MINING PERMIT APPLICATION

FOR THE

Yoctolux Investments (Pty) Ltd Weltevreden Colliery

ON THE FARM

Weltevreden 324JS Portion 2

Department Minerals Resources Ref: MP30/5/1/3/2/10487MP

REPORT

2014

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Project Number:	Version:	Date:
14-017-AUTH-REP	FINAL	09/07/2014

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Senior Environmental Consultant

SIGNATURE

DATE

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ISO 14001:2004 Auditor

SIGNATURE

DATE

APPROVED BY: Nicholus Maloba
Applicant: Yoctolux Investments (Pty) Ltd

SIGNATURE

DATE

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

NAME OF APPLICANT: Yoctolux Investments (Pty) Ltd

REFERENCE NUMBER: MP30/5/1/3/2/10487MP

ENVIRONMENTAL MANAGEMENT PLAN

SUBMITTED

IN TERMS OF SECTION 39 AND OF REGULATION 52 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002, (ACT NO. 28 OF 2002) (the Act)

STANDARD DIRECTIVE

Applicants for prospecting rights or mining permits, are herewith, in terms of the provisions of Section 29 (a) and in terms of section 39 (5) of the Mineral and Petroleum Resources Development Act, directed to submit an Environmental Management Plan strictly in accordance with the subject headings herein, and to compile the content according to all the sub items to the said subject headings referred to in the guideline published on the Departments website, within 60 days of notification by the Regional Manager of the acceptance of such application. This document comprises the standard format provided by the Department in terms of Regulation 52 (2), and the standard environmental management plan which was in use prior to the year 2011, will no longer be accepted.

IDENTIFICATION OF THE APPLICATION IN RESPECT OF WHICH THE ENVIRONMENTAL MANAGEMENT PLAN IS SUBMITTED.

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PROJECT DETAILS	
Department of Mineral Resources:	Mpumalanga
Reference No:	MP30/5/1/3/2/10487MP
Applicant:	Yoctolux Investments (Pty) Ltd
Project Title:	Weltevreden Mining Permit
Project Number:	14-017-AUTH-REP
Compiled by:	Eco Elementum (Pty) Ltd
Date:	July 2014
Property Description:	A portion of Portion 2 of the farm Weltevreden 324JS

Municipality:	Emalahleni Local Municipality
Water Management Area:	Olifants Water Management Area (WMA 4)
Catchment Description:	Wilge River Catchment Area_ Quaternary B20G Saalboomspruit (MU21, confluence with Wilge)
Topographical 1:50 000 Reference:	2529CC
Site Middlepoint Coordinates:	25°56'38.94"S 29° 6'0.95"E
Mineral to be mined	Coal and clay
Mining Method	Opencast – Continuous rollover rehabilitation sequence
Mining Area	5 ha
Life of mine	3 years
Total tonnages	400 000tons

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1. REGULATION 52 (2): Description of the environment likely to be affected by the proposed prospecting or mining operation

1.1 The environment on site relevant to the environment in the surrounding area

1.1.1 Site overview and regional description

There is no difference between the characteristics of the surrounding areas and the proposed site. The proposed 5ha site reflects the typical characteristics of the surrounding areas and can be described as follows:

Agriculture: The land use is limited farming with mainly grazing land available due to the topography.
Mining: Mining operations (historical and current) exist on the property or on the immediate vicinity of the property, directly to the west and north of the property are active mining sites.
Infrastructure: The area is well served by road with the N4 running towards the north of the site and the N12 to the south of the site (both in west-east directions mainly). The R547 runs parallel to the east of the site in a north-south direction.
Residential: This area is situated in a rural area and provides residence for only a small number of farm labourers. A farming homestead is situated on the property to the south while a small local community inhabits the northern boundary of the site. The nearest residential area is approximately 4km to the north of the site namely Clewer while Emahlahleni is approximately 12km in a north-eastern direction from the site.

All available geological, ecological, physical, spatial, hydrological and hydrogeological data for the study area was compiled from various sources and analysed. Data from the relevant hydrogeological databases, the National Groundwater Database and the Water Use Authorisation and Registration Management System (WARMS) database, were obtained from the Department of Water Affair. A data search of relevant geological data, for the study area, was conducted at the Council of Geoscience in Pretoria.

Aerial photographs were obtained from the Survey General's office in Pretoria. Aerial Photographic Interpretation (API) was conducted to determine possible geological structures or the proposed prospecting site.

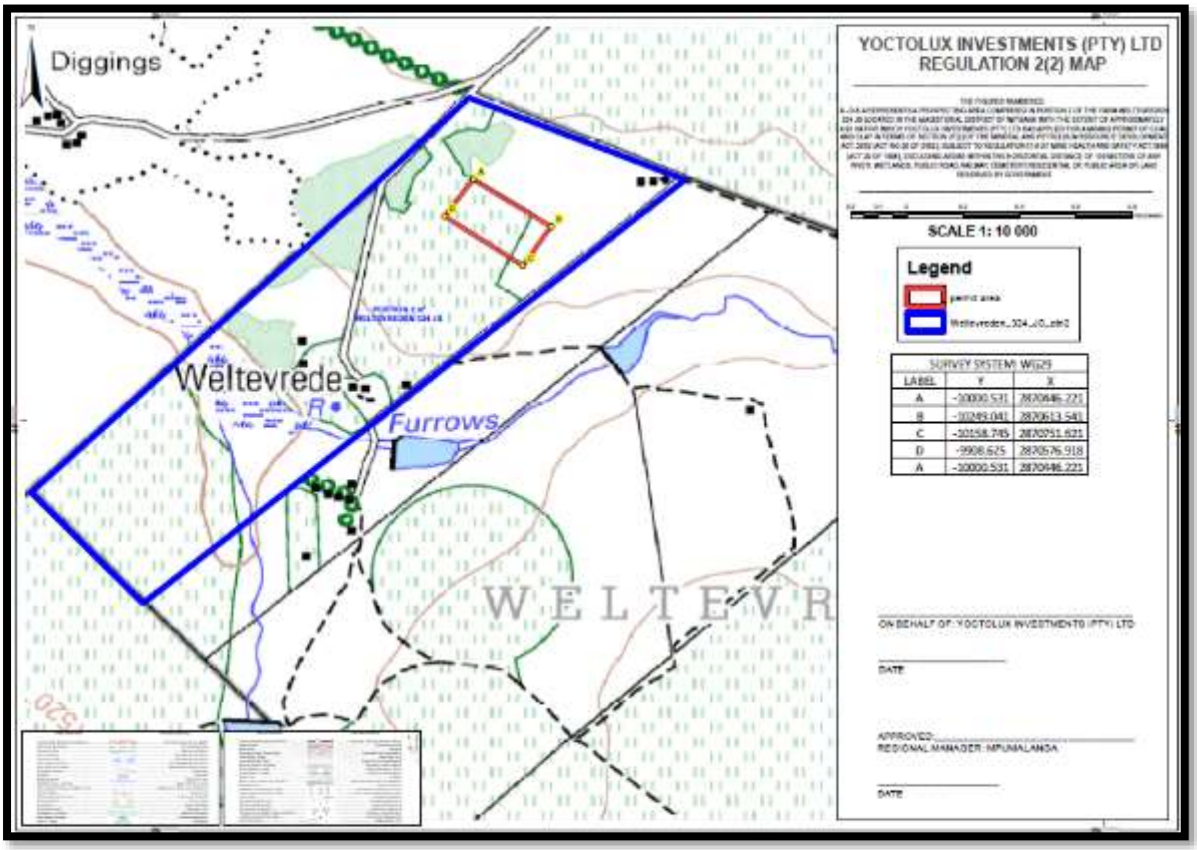


Figure 1: Regulation 2.2 Map of Mining Permit Area on the farm Weltevreden 324JS a Portion of Portion 2

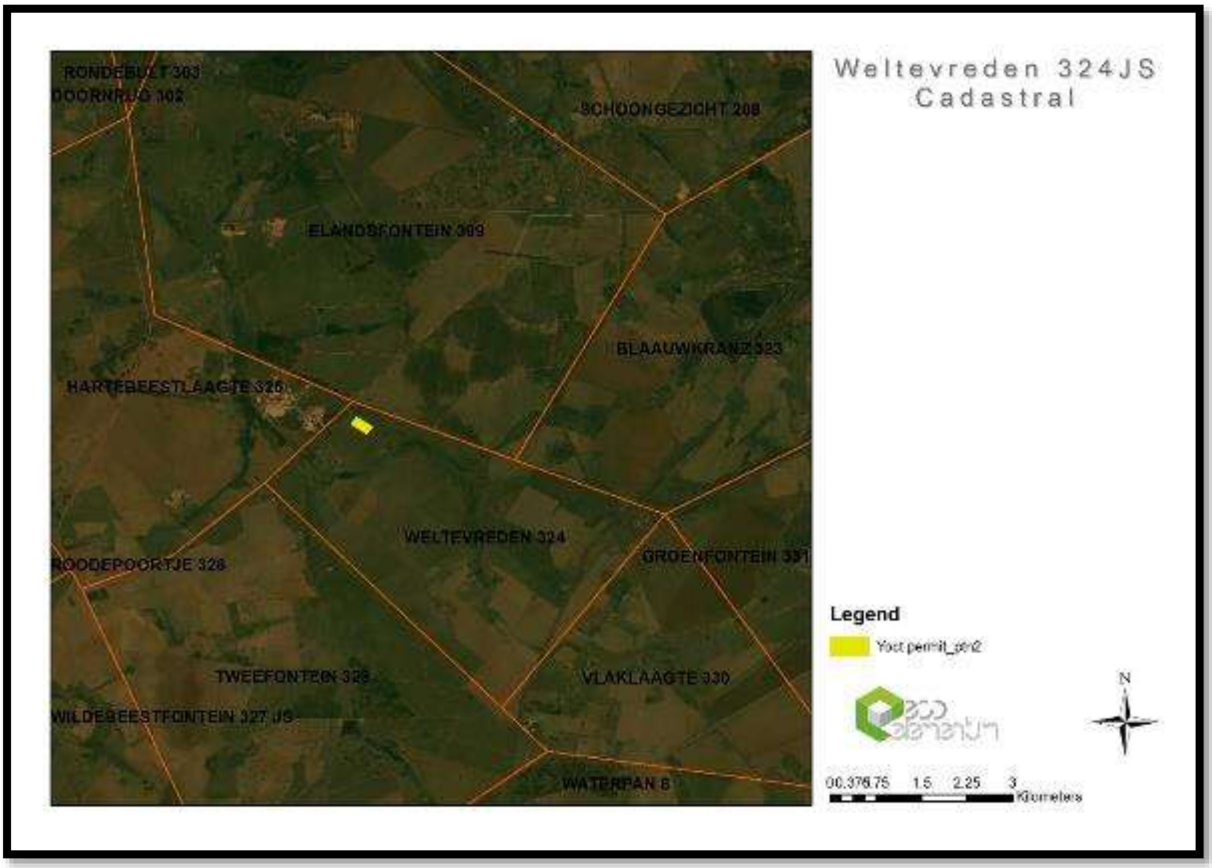


Figure 2: Cadastral information on an aerial photograph of the site indicating the Mining Permit area in yellow

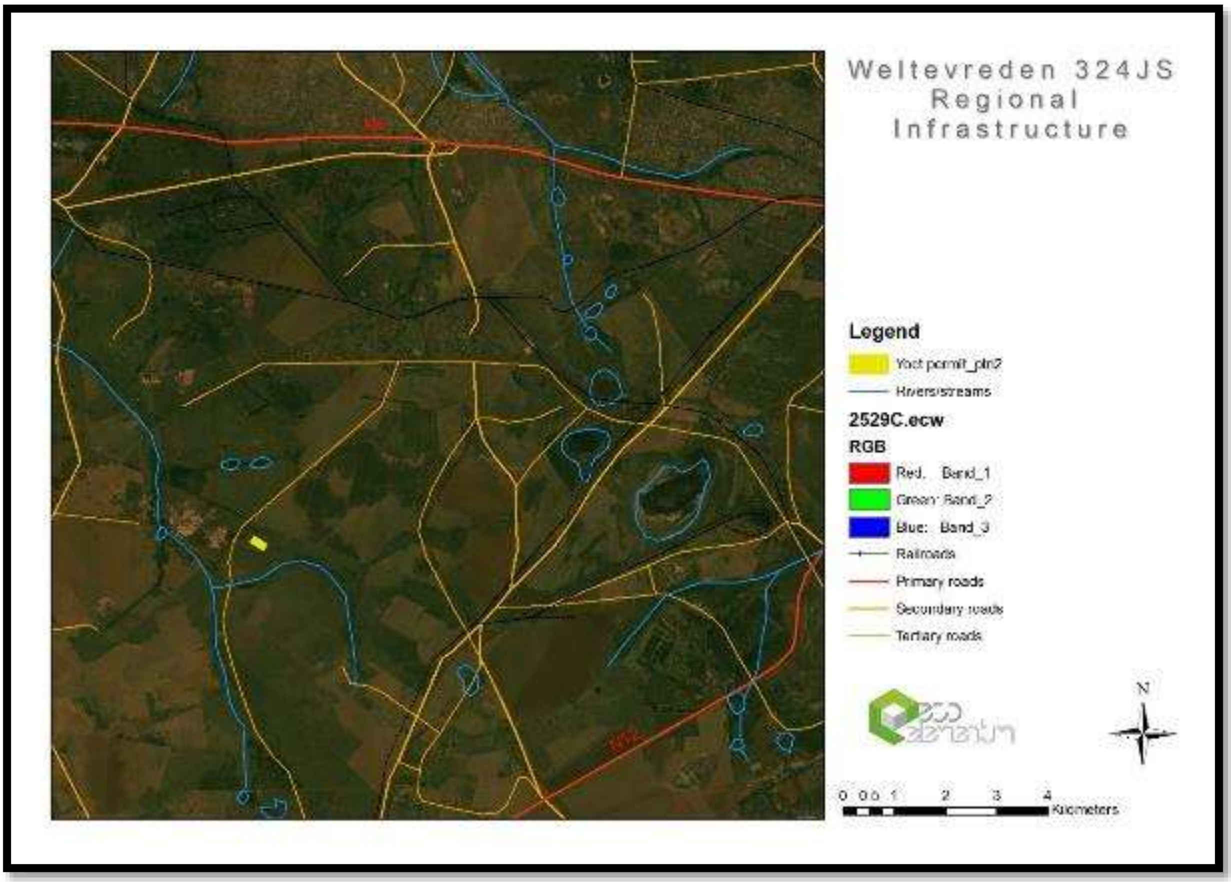


Figure 3: Regional infrastructure in relation to the Mining Permit Site indicated in yellow

Figure 4: Google earth high resolution image of Weltevreden 324JS Portion 2

1.1.2 Geology

Local geological maps covering this farm show rocks belonging to the coal bearing Vryheid Formation covering the extent of the farm. It is further recorded that coal bearing lithologies traverse the south eastern portion of the farm with adequate cover within certain portions of interest. No regional structural complexities or the later phase intrusions could be determined on that scale.

The regional geology for the area comprises sediments and intrusive rocks of Vaalian to Permian age. Vaalian aged intrusive rocks, which from part of the Bushveld Complex, are mapped within the study area.

Table 1: Lithostratigraphy of the regional geology

AGE	SEQUENCE	GROUP	FORMATION	LITHOLOGY
Permian	Karoo		Ecca	(Pe) Shale, shaly sandstone, grit sandstone, conglomerate, **coal** in places, near grit and top
Permian	Karoo		Dwyka	(Pd) Tillite, shale
Mogolian1			Intrusive	(di) Diabase
Vaalian	Rashoop Granophyre Suite		Intrusive	(Vra) Red to grey granophyric quartz feldspar rocks
Vaalian			Loskop	(Vl) Shale, sandstone, conglomerate, volcanic rocks
Vaalian		Pretoria	Magaliesburg	(Vm) Quartzite, minor hornfels
Vaalian		Pretoria	Silverton	(Vsi) Shale, carbonaceous in places, hornfels, chert
Vaalian		Pretoria	Daspoort	(Vdq) Quartzite

The Karoo Supergroup sediments, located within the study area, consist of the Ecca and Dwyka formations. These younger Ecca Formation rocks lie conformably on the pre-existing glacially produced tillite of the Dwyka Formation.

The Karoo Sequence rocks are unconformably underlain by Pretoria Group formations. The Magaliesburg formation consists of several quartzite layers separated from one another by argillaceous rocks, which have been metamorphosed to hornfels. Older rocks mapped on site are shale, carbonaceous in places with hornfels, and chert of the Silverton Formation and quartzite of the Daspoort Formation.

The Rashoop Granophyre Suite, consisting of red to grey granophyric quartz feldspar rocks, intruded into the Pretoria Group rocks. Younger diabase intrusions into the Pretoria Group in the form of sills occur within the study area. The diabase is often deeply weathered and has little in the form of structural presence.

According to the ENPAT (Environmental National Potential Atlas) data for the study area, indicated in the map below, the largest area of the property is identified as; Shale, hornfels and chert of the Silverton Formation, Pretoria Group; tillite and shale of the Dwyka Formation; diabase; shale, shaly sandstone, grit, sandstone and conglomerate of the Ecca Group; eruptive breccia, agglomerate and lava.

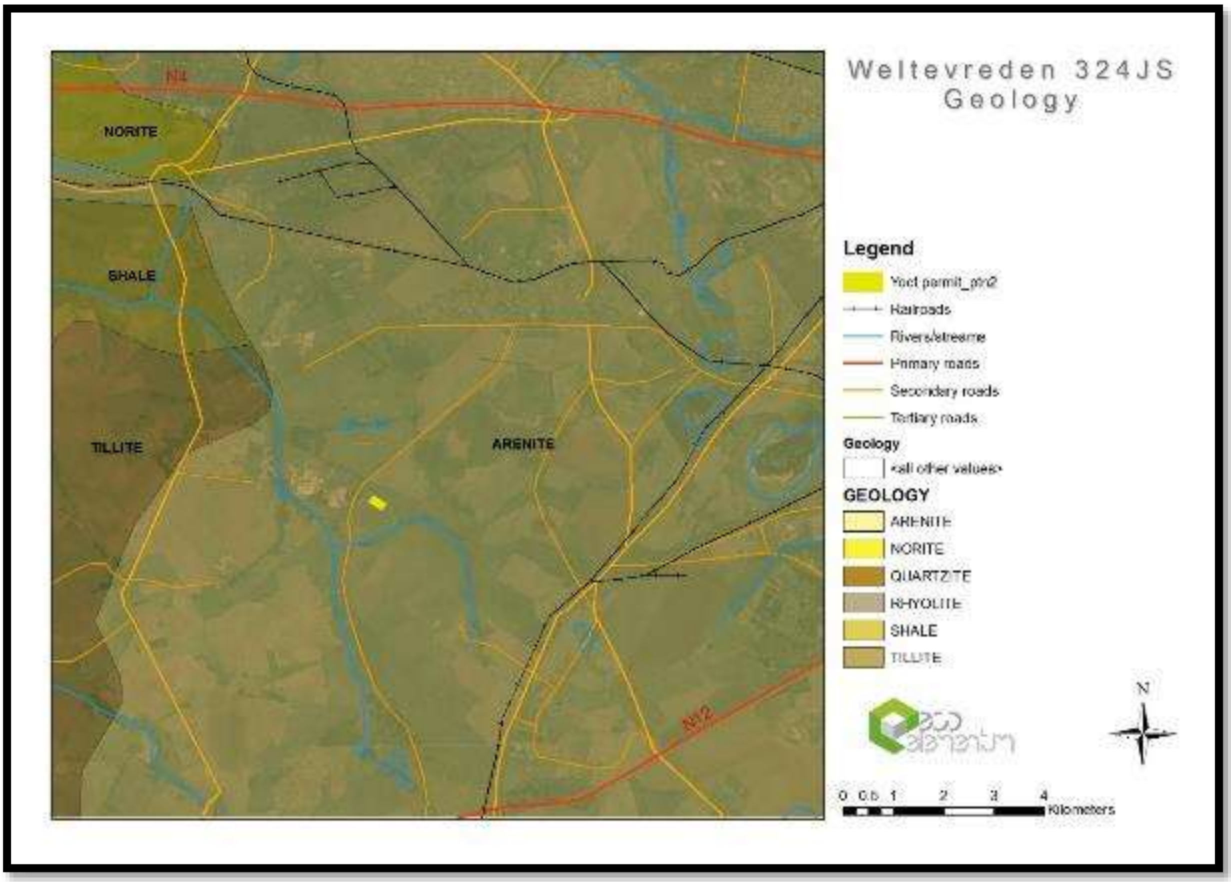


Figure 5: Regional geology map

1.1.3 Climate

1.1.3.1 Regional climate

Mpumalanga's weather is naturally defined by its topography. Mpumalanga is a province of two halves, namely the high-lying grassland savannah of the highveld escarpment and the subtropical Lowveld plains. The western side of Mpumalanga, on the highveld escarpment, is like a rise of tropics, an ascent into an uncompromising range of temperatures. The west is drier, hotter and much colder than the rest of the Mpumalanga province.

The Lowveld is subtropical, due to its proximity to the warm Indian Ocean and latitude. The Highveld is comparatively much cooler, due to its altitude of 2300m to 1700m above sea level. The Drakensberg Escarpment receives the most precipitation, with all other areas being moderately well-watered by mostly summer thunderstorms. The Highveld often experiences severe frost, whilst the Lowveld is mostly frost-free. Winter rainfall is rare, except for some drizzle on the escarpment. The differences in climate are demonstrated below by the capital, Nelspruit, which is in the Lowveld, located just an hour from Belfast on the Highveld.

1.1.3.2 Mean monthly and annual rainfall

The proposed coal prospecting area is located in the summer rainfall region of South Africa and thus receives most of its rainfall during this period. Station 0478093 Ogies reflects a mean annual precipitation (MAP) of 719 mm, recorded over the course of 92 years (1908 - 2000). Precipitation is often characterised by intense thunderstorms, which occur mainly in the late afternoon, from October to March, with the maximum in January. These thunderstorms, although brief, are often ferocious, and are accompanied by thunder, lightning and occasional hail, and are generally followed by clear skies.

Table 2: Average rainfall per month, over a 10 month period from 1989 – 1999

MONTH	AVERAGE NUMBER OF RAINY DAYS PER MONTH	AVERAGE RAINFALL PER MONTH (mm)
January	9.9	87.5
February	7.1	99.5
March	7.6	82.3
April	2.9	31.6
May	0.8	4.1
June	1.5	14.2
July	0.4	1.6
August	1.0	6.1
September	3.2	30.4
October	6.4	79.1
November	7.8	98.9
December	9.7	85.7

1.1.3.3 Wind speed and direction

Wind roses summarize the occurrence of winds at a specified location via representing their strength, direction and frequency. Calm conditions are defined as wind speeds of less than 1 m/s which are represented as a percentage of the total winds in the centre circle. Each directional branch on a wind rose represents wind originating from that specific cardinal direction (16 cardinal directions). Each cardinal branch is divided into segments of different colours which represent different wind speed classes. For the current wind roses, wind speed is represented in classes, 1 to 2 m/s in blue, 2 to 4 m/s in dark green, 4 to 6 m/s in light green and > 6 m/s in yellow. Each circle represents a percentage frequency of occurrence.

Between 00:00 to 05:59, winds are predominantly from the north (15% of the time) and north-north-east (13% of the time). During the morning (06:00 to 11:59), winds are predominantly from the north (15.5% of the time) and north-north-west (10.5% of the time). During the afternoon (12:00 to 17:59), winds are predominantly from the north-west (14.5% of the time) and north-north-west (12% of the time). During the evening (18:00 – 23:59), winds are predominantly from the north (11.0% of the time) and north-north-east (10.75% of the time).

During summer (DJF), winds are predominantly from the north (17.5% of the time) and north-north-east (10.5% of the time). During autumn (MAM), winds are predominantly from the east (10.5% of the time) and east-south-east (9.25% of the time). During winter (JJA), winds are predominantly from the south-east (13.75% of the time) and east-south-east (13.5% of the time). During spring (SON), winds are predominantly from the north (22.5% of the time) and north-north-east (13%).

The average monthly wind speed is 10.26 m/s for the period 1993 - 2003. The maximum wind speed of 13.6 m/s was measured in October 1995 and the minimum wind speed of 8 m/s was experienced in June and July 2000.

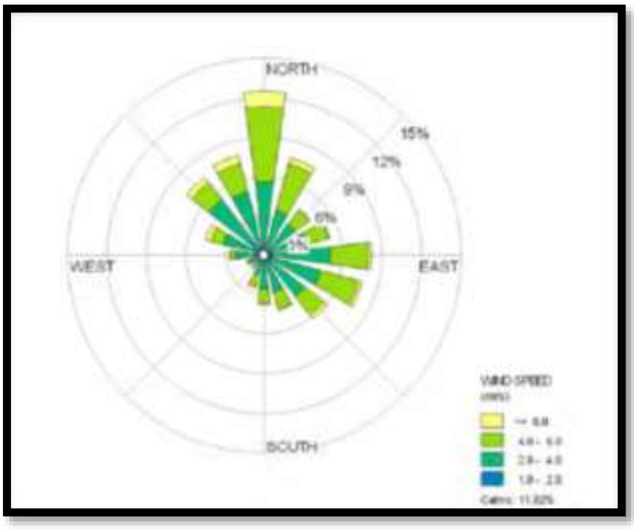


Figure 6: Modelled wind rose for 2010 (average wind velocities and directions)

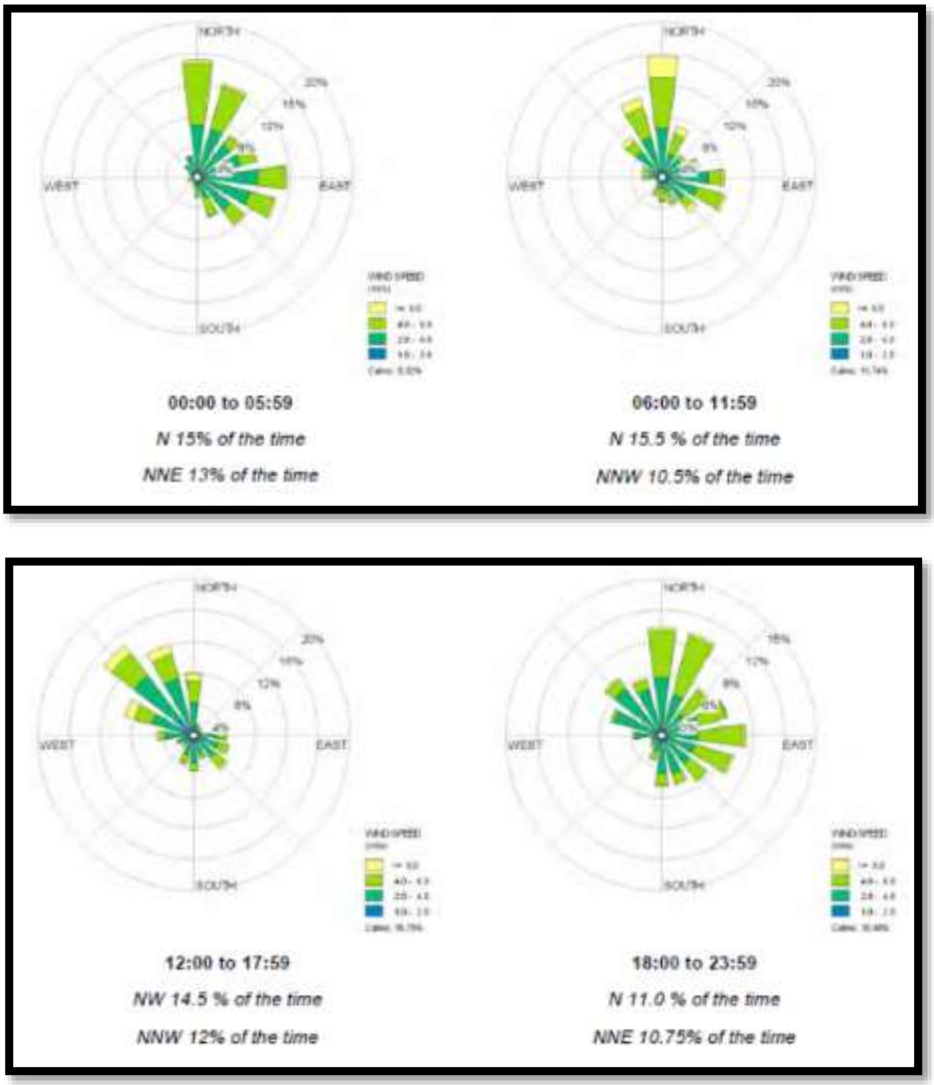


Figure 7: Modelled diurnal wind roses with predominant wind direction for 2010

1.1.3.4 Mean monthly maximum and minimum temperatures

The temperature profile depicts what is typically expected for the Highveld. The highest temperatures in the region are experienced during the summer months of December, January and February and the lowest during the winter months of June, July and August. The average daily maximum temperatures range from approximately 24°C in January to approximately 16°C in June, with minima ranging from approximately 13°C in January to approximately 1°C in June (World Weather Online, 2011).

The mean daily maximum temperature is 25 – 27°C in December / January and in July 17°C. The mean daily minimum ranges from 13°C in January to 0°C in July.

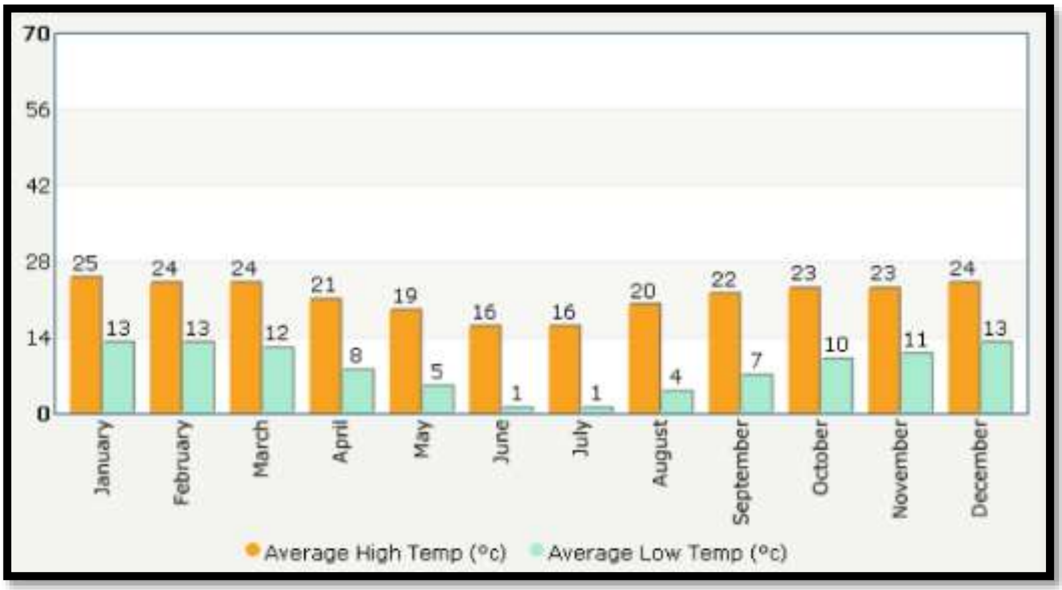


Figure 8: Average high and low temperatures for Ogies in 2010 (source: World Weather Online, 2011)

1.1.3.5 Mean monthly evaporation

Gross annual average "A" pan evaporation at Bethal is 1,702 mm, and at Kriel, 1,733 mm. Maximum evaporation occurs in summer from October to January, due to high summer temperatures. Thunderstorms are frequent during the rainy season and are usually accompanied by lightning, heavy rain, strong winds and sometimes hail. The storms are highly localised.

Table 3: Evaporation records for station 0478/867 Bethal

Month	Mean monthly evaporation (mm)
January	179.8
February	151.1
March	147.8
April	111.1
May	94.8
June	79.2
July	89.0
August	132.0
September	167.0
October	186.6
November	167.6
December	195.9
Annum	**1702.0**

1.1.4 Topography

The proposed site itself is representative of the local topography and is not characterised by any prominent topographical features, but lies on undulating topography between 1540-1600 m above mean sea level. The eastern region of the Mpumalanga is characterised by a gently undulating plateau with fairly broad to narrowly incised valleys such as the Olifants River Valley. The general elevation of the area lies between 1,400 and 1,600 metres above mean sea level (mamsl). The onsite elevation ranges between 1510 and 1560 mamsl and therefore relatively flat and undulating. Slopes are between 0-9% according to the ENPAT data sets, refer to maps below. The terra-morphology of the study site is characterised as moderately undulating plains and pans.

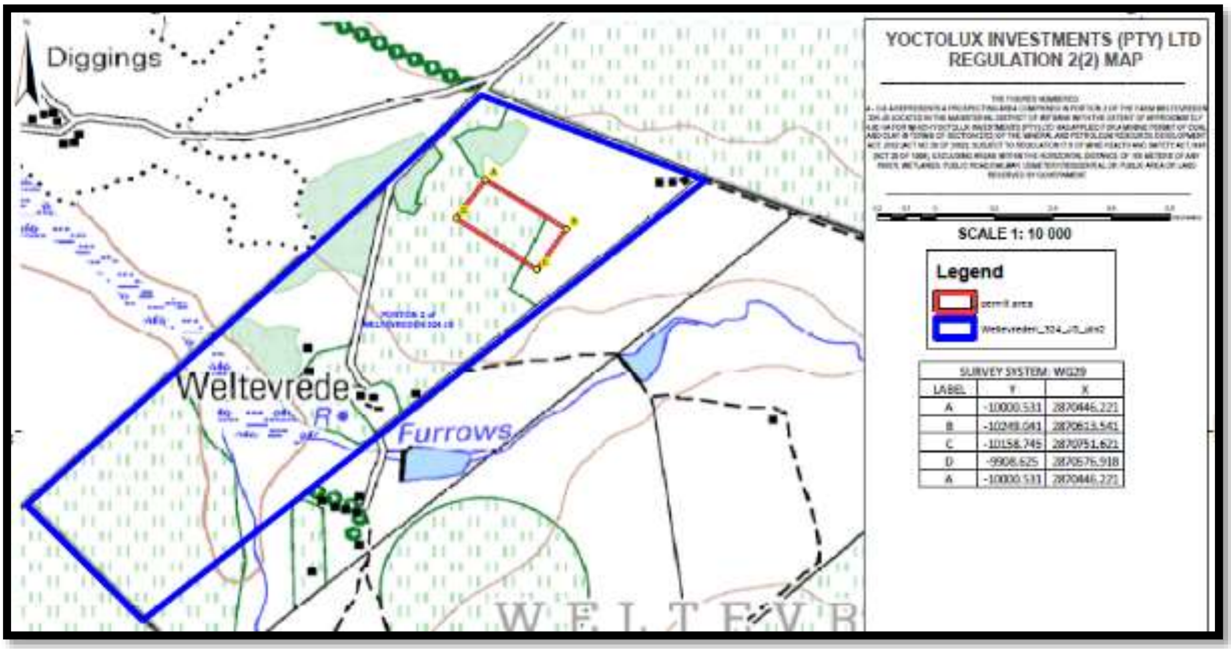


Figure 9: Topographical 1:50 000 map of the study area

1.1.5 Soils

Previous studies indicate that the soils within the vicinity of the proposed prospecting area have high agricultural potential and/or are of importance from a wetland and hydrological perspective. These soils are predominantly moderately deep to deep. Rocky and low potential areas are consequently limited (Terrasoil Science, 2010). Seven soil groups are typical in the larger study area: Red apedal, arable yellow-brown apedal, nonarable yellow-brown apedal, shallow rocky, disturbed, vertic, and wetland soils. The soils at the study area can be described as;

Plinthic catena: dystrophic and/or mesotrophic; red soils widespread, upland duplex and margalitic soils rare.

1.1.6 Land capability and land use

The land use capability of these soil groups (section 1.1.5) vary from arable and grazing, to wetlands. Seventeen soil forms are typical in the vicinity of the proposed prospecting area namely; Hutton, Clovelly, Griffin, Pinedene, Avalon, Bainsvlei, Glencoe, Dresden, Katspruit, Glenrosa, Mispah, Rensburg, Tukula, Fernwood, Longlands, Wesbank, and Kroonstad (Steenekamp, 2007). The area being applied for is currently being utilised for agricultural

purposes, mostly for the cultivation of crops and grazing for cattle. The dominant land use in the study region is mining which occurs to the east and north in close proximity of the site while there is also a section of exotic forest on the western boundary of the property.
The main land uses within the area span from grasslands and grazing land to mostly cultivated and temporary commercial irrigated lands. There are several small water bodies, within the portions of interest, which could be used as a source of raw water if the necessary water use authorisations are applied for [if Section 21 Water Use Activities are triggered in terms of the National Water Act (Act36 of 1998)]. On the Southern edge of the property Weltevreden 324 JS Portion 2 is a National Freshwater Ecological Priority Area – a Water Use License needs to be obtained if section 21 water use activities will be trigger within the 500m regulated area of the wetland.

Land-Use in the study area is dominated by maize and sunflower farming, grazing, coal mines and power stations. Land uses also occurring in the area include Commercial / Industrial, Conservation areas, Cultivated land, Forestry areas, Residential, Subsistence farming and Vacant or Unspecified land, however for the purposes of this report, land use of the region is grouped into urban, cultivation, grassland / plantations, mines and quarries and water bodies / wetlands.

The Land-Use on site is dominated by maize, exotic plantations, grazed fields, quarries, residential and man-made dams. Water bodies are the only land cover identified which is regarded as sensitive and as such certain mitigation measures will be outlined. The study area is located in an area which is predominantly unimproved grassland and this type of land cover is associated with intensive grazing.

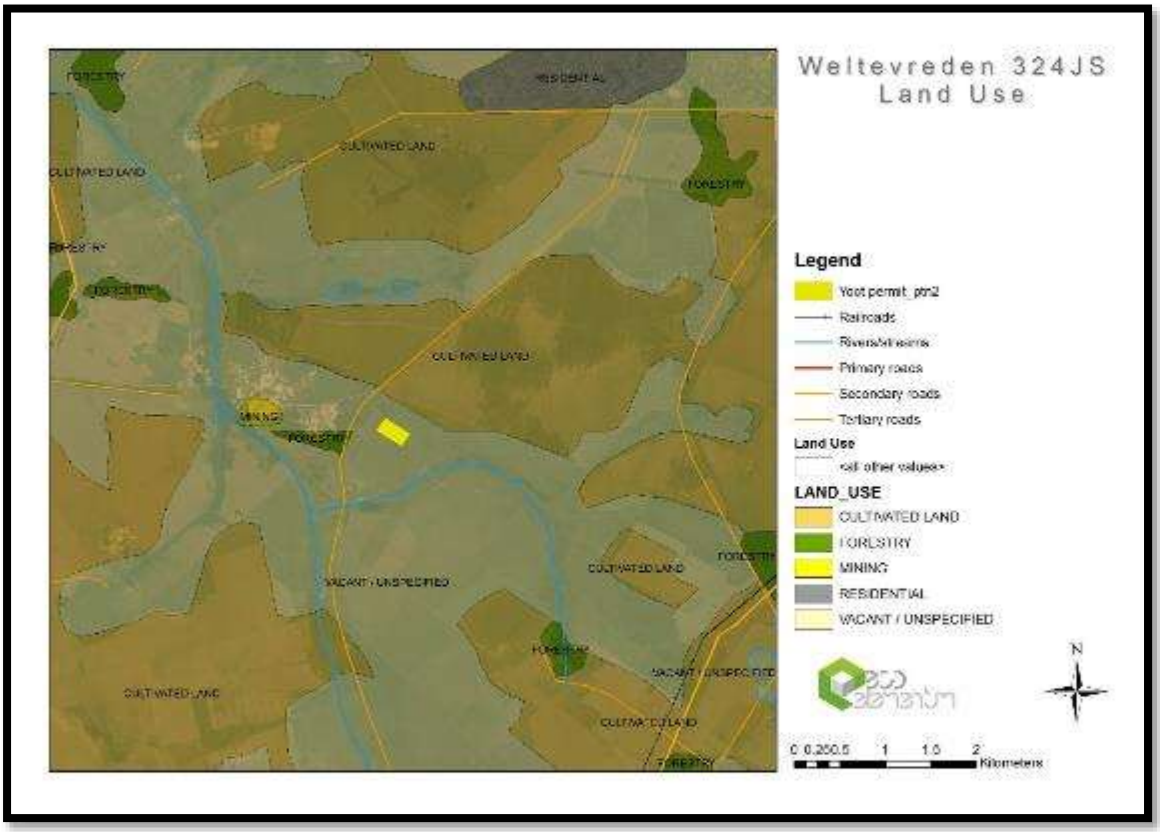


Figure 10: Land use of the proposed mining area

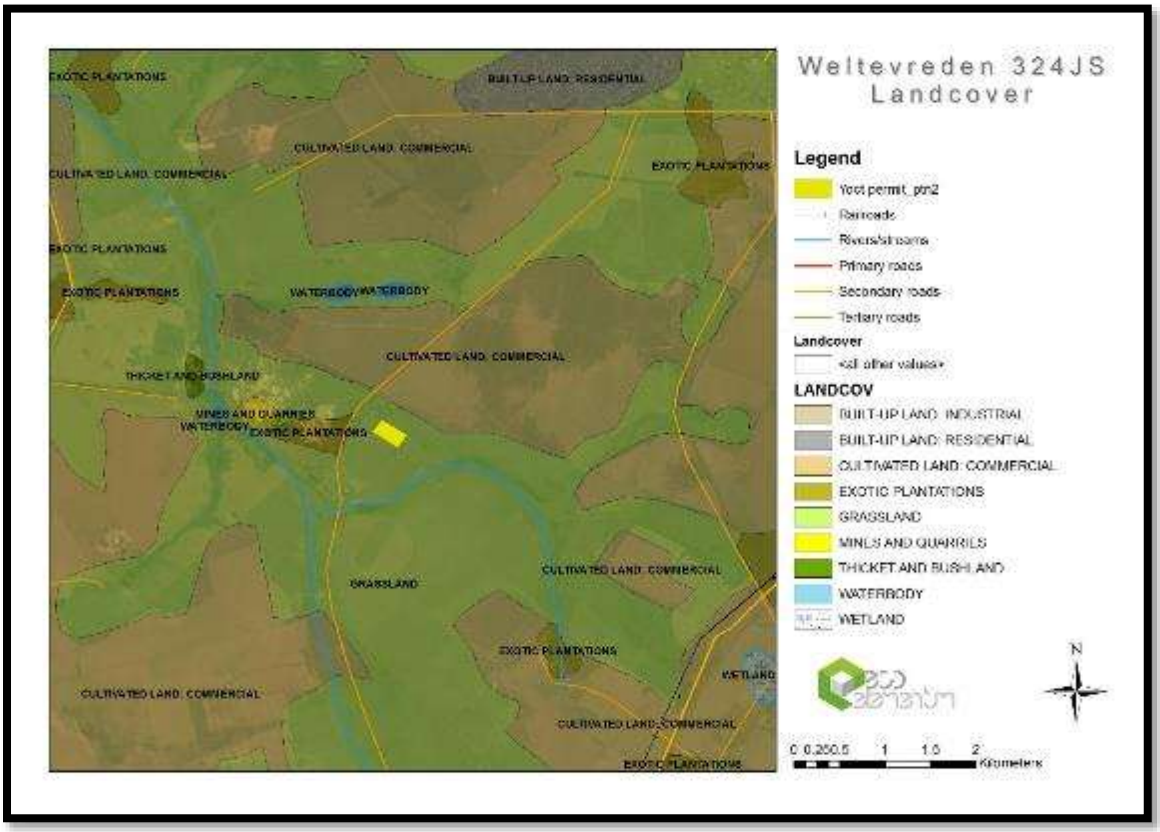


Figure 11: Land cover of the proposed mining area

1.1.7 Vegetation/flora

The floral data below is taken from The Vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford 2006). Also, the following field guides were used:

- Guide to Grasses of Southern Africa (Frits van Oudtshoorn, 1999);
- Field Guide to Trees of Southern Africa (Braam vanWyk and Piet vanWyk, 1997);
- Field Guide to the Wild Flowers of the Highveld (Braam van Wyk and Sasa Malan, 1998);
- Problem Plants of South Africa (Clive Bromilow, 2001);
- Medicinal Plants of South Africa (Ben-Erik van Wyk, Bosch van Oudtshoorn and Nigel Gericke, 2002)

According to the South African National Biodiversity Institute, the study area falls within the Grassland Biome, where most of the county's maize production occurs. The study area comprises of the Rand Highveld Grassland, Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands vegetation units as classified by Mucina and Rutherford. Each of these vegetation units are described in more detail below.

Rand Highveld Grassland

Rand Highveld Grassland is found in the highly variable landscape with extensive sloping plains and ridges in the Gauteng, North-West, Free State and Mpumalanga Provinces. The vegetation type is found in areas between rocky ridges from Pretoria to eMahlahleni, extending onto ridges in the Stoffberg and Roossenekal regions as well as in the vicinity of Derby and Potchefstroom, extending southwards and north-eastwards from there. The vegetation is species rich, sour grassland alternating with low shrubland on rocky outcrops. The most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High numbers of herbs, especially *Asteraceae* are also found. In rocky areas shrubs and trees also prevail and are mostly *Protea caffra, Acacia caffra, Celtis africana* and *Rhus spp*.

This vegetation type is poorly conserved (approx 1 %) and has a target of 24 % of the vegetation type to be conserved. Due to the low conservation status this vegetation type is classified as endangered. Almost half of the vegetation type has been transformed by cultivation, plantations, urbanisation or dam-building. Scattered aliens (*Acacia mearnsii*) are present in the unit.

Eastern Highveld Grassland

The Eastern Highveld Grassland is found in the Mpumalanga and Gauteng Provinces on the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. The landscape is dominated by undulating plains and low hills with short dense grassland dominating belong to the genera *Themeda, Aristida*, *Digitaria, Eragrostis, Tristachya* etc. Woody species are prevalent on the rocky outcrops. In terms of conservation and disturbance, 44 % of the vegetation type is already transformed by cultivation, plantations, mines, and urbanisation. No serious alien invasion, but *Acacia mearnsii* can dominate in certain areas

Eastern Temperate Freshwater Wetlands

Another vegetation type associated with the region is the Eastern Temperate Freshwater Wetlands, found around water bodies and embedded within the Grassland biome. Eastern Temperate Freshwater Wetlands are typically found in flat landscapes or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and hydrophillous (water loving) vegetation of temporarily flooded grasslands and ephemeral herblands. Important species include *Cyperus congestus, Phragmites australis, Marsilea farinose, Rorippa fluviatalis, Disa zuluensis*,

Crassula tuberella and the carnivorous herb *Utricularia inflexa*. These wetlands are one of the most sensitive vegetation units found in the region and have been extensively modified by mining and industrial activities in the region.

Three main vegetation types were identified, namely Disturbed/Grazed Grassland, Undisturbed/Natural Grassland and Wetland and Riparian communities. Each of these vegetation types are described in more detail below. The species that could occur in the quarter degree grid was obtained from the Plants of Southern Africa (POSA) online database upheld by the South African National Botanical Institute (SANBI) and supplemented with field notes. The list provides species names, common names, as well as notes on which species were observed on site. In total 136 species could occur in the study area.

Disturbed/Grazed Grassland

Disturbed grassland or other disturbed areas such as road reserves or fallow fields, not cultivated for some years, are also usually *Hyparrhenia* dominated. However, while *Hyparrhenia* – is present in this vegetation unit, it is not dominant. This grassland is a result of high disturbance as a result of over-grazing, characterised by Bankrupt Bush (*Stoebe vulgaris*), an invader dwarf shrub which usually indicates grassland's degraded condition.

This grassland mostly has low species richness, with only a few other species able to establish or survive in the shade of the dense sward of tall grass. Most of these species are relict pioneers or early seral species. The most prominent species include the grasses *Cynodon dactylon, Eragrostis plana, E. racemosa, E. curvula and E. capensis*. Herbaceous species such as *Anthospermum rigidum, Conyza podocephala, Crabbea angustifolia* and *Helichrysum rugulosum* are present. Alien species such as *Acacia mearnsii* (BlackWattle) have also invaded this vegetation unit.

Undisturbed/Natural Grassland

This grassland comprises both the Eastern Highveld Grassland and the Rand Highveld Grassland and is dominated by the grasses of these vegetation types.

The vegetation is species rich located on a landscape is dominated by undulating plains and low hills with short dense, sour grassland alternating with low shrubland on rocky outcrops. The most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon, Aristida, Digitaria, Tristachya and Elionurus*. High numbers of herbs, especially Asteraceae are also found.

In rocky areas shrubs and trees also prevail and are mostly *Protea caffra, Acacia caffra, Celtis africana* and *Rhus spp*.

Wetland and Riparian communities

Wetland and Riparian communities are seasonally wet areas that occur in sandy areas where water seeps into low lying drainage lines after rains. These areas are usually covered by hygrophytes such as sedges and reeds. The dominant sedge in the study area is *Juncus rigidus*. Sometimes bulrush (Typha capensis) and reeds (*Phragmites australis*) also occurs.

Wetlands are of a more permanent nature and occur in low-lying areas such as tributaries of streams and rivers. Wetlands are typically found in flat landscapes or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and *hydrophillous* (water loving) vegetation of temporarily flooded grasslands and ephemeral herblands.

Table 4: Vegetation description summary for the proposed mining area

Name of vegetation type	Eastern Highveld Grassland
Code as used in the Book - contains space	Gm12
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	0.3%
Remaining (percent of area) from NSBA	56%
Description of conservation status from NSBA	Endangered
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	12669.04
Name of the Biome	Grassland Biome
Name of Group (only differs from Bioregion in Fynbos)	Mesic Highveld Grassland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Mesic Highveld Grassland Bioregion

Distribution

Mpumalanga and Gauteng Provinces: Plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. Altitude 1 520–1 780 m, but also as low as 1 300 m.

Conservation

Endangered. Target 24%. Only very small fraction conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and in private reserves (Holkranse, Kransbank, Morgenstond). Some 44% transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. No serious alien invasions are reported, but *Acacia mearnsii* can become dominant in disturbed sites. Erosion is very low.

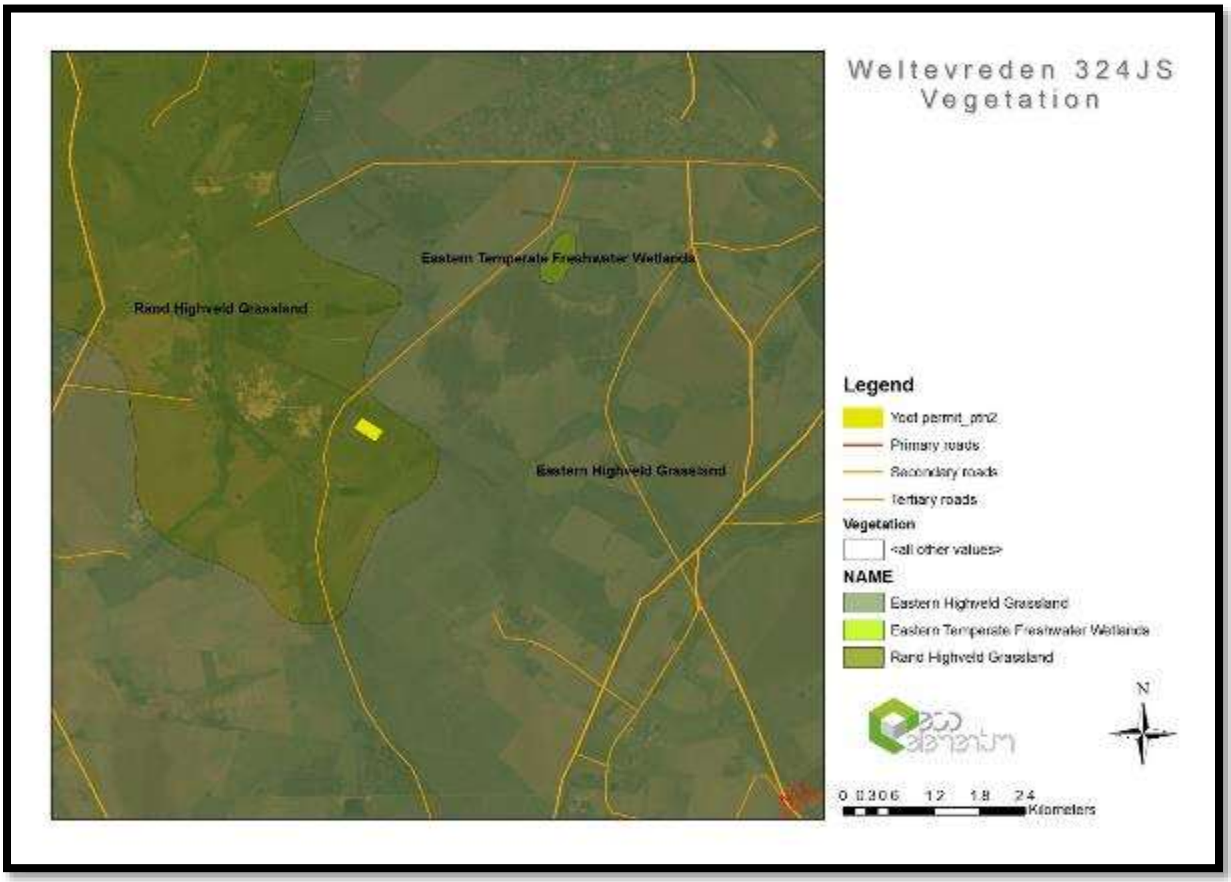


Figure 12: Vegetation map for the proposed mining area indicated in yellow

1.1.8 Animals/fauna

A literature review of the faunal species that could occur in the area was conducted. C-Plan (Conservation Plan) data provided from the Mpumalanga provincial department was used to conduct a desktop study of the area. This data consists of terrestrial and aquatic components, ratings provide an indication as to the importance of the area with respect to biodiversity.

Regional Description

As a consequence of mining and farming in the area, it appears that only small animals are to be found at the site. Small mammals known to occur in the area include hedgehog, rabbits, polecat, meerkat and the ubiquitous rats and mice. Given the habitat, it is likely that korhaans, larks, longclaws, species of Euplectes (bishops and widows), weavers, starlings and sparrows occur in the grassland.

The area surrounding proposed prospecting operation does include areas of terrestrial and aquatic habitats. These areas should be treated as sensitive and should therefore be managed accordingly; if feasible they should be avoided.

Site Description

The habitat on site is described in the vegetation site description and land use site description in the section above. All of the vegetation types identified have been disturbed to a certain extent, as the main land use in the area is cultivation of crops and grazing of livestock with mining in close vicinity of the site.

Herpetofauna

Herptofauna could potentially occur in all the habitat types. The Riparian and Wetland zones could potentially support amphibians representative of the region, specifically *Pyxicephalus adspersus* (African Bullfrog) which is a species rated as “near threatened” and is a protected species in South Africa.

The region is known to contain *Geochelone pardalis* (Leopard tortoise), *Aparallactus capensis* (Cape Centipede Eater), *Atractaspis bibronii* (Southern or Bibron’s Burrowing Asp), *Causus rhombeatus* (Common Night Adder), *Crotaphopeltis hotamboeia* (Herald or Red-lipped Snake), *Dasypeltis scabra* (Common or Rhombic Egg Eater), *Hemachatus haemachatus* (Rinkhals), *Lycodonomorphus rufulus* (Common Brown Water Snake), *Naja annulifera annulifera* (Snouted Cobra), *Psammophylax tritaeniatus* (Striped Skaapsteker), *Agama atra* (Southern Rock Agama), *Bitens arietans* (Puff Adder), *Cordylus vittifer* (Transvaal Girdled Lizard), *Gerrhosaurus flavigularis* (Yellow Throated Plated Lizard), Lygodactylus ocellatus (Spotted Dwarf Gecko), Pachydactylus *affinis* (Transvaal Thick-toed Gecko), *Telescopus semiannulatus semiannulatus* (Eastern Tiger Snake), *Psammophis brevirostris brevirostris* (Leopard or Short-snouted Grass Snake) and *Varanus niloticus* (Water Monitor). *Hemachatus* *haemachatus* (Rinkhals), *Psammophis brevirostris brevirostris* (Leopard or Short-snouted Grass Snake) and *Cordylus vittifer* (Transvaal Girdled Lizard) are endemic to Southern Africa, while *Lygodactylus ocellatus* (Spotted Dwarf Gecko) and *Pachydactylus affinis* (Transvaal Thick-toed Gecko) are endemic to South Africa.

Avifauna

Table 5: Avifaunal species that could potentially occur in the region

SPECIES	COMMON NAME
Phalacrocorax africanus	Reed Cormorant
Ardea cinerea	Grey Heron
Ardea melanocephala	Blackheaded Heron
Bubulcus ibis	Cattle Egret
Bostrychia hagendash	Hadeda Ibis
Plegadis falcinellus	Glossy Ibis
Alopochen aegyptiacus	Egyptian Goose
Elanus caeruleus	Blackshouldered Kite
Francolinus swainsonii	Swainson's Francolin
Nomida meleagris	Helmeted Guineafowl
Fulicia cristata	Redknobbed Coot
Gallinula chloropus	Moorhen
Anthropoides paradisea	Blue Crane
Sagittarius serpentarius	Secretary Bird
Eupodotis cafra	Whitebellied Korhaan
Vanellus armatus	Blacksmith Plover
Vanellus coronatus	Crowned Plover
Streptopelia semitorquata	Redeyed Dove
Streptopelia senegalensis	Laughing Dove
Asio capensis	March Owl
Colius striatus	Speckled Mousebird
Mirafra africana	Rufousnaped Lark
Corvus albus	Pied Crow
Saxicola torquata	Stone Chat
Phylloscopus trochillus	Willow Warbler
Cisticola fulvicapilla	Neddicky
Motacilla clara	Cape Wagtail
Anthus cinnamomeus	Grassveld Pipit
Passer domesticus	House Sparrow
Ploceus velatus	Masked Weaver
Euplectes orix	Red Bishop
Emberiza capensis	Cape Bunting

The species that could potentially occur on site include waterfowl, grassland specialists and common generalists. This is attributed to the variety of habitats that occur on site, as well as the adequate supply of fresh water.

It is widely accepted that vegetation structure, rather than actual plant species, influences bird species' distribution and abundance. Therefore the vegetation description used in the Harrison et al (1997) in the Atlas of Southern African Birds does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. It is important to note that no new boundaries were created and use was made of previously published data.

The study area is dominated by grassland biome. Many grassland bird species show a preference for sour grassland over sweet or mixed grassland. The grassland biome is very important from a Red Data perspective, as it is the preferred habitat of several grassland birds. The study area however, has been transformed to a large degree by intensive cultivation, which has placed it under severe pressure.

Parts of the study area have been extensively transformed through dryland cultivation. Data from the CAR project indicates that agricultural land is used to a limited extent by large terrestrial birds in the Mpumalanga Highveld as they prefer natural grassland. Fallow fields are used to a limited extent by Blue Cranes in summer, and pastures are used by Southern Bald Ibis *Geronticus calvus*. Blue Cranes also use recently ploughed fields in winter (Young et al, 2003). Indications are that Blue Korhaan *Eupodotis caerulescens* may also utilise agricultural fields to a limited extent (Young et al, 2003). A Red Data species that could also occur in the habitat from time to time is the Black-winged *Partincole Glareola nordmanni*. Overall though, agricultural lands are not as important for birds in the study area as natural grass.

Mammals

Large mammals have to a large extent been removed from the area and the only indication of large mammal species that could have previously occurred in the area are re-introduced mammals found on a few game farms and lodges encountered during the site visit. These include Springbok (*Antidorcas marsupialis*), Blesbok (*Damaliscus dorcas phillipsi*), Blue Wildebeest (*Connochaetes taurinus*) and Burchell's Zebra (*Equus burchelli*). During the site visit, signs of small mammals such as droppings were observed. Small mammals known to occur in the area include Hedgehog (*Atelerix frontalis*), Striped Polecat (*Ictonyx striatus*), Suricate / Meerkat (*Suricata suricatta*), Aardvark / Antbear (*Orycteropus afer*) and the ubiquitous rats and mice. Sensitive mammal species that could occur in the region include *Genetta tigrina* (Large-spotted Genet), *Lepus saxatilis* (Scrub hare), *Hyaena brunnea* (Brown Hyaena), *Sylvicapra grimmia* (Common/Grey Duiker), *Tragelaphus scriptus* (Bushbuck), *Vulpes chama* (Cape Fox). None of these species were however identified on site but a thorough ecological investigation will be conducted during the following phase of the project.

1.1.9 Surface water

From the table below it can be seen that the study area falls into the Wilge River Catchment Area B20G which forms part of the Olifants Water Management Area (WMA 4).

Table 6: Integrated Units of Analysis

IUA	Delineation	Quaternary Catchment
2	Wilge River catchment area	B20A, B20B, B20C, B20D, B20E, B20F, B20G, B20H, B20J

When considering the Classification of significant water resources in the Olifants Water Management Area (WMA4): WP 10383 - The quaternary catchment B20G is described by the nodes Saalboomspruit (MU21, confluence Wilge) with a node type and consideration being further described as; Management Unit, Future Mining Impacts. There is no EI, ES or PES determined currently but will be determined during the surface water study in the next phase of the applications. The main river in Quaternary Catchment B20G is the Saalboomspruit and the table below indicate specific attributes for this river system.

Table 7: Results of the Evaluation of PES and EIS per Quaternary Catchment in the Olifants WMA (2010)

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Saalboomspruit	B20G-01099	MODERATE	HIGH	C	B

<u>The present ecological state, ecological importance of the Saalboomspruit</u>: The rivers in the IUA are in a moderately modified state (category C) with less developed areas in the catchment. Impacts within the catchment are related to agriculture, dams and some mining. The importance of the resources is moderate especially in terms of good water quality they contribute to the main stem Olifants above Loskop Dam.

The primary surface water uses in the region are irrigation, formal and informal domestic usage, and livestock watering. Downstream of the proposed site, surface water use is primarily for agricultural and informal domestic purposes. Witbank Dam is used for both potable and industrial purposes, as well as for recreation (Jones and Wagner, 2010).

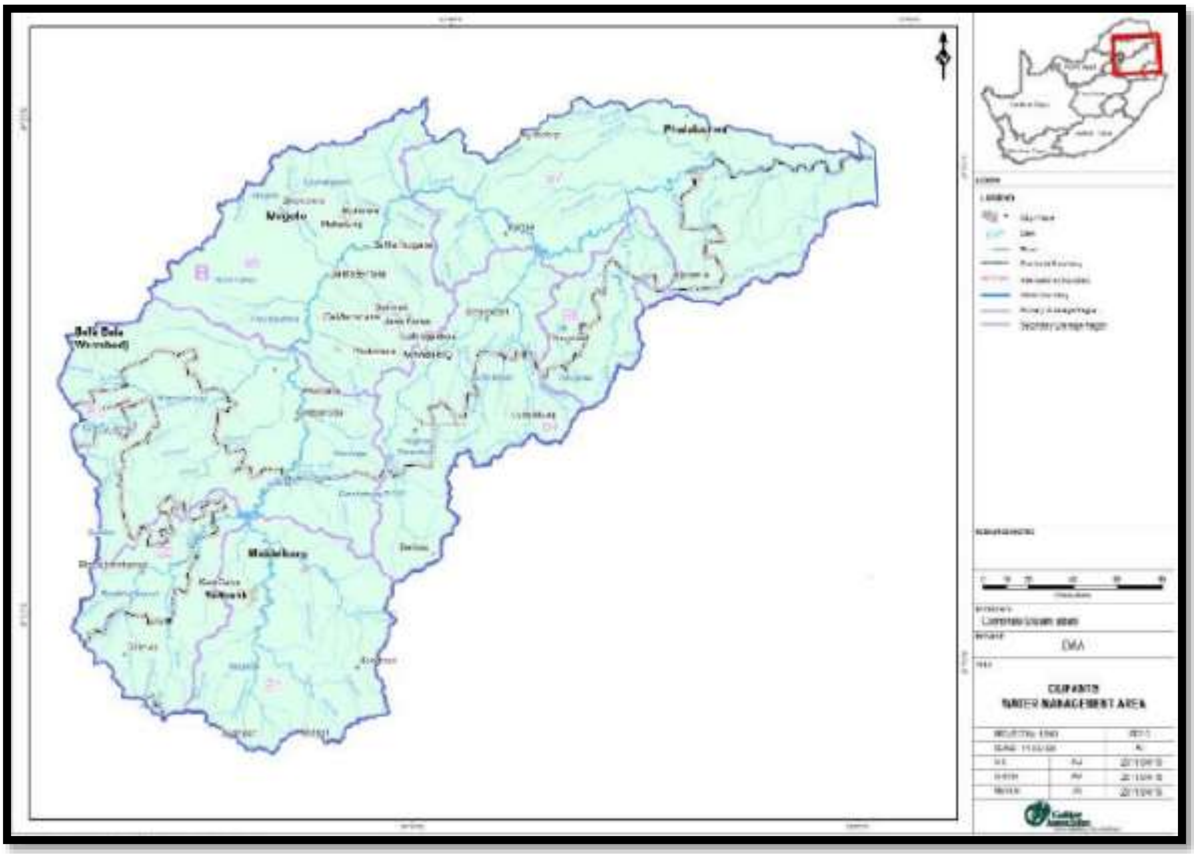


Figure 13: Olifants Catchment Water Management Area

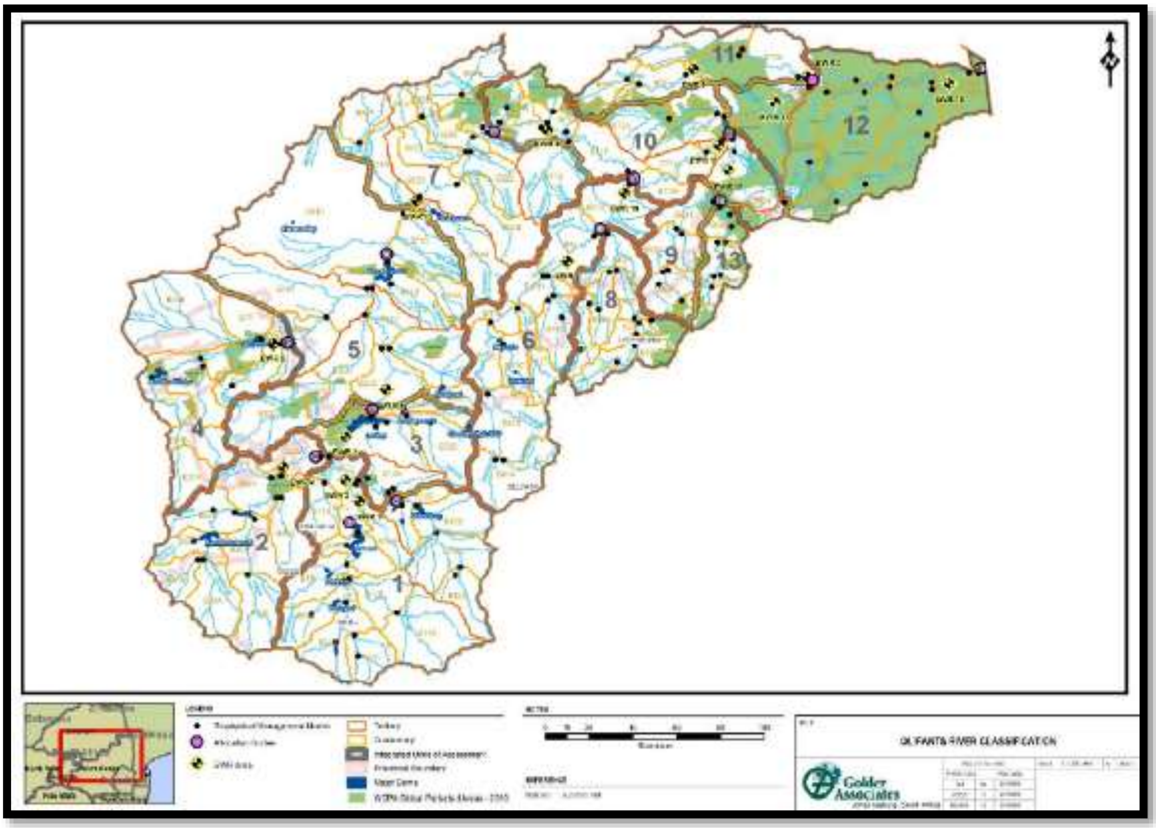


Figure 14: IUAs within Olifants WMA indicating location of proposed nodes and EWR sites

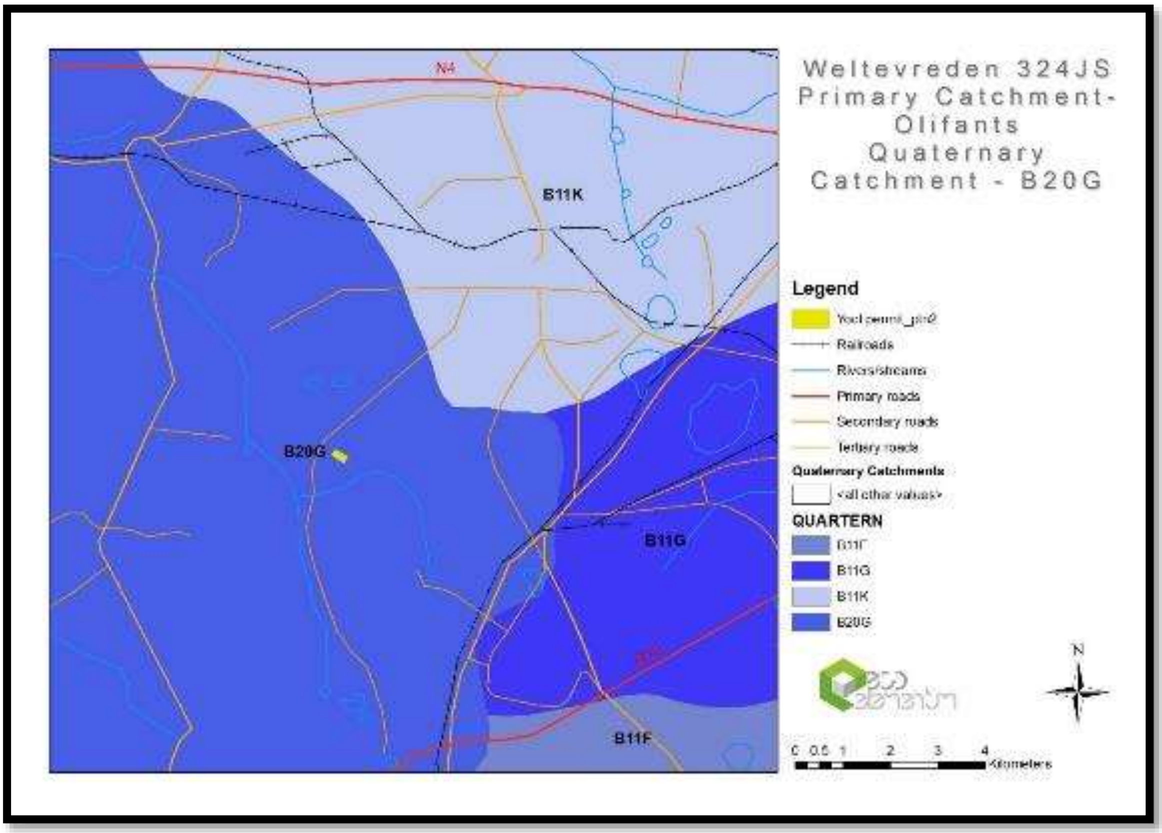


Figure 15: Quaternary catchments, study area situated in B20G

Wetlands

The Zaalklapspruit wetland is a naturally un-channelled valley bottom wetland system which is 139 hectares in size. It is located in the Mpumalanga Upper Olifants catchment (Quaternary Catchment B20G) and forms part of a larger wetland system which lies along a tributary of the Zaalklapspruit River, the Grootspruit. The Grootspruit River then flows into the Wilge River, which is approximately 35km northwest of the Town of Witbank. The wetland has been identified as a 'National Freshwater Ecosystem Area' and falls within a 'critically endangered wetland type'.

The catchment area of 9603 hectares consists of cultivated lands, plantations and coal mines. There is significant water quality impacts associated with the current catchment land-uses. However, the wetland is not functioning optimally at present due primarily to permanent channel incision which has resulted in concentrated, canalized water flow and consequently reduced plant life, all of which inhibit its ability to enhance water quality. The causes are identified as historic agricultural practices, namely ridge and furrow cultivation and artificial drainage in the central reaches of the wetland.

It is thus proposed to rehabilitate the Zaalklapspruit Wetland located in the eMalahleni Local Municipality in Mpumalanga. The project will form part of the Wetland Rehabilitation Intervention for the Working for Wetlands

Programme in partnership with Coaltech who is providing the funding. The Council for Scientific and Industrial Research (CSIR) will contribute through the provision of water testing.

On the study itself various NFEPA wetland units have been identified in the map below. A Water Use License application will be submitted should any of the proposed activities be within the 500m regulated area of these wetlands.

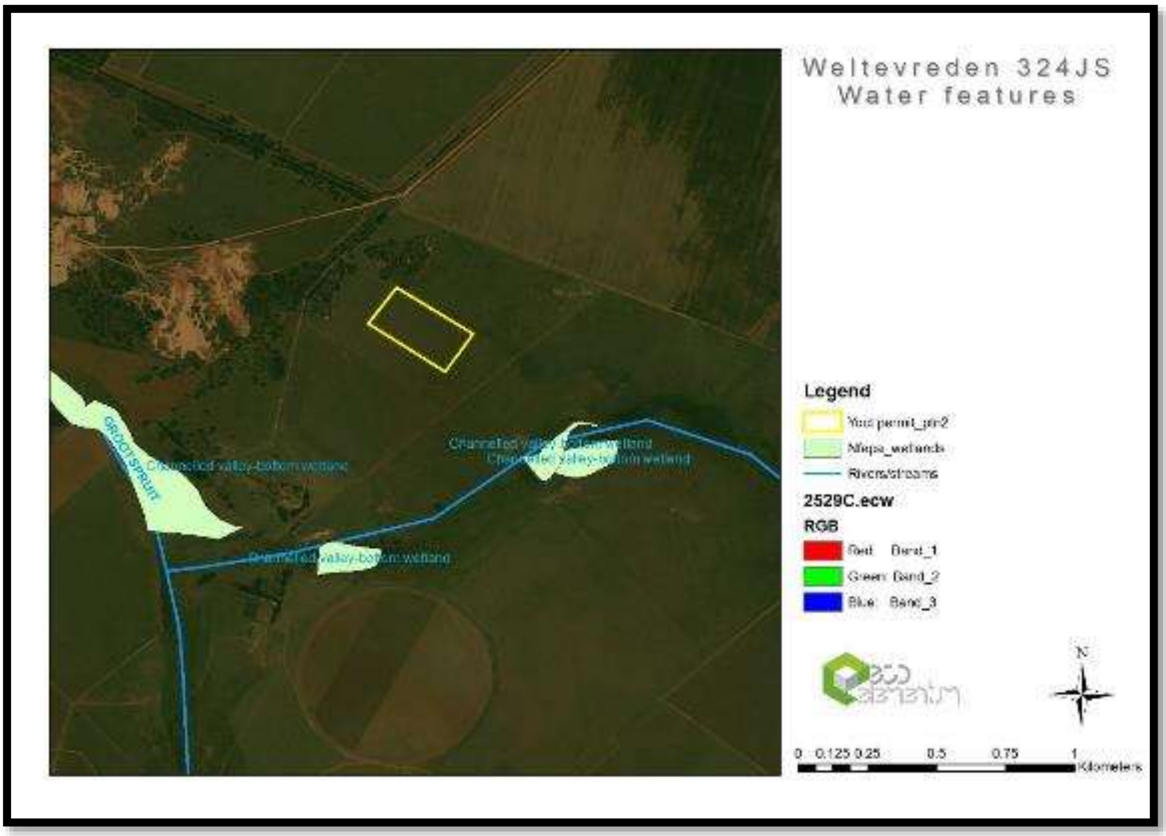


Figure 16: Surface water features in the vicinity of the proposed mining area indicated in yellow

1.1.10 Groundwater

Based on regional data, obtained during the literature review and from the National Groundwater Database (NGDB) and the WARMS database, the following information is relevant regarding the hydrogeology of the study area: -

- The groundwater potential of the formations located in the study area is limited in their pristine state due to low primary permeability, storage, and transmissivity. Secondary processes, such as weathering, fracturing, etc., are required to enhance the groundwater potential.
- Groundwater potential of the Ecca Formation sediments is negligible in the primary state unless altered by weathering, fracturing, faulting, or diabase intrusion. The aquifer system consist of a intergranular or fractured aquifer system with typical borehole yields between 0.5 and 2 l/s

- Two important quartzite horizons of the Pretoria Group include the Daspoort and the Magaliesburg formations, which provide the dominant aquifers. The aquifer potential of the quartzite is the result of secondary weathering and the extent of jointing and fracturing within the rocks.
- The contact between the shale and quartzite layers generally form good groundwater targets and have a high aquifer potential.
- The shale horizons of the Silverton Formation are not considered viable aquifer units due to the presence of swelling clays and the generally poor quality water associated with the shale.
- The aquifer system of the Dwyka Formation can be regarded as a fractured aquifer system with typical borehole yields between 0.5 and 2 l/s. Groundwater derived from the Dwyka Formation tillite can often be of poor quality water and boreholes characteristically have low sustainable yields.
- The candidate site fall within the B11F and B11G, with a small portion in B20G quaternary catchment with a total area of 504 km^2 and an average rainfall of 667 mm/annum.

The following hydrogeological data for the catchment area is available from the South African Groundwater Decision Tool2 (SAGT): -

- The rainfall component to groundwater recharge equals a volume of 32.7 Mm^3/a (million cubic meters per annum over the 504 km^2 area).
- The groundwater component of river flow equals a total volume of 1.8 Mm^3/a.
- The total population for the sub-catchment area equals 3 400 persons with basic human need of 31 x 106 m^3/annum.

The Groundwater Resources of the Republic of South Africa sheet 1 (DWAF, 1995) indicates the following information: -

- The probability of drilling a successful borehole (yield > 0.1 l/s) ranges between 40 and 60%
- The recommended drilling depth for the area is between 30 and 50 meters below ground level
- The depth of the groundwater level ranges between 10 and 20 meters below surface for the sub-catchment 2

In order to determine the volume of groundwater that can safely be abstracted from the study area without "mining" the resource, i.e. without removing groundwater from storage, a water balance will be calculated during the Water Use License application phase.

The groundwater balance will be calculated using the following variables: -

- Area of sub-catchment;
- Rainfall recharge and effective storage;
- Existing abstraction; and

- Ecological reserve.

The portions of the farm are classified as either non-aquifer or minor aquifer systems, according to Parsons classification (Parsons, 1995), where:-

Non-Aquifer Systems occurs where the formations have negligible permeability and are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer as unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risks associated with persistent pollutants.

Where groundwater potential has been enhanced along areas of secondary processes, such as diabase intrusions then there has been the development of discrete minor aquifer systems, where: -

A **Minor Aquifer System** comprises fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow for rivers.

Groundwater level depths are measured before the establishment of mines. The groundwater levels are typically 5 m to 10 m below surface within the study area Karoo geology. The coal prospecting phase infrastructures, including access roads, drill areas (similar to drilling domestic and irrigation bores – the holes, however, are usually 8.5 inches (22cm) in diameter). Water level records indicate that the groundwater levels can rise markedly due to the seepage into the ground. Groundwater contamination can occur as a result of poor quality water recharging the underlying aquifers.

Examination of the rise in groundwater levels and the hydraulic response of the aquifer in areas away from the artificial recharge points, known as the equalisation reaction, provide an indication of the hydraulic characteristics of the aquifer. Typically there is a localised nature of the groundwater mounds around the recharge points and the limited zone of influence suggests low regional permeabilities within the Karoo sediments.

The groundwater level data typically indicates interconnectivity between the coal mining phase infrastructures and the aquifers over a relatively small area, and that groundwater contamination could occur but would migrate at a very slow rate. Pollution plume migration, within the tillite and shale, is predicted to be retarded, due to indirect flow paths along fractures in the rock and because of chemical reactions and ionic bonding.

1.1.11 Air quality

The proposed mining site is located within the Highveld Priority Airshed (HPA). The HPA covers approximately 31,106 km2, including parts of Gauteng and Mpumalanga Provinces, with a single metropolitan municipality, three district municipalities, and nine local municipalities. Within the HPA, the project is located approximately 7 km south east of Ogies in the eMalahleni Local Municipality (Mpumalanga).

The local municipality has a population of approximately 407,100 and a relatively high population density of 152 per km² compared to national levels of 41 per km² (STATSSA, 2007).

The municipality is mostly characterised by rural farmland, dispersed urban settlements, coal mines and power stations. Although eMalahleni is traditionally known for coal mining and electricity production, other manufacturing industries are also developing, making eMalahleni a prominent industrial node. Urban centres have largely been developed around mining and electricity operations, some of which are now decommissioned. These account for the high population density and include the eMalahleni complex, the largest urban area in the municipality, Kriel, and Ogies.

1.1.12 Noise

Measurements of the existing noise climate in accordance with the relevant SANS 10103:2008 Code of practice within the Project area were made at 5 defined positions around the site.

In summary the results of the noise baseline indicated that existing sources of noise in the Project area are:

- Natural sounds of the bush;
- Noise of existing mining activities near to the site; and
- Noise from roads (incl. domestic traffic as well as trucks carrying coal from the mines).

Noise and vibration is not monitored at the proposed site as it is not currently being mined. As with air quality, the surrounding mines and industries impact on noise levels from vehicular and mechanical equipment.

The current ambient noise levels are generally comparable with the levels associated with farming activities. Due to numerous daytime sources including traffic on the adjacent national roads, haul roads and mining related blasting activities, the noise and vibration levels are most prominent during the daytime and the noise emitted during these activities is occasionally intrusive to the wellbeing of the community.

1.1.13 Visual aspects

Landscape character is a visually-orientated description of the natural (physical and biological) and human made (land-use) attributes within the study area. The nature and occurrence of these elements together determine the visual quality or visual resource value of the landscape.

The regional topography is generally undulating with few prominent landforms, although localised alterations by open pit mining are especially prevalent in the vicinity of the site. These landforms create prominent landmarks, but they are visually intrusive and they detract from the visual quality of the landscape. Agricultural and mining activity in the proposed project area has resulted in the large-scale transformation or complete removal of the representative grassland plant communities. The result is that natural or somewhat disturbed vegetation only occurs along watercourses or fringes of other activities. Visually, the remaining vegetation cover throughout the project area is largely homogenous in appearance and localised clumps of alien invader trees (predominantly Eucalyptus and Wattle species) and human-made infrastructure become prominent elements in the landscape.

In addition to the afore-mentioned mining and agricultural activities, a number of other manmade elements occur in the project vicinity. These include the towns, regional roads, high mast power lines and other linear infrastructure. Based on landscape character, the visual quality of the study area varies somewhat, with the areas most affected by mining having the lowest resource value. Agricultural land uses, although artificial, have a somewhat higher resource value as they are closer in appearance to the natural or pre-mining visual environment; however few areas with a high resource value remain.

The visual impact of the proposed mining operation is assessed by combining a quantitative component of the physical visibility together with a qualitative estimation of the emotional effect experienced by the viewer.

Criteria used in the determination of the overall visual impact include the following (Oberholzer, 2005):

Visibility

The geographic area from which the project will be visible or the actual zone of visual influence of the project may be smaller because of screening by existing trees and buildings. This also relates to the number of receptors affected. With the prospecting activities being on a relatively flat area, it is highly unlikely that it would be visually disturbing.

Visual exposure

Visual exposure is based on distance from the project to selected viewpoints. Exposure or visual impact tends to diminish exponentially with distance. Due to topographic ranges the proposed prospecting area will only be visible from selected angles. With the increase in distance the area becomes part of the background.

Visual sensitivity of the area

The geographic location of the prospecting activities is distant from the prospecting dominated eMalahleni town area. Largely natural tourism activities surround the proposed activities and increase the sensitivity of the area.

Visual sensitivity of the receptors

Receptors refer to the people who are affected. Of these most will be local residents passing through and holiday visitors at tourism destinations in the area. Local residents will in time get used to the scenery along the road, whereas holiday visitors will be majorly affected.

Visual absorption capacity

Visual absorption capacity refers to the potential of the landscape to conceal the proposed project.

Visual intrusion

This criterion also strengthens the location of the development compared to the surrounding activities. Most of the neighbouring farms have very little development and adds significant value to the natural beauty of the landscape. There will probably be a permanent residual impact on the receiving visual environment as a result of newly constructed roads leading to the prospecting sites. The mine will definitely create an intrusion on the overall sense of place for the surrounding areas.

1.1.14 Regional socio-economic structure

The project is located in eMalahleni Local Municipality, a municipality covering just less than 2,700 km^2 in Nkangala District Municipality, Mpumalanga Province. The local municipality has a population of approximately 407,100 (increasing by 23% since 2005) and a relatively high population density of 152 per km^2 compared to national levels of 41 per km^2.

The municipality is mostly characterised by rural farmland, dispersed urban settlements, coal mines and power stations. Although eMalahleni is traditionally known for coal mining and electricity production, other manufacturing industries are also developing, making eMalahleni a prominent industrial node. Urban centres have largely been developed around mining and electricity operations, some of which are now decommissioned. These account for the high population density and include the eMalahleni complex, the largest urban area in the municipality, Kriel, and Ogies, the closest buying centre to the project area approximately 10km away, housing several businesses including filling stations, groceries, banks and medical facilities. The project footprint is located on mine-owned land. Two small businesses, an engineering firm and a small restaurant / shop, are within 100m of the project footprint. Within a 5km radius, the project area is surrounded by agricultural land to the south and west, interspersed with farm houses, operations and farmworker housing, and mine-owned land to the north and east. Heavy vehicles on surrounding roads and evident mining activities are visible everywhere in this area.

Given the natural resources of the municipality and associated developments, employment is centred on the mining and quarrying industry sectors and the wholesale and retail trade, each sector representing 23% of employment in eMalahleni Local Municipality. However, mining and quarrying have a significantly larger economic contribution, with the sector representing 40% of Gross Value Added (GVA) in the municipality, compared to only 6% at national level. Manufacturing, predominantly in eMalahleni town, is the second largest and increasingly important economic contributor, representing 18% of GVA in 2010, an increase of 6 % since 2000.

Table 8: Annual household income categories in the Olifants WMA (Census 2001)

Income Category	Number of Households
Very Poor (no income-R9600)	261 827
Poor (R9601-R38 400)	133 456
Tolerable (38 401-R76 800)	35 036
Comfortable (R76 801-R153 600)	20 790
Wealthy (R153 601 & above)	13 286
Total	**464 395**

Table 9: Employment by sector in the Olifants WMA (Census 2001)

Sector	Employment
Agriculture; hunting, forestry and fishing	25 959
Mining and quarrying	33 858
Manufacturing	30 415
Electricity; gas and water supply	7 668
Construction	20 309
Wholesale and retail trade; repairs, hotels and restaurants	40 693
Transport, storage and communication	11 752
Financial intermediation; insurance; real estate and business services	16 711
Community; social and personal services	57 393
Private households	35 212
Extraterritorial organisations	11
Representatives of foreign governments	16
Undetermined	21 924
Total	**301 920**

1.1.14.1 Mpumalanga Province

The trade industry (wholesale and retail trade) employed the largest share of individuals in the province at 24.9 per cent at the end of the first quarter 2012. This was larger than the 24.8 per cent share registered 12 months earlier.

Community and social services (16.3 per cent) was the second biggest employer, albeit with a smaller share than at the end of the first quarter 2011 (19.6 per cent). The utilities industry was the smallest in both quarters, followed by transport as the second smallest. In this regard, transport (14 000), agriculture (12 000) and mining (12 000) were the three industries in Mpumalanga that recorded the highest employment increase from the start of the first quarter 2011 to the end of the first quarter 2012. Private households (not in industry in the true sense of the word) also registered an increase of 13 000 year-on-year. Community services (23 000) recorded the highest number of job losses over the same period. The strong reliance upon Community Services as most important economic sector, in e.g. employment provision still raises some concern in the CRDP municipalities. Primary industries (viz. Agriculture and Mining) provide fuel for the economic vehicle to run – but the engine resides in the Secondary industries, viz. Manufacturing, Utilities and Construction. The contribution in these industries is extremely low and should become the future focus to facilitate the process of alleviating and ultimately eradicating poverty.

The implementation of the CRDP projects in the seven pilot municipalities in Mpumalanga provided the opportunity for hindsight analysis. The CRDP wards were selected from the following seven (7) local municipalities: Mkhondo, Dr Pixley ka IsakaSeme, Albert Luthuli, Nkomazi, Bushbuckridge, Dr JS Moroka and Thembisile Hani. There should be an increased motivation for the inhabitants in these wards to become involved in the secondary industries – especially manufacturing and utilities.

It is clear from the above that the non-CRDP municipal areas dominated the provincial economy in 1996 (85.6 per cent) and strengthened its position over the 14-year period with an 87.1 per cent contribution to provincial GVA in 2010. In 2010, the CRDP municipal areas made only meaningful contributions to the provincial community services (30.3 per cent), agriculture (29.2 per cent), construction (20.2 per cent) and trade (19.1 per cent) industries. Over the 14-year period under consideration, the CRDP grouping only increased its share of agriculture (from 28.5 per cent to 29.2 per cent) and utilities (from 6.7 per cent to 7.3 per cent).

To follow is an excerpt from the report, indicating the key findings:

- Unemployment was considerably higher in the 7 CRDP areas (average of 38.4 percent) compared to the 11 non-CRDP areas (19.7 per cent);
- A higher share of the population in the CRDP areas lived in poverty (an average of 51.4 per cent) compared to residents in the non-CRDP areas (37.5 per cent);

- The CRDP areas‘ percentage of households with formal housing (89.7 per cent) and electrical connections (85.9 per cent) were higher than non-CRDP areas;
- Bushbuckridge finished 2010 with the lowest infrastructure index score (an indicator of service delivery) of the 18 municipalities in Mpumalanga;
- The community services industry was the industry that employed the largest number of workers and made the largest economic contribution in the CRDP areas –a high dependence on government;
- Four of the CRDP areas recorded poverty rates of more than 50 per cent, with Mkhondo registering the highest (worst);
- Three of the CRDP areas recorded unemployment rates of more than 40 per cent, with Bushbuckridge registering the highest (worst); and
- Five CRDP areas are expected to achieve economic growth in excess of 3.0 percent over the period 2010-2015, with Dr Pixley Ka Isaka Seme leading at 4.7 per cent.

1.1.14.2 Nkangala District Municipality (DC31)

Nkangala District Municipality is a Category C municipality found in the Mpumalanga province. It is composed of six local municipalities: Victor Khanye/Delmas, eMalahleni, Steve Tshwete, Emakhazeni, Thembisile and Dr JS Moroka.

The main towns are Steve Tshwete, eMalahleni, Thembisile, Dr JS Moroka, Delmas and Emakhazeni. The headquarters of the district is in Middelburg (Steve Tshwete Local Municipality). The population is divided as follows: 435 226 people reside in eMalahleni, being the largest number, with Thembisile as the second-largest municipality with a population of 278 518 people.

Nkangala is the economic hub of Mpumalanga and is rich in minerals and natural resources. The Districts' economy is dominated by electricity, manufacturing and mining. These sectors are followed by community services, trade, finance, transport, agriculture and construction.

1.1.14.3 eMalahleni Local Municipality (Ward 2)

The local economic growth and associated employment opportunities have resulted in a large population influx into the municipality, causing a population growth 17% higher than in South Africa as a whole over the last five years. The requirements of the mining and manufacturing sectors for a skilled workforce attract the educated and economically active population into the area. As such, education levels are above average, the population of working age is greater, the population not economically active is lower and more than 50% of households earn above R19,200 per annum. Although employment levels are higher in eMalahleni Local Municipality than at national level, the higher proportion of economically active population results in higher unemployment figures. As such, should employment opportunities be created, it is expected that positions can be filled locally.

The disadvantage of a large population influx is the resulting pressure on local services. The eMalahleni Local Municipality Integrated Development Plan 2010/11 (IDP) indicates a housing backlog of 45,408, the highest housing backlog in Nkangala District Municipality. eMalahleni Local Municipality has committed to build 7,900 houses per annum to address the backlog and increasing sizes of informal settlements. In addition, household electricity provision is 18% lower than at national level and the eMalahleni Integrated Development Plan indicates that 9,716 households do not have adequate water supply and 18,585 households do not have sufficient sanitation services.

Continued developments over the next 20 years will increase pressure on the local municipality to ensure sufficient raw water supply that can be purified to satisfy the projected water demands. The Witbank Dam, which has a 98% assured yield of 32 million m³/annum (87.7Ml/d), is the major source of water, supplying almost 90% of potable water demand in eMalahleni Local Municipality. However, given the population growth, the projected water demand for 2025 is almost double this current yield at around 171Ml/d3.

1.2 The specific environmental features on the site applied for which may require protection, remediation, management or avoidance.

Agricultural activities take place on the property – cattle grazing and planted pastures and maize cultivation. Mining and mining related activities takes place towards the west and north of the site in very close proximity.

The proposed 5ha area under application has no specific environmental features that require protection, remediation, management or avoidance. The current agricultural use must be re-established after rehabilitation.

Should the current mine planning go within the 500m regulated area of wetlands or within 100m of streams would it be required to obtain relaxation of these buffers through a Water Use License Application to be submitted to the Department of Water Affairs.

During the survey for the proposed mining area no sites of heritage significance were found in the development footprint and from an archaeological point of view there is no reason why the development cannot commence work based on approval from SAHRA.

1.3 Map showing the spatial locality of all environmental, cultural/heritage and current land use features identified on site.

During the Heritage specialist study no features of concern were observed. The closest surface water body to the mine is approximately 450m to the east. The mine shares a western boundary with an existing active mine while exotic plantations thrive in the area. Another active coal mine is situated within a 1km radius towards the north-east. The local community is approximately 350m to the north-east of the site while the closest farming homestead is approximately 650m to the south-west of the mine. The area where the mine layout has been planned has been extensively disturbed and overgrazed.

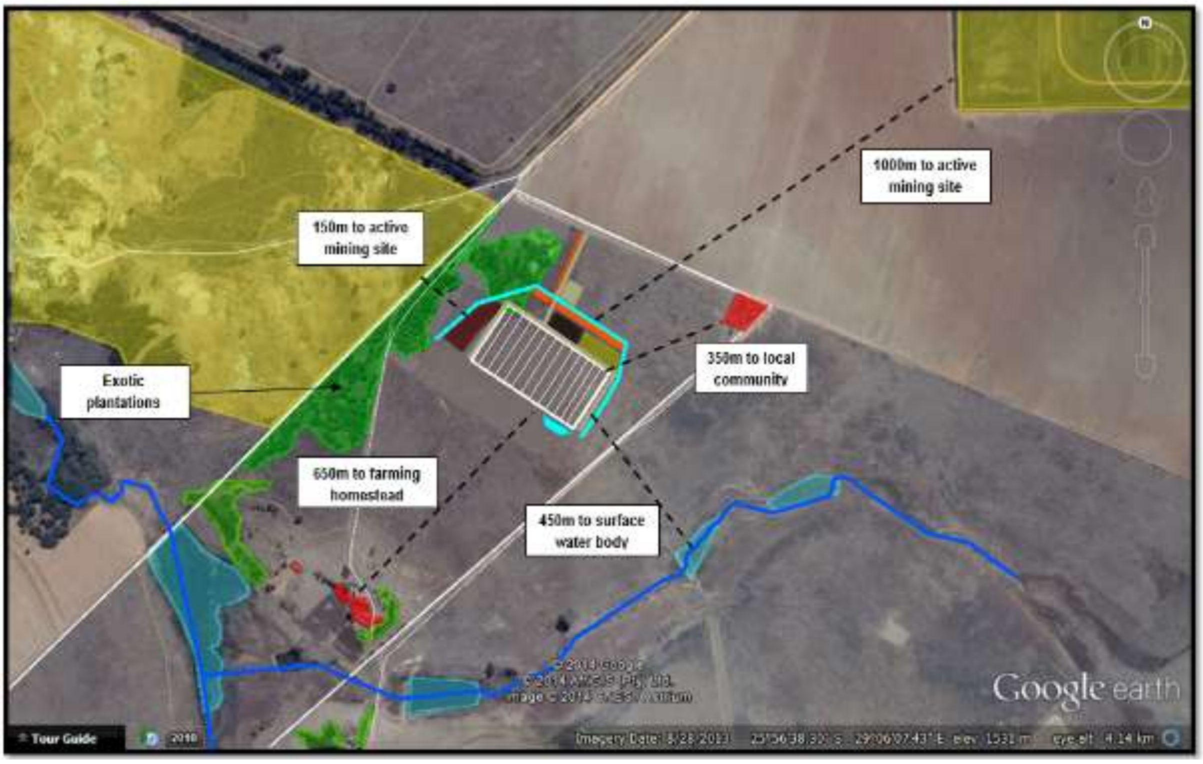


Figure 17: Map indicating all relevant features on site

1.4 Confirmation that the description of the environment has been compiled with the participation of the community, the landowner and interested and affected parties

The public consultation process included all invited IAP's from the neighbouring areas, those that responded to the newspaper advertisement, written notifications and the land owner. Comment on all aspects of the process was welcomed during the consultation including comment on the description of the environment. No comments or concerns regarding the description of the environment were raised during public consultation.

Yoctolux Investments (Pty) Ltd (the applicant) will lease the property Weltevreden 324JS Portion 2 from the local community who is currently the landowners for the duration of the Mining Permit execution. This EMP will be circulated to the community, all I&AP's as well as the stakeholders for perusal. All information gathered from the Public Participation Process (PPP) as described in the Annexure of this report, which includes the newspaper advertisement period, various email correspondence, on site meetings and site notices, shall be included in the final EMP to be submitted to DMR. The description of the environment has been compiled with the participation of the community, the landowner and interested and affected parties. More detail has been provided in the Public Participation Report attached as an Annexure to this EMP.

2. REGULATION 52 (2) (B): Assessment of the potential impacts of the proposed prospecting or mining operation on the environment, socio-economic conditions and cultural heritage.

2.1 Description of the proposed prospecting or mining operation.

2.1.1 The main prospecting or mining activities (e.g. access roads, topsoil storage sites and any other basic prospecting design features)

The Yoctolux Weltevreden Colliery will be an opencast mine producing 400 000tons of high grade Bituminous Coal found in a single coal seam (3.5 -6.0m thick) of the Witbank Coal Field at depths varying from 6.5m to 28m deep. The colliery will be covering an extent of approximately 5ha of Portion 2 of Weltevreden 324 JS 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 permit with reference has MP30/5/1/3/2/10487MP is being applied for by Yoctolux Investments (Pty) Ltd. An application for a Water Use License will be lodged upon successful granting of the Mining Permit.

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 Yocotolux Weltevreden 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.

Besides the rate and method of mining, the location, variety and scale of mine infrastructure also influences the nature and extent of impacts. The Yoctolux Weltevreden Colliery will be mined relatively quickly in a period of 3 years 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 storage yards); tailings and waste rock disposal areas; transport and service corridors (e.g. roads, pipelines, conveyers, power and water corridors); product stockpiles; chemicals and fuel storage, pollution control dams, storm water management infrastructure and temporary housing facilities.

Table 10: 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**

As a summary the following activities will be carried out and are associated with the proposed Yoctolux Weltevreden 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.

2.1.1.1 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 Yoctolux Weltevreden 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 anaerobic 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.

2.1.1.2 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 Yoctolux Weltevreden 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 open-castable 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.

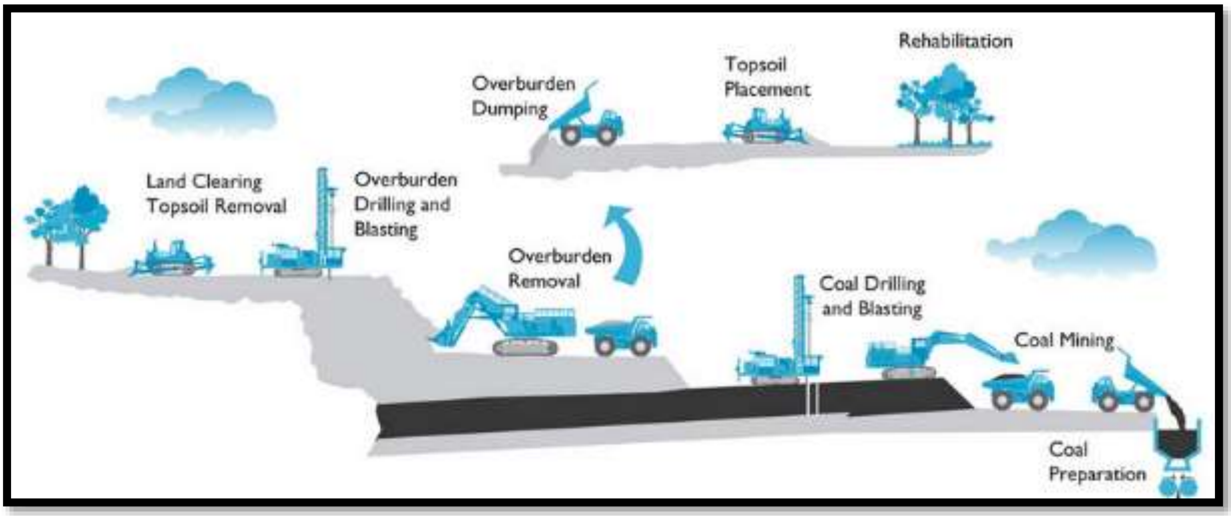


Figure 18: Typical coal surface mining opencast sequence indicating primary procedures

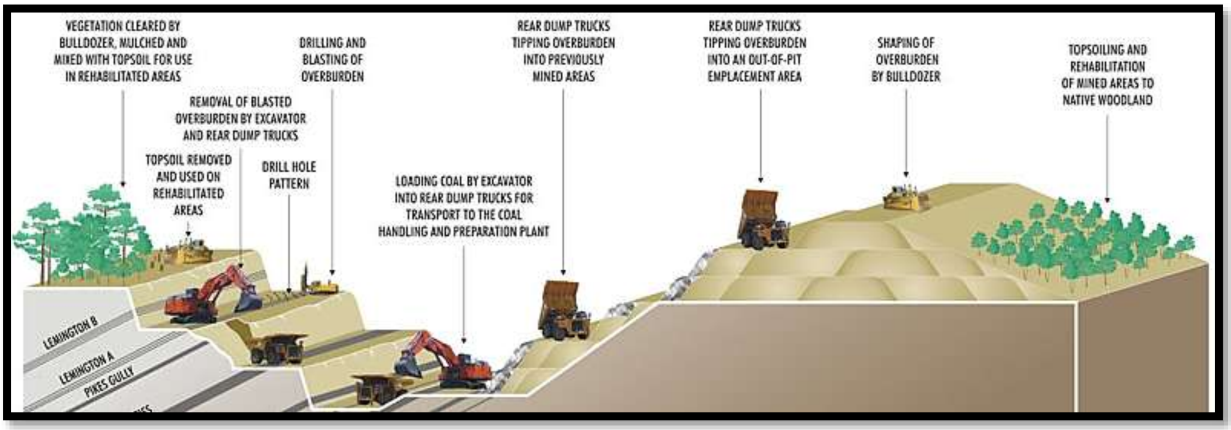


Figure 19: Typical coal surface mining opencast sequence indicating rollover backfill rehabilitation methodology

The figure 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.

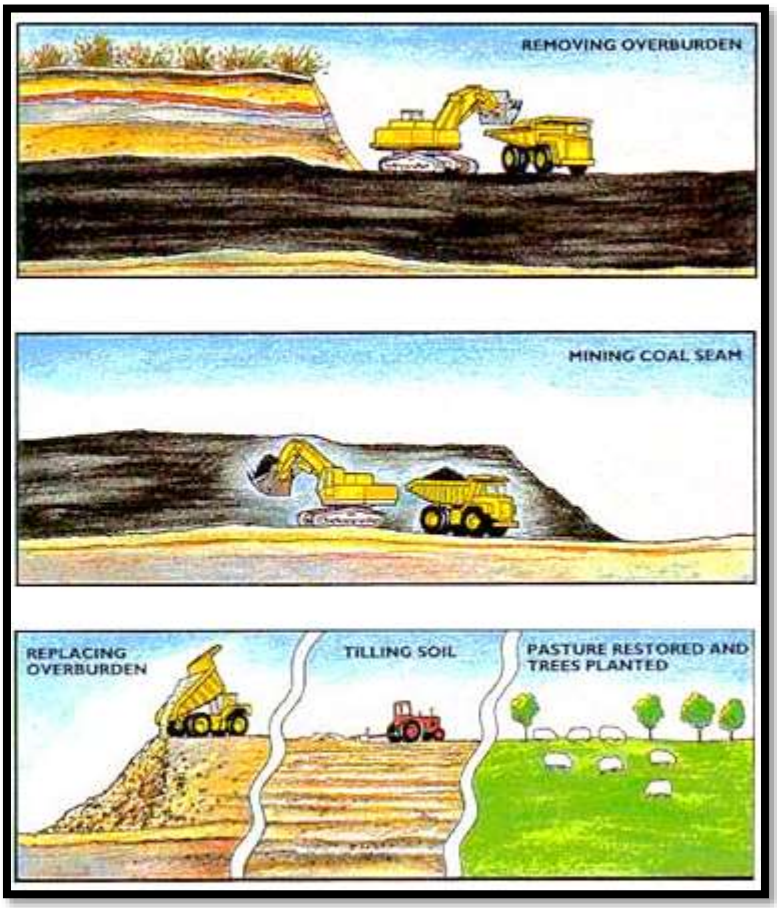


Figure 20: Opencast Coal Mining Sequence

The sequence in the following figure 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.

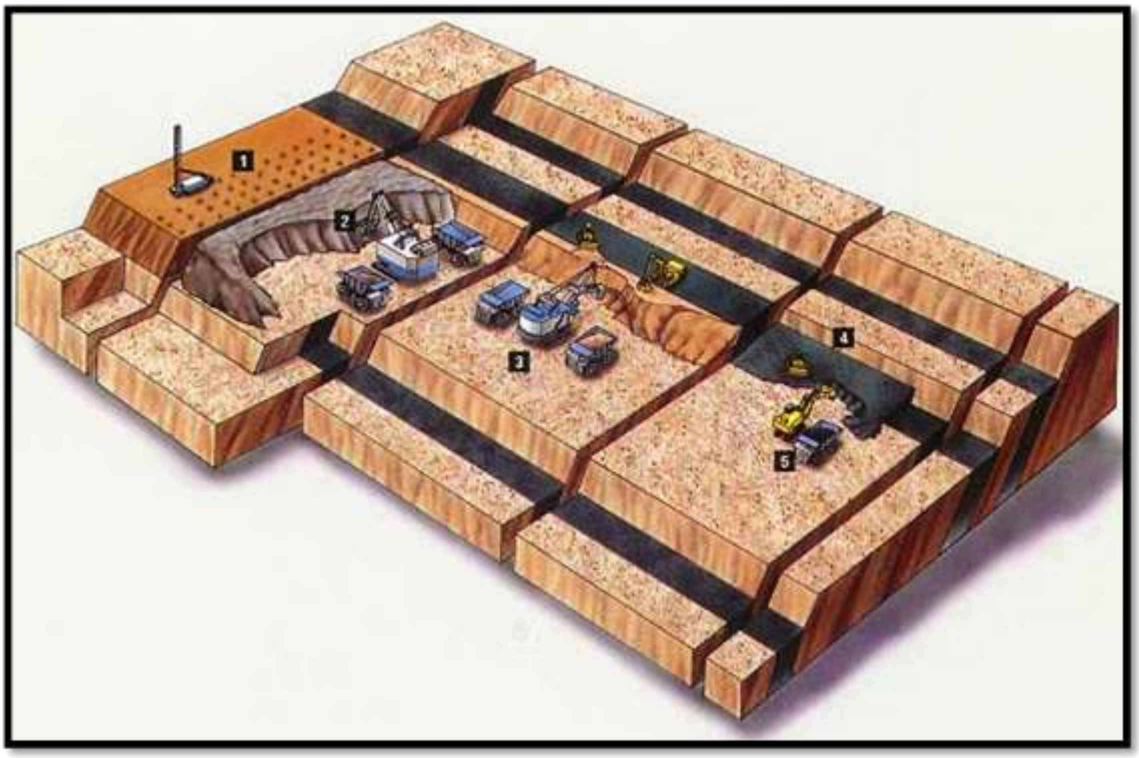


Figure 21: Opencast coal mining typical progressive steps (No 1- 5)

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;
- Reinstate 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 alternatives substrates, e.g. overburden that may 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.

2.1.1.3 Crushing and Screening of 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 din 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.

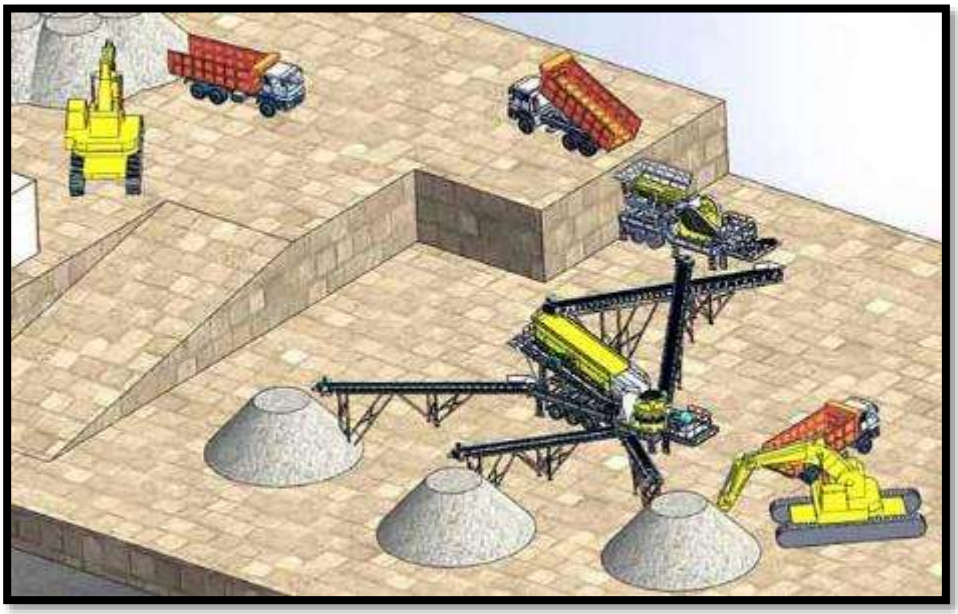


Figure 22: Typical mobile crushing and screening facility illustration with associated activities

2.1.1.4 Access and haul roads construction

The mine access road will lead off one of the dirt roads serving the purpose to only give farmers access to their properties. The dirt road will be upgraded to the applicable standards which includes a gravel road leading into the mine. The road will be used to access the mine offices, workshop complex, and mining area (including mobile crushing and screening facility with ROM stockpiles). Coal transportation trucks will also use this road to enter and exit the mine premises, including travelling to the weighbridge. The weighbridge will be a 22 x 3m, 70ton weighbridge adjacent to the new access road. Several temporary haul roads will also be constructed to access the mine area as well as the ROM stockpiling area. These haul roads will be used by mine personnel to access the mine areas for their day to day duties and the dump trucks will use the road for haulage of coal to the ROM stockpiles. The roads will be constructed to have a width of 8m while dust suppression using water carts with an added chemical dust suppressant (environmentally friendly) product will be employed.

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.

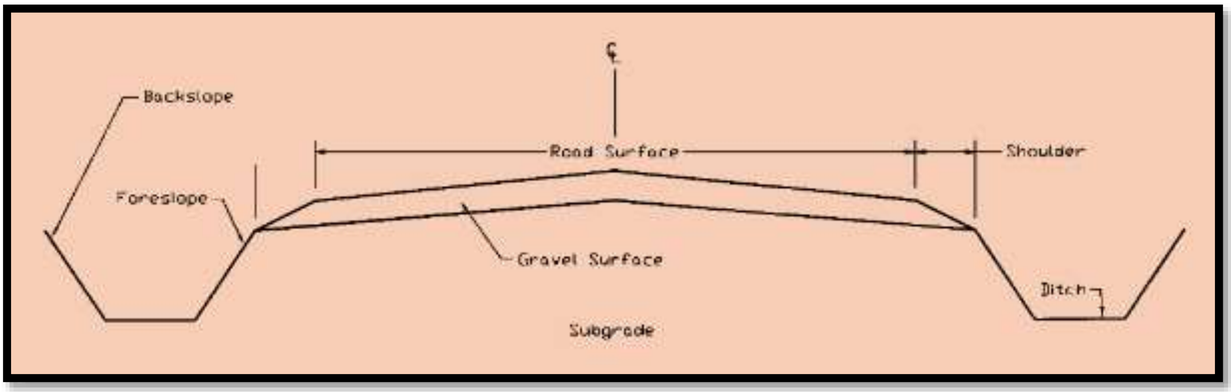


Figure 23: The components associated with a gravel road section

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 during road planning. 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.

2.1.1.5 Semi temporary site and security offices

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 shelve 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 24: Typical semi temporary site offices and security office

2.1.1.6 Semi temporary sanitation and change house

Similar to the structure indicated in the section 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.

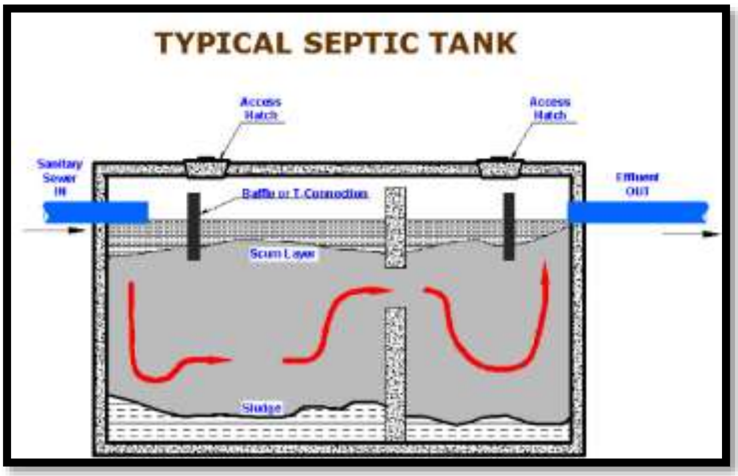


Figure 25: Typical septic tank cross section and chemical toilet illustration

2.1.1.7 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.

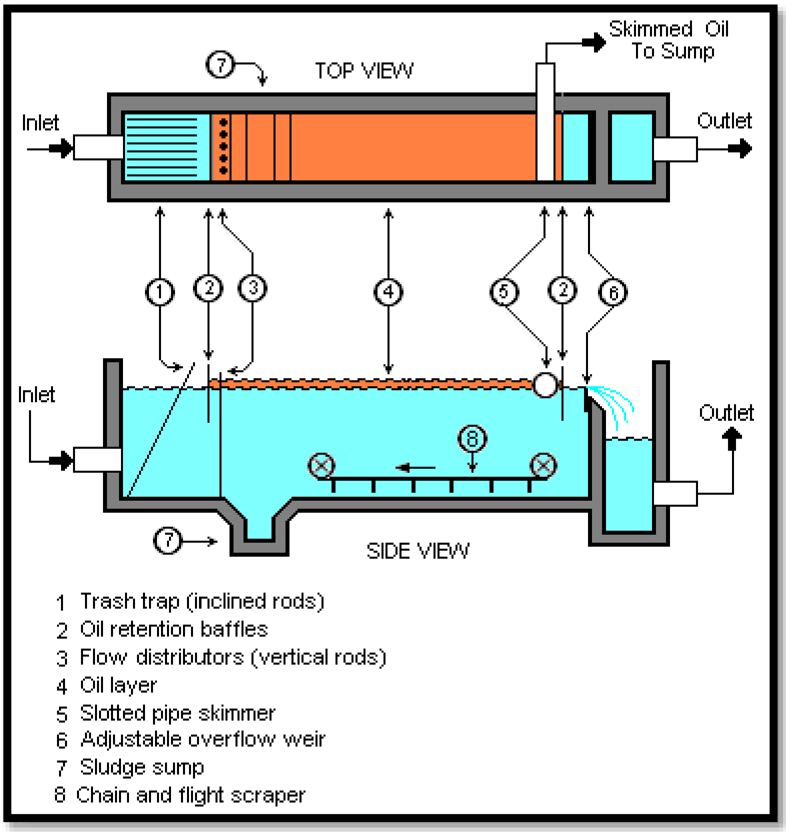


Figure 26: Typical oil trap (oil-water separator) system cross sectional design

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

Table 11: Principles of safe design

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.

2.1.1.8 Bulk fuel storage

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.

Figure 27: Typical surface fuel storage tank with bunding

2.1.1.9 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 as part of the Water Use License Application phase 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 will be submitted to the Department Water Affairs.

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 28: Lined pollution control dam (PCD) 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. 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.

2.1.1.10 Clean and dirty water separation

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 the Water Use License Application 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.

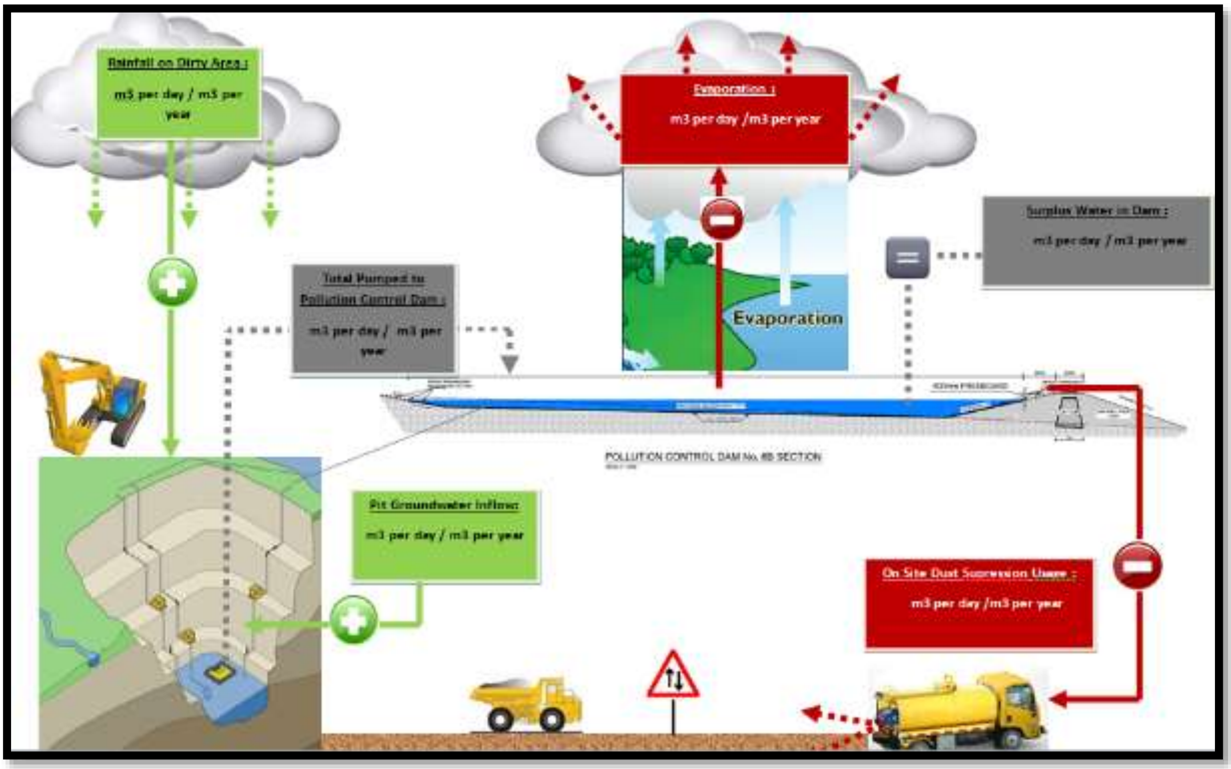


Figure 29: Typical water balance considerations during the design of a clean and dirty water separation system

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 during the Water Use License Application.

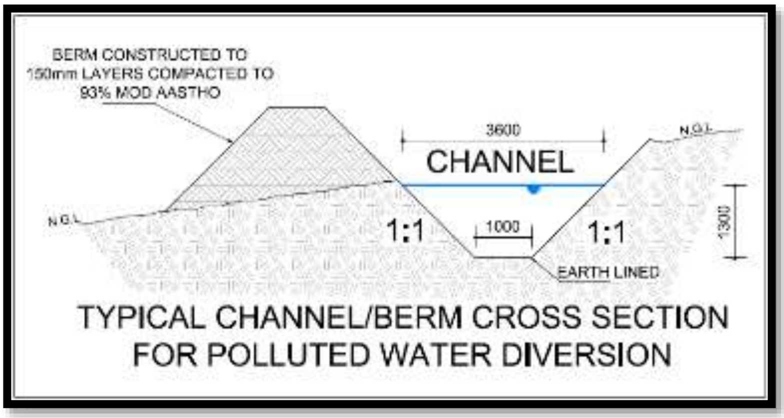


Figure 30: Typical channel/berm cross section for polluted water diversion

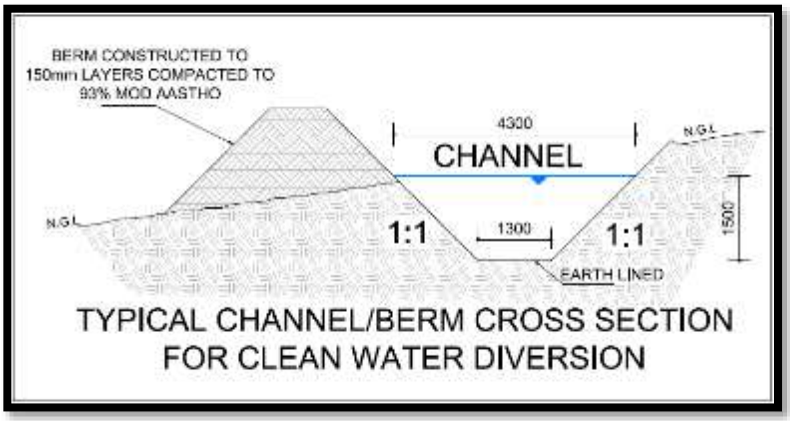


Figure 31: Typical channel/berm cross section for clean water diversion

2.1.1.11 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 32: Typical mine fence signage

2.1.1.12 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.

2.1.1.13 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

2.1.1.14 Topsoil, subsoil, overburden, discard and ROM stockpiles

Positions of the topsoil, subsoil and overburden stockpiles have been indicated on the mine plan. 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 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 2ha, of which the topsoil will be stripped and stockpiled separately. The hard overburden stockpiles will contain approximately $50m^3$ (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.

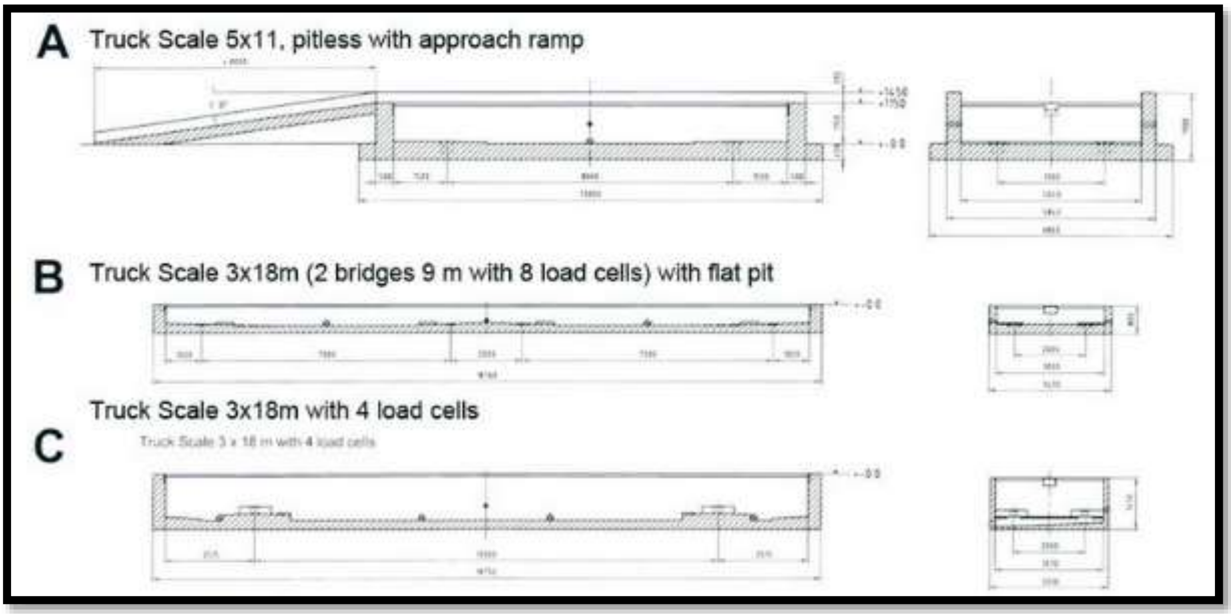


Figure 33: Three potential alternative weighbridge designs and cross sections

2.1.1.15 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.

2.1.1.16 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.

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

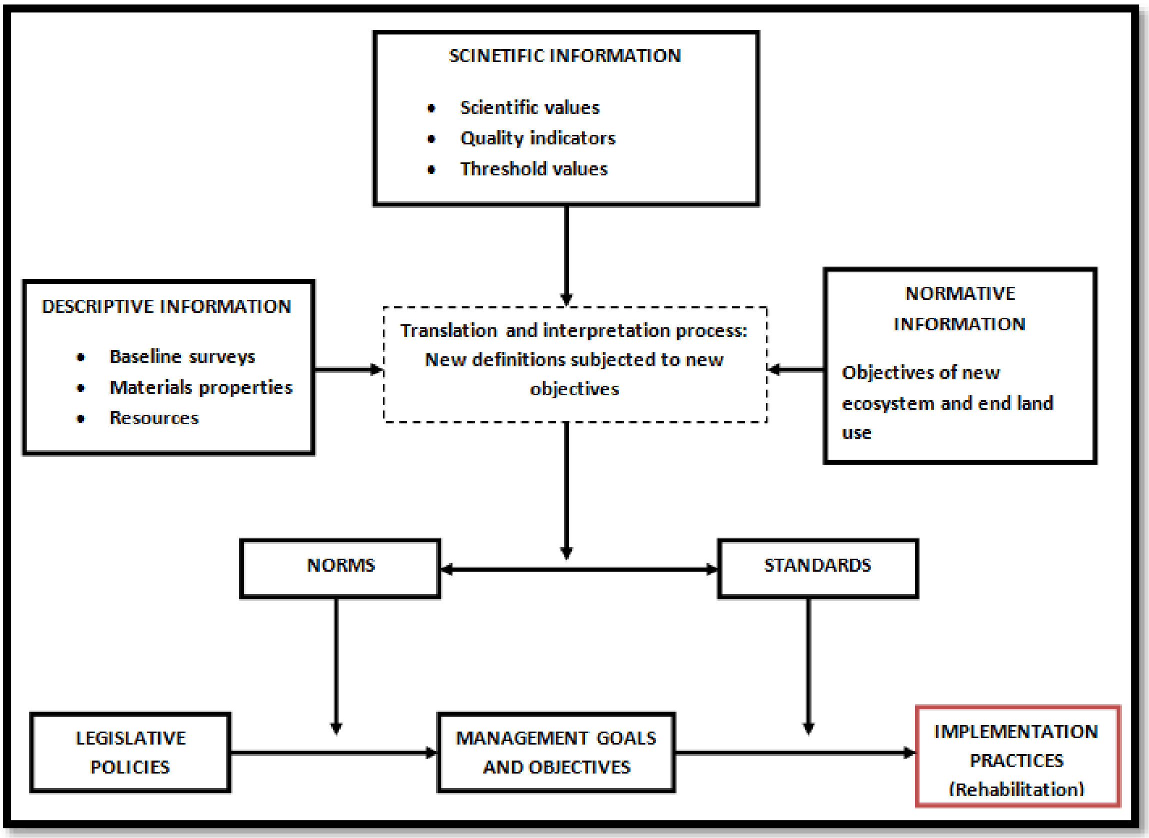


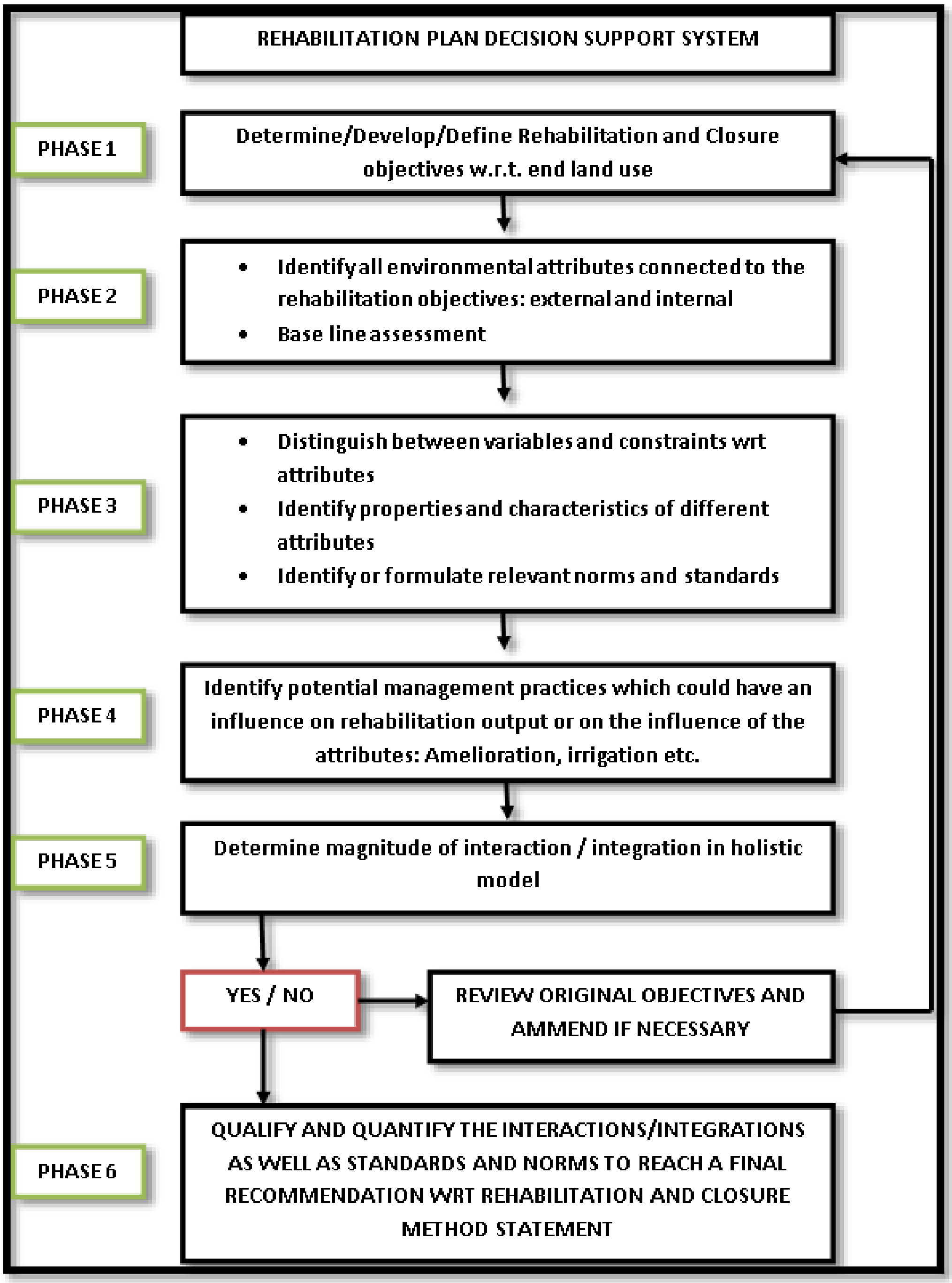
Figure 34: Diagrammatic illustration of rehabilitation plan development

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 mixure.



2.1.2 Plan of the main activities with dimensions

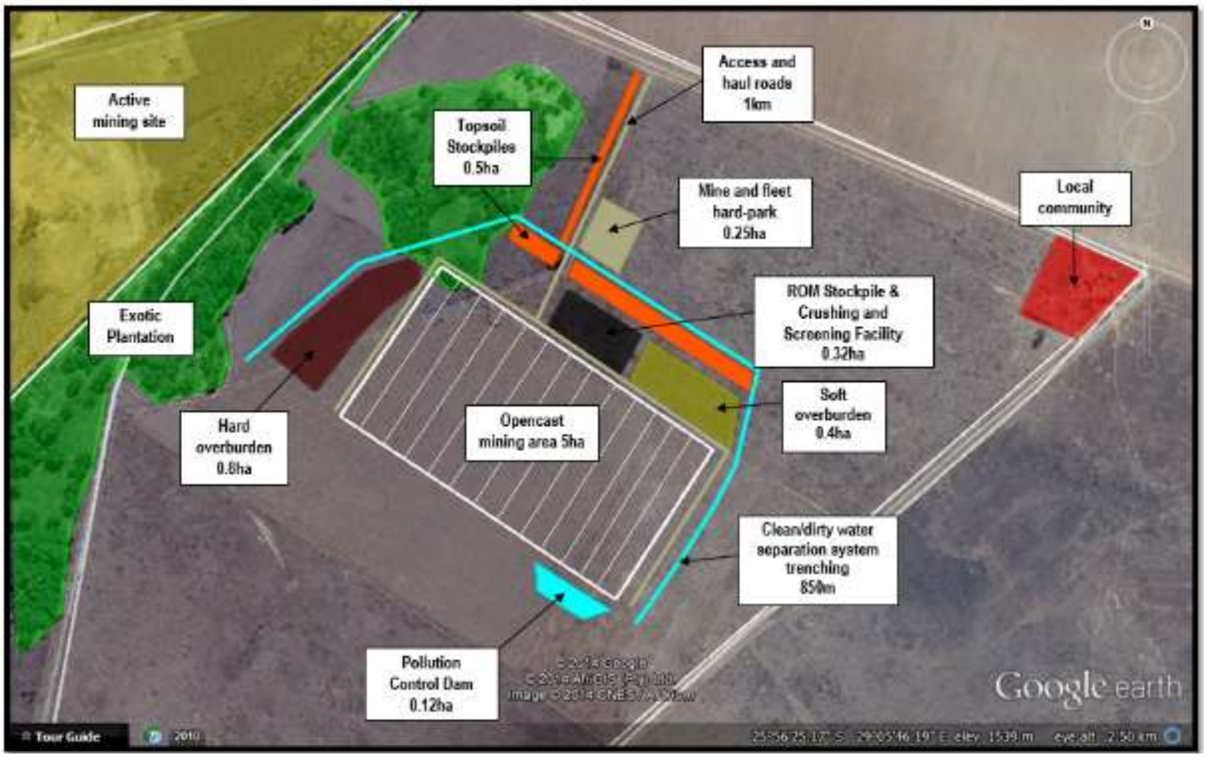


Figure 35: Plan of the main activities with dimensions

2.1.3 Description of construction, operational, and decommissioning phases

The following section serves as a summary of the three phases which have been described in more detail in the previous section.

CONSTRUCTION PHASE

It is assumed that the construction activities will only take place during daylight hours. The following activities during the construction phase are identified:

- Site Clearing: Stripping and removal of topsoil & vegetation;
- Construction of any surface infrastructure e.g. haul roads, pipes, stormwater diversion berms (including transportation of materials & stockpiling); and
- Blasting and development of initial boxcut for mining (incl. stockpiling from initial cuts)

During the construction assessment phase it is expected that, the main sources of impact will result due to the construction of haul roads, the plant area and the initial box cut associated with open pit mining. Construction is commonly of a temporary nature with a definite beginning and end. Construction usually consists of a series of different operations, each with its own duration and potential for impacts.

The construction phase include;

- Construction and Grading of Haul Roads
  - Scraping;
  - Overburden handling;
  - Overburden stockpiles; and
  - Truck transport and dumping of debris.
- Preparation of plant (crushing and screening) area
  - Clearing of area for infrastructure;
  - Overburden handling;
  - Overburden stockpiles; and
  - Truck transport and dumping of debris.
- Establishment of mining operations
  - Removal of overburden; and
  - Setting up of site offices and workshop

OPERATIONAL PHASE

The operation phase of the proposed mining will involve/include the following:

- 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;
- 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.

DECOMISSIONING AND CLOSURE PHASE

It is assumed that the decommissioning and closure activities will only take place during daylight hours. The decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The following activities are associated with the decommissioning phase:

- Existing buildings and structures demolished, rubble removed and the area levelled;
- Remaining exposed excavated areas filled and levelled using overburden recovered from stockpiles;
- Stockpiles to be smoothed and contoured;
- Topsoil replaced using topsoil recovered from stockpiles; and

- Disturbed land prepared for revegetation.

Truck and shovel methods would be used during roll-over backfilling of cut/strips. Compaction and final top soiling will be conducted to bring the final topography back to its pre-mining contours. Finally seeding will be conducted in accordance with the seasonal precipitation in order to facilitate quick root establishment and therefore minimise erosion potential.

2.1.4 Listed activities (in terms of the NEMA EIA regulations)

No listed activities in terms of the NEMA EIA regulations have been identified. Should any NEMA listed activities be identified during this project will the necessary applications be made to the relevant authority.

2.2 Identification of potential impacts

2.2.1 Potential impacts per activity and listed activities

CONSTRUCTION PHASE

ASPECT	IMPACT
Potential oil, diesel and chemical spills from machinery	Ground water pollution
Contamination potential of mine material exposed during mine construction	Possible ground water contamination
Vegetation clearance	Impact on wetland
Increased sediment and silt load deposition and siltation	Impact with sedimentation and siltation
Increased dust deposition and fugitive dust emissions	Air pollution
Increased ambient noise due to activities	Noise pollution
Mining activities with associated structures, activities and stockpiles	Visual and aesthetic impacts due to mining activities
Increased traffic, construction vehicles and destruction of natural habitat	Impacts on the natural environment
Clearance of vegetation	Impact on the plant species
Habitat destruction and sensitive species disturbance	Impact on animal species
Destruction and degradation of habitats and food on opencast pit area	Impact on animal species
Creation of more employment opportunities	Impact on the socio-economic environment

Disruption of existing family structures and negative impacts due to social interaction of mine workers with local community	Impact on the socio-economic environment
Damage to infrastructure on surrounding properties	Impact on the physical economic environment
Reduced quality of life	Impact on physical and psychological health
Financial loss due to damage to farming land and infrastructure	Impacts on financial wellbeing and socio economic environment
Soil stripping	Soil loss and soil impacts
Change the soil's physical, chemical and biological properties	Soil contamination
Change to the traffic flow volumes and impact on roads	Traffic impact

OPERATIONAL PHASE

ASPECT	IMPACT
Affecting water supply of groundwater users surrounding mine	Groundwater quantity – lowering of groundwater table
Groundwater quantity – lowering of groundwater table	Potential impact on base flow of streams/wetland
Deterioration of groundwater quality down gradient of the mining operations	Groundwater quality – contamination of groundwater
Oil, diesel and chemical spills/leaks from machinery and storage facilities/ Sewage related groundwater contamination	Groundwater quality – contamination of groundwater
Regional water demand	Reduced flows of the unnamed tributary
Operational activities affecting watercourses	Impacts on the functionality of watercourses, aquifers and drainage channels
Disruption of drainage paths	Storm water runoff
Deterioration of surface water quality	Impact on surface water quality – surface water pollution
Increased dust deposition and fugitive dust emissions	Air pollution
Increased ambient noise due to activities	Noise pollution
Mining activities with associated structures, activities and stockpiles	Visual and aesthetic impacts due to mining activities
Soil compaction	Soil pollution

Exotic/invasive species, watercourse disturbance and dust	Impact on plant species
Damage and destruction of habitats, noise, habitat fragmentation and disturbance	Impacts on animal species
Disruption/modification of sense of place	Impact on the socio-economic environment
Reduced quality of life	Impact on physical and psychological health
Soil stripping	Soil loss and soil impacts
Change the soil's physical, chemical and biological properties	Soil contamination
Change to the traffic flow volumes and impact on roads	Traffic impact

DECOMISSIONING AND CLOSURE PHASE

ASPECT	IMPACT
Decant volume	Impact on groundwater quantity – change in groundwater level
Deterioration of groundwater quality down gradient of the mining operations due to plume movement	Impact on groundwater quality – Contamination of groundwater
Deterioration of surface water quality as a result of Acid Mine Drainage	Surface water pollution and increase in decant volume
Increased dust deposition and fugitive dust emissions	Air Pollution
Increased ambient noise due to activities	Noise pollution
Mining activities with associated structures, activities and stockpiles	Visual and aesthetic impacts due to mining activities
Damage and destruction of habitats, noise, habitat fragmentation and disturbance	Ecological impacts
Unsuccessful rehabilitation – non self-sustaining environment	Impact on animal and plant species
Microhabitat and burrow formation	Impacts on animal species
Impact on surrounding community	Impact on the socio-economic environment
Soil stripping	Soil loss and soil impacts
Change the soil's physical, chemical and biological properties	Soil contamination
Change to the traffic flow volumes and impact on roads	Traffic impact

2.2.2 Potential cumulative impacts

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 Yoctolux Weltevreden Colliery. A summary of potential cumulative impacts that are expected to occur in the region is provided in the following table.

Table 12: Identification of potential cumulative impacts

Potential cumulative impacts
Contributing to energy security in the country as a result of mining coal
Local economic diversification
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).
Urban sprawl and/or expansion of informal settlements.
Added pressure on local service delivery and infrastructure, including roads, water and sewage treatment works, schools, police services and waste management facilities.
The use of imported labour, due to unavailability of local skilled labourers causing tension in local communities.
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.
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
The topography and landscape character will be altered and the overall visual 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.
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.
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.

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.

2.2.3 Potential impact on heritage resources

The topography of the study area is relatively flat with no geographical features like drainage systems, pans or rocky outcrops and was used extensively for agricultural purposes in the past. Due to the disturbed nature of the site the chances of recovering archaeological materials *in situ,* are limited. No buildings, cemeteries or archaeological sites were recorded in the study area during the survey. Several previous studies were conducted in the immediate vicinity of the study area and similarly very few heritage sites were recorded. The sites that were recorded consisted of cemeteries and features older than 60 years. Consultation with regards to heritage sites with the farm owner Mr. Mahlangu was conducted on the 12th of June. Mr Mahlangu indicated that he is also not aware of any sites in the permit area but that a cemetery occurs in the south western portion of the farm well away from the study area, close to the current farmhouse.

During the survey for the proposed mining area no sites of heritage significance were found in the development footprint and from an archaeological point of view there is no reason why the development cannot commence work based on approval from SAHRA.

If during construction, any archaeological finds are made (e.g. stone tools, skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds.

2.2.4 Potential impacts on communities, individuals or competing land uses in close proximity.

The impact of the proposed 5ha mining area will not noticeably impact on the surrounding communities. The limited size of the proposed area and the relatively short duration means that this impact will be negligible. The community members raised the issue of fugitive dust as being the greatest influence on them from mining in general. In addition concern over ground water impacts was also raised. The local community in closest proximity of the mine is also the surface right owners and will benefit positively from the project and has indicated their interest and positive excitement of the development.

2.2.5 Confirmation that the list of potential impacts has been compiled with the participation of the landowner and interested and affected parties

The public consultation process included all invited IAP's from the neighbouring areas, those that responded to the newspaper advertisement, written notifications and the land owner. Comment on all aspects of the process was welcomed during the consultation including comment on the description of the environment. No comments or concerns regarding the description of the environment were raised during public consultation.

Yoctolux Investments (Pty) Ltd (the applicant) will lease the property Weltevreden 324JS Portion 2 from the local community who is currently the landowners for the duration of the Mining Permit execution. This EMP will be circulated to the community, all I&AP's as well as the stakeholders for perusal. All information gathered from the Public Participation Process (PPP) as described in the Annexure of this report, which includes the newspaper advertisement period, various email correspondence, on site meetings and site notices, shall be included in the final EMP to be submitted to DMR. The description of the environment has been compiled with the participation of the community, the landowner and interested and affected parties. More detail has been provided in the Public Participation Report attached as an Annexure to this EMP.

2.2.6 Confirmation of specialist report appended

The heritage specialist study entitled: *"Archaeological Impact Assessment For the proposed Clay and Coal Mining project on a Portion of Portion 2 of the Farm Weltevreden 324 JS, Magisterial District of Witbank"* has been attached to this report. Refer to the report by Herotage Contracts and Archaeological Consulting as illustrated below.

Figure 36: Heritage subcontractors

3. REGULATION 52 (2) (c): Summary of the assessment of the significance of the potential impacts and the proposed mitigation measures to minimise adverse impacts.

3.1 Assessment of the significance of the potential impacts

3.1.1 Criteria of assigning significance to potential impacts

Mining activities can have a wide variety of different impacts, often occurring over different time and spatial scales. Certain impacts will occur immediately whilst others will take place gradually; the extent of these impacts can also range from scarcely perceptible too highly obtrusive.

Similarly, the nature of the impact can also vary widely depending on the type of physical environment, the size of the development and the perceptions and values of each of the affected parties.

Ideally, an assessment of the extent of any disruption of the natural and social environment that can be attributed to a particular operation should follow a logical sequence of procedures being:

- Define acceptable standards and criteria for quantifying the extent and importance of an impact in a comparable manner;
- Identify and express the nature and extent of each impact with reference to this rational and consistent system of measurement;
- Compare the measured, or predicted, impact with the relevant standards;
- Implement remedial measures, if necessary, to reduce the impact to conform with the accepted standards, or to enhance positive benefits; and
- Design and implement an appropriate monitoring programme to ensure compliance with agreed standards.

The majority, although not necessarily all, of the environmental problems associated with mining/prospecting projects tend to diminish with increasing distance from the proposed activity. Consequently, the most easily noticeable environmental problems are usually identified adjacent to and on the site of operations. Whilst the parties most likely to be affected will be those in close proximity to a particular prospecting/mining activity, the full environmental impact of such an operation will often extend far wider.

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.

Table 13: Impact 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%.

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 14: Description of the 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

3.1.2 Potential impact of each main activity in each phase, and corresponding significance assessment

GROUNDWATER

Table 15: Groundwater – Construction Phase Impact Rating (1)

Activity	**Start-up of mining operations at the specific site before actual mining operations commences.**	
Aspect	**Potential oil, diesel and chemical spills from machinery**	
Mining Phase	**Construction Phase**	
Impact:	**Ground water pollution**	
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 box-cut. 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 16: Groundwater - Construction Phase Impact Rating (2)

Activity	**Start-up of mining operations at the specific site before actual mining operations commences.**
Aspect	**Contamination potential of mine material exposed during mine construction**
Mining Phase	**Construction Phase**
Impact:	**Possible ground water contamination**
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 box-cut. 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) x 2 = 12 **LOW**
	With mitigation (WM)	**WOM x ME = WM** 12 x 1.0 = 12 **LOW**
Significance With Mitigation (WM)	**LOW**	

Table 17: 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	**Affecting water supply of groundwater users surrounding mine**	
Mining Phase	**Operational Phase**	
Impact	**Groundwater quantity – lowering of groundwater table**	
Impact description	The operational phase is interpreted as the active mining of the opencast reserve 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 a groundwater model is initiated once final information is available. 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.	
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) x 3 = 27 **LOW TO MEDIUM**
	With mitigation (WM)	**WOM x ME = WM** 27 x 1.0 = 27 **LOW TO MEDIUM**
Significance With Mitigation (WM)	**LOW TO MEDIUM**	

Table 18: 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	The operational phase is interpreted as the active mining of the opencast reserve 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 a groundwater model is initiated once final information is available. 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.		
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 19: Groundwater – 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	**Deterioration of groundwater quality down gradient of the mining operations**
Mining Phase	**Operational Phase**
Impact	**Groundwater quality – contamination of groundwater**

Impact description	The operational phase is interpreted as the active mining of the Weltevreden 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 a groundwater model is initiated once final information is available. 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.	
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 20: 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	**Oil, diesel and chemical spills/leaks from machinery and storage facilities/ Sewage related groundwater contamination**	
Mining Phase	**Operational Phase**	
Impact	**Groundwater quality – contamination of groundwater**	
Impact description	The operational phase is interpreted as the active mining of the Wetevreden 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 a groundwater model is initiated once final information is available. 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.	
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) x 3 = 30 **LOW TO MEDIUM**
	With mitigation (WM)	**WOM x ME = WM** 30 x 0.2 = 6 **LOW**
Significance With Mitigation (WM)	**LOW**	

Table 21: Groundwater – Decommissioning and Closure Phase Impact Rating (1)

Activity	**The closing of mining operations, site clean-up and rehabilitation of the mining area.**		
Aspect	**Decant volume**		
Mining Phase	**Decommissioning and Closure Phase**		
Impact	**Impact on groundwater quantity – change in groundwater level**		
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. 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. 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. 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. Intuitively, it would be expected that this raise in groundwater could result in decanting of the opencast.		
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)]		**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)]		**MEDIUM**
Significance	**Without mitigation (WOM)**	**(Extent + Duration + Intensity + Probability) x WF = WOM** (2 + 5 + 3 + 4) x 5 = 70 **MEDIUM TO HIGH**	
	With mitigation (WM)	**WOM x ME = WM** 70 x 0.6 = 42 **MEDIUM**	

Significance With Mitigation (WM)	**MEDIUM**

Table 22: Groundwater – Decommissioning and Closure Phase Impact Rating (2)

<table>
<tr><td>Activity</td><td colspan="3">The closing of mining operations, site clean-up and rehabilitation of the mining area.</td></tr>
<tr><td>Aspect</td><td colspan="3">Deterioration of groundwater quality down gradient of the mining operations due to plume movement</td></tr>
<tr><td>Mining Phase</td><td colspan="3">Decommissioning and Closure Phase</td></tr>
<tr><td>Impacts</td><td colspan="3">Impact on groundwater quality – Contamination of groundwater</td></tr>
<tr><td>Impact description</td><td colspan="3">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 specialist studies, it can be estimated from the figures that:
The sulphate pollution plume emanating from the opencast is predicted to reach wetland areas as well as tributaries for 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 of the opencast, due to evapotranspiration.
Intuitively, it would be expected that this raise in groundwater could result in decanting of the opencast.</td></tr>
<tr><td rowspan="4">Magnitude</td><td colspan="2">Extent [footprint(1); site(2); regional(3); national(4); international(5)]</td><td>REGIONAL</td></tr>
<tr><td colspan="2">Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]</td><td>LONG</td></tr>
<tr><td colspan="2">Intensity [low(1); medium(3); high(5)]</td><td>HIGH</td></tr>
<tr><td colspan="2">Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]</td><td>PROBABLE</td></tr>
<tr><td>Weighting factor (WF)</td><td colspan="2">WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]</td><td>HIGH</td></tr>
<tr><td>Mitigation Efficiency (ME)</td><td colspan="2">ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]</td><td>MEDIUM</td></tr>
<tr><td rowspan="2">Significance</td><td>Without mitigation (WOM)</td><td colspan="2">(Extent + Duration + Intensity + Probability) x WF = WOM
(3 + 4 + 5 + 1) x 5 = 65
MEDIUM TO HIGH</td></tr>
<tr><td>With mitigation (WM)</td><td colspan="2">WOM x ME = WM
65 x 0.6 = 39
LOW TO MEDIUM</td></tr>
</table>

Significance With Mitigation (WM)	LOW TO MEDIUM

SURFACE WATER

Table 23: Surface Water – Construction Phase Impact Rating (1)

Activity	**An area of 5 hectares will be cleared for construction activities.**		
Aspect	**Vegetation clearance**		
Mining Phase	**Construction Phase**		
Impacts	**Impact on wetland**		
Impact description	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 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		
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)]		**DEFINTIVE**
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 24: Surface Water – Construction Phase Impact Rating (2)

Activity	**Activities increasing sedimentation and siltation** • **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	**Increased sediment and silt load deposition and siltation**	
Mining Phase	**Construction Phase**	
Impacts	**Impact with sedimentation and siltation**	
Impact description	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 Wilge River catchment. Impact on the stream to be mitigated with the implementation of storm water management plan in accordance with GN 704 requirements	
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 25: 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 Wilge River catchment. 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 26: 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	**Operational activities affecting watercourses**		
Mining Phase	**Operational Phase**		
Impacts	**Impacts on the functionality of watercourses, aquifers and drainage channels**		
Impact description	Activities either in the construction phase or operational phase that is within the vicinity of watercourses can adversely affect these watercourses and possible impact permanently on their functionality. Construction must be well monitored and must receive extra attention when approaching a watercourse. Mining box cuts to be outside the 100 meter buffer zone of streams. Dewatering of pit water not to be discharged to the water 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 27: 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	**Disruption of drainage paths**		
Mining Phase	**Operational Phase**		
Impacts	**Storm water runoff**		
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 storm water 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 28: 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	**Deterioration of surface water quality**		
Mining Phase	**Operational Phase**		
Impacts	**Impact on surface water quality – surface water pollution**		
Impact description	Inappropriate water management based on illegal discharges, dewatering of access water and diffuse pollution to cause significant degradation of water quality in Wilge River catchment. Mining footprint to remain as small as possible with dirty storm water 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 29: Surface Water – Decommissioning and Closure Phase Impact Rating (1)

Activity	**The closing of mining operations, site clean-up and rehabilitation of the mining area.**	
Aspect	**Deterioration of surface water quality as a result of Acid Mine Drainage**	
Mining Phase	**Decommissioning and closure phase**	
Impacts	**Surface water pollution and increase in decant volume**	
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 modelling 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**		

AIR QUALITY

Table 30: Air Quality – Construction Phase Impact Rating (1)

Activity	**Construction and Grading of Haul Roads** • **Scraping;** • **Overburden handling;** • **Overburden stockpiles; and** • **Truck transport and dumping of debris.**		
Aspect	**Increased dust deposition and fugitive dust emissions**		
Mining Phase	**Construction**		
Impacts	**Air pollution**		
Impact description	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.		
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 31: Air Quality – Construction Phase Impact Rating (2)

Activity	**Preparation of plant (crushing and screening) area** • **Clearing of area for infrastructure;** • **Overburden handling;** • **Overburden stockpiles; and** • **Truck transport and dumping of debris.**		
Aspect	**Increased dust deposition and fugitive dust emissions**		
Mining Phase	**Construction**		
Impacts	**Air pollution**		
Impact description	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.		
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 32: Air Quality – Construction Phase Impact Rating (3)

Activity	**Establishment of mining operations** • **Removal of overburden; and** • **Setting up of site offices and workshop**	
Aspect	**Increased dust deposition and fugitive dust emissions**	
Mining Phase	**Construction**	
Impacts	**Air pollution**	
Impact description	Opencast mining will commence with the clearing of the site and stripping of the vegetation for the initial box cut. 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 33: Air Quality – Operational Phase Impact Rating (1)

Activity	**The following activities during the operational phase are identified as possible fugitive emission sources** • **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 re-vegetation.**	
Aspect	**Increased dust deposition and fugitive dust emissions**	
Mining Phase	**Operation**	
Impacts	**Air pollution**	
Impact description	The primary procedures that will be implemented during the mining process that will cause dust 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; • 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)**: **(Extent + Duration + Intensity + Probability) x WF = WOM** (2 + 4 + 3 + 5) 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 34: Air Quality – Operational Phase Impact Rating (2)

<table>
<tr><td>Activity</td><td colspan="3">Drilling/blasting hard overburden</td></tr>
<tr><td>Aspect</td><td colspan="3">Increased dust deposition, fugitive dust and gas emissions</td></tr>
<tr><td>Mining Phase</td><td colspan="3">Operation</td></tr>
<tr><td>Impacts</td><td colspan="3">Air Pollution</td></tr>
<tr><td>Impact description</td><td colspan="3">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 sulphur dioxide. The amount of dust and gases generated depend upon the composition of the explosive and the material undergoing blasting.</td></tr>
<tr><td rowspan="4">Magnitude</td><td colspan="2">Extent [footprint(1); site(2); regional(3); national(4); international(5)]</td><td>SITE</td></tr>
<tr><td colspan="2">Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]</td><td>SHORT</td></tr>
<tr><td colspan="2">Intensity [low(1); medium(3); high(5)]</td><td>HIGH</td></tr>
<tr><td colspan="2">Probability [probable(1); possible(2); likely(3); highly likely(4); definite(5)]</td><td>DEFINITE</td></tr>
<tr><td>Weighting factor (WF)</td><td colspan="2">WF [low(1); low-medium(2); medium(3); medium-high(4); high(5)]</td><td>HIGH</td></tr>
<tr><td>Mitigation Efficiency (ME)</td><td colspan="2">ME [high(0.2); medium-high(0.4); medium(0.6); low-medium(0.8); low(1.0)]</td><td>LOW-MEDIUM</td></tr>
<tr><td rowspan="2">Significance</td><td>Without mitigation (WOM)</td><td colspan="2">(Extent + Duration + Intensity + Probability) x WF = WOM
(2 + 1 + 5 + 5) x 5 = 65
MEDIUM TO HIGH</td></tr>
<tr><td>With mitigation (WM)</td><td colspan="2">WOM x ME = WM
65 x 0.8 = 52
MEDIUM</td></tr>
<tr><td>Significance With Mitigation (WM)</td><td colspan="3">MEDIUM</td></tr>
</table>

Table 35: Air Quality – Closure and Decommissioning Phase Impact Rating (1)

<table>
<tr><td>Activity</td><td colspan="2">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:
• Demolition & Removal of all infrastructure (incl. transportation off site); and
• Rehabilitation (spreading of soil, re-vegetation & profiling/contouring);</td></tr>
<tr><td>Aspect</td><td colspan="2">Increased dust deposition and fugitive dust emissions</td></tr>
<tr><td>Mining Phase</td><td colspan="2">Closure and decommissioning</td></tr>
<tr><td>Impacts</td><td colspan="2">Air Pollution</td></tr>
<tr><td>Impact description</td><td colspan="2">Possible sources of fugitive dust emission during the closure and post-closure phase include:
• 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 re-vegetation – ploughing and addition of fertiliser, compost etc.</td></tr>
<tr><td rowspan="3">Magnitude</td><td>Extent [footprint(1); site(2); regional(3); national(4); international(5)]</td><td>SITE</td></tr>
<tr><td>Duration [short(1); short-med(2); medium(3); long(4); permanent(5)]</td><td>SHORT-MEDIUM</td></tr>
<tr><td>Intensity [low(1); medium(3); high(5)]</td><td>MEDIUM</td></tr>
</table>

	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**	

NOISE

Table 36: Noise – Construction and Operational Phase Impact Rating (1)

Activity	**The following activities during the construction and operational phase are identified as possible noise sources** • **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 re-vegetation.**	
Aspect	**Increased ambient noise due to activities**	
Mining Phase	**Construction and Operation**	
Impacts	**Noise pollution**	
Impact description	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.	
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)**	**(Extent + Duration + Intensity + Probability) x WF = WOM** (2 + 4 + 3 + 4) 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 37: Noise – Closure and Decommissioning Phase – Impact Rating (1)

Activity	**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:** • **Demolition & Removal of all infrastructure (incl. transportation off site); and** • **Rehabilitation (spreading of soil, re-vegetation & profiling/contouring);**		
Aspect	**Increased ambient noise due to activities**		
Mining Phase	**Closure and Decommissioning Phase**		
Impacts	**Noise pollution**		
Impact description	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.		
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**		

ARCHAEOLOGICAL

Table 38: Archaeological – 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	**Potential grave disturbance due to mining activities**	
Mining Phase	**Construction, Operational and Closure & Decommissioning Phase**	
Impacts	**Potential impacts on identified archaeological sites**	
Impact description	No potential impacts are anticipated as the Heritage Specialist Report (appended) did not discover any features of significance.	
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)]	**PROBABLE**
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 + 1) x 1 = 4 **LOW**
	With mitigation (WM)	**WOM x ME = WM** 4 x 0.2 = 0.8 **LOW**
Significance With Mitigation (WM)	**LOW**	

VISUAL

Table 39: 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	**Mining activities with associated structures, activities and stockpiles**		
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. The construction and operation of the Weltevreden 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: • 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**	

ECOLOGICAL

Table 40: 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	**Increased traffic, construction vehicles and destruction of natural habitat**		
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 41: Ecological – Construction Phase – Impact Rating (2)

Activity	**Site clearance and removal of vegetation**	
Aspect	**Clearance of vegetation**	
Mining Phase	**Construction phase**	
Impacts	**Impact on the plant species**	
Impact description	Most of the impacts on plant species will occur during the construction phase. The species found at site 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 42: Ecological – Construction Phase – Impact Rating (3)

Activity	Site clearance, removal of vegetation, opencast pit construction.		
Aspect	Habitat destruction and sensitive species disturbance		
Mining Phase	Construction phase		
Impacts	Impact on animal species		
Impact description	The removal of vegetation (open cast mining) in 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 43: Ecological – Construction Phase – Impact Rating (4)

Activity	Opencast pit construction	
Aspect	Destruction and degradation of habitats and food on opencast pit area	
Mining Phase	Construction phase	
Impacts	Impact on animal species	
Impact description	The removal of vegetation in 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)]	**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 44: Ecological – Operational Phase – Impact Rating (1)

Activity	**Increased traffic and personnel, heavy machinery and vehicle operation and soil compaction.**	
Aspect	**Soil compaction**	
Mining Phase	**Operational phase**	
Impacts	**Soil pollution**	
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 45: 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	**Exotic/invasive species, watercourse disturbance and dust**
Mining Phase	**Operational phase**
Impacts	**Impact on plant species**
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. • Watercourse 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 46: Ecology – Operational Phase – Impact Rating (3)

Activity	**Physical opencast mining, crushing and screening, vehicle and machinery operation and human movement**	
Aspect	**Damage and destruction of habitats, noise, habitat fragmentation and disturbance**	
Mining Phase	**Operational phase**	
Impacts	**Impacts on animal species**	
Impact description	• 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 47: Ecology – Decommissioning and Closure Phase – Impact Rating (1)

Activity	**Site decommissioning, closure and rehabilitation**		
Aspect	**Damage and destruction of habitats, noise, habitat fragmentation and disturbance**		
Mining Phase	**Decommissioning and closure**		
Impacts	**Ecological impacts**		
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 48: Ecology – Decommissioning and Closure Phase – Impact Rating (2)

Activity	**Site decommissioning, closure and rehabilitation**		
Aspect	**Unsuccessful rehabilitation – non self-sustaining environment**		
Mining Phase	**Decommissioning and closure**		
Impacts	**Impact on animal and plant species**		
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 49: Ecology – Decommissioning and Closure Phase – Impact Rating (3)

Activity	**Site decommissioning, closure and rehabilitation**		
Aspect	**Microhabitat and burrow formation**		
Mining Phase	**Decommissioning and closure**		
Impacts	**Impacts on animal species**		
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**		

SOCIO-ECONOMICAL

Table 50: Socio-economic – Construction Phase – Impact Rating (1)

Activity	**Job creation**	
Aspect	**Creation of more employment opportunities**	
Mining Phase	**Construction Phase**	
Impacts	**Impact on the socio-economic environment**	
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.	
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**		

Table 51: Socio-economic – Construction Phase – Impact Rating (2)

Activity	**Social effect of job creation by the mine**		
Aspect	**Disruption of existing family structures and negative impacts due to social interaction of mine workers with local community**		
Mining Phase	**Construction Phase**		
Impacts	**Impact on the socio-economic environment**		
Impact description	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. 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).		
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 52: Socio-economic – Construction Phase – Impact Rating (3)

Activity	**Presence and movement of mine workers**
Aspect	**Damage to infrastructure on surrounding properties**
Mining Phase	**Construction Phase**
Impacts	**Impact on the physical economic environment**

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 53: Socio-economic – Construction Phase – Impact Rating (4)

Activity	**Movement of vehicles and trucks**		
Aspect	**Reduced quality of life**		
Mining Phase	**Construction Phase**		
Impacts	**Impact on physical and psychological health**		
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.		
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 54: Socio-economic – Construction Phase – Impact Rating (5)

Activity	**Construction activities resulting in damage to agricultural land and infrastructure**
Aspect	**Financial loss due to damage to farming land and infrastructure**
Mining Phase	**Construction Phase**
Impacts	**Impacts on financial wellbeing and socio economic environment**

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 55: Socio-economic – Operational Phase – Impact Rating (1)

Activity	**Alteration of the physical landscape**		
Aspect	**Disruption/modification of sense of place**		
Mining Phase	**Operational Phase**		
Impacts	**Impact on the socio-economic environment**		
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 56: Socio-economic – Operational Phase – Impact Rating (2)

Activity	**Impact of mining on the community**
Aspect	**Reduced quality of life**
Mining Phase	**Operational Phase**

Impacts	**Impact on physical and psychological health**		
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 57: Socio-economic – Decommissioning and Closure Phase – Impact Rating (1)

Activity	**Rehabilitation and restoration**		
Aspect	**Impact on surrounding community**		
Mining Phase	**Decommissioning and Closure Phase**		
Impacts	**Impact on the socio-economic environment**		
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

LAND CAPABILITY

Table 58: Land Capability – Construction, Operation and Decommissioning and Closure Phase – Impact Rating (1)

Activity	Soil stripping during construction of the mine		
Aspect	**Soil stripping**		
Mining Phase	**Construction, Operation and Decommissioning Phase**		
Impacts	**Soil loss and soil impacts**		
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 59: Land Capability – Construction, Operation and Decommissioning and Closure Phase – Impact Rating (2)

Activity	Mixing and moving of soil layers		
Aspect	**Change the soil's physical, chemical and biological properties**		
Mining Phase	**Construction, Operation and Decommissioning Phase**		
Impacts	**Soil contamination**		
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**	

TRAFFIC

Table 60: Traffic - Construction, Operation and Decommissioning and Closure Phase – Impact Rating (1)

Activity	**Vehicle movement and traffic increase as a result of mining**		
Aspect	**Change to the traffic flow volumes and impact on roads**		
Mining Phase	**Construction, Operation and Decommissioning Phase**		
Impacts	**Traffic impact**		
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**		

3.1.3 Assessment of potential cumulative impacts

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 Yoctolux Weltevreden Colliery. A summary of the assessment of the potential cumulative impacts that are expected to occur in the region is provided in the following table.

Table 61: Assessment of potential cumulative impacts

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 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.	Negative	Local
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

3.2 Proposed mitigation measures to minimise adverse impacts

3.2.1 List of actions, activities, or processes that have sufficiently significant impacts to require mitigation.

GROUNDWATER

- **Construction Phase**
  - Potential oil, diesel and chemical spills from machinery
  - Contamination potential of mine material exposed during mine construction
- **Operational Phase**
  - Affecting water supply of groundwater users surrounding mine
  - Groundwater quantity – lowering of groundwater table
  - Deterioration of groundwater quality down gradient of the mining operations

- Oil, diesel and chemical spills/leaks from machinery and storage facilities/ Sewage related groundwater contamination

- **Decommissioning and Closure Phase**
  - Decant volume
  - Deterioration of groundwater quality down gradient of the mining operations due to plume movement

SURFACE WATER

- **Construction Phase**
  - Vegetation clearance
  - Increased sediment and silt load deposition and siltation
- **Operational Phase**
  - Regional water demand
  - Operational activities affecting watercourses
  - Disruption of drainage paths
  - Deterioration of surface water quality
- **Decommissioning and Closure Phase**
  - Deterioration of surface water quality as a result of Acid Mine Drainage

AIR QUALITY

- **Construction, Operation, Decommissioning and Closure Phase**
  - Increased dust deposition and fugitive dust emissions

NOISE

- **Construction and Operational Phase**
  - Increased ambient noise due to activities
- **Decommissioning and Closure Phase**
  - Increased ambient noise due to activities

ARCHAEOLOGICAL

- **Potential discovery of archaeological finds**

VISUAL

- **Construction, Operation, Decommissioning and Closure**
  - Mining activities with associated structures, activities and stockpiles

ECOLOGICAL

- **Construction Phase**
  - Increased traffic, construction vehicles and destruction of natural habitat
  - Clearance of vegetation
  - Habitat destruction and sensitive species disturbance
  - Destruction and degradation of habitats and food on opencast pit area
- **Operational Phase**
  - Soil compaction
  - Exotic/invasive species, watercourse disturbance and dust
  - Damage and destruction of habitats, noise, habitat fragmentation and disturbance
- **Decommissioning and Closure Phase**
  - Damage and destruction of habitats, noise, habitat fragmentation and disturbance
  - Unsuccessful rehabilitation – non self-sustaining environment
  - Microhabitat and burrow formation

SOCIO-ECONOMICAL

- **Construction Phase**
  - Creation of more employment opportunities
  - Disruption of existing family structures and negative impacts due to social interaction of mine workers with local community
  - Damage to infrastructure on surrounding properties
  - Reduced quality of life
  - Financial loss due to damage to farming land and infrastructure
- **Operational Phase**
  - Disruption/modification of sense of place
  - Reduced quality of life
- **Decommissioning and Closure Phase**
  - Impact on surrounding community

LAND CAPABILITY

- **Construction, Operation, Decommissioning and Closure Phases**
  - Soil stripping
  - Change the soil's physical, chemical and biological properties

TRAFFIC

- **Construction, Operation, Decommissioning and Closure Phases**

- Change to the traffic flow volumes and impact on roads

3.2.2 Concomitant list of appropriate technical or management options

CONSTRUCTION PHASE

REF NO:	ASPECT	IMPACT ON:	MANAGEMENT & MITIGATION MEASURES	RESPONSIBLE PRESON	TIMEFRAME
001	**Oil, diesel and chemical spills from machinery**	**Groundwater**	▪ 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.	Environmental Control Officer Engineering Contractor	Throughout the Construction phase
002	**Contamination potential of mine material exposed during mine construction**	**Groundwater**	▪ Ensure that the appropriate design facilities (berms, storm water channels etc.) are constructed before constructing the coal handling facilities and box cuts. ▪ 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.	Environmental Control Officer Engineering Contractor	Beginning and throughout the Construction Phase
003	**General**	**Groundwater**	▪ 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.	Environmental Control Officer Engineering Contractor Mine Infrastructure Engineer	Beginning and throughout the Construction Phase
004	**Increased sediment generation**	**Surface Water**	▪ 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	Environmental Control Officer Engineering Contractor	Beginning and throughout the Construction Phase

005	**Pollution of stream**	**Surface Water**	▪ Zero effluent discharge policy from Weltevreden Mine (no discharge to dam or stream) ▪ Strict regulatory control on all water containing waste generated and disposal of effluent (WWTW)	Environmental Control Officer Engineering Contractor	Beginning and throughout the Construction Phase
006	**Damage to riparian vegetation**	**Surface Water**	▪ 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 Weltevreden Mine ▪ Compliance with all environmental legislation	Environmental Control Officer Engineering Contractor Mine Infrastructure Engineer	Beginning and throughout the Construction Phase
007	**Degradation of riparian areas by constructing and operation of Weltevreden Mine**	**Surface Water**	▪ 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	Environmental Control Officer Engineering Contractor Mine Infrastructure Engineer	Beginning and throughout the Construction Phase
008	**Damage and degradation to the in-stream habitat caused by prolonged mining activities**	**Surface Water**	▪ Strict control measures to be implemented in terms of impact minimisation on the in-stream habitat	Environmental Control Officer	Beginning and throughout the Construction Phase
009	**Development within water resources e.g. mining footprint encroaches onto wetland area or riparian area,**	**Surface Water**	▪ 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.	Environmental Control Officer Engineering Contractor Mine Infrastructure Engineer	Beginning and throughout the Construction Phase

	thereby diverting or impeding flow **Lack of adequate rehabilitation resulting in invasion by woody invasive plants** **Vehicles driving in / through watercourses**		▪ 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		
010	**Changing the amount of sediment entering water resource and associated change in turbidity**	**Surface Water**	▪ 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.	Environmental Control Officer Engineering Contractor Mine Infrastructure Engineer	Beginning and throughout the Construction Phase

			▪ 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		
011	**Alteration of water quality**	**Surface Water**	▪ 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	Mine Infrastructure Engineer Environmental Control Officer	Beginning and throughout the Construction Phase
012	**General**	**Surface Water**	▪ Obtain the necessary Water Use License ▪ Development of an Integrated Water Resource Management Plan (as part of the WULA);	Consultants Environmental Control Officers	Beginning and throughout the

			▪ 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 for the catchment; ▪ Eco-classification 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).	Environmental Liaison Officers Engineering Contractor	Construction Phase
013	**Drilling and blasting**	**Air Quality**	▪ 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	Environmental Control Officer Engineering Contractor	Beginning and throughout the Construction Phase
014	**Material extraction**	**Air Quality**	▪ Low or in-pit dumping of overburden during high wind conditions	Environmental Control Officer Engineering Contractor	Beginning and throughout the Construction Phase

015	**Transport and transfer of material**	**Air Quality**	▪ 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	Environmental Control Officer Engineering Contractor Environmental Liaison Officer	Beginning and throughout the Construction Phase
016	**Storage of material**	**Air Quality**	▪ 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	Environmental Control Officer Engineering Contractor Environmental Liaison Officer	Beginning and throughout the Construction Phase
017	**Exposed areas**	**Air quality**	▪ 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	Environmental Control Officer	Beginning and throughout the Construction Phase

018	**General**	**Air Quality**	▪ 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. ▪ Wheere 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.	Environmental Control Officer Engineering Contractor Environmental Liaison Officer	Beginning and throughout the Construction Phase
019	**Barriers**	**Noise**	▪ 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 nearby town. ▪ 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.	Environmental Control Officer Engineering Contractor	Beginning and throughout the Construction Phase
020	**Vehicle noise**	**Noise**	▪ 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. ▪ 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.	Consultants Environmental Control Officers Environmental Liaison Officers Engineering Contractor	Beginning and throughout the Construction Phase

			▪ 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.		
021	**Blasting**	**Noise**	▪ 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.	Environmental Control Officer Engineering Contractor Consultants	Beginning and throughout the Construction Phase
022	**Potential impacts on identified heritage/ archaeological sites**	**Heritage & Archaeological**	▪ If during construction, any archaeological finds are made (e.g. stone tools, skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. ▪ 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)). ▪ Should the need arise to expand the development beyond the current scope demarcated area mentioned in the specialist study, the following applies: ○ 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.	Environmental Control Officer Consultants	Beginning and throughout the Construction Phase

023	**Visual and aesthetic impacts due to mining activities**	**Visual**	▪ 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	Environmental Control Officer Mine Infrastructure Engineer	Beginning and throughout the Construction Phase
024	**Impacts on the natural environment**	**Ecological**	▪ 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.	Environmental Control Officer	Beginning and throughout the Construction Phase
025	**Impacts on plant species**	**Ecological**	▪ A management plan for control of invasive plant species needs to be implemented on all areas of the mining areas. 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 watercourse areas. The watercourses 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 delineation should be	Environmental Control Officer Mine Infrastructure Engineer Contractor/Scientist	Beginning and throughout the Construction Phase

			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.		
026	**Impacts on animal species**	**Ecological**	▪ 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 the specific mining areas.	Environmental Control Officer Mine Infrastructure Engineer Contractor/Scientist	Beginning and throughout the Construction Phase
027	**Habitat destruction and sensitive species disturbance**	**Ecological**	▪ 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. ▪ A linear corridor between the wetlands and river should be maintained at all times during construction and operational phases.	Environmental Control Officer Mine Infrastructure Engineer Contractor/Scientist	Beginning and throughout the Construction Phase
028	**General**	**Ecological**	▪ 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 mining areas.	Environmental Control Officer Mine Infrastructure Engineer Contractor/Scientist	Beginning and throughout the Construction Phase

			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. ▪ 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 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. ▪ 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. 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.		
029	**Vehicle and equipment movement**	**Traffic**	▪ 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.	Environmental Control Officer Mine Infrastructure Engineer	Beginning and throughout the Construction Phase

030	**Creation of more employment opportunities**	**Socio-economic**	▪ 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.	Environmental Control Officer Environmental Liaison Officer Mine Owner.	Beginning and throughout the Construction Phase
031	**Disruption of existing family structures and negative impacts due to social interaction of mine workers with local community**	**Socio-economic**	▪ 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 by all relevant stakeholders in order to provide guidance on what behaviour is or is not permitted or acceptable. ▪ 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.	Environmental Control Officer Environmental Liaison Officer Mine Owner.	Beginning and throughout the Construction Phase

032	**Damage to infrastructure on surrounding properties**	**Socio-economic**	▪ 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.	Environmental Control Officer Environmental Liaison Officer Mine Owner.	Beginning and throughout the Construction Phase
033	**Reduced quality of life**	**Socio-economic**	▪ 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.	Environmental Control Officer Environmental Liaison Officer Mine Owner Mine Infrastructure Engineer	Beginning and throughout the Construction Phase

			▪ 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. ▪ 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 compiled and if not urgent measures are taken to correct the situation.		
034	**Financial loss due to damage to farming land and infrastructure**	**Socio-economic**	▪ 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.	Environmental Control Officer Environmental Liaison Officer Mine Owner.	Beginning and throughout the Construction Phase

			▪ 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.		
035	**Soil stripping and loss**	**Land Capability**	▪ Effort should be made to strip the topsoil separate from the underlying plinthic material ▪ The average soil depth ranges from 30-90 overall shallower then 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 the pre-mining land capability, i.e. arable cropping land. ▪ 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.	Environmental Control Officer Mine Infrastructure Engineer Contractor	Beginning and throughout the Construction Phase
036	**Vehicle and machinery movement**	**Land Capability**	▪ 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).	Environmental Control Officer Mine Infrastructure Engineer Engineering Contractor	Beginning and throughout the Construction Phase

037	**Receiving environment contamination**	**Waste**	▪ 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; ▪ 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 local 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.	Environmental Control Officer Mine Infrastructure Engineer Engineering Contractor	Beginning and throughout the Construction Phase

	▪ 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.	

OPERATIONAL PHASE

REF NO:	ASPECT:	IMPACT ON:	MANAGEMENT & MITIGATION MEASURES	RESPONSIBLE PERSON	TIMEFRAME
038	**Water supply of groundwater users surrounding mine**	**Groundwater**	▪ 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 re-acted 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	Environmental Control Officer Engineering Contractor Consultants	Throughout the Operational Phase – Life of Mine Quarterly Monitoring
039	**Base flow of streams/wetland**		▪ If it is proven that the opencast is impacting on base flow 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	Environmental Control Officer Consultants	Throughout the Operational Phase – Life of Mine
040	**Deterioration of groundwater quality down gradient of the mining operations**		▪ 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.	Environmental Control Officer Consultants – hydrologists Mine Infrastructure Engineer	Throughout the Operational Phase – Life of Mine Quarterly Monitoring

			▪ 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.		
041	**Oil, diesel and chemical spills/leaks from machinery and storage facilities/ Sewage related groundwater contamination**		▪ 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	Environmental Control Officer	Throughout the Operational Phase – Life of Mine
	General		▪ 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.	Environmental Control Officer	Throughout the Operational Phase – Life of Mine Bi Annual Monitoring
042	**Increased sediment generation**	**Surface Water**	▪ 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	Environmental Control Officer	Throughout the Operational Phase – Life of Mine
043	**Pollution of stream**	**Surface Water**	▪ Zero effluent discharge policy from Weltevreden Mine (no discharge to dam or stream) ▪ Strict regulatory control on all water containing waste generated and disposal of effluent (WWTW)	Environmental Control Officer	Throughout the Operational Phase – Life of Mine
044	**Damage to riparian vegetation**	**Surface Water**	▪ 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 Weltevreden Mine	Environmental Control Officer	Throughout the Operational Phase – Life of Mine

			▪ Compliance with all environmental legislation		
045	**Degradation of riparian areas by constructing and operation of Weltevreden Mine**	**Surface Water**	▪ 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	Environmental Control Officer Contractor	Throughout the Operational Phase – Life of Mine
046	**Damage and degradation to the in-stream habitat caused by prolonged mining activities**	**Surface Water**	▪ Strict control measures to be implemented in terms of impact minimisation on the in-stream habitat	Environmental Control Officer	Throughout the Operational Phase – Life of Mine
047	**Storm water control**	**Surface Water**	▪ Dirty and clean storm water should be separated systems. Dirty storm water 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 Wilge River Catchment. ▪ Where storm water enters the water resource sediment and debris trapping, as well as energy dissipation control structures should be put in place.	Environmental Control Officer Contractors	Throughout the Operational Phase – Life of Mine
048	**Water Pollution Control facilities**	**Surface Water**	▪ 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	Environmental Control Officer	Throughout the Operational Phase – Life of Mine

			▪ 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.		
049	**Development within water resources e.g. mining footprint encroaches onto wetland area or riparian area, thereby diverting or impeding flow** **Lack of adequate rehabilitation resulting in invasion by woody invasive plants** **Vehicles driving in / through watercourses**	**Surface Water**	▪ 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	Environmental Control Officer Mine Infrastructure Engineer	Throughout the Operational Phase – Life of Mine
050	**Changing the amount of sediment**	**Surface Water**	▪ Construction in and around watercourses must be restricted to the dryer winter months.	Environmental Control Officer	Throughout the Operational Phase – Life of Mine

entering water resource and associated change in turbidity	▪ 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 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.	Mine Infrastructure Engineer

			▪ 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		
051	**Alteration of water quality**	**Surface Water**	▪ 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	Environmental Control Officer	Throughout the Operational Phase – Life of Mine
052	**General**	**Surface Water**	▪ 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	Environmental Control Officer	Throughout the Operational Phase – Life of Mine Monitoring on quarterly basis
053	**Drilling and blasting**	**Air Quality**	▪ 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	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine

054	**Material extraction**	**Air Quality**	▪ Low or in-pit dumping of overburden during high wind conditions	Engineering Contractor	
055	**Transport and transfer of material**	**Air Quality**	▪ 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	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine
056	**Storage of material**	**Air Quality**	▪ 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	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine
057	**Exposed areas**	**Air quality**	▪ 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	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine

058	**General**	**Air Quality**	▪ 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. ▪ 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.	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine
059	**Barriers**	**Noise**	▪ 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. ▪ 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.	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine

060	**Vehicle noise**	**Noise**	▪ 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. ▪ 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.	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine
061	**Blasting**	**Noise**	▪ 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. •	Engineering Contractor Environmental Control Officer	Throughout the Operational Phase – Life of Mine

062	**Potential impacts on identified heritage/archaeological sites**	**Heritage & Archaeological**	▪ If during mining, any archaeological finds are made (e.g. stone tools, skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. ▪ 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)). ▪ Should the need arise to expand the development beyond the current scope demarcated area mentioned in the specialist study, the following applies: o 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.	Environmental Control Officer Contractors	Throughout the Operational Phase – Life of Mine
063	**Visual and aesthetic impacts due to mining activities**	**Visual**	▪ 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	ECO and Mine Infrastructure Engineer	Throughout the Operational Phase – Life of Mine
064	**Impacts on the natural environment**	**Ecological**	▪ 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.	ECO	Throughout the Operational Phase – Life of Mine
065	**Impacts on plant species**	**Ecological**	▪ A management plan for control of invasive/exotic plant species needs to be implemented. This should be an ongoing activity on all areas.	Environmental Control Officer Contractors	Throughout the Operational Phase – Life of Mine

			▪ 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.		
066	**Impacts on animal species**	**Ecological**	▪ 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 areas should be avoided at all cost. Strict measurements should be implemented. No foraging, food and wood collecting within the veld should be allowed. ▪ Activity and housing of workers should be kept out of restricted areas.	Environmental Control Officer Contractors	Throughout the Operational Phase – Life of Mine

			▪ 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.		
067	**General**	**Ecological**	▪ 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. 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 halters 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	Environmental Control Officer Contractors	Throughout the Operational Phase – Life of Mine

			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.		
068	**Vehicle and equipment movement**	**Traffic**	▪ 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.	Engineering Contractor	Throughout the Operational Phase – Life of Mine
069	**Creation of jobs**	**Socio-economic**	▪ Labour (particularly semi-skilled and low skilled) and contractors should be sourced locally where possible and reasonable. ▪ 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.	Mine Owner Engineering Consultant ECO ELO	Throughout the Operational Phase – Life of Mine
070	**Disruption/modification of sense of place**	**Socio-economic**	▪ 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.	Mine Owner Engineering Consultant ECO ELO	Throughout the Operational Phase – Life of Mine

071	**Reduced quality of life**	**Socio-economic**	▪ 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. ▪ 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.	Mine Owner Engineering Consultant ECO ELO	Throughout the Operational Phase – Life of Mine
072	**Soil handling and preservation**	**Land Capability**	▪ 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.	ECO	Throughout the Operational Phase – Life of Mine

			▪ If used to screen operations, the surface of the stockpile should not be used as roadway as this will result in excessive soil compaction.		
073	**Soil contamination**	**Land Capability**	▪ 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	ECO	Throughout the Operational Phase – Life of Mine
074	**Receiving environment contamination**	**Waste**	▪ 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; ▪ 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	Environmental Control Officer	Throughout the Operational Phase – Life of Mine

	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 local 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.	

DECOMMISSIONING AND CLOSURE PHASE

REF NO:	ASPECT:	IMPACT ON:	MANAGEMENT & MITIGATION MEASURES	RESPONSIBLE PERSON	TIMEFRAME
075	**Decant volume**	**Groundwater**	▪ 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	ECO and Mine Infrastructure Engineer	Decommissioning and Closure phase
	Deterioration of groundwater quality down gradient of the mining operations due to plume movement		▪ 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.	ECO and Mine Infrastructure Engineer Hydrologist	Decommissioning and Closure phase and monthly/quarterly monitoring
	General		▪ 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	ECO and Mine Infrastructure Engineer	Decommissioning and Closure phase and bi annual monitoring

			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.		
076	**Increased sediment generation**	**Surface Water**	▪ 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	ECO and Mine Infrastructure Engineer	Decommissioning and Closure phase
077	**Pollution of stream**	**Surface Water**	▪ Zero effluent discharge policy from Weltevreden Mine (no discharge to dam or stream) ▪ Strict regulatory control on all water containing waste generated and disposal of effluent (WWTW)	ECO and Mine Infrastructure Engineer	Decommissioning and Closure phase
078	**Damage to riparian vegetation**	**Surface Water**	▪ 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 Weltevreden Mine ▪ Compliance with all environmental legislation	ECO and Mine Infrastructure Engineer	Decommissioning and Closure phase
079	**Degradation of riparian areas by constructing and operation of Weltevreden Mine**	**Surface Water**	▪ 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	ECO and Mine Infrastructure Engineer	Decommissioning and Closure phase
080	**Damage and degradation to the in-stream habitat caused by prolonged mining activities**	**Surface Water**	▪ Strict control measures to be implemented in terms of impact minimisation on the in-stream habitat	ECO	Decommissioning and Closure phase

081	**General**	**Surface Water**	▪ 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	ECO	Decommissioning and Closure phase and monitoring on a quarterly basis
082	**Material extraction**	**Air Quality**	▪ Low or in-pit dumping of overburden during high wind conditions	ECO	
083	**Transport and transfer of material**	**Air Quality**	▪ 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	ECO	Decommissioning and Closure phase
084	**Storage of material**	**Air Quality**	▪ 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	ECO	Decommissioning and Closure phase
085	**Exposed areas**	**Air quality**	▪ 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	ECO and Engineering Consultant	Decommissioning and Closure phase

			▪ Constricting the areas and time of exposure of pre-strip clearing in advance of mining development		
086	**Vehicle noise**	**Noise**	▪ 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. ▪ 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.	ECO and Engineering Consultants	Decommissioning and Closure phase
087	**Potential impacts on identified archaeological sites**	**Heritage & Archaeological**	▪ If during closure, any archaeological finds are made (e.g. stone tools, skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. ▪ 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)). ▪ Should the need arise to expand the development beyond the current scope demarcated area mentioned in the specialist study, the following applies: ▪ 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	ECO and Specialist	Decommissioning and Closure phase

			archaeological sites and the impact development might have on these sites.		
088	**Visual and aesthetic impacts due to mining activities**	**Visual**	▪ 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	Mine Infrastructure Engineer and ECO	Decommissioning and Closure phase
089	**Impacts on the natural environment**	**Ecological**	▪ 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.	ECO	Decommissioning and Closure phase
090	**Impacts on the plant species**	**Ecological**	▪ 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.	ECO Consultant	Decommissioning and Closure phase with monitoring every six months

			▪ The use of the farm post-closure should be grazing. The veld management plant 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.		
091	**Impacts on the animal species**	**Ecological**	▪ 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.	ECO Consultant	Decommissioning and Closure phase
092	**General**	**Ecological**	▪ 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 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	ECO Consultant	Decommissioning and Closure phase and monitoring every six months

			rehabilitation plan would be to deliver the best overall environmental, economic and social outcomes. ▪ 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 al degraded areas and bare patches is advised to speed recovery to natural, self-sustaining state as soon as possible		
093	**Vehicle and equipment movement**	**Traffic**	▪ 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.	Engineering Consultant	Decommissioning and Closure phase

			▪ Ensure speed limits are set on all roads and enforce speed limits. Ensure all drivers at the site are informed about speed limits.		
094	**Impact on surrounding community**	**Socio-economic**	▪ 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.	Mine Owner ECO ELO Engineering Consultant	Decommissioning and Closure phase
095	**Soil handling and preservation**	**Land Capability**	▪ Loss of topsoil and usable soil ▪ Strip all usable soil and stockpile. ▪ Vegetate long-term soil stockpiles ▪ Contamination of topsoil and stockpiled soil ▪ 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 ▪ Ensure that all stockpiles have a storm water diversion berm for protection against erosion and contamination by dirty water.	ECO Consultant	Decommissioning and Closure phase
096	**General**	**Land Capability**	▪ 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.	ECO Engineering Consultant	Decommissioning and Closure phase

			▪ 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.		
097	**Receiving environment contamination**	**Waste**	▪ 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; ▪ 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	ECO	Decommissioning and Closure phase

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 local 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.

4. REGULATION 52 (2) (d): Financial provision

4.1 Plans for quantum calculation purposes.

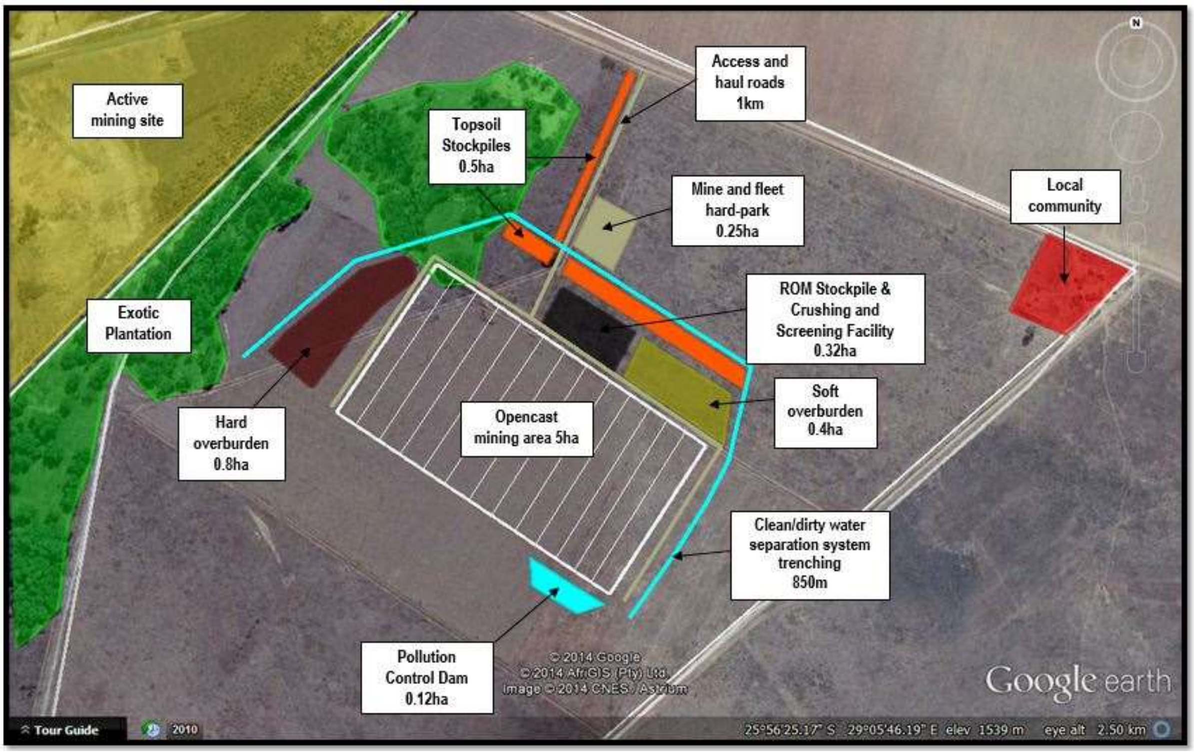


Figure 37: Mine planning for quantum calculation purposes

4.2 Alignment of rehabilitation with the closure objectives

The rehabilitation plan has been developed specifically to meet the closure objectives for this project.

<u>Final end land use:</u> - Natural veldt, potentially grazing.

Environmental objectives:

- The box-cut area will be rehabilitated to ensure a free-draining landform and the whole area will be shaped in order to promote unrestricted drainage throughout the rehabilitated area, thus limiting water-logging and slumping.
- After direct placement of topsoil, the area will be profiled to a free-draining landform.
- The soils will be ripped, treated and re-vegetated using a natural grass / shrub / tree mixture.
- The re-vegetation must use and indigenous seed mix (such as Erogrostis cuvula, Eraqrostis teff, Cynadon dactylon, Digitaria erianthra and Chloris gayana) which restores the land to a stable and non-erodible land form.
- The rehabilitated areas will be monitored for declared weeds and invasive plants. This will be controlled and managed as per the normal procedure.

- Grazing of rehabilitated areas will be avoided for the first 3-5 years until the desired nutritional status and vegetation coverage has been achieved.
- With proper rehabilitation and fertilisation techniques, this can be reduced to a minimum to ensure that the rehabilitated area is sustainable and will not degrade further due to erosion.
- Allowance will be made for a maintenance period of one year following rehabilitation

4.3 Quantum Calculations

CALCULATION OF THE QUANTUM - WELTEVREDEN OPENCAST							
MINE : Yoctolux Investments (Pty) Ltd - Weltevreden Colliery				OLIFANTS WATER MANAGEMENT AREA - QUATERNARY B20G			
EVALUATORS : Eco Elementum (Pty) Ltd				Jul-14			
COMPONENT NO	MAIN DESCRIPTION	[B] CPIX CUMULATIVE ESCALATED MASTER RATE 2014	[A] QUANTITY	UNITS	[C] MULTIPLICATION FACTOR	[D] WEIGHTING FACTOR 1	SUB TOTALS [A*B*C*D]
		STEP 4.3	STEP 4.5		STEP 4.3	STEP 4.4	
1	Dismantling of processing plant and structures	R 11.72		m3			
2(A)	Demolition of steel buildings and structures	R 163.28		m2			
2(B)	Demolition of reinforced concrete buildings and structures	R 240.62		m2			
3	Rehabilitation of access roads	R 29.22	6000.00	m2	1.00	1.00	R 175 308.30
4(A)	Demolition and rehabilitation of electrified railw ay lines	R 283.59		m			
4(B)	Demolition and rehabilitation of non-electrified railw ay lines	R 154.68		m			
5	Demolition of housing and facilities	R 326.55		m2			
6	Opencast rehabilitation including final v oids and ramps	R 166 199.14	1.50	ha	0.52	1.00	R 129 635.33
7	Sealing of shafts, adits and inclines	R 87.65		m3			
8(A)	Rehabilitation of ov erburden and spoils	R 114 122.26	1.20	ha	1.00	1.00	R 136 946.72
8(B)	Rehabilitation of processing w aste deposits and ev aporation ponds (basic, salt-producing w aste)	R 142 137.22		ha			
8(C)	Rehabilitation of processing w aste deposits and ev aporation ponds (acidic, metal-rich w aste)	R 412 833.86	0.32	ha	0.80	1.00	R 105 685.47
9	Rehabilitation of subsided areas	R 95 560.21		ha			
10	General surface rehabilitation, including grassing of denuded areas	R 90 404.08	2.50	ha	1.00	1.00	R 226 010.21
11	Riv er div ersions	R 90 404.08		ha			
12	Fencing	R 103.12		m			
13	Water management (Separating clean and dirty w ater, managing polluted w ater and managing the impact on groundw ater, including treatment, w hen required)	R 34 374.18	2.00	ha	0.67	1.00	R 46 061.40
14	2 to 3 y ears of maintenance and after care	R 12 030.96	10.00	ha	1.00	1.00	R 120 309.62
15	Specialist study	sum					
SUBTOTAL (1 to 15 abov e)							**R 939 957.04**

CALCULATION OF QUANTUM OF FINANCIAL PROVISION	
Subtotal 1	**R 939 957.04**
Preliminary and general (WF 2 = 1.05)	R 986 954.89
Add 12% if less than R100mil	R 118 434.59
Administrative and supervision costs 6%	R 56 397.42
Engineering drawings and specifications 2%	R 18 799.14
Engineering and procurement of specialist 2.5%	R 23 498.93
Development of closure plan & final groundwater modelling 2.5%	R 23 498.93
Subtotal 2	**R 1 180 586.04**
Contingency as a percentage (10%) of Subtotal 1	R 9 399.57
Subtotal 3	**R 1 189 985.61**
VAT 14%	R 166 597.98
TOTAL	**R 1 356 583.59**

4.4 Undertaking to provide financial provision

Amount of financial provision required:

R 1 358 583.59

Method preferred to furnish the amount of financial provision required to the DMR:

Cash deposit	
Bank guarantee	**X**
Trust fund	
Other: (specify – Minister to approve)	

5. REGULATION 52 (2) (e): Planned monitoring and performance assessment of the environmental management plan.

5.1 List of identified impacts requiring monitoring programmes.

The following main environmental aspects require monitoring;

- Ground water
- Surface water
- Bio-monitoring
- Noise
- Air quality
- Archaeological
- Ecology
- Social
- Blasting

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." 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 already in the vicinity of the site 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.

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 the applicant 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 62: 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

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.

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 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.

Table 63: 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 as proposed by the bio-monitoring aquatic specialists. The bio-monitoring will assist in the determination of potential long term impacts on the receiving water environment.

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).

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/m^2/day) (monthly 8 samples)**

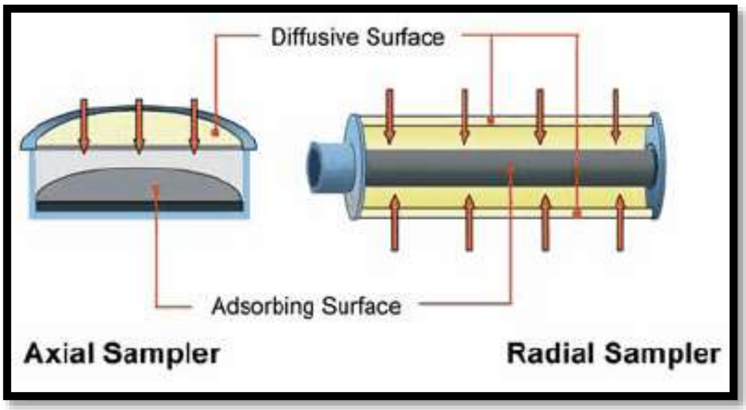
Site layout for the sampling points will be carried out according to the eight main compass directions; the site layout and equipment placement is done in accordance with the ASTM standard, D 1739 – 2010, thereafter relevant sampling reference numbers will be allocated to the receptors accordingly. At 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/m^2/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 gravimetrical 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	0.1ft3(2.83L/min) controlled by internal pump
Count Modes	Totalize, Concentration, Audio
Coincidence Loss	5%, 2000000 particles per ft3
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;



ARCHAEOLOGICAL MONITORING

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.

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.

ECOLOGY

Monitoring's framework should be instigated and managed by their Environmental Control Officer (ECO) due to the fact that Yoctolux Investments (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 and 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.

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.

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 needs to be monitored in accordance with specific limitations. Kindly refer to the specialist Blast Risk Assessment reports which have been attached.

5.2 Functional requirements for monitoring programmes.

1. All relevant monitoring results shall be evaluated and reported on during relevant meetings;
2. Any deviations to the targets shall be regarded as a non-conformance and handled this way as per the Incidents / Accident investigation procedure;
3. Reporting shall be undertaken as required by individual monitoring criteria, stipulated in the monitoring programme and discussed at Management Review meetings as required;
4. Where necessary, actions shall be implemented to improve standards or deal with non-conformances as they occur;
5. Monitoring equipment shall be calibrated and traceable to a national or international standard where possible;
6. If the equipment cannot be calibrated or is not traceable to a national or international standard, the method for ensuring the accuracy of the equipment shall be documented;
7. Equipment shall also be maintained as required in individual monitoring procedures or as per the manufacturers' manual;
8. All new equipment shall be deemed being accurately calibrated.

5.3 Roles and responsibilities for the execution of monitoring programmes.

Table 64: Monitoring programme

Aspect	Location	Timeframe	Responsible
Groundwater	Upstream and downstream	Quarterly	External service provider – specialists
Surface Water	Upstream, downstream and on-site	Monthly	External service provider – specialists

Biomonitoring	Upstream and downstream	Seasonal	External service provider – specialists
Noise	4 main wind directions, border of operation	Quarterly	External service provider – specialists
Gravimetric Dust Fallout	8 main wind directions, border of operation	Quarterly	External service provider – specialists
PM 10 and 2.5 dust	8 main wind directions, border of operation	Quarterly	External service provider – specialists
Sulphar Dioxide	4 main wind directions, border of operation	Quarterly	External service provider – specialists
Archaeological	Operational area	Monthly	External service provider – specialists
Ecological	Operational area and receiving environment	Quarterly	External service provider – specialists
Social	Regional	On-going	Mine management
Blast	Operational area and receiving environment	During blasting events	External service provider – specialists

5.4 Committed time frames for monitoring and reporting.

Refer to section 5.3 above.

6. REGULATION 52 (2) (f): Closure and environmental objectives.

6.1 Rehabilitation Plan

6.1.1 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 1700kglm 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.

6.1.2 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 way 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

6.1.3 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.

6.1.4 Rehabilitation and soil sustainability

The following section deals with the principles of soil sustainability and rehabilitation pf 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 then 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.

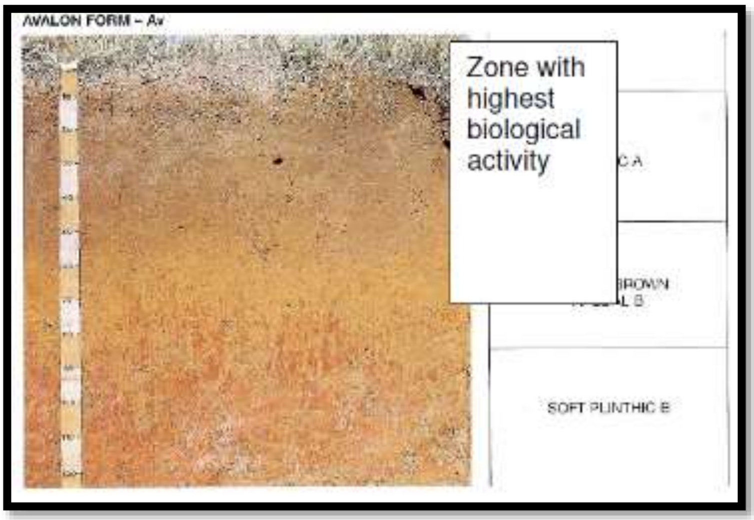


Figure 38: Avalon Soil showing different horizons (MacVicar 1991)

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

6.1.5 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 reseeding 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.

6.2 Closure objectives and their extent of alignment to the pre-mining environment.

General

The closure objectives for the Weltevreden 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 Weltevreden 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 done without impacting the on the wetland systems that has been delineated on site. On-going rehabilitation as mining operations progress will be implemented.

6.3 Confirmation of consultation

This EMP will be circulated to I&AP's for review as part of the consultation process, as well as further proof in the Annexure to this report dealing specifically with Public Participation.

7. REGULATION 52 (2) (g): Record of the public participation and the results thereof.

7.1 Identification of interested and affected parties.

Refer Annexure 2

7.2 The details of the engagement process.

Refer Annexure 2

7.2.1 Description of the information provided to the community, landowners, and interested and affected parties.

Refer Annexure 2

7.2.2 List of which parties identified in 7.1 above that were in fact consulted, and which were not consulted.

Refer Annexure 2

7.2.3 List of views raised by consulted parties regarding the existing cultural, socio-economic or biophysical environment.

Refer Annexure 2

7.2.4 List of views raised by consulted parties on how their existing cultural, socio-economic or biophysical environment potentially will be impacted on by the proposed prospecting or mining operation.

Refer Annexure 2

7.2.5 Other concerns raised by the aforesaid parties.

Refer Annexure 2

7.2.6 Confirmation that minutes and records of the consultations are appended.

Refer Annexure 2

7.2.7 Information regarding objections received.

Refer Annexure 2

7.3 The manner in which the issues raised were addressed.

Refer Annexure 2

8. SECTION 39 (3) (c) of the Act: Environmental awareness plan.

8.1 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 65: 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.

8.2 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.

8.3 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 mining activities.

- **Overview of the applicable Environmental, Health, Safety and Community Legal Framework**
    - Description of the approved mining activities and content of the mining 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.

9. SECTION 39 (4) (a) (iii) of the Act: Capacity to rehabilitate and manage negative impacts on the environment.

9.1 The annual amount required to manage and rehabilitate the environment.

Monthly Environmental Management Cost Breakdown Estimation		
Topsoil and Biodiversity Concurrent Management Measures	**Cost Implication**	**Cost Identification**
1. A topsoil management guide is detailed below, detailing topsoil stripping, storage and replacement requirements. Specific commitments related to topsoil management include:		
• Where construction/drilling/road construction activities are undertaken, topsoil will be stripped to the maximum available depth;	☑	Handling
• Recovered topsoil shall be stored within demarcated areas, and outside the 1:50 year flood line of any watercourse;	☑	Management
• Topsoil shall be stored, on stockpiles not exceeding a height of 2 m;		
• Topsoil shall not be used for any activity other than rehabilitation;		
• Alien invasive plant growing on the topsoil stockpiles shall be eradicated on an annual basis during the growth season prior to seeds being viable;	☑	Alien species eradication
• Regular inspections shall be undertaken on topsoil stockpiles to verify that no erosion and/or topsoil scavenging are occurring;	☑	Specialist
• Prior to topsoil replacement (as part of rehabilitation), the topsoil shall be assessed to verify suitability for rehabilitation purposes (e.g. Topsoil fertility assessment);	☑	Laboratory analysis
• Regular inspections shall be undertaken to identify erosion concerns, and the necessary erosion protection and rehabilitation undertaken;	☑	ECO
• Gravel drifts, diversion berms and cut lines should be constructed as is required in order to minimise soil erosion, especially on road surfaces; and	☑	Construction
• Areas cleared for mining operations should be leveled in order to minimise the possibility of soil erosion.	☑	Equipment
2. There shall be no activities conducted within 100 meters from the buffer zone of the watercourses. Environmental awareness campaigns and training of staff shall be conducted on protection of sensitive areas;	☑	Training
3. Road construction shall be limited to create access for the drill rigs and not throughout the entire farm.		
4. Large areas shall be kept available for commercial farming and this should not be disturbed by road construction related activities;		
5. Eradication of alien invasive plants program shall continue to be part of operations;	☑	Alien species eradication
6. Environmental specialist shall be consulted to identify alien invasive plants;	☑	Specialist consultation
7. No collection of firewood shall be allowed;		
8. No poaching / snaring shall be allowed;		
9. Fragments shall be linked by preserving corridors of native vegetation;		
10. No disturbance of game / wildlife encountered shall be allowed. Environmental awareness campaigns and training of staff shall be conducted on protection of game and wildlife;		
11. Driving shall continue to be restricted to daylight hours; and		
12. The necessary rehabilitation of areas cleared will be done when mining activities have ceased.	☑	General surface rehabilitation
	Subtotal 1	**R 2 500**

Vegetation Destruction Concurrent Management Measures	Cost Implication	Cost Identification
1. Vegetation clearing shall be restricted to the minimum, where this is impossible a permit shall be acquired for the relocation of red data species. Relocation will be done as per red data relocation procedure as stated below.		
• Identify species that require relocation;	☑	Specialist consultation
• Draft a letter for submission to the Department of Environmental Affairs (National and Provincial Authority) requesting a permit for the removal of the specific species. Blanket Permits can be applied for more than one tree species (as per communication with the Provincial government);		
• Once the Regulatory Authority has approved the relocation / destruction of the specified species and a valid permit for the relocation / destruction of the species has been received the protected plants in danger of becoming destroyed during any of the planned activities shall be removed prior to the commencement of construction activities and translocated to suitable habitat, or used during the rehabilitation phase;		
• Conduct a baseline risk assessment for the removal of the species stipulating all activities and hazards involved with the relocation process. Employees shall understand and sign the risk assessment before any work commences;	☑	Specialist consultation
• Compile a map displaying:	☑	GIS Specialist
o The area where the species will be removed;		
o Route that will be travelled during the process;		
o The new site identified for relocation;		
o All power lines;		
o All water pipelines; and		
o Any other areas that could raise a concern during the operation.		
2. Proper demarcation of areas to be cleared shall be done which will reduce the risk of unnecessary destruction of vegetation.	☑	Management
3. A "walk-through" of the area shall be done during the summer season. The purpose of this would be to screen the area for potential protected or threatened species and to prevent any further loss of biodiversity. If a protected or threatened species is located, a road shall be constructed around the area of species existence to reduce the risk of unnecessary destruction of vegetation.	☑	ECO
In instances where the species cannot be avoided, it shall be removed and translocated to a suitable area in close proximity. If a high density of protected or threatened species is located on the area, the proposed footprint site shall be moved to an appropriate area.	☑	Handling
4. The mitigation hierarchy (firstly avoid, secondly minimize and lastly mitigate) shall be considered when protected species relocations are required. Relocations of the species should only be considered as a last resort if there are no other alternatives or solutions.		
	Subtotal 2	R 2 400

Erosion Concurrent Management Measures	Cost Implication	Cost Identification
1. Areas cleared for mining operations shall be leveled in order to minimise the possibility of soil erosion;	☑	Equipment
2. Gravel drifts and cut lines shall be constructed in order to divert water runoff from roads;	☑	Construction cost
3. Areas where soil erosion is taking place shall be rehabilitated in order to prevent further erosion of the specific area;	☑	Management
4. Road surfaces shall be monitored on a regular basis for any signs of erosion;	☑	ECO
5. Potentials for erosion shall be minimised by appropriate surface shaping;	☑	Equipment
6. Dust abatement techniques shall be used on un-vegetated surfaces to minimize windblown erosion;	☑	Dust supression
7. Erosion controls shall be applied to minimize soil erosion from vehicular traffic and during prospecting activities;		
8. Equipment and vehicles shall be kept within the limits of the initially disturbed areas;		
9. Routine site inspections shall be conducted to assess the effectiveness and the maintenance requirements for erosion and sediment control system.	☑	ECO
	Subtotal 3	**R 3 200**

Alien Invasive Species Concurrent Management Measures	Cost Implication	Cost Identification
1. Proposed mining area shall be surveyed before and after mining activities takes place. The purpose would be to screen the area for potential establishment of alien invasive species;	☑	Management
2. Established species shall be eradicated before propagation depending on each species;	☑	Handling
3. All updated legislation shall be included in the alien invasive management plan;		
4. Areas where alien weeds and invasive plants occur on the premises shall be identified;	☑	ECO
5. The services of a specialist shall be employed, if required, to verify the information and suitable eradication method;		
6. Appropriate resources to remove or control all identified plants shall be identified in the form of an action plan;		
7. The action plan shall be implemented;		
8. Any action taken to control and eradicate a listed invasive species shall be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment;	☑	Management
9. The methods employed to control and eradicate a listed invasive species shall also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner;		
10. An ongoing monitoring and eradication programme shall be implemented for all invasive and weedy plant species growing on the site; and	☑	ECO
11. Ongoing monitoring of areas from which alien vegetation has been cleared shall take place to ensure no re-infestation occurs.	☑	ECO
	Subtotal 4	**R 3 300**

Water Concurrent Management Measures	Cost Implication	Cost Identification
1. Clean and dirty water shall be kept separate;	☑	Management
2. Storm water culverts shall be constructed to effectively channel the water;	☑	Construction
3. All water drainage infrastructures (e.g. culverts) shall be placed on a regular maintenance schedule to prevent blockage and overflow;	☑	Maintenance
4. Adequate storm water measures (storm channels) shall be put in place to ensure that water runoff does not create erosion;	☑	Construction
5. Stormwater channels shall be kept clean from blockages such as sediment and vegetation;	☑	Management
6. The channels shall be maintained to prevent any process or dirty water from entering the clean stormwater system;	☑	Maintenance
7. Regular inspections shall be undertaken to ensure water drainage infrastructure is kept clear of any obstructions; and	☑	ECO
8. Where such activity constitutes a water use authorisation, a water use license application for this activity shall be submitted.		
	Subtotal 5	R 2 500

Air Quality Concurrent Management Measures	Cost Implication	Cost Identification
1. Dust created by onement of trucks, blasting and the crushing and screening will be supressend by dust management practises - dust supressent trucks	☑	Water acquisition
2. Vehicles shall travel at low speed on these roads to limit dust creation;		
3. Regular water spraying of mining sites shall be undertaken in order to suppress the generation of dust;	☑	Dust supression
4. Watering of the roads to suppress the dust will be undertaken;	☑	Dust supression
5. The operation shall only take place during daylight hours; and		
6. Personnel working in a high potential dust generating environment shall wear protective clothing – dust masks.	☑	PPE
	Subtotal 6	R 4 500

Noise Quality Concurrent Management Measures	Cost Implication	Cost Identification
1. Exhaust systems of all vehicles shall be regularly inspected as per maintenance register;	☑	Management
2. Drilling operations and road construction activities shall be restricted to daylight hours; and		
3. The blasting and mining is a high source of noise and although all the workers are wearing some kind of hearing protection, it is suggested that they will also be issued with ear muffs as a double protection or even in place of the ear plugs. The concern with ear plugs is that they are not always inserted correctly into the ear and therefore the noise can still penetrate and cause damage in the long term.	☑	PPE
	Subtotal 7	R 1 100

Waste Concurrent Management Measures	Cost Implication	Cost Identification
1. All general waste generated shall be removed to the local municipal waste disposal facility by independent waste removal company;	☑	Handling
2. Waste bins shall be made available at selected sites;		
3. Bins with attached lids shall prevent litter from blowing from the bins;		
4. Contents of bins shall be emptied at regular intervals preventing spillages from these bins;	☑	Handling
5. Management shall conduct regular inspections to ensure that no littering occurs;	☑	ECO
6. Hazardous waste bins shall be provided, in the case of any such waste being generated; and		
7. A contractor was appointed to dispose the content of a chemical toilet at eMalahleni Municipal Sewage Treatment Facility.	☑	Handling
	Subtotal 8	R 8 200

Hazardous Substances Concurrent Management Measures	Cost Implication	Cost Identification
1. Trays shall be placed under potable generators and equiment if required to contain any spills that may arise during the operation;	☑	Equipment
2. Diesel and other chemicals shall be stored within contained bunded areas;	☑	Construction
3. In the event where spills do occur, soil will be removed and placed in 25 plastic drums;	☑	Handling
4. These drums shall then be taken to hazardous waste bins to be disposed of at a licensed hazardous waste landfill site. This will ensure that no contaminated soil is left on the site as well as ensuring correct disposal; and	☑	Handling
5. The trays that have collected any spills that may occur will be emptied into 25 plastic containers and temporarily stored in hazardous waste bins.	☑	Handling
	Subtotal 9	R 6 100

Estimated Total Monthly Environmental Management Cost	R 33 800
(Sum of subtotal 1-9)	
Annual Amount Required to Manage and Rehabilitate Prospecting stie	R 405 600
(Monthly total x 12)	

Estimated cost breakdown discussion:

Various items listed in the annual environmental management and rehabilitation costs are once-off acquisition or construction costs and have therefore been divided between the 12 month financial cycles to only reflect a true value in the total annual amount required. The costs are not fixed and merely an indication of costs that could be expected, although specific on site conditions once mining commence might require additional or even less funds to be allocated towards these functions. The recommendation therefore is to ensure the ECO communicate the costs incurred as a result of the EMP directly to management on a monthly basis and that a good record is kept in order to ensure sound future financial projections can be made regarding the environmental management and rehabilitation costs.

9.2 Confirmation that the stated amount correctly reflected in the Prospecting Work Programme as required.

It can be confirmed that the stated amount correctly reflected in the PWP.

10. REGULATION 52 (2) (h): Undertaking to execute the environmental management plan.

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises EIA and EMP compiled in accordance with the guideline on the Departments official website and the directive in terms of sections 29 and 39 (5) in that regard, and the applicant undertakes to execute the Environmental management plan as proposed.	
Full Names and Surname	
Identity Number	
Signature	