Morning peak hour	35	8
General trips	22	22
Product	42	42
Afternoon peak hour	8	35
Total trips (24 hour)	107	107

The construction phase's trip generation will be significantly lower than that of the opencast mine once it is in production. The construction phase will be over a relatively short period and we will therefore only evaluate the traffic impact during the operational phase.

The closure and rehabilitation period is expected to have a significantly lower trip generation due to the fact that no product trips will be on the road network, and the actual construction period (of the rehabilitation) will extend over a relatively short period of time. The operational phase will be the worst case scenario from a trip generation and traffic impact point of view.

In terms of the Manual for Traffic Impact Studies, intersections where more than 75 peak hour trips are added to the critical movements must be analysed to determine the impact of the additional traffic on the operating conditions of the intersections. In this instance this is not expected at any of the major intersections. We did however include analyses of the two major intersections on the route to quantify the current and future operating conditions of these intersections;

- Intersection N11 and Road D2274
- The approaches to the intersection currently operate at acceptable levels of service during both peak traffic hours and will continue to do so with the additional traffic from the mine.
- Intersection Road D2274 and Road 2539
- The approaches to the intersection currently operate at acceptable levels of service during both peak traffic hours and will continue to do so with the additional traffic from the mine.

Road D2539 needs to be realigned in order to mine the area which the existing road crosses. A separate re-alignment has been submitted to the Mpumalanga Roads Department for comment and it has subsequently been authorised. Access to the mine will be located on this re-aligned section of Road D2539. The proposed mine development can be supported from a traffic flow point of view.

2.6 Semi Temporary Site Offices and Security Office

The site offices for the project, including a small security hut at the entrance of the mining area next to the main entrance road will consist of container-type offices that is commercially available as off the shelf products, as illustrated in the image below. This ensures minimal construction requirements on site and also minimal footprint. Keeping the disturbance area minimal and ensuring ease of mine closure and rehabilitation after life of mine make the temporary offices ideal, especially considering the short duration of the proposed activities and requirement of these offices. The visual impact associated with the structures will also be considered and natural colour paint will be applied to the structures to blend in with the background features.

Storm water management around the facilities will also be considered and the necessary waste receptacles will be in place for general domestic waste separation and management. Waste skips will be used for waste collection and any domestic waste will be removed from the site to a licensed waste facility by a registered and approved contractor. No housing facilities will be required as personnel will not be allowed to reside on site for the duration of the project but instead live off site from the mine. The security will however be present 24hours a day on the mine for the duration of the project and even longer during the mine closure and rehabilitation period.



Figure 10: Typical semi temporary site offices and security office

2.7 Semi Temporary Sanitation and Change House

Similar to the structure indicated in 2.6 above, will the semi temporary sanitation and change house also be container type facilities which can easily be brought to site and also removed after life of mine. For the change house and ablution facility a septic tank system will be implemented which is temporary of nature and can also be decommissioned easily. The septic tank system will ensure a 'honey-sucker' type sewage removal vehicle can remove and dispose of sewage at an appropriate facility off site. This ensures no major construction and approval is required for a full scale sewage treatment facility. Mobile chemical toilets will also be used where necessary and supplied by an approved contractor whom will be responsible for the management of these toilets. Water requirements relating to ablutions and drinking water are expected to be minimal and if water cannot be sourced on site from a borehole it will be brought in by a tanker. The current expectation is that 100 employees will require 45liter per person per day (liter pp/day) amounting to 4500liters per day.

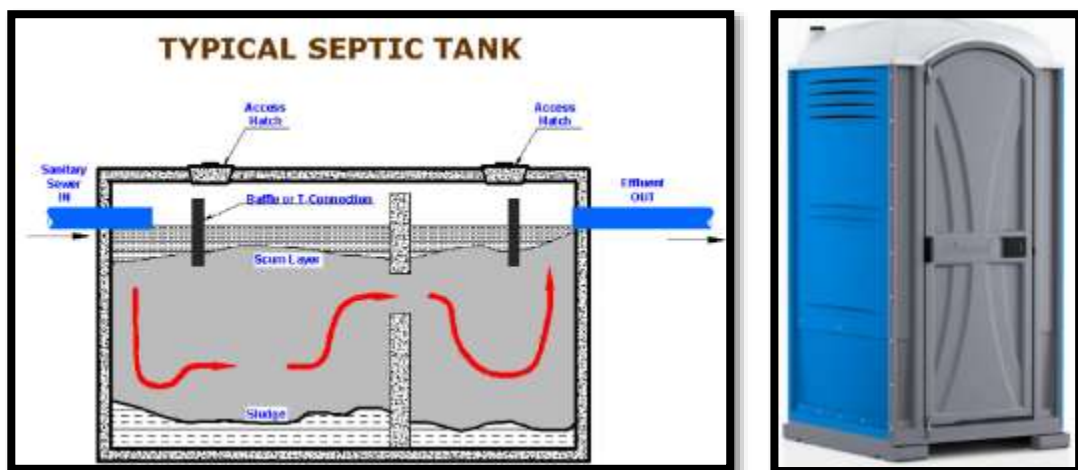


Figure 11: Typical septic tank cross section and chemical toilet illustration

2.8 Stores, Stores Yard, Workshop and Maintenance Area

The stores, stores yard, workshop and maintenance area are all related activities and therefore discussed under one heading. All these facilities will be constructed with heavy steel structural support frames, covered with light steel sheet metal roofing and side panels (typically corrugated iron sheets) to prevent rain water from entering the facilities. These areas will house various hydrocarbon and chemical materials such as oils, greases and paints required for maintenance and operational purposes and therefore the need exist to keep such materials in designated bays designed specifically to ensure no contamination to the receiving environment. The floors of these areas will be constructed of impermeable layers typically concrete.

Storm water management will be ensured around these areas to ensure clean and dirty water separation. An oil trap (oil-water separator) will be constructed to ensure oils and greases can be separated and oils/grease can be removed by an approved subcontractor for recycling purposes. All harmful materials will be properly stored in a dry, secure environment, with concrete or sealed flooring and a means of preventing unauthorised entry. Furthermore, it will be ensured that material storage facilities are cleaned/maintained on a regular basis, and that leaking containers are disposed of in a manner that allows no spillage onto the bare soil. The management of such storage facilities and means of securing them shall be agreed.

The general working of an oil-water separator as illustrated below can be summarized as follow (take note, final design might vary depending on the contracting technology acquired);

1. The oil/water/sludge mixture enters the oil water separator;
2. The heavier sludge and particulates fall out of the fluid and are captured in the sludge hopper;
3. The oil and water mixture with lighter particulates travels up the inclined plates;
4. The inclined plates start to separate the mixture. Some oil rises to the top of the separator and the remainder of the particulates slide back down to the sludge hopper;
5. The remaining oil and water mixture then moves through the coalescing media packs where the majority of the smaller oil particles attach to the media and combine together to form larger oil particles;
6. These larger oil particles become so buoyant that they release from the media and travel to the top of the separator;
7. As the oil volume in the separator reaches a certain level, the oil is drained to through piping to an oil storage tank;
8. The clean water continues over the weir to the clean water chamber where it goes through a final polishing pack and out to the sewer.

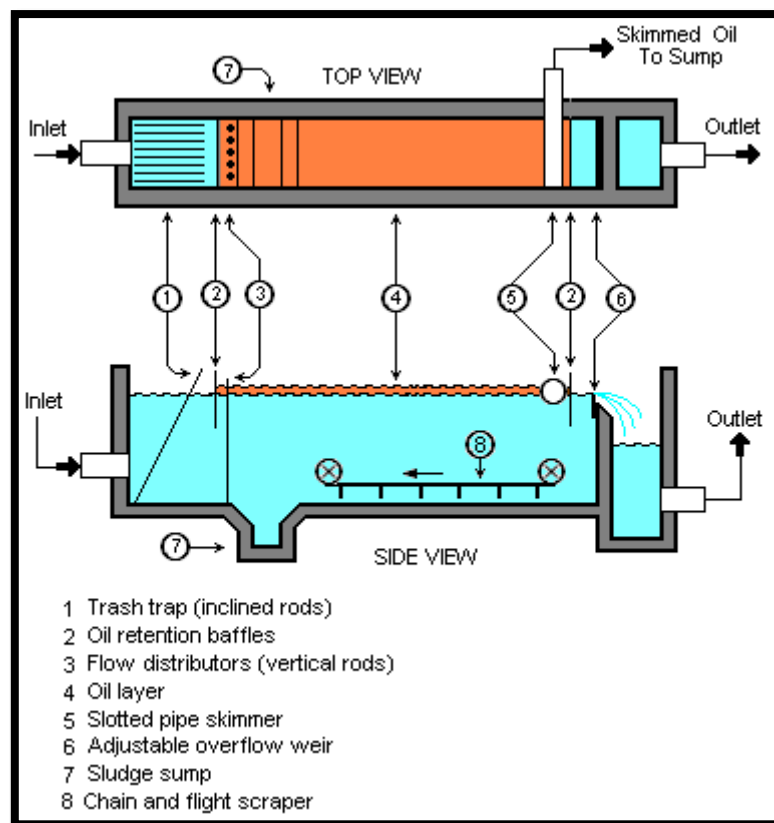


Figure 12: Typical oil trap (oil-water separator) system cross sectional design

The following principles of safe design will be adhered to during the design of the stores, stores yard, and workshop and maintenance area;

Principle 1:	People with control	Safe design is everyone's responsibility – ensuring safe design rests with all parties influencing the design of a building or structure.
Principle 2:	The life cycle	Safe design employs life cycle concepts – applying to every phase in the life cycle of a building or structure, from conception through to redevelopment and demolition.
Principle 3:	Risk management	Safe design implements risk management – through systematically identifying, assessing and controlling hazards.
Principle 4:	Knowledge and capability	Safe design requires knowledge and capability – which should be either demonstrated or accessed by any person influencing design.
Principle 5:	Information transfer	Safe design relies on information – requiring effective documentation and communication between everyone involved in the life cycle of a building or structure.

2.9 Bulk Fuel Storage

The activity being applied for in this EIA reads as follow; storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres. The main fuel storage will be diesel in above ground storage tanks with an impermeable floor and berms designed to hold 120% the capacity of the tanks. The berms will also have release valves in the case of a spillage to ensure the diesel can safely be removed. An important aspect is to ensure the area is covered to ensure rain water does not enter the bunded holding areas.

2.10 Pollution Control Facility/Dam (Evaporation and Dust Suppression Usages)

Water is typically the prime environmental medium (besides air) that is affected by mining activities. Mining adversely affects water quality and poses a significant risk to South Africa's water resources. Mining operations can further substantially alter the hydrological and topographical characteristics of the mining areas and subsequently affect the surface runoff, soil moisture, evapo-transpiration and groundwater behaviour. Failure to manage impacts on water resources (surface and groundwater) in an acceptable manner throughout the life-of-mine and post-closure, on both a local and regional scale, will result in the mining industry finding it increasingly difficult to obtain community and government support for existing and future projects. Consequently, sound management practices to prevent or minimise water pollution are fundamental for mining operations to be sustainable.

Pro-active management of environmental impacts is required from the outset of mining activities. Internationally, principles of sustainable environmental management have developed rapidly in the past few years. Locally the Department of Water Affairs (DWA) and the mining industry have made major strides together in developing principles and approaches for the effective management of water within the industry. This has largely been achieved through the establishment of joint structures where problems have been discussed and addressed through co-operation.

The National Water Act (Act 36 of 1998) requires that the dirty water originating from the mining operations be kept separate from the clean water systems outside and on top of the mining area. Therefore in-pit water storage cannot be considered for this application and the additional requirements of the NWA will also need to be complied with. Data generated during the geohydrological investigation will guide the civil engineering team to accurately size and design the pollution control facilities, in this case lined dams above ground, to be used as evaporation dams and also for water abstraction for dust suppression carts on the mine. The main concern regarding coal mining is the correct treatment and disposal of water. Sufficient provision will be made in the form of trenches for surface water runoff diversion away from the mining area, to ensure clean and dirty water

separation takes place. This way contamination of water can be minimised. Water that has been contaminated and in-pit ingress water will be pumped to above ground pollution control dams which will be lined to ensure no ground water infiltration can take place. The pollution control dam(s) will be constructed, fenced and notices erected to warn the public with regards to safety, at the proposed mining area for the storage of dirty water. The pollution control dam will be designed by a registered professional civil engineer and have capacity to handle all dirty water emanating from the dirty water areas on the mining area. An Integrated Water Use License Application (IWULA) covering the mine related water uses was submitted to DWA in November 2013.

Pollution control dams (PCDs) form an integral and important part of the water management systems on a mine. Different types of PCDs may exist on a mine site, such as process water dams, storm water dams, evaporation dams and other dams, possibly including excess mine water dams and natural pans.

The purpose of PCDs for the mine and in the water management circuits are to:

- Minimise the impact of polluted water on the water resource;
- Minimise the area that is polluted as far as possible, by separating out clean and dirty catchments; and
- Capture and retain the dirty water contribution to the PCDs that cannot be discharged to the water resource, due to water quality constraints, and manage this dirty water through recycling, reuse, evaporation and/or treatment and authorised discharge.

The design, operation and closure of PCDs are important aspects in the successful operation of a mine, given the inherent safety and environmental risks posed by structural failure, spillage or overtopping of these facilities. It is thus important that practitioners within this field have a good understanding of the management of water, surface and groundwater, when designing and/or operating PCDs. To this end, the Department: Water Affairs (DWA) have prepared an activity-related Best Practice Guideline to focus on mine water PCDs which will be adhered to during the design and construction of the pollution control dam(s).

Best practice for mine water PCDs is developed from a combination of the following requirements:

- Legislative requirements
- Industry norms and generally accepted good practices
- Technically and environmentally sound design practices
- Life cycle planning for the PCD
- Management of hazards and risks
- Effective water resources management, both for the mine site and within the regional Catchment Management Plan, and
- Other factors, such as site specific conditions.

Effective design, operation, management and closure of PCDs are ensured through adherence to the above requirements. The image below is an illustration of the typical pollution control dam that will be constructed.



Figure 13: Lined pollution control dam illustration

Best Practice water management for PCDs will be based on the following general principles:

- All PCDs will comply with the legal and regulatory conditions within South Africa
- Worst-case conservative assumptions will be made in instances where the quality of water to be contained within the PCD cannot be established with certainty
- PCDs are to be sited, sized and operated to maximise the opportunities for water reuse and reclamation and to minimise the impacts on the water resource
- Designs will adhere to the generally accepted principles of sustainable development and Best Practice Environmental Option (BPEO), as defined in section 2 of NEMA, by integrating social, economic and environmental factors during the planning and implementation and closure phases
- Technical studies and the design of PCDs will be undertaken by suitably qualified personnel (registered civil engineers)
- The full life cycle of the PCD will be considered in the design, operation and closure of PCDs
- Designs will adopt a holistic approach, including:
 - Sustainability
 - Full life cycle of the PCD
 - Water quantity and quality, and
 - Surface water and groundwater

The siting of pollution control dams is critical in order that it maximizes the containment of all polluted water. The pollution control dam design specifications are as set out below. The reader is referred to Appendix B for the siting and layout of the surface water management structures.

It is a requirement that pollution control dams do not leach any of the polluted contents into the groundwater and is therefore required to be lined in order to limit seepage. It is proposed that a 1,5mm thick HDPE lining be used to line the dam basin. The lining will be covered by a 200mm thick soil backfill.

Table 10: Pollution Control Dam Details

POLLUTION CONTROL DAM SOUTH		
-	Type of dam structure	: Earth embankment
-	Seepage control	: 1,5mm thick HDPE lining
-	Earth embankment height	: 3m
-	Earth embankment crest width	: 3m
-	Earth embankment crest length	: 320m
-	Earth embankment slopes	: 1:3 (for both up- and downstream slopes)
-	Free board	: 800mm
A typical cross section of the pollution control dam is provided on Drawing No 2379/003A attached as Appendix E.		
POLLUTION CONTROL DAM NORTH		
-	Type of dam structure	: Earth embankment
-	Seepage control	: 1,5mm thick HDPE lining
-	Earth embankment height	: 3m
-	Earth embankment crest width	: 3m
-	Earth embankment crest length	: 330m
-	Earth embankment slopes	: 1:3 (for both up- and downstream slopes)
-	Freeboard	: 800mm
A typical cross section of the pollution control dam is provided on Drawing No 2379/003A attached as Appendix E.		

2.11 Clean and Dirty Water Separation System

The clean and dirty water separation on the mine has been discussed to an extent under relevant sections where applicable, although, a detailed surface water management plan will be drawn up as part of this EIA including the determination of flood lines, identification of sensitive receptors and existing surface water systems and flow paths, and civil engineering design reports for the required trenches and water management facilities. The geohydrological investigation will also feed into these designs as the anticipated pollution will be modelled. Trenching around the mining area forms part of the clean and dirty water separation and is to a large extent based on the water balance as calculated by the civil engineering team. The image below is a typical illustration of aspects to consider during the calculation of the opencast mining area water balance.

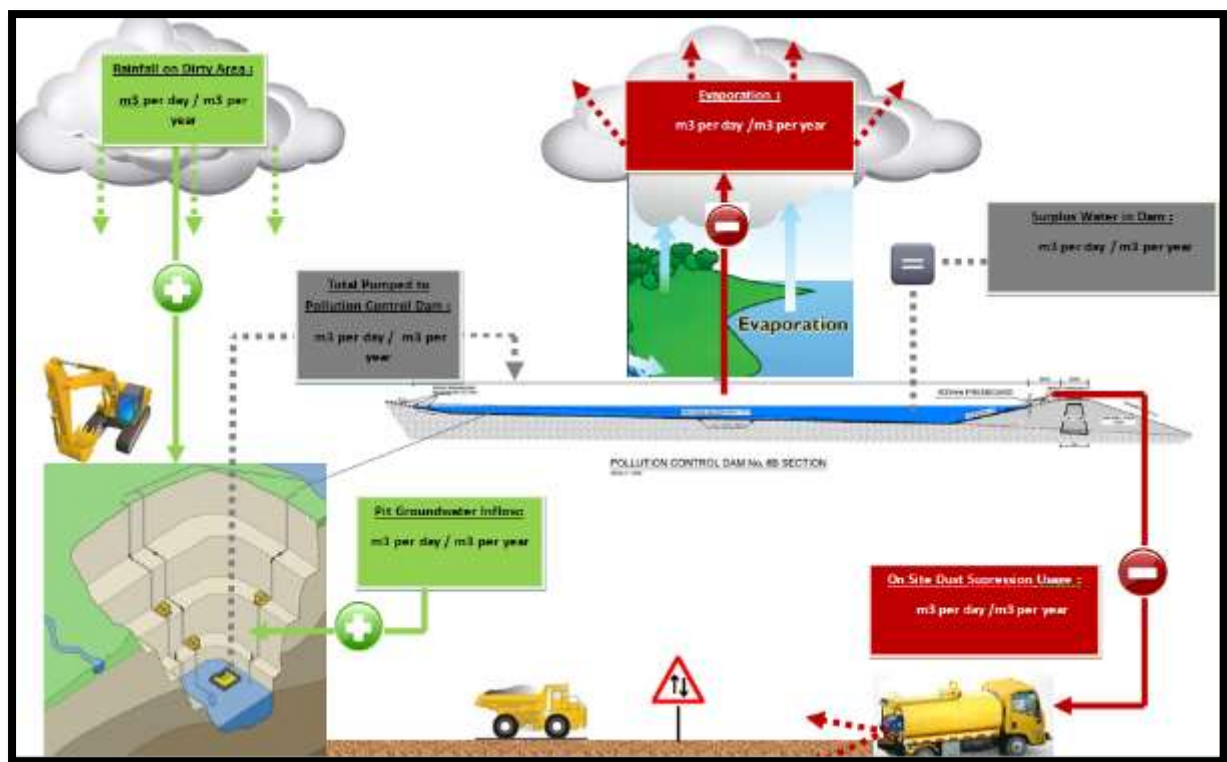


Figure 14: Typical water balance considerations during the design of a clean and dirty water separation system

Further images for clarification purposes have been provided below to indicating cross sections of both the dirty water and clean water diversion trenches which will be constructed around the mining area. These designs will also form part of the final master plan to be implemented.

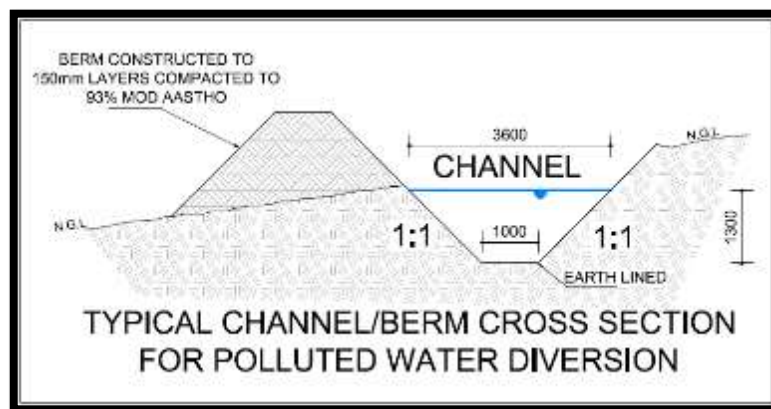


Figure 15: Typical channel/berm cross section for polluted water diversion

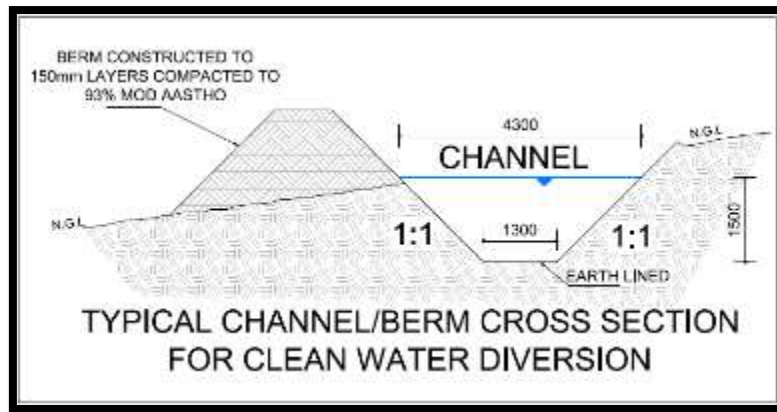


Figure 16: Typical channel/berm cross section for clean water diversion

2.12 Fencing

Fencing of the entire mining area will be required as a means of ensuring safety and also keeping trespassers at bay. The fencing however will be ecologically sensitive to ensure the sound migration of certain smaller species as will be identified in the ecological specialist investigation can still take place. Fences will be clearly demarcated and appropriate signage will be displayed, similar to the signs in the images below. Fencing of the sensitive receptors such as wetlands will also take place ensuring no mining personnel will enter these areas and that it will remain protected for the duration of the project. Sites of archaeological and heritage importance will also need to be fenced off while safe access to these sites will be provided. The necessary signage will also be erected at sites of archaeological and/or heritage importance to ensure visitors can easily and safely access the premises.



Figure 17: Typical mine fence signage

2.13 Mine Fleet Hard Park, Staff and Visitors Parking

Designated parking areas will be constructed by compaction of the subsoil after removal, storage and preservation of the valuable layer of topsoil. Uncovered parking areas for mine fleet vehicles will be constructed in a separate area to the staff and visitors parking as a safety measure as the mine fleet vehicles are very large and pose a safety hazard. The staff and visitors parking will be separate from the latter and possibly covered.

Storm water management control around these areas will be implemented while the necessary signage will be erected to ensure optimal safety while reverse parking will be implemented at all parking bays. The necessary waste receptacles as well as oil spill kits will be provided at these sites in case of accidental spillage or leakage of hydrocarbon fuel/oil/greases from the vehicles.

2.14 Drilling, Blasting and Explosives Handling

Blasting of mine overburden to allow efficient recovery of the underlying coal can have impacts on the surrounding community. These impacts mainly include vibration through the air (overpressure) and earth (ground vibration) along with the generation of dust and fume. Overpressure and ground vibration limits in place for private residences and heritage structures are prescribed by government based on standards. Blasts are designed and managed to minimise the risk of exceeding these limits, and to minimise impacts they have on the community, surrounding structures and environment.

Due to the nature of the activities associated with open cast activities, blasting will mainly occur during the construction phase of the initial box cut, however, subsequent blasting to remove overburden and gain access to the mineral reserve will also take place during the life of mine. A suitably qualified blasting contractor will be appointed to construct a blasting design and conduct blasting activities. There will be no explosives magazine on site and the blasting contractor will be required to supply the explosives and consumables required to blast.

The risks associated with blasting have been identified and include blast and potential fly-rock. There is a limited risk of air blast due to mining activities resulting in property damage. Blasting controls will include monitoring of blast design, powder factors and stemming levels to minimise the effects of air blast and ground vibrations. The mining area will be evacuated prior to blasting to a radius of >500m while the adjacent property owners will also be informed accordingly prior to blasting events. Eskom has indicated that they also need to be informed well in advance of blasting events as several power lines transect the mining footprint that need to be protected.

A blast management plan will be implemented with the objectives of;

- Ensuring all relevant statutory requirements and company Policies and Standards are met;
- Managing and minimising the impact of blasting from mining operations on the environment and nearby residences;
- Maintaining an effective response mechanism to deal with issues and complaints; and
- Ensuring the results of blast monitoring comply with applicable criteria

2.15 Topsoil, Subsoil, Overburden, Discard and ROM Stockpiles;

Positions of the topsoil, subsoil and overburden stockpiles have been indicated on the mine plan. The locations will be indicated on the final master plan of the mine. The current mine plan however is in accordance with the approved DMR Mining Right EIA and EMPr. All topsoil, subsoil and overburden material will be removed during the mining operation and stockpiled separately for the purpose of backfill rehabilitation as discussed earlier. The stripping, handling and preservation of topsoil have also been discussed earlier in this report as a separate chapter (2.2 Site preparation) due to the importance of topsoil for rehabilitation purposes. The topsoil stockpiles will not exceed a height of six meters which is high enough to reduce leaching impacts of stockpiled topsoil. The subsoil and overburden stockpiles will however exceed this height.

Topsoil will be kept separate from other stockpiles and shall not be used for construction purposes or for maintenance of the access roads. The topsoil shall be adequately protected from being blown away by wind or eroded by the force of water. The subsoil and overburden stockpile areas will cover an area of approximately 5ha and 2ha respectively, of which the topsoil will be stripped and stockpiled separately. The hard overburden stockpiles will contain approximately 50m³ (bulking factor of 1.1) of blasted overburden material.

Stockpiles may be used in some instances to provide visual and noise barriers between the mining operations and neighbouring land users. These stockpiles will be constructed from either overburden or from soil and will be in place for the life of mine and will be top-soiled and grassed immediately after their construction. Topsoil removal will take place by means of excavators and hauled with Articulate Dump Trucks (ADT's).

The ROM stockpiling area will be constructed to cover an area of approximately 1ha and will not contain more than 10 000tons of ROM coal at one period. The stockpile will also not exceed a height of 4m. The stockpile will be used to load coal from the mining area as well as to cater for any ceases in production resulting from breakdown or disruption of workings. Dirty water emanating from this area will be diverted to the pollution control dam area.

A weighbridge will be constructed adjacent to the ROM coal stockpile area on a concrete slab footprint. The exact design will be made available once the external service providers have submitted their designs and a decision have been made regarding the procurement of a weighbridge. Below, cross sections of three typical weighbridge designs have been provided for clarification purposes. The impacts associated with these three structures are very closely related and would not significantly change the impact rating or influence the final outcome of the EIA which ever design is implemented.

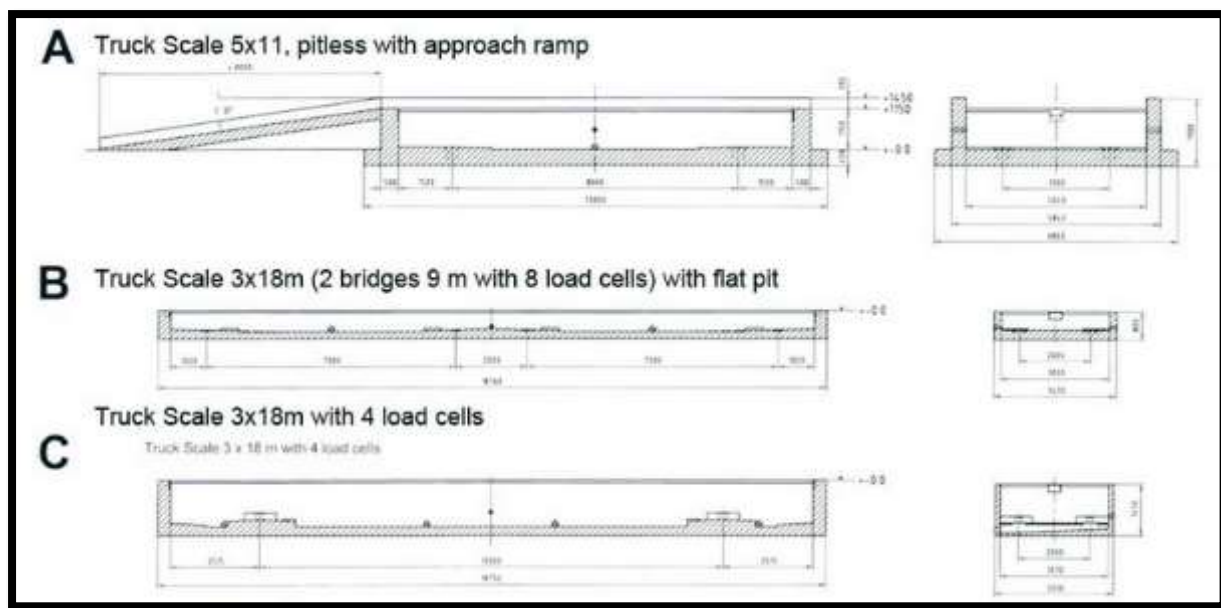


Figure 18: Three alternative weighbridge designs and cross sections

2.16 Waste Management

Waste will be generated from the start to the decommissioning of the project. It is proposed that the waste that would be generated on site would be managed by reducing, reusing and recycling as far as possible. A certified and approved external contractor will be responsible for the removal and disposal of the waste at a registered landfill. The overall aim of the project is to keep the carbon footprint of the entire project as small as possible. This will include the use of “green” products as far as possible as well as the reclamation of all building rubble during the construction phase.

Several waste streams are likely to originate from the activities associated with day to day activities in the workplace. Some of these waste streams may not be hazardous, but the majority may contain a component(s) that may need special treatment. The nature of these waste streams may also vary due to composition and physical form. In order to make informed decisions on determining the appropriate waste management options to handle, treat and dispose of waste, the different waste streams must be identified in terms of hazardous and non-hazardous wastes.

Waste streams can be categorised into 6 (six) different streams, based on similar health and environmental concerns namely:

Inorganic wastes – acids, alkalis, cyanide wastes, heavy metal sludges and solutions, asbestos wastes and other solid residues.

Oily wastes – primarily from the processing, storage and use of mineral oils.

Organic wastes – halogenated solvents residues, non-halogenated solvent residues, polycarbon based (PCB) wastes, paint and resin wastes.

Putrescible Organic Waste – wastes from production of edible oils, slaughter houses, tanneries and other animal based products.

High Volume/Low Hazard Wastes – waste based on their intrinsic properties present relatively low hazards but may pose problems due to high volumes such as fly ash from power plants.

Miscellaneous Wastes – infectious waste from diseased human/animal tissue, redundant chemicals, laboratory wastes and explosive wastes from manufacturing operations or redundant munitions.

The following shall apply to the temporary storage of waste at source:

- The employer shall provide adequate and appropriate containers/receptacles for the temporary storage of waste at source;
- Adequate containers must be available to store different types of waste separately to allow for recycling and disposal according to the integrated waste management plan;
- Dedicated storage areas for various types of waste must be allocated and clearly demarcated;
- Waste collected at source shall be collected on a daily basis;
- Waste must be stored in such a manner that it can be safely accessed and loaded;
- Should waste be stored in containers, drums or skips care must be taken that:
 - Waste types (special vs. controlled vs. general waste) are not mixed.
 - Waste is not kept in a corroded or worn container.
 - The container is secure so as to prevent accidental spillage or leakage.
 - All waste skips and containers are labelled with their contents.
 - Skips or containers do not overflow.
 - Skips for special waste is always covered.
 - Skips for controlled waste is covered skips wherever possible.
- Waste must be kept in such a way as to prevent it falling while in storage or while it is being transported;
- Waste must be protected from scavenging by people and animals;
- Do not dispose of (burn, bury or treat) waste on site;
- Collection of waste must be scheduled and the site/location manager must be notified beforehand of collection times and type of waste to be collected; and
- Implement dust suppression measures, such as wetting of access routes and accumulated controller waste.

2.17 Mine Closure and Rehabilitation

In planning for closure, there are four key objectives that will be considered:

1. Protect public health and safety;

2. Alleviate or eliminate environmental damage;
3. Achieve a productive use of the land, or a return to its original condition or an acceptable alternative;
- and,
4. To the extent achievable, provide for sustainability of social and economic benefits resulting from mine development and operations.

Impacts that change conditions affecting these objectives are often broadly discussed as the 'impacts' or the environmental impacts of a site or a closure plan. It is convenient to consider potential impacts in four groupings:

- **Physical stability** - buildings, structures, workings, pit slopes, underground openings etc. must be stable and not move so as to eliminate any hazard to the public health and safety or material erosion to the terrestrial or aquatic receiving environment at concentrations that are harmful. Engineered structures must not deteriorate and fail.
- **Geochemical stability** - minerals, metals and 'other' contaminants must be stable, that is, must not leach and/or migrate into the receiving environment at concentrations that are harmful. Weathering oxidation and leaching processes must not transport contaminants, in excessive concentrations, into the environment. Surface waters and groundwater must be protected against adverse environmental impacts resulting from mining and processing activities.
- **Land use** - the closed mine site should be rehabilitated to pre-mining conditions or conditions that are compatible with the surrounding lands or achieves an agreed alternative productive land use. Generally the former requires the land to be aesthetically similar to the surroundings and capable of supporting a self-sustaining ecosystem typical of the area.
- **Sustainable development** - elements of mine development that contribute to (impact) the sustainability of social and economic benefit, post mining, should be maintained and transferred to succeeding custodians.

The diagram below illustrates the typical requirements and flow of information to reach a point where rehabilitation practices can be implemented. Various forms of information exists that must be integrated in a translation and interpretation process where new definitions subjected to new objectives can be reached. Basically the information gathering process will guide the development of a site specific rehabilitation plan. From the information gathered new rehabilitation and closure objectives can be established. The EIA process will provide guidance through the development of the rehabilitation plan as new information that will be generated during the EIA and especially all the specialist studies and investigations will define the rehabilitation objectives specific to the site.

The types of information available to be considered include;

- **Descriptive information**
 - Baseline surveys
 - Materials properties
 - Resources
- **Scientific information**
 - Scientific values
 - Quality indicators
 - Threshold values
- **Normative information**
 - Objectives of new ecosystem and end land use

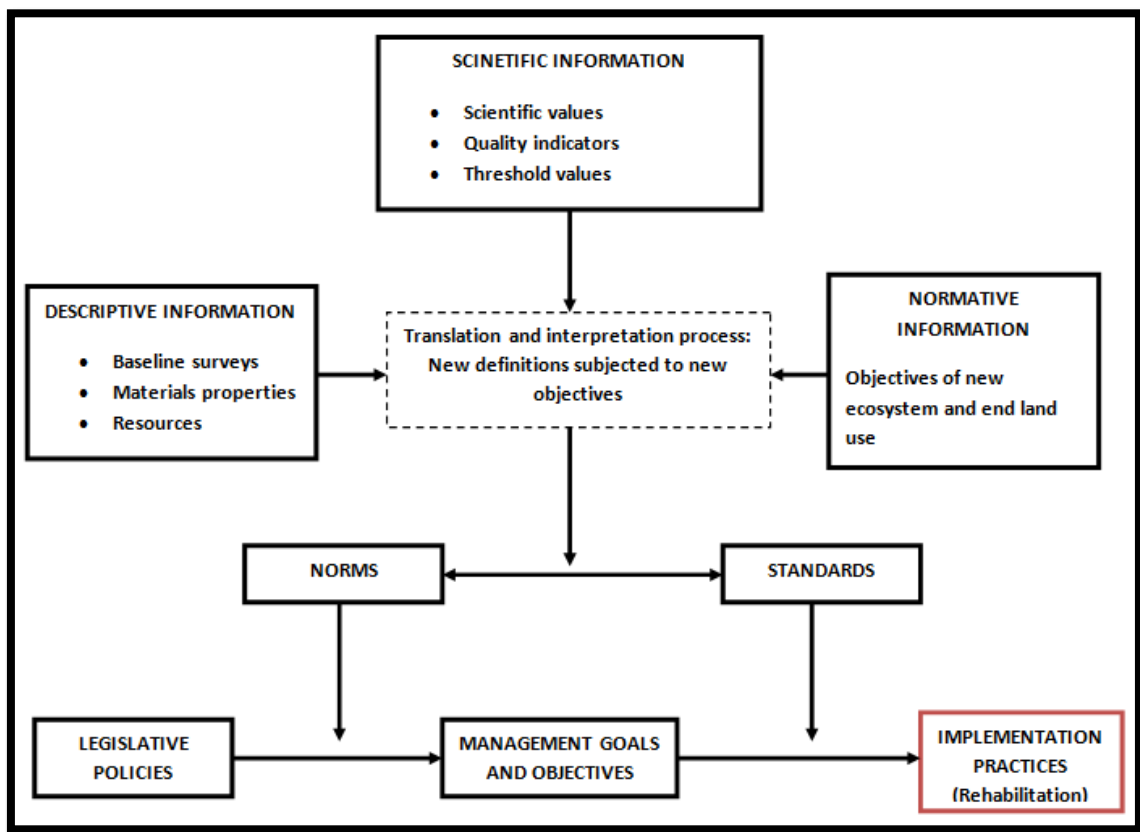
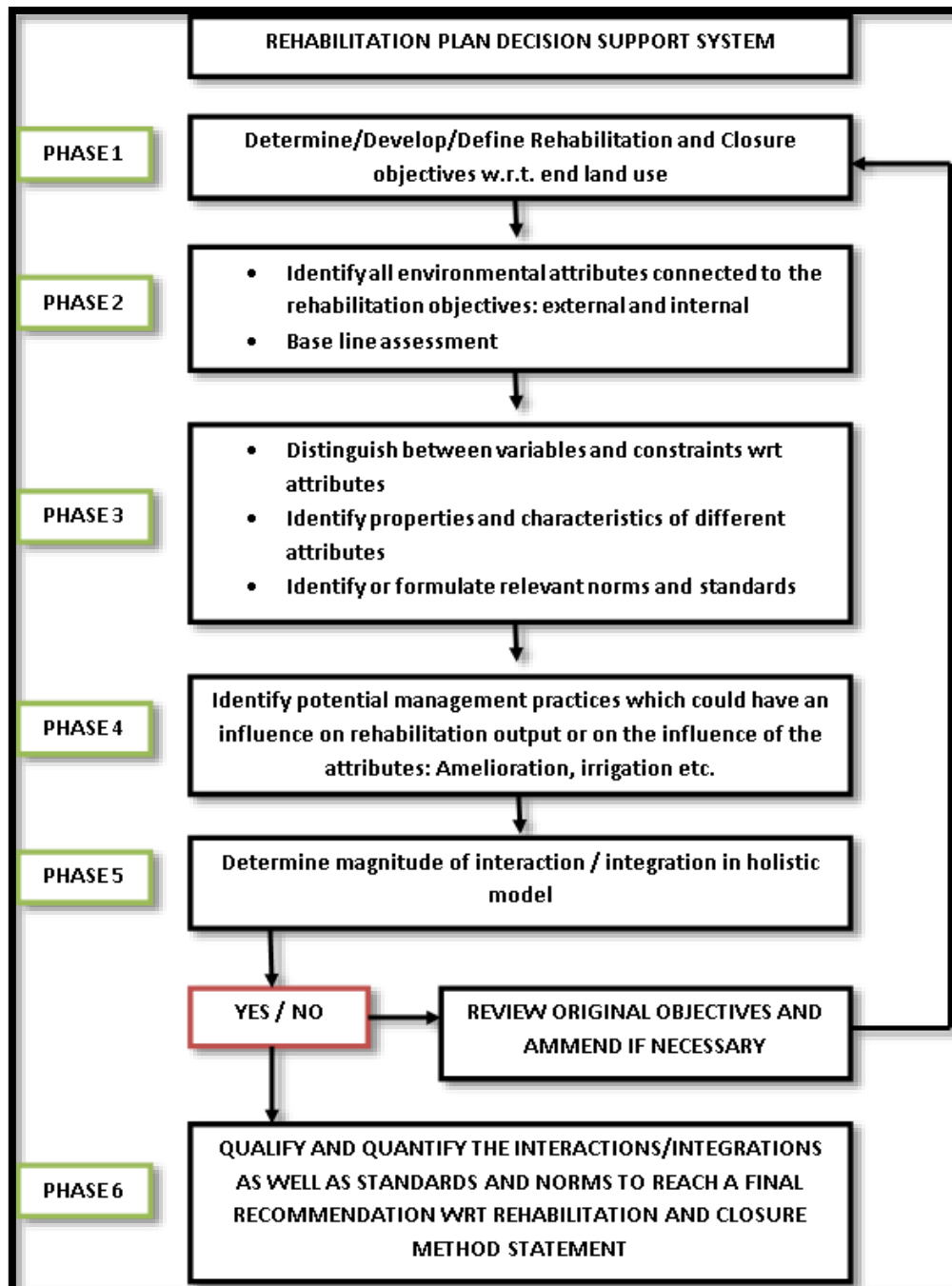


Figure 19: Diagrammatic illustration of rehabilitation plan development

In addition and further to the above diagrammatic illustration of rehabilitation plan development has a rehabilitation plan decision support system been proposed consisting of 6 phases to ultimately reach a rehabilitation method statement which can physically be implemented on site. The current main aspects of the mine closure and rehabilitation plan are to remove all infrastructures at closure. The offices, workshops and other facilities will be removed and sold for their salvage value in order to be re-used or disposed of as scrap (re-use and recycling). Electrical and water supplies to the mining area will be terminated and made safe. Surface haul roads and compacted surfaces will be ripped, top soiled where necessary and vegetated.

In general, the current planning without the necessary inputs of the specialist studies and investigations include;

- The introduction of both organic and inorganic ameliorants (fertilizers) where required;
- Soil testing will be undertaken to determine the fertility status of the soils, which will then be compared to the baseline levels to determine the ameliorant requirements;
- Topsoil will be replaced, ameliorants added and planted with and appropriate seed mixture.



2.18 Water Use License Application

The following water uses have been identified and have been applied for, to be licensed in accordance with Section 40 of the National Water Act, 1998 (Act 36 of 1998), as listed and described in the following tables;

Table 11: Detailed information on water uses to be licensed, their location and description

	Activity	Coordinates		Description	Dimensions	Type
S21(a)	Taking water from a resource	26°01'4.00"S	29°34'38.00"E	Borehole water will be abstracted for potable use	Abstraction from borehole on Portion 17 (already installed) Estimated 4 m³/day, 1440 m³/annually (120 m ³ per 30 days)	License
S21(a)	Taking water from open cast pit	26°0'20.28"S	29°34'48.35"E	Water will be abstracted from the open cast as it fills with water	120 m³/day estimated as inflow ¹¹ that will have to be remove or 43 800 m³ annually removed	License
S21 (c)&(i)	Impacting on the natural drainage of permanent wetland (channeled valley bottom)	26° 0'15.49"S	29°34'51.99"E	The mining activities will be within 500 m of the wetland	n/a	License
S21 (c)&(i)	Impacting on the natural drainage of water of the non-channeled bottom valley wetland	26° 0'32.83"S	29°34'46.41"E	The mining activity will be within 500 m of the wetland	n/a	License
S21 (c)&(i)	Altering the beds & banks of the watercourse of the river indicated	From: 26° 0'26.23"S To: 26° 0'16.37"S	29°34'55.19"E 29°34'53.96"E	The main open cast will alter the banks of the watercourse to the right of the open pit.	295 m length along banks will be disturbed	License
S21 (c)&(i)	Altering the beds & banks of the watercourse of the river indicated	From: 26° 0'28.80"S To: 26° 0'21.33"S	29°35'1.10"E 29°34'58.77"E	The small open cast will alter the banks of the watercourse to the left of the smaller open pit.	260 m length will be disturbed within the riparian zone (channeled bottom valley wetland)	License

	Activity	Coordinates		Description	Dimensions	Type
S21 (c)&(i)	Overburden Dump within 500 m buffer zone	26°0'13.53"S 26° 0'16.15"S	29°34'53.81"E 29°34'53.76"E	Overburden within 500 m of watercourse of the river indicated	200 m x 120 m area 120 m along watercourse	License
S21(g)	Disposing of overburden material & Overburden Dump within 500 m of watercourse of the river indicated	26° 0'28.49"S 26° 0'32.46"S 26° 0'32.78"S 26° 0'29.21"S	29°34'53.52"E 29°34'53.92"E 29°34'51.63"E 29°34'50.90"E	Total volume of material to be used in backfill 50 m ³	125 m x 60 m area 120 m along watercourse	License
		26° 0'11.48"S 26° 0'13.18"S 26° 0'11.93"S 26° 0'9.02" S	29°34'39.71"E 29°34'43.25"E 29°34'44.61"E 29°34'41.86"E		100 m x 120 m area	
	Disposing of soft materials (Topsoil)	26° 0'7.21"S 26° 0'7.95"S 26° 0'12.77"S 26° 0'11.70"S	29°34'43.79"E 29°34'44.44"E 29°34'40.24"E 29°34'39.87"E	Topsoil removed will be only temporary stored until backfilling and rehabilitation will be implemented	5 hectares and <3m height 500 m x 100 m	License
		26° 0'29.90"S 26° 0'28.53"S 26° 0'20.98"S 26° 0'21.06"S	29°34'44.94"E 29°34'45.30"E 29°34'38.75"E 29°34'37.75"E	Topsoil removed will be only temporary stored until backfilling and rehabilitation will be implemented	2 hectares and <3m height 200 m x 100 m	
	ROM Stockpile	26° 0'25.92"S 26° 0'24.98"S 26° 0'22.27"S 26° 0'23.63"S	29°34'42.17"E 29°34'43.43"E 29°34'41.09"E 29°34'39.88"E	Raw coal material temporary dump	100 m x 100 m area The ROM stockpiling area will be constructed to cover an area of approximately 1ha and will not contain more than 10 000 tons of ROM coal at one period. A height of 4 m will not be exceeded at any one point.	License
	Dust Suppression	26° 0'20.24"S	29°34'47.75"E	Process water will be used for dust suppression around the plant and open quarry area.	Stormwater run-off containing waste from Mining residues requires license.	License
	Pollution Control Dam (North)	26° 0'12.69"S 26° 0'15.98"S	29°34'48.93"E 29°34'49.48"E	Pollution control for waste water generated	130 m x 50 m 3 m height	License

	Activity	Coordinates	Description	Dimensions	Type
		26° 0'15.57"S 29°34'51.15"E 26° 0'12.65"S 29°34'50.42"E		22 700 m ³ capacity	
	Pollution Control Dam (South)	26° 0'28.43"S 29°34'53.94"E 26° 0'32.56"S 29°34'54.42"E 26° 0'32.33"S 29°34'56.25"E 26° 0'28.34"S 29°34'55.43"E	Pollution control for waste water generated	130 m x 50 m 3 m height 22 700 m ³ capacity	License
S21(j)	Removing water from the mining pits as it fills with water	26°0'20.28"S 29°34'48.35"E	See S21(a) on pit dewatering	120 m ³ /day estimated as inflow and will have to be removed – 43 800 m ³ annually removed	License

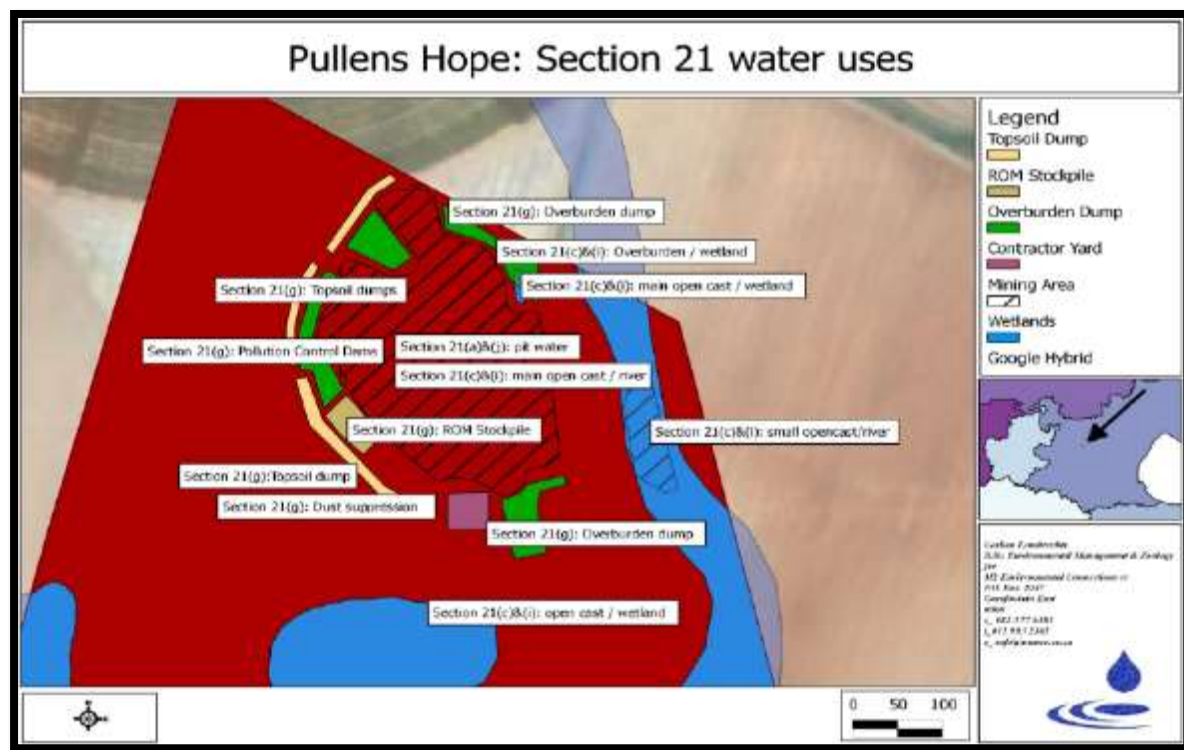


Figure 20: Section 21 C & I water uses

3. Nature and Extent of the Environment Affected by the Activity

3.1 Locality

Kebrafield Roodepoort Colliery is located on the farm Roodepoort 151IS Portion 17, which is situated on the western border of the town Pullenshope in Mpumalanga. Pullenshope is approximately 5 km west of the N11 between Middelburg and Hendrina. The proposed development is situated south of Optimum Colliery, which supplies coal to the Hendrina power station immediately southwest of Pullenshope. Pullenshope used to be the village of Hendrina powerstation which housed all the employees of the powerstation. Now the properties belong mostly to private owners although not all has been sold off by the powerstation. Coal mining operations forms an integrated part of the Hendrina power generation activities. Big scale coal mining operations occur in the local catchment area of the power station. The image below illustrates the relative position of the proposed project site to other towns in the vicinity of the operation. The farm Roodepoort 151IS Portion 17 of which only the northern section of the property is proposed for the development is indicated by the reddish polygon to the west of the town Pullenshope.

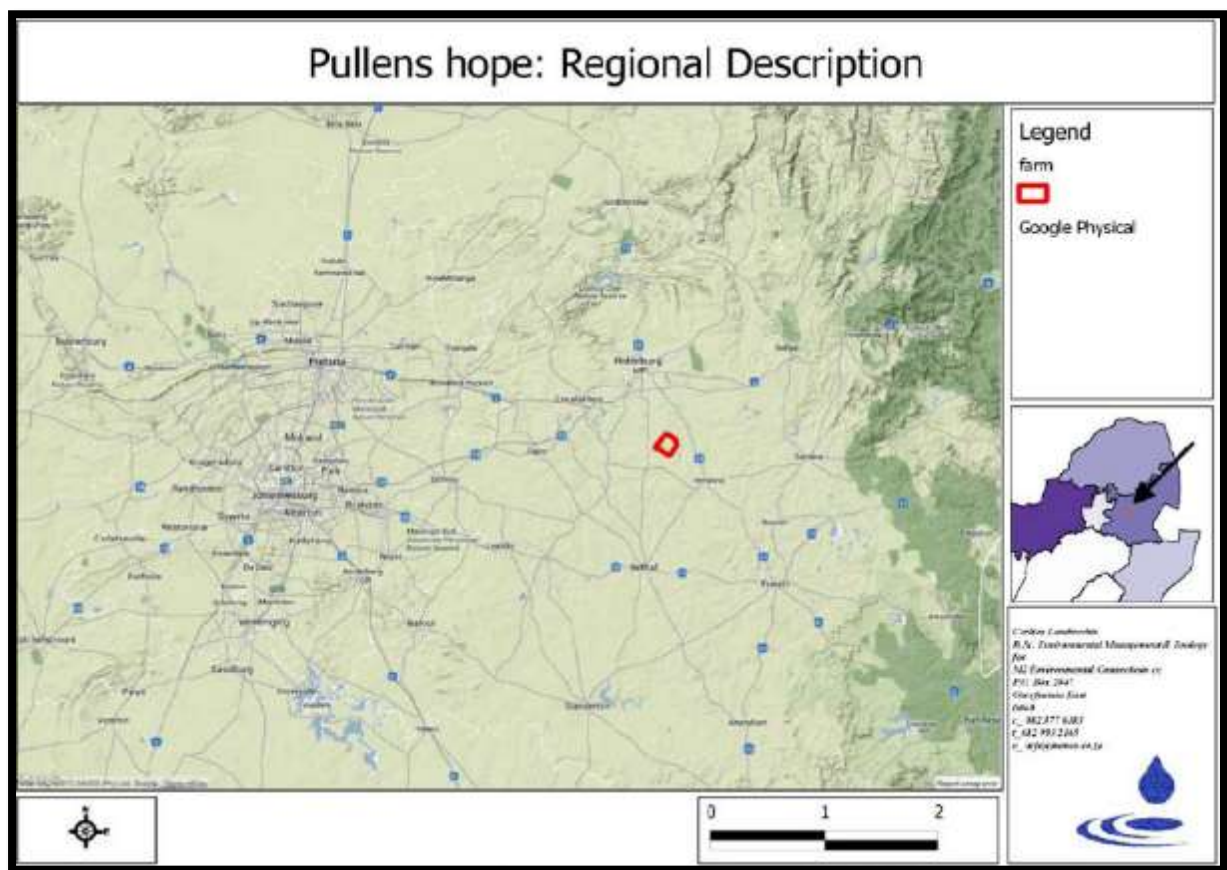


Figure 21: Regional description of the proposed Kebrafield Roodepoort Colliery

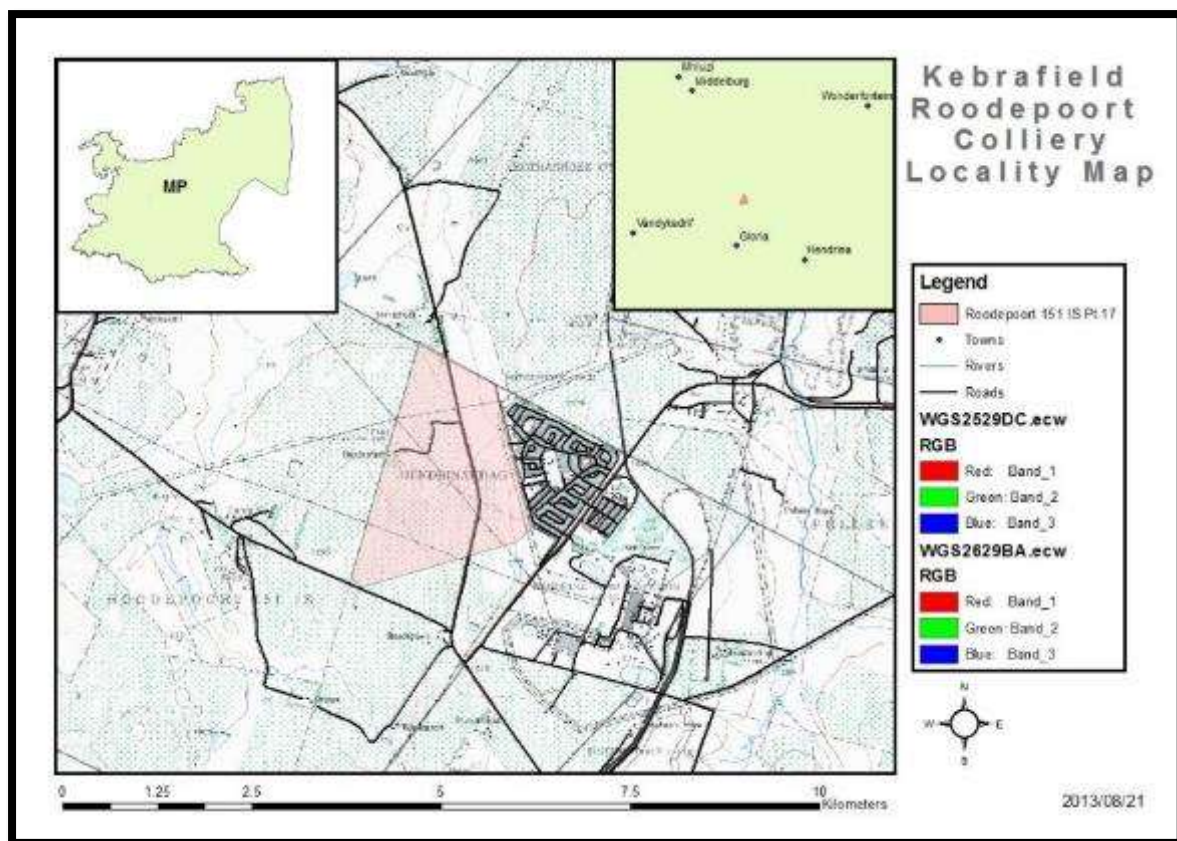


Figure 22: Kebrafield Roodepoort Colliery Locality Map – 1:50 000 Topographical Datasheets WGS2529DC & WGS2629BA

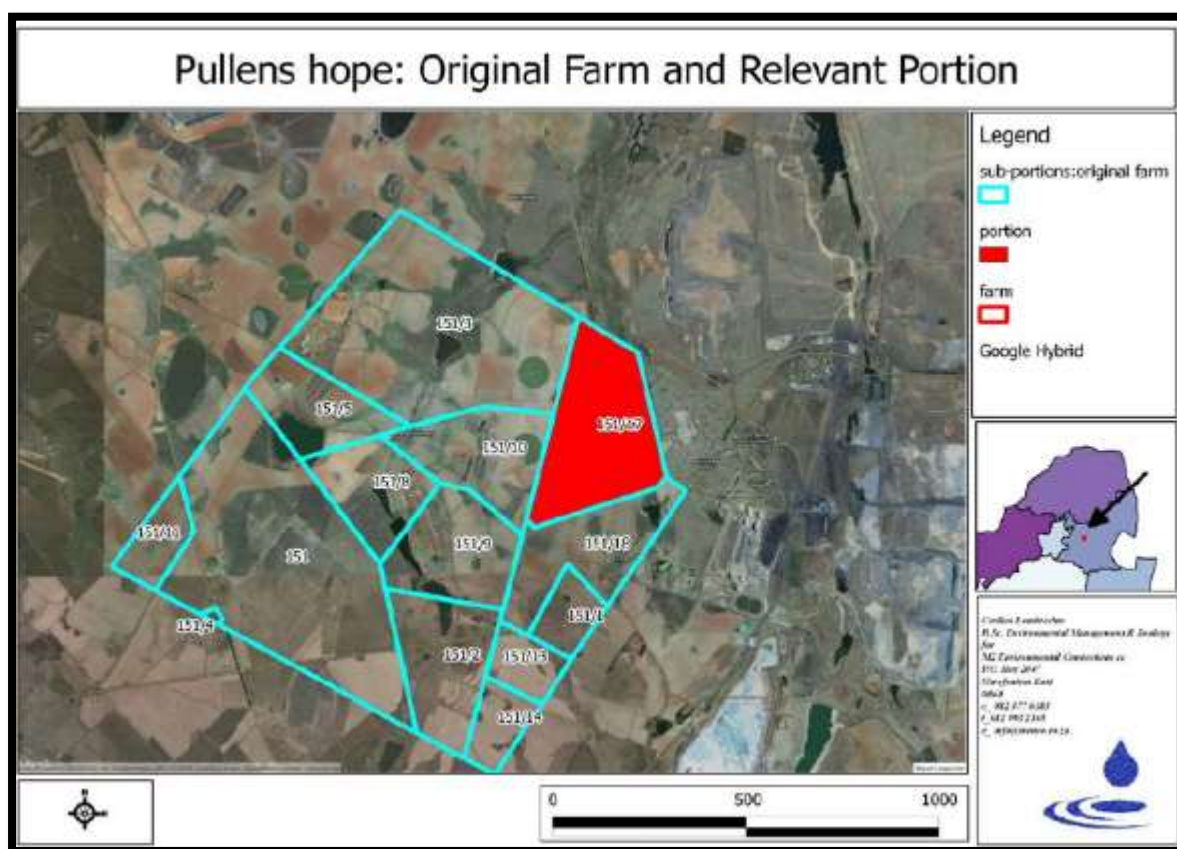


Figure 23: Roodepoort: Original Farm and Relevant Portion

The proposed activities are primarily surrounded by agricultural small holdings, power generation and neighbouring mining operations. Major residential areas in the region include Middelburg (~25km northwest), eMalahleni (~35km west-northwest), Bethal (~45 km southwest) and Ermelo (~60km southeast). Smaller residential areas in the region include Arnot (~20 km northeast), Pullen's Hope (~1 km east), Komati (~12 km southwest), KwaZamokuhle (~17 km southeast) and Hendrina (~17 km southeast) which may include schools and hospitals/clinics. Individual residences (i.e. farm houses) are also in the immediate vicinity of the proposed operations.

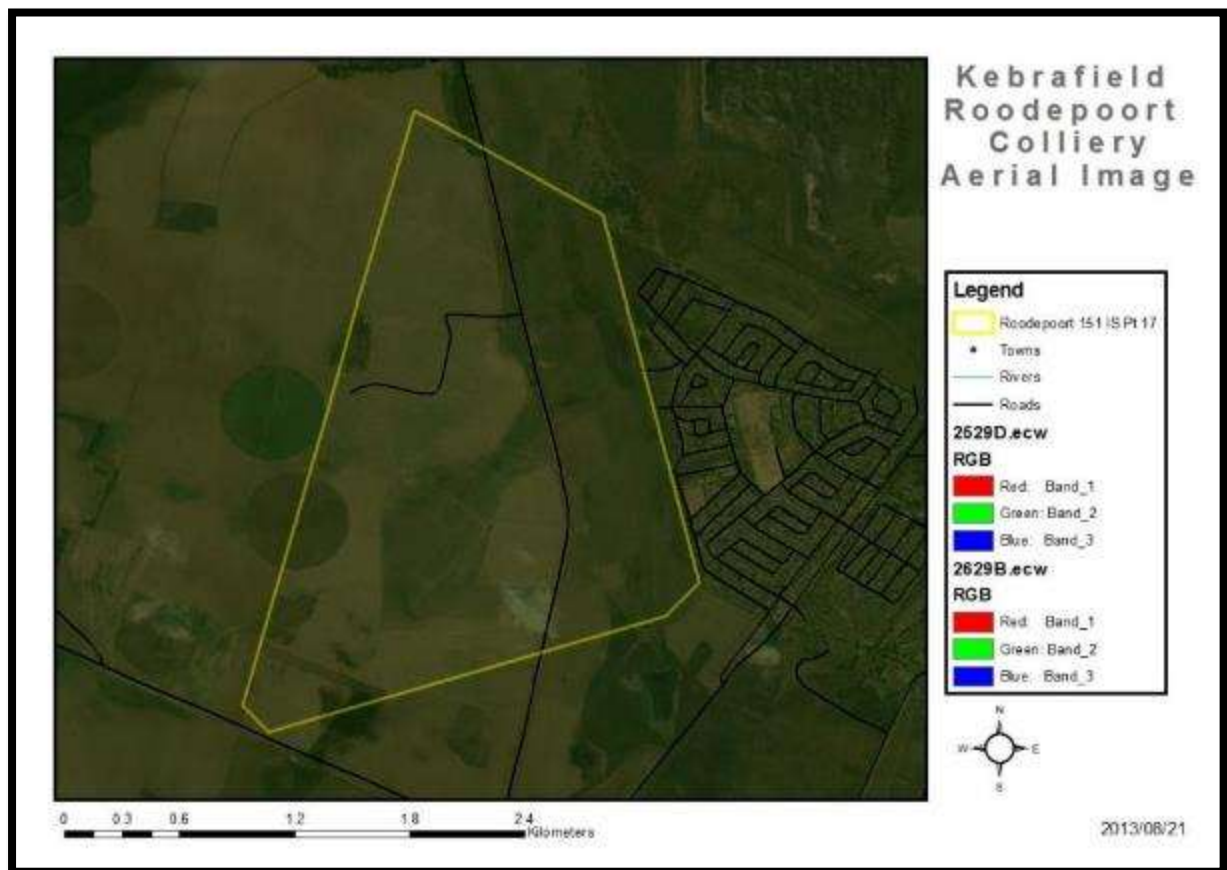


Figure 24: Aerial imagery (2010 Landsat Data) indicating the extent of the farm Roodepoort 151IS Portion 17

Surrounding land uses in the vicinity of the proposed mining site are farming with agricultural as the predominantly activity as well as power generation and the residential areas of Pullens Hope to the right. Agricultural activities include cultivated crops with clear irrigation practices and livestock farming. Optimum Colliery is an active colliery located to the right of Portion 17.

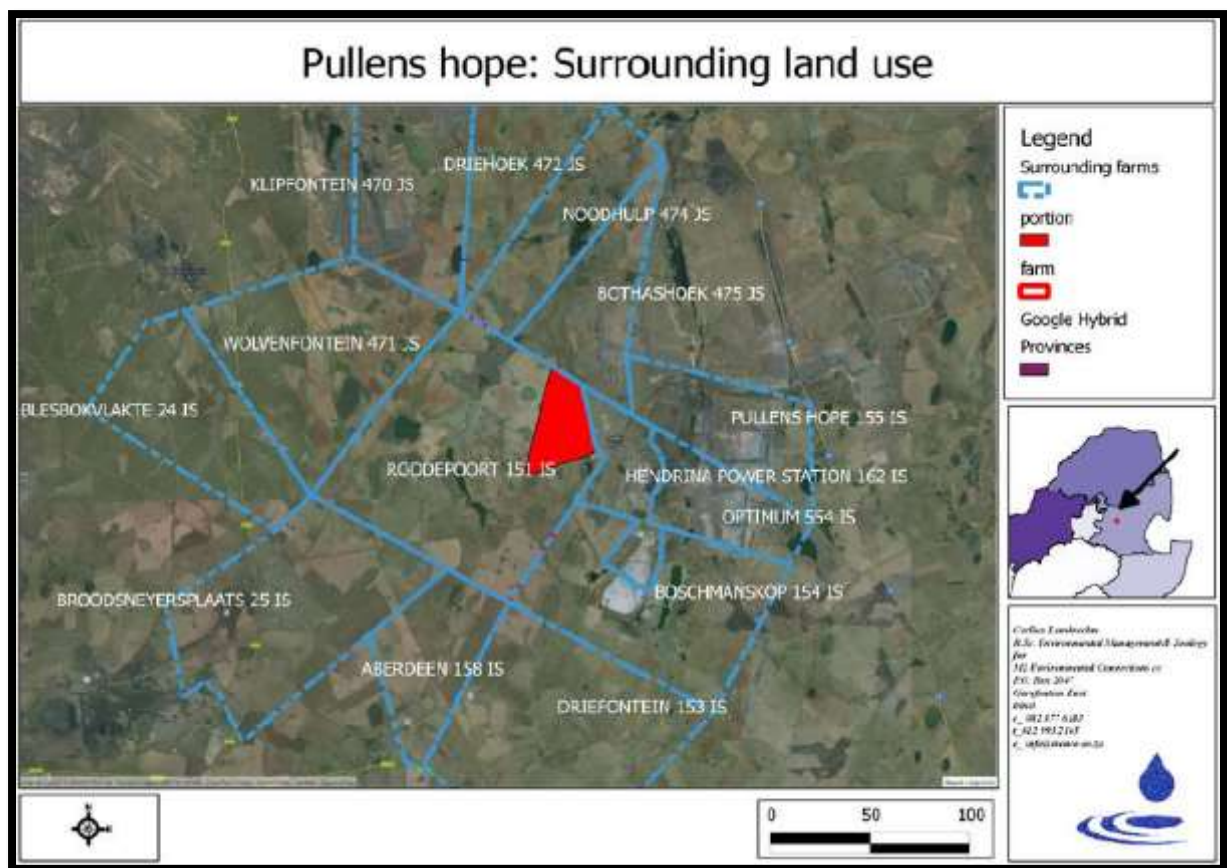


Figure 25: Surrounding land use description

Table 12: Zoning information of surrounding areas

Title name	SG Code of Original	Zoning information
Roodepoort 151 IS	T0IS00000000015100000	Agricultural Holding (All Portions)
Bothashoek 475 JS	T0JS00000000047500000	Mining: Optimum Coal Mine
Pullens hope 155 IS	T0IS00000000015500000	Mining: Optimum Coal Mine (Portion 0 – 3, 9 – 12) Other Purposes: RSA Government Property (Portion 5) Mining: Privately Owned (Portion 6) Mining: Billiton Energy Coal (Portion 8)
Optimum 554 IS	T0IS00000000055400000	Open Cast Colliery: Mining Right
Hendrina Power Station 162 IS	T0IS00000000016200000	Other Purposes: Eskom (Portion 0) Government: Schools (Portion 1) Government: Business (Portion 2) Residential Area (Portion 4) Commercial / Industrial Purposes (Portion 6)
Boschmanskop 154 IS	T0IS00000000015400000	Agricultural Holding (All other)

		Other Purposes: Eskom (Portion 5) Commercial / Industrial Purposes (Portion 8) Mining: Optimum Coal Mine (Portion 11, 21)
Driefontein 153 IS	T0IS000000000015300000	Agricultural Holding (All other) Commercial / Industrial (Portion 38 – 41)
Aberdeen 158 IS	T0IS000000000015800000	Agricultural Holding (All)
Broodsneeyersplaats 25 IS	T0IS000000000002500000	Agricultural Holding (All other) Public Service Infrastructure (Portion 14, 20, 21, 23-35) Mining: Billiton Energy Coal (Portion 9) Other Purposes: RSA Government Property (Portion 22)
Blesbokvlakte 24 IS	T0IS000000000002400000	Agricultural Holding (All other) Public Service Infrastructure (Portion 11-13)
Wolvenfontein 471 JS	T0JS0000000000047100000	Agricultural Holding (All other) Mining: Anglo Operations (Portion 8) Commercial / Industrial Purposes (Portion 14) Other Purposes: RSA Government Property (Portion 15) Public Worship (Portion 23)
Klipfontein 470 JS	T0JS0000000000047000000	Mining: Ingwe Surface Holdings (Portion 0-2)
Driehoek 472 JS	T0JS0000000000047200000	Agricultural Holding (All)

3.2 Geology

3.2.1 Regional Geology

The investigated area falls within the 2528 Pretoria and 2628 East Rand 1:250 000 geology series maps and is situated approximately 2 km north-west of Pullens Hope, Mpumalanga. An extract of this map is shown below.

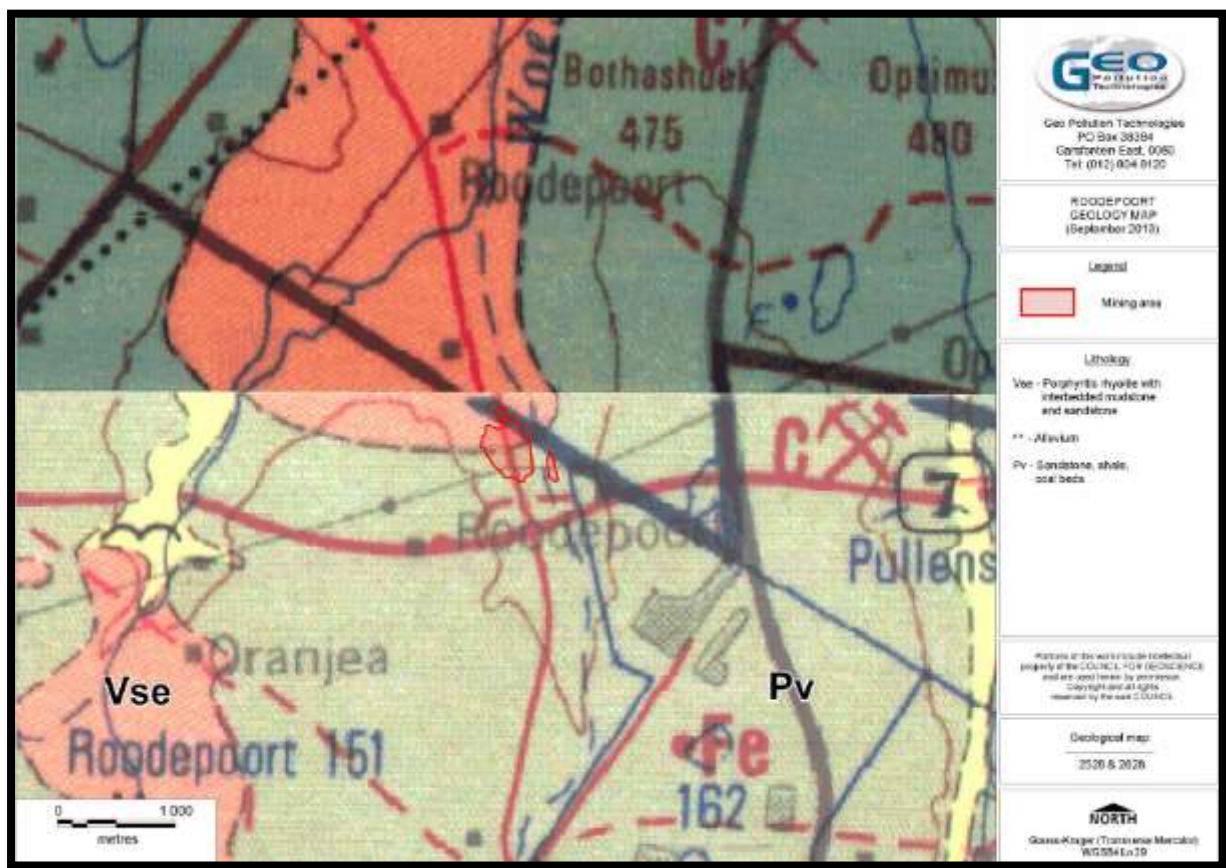


Figure 26: Geology Map

The proposed opencast mining areas fall within the Witbank coalfield, which extends from Belfast in the north-east to Springs in the south-west covering a surface area of approximately 9000 km². There are five coal seams present regionally. These coal seams are numbered from 5 (top) to 1 (bottom) and the distribution of these coal seams are affected by the topography of the pre-Karoo basement and the present day erosional surface. The area is characterised by consolidated sedimentary layers of the Karoo Supergroup. It consists mainly of sandstone, shale and coal beds of the Eccra Group (Vryheid Formation) and is underlain by the Dwyka Group. Jurassic dolerite intrusions occur throughout the area in the form of sills and dykes with outcrops found throughout the whole area.

The Eccra Group (Vryheid Formation), which is part of the Karoo Supergroup, comprises of sediments deposited in shallow marine and fluvio-deltaic environments with coal accumulated as peat in swamps and marches associated with these environments. The sandstone and coal layers are normally reasonable aquifers, while the shale serves as aquitards. Several layered aquifers perched on the relative impermeable shale are common in such sequences. The Dwyka Formation comprises consolidated products of glaciation (with high amounts of clay) and is normally considered to be an aquiclude.

The generally horizontally disposed sediments of the Karoo Supergroup are typically undulating. The extent of the coal is largely controlled by the pre-Karoo topography. Steep dips can be experienced where the coal butts against pre-Karoo hills. Displacements, resulting from intrusions of diabase sills, are common. These intrusions comprise sills, which vary from being concordant to transgressive in structure, and feeder dykes. Although these structures serve as aquitards and tend to compartmentalise the groundwater regime, the contact zones with the pre-existing geological formations also serve as groundwater conduits. There are common occurrences of minor slips or faults, particularly in close proximity to the dolerite intrusives. Within the coalfield, these minor slips, displacing the coal seam by a matter of 1 to 2 metres, are likely to be commonplace.

Rocks of the Selons River Formation (Rooiberg Group) and quaternary alluvium are also present regionally. The Selons River Formation consists of porphyritic rhyolite with interbedded sandstone and mudstone.

3.2.2 Local Geology

From the sheet of 2528 Pretoria and the 2628 East Rand geology series map it is evident that the shale, mudstone and coal beds of the Ecca Group as well as the rhyolites of the Rooiberg Group outcrop in the area. The local geology is best concluded from information obtained from borehole logs from the National Groundwater Archive. A generalised geological stratigraphy, as presented in the table below, was derived from borehole log 2629BA00072, which is the NGA borehole with the closest proximity to the proposed open cast.

Table 13: Generalised Stratigraphic Column of Borehole Log 2629BA00072

AVERAGE DEPTH (MBGL)	AVERAGE THICKNESS (METRES)	DESCRIPTION
0 –5.79	5.8	Shale
5.79 -15.84	10.1	Shale
15.84-24.84	8.2	Coal
24.04 – 28.04	4.0	Shale
28.04 – 34.44	6.4	Sandstone
34.44 – 36.57	2.1	Diabase

3.3 Hydrogeology

3.3.1 Regional Hydrogeology

The area of concern is situated in the Olifants Water Management area. On regional scale the hydrogeology consist of intergranular and fractured aquifers of the Karoo Supergroup and Rooiberg Group and locally the

Karoo Supergroup as well as Jurassic dolerite intrusions, with predominantly arenaceous rocks (sandstone). Blow yields of 0.1 – 0.5 l/s can be expected regionally.

The hydrogeology of the area can be described in terms of the saturated and unsaturated zones:

Saturated Zone

In the saturated zone, at least four aquifer types may be inferred from knowledge of the geology of the area:

- A shallow aquifer formed in the weathered zone, perched on the fresh bedrock.
- An intermediate aquifer formed by fracturing of the Karoo sediments.
- Aquifers formed within the more permeable coal seams and sandstone layers.
- Aquifers associated with the contact zones of the dolerite intrusives.

Although these aquifers vary considerably regarding hydrogeological characteristics, they are seldom observed as isolated units. Usually they would be highly interconnected by means of fractures and intrusions. Groundwater will thus flow through the system by means of the path of least resistance in a complicated manner that might include any of these components.

Shallow perched aquifer

A near surface weathered zone is comprised of transported alluvium and *in-situ* weathered sediments and is underlain by consolidated sedimentary rocks (sandstone, shale and coal). Groundwater flow patterns usually follow the topography, often coming very close to surface in topographic lows, sometimes even forming natural springs. Experience of Karoo geohydrology indicates that recharge to the perched groundwater aquifer is relatively high, up to 3% of the Mean Annual Precipitation (MAP).

Fractured rock aquifers

The host geology of the area consists of consolidated sediments of the Karoo Supergroup and consists mainly of sandstone, shale and coal beds of the Eccu Group (Vryheid Formation). Most of the groundwater flow will be along the fracture zones that occur in the relatively competent host rock. The geology map does not indicate any major fractures zones in this area, but from experience it can be assumed that numerous major and minor fractures do exist in the host rock. These conductive zones effectively interconnect the strata of the Karoo sediments, both vertically and horizontally into a single, but highly heterogeneous and anisotropic unit.

The Selons River Formation forms a secondary aquifer that is composed of porphyritic rhyolite with interbedded sandstone and mudstone. Groundwater in this aquifer is generally found at the boundary between weathered and solid rock and along joint and contact zones. These aquifers have a poor potential yield based on the 86 % of boreholes (from available records) with yields of less than 2l/s. The water level in these aquifers is usually between 10 and 30 mbgl.

Aquifers associated with coal seams

The coal seam forms a layered sequence within the hard rock sedimentary units. The margins of coal seams or plastic partings within coal seams are often associated with groundwater. The coal itself tends to act as an aquitard allowing the flow of groundwater at the margins.

Aquifers associated with dolerite intrusives

Dolerite intrusions in the form of dykes and sills are common in the Karoo Supergroup, and are often encountered in this area. These intrusions can serve both as aquifers and aquifuges. Thick, unbroken dykes inhibit the flow of water, while the baked and cracked contact zones can be highly conductive. These conductive zones effectively interconnect the strata of the Eccra sediments both vertically and horizontally into a single, but highly heterogeneous and anisotropic unit on the scale of mining. These structures thus tend to dominate the flow of groundwater. Unfortunately, their location and properties are rather unpredictable. Their influence on the flow of groundwater is incorporated by using higher than usual flow parameters for the sedimentary rocks of the aquifer.

Unsaturated Zone

Although a detailed characterization of the unsaturated zone is beyond the scope of this study, a brief description thereof is supplied. The unsaturated zone in the proposed mining area is in the order of between 2.5 and 15.54 metres thick (based on static groundwater levels measured in the existing boreholes as well as the NGA boreholes) and consists of alluvial sediments at the top, underlain by residual sandstone/siltstone/mudstone of the Eccra Group that becomes less weathered with depth.

3.3.2 Local Hydrogeology

Based on borehole logs obtained from the NGA and literature, the following local hydrogeological description (within the aquifer boundary) from top (surface) to bottom can be deduced as follows:

Shallow weathered aquifer (unconfined)

This aquifer comprises of weathered arenaceous sandstones and shales. The Eccra sediments are weathered below surface throughout the area. The upper aquifer is associated with this weathered zone and water is found deep below the surface, often deeper than this hydrogeological unit. The hydraulic conductivity value for the aquifer is estimated at 1×10^{-6} m/d to 0.10 m/d

The estimated thickness of the aquifer is estimated to have an average thickness of 6 m. Water levels measured in this aquifer ranged from 2.3 to 2.5 meters below ground level.

Deeper fractured aquifer (confined)

The pores within the Karoo and more specifically the Eccu sediments are too well-cemented to allow any significant flow of water. All groundwater movement therefore occurs along secondary structures, such as fractures and joints in the sediments. These structures are better developed in competent rocks, such as sandstone, hence the better water-yielding properties of the latter rock type.

It should be emphasised, however, that not all secondary structures are water-bearing. Many of these structures are constricted because of compression forces that act within the earth's crust. The chances of intersecting a water-bearing fracture by drilling decrease rapidly with depth. At depths of more than 30 m, water-bearing fractures with significant yield were observed to be spaced at 100 m or greater.

The thickness of the aquifer was estimated at a mean of 18 m. Water levels measured in this aquifer ranged from 8 to 8.6 m below ground level.

Dwyka Tillite occurs at the base of the aquifer. Packer testing of the Dwyka Tillite done by Hodgson (1998) had a permeability distribution as indicated in Table 3. This permeability is very low and therefore can be regarded as a confining layer.

Table 14: Statistics for results on packer hydraulic conductivity testing of the Dwyka Tillite (Hodgson et al., 1998).

Statistics	Dwyka Permeability (m/d)
Mean	0.0034
Median	0.0024
Standard Deviation	0.0034
Minimum	0.0002
Maximum	0.0148

Additionally, the presence of the dense, unfractured rhyolites of the Selonsriver formation may also act as a hydraulic boundary as the conductivities of these igneous rocks are low, with groundwater movement occurring at less than 10-5 m/d, based on available data.

Lateral extent of aquifers

The lateral extent of the groundwater zone is a severely complex issue. The weathered and fractured Karoo aquifers, barring the occurrence of dolerite intrusions and hydraulic boundaries on the scale of the area of investigation can be taken as infinite. It is obvious however that their lateral extent in the study area is highly dependent on the distribution of dolerite dykes and sills.

Ignoring the effects of geological features, the maximum lateral extent of the aquifers is also limited by hydraulic boundaries as formed by major rivers/streams which act as groundwater discharge boundaries, topographical watersheds which act as no-flow boundaries and surface infiltration sources which usually represent constant head influxes.

Recharge

The main source of recharge into the upper aquifer is rainfall that infiltrates the aquifer through the overlying unsaturated zone. Rainfall that manifests as surface run-off and drains to streams may also subsequently enter the shallow aquifer by infiltrating the stream bed (Grobelaar, 2001). Water impoundments and features such as tailings dams may constitute additional recharge sources in certain areas.

The rainfall ultimately recharging the upper aquifer is estimated at 3–5 %. A higher proportion of infiltration may occur in areas where the natural permeability is increased, such as the increased fracturing associated with high extraction mining. Generally accepted values for recharge in high extraction areas are between 5 % and 7 %.

Recharge of the deep Karoo aquifer occurs from the shallow Karoo aquifer through permeable fracture systems that link the two aquifers. The natural distribution of such fracture systems is highly variable, and the recharge of the deep aquifer is expected to be some orders of magnitude lower than for the shallow aquifer. However, induced fracturing associated with mining can extend from the deep aquifer up to the surface and provides a relatively direct and highly permeable recharge route. The magnitude of recharge by this route depends on the extent of mining and the nature of the induced fracture pattern.

The recharge calculation for the unconfined (water table) aquifer for the study area is calculated below;

Table 15: Recharge calculation for the shallow unconfined aquifer

Recharge Estimation			
Method	mm/a	% of rainfall	Certainty (Very High=5 ; Low=1)
Chloride	64.1	9.2	4
Schematic maps			
Soil	42	5.9	3
Geology	34.7	4.9	3
Vegter	32.0	4.5	3
Acro	20.0	2.8	3
Harvest Potential	25.0	3.5	3

Summary

Based on the data detailed in the preceding sections the following can be concluded:

- Three aquifers are inferred to be present across the site at varying depths;
- The extent and depth of the aquifers is controlled by the sub-surface Karoo formation layering, weathering, geometry and post-Karoo intrusions;
- Flow within the weathered aquifer is thought to be multi-porous and is controlled by weathering, flow within the fractured aquifer is controlled by the fracturing network while the competent host rocks serve as storage;
- Recharge into the weathered aquifer is thought to be directly linked to rainfall while recharge into the fractured aquifer is linked to shallower aquifers.

3.3.3 Results of the Specialist Geohydrological Study

The area is characterised by a gentle undulating topography and in the area of the proposed opencast coal mine the slope is more or less in the order of 1:40 (0.025). The direction of the slope on site is towards the east.

There are a few surface water points around the proposed opencast mine, with a stream down gradient to the east of the site. On a larger scale, drainage occurs towards the generalised flow of the Woes-Alleen spruit which confluences with the Klein Olifants River approximately 12 km from the site.

Groundwater levels were measured in six boreholes during a hydrocensus conducted in September 2013 for the proposed opencast coal mine. The depth of the groundwater was found to vary between 2.3m and 8.6m below ground level.

The fractured aquifer was classified as a minor aquifer as it is not a highly productive aquifer. Using the Groundwater Decision Tool it was found that the aquifer has a medium to high vulnerability and as a result it also has a medium level groundwater quality management index. This indicates that a medium level of aquifer protection is required in the area of the proposed opencast.

Based on the data collected in terms of hydrogeology, the following can be concluded.

- Three aquifers are inferred to be present across the site at varying depths.
- The extent and depth of the aquifers is controlled by the sub-surface Karoo formation layering, weathering, geometry and post-Karoo intrusions.
- Flow within the weathered aquifer is thought to be multi-porous and is controlled by weathering, flow within the fractured aquifer is controlled by the fracturing network while the competent host rocks serve as storage.

- Recharge into the weathered aquifer is thought to be directly linked to rainfall while recharge into the fractured aquifer is linked to shallower aquifers.

If collected the groundwater samples, are compared to the DWA guidelines for domestic use, only pH is elevated above the tolerable water quality (ROD1). The concentration of Mn in ROD4 and ROD6 is also elevated above the target water quality range but still falls within the tolerable water quality range. This constituent can be sourced directly from the underlying geology. Mn is a common component in sandstones of the Eccu. Additionally, Na falls within the tolerable water quality range for ROD6.

3.4 Topography

The surface topography of the area is typical of the Mpumalanga Highveld, mainly a gently undulating plateau, varying between approximately 1680 mamsl underneath Ash Dam 4 to 1600 mamsl along the Woest-Alleen Spruit (East) and the lower reaches of the Woest-Alleen Spruit (West). The mining area is situated between the contour lines of the 1600 mamsl to 1610 mamsl. Several man-made features are also of significance at the site. Numerous dams have been constructed for a variety of purposes, the most obvious of which is the man made dam to the east of the study area, situated right in the middle of a wetland. Various Eskom power lines transect the proposed mining area while there is a gravel road that runs straight through the middle of the mining footprint. These features are indicated in the figure below, 1:50 000 topographical map.

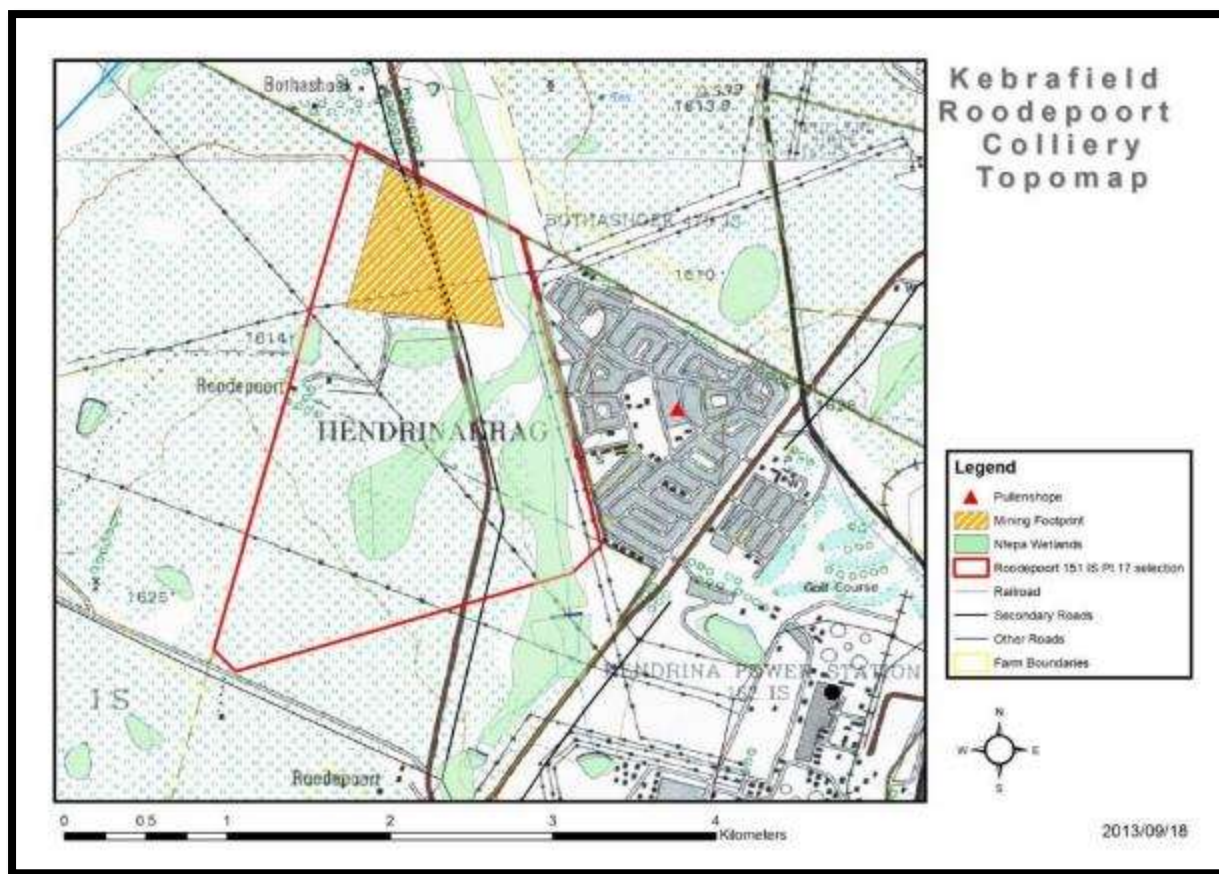


Figure 27: Topography according to the 1:50 000 topographical map

3.5 Climate

3.5.1 Regional Climate

Kebrafield Roodepoort Colliery is situated on the Mpumalanga Highveld. The usual highveld weather conditions prevail with warm summers and cold winters with the main temperature at 14:00 in winter being about 17°C. The climate of the area under investigation is classified as the Highveld region (Region H), which is defined as a climate with a temperate to warm temperature and summer rains.

3.5.2 Rainfall Data

The average annual precipitation in the Highveld region varies from about 900 mm on its eastern border to about 650 mm in the west. The rainfall is almost exclusively due to showers and thunderstorms and falls mainly in summer, from October to March, the maximum fall occurring during January. The winter months are normally dry and about 85% of the annual rainfall falls in the summer months; heavy falls of 125 mm to 150 mm occasionally fall in a single day. This region has about the highest hail frequency in South Africa; about 4 to 7 occurrences may be expected annually at any one spot.

Kebrafield Roodepoort Colliery lies within quaternary sub-catchment B12B of rainfall zone B1B. The average precipitation for this region at weather station 0516 480 is 672 mm.

The average monthly rainfall recorded at weather stations within quaternary sub-catchment B12B is summarised in the table below and displayed graphically in the figure below. Data from the measurements taken during 70 years (1920 - 1989) were obtained. From the data listed in the table it can be seen that the wettest months (on average) are November, December and January whilst the driest months are June, July and August.

Table 16: Average rainfall recorded at weather station within quaternary sub-catchment B12B.

Month	Average rainfall	
	(516 480)	(516 414)
Jan	115.92	115.75
Feb	87.36	87.23
Mar	72.31	72.20
Apr	42.07	42.00
May	14.92	14.90
Jun	7.73	7.72
Jul	6.45	6.44
Aug	6.85	6.84
Sep	25.00	24.96
Oct	68.54	68.44
Nov	113.43	113.26
Dec	109.67	109.51

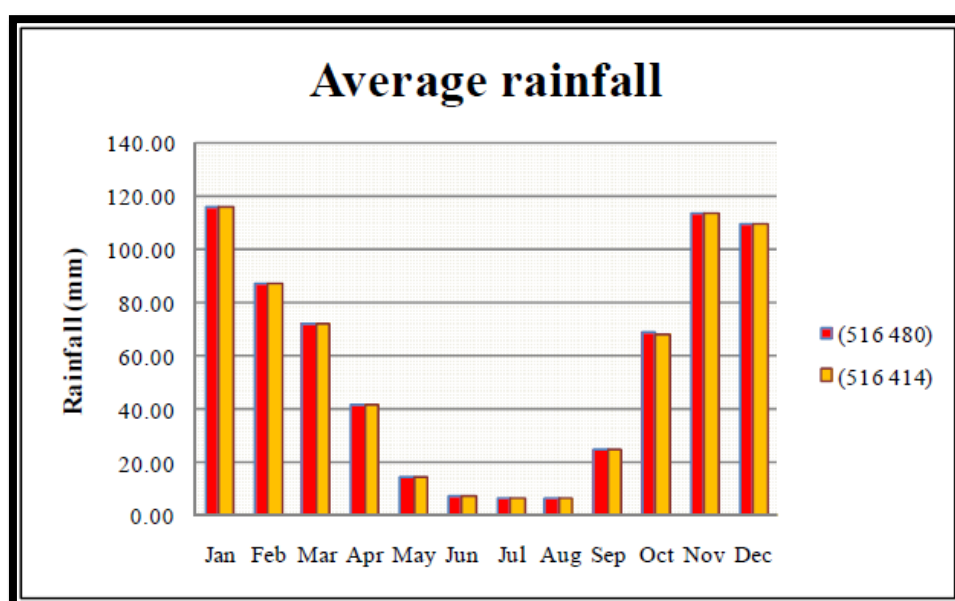


Figure 28: Average rainfall recorded at weather station 0516 480 (Over a period of 70years)

Rainfall represents an effective removal mechanism of atmospheric pollutants and is therefore frequently considered during air pollution studies. Monthly rainfall for the site (2007 – 2009) is given in the table below. Average monthly rainfall for this period is in the range of 306 mm. The study area falls within a summer rainfall region, with over 85% of the annual rainfall occurring during the October to March period.

Table 17: Monthly average rainfall for the site for the period 2007 – 2009

Month	Average rain (mm)	Average No. hours>0.254mm	Average No. days>0.254mm
Jan	973	182	21
Feb	315	87	13
Mar	236	74	12
Apr	107	37	7
May	60	19	3
Jun	23	10	2

3.5.3 Temperature

Average daily maximum temperatures are roughly 27°C in January and 17°C in July but in extreme cases these may rise to 38°C and 26°C respectively. Average daily minima range from about 13°C in January to 0°C in July, whereas extremes can sink to 1°C and –13°C respectively. The period during which frost is likely to form lasts on the average for about 120 days from May to September.

Table 18: Average monthly temperatures. – Climate of SA, WB 42 (1961 – 1990)

	AVERAGE OF DAILY			
	MAX	MIN	MEAN	RANGE
	TX	TN	(TX+TN)/2	TX - TN
J	25,6	13,8	19,7	11,8
F	25,2	13,2	19,2	12,1
M	24,6	11,8	18,2	12,8
A	21,8	8,6	15,1	13,2
M	19,5	4,4	11,9	15,1
J	16,5	0,8	8,7	15,6
J	17,1	1,0	9,0	16,2
A	19,9	3,8	11,9	16,1
S	23,2	7,5	15,3	15,7
O	23,9	9,9	17,0	14,1
N	24,0	11,8	17,9	12,3
D	25,3	13,1	19,2	12,2
YR	22,2	8,3	15,3	13,9

Table 19: Average Max temperatures. – Climate of SA, WB 42 (1961 – 1990)

	MAXIMUM (TX) P = 26 Years											
	HIGHEST (TXX)			AVERAGE NUMBER OF DAYS WITH TX						LOWEST (TXN)		
	MAX	YY/DD	MEAN	>=35	>=30	>=25	>=20	>=15	<10	MEAN	MIN	YY/DD
J	33,7	69/13	30,0	0,0	2,0	19,5	29,5	30,9	0,0	18,8	13,1	72/23
F	34,4	83/27	29,5	0,0	1,2	16,3	26,9	28,2	0,0	18,6	13,2	76/12
M	32,6	73/15	28,7	0,0	0,7	15,4	28,8	30,6	0,0	17,4	11,5	67/19
A	30,0	87/04	26,3	0,0	0,0	4,9	22,9	29,0	0,1	14,6	7,9	72/30
M	27,0	83/01	23,8	0,0	0,0	0,4	14,4	28,9	0,1	13,0	7,9	72/12
J	23,5	66/11	20,9	0,0	0,0	0,0	3,2	23,2	1,1	9,5	3,3	84/14
J	24,6	88/17	21,5	0,0	0,0	0,0	4,4	25,5	0,8	9,8	2,5	67/14
A	26,6	65/22	25,1	0,0	0,0	1,4	17,4	28,6	0,6	11,3	6,0	68/10
S	32,0	83/29	28,8	0,0	0,2	12,9	24,0	28,4	0,4	12,2	6,4	88/02
O	33,0	65/31	29,9	0,0	1,7	14,8	25,3	29,8	0,1	14,1	8,0	81/04
N	32,6	68/07	29,4	0,0	1,2	13,5	26,0	29,0	0,2	15,4	6,8	68/11
N	33,0	68/29	29,6	0,0	1,4	18,0	29,2	30,9	0,0	18,0	14,1	73/10
YR	34,4	83/27	31,6	0	9	117	252	343	3	7,1	2,5	67/14

A correlation exists between the temperatures and the evaporation tempo, therefore the highest temperatures and evaporation occurs during the summer.

Table 20: Average Min temperatures. – Climate of SA, WB 42 (1961 – 1990)

MINIMUM (TN) P = 26 Years												
HIGHEST (TNX)			AVERAGE NUMBER OF DAYS WITH TN						LOWEST (TNN)			
MAX	YY/DD	MEAN	>=20	<15	<10	<5	<0	<-5	MEAN	MIN	YY/DD	
18,5	83/29	16,6	0,0	22,2	1,1	0,0	0,0	0,0	9,7	6,5	77/02	J
20,5	79/05	16,6	0,0	22,2	2,4	0,0	0,0	0,0	8,6	5,5	63/28	F
20,1	79/20	15,8	0,0	28,6	6,3	0,2	0,0	0,0	6,6	0,5	74/19	M
15,5	87/05	13,4	0,0	30,0	18,7	3,7	0,2	0,0	2,2	-1,4	88/26	A
12,7	79/04	9,6	0,0	31,0	30,0	17,7	2,1	0,0	-1,3	-3,9	63/31	M
10,5	79/01	6,3	0,0	30,0	30,0	26,7	11,4	0,8	-4,4	-9,2	64/27	J
8,7	83/14	6,1	0,0	31,0	31,0	28,5	11,0	0,5	-4,1	-8,0	64/26	J
11,5	86/28	9,5	0,0	31,0	30,4	18,7	4,2	0,2	-2,8	-7,5	72/02	A
14,8	65/18	12,7	0,0	30,0	22,6	5,9	0,9	0,0	0,4	-4,8	74/08	S
16,9	67/24	14,7	0,0	30,5	13,4	2,1	0,2	0,0	3,7	-1,2	65/21	O
18,0	80/11	15,6	0,0	28,1	5,8	0,4	0,0	0,0	6,6	3,0	69/12	N
17,7	87/21	16,1	0,0	25,2	2,0	0,1	0,0	0,0	8,2	2,6	70/07	D
20,5	79/05	17,3	0	340	194	104	30	1	-5,5	-9,2	64/27	YR

Air temperature has important implications for the buoyancy of plumes; the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise. Temperature also provides an indication of the extent of insolation, and therefore of the rate of development and dissipation of the mixing layer. The diurnal temperature profile for the site (2009) is given in the figure below (Diurnal temperature for site during 2009). Annual maximum, minimum and mean temperatures for the site are given as 25.7°C, 2.2°C and 15°C, respectively, based on the calculated MM5 data for the period 2009. Average daily maximum temperatures range from 25.7°C in December to 12.6°C in July, with daily minima ranging from 16.6°C in January to 2.2°C in July (Figure: Minimum, maximum and average monthly temperatures for the site during the period 2009).

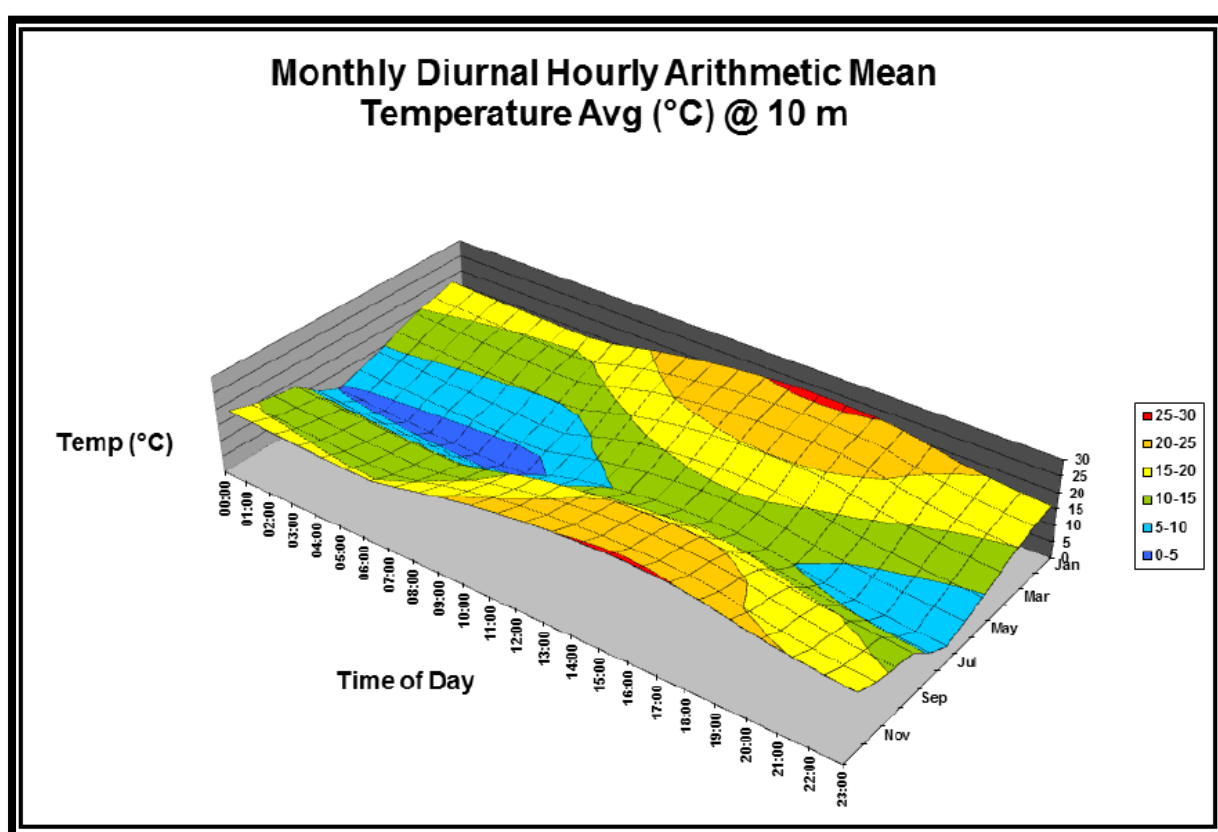


Figure 29: Diurnal temperature profile for the site (2009)

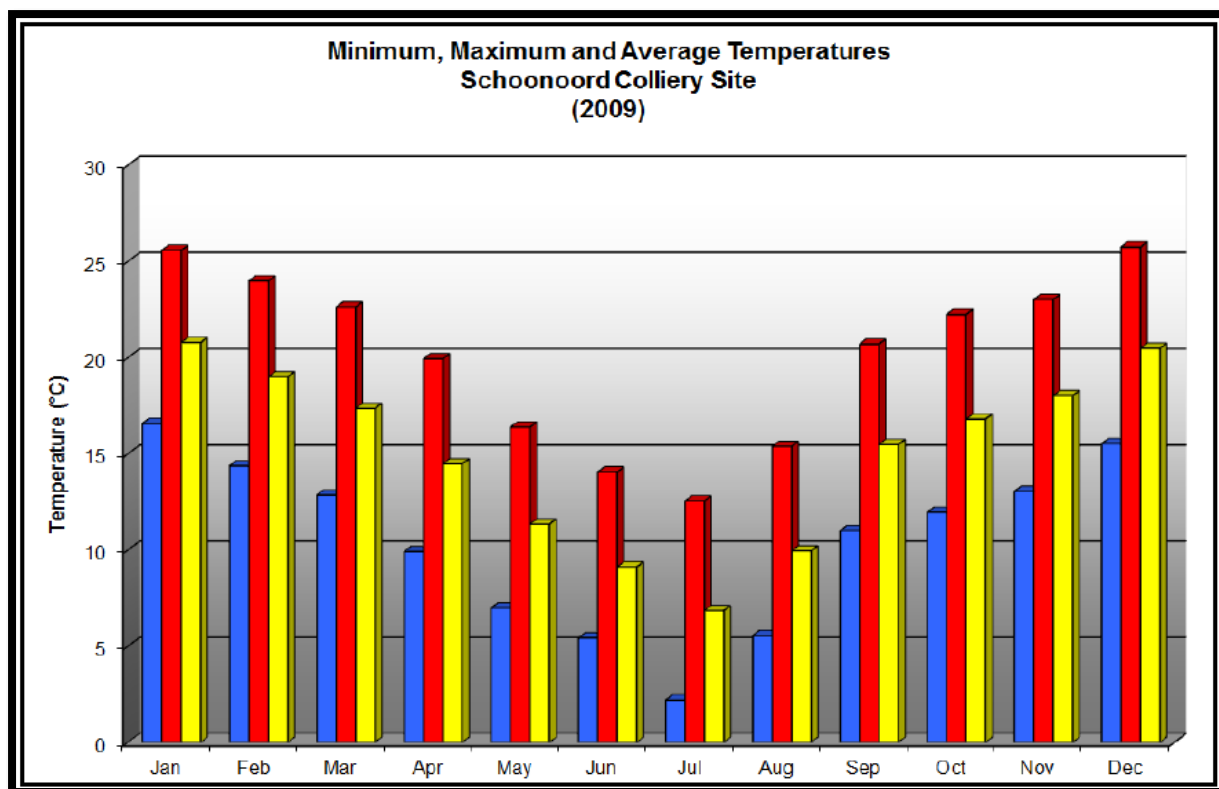


Figure 30: Minimum, maximum and average monthly temperatures for the site during the period 2009

3.5.4 Evaporation

The mean monthly evaporation records are obtained from Hydrological Information Publication No. 13, Evaporation and Precipitation Records, WB42, 1990. These records are listed in the table below.

Table 21: Evaporation data. – Climate of SA, WB 42.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1963	167.6	202.2	117.2	107.2	97.3	60.5	79.2	141.2	176.3	188	151.4	216.7
1964	177	180.6	187.7	123.7	106.9	78.5	94.5	142.5	194.3	160.9	189	158
1965	185.4	179.6	174.2	106.4	105.2	80.3	90.4	137.7	168.7	222	185.7	217.4
1966	187.7	135.1	179.3	128.8	121.2	82.3	115.3	142	181.4	196.3	189	166.4
1967	170.9	115.8	140	87.1	83.6	78.7	80.8	117.9	178.8	199.6	166.9	204
1968	200.5	188	110.2	102.2	78.4	67.8	106.2	137.3	186.9	241.1	155.7	209.5
1969	228.1	162.3	110.2	111.3	70.7	83.2	87.9	131.9	180.2	168.3		
1970		154.7	189	140.1	123.2	92.3		178.2		212	199.7	256.6
1971	163.3	154.1	195.5	123.8	98	93.4	117.7	167	200.8	196		198
1972	153	160.8	137.7	131.3	104.9	101.2	121.6	166.7	209.7	211.9	179.1	264.4
1973	227.4	157.2	188.5	98.6	114	105.6	108	147.4	230.9			190
1974	153.9	161.7	170.9	93.7	104	99.6	103	168.3	213.4	259.4	168.8	218.4
1975	174.5	136.6	138.5	103.2	81.8	66.2	81.9	116.3	142.2	174.6	158	
1976		130.6	100.2		59.5		75.5			157.6	159.7	174.9
1977	179.3	136.4	108.4	103.5	97.7	91.9	85.5	119.2	130.7			
1978					92.8		67.6	124.3	144.9	176	163.6	186.4
1979	178.6	157.1	151.6	117.2	84.9	73.9		104.5		165.5	159.8	164.5
1980	189.3	130.6	130.8	123.3	101.2	66.2	73.1		137.7	198.2	181.2	168.2
1981	156.2	109.5	131.5	102.8	70.8	74.3	72.4	88.8	144.2	148.5	175.7	184.8
1982	174.1		139	92.4	86.8	71.2	76	106	133.3	158.2	140.2	222.8
1983	177.3	153.5	141.9	109.7	102.6	69.9	82.4	104.2	167.4	153.4	169.9	158.5
1984	161.5	144.2	127.1	99.6	96.2	64.4	69.5	108.7	124	153.2	139.9	201.7
1985	164.1	123.5	130.4	116.4	85.5	76.9	82.2	114.6	125.8	169.2	174.5	189.2
1986	196.7	148.8	153.1	108.9	93.4	66.4		127.1	128.4	146.7	143.1	166.1
1987	189	153.2	139.4	123.2	110.3	77.1	87	122	118			184.5
AVE	179.8	151.1	147.8	111.1	94.8	79.2	89	132	167	186.6	167.6	195.9
YEAR	AVE : 1702											

3.2.5 Wind Regime

On the whole winds are light except for the short periods during thunderstorms. Very occasionally tornadoes do occur and cause tremendous damage if they happen to strike a populated area. The figure indicating wind roses below provides period wind roses for the proposed Kebrafield Roodepoort Colliery, with the next figure including the seasonal wind roses for the same site. The predominant wind direction is northwesterly and easterly with a >10% frequency of occurrence. Winds from the southwesterly sectors are relatively infrequent occurring <5% of the total period. Calm conditions (wind speeds < 1 m/s) occur for 11% of the time.

Table 22: Hourly wind analysis. – Climate of SA, WB 42 (Witbank 1993 - 2000)

Hourly Wind Analysis																																	
Percentage frequency (f) for each direction (incl calms) and average speed (s) in m/s																																	
Analysis based on hourly values. - Witbank (1993/11/01 - 2000/12/31)																																	
Month	Calm	N		NNE		NE		ENE		E		ESE		SE		SSE		S		SSW		SW		WSW		W		WNW		NW		NNW	
		f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s	f	s
1	5	9	3	4	3	3	2	4	3	19	4	19	4	7	4	3	4	4	3	3	3	2	3	2	3	5	3	4	3	3	3	5	3
2	4	8	3	4	2	3	2	4	3	21	4	22	4	6	3	3	3	5	3	3	3	2	3	2	3	5	3	3	3	3	2	3	2
3	6	10	3	4	3	3	2	4	2	17	3	17	4	6	3	3	3	4	3	2	3	2	3	2	3	5	3	5	3	5	3	5	3
4	8	11	3	4	3	2	2	2	2	12	3	12	3	6	3	4	3	6	3	3	3	2	3	3	3	6	3	7	3	6	3	5	3
5	8	8	3	3	2	2	2	2	2	7	3	11	3	7	3	4	3	8	3	6	3	5	3	5	3	9	3	7	3	6	2	4	2
6	11	8	3	2	2	1	2	1	3	4	3	8	3	6	3	4	3	9	3	7	3	4	3	5	3	9	3	8	3	7	3	5	2
7	9	11	3	3	3	2	3	2	2	8	4	12	4	7	3	4	3	7	3	5	4	3	3	3	3	7	3	7	3	6	3	6	3
8	7	14	3	5	3	3	2	3	3	9	3	10	3	5	3	2	3	6	3	6	4	3	4	3	3	6	3	6	3	6	3	6	3
9	4	20	3	7	3	4	3	4	3	12	4	7	4	3	3	1	3	3	3	4	4	3	4	2	3	5	3	6	3	6	3	10	3
10	3	19	4	8	3	5	3	4	3	14	5	10	5	3	3	4	2	3	4	2	4	1	4	2	3	5	3	5	3	5	3	8	3
11	3	24	3	8	3	5	3	5	3	11	4	7	4	3	3	1	3	3	4	3	4	2	4	2	3	4	3	5	4	6	3	7	4
12	3	20	3	6	3	4	3	4	3	13	4	9	4	3	4	2	3	3	4	2	4	1	3	2	3	5	3	7	3	6	3	8	3
Year	6	13	3	5	3	3	3	3	3	12	4	12	4	5	3	3	3	5	3	4	4	3	3	3	3	6	3	6	3	5	3	6	3

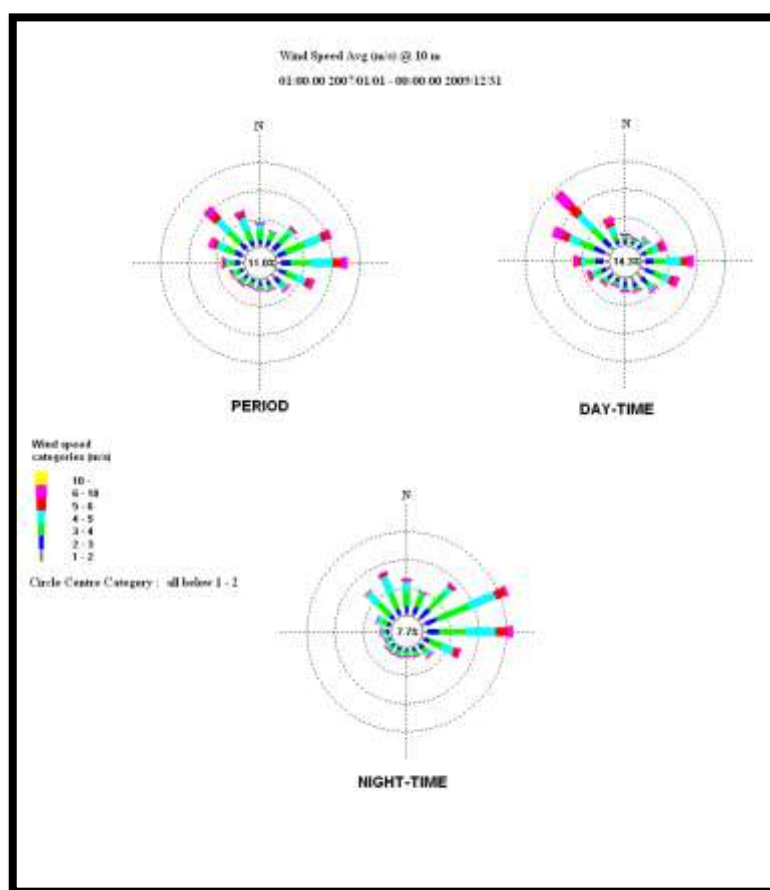


Figure 31: Period, day-time and night-time wind roses for Hendrina Wet Ash Disposal facility (1 January 2007 to 31 December 2009)

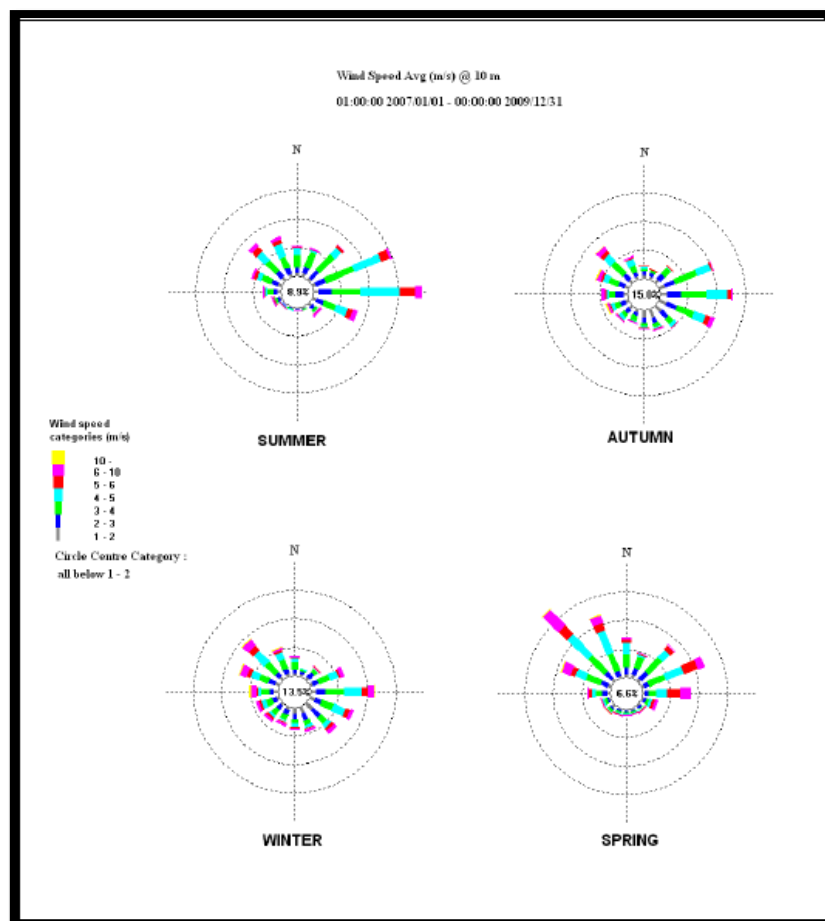


Figure 32: Seasonal wind roses for Hendrina Wet Ash Disposal facility (1 January 2007 to 31 December 2009)

A frequent northwesterly flow dominates day-time conditions with ~15% frequency of occurrence. During the night-time an increase in easterly and east-northeasterly flow is observed with a decrease in northwesterly air flow. During summer months, winds from the east become more frequent, due to the strengthened influence of the tropical easterlies and the increasing frequency of occurrence of ridging anticyclones off the east coast. There is an increase in the frequency of calm periods (i.e. wind speeds <1 m/s) during the winter months of 13.5%. Wind speeds in general range between 0 m/s and 14 m/s, with an average of 3.4 m/s.

3.2.5.1 Atmospheric Stability

The vertical component of dispersion is a function of the extent of thermal turbulence and the depth of the surface mixing layer. Unfortunately, the mixing layer is not easily measured, and must therefore often be estimated using prognostic models that derive the depth from some of the other parameters that are routinely measured, e.g. solar radiation and temperature. During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the extension of the *mixing layer* to the lowest elevated inversion. Radiative flux divergence during the night usually results in the establishment of ground based inversions and the erosion of the mixing layer. The mixing layer ranges in depth

from ground level (i.e. only a stable or neutral layer exists) during night-times to the base of the lowest-level elevated inversion during unstable, day-time conditions. Atmospheric stability is frequently categorised into one of six stability classes. These are briefly described in the table below;

Table 23: Atmospheric stability classes

A	very unstable	calm wind, clear skies, hot daytime conditions
B	moderately unstable	clear skies, daytime conditions
C	unstable	moderate wind, slightly overcast daytime conditions
D	neutral	high winds or cloudy days and nights
E	stable	moderate wind, slightly overcast night-time conditions
F	very stable	low winds, clear skies, cold night-time conditions

The atmospheric boundary layer is normally unstable during the day as a result of the turbulence due to the sun's heating effect on the earth's surface. The thickness of this mixing layer depends predominantly on the extent of solar radiation, growing gradually from sunrise to reach a maximum at about 5-6 hours after sunrise. This situation is more pronounced during the winter months due to strong night-time inversions and a slower developing mixing layer. During the night a stable layer, with limited vertical mixing, exists. During windy and/or cloudy conditions, the atmosphere is normally neutral.

For low level releases, such as due to vehicle entrainment from unpaved roads, the highest ground level concentrations will occur during weak wind speeds and stable (night-time) atmospheric conditions. Wind erosion, on the other hand, requires strong winds together with fairly stable conditions to result in high ground level concentrations i.e. neutral conditions.

3.2.5.2 Regional Ambient Air Quality

The Department of Environmental Affairs (DEA) operates a monitoring network over the Highveld region at the residential areas of Hendrina, Ermelo, Middleburg, Secunda and eMalahleni. The closest monitoring station to the proposed Kebrafield Roodepoort Colliery is located at Hendrina. The highest daily and monthly PM10 concentrations for the period 2008-2010 are given in the following two figures respectively.

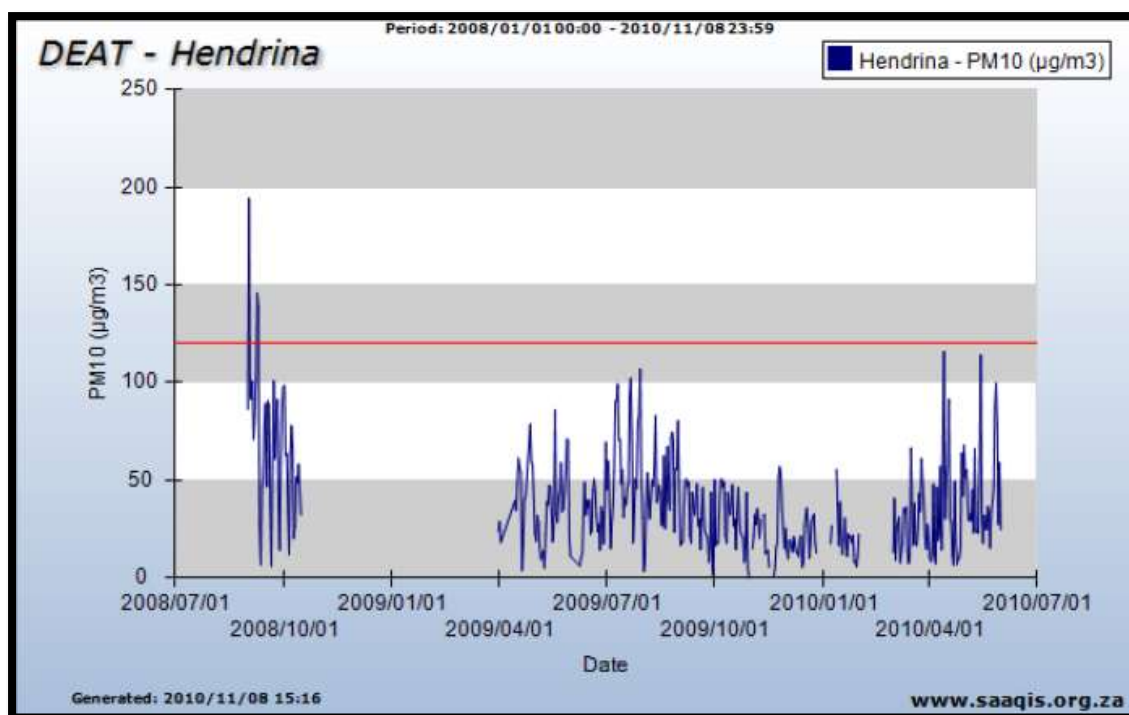


Figure 33: Daily measured PM10 ground level concentrations (µg/m³) at the Hendrina DEA monitoring station (for the period 2007-2010) (as downloaded from the SAAQIS website)

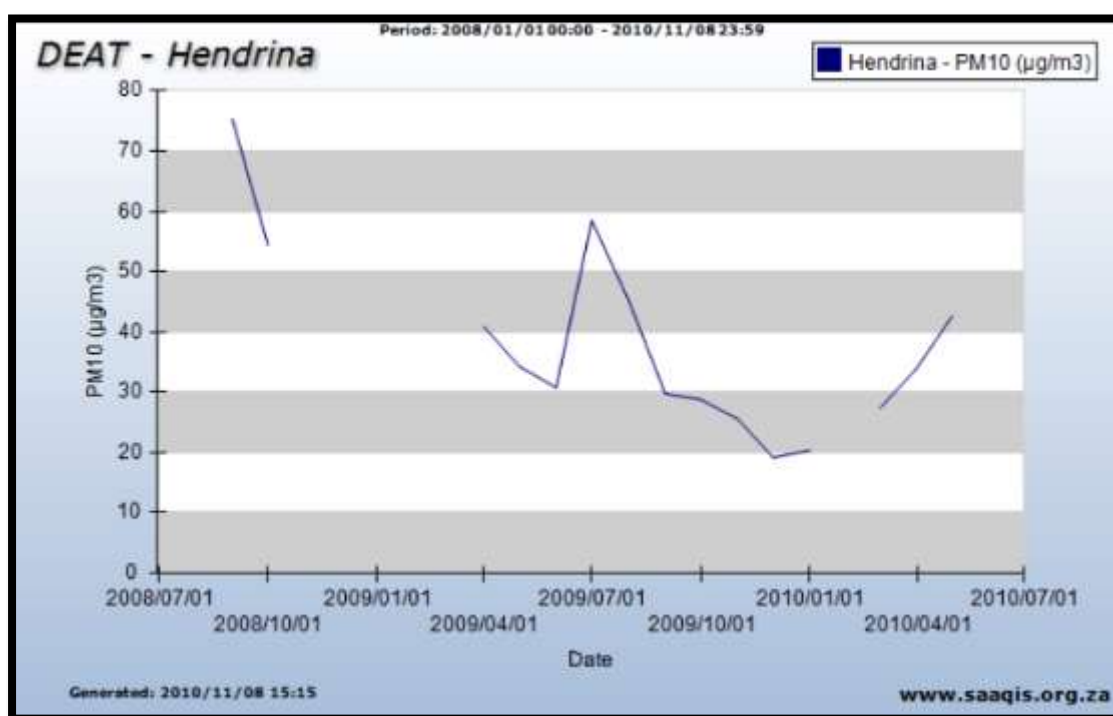


Figure 34: Monthly measured PM10 ground level concentrations (µg/m³) at the Hendrina DEA monitoring station (for the period 2007-2010) (as downloaded from the SAAQIS website)

Exceeding of the SA air quality PM10 limits were found to occur at the Hendrina monitoring station. However, the National Ambient Air Quality Standards (NAAQS) allow 4 daily exceedances per calendar year. When compared

to the NAAQS applicable immediately till 31 December 2014, the predicted PM10 concentrations for the period 2008 – 2010 were found to result in less than 4 allowable exceedances. For the NAAQS applicable from 1 January 2015, the predicted concentrations for the period 2008 – 2010 were found to result in more than 4 allowable exceedances for the period 2009. Annual concentrations were estimated from the monthly PM10 concentrations for the period April 2009 to March 2010.

High ambient particulate concentrations have been found to coincide with low ambient temperatures and low rainfall. Increases in domestic coal burning and poor atmospheric dispersion potentials, together with persistent industrial emissions, combine to produce elevated ambient concentrations during winter months. High concentrations during summer months are usually associated with increases in fugitive dust emissions. Rainfall events result in a reduction of airborne concentrations due to reductions in the potential for fugitive dust emissions and due to the removal of particulates in the atmosphere by raindrops.

3.6 Cadastral Information

The Kebrafield Roodepoort Colliery situated on the Farm Roodepoort 151IS Portion 17 is surrounded by the following holding farms, as indicated in the figure below;

- North – Bothashoek 475
- East – Pullens Hope 155
- South East – Boschmanskop 154
- South – Broodsnyersplaas 25
- West – Roodepoort 151
- North West – Wolwenfontein 471

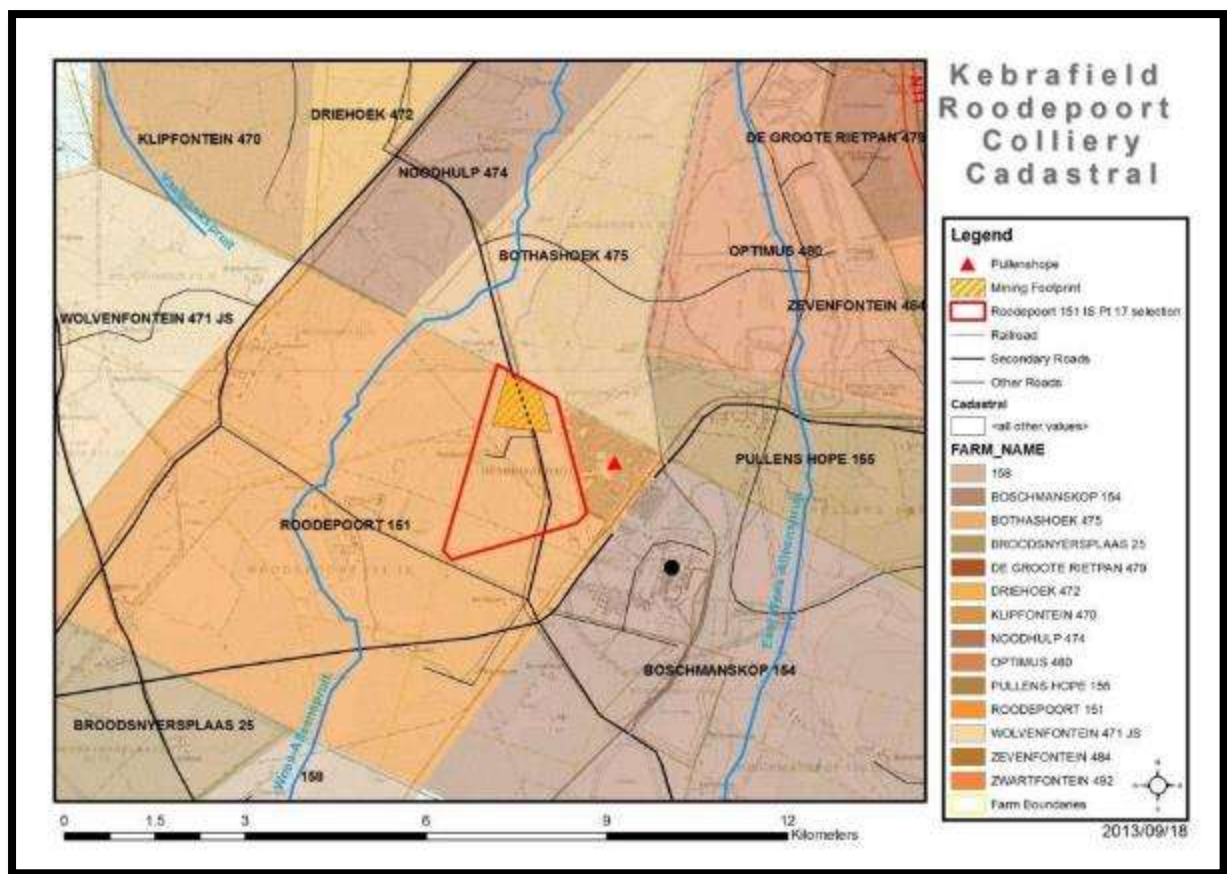


Figure 35: Neighbouring holding farms

3.7 Catchment Description

According to the South African National Biodiversity Institute's (SANBI) Atlas for Freshwater Ecosystem Priority Areas (2011), the project area is not situated within a FEPA with regards to the rivers found in the quaternary catchment (Figure indicating catchment B12B below). However, this is not applicable to the wetlands found within the area, which are considered to be wetlands of national priority. The following sequence of imagery provides data regarding the catchment description for the Olifants Management Area.

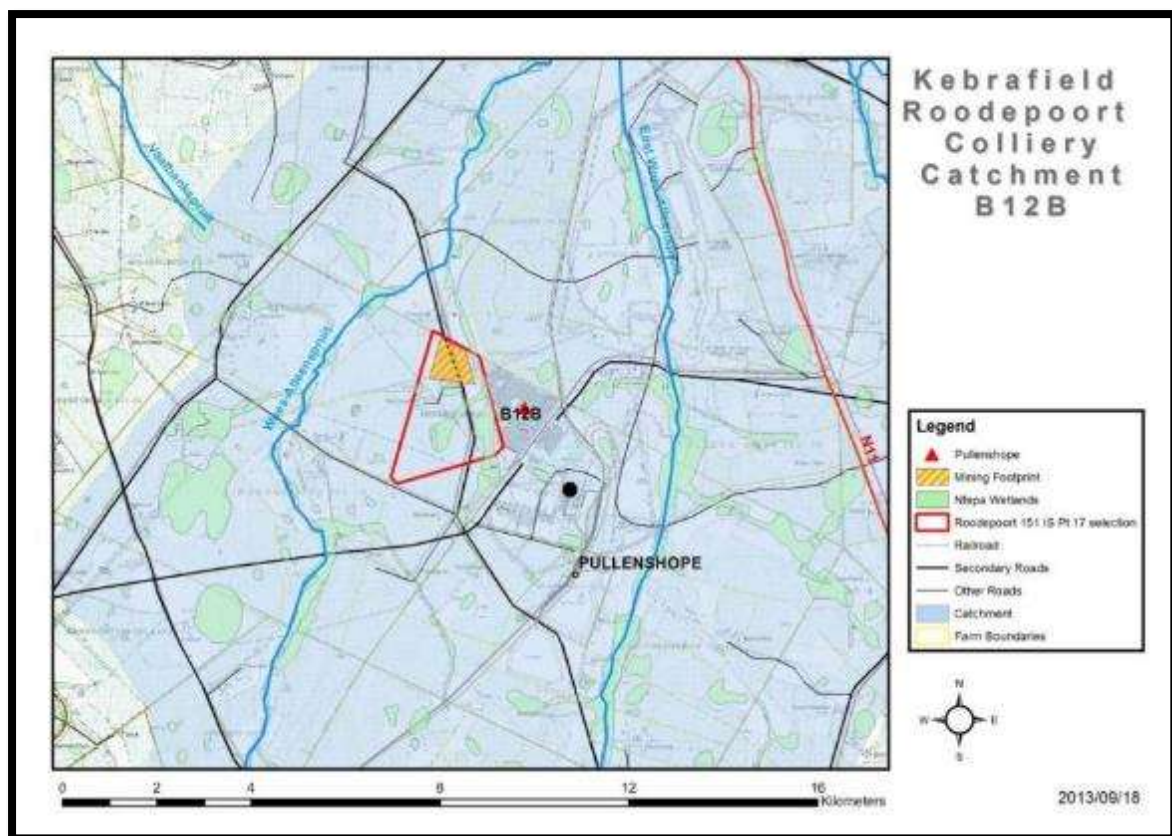


Figure 36: Catchment map – Kebrafield Colliery Situated in Catchment B12B

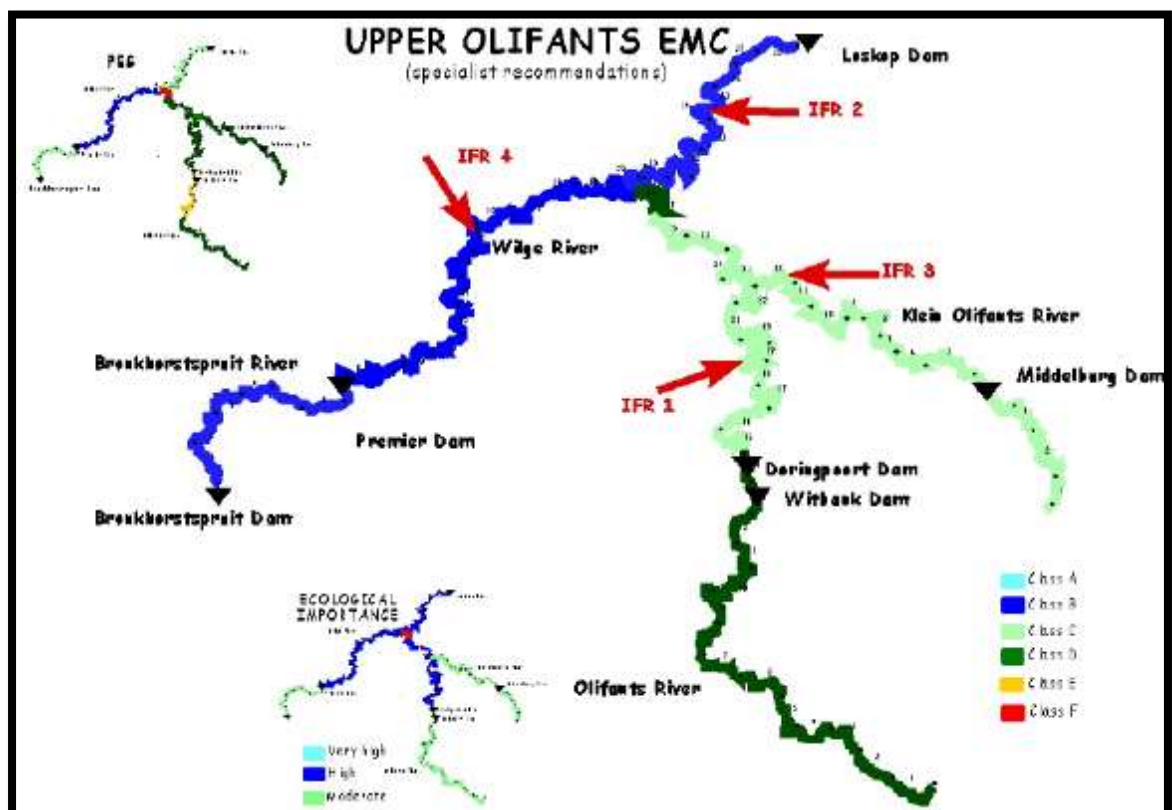


Figure 37: Upper Olifants River Water Management Area, (DWA 2001)



Figure 38: Olifants WMA Management Areas

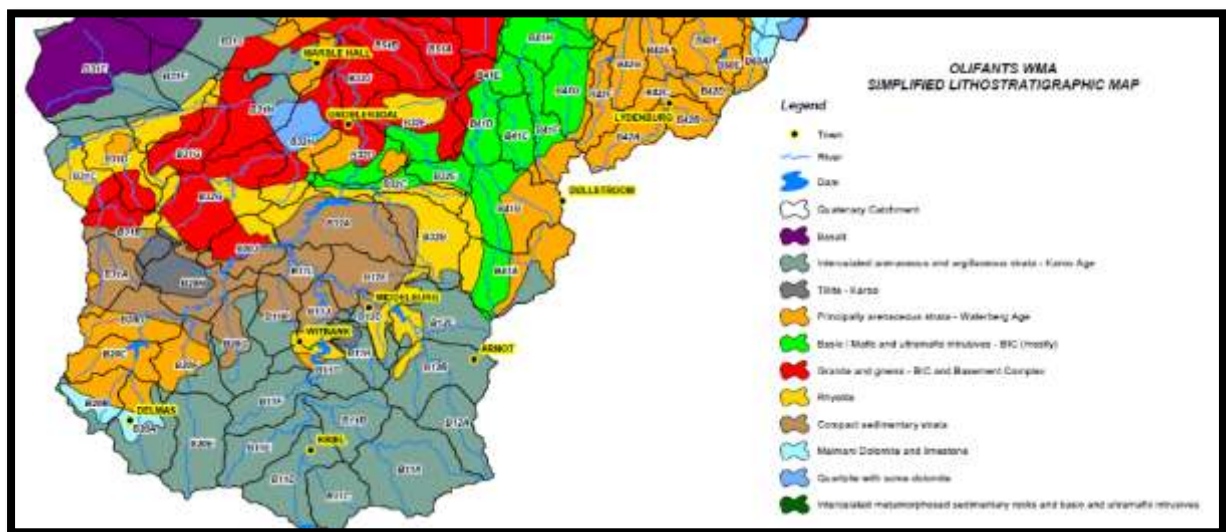


Figure 39: Olifants WMA simplified Lithostratigraphic map

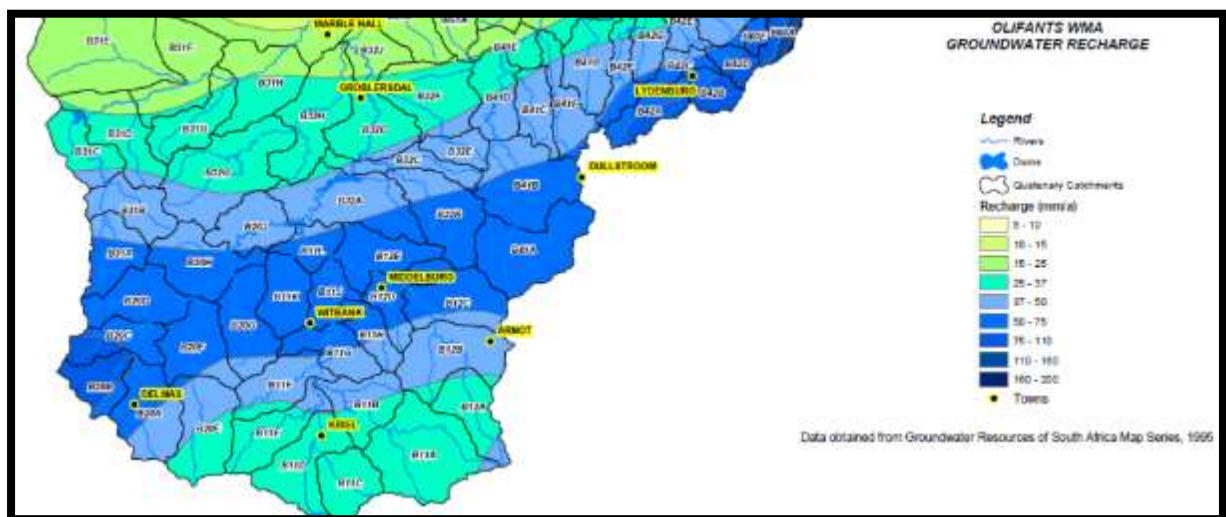


Figure 40: Olifants Groundwater recharge map

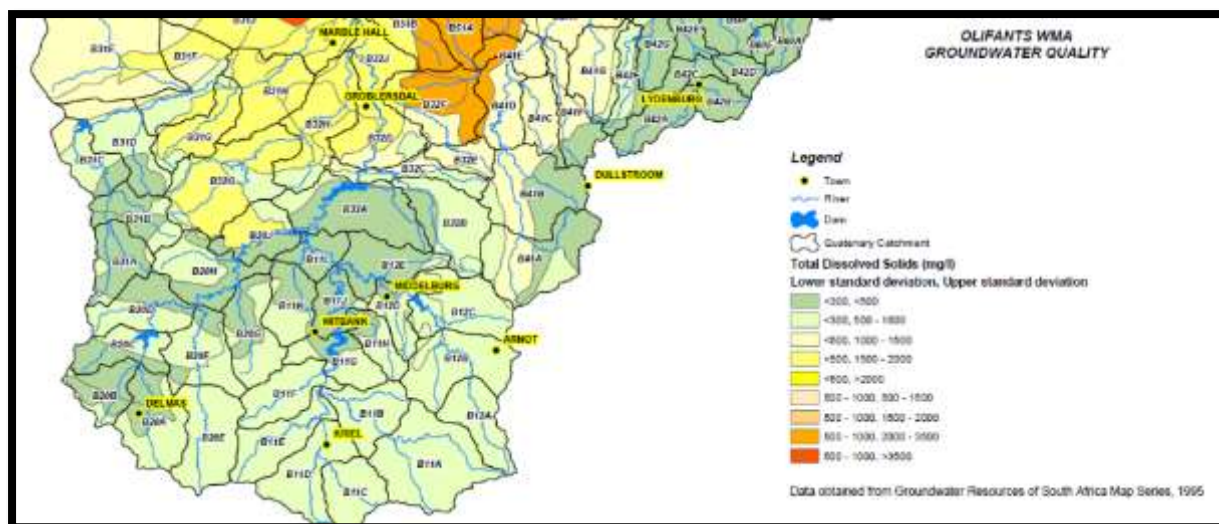


Figure 41: Olifants ground water quality

The study area is located in quaternary catchment B 12B, within the Olifants Water Management Area. The Groundwater Harvest Potential Map of South Africa (Baron et al, 1998) classifies the study area as having an estimated groundwater harvest potential I of 10 000 to 15 000 m³/km²/year (i.e. relatively low). The average borehole yield is > 0.4 litres per second (L/s), and the total dissolved solids concentration of the (unpolluted) groundwater is between 200 and 300 mg/l (i.e. relatively fresh). No major groundwater abstractions are shown on the DWA1:500 000 scale hydrogeology map of the area (Sheet 2526 Johannesburg) in the area. The GRA2 data for the quaternary catchment B12B is summarized in the table below below:

Table 24: GRA2 Data Summary for Quaternary Catchment B12B

Area (km ²)	658.5
Average water level (metres below ground level)	8.7
Volume of water in aquifer storage (Mm ³ /km ²)	467.7
Specific Yield	0.003
Harvest Potential (Mm ³ /a)	14.6
Contribution to river base flow (Mm ³ /a)	7.8
Utilizable groundwater exploitation potential in a wet season (Mm ³ /a)	9.5
Utilizable groundwater exploitation potential in a dry season (Mm ³ /a)	6.3

Most of the upper Olifants River Catchment falls within the Highveld Ecoregion, (elevation of 1250 to 1750 mamsl), characterised by gently undulating grasslands with numerous wetlands, and underlain the Vryheid formation Karroo Series sediments. Median annual simulated runoff per quaternary catchment varies from 10 to 250 mm. The coefficient of variation for annual simulated runoff per quaternary catchment varies between 40 and 160 % (Kleynhans *et al*, 1998).

Table 25: Quaternary catchment description with Integrated Ecological Importance, Resource Stress and Recommendations

Quat	River	Integrated Ecological Importance	Resource stress	Recommendation
B12B	Klein Olifants	D (Low)	Water Quality	EcoStatus 3 Rapid III Address water quality issues to improve RHP monitoring
B12E	Klein Olifants	C (PES, High)	Upstream dam, not fully utilised, water quality problems)	EcoStatus 4 Intermediate ERM

Reserve Determination

Table 26: Reserve determination (Water Quality)

Parameter	Ambient Ground Water Quality	Basic Human Needs Reserve	Ground Water Quality Reserve
Electrical Conductivity (mS/m)	38	<150	41.8
pH	7.6	5.0 – 9.5	5.0 – 9.5
Sodium (mg/l)	17	<200	18.7
Magnesium (mg/l)	18	<100	19.8
Calcium (mg/l)	29	<150	31.9
Chloride (mg/l)	21	<200	23.1
Sulphate (mg/l)	21	<400	23.1

Table 27: Target water quality ranges

Chemical Parameter	Target Water Quality Ranges ⁹		
	Class 0	Class I	Class II
pH	5-9.5	4.5-10	4-10.5
Electrical Conductivity	<70	70-150	150-370
Calcium as Ca	<80	80-150	150-300
Magnesium as Mg	<70	70-100	100-200
Sodium as Na	<100	100-200	200-400
Chloride as Cl	<100	100-200	200-600
Sulphate as SO ₄	<200	200-400	400-600
Nitrate as NO ₂ - N	<6	6-10	10-20

Table 28: Reserve determination (Water Quantity)

Tertiary	Recharge (Mm ³ /a)	Groundwater baseflow (Mm ³ /a)	Baseflow required	BHN Reserve (Mm ³ /a) ¹⁰	Reserve as % of Recharge
B12	50.25	11.08	5.06	-	10.00

3.8 Wetlands

All wetlands identified on the study site are classified within the Central Bushveld Group 3 wetland vegetation group. The wetland(s) are delineated as channeled valley bottomed wetlands (figures below). It is recommended that all information resources available for decision making regarding the extent of wetlands associated with the study area be utilized i.e. SANBI GIS Database, desktop delineation and field delineation.

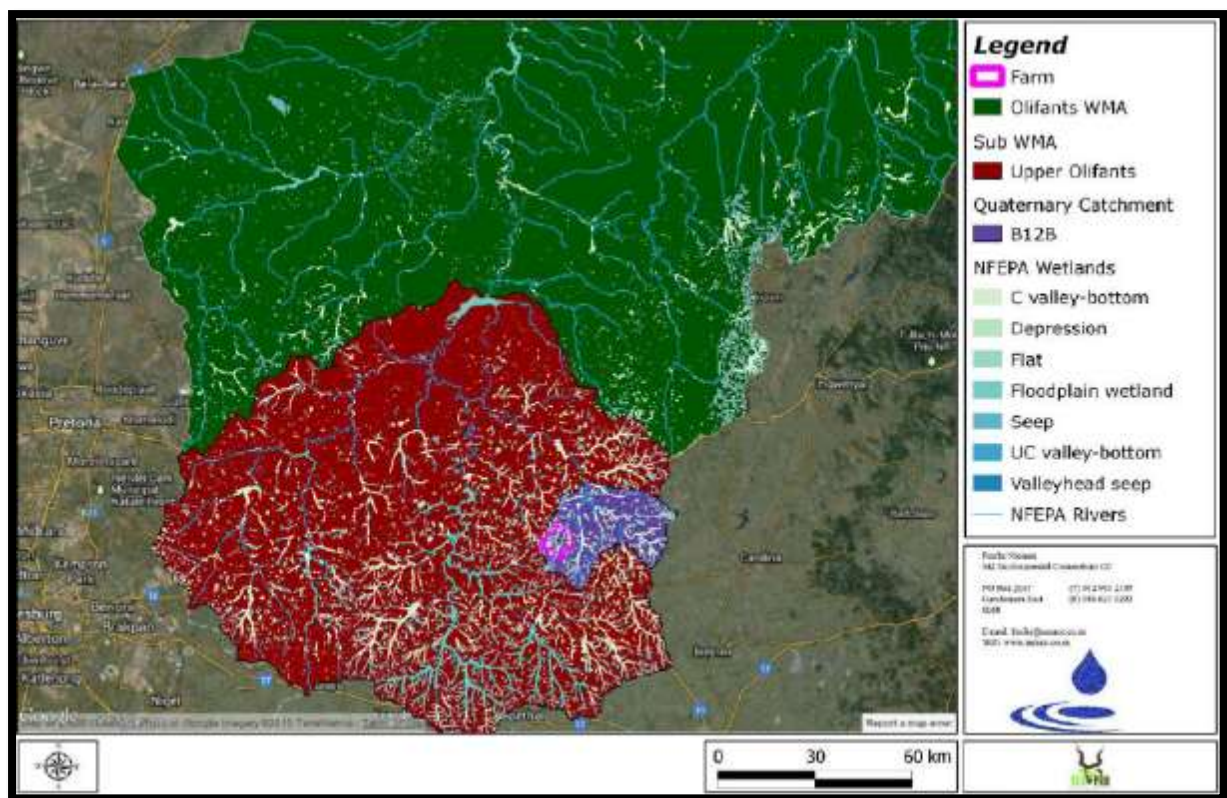


Figure 42: National Freshwater Priority Wetland types applicable to the B12B drainage region

Wetland functionality is defined as a measure of the deviation of wetland structure and function from its natural reference condition. In the current assessment the hydrological, geomorphological and vegetation integrity was assessed for the wetland unit associated with the study site in order to provide a Present Ecological Status (PES) score. The health categories used to describe the integrity of wetlands are contained in the table below.

Table 29: Health categories used for describing Wetlands (WET-Health)

Description	Class Boundary	Health Status
Unmodified natural	>4	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place	>3 and <=4	B
Moderately modified. A moderate change in ecosystem and loss of natural habitats has taken place but the natural habitat remains predominantly intact	>2 and <=3	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred	2	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	>0 and <2	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota	0	F

The present Ecological status (PES) method (DWAF, 1995) was used to establish the integrity of the wetland located on Roodepoort 151 IS. This method is based on the modified Habitat Integrity Approach developed by Kleynhans (DWAF, 2005). Anthropogenic modification of the criteria and its attributes can have an impact on the ecological integrity of the wetland as illustrated.

Wetlands and riparian areas perform many functions that are valuable to society including the supply of water and the improvement of water quality. The habitats created by wetlands and rivers are also important for many plant and animal species. Not all wetlands or rivers develop in the same way and may not perform ecosystem services to the same extent. Where areas of human settlement and development threaten to encroach and impact on wetlands or riparian areas, it is important that the wetland's ecological integrity be assessed.

With reference to the figure below, it is evident that the proposed mining development plan falls within the wetland buffer zone. However, mining in this area could be considered in terms of the impacted system caused by drain water discharge from the Hendrina Power Station. This wetland appears to be largely impacted by mining and farming activities in close proximity. Sediment input into the system is increased from the natural reference condition due to various roads and mining activities. Roads and channels have impacted the natural flow of the system.

Some of the water is caught up in a dam area within the wetland further impacting on the natural flow. The vegetation of this wetland has been significantly altered, although some natural occurring plants, such as *Phragmites australis*, and *Typha capensis* remain within the centre of the wetland (Permanent zone) the surrounding area has been invaded by various exotic plants and trees such as *Acacia mearnsii* and *Verbena bonariensis*.

Table 30: Hydrological benefits provided by identified wetland units

Wetland	Generic Hydrological benefits provided by the wetlands							
Hydro-Geomorphic Type	Flood attenuation		Stream flow regulation	Erosion control	Sediment trapping	PO ₄	NO ₃	Toxicants ¹
	Early wet Season	Late wet Season						
Channeled valley bottom wetland	+	+	++	++	++	++	++	++
Depression	0	0	0	+	++	++	++	++
Rating	0 + ++	Benefit unlikely to be provided to any significant extent Benefit likely to be present at least to some degree Benefit very likely to be present (and often supplied to a high level)						

3.9 Land Cover

The land cover of the proposed mining site as indicated in the figure below is mainly grasslands and cultivated commercial areas. The study area (yellow diagonal lines in the image below) covers only the northern portion of portion 17 of the Farm Roodepoort 151IS (indicated as a red polygon in the image below). A NFEPA wetland is situated to the east of the proposed study area and has been discussed under the previous section under the heading "Wetlands". The large yellow polygon to the north and east of the study area has been classified according to the ENPAT data set as "Mining and Quarries". Various previous studies conducted in the study region have acknowledged the fact that the catchment has already been largely transformed by mining activities. The proposed Kebrafield Roodepoort Colliery intends to keep clear of the wetland areas while adhering to a 100m buffer as proposed by the Wetland specialists during an initial prefeasibility study. The majority of the area to the east has been built up by the previous Hendrina Power Station Village, which today has become known as the town of Pullenshope as the majority of land ownership vest with private persons/entities.

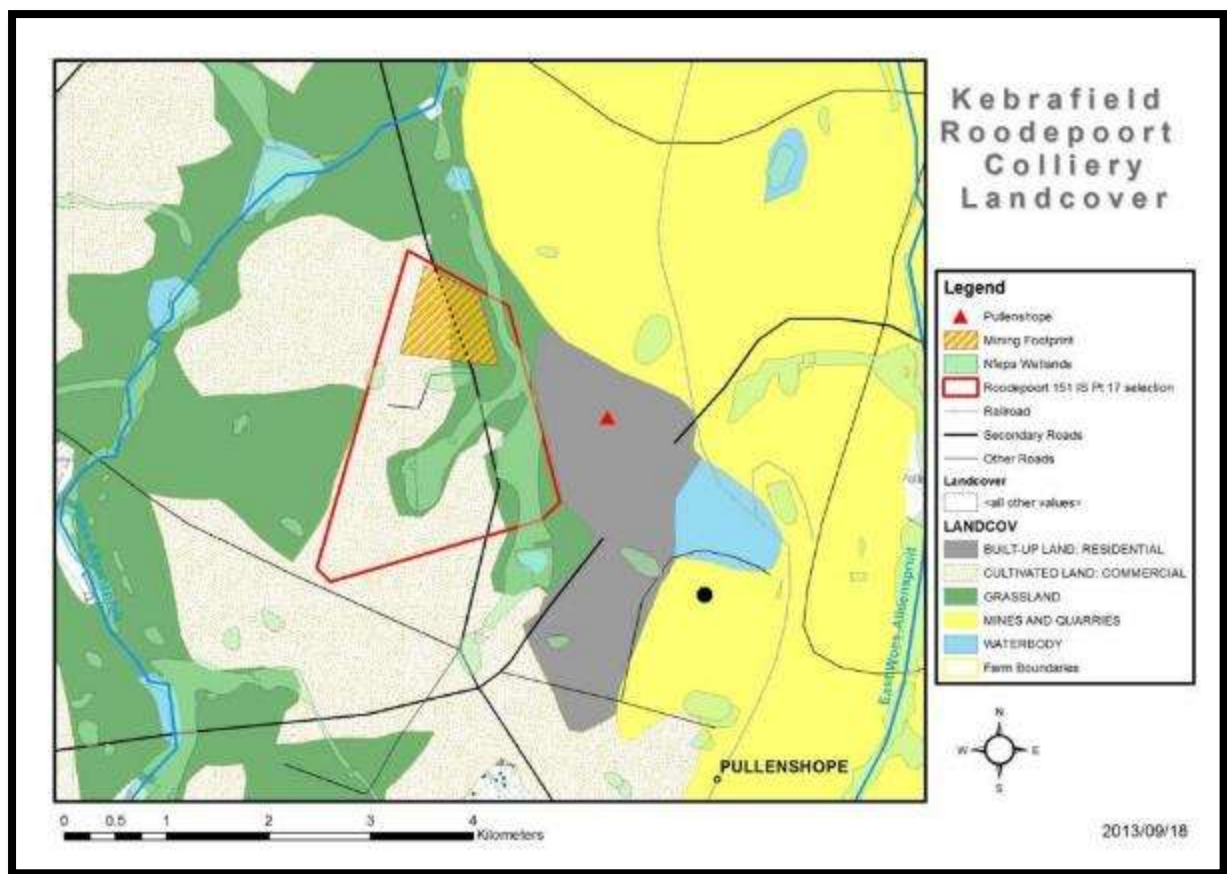


Figure 44: Land Cover map indicating overall land-cover of the study area (NFEPA and ENPAT data sets)

Land cover categories are presented above. For the purpose of this assessment, land cover are loosely categorised into classes that represent natural habitat and land use categories that contribute to habitat degradation and transformation on a local or regional scale. Areas that are characterised by high levels of transformation and habitat degradation is generally accepted as being suitable for development purposes as it is unlikely that biodiversity attributes of sensitivities will be present or affected by development. Conversely, areas that are characterised by extensive untransformed and pristine habitat are generally not regarded suitable options for development purposes.

The status of natural habitat does however have bearing on the suitability of a site. The region comprises extensive transformed habitat that resulted from agriculture and mining, rendering remaining habitat fragmented and isolated and ultimately relatively sensitive. Little natural grassland habitat remains in the area, the majority being around streams and rivers where ploughing is not possible or soils are poor in nutrients. One of the shortfalls of the Environmental Potential Atlas database (ENPAT) is that it does not reflect the current status of natural habitat within the study area. At this stage of the process it is therefore assumed that all areas indicated to comprise of natural grassland is representative of the regional vegetation types and are in a good condition. While this assumption is unlikely to hold true for most of the study area, an assessment of the actual ecological

status of grasslands within the study area is beyond the scope of this report and will only be compiled during the EIA phase.

The land capability investigation consisted of a detailed field investigation where test pits were augered on different positions to get a good view of the area spatially. Test pits were augered to a depth of 1.2 m and the following variables were recorded: clay percentage, effective depth, colour of soil and soil type. The images below shows the investigated area as well as the position of the test pits. The soil profile was described in accordance to ***“Soil Classification, a taxonomic classification for South-Africa”***

The area investigated is typical high veld grassland. A big part of the area is used for dry land crop production. The rest of the area is low laying water canal with wetland properties and is primarily used for grazing. The soil texture is sandy loam and the average soil depth on arable land is 1.2 m. The grazing area's depth is about 400 mm. The total size of the investigated area is 150 hectares.

Soil classification:

- The arable land has an average soil depth of about 1.2 m.
- The clay percentage differs between 15 and 30 %.
- The colour of the soil profiles differs between red, yellow and brown.
- The most predominant soil types on the croplands are Avalon and Huttons.
- The predominant soil type on the grazing areas is some Westleigh and Longlands.
- The soil potential with the average rainfall on the crop fields could yield up to 7 t/ha maize. The Grazing area has low potential for crop production and could yield up to 3 t/ha.

Table 31: Details of test pits

Test Pit	LONGITUDE	LATITUDE	Clay%	Colour	Effective Depth(mm)	Limiting Layer	Soil type	Crop Potential
1	29.56424957	-26.01822799	20	Brown	800	Soft Plinthite	Avalon	Medium
2	29.58304693	-26.01552600	20	Red	1200	Unspecified	Hutton	High
3	29.58267109	-26.01073005	20	Brown	300	Soft Plinthite	Westleigh	Low
4	29.58056656	-26.00633944	15	Brown	300	E-Horizon	Longlands	Low
5	29.57908997	-26.00323227	15	Brown	300	E-Horizon	Longlands	Low
6	29.57643244	-26.00323227	20	Red	1200	Unspecified	Hutton	High
7	29.57680828	-26.00816334	25	Red	1200	Unspecified	Hutton	High
8	29.57797337	-26.01403285	20	Yellow	500	Soft Plinthite	Avalon	Medium

The above observations are based on standard agricultural practices and methods used in most agricultural developments as well as ***“CRITERIA FOR HIGH POTENTIAL AGRICULTURAL LAND IN SOUTH AFRICA”*** Report nr. GW/A/2002/21.

The agricultural potential for crop production on the existing arable land is high. The area used as grazing has low to medium potential as crop production areas. The farms existing agricultural use of the area is optimum. The best agricultural purpose for the area is as it is currently being used.

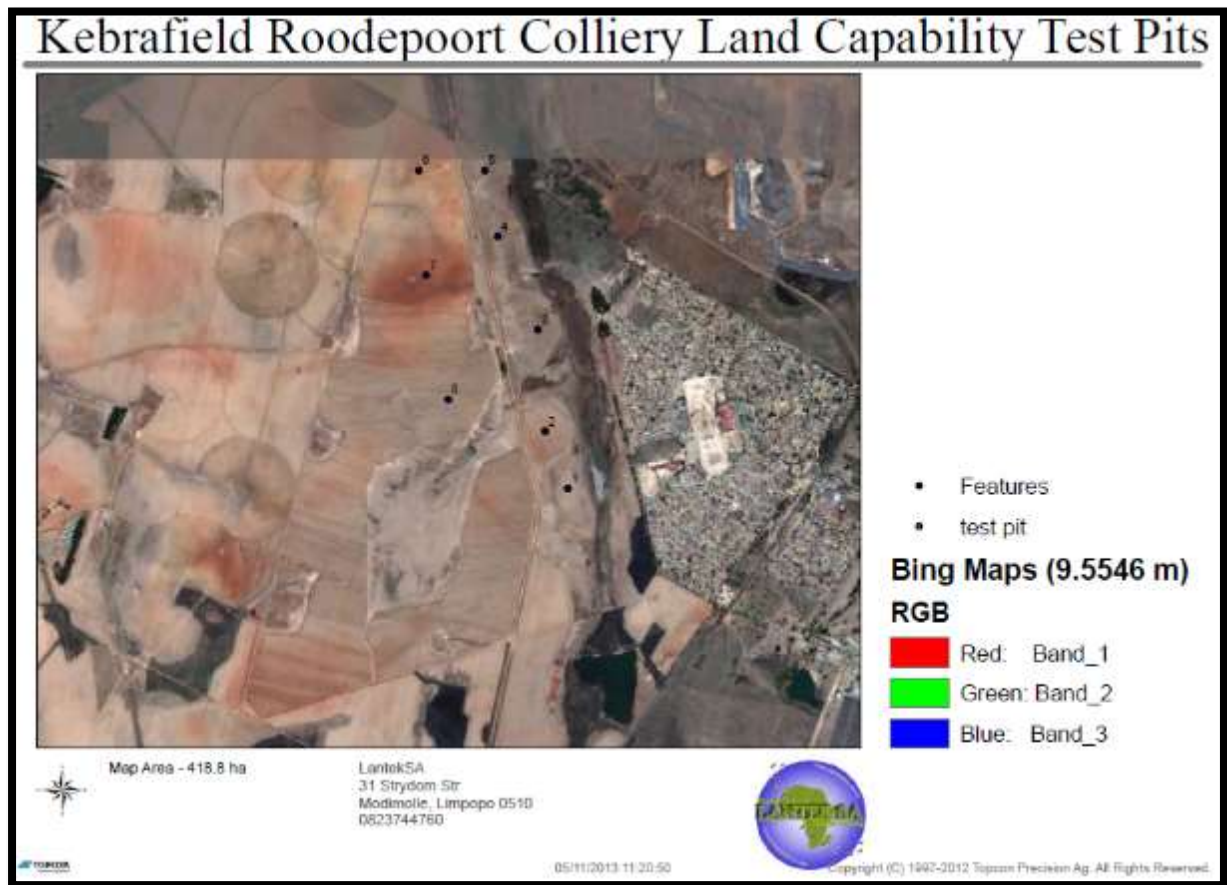


Figure 45: Land capability test pits

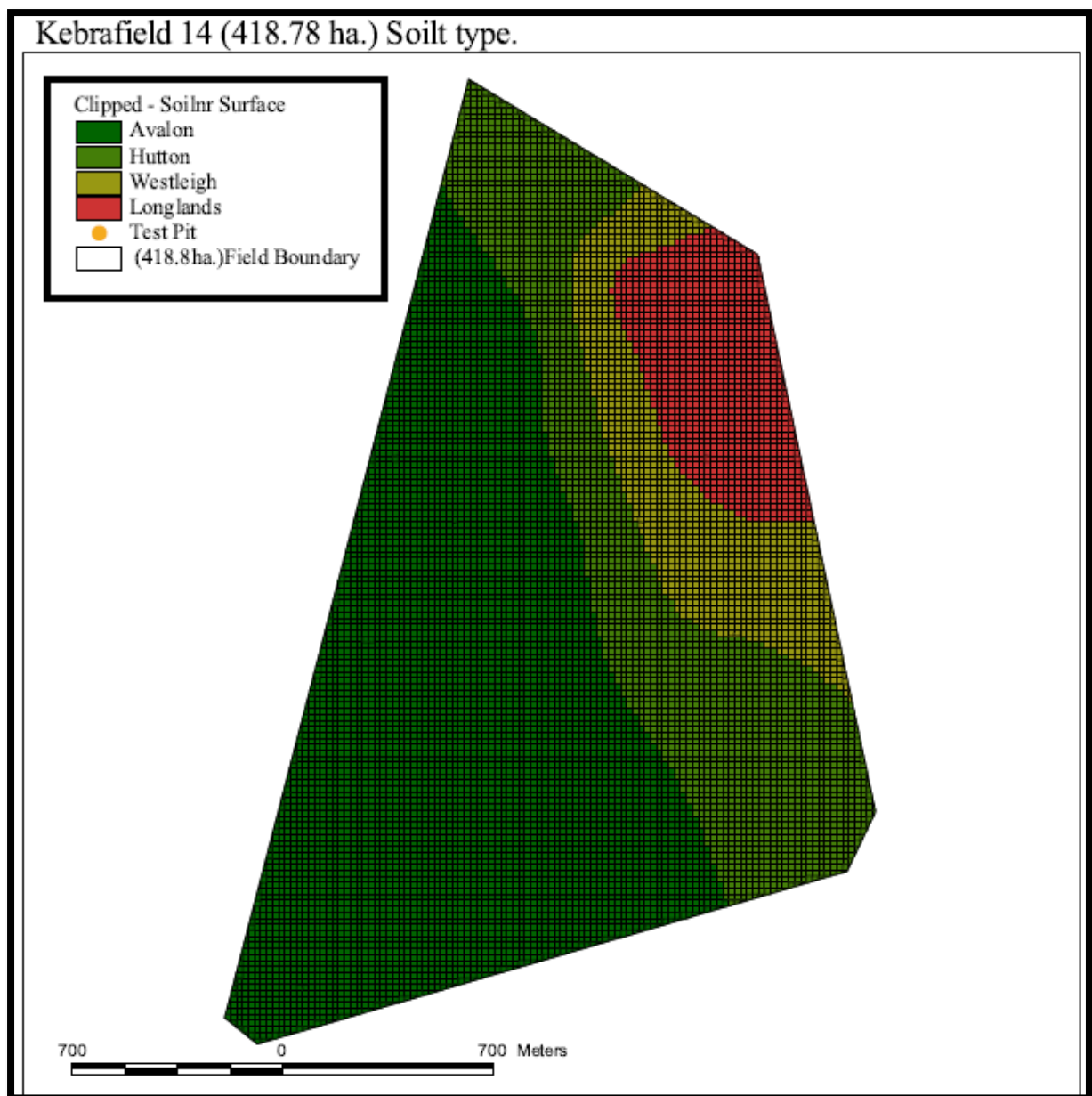


Figure 46: Soil type map

3.10 Flora and Biodiversity Conservation

3.10.1 Regional Vegetation

Terrestrial grassland patches that are captured within the respective site alternatives represent the Eastern Highveld Grassland. This vegetation type is Endangered and only small fractions are conserved in statutory reserves. Some 44% is transformed by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact than which is currently indicated by land cover data. The vegetation is short dense grassland dominated by *Aristida*, *Digitaria*, *Eragrostis*, *Themeda* and *Tristachya* species. Small rocky outcrops are scattered across the landscape. Wiry grasses and woody species are associated with these outcrops. These include species such as *Acacia caffra*, *Celtis africana*, *Diospyros*

lycioides, *Parinari capensis*, *Protea caffra* and *Searsia magalismontanum* (Mucina & Rutherford, 2006). The Endangered status of this vegetation type warrants a medium-high environmental sensitivity. Small portions of the Eastern Temperate Freshwater Wetlands vegetation type are located within the study area.

Table 32: Environmental variables and geomorphic description of the study area (Mucina & Rutherford, 2006).

Eastern Highveld Grassland Characteristics	
Biome	Grassland Biome
Vegetation unit	Eastern Highveld Grassland
Landscape Features	Slightly to moderately undulating plains with some hills and pan depressions. Short grasses, scattered rocky outcrops, sour grasses and some woody species are characteristic of this vegetation unit.
Geology and soils	Red to yellow sandy soils of the Ba and Bb land types. Geology consists of shales and sandstones of the Madzaringwe Formation.
MAP (mm)	650 – 900 mm (average of 726 mm)
Status	Endangered

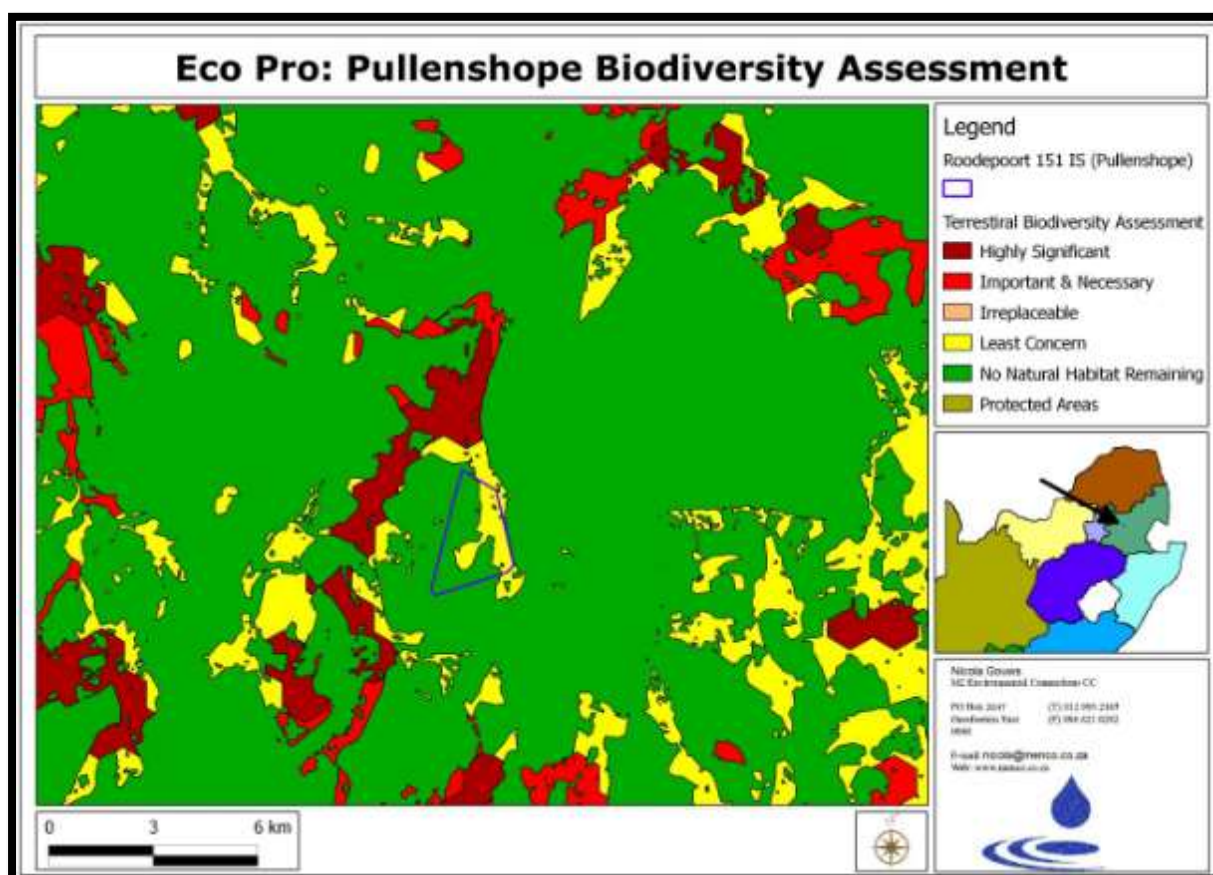


Figure 47: Map indicating the critical terrestrial biodiversity areas in or surrounding the farm Roodepoort 151 IS.

According to the terrestrial biodiversity assessment the farm Roodepoort 151 IS is located within an area that has two ecological classifications. The first section on which the infrastructure of the mine will be constructed and the open cast mining conducted is classified with a “**Least Concern**” status whilst, the remainder of the farm is classified as having “**No Natural Habitat Remaining**”.

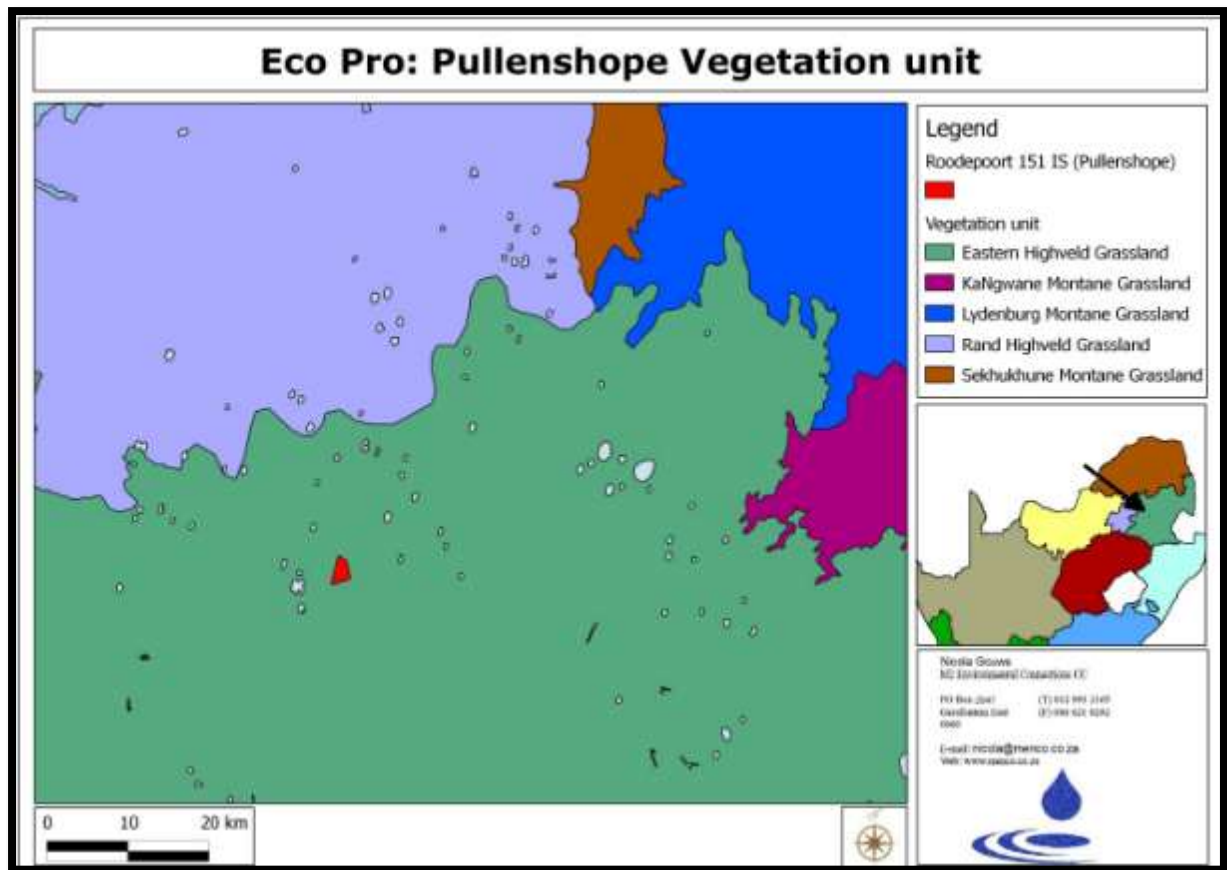


Figure 48: The farm Roodepoort 151 IS as located within the Eastern Highveld Grassland vegetation unit.

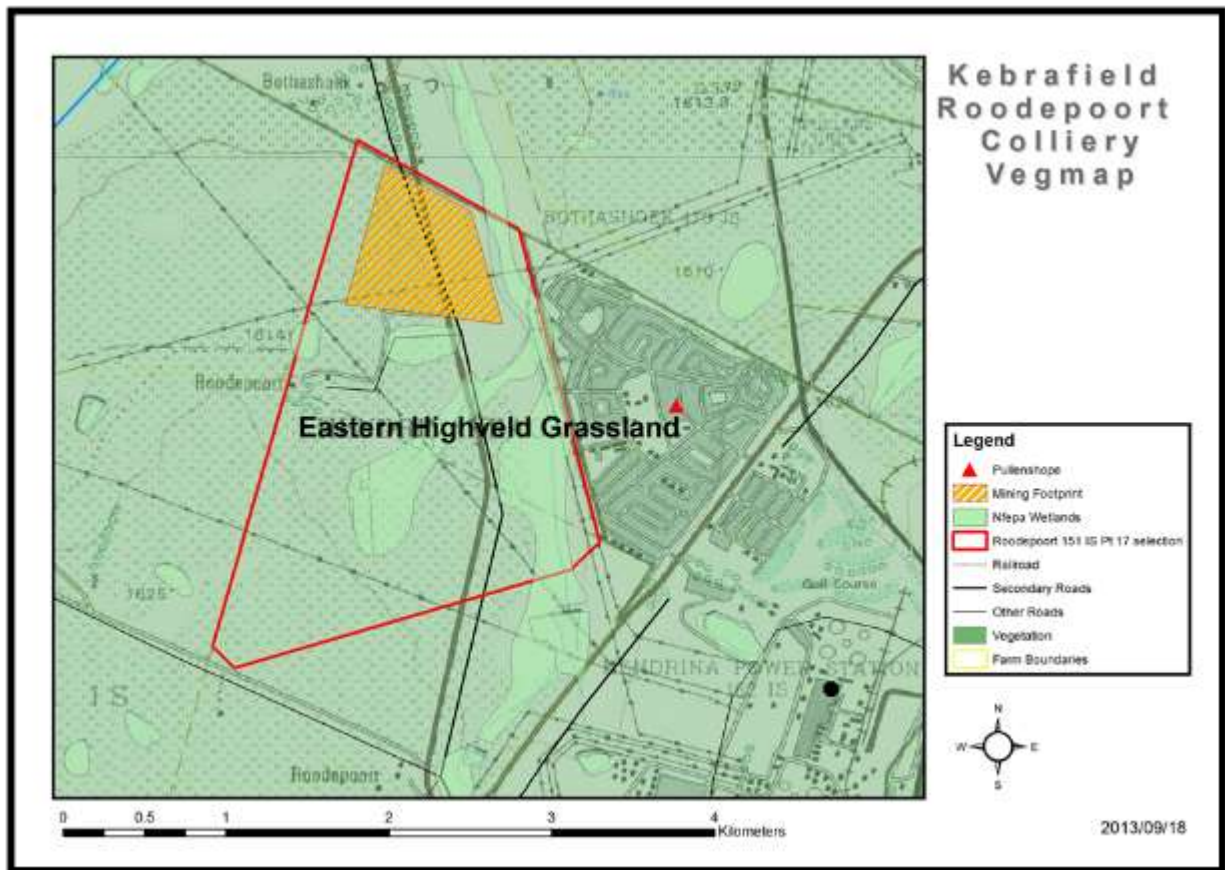


Figure 49: Vegetation map of the proposed Kebrafield Roodepoort Colliery – Eastern Highveld Grassland

3.10.2 Mpumalanga Biodiversity Conservation Plan

Classification of the Terrestrial Biodiversity Classification categories in the study area is as follows:

- **Highly Significant areas** - protection needed, very limited choice for meeting targets;
- **Important and Necessary areas** - protection needed, greater choice in meeting targets;
- **Areas of Least Concern** – natural areas with most choices, including for development;
- **Areas with No Natural Habitat Remaining** – transformed areas that make no contribution to meeting targets.

The only category of note within the site alternatives is '**Least Concern**', generally conforming to the remaining natural grassland, as depicted in the land cover database as well as wetland and surface water habitats. These areas are generally regarded as moderately sensitive, mainly as a result of the extensive habitat transformation of the general region and the small portions of remaining natural habitat.

No area of restriction is identified within the footprint of the proposed Kebrafield Roodepoort Colliery in terms of the MBCP classification database as illustrated in the figure below.

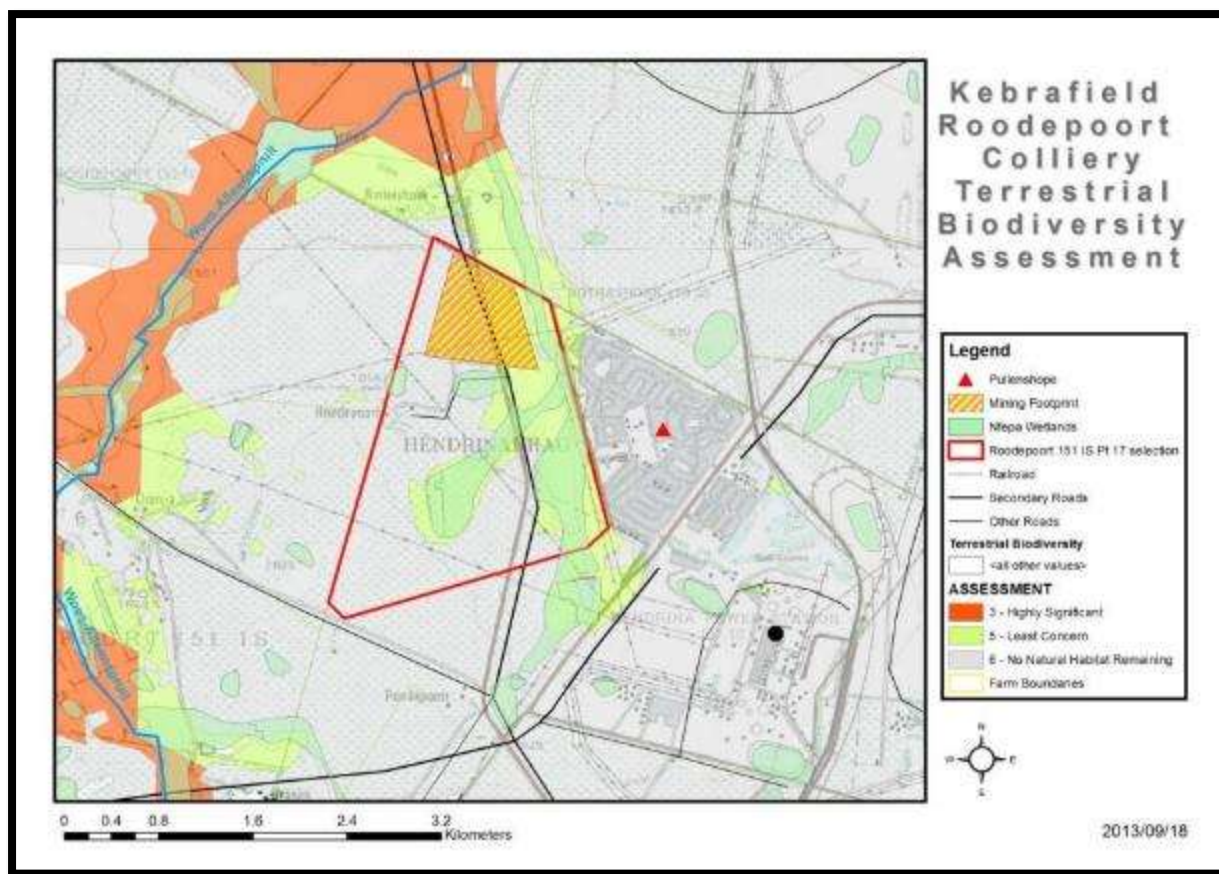


Figure 50: Kebrafield Roodepoort Colliery Terrestrial Biodiversity Assessment Map – Mainly Least Concern Areas

3.10.3 Specialist investigation

The SANBI database indicates the known presence of only 38 plant species within this particular $\frac{1}{4}$ degree grid (2629BA). This low diversity is the result of poor floristic knowledge of the area and is not a reflection of a poor habitat and floristic diversity. No floristic species of conservation importance is known to occur in this region, according to the SANBI database. However, all areas of natural grassland habitat and wetland habitat, in particular, are regarded suitable for the potential presence of flora species of conservation importance.

Eastern Highveld Grassland (Gm12) is characterized by slightly-to-moderately undulating plains with low hills and pan depressions. The vegetation is dominated by grassland with small, scattered rocky outcrops and some woody species occurring in the area. Typical grassland species are common within this vegetation unit including *Aristida*, *Digitaria*, *Eragrostis*, *Themeda* and *Tristachya* grass species. Typical herbs include members of the Family Asteraceae such as *Berkheya setifera*, *Haplocarpha scaposa*, *Dicoma anomala*, *Euryops gilfillanii*, *Helichrysum* spp., *Senecio coronatus* and *Vernonia oligocephala* (Mucina & Rutherford, 2006). Other herbs that do not form part of the Asteraceae Family include *Justicia anagalloides*, *Pelargonium luridum*, *Acalypha angustata* and *Chamaecrista mimosoides* (Mucina & Rutherford, 2006). A few geophytic and succulent herbs also occur within the area such as *Gladiolus crassifolius* and *Aloe ecklonis* respectively. Two shrubs have also

been classified as occurring within the area namely, *Anthospermum rigidum* subsp. *pumilum* and *Stoebe plumosa* (Mucina & Rutherford, 2006).

The soil is characterized as red to yellow sandy soils of the Ba and Bb land types with a plinthic horizon. The geology consists of shales and sandstones of the Madzaringwe Formation from the Karoo Supergroup (Mucina & Rutherford, 2006). The climate for this vegetation type falls within a summer rainfall period, with very dry winters. The mean annual precipitation ranges between 650 – 900 mm. This vegetation unit does receive frost but it varies between different areas and is usually higher at higher elevations (Mucina & Rutherford, 2006).

The Eastern Highveld Grassland in the Mpumalanga Province is classified as having an Endangered conservation status with only a small fraction statutorily conserved but with a conservation target of 24% (Mucina & Rutherford, 2006). The ecosystem is protected within the Nooitgedacht Dam Nature Reserve and the Jericho Dam Nature Reserve, as well as small private reserves (SANBI & DEAT, 2009). It is estimated that 44% of the vegetation unit is transformed as a result of primarily cultivation but also plantations, mines, urbanisation and the construction of dams.

Information on plant species recorded for the Quarter Degree Squares (QDS) was extracted from the POSA online database hosted by SANBI. A list of plant species that has a high probability of occurring in the 2629BA QDS grid is provided in Appendix D. However, plants species lists for the following QDS are also provided: 2629AB, 2629BC and 2529DC. This is a considerably larger area than the study area and consequently the list will contain more species than actually occur at the site. However, this is a conservative approach that takes into account the fact that not all parts of the study will have been sampled in the past. The results indicate that approximately 248 plant species occur within the four QDS grid cells, consisting of 59 Families. The most prominent families are Poaceae (grasses) and Cyperaceae that has 51 and 31 species respectively. Other prominent families are Fabaceae with 19 species and Asteraceae with 18 species. The most species has a perennial lifecycle and only a few annual species is present. A total of 16 exotic species are common in these four areas.

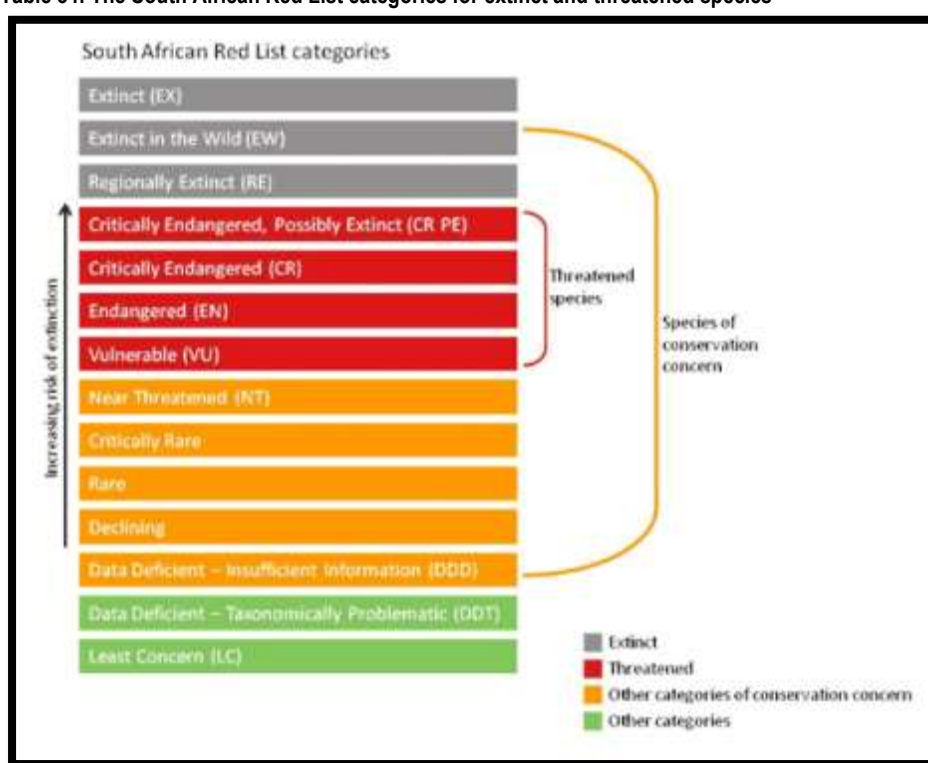
Table 33: Number of families and species that occur within the four QDS grid cells

Number of Families	Number of species	Perennial species	Annual species	Exotic species
59	248	197	51	16

Almost all of these species are classified with a “Least Concern” (LC) IUCN status and is therefore considered at a low risk of extinction and includes widespread and abundant species. However, one species was classified with a “DDT” status namely, *Alepidea peduncularis* and one species with a “Declining” status namely, *Hypoxis hemerocallidea*. A species is classified by the IUCN as DDT (Data Deficient – Taxonomically Problematic) when

taxonomic problems hinder the distribution range and habitat from being well defined. Therefore, it is difficult to assess whether this species is at a risk of becoming extinct. A species is classified as “Declining” by the national Red List categories when it does not meet any of the five IUCN criteria and does not qualify for any of the categories for Critically Endangered, Endangered, Vulnerable or Near Threatened species but when threatening processes are in place that cause a continuing decline of that species. An example of the South African Red List categories is provided in the table below with DDT and LC classified species indicated as green. The Declining species are considered as one of the species of conservation concern indicated in orange. None of the species listed in the ToPS list (Threatened and Protected Species) as published in the Government Gazette (23 February 2007) as part NEMBA (Act 10 of 2004) was found on the plant species recorded in any of the four QDS grid cells.

Table 34: The South African Red List categories for extinct and threatened species



These species was not identified during the field survey. It is however, the mines' responsibility that if these species are found during any period of the life of the mine, it be removed with the help of a specialist and replanted in favorable conditions where it will not be exposed to any threats on its survival.

IUCN Red Data, CITES and Endemic Species

No Red Data, CITES or Endemic species were encountered during the field assessment. However, from the QDS grid cells in and surrounding the area, three species may occur within the area that is either red listed on the IUCN database and/or endemic. These species and their status are indicated in the table below.

Table 35: Possible IUCN Red Data, CITES and Endemic Species

Species	IUCN Status / CITES	Endemism and Distribution
• <i>Alepidea peduncularis</i>	DDT*	<u>South African Endemic</u> Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo and Mpumalanga
• <i>Hypoxis hemerocallidea</i>	Declining*	<u>Not endemic to South Africa</u> Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga and North-West
• <i>Anacampseros subnuda</i> subsp. <i>lubbersii</i>	VU*; CITES Appendix 4	<u>South African Endemic</u> Mpumalanga (Witbank and Middelburg)
<p>*DDT (Data Deficient – Taxonomically Problematic): A species is classified as DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.</p> <p>*Declining: A species is classified as Declining when it does not meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline of the species.</p> <p>*VU (Vulnerable): A species is classified as Vulnerable when the best available evidence indicates that it</p>		

Invasive species

None of the invader species as listed in the Conservation of Agricultural Resources Act (Act 43 of 1983) was observed during the field assessment. Exotic species that were observed are not classified in any of the three invader categories. However, they have to be mitigated to prevent further distribution. These species include:

- *Schkuhria pinnata* (Lam.) Kuntze ex Thell
- *Tagetes minuta* L.

Plants of cultural significance

Some of the species that were encountered during the field survey have cultural significance and/or medicinal use. The SIBIS (SANBI's Integrated Biodiversity Information System) and SABIF (South African Biodiversity Information Facility) databases on SANBI's website were used to verify whether the species have any medicinal uses. Ten species were found that have medicinal use and their distribution in the various study sites are indicated in the table below.

Table 36: Number of medicinal species in the various study sites

Site	Total number of species in the study unit	Number of medicinal species in study unit
Site 1 (Oldfields)	0	0
Site 2	9	6
Site 3	7	4
Site 4	3	1
Site 5	9	5

From the table above, it is evident that many of the species occurring within each area (apart from site 1) has medicinal value to some extent. This indicates that these sites could possibly have a high cultural significance.

The species that had medicinal value as verified on the SABIF and SIBIS databases are:

- *Arundinella nepalensis* Trin.
- *Berkheya bipinnatifida* (Harv.) Roessler subsp. *echinopsoides* (Baker) Roessler
- *Berkheya setifera* DC.
- *Cynodon dactylon* (L.) Pers.
- *Eragrostis gummiflua* Nees
- *Juncus effusus* L.
- *Schkuhria pinnata* (Lam.) Kuntze ex Thell.
- *Sporobolus pyramidalis* P.Beauv.
- *Tagetes minuta* L.
- *Themeda triandra* Forssk.

Sensitivity of area

Some areas would be affected more severely during the proposed development than others and would therefore have a higher level of sensitivity. Site 2 and the riverine/wetland area will have the highest level of sensitivity with site 2 being completely destroyed during the construction phase of the mine since it falls within the proposed area of the mine. It is recommended that a buffer area is established at 100 m surrounding the river as well as the wetland. No mining activities are to occur within the wetland or associated buffer area. Sites 3 and 5 are predicted to have a moderate level of sensitivity and would be affected by the development of the mine. However, if mitigation measures such as alien species eradication is established and implemented, the proposed impact will be low. The remaining areas of the farm are considered to have a low sensitivity because of the oldfields that are devoid of any vegetation. These areas cover the majority of the study area and will not be influenced by the proposed activities.

When compared on a broader geographical scale, Roodepoort 151 IS is subject to cumulative impacts from its surrounding areas. The western section of the farm consist mostly of stripped oldfields (*Zea mays*), whilst many other areas in the region are also being used for agricultural purposes. The farm is also in close proximity to the local town, Pullenshope, with mining and energy generation facilities occurring within the area such as the Hendrina Power Station. The accumulation of salt at site 3 near the riverine/wetland area is a possible example of these impacts. This could be the result of storm water runoff containing high levels of pollution. A large portion of the farm is fragmented because of the oldfields and fencing on the farm, as well as the town which is located east of the farm. The remaining natural areas that are fragmented will increase the “edge effects” of the habitat. Therefore, because of the severity of the surrounding areas, as well as the low biodiversity, the proposed development will have a low impact on the local scale and a medium to low impact on the footprint of the mine.

3.11 Fauna

The faunal investigation provides a description of the ecological diversity in terms of species identification as well as the occurrence of threatened/sensitive species that is dependent on available habitat. During the desktop analysis, it was determined that several Red Data species were listed on the South African National Biodiversity database (SANBI) for the specific area.

The most important species of concern that will lead the management of the open cast is determined to be:

- a specific butterfly species (Hesperiidae family): *Metisella meninx* (Marsh sylph)
- *Aonyx spp.* that was discovered to inhabit the area
- Near Threatened Serval spp (*Leptailurus serval*)
- The Waderbird families that is expected to occur within the aquatic areas (AEWA protected and Red Data species identified)

The species of butterfly is Vulnerable due to its Endemic status to the wet wetlands within the Eastern Highveld grasslands within the area and has become extinct in several areas due to building developments and the resulting habitat destruction. They are specifically dependent on the availability of the Poaceae marsh grass species, preferably *Leersia hexandra* on which the larvae feed and females will only lay their eggs on this specific plant. These grass species are known to occur within this area. It is also important to note that previous biodiversity assessments have also indicated its occurrence within the area. This leads to the conclusion that numbers are expected to be favourable. None was observed during the field survey (except for their specific habitat), which is understandable due to their wing period being only between December and March. It was thus difficult to locate this rare and sensitive butterfly species within their egg or larvae form on the property. It is important to note that previous studies have recorded this species within the area and are also listed on the SANBI Database for the specific quarter degree cell.

The Otter droppings that were discovered near the edge of the dam indicate the presence of the Otter spp. within this area. The Clawless Otter is listed as Least Concern (IUCN and SA Red Data Book) while the Spotted necked Otter are listed as Protected within the ToPS List (2007) and Near Threatened within the SA Red Data Book. It is presumed the Otter spp. discovered will be African clawless otter. These will live in neighboring territories of family groups of up to five individuals. Each still having its own range within that territory, they mostly keep to themselves unless seeking a mate. It signals thus the importance of maintaining the linear corridor along the wetland systems and the Woestalleen spruit (and the main river tributaries) at all times during the development.

Mammals recorded

The habitat type suggests sparse species diversity in terms of mammalian groups. The farm has cattle that forage on the farm within the grass fields. Sightings of mammals were limited. Limited sightings are expected within the area and specific habitat type during the day. Dung pellets/droppings/scat and spoor were investigated, due to the lack of sightings for larger animals during the field visit.

Mammal species recorded during the field survey were:

- *Canidae canis* (Jackals holes were sighted, as well as the remains of a duiker, indicative of their activity)
- *Sylvicapra grimmia* (Common duiker) carcass, droppings and spoor were sighted
- *Hystrix africaeaustralis* (Porcupine spines and scat were collected on site)
- *Atilax palundinosus* (Marsh mongoose) spoor was identified near the large water body observed on site
- *Canis mesomelas* / *Vulpes chama* droppings
- *Aonyx capensis* Droppings (Recorded near the Surface Water Body)
- *Leptailurus serval* (scat and spoor of the Serval was recorded on site)

The Serval is also listed in CITES Appendix II, indicating it is "not necessarily now threatened with extinction, but that may become so unless trade is closely controlled." Serval are considered as Near Threatened and listed in the SA Red Data Book and considered Protected within the TOPS List (2007) along with the Cape fox that is also present on site.

Civet, Genet and Honey badger activity was recorded in the 2010 study conducted by Pachnoda Consulting cc, but could not be confirmed during the field survey in the relevant area of Portion 17 of Roodepoort 151 IS. This does not necessarily dispute their findings.

These species listed above are all considered typical species communities which inhabit Highveld grassveld vegetation areas.

Aves Assessment

The birds noted in the desktop study show that the species richness and diversity is high within the area. Most birds expected to be seen within the area are Wading Birds and Aquatic birds that utilise the wetland zones and large surface water body to the South of the proposed development area. This may be due of the fact that the grass layer within the area is considered dominant.

Bird species recorded during the field survey were mostly related to the wet areas and surface water body that are present. The following species were sighted:

- *Numida meleagris* - Common Guinea fowl
- *Coturnix coturnix* - Common Quail
- *Vanellus coronatus* - Crowned Lapwing
- *Vanellus lugubris* - Senegal Lapwing
- *Upupa epops* - African Hoopoe
- *Phalacrocorax africanus* - Reed Cormorant
- *Dendrocygna viduata* - White faced Duck
- *Bubulcus ibis* - Cattle Egret
- *Fulica cristata* - Red-knobbed Coot
- *Streptopelia semitorquata* - Laughing Dove
- *Egretta garzetta* - Little Egret
- *Ploceus xanthops* - Golden Weaver nests
- *Euplectes progne* - Long-tailed widowbird
- Numerous waterbird species were sighted within the proximity that is expected within permanent water zones. These are all included within the baseline study recorded within the specialist report

Reptiles recorded

No reptiles were recorded during the field survey, possibly due to the weather conditions and the recent veld fire that has levelled most of the field. No ridges or rocky formations were observed during the field assessment, which is usually the preferred habitat for these creatures.

This confirms the possibility for the previous mention of the occurrence of “ouvolk” within this area. The giant girdled lizard’s preferred habitat is typically that which may be observed on Portion 17 which is mostly Highveld grass fields and marshy terrain within some areas.

It is also evident that snakes will be fairly common within the area during summer, with adequate food and shelter available (Please refer to the specialist report for a potential list of species).

Amphibian assessment

The following limitations are associated with the finding in this regard:

- The survey was done after the winter months in the Southern hemisphere, but before any rain have occurred within the area. The area has ample wetland zones and water availability which leads to the conclusion that amphibians are rich within the area.
- A comprehensive amphibian survey by a qualified herpetologist will be the most reliable source to establish the distribution of this or any other amphibians associated with this habitat. It should be conducted during the wet season to provide an accurate account of the species type. The study should determine if Bullfrog breeding areas are present.
- Most frogs spend the dry season underground and only surface after adequate rains have fallen and was thus not visibly present at the time of the field survey. This is especially the case for the Threatened and Protected Bullfrog species within South Africa. It is unlikely that Bullfrogs may be breeding within this specific area due to their preference for seasonal wetland zones with short grass and the nature of the wetland areas within the development footprint may be classified as permanent wet zones with a clear riparian zone consisting of *Phragmites* spp. (not ideally indicative of bullfrog breeding habitat) but this will have to be confirmed by a qualified herpetologist as it may have implications in terms of development within proximity of the water body.

Insect Assessment

The insect evaluation was conducted on a desktop level and no pits or traps were implemented during the field assessment. The desktop findings were decided to be adequate and descriptive of the overall area of which Portion 17 will form part of (Please refer to specialist report above for the Insect evaluation conducted). The beetles (Stag Beetle: *Lucanidae* family and the Tiger Beetle: *Carabidae cicindelinae*) and the butterfly species (Marsh Sylph: *Metisella meninx*) noted will be deemed the most important aspect in terms of the Insect assessment conducted. These will be incorporated within the Management Plan provided.

3.12 Macro Habitats

From initial field investigations the major habitat types that were identified within the proposed site include the following:

- **Agricultural fields** – comprises areas that are currently actively cultivated (mainly maize). Edges are generally characterised by a composition of weeds, invasive forbs and poor quality grasses and herbs. The faunal component of these areas might be relative diverse, but mostly comprises animals that utilises these areas on an infrequent basis or because of the unnatural food source that is presented by agriculture during parts of the year. The composition of animals in these areas are entirely different to that of natural grassland habitat;

- **Natural grasslands** – Fragmented and isolated areas of natural grassland comprise grassland attributes of moderate sensitivity. These areas are frequently also associated with wetland habitat of the region. The species composition of these areas provides indication of the natural status of the grassland remnants. A diverse composition that is typical of the Eastern Highveld Grassland vegetation type comprises an admixture of forbs (particularly geophytes) and grasses. It should be noted that, at this stage of the process, no distinction is yet made between prime grassland and areas where a poor quality is prevalent;
- **Wetlands** – all areas of wetland related habitat as discussed earlier in this report.; and
- **Transformed habitat** – all areas where development has resulted in the decimation of natural habitat. Species generally associated with these areas comprises plants that are used for garden purposes, windbreaks or species associated with habitat transformation.

Sensitivities associated with the latter identified macro habitats;

- **Agricultural fields** – No attributes of natural habitat remains within these areas and a low ecological sensitivity is ascribed to these parts. It is also unlikely that these areas will recover to a natural state;
- **Natural grasslands** – A moderate to high sensitivity (depending on the actual status) is normally ascribed to these parts, mainly as a result of the severe fragmentation and isolation of remaining fragments;
- **Wetlands** – A high sensitivity is ascribed to these parts although the specialist studies will further investigate and aid in sensitivity analysis, currently a 100m buffer is being prescribed; and
- **Transformed habitat** – No attributes of natural habitat remains within these areas and a low ecological sensitivity is ascribed to these parts. It is also unlikely that these areas will recover to a natural state.

3.13 Avifauna

3.13.1 Regional Avifaunal Description

Data on the bird species that could occur in the study area and their abundance was obtained from the Southern African Bird Atlas Project (Harrison et al, 1997). These data provided an indication of the bird species that were recorded in the quarter degree squares within which this proposed project falls.

The table below indicate Red Listed bird species recorded in the quarter degree squares within which the study area is located (Harrison et al, 1997). Report rates are percentages of the number of times a species was recorded by the number of times the square was counted. Conservation status is classified according to Barnes (2000).

Table 37: Red Listed bird species recorded in the quarter degree squares

Total Cards		66	64
Total Species		193	221
Total Breeding Species		44	27
Name	Conservation status	2629BA report rate	2529DC report rate
Botha's Lark	EN	2	-
Southern Bald Ibis	VU	5	14
African Marsh-Harrier	VU	2	-
Lesser Kestrel	VU	3	13
African Grass Owl	VU	2	2
Denham's Bustard	VU	-	2
White-bellied Korhaan	VU	-	2
Yellow-billed Stork	NT	3	-
Greater Flamingo	NT	27	36
Lesser Flamingo	NT	8	17
Secretarybird	NT	3	5
Black Harrier	NT	2	-
Pallid Harrier	NT	-	2
Blue Korhaan	NT	3	2
Black-winged Pratincole	NT	5	2
Black Stork	NT	-	5
White Stork	Bonn	11	14
EN=Endangered; VU=Vulnerable; NT=Near-threatened; Bonn=Protected Internationally under the Bonn Convention on Migratory Species.			

The SABAP data lists 1 Endangered, 6 Vulnerable and 9 near threatened species as occurring within the study area. In addition, one species, the White Stork is protected internationally under the Bonn Convention on Migratory Species.

SABAP 2 data was also consulted, with the two pentads in the study area, 2600_2935 and 2555_2935, recording totals of 70 and 78 species respectively. Only one card had been submitted for pentad 2600_2935, while three counts have been conducted in pentad 2555_2935 to date. This represents insufficient data to be considered an accurate indication of species present or absent. It was noted, however, that pentad 2555_2935 had report rates of 33% (i.e. 1 of 3 counts) for both Greater and Lesser Flamingoes.

The 2629BA QDGS, in which the proposed site is located, also incorporates part of an Important Bird Area (IBA) - Amersfoort-bethal-carolina District. Although this IBA falls outside of the 8km study radius, it is known to hold a large proportion (>10%) of the global population of the endangered Botha's Lark (Barnes 1998). This species favors short dense, natural grassland found on plateaus and upper hill slopes. Such habitat was not observed at the proposed site for this project. The majority of the study area comprised of agricultural lands, planted pastures, vleis and dams which are habitats not usually preferred by Botha's Lark.

3.13.2 Avifaunal Micro-habitats

An examination of the micro habitats available to birds was conducted during the initial site investigations. These are generally evident at a much smaller spatial scale than vegetation types, and are determined by a host of factors such as vegetation type, topography, land use and manmade infrastructure. The following micro-habitats were identified in the study area.

- **Cultivated Lands and Pasture**

Arable or cultivated land as well as pastures, represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources readily accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. Arable lands exist in this study area, mostly planted to pasture or corn at the time of site visit. Relevant bird species that will be attracted to these areas include the Denham's Bustard and White Stork.

- **Drainage Lines and Wetlands**

Drainage lines and wetlands are an important form of habitat to numerous species. Drainage lines are often surrounded by natural grasslands, which may provide habitat for species such as African Grass Owl and Botha's lark. Various waterfowl, such as ducks and geese, may make use of these areas.

- **Man-made Dams**

Artificially constructed dams (such as the dam located to the east of the study area in the middle of the NFEPA Wetland) have become important attractants to various bird species in the South African landscape. Various waterfowl frequent these areas and crane species often use dams to roost in communally. Birds such as flamingos and African Spoonbills may make use of these areas, although not identified during the initial field investigations.

- **Open Grassland**

Grasslands represent a significant feeding area for many bird species, as well as possible breeding areas for others such as the African Grass Owl. Specifically, these open grassland patches typically attract the Blue Crane, Grey Crowned Crane (which have been identified in the nearby IBA discussed above) Sothorn Bald Ibis, Secretarybird, White-bellied Korhaan, Denham's Bustard and White Stork. The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl. This in turn attracts large raptors because of both the presence and accessibility of prey.

- **Stands of Alien Trees**

These areas will mostly be important to physically smaller bird species and passerines, as well as providing roosting for certain raptors and larger species such as Geese and Ibises.

The table below shows the micro habitats that each Red Data bird typically frequents in the study area. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis below represents each species' most preferred or normal habitats. These locations are where most of the birds of that species will spend most of their time – so logically that is where impacts on those species will be most significant.

Table 38: Preferred Micro-habitats and likelihood of occurrence on site of Red Data species recorded in the relevant QDGS's.

Species	Preferred Micro-habitat	Likelihood of occurrence on site
Botha's Lark	Long, mature natural grassland	Unlikely
Southern Bald Ibis	Grassland	Likely
African Marsh-Harrier	Dams and Wetlands	Possible
Lesser Kestrel	Arable lands and Grasslands	Possible
African Grass Owl	Grasslands	Unlikely
Denham's Bustard	Cultivated lands and Grasslands	Possible
White-bellied Korhaan	Cultivated lands and Grasslands	Possible
Yellow-billed Stork	Cultivated lands and Grasslands	Possible
Greater Flamingo	Dams and wetlands	Possible
Lesser Flamingo	Dams and Wetlands	Possible
Secretarybird	Cultivated lands and Grasslands	Unlikely
Black Harrier	Cultivated lands and Grasslands	Possible
Pallid Harrier	Grasslands and Wetlands	Unlikely
Blue Korhaan	Cultivated lands and Grasslands	Possible
Black-winged Pratincole	Cultivated lands and Grasslands	Possible
Black Stork	Rivers and Kloofs	Unlikely
White Stork	Cultivated lands and Grasslands	Likely

3.14 Surface Water Systems

A characterisation of the rivers in the study area reveals that the receiving Klein-Olifants River is an order three river. Six attributes were used to obtain the PES on desktop quaternary catchment level. These attributes predominantly suggest to habitat integrity of instream and riparian habitat. With this in mind, the receiving Klein-Olifants River and the Woestalleen systems fall within a D-category, which relates to a largely transformed ecosystem state. Biological communities also reflect fair to unacceptable health in these systems (RHP, 2001). The instream habitat associated with the ecoregion in the study area reflects more degradation than adjacent ecoregions (RHP, 2001). According to the desktop PES category from DWAF (2000), the rivers in quaternary catchment B12B fall in a C ecological category, indicating a moderately modified ecosystem with clear community modifications and some impairment of health evident.

The catchment at present is affected by severe erosion, sedimentation, weirs, infrastructural development in the form of power stations and mines, and translocation of species (*Labeo umbratus*). The EIS (DWAF, 2000) is considered moderately sensitive due to the expected presence of flow intolerant fish species in parts of the catchment, and the system's sensitivity to changes in flow and water quality.

Table 39: Desktop river characterisation of rivers and streams located in the study area (Nel et al., 2004) and DWAF (2000).

	Klein-Olifants River	Woestalleen System
River Order	3	1
Quaternary Catchment	B12B	B12B
Class	Perennial	Perennial
PES (NSBA)	D	D
PES (DWAF)	C	C
EIS (DWAF)	Moderate	Moderate
Conservation Status (NSBA)	Critically Endangered	Critically Endangered

The proposed development site falls within the Upper Olifants Sub-Area of the Olifants Water Management Area (WMA4). The Upper Olifants Sub-Area is the most urbanised of the 4 sub-areas in WMA4. The Upper Olifants covers an area of 11 464 km² with a mean annual runoff of 10 780 million m³ (Midgley et al., 1994). Surface runoff in this area is regulated by a number of large dams, namely Witbank, Bronkhorstspuit and the Middelburg dams (Basson et al., 1997). Majority of the urban population is located in Witbank and Middelburg areas, and it is projected that the population in these urban areas is expected to grow in the near future therefore increasing the water requirement in the Sub-Area. Extensive coal mining activities are taking place in the sub-area, both for export to other provinces and for use in the six active coal fired power stations in the sub-area. Water quality in this sub-area is therefore under threat. Mining activities in the area impact on the natural hydrological system by increasing infiltration and recharge rates of the groundwater. Approximately 62 million m³ is predicted to decant from mining activities (post closure) every year, creating a need for water quality management plans in this Sub-Area (DWAF, 2004).

Table 40: Reconciliation of water requirements and availability (million m³/a) for the year 2000 in the Olifants Water Management Area (DWAF, 2004b).

Sub-area	MAR	Local yield	Transfers in	Transfer out	Local requirement	Deficit
Upper Olifants	465	238	171	96	314	1
Middle Olifants	481	210	91	3	392	94
Steelpoort	396	61	0	0	95	34
Lower Olifants	698	100	1	0	104	63

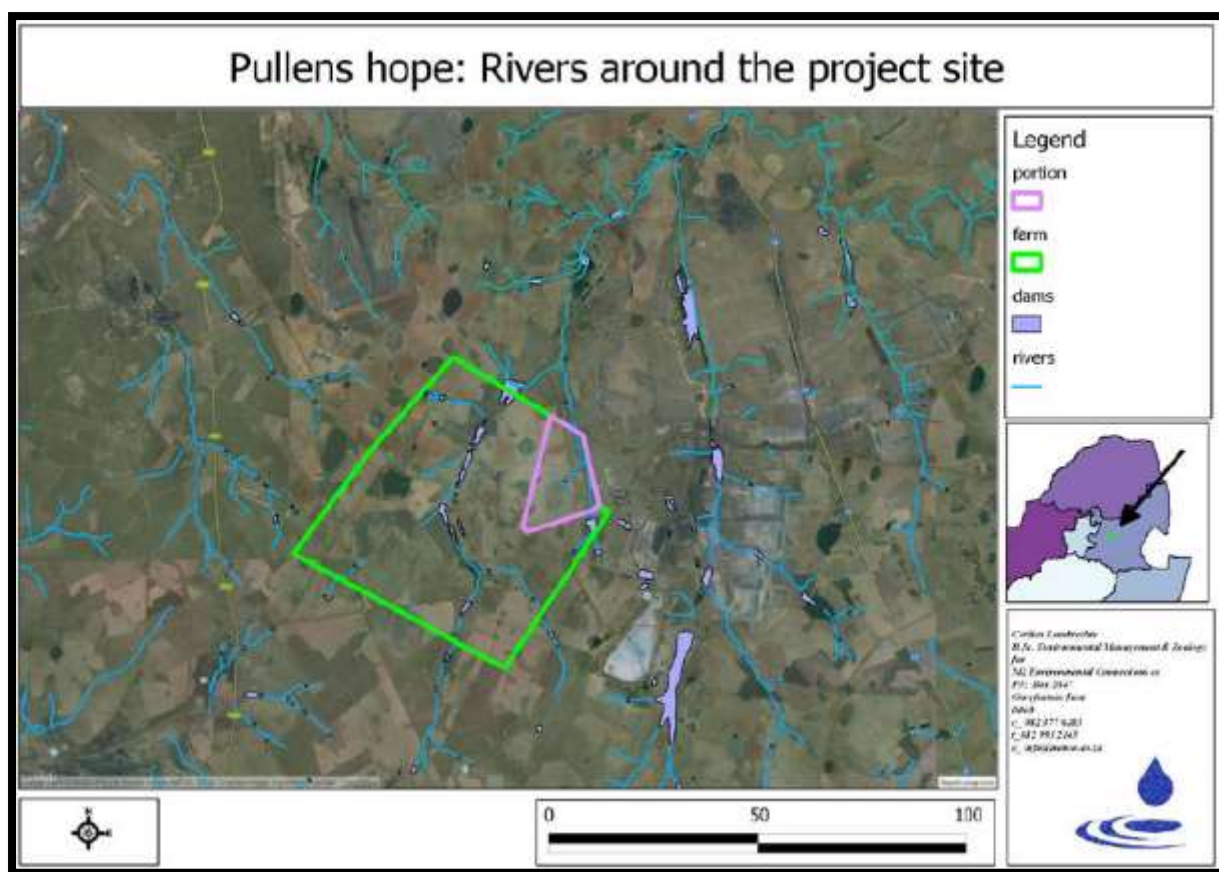


Figure 51: Rivers/streams in vicinity of the proposed mine

The findings below are based on the SASS5 bio-monitoring as conducted the 10th of September 2013 in the tributary of the Woestalleen Spruit. There is no reference for a previous dry season monitoring done in this stream and these results will be used to set the baseline and act as the pre-mining conditions. Therefore, it can only be measured on merit of the Departmental reference of the catchment, and the associated water qualities.

Table 41: Target water Quality range for B12B Catchment

Chemical Parameter	Target Water Quality Ranges		
	Class 0	Class I	Class II
pH	5 – 9.5	4.5 – 10	4 – 10.5
Electrical Conductivity	< 70	70 – 150	150 – 370
Calcium as Ca	< 80	80 – 150	150 – 300
Magnesium as Mg	< 70	70 – 100	100 – 200
Sodium as Na	< 100	100 – 200	200 – 400
Chloride as Cl	< 100	100 – 200	200 – 600
Sulphate as SO ₄	< 200	200 – 400	400 – 600
Nitrate as NO _x -N	< 6	6 – 10	10 – 20

The Woestalleen Spruit and its tributaries is impacted by the riparian agriculture and the industrial related activities found in the area. This is evident in the baseline water quality results as conducted on the 10th of September 2013. The in-situ data is depicted in the table below. The monitoring points were subject to the

availability of the habitat able to support sensitive species. These sites had low IHAS scores and this is reflective of the current impacts associated with the watercourse. In terms of above the water analysed is found to be within the Class 0 TWQR. These results can be seen in the table below.

Table 42: Water quality data applicable to Kebrafield Mine - September 2013

Analyses in mg/ℓ	Sample Identification: Pullenshope		
	KFBM3	KFBM2	KFBM4
pH – Value at 25°C	7.5	8.8	7.2
Electrical Conductivity in mS/m at 25°C	77.2	78.8	57.7
Total Dissolved Solids at 180°C	518	528	374
Suspended Solids at 105°C	17.2	3.6	324
Turbidity in N.T.U	8.6	1.5	354
Total Hardness as CaCO ₃	274	260	169
Chloride as Cl	34	40	34
Sulphate as SO ₄	200	224	115
Nitrate as N	<0.2	<0.2	<0.2
Nitrite as N	<0.1	<0.1	<0.1
Total Phosphate as P	<0.2	0.2	2.7

Analyses in mg/ℓ	Sample Identification: Pullenshope		
	KFBM3	KFBM2	KFBM4
Ortho Phosphate as P	<0.2	<0.2	<0.2
Chemical Oxygen Demand as O ₂ (Total)	40	36	123
Dissolved Oxygen as O ₂	5.2	7.3	2.9
Sodium as Na	50	47	47
Potassium as K	12.4	13.3	9.8
Calcium as Ca	49	48	28
Magnesium as Mg	37	34	24
Aluminum as Al	<0.100	<0.100	0.228
Aluminum as Al (Dissolved)	<0.100	<0.100	<0.100
Iron as Fe	0.924	0.102	76
Iron as Fe (Dissolved)	<0.025	<0.025	0.257
Manganese as Mn	0.044	0.025	3.07
Manganese as Mn (Dissolved)	<0.025	<0.025	0.751
Zinc as Zn	<0.025	<0.025	<0.025
Zinc as Zn (Dissolved)	<0.025	<0.025	<0.025

Table 43: Site specific *in-situ* data for sites in a Tributary of the Woestalleen Spruit

Site	Date	pH	EC (mS/m)	DO (mg/l)	SASS5	ASPT	Health Class	IHAS
KFBM2	Sept'13	8.8	78.6	10.52	42	5.3	Class B	61
KFBM3	Sept'13	7.2	76.5	6.49	37	4.6	Class C	39
KFBM4	Sept'13	6.3	56.2	3.82	60	5	Class B	39



Figure 52: Surface water sampling points

The water qualities are indicative that there are form of pollution entering the system in the area between KFBM3 and KFBM4. The increase in the phosphates is indicative of the biological pollution taking place at point KFBM4. The higher levels in Turbidity, Suspended Solids, and COD's are supportive to this form of pollution. The decrease in DO is another indicator of biological pollution that is clearly taking place. Upon the site visit it was noticed that there were a sewerage leakage in the town of Pullenshope and it is therefore assumed that this is the cause of this pollution as the stormwater drains into the tributary.

Further, the elevated Iron and Aluminum is indicative of the diffuse impacts caused by the mining activities in the area.

From the above mentioned it is evident that there are already impacts associated with anthropogenic and urban development, sewerage, power generation (Eskom Hendrina Power Station) and mining (Optimum Colliery). This should be taken into close consideration when the RQO's are set as this is the baseline for the area. The Roodepoort Colliery has no activities on the property as yet.

Even though the in stream habitat was found to be insufficient to support sensitive biota, there were still some sensitive species identified. These species included the likes of *Helodidae* (Marsh beetles); *Hydraenidae* (Minute moss beetles) and *Hydracarina* (Mites). It was found at KFBM2 that the IHAS showed the necessary habitat, yet there were no sensitive species found. The ASPT was however evident of a Class B. The main reason found that there were no sensitive species is the fact that this is however the overflow of the dam situated in the stream. This is also the closest point to the dam of all the points monitored and the assumption is that the sensitive species has not yet established at this point.

3.15 Sites of Archaeological, Historical and Cultural Interest

3.15.1 Archaeological Background

3.15.1.1 The Early Stone Age

The earliest stone tool industry, the Oldowan, was developed by early human ancestors which were the earliest members of the genus *Homo*, such as *Homo habilis*, around 2.6 million years ago. It comprises tools such as cobble cores and pebble choppers (Toth & Schick 2007). The oldest stone tools from the Sterkfontein Caves are found in the Oldowan Infill and date to between 2 and 1.7 million years ago. As the name suggests, these tools are similar to those found at Olduvai Gorge in Tanzania. Archaeologists suggest these stone tools are the earliest direct evidence for culture in southern Africa (Clarke & Kuman 2000). The advent of culture indicates the advent of more cognitively modern hominins (Mitchell 2002: 56, 57)

The Acheulean industry completely replaced the Oldowan industry. The Acheulian industry was first developed by *Homo ergaster* between 1.8 to 1.65 million years ago and lasted until around 300 000 years ago. Archaeological evidence from this period is also found at Swartkrans, Kromdraai and Sterkfontein. Around 1.5 million years ago, the western side of the cave probably enlarged, since artefact-bearing breccias (coarsegrained sedimentary rock made of sharp fragments of rock and stone cemented together by finer material, which is produced by volcanic activity or erosion, including frost shattering) are more widely distributed.

The most typical tools of the ESA are handaxes, cleavers, choppers and spheroids. Although hominins seemingly used handaxes often, scholars disagree about their use. There are no indications of hafting, and some artefacts are far too large for it. Hominins likely used choppers and scrapers for skinning and butchering scavenged animals and often obtained sharp ended sticks for digging up edible roots. Presumably, early humans

used wooden spears as early as 5 million years ago to hunt small animals. The hominin *Homo erectus* and *Homo ergaster* used fire as early as between 300,000 and 1.5 million years ago, and possibly even earlier. The invention of fire reduced mortality rates and provided protection against predators. Examples of sites from this time period include Kromdraai, Makapansgat and Sterkfontein and Swartkrans (Toth & Schick 2007).

3.15.1.2 The Middle Stone Age

Middle Stone Age artefacts started appearing about 250 000 years ago and replaced the larger Early Stone Age bifaces, handaxes and cleavers with smaller flake industries consisting of scrapers, points and blades. These artefacts roughly fall in the 40-100 mm size range and were, in some cases, attached to handles, indicating a significant technical advance. Few other artefacts from this period remain. In some cases, archaeologists found circular hearths, which indicate the ability to make fire. Animal and plant remains indicate a hunting and gathering lifestyle. The first *Homo sapiens* species also emerged during this period. Associated sites are Klasies River Mouth, Blombos Cave and Border Cave (Deacon & Deacon 1999). The most recent deposit in the Sterkfontein cave dates to between 115 000 and 253 000 years ago and includes a few hominin bone fragments, fauna and Middle Stone Age artefacts (Clarke & Kuman 2000:10-13). Anatomically modern *Homo sapiens* emerged around 150 000 years ago (Mitchell 2002:42).

3.15.1.3 The Later Stone Age

Although the transition from the Middle Stone Age to the Later Stone Age did not occur simultaneously across the whole of southern Africa, the Later Stone Age ranges from about 20 000 to 2000 years ago. Stone tools from this period are generally smaller, but were used to do the same job as those from previous periods; only in a different, more efficient way. At the time of European contact in South Africa, some groups, for example the Khoisan, were still producing and using these tools. This aided understanding how and for what these tools were used. The Later Stone Age is associated with: rock art, smaller stone tools (microliths), bows and arrows, bored stones, grooved stones, polished bone tools, earthenware pottery and beads. Examples of Later Stone Age sites are Nelson Bay Cave, Rose Cottage Cave and Boomplaas Cave (Deacon & Deacon 1999).

3.15.1.4 Early Iron Age

The Early Iron Age marks the movement of farming communities into South Africa in the first millennium AD, or around 2500 years ago (Mitchell 2002:259, 260). These groups were agro-pastoralist communities that settled in the vicinity of water in order to provide subsistence for their cattle and crops. Archaeological evidence from Early Iron Age sites is mostly artefacts in the form of ceramic assemblages. The origins and archaeological identities of this period are largely based upon ceramic typologies. Some scholars classify Early Iron Age ceramic traditions into different “streams” or “trends” in pot types and decoration, which emerged over time in southern Africa. These “streams” are identified as the Kwale Branch (east), the Nkope Branch (central) and the Kalundu Branch (west). Early Iron Age ceramics typically display features such as large and prominent inverted rims, large neck areas and fine elaborate decorations. This period continued until the end of the first millennium AD (Mitchell

2002; Huffman 2007). Some well-known Early Farming community sites include the Lydenburg Heads in Mpumalanga, Happy Rest in the Limpopo Province and Mzonjani in Kwa-Zulu Natal.

3.15.1.5 Later Iron Age and Historical Periods

According to literary sources, it appears that the study area was not directly influenced by major events in human settlement patterns during the Later Iron Age and later times. Missionaries from Berlin, who settled in the Middelburg area during the second half of the 19th century, reported that there were Kwena and Kgatla farming communities living in the general vicinity during that time (Bergh 1998:106). According to Bergh (1998: 11) the Phuting were active in a north-south direction to east of the study area during the 'Difaqane'. Generally more information is available on areas further north of the study area.

Establishment of Middelburg (1859 – 1874)

Present-day Middelburg was initially named Nazareth on 28 March 1860, although the Transvaal Republic established the town on 25 October 1859. It was officially proclaimed a town under the magistrate of Lydenburg in 1867. In 1874, the name changed to Middelburg. It is generally accepted that the name Middelburg refers to the midpoint between Lydenburg and Pretoria (Pistorius 2004).

Establishment of Hendrina (1914)

Hendrina is situated about 50 km southeast of Middelburg and 20 km southeast of Pullens Hope. Hendrina is located on the farm Garsfontein and was bought from Gerard Beukes. The town was named after his wife (Pistorius 2004).

The First (1880 – 1881) and Second Freedom Wars (1899 – 1902)

The naming of Middelburg coincides with the year Lord Carnarvon, the Colonial State Secretary, decided he wanted to unite British territory and the two Boer Republics under the British flag. None of these states were in favour, and Carnarvon decided uniting with the Transvaal might urge the others to follow. He sent Shepstone from Natal to Pretoria with a police force of 25 to annex the Transvaal, and Shepstone hoisted the British flag on 12 April 1877, without firing a single shot.

After failing to regain independence through requests sent to England, S. P. J. Kruger, P. Joubert and M. W. Pretorius held a meeting from 12 to 16 December 1880 to discuss the matter. The British decided to attack the republicans and the Battle of Bronkhorstspuit, about 50 km west of Middelburg, ensued on 20 December 1880. The British forces consisted of 257 men under Colonel Anstruther, and the Boer forces were roughly the same number under Frans Joubert. The battle lasted a mere 10 to 20 minutes, and ended with 76 killed and 62 wounded on the British side and one killed and five wounded on the Boer side. This was the first open battle of the First Freedom War, also known as the First Anglo-Boer War (Roodt 1949: 7-9). During the Second Freedom

War, also known as just the Anglo-Boer War, General French and Hutton's Brigade of Mounted Infantry marched into and annexed Middelburg on 27 July 1900 (Wilson 1902:94).

3.15.2 Archaeological and Historical Remains

3.15.2.1 Stone Age Remains

No Stone Age archaeological remains were found.

3.15.2.2 Iron Age Farmer Remains

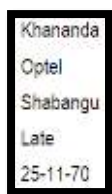
No Iron Age Farmer archaeological remains were identified on the study area. Previous reports indicated no potential for the direct environment, although circular stone wall enclosures may be present on a regional scale.

3.15.2.3 Historical Remains

No Historical archaeological remains were identified on the section demarcated for development.

3.15.3 Graves

One graveyard and one isolated grave were located on the area demarcated for development. The graveyard is located on the northern border of Portion 17 of the farm Roodepoort 151 IS with a section falling outside of the northern boundary of the portion demarcated for development. The section of the graveyard falling outside of the demarcated section for development is located on portion 1 of the farm Botashoek 475 JS. This section consists of 26 graves oriented in an east-west direction and one grave oriented in what appears to be a north-south direction. The graves do not have headstones and generally consists of stacked stones. It is possible that these may be the graves of farm workers. One grave, however, is outlined with bricks and has a headstone. This is also the only grave on the northern section of the border with a date. The inscription on the headstone reads:

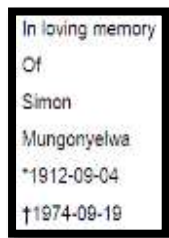


The graves on the southern side of the boundary, which therefore fall on the property of the portion to be developed, consists of 36 graves oriented in an east-west direction. The majority of the graves consist of stacked stones as well and may also be that of farm workers. Six graves, however, contained headstones.

The grave of Sukwini Nonighty is one of the oldest graves with an inscription. The headstone reads:

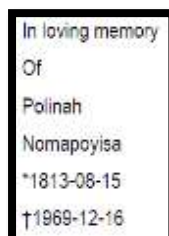


Two graves containing headstones are located in a fenced-off area on the southern side of the graveyard. However, the fence as well as the headstones are damaged, probably as a result of cattle grazing. The one grave dates to 1974 and has the following inscription on the headstone:



In loving memory
Of
Simon
Mungonyelwa
*1912-09-04
†1974-09-19

The other fenced-off grave dates to 1969. The inscription on the headstone reads:



In loving memory
Of
Polinah
Nomapoyisa
*1813-08-15
†1969-12-16

Concerning the graves with headstones, three appear to be of western decent. It is also noted that at least two of these are children's graves. The inscription on the headstone of the third grave, however, is no longer visible. It should be noted that these three headstones are similar in style. The first of these dates to 1920 and has the following inscription on the headstone:



Hier rus
Anne
Catharina
Vd Merwe
Geb. 2_6_1920
E.v.L 18_9_1920

The second has the following inscription on the headstone:



Hier rus
Maria
Elizabeth
Vd Merwe
Geb 21_4_1914
E.v.L 25_6_1919

The third grave indicates a similar style compared to the previous two graves, except that in the first two cases the graves are cemented, while rocks are utilised in the third case. Also, the types of rock in this case differ from the type used in the rest of the graves.

Worthy of noting is the fact that two monoliths are associated with the graveyard. The significance of the monoliths are unclear.

One isolated grave is located towards the southern boundary of the area demarcated for development. The headstone appears to be similar to the western graves, but there are no inscriptions visible. The grave is also lined with bricks and rocks and the area around the grave cleared.

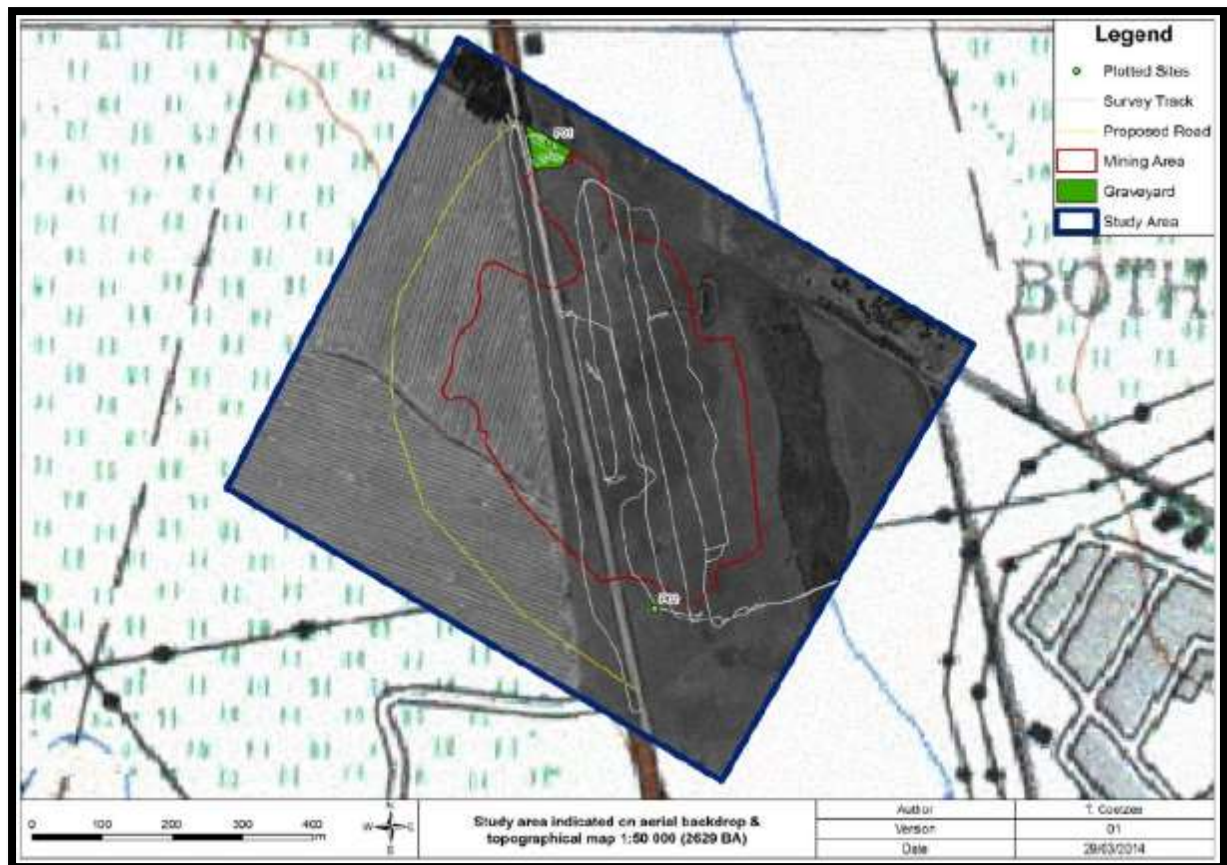


Figure 53: Distribution of archaeologically sensitive areas and extent of fieldwork on portion 17 of the farm Roodepoort 151 IS

3.15.4 Archaeological Evaluation

The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences.

A fundamental aspect in the conservation of a heritage resource relates to whether the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. There are many aspects that must be taken into consideration when determining significance, such as rarity, national significance, scientific importance, cultural and religious significance, and not least, community preferences. When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research

potential must be assessed and if appropriate mitigated in order to gain data / information which would otherwise be lost. Such sites must be adequately recorded and sampled before being destroyed.

3.15.4.1 Field Rating

All sites should include a field rating in order to comply with section 38 of the national legislation. The field rating and classification in this report is prescribed by SAHRA.

Table 44: Field Rating

Rating	Field Rating/Grade	Significance	Recommendation
National	Grade 1		National site
Provincial	Grade 2		Provincial site
Local	Grade 3 A	High	Mitigation not advised
Local	Grade 3 B	High	Part of site should be retained
General protection A	4 A	High/Medium	Mitigate site
General Protection B	4 B	Medium	Record site
General Protection C	4 C	Low	No recording necessary

Site: P01 (Graveyard)

Rating	Field Rating/Grade	Significance	Recommendation
Local	Grade 3 A	High	Mitigation not advised

Site: P02 (Isolated grave)

Rating	Field Rating/Grade	Significance	Recommendation
Local	Grade 3 A	High	Mitigation not advised

3.15.4.2 Statement of Significance

One graveyard and on isolated grave were observed on the section demarcated for development on Portion 17 of the farm Roodepoort 151 IS. It is unknown whether the graveyard is still in use, but it is assumed that there are no recent burials due to the absence of head stones with dates, fences, other artefacts associated with graves or the presence of recent activity. Because of the proximity of sensitive areas to the planned development, it is likely that they will be impacted on. Only seven of the 61 observed graves indicate a birth or decease date. Of these the most recent dates to 1974 and the oldest to 1919. The dates therefore vary between historical and more recent times. Because these graves are protected by legislation, the following apply: The National Heritage Resources Act (25 of 1999) and the Human Tissues Act (65 of 1983) protect graves older than 60 years. Graves younger than 60 years, however, are protected under the Human Tissue Act (65 of 1983) and fall under Section 2 (1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925). The exhumation of graves falls under the jurisdiction of the National Department of Health and the relevant Provincial

Department of Health. Exhumation permission must also be obtained from the relevant local or regional council where graves are located, and from the relevant regional and local council to where the grave will be relocated.

3.16 Socio-economic Overview of the Study Area

The role of an SIA as part of an EIA study cannot be downplayed as it aids in providing a better understanding of the affected communities who make up the social environment. The Guidelines for Involving Social Assessment Specialists in EIA Processes (DEADP, 2007), outlines the following as key components of an SIA:

- *“Describing and obtaining an understanding of the proposed intervention (type, scale, location), the communities likely to be affected and determining the need and scope of the SIA.*
- *Collecting baseline data on the current social environment and historical social trends.*
- *Identifying potential alternatives.*
- *Identifying and collecting data on the SIA variables and social change processes related to the proposed intervention. This requires consultation with affected individuals and communities.*
- *Assessing and documenting the significance of social impacts associated with the proposed intervention.*
- *Assessing the alternatives and identifying potential mitigation measures.*
- *Developing a Monitoring and Evaluation Programme.”*

The Kebrafield Roodepoort Colliery is situated in the Mpumalanga Province and within the Steve Tshwete Local Municipality area of jurisdiction. The closest towns include Hendrina and Middelburg with the small community of Pullenshope situated right next to the proposed development site on the eastern border.

The town of Hendrina was proclaimed on 5 June 1916 and is approximately 20 km from the proposed Kebrafield Roodepoort Colliery. Hendrina is the second largest town in the municipality (after Middelburg). The main business / commercial activities in Hendrina include the OTK cooperation and a large manufacturing company. Pullenshope is situated directly to the east of the proposed project site and is considered to be the fourth largest settlement in the municipal area. The original stands were developed by Eskom to accommodate personnel employed at the Hendrina power station. The current ownership of the community is assumed to be municipal however, this remains to be confirmed as some articles suggest private ownership mainly exists within the town today.

The Olifants WMA is one of the most economically important areas within South Africa. Activities are diverse and is mainly characterised by mining, metallurgic activities, commercial agriculture. Large coal deposits are found in the Emalahleni and Middelburg areas, while large platinum group elements (PGE's) are found in Steelpoort and Phalaborwa areas towards the North.

Eskom currently has seven coal fired power stations (and constructing an eighth) which support the country of 70 percent of their main power supply.

This section aims to put into context the social environment of the area of the proposed development by providing information on a three levels namely:

- Provincial Level
- District Municipality Level
- Local Municipality Level

3.16.1 Mpumalanga Province

Mpumalanga province is the second smallest in size after Gauteng measuring 76495km² and covering 6.3% of the land area in the country. This current land area represents a decrease in the land area as the size recorded during census 2001 was 79487km². This decrease is attributed to the allocation of land to the City of Tshwane from the Victor Kanya (previously called Delmas) (Statistics SA, 2012).

The province is bordered to the North by Limpopo, to the West by Gauteng, to the South West by Free State, to the South East by KwaZulu Natal and Swaziland to the East. The administrative capital of the province is Nelspruit which is located approximately 400k from Johannesburg.

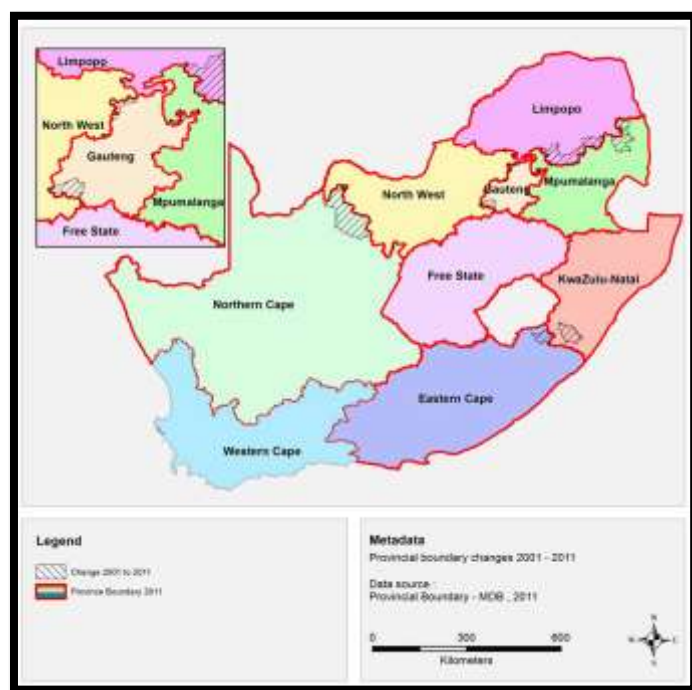


Figure 54: Provincial Boundary Changes from 2001 to 2011 (Statistics SA, 2012)

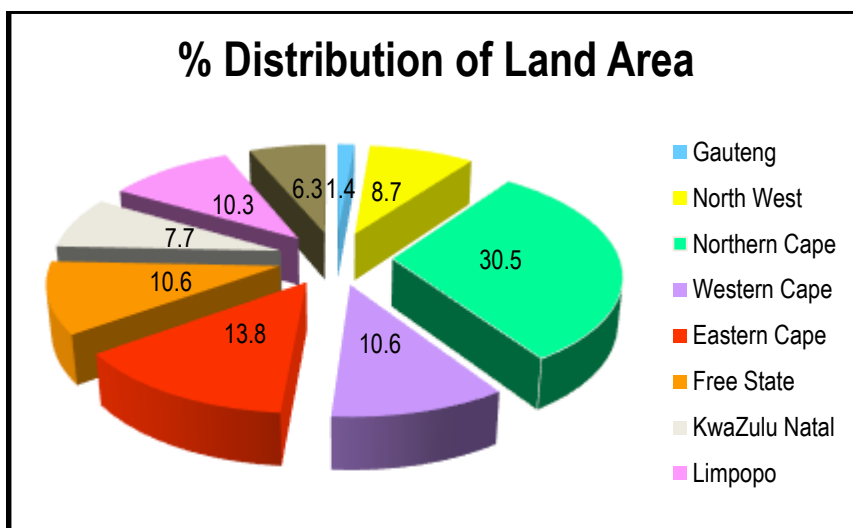


Figure 55: South Africa Land Area Distribution (Statistics SA, 2014)

3.16.1.1 Population

The population of Mpumalanga has been steadily rising over the years with the current population recorded as 4 039 939 persons. A comparison between the three census periods reveals that between 1996 and 2001, the population increased by 7.7%, from 2001 to the 2007 Community Survey (CS) it increased by 8.3% and finally by 10.9% from the CS to 2011.

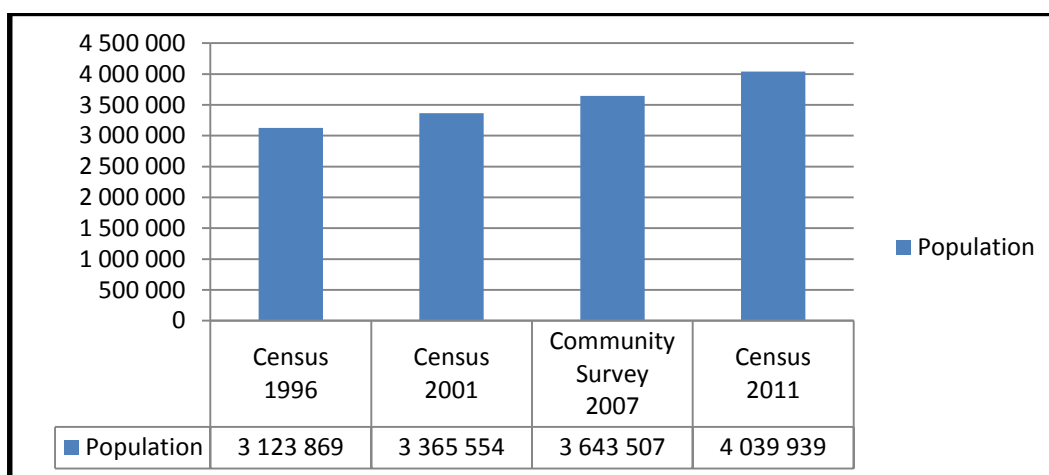


Figure 56: Population of Mpumalanga Province (Statistics SA, 2014)

The number of households in the province has also been increasing over the years in line with the increasing population as shown. Over a 15 year period, the number of households has risen from 669 801 in 1996 to 1 075 488 in 2011.

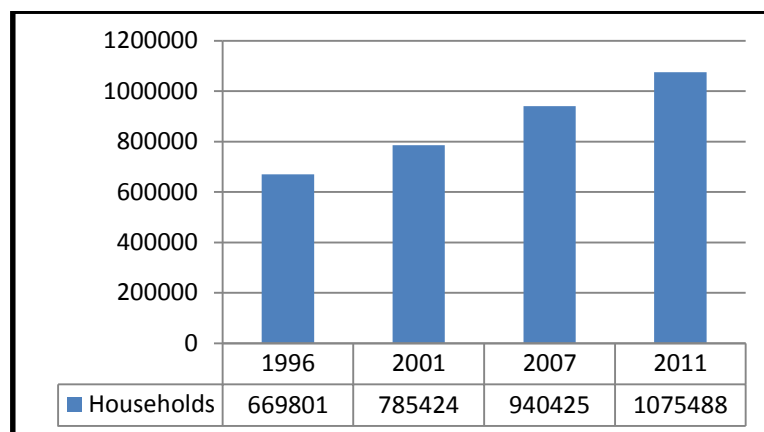


Figure 57: Number of Households in Mpumalanga (Statistics SA, 2014)

3.16.1.2 Age-Sex Structure

The figure below illustrates the age-sex structure of the province which reveals that the population in Mpumalanga is mainly made up of young people falling under the age of 35. From a sex perspective, 48.6% of the population is composed of males while 51.4% are females, a ratio that has been maintained over the years from 1996.

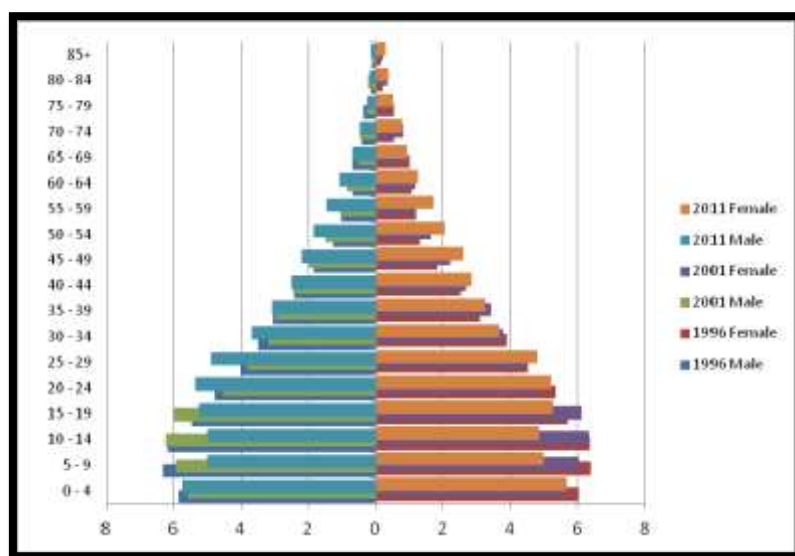


Figure 58: Age-Sex Structure (Statistics SA, 2014)

3.16.1.3 Marital Status

In terms of marital status, the majority of the population has never been married a situation that has remained almost constant at over 60% over the three census periods. In contrast, the segment of the population that is married or living together as partners has remained under 30%.

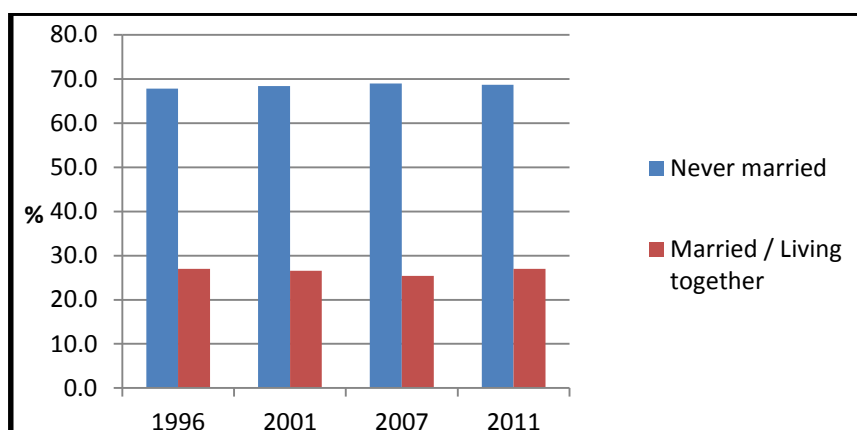


Figure 59: Marital Status (Statistics SA, 2014)

3.16.1.4 Education

The level of education of the people (aged 20 years and above) of Mpumalanga shows a trend of fluctuation amongst those who have no form of schooling and those who have a grade 12 / Std 10 / Matric level of education. During censuses 1996 and 2001, a large segment of the population had no schooling whereas census 2011 revealed that the majority had at minimum a grade 12 / Std 10 / matric level of education. In contrast, the number of people who have received higher education training has steadily been rising over the years.

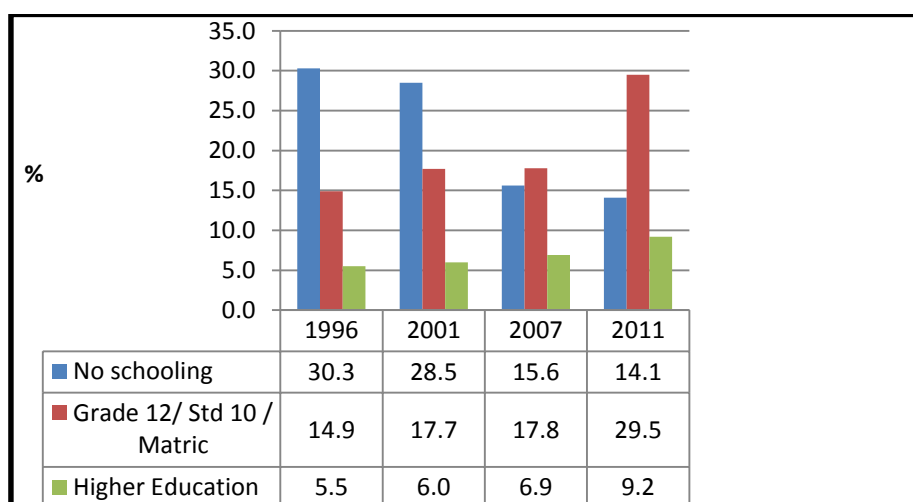


Figure 60: Level of Education for those Aged 20 Years and Older (Statistics SA, 2014)

3.16.1.5 Type of Dwelling

The majority of the population of Mpumalanga lives in formal dwellings whereas the percentage of the population living in informal dwellings has been gradually declining.

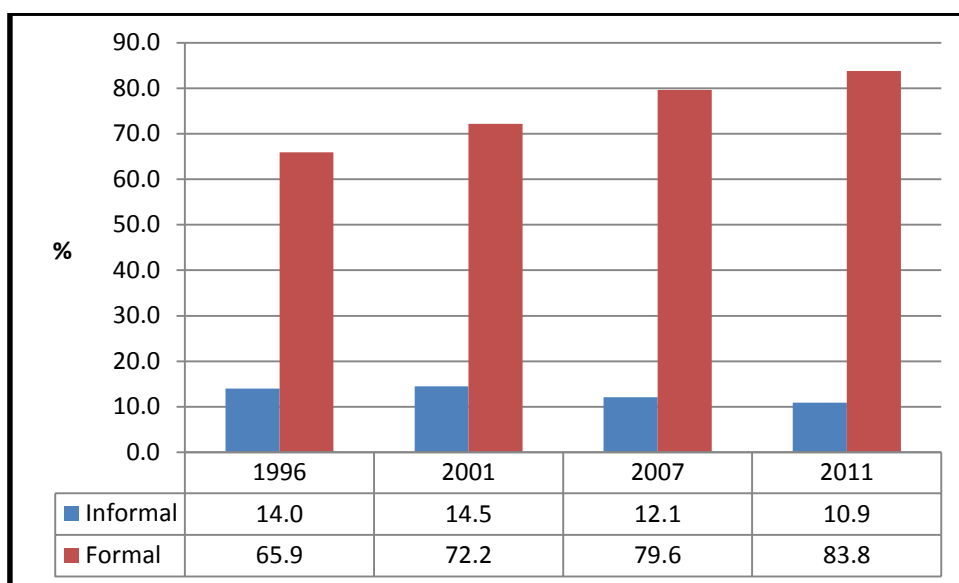


Figure 61: Types of Dwellings (Statistics SA, 2014)

3.16.1.6 Tenure Status

Majority of the residents (over 50% of households) of Mpumalanga own their houses which they have paid off or are still paying for and this has been varying over the years. The percentage of households that rent houses has also been changing with a sharp increase experienced for the period 2007 to 2011.

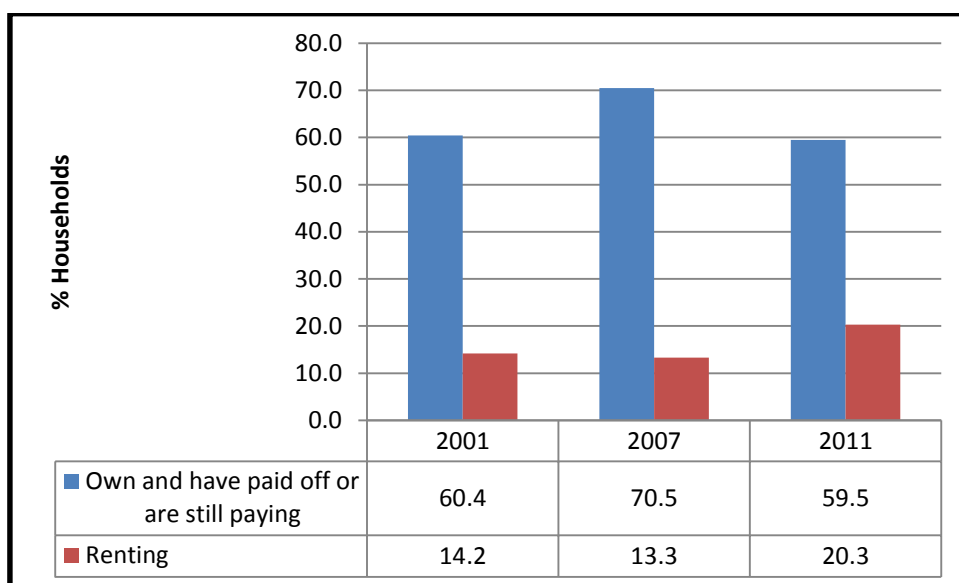


Figure 62: Tenure Status (Statistics SA, 2014)

3.16.1.7 Electricity Use

Electricity is used for various purposes in the province and these include cooking, heating and lighting. The largest percentage of households utilizes electricity for lighting, followed by cooking and lastly for heating and all this use has been steadily increasing over the years.

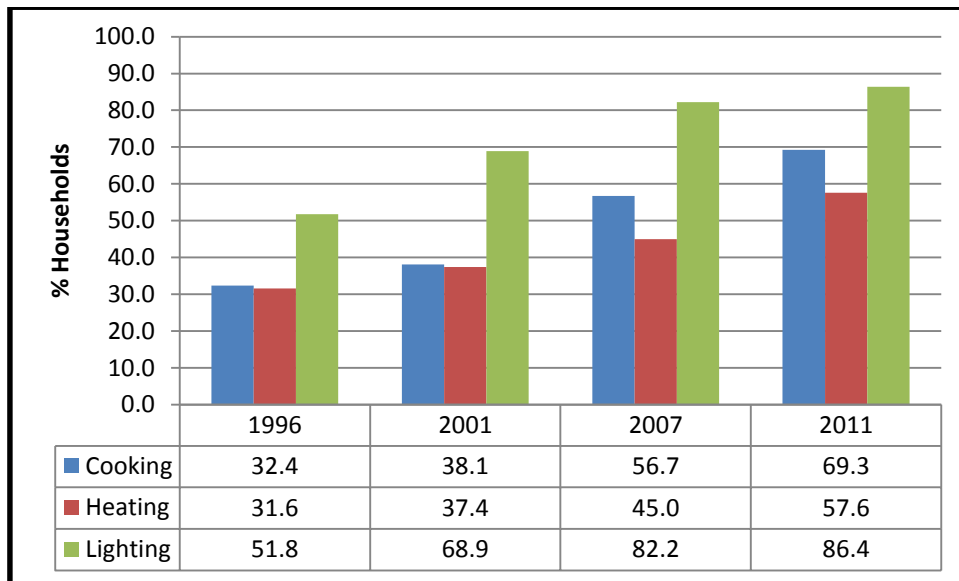


Figure 63: Electricity Use in Mpumalanga (Statistics SA, 2014)

3.16.1.8 Access to Basic Services

The provision of basic services namely, refuse removal, toilet facilities and potable water is one of the major responsibilities of local municipalities. In Mpumalanga, 30% of the households at minimum have access to these basic services of which the highest percentage of households recorded during census 2011 had access to piped water. Access to refuse removal services and flush toilets has been increasingly steadily although it still remains relatively low at below 50% of the households.

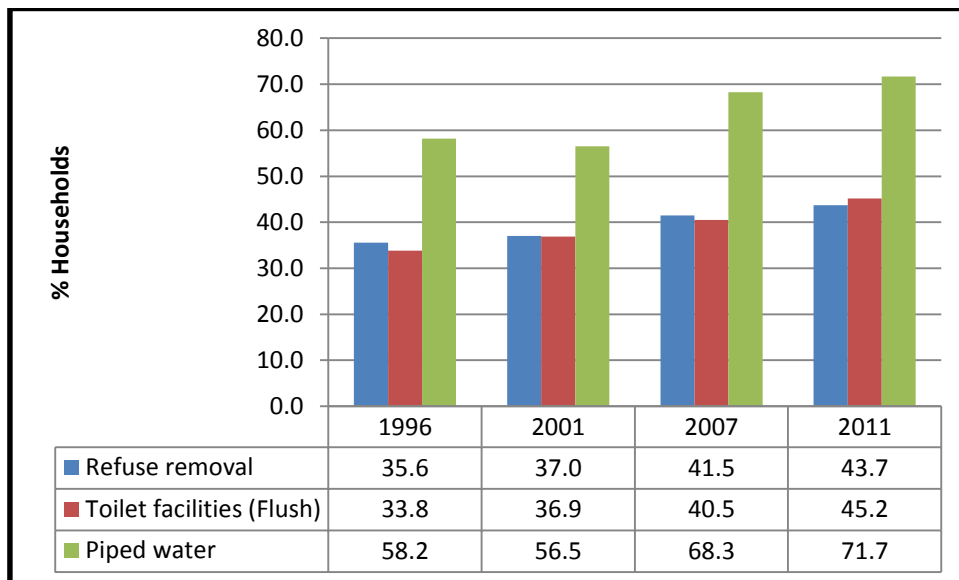


Figure 64: Access to Basic Services (Statistics SA, 2014)

3.16.1.9 Labour Force

The number of people in the province who are employed has been constantly increasing with over 800000 persons recorded to be employed during census 2011. In contrast, the number of people unemployed has remained low over the years at slightly over 400000 during the last two census events. The unemployment rate (defined as percentage of unemployed persons over the sum of employed and unemployed persons) has

indicated variations by ranging from 34.8% in 1996 to 43.1% in 2001 to 31.6 in 2011. The highest number of people who are not economically active was recorded in 2011 at over 1 million.

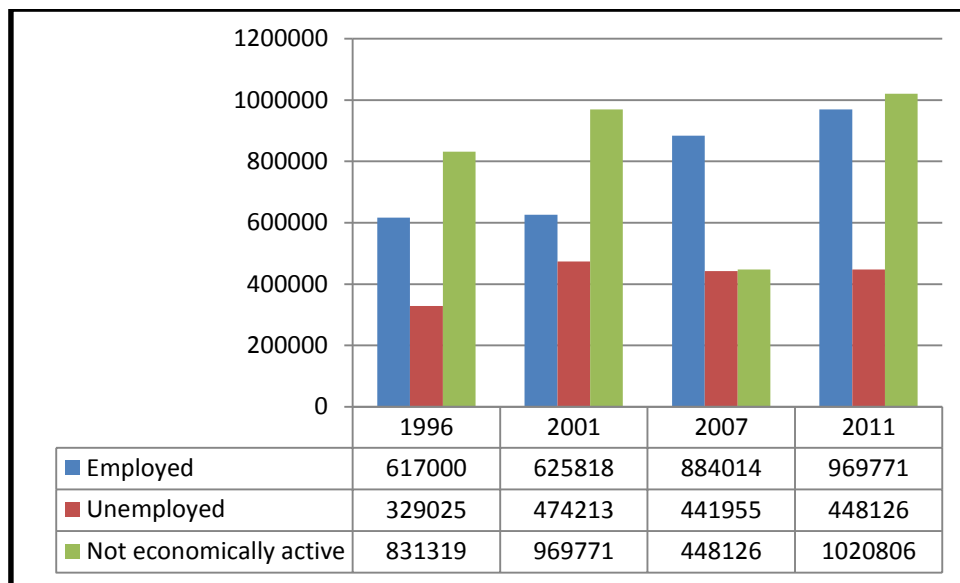


Figure 65: Employment and Unemployment (Statistics SA, 2014)

3.16.2 Nkangala District Municipality

Mpumalanga province is divided into four (4) district municipalities (DMs) namely Nkangala, Ehlanzeni and Gert Sibande. Nkangala DM covers 16892km² / 188118ha in area and is further composed of six local municipalities namely:

- i. Steve Tshwete
- ii. Victor Khanye
- iii. Emalahleni
- iv. Emakhazeni
- v. Thembisile Hani
- vi. Dr J S Moroka

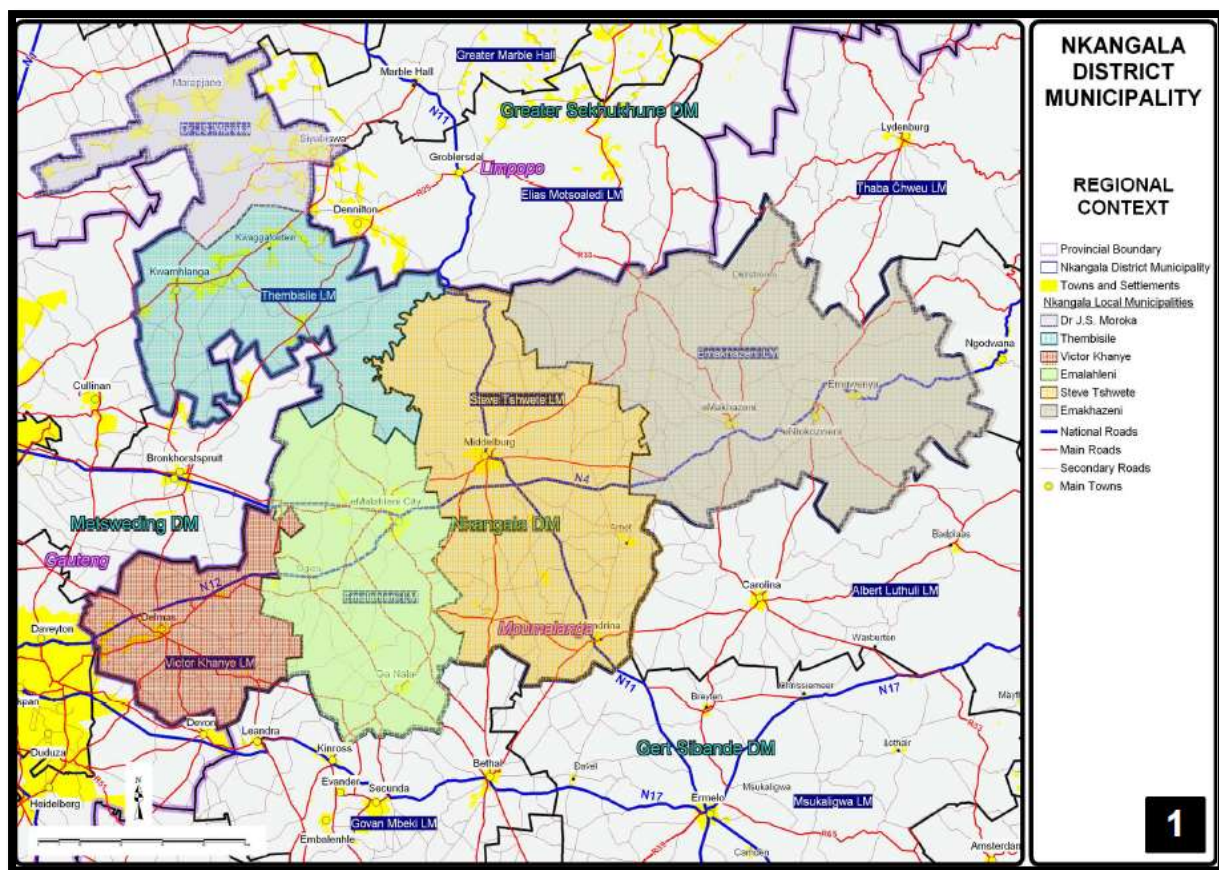


Figure 66: Nkangala District Municipality Map (Source: Steve Tshwete SDF, 2010)

3.16.2.1 Population

3.16.2.1.1 Population Size

The population of Nkangala DM has been rising over the years as revealed by the census data and currently stands at 1150240. As per census 2011, the DM has a ratio of almost 1:1 for males and females and the trend has remained constant with females forming a larger part of the population than males.

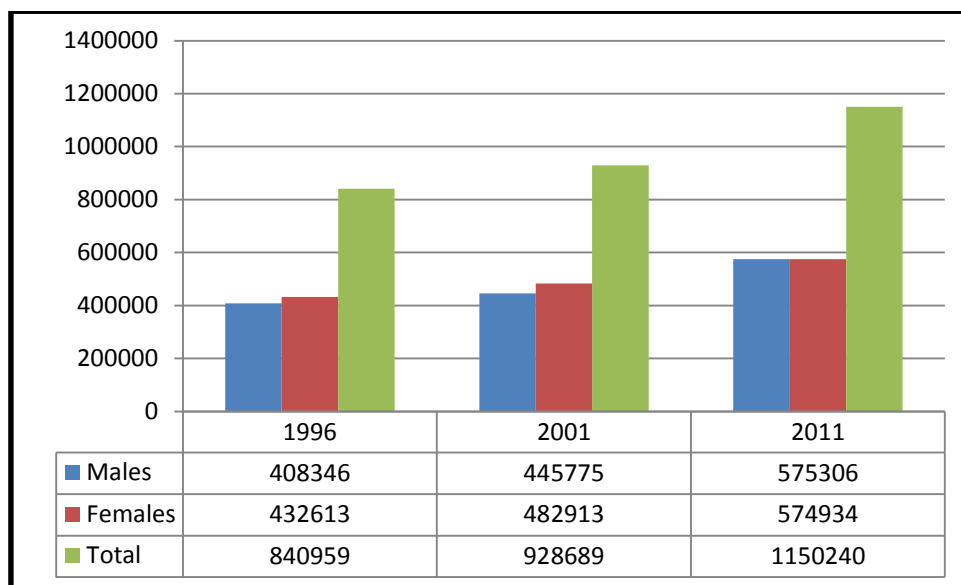


Figure 67: Population of Nkangala DM (Statistics SA, 2014)

3.16.2.1.2 Population Growth Rate

A comparison of Nkangala with Gert Sibande and Ehlanzeni DMs shows that during the 10 year period between 2001-2011 it experienced the highest population growth at 2.5%.

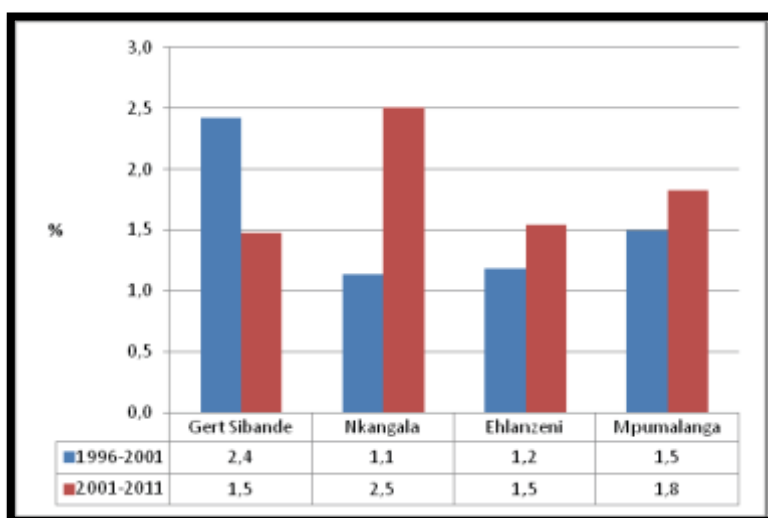


Figure 68: Population Growth Rates (Statistics SA, 2014)

3.16.2.1.3 Race Groups

The population of Nkangala is mainly composed of Black / African racial groups followed by Whites, Coloured and lastly Indians / Asians being the least. Trends from 2001 to 2011 shows that the percentage of black people has reduced from 91.2% to 88.2%, while coloureds have slightly increased from 0.9% to 1.1%, Indians have increased from 0.3% to 0.7% and whites have also increased significantly from 7.7% to 9.9%.

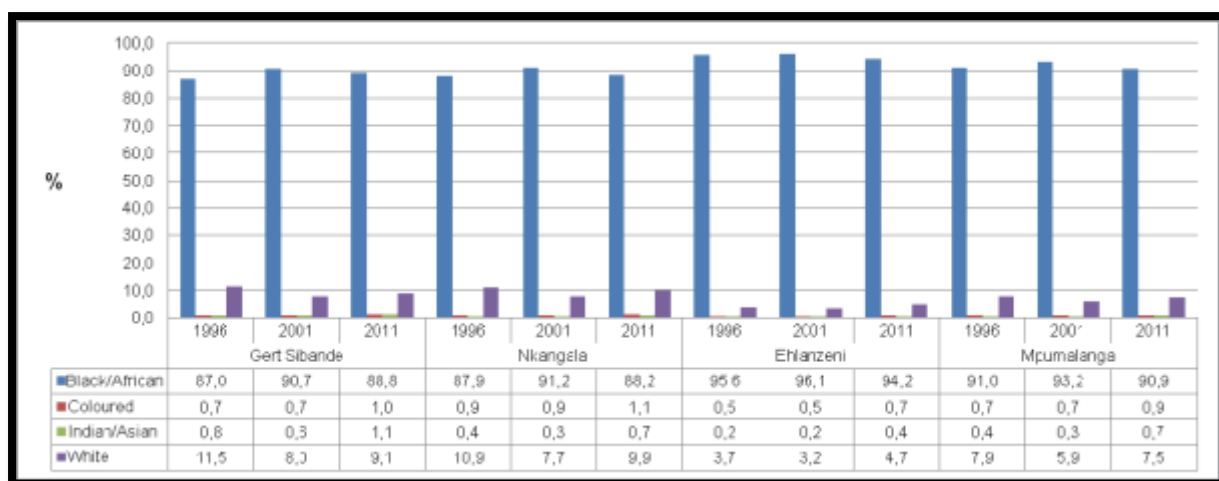


Figure 69: Race Groups in Nkangala (Statistics SA, 2014)

3.16.2.1.4 Functional Age Group

The percentage of the population in the functional age groups of 0-14 years has declined significantly by 4.9% from 2001 to 2011. Additionally, the percentage of those 65 years and above has increased slightly by 0.6% within the same time period while the percentage of the population aged between 15-64 years has consistently increased by 4.3%.

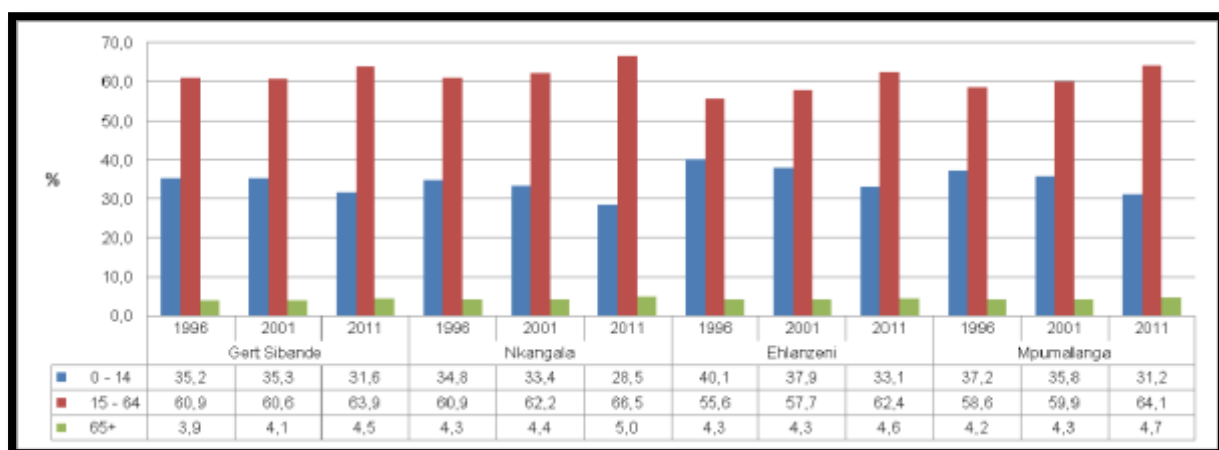


Figure 70: Functional Age Groups in Nkangala (Statistics SA, 2014)

3.16.2.1.5 Household Heads

The percentage of female headed households has declined significantly by 5.8% from 2001 to 2011 and similarly the percentage of child headed households has also declined by 0.8%.

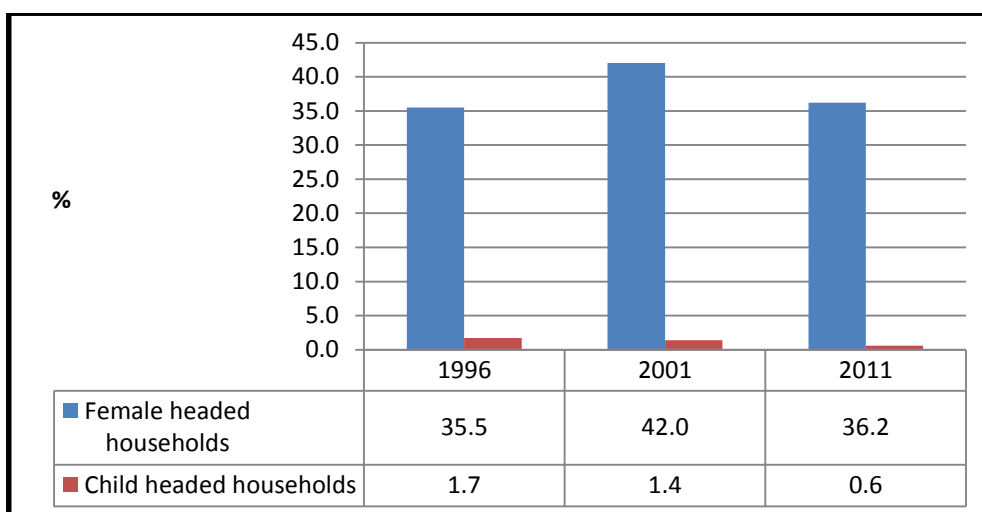


Figure 71: Female and Child Household Heads in Nkangala (Statistics SA, 2014)

3.16.2.1.6 Age and Sex Structure

The population of Nkangala is mainly made up of young people under the age of 29.

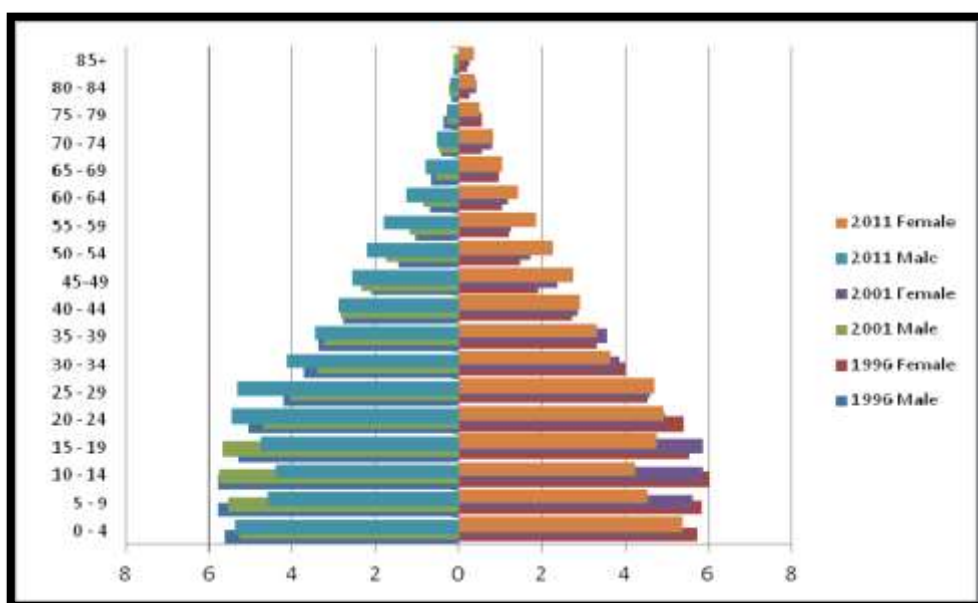


Figure 72: Age-Sex Structure of Nkangala DM (Statistics SA, 2014)

3.16.2.1.7 Dependency Ratio

The dependency ratio (*defined as the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64*) of Nkangala has been steadily decreasing from when it stood at 64.2% in 1996 to 60.7% in 2001 and finally to 50.4% in 2011.

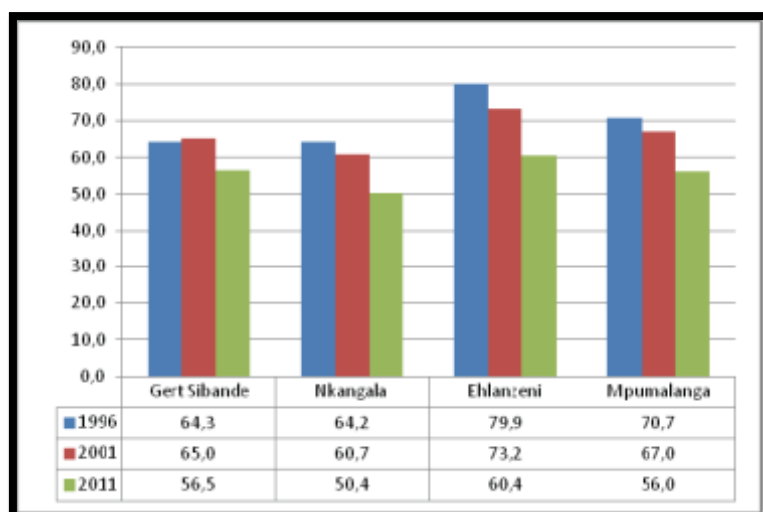


Figure 73: Dependency Ratios in Nkangala (Statistics SA, 2014)

3.16.2.1.8 Marital Status

The marital status of the people of Nkangala has been varying over the years and results of census 2011 reveals that the largest proportion of the population has never been married. The proportion of those who are married / living together stands at 29.3%. On the other hand, the proportion of those who are widowed and divorced / separated is 3.2% and 1.4% respectively.

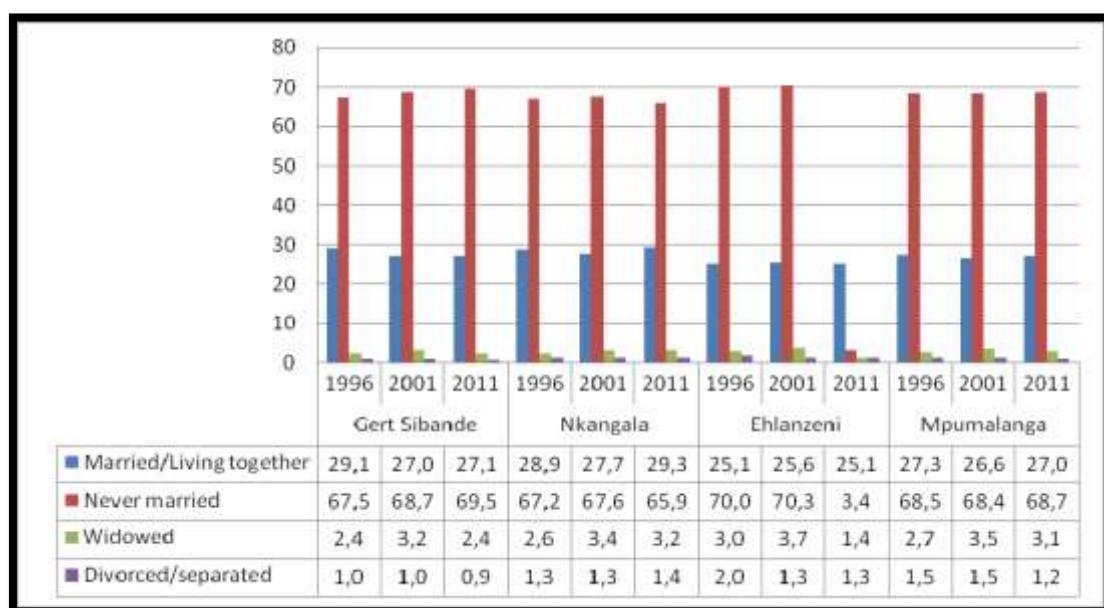


Figure 74: Marital Status in Nkangala (Statistics SA, 2014)

3.16.2.2 Education

3.16.2.2.1 Highest Level of Education Attained

For the population group of those aged 20 years and above, the percentage of those who have no schooling has impressively declined by almost half (11.42%) as it was recorded at 24.61% in 2001. The percentage of those

who have attained Grade 12 / Matric has also improved from 19.9% in 2001 to 30% in 2011. Similarly, those who have attained a higher education has increased gradually from 6.1% in 2001 to 9.9% in 2011

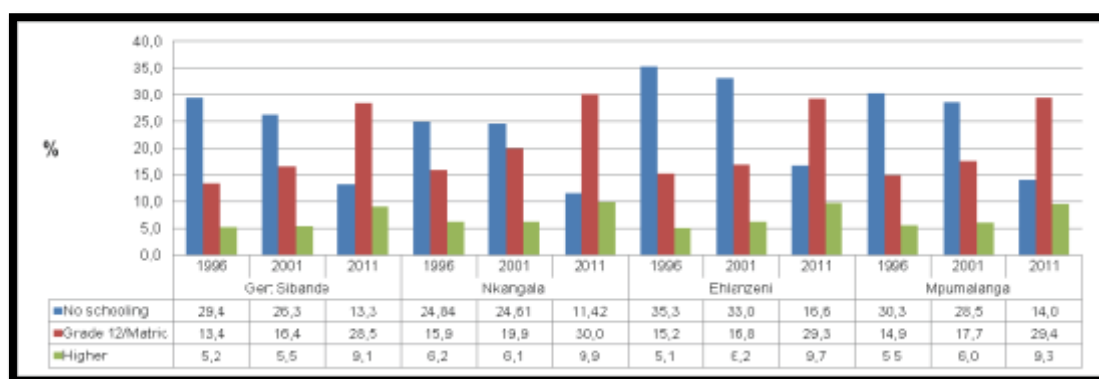


Figure 75: Level of Education of the Population Group Aged 20 Years and Above in Nkangala (Statistics SA, 2014)

3.16.2.2.2 School Attendance

The segment of the population of Nkangala aged between 5 and 24 years that attend school has been fluctuating over the years but has constantly remained above the 70% mark. As of 2011, 73.5% of the population attended school which was similar to what was recorded in 2001 and lower than 2001 when 74.6% attended school (a decline of 0.1%).

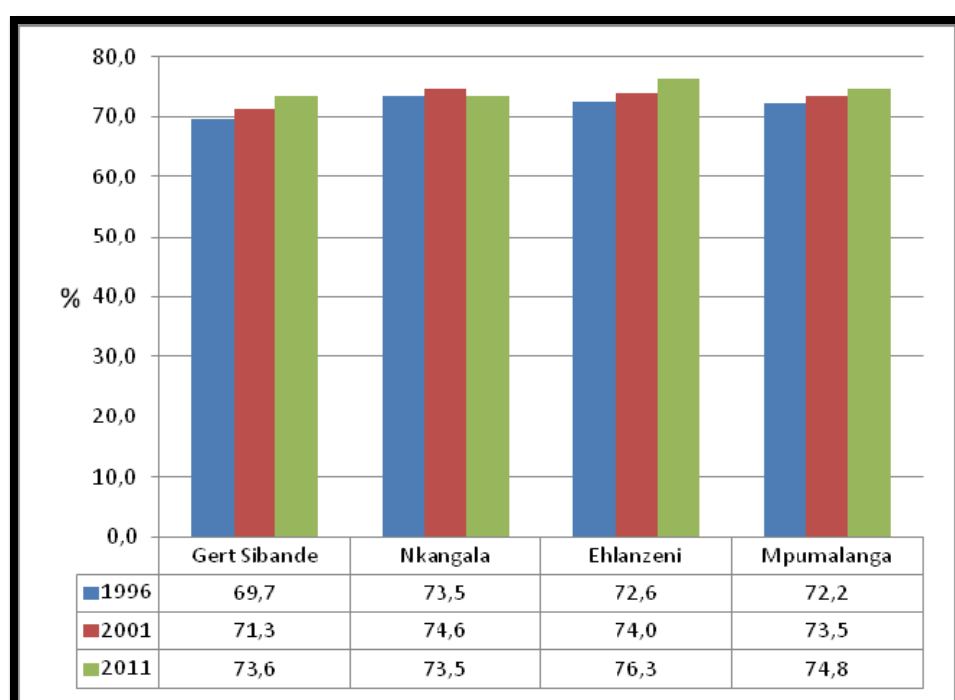


Figure 76: School Attendance of the Population Group Aged 5 to 24 Years (Statistics SA, 2014)

3.16.2.3 Unemployment Rate

The unemployment rate of Nkangala has been fluctuating over the years ranging from 35.2% in 1996 to a sharp increase in 2001 (43.8%) and a sharp decline by 2011 to 30.2%.

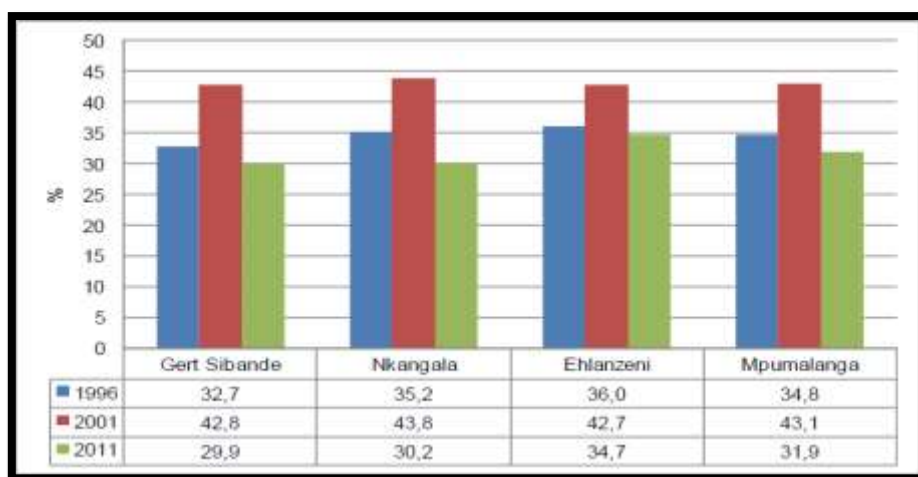


Figure 77: Unemployment Rate in Mpumalanga (Statistics SA, 2014)

3.16.2.4 Housing

3.16.2.4.1 Average Household Size

The average household size in Nkangala has been progressively declining over the years with the size recorded in 2011 at 3.6%.

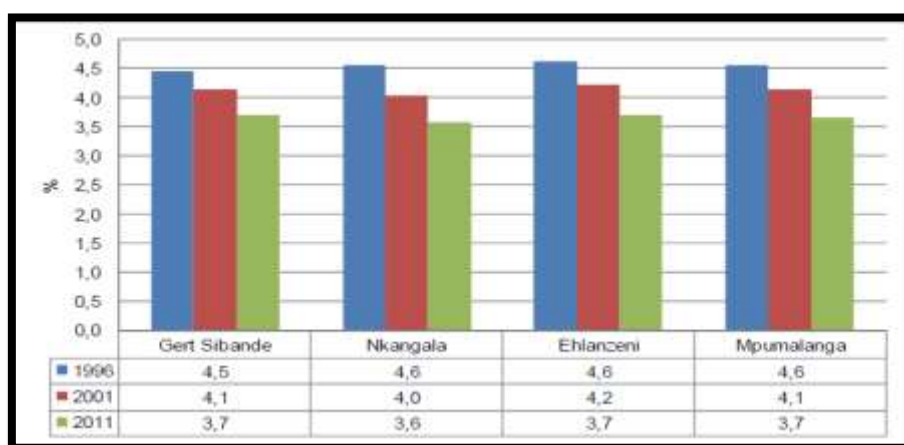


Figure 78: Average Household Size in Nkangala (Statistics SA, 2014)

3.16.2.4.2 Types of Main Dwelling

According to census 2011, the most common form of dwelling in Nkangala is formal dwellings at 82.8% followed by informal dwellings at 13.9%. Traditional dwelling is the least popular at 2.4% which is a sharp decline from 11.4% in 1996 to 7.4% in 2001 and then to 2.4% in 2011.

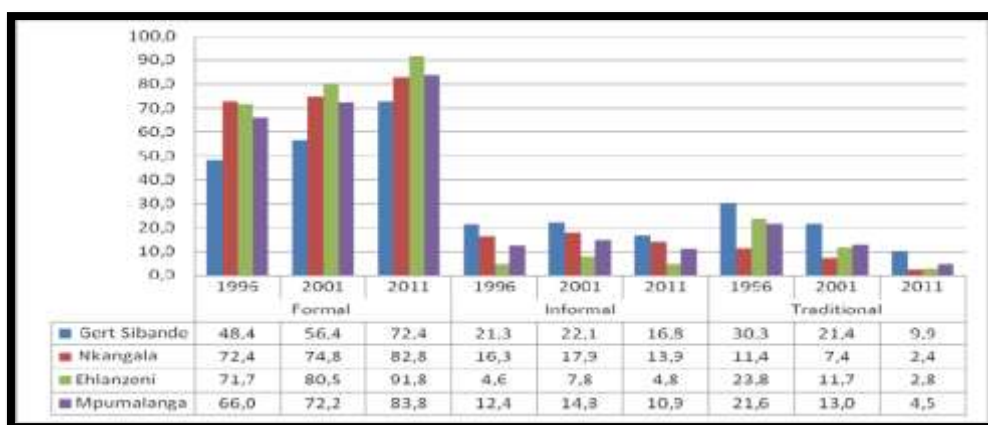


Figure 79: Main Dwelling Types in Nkangala (Statistics SA, 2014)

3.16.2.4.3 Tenure Status

A comparison between the findings of census 2001 and census 2011 reveals that the percentage of people owning houses has declined by 3.4% while those who rent their houses has increased by 9.3%.

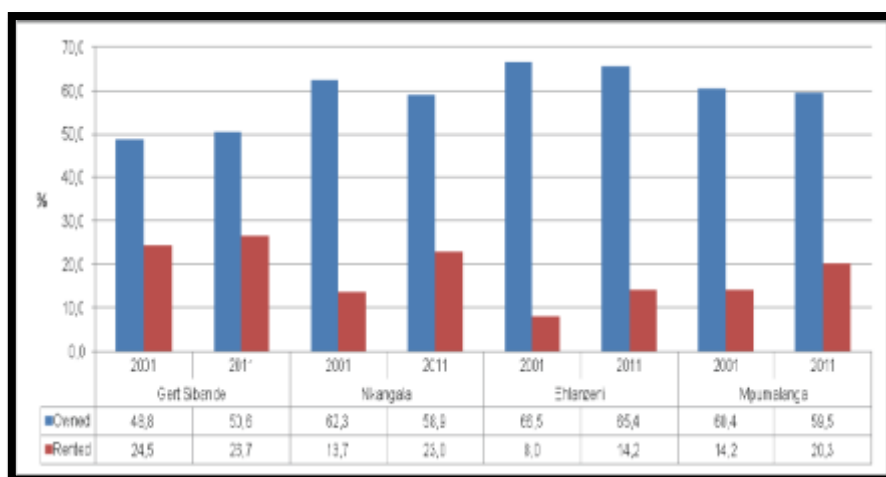


Figure 80: Tenure Status in Nkangala (Statistics SA, 2014)

3.16.2.5 Access to Basic Services

3.16.2.5.1 Electricity Use

Electricity in Nkangala is mainly used for lighting and the percentage of population utilizing it for this purpose has been rising. The other major forms of uses are heating which is second most common whereas cooking is the least common use.

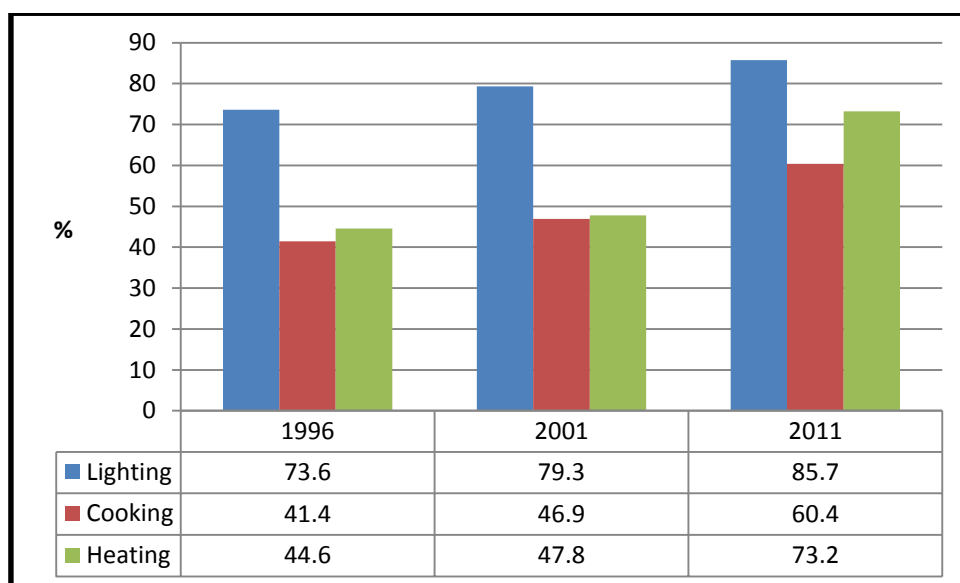


Figure 81: Electricity Use in Nkangala (Statistics SA, 2014)

3.16.2.5.2 Refuse Removal

A large percentage of the population in Nkangala has access to some form of refuse removal. 49.7% have their refused removed by the local municipality or a private company while 43.4% have access to a communal dump or own one. Only 6.3% have no access to any form of refuse removal.

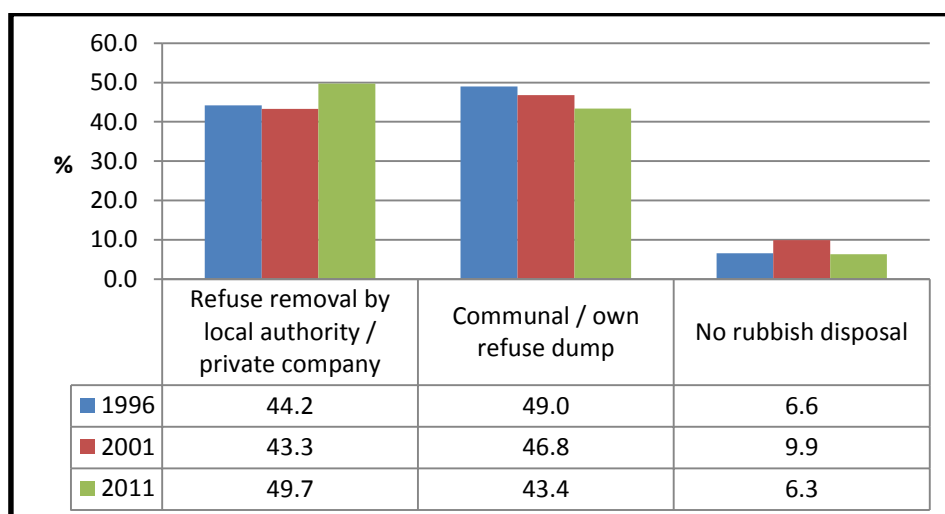


Figure 82: Access to Refuse Removal (Statistics SA, 2014)

3.16.2.5.3 Potable Water

The percentage of the population recorded in census 2011 with access to piped water inside a dwelling or yard was 81.6%. Notably, the percentage with no access to piped water has been reducing from 12.2% in 1996 to 11.2% in 2001 and remarkably to 7.8% in 2011.

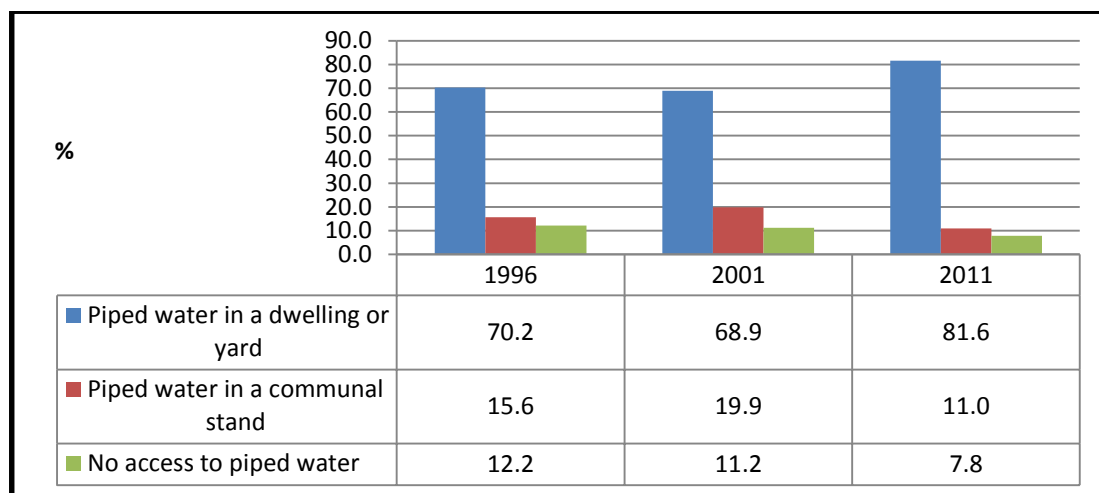


Figure 83: Access to Piped Water (Statistics SA, 2014)

3.16.2.5.4 Sanitation Facilities

Over 50% of the population of Nkangala has access to sanitation facilities in the form of a chemical or flush toilet. On the other hand, the percentage of the population with no access to sanitation facilities has also decreased and currently stands at 2.5% as per census 2011.

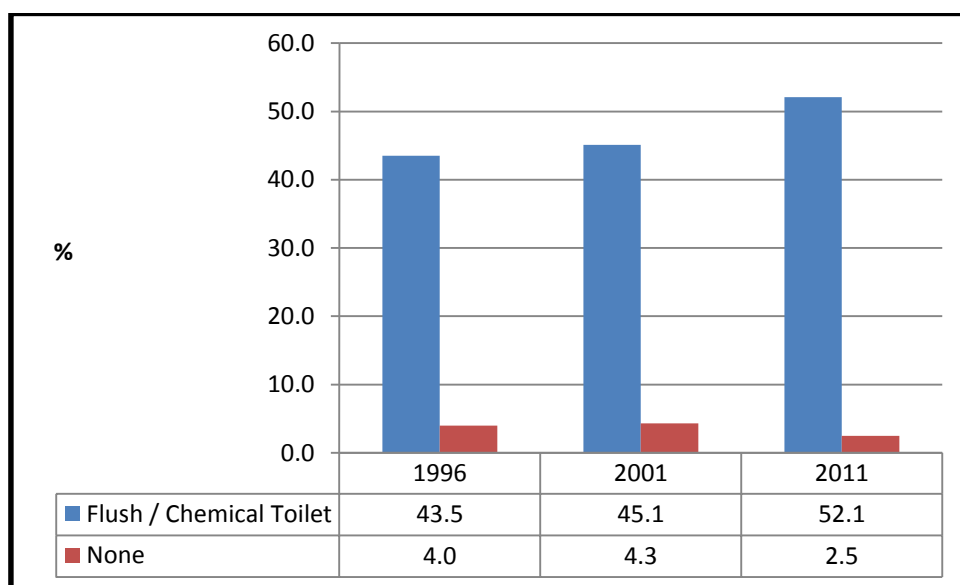


Figure 84: Access to Sanitation Facilities (Statistics SA, 2014)

3.16.2.6 Average Household Income

The average household income has increased during the period 2001 to 2011 from R 35177 to R 89006 an increase of 153%.

3.16.3 Steve Tshwete Local Municipality

According to the draft Spatial Development Framework (2010), Steve Tshwete local municipality is located within Nkangala DM, and measures 3976km² with the municipality office being based in Middelburg. Steve Tshwete is

composed of a number of towns and settlements namely Komati, Blinkpan, Pullen's Hope, Doornkop, Middelburg, Hendrina, Kraanspoort, Koorfontein, Rietkuil, Mhluzi, Kwa Makalane, Lesedi, Kwazamokuhle, Naledi and Presidentsrus. The town of Pullen's Hope is situated directly to the east of the proposed mine site and is located approximately 40km south of Middelburg and it is the 4th largest within the municipality. Pullen's Hope is also important because it serves the Hendrina Power Station which is located within its boundaries.

Steve Tshwete is located in a prime position as it is near the Maputo Development Corridor and the Middelburg/Bethal/Ermelo/Richards Bay Corridor and it also hosts the Columbus Steel factory. Additionally, Steve Tshwete is the second most urbanized local municipality at 72.1% after Emalahleni at 86.2% (IDP, 2013-2014).

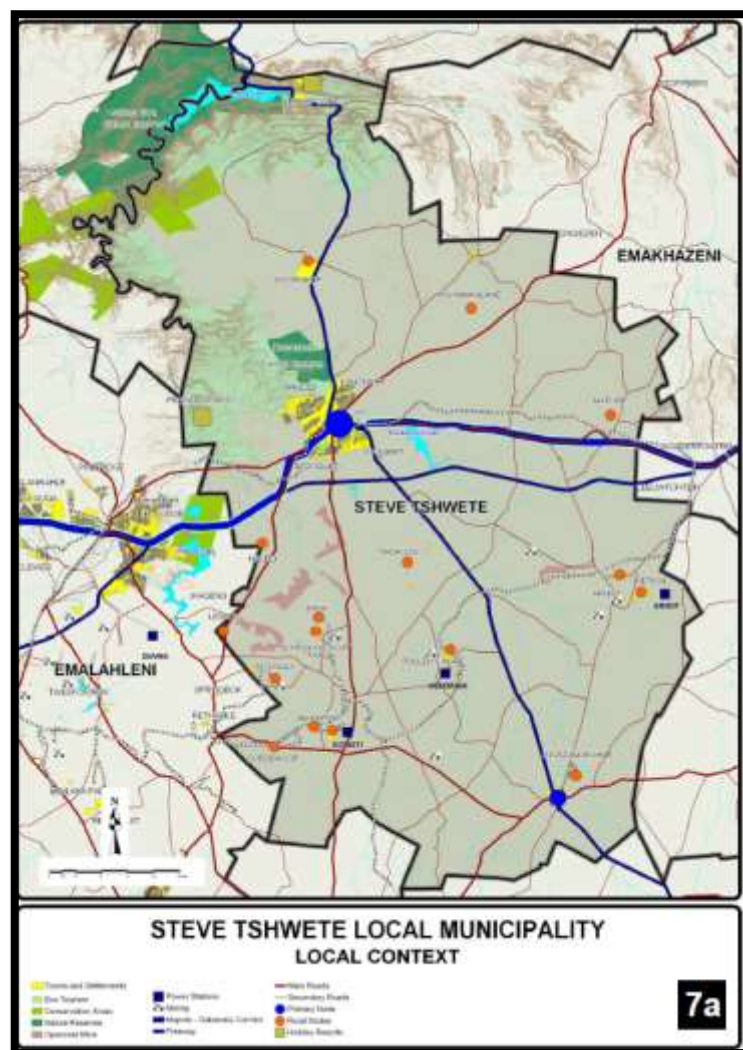


Figure 85: Local Municipality Locality Map (Source: Steve Tshwete LM SDF, 2010)

3.16.3.1 Population

3.16.3.1.1 Population Size

The population of Steve Tshwete Local Municipality (LM) has increased significantly from 132263 in 1996 to 229830 in 2011. The male to female ratio has been almost equal over the past census periods and a change was recorded in 2001 when the number of males in the population surpassed that of females.

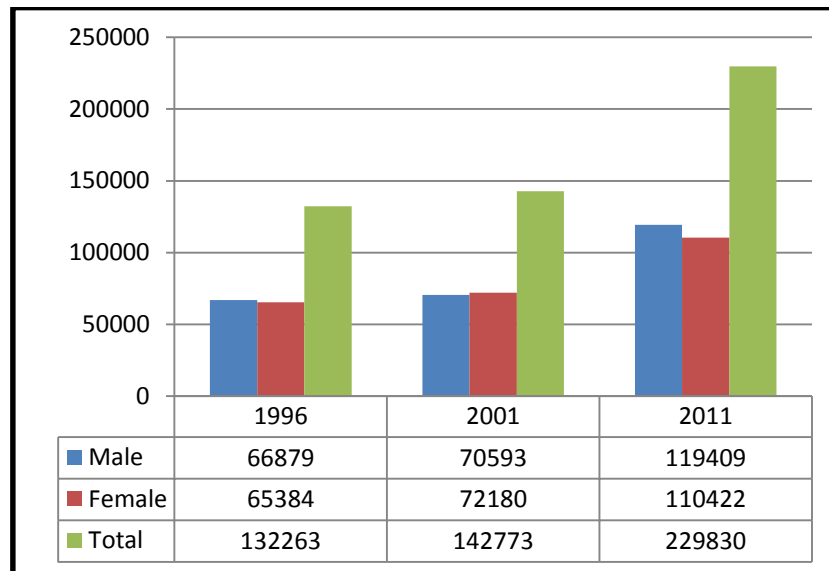


Figure 86: Population of Steve Tshwete (Statistics SA, 2014)

3.16.3.1.2 Population Growth Rate

The population growth rate of Steve Tshwete has more than quadrupled from the period 1996-2001 when it was 1.07% to 2001-2011 recorded as 4.76%. This is evidenced by the increase in the population discussed in section 4.3.2.1 above.

3.16.3.1.3 Race Groups

The population of the local municipality is dominated by black Africans followed by whites, a trend that has been maintained over the three census periods. Coloureds and Indians are also present but in very small numbers with the latter forming the smallest component of the population.

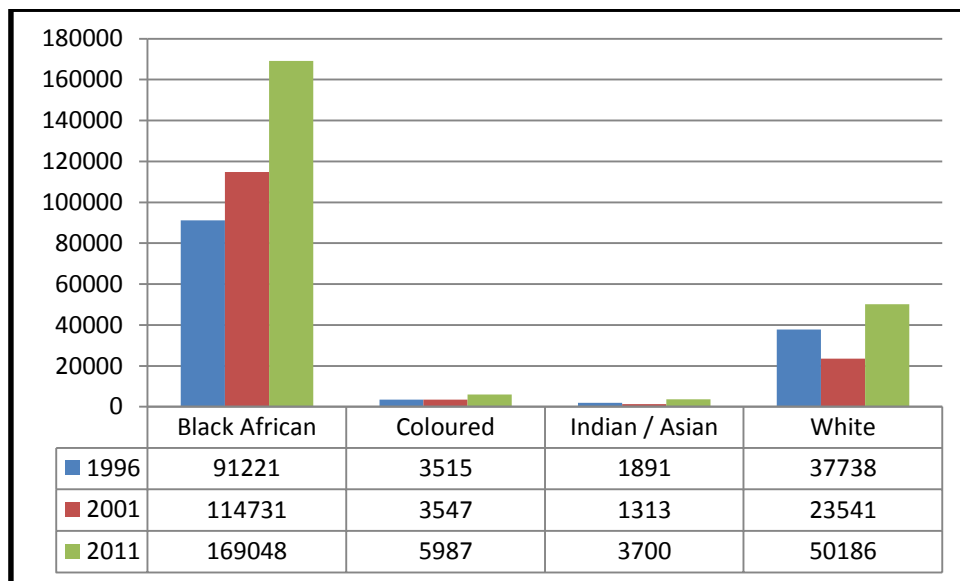


Figure 87: Race Groups in Steve Tshwete (Statistics SA, 2014)

3.16.3.1.4 Functional Age Group

The age group of 15-64 years is the largest within the population of Steve Tshwete and it has been rising with the largest increase experienced between 2001 and 2011. The second biggest age group in the population is 0-14 years while the smallest is individuals 65 years and older.

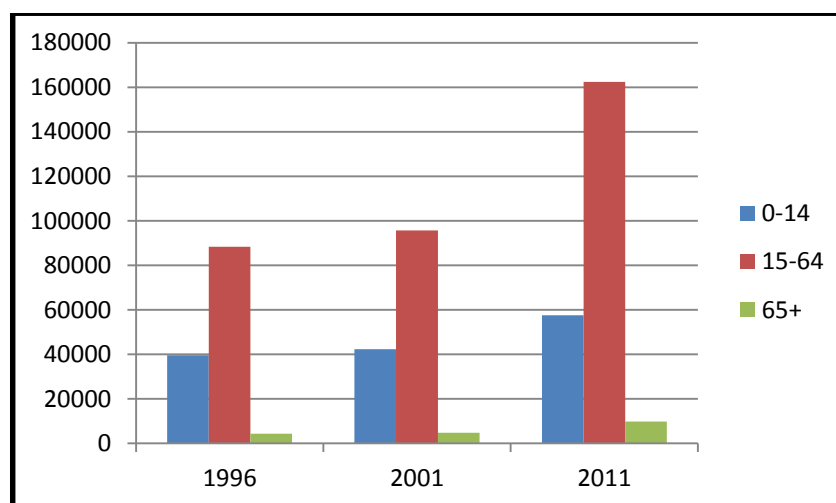


Figure 88: Functional Age Groups (Statistics SA, 2014)

3.16.3.1.5 Age Structure

Steve Tshwete's population is mainly composed of young people between the ages of 0-34 years where after it steadily declines with the least population group aged 85 years and above.

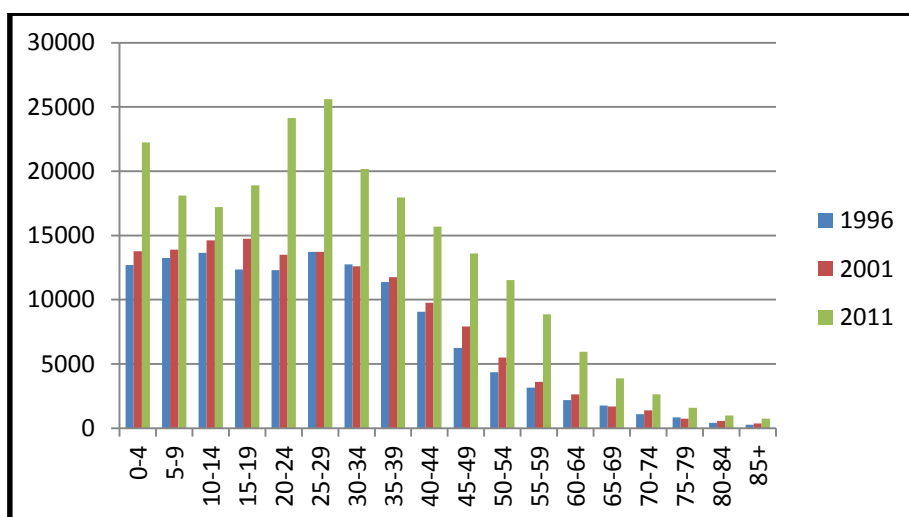


Figure 89: Age Structure of Steve Tshwete (Statistics SA, 2014)

3.16.3.1.6 Household Heads

The percentage of the local municipality's population that is headed by females increased from 1996 to 2001 and thereafter, it stagnated between 2001 and 2011. In contrast, the highest percentage of child headed households was recorded in 1996 at 0.3% and there after it reduced to 0.3% in 2001 which was maintained for 2011.

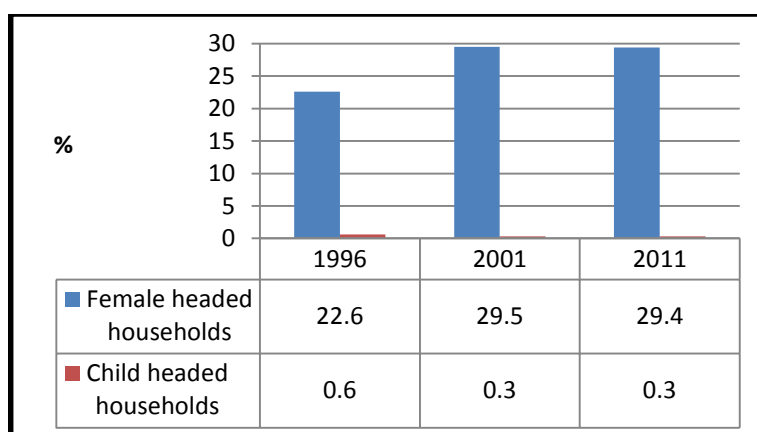


Figure 90: Household Heads in Steve Tshwete (Statistics SA, 2014)

3.16.3.1.7 Dependency Ratio

Steve Tshwete LM hosts a population that is mainly made up of individuals falling under the working age group (over 80000 to 160000 individuals from 1996 to 2011). This is followed by dependants who are mainly individuals aged 14 years and younger (over 40000 individuals) and very few individuals over the age 65 (less than 20000) individuals.

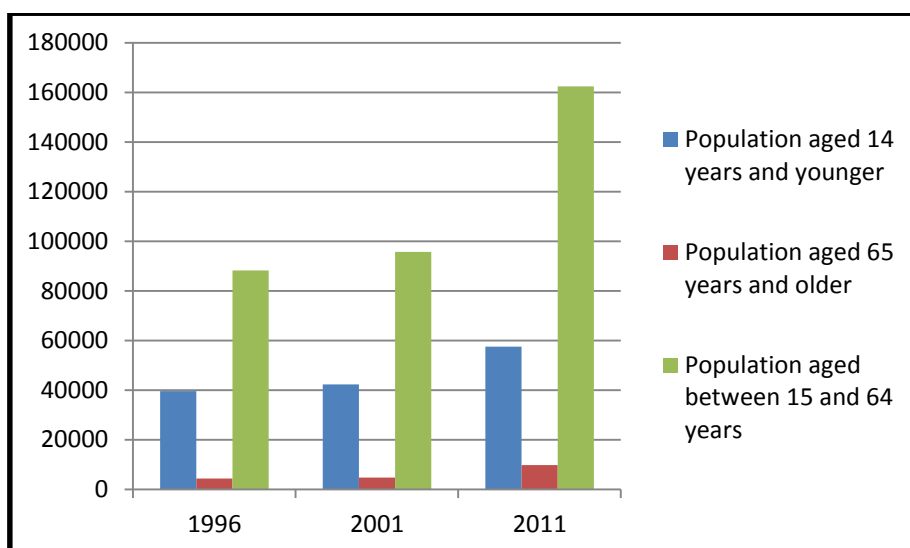


Figure 91: Dependency Ratio of Steve Tshwete (Statistics SA, 2014)

3.16.3.1.8 Marital Status

Over the three census periods, the marital status of Steve Tshwete has been dominated by individuals who have never been married. This is then followed by individuals who are married / living together whereas individuals who are widowed and divorced form the least number.

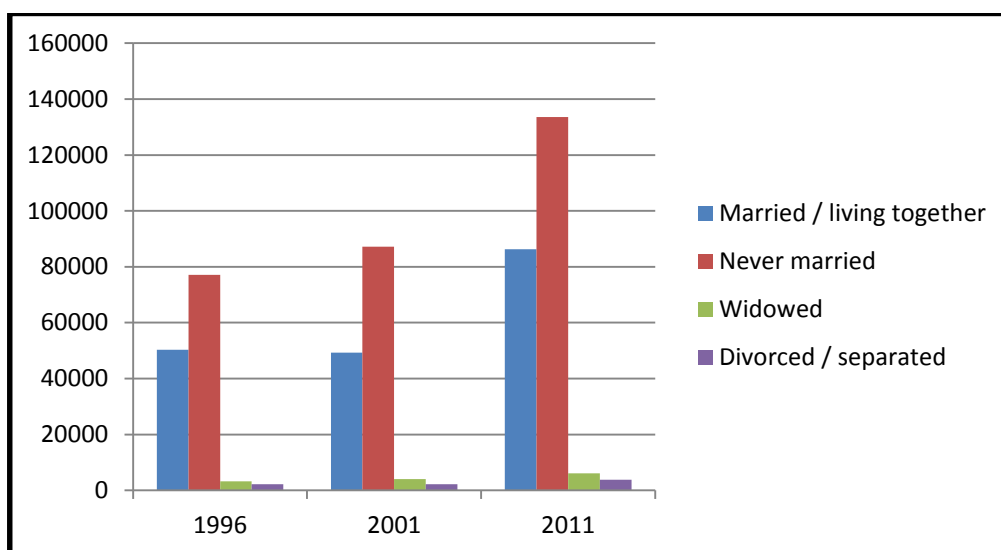


Figure 92: Marital Status of Steve Tshwete (Statistics SA, 2014)

3.16.3.2 Education

3.16.3.2.1 Highest Level of Education Attained

According to the 1996 and 2001 censuses, the largest portion of the population in terms of higher education had completed some secondary education with the smallest portion only having completed primary school. This changed in 2011 as individuals who had completed grade 12 formed the largest portion while the least remained individuals who have only completed primary school.

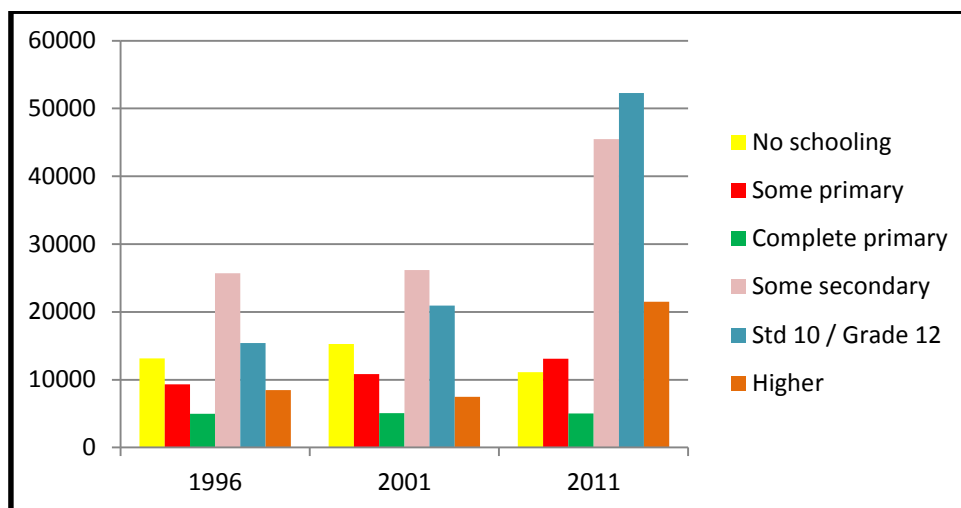


Figure 93: Highest Level of Education Attained for Population Aged between 5 and 24 Years (Statistics SA, 2014)

3.16.3.2.2 School Attendance

The number of people attending school in the municipality continues to increase as revealed by the census results where in 2011 it stood at over 50000 individuals. Similarly, those not attending school have also been rising but to a smaller extent with the highest number (over 20000) recorded during census 2011.

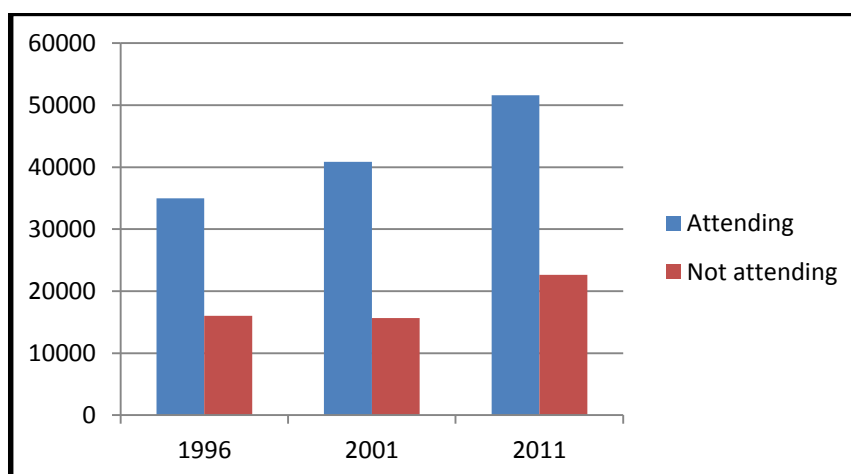


Figure 94: School Attendance in Steve Tshwete for Population Aged between 5 and 24 Years (Statistics SA, 2014)

3.16.3.3 Employment

3.16.3.3.1 Unemployment Rate

The highest unemployment rate in the municipality was recorded in census 2001 when it stood at 35.4%. This rate had reduced drastically as recorded during census 2011 which was almost equal to that recorded during the 1996 census.

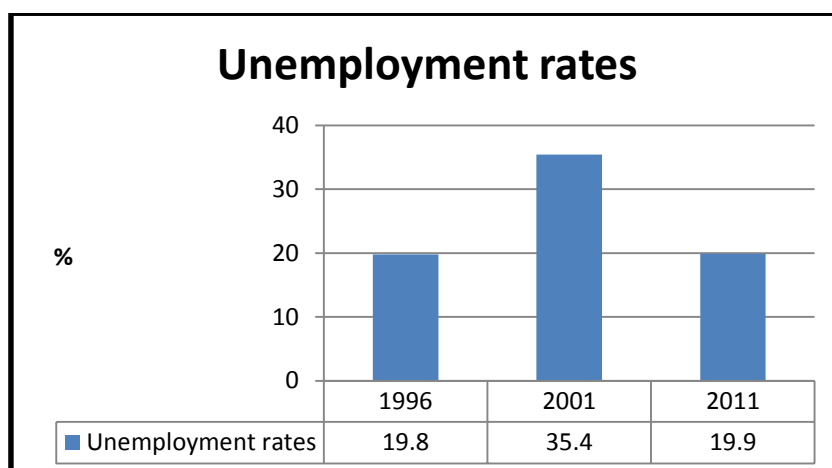


Figure 95: Unemployment Rate in Steve Tshwete (Statistics SA, 2014)

3.16.3.3.2 Employment Status

The number of people employed in the local municipality is more than the unemployed, a situation that has been constant over the three census periods. The highest number of employed people was recorded in 2011 at over 80000 while the lowest number of unemployed people was recorded in 1996.

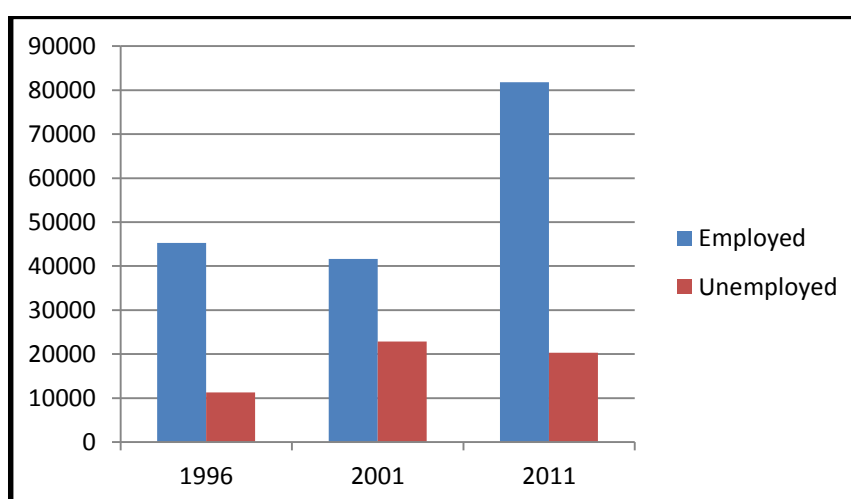


Figure 96: Employment Status in Steve Tshwete (Statistics SA, 2014)

3.16.3.4 Housing

3.16.3.4.1 Type of Main Dwelling

The most common form of dwelling in Steve Tshwete is formal housing followed by informal dwellings albeit to a significantly reduced extent. The least number (below 10000) of households in the municipality live in traditional houses.

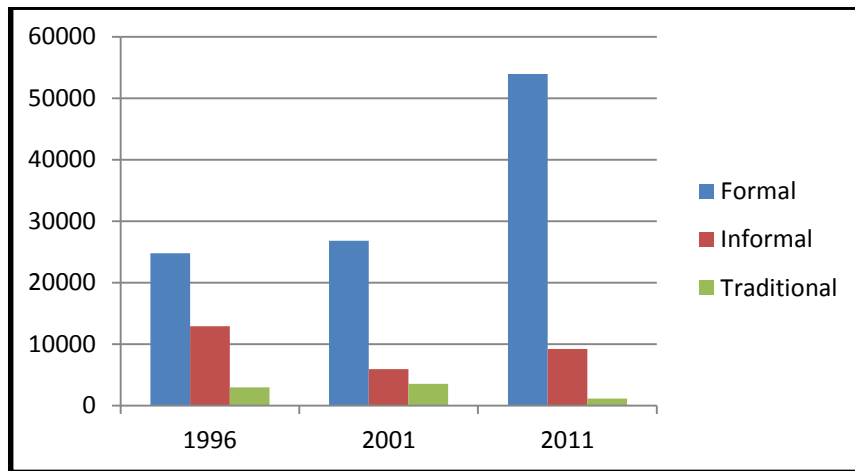


Figure 97: Type of Main Dwelling (Statistics SA, 2014)

3.16.3.4.2 Tenure Status

During census 2001, the majority of the residents of Steve Tshwete lived in houses that they owned / had fully paid off and the least occupied houses that were rent free. This changed in 2011 as the majority of the residents lived in rented houses, and this was closely followed by residents who owned their houses. An almost equal number of residents lived in houses that were still on mortgage or were rent free.

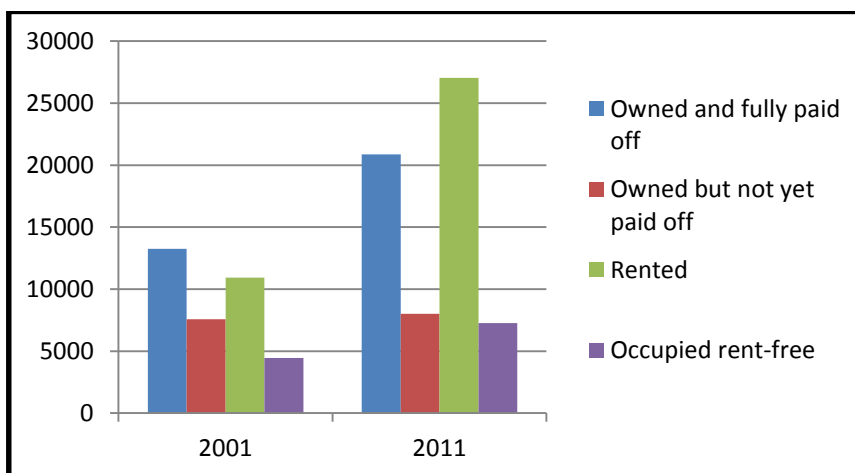


Figure 98: Tenure Status in Steve Tshwete (Statistics SA, 2014)

3.16.3.4.3 Number of Households

The total number of households in Steve Tshwete has been steadily increasing over the years and the current count is 64971 as revealed by census 2011.

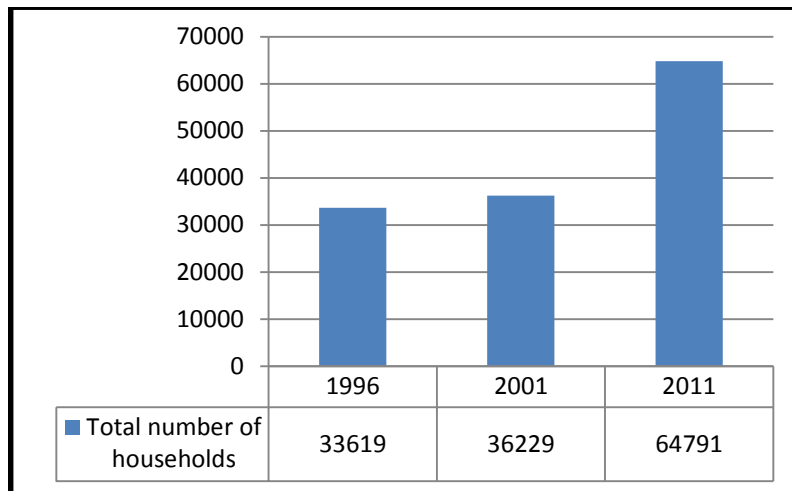


Figure 99: Number of Households (Statistics SA, 2014)

3.16.3.4.4 Household Size

The average household size currently stands at 3.3% which is a decrease from 1996 when it was 3.9% and 3.8% in 2001.

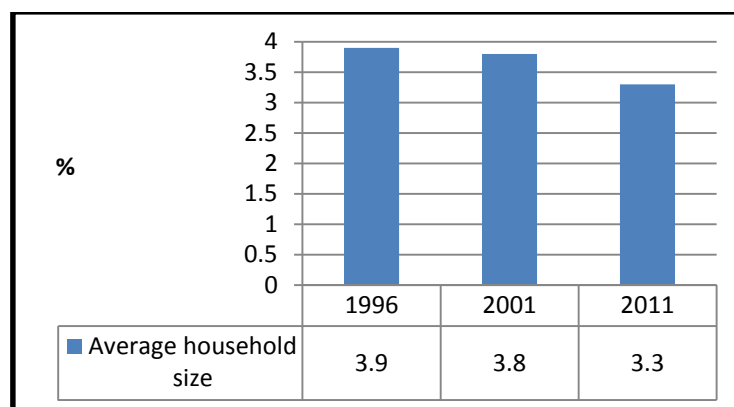


Figure 100: Average Household Size (Statistics SA, 2014)

3.16.3.5 Access to Basic Services

3.16.3.5.1 Electricity Use

In Steve Tshwete, electricity is mainly used for lighting and this is supported by the constant results of the censuses 1996, 2001 and 2011. To date, the number of households with access to electricity has also increased to over 40,000 compared to approximately 20,000 households in 1996 and 2001.

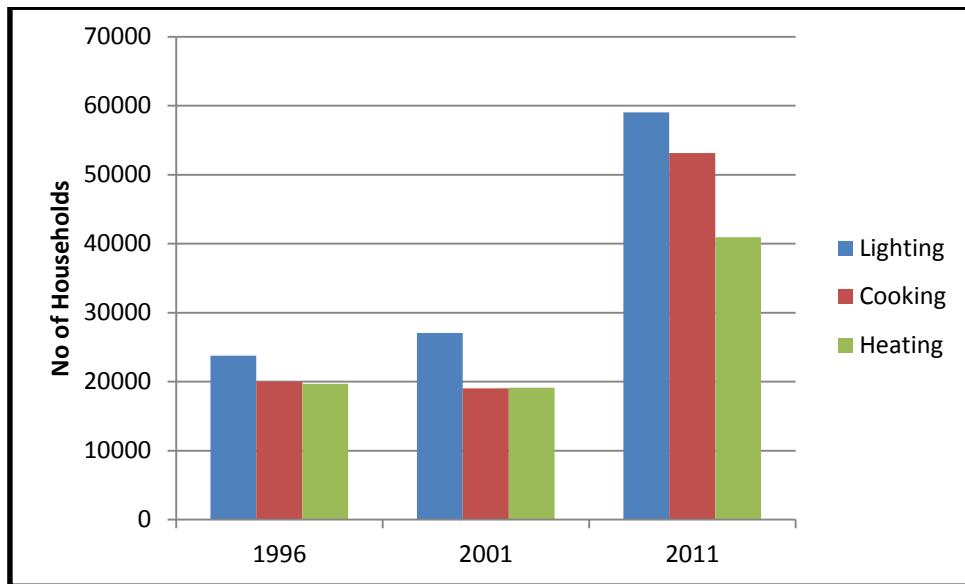


Figure 101: Electricity Use in Households (Statistics SA, 2014)

3.16.3.5.2 Refuse Removal

Refuse in Steve Tshwete is mainly removed by the local municipality and according to census 2011 results, more than 50,000 households were serviced. Other households make use of communal or own refuse dumps for waste management whereas the number of households with no access to a form of rubbish disposal is minimal.

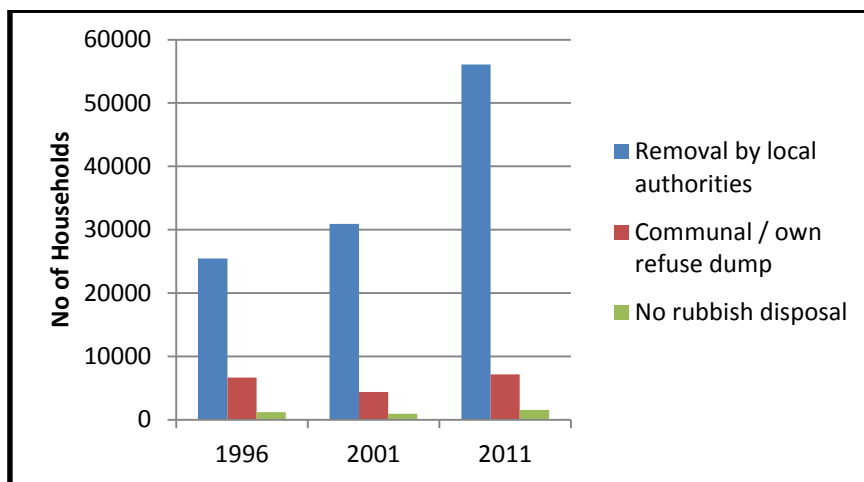


Figure 102: Households with Access to Refuse Removal (Statistics SA, 2014)

3.16.3.5.3 Potable Water

The number of households in Steve Tshwete with piped water inside the house / yard has exponentially increased from the last count conducted during census 2001. Currently, over 50,000 homes have access to tap water as compared to under 10,000 households which still access water from communal taps or have none at all.

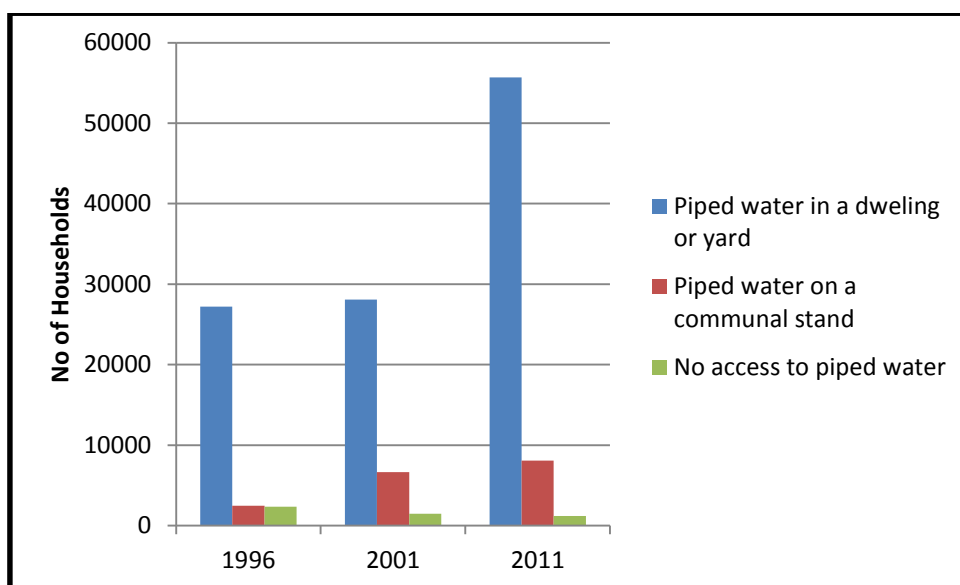


Figure 103: Households with Access to Tap / Piped Water

3.16.3.5.4 Toilet Facilities

The most widespread type of toilet facility among households in the local municipality is the use of flush / chemical toilets. The use of chemical / flush toilets has increased over the years and currently stands at over 50000 households. The use of pit latrines and bucket toilets is not common occurring in less than 10000 households over the three census periods. In 2001, 1381 households were recorded as having no access to a toilet.

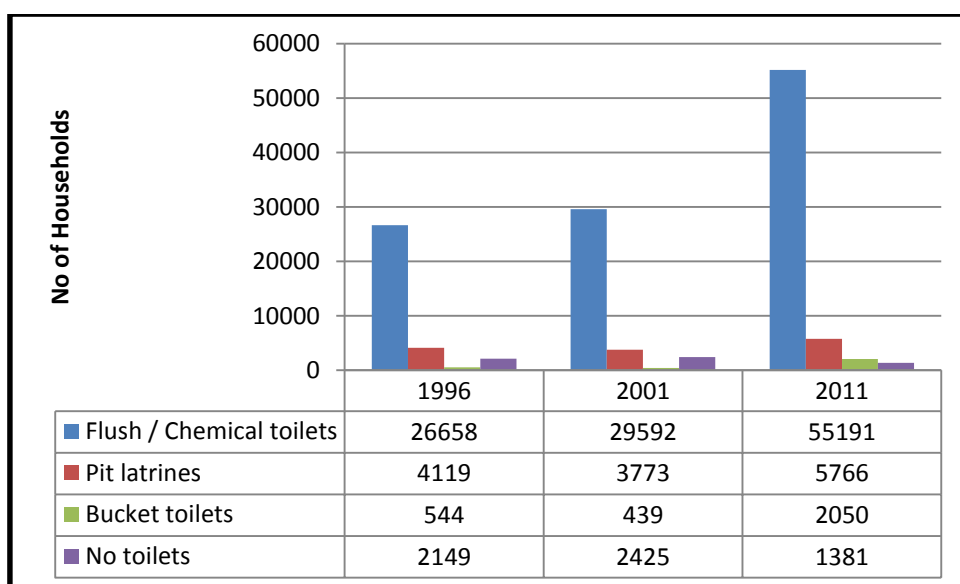


Figure 104: Households with Access to a Toilet Facility (Statistics SA, 2014)

3.16.3.6 Average Household Income

The distribution of the average household income in Steve Tshwete has increased from R55369 in 2001 to R1340266 in 2011 (242%). In terms of annual per capita disposable income (income received after taxes), Steve Tshwete had the highest amongst all LMs at R29339 (IDP, 2013-2014).

3.16.3.7 Land Use

Steve Tshwete municipality is covered by a number of land uses as shown in the figure below.

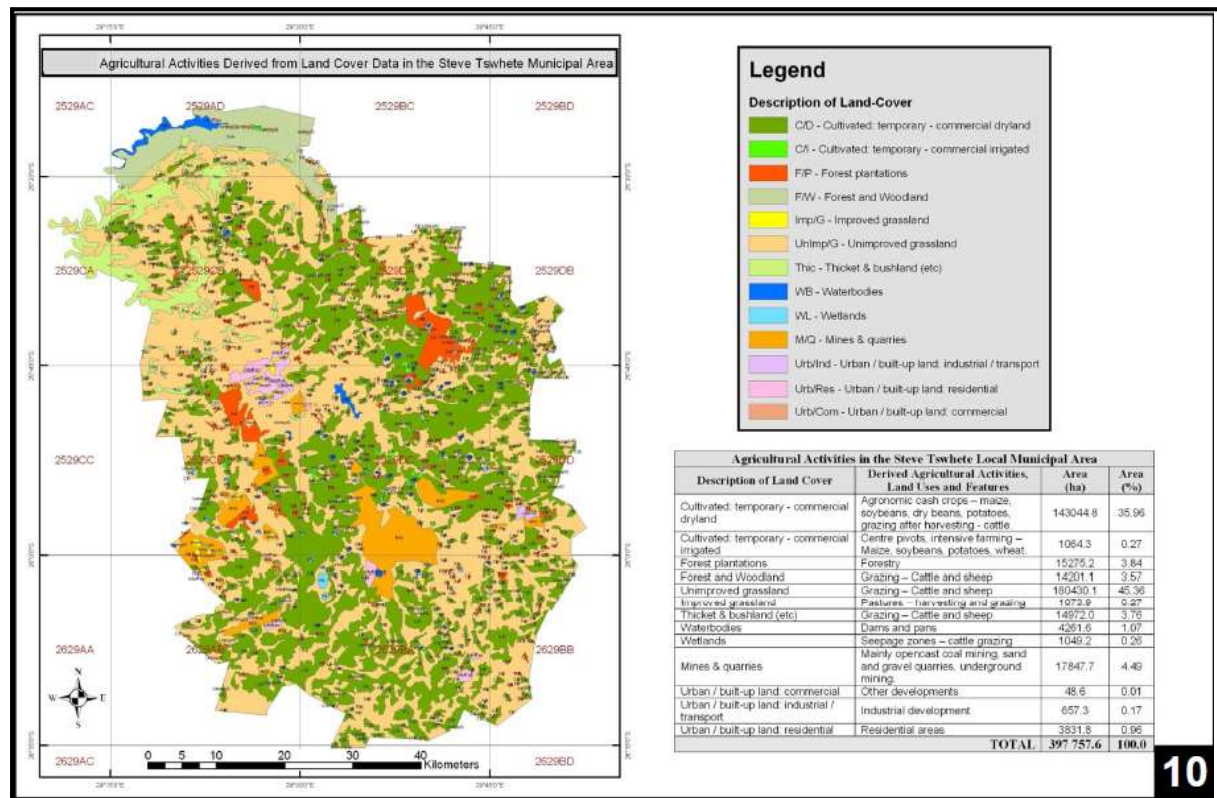


Figure 105: Land Cover and Use in Steve Tshwete (Source: Steve Tshwete LM SDF, 2010)

3.17 Servitudes

During the mining right EIA various Eskom Transmission lines were identified and Eskom was also invited as an Interested and Affect Party to the EIA process. Eskom will also be informed of the particular NEMA application as the mining right EIA covered a much larger area including various farms and farm portions. For this particular application only the farm Roodepoort 151IS portion 17 is applicable and the preliminary identified Eskom Transmission services are indicated in the mine plan below as yellow dashed lines. Eskom indicated that they will raise no objection to the proposed mining provided that their rights and services are acknowledged and respected at all times.

The road which transects the mining area is indicated in the image below as the orange line and will need to be diverted around the mining area. SANRAL will be informed and the necessary approvals will need to be granted before such road diversion will be implemented. A traffic Engineer, Cobus Havenga has been appointed to liaise with SANRAL regarding the diversion of the road.

Transnet responded to Eco Elementum during the PP process in a formal letter (Ref: PYP/W1/07/05/NC/15963) and indicated that our Background Information Document with reference numbers 17/2/3N-289 and MP30/5/1/2/2/479 MR dated 29 Oct 2013 has reference. Transnet further went on to state that Transnet

Pipelines (ex-Petronet), a division of Transnet SOC Limited, is not affected by the proposal as indicated on our Topographical & Overview Maps and Aerial Images.

Figure 106: Servitudes identified within the proposed mining layout

It was considered that the most effective methodology for determining the fossiliferous potential of the project area was to traverse the area by foot. Given the large aerial extent of the proposed development it was impossible to visit the entire land surface of the site within an acceptable timeframe. It was decided that the most appropriate methodology was to traverse the area by foot, and to ensure that a representative coverage of the project area was achieved.

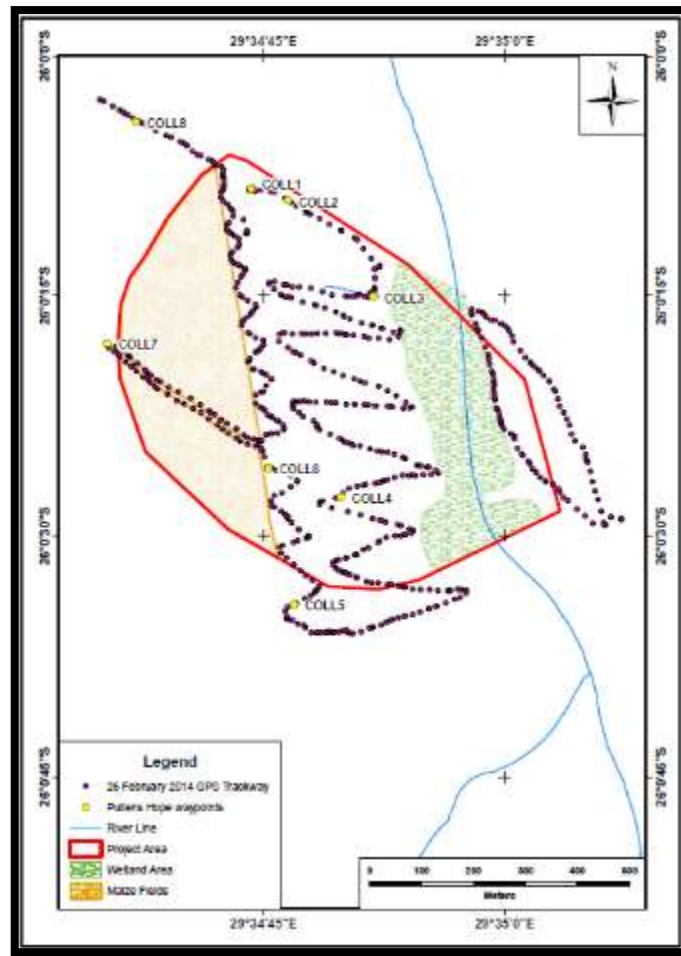


Figure 107: Map indicating the Paleontological traverse of the study area

Geology and Fossil Potential

The figure below shows that the region underlying the three project areas is underlain by Permian sedimentary rocks of the Vryheid Formation, Karoo Supergroup. A summary of the characteristics of this geological unit and its fossiliferous potential follows. It was evident during the inspection of the project area that the entire extent of the land surface is covered with unfossiliferous regolith.

Vryheid Formation

The Main Karoo Basin consists of a retro-arc foreland basin filled with a lithological succession ranging in age from the Late Carboniferous to the Middle Jurassic (Johnson *et al.*, 2006). The basin-fill sequence wedges out northwards over the adjacent Kaapvaal Craton.

In the Main Karoo Basin of South Africa the Vryheid Formation is a sandstone and coalrich stratigraphic unit that interfingers with (i.e., is transitional with and partially time equivalent to) the overlying Volkrust and underlying Pietermaritzburg Formations; both of which are both are predominantly argillaceous. Genetically the formation can be divided into lower fluvial-dominated deltaic interval, a middle fluvial interval (the coal-bearing zone) and

an upper fluvial-dominated deltaic interval (Johnson *et al.*, 2006). The thickness and frequency of the sandstone units increases from the base of the formation, reaching their maximum in the middle fluvial interval and then decrease again towards the overlying Volksrust Formation. To the south and south-east the Vryheid Formation grades laterally into undifferentiated, deep-water argillites of the Ecca Group.

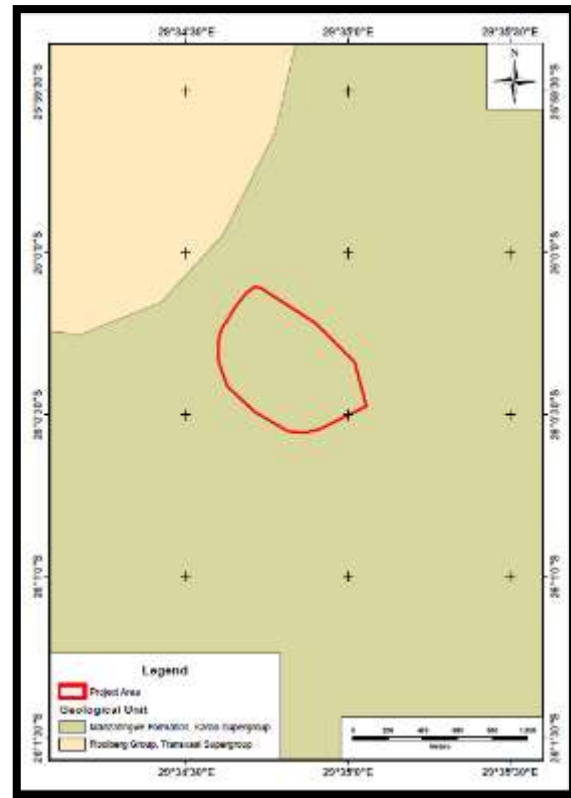


Figure 108: Map of the geology underlying the project area and its surrounding environs

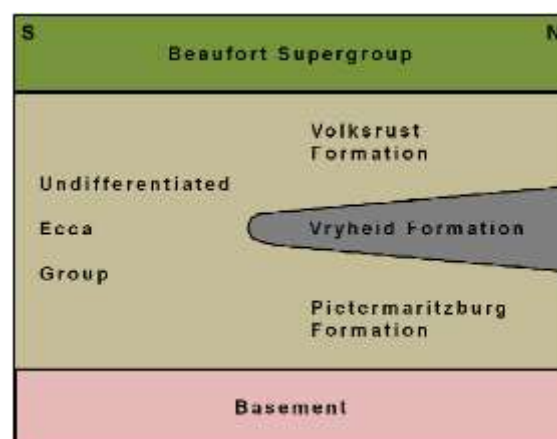


Figure 109: Schematic north-south orientated stratigraphic section of the Ecca group in the north-east corner of the Karoo Basin

The Volksrust and Pietermaritzburg Formations can only be recognised when the Vryheid Formation forms part of the vertical sequence. In the north and north-western portions of the basin the Pietermaritzburg Formation was not deposited and the coal-bearing strata of the Vryheid Formation rest directly upon the basement.

The Vryheid Formation is one of sixteen (16) recognised stratigraphic units that constitute the Permian Eccca Group. During the deposition of the Eccca Group the basin was dominated by a large sea (the salinity levels of this water body remain unresolved). The exception to this model was the deposition of the coal-bearing strata of the Vryheid Formation along the northern margin during an episode of deltaic progradation into the basin.

Deposition of the Vryheid Formation was terminated by a basin-wide transgression that drowned the Vryheid deltas and their coal swamps resulting in the deposition of the deep water sediments of the Volksrust Formation.

Paleontological potential

The most conspicuous and common components of the paleontological record of the Eccca Group in general are the plant macrofossils of the *Glossopteris* flora. Two large and conspicuous leaf form taxa dominate the *Glossopteris* flora; these being *Glossopteris* and *Gangamopteris*. Within the upper Eccca (containing the Vryheid Formation) *Gangamopteris* has ceased to occur with only *Glossopteris* present (Anderson and McLauchlan, 1976). The palaeobotanical record of the Eccca Group is diverse and the literature describing it is voluminous (numerous papers having been published by E. Plumstead, H. Anderson, J. Anderson, E. Kovaks-Endridy and M. Bamford amongst others). A comprehensive review of the flora in the Karoo Basin literature is, accordingly, beyond the scope of this study, but a thorough review of the palaeobotanical content of the Eccca Group in general and the Vryheid Formation in particular is presented in Bamford (2004). In that summary it is indicated that the Vryheid Formation can be expected to contain the plant macrofossils *Buthleziea*, *Sphenophyllum*, *Rangia*, *Phyllothea*, *Schizoneura*, *Sphenopteris*, *Noeggerathiopsis*, *Taeniopteris*, *Pagiophyllum* and *Benlightfootia* and the wood taxa *Australoxylon* and *Prototaxoxylon*. In addition to the above records can be added the observations of Tavener-Smith *et al.*, (1988) where it was noted that both *Glossopteris* and *Vertebraria* occur within the paleontological record of the formation.

In portions of the formation that are typified by low thermal alteration abundant assemblages of palynomorph plant microfossils (including acritarchs) can be expected (Anderson, 1977).

Jubb and Gardiner (1975) report the presence of fragmentary fish fossils within the Eccca sequence of southern Africa; these being *Coelacanthus dendrites* from the Somkele coalfield of northern Natal and *Namaicthys digitata* from correlative strata in the Senge Coalfields of Zimbabwe. While fish faunas are obviously rare and none have been reported from the Vryheid Formation the possibility remains that they may be present.

Animal body fossils are rare within the Eccca Group in general (excepting the time equivalent faunas of the Whitehill Formation). However, no reptile fossils have been identified within the Vryheid Formation.

Hobday and Tavener-Smith (1975) reviewed trace fossil assemblages identified within the Vryheid Formation. Within that fossil assemblage they identified two forms (*Helminthiopsis* and *Taphrelminthopsis* within horizontally laminated siltstones and mudstones that represent part of the deep water *Nerites* community.

4. Alternatives

The IEM procedure stipulates that the environmental investigation needs to consider feasible alternatives for any proposed development. Therefore, a number of possible proposals or alternatives for accomplishing the same objectives should be identified and investigated. The various alternatives are assessed in terms of both environmental acceptability as well as economic feasibility. The preferred option is to be highlighted and presented to the authorities.

Alternatives are defined in the NEMA EIA Regulations (2010) as “*different means of meeting the general purpose and requirements of the activity, which may include alternatives to: (a) the property on which or location where it is proposed to undertake the activity; (b) the type of activity to be undertaken; (c) the design or layout of the activity; (d) the technology to be used in the activity; and (e) the operational aspects of the activity and (f) the option of not implementing the activity*”.

4.1 Property or Location Alternatives

For the purpose of this EIA farm portion 17 of the farm Roodepoort 151IS was considered due to the positive results obtained during prospecting with regards to the underlying mineral reserve; high grade coal. An initial desktop survey indicating the NFEPA wetlands were conducted as a pre-feasibility study and it was indicated that various wetland areas do transect this particular farm portion. The only position that was left for the proposed opencast mine was at the furthest northern edge on the farm. This area covers a mere 60ha of the total approximately 410ha farm portion. If viable the proponent would have wanted to mine the entire farm portion indicated in the image below, but as can be observed the wetlands do not allow for alternative layouts and this is the optimal layout for opencast operations. The hatched yellow polygon indicates the proposed opencast area as Alternative A while the orange polygon feature indicates alternative B. Both alternative A and B have been indicated in the figure below with ‘text boxes’. A NFEPA wetland transects the area marked as alternative B and therefore it is not viable to mine this section unless a serious offset strategy is in place. The cost associated with off-set strategies will not be viable given the size of the reserve at 800 000ton mineable reserves. Given both the fact that there is sensitive wetland habitat and the cost involved with offset strategies, alternative A is better than alternative B.

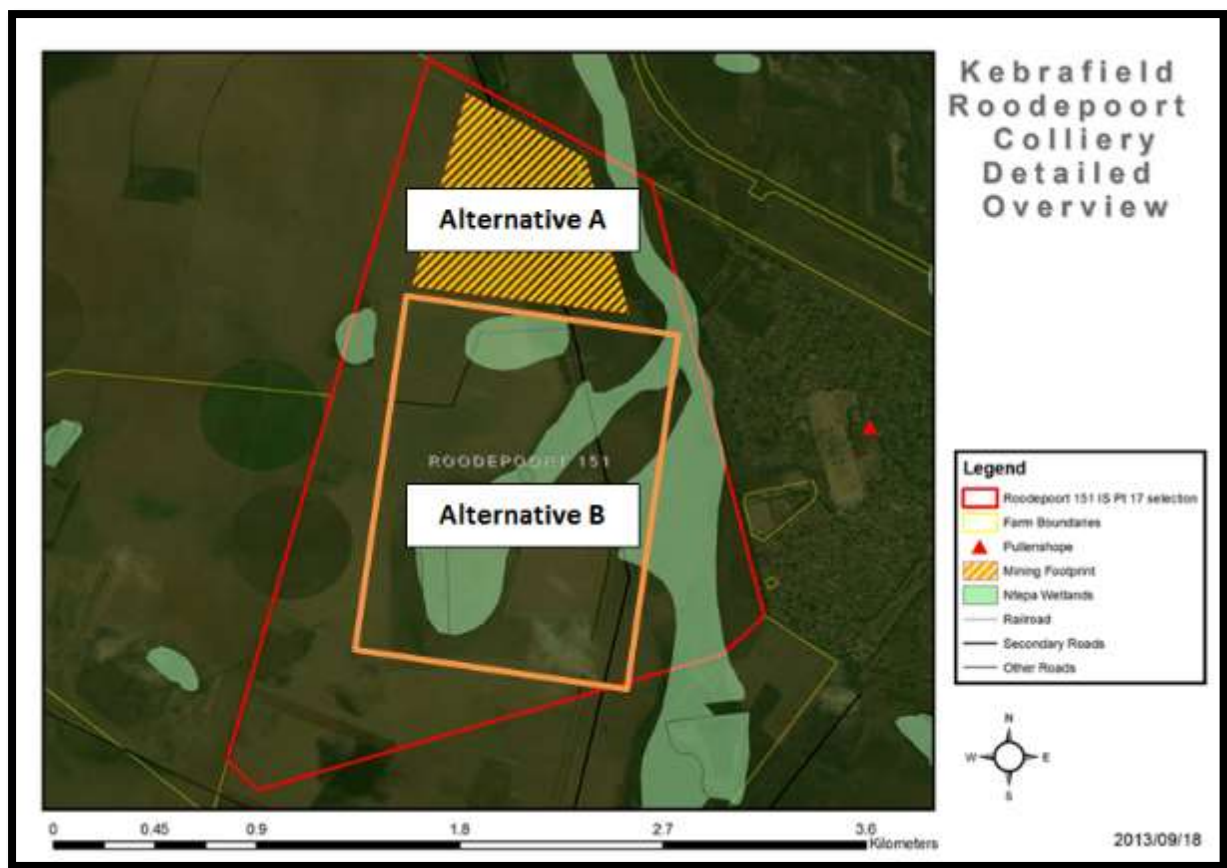


Figure 110: Alternative location on mining right property where coal is present

4.2 Type of Activity to be Undertaken Alternatives

Alternative A which is suggested is mining of coal due to the results obtained during the prospecting phase, while alternative B would be to use the area for its agricultural potential. Based on the land cover map the area to the east of the proposed mining area is already being mined by various other mines. It might be beneficial to develop this new mine in an area where mining is already taking place and all the auxiliary mining services are readily available. The coal is also of a very high grade and job creation will be more than for alternative B if agriculture continued. The area is currently being used for grazing land while Alternative A of mining the area will only disturb the grazing land for a period of three years where after it will be rehabilitated back to its original state, which will be grazing once again. The impact on the type of activity which could be undertaken alternatively if Alternative A was decided upon would be temporary and Alternative B would also have the potential to be undertaken after the three year life of mine period. Other alternatives for types of activities to be undertaken could be Alternative C as a residential development. Pullenshope is already to the east of the project area and creating a residential development on portion 17 of the farm Roodepoort 151IS will require its own infrastructure, services and clearance of vegetation. There is a great possibility that wetland crossings will be required to reach the existing Pullenshope town and this will impact upon the wetland system. Alternative A and B do not require any wetland crossings at the moment and propose to protect the wetland areas. Alternative C

will have longer term impacts on the environment than alternative A and B from a general and sewage waste generation perspective.

4.3 Design or Layout Alternatives for the Activity

Overburden placement

The first design Alternative A is the current layout as it is depicted in the mine planning reports throughout this report. Alternative B would be to change the placement of overburden towards the eastern edge of the mine instead. This however would pose a risk to the water quality in the receiving wetland area as leachate might occur. The best would be to keep the overburden dumps as far away as possible from the wetland receptors.

Roads

Alternative A is to divert the current road around the opencast mining area to ensure the vehicles do not have to travel through the mining area. Alternative B would be to keep the road in its current position and mine on both sides of the road. Alternative B poses a great safety concern and at the same time will sterilise a lot of the reserve. Alternative A would be preferred as traffic could then be diverted safely around the mine and a greater proportion of the reserve can be mined, ensuring better economic benefits to the local community and the country's economy as a whole.

Boxcut mining methods

Alternative A proposes to use a method of roll-over rehabilitation concurrently as mining progress. This way a minimum area is exposed at one point in time, the overburden dumps are kept to a minimum, the sandbank in the topsoil stay preserved as it is used quickly for rehabilitation and the overall mine closure liability is significantly reduced. Alternative B would be to open the entire reserve at once and close everything only at end of life of mine. This would ensure much better cash flow for the mine as concurrent rehabilitation costs would not exist during the mining phase, however, the footprint will be much greater, there's a risk that the seedbank will become sterile, there's a risk that the mine closure liability become to great and insufficient provision is in place to close everything at once and the leachate from the overburden dumps and coal footprint areas will be much greater than for Alternative A. Alternative A would be recommended in this regard.

4.4 Technology Alternatives

Alternative A would use technology associated with opencast mining, while alternative B would be to use deep mining/underground methods. Deep coal mining or underground mining is the extraction of resources (coal in this case) below the ground surface. Underground mining takes place where it is uneconomical to remove the

overburden from the seam. Deep coal mining is very expensive both to set up (initial costs) and also to run the mine (extraction of water and air regulation). Deep coal mining however has very little effect on any natural habitats and has little surface disruption other than a pit shaft and works (assuming there is no subsidence.) Alternative A however can be considered as the coal is at a depth where it can be mined economically without the requirement to go underground. The coal seam depth varies between 6m to 28m and at a depth of 6m underground mining in accordance with alternative B would not even be viable due to the safety associated with the roof thickness.

Alternative A is open cast mining where the coal seam is relatively close to the surface, thus it is cost effective to remove overlying rocks to access the coal. The coal is then extracted. Open cast mining often has higher tonnage as for alternative B pillars would have been left underground sterilising a proportion of the resource. Open cast (surface mining) affects habitats greatly (either by direct destruction, or indirectly such as blasting. In this case alternative A is preferred as the coal is very close to the surface at sections and due to the fact that it is economically much more viable than underground methods for this particular reserve.

4.5 No-go Alternative

The no-go alternative would entail not mining the reserve and leaving the area as grazing land. Coal is currently becoming a very strategic resource in South Africa and as has also been highlighted in the project motivation coal resources are essential to ensure economic growth in South Africa. By not implementing this project in excess of 100 jobs will not be created and 800 000tons of coal which could potentially have benefitted the economy would become sterilised. The negative impacts on the environment however would not exist should the project not be implemented, although it must also be considered that the present ecological status of the wetland is very low and ecological importance of the proposed mining area is not very significant as the case is currently. This EIA will include an EMP to consider management options to mitigate and in some instances even better environmental conditions as it currently is for eg. the wetland management plan as part of the wetland specialist study which will form part of the overall EMP.

The main negative effects of the no-go alternative can be summarised as:

- Employment to a number of people during the construction and operational phases will not take place and no new opportunities will be presented to the local community. The numbers of jobs created are significant to the local and regional economy but will not exist if the project does not continue.
- No large capital investment and substantial offshore revenue generation will take place.
- No capital investment in the form of the company payroll will be instated.
- Significant amounts paid to the government in the form of local, regional and national taxes and levies will merely go lost.

- Creation and support of service-sector jobs, the annual procurement of large quantities of consumables and the outsourcing of service provision to local service providers will not take place and poverty will continue existing.
- No produce will be generated to go towards Eskom's Power Generation needs and therefore the electricity output needed in South Africa will not benefit from the project.

5. Public Participation Process

5.1 Introduction to Public Participation

Within Guideline 7 on *"Public Participation in the Environmental Impact Assessment Process"*, published by Department of Environmental Affairs (DEA) in October 2012, it is stated that public participation is one of the most important aspects of the environmental authorisation process. This stems from the requirement that people have a right to be informed about potential decisions that may affect them and that they must be afforded an opportunity to influence those decisions. Effective public participation also facilitates informed decision-making by the Competent Authority and may result in better decisions as the views of all parties are considered.

The benefits of public participation include but are not limited to the following:

- Provides an opportunity for Interested and Affected parties (I&APs), Environmental Assessment Practitioners (EAPs) and the Competent Authority (CA) to obtain clear, accurate and understandable information about the environmental impacts of the proposed activity or implications of a decision;
- Provides I&APs with an opportunity to voice their support, concerns and questions regarding the project, application or decision;
- Provides I&APs with the opportunity of suggesting ways of reducing or mitigating negative impacts of an activity and for enhancing positive impacts;
- Enables the applicant to incorporate the needs, preferences and values of affected parties into the application;
- Provides opportunities for clearing up misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;
- It is an important aspect of securing transparency and accountability in decision-making; and
- Contributes toward maintaining a healthy, vibrant democracy.

All PPP undertaken is in accordance with the requirements of the EIA Regulations (2010). Refer to the Public Participation Report (as per Annexure 2).

5.2 Public Participation to date

Initial Public Participation has already been conducted during the Mining Right Application Phase (Ref MP 30/5/1/2/2/479 MR) by GEM-Science CC and is captured in the Public Participation Report dated 15 January 2011 in Annexure 2 of this report. This report however was for a mining right over the following properties, also including the property being applied for in this NEMA EIA;

- Bultfontein 187 IS portions 11, 15, 17, 18, 19 and the Remaining Extent,
- Driefontein 153 IS portions 1, 4, 6, 7, 8, 9, 10, 11, 20, 21, 22, 23, 24, 25 and the Remaining Extent,
- Geluk 26 IS portions 1, 2, 3, 8, 10, 11, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25 and the Remaining Extent,
- Wolvenfontein 471 JS portions 4, 10, 16 and 17,
- **Roodepoort 151 IS** portions 1, 2, 3, 5, 8, 9, 10, 11, 13, **17** and 18.

However, for this particular NEMA application only the farm **Roodepoort 151 IS portion 17** is being applied for and therefore a more focussed public participation will be conducted. The mining right public participation was very thorough but extensive in terms of the properties covered. Issues and concerns raised during the Mining Right EIA process will also be incorporated and addressed into this particular NEMA EIA and also addressed in the WULA.

The following PPP tasks were conducted to date for the proposed new Kebrafield Roodepoort Colliery NEMA EIA:

1. Identification of key Interested and Affected Parties (affected and adjacent landowners) and other stakeholders (organs of state and other parties);
2. Formal notification of the application to key Interested and Affected Parties (all adjacent landowners) and other stakeholders;
3. Consultation and correspondence with I&APs and Stakeholders and the addressing of their comments; and
4. Release of the Draft Scoping Report to I&APs and stakeholders for review and comment.

Task 1: I&AP and Stakeholder identification, registration and the creation of an electronic database

Public Participation is the involvement of all parties who are either potentially I&AP by the proposed development. The principle objective of public participation is to inform and enrich decision-making. This is also its key role in this Environmental Impact Assessment (EIA) process.

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

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

Refer to the PPP Report (Annexure 2) for I&AP and stakeholder database.

Task 2: Formal notification of the application to key Interested and Affected Parties (all adjacent landowners) and other stakeholders

The project was announced as follows:

Newspaper Advertisements:

Middelburg Observer – 22 000 prints



Distribution areas for Middelburg Observer: Middelburg , Witbank, Belfast , Hendrina, Mines and Power Stations including Hendrina Power Station and the town of Pullenshope situated directly adjacent to the proposed project area.

Refer to the PPP Report (Annexure 2) for proof of placement of the newspaper advert.

Public notice placement

Notices informing the public of the proposed mining activities and the Open Days to take place and inviting their input, comments and concerns were done by fixing of four notice boards at places conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is or is to be undertaken.

Refer to the PPP Report (Annexure 2) for proof of site notice placement.

Written notification

I&AP's and other key stakeholders, who included the abovementioned sectors, were directly informed of the proposed development by e-mail. The Background Information Document (BID) and Registration and Comment sheets were also supplied to all parties. I&APs were given 40 days to comment and / or raise issues of concern regarding the proposed development. The commenting period expired on the 25 November 2013. However, comments were being received up to 21 February 2014 before the Final Scoping Report was released for a 21 day commenting period.

Refer to the PPP Report (Annexure 2) for a copy of the BID and proof of email notification.

Task3: Consultation and correspondence with I&APs and Stakeholders and the addressing of their comments.

I&APs have the opportunity to raise issues either in writing, by telephone, fax and/or email. Concerns raised, as well as responses to these concerns, are detailed in the Comments and Response Report.

All the issues raised by I&APs during the EIA process will be captured in a Comments and Response Report and I&APs will receive letters acknowledging their contributions.

Task 4: Release of the Draft Scoping Report to I&AP's and stakeholders for review and comment.

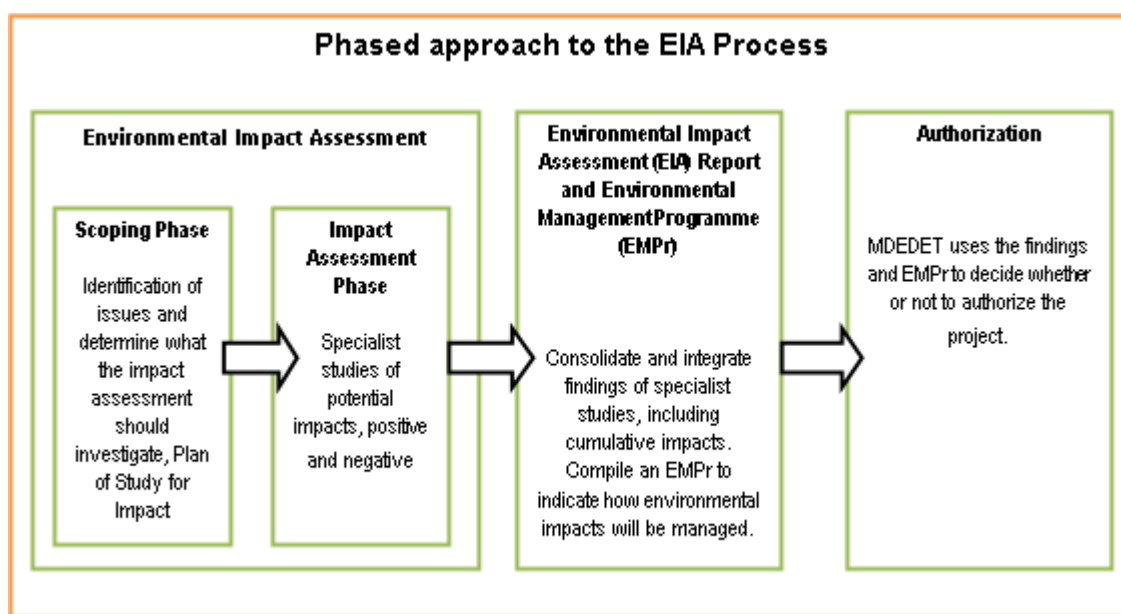
The Draft Scoping Report (DSR) and Plan of Study (POS) were submitted to the Competent Authority on 16 October 2013 as per the requirements of Regulation 56 (4). The DSR and supporting documentation were subsequently released for a period of 40 days from 15 October 2013 to 25 November 2013 for public review and comment. All stakeholders and I&AP's was notified of the DSR availability for comment. Hardcopies of the DSR was submitted to all organs of state and relevant authorities. The Draft Scoping Report and supporting documentation was made available for review at the Pullenshope Public Library; and via email upon request to info@ecoelementum.co.za.

5.3 Public Participation Next Steps

All stakeholders and registered I&AP's will have the opportunity to review and comment on all the documents released in the Final Scoping, Draft EIA and Final EIA phases respectively. All final reports will be released for a period of 21 days for review and comment. The draft EIA will be released for 40 days. During all the PPP phases, hardcopies and CD's of all reports and supporting documents will be submitted to the organs of state and relevant authorities. All the reports will also be placed at the Pullenshope Public Library and via email upon request to info@ecoelementum.co.za.

All comments and responses received and sent throughout the entire process will be updated and included in comments and responses chapter (as attached in Annexure 2). Note that this PPP Report shall be updated at each phase as required.

6. Environmental Impact Assessment Approach and Methodology



6.1 Scoping Phase Process

A scoping study is conducted as the first phase in the EIA process during which:

- Project and baseline environmental information is collated. Baseline information for the scoping report is gathered through visual inspections during field visits of the proposed project area and surroundings, desktop studies and review of existing reports available to the EAP.
- Landowners, adjacent landowners, local authorities, environmental authorities, as well as other stakeholders which may be affected by the project, or that may have an interest in the environmental impacts of the project are identified.
- Interested and affected parties (I&APs) are informed about the proposed project.
- Public meetings are arranged and I&AP issues and concerns are identified.
- Environmental authorities are consulted to confirm legal and administrative requirements.
- Environmental issues and impacts are identified and described.
- Development alternatives are identified and evaluated, and non-feasible development alternatives are eliminated.
- The nature and extent for further investigations and specialist input required in the EIA phase is identified.

- The draft and final scoping reports are submitted for review by authorities, relevant organs of state and I&APs.
- Key I&AP issues and concerns are collated into an issues and response report for consideration in the EIA phase.

6.2 EIA Phase Process

After the initial scoping phase, the EIA phase of the application includes:

- Specialist investigations are undertaken in accordance with the terms of reference established in the scoping assessment (plan of study for EIA appended to the scoping report). The scope for specialist work is determined accordingly to the nature and scale of the project impacts.
- An evaluation of development alternatives and identification of a proposed option.
- An assessment of existing impacts (no-go development option), environmental impacts that may be associated with the proposed project option, and cumulative impacts using the impact assessment methodology.
- Identification of mitigation measures to address the environmental impacts and development of actions required to achieve the mitigation required.
- Consultation with I&APs.
- Incorporation of public comment received during scoping and the draft EIA into the final EIA report.
- Issuing of the final EIA report for review.
- After the draft EIA report was reviewed, comments received are incorporated in the final EIA report and final EMP.

6.3 EIA Programme and Opportunities for I&AP and Authority Involvement

[illegible]

7. Environmental Impacts

7.1 Potential Environmental Impacts

Potential impacts resulting from the proposed Kebrafield Roodepoort Colliery were identified using input from the following sectors:

- Views of interested and affected parties;
- Existing information;
- Site visit with the project team;
- Guidelines; and
- Legislation.

The following potential impacts were identified:

- Ground and Surface Water contamination;
- Geology, Soil and Land Capability;
- Socio-Economic Issues;
- Waste Products;
- Floral and Faunal Displacement;
- Impacts on the wetland and drainage patterns;
- Dust and Noise Impacts;
- Visual Impacts;
- Blast and Vibration Impacts;
- Identified heritage sites and
- Paleontological Impacts.

Table 45: Detailed breakdown of potential environmental impacts

Detailed Breakdown of Potential Environmental Impacts	
Ground Water Contamination	<ul style="list-style-type: none"> • During mining ground water can seep through the high walls and become contaminated in the pit when in contact with carbonaceous material • Based on the Acid Base Accounting score for the material that will be mined including the material used for backfill rehabilitation potential water contamination can occur • The drawdown effect can cause water sources in the vicinity of the opencast pit to potentially flow into the pit
Surface Water Contamination	<ul style="list-style-type: none"> • Open pit mining is associated with surface

	<p>water contamination due to the leaching of stockpiles - also dependant on the characteristics of the stockpiled material</p> <ul style="list-style-type: none"> • The quality of the water used for dust suppression has the potential to contaminate surface water sources • The clean and dirty water separation system could potentially contaminate surface water sources • Erosion of denuded soil surfaces could potentially increase the total dissolved solids and cause sedimentation of surface water sources
Geology, soil and land capability	<ul style="list-style-type: none"> • Opencast mining will impact the geology, soil and land capability and must be addressed during the backfill rollover rehabilitation
Socio-economic issues	<ul style="list-style-type: none"> • A potential positive impact could occur as the mine will create in excess of direct 100 jobs while many more indirect jobs will be created • The mining of the coal resource will positively impact on the economy of the country
Waste products	<ul style="list-style-type: none"> • General waste will be generated on site • Small amounts of hydrocarbon waste associated with maintenance activities will be generated on site • No washing of coal will take place on site therefore no negative impact from slurry dams
Flora and faunal displacement	<ul style="list-style-type: none"> • During opencast mining total displacement of flora and fauna will take place within the footprint of the opencast pit
Impacts on the wetlands and drainage patterns	<ul style="list-style-type: none"> • Potential impacts could arise due to mining in the vicinity of a wetland and therefore a 100m buffer must be adhered to according to specialist investigations. A WULA will however be applied for to authorise mining within the 500m radius from a wetland up and to the 100m buffer line. • Surface water drainage patterns will be altered according to the storm water management plan to ensure clean and

	dirty water separation.
Dust and noise impacts	<ul style="list-style-type: none"> • Mining is associated with dust and noise impacts as a result of blasting, excavation, stockpiling, crushing & screening and general vehicle movement on gravel roads.
Visual impacts	<ul style="list-style-type: none"> • Opencast mining is associated with potential visual impacts as a result of the stockpiles and waste rock dumps that is higher than the initial topography before mining
Blast & vibration impacts	<ul style="list-style-type: none"> • Blasting will be required during the opencast mining operation and potential blast and vibration impacts exist
Identified heritage sites	<ul style="list-style-type: none"> • Various graves have been identified during the initial site visits on the edge of the mining footprint (not within) that might be impacted due to mining activities
Paleontological impacts	<ul style="list-style-type: none"> • Based on the findings from the Paleontological investigation can we further determine possible impacts

7.2 Specialist Studies to Assess the Environmental Impacts

The following specialist studies and investigations were undertaken in order to quantify and qualify the potential environmental impacts while also developing appropriate mitigation measures, management plans and monitoring schedules;

Table 46: Specialist Impact Studies

Specialist Impact Studies
<i>Geohydrological Investigation, Impact Assessment and Modelling;</i>
<i>Hydrological/Surface Water Impact Assessment;</i>
<i>Wetland Delineation, Assessment and Impact Assessment (PES and EIS);</i>
<i>River Health Assessment (SASS5);</i>
<i>Floodline Determination;</i>
<i>Civil Engineering Pollution Control Dam Designs and Storm-water Management Plan,</i>
<i>Baseline Ambient Air Quality Assessment;</i>
<i>Baseline Noise Assessment;</i>
<i>Soils and Land Capability assessment;</i>
<i>Visual Impact Assessment;</i>
<i>Traffic Impact Assessment;</i>

<i>Heritage, Cultural and Archaeological Impact Assessment;</i>
<i>Social Impact Assessment;</i>
<i>Blast and Vibration Risk Assessment;</i>
<i>Ecological, Fauna & Flora Impact Assessment; and</i>
<i>Paleontological Impact Assessment.</i>

7.3 Impact Assessment Methodology

7.3.1 Introduction to Impact Assessment Methodology

The criteria for the description and assessment of environmental impacts were drawn from the EIA Guidelines, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989). Although the ECA EIA Regulations have been repealed, the Guideline Document still provides good guidance for significance determination.

The level of detail as depicted in the EIA regulations were fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project.

The impact assessment criteria used to determine the impact of the proposed development are as follows:

- **Nature** of the impact;
- The **Source** of the Impact;
- Affected Stakeholders;
- **Extent** - The physical and spatial scale of the impact;
- **Duration** - The lifetime of the impact, that is measured in relation to the lifetime of the proposed development;
- **Intensity** - The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself;
- **Probability** - This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time;
- **Mitigation**: The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development

considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.

- **Determination of Significance – Without Mitigation:** Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact “without mitigation” is the prime determinant of the nature and degree of mitigation required.
- **Determination of Significance – With Mitigation:** Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the identified mitigation measures.

Previous experience has shown that it is often not feasible or practical to only identify and address possible impacts. The rating and ranking of impacts is often a controversial aspect because of the subjectivity involved in attaching values to impacts. Therefore, the assessment will concentrate on addressing key issues.

The methodology employed will involve a circular route, which will allow for the evaluation of the efficiency of the process itself. The project will be divided into three phases in order to assess impacts related to the Constructional, Operational and Decommissioning & Closure Phases . The assessment of actions in each phase will be conducted in the following order:

- a) Identification of key issues;
- b) Analysis of the activities relating to the proposed development;
- c) Assessment of the potential impacts arising from the activities, without mitigation; and
- d) Investigation of the relevant mitigation measures, as well as an assessment of their effectiveness in alleviating impacts.

7.3.2 Assessment of Biophysical Cumulative Impacts

The criteria for the description and assessment of environmental impacts were drawn from the EIA Guidelines and in terms of the Environmental Conservation Act, 1989 (Act No 73 of 1989) [ECA]. Although the ECA EIA Regulations have been repealed the Guideline Document still provides good guidance for significance determination.

Activities within the framework of the proposed development and their respective construction and operational phases, give rise to certain impacts. For the purpose of assessing these impacts, the project has been divided into two phases from which impacting activities can be identified, namely:

- a) Construction phase: All the construction related activities on site, until the contractor leaves the site.
- b) Operational phase: All activities, including the operation and maintenance of the proposed development.

The activities arising from each of these phases have been included in the tables. This is to identify activities that require certain environmental management actions to mitigate the impacts arising from them. The criteria against which the activities were assessed are given in the next section.

7.3.3 Assessment Criteria

EXTENT: GEOGRAPHICAL	
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Site	The impact could affect the whole, or a significant portion of the site.
Regional	The impact could affect the area including the neighbouring properties, the transport routes and the adjoining towns.
National	The impact could have an effect that expands throughout the country (South Africa).
International	Where the impact has international ramifications that extent beyond the boundaries of South Africa.
DURATION	
Short term	The impact would either disappear with mitigation or will be mitigated through natural processes in a period shorter than that of the construction phase.
Short – Medium term	The impact will be relevant through to the end of the construction phase.
Medium term	The impact will last up to the end of the development phases, where after it will be entirely negated.
Long term	The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
INTENSITY	
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
Medium	The affected environment is altered, but functions and processes continue, albeit in a

	modified way.
High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
PROBABILITY	
Impossible	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0%).
Possible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25%.
Likely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50%.
Highly likely	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75%.
Definite	The impacts will take place regardless of any provisional plans, and or mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100%.

7.3.4 Mitigation

The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.

Determination of Significance – Without Mitigation

Significance is determined through a synthesis of impacts as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact “without mitigation” is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, significance is noted as “positive”. Significance is rated on the following scale:

- a) **No significance:** The impact is not substantial and does not require any mitigation action.
- b) **Low:** The impact is of little importance, but may require limited mitigation.
- c) **Medium:** The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.

- d) **High:** The impact is of major importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

Determination of Significance – With Mitigation

Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. Significance with mitigation is rated on the following scale:

- a) **No significance:** The impact will be mitigated to the point where it is regarded as insubstantial.
- b) **Low:** The impact will be mitigated to the point where it is of limited importance.
- c) **Low to Medium:** The impact is of importance however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.
- d) **Medium:** Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
- e) **Medium to High:** The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
- f) **High:** The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

Assessment Weighting

Each aspect within the impact description was assigned a series of quantitative criteria. Such criteria are likely to differ during the different stages of the project's life cycle. In order to establish a defined base upon which it becomes feasible to make an informed decision, it is necessary to weigh and rank all criteria.

Ranking, Weighting and Scaling

For each impact under scrutiny, a scale weighting factor is attached to each respective impact (refer to the figure below). The purposes of assigning such weights serve to highlight those aspects considered most critical to the various stakeholders and ensure that each specialist's element of bias is taken into account. The weighting factor also provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspects criteria.

Simply, such a weighting factor is indicative of the importance of the impact in terms of the potential effect that it could have on the surrounding environment. Therefore, the aspects considered to have a relatively high value will score a relatively higher weighting than that which is of lower importance.

Table 47: Description of the biophysical assessment parameters with its respective weighting

Extent	Duration	Intensity	Probability	Weighting Factor (WF)	Significance Rating (SR)	Mitigation Efficiency (ME)	Significance Following Mitigation (SFM)
Footprint 1	Short term 1	Low 1	Probable 1	Low 1	Low 0-19	High 0,2	Low 0-19
Site 2	Short to medium 2		Possible 2	Low to medium 2	Low to medium 20-39	Medium to high 0,4	Low to medium 20-39
Regional 3	Medium term 3	Medium 3	Likely 3	Medium 3	Medium 40-59	Medium 0,6	Medium 40-59
National 4	Long term 4		Highly Likely 4	Medium to high 4	Medium to high 60-79	Low to medium 0,8	Medium to high 60-79
International 5	Permanent 5	High 5	Definite 5	High 5	High 80-100	Low 1,0	High 80-100

7.4 Impact Assessment – Descriptions & Ratings

7.4.1 Groundwater

Table 48: Groundwater – Construction Phase Impact Rating (1)

Activity	Start-up of mining operations at the specific site before actual mining operations commences.	
Aspect	Deterioration of groundwater quality	
Mining Phase	Construction Phase	
Impact:	Oil, diesel and chemical spills from machinery	
Impact description	It is accepted for the purposes of this document that the construction phase will consist of preparations for the opencast, which is assumed to consist mainly of establishment of infrastructure on site, the mobilisation of earth moving equipment and the opening of the boxcut. This phase is not expected to influence the groundwater levels. With the exception of lesser oil and diesel spills, there are also no activities expected that could impact on regional groundwater quality. This phase should thus cause very little additional impacts in the groundwater quality. It is expected that the current status quo will be maintained.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	FOOTPRINT
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT
	Intensity [low(1); medium(3); high(5)]	LOW
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	LOW
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (1 + 1 + 1 + 4) x 2 = 14 LOW
	With mitigation (WM)	WOM x ME = WM 14 x 0.2 = 2.8 LOW
Significance With Mitigation (WM)	LOW	

Table 49: Groundwater - Construction Phase Impact Rating (2)

Activity	Start-up of mining operations at the specific site before actual mining operations commences.	
Aspect	Deterioration of groundwater quality	
Mining Phase	Construction Phase	
Impact:	Contamination potential of mine material exposed during mine construction	
Impact description	It is accepted for the purposes of this document that the construction phase will consist of preparations for the opencast, which is assumed to consist mainly of establishment of infrastructure on site, the mobilisation of earth moving equipment and the opening of the boxcut. This phase is not expected to influence the groundwater levels. With the exception of lesser oil and diesel spills, there are also no activities expected that could impact on regional groundwater quality. The chemical properties of the material exposed during the mine construction could potentially impact on the groundwater quality. This phase should thus cause very little additional impacts in the groundwater quality. It is expected that the current status quo will be maintained.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT
	Intensity [low(1); medium(3); high(5)]	LOW
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	LOW-MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	LOW
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM $(2 + 1 + 1 + 2) \times 2 = 12$ LOW
	With mitigation (WM)	WOM x ME = WM $12 \times 1.0 = 12$ LOW
Significance With Mitigation (WM)	LOW	

Table 50: Groundwater – Operational Phase Impact Rating (1)

Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.	
Aspect	Groundwater quantity – lowering of groundwater table	
Mining Phase	Operational Phase	
Impact	Impact on water supply of groundwater users surrounding mine	

Impact description	<p>The operational phase is interpreted as the active mining of the Roodepoort opencast as well as the operation of the associated stockpile and overburden dumps. It is inevitable that these operations will impact on the groundwater regime. The potential impacts that will be considered are the groundwater quantity and quality. Conceptual layouts were made available at the time of this study, and conservative assumptions were thus made regarding layout planning. It is recognised that the layout might be simplistic, and it is essential that this model is updated once final information is available.</p> <p>During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. Water entering the mining areas will have to be pumped out to enable mining activities. This will cause a lowering in the groundwater table, in and adjacent to the mine.</p> <p>The figures presented in the Geohydrological study are overestimations and probably reflect worst-case scenarios. The actual inflow will depend on the area being mined at any one moment in time. However, at the last boxcut, the inflow from the backfilled portion of the opencast could be substantial and the above inflows can be approached.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	LOW
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	LOW
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM $(2 + 3 + 1 + 3) \times 3 = 27$ LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM $27 \times 1.0 = 27$ LOW TO MEDIUM
Significance With Mitigation (WM)	LOW TO MEDIUM	

Table 51: Groundwater Operational Phase Impact Rating (2)

Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.	
Aspect	Groundwater quantity – lowering of groundwater table	
Mining Phase	Operational Phase	
Impact	Potential impact on base flow of streams/wetland	
Impact description	<p>The operational phase is interpreted as the active mining of the Roodepoort opencast as well as the operation of the associated stockpile and overburden dumps. It is inevitable that these operations will impact on the groundwater regime. The potential impacts that will be considered are the groundwater quantity and quality. Conceptual layouts were made available at the time of this study, and conservative assumptions were thus made regarding layout planning. It is recognised that the layout might be simplistic, and it is essential that this model is updated once final information is available.</p> <p>The flow in the aquifer will be directed towards the opencast during this stage of mining, and very little groundwater pollution is thus expected. Any contamination that may take place is likely to be directed towards the opencast.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY

Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 3 + 3 + 4) x 4 = 48 MEDIUM	
	With mitigation (WM)	WOM x ME = WM 48 x 0.6 = 28.8 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 52: Groundwater – Operational Phase Impact Rating (3)

Table 5.2: Groundwater – Operational Phase Impact Mining (x)			
Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.		
Aspect	Groundwater quality – contamination of groundwater		
Mining Phase	Operational Phase		
Impact	Deterioration of groundwater quality down gradient of the mining operations		
Impact description	<p>The operational phase is interpreted as the active mining of the Roodepoort opencast as well as the operation of the associated stockpile and overburden dumps. It is inevitable that these operations will impact on the groundwater regime. The potential impacts that will be considered are the groundwater quantity and quality. Conceptual layouts were made available at the time of this study, and conservative assumptions were thus made regarding layout planning. It is recognised that the layout might be simplistic, and it is essential that this model is updated once final information is available.</p>		
	<p>The flow in the aquifer will be directed towards the opencast during this stage of mining, and very little groundwater pollution is thus expected. Any contamination that may take place is likely to be directed towards the opencast.</p>		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		MEDIUM
	Intensity [low(1); medium(3); high(5)]		MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 3) x 4 = 48 MEDIUM	
	With mitigation (WM)	WOM x ME = WM 48 x 0.6 = 28.8 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 53: Groundwater – Operational Phase Impact Rating (4)

Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.		
Aspect	Groundwater quality – contamination of groundwater		
Mining Phase	Operational Phase		

Impact	Oil, diesel and chemical spills/leaks from machinery and storage facilities/ Sewage related groundwater contamination	
Impact description	<p>The operational phase is interpreted as the active mining of the Roodepoort opencast as well as the operation of the associated stockpile and overburden dumps. It is inevitable that these operations will impact on the groundwater regime. The potential impacts that will be considered are the groundwater quantity and quality. Conceptual layouts were made available at the time of this study, and conservative assumptions were thus made regarding layout planning. It is recognised that the layout might be simplistic, and it is essential that this model is updated once final information is available.</p> <p>The flow in the aquifer will be directed towards the opencast during this stage of mining, and very little groundwater pollution is thus expected. Any contamination that may take place is likely to be directed towards the opencast.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM $(2 + 3 + 3 + 2) \times 3 = 30$ LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM $30 \times 0.2 = 6$ LOW
Significance With Mitigation (WM)	LOW	

Table 54: Groundwater – Decommissioning and Closure Phase Impact Rating (1)

Activity	The closing of mining operations, site clean-up and rehabilitation of the mining area.
Aspect	Groundwater quantity – change in groundwater level
Mining Phase	Decommissioning and Closure Phase
Impact	Decant volume

Impact description	<p>During this phase of mining it is assumed that dewatering of the opencast will be ceased, and the surface of the opencast will be rehabilitated. The groundwater regime will return to a state of equilibrium once mining has stopped and the removal of water from the mining void has been discontinued. The rise in groundwater level is predicted to be relatively slow and the water levels are expected to recover only in about 10 - 20 years. The slow recovery is ascribed to the low hydraulic conductivity of the surrounding bedrock. No additional impacts on the groundwater of the study area other than the impacts discussed above for operational phase are expected during the decommissioning phase of the project.</p> <p>Following closure of the opencast, the groundwater level will rise to an equilibrium that will differ from the pre-mining level due to the disturbance of the bedrock and increase in recharge from rainfall.</p> <p>After closure, the water table will rise in the rehabilitated opencasts to reinstate equilibrium with the surrounding groundwater systems. However, the mined areas will have a large hydraulic conductivity compared to the pre-mining situation. This will result in a relative flattening of the groundwater table over the extent of mining, in contrast to the gradient that existed previously.</p> <p>The end result of this will be a permanent lowering of the groundwater level in the higher topographical area and a rise in lower lying areas.</p> <p>Intuitively, it would be expected that this raise in groundwater could result in decanting of the opencast. However, the predicted groundwater levels indicate that decanting will most probably not occur.</p>	
	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	PERMANENT
	Intensity [low(1); medium(3); high(5)]	MEDIUM
Magnitude	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Weighting factor (WF)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM
Significance	Without mitigation (WOM)	$(\text{Extent} + \text{Duration} + \text{Intensity} + \text{Probability}) \times \text{WF} = \text{WOM}$ $(2 + 5 + 3 + 4) \times 5 = 70$ MEDIUM TO HIGH
	With mitigation (WM)	$\text{WOM} \times \text{ME} = \text{WM}$ $70 \times 0.6 = 42$ MEDIUM
Significance With Mitigation (WM)	MEDIUM	

Table 55: Groundwater – Decommissioning and Closure Phase Impact Rating (2)

Activity	The closing of mining operations, site clean-up and rehabilitation of the mining area.
Aspect	Groundwater quality – Contamination of groundwater
Mining Phase	Decommissioning and Closure Phase
Impacts	Deterioration of groundwater quality down gradient of the mining operations due to plume movement

Impact description	During this phase of mining it is assumed that dewatering of the opencast will be ceased, and the surface of the opencast will be rehabilitated. The groundwater regime will return to a state of equilibrium once mining has stopped and the removal of water from the mining void has been discontinued. The rise in groundwater level is predicted to be relatively slow and the water levels are expected to recover only in about 10 - 20 years. The slow recovery is ascribed to the low hydraulic conductivity of the surrounding bedrock. No additional impacts on the groundwater of the study area other than the impacts discussed above for operational phase are expected during the decommissioning phase of the project.		
	Groundwater within the mined areas is expected to deteriorate due to chemical interactions between the geological material and the groundwater. The resulting groundwater pollution plume will commence with downstream movement.		
	Once the normal groundwater flow conditions have been re-instated, polluted water can migrate away from the rehabilitated areas. As some coal and discards will remain in the mine, this outflow will be contaminated as a result of acid or neutral mine drainage. As sulphate is normally a significant solute in such drainage, it has been modelled as a conservative (non-reacting) indicator of mine drainage pollution. A starting concentration of 2 000 mg/litre has been assumed as a worst case scenario, based on past experience.		
	Within the limitations of the assumptions listed in the specialist study, it can be estimated from the figures that: <ul style="list-style-type: none">• The sulphate pollution plume emanating from the opencast is predicted to reach the wetland as well as the tributary of the Woes-Alleenspruit about 10 years after mine closure and rebound of the groundwater levels.• Following this eventual period, seepage of AMD will increase in concentration and could reach very high levels in the wetland and tributary east of the opencast, due to evapotranspiration.• No identified privately owned boreholes are likely to be affected by the sulphate pollution plume.		
	Intuitively, it would be expected that this raise in groundwater could result in decanting of the opencast. However, the predicted groundwater levels indicate that decanting will most probably not occur.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		LONG
	Intensity [low(1); medium(3); high(5)]		HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		PROBABLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 1) x 5 = 65 MEDIUM TO HIGH	
	With mitigation (WM)	WOM x ME = WM 65 x 0.6 = 39 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

7.4.2 Surface Water

Table 56: Surface Water – Construction Phase Impact Rating (1)

Activity	An area of 50 hectares will be cleared for construction activities.
Aspect	Wetlands

Mining Phase	Construction Phase	
Impacts	Vegetation clearance impact on wetland	
Impact description	<p>The construction phase will inevitably clear vegetation as preparation of the site. This may potentially remove or impact wetland areas on site/or in close vicinity of the site depending on the exact location of the infrastructure</p> <p>Impact on the potential wetland areas are to be reduced with proper delineation of wetland areas and planning of the site of the plant in relation to the wetland areas</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITIVE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 5 + 5) x 5 = 80 HIGH
	With mitigation (WM)	WOM x ME = WM 80 x 0.2 = 16 LOW
Significance With Mitigation (WM)	LOW	

Table 57: Surface Water – Construction Phase Impact Rating (2)

Activity	Activities increasing sedimentation and siltation <ul style="list-style-type: none"> • Clearance of vegetation to prepare site for box cut; • Storage of fuel and oil for earth moving machinery; • Cement and concrete batching; • Transportation of material to site and the storage of material on site; and • Dust as a result of construction activities • Impact on watercourses during road construction with installation of culverts for storm water diversion. 	
Aspect	Sedimentation and siltation	
Mining Phase	Construction Phase	
Impacts	Increased sediment and silt load deposition	
Impact description	<p>The construction phase will inevitably clear vegetation as preparation of the site. This will cause and increase in sediment and silt load deposition towards the Woestalleen catchment.</p> <p>Impact on the stream to be mitigated with the implementation of storm water management plan in accordance with GN 704 requirements</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 4) x 4 = 64 MEDIUM TO HIGH

	With mitigation (WM)	WOM x ME = WM 64 x 0.2 = 12.8 LOW
Significance With Mitigation (WM)	LOW	

Table 58: Surface Water – Operational Phase Impact Rating (1)

Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.	
Aspect	Regional water demand	
Mining Phase	Operational Phase	
Impacts	Reduced flows of the unnamed tributary	
Impact description	Over utilisation and injudicious use of ground and surface water resources will result in reduced flows of the unnamed tributary and subsequent Woestalleen Spruit. This will put pressure on the minimum in stream flow requirements necessary to be environmentally and socially sustainable. Judicious legal abstraction and utilisation of water that maintains the in stream flow requirements of the unnamed tributary and the wetland areas on the property.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 4) x 4 = 64 MEDIUM TO HIGH
	With mitigation (WM)	WOM x ME = WM 64 x 0.2 = 12.8 LOW
Significance With Mitigation (WM)	LOW	

Table 59: Surface Water – Operational Phase Impact Rating (2)

Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.	
Aspect	Wetlands, Aquifers and Drainage Channels	
Mining Phase	Operational Phase	
Impacts	Operational activities affecting wetlands	
Impact description	Activities either in the construction phase or operational phase that is within the vicinity of wetlands can adversely affect these wetlands and possible impact permanently on their functionality. Construction must be well monitored and must receive extra attention when approaching wetland areas. Mining box cuts to be outside the 100 meter buffer zone. Dewatering of pit water not to be discharged to the wetland system.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG

	Intensity [low(1); medium(3); high(5)]		HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 4) x 4 = 64 MEDIUM TO HIGH	
	With mitigation (WM)	WOM x ME = WM 64 x 0.6 = 38.4 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 60: Surface Water – Operational Phase Impact Rating (3)

Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.		
Aspect	Stormwater runoff		
Mining Phase	Operational Phase		
Impacts	Disruption of drainage paths		
Impact description	The disruption of drainage paths takes place due to operational opencast mining activities. Mining footprint must remain as small as possible and rehabilitation must be done where needed. Dirty stormwater to be contained in PCD's		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL	
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG	
	Intensity [low(1); medium(3); high(5)]	HIGH	
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITIVE	
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH	
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH	
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 5) x 5 = 85 HIGH	
	With mitigation (WM)	WOM x ME = WM 85 x 0.4 = 34 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 61: Surface Water – Operational Phase Impact Rating (4)

Activity	The conditions expected to prevail during the mining of the new opencast. Physical opencast mining and mineral extraction with a concurrent roll-over rehabilitation approach.		
Aspect	Surface Water Quality		
Mining Phase	Operational Phase		
Impacts	Deterioration of surface water quality		

Impact description	Inappropriate water management based on illegal discharges, dewatering of access water and diffuse pollution to cause significant degradation of water quality in Woestalleen catchment. Mining footprint to remain as small as possible with dirty stormwater to be contained in PCD's. PCD to be designed in accordance with GN 704 requirements. Managed PCD with 0.8 m free board at all times. Maintain water management and pollution control infrastructure	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITIVE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 5) x 5 = 85 HIGH
	With mitigation (WM)	WOM x ME = WM 85 x 0.6 = 51 MEDIUM
Significance With Mitigation (WM)	MEDIUM	

Table 62: Surface Water – Decommissioning and Closure Phase Impact Rating (1)

Activity	The closing of mining operations, site cleanup and rehabilitation of the mining area.	
Aspect	Decant volume	
Mining Phase	Decommissioning and closure phase	
Impacts	Deterioration of surface water quality as a result of Acid Mine Drainage	
Impact description	Impact of AMD decant on surface water quality from rehabilitated coal mine as a result of increased ingress of surface water in areas cracked areas and connected to seep zone. Impact on catchment RQO caused by long-term residual impacts to be mitigated by free draining rehabilitation, AMD and ABA modeling to understand calibration model. Closure Planning based on isolation of seep zones with clay material and compaction.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 4) x 5 = 80 HIGH
	With mitigation (WM)	WOM x ME = WM 80 x 0.6 = 48 MEDIUM
Significance With Mitigation (WM)	MEDIUM	

7.4.3 Air Quality

Table 63: Air Quality – Construction Phase Impact Rating (1)

Activity	Construction and Grading of Haul Roads <ul style="list-style-type: none"> • Scraping; • Overburden handling; • Overburden stockpiles; and • Truck transport and dumping of debris. 	
Aspect	Air quality	
Mining Phase	Construction	
Impacts	Increased dust deposition and fugitive dust emissions	
Impact description	<p>The construction of haul roads take place through removing the topsoil and then grading the exposed surface in order to achieve a smooth finish for vehicles to move on. Temporary stockpiles will be created close to the edge of the road in order to be backfilled easily once the road has expired or need to be rehabilitated. Haul trucks generate the majority of dust emissions from surface mining sites. Observations of dust emissions from haul trucks show that if the dust emissions are uncontrolled, they can be a safety hazard by impairing the operator's visibility. Substantial secondary emissions may be emitted from material moved out from the site during grading and deposited adjacent to roads (USEPA, 1996). Passing traffic can thus loosen and re-suspend the deposited material again into the air.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM $(2 + 1 + 3 + 5) \times 3 = 33$ LOW-MEDIUM
	With mitigation (WM)	WOM x ME = WM $33 \times 0.4 = 13.2$ LOW
Significance With Mitigation (WM)	LOW	

Table 64: Air Quality – Construction Phase Impact Rating (2)

Activity	Preparation of plant (crushing and screening) area <ul style="list-style-type: none"> • Clearing of area for infrastructure; • Overburden handling; • Overburden stockpiles; and • Truck transport and dumping of debris. 	
Aspect	Air quality	
Mining Phase	Construction	
Impacts	Increased dust deposition and fugitive dust emissions	
Impact description	<p>Material will be removed by using a bulldozer and then storing this material separately for use during rehabilitation at end of life of mine when the operation cease. These construction sites are ideal for dust suppression measures as land disturbance from clearing and excavation generates a large amount of soil disturbance and open space for wind to pick up dust particles and deposit it elsewhere (wind erosion). Issues with dust can also arise during the transportation of the extracted material, usually by truck and shovel methods, to the stock piles. The dust can further be created by the entrainment from the vehicle itself or due to dust blown from the back of the bin of the trucks during transportation of material to and from stockpiles.</p>	

Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 1 + 3 + 5) x 3 = 33 LOW-MEDIUM
	With mitigation (WM)	WOM x ME = WM 33 x 0.4 = 13.2 LOW
Significance With Mitigation (WM)	LOW	

Table 65: Air Quality – Construction Phase Impact Rating (3)

Activity	Establishment of mining operations <ul style="list-style-type: none"> Removal of overburden; and Setting up of site offices and workshop 	
Aspect	Air quality	
Mining Phase	Construction	
Impacts	Increased dust deposition and fugitive dust emissions	
Impact description	Opencast mining will commence with the clearing of the site and stripping of the vegetation for the initial boxcut. Topsoil and overburden need to be removed and stockpiled separately by means of truck and shovel methods (front end loaders, excavators and haul trucks). Once the rock has been reached will blasting be required to further remove material to the point where the mineral can be extracted. Bulldozing, excavation, drilling and blasting operations will result in the emission of dust to atmosphere.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT-MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 2 + 3 + 5) x 4 = 48 MEDIUM
	With mitigation (WM)	WOM x ME = WM 48 x 0.6 = 28.8 LOW TO MEDIUM
Significance With Mitigation (WM)	LOW TO MEDIUM	

Table 66: Air Quality – Operational Phase Impact Rating (1)

Activity	<p>The following activities during the operational phase are identified as possible fugitive emission sources</p> <ul style="list-style-type: none"> • Removal of overburden and backfilling when possible; • Use and maintenance of haul roads (incl. transportation of coal to washing plant off site); • Removal of coal (mining process) and ROM coal Stockpile; and • Concurrent roll-over backfill rehabilitation and replacement of overburden, topsoil and revegetation. 	
Aspect	Air quality	
Mining Phase	Operation	
Impacts	Increased dust deposition and fugitive dust emissions	
Impact description	<p>The primary procedures that will be implemented during the mining process that will cause dust include;</p> <ul style="list-style-type: none"> • Removing and stockpiling of topsoil; • Construction of the pollution control evaporation dam(s) also used for dust suppression; • Trenching around the mining footprint to ensure stormwater is diverted away from the open cast pit; • Stripping and stockpiling of overburden; • Excavation of the initial strip of the box-cut; • Excavation of coal (ROM); • Crushing, screening and stockpiling coal; • Backfill rehabilitation concurrently as mine progress forward. 	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	$(\text{Extent} + \text{Duration} + \text{Intensity} + \text{Probability}) \times \text{WF} = \text{WOM}$ $(2 + 4 + 3 + 5) \times 5 = 70$ MEDIUM TO HIGH
	With mitigation (WM)	$\text{WOM} \times \text{ME} = \text{WM}$ $70 \times 0.4 = 28$ LOW TO MEDIUM
Significance With Mitigation (WM)	LOW TO MEDIUM	

Table 67: Air Quality – Operational Phase Impact Rating (2)

Activity	Drilling/blasting hard overburden	
Aspect	Air quality	
Mining Phase	Operation	
Impacts	Increased dust deposition, fugitive dust and gas emissions	
Impact description	<p>At surface and underground mines, miners routinely detonate explosives to break the overburden, coal, ore or host rock into smaller pieces that can be readily transported for processing, beneficiation or disposal. The detonation of explosives generates potentially harmful dust and also gases such as carbon dioxide, carbon monoxide, oxides of nitrogen, ammonia, and sulfur dioxide. The amount of dust and gases generated depend upon the composition of the explosive and the material undergoing blasting.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT
	Intensity [low(1); medium(3); high(5)]	HIGH

	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	LOW-MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 1 + 5 + 5) x 5 = 65 MEDIUM TO HIGH
	With mitigation (WM)	WOM x ME = WM 65 x 0.8 = 52 MEDIUM
Significance With Mitigation (WM)	MEDIUM	

Table 68: Air Quality – Closure and Decommissioning Phase Impact Rating (1)

Activity	<p>The following activities during the decommissioning phase are identified as possible air impacting sources and may impact on the ambient air quality at the relevant noise sensitive receivers:</p> <ul style="list-style-type: none"> • Demolition & Removal of all infrastructure (incl. transportation off site); and • Rehabilitation (spreading of soil, revegetation & profiling/contouring); 	
Aspect	Air quality	
Mining Phase	Closure and decommissioning	
Impacts	Increased dust deposition and fugitive dust emissions	
Impact description	<p>Possible sources of fugitive dust emission during the closure and post-closure phase include:</p> <ul style="list-style-type: none"> • Smoothing of stockpiles by bulldozer; • Grading of sites; • Transport and dumping of overburden for filling; • Infrastructure demolition; • Infrastructure rubble piles; • Transport and dumping of building rubble; • Transport and dumping of topsoil; and • Preparation of soil for revegetation – ploughing and addition of fertiliser, compost etc. 	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT-MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	LOW-MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 2 + 3 + 4) x 5 = 55 MEDIUM
	With mitigation (WM)	WOM x ME = WM 55 x 0.2 = 31 LOW TO MEDIUM
Significance With Mitigation (WM)	LOW TO MEDIUM	

7.4.4 Noise

Table 69: Noise – Construction and Operational Phase Impact Rating (1)

Activity	<p>The following activities during the construction and operational phase are identified as possible noise sources</p> <ul style="list-style-type: none"> • Removal of overburden and backfilling when possible; • Use and maintenance of haul roads (incl. transportation of coal to washing plant off site); • Removal of coal (mining process) and ROM coal Stockpile; and • Concurrent roll-over backfill rehabilitation and replacement of overburden, topsoil and revegetation. 	
Aspect	Noise	
Mining Phase	Construction and Operation	
Impacts	Increased ambient noise	
Impact description	<p>The construction machinery will be a source of continuous noise throughout the construction and operational phase. The blasting activities during the construction and operational phase are identified as the highest noise producing source, the noise from blasting is called impulsive noise, it is brief and abrupt, and its startling effect causes greater annoyance than would be expected from continuous noise sources.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	LOW-MEDIUM
Significance	Without mitigation (WOM)	<p>(Extent + Duration + Intensity + Probability) x WF = WOM</p> <p>(2 + 4 + 3 + 4) x 5 = 65</p> <p>MEDIUM TO HIGH</p>
	With mitigation (WM)	<p>WOM x ME = WM</p> <p>65 x 0.8 = 52</p> <p>MEDIUM</p>
Significance With Mitigation (WM)	MEDIUM	

Table 70: Noise – Closure and Decommissioning Phase – Impact Rating (1)

Activity	<p>The following activities during the decommissioning phase are identified as possible noise sources and may impact on the ambient noise level at the relevant noise sensitive receivers:</p> <ul style="list-style-type: none"> • Demolition & Removal of all infrastructure (incl. transportation off site); and • Rehabilitation (spreading of soil, revegetation & profiling/contouring); 	
Aspect	Noise	
Mining Phase	Closure and Decommissioning Phase	
Impacts	Increased ambient noise	
Impact description	<p>The machinery involved with the above mentioned activities will be a source of continuous noise throughout the decommissioning phase. The results will be similar to that of the construction phase with regards to the expected noise levels although blasting will not occur, therefore it is probable that the noise from the proposed mining activities will be similar or lower to that of the current ambient noise levels at the indicated noise sensitive receivers.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT-MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM

	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		LOW-MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 2 + 3 + 4) x 5 = 55 MEDIUM	
	With mitigation (WM)	WOM x ME = WM 55 x 0.8 = 44 MEDIUM	
Significance With Mitigation (WM)	MEDIUM		

7.4.5 Archaeological

Table 71: Archaeological – Construction, Operation, Closure and Decommissioning Phase – Impact Rating (1)

Table 11: Archaeological Construction, Operational, Closure and Decommissioning Phase Impact Rating (1)			
Activity	All mining associated activities during the construction, operation, closure and decommissioning phases of the project that might potentially impact the identified sites of archaeological importance.		
Aspect	Archaeology		
Mining Phase	Construction, Operational and Closure & Decommissioning Phase		
Impacts	Potential impacts on identified archaeological sites		
Impact description	One graveyard and on isolated grave were observed on the section demarcated for development on Portion 17 of the farm Roodepoort 151 IS. It is unknown whether the graveyard is still in use, but it is assumed that there are no recent burials due to the absence of head stones with dates, fences, other artefacts associated with graves or the presence of recent activity. Because of the proximity of sensitive areas to the planned development, it is likely that they will be impacted on. Also, no mining activities or development should take place within a radius of 15 m of the fences.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		LONG
	Intensity [low(1); medium(3); high(5)]		MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 3 + 2) x 4 = 44 MEDIUM	
	With mitigation (WM)	WOM x ME = WM 44 x 0.6 = 26.4 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

7.4.6 Paleontological

Table 72: Paleontological – Construction, Operation, Closure and Decommissioning Phase – Impact Rating (1)

Activity	All mining associated activities during the construction, operation, closure and decommissioning phases of the project that might potentially impact the identified sites of archaeological importance.		
Aspect	Palaeontology		
Mining Phase	Construction, Operational and Closure & Decommissioning Phase		

Impacts	Potential impacts on Paleontological heritage	
Impact description	<p>The potential negative impacts of the proposed project on the paleontological heritage of the proposed Roodepoort Coal Mine are:</p> <ul style="list-style-type: none"> • Damage or destruction of fossil materials during the construction of project infrastructural elements to a maximum depth of those excavations. Many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of the projects infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s). • Movement of fossil materials during the construction phase, such that they are no longer <i>in situ</i> when discovered. The fact that the fossils are not <i>in situ</i> would either significantly reduce or completely destroy their scientific significance. • The loss of access for scientific study to any fossil materials present beneath infrastructural elements for the life span of the existence of those constructions and facilities. <p>The Vryheid Formation is well known for its contained plant macrofossil and trace fossil assemblages, however, no fossil materials were located during the conduct of the field investigation.</p> <p>Given the combination of factors discussed above, it is anticipated that as long as the adequate mitigation protocols are emplaced little to no negative effect on the paleontological heritage of the area is anticipated.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	PERMANENT
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	$(\text{Extent} + \text{Duration} + \text{Intensity} + \text{Probability}) \times \text{WF} = \text{WOM}$ $(2 + 5 + 5 + 2) \times 5 = 70$ MEDIUM TO HIGH
	With mitigation (WM)	$\text{WOM} \times \text{ME} = \text{WM}$ $70 \times 0.2 = 14$ LOW
Significance With Mitigation (WM)	LOW	

7.4.7 Visual

Table 73: Visual – Construction, Operation, Closure and Decommissioning – Impact Rating (1)

Activity	All mining associated activities during the construction, operation, closure and decommissioning phases of the project that might potentially result in visual impacts.
Aspect	Visual
Mining Phase	Construction, Operational and Closure & Decommissioning Phase
Impacts	Visual and aesthetic impacts due to mining activities

Impact description	Viewpoints have been selected based on prominent viewing positions in the area. The selected viewpoints and view corridors are used as a basis for determining potential visual ability and visual impacts of the proposed mine activities. Three viewpoints were identified based on sensitivity and visual impact of the area.	
	Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed mine activities and associated infrastructure were not visible, no visual impact would occur. Visual exposure is determined by the view shed or the view catchment being the area within which the proposed development will be visible.	
	Visual sensitivity can be determined by a number of factors in combination, such as prominent topographic or other scenic features, including: <ul style="list-style-type: none">• High points, ridges and spurs (visible from a greater distance and determines the horizon effects);• Steep slopes (tends to be more prominent and visible from a distance);• Axial vistas.	
	Landscape integrity is visual qualities represented by the following qualities, which enhance the visual and aesthetic experience of the area: <ul style="list-style-type: none">• Intactness of the natural and cultural landscape;• Lack of visual intrusions or incompatible structures;• Presence of a 'sense of place'.	
	The Visual Absorption Capacity (VAC) is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing, sparse and patchy vegetation will have a low VAC. Topography and built forms have the capacity to 'absorb' visual impact. The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate potential visual absorption capacity (VAC). It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, topography and structures.	
	The construction and operation of the Kebrafield Roodepoort Mine related activities and its associated infrastructure will have a visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact can be decreased to a point where the visual impact can be seen as insignificant.	
	The moderating factors of the visual impact of the facility in the close range are the following: <ul style="list-style-type: none">• Short exposure time of road users• The time the structure will be visual due to roll-over mining• Number of human inhabitants located in the area• Natural topography and vegetation• Mitigation measures that will be implemented such as the establishment of barriers or screens• The size of the operation• Medium to high absorption capacity of the landscape	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM

Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 4) x 4 = 52 MEDIUM
	With mitigation (WM)	WOM x ME = WM 52 x 0.6 = 31.2 LOW TO MEDIUM
Significance With Mitigation (WM)	LOW TO MEDIUM	

7.4.8 Ecological

Table 74: Ecological – Construction Phase – Impact Rating (1)

Activity	Constructional phase activities – increased traffic and personnel, heavy construction vehicle movement and operation, soil compaction, storing of materials and construction material preparation.	
Aspect	Natural environment	
Mining Phase	Construction phase	
Impacts	Impacts on the natural environment	
Impact description	The construction activities might result in impacts to the natural environment due to increased traffic and construction personnel to the area. Constructing activities and heavy construction vehicles might result in compaction of the soil. Storing of construction material, mixing of concrete or collection and delivering could result in pollution. Pristine areas will be severely impacted if not managed well.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 4) x 4 = 64 MEDIUM TO HIGH
	With mitigation (WM)	WOM x ME = WM 64 x 0.6 = 38.4 LOW TO MEDIUM
Significance With Mitigation (WM)	LOW TO MEDIUM	

Table 75: Ecological – Construction Phase – Impact Rating (2)

Activity	Site clearance and removal of vegetation	
Aspect	Plant species	
Mining Phase	Construction phase	
Impacts	Clearance of vegetation	
Impact description	Most of the impacts on plant species will occur during the construction phase. The species found at site 2 will be completely destroyed and cleared for construction to take place. Pathways should be clearly demarcated and kept to.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	FOOTPRINT
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	PERMANENT
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH

Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		LOW-MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (1 + 5 + 5 + 5) x 5 = 80 HIGH	
	With mitigation (WM)	WOM x ME = WM 80 x 0.8 = 64 MEDIUM TO HIGH	
Significance With Mitigation (WM)	MEDIUM TO HIGH		

Table 76: Ecological – Construction Phase – Impact Rating (3)

Activity	Site clearance, removal of vegetation, opencast pit construction.		
Aspect	Animal species		
Mining Phase	Construction phase		
Impacts	Habitat destruction and sensitive species disturbance		
Impact description	The removal of vegetation (open cast mining) in Portion 17 will result in the destruction of macro- and microhabitats. It might also result in the disturbance of sensitive animal species identified within the body of the text, especially the animals that are dependent on the water body. This will lead to increases in inter- and intra-specific competition between species for the remaining habitats and food. The result is the out competing of individuals and certain species.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE	
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG	
	Intensity [low(1); medium(3); high(5)]	HIGH	
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE	
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH	
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH	
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 5 + 5) x 5 = 80 HIGH	
	With mitigation (WM)	WOM x ME = WM 80 x 0.4 = 32 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 77: Ecological – Construction Phase – Impact Rating (4)

Activity	Opencast pit construction		
Aspect	Animal species		
Mining Phase	Construction phase		
Impacts	Destruction and degradation of habitats and food		
Impact description	The possible drainage (due to open cast mining) of the wetland areas within in Portion 17 will result in the destruction of aquatic habitat for the sensitive species identified within the document (Otter, Butterfly, Golden Mole & Waterbirds). This will lead to destruction and degradation of habitats and food.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL	
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG	
	Intensity [low(1); medium(3); high(5)]	HIGH	
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE	
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH	

Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 2) x 5 = 70 MEDIUM TO HIGH	
	With mitigation (WM)	WOM x ME = WM 70 x 0.4 = 28 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 78: Ecological – Operational Phase – Impact Rating (1)

Activity	Increased traffic and personnel, heavy machinery and vehicle operation and soil compaction.		
Aspect	Natural environment		
Mining Phase	Operational phase		
Impacts	Soil compaction		
Impact description	The operational activities might result in impacts to the natural environment due to increased traffic and personnel to the area. Activities and heavy vehicles might result in compaction of the soil.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		FOOTPRINT
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		LONG
	Intensity [low(1); medium(3); high(5)]		MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (1 + 4 + 3 + 4) x 3 = 36 LOW TO MEDIUM	
	With mitigation (WM)	WOM x ME = WM 36 x 0.6 = 21.6 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 79: Ecology – Operational Phase – Impact Rating (2)

Activity	Increased traffic, vehicle movement on site, disturbance of the areas adjacent to the site and dust generation due to operational activities		
Aspect	Plant species		
Mining Phase	Operational phase		
Impacts	Exotic/invasive species, wetland disturbance and dust		
Impact description	Once in operation the mine may have an increase of traffic in the area. Pathways should be clearly demarcated and kept to. Exotic/invasive species may become established. Native and endemic species may become threatened. Wetland areas may be disturbed. Dust from open cast mining may increase tremendously.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE	
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG	
	Intensity [low(1); medium(3); high(5)]	MEDIUM	
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	LIKELY	

Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 3 + 3) x 3 = 36 LOW TO MEDIUM	
	With mitigation (WM)	WOM x ME = WM 36 x 0.4 = 14.4 LOW	
Significance With Mitigation (WM)	LOW		

Table 80: Ecology – Operational Phase – Impact Rating (3)

Activity	Physical opencast mining, crushing and screening, vehicle and machinery operation and human movement		
Aspect	Animal species		
Mining Phase	Operational phase		
Impacts	Damage and destruction of habitats, noise, habitat fragmentation and disturbance		
Impact description	<ul style="list-style-type: none">The damage to plant communities will result in the destruction of microhabitats and burrows of animals. It might also result in the disturbance of sensitive animal species.Noises during the operational phase due to blasting and other mining activities will result in a less favourable habitat for species and several communities may seek other more favourable areas to inhabit.Fragmentation of habitat areas due to fencing and activity will fragment ranges that certain areas may need to sustain adequate foraging area and breeding grounds.Anthropogenic influence stemming from workers that infiltrate/penetrate the natural veld areas will damage and impact on species communities within certain areas.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE	
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG	
	Intensity [low(1); medium(3); high(5)]	HIGH	
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE	
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 5 + 5) x 5 = 80 HIGH	
	With mitigation (WM)	WOM x ME = WM 80 x 0.2 = 16 LOW	
Significance With Mitigation (WM)	LOW		

Table 81: Ecology – Decommissioning and Closure Phase – Impact Rating (1)

Activity	Site decommissioning, closure and rehabilitation		
Aspect	Natural environment		
Mining Phase	Decommissioning and closure		
Impacts	Damage and destruction of habitats, noise, habitat fragmentation and disturbance		
Impact description	Increased activity and traffic within a shorter timeframe (closure phase) may degrade the area		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE	

	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT-MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 2 + 3 + 2) x 3 = 27 LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM 27 x 0.4 = 10.8 LOW
Significance With Mitigation (WM)	LOW	

Table 82: Ecology – Decommissioning and Closure Phase – Impact Rating (2)

Activity	Site decommissioning, closure and rehabilitation	
Aspect	Plant species	
Mining Phase	Decommissioning and closure	
Impacts	Unsuccessful rehabilitation – non self-sustaining environment	
Impact description	Most of the impacts on plant species will occur during the construction- and operational phases. Final steps in the rehabilitation process will take place. Without the necessary mitigation measures, rehabilitation will be unsuccessful and the environment will not be self-sustaining. If these mitigation measures are not planned well in advance before the rehabilitation phase commences, the rehabilitation process will be unsuccessful.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT-MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 3 + 3 + 2) x 4 = 40 LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM 40 x 0.4 = 16 LOW
Significance With Mitigation (WM)	LOW	

Table 83: Ecology – Decommissioning and Closure Phase – Impact Rating (3)

Activity	Site decommissioning, closure and rehabilitation	
Aspect	Animal species	
Mining Phase	Decommissioning and closure	
Impacts	Microhabitat and burrow formation	
Impact description	The completion of the decommissioning process might create microhabitats and burrows that had been destroyed in the construction/operational phase. The impact is therefore seen as minimal and animals will start to inhabit previous areas that have been deemed inhabitable due to activity and noises.	

Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	SHORT-MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 2 + 3 + 2) x 3 = 27 LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM 27 x 0.4 = 10.8 LOW
Significance With Mitigation (WM)	LOW	

7.4.9 Socio-economical

Table 84: Socio-economic – Construction Phase – Impact Rating (1)

Activity	Job creation	
Aspect	Socio-economic	
Mining Phase	Construction Phase	
Impacts	Creation of more employment opportunities	
Impact description	Approximately more than 100 direct jobs will be created which will be a mix of skilled (e.g. engineers, land surveyors, project managers), semi-skilled (e.g. equipment operators, vehicle drivers) and non skilled (e.g. manual labourers) positions.	
	The jobs created are mainly associated with the construction of various infrastructure that is required at a mine e.g. roads, offices, stores, dams, fences, etc. A portion of the jobs created should be made available to local community members particularly the historically disadvantaged (HD) ones.	
	Additional, complementary local jobs other than those directly associated with the construction of mine infrastructure might also be created. These include businesses such as catering grocery, plant hire / supply, cleaning, transport, security, rental of accommodation, clothing stores, training facilities etc.	
	All the above have the net effect of transforming the town of Pullen's Hope into a stature almost similar to that of Hendrina. Furthermore, the income generated will add to the much needed revenue that will be collected by the Steve Tshwete LM.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 4) x 3 = 39 LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM 39 x 0.2 = 7.8 LOW

Significance With Mitigation (WM)	LOW
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Table 85: Socio-economic – Construction Phase – Impact Rating (2)

Activity	Social effect of job creation by the mine	
Aspect	Socio-economic	
Mining Phase	Construction Phase	
Impacts	Disruption of existing family structures and negative impacts due to social interaction of mine workers with local community	
Impact description	<p>Disruption of existing family structures and social networks due to the in migration of workers and job seekers into the area and possible relocation of households that are too near the mine site.</p> <p>The movement of people particularly males into the local municipality may lead to incidences such as increased crime levels for those who are not able to secure employment; dilution of family values leading to behaviours such as prostitution, promiscuity, teenage pregnancies and alcohol and drug abuse; increased number of people infected with HIV/AIDs and Sexually Transmitted Diseases (STDs).</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 3) x 3 = 36 LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM 39 x 0.2 = 7.2 LOW
Significance With Mitigation (WM)	LOW	

Table 86: Socio-economic – Construction Phase – Impact Rating (3)

Activity	Presence and movement of mine workers	
Aspect	Socio-economic	
Mining Phase	Construction Phase	
Impacts	Damage to infrastructure on surrounding properties	
Impact description	Increased risk of damage to infrastructure on surrounding properties. The presence of workers at the site and their constant movement and activities could potentially result in veld fire incidences, damage to fences, gates, crops and possible death of livestock.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	LOW
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	LOW-MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (1 + 3 + 1 + 2) x 2 = 14 LOW

	With mitigation (WM)	WOM x ME = WM 14 x 0.4 = 5.6 LOW
Significance With Mitigation (WM)	LOW	

Table 87: Socio-economic – Construction Phase – Impact Rating (4)

Activity	Movement of vehicles and trucks	
Aspect	Socio-economic	
Mining Phase	Construction Phase	
Impacts	Reduced quality of life	
Impact description	Reduced quality of life of the community in terms of physical and psychological health. During construction, many trucks, cars, and equipment such as fork lifts, cranes, and excavators will be in use at the site. This might lead to damage of existing roads; decreased safety of pedestrians and other road users; increase in traffic, increase in dusty and noisy conditions; improper waste management; and contamination of ground and surface water resources. Presently, the roads in Pullen's Hope are tarred and in a fairly good condition.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 3) x 3 = 36 LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM 36 x 0.4 = 14.4 LOW
Significance With Mitigation (WM)	LOW	

Table 88: Socio-economic – Construction Phase – Impact Rating (5)

Activity	Construction activities resulting in damage to agricultural land and infrastructure	
Aspect	Socio-economic	
Mining Phase	Construction Phase	
Impacts	Financial loss due to damage to farming land and infrastructure	
Impact description	Damage to farming land and infrastructure such as buildings and roads due to construction activities may result in huge financial losses (repair costs, demolitions or decreased property values) and loss of land for cultivation and grazing particularly on surrounding farm portions. Blasting of the ground for establishment of foundations might cause sink holes, underground fires or reduce stability of the land. This impact is critical because rural folk mainly rely on natural resources to sustain their livelihoods	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH

Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 3) x 3 = 36 LOW TO MEDIUM
	With mitigation (WM)	WOM x ME = WM 36 x 0.4 = 14.4 LOW
Significance With Mitigation (WM)	LOW	

Table 89: Socio-economic – Operational Phase – Impact Rating (1)

Activity	Job creation	
Aspect	Socio-economic	
Mining Phase	Operational Phase	
Impacts	Creation of jobs	
Impact description	<p>The operation of the mine will create a number of full time direct jobs which will be created which will be a mix of skilled (e.g. engineers, land surveyors, project managers), semi-skilled (e.g. equipment operators, vehicle drivers) and non skilled (e.g. manual labourers) positions.</p> <p>Additional, complementary local jobs other than those directly associated with the operation of the mine infrastructure might also be created. These include businesses such as catering grocery, plant hire / supply, cleaning, transport, security, rental of accommodation, clothing stores, training facilities etc.</p> <p>All the above have the net effect of transforming the town of Pullen's Hope into a stature almost similar to that of Hendrina. Furthermore, the income generated will add to the much needed revenue that will be collected by the Steve Tshwete LM.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	MEDIUM
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	LOW
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 5 + 4) x 4 = 60 MEDIUM TO HIGH
	With mitigation (WM)	WOM x ME = WM 60 x 1.0 = 60 MEDIUM TO HIGH
Significance With Mitigation (WM)	MEDIUM TO HIGH	

Table 90: Socio-economic – Operational Phase – Impact Rating (2)

Activity	Job creation and generation of wealth for labourers	
Aspect	Socio-economic	
Mining Phase	Operational Phase	
Impacts	Increased disposable income	
Impact description	<p>The employment of workers at the mine will lead to an increase in disposable income in the town of Pullen's hope. These workers will spur economic growth by spending money in the local towns by shopping for household items, clothing, and spending money in entertainment areas and by rental or purchase of property.</p>	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	REGIONAL

	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		LONG
	Intensity [low(1); medium(3); high(5)]		HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		LOW
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 5) x 4 = 68 MEDIUM TO HIGH	
	With mitigation (WM)	WOM x ME = WM 68 x 1.0 = 68 MEDIUM TO HIGH	
Significance With Mitigation (WM)	MEDIUM TO HIGH		

Table 91: Socio-economic – Operational Phase – Impact Rating (3)

Activity	Job creation and generation of wealth for labourers		
Aspect	Socio-economic		
Mining Phase	Operational Phase		
Impacts	Increased quality of life		
Impact description	The operation of the mine may lead to an improvement of the quality of life of the community due to an increase in income levels.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		LONG
	Intensity [low(1); medium(3); high(5)]		HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 5 + 5) x 4 = 68 MEDIUM TO HIGH	
	With mitigation (WM)	WOM x ME = WM 68 x 0.4 = 27.2 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 92: Socio-economic – Operational Phase – Impact Rating (4)

Activity	Alteration of the physical landscape		
Aspect	Socio-economic		
Mining Phase	Operational Phase		
Impacts	Disruption/modification of sense of place		
Impact description	Disruption / modification of the sense of place and visual landscape. Currently, the proposed site is being used for maize cultivation which is a typical rural land use.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		MEDIUM
	Intensity [low(1); medium(3); high(5)]		MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM-HIGH

Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 5) x 4 = 56 MEDIUM TO HIGH	
	With mitigation (WM)	WOM x ME = WM 56 x 0.4 = 22.4 LOW TO MEDIUM	
Significance With Mitigation (WM)	LOW TO MEDIUM		

Table 93: Socio-economic – Operational Phase – Impact Rating (5)

Activity	Impact of mining on the community		
Aspect	Socio-economic		
Mining Phase	Operational Phase		
Impacts	Reduced quality of life		
Impact description	Reduced quality of life of the community in terms of physical and psychological health. During operation, many trucks, cars, and equipment such as fork lifts, cranes, and excavators will be in use at the site. This might lead to damage of existing roads; decreased safety of pedestrians and other road users; increase in traffic, increase in dusty and noisy conditions; improper waste management; and contamination of ground and surface water resources.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		MEDIUM
	Intensity [low(1); medium(3); high(5)]		MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		POSSIBLE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 3 + 3 + 2) x 4 = 44 MEDIUM	
	With mitigation (WM)	WOM x ME = WM 44 x 0.4 = 17.6 LOW	
Significance With Mitigation (WM)	LOW		

Table 94: Socio-economic – Operational Phase – Impact Rating (6)

Activity	Job creation as a result of mining		
Aspect	Socio-economic		
Mining Phase	Operational Phase		
Impacts	Contribution to national economy		
Impact description	The mine will contribute to the growth of the national economy by creating employment opportunities which consequently improves the lives of the employees and the communities in which they live. In addition, the coal mined will be supplied to the Hendrina Power Station so as to generate electricity that is distributed around the country.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	NATIONAL	
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG	
	Intensity [low(1); medium(3); high(5)]	HIGH	
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE	
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH	

Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		LOW
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (5 + 4 + 5 + 5) x 5 = 95 HIGH	
	With mitigation (WM)	WOM x ME = WM 95 x 1.0 = 95 HIGH	
Significance With Mitigation (WM)	HIGH		

Table 95: Socio-economic – Decommissioning and Closure Phase – Impact Rating (1)

Activity	Rehabilitation and restoration		
Aspect	Socio-economic		
Mining Phase	Decommissioning and Closure Phase		
Impacts	Impact on surrounding community		
Impact description	The proposed mine is expected to last for approximately 3 years after which it will need to be decommissioned. This may involve the demolition of the infrastructure, removal of equipment, and rehabilitation of the entire status to the natural state that it was in originally. Few job opportunities will be available during decommissioning and will only be temporary in nature. Furthermore, those employed at the mine will be laid off which has a negative spin off on their dependents and community in which they are based. This therefore, highlights the critical importance of a Social and Labour Plan in which the mine owners must fund and facilitate implementation of programmes that ensure the livelihoods of the community are protected throughout the life of the mine up to decommissioning. A positive impact of the decommissioning is that after rehabilitation, the natural environment will be restored to a post mining condition and also the site can be used for cultivation or livestock grazing which the local community can use to sustain their livelihood.		
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]		REGIONAL
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]		LONG
	Intensity [low(1); medium(3); high(5)]		MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]		HIGHLY LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]		MEDIUM
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]		MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (3 + 4 + 3 + 4) x 3 = 42 MEDIUM	
	With mitigation (WM)	WOM x ME = WM 42 x 0.4 = 16.8 LOW	
Significance With Mitigation (WM)	LOW		

7.4.10 Land Capability

Table 96: Land Capability – Construction, Operation and Decommissioning and Closure Phase – Impact Rating (1)

Activity	Soil stripping during construction of the mine		
Aspect	Land Capability		
Mining Phase	Construction, Operation and Decommissioning Phase		
Impacts	Soil loss		

Impact description	This is due to stripping, handling and placement of the soil associated with the pre-construction land clearing and rehabilitation. Loss of soil may also lead to a decline in agricultural potential.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 3 + 3) x 4 = 40 MEDIUM
	With mitigation (WM)	WOM x ME = WM 40 x 0.4 = 16 LOW
Significance With Mitigation (WM)	LOW	

Table 97: Land Capability – Construction, Operation and Decommissioning and Closure Phase – Impact Rating (2)

Activity	Soil contamination	
Aspect	Land Capability	
Mining Phase	Construction, Operation and Decommissioning Phase	
Impacts	Change to soil's physical, chemical and biological properties	
Impact description	There is a high probability that topsoil will be lost due to wind and water erosion, which will alter the soils properties. Stockpiling and subsequent mixing of soil layers during handling will ultimately have a negative effect on altering the basic soil properties. The effect on soils may lead to loss of agricultural potential and subsequent decrease in regional food production/ food security.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	MEDIUM
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	HIGHLY-LIKELY
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	MEDIUM-HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 3 + 4) x 4 = 52 MEDIUM
	With mitigation (WM)	WOM x ME = WM 40 x 0.4 = 16 LOW
Significance With Mitigation (WM)	LOW	

7.4.11 Traffic

Table 98: Traffic - Construction, Operation and Decommissioning and Closure Phase – Impact Rating (1)

Activity	Vehicle movement and traffic increase as a result of mining
Aspect	Traffic
Mining Phase	Construction, Operation and Decommissioning Phase
Impacts	Change to the traffic flow volumes and impact on roads

Impact description	Due to the establishment of mine the regional traffic flow will be affected as a result of increased vehicle loads on the roads and also an increased flow in traffic. Extra pressure on the roads will result in degradation of the existing roads.	
Magnitude	Extent [footprint(1); site(2); regional(3); national(4); international(5)]	SITE
	Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]	LONG
	Intensity [low(1); medium(3); high(5)]	HIGH
	Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]	DEFINITE
Weighting factor (WF)	WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]	HIGH
Mitigation Efficiency (ME)	ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]	MEDIUM-HIGH
Significance	Without mitigation (WOM)	(Extent + Duration + Intensity + Probability) x WF = WOM (2 + 4 + 5 + 5) x 5 = 80 HIGH
	With mitigation (WM)	WOM x ME = WM 80 x 0.4 = 32 LOW TO MEDIUM
Significance With Mitigation (WM)	LOW TO MEDIUM	

7.5 Cumulative Impact Assessment

Cumulative environmental impacts generally refer to impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project in question, in this case the Kebrafield Roodepoort Colliery.

A summary of potential cumulative impacts that are expected to occur in the region is provided in the following table.

Nature of the impacts	Effects	Extent
Contributing to energy security in the country as a result of mining coal	Positive	National
Local economic diversification	Positive	Local and regional
Improved standard of living of the directly and indirectly affected households through job creation. Mining will support hundreds of families with a multiplier effect of around four (4).	Positive	Regional and national
Urban sprawl and/or expansion of informal settlements.	Negative	Local
Added pressure on local service delivery and infrastructure, including roads, water and sewage treatment works, schools, police services and waste management facilities.	Negative	Local
The use of imported labour, due to unavailability of local skilled labourers causing tension in local communities.	Negative	Local
Traffic will be increased as a result of expected trips generated by the proposed development during the construction, operation and decommission / close phases. This may lead to increased safety risks such as road accidents, which result in injuries and/or fatalities.	Negative	Local and regional
Potential significant negative changes in the air quality of the district as a cumulative effect due to other activities in the region already impacting on the air quality	Negative	Local and regional
The topography and landscape character will be altered and the overall visual	Negative	Local

resource of the area will be changed, affecting receptors located within close proximity. The negative impact can be mitigated to a degree, but the landscape character of the region will be changed from agricultural to mining and then again back to agricultural.		
Conservation of areas (especially wetlands) around the proposed infrastructure for this project and others with wildlife corridors and green belts, as well as a rehabilitation plan can have a positive impact on the environment.	Positive	Local
The predicted PM2.5 and PM10 concentrations for cumulative impacts (taking into consideration the annual average measured baseline PM2.5 and PM10 concentrations) may be in non-compliance with NAAQS at the closest identified sensitive receptors to the operations due to elevated background particulate levels.	Negative	Local
Construction and operational activities, such as construction of mining infrastructure, fencing of project areas, vegetation removal, transportation of material and generation of waste, amongst others, will negatively affect species populations and habitats. This in turn will negatively impact on the status of the regional biodiversity and terrestrial ecology.	Negative	Local and Regional
Increased industrial development and mining activities will result in the introduction and increase of alien vegetation and foreign species. The general functioning and provision of ecosystem services in the greater area ecosystem will subsequently be reduced and impaired.	Negative	Local and regional

8. Environmental Management Programme

CONSTRUCTION PHASE

ASPECT	IMPACT	MANAGEMENT & MITIGATION MEASURES
Groundwater	Oil, diesel and chemical spills from machinery	<ul style="list-style-type: none"> It must be ensured that a credible company removes used oil after vehicle servicing. A sufficient supply of absorbent fibre should be kept at the site to contain accidental spills Store all potential sources in secure facilities with appropriate storm water management, ensuring contaminants are not released into the environment.
Groundwater	Contamination potential of mine material exposed during mine construction	<ul style="list-style-type: none"> Ensure that the appropriate design facilities (berms, storm water channels etc.) are constructed before constructing the coal handling facilities and boxcuts. Implement the EMP's of other environmental related aspects, including pollution prevention and impact minimisation. Groundwater monitoring boreholes should be sited with the aid of geophysics at designated positions based on final infrastructure layout, to comply with the design requirements of a groundwater monitoring system, as recommended. Groundwater monitoring boreholes should be installed to comply with the minimum requirements as set by governmental guidelines.
Groundwater	General	<ul style="list-style-type: none"> All the monitoring data needs to be collated and analysed on at least a bi-annual basis and included in management reports. This information will also be required by government departments (Department of Water Affairs, Department of Environmental Affairs) for compliance monitoring. After 2 years from start of mining, the monitoring information collated should be used to update the groundwater flow and geochemical models. These models should thereafter be updated so that sufficient mitigation measures can be implemented. Management and mitigation plans should be continuously adapted using the monitoring data.
Surface Water	Increased sediment generation	<ul style="list-style-type: none"> Strict erosion control No development within riparian zone Access roads to be well maintained Stream-bank at dam spillway and downstream of dam to be well protected against flood damage and erosion
Surface Water	Pollution of stream	<ul style="list-style-type: none"> Zero effluent discharge policy from Roodepoort Colliery (no discharge to dam or stream) Strict regulatory control on all water containing waste generated and disposal of effluent (WWTW)
Surface Water	Damage to riparian vegetation	<ul style="list-style-type: none"> Introduce strict rehabilitation programme with erosion control and re-vegetation of disturbed areas using indigenous plants and shrubs Disturbed footprint and rehabilitated areas to be monitored throughout life of the Roodepoort Colliery Compliance with all environmental legislation

Surface Water	Degradation of riparian areas by constructing and operation of Roodepoort Colliery	<ul style="list-style-type: none"> Activities secondary to mine construction and operation to be located out of riparian zone as far as possible All work areas including access road and mining complex to be rehabilitated on completion
Surface Water	Damage and degradation to the in-stream habitat caused by prolonged mining activities	<ul style="list-style-type: none"> Strict control measures to be implemented in terms of impact minimisation on the in-stream habitat
Surface Water	<p>Development within water resources e.g. mining footprint encroaches onto wetland area or riparian area, thereby diverting or impeding flow</p> <p>Lack of adequate rehabilitation resulting in invasion by woody invasive plants</p> <p>Vehicles driving in / through watercourses</p>	<ul style="list-style-type: none"> No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only a minor footprint and no access roads can be considered. This is subjected to authorization by means of a water use license. Construction in and around watercourses must be restricted to the dryer winter months. A temporary fence or demarcation must be erected around the works area to prevent access to sensitive environs. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the mine Prevent pedestrian and vehicular access into the wetland and buffer areas as well as riparian areas. Consider the various methods of mining layout that will have the least impact on watercourses Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. Management of on-site water use and prevent storm water or contaminated water directly entering the watercourse Management of point discharges Planning of mining site must include eventual rehabilitation / restoration of indigenous vegetative cover Alien plant eradication and follow-up control activities prior to construction, to prevent spread into disturbed soils, as well as follow-up control during construction The amount of vegetation removed should be limited to the least amount possible Rehabilitation of damage/impacts that arise as a result of construction and mining operations must be implemented immediately upon completion of activities
Surface Water	Changing the amount of sediment entering water resource and associated change in turbidity	<ul style="list-style-type: none"> Construction in and around watercourses must be restricted to the dryer winter months. A temporary fence or demarcation must be erected around the works area to prevent water runoff and erosion of the disturbed or heaped soils into wetland areas. Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005). A vegetation rehabilitation plan should be implemented. Grassland can be removed as sods and stored within transformed vegetation. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other or within sensitive environs. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice

		<p>more over the next 2 weeks.</p> <ul style="list-style-type: none"> • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. • Rehabilitation plans must be submitted and approved for rehabilitation of damage areas during mining and that plan must be implemented immediately upon completion of mining. • Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. • Ideally, the rehabilitated mining footprints, especially on slopes and along riparian and wetland areas, must be fenced to prevent livestock grazing and trampling. Once rehabilitation was observed to be successful during monitoring, the fenced may be removed (at least two years). • Negotiate with landowners to delay the reintroduction of livestock (where applicable) to all rehabilitation areas until an acceptable level of re-vegetation has been reached, especially against slopes. • During the construction and operational phases measures must be put in place to control the flow of excess water so that it does not impact on the surface vegetation. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the mining box-cut and work areas. • Runoff from roads must be managed to avoid erosion and pollution problems. • Implementation of best management practices • Source-directed controls • Buffer zones to trap sediments • Active rehabilitation
Surface Water	Alteration of water quality	<ul style="list-style-type: none"> • After construction the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. • Ensure that maintenance work does not take place haphazardly, but, according to a fixed plan, from one area to the other. • Maintenance of mining vehicles • Control of waste discharges • Guidelines for implementing Clean Technologies • Maintenance of buffer zones to trap sediments with associated toxins and pollutants
Surface Water	General	<ul style="list-style-type: none"> • Obtain the necessary Water Use License • Development of an Integrated Water Resource Management Plan (as part of the WULA); • Wetland and riverine areas to be considered as no go zones unless authorisation is obtained; • Separation of clean and dirty water systems; • Containment of all contaminated water in dedicated pollution control design facilities; • Re-use, recycle and minimise all waste water generated on the site; and • Implementation of compliance monitoring program with associated auditing and reporting • Water quality (for surface and groundwater) should adhere and comply with the Resource Quality Objectives set

		<p>for the catchment;</p> <ul style="list-style-type: none"> • Ecoclassification for the affected catchment in terms of PES and EISC shall be maintained at Class D • The construction of roads and road servitudes (disturbance zones) in or adjacent to the wetland/riparian zone is to be managed and strictly controlled to minimize damage to the impoundment, rivers and wetlands. • Where vegetation removal has occurred adjacent to the new route, mining site and associated infrastructure, monitoring should take place to ensure successful re-establishment of natural vegetation. Alien vegetation should be removed from these disturbed areas on an ongoing basis to ensure the successful re-vegetation by indigenous species. • When debris collect at the base of culverts they create hydraulic obstacles resulting in the scouring (erosion) of the downstream banks (and this may also lead to an excessive soil deposition upstream of the culvert). It is therefore essential that a long-term monitoring and maintenance plan be implemented by the applicant whereby the applicant will be obligated to maintain bank stability (i.e. to control any erosion that has taken place as a result of the mining infrastructure) as well as to clear any debris away from the base of culverts (especially after high rainfall and flood events).
Air Quality	Drilling and blasting	<ul style="list-style-type: none"> • Use of pre-blast environmental checklists, real-time weather monitoring data and stringent controls on blasts carried out in sensitive areas • A no-blast arc is automatically calculated for the nearest private residence based on the latest relevant weather conditions, including wind speed and direction, temperature inversions and amount of atmospheric turbulence (i.e. stability category) before the blast can be fired
Air Quality	Material extraction	<ul style="list-style-type: none"> • Low or in-pit dumping of overburden during high wind conditions
Air Quality	Transport and transfer of material	<ul style="list-style-type: none"> • Use of a global positioning system as a tool to track the locations of mining and dust suppression equipment (e.g. water carts) and cross-referencing this information with real-time weather monitoring to assist with dust control • Use of water sprays at each contact or transfer point along the conveyance system which have adjustable rates of application (low, medium and high) depending on dust levels • Automatic water sprays installed at the ROM hopper bin that produce a fine mist to suppress dust generated with the triggering of sensors when a truck enters the dump zone and automatic sprays activated until a set time following the departure of the truck • Use of a reclaim tunnel at the product coal stockpile and an enclosed conveyor to transfer coal to the loader, both of which minimise dust generation • Use of a retractable telescopic chute with curtains to load coal into carriages/trucks
Air Quality	Storage of material	<ul style="list-style-type: none"> • Automatic sprays installed around the perimeter of the ROM stockpile activated when the wind speed is >6 m/sec (averaged over 15 minutes) • Finished product stockpiles formed on an as-needs basis with stockpiled coal loaded out within 24 hours • A tree windbreak located downwind of the prevailing wind direction to minimise dust from the finished product stockpiles • Topsoil handling and storage procedures including stockpile inventory, vegetative cover and signage to optimise rehabilitation and minimise wind erosion

		<ul style="list-style-type: none"> • Successful trialling of a chemical dust suppressant on haul roads resulting in a considerable reduction in the amount of water used for dust suppression on haul roads
Air quality	Exposed areas	<ul style="list-style-type: none"> • Successful trialling of broadacre temporary rehabilitation of unshaped overburden emplacement areas by aerial sowing of a cover crop, providing an established vegetative stabilisation to minimise the potential for windblown dust generation • Constricting the areas and time of exposure of pre-strip clearing in advance of mining development
Air Quality	General	<ul style="list-style-type: none"> • Climatic conditions need to be taken into considerations. • Topsoil should not be removed during windy periods as dust levels will increase as well as the fallout area. • Hydromulch stockpiles to prevent wind erosion • The area of disturbance must be kept to a minimum and no unnecessary clearing of vegetation must occur. • Where possible, stockpiles must be vegetated as soon as possible to reduce exposed surfaces. • Handling soil while it has a high moisture content can aid in reducing dust generation • It is recommended that water be used in combination with chemical surfactants to reduce the amount of water required to achieve certain control efficiencies.
Noise	Barriers	<ul style="list-style-type: none"> • A noise barrier in the form of a berm should be constructed on the eastern boundary of the proposed opencast area as soon as possible, • Barrier must be situated between the main noise source noise sensitive receivers which is mainly the town of Pullenshope. • The berm will help with the attenuation of noise produced by the mining activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance.
Noise	Vehicle noise	<ul style="list-style-type: none"> • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers. • Switching off equipment when not in use. • Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source. • Barriers should be installed between the noise source and sensitive noise receptor, as close to the noise source as possible. • All project employees and contractors will be instructed to avoid the use of engine compression brakes when approaching the Mine entrance or driving through or in the vicinity of the town of Pullenshope. • All access roads will be signposted and speed limited to minimise transport noise. • Equipment with lower sound power levels would be used in preference to more noisy equipment. • All equipment used onsite will be regularly serviced to ensure the sound power levels remain at or below the levels used in the modelling to assess generated noise levels and compliance with the criteria. • The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.

Noise	Blasting	<ul style="list-style-type: none"> • The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended. • Reduction of the powder factor, that is, use of less explosive per cubic meter of overburden. • Restriction of blasting to daylight hours are mitigation measures that should be followed • Maintaining good public relations with the surrounding communities • Warning the local communities in advance before blasts.
Heritage & Archaeological	Potential impacts on identified heritage/ archaeological sites	<ul style="list-style-type: none"> • The graveyard (P01) and the isolated grave (P02) fall within the area demarcated for development and are protected under legislation. • The expansion of the graveyard, as well as the area associated with the isolated grave within the portion demarcated for development be ceased, fenced off, and continued elsewhere as directed by the local municipality. • No mining activities or development should take place within a radius of 15 m of the fences. • Alternatively the affected graves may be relocated by a qualified graves relocation unit to a premises earmarked by the local municipality, but will set in motion a substantial process as new legislation will be triggered. • Access must be allowed to the fenced-off graveyard and the isolated grave. • These processes, however, must be performed in accordance with the involvement of community leaders and the relatives of the deceased buried in the concerned graveyards. • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material and skeletal remains may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist (See National Heritage and Resources Act, 25 of 1999 section 36 (6)). • From a heritage point of view, development may proceed on the demarcated section of Portion 17 of the farm Roodepoort 151 IS subject to the abovementioned conditions and recommendations.. • Should the need arise to expand the development beyond the 40 hectare demarcated area mentioned in the specialist study, the following applies: <ul style="list-style-type: none"> ○ a qualified archaeologist must conduct a full Phase 1 assessment on the sections beyond the demarcated areas which will be affected by the expansion, in order to determine the occurrence and extent of any archaeological sites and the impact development might have on these sites.
Paleontological	Potential impacts on Paleontological heritage	<ul style="list-style-type: none"> • Regular inspections should be made by a palaeontologist of all mining areas, as well as any excavations and construction sites during the development of the project to ascertain if any fossil materials have been uncovered. • Should any fossil material be located during the proposed inspections the relevant portion of the excavations should be halted and SAHRA informed of the discovery. • Should any fossil material be identified a palaeontologist should be contacted to evaluate the material and advise on its scientific importance and, if necessary, excavation or preservation.

Visual	Visual and aesthetic impacts due to mining activities	<ul style="list-style-type: none"> • Dust from Stockpile areas, roads and other activities must be managed by means of dust suppression to prevent excessive dust. • Stockpiles should not exceed 15m in height. • Rehabilitation of the area must be done as the mining is completed. • The visual impact can be minimized by the creation of a visual barrier. • The retention of as much existing vegetation as possible, specifically the existing mature trees in the area to conceal the mining activity as much as possible. • During the construction of the mine infrastructure, consideration to the natural hues can be achieved by painting infrastructure with matt tones to help camouflage the infrastructure. • Down-lighting should also be implemented to minimise light pollution at night
Ecological	Impacts on the natural environment	<ul style="list-style-type: none"> • The construction area should be well demarcated and construction workers should not enter into adjacent areas. • Mixing of concrete or collection of building material must be restricted to designated sites to minimize the impact. • Plant removal may result in soil erosion, thus storm water management procedures need to be put into place. • Continuous rehabilitation of the area should occur during construction.
Ecological	Impacts on plant species	<ul style="list-style-type: none"> • A management plan for control of invasive plant species needs to be implemented on all areas of the farm Roodepoort 151 IS. This will be most viable with the implementation of a buffer zone. • During the removal of the soil, the topsoil or A-zone should be stored separately from the other zones. A soil scientist should be employed during this phase of the mine. The scientist should test the soil during this phase of the mine. • A buffer zone should be implemented surrounding the wetland areas. The wetlands are extremely important in providing valuable ecosystem services and it is essential that no mining occurs there. Buffer zones should be clearly demarcated as a no go zone. Thorough wetland delineation should be conducted by a wetland specialist. This should be completed before any construction within the area is initiated. • Any species that are either endemic or vulnerable should be relocated to favourable sites with the help of a specialist prior to vegetation removal for the construction of the mine. This should be done or assessed before the construction of the mine commences to ensure that these species are relocated.

Ecological	Impacts on animal species	<ul style="list-style-type: none"> • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Activities on site must comply with the regulations of the Animal Protection Act 1962 (Act No. 71 of 1962). Workers should also be advised on the penalties associated with the needless destruction of wildlife, as set out in this act. • Activities should not commence near the surface water areas or wetlands on the specific Portion of Roodepoort 151 IS.
Ecological	Habitat destruction and sensitive species disturbance	<ul style="list-style-type: none"> • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Activities should not commence near the surface water areas or wetlands on the specific Portion of Roodepoort 151 IS. • A linear corridor between the wetlands and river should be maintained at all times during construction and operational phases.
Ecological	General	<ul style="list-style-type: none"> • Responsible persons from the staff members/workers should be identified to ensure that the necessary mitigation measures are implemented and established. These personnel should also enforce the collaboration of other staff members, contractors and workers to comply with these mitigation measures. • A management plan for the control of invasive/alien weed species needs to be implemented. This should not only be conducted within the direct location of the mining area but, also the remainder of the farm Roodepoort 151 IS. This will be most viable with the implementation of a buffer zone. Staff members are prohibited from these buffered areas and the responsible person (mentioned previously) should authorize these areas. • A buffer zone should be implemented surrounding the wetland areas. The wetlands are extremely important in providing valuable ecosystem services and it is essential that no mining occurs there. Buffer zones should be clearly demarcated as a no go zone. It is highly recommended that a wetland specialist conduct a thorough wetland delineation of all wetland areas located on the farm Roodepoort 151 IS. This should be completed before any construction within the area is initiated. • During the construction phase the soil is removed. The A-zone of the soil (topsoil) should be stored separately from the other zones. Fortunately, this is part of the plan of the mine. However, it is highly recommended that a soil scientist is employed during this phase of the mine to ensure that it is done correctly. The soil scientist should test the topsoil during the construction phase as well as before the rehabilitation phase is to commence to ensure that the quality of the soil is good. It is also essential that during the rehabilitation phase the soil is

		<p>replaced within the correct order, with the A-zone at the top part. This process should also be accompanied with the assistance of a soil scientist.</p> <ul style="list-style-type: none"> Any species that are either endemic or vulnerable should be relocated to favorable sites with the help of a specialist prior to vegetation removal for the construction of the mine. This should be done or assessed before the construction of the mine commences to ensure that these species are relocated. The vegetation removal (and associated fauna) should be controlled and should be very specific. For example, it is viable to store/collect the seeds of plants and other plant propagules, soil nutrients and biota, decaying organic matter etc. that can be used during the rehabilitation phases.
Traffic	Vehicle and equipment movement	<ul style="list-style-type: none"> Ensure trucks and vehicles remain on roads and areas designated as a construction site to limit disturbance to areas unaffected by construction. Ensure drivers are informed that off-road travelling is prohibited. Ensure speed limits are set on all roads and enforce speed limits. Ensure all drivers at the site are informed about speed limits.
Socio-economic	Creation of more employment opportunities	<ul style="list-style-type: none"> Labour (particularly semi-skilled and low skilled) and contractors should be sourced locally where possible and reasonable. Local construction personnel and contractors must be trained so that their skills may be developed for use in the future beyond the jobs at the mine. Local community members, authorities and organizations should be informed of job opportunities available and the procedures (if applicable) to be followed in order to secure the jobs. Women should be considered in the provision of jobs to ensure that the entire community benefits. The developer must compile a database of goods and services providers from the local community who comply with their procurement requirements before commencement of the tender process for acquiring various services and goods. The developer and the local branch of the chamber of commerce in Steve Tshwete should strategize on ways in which the benefits of the proposed mine can be enhanced for the benefit of the receiving area.
Socio-economic	Disruption of existing family structures and negative impacts due to social interaction of mine workers with local community	<ul style="list-style-type: none"> Labour (particularly semi-skilled and low skilled) and contractors should be sourced locally where possible and reasonable. This is because those from the local community already form a part of that society and there will be no added pressure on available local amenities such as housing. A monitoring forum should be formed consisting of community members so that the community can be briefed from time to time on the risks to the society's fabric as a result of the project. A code of conduct for the construction workers should be compiled, and the information provided to and signed

		<p>by all relevant stakeholders in order to provide guidance on what behaviour is or is not permitted or acceptable.</p> <ul style="list-style-type: none"> • A HIV/AIDs, STDs awareness programme should be designed and the members of the community together with the workers should be regularly trained and road shows conducted on risky behaviour that could expose them to these diseases. • The contractor / developer should plan and provide for transport, housing, weekend breaks of any workers who are brought in from outside the town. • The development site must be fenced off to prevent trespassing.
Socio-economic	Damage to infrastructure on surrounding properties	<ul style="list-style-type: none"> • Surrounding land owners need to be notified well in advance of planned developments so that they are able to secure their property. • An agreement needs to be deliberated on, accepted and signed by all parties on what action to take in the event of damage to property. • An incidents report needs to be opened and maintained by the Environmental Control Officer at the site. This report will be used to record any complaints or incidences of damage to property. • A code of conduct for the construction workers should be compiled and the information provided to and signed by all relevant stakeholders in order to provide guidance on what behaviour is or is not permitted and the consequences of disobedience. • The development site must be fenced off to prevent trespassing. • Housing for site workers should be provided at a properly designed and constructed camp. • Open fires for whatever purpose be it cooking or heating must be strictly prohibited at the construction site and camp. • Construction activities such as welding should be confined to designated areas and should be conducted during weather conditions that are not risky e.g. calm winds. • Adequate and easily accessible firefighting equipment and a well-stocked tool shed must be maintained to enable repairs on damage property to be done without delay. In addition, a few workers should be trained on the proper use of the equipment.
Socio-economic	Reduced quality of life	<ul style="list-style-type: none"> • Ensure the appointment of a Safety Officer to continuously monitor the safety conditions during construction. • All safety incidents must be reported to the appointed safety officer. • Proper signage must be erected on the site and adjacent properties so that people are made aware of the activities and its dangers. • Ablution facilities must be provided on site and should be regularly emptied by a licensed service provider. Workers should be informed that relieving of oneself in surrounding bushes is strictly prohibited.

		<ul style="list-style-type: none"> • Speed limits that have been set at the site and surrounding areas must be strictly adhered to and harsh punishments set for offenders. • The appointed contractor must ensure that any road damage caused by mine trucks is swiftly repaired to ensure safety of all road users. • Dust suppression measures must be implemented to reduce the amount of dust released into the air. Such measures include using water bowzers to periodically spray the site especially during dry weather conditions. In addition, trucks transporting spoil material or top soil from the site must be covered to prevent loss of material while in transit. • Equipment and trucks that produce loud noise must be fitted with appropriate silencers where possible. • Workers on site must be trained on the correct handling of spillages and precautionary measures that need to be implemented to minimize potential spillages. • Workers must be provided with spill kits and spills must be cleaned up immediately. • General and hazardous waste disposal bins must be provided at various strategic locations on the site. • An Environmental Control Officer (ECO) must be appointed to monitor that measures prescribed for noise, dust, and water resources protection are adhered to. • A system needs to be put in place at the local health centres to monitor any changes in diseases particularly respiratory or those associated with contaminated water such as dysentery, typhoid etc. • Ground water, surface water, air quality, and noise monitoring system must be implemented to ensure that levels prescribed are complied and if not urgent measures are taken to correct the situation.
Socio-economic	Financial loss due to damage to farming land and infrastructure	<ul style="list-style-type: none"> • The mine should be designed in an efficient way that maximizes use of space and reduce wastage. This will eventually reduce the footprint of the mine. • A rehabilitation programme must be compiled before construction commences. In addition, the compliance with the rehabilitation programme must be included in the appointed contractor's contract. • Disturbed areas must be fully rehabilitated so that in future they can be utilized for uses such as maize farming that is presently being undertaken. • The appointed ECO must ensure that the rehabilitation programme is complied with.
Land Capability	Soil stripping and loss	<ul style="list-style-type: none"> • Effort should be made to strip the topsoil separate from the underlying plinthic material • The soils in the wetland should be kept undisturbed. • The average soil depth ranges from 30-90 overall shallower than 70cm. • If soil stripping is necessary, it is recommended to strip only 40-60cm of the soil. These estimates take into consideration a possible 10% topsoil loss through compaction and allow the rehabilitated areas to be returned to

		<p>the pre-mining land capability, i.e. arable cropping land.</p> <ul style="list-style-type: none"> • During the construction phase it is recommended that the topsoil be stripped and stockpiled in advance of construction activities that might contaminate the soil. • The stripped soils should be stockpiled upslope of areas of disturbance to prevent contamination of stockpiled soils by dirty runoff or seepage. • All stockpiles should also be protected by a bund wall to prevent erosion of stockpiled material and deflect water runoff.
Land Capability	Vehicle and machinery movement	<ul style="list-style-type: none"> • The soil map compiled should be considered and mitigation measures on soil management implemented. • Dump trucks must only operate on the basal/non-soil layer and their wheels must not run on the soil layers. • The excavator should only operate on the topsoil layer. • Implementation of a bed/strip system avoids the need for trucks to travel on the soil layers. • Machines are to only work when ground conditions enable their maximum operating efficiency. • If compaction is caused then measures are required to treat (consult an experienced specialist).
Waste	Receiving environment contamination	<ul style="list-style-type: none"> • A waste management procedure must be developed and implemented. It covers the storage, handling and transportation of waste. • Opportunities to minimize waste production will be identified and taken where possible. Where possible, waste will be recycled. • Waste collection points will be established on site. Care must be taken to ensure that there are sufficient collection points for each designated type of waste with adequate capacity and that these are serviced frequently. • At present there is no intention to develop waste disposal facilities on site; <ul style="list-style-type: none"> ○ No waste disposal facility will be developed by the mine without the relevant permissions. These permissions include an environmental authorisation (from DEA) and a waste permit (from DEA) in terms of the National Environmental management: Waste Act, 2008. • Waste will be disposed of at appropriate permitted waste disposal facilities. These will vary depending on the waste. • An approved subcontractor, working to local authority standards, will undertake the waste transport to remove domestic waste and sewage sludge (if necessary). • Hazardous industrial wastes are stored in specially marked bins or other storage areas (engineering workshops) before removal for either recycling such as for waste oils, which are sold to contractors or removed to hazardous waste disposal facilities to returned to the supplier. Contractors remove the hazardous waste such as

		<p>PCB contaminated transformer lubricates from the site immediately after servicing. The frequency of disposal is as required.</p> <ul style="list-style-type: none"> • Domestic waste generated by the opencast area, crushing and screening plant & offices is collected daily from waste bins and collections points and transported by contractors to the Belfast Waste Disposal Site • The solid industrial waste from the crushing and screening plant is collected by contractors from points of collection. • If remediation of the soil in situ is not possible, the soils will be classified as a waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted waste facility. • Care will be taken to ensure that scrap metal does not become polluted or mixed with any other waste (picks, bits, roof bolts, wire and cabling). • The scrap metal must be collected in a designated area for scrap metal (scrap yard). It can be sold to scrap dealers. • Oil must be collected in suitable containers at designated collection points. The collection points must be bunded and underlain by impervious materials to ensure that any spills are contained. Notices must be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor must remove oil from site.
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OPERATIONAL PHASE

ASPECT	IMPACT	MANAGEMENT & MITIGATION MEASURES
Groundwater	Impact on water supply of groundwater users surrounding mine	<ul style="list-style-type: none"> Monitor static groundwater levels on a quarterly basis in all boreholes within a zone of one to two kilometres surrounding the opencast to ensure that any deviation of the groundwater flow from the idealised predictions is detected in time and can be reacted on appropriately. If it can be proven that the mining operation is indeed affecting the quantity of groundwater available to certain users, the affected parties should be compensated. This may be done through the installation of additional boreholes for water supply purposes, or an alternative water supply. The numerical model should be updated during mining by using the measured water ingress, water levels, mining and geophysics information to re-calibrate and refine the impact prediction
	Potential impact on base flow of streams/wetland	<ul style="list-style-type: none"> If it is proven that the opencast is impacting on baseflow in the tributary and wetland, various options should be investigated such as if clean discharge is available to be pumped back into the surface water bodies. Ensure that all fracture or groundwater intersections be thoroughly sealed
	Deterioration of groundwater quality down gradient of the mining operations	<ul style="list-style-type: none"> Groundwater quality must be monitored on a quarterly basis. The monitoring results must be interpreted annually by a qualified hydrogeologist and the monitoring network should be audited annually to ensure compliance with regulations. Numerical groundwater model must be updated by calibrating the model with monitoring data. Pollution control dams should be lined to prevent ingress of contamination. Mine sections should be sealed where possible during mining to reduce the contact of water and air with remaining sulphides. Install water collection and pumping systems within the mining areas capable of rapidly pumping water out, so minimising contact of water with the geochemically reactive material. Assess the impact of the neighbouring mines on this colliery and vice versa. This is best done by pooling measured groundwater data to update and expand the current numerical model. Kinetic testing of the overburden and discard material should be conducted to aid in the prediction of post mining geochemical conditions. Clean and dirty water systems should be separated. Construct berms and pollution control dams between the wetland and opencast to ensure that contaminated runoff does not enter the wetland system.
	Oil, diesel and chemical spills/leaks from machinery and storage facilities/ Sewage related groundwater contamination	<ul style="list-style-type: none"> It must be ensured that a credible company removes used oil after vehicle servicing. A sufficient supply of absorbent fibre should be kept at the site to contain accidental spills. Store all potential sources in secure facilities with appropriate storm water management, ensuring contaminants are not released into the environment. Sewage effluent emanating from latrines or ablution blocks should be treated to acceptable levels before discharge into the environment
	General	<ul style="list-style-type: none"> All the monitoring data needs to be collated and analysed on at least a bi-annual basis and included in

		<p>management reports. This information will also be required by government departments (Department of Water Affairs, Department of Environmental Affairs) for compliance monitoring.</p> <ul style="list-style-type: none"> • After 2 years from start of mining, the monitoring information collated should be used to update the groundwater flow and geochemical models. These models should thereafter be updated so that sufficient mitigation measures can be implemented. Management and mitigation plans should be continuously adapted using the monitoring data.
Surface Water	Increased sediment generation	<ul style="list-style-type: none"> • Strict erosion control • No development within riparian zone • Access roads to be well maintained • Stream-bank at dam spillway and downstream of dam to be well protected against flood damage and erosion
Surface Water	Pollution of stream	<ul style="list-style-type: none"> • Zero effluent discharge policy from Roodepoort Colliery (no discharge to dam or stream) • Strict regulatory control on all water containing waste generated and disposal of effluent (WWTW)
Surface Water	Damage to riparian vegetation	<ul style="list-style-type: none"> • Introduce strict rehabilitation programme with erosion control and re-vegetation of disturbed areas using indigenous plants and shrubs • Disturbed footprint and rehabilitated areas to be monitored throughout life of the Roodepoort Colliery • Compliance with all environmental legislation
Surface Water	Degradation of riparian areas by constructing and operation of Roodepoort Colliery	<ul style="list-style-type: none"> • Activities secondary to mine construction and operation to be located out of riparian zone as far as possible • All work areas including access road and mining complex to be rehabilitated on completion
Surface Water	Damage and degradation to the in-stream habitat caused by prolonged mining activities	<ul style="list-style-type: none"> • Strict control measures to be implemented in terms of impact minimisation on the in-stream habitat
Surface Water	Stormwater control	<ul style="list-style-type: none"> • Dirty and clean stormwater should be separated systems. Dirty stormwater to be contained • The erosion down verges on the approach to a water course should be minimised by including frequent discharge points with energy dissipaters before discharging storm water into the adjacent wetland and grasslands (where applicable). • Infiltration down the verges of the roads rather than surface runoff should be encouraged (this could for example include the use of grassed swales, Hyson Cells or grass blocks). The construction of small detention ponds filled with Phragmites reeds would allow sediment and debris/litter to be trapped before entering the unnamed drainage lines of the Woestalleen Spruit Catchment. • Where storm water enters the water resource sediment and debris trapping, as well as energy dissipation control structures should be put in place.
Surface Water	Water Pollution Control facilities	<ul style="list-style-type: none"> • Turbidity, sedimentation and chemical changes to the composition of the water must be limited. • The possibility of spillages should be catered for in the design of the infrastructure development where, pollution control dams or attenuation ponds prior to the discharge of storm water could be contained • Storm water systems to be designed in such a way that it can be easily sealed off after the occurrence of a spill. If a spill occurs during the operational phase of the water use, a qualified team of experts will need to be

		consulted, rehabilitation plan drawn up and implemented and the Regional DWA Office should be informed immediately.
Surface Water	<p>Development within water resources e.g. mining footprint encroaches onto wetland area or riparian area, thereby diverting or impeding flow</p> <p>Lack of adequate rehabilitation resulting in invasion by woody invasive plants</p> <p>Vehicles driving in / through watercourses</p>	<ul style="list-style-type: none"> • No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only a minor footprint and no access roads can be considered. This is subjected to authorization by means of a water use license. • Construction in and around watercourses must be restricted to the dryer winter months. • A temporary fence or demarcation must be erected around the works area to prevent access to sensitive environs. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the mine • Prevent pedestrian and vehicular access into the wetland and buffer areas as well as riparian areas. • Consider the various methods of mining layout that will have the least impact on watercourses • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Management of on-site water use and prevent stormwater or contaminated water directly entering the watercourse • Management of point discharges • Planning of mining site must include eventual rehabilitation / restoration of indigenous vegetative cover • Alien plant eradication and follow-up control activities prior to construction, to prevent spread into disturbed soils, as well as follow-up control during construction • The amount of vegetation removed should be limited to the least amount possible • Rehabilitation of damage/impacts that arise as a result of construction and mining operations must be implemented immediately upon completion of activities
Surface Water	<p>Changing the amount of sediment entering water resource and associated change in turbidity</p>	<ul style="list-style-type: none"> • Construction in and around watercourses must be restricted to the dryer winter months. • A temporary fence or demarcation must be erected around the works area to prevent water runoff and erosion of the disturbed or heaped soils into wetland areas. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAf, 2005). • A vegetation rehabilitation plan should be implemented. Grassland can be removed as sods and stored within transformed vegetation. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other or within sensitive environs. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks. • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. • Rehabilitation plans must be submitted and approved for rehabilitation of damage areas during mining and that

		<p>plan must be implemented immediately upon completion of mining.</p> <ul style="list-style-type: none"> • Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. • Ideally, the rehabilitated mining footprints, especially on slopes and along riparian and wetland areas, must be fenced to prevent livestock grazing and trampling. Once rehabilitation was observed to be successful during monitoring, the fenced may be removed (at least two years). • Negotiate with landowners to delay the reintroduction of livestock (where applicable) to all rehabilitation areas until an acceptable level of re-vegetation has been reached, especially against slopes. • During the construction and operational phases measures must be put in place to control the flow of excess water so that it does not impact on the surface vegetation. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the mining box-cut and work areas. • Runoff from roads must be managed to avoid erosion and pollution problems. • Implementation of best management practices • Source-directed controls • Buffer zones to trap sediments • Active rehabilitation
Surface Water	Alteration of water quality	<ul style="list-style-type: none"> • After construction the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. • Ensure that maintenance work does not take place haphazardly, but, according to a fixed plan, from one area to the other. • Maintenance of mining vehicles • Control of waste discharges • Guidelines for implementing Clean Technologies • Maintenance of buffer zones to trap sediments with associated toxins and pollutants
Surface Water	General	<ul style="list-style-type: none"> • Dirty water collection at the station drains and sumps • Clean water diversion (bunds/ canals). • Good housekeeping (clean-up of spills and minimise informal storage of materials) • Leak detection through inspection • Good housekeeping (maintenance of equipment) • Storm water diversion upstream of the facilities • Either run off will be contained in paddocks for collection and evaporation or run off will be captured in the drain system and channelled to the PCD compartment. • Monitor seepage at PCD on a quarterly basis • Isolate pollution sources with roofs, concrete bases, traps, sumps and bund walls (e.g. diesel/petrol storage, wash bays and workshops) • Roads will be surfaced

		<ul style="list-style-type: none"> Vehicle maintenance will be conducted on bunded concrete surfaces
Air Quality	Drilling and blasting	<ul style="list-style-type: none"> Use of pre-blast environmental checklists, real-time weather monitoring data and stringent controls on blasts carried out in sensitive areas A no-blast arc is automatically calculated for the nearest private residence based on the latest relevant weather conditions, including wind speed and direction, temperature inversions and amount of atmospheric turbulence (i.e. stability category) before the blast can be fired
Air Quality	Material extraction	<ul style="list-style-type: none"> Low or in-pit dumping of overburden during high wind conditions
Air Quality	Transport and transfer of material	<ul style="list-style-type: none"> Use of a global positioning system as a tool to track the locations of mining and dust suppression equipment (e.g. water carts) and cross-referencing this information with real-time weather monitoring to assist with dust control Use of water sprays at each contact or transfer point along the conveyance system which have adjustable rates of application (low, medium and high) depending on dust levels Automatic water sprays installed at the ROM hopper bin that produce a fine mist to suppress dust generated with the triggering of sensors when a truck enters the dump zone and automatic sprays activated until a set time following the departure of the truck Use of a reclaim tunnel at the product coal stockpile and an enclosed conveyor to transfer coal to the loader, both of which minimise dust generation Use of a retractable telescopic chute with curtains to load coal into carriages/trucks
Air Quality	Storage of material	<ul style="list-style-type: none"> Automatic sprays installed around the perimeter of the ROM stockpile activated when the wind speed is >6 m/sec (averaged over 15 minutes) Finished product stockpiles formed on an as-needs basis with stockpiled coal loaded out within 24 hours A tree windbreak located downwind of the prevailing wind direction to minimise dust from the finished product stockpiles Topsoil handling and storage procedures including stockpile inventory, vegetative cover and signage to optimise rehabilitation and minimise wind erosion Successful trialling of a chemical dust suppressant on haul roads resulting in a considerable reduction in the amount of water used for dust suppression on haul roads
Air quality	Exposed areas	<ul style="list-style-type: none"> Successful trialling of broadacre temporary rehabilitation of unshaped overburden emplacement areas by aerial sowing of a cover crop, providing an established vegetative stabilisation to minimise the potential for windblown dust generation Constricting the areas and time of exposure of pre-strip clearing in advance of mining development
Air Quality	General	<ul style="list-style-type: none"> Overburden which may include combustible shale must be covered with non-shale overburden. Once areas are available for rehabilitation it must be undertaken with a minimal lag (slopes covered within 8 weeks). Heat generation monitoring of the dump must be undertaken It is recommended that water be used in combination with chemical surfactants to reduce the amount of water required to achieve certain control efficiencies.

		<ul style="list-style-type: none"> • Purchase processing equipment with built-in dust suppression technology, and install additional sprays to control dust for those few areas remaining where dust is an issue. • The discard dump must be compacted on a daily basis to reduce the occurrence of spontaneous combustion. • Once areas of the discard dump are available for rehabilitation it must be undertaken with a minimal lag (slopes covered within 8 weeks). • All stockpiles must be vegetated as soon as possible to reduce exposed surfaces. • Handling soil while it has a high moisture content can aid in reducing dust generation • Sloped areas must not be exposed for more than 8weeks and plateau areas must not be left exposed for more than 3 months. • Compaction must be undertaken. • Backfilling must be done in accordance to the rehabilitation plan.
Noise	Barriers	<ul style="list-style-type: none"> • A noise barrier in the form of a berm should be constructed on the eastern boundary of the proposed opencast area as soon as possible, • Barrier must be situated between the main noise source noise sensitive receivers which is mainly the town of Pullenshope. • The berm will help with the attenuation of noise produced by the mining activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance.
Noise	Vehicle noise	<ul style="list-style-type: none"> • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers. • Switching off equipment when not in use. • Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source. • Barriers should be installed between the noise source and sensitive noise receptor, as close to the noise source as possible. • All project employees and contractors will be instructed to avoid the use of engine compression brakes when approaching the Mine entrance or driving through or in the vicinity of the town of Pullenshope. • All access roads will be signposted and speed limited to minimise transport noise. • Equipment with lower sound power levels would be used in preference to more noisy equipment. • All equipment used onsite will be regularly serviced to ensure the sound power levels remain at or below the levels used in the modelling to assess generated noise levels and compliance with the criteria. • The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.

Noise	Blasting	<ul style="list-style-type: none"> • The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended. • Reduction of the powder factor, that is, use of less explosive per cubic meter of overburden. • Restriction of blasting to daylight hours are mitigation measures that should be followed • Maintaining good public relations with the surrounding communities • Warning the local communities in advance before blasts.
Heritage & Archaeological	Potential impacts on identified heritage/archaeological sites	<ul style="list-style-type: none"> • The graveyard (P01) and the isolated grave (P02) fall within the area demarcated for development and are protected under legislation. • The expansion of the graveyard, as well as the area associated with the isolated grave within the portion demarcated for development be ceased, fenced off, and continued elsewhere as directed by the local municipality. • No mining activities or development should take place within a radius of 15 m of the fences. • Alternatively the affected graves may be relocated by a qualified graves relocation unit to a premises earmarked by the local municipality, but will set in motion a substantial process as new legislation will be triggered. • Access must be allowed to the fenced-off graveyard and the isolated grave. • These processes, however, must be performed in accordance with the involvement of community leaders and the relatives of the deceased buried in the concerned graveyards. • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material and skeletal remains may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist (See National Heritage and Resources Act, 25 of 1999 section 36 (6)). • From a heritage point of view, development may proceed on the demarcated section of Portion 17 of the farm Roodepoort 151 IS subject to the abovementioned conditions and recommendations.. • Should the need arise to expand the development beyond the 40 hectare demarcated area mentioned in the specialist study, the following applies: <ul style="list-style-type: none"> ○ a qualified archaeologist must conduct a full Phase 1 assessment on the sections beyond the demarcated areas which will be affected by the expansion, in order to determine the occurrence and extent of any archaeological sites and the impact development might have on these sites.
Paleontological	Potential impacts on Paleontological heritage	<ul style="list-style-type: none"> • Regular inspections should be made by a palaeontologist of all mining areas, as well as any excavations and construction sites during the development of the project to ascertain if any fossil materials have been uncovered. • Should any fossil material be located during the proposed inspections the relevant portion of the excavations should be halted and SAHRA informed of the discovery. • Should any fossil material be identified a palaeontologist should be contacted to evaluate the material and advise on its scientific importance and, if necessary, excavation or preservation.

Visual	Visual and aesthetic impacts due to mining activities	<ul style="list-style-type: none"> • Dust from Stockpile areas, roads and other activities must be managed by means of dust suppression to prevent excessive dust. • Stockpiles should not exceed 15m in height. • Rehabilitation of the area must be done as the mining is completed. • The visual impact can be minimized by the creation of a visual barrier. • The retention of as much existing vegetation as possible, specifically the existing mature trees in the area to conceal the mining activity as much as possible. • Down-lighting should also be implemented to minimise light pollution at night
Ecological	Impacts on the natural environment	<ul style="list-style-type: none"> • The activity area should be well demarcated and workers should not enter into adjacent areas. • Plant removal may result in soil erosion, thus storm water management procedures need to be put into place. • Continuous rehabilitation of the area should take place.
Ecological	Impacts on plant species	<ul style="list-style-type: none"> • A management plan for control of invasive/exotic plant species needs to be implemented. This should be an ongoing activity on all areas of the farm Roodepoort 151 IS. • Continuous rehabilitation of area should be implemented during the operational phase. • Ensure awareness amongst all staff, contractors and visitors to site to not needlessly damage flora and ensure they stay clear from the no go zones in the wetland buffer area. • A post-closure plan for the mine should be developed. A possible solution is to utilize the land for grazing. This will be conducted with the assistance of a veld management expert during operational phase. • Limit activities (transport etc.) to the smallest area possible. This is to prevent fragmentation that may have irreversible changes to flora and fauna communities. It also increases the invasion of exotic/invasive species. • The remaining natural areas after construction should be managed to prevent further degradation. No staff, contractors or visitors are allowed to access these areas. • Dust pollution measures should be set in place to prevent vegetation from being covered in layers of dust. • Relocate plants, particularly protected and endemic species, with specialist advice.
Ecological	Impacts on animal species	<ul style="list-style-type: none"> • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Activities on site must comply with the regulations of the Animal Protection Act 1962 (Act No. 71 of 1962). Workers should also be advised on the penalties associated with the needless destruction of wildlife, as set out in this act. • All mining activities should be restricted to one are within the farm and activity and access into larger intact

		<p>areas should be avoided at all cost. Strict measurements should be implemented. No foraging, food and wood collecting within the veld should be allowed.</p> <ul style="list-style-type: none"> • Activity and housing of workers should be kept out of restricted areas. • Implementation of a buffer-zone is suggested to limit impacts on larger extent of farm. • All noisy equipment should be mitigated to lessen the sound levels.
Ecological	General	<ul style="list-style-type: none"> • A management plan for the control of invasive/exotic weed species needs to be implemented. This is not a once-off activity and needs to be ongoing. Also, this should not only be implemented in the mining location but also all other areas of the farm Roodepoort 151 IS. The mine will be the responsible party for these areas as well. The removal of exotic/invasive species can be conducted with the use of herbicides. However, it is essential that these herbicides are low in human toxicity, effective against target species and have minimal effects on non-target species and the environment. It is advised not to use herbicides within the wetland/riverine areas to prevent possible pollution of fresh water systems. • Ensure linear structures, like roads and pipelines, are well managed to reduce the degradation of vegetation due to edge effects. This will be facilitated by ensuring vehicles remain on roads and alien invasive species introduction is controlled along road verges. • Continuous rehabilitation should be implemented during the operational phase. However, open cast mining deepens and widens progressively which hinders the implementation for early rehabilitation procedures. Fortunately, progressive rehabilitation can be implemented as the mined areas may be re-contoured behind the active mining areas. • During this phase of the mine, possible post-closure land-use for the area should be determined. Although the use of the farm for conservation purposes after rehabilitation is very low, it is recommended to utilize it for grazing. In this stage of the mine, a veld management specialist should be employed to develop an adequate veld management plan for the area. • Ensure awareness amongst all staff, contractors and visitors to site to not needlessly damage flora and ensure they stay clear from the no go zones in the wetland buffer area. • Limit activities (transport etc.) to the smallest area possible. This is to prevent fragmentation that may have irreversible changes to flora and fauna communities. Fragmentation also increases the invasion of exotic/invasive species. • The remaining natural areas after construction should be managed to prevent further degradation. No staff, contractors or visitors are allowed to access these areas; only the responsible authorities are to be permitted. • Dust pollution measures should be set in place to prevent vegetation from being covered in thick layers of dust. • Relocate plants, particularly protected and endemic species, with specialist advice.

Traffic	Vehicle and equipment movement	<ul style="list-style-type: none"> • Ensure trucks and vehicles remain on roads and areas designated as a construction site to limit disturbance to areas unaffected by construction. • Ensure drivers are informed that off-road travelling is prohibited. • Ensure speed limits are set on all roads and enforce speed limits. Ensure all drivers at the site are informed about speed limits.
Socio-economic	Creation of jobs	<ul style="list-style-type: none"> • Labour (particularly semi-skilled and low skilled) and contractors should be sourced locally where possible and reasonable. • The number of employment opportunities for local community members can be increased through the implementation of a skills development and training programme that will aid in meeting some goals in the Steve Tshwete local municipality IDP. • Local community members, authorities and organizations should be informed of job opportunities available and the procedures (if applicable) to be followed in order to secure the jobs. • Women should be considered in the provision of jobs to ensure that the entire community benefits. • The developer must compile a database of goods and services providers from the local community who comply with their procurement requirements before commencement of the tender process for acquiring various services and goods. • The developer and the local branch of the chamber of commerce in Steve Tshwete should strategize on ways in which the benefits of the proposed mine can be enhanced for the benefit of the receiving area.
Socio-economic	Increased disposable income	<ul style="list-style-type: none"> • The local municipality must improve the social amenities so as to encourage its residents to spend money locally.
Socio-economic	Increased quality of life	<ul style="list-style-type: none"> • All workers must be trained on financial management to ensure that they spend their money prudently and thus eventually having a positive impact on their living conditions. • As per the requirements of the Social and Labour Plan, the mine must be obliged to form a community trust into which a certain percentage of the coal revenue will be deposited into the trust. The money in the trust must be used in community up-liftment projects such as building of schools, health centres, libraries, community halls, crèches etc. • The funds in the trust must be monitored and audited to ensure that they are used for credible projects that benefit all members of the community.
Socio-economic	Disruption/modification of sense of place	<ul style="list-style-type: none"> • Natural vegetation must be maintained as much as possible during mining. This is because vegetation creates a screening effect thereby reducing the impact on the natural landscape. • Other mitigation measures prescribed in the visual impact assessment report must be implemented.
Socio-economic	Reduced quality of life	<ul style="list-style-type: none"> • Ensure the appointment of a Safety Officer to continuously monitor the safety conditions during construction. • All safety incidents must be reported to the appointed safety officer. • Proper signage must be erected on the site and adjacent properties so that people are made aware of the

		<p>activities and its dangers.</p> <ul style="list-style-type: none"> • Ablution facilities must be provided on site and should be regularly emptied by a licensed service provider. Workers should be informed that relieving of oneself in surrounding bushes is strictly prohibited. • Speed limits that have been set at the site and surrounding areas must be strictly adhered to and harsh punishments set for offenders. • The appointed contractor must ensure that any road damage caused by mine trucks is swiftly repaired to ensure safety of all road users. • Dust suppression measures must be implemented to reduce the amount of dust released into the air. Such measures include using water bowsers to periodically spray the site especially during dry weather conditions. In addition, trucks transporting spoil material or top soil from the site must be covered to prevent loss of material while in transit. • Equipment and trucks that produce loud noise must be fitted with appropriate silencers where possible. • Workers on site must be trained on the correct handling of spillages and precautionary measures that need to be implemented to minimize potential spillages. • Workers must be provided with spill kits and spills must be cleaned up immediately. • General and hazardous waste disposal bins must be provided at various strategic locations on the site. • An Environmental Control Officer (ECO) must be appointed to monitor that measures prescribed for noise, dust, and water resources protection are adhered to.
Land Capability	Soil handling and preservation	<ul style="list-style-type: none"> • Stockpiles can be used as a barrier to screen operational activities. If stockpiles are used as screens, the same preventative measures described for the constructional phase should be implemented to prevent loss or contamination of soil. • The stockpiles should not exceed a maximum height of 6m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion and to keep the soils biologically active. • If used to screen operations, the surface of the stockpile should not be used as roadway as this will result in excessive soil compaction.
Land Capability	Soil contamination	<ul style="list-style-type: none"> • Keep vehicles on roads. • Remove and stockpile topsoil from roads, building platforms, stockpile and dam areas prior to construction. • Petrochemical spillages to be collected in a drip tray and drum to store excavated spill affected soil for disposal at a registered facility. • Construct runoff and erosion control measures. • All trucks leaving the site to the siding must be covered to reduce spillages from the truck
Waste	Receiving environment contamination	<ul style="list-style-type: none"> • A waste management procedure must be developed and implemented. It covers the storage, handling and transportation of waste. • Opportunities to minimize waste production will be identified and taken where possible. Where possible, waste will be recycled. • Waste collection points will be established on site. Care must be taken to ensure that there are sufficient

		<p>collection points for each designated type of waste with adequate capacity and that these are serviced frequently.</p> <ul style="list-style-type: none"> • At present there is no intention to develop waste disposal facilities on site; <ul style="list-style-type: none"> ◦ No waste disposal facility will be developed by the mine without the relevant permissions. These permissions include an environmental authorisation (from DEA) and a waste permit (from DEA) in terms of the National Environmental management: Waste Act, 2008. • Waste will be disposed of at appropriate permitted waste disposal facilities. These will vary depending on the waste. • An approved subcontractor, working to local authority standards, will undertake the waste transport to remove domestic waste and sewage sludge (if necessary). • Hazardous industrial wastes are stored in specially marked bins or other storage areas (engineering workshops) before removal for either recycling such as for waste oils, which are sold to contractors or removed to hazardous waste disposal facilities to returned to the supplier. Contractors remove the hazardous waste such as PCB contaminated transformer lubricates from the site immediately after servicing. The frequency of disposal is as required. • Domestic waste generated by the opencast area, crushing and screening plant & offices is collected daily from waste bins and collections points and transported by contractors to the Belfast Waste Disposal Site • The solid industrial waste from the crushing and screening plant is collected by contractors from points of collection. • If remediation of the soil in situ is not possible, the soils will be classified as a waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted waste facility. • Care will be taken to ensure that scrap metal does not become polluted or mixed with any other waste (picks, bits, roof bolts, wire and cabling). • The scrap metal must collected in a designated area for scrap metal (scrap yard). It can be sold to scrap dealers. • Oil must be collected in suitable containers at designated collection points. The collection points must be bunded and underlain by impervious materials to ensure that any spills are contained. Notices must be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor must remove oil from site.
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DECOMMISSIONING AND CLOSURE PHASE

ASPECT	IMPACT	MANAGEMENT & MITIGATION MEASURES
Groundwater	Decant volume	<ul style="list-style-type: none"> All sulphate containing waste material should be stored at the base of the pit and flooded as soon as possible to exclude oxygen. Major underground fractures encountered while mining must be sealed by grouting, both on inflow and outflow areas
	Deterioration of groundwater quality down gradient of the mining operations due to plume movement	<ul style="list-style-type: none"> Pollution control dams should be maintained to intercept polluted seepage water. This is necessary even after mine closure to ensure the wetland is not negatively affected by pollution. Regular sampling of the streams and wetland is essential to determine the efficiency of this action. Implement as many closure measures during the operational phase, while conducting appropriate monitoring programmes to demonstrate actual performance of the various management actions during the life of mine. All mined areas should be flooded as soon as possible to minimise oxygen from reacting with the remaining pyrite. Mining should remove all coal from the opencast and separate acid forming and non-acid forming material. Deposit acid forming material at the base of the pit. The final backfilled opencast topography should be engineered such that runoff is directed away from the opencast areas. The final layer (just below the topsoil cover) should be as clayey as possible and compacted if feasible, to reduce recharge to the opencast. Quarterly groundwater sampling must be conducted to establish a database of groundwater quality to assess plume movement trends. Audit the monitoring network annually. Remove or remediate areas of hydrocarbon contaminated soils by following a risk based approach, take action if a negative risk is found. A risk assessment should be conducted by a qualified hydrogeologist.
	General	<ul style="list-style-type: none"> All the monitoring data needs to be collated and analysed on at least a bi-annual basis and included in management reports. This information will also be required by government departments (Department of Water Affairs, Department of Environmental Affairs) for compliance monitoring. After 2 years from start of mining, the monitoring information collated should be used to update the groundwater flow and geochemical models. These models should thereafter be updated so that sufficient mitigation measures can be implemented. Management and mitigation plans should be continuously adapted using the monitoring data. A detailed mine closure plan should be prepared during the operational phase, including a risk assessment, water resource impact prediction etc. as stipulated in the DWA Best Practice Guidelines. The implementation of the mine closure plan, and the application for the closure certificate can be conducted during the decommissioned phase.
Surface Water	Increased sediment generation	<ul style="list-style-type: none"> Strict erosion control

		<ul style="list-style-type: none"> No development within riparian zone Access roads to be well maintained Stream-bank at dam spillway and downstream of dam to be well protected against flood damage and erosion
Surface Water	Pollution of stream	<ul style="list-style-type: none"> Zero effluent discharge policy from Roodepoort Colliery (no discharge to dam or stream) Strict regulatory control on all water containing waste generated and disposal of effluent (WWTW)
Surface Water	Damage to riparian vegetation	<ul style="list-style-type: none"> Introduce strict rehabilitation programme with erosion control and re-vegetation of disturbed areas using indigenous plants and shrubs Disturbed footprint and rehabilitated areas to be monitored throughout life of the Roodepoort Colliery Compliance with all environmental legislation
Surface Water	Degradation of riparian areas by constructing and operation of Roodepoort Colliery	<ul style="list-style-type: none"> Activities secondary to mine construction and operation to be located out of riparian zone as far as possible All work areas including access road and mining complex to be rehabilitated on completion
Surface Water	Damage and degradation to the in-stream habitat caused by prolonged mining activities	<ul style="list-style-type: none"> Strict control measures to be implemented in terms of impact minimisation on the in-stream habitat
Surface Water	General	<ul style="list-style-type: none"> Dirty water collection at the station drains and sumps Clean water diversion (bunds/ canals). Good housekeeping (clean-up of spills and minimise informal storage of materials) Leak detection through inspection Good housekeeping (maintenance of equipment) Storm water diversion upstream of the facilities Either run off will be contained in paddocks for collection and evaporation or run off will be captured in the drain system and channelled to the PCD compartment. Monitor seepage at PCD on a quarterly basis Isolate pollution sources with roofs, concrete bases, traps, sumps and bund walls (e.g. diesel/petrol storage, wash bays and workshops) Roads will be surfaced Vehicle maintenance will be conducted on bunded concrete surfaces
Air Quality	Material extraction	<ul style="list-style-type: none"> Low or in-pit dumping of overburden during high wind conditions
Air Quality	Transport and transfer of material	<ul style="list-style-type: none"> Use of a global positioning system as a tool to track the locations of mining and dust suppression equipment (e.g. water carts) and cross-referencing this information with real-time weather monitoring to assist with dust control Use of water sprays at each contact or transfer point along the conveyance system which have adjustable rates of application (low, medium and high) depending on dust levels Use of a retractable telescopic chute with curtains to load coal into carriages/trucks
Air Quality	Storage of material	<ul style="list-style-type: none"> A tree windbreak located downwind of the prevailing wind direction to minimise dust from the finished product stockpiles

		<ul style="list-style-type: none"> • Topsoil handling and storage procedures including stockpile inventory, vegetative cover and signage to optimise rehabilitation and minimise wind erosion • Successful trialling of a chemical dust suppressant on haul roads resulting in a considerable reduction in the amount of water used for dust suppression on haul roads
Air quality	Exposed areas	<ul style="list-style-type: none"> • Successful trialling of broadacre temporary rehabilitation of unshaped overburden emplacement areas by aerial sowing of a cover crop, providing an established vegetative stabilisation to minimise the potential for windblown dust generation • Constricting the areas and time of exposure of pre-strip clearing in advance of mining development
Noise	Barriers	<ul style="list-style-type: none"> • A noise barrier in the form of a berm should be constructed on the eastern boundary of the proposed opencast area as soon as possible, • Barrier must be situated between the main noise source noise sensitive receivers which is mainly the town of Pullenshope. • The berm will help with the attenuation of noise produced by the mining activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance.
Noise	Vehicle noise	<ul style="list-style-type: none"> • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers. • Switching off equipment when not in use. • Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source. • Barriers should be installed between the noise source and sensitive noise receptor, as close to the noise source as possible. • All project employees and contractors will be instructed to avoid the use of engine compression brakes when approaching the Mine entrance or driving through or in the vicinity of the town of Pullenshope. • All access roads will be signposted and speed limited to minimise transport noise. • Equipment with lower sound power levels would be used in preference to more noisy equipment. • All equipment used onsite will be regularly serviced to ensure the sound power levels remain at or below the levels used in the modelling to assess generated noise levels and compliance with the criteria. • The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.
Heritage & Archaeological	Potential impacts on identified archaeological sites	<ul style="list-style-type: none"> • The graveyard (P01) and the isolated grave (P02) fall within the area demarcated for development and are protected under legislation. • The expansion of the graveyard, as well as the area associated with the isolated grave within the portion demarcated for development be ceased, fenced off, and continued elsewhere as directed by the local municipality. • No mining activities or development should take place within a radius of 15 m of the fences.

		<ul style="list-style-type: none"> • Alternatively the affected graves may be relocated by a qualified graves relocation unit to a premises earmarked by the local municipality, but will set in motion a substantial process as new legislation will be triggered. • Access must be allowed to the fenced-off graveyard and the isolated grave. • These processes, however, must be performed in accordance with the involvement of community leaders and the relatives of the deceased buried in the concerned graveyards. • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material and skeletal remains may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist (See National Heritage and Resources Act, 25 of 1999 section 36 (6)). • From a heritage point of view, development may proceed on the demarcated section of Portion 17 of the farm Roodepoort 151 IS subject to the abovementioned conditions and recommendations.. • Should the need arise to expand the development beyond the 40 hectare demarcated area mentioned in the specialist study, the following applies: <ul style="list-style-type: none"> ○ a qualified archaeologist must conduct a full Phase 1 assessment on the sections beyond the demarcated areas which will be affected by the expansion, in order to determine the occurrence and extent of any archaeological sites and the impact development might have on these sites.
Paleontological	Potential impacts on Paleontological heritage	<ul style="list-style-type: none"> • Regular inspections should be made by a palaeontologist of all mining areas, as well as any excavations and construction sites during the development of the project to ascertain if any fossil materials have been uncovered. • Should any fossil material be located during the proposed inspections the relevant portion of the excavations should be halted and SAHRA informed of the discovery. • Should any fossil material be identified a palaeontologist should be contacted to evaluate the material and advise on its scientific importance and, if necessary, excavation or preservation.
Visual	Visual and aesthetic impacts due to mining activities	<ul style="list-style-type: none"> • Dust from Stockpile areas, roads and other activities must be managed by means of dust suppression to prevent excessive dust. • Stockpiles should not exceed 15m in height. • Rehabilitation of the area must be done as the mining is completed. • The visual impact can be minimized by the creation of a visual barrier. • The retention of as much existing vegetation as possible, specifically the existing mature trees in the area to conceal the mining activity as much as possible. • Down-lighting should also be implemented to minimise light pollution at night

Ecological	Impacts on the natural environment	<ul style="list-style-type: none"> • Pathways should be clearly demarcated and be kept to. It is important that animals (wildlife and domestic animals) are not handled, removed, killed or interfered with. • Activities must comply with the regulations of the Animal Protection Act 1962 (Act No. 71 of 1962). • Rehabilitation of degraded areas is a must.
Ecological	Impacts on the plant species	<ul style="list-style-type: none"> • A management plan for control of invasive/exotic plant species needs to be implemented. This will be ongoing until the end of the mining closure phase. The mine will be held accountable in this regard. • Rehabilitation plan should be implemented. This includes the return of the topsoil and the process of replanting the vegetation. The replacement of the topsoil should be done with the assistance of a soil scientist. Topsoil should be tested closer to the rehabilitation phase to ensure that the soil is of an adequate quality. The post-closure rehabilitation plans should be adopted according to the necessary actions needed during the final stage of the life of mine. • The use of the farm post-closure should be grazing. The veld management plan that was created by the veld management expert should be thoroughly implemented. • Close monitoring of plant communities to ensure that ecology is restored and self-sustaining. The monitoring of the flora should be conducted every six months by the environmental practitioner. A report should be written and stored to be made available and should be available at all times.
Ecological	Impacts on the animal species	<ul style="list-style-type: none"> • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees. • Activities on site must comply with the regulations of the Animal Protection Act 1962 (Act No. 71 of 1962). Workers should also be advised on the penalties associated with the needless destruction of wildlife, as set out in this act. • Ensure that an acceptable aesthetic scenario is created post closure. This will be reached through adequate rehabilitation practices by restoring damaged and degraded habitat areas. • When closure is considered successful and rehabilitation complete, unnecessary fences should be lifted to restore larger foraging areas, especially for larger mammalian species within the area.
Ecological	General	<ul style="list-style-type: none"> • A management plan for control of invasive/exotic plant species needs to be implemented. This will be ongoing until the end of the mining closure phase. The mine will be held accountable in this regard. • A rehabilitation plan should be implemented. This includes the return of the topsoil and the process of replanting the vegetation. It is recommended that the replacement of the topsoil is done with the assistance of a soil scientist. The topsoil should also be tested closer to the rehabilitation phase to ensure that the soil is of an

		<p>adequate quality. The post-closure rehabilitation plans should be adopted according to the necessary actions needed during the final stage of the life of the mine. The focus of the rehabilitation plan would be to deliver the best overall environmental, economic and social outcomes.</p> <ul style="list-style-type: none"> • Close monitoring of plant communities to ensure that ecology is restored and self-sustaining. The monitoring of the flora should be conducted every six months by the environmental practitioner. A report should be written and stored to be made available and should be available at all times. • The use of the farm for conservation purposes post-closure of the mine is very low. Therefore, a possible use after rehabilitation would be to utilize it for grazing purposes. For grazing to be efficient, a veld management expert should be employed to develop a veld management programme for the area. This should be done long before rehabilitation is started, especially before the replacing of the soil, to ensure that an adequate and realistic programme is implemented. A possible method for reseeding should be to sow many pioneer species during the first process that will become established more easily. It will make the area suitable for other species to also become established. Therefore, a successional process should be followed. For example, Themeda triandra currently occurs within the area which is a climax species. Once removed these species take a long time before becoming established again. This should be taken into consideration and it should be followed by processes that initiate succession. • Ensure awareness amongst all staff, contractors and visitors to the site to not needlessly damage flora. • Rehabilitate surrounding area with natural, indigenous vegetation as much as possible, consulting with specialists as to the most appropriate methods. • Re-vegetation of all degraded areas and bare patches is advised to speed recovery to natural, self-sustaining state as soon as possible
Traffic	Vehicle and equipment movement	<ul style="list-style-type: none"> • Ensure trucks and vehicles remain on roads and areas designated as a construction site to limit disturbance to areas unaffected by construction. • Ensure drivers are informed that off-road travelling is prohibited. • Ensure speed limits are set on all roads and enforce speed limits. Ensure all drivers at the site are informed about speed limits.
Socio-economic	Impact on surrounding community	<ul style="list-style-type: none"> • All workers must be given sufficient notice to allow them to plan for the immediate future. • Adequate and reasonable severance packages must be provided to all workers to be retrenched. • All rubble from demolition and disused and damaged equipment must be transported off site to a licensed disposal facility so that it does not become an eyesore.

Land Capability	Soil handling and preservation	<ul style="list-style-type: none"> • Loss of topsoil and usable soil <ul style="list-style-type: none"> ○ Strip all usable soil and stockpile. ○ Vegetate long-term soil stockpiles • Contamination of topsoil and stockpiled soil <ul style="list-style-type: none"> ○ Prevent contamination of topsoil and stockpiled soil. ○ Site all soil stockpiles upslope from any mining / development activities ○ Position stockpiles upslope of mining areas, or as screens to restrict visibility of the mining operation provided that in doing so, the stockpile is not exposed to the risk of seepage or dirty water contamination. • Erosion of stockpiled soil <ul style="list-style-type: none"> ○ Ensure that all stockpiles have a storm water diversion berm for protection against erosion and contamination by dirty water.
Land Capability	General	<ul style="list-style-type: none"> • Keep vehicles on roads. • Petrochemical spillages to be collected in a drip tray and drum to store excavated spill affected soil for disposal at a registered facility. • Fill in all foundation trenches • Replace subsoil and topsoil to at least 350 mm depth. • Soil sampling and analysis. • Fertilise according to vegetation needs based on results of soil assessment and fertility analysis. • Re-vegetate areas where infrastructure was removed using site specific species. • Use area specific adapted indigenous grass seed. • Integrate disturbed area to most appropriate land use to ensure long-term stability of restored topsoil. • Develop post-mining environments in conjunction with regional development plans. • Recreate habitats where possible or structure altered landscapes to be compatible with regional habitat mosaics to resist water and wind erosion of soils. • Measure vegetation performance.
Waste	Receiving environment contamination	<ul style="list-style-type: none"> • A waste management procedure must be developed and implemented. It covers the storage, handling and transportation of waste. • Opportunities to minimize waste production will be identified and taken where possible. Where possible, waste will be recycled. • Waste collection points will be established on site. Care must be taken to ensure that there are sufficient

		<p>collection points for each designated type of waste with adequate capacity and that these are serviced frequently.</p> <ul style="list-style-type: none"> • At present there is no intention to develop waste disposal facilities on site; <ul style="list-style-type: none"> ◦ No waste disposal facility will be developed by the mine without the relevant permissions. These permissions include an environmental authorisation (from DEA) and a waste permit (from DEA) in terms of the National Environmental management: Waste Act, 2008. • Waste will be disposed of at appropriate permitted waste disposal facilities. These will vary depending on the waste. • An approved subcontractor, working to local authority standards, will undertake the waste transport to remove domestic waste and sewage sludge (if necessary). • Hazardous industrial wastes are stored in specially marked bins or other storage areas (engineering workshops) before removal for either recycling such as for waste oils, which are sold to contractors or removed to hazardous waste disposal facilities to returned to the supplier. Contractors remove the hazardous waste such as PCB contaminated transformer lubricates from the site immediately after servicing. The frequency of disposal is as required. • Domestic waste generated by the opencast area, crushing and screening plant & offices is collected daily from waste bins and collections points and transported by contractors to the Belfast Waste Disposal Site • The solid industrial waste from the crushing and screening plant is collected by contractors from points of collection. • If remediation of the soil in situ is not possible, the soils will be classified as a waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted waste facility. • Care will be taken to ensure that scrap metal does not become polluted or mixed with any other waste (picks, bits, roof bolts, wire and cabling). • The scrap metal must collected in a designated area for scrap metal (scrap yard). It can be sold to scrap dealers. • Oil must be collected in suitable containers at designated collection points. The collection points must be bunded and underlain by impervious materials to ensure that any spills are contained. Notices must be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor must remove oil from site.
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9. Environmental Monitoring Plans

9.1 Groundwater Monitoring

Source, plume, impact and background monitoring

A groundwater monitoring network should contain monitoring positions which can assess the groundwater status at certain areas. The boreholes can be grouped according to the following purposes:

- Source monitoring – monitoring boreholes are placed close to or in the source of contamination to evaluate the impact thereof on the groundwater chemistry.
- Plume monitoring – monitoring boreholes are placed in the primary groundwater plume's migration path to evaluate the migration rates and chemical changes along the pathway.
- Impact monitoring – monitoring of possible impacts of contaminated groundwater on sensitive ecosystems or other receptors. These monitoring points are also installed as early warning systems for contamination break-through at areas of concern.
- Background monitoring – background groundwater quality is essential to evaluate the impact of a specific action/pollution source on the groundwater chemistry.

System Response Monitoring Network

Groundwater levels – Static water levels are used to determine the flow direction and hydraulic gradient within an aquifer. Where possible all of the above mentioned borehole's water levels need to be recorded during each monitoring event.

Monitoring frequency

In the operational phase, quarterly monitoring of groundwater quality and groundwater levels is recommended. Quality monitoring should take place before, after and during the wet season, i.e. during September and March. It is important to note that a groundwater-monitoring network should also be dynamic. This means that the network should be extended over time to accommodate the migration of potential contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources.

Monitoring Parameters

The identification of the monitoring parameters is crucial and depends on the chemistry of possible pollution sources. They comprise a set of physical and/or chemical parameters (e.g. groundwater levels and predetermined organic and inorganic chemical constituents). Once a pollution indicator has been identified it can be used as a substitute a full analysis and therefore save costs. The use of pollution indicators should be validated on a regular basis in the different sample positions. The parameters should be revised after each

sampling event; some metals may be added to the analyses during the operational phase, especially if the pH drops.

Abbreviated analysis (pollution indicators)

Physical Parameters:

- Groundwater levels

Chemical Parameters:

- Field measurements:
 - pH, EC
- Laboratory analyses:
 - Major anions and cations (Ca, Na, Cl, SO₄)
 - Other parameters (EC)

Full analysis

Physical Parameters:

- Groundwater levels

Chemical Parameters:

- Field measurements:
 - pH, EC
- Laboratory analyses:
 - Anions and cations (Ca, Mg, Na, K, NO₃, Cl, SO₄, F, Fe, Mn, Al, Cr, Hg & Alkalinity)
 - Other parameters (pH, EC, TDS)
 - Petroleum hydrocarbon contaminants (where applicable, near workshops and petroleum handling facilities)
 - Sewage related contaminants (E.Coli, faecal coliforms) in boreholes in proximity to septic tanks or sewage plants.

Monitoring Boreholes

There are no source/plume monitoring boreholes that match the criteria as mentioned in the preceding paragraphs. Therefore at least 4 to 6 monitoring holes are recommended to be constructed around each opencast upstream and downstream of the site.

DWAF (1998) states that “A monitoring hole must be such that the section of the groundwater most likely to be polluted first, is suitably penetrated to ensure the most realistic monitoring result.”¹⁶ Therefore it is

recommended that boreholes be drilled on the positions as mentioned in the paragraph. These boreholes should be drilled as close possible to the opencast and monitored appropriately. Construction of these boreholes should be overseen by a qualified hydrogeologist to monitor the upper weathered as well as lower fractured aquifer.

A monitoring network should be dynamic. This means that the network should be extended over time to accommodate the migration of contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources. An audit on the monitoring network should be conducted annually.

In the table below a monitoring network extension is proposed. These boreholes should be added to boreholes mentioned in Table 5 as part of an extended monitoring network and should be sited using geophysical methods. The monitoring positions are indicated below and show potential drilling positions. However, these positions are purely indications.

Table 99: Proposed groundwater monitoring network

Name	X-coord	Y-coord	Monitoring Requirement
RDM01	29.5839211	-26.00813933	Source/Plume Monitoring
RDM02	29.57975849	-26.00823285	Source/Plume Monitoring
RDM03	29.57688704	-26.00306219	Source/Plume Monitoring
RDM04	29.57930092	-26.00155548	Source/Plume Monitoring
RDM05	29.58232399	-26.00300201	Source/Plume Monitoring
RDM06	29.58394288	-26.00395514	Source/Plume Monitoring

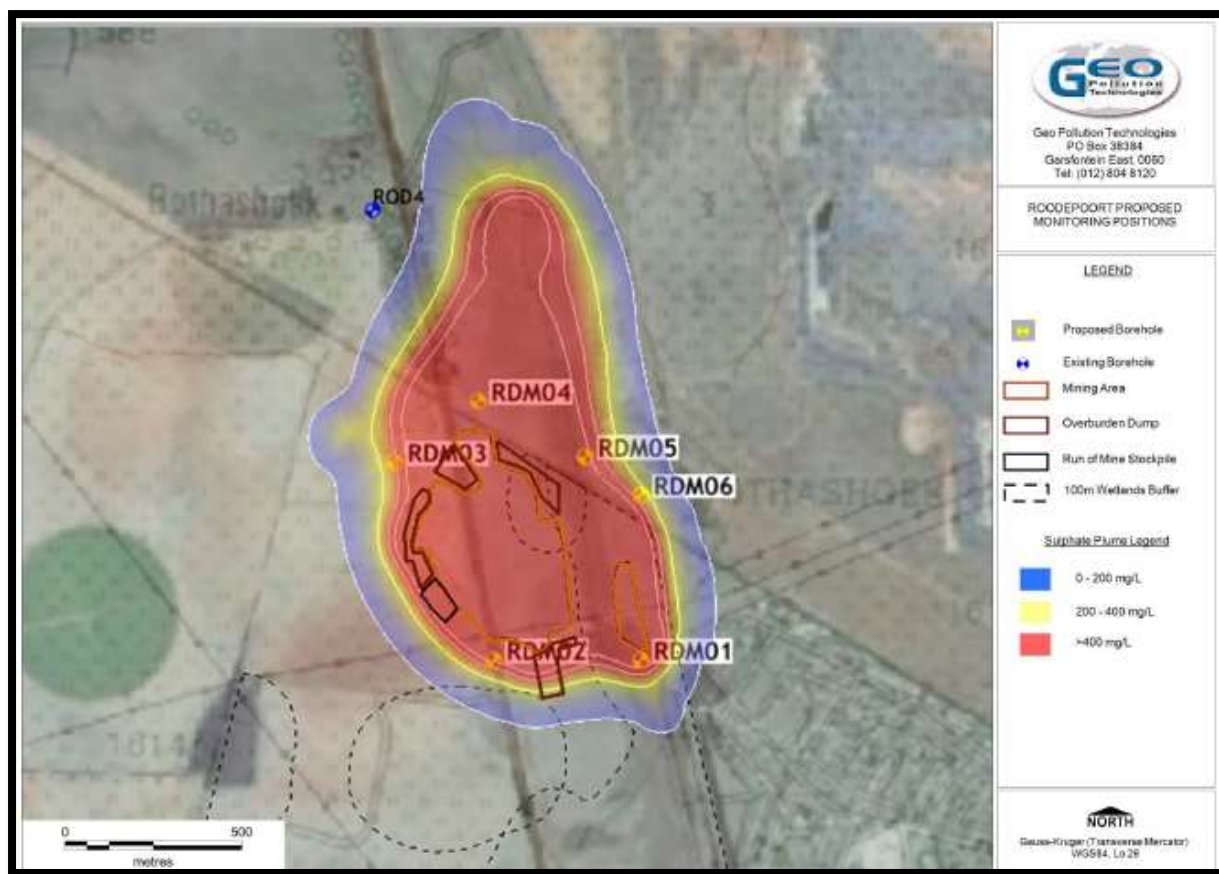


Figure 111: Proposed monitoring borehole localities

9.2 Surface Water Monitoring

Water is typically the prime environmental medium that is affected by mining activities. Mining adversely affects the water quality and poses a potential significant risk to the area's water resources. The proposed mining could also substantially alter the hydrological and topographical characteristics of the mining footprint area. This would ultimately affect the mean surface runoff, soil moisture, evapo-transpiration and groundwater behaviour. Failure to manage impacts on regional water resources in an acceptable manner throughout Life of Mine and post-closure, will result in Kebra Fields finding it increasingly difficult to obtain community and government support for their existing projects. Consequently sound management practices to prevent and minimise water pollution are fundamental for coal mining operations to be sustainable. Therefore, in order to manage the mine properly monitoring is critical in order to take the correct management decisions. The following monitoring system is proposed to provide sound information on the effectiveness of protection measures.

Water Monitoring

Water quality monitoring parameters as indicated below must be monitored on a monthly basis or in accordance with the frequency as specified in a water use authorisation.

Table 100: Water monitoring parameters

Variable	Unit
pH	
Electrical Conductivity as EC	mS/m
Suspended Solids as SS	mg/l
Total Dissolved Solids as TDS	mg/l
Sulphate as SO ₄	mg/l
Nitrate as NO ₃	mg/l
Sodium as Na	mg/l
Chloride as Cl	mg/l
Calcium as Ca	mg/l
Potassium as K	mg/l
Magnesium as Mg	mg/l
Total hardness as CaCO ₃	mg/l
Total alkalinity	mg/l
Fluoride as F	mg/l
Aluminium as Al	mg/l
Iron as Fe	mg/l
Manganese as Mn	mg/l

Surface Water Monitoring

There are several small surface drainage channels on the property. However, two main identified channels that drain the mining area could be regarded as perennial of nature and forms part of a channelled bottom valley wetland system. Due to the size and risk categorisation of the proposed operations as well as the significant (high) risk of surface water pollution, surface water quality monitoring is proposed at points as indicated in the table below. The surface water monitoring points as indicated in the figure below were used to characterise the water resources in the project area.

Table 101: Proposed surface water monitoring points

Sampling point	Coordinates	
	Longitude	Latitude
KFBM04: At bottom valley channelled wetland. Unnamed tributary to Woestalleen Spruit	25°59'56.98" S	29°34'52.06"E
KFBM03: Tributary of Woestalleen Spruit, direct opposite from proposed mining area	26° 0'14.90" S	29°34'56.62"E
KFBM02: Tributary of Woestalleen Spruit, overflow from dam	26° 0'26.33" S	29°34'56.64" E
Dam: Grab sample from dam on property	26° 0'34.83" S	29°35'2.80" E
KFBM01: Upstream of mining area and below second dam on property	26° 1'14.71" S	29°35'9.44" E

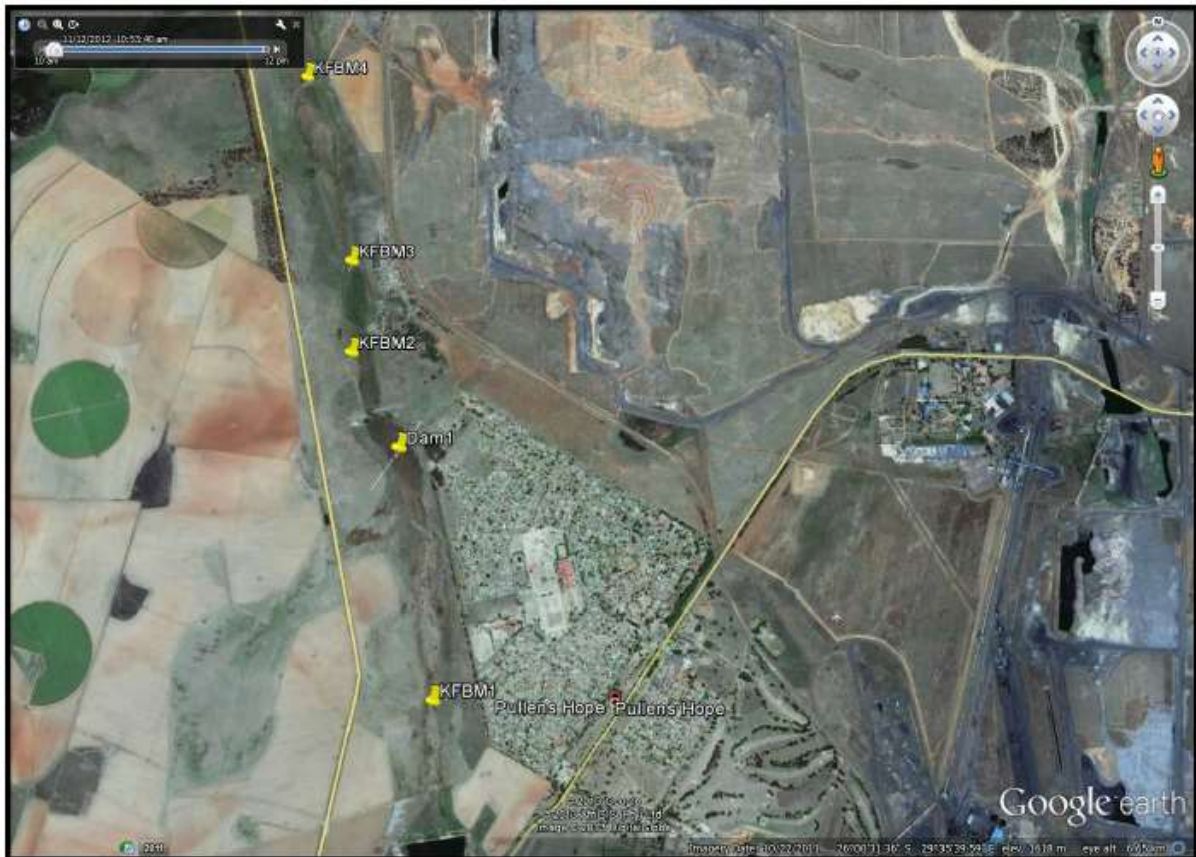


Figure 112: Surface water monitoring points

In addition, monitoring of the water quality in the pollution control dams will be done on a quarterly (October, January, April, July) basis and include the variables as specified in the table. The water quality will be representative of:

- Seepage/run off from the mining areas
- Seepage from waste rock dump
- Dewatering of the open pit
- Potential impacts from upstream land use activities

Proposed monitoring points as indicated in the table should be initiated during the operational phase of the mine. Once the mine moves towards decommissioning and closure, the monitoring programme will have to be updated and upgraded to cover the monitoring needs related to the specific closure objectives.

Due to the fact the Roodepoort Colliery mining area is located in the upper reaches of the Woestalleen Spruit catchment, no additional upstream monitoring points are anticipated. Upstream water quality at monitoring point KFBM1 is considered to be representative of water quality stemming from natural land use conditions.

Furthermore, the proposed colliery being situated below Hendrina Power Station and the Pullenshope Waste Water Treatment Works has two drainage areas that need to be covered by the monitoring programme. Mine

drainage area 1 drains towards the Northern PCD and impacts will be determined at monitoring point KFBM04. Mine drainage area 2 drains towards the Southern PCD and potential impacts stemming from mining will be determined at monitoring point KFBM03. Monitoring point KFBM01 is directly upstream of the dam on the farm Roodepoort 151 IS. Monitoring point "Dam" was done to determine the background water quality of the water in the system. Should the mine start to decant, monitoring point KFBM02 will act as an early warning system. A proposed layout of the annual report to be submitted to DWA is presented in the table below.

Table 102: Monitoring and Review Measures

What	Where	When	Responsibility	Reporting Requirements
Water quality	Below bridge at KFBM01 and KFBM03	Monthly	Contractor	As per WUL
Riparian zone Vegetation / Fauna	Between dam up to point where alteration ends	Bi-annual	Contractor, Kebrafield	As per WUL
Alien Vegetation	On site	Annually	Contractor, Kebrafield	As per WUL
Woestalleen upstream	Upstream	Monthly	Contractor	As per WUL
Woestalleen downstream	Downstream	Monthly	Contractor	As per WUL
Emergency and pollution incidents ¹	All mine activity sites	At all times	Contractor (ECO)	Section 19 and 20 of the National Water Act

Table 103: Proposed layout of annual report to DWA

Section	Title	Description
	Executive summary	
1	Introduction and scope of work	Why do report? Where info has been obtained from
2	Background and Brief	Overview of Project
2.1	Background of project	Where is mine located (brief)
2.2	Nature of Brief / Terms of Reference	Who was appointed and when to report: Responsible persons
3	Program Objectives and Work Program	
3.1	Program Objectives	Objective of report
3.2	Work Program / Scope of work	What does the report cover
3.3	Project team	Who is on the monitoring team
4	Overview of the mining / activity operation	Describe mining operations and give brief summary of expansions in the last year
5	Water use license application update	Mention any Exemptions or permits and brief overview of what has happened or where the licensing process is standing. Compliance audit
6	Environmental incidents	Brief summary of any environmental incidents for the year
7	Overview of the water environment and potential impacts from the mining operation (/plans/maps/regional setting and local use of water)	Describe water resources in and around mine lease area, describe the mining operation in relation to the potential of the infrastructure to impact on the water environment and downstream users

7.1	Catchment overview	Indicate which catchment is applicable + quaternary; Map indicating operations in relation to catchments
7.2	Surface water	Detail on surface water catchments
7.2.1	Rainfall and evaporation	Monthly recorded volumes and 24 hour rainfall events vs. return periods (1 in 5 etc.)
7.2.2	Surface water users	Outline of what the surface users use water for
7.2.3	Flow measurements (Continuous monitoring)	Report on any continuous water flow data
7.3	Groundwater	Detail on groundwater aquifers flow etc.
7.3.1	Aquifer types and characteristics	ID and Describe types affected
7.3.2	Groundwater users	Indicate if groundwater is used in the vicinity, if possible ID uses
7.3.3	Groundwater management plan	How will the mine prevent future water pollution
7.3.4	Groundwater dewatering	Describe any dewatering activities
7.4	Potential impacts from the mining infrastructure	Describe possible impacts
7.4.1	Potable water consumption	Compliance with allocated potable water
7.4.2	Re-use of water	Describe where and how re-used
7.5	Water and salt balance update	According to BPG G2
7.6	Water conservation and use efficiency	How is water conserved, and strategies to effectively use water / prevent losses

8	Water quality	Describe the water monitoring programme and gives an assessment of the surface and water quality data
8.1	Water monitoring programme	Objectives of monitoring, Brief description of monitoring plan, schedule, parameters, review, maps, sampling reconciliation (when was sample taken and when not) etc.
8.2	Surface water quality	Results, overview and discussion
8.3	Process water quality	Results, overview and discussion
8.4	Groundwater quality	Results, overview and discussion
9	Bio-monitoring	Results, overview and discussion
10	Regulation 704 compliance	Compliance audit
11	Management measures and actions implemented to minimize water quality impacts	Identify and discuss
12	Potable water use saving strategies	Identify and discuss
13	Water management commitments	Identify and discuss
14	Stakeholder and Governmental Departments	Summary of Issues raised relating to water and steps taken
15	Conclusions and Recommendation	Highlight non-compliance and rectifying measures implemented
16	Reference and Bibliography	
	Appendices	

Bio-monitoring

Bio-monitoring will be conducted on a bi-annual basis at the points KF01 – KF03 as proposed in the figure in the previous section. The bio-monitoring will assist in the determination of potential long term impacts on the receiving water environment.

9.3 Noise Monitoring

It is recommended that the monitoring plan be implemented to determine potential sources of noise, increases and decreases in noise levels, and determine level of mitigation required.

Components to be included in the proposed monitoring plan are discussed below.

Noise monitoring is to be conducted on a quarterly basis throughout the life of mine to determine the impact of the noise levels on the relevant noise sensitive receivers as well as determine the level of mitigation.

The noise measurements should be taken as per the baseline noise measurement locations of this report although additional noise monitoring points should be identified should other sensitive receptors become known during the physical implementation of the activity. A report must be compiled quarterly and submitted to management to ascertain compliance with the required standards. Mine management should be advised of any significant increase in the ambient sound level as operations continue. At each measurement point the ambient noise level will be sampled in terms of the following parameters:

- The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point.
- Measurements to be taken during both daytime (06:00 to 22:00) and the night time (22:00 to 06:00).

9.4 Air Quality Monitoring

Monitoring Aspect	Receptors	Frequency
Gravimetric Dust Fallout	8 main wind directions border of property	Monthly
Particulate Matter PM10	8 main wind directions border of property and at fugitive dust sources	Monthly
Sulphur Dioxide	4 sample points, border of property	Quarterly
Noise	8 sampling points, border of property and at sensitive receptors as required	Quarterly

- **Gravimetrical Dust Fallout – (milligram/square meter/day) or (mg/m²/day) (monthly 8 samples)**

Site layout for the sampling points will be carried out according to the eight main compass directions; the site layout and equipment placement is done in accordance with the ASTM standard, D 1739 – 2010, thereafter relevant sampling reference numbers will be allocated to the receptors accordingly. At each gravimetric dust fallout gauge/receptor point there is a stand built according to specification containing the dust sample collection bucket. Samples will be collected after a 1 month running period (+/-30days exposure). After sample collection the samples are taken to the relevant SANAS accredited laboratory as required. A visual site investigation is done where after correlations and drawn and findings are identified and reported on.

Dust buckets of a standard size and shape are prepared and set up at locations related to the eight main compass points (currently limited to six sampling points due to sampling site in process of obtaining two more monitoring gauges) on the borders of the property so that dust can settle in them for periods of 30+/-2 days. The dust buckets is then sealed and replaced with new empty ones and send away to the SANAS accredited laboratory for analysis. The masses of the water-soluble and –insoluble components of the material collected are then determined and results are reported as mg/m²/day. This methodology is described according to South African National Standards 1929:2004 and the American Society for Testing and Materials (ASTM) Designation: D 1739-98 (2010). The results for this method of testing are obtained by gravimetical weighing. The apparatus required include open top buckets/containers not less than 150mm in diameter with a height not less than twice its diameter. The buckets must be placed on a stand at a height of 2+/-0.2m above the ground.

- **Particulate matter PM10 & PM 2.5 sampling (monthly 8 samples)**

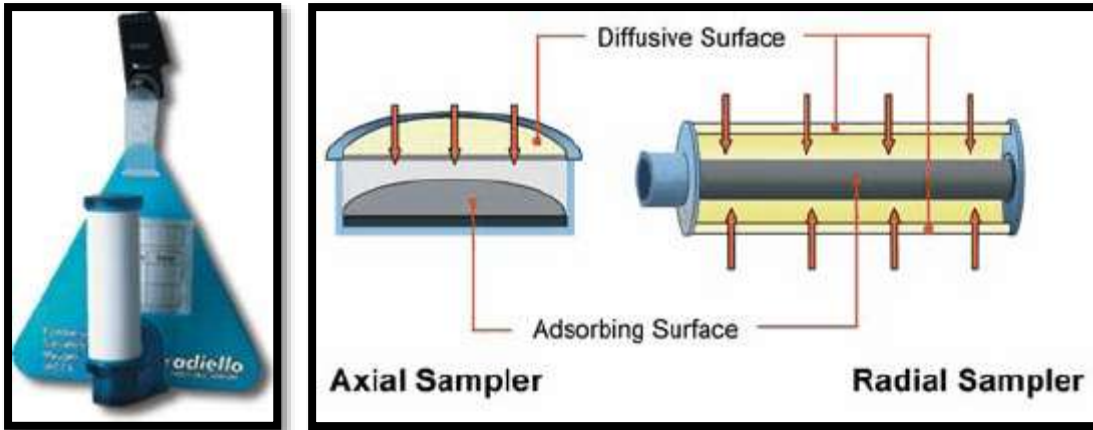
- Handheld particulate sampling equipment will be utilised as indicated in the image below and specified in the accompanying table.



Specifications:	
Particle Counter	
Channel	0.3, 0.5, 1.0, 2.5, 5.0, 10µm
Flow Rate	0.1ft ³ (2.83L/min) controlled by internal pump
Count Modes	Totalize, Concentration, Audio
Coincidence Loss	5%, 2000000 particles per ft ³
IR Temperature Measure	
IR Temp. Range	-20.0°C to 500.0°C/-4.0°F to 916°F ; Basic Accuracy: ±1.5% of reading
Optical Resolution	8:1 Distance to Spot size
Emissivity Adjustable	0.10~1.0 Adjustable
Response Time	500mS
Air Temperature Measure	
Air Temp Range	0 to 50°C/32 to 122°F; Basic Accuracy: ±0.5°C/1°F
Humidity Range	0 to 100%RH; Basic Accuracy: ±2.5%RH(20%~80%RH)
Dew Point Temp. Range	-30~100°C/ -22~199°F
Wet Bulb Temp. Range	0~80°C/ 32~176°F

- **Sulphur Dioxide (4 samples quarterly)**

- Gas sampling will be conducted quarterly to determine the risk of coal burning due to spontaneous combustion contributing to air quality deterioration
- Radiello passive diffuse sampling badges as illustrated below will be utilised for this purpose;



9.4 Archaeological/Heritage and Paleontological

Monitoring should take place to ensure compliance with the conditions as set out in the EMP and associated specialist report appended to this EIA/EMP.

- Regular inspections should be made by a palaeontologist of all mining areas, as well as any excavations and construction sites during the development of the project to ascertain if any fossil materials have been uncovered.
- Should any fossil material be located during the proposed inspections the relevant portion of the excavations should be halted and SAHRA informed of the discovery.
- Should any fossil material be identified a palaeontologist should be contacted to evaluate the material and advise on its scientific importance and, if necessary, excavation or preservation.

A Phase 3 Heritage Impact Assessment (HIA) needs to be implemented if sites of archaeological or cultural significance are located in the footprint areas of development.

9.5 Ecology

Monitoring's framework should be instigated and managed by their Environmental Control Officer (ECO) due to the fact that Kebrafields (Pty) Ltd will follow a SHEQ Management System.

- Quarterly visual assessment of areas to determine if vegetation in undisturbed areas is being impacted.
- A biodiversity baseline assessment conducted should be used to compare results with future biodiversity assessments. Annual biodiversity monitoring of areas both affected and unaffected by activities should be initiated to determine annual fluctuation in species numbers and if necessary relate this to activities on site.

- Determine annual fluctuation in species numbers and if necessary relate this to activities on site.
- Establish a monitoring programme for early detection of alien invasive species and establish an alien invasive awareness, eradication and control programme.
- Continue with annual biodiversity monitoring. Include biodiversity monitoring sites in rehabilitated areas to determine if these are improving with regard to habitat.
- Continue with alien invasive monitoring, eradication and control programme.

9.6 Social

A Social Management Plan needs to be implemented. The commitments in the Social and Labour Plan in terms of providing portable skills training, with specific emphasis on local employees, also need to be adhered to. This must include Human Resource (HR) and retrenchment plan. A procurement policy should be designed and implemented that promotes preferential procurement of local and Historically Disadvantaged South Africans (HDSA) suppliers. Corporate social responsibility projects should be designed in close consultation with the Integrated Development Plan (IDP) and Local Economic Development (LED) managers for the LLM so that core needs and priorities are addressed. Implement mitigation measures stipulated in Groundwater Impact Assessment to reduce impact on water supplies. It is also recommended to implement mitigation measures stipulated in Noise and Air Quality Impact Assessments to reduce impact on visual, noise and air quality impacts that could affect surrounding properties. At the time of closure, alternative options for re-deployment or employment in other sectors should be investigated.

9.7 Blasting

A blasting monitoring plan needs to be implemented to assess ground vibration and air blast levels and assist in mitigating these aspects properly. Ground vibration and air blasts need to be monitored in accordance with specific limitations. Kindly refer to the specialist Blast Risk Assessment reports which have been attached.

10. Environmental Management System

Though Kebrafield (Pty) Ltd: Roodepoort Colliery is not ISO certified, they implement an approved SHEQ manual that is based on the following documents:

- ISO 9001 : 2008 : Section 4.2.1
- ISO 14001 : 2004 : Section 4.4.4
- OHSAS 18001 : 2007 : Section 4.4.4
- Mine Health and Safety Act 29 / 1996
- Occupational Health and Safety Act 85 / 1993

The SHEQ plan seeks to promote continuous improvement to the working conditions of activities. The ultimate goal for SHEQ improvement is the elimination of losses in all activities involving people, equipment, and material

in addition to protecting the environment. Kebrafield (Pty) Ltd will seek to effectively control all hazards and reduce the risk to all personnel to a zero incident level.

Kebrafield (Pty) Ltd established and maintains an emergency plan and documented procedure to identify the potential for, and responses to, incidents and emergency situations. The procedure describes preventing and mitigating any likely illness and injury that may be associated with Kebrafield (Pty) Ltd. The emergency preparedness and response plans and procedures will be reviewed as stated in the procedure, as well as after the occurrence of incidents or emergency situations. Periodic tests are carried out to test if the emergency preparedness response procedure and plan is adequate.

10.1 Recording of incidents

The procedure for accidents, incidents, non-conformances and corrective and preventive action for Kebrafield (Pty) Ltd will be done in accordance with the prescribed legislation. The handling and investigation of accidents; incidents; non-conformances; taking action to mitigate any consequences arising from accidents, incidents or non-conformances; the initiation and completion of corrective and preventive actions; and confirmation of the effectiveness of corrective and preventive actions taken will be described criteria in the said procedure.

All proposed corrective and preventive actions are reviewed through the risk assessment process prior to implementation.

Any corrective or preventive action taken to eliminate the causes of actual and potential non-conformances is appropriate to the magnitude of problems and commensurate with the SHEQ risk encountered.

Any changes in the documented procedures resulting from corrective and preventive action are implemented and recorded.

10.2 Environmental Impact Register

Kebrafield (Pty) Ltd established and maintains a procedure for the identification, maintenance and disposition of SHEQ records, as well as the results of audits and reviews.

SHEQ records are:

- Legible, identifiable and traceable to the activities involved
- Stored and maintained in such a way that they are readily retrievable and protected against damage, deterioration or loss, as indicated in the relevant procedure

Retention times for all records are established and recorded in each procedure and records are maintained demonstrating conformance to the system and to the organization.

10.3 Auditing and reporting

A procedure to monitor and measure SHEQ performance on a regular basis will be established.

Both qualitative and quantitative measures appropriate to the needs of the organization are measured. Monitoring is done to determine the extent to which the organization's SHEQ objectives are met.

Pro-active measures of performance that monitor compliance with the SHEQ management programme are operational criteria, applicable legislation and regulatory requirements.

Accidents, ill health, incidents (including near-misses) and other historical evidence of deficient SHEQ performance forms part of reactive measures of performance monitoring.

Data are recorded and results of monitoring and measurement are used to facilitate subsequent corrective and preventive action analysis.

Monitoring equipment required for performance measurement and monitoring, as well as the calibration and maintenance activities thereof, is included in Kebrafield (Pty) Ltd's measurement and monitoring procedure.

Kebrafeld (Pty) Ltd established, implemented and maintains a procedure for periodically evaluating compliance with applicable legal requirements. The results of the periodic evaluations are kept as indicated in the section "Records" identified in each procedure.

Kebrafield (Pty) Ltd will also evaluate compliance with ISO 9001, ISO 14001 and OHSAS 18001 as described in the evaluation of compliance procedure.

Kebrafield (Pty) Ltd established and maintains an audit programme and a documented procedure for periodic SHEQ management system as well as legal audits to be carried out, in order to:

- Determine whether or not the OH&S management system:
 - Conforms to planned arrangements for OH&S management including the requirements of the OHSAS 18001 specification and legal requirements
 - Has been properly implemented and maintained
 - Is effective in meeting the organization's policy and objectives
- Review the results of previous audits
- Provide information on the results of audits to management

The following reports will be submitted to the indicated Provincial Government Departments:

- Rehabilitation plan: DMR, DWA, DEA
- Annual water report: DWA
- Annual audit report: DMR and DWA

In addition to the above Kebrafield Pty (Ltd) will ensure continuing suitability, adequacy and effectiveness by establishing and maintaining a system to periodically review the companies SHEQ system. All the necessary information is collected to allow management to evaluate and document this review. The management review shall address the possible need for changes to policy, objectives and other elements of the SHEQ management system, in the light of SHEQ management system audit results, changing circumstances and the commitment to continual improvement.

11. Responsibilities and Prescribed Occupations

11.1 Department of Environmental Affairs

Authorisation in the form of an Environmental Authorisation is required from the Department of Environmental Affairs based on the application and scoping documents as well as the Environmental Impact Assessment Report as submitted. From the Environmental Authorisation will flow site specific requirements that will align the EMP and the intended activity.

11.2 Mine Owner

The mine owner remains ultimately responsible for ensuring that the development is implemented according to the requirements of the EMP. Although the mine owner appoints specific role players to perform functions on his/her behalf, this responsibility is delegated. The mine owner is responsible for ensuring that sufficient resources (time, financial, human, equipment, etc.) are available to the other role players (e.g. Kebrafield (Pty) Ltd) to efficiently perform their tasks in terms of the EMP. The owner is ultimately liable for restoring the environment in the event of negligence leading to damage to the environment.

11.3 Owner of Mine Infrastructure

The owner of the mining infrastructure who acts as the liable and responsible entity is tabled below.

Applicant:	Eyethu Coal (Pty) Ltd
Postal Address:	P.O. Box 71286 Die Wilgers 0041
Telephone No.:	011 867 0836 082 971 5863
Contact Person:	Mr. Rirhandzu Owner Siweya

The Roodepoort Colliery mine owner remains responsible for ensuring that the infrastructure is maintained and operated to ensure compliance to all legislative requirements. Although the mine owner appoints specific role players to perform functions on his/her behalf, this responsibility is delegated. The mine owner is responsible for

ensuring that sufficient resources (time, financial, human, equipment, etc.) are available to the other role players (e.g. the ECO, ELO and contractor) to efficiently perform their tasks in terms of the EMP. The mine owner could be held accountable for restoring the environment in the event of negligence leading to damage to the environment.

The mine owner must ensure that the EMP is included in the tender documentation so that the contractor who is appointed is bound to the conditions of the EMP. The mine owner must appoint an Environmental Control Officer (ECO) during the construction phase to oversee all the environmental aspects relating to the mining development.

11.4 Engineering Contractor

The contractor, as the Mine Owners' agent on site, is bound to the EMP conditions, and is responsible for ensuring that he/she adheres to all the conditions of the EMP. The contractor must thoroughly familiarise him/herself with the EMP requirements before coming onto site and must request clarification on any aspect of these documents, should they be unclear. The contractor must ensure that he/she has provided sufficient budget for complying with all EMP conditions at the tender stage.

The contractor must comply with all orders (whether verbal or written) given by the ECO, project manager or site engineer in terms of the EMP.

The contractor must ensure that the Mining Construction contractor built the Water Management Infrastructure and PCD's according to the approved specification and design of the approved plans.

11.5 Mining Construction Contractor

The contractor, as the Engineers agent on site, is bound to the EMP conditions and is responsible for ensuring that he/she adheres to all the conditions of the EMP. The contractor must thoroughly familiarise him/herself with the EMP requirements before coming onto site and must request clarification on any aspect of these documents, should they be unclear. The contractor must ensure that he/she has provided sufficient budget for complying with all EMP conditions at the tender stage.

The contractor must comply with all orders (whether verbal or written) given by the ECO, project manager or site engineer in terms of the EMP.

11.6 The Environmental Control Officer (ECO)

It is recommended that an Environmental Control Officer (ECO) be appointed by the Owner to oversee all the environmental aspects relating to this development. The ECO should be appointed during the planning phase and form part of the project team. He/she should attend relevant project meetings, conduct audits to assess

compliance with the EMP and be responsible for providing feedback on potential environmental problems associated with the development.

In addition, the ECO would be responsible for:

- Liaison with relevant authorities
- Liaison with contractors regarding environmental management
- Undertaking routine monitoring and appointing a competent person/institution to be responsible for specialist monitoring, if necessary

Liaison with Authorities

The ECO would be responsible for liaising with DWA. During the construction phase, the ECO would be responsible for submitting monthly Environmental Audit Reports on the development to the Competent Authority. These audit reports will be based on the mitigating measures recommended and will include a description of the general state of the site, with specific reference to sensitive areas and areas of non-compliance. In order to keep a record of any impacts, an environmental log (Incident Register) should be kept on a continual basis.

Liaison with Contractors

The ECO will be responsible for informing the contractors of any decisions that are taken concerning the natural and social environment during the construction phase of the development. This would also include informing the contractors of the necessary corrective actions to be taken against employees transgressing the management activities stipulated in this EMP.

11.7 Environmental Liaison Officer (ELO)

An Environmental Liaison Officer (ELO) must be appointed by the Contractor to assist with the more regular monitoring of the construction activities. Any issues raised by the ECO will be routed to the ELO for the Contractors' attention. The ELO shall be permanently on site to ensure daily environmental compliance with the EMP and would ideally also be a senior and respected member of the construction crew. Past experience has revealed that ELOs that can relate to the work force and are the most effective for information transfer and ensuring compliance with the EMP.

12. Environmental Awareness Training Plan

12.1 Employee communication process

As part of the environmental awareness training the employees will be trained on all environmental risks pertaining to these prospecting activities.

An Environmental Awareness and Risk Assessment Schedule have been developed and is outline in the table below. The purpose of this schedule is to ensure that employees are not only trained but that the principles are continuously re-enforced.

Table 104: Environmental Training and Awareness Schedule

Aspect	Frequency/time	Objective
Inductions (all staff, workers, contractors and visitors)	1 hour environmental awareness training	1. Develop an understanding of what is meant by the environmental and social environment and establish a common language as it relates to environmental, health, safety and community aspects. 2. Establish a basic knowledge of the environmental legal framework and consequences of non-compliance 3. Clarify the content and required actions for the implementation of the Environmental Management Plan 4. Confirm the spatial extent of areas regarded as sensitive and clarify restrictions 5. Provide a detailed understanding of the definition, the method for identification and required response to emergency incidents.
Monthly Awareness Talks (all staff, workers, contractors and visitors)	30 min awareness talks	Based on actual identified risks and incidents (if occurred) reinforce legal requirements, appropriate responses and measures for the adaptation of mitigation and/or management practices.
Risk assessments (supervisors and workers responsible for)	10min task based risk assessment	Establish an understanding of the risks associated with a specific task and the required mitigation and management measures.

12.2 Description of solutions to risks

As prescribed in the table above, Task / Issue Based Risk Assessments must be undertaken with all worker involved in the specific task in order to establish an understanding of the risks associated with a specific task and the required mitigation and management measures.

12.3 Environmental awareness training

The general environmental awareness training program focuses on the following aspects:

1. Explaining clearly what the environment is and what the environment consist of namely air, water, soil, fauna, flora and people;
2. Once participants have grasped the description of what the environment entails the training focuses on the potential impacts the mining activity may have on each one of these environmental components. This is done by making use of the aspect register where each one of the environmental aspects and associated impacts have been identified;
3. To ensure that the training is effective visual aids are used. Photos are taken of actual and potential impacts occurring on site and in some cases role-play is used to generate a photo of a potential impact;

4. The participants are then exposed to a poster that reflects the various environmental components. The various photos taken are posted on the poster on a rotational basis and the participants indicate (based on the visual component) what environmental component was or could have been affected by the activities portrayed on the photo;
5. By doing this the participants visualize the action as well as the potential consequence (environmental impact) of their action; and
6. This General awareness training is done every two years and the poster is posted in the communal area where the impacts are visualized and the photos rotated on a monthly basis.

Environmental Awareness Training Content – Induction Training

The following environmental awareness training will be provided to all staff and workers who will be involved in prospecting activities.

- **Overview of the applicable Environmental, Health, Safety and Community Legal Framework**
 - Description of the approved prospecting activities and content of the prospecting right;
 - An overview of the applicable legislation and regulations as it relates to environmental, health, safety and community including (but not limited to):
 - General Environmental Legal Principles and Requirements
 - Air Quality Management
 - Water and Wastewater Management
 - Hazardous Substances
 - Non-Mining-Related Waste Management
 - The Appropriate Remediation Strategies & Deteriorated Water Resources
 - Biodiversity
 - Weeds and Invader Plants
 - Rehabilitation
 - Contractors and Tenants
 - Energy & Conservation
 - Heritage Resources
 - General Health and Safety Matters
 - Basic Conditions of Employment
 - Compensation for Occupational Injuries and Diseases
 - General Mine Health and Safety Matters
 - Smoking in the Workplace
 - Noise & Hearing Conservation
 - Handling, Storage and use of Hazardous Substances
 - Weapons and Firearms

- **Content and implementation of the approved Environmental Management Plan**
 - Allocated responsibilities and functions
 - Management and Mitigation Measures
 - Identification of risks and requirements adaptation
- **Sensitive environments and features**
 - Description of environmentally sensitive areas and features
 - Prohibitions as it relates to activities in or in proximity to such areas
- **Emergency Situations and Remediation**
 - Methodology for the identify areas where accidents and emergency situations may occur, communities and individuals that may be impacted
 - An overview of the response procedures,
 - Equipment and resources
 - Designate of responsibilities
 - Communication, including communication with potentially Affected Communities

Training schedule to ensure effective response.

13. Rehabilitation

13.1 Environmental rehabilitation objectives

General

The closure objectives for the Kebrafield open cast coal mine can be summarised as follows:

- Make all areas safe for both humans and animals;
- Make all areas stable and sustainable;
- Ensure impact on any water bodies, water courses and catchment areas have been avoided or minimised;
- Rehabilitate disturbed areas as soon as possible; and
- Minimise the impact on the local community.

Groundwater

- Rehabilitation of the surface infrastructure where necessary to minimize infiltration into the underground water regime (the philosophy of concentration and containment); and
- Rehabilitation to minimise contamination of surface water resources (the philosophy of dilution and dispersion).

Sustainable Development

Mining cannot be considered sustainable since it relies on exploitable and non-renewable resources. However, if mining can contribute towards quality of life and has an overall positive impact with its interaction with the environment, mining can be regarded as a sustainable development. The following objectives are listed to be achieved as part of sustainable development:

- Interaction with key stakeholders in terms of the project, design and planning in addressing community issues
- Maintain on-going and transparent communications with stakeholders
- Demonstrate corporate and social responsibility; and
- Prevent and manage undue expectations of the project on the part of the regional stakeholders and local communities

Surface Water

As a management objective the regulatory authority has a mandate to manage water resources in a sustainable manner. This implies that the Regional Office of the DWA responsible for the catchment will incorporate a holistic approach to planning and protection in order to promote social and economic development without irreversibly damaging the water resource.

The overall objective of water resource management is to ensure that the water is fit for the use for which it is intended. This would be applicable to future water use at the proposed Usutu Colliery. In addition the overall objective is for the mine to minimize the adverse impacts of mining on the water resource. This is to be achieved by the following fundamental principles:

- Adhering to the departmental requirements as specified in the BPG series;
- Prescribing to the RQO's set for the catchment
- Promoting the development, adoption and implementation of effective waste minimisation measures in order to reduce:
 - the threat on the integrity and sustainability of the water resource
 - the natural aquatic environment
 - the impact of water quality
 - the impact on catchment yield and hydrology
- Precautionary management of the water resource
- Pollution prevention
- Integrated environmental management
- Public Participation

In addition to the measures described in the previous section the following surface water management objectives will be applicable for the proposed mining activity:

- Identify any potential risks from the proposed project and the existing infrastructure on the surface water resource
- Protect and conserve the aquatic and surface water environment from any impacts
- Prevent the aquatic and surface water environment from degrading due to the activities of the mine
- Optimize water use on the mine
- Strive for zero effluent discharge site (ZED)
- Preserve the water resources in line with the management objectives of the CMA/DWA for the management unit
- Water use authorisation to be obtained from the relevant regulatory body; and
- To ensure compliance with GN 704

Storm water

Storm water management will be based on the objective of separating clean water from dirty water and therefore encompass the key principle of pollution prevention. The following objectives will apply:

- Keep clean water clean
- Collect and contain dirty water as close to the source as possible
- Ensure sustainable storm water management over mine life cycle; and
- Compliance with Regulations as contained in GN 704

Residual Impacts

The following rehabilitation and closure objectives will be applicable for the effective and efficient long-term management of residual impacts:

- Create a long-term ecologically stable and self-sustaining system
- Minimise the disturbance of any ecological sensitive system in the short-term
- Meet with prevailing environmental legal requirements; and
- Prevent / Minimise negative impacts as identified in this report

Due to the nature of coal mining and the potential impact on surface water due to acid mine drainage, rehabilitation must be conducted in such a way that pollution of the surface water resource is prevented / minimised.

Where possible, rehabilitation must be planned to promote free drainage in order to minimise or eliminate ponding of storm water on sponge areas. This must be done without impacting the wetland systems that have been delineated on site. On-going rehabilitation as mining operations progress will be implemented.

13.2 General environmental rehabilitation measures/conditions

Rehabilitation and Management

- The applicant must embark on a systematic long-term rehabilitation programme to restore the watercourse(s) to environmentally acceptable and sustainable conditions after completion of the activities, which must include but not be limited to the rehabilitation of disturbed and degraded riparian areas to restore and upgrade the riparian habitat integrity to sustain a bio-diverse riparian ecosystem.
- All disturbed areas must be re-vegetated with an indigenous seed mix in consultation with an indigenous plant expert ensuring that during rehabilitation only indigenous shrubs, trees and grasses are used in restoring the biodiversity.
- An active campaign for controlling invasive species must be implemented within disturbed zones to ensure that it does not become a conduit for the propagation and spread of invasive exotic plants.
- Rehabilitation must be concurrent with construction.
- Shaping of spoils to the original topography is compulsory.
- No final voids to be left after mining ceased.
- Topsoil must be stripped and redistributed. Topsoil stockpiles' height must be re-evaluated by a professional, registered soil scientist and addressed as such. A height restriction of not more than 6m is recommended in order to preserve the soil's microbiological and nutrient characteristics. Topsoil must be placed immediately after stripping, if possible, but not stockpiled for longer than three (3) months. Vegetation (indigenous) of topsoil stockpiles must be considered.
- Rehabilitated areas must have a final soil depth of at least 0.8m, have a bulk density not exceeding 1700kg/m³ and an organic carbon content matching 0.4% or more.
- The applicant must submit a final rehabilitation plan, with elevations, of all disturbed areas (infrastructure and mining) within a reasonable period after the issuance of the authorisation to the Regional Head for written approval. Final rehabilitated areas in the opencast pits must be free draining at all times.
- Compacted and disturbed areas must be shaped to natural forms and to follow the original contour. In general cut and fill slopes and other disturbed areas must not exceed 1:3 (v:h) ratio, it must be protected, vegetated, ripped and scarified parallel with the contour.
- All stockpiles, dams and residue deposits must continuously be cladded (soil and vegetation placed on the side walls) to minimise dust pollution on the wetlands that might alter the wetland's characteristics and must be monitored and recorded closely.
- The Regional Head must sign a release form indicating that rehabilitation was done satisfactory according to specifications as per this document.
- A photographic record must be kept as follows and submitted with reports;
 - Dated photographs of all the sites to be impacted before construction commences;

- Dated photographs of all the sites during construction on a monthly basis; and
- Dated photographs of all the sites after completion of construction, seasonal
- Rehabilitation structures must be inspected regularly for the accumulation of debris, blockages, instabilities and erosion with concomitant remedial and maintenance actions.
- A comprehensive and appropriate Wetland rehabilitation and management programme to restore the watercourse(s) to environmentally acceptable and sustainable conditions after construction must be developed and submitted to the Regional Head for a written approval should the wetlands be impacted on.

General and Site Specific Conditions with reference to Rehabilitation

- Water samples must be taken from all the monitoring boreholes by using approved sampling techniques and adhering to recognized sampling procedures. Samples must be analysed for both organic as well as inorganic pollutants as mining activities often lead to hydrocarbon spills in the form of diesel and oil.
- These must be recorded on a data sheet. It is proposed that the data must be entered into an appropriate computer database and reported to the Department of Water Affairs.
- The mining areas must be flooded as soon as possible to prevent oxygen from reacting with remaining pyrite.
- The applicant must remove all coal from the opencast and as little as possible must be left.
- The final backfilled opencast topography must be engineered such that runoff is directed away from the opencast areas.
- The final layer must be as clayey as possible and compacted if feasible, to reduce recharge to the opencasts.
- Quarterly groundwater sampling must be done to establish a database of plume movement trends, to aid eventual mine closure.
- The applicant must ensure in advance that alternative water supply for external water users is provided to these users must groundwater resources be impacted
- The applicant must participate at the regional Catchment Forum which is held quarterly.
- A proper ground and surface water monitoring network must be established to monitor the quality and quantity of groundwater as per the report recommendation and ensuring that water used by other water users are safeguarded in accordance to chapter 14 of the National Water Act. 1998.
- The pollution control dam(s) must be designed in such a manner that any spillage can be contained and reclaimed without any impact on the surrounding environment. A plan must be in place to stop overflowing in a dam in case of rainy seasons.
- The applicant must at all times together with the conditions of this authorisation adhere to the Regulations on use of water for mining and related activities aimed at the protection of water resources (GN 704, 4 June 1999).

- The applicant must ensure that backfill materials are checked for quality purpose before using to avoid further groundwater contamination.
- The applicant must ensure that dams are lined and sealed for migration and prevention of mining pollution due to the fractures of the underlying geology
- The applicant must monitor both quantity and quality monthly instead of quarterly in vulnerable areas that have high concentration level of metals like Fluoride, Iron, Sulphide, Calcium and Magnesium and where there are pollution pathways. Groundwater modelling must be revised within a five year period for early warning in terms of pollution plume mitigation and any changes in the environment so that there will be alterations in mitigation measures and management plan.
- Groundwater quantity results must be recorded and analysed as it can also affect the environment detrimentally by depleting the aquifer, the aquifer need to be monitored regularly preferably once a month for a year and thereafter quarterly this will also help to detect if there is occurrence of sinkholes in future.
- Additional monitoring boreholes must be sited as indicated on the geohydrology report. Any tailings storage facilities, wastewater dams, pollution control dams and any hazardous storage facilities must be properly lined as suggested by the Civil Engineering Directorate

Closure and Post Closure Water Management

- The applicant must do the mine closure plan and submit it to the Department in accordance to the Best Practice Guideline-G5: Water Management Aspects for Mine Closure.
- The applicant must do the financial provision for post closure water management and submit it to the Department in accordance to the Best Practice Guideline-G5: Water Management Aspects for Mine Closure
- The two issues above must be submitted within reasonable time from date of issuance of the authorisation.
- The applicant must ensure that at the end of mining, the mine has a plan that can be implemented to sustain, protect and preserve the water quality and quantity upstream and downstream of the mine after mine closure and that water users are protected.
- The applicant must ensure that the final post-Closure land use is sustainable and no final void is left.

13.3 Rehabilitation and soil sustainability

The following section deals with the principles of soil sustainability and rehabilitation of opencast mining soils as presented by Mr Francois Botha (Botha, 2012).

Global agriculture is facing a trend in yield decline for most crops. This is specifically applicable to crops that are practised under a mono-cropping system. It is a well-known scientific fact that monoculture has a negative impact on soil fertility and potential.

With mono cropping and overuse of land, it has become necessary for farmers to resort to more drastic measures to maintain yields. One such practise is to increase N, P and K chemical fertilisers at ever increasing costs, because the perception is that the higher the fertiliser levels the higher the yield.

This same mind-set is prevalent with the rehabilitation of opencast mining areas. The impact of mining operations is just so much amplified as the whole soil profile with all the integrated soil physical, chemical and biological processes is destroyed. This is often the result of a lack of understanding that soil is a living eco-system and that there is a difference between soil fertility and plant nutrition. There is also a difference in understanding the term topsoil from a soil science and mining perspective.

A distinction must be made between restoring soils to previous inherent potential for crop production and sustainable rehabilitation. As previously mentioned soils form over a long period of time with various processes involved. The opencast mining operations totally disturb these process and soil forming factors.

It is not possible to restore the soil potential and initial characteristics to its original state but huge improvements can be made in the methodology of stripping and re-dressing of soil material to ensure sustainability of rehabilitation. Over time these soils can produce proper vegetation and grazing of cattle and arable crop production at lower yields than the initial soil potential.

To achieve this it is necessary to understand the soil forming factors and processes and the difference between soil fertility and plant nutrition.

Definition of Soil

Soil is an open living ecosystem and can therefore be defined as a function of physical, chemical and biological processes.

Soil Forming Processes

The following factors are involved in soil formation:

- Parent Material (geology, e.g. sedimentary rock (sandstone), acid igneous (granite) or basic rock (dolerite) etc.)
- Topography (slope of landscape)
- Climate (wind, water, temperature etc.)
- Microbial Activity and microbial diversity
- Time (soil formation occurs over a long time period, e.g. 1cm of topsoil is formed over 100yrs)

These factors with different physical, chemical and biological processes combine under specific conditions to form specific soil diagnostic horizons with a unique character and inherent soil fertility.

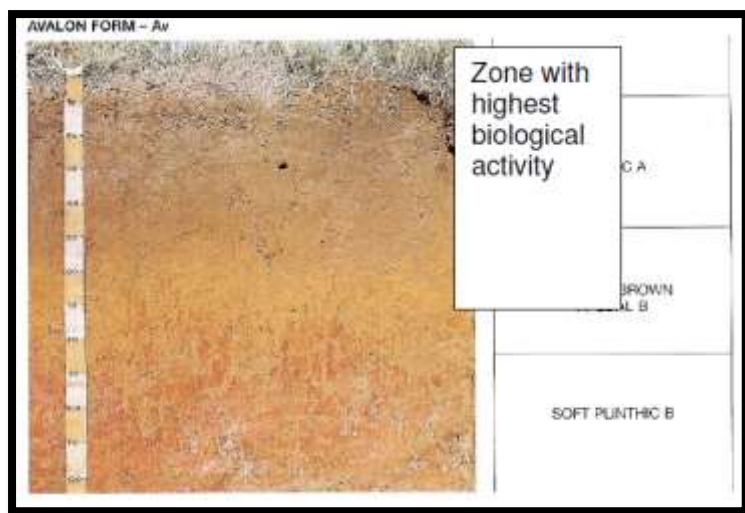


Figure 113: Avalon Soil showing different horizons (MacVicar 1991)

Fertility/Plant Nutrition

Fertility refers to the inherent capacity of a soil to supply nutrients to plants in adequate amounts and in suitable proportions as well as oxygen and moisture to maintain a healthy soil bio-diversity (active micro-biology, immune system). The focus here is soil health.

Plant nutrition refers to the soils ability to supply nutrients to the plant so it can complete its reproductive cycle. The nutrient status of the soil can be manipulated by adding organic and inorganic fertilisers according to the crop's need. The focus here is on the crop's needs.

It can now be summarised that different soils have different levels of soil fertility according to the combination of the soil forming factors and soil processes involved under specific conditions. All these factors and processes are interlinked and no single soil type has all these factors in the ideal combination, therefore the yield potential and use of soils varies.

Unfortunately soil fertility and nutrition was relegated to a simple recipe of four elements provided through chemical fertilisers e.g. Nitrogen (N), Phosphorous (P), Potassium (K) and Zinc (Zn) to meet only the crop needs at the expense of soil fertility. Very little attention was given to the important role of bio-diversity and active microbiology in plant nutrition. It is only in the last couple of years that there is a serious interest on this matter.

The Role of Biodiversity

Active and healthy soil microbiology is able to:

- Mineralise nitrogen, phosphorous and sulphur
- Suppress nematodes, bacterial and fungal diseases
- Actively decompose organic material

- Improve root development with the result of better nutrient and water uptake
- Recycle and keep nutrients available for plants, especially micro-nutrients
- Improve soil physical and chemical conditions by increasing the humus content
- Improve water holding capacity of soil
- Less KWA power needed for soil tillage

Mining Practises that Contribute to the Destruction of Soil Fertility and Loss of Biodiversity

- Incorrect stripping of topsoil. Various soil horizons with different properties are stripped together and stockpiled.
- Stockpiling of proper topsoil with sterile or acidic subsoil (plinthic or grey clay material)
- Long periods of stockpiling kills of soil biology or changes bio diversity due to anaerobic conditions. Soils are nutritionally stripped and low microbial activity occurs.
- Long fallow periods are as detrimental to soil health as no fallowing.
- Incorrect soil placement with rehabilitation (plinthic and grey clay material on the soil surface), causes slaking, increasing crust formation, and compaction resulting in poor infiltration, aeration and increased run-off and erosion. These plinthic and grey clay materials are also basically sterile in terms of microbial activity
- Poor irrigation practises. Over irrigation causes leaching of nutrients.
- Decline in water quality in major river systems is causing a gradual build-up of salinity and sodicity.

In most cases poor seed germination or die-back of seeded grass occur because of a combination of these factors mentioned.

The following can be done to improve soil bio-diversity and therefore sustainable rehabilitation:

- Crop rotation
- Fallowing and green-manuring
- If there is not sufficient time to introduce proper fallowing or green-manuring practises compost can be applied to the soil

Recommendations for Proper Rehabilitation of Soils Disturbed by Opencast Mining Operations

Stripping

- Sequential stripping of soil horizons. In some cases the A and B Horizons can be stripped together. This has a huge practical, logistics and cost implication, but until such time that it is implemented, no improvement in sustainability of rehabilitation will occur
- Smaller stockpiles and seeding of stockpiles with grass

Landscaping and Replacement of Soils

- It is imperative to reshape the landscape as close as possible to its original topographic features (e.g. slope and drainage lines, wetlands). Various surveying and GIS software can be used to achieve this goal
- Where possible use the “freshest” stripped soils for redressing, as this will alleviate the soils becoming sterile or lose microbial activity
- Place the plinthic and grey clay material in the sub-soils and the original A and B horizon material on top. Create an environment where the topsoil is at least 40- 60cm deep for proper aeration water-holding capacity and drainage, resulting in proper root development

Seeding with Grass Species and Legume Crops

- A three stage approach can be implemented where pioneer species is planted to create a soil environment for sub-climax species. After some time climax species can be introduced. There are many case studies where reseedling is necessary because the sub-climax and climax grass species die back after the first or second season
- Legume crops like soya, cow peas, Dolichos, or Lucerne can be introduced to improve the soils microbial activity and soil structure.
- Compost and other organic humic substances can be used to speed up the process of restoring soil biodiversity

The Role of Compost and other Humic Substances in Restoring Biodiversity in Disturbed Areas

Many books have been written about the role of compost in improving soil bio-diversity as well as the making of compost. It never became a standard practise in commercial agriculture for the following reasons:

- It is bulky and transport costs did not make it viable
- Practical problems with application
- The value was always measured in terms of N, P and K content and in monetary terms.

Times have changed however and recent research across the world has shown that soil bio-diversity has great value in commercial agriculture and rehabilitation both from fertility as well as a plant nutrition perspective. Compost is a great and fairly quick way in restoring soil fertility although it must be made clear that it is a long term approach that is necessary. Organic and humic products can overcome to some degree the practical and logistical problems posed of importing large volumes of organic matter.

Rehabilitation and Soil Sustainability Summarised

There is no quick fix solution to the seriously negative impact of opencast mining on high potential soils

- Proper stripping and replacement of soils is imperative for any proper redressing and seeding with grass species to take place
- A holistic long term, staged approach is necessary to restore physical, chemical and biological processes in the growth medium
- Long term monitoring and relevant adjustments must be made to restore the soils to some sort of arable crop production potential to ensure future food security problems that might loom.

14. Evaluation and Recommendations

14.1 Impact Identification Summary

The purpose of this report is to scope and identify the potential impacts associated with the proposed development of the Kebrafield Roodepoort Colliery. Potential impacts were identified in consultation with I&APs, and through the technical expertise and experience of the Environmental Assessment Practitioners.

The report sought to identify the impacts of the proposed development on the environment, of which we humans are part, and the probability of the impacts occurring.

The proposed opencast colliery can pose various risks to the environment as well as the residents in the vicinity of the development, although these risks are likely to be limited in its extent. The issues related to the development were identified and will be assessed and evaluated during the EIA phase in terms of various criteria such as extent, duration, intensity and significance.

Significant impacts to be considered during the EIA phase includes *inter alia*:

- Contamination of surface and groundwater;
- Air pollution caused by fugitive dust and noxious gas emissions;
- Loss of agricultural land;
- Sense of place and visual impacts;
- Socio-economic (positive);
- Traffic Impacts;
- Ecological (Faunal & Floral) Impacts;
- Archaeological and Heritage Impacts
- Blast and Vibration Impacts; and
- Noise impacts from operations.

14.2 Recommendations

A variety of specialist studies have been conducted that will serve to suggest mitigation measures to mitigate the scale, intensity, duration or significance of the impacts associated with the proposed new Kebrafield Roodepoort Colliery. These include guidelines to be applied during the construction, operational and closure phases of the

project. The Environmental Management Programme (EMPr) which will form part of the Environmental Impact Report will contain more detailed mitigation measures.

This EIA/EMP is the culmination of the various specialist studies that formed part of the larger Environmental Management Programme Reports for Kebrafield (Pty) Ltd. Its purpose is not only to summarize the important sections of these baseline studies, but also to serve as the Technical Supporting Document for the Licence Application, while at the same time highlighting issues of concern as well as evaluating available data. Considering the objections as received from the various Interested and Affected Parties the following matters are identified as key concerns:

- Mining in the area not compatible with the EMF for Steve Tshwete LM
- Destruction/degradation of the Woestalleen Wetland system
- Accumulated ground and surface water pollution in the Klein Olifants River water management area

It is anticipated that a maximum 35 000 tons per month of soil, overburden and waste rock will be moved / screened. No coal washing will take place, only crushing and screening. The life of mine is expected to be 5 years.

Although the mining activities have potential negative effects on the surface water resource, the impacts are considered to have Low-Medium to Medium significance with mitigation. Storm water management measures will comply with GN704 regulations. Each open pit area will have clean storm water diversion to prevent water from entering the mining areas. In addition, dirty storm water from each mining site will be contained in a lined pollution control dam that will comply with GN704 regulations.

Several impacts had been identified that could influence the ambient groundwater quality of the area. The most significant impact is the formation of Acid Mine Drainage (AMD) and the potential for decanting to occur. Mitigations to prevent decanting of the opencasts include the reduction of the hydraulic conductivity of the opencast backfilled material, reduction of the rainfall recharge at the opencast, evaporating water from the final void in the pit, intercepting decant or redesigning the aerial extent of the opencast. With mitigation measures in place, the significance of the potential impacts on the ground water is considered to be Low.

The riparian wetlands within the footprint of the study area are considered a low significance. The wetlands in the wider study area are considered most sensitive with unique species composition and aquatic ecosystem functioning. It is not foreseen that Kebrafield will impact on the Pullenshope wetland systems. The mine will include as part of the rehabilitation plan the restoration of degraded wetlands caused by historic mining activities and invasion of alien plant species. Mining can only commence with the issuance of a water use license for the relevant water uses.

Very little waste will be produced on site. However, the following waste management hierarchy will be applied: reduce at source, re-use, and re-cycle. Any waste generated will be disposed in an environmentally responsible manner. Therefore, the impact of waste is considered to be Low with mitigation.

It is important to follow the recommended management actions and to monitor the surface water resources, ground water, waste facilities and rehabilitation measures.

A final rehabilitation plan needs to be drawn up and will be implemented concurrently with closing of the open pits. Proper stripping, stockpiling and shaping of the spoil layer are important to ensure efficient rehabilitation to set post-mining land capability classes. Based on the moderate risks, as well as moderate environmental significance that the activities pose to the aquatic environment, it is recommended that the water uses applied for be approved prior to any mining activity to commence.

Our recommendation, based on the assessment of the available information, is that application for the proposed development should continue, and that the Applicant be allowed to investigate the development of the Kebrafield Roodepoort Colliery on portion 17 of the farm Roodepoort 151IS. This authorisation should be in line with sensitive planning, design and good environmental management. Development of the proposed opencast colliery, should take the flood lines, wetland and sensitive riparian ecosystem into account, and the identified buffer along this strip must be honoured. The identified sites of archaeological and heritage importance must also be managed and preserved according to the recommendations of the specialist. The necessary Water Use License must be obtained for all the water uses that will be triggered in terms of section 21 listed activities within the National Water Act. The results of the various studies and how this influenced the location of the opencast colliery will be reported on in the Environmental Impact Assessment Report, once authorisation for the Scoping Report has been received.

The proposed development of the opencast coal mine on portion 17 of the farm Roodepoort 151IS, Mpumalanga Province forms part of the Steve Tshwete Local Municipality. If the concept of sustainable development is considered it is proposed opencast colliery will have a positive impact on the provision of social and economic criteria. With the recommended guidelines which would be provided by the various specialists' studies; the ecological component can also be brought into balance.

It is therefore recommended that Kebrafield (Pty) Ltd will be issued the authorisation for the requested period.