mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

VANDYKSDRIFT CENTRAL INFRASTRUCTURE AND MINING DEVELOPMENT

PART B

CONSULTATION ENVIRONMENTAL MANAGEMENT PROGRAMME

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Abbreviations used in the report:

Abbreviation	Meaning
ABA	Acid Base Accounting
AMD	Acid mine drainage
AMIRA	Australian Mining Industry Research Association
BMC	Blast Management & Consulting
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIAR	Environmental Impact Assessment Report
ELM	eMalahleni Local Municipality
EMPr	Environmental Management Programme
EMPR	Environmental Management Programme Report
GNR	Government Notice Regulation
ha	hectares
I&APs	Interested and Affected Parties
IFC	International Finance Corporation
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Waste Management Plan
J&W	Jones & Wagener Engineering and Environmental Consultants
L_{Aeq}	The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured) (in dBA)
LAC	Low Ash Coal
LoM	Life of mine
m	metre
mamsl	metres above mean sea level
mg/ℓ	milligram per litre
mm	millimetre
MEND	Mine Environment Neutral Drainage
MIRAI	Macroinvertebrate Response Assessment Index
MOD AASHTO	Modified American Association of State Highway and Transportation Officials – classification of soils
MRA	Mining Rights Area
N/A	Not applicable
NAAQS	National Ambient Air Quality Standards

Abbreviation	Meaning
NAG	Net Acid Generation
No	Number
NDCR	National Dust Control Regulations (GNR827 of 1 November 2013)
NWA	National Water Act, 1998 (Act 36 of 1998)
PAG	Potentially Acid Generating
PCD	Pollution control dam
PHD	Pulles, Howard and De Lange
PM	Particulate matter
POI	Point of Interest
PSS	Power Station Smalls
ROM	Run-of-Mine
RQO	Resource Quality Objective
South32	South32 SA Coal Holdings (Pty) Limited
SANS	South African National Standards
SAR	Sodium Adsorption Ratio
SASS5	South African Scoring System Version 5
SDS	Safety Data Sheet
SHE	Safety, Health and Environmental
SKS	Steenkoolspruit
TDS	Total Dissolved Solids
TC	Total Concentration
TSP	Total Suspended Particulates
VDDC	Vandyksdrift Central
WTP	Water Treatment Plant
WUL	Water Use Licence
WVK	Wolvekrans Colliery
XRD	X-ray diffraction-

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME

1. DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME.

1.1 Details of the EAP

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

Details of the EAPs are provided in **Section 3** of **Part A**.

1.2 Description of the Aspects of the Activity

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

Aspects of the activity are described in **Section 5** of **Part A.**

1.3 Composite Map

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

The map is provided in **Appendix 6**.

1.4 Description of Impact management objectives including management statements

1.4.1 Determination of closure objectives

(ensure that the closure objectives are informed by the type of environment described in 2.4 herein)

The closure objectives for the Wolvekrans Colliery, and therefore the VDDC mining and infrastructure project, are as follows:

Land use:

- To mimic regional geomorphological features by maintaining a free-draining topography across the rehabilitated Mining Right Area (MRA);
- To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over 80% of the rehabilitated portions of the MRA, that can sustain between 2.4 ha/LSU and/or 5t/ha carrying capacity;
- To maintain a productive vegetation cover that supports a regional pasture-related carrying-capacity of 2.4 ha/LSU and/or 5t/ha of hay, at a vegetal cover of > 75%;
- To achieve creation of habitats for local fauna expected to occur within the rehabilitated areas on which a grazing land use is taking place;

- To maintain the visual landform as aligned to the approved surface rehabilitation landform design of the rehabilitated landscape, that blend into the surrounding areas.

Water:

- To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions;
- To guide appropriate groundwater abstraction within the MRA to an authorised quantity;
- To have implemented an alternative, agreed-on landowner/user-maintained groundwater supply or source for predefined landowner/user/s who were supplied water during mining operations;
- To not exceed agreed-on, predefined surface water quality objectives, as stipulated in the Resource Quality Objectives (RQOs) for the following catchments: B11B, B11F and B11G;
- To limit the impact on the quality of the aquifer adjacent to the rehabilitated open pits by not exceeding the predefined groundwater quality objectives.

Air quality

- To maintain local air quality parameters to agreed-on, predefined human health-related standards, in terms of national ambient air quality of the Highveld Priority Area;

Social

- To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives;
- To have completed implementation of the closure-related projects agreed-on in the mine's approved Social and Labour Plan, focusing on personal skills development and local economic development.

Substitute Economics

- To have developed a plan for care-and-maintenance of remaining mining-related surface infrastructure that has a beneficial re-use, for hand-over to, and accountability by the next landowner;
- To have removed or demolished other infrastructure (non-mining related), except for those facilities that have been identified as having a beneficial post-mining use potential (e.g. powerlines, water pipelines, boreholes etc.);
- To have identified public-private partnerships accountable for management and maintenance of the rehabilitated landscape as its long-term use/s;
- To leave behind a rehabilitated landscape that will retain long-term economic value for future landowners.

1.4.2 The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity.

An assessment of potentially significant impacts and risks associated with the proposed infrastructure development was conducted and is presented in detail in **section 18** of **Part A** (specifically **Table 18-6** to **Table 18-8**). The activity, impacts, associated project

phases, size and scale of disturbance and proposed mitigation measures that can be implemented to avoid, reduce or control the impact is provided.

1.4.3 Potential risk of Acid Mine Drainage

(Indicate whether or not the mining can result in acid mine drainage).

The VDDC Project area's geochemistry and hydrochemistry has been extensively examined in the past. A summary of the key studies is provided below.

1.4.3.1. Acid-base Accounting and Long-term Mine Water Chemistry at Douglas Colliery by Hodgson et al. dated 1999

Core rock and coal samples were tested to investigate the long-term hydro chemical character of the opencast and underground mine water at the (then) Douglas Colliery, by performing acid-base accounting and leaching tests on the samples, as well as geochemical modelling.

In terms of future salt load, a sulphate generation rate of 50 tonnes/day was suggested for Douglas Colliery. This was predicted to result in an average sulphate concentration of 1 800 mg/ℓ in the seepage water. In areas of low water through flow, the sulphate concentration was expected to rise to saturation levels. At a pH of 6.5 and a calcium concentration of 250 – 380 mg/ℓ, the sulphate concentration was predicted to be in the range of 1 825 – 3 300 mg/ℓ. At pH-levels below 3.0, sulphate concentrations were assessed to potentially increase to well over 4 000 mg/ℓ.

The overall conclusion was that eventual acidification of the opencast water at Douglas Colliery was unavoidable. The scale of mining was seen as simply too large and that mining has progressed too far to make a meaningful and permanent change at that stage. The final fate of the underground water in terms of acidity was concluded to depend on issues such as its interconnectivity to opencast, and the surface and the rate of flooding. It was therefore recommended that Douglas Colliery should provide for neutralisation of the mine water in their closure plan. Controlled flood release of treated water or irrigation were seen as the preferred option to dispose of this water. It was considered inevitable that the mine water at Douglas Colliery would eventually acidify to the extent that acid water will be the dominant type (J&W, 2019a).

1.4.3.2. Geochemical Assessment as part of Douglas EMPR Amendment by PHD dated 2004

An application for the amendment of the Douglas Colliery EMPR was undertaken in support of expanding their operations to include additional opencast operations at Steenkoolspruit and Kleinkopje, as well as pillar mining operations at Vandyksdrift.

The objective was to carry out a screening level geochemical assessment of the long-term water quality impact associated with the proposed new mining development including evaluation of the existing acid base-accounting (ABA) data, salt balance and metal leaching potential and kinetic geochemical modelling for long-term water quality prediction. The modelling was undertaken as a preliminary screening-level study with a number of simplistic assumptions being made.

The study showed that, overall, waste rock had less acid generation potential than the coal seams, which all had strong acid potential. Furthermore, equilibrium modelling results indicated that the waste rock material had a moderate Neutralising Potential (NP), but substantial Net Neutralising Potential (NNP) (>20), indicating that the potential for acid mine drainage (AMD) generation from the waste rock material is low.

The kinetic geochemical modelling, using the sparse existing data that could be extrapolated to the site, suggested that the ABA results were misleading and that the long-term prognosis for the mine is one of neutral pH with relatively low salinity water at the time of eventual pit discharge (J&W, 2019a).

1.4.3.3. VDDC project: Mineral Residue Assessment Report by J&W dated 2014

In 2014, J&W conducted a study to determine the pollution potential of the residue materials and to assess the likelihood of residue materials generating AMD.

The objectives of the geochemical assessment were to:

- Determine the pollution potential of the residue materials;
- Assess the likelihood of the residue materials generating AMD;
- Assess the residues in terms of GNR 635, the *National Norms and Standards for the Assessment of Waste for Landfill Disposal* as promulgated on 23 August 2013.

Samples of the coal discard, coal rejects, slurry (from the Discard Processing Plant, and the slurry ponds on the PSS dump), as well as overburden material from the SKS operations were collected and sent for leach and static tests.

The major minerals in the coal rejects and coal slurry samples were graphite and kaolinite whereas the overburden sample did not contain any detectable concentrations of graphite. All the samples contained varying percentages of pyrite (FeS), which could result in the generation of AMD.

Based on the total concentrations (TCs) of the various coal waste samples it was noted that the coal discard, coal rejects and slurries generally contained elevated concentrations of antimony, arsenic, barium, cadmium and lead, while the overburden material contained elevated concentrations of antimony, cadmium, chromium, iron, lead and zinc. The overburden contained the highest total concentrations of cadmium, cobalt, chromium, copper, manganese, nickel, vanadium and zinc of all the residues tested.

The paste pH of most of the coal discard, slurry and overburden samples was acidic with the potential to generate acidic seepage or runoff. The slurry from the discharge into the slimes dam had acidic paste pH and the potential to generate acidic seepage and runoff in the short term.

The coal discard, slurries and overburden were assessed as Type 3 wastes in terms of GNR 635.

It was noted that the overburden acid base accounting assessment was based on only one composite sample of unknown rock type and may therefore not have been representative of the overburden as a whole. Kinetic testing of representative samples of the overburden was suggested to evaluate its AMD potential. This was addressed by the J&W (2016) investigation.

1.4.3.4. Geochemistry assessment as part of geohydrological investigation for the storage of water in the SKS pit by J&W dated 2016

The primary objectives of this assessment were as follows:

- To determine the geochemical nature of the material in the backfilled SKS pit;
- To determine the long-term net acid generation potential;
- To identify metals that may be present in drainage from the pit; and

- Perform geochemical modelling in order to predict future discharge water qualities from the pit.

The coal seams, as well as some of the sedimentary host rocks are known to generate acid-mine drainage when exposed through mining. The largest part of the SKS pit is already backfilled with waste rock but some final mining is still taking place and planned on the eastern side of the pit. The SKS pit is also considered for storage of water pumped from underground from nearby opencast mining of old underground pillars at VDDC. In this report the potential and degree of acid-mine drainage that may occur at the SKS Pit was addressed.

The results of the study are summarised as follows:

- Bicarbonate is the dominant anion in the infiltrating groundwater into the backfilled pit. Sulphate, however, quickly becomes the dominant anion in interstitial water in the backfill due to sulphide oxidation. Sulphate will be the major indicator of any mine drainage related impact at the Steenkoolspruit Pit. Sulphate is fairly mobile and the first indicator of sulphide oxidation. Alkalinity is still present in the underground mine water, although sulfate is the dominant anion. Alkalinity will also be present in the pit water while it is still near neutral;
- No pumping from underground: Through the modelling it was estimated that if the backfilled Steenkoolspruit pit floods to discharge elevation of 1 505 mamsl, pit water will have a sulphate concentration of up to ± 3 500 mg/ℓ (Model A Scenario 1) decreasing to about 3 000 mg/ℓ over the long-term (50 - 200 years). If the backfilled pit floods to the pump elevation of 1 502 mamsl, pit water will have a sulphate of up to ± 3 550 mg/ℓ (Model A Scenario 2) decreasing to about 3 000 mg/ℓ over the long-term (75 – 200 years). The 3 meters additional unsaturated zone (1 505 vs 1 502 mamsl) does not result in a significant difference in the pit water quality;
- Pumping from underground: If water is pumped from the underground to the pit and the pit floods to discharge elevation of 1 505 mamsl, the pit water will have an initial sulphate concentration of up to 4 300 mg/ℓ (Model B Scenario 1) over the short term (0 – 25 years); this will decrease to 3 500 mg/ℓ over the medium term (25 - 50 year) and to 3 000 mg/ℓ over the long-term (50 - 200 year). If the pit floods to 1 505 mamsl, the pit water will have an initial sulphate concentration of up to ±4 500 mg/ℓ (Model B Scenario 2) over the short term (0 - 25 years); this will decrease to 3 500 mg/ℓ over the medium term (25 - 75 year) and to 3 000 mg/ℓ over the long-term (75 - 200 year). Once again, the 3 meters additional unsaturated zone (1 505 vs 1 502 mamsl) does not result in a significant difference in the pit water quality and also the pumping of water from the underground to the pit only results in a short term increase in the sulphate concentrations within the pit;
- Initially, magnesium and calcium are the dominant cations in the neutral pit mine water due to the neutralization reactions of carbonate minerals (i.e. calcite and dolomite). It is important to note that Mg is the dominant cation present in the pumped underground mine water which was classified as a Mg-SO_4 water. The still neutral underground mine water was also in equilibrium with calcite and dolomite. The pit water will also be initially in equilibrium with calcite and dolomite. Because of the dominance of Mg with respect to calcium, gypsum may be slightly under saturated with the result that sulphate reaches the relatively high concentrations (3 000 – 4 000 mg/ℓ) in the pit water discussed above;
- Where carbonate minerals become depleted (e.g. at the top of the unsaturated zone) acidification will take place. Aluminium, iron and manganese will become the major cations in acidic to slightly acidic seepage from the backfill as not enough basic cations are present. There will be parts of the backfill (hot-spots) in the oxic zone that will acidify

(e.g. highly carbonaceous material). This will occur first at the top of the (oxic) unsaturated zone where acidification takes place. In the hot-spot material the pH range was given as pH 3 – 5;

- In *neutral pit water* aluminium and iron will mostly be present at concentrations of below 2 mg/ℓ. Manganese may reach higher concentrations because there is some siderite in the rock that contain manganese in trace amounts and manganese may be persistently present at even neutral conditions;
- After acidification, seepage will have aluminium, iron and manganese concentrations that may reach concentration above 10 mg/ℓ and even up to 500 mg/ℓ. This is typical concentrations also measured in acid mine drainage at other mine sites. The reason that these concentrations are so high under acidic conditions is because not enough basic cations (like calcium and magnesium) are present. Over the long-term aluminium will become dominant as it is released from the silicate mineralogy;
- In acidic drainage, pH 3 - 5; the concentration of trace metals like cobalt and nickel will also become elevated (0.1 - 2 mg/ℓ);
- Metal concentrations under acidic conditions can, however, be expected to be very erratic and will change significantly between each monitoring run;
    - During the first stage, pyrite oxidation takes place but enough carbonate minerals are available to neutralise the acid generated. This results in gypsum precipitation as enough calcium is available. Gypsum will precipitate in favour of Al-Fe-sulphates. Metals are generally not elevated during this phase as the pH remain near neutral. The sulfate is generally below 2 500 mg/ℓ because of the gypsum precipitation if enough calcium is available. However, higher sulfate concentrations may be reached if other cations dominate calcium.
    - During the second stage, pyrite oxidation takes place but carbonate minerals have become depleted. Gypsum does not precipitate anymore as no calcium is generated (from carbonates anymore) and gypsum rather starts to dissolve contributing to the sulfate in solution. Acidic conditions are reached and the sulfate reaches a maximum concentration well above 2 500 mg/ℓ. Aluminium and iron become major cations and Al-Fe-sulphates starts to precipitate;
    - During the third stage, pyrite is depleted in the upper oxidation zone but may still be present deeper in the rock pile. Gypsum is also depleted and sulfate concentrations decreases. Metal concentrations also starts to decrease resulting in a change in the secondary Al-Fe-sulphates. Conditions remain acidic as silicate minerals are usually not able to neutralise the long-term acidity.
    - It is important to notice that all three stages may eventually be present at a mine as different parts of the dump/mine are subjected to different degrees of oxidation. The upper oxic zone of a dump will reach Stage 3 quicker while deeper saturated parts will remain as stage 1 or AMD generation may stop altogether;
- In the backfilled pit AMD Stage 1 will be present for the first 10 - 25 years after closure. Thereafter Stage 2 (acidification) will commence in certain parts of the backfill situated in the oxic part of the unsaturated zone. The maximum sulphate concentration will be reached about 50 - 75 years after closure where after the sulphate may slightly decrease.

1.4.3.5. A detailed and comprehensive geochemistry assessment was conducted by Golder Associates in early 2018 for the entire Wolvekrans Colliery.

A detailed and comprehensive geochemistry assessment was conducted by Golder Associates in early 2018 for the entire Wolvekrans Colliery.

The results of the study relevant to the VDDC Project are summarised as follows:

Characteristics of Spoils, Coarse Discard, Slurry and Coal

- Mineralogy results indicated that pyrite and carbonates were heterogeneously distributed in spoils, coal slurry and discard materials, and Siderite was the most ubiquitous carbonate in spoils and calcite was widespread in the coal materials.
- The sulphide content was generally low (<0.3%) for spoils, variable for slurry (0.07-0.71%) and high for coarse discard (0.32-3.0%) and coal (0.20-4.8%).
- Acid generation potential of spoils was variable: the spoils are expected to produce near-neutral to saline acid rock drainage in the short term, and metalliferous acid rock drainage in the long term as confirmed by kinetic tests, which indicated that the neutralisation potential will be depleted before sulphides.
- The discard materials are likely to produce near-neutral drainage with low metal content in the short term to acid rock drainage with low to high metal content in the long term as confirmed by both static and kinetic tests.
- The slurry had uncertain to acid generating potential and the drainage is likely to be near-neutral to acid rock drainage with low metal content in the short and long term.
- The coal had low to acid generating potential and the drainage is expected to be near-neutral mine drainage with low metals in the short term.
- Discard from PSS dump and LAC dump and slurry materials from PSS dump are assessed as Type 3 waste.
- Coal samples collected from Steenkoolspruit pit and spoils from SKS main pit are not Type 4 wastes as at least one parameter exceed TCT0, but it does not meet the definition of Type 3 waste due to low risk from leachate.
- Discard is classified as hazardous, while spoils, slurry and coal were classified as non-hazardous in terms of SANS10234.
- The main environmental risks from spoils materials and pit water are saline to acid rock drainage with elevated levels of TDS, EC, sulphate, fluoride, calcium, magnesium, sodium, aluminium, iron, manganese and cobalt.
- The main environmental risk from discard and slurry materials in acid rock drainage with elevated levels of TDS, EC, sulphate, calcium, manganese, aluminium, iron, copper, cobalt and selenium.

Risk Profile of Pits and Residue Facilities

- The following relevant sections were modelled as having pits with moderate to high AMD risk:
    - Wolvekrans – some of the pits in this section have acidic outflow;
    - Vandyksdrift;
    - Steenkoolspruit, although circum-neutral seepage with high TDS has been modelled from spoils kinetics.

- The acid rock drainage from pits exceeded DWAF water quality guidelines and the DWS 2016 Water Quality Planning Limits (WQPL) for pH, TDS, EC, sulphate, fluoride, aluminium, calcium, cobalt, copper, iron, magnesium, manganese, nickel and zinc, while the saline drainage from pits exceeded guidelines and WQPL for TDS, EC, sulphate, fluoride, nitrate, boron, cadmium, cobalt, magnesium, manganese, molybdenum, sodium and sodium adsorption ratio (SAR).
- Coarse discard has acid rock drainage risk:
    - LAC Discard Dump: kinetic modelling predicted acidic drainage in the short-term (pH 4-5) and long-term (pH 5-6), with extremely high sulphate levels in the short-term (5 000 – 10 000 mg/ℓ) dropping to high levels in the long-term (2 000 – 2 500 mg/ℓ); and
    - Wolvekrans Discard Dump west of the Olifants river: the stream draining this dump is acidic (pH 3-4) and has high sulphate levels (2 000 – 3 000 mg/ℓ), despite the dump being rehabilitated and revegetated.
- Slurry has a moderate acid rock drainage risk (Golder Associates, 2018).

1.4.3.6. Geochemical impact prediction: coal slurry in underground workings

The previous studies outlined above considered discard, coal slurry from surface sources, as well as coal and overburden from the SKS operations. These were regarded as sufficient to obtain an understanding of the geochemical characteristics of the material at the VDDC operations. Apart from the geochemical interpretation of the results based on the tests conducted, a SANS 10234 classification was also done by Golder Associates of the coal, surface slurry, discard and overburden and a GNR 635 waste assessment to determine the barrier systems required for the coal, coal slurry discard and overburden material.

The only mine residue not characterised previously, was the slurry stored in the underground workings. A study was therefore undertaken in 2019 by J&W.

The objectives of the study were as follows:

- Conduct a geochemical assessment of the fine coal slurry;
- Conduct a SANS 10234 classification of the fine coal slurry as required in terms of GNR 634;
- Develop a Safety Data Sheet (SDS) for the fine coal slurry based on the SANS 10234 classification results;
- Conduct a waste assessment for stockpile and disposal purposes as required in GNR 635.

Details of the ABA are summarised below. Please refer to section 5.2.3.1 of Part A for detail on the SANS 1023 Classification and waste assessment in terms of GNR 635 for the coal slurry.

The results from the X-ray powder diffraction (XRD) analysis of the fine coal showed that the major minerals in the fine coal sample in descending order are kaolinite, quartz, muscovite, microcline, goethite and dolomite. The amorphous (graphite) percentage in the sample was 54.45%. It is noted the XRD results did not indicate any pyrite (FeS) or siderite ($FeCO_3$), which can result in the generation of AMD.

Based on the information obtained, the coal slurry has concentrations of arsenic, barium, iron, molybdenum and zinc which are elevated above the average Alloway Crustal Abundance concentrations of the particular elements, which is simply an indication of the

average abundance of an element in the earth's crust. By calculating the ratio of the elemental concentrations to the average composition of the earth's crust (Crustal abundances) an indication can be obtained whether the concentration of a particular element is raised above the average crustal abundance due to natural processes.

The coal slurry sample was subjected to ABA and Net Acid Generation (NAG) potential testing. Two assessments methods were used, namely the MEND and the AMIRA method (please refer to the report attached in **Appendix 11.2**) for details on the methodologies). The results are summarised in **Table 1-1**.

The Neutralising Potential Ratio results of the coal slurry is below one, the NAG Potential is positive at NAG pH below 7.0 and the sample is therefore classified as Potentially Acid Generating (PAG) according to both the AMIRA and MEND systems (J&W, 2019d).

Table 1-1: Acid generation potential results of coal slurry from underground workings (J&W, 2019d)

Parameter	VDDC coal slurry
Paste pH	Not determined
Total Sulphur (%)	0.50
Sulphate sulphur	0.43
Sulphide sulphur	0.07
AMIRA method	
Acid Potential (AP) (kg/t)	16
Neutralization Potential (NP)	12
Nett Neutralization Potential (NNP)	-3.64
Neutralising Potential Ratio (NP/AP)	0.766
MEND method	
pH 4.5	
NAG pH	6.2
Nett Acid Producing Potential (kg H_2SO_4/t) TS	<0.01
pH 7	
NAG pH	6.2
Nett Acid Producing Potential (kg H_2SO_4/t) TS	0.02
AMD Assessment	
MEND - Based on total sulphur	Potentially Acid Generating
AMIRA - Based on total sulphur	Potentially Acid Generating
Overall	Potentially Acid Generating

1.4.4 Steps taken to investigate, assess, and evaluate the impact of AMD

A detailed geochemical assessment of the potential pollution sources has been done as outlined in **Section 1.4.3** above.

The outcome of the geochemical assessments was used in the groundwater flow and transport model to predict the impact on the groundwater resources during the operational phase, as well as post mining. Details of the outcome of this assessment are provided in section sulphate 18.5 of Part A, and the key findings with regard to AMD are as follows:

- After mining has ceased, dewatering of the mining area will cease, and it will be allowed to flood. The groundwater regime will return to a state of equilibrium;
- The rise in groundwater level is predicted to be relatively quick and the water levels are expected to recover in about 2 – 5 years. The quick recovery is ascribed to the elevated hydraulic conductivity of the surrounding bedrock due to historic mining activities as well as connections to surrounding defunct underground and opencast mines;
- Once the normal groundwater flow conditions have been re-instated, polluted water could potentially migrate away from the mining area. As some discards and exposed reactive mineral surfaces will remain in the mine, this outflow could be contaminated as a result of mine drainage. Sulphate is normally a significant solute in drainage from mines, and therefore the concentration from the mine has been modelled as a conservative (non-reacting) indicator pollution associated with mining. A starting concentration of 3 000 mg/ℓ has been assumed as a worst-case scenario based on the J&W report of 2016. However, geological material is a transient contaminant source and decreases in the concentration of released contaminants are expected over time. A 1% decrease in contaminant concentrations in the mine was incorporated into the transport modelling. This relates to sulphide mineral oxidation and dilution effects depleting the source of sulphate;
- An increase in sulphate concentration of 200 – 1 000 mg/ℓ is expected within the aquifer;
- The predicted decant areas are shown in **Figure 18-7** in **Part A**. Please note that predicted discharge areas may vary from exact discharge areas due to sub-surface heterogeneity, however the general areas of predicted discharge should be consistent. The calculated subsurface mine water movement resulting in decant will move through the south-eastern edge of the backfilled pit of VDDC. The calculated sub-surface decant elevation is approximately 1 530 mamsl with a discharge volume of approximately 0.5 ℓ/s. The water level in the backfilled pit should be maintained approximately 5 m below the sub-surface discharge elevation as a safe management level. Please note that this decant rate and elevation is based on a model that incorporates an intact geological barrier between the VDDC opencast and the SKS and Glencore backfilled pits to the west. Should this not be the case, the decant location, rate and elevation is expected to be different.

1.4.5 Engineering or mine design solutions to be implemented to avoid or remedy AMD

AMD can be dealt with as follows;

- Cover and capping design for the final rejects dump to reduce water and oxygen reactions;
- Use overburden backfill in open pits;

- Neutralisation (e.g. lime) and treatment (stimulation of sulphate reducing bacteria).

Barrier system for Eastern overburden dump

Previous assessments of the overburden at the SKS operation in terms of GNR 635, showed that overburden is a Type 3 waste and therefore a Class C barrier system will be applicable. However, the requirement to conduct a waste assessment for mine residue facilities has been removed from the regulations related to the planning and management of residue stockpiles and replaced with a risk-based approach whereby resource-pathway-receptor modelling can be conducted to determine the barrier requirements for these facilities. An assessment was done by Jacana Environmentals and a Class D barrier design was recommended for the Eastern Overburden Dump (refer to the Memorandum attached in **Appendix 11.3**). The environmental risk associated with drainage from the spoils is similar to that of a Type 4 waste due to low concentrations of leachable constituents (Jacana, 2019).

Base preparation of the dump will therefore comprise of a Class D barrier system, comprising:

- 300 mm topsoil strip to stockpile.
- Rip and recompact to a depth of 300 mm (or base preparation layer layer).
- Finishing, topsoiling and grassing of constructed embankments and disturbed area (Worley, 2019).

Perimeter pollution control drains will be constructed on all downstream slopes which are designed to retain all runoff and transported silt from the dumps. Runoff from this facility will be diverted to silt traps and then to an existing borehole which will convey water into the underground workings. This will allow the water to be temporarily stored until it can be pumped via the mine dewatering system to the Vleishaft PCD.

Material stockpiled on the Eastern overburden dump will be used in the rehabilitation of the opencast pit. The potential pollution source will therefore be removed and the footprint area rehabilitated.

Barrier system for Mixed ROM coal and slurry stockpiles

An assessment of the slurry stored in the underground workings by J&W in 2019 in terms of GNR 635 indicated that the slurry is a Type 3 waste and therefore storage facilities are to be equipped with a Class C barrier system. However, the requirement to conduct a waste assessment for mine residue facilities has been removed from the regulations related to the planning and management of residue stockpiles and replaced with a risk-based approach whereby resource-pathway-receptor modelling can be conducted to determine the barrier requirements for these facilities. An assessment was done by Jacana Environmentals and a Class D barrier design was recommended for the Mixed ROM coal and slurry stockpile areas (refer to the Memorandum attached in **Appendix 11.3)**.

Base preparation of the stockpile areas will therefore comprise of the following:

- 300 mm topsoil strip;
- Rip and recompact 200 mm in situ material to 93% MOD AASHTO[1];

[1] Modified American Association of State Highway and Transportation Officials. Relates to the moisture-density relationship of material when prepared and compacted

- Fills in 500 mm thick layers from dump rock stockpile, compacted to rock compaction specifications;
- 1 000 mm base layer compacted in 500 mm layers to rock compaction specifications.
- 200 mm wearing course layer of G7 and stabilised with chemical stabiliser (Worley, 2019).

The stockpile terraces include concrete lined perimeter drains that convey polluted water runoff to a silt trap and then to the Vleishaft PCD.

The Primary Mixed ROM Coal and slurry stockpile area will be mined out.

Material from the Secondary Mixed ROM coal and slurry stockpile area will be removed to the processing plant and the footprint rehabilitated. The source will therefore be removed.

Management of water levels to prevent/limit decant

A groundwater flow and transport was developed to predict the expected decant as described in section 1.4.4. The calculated subsurface mine water movement resulting in decant will move through the south-eastern edge of the backfilled pit of VDDC. The calculated sub-surface decant elevation is approximately 1 530 mamsl with a discharge volume of approximately 0.5 ℓ/s. The following will be implemented:

- All sulphide containing waste material will be stored at the bottom of the opencast pit and flooded as soon as possible to exclude oxygen. However, flooding should be monitored to ensure the pit is flooded as quickly as possible and to control potential decant;
- Backfilled material will be compacted and surface water flow will be routed around the backfilled opencast mine to reduce recharge to a maximal extent;
- Efforts will be made to ensure the final layer (just below the topsoil cover) is as clayey as possible and compacted if feasible, to reduce recharge to the opencast area;
- The numerical and geochemical model will be updated and calibrated every five (5) years against monitored data during operations. Model calibration will include confirmation of the status of the geological barrier between the VDDC opencast and the SKS and Glencore backfilled pits to the west;
- The water level in the pit should be maintained approximately 5 m below the sub-surface discharge elevation as a safe management level. Alternatively, an interception trench can be constructed to capture contaminated subsurface seepage for storage in a lined PCD for evaporation or treatment;
- A water management strategy, including a decant management plan will be developed at least five (5) years prior to closure which may include passive or active treatment options;
- Options for treatment of polluted groundwater post-closure include:
  - Integrate capture store-release systems;
  - Utilise evapotranspiration;
  - Wetland filtration.

1.4.6 Measures that will be put in place to remedy any residual or cumulative impact that may result from AMD

Refer to **section 1.4.5** above, as well as mitigation measures listed in **section 18** of **Part A**.

1.4.7 Volumes and rate of water use required for the mining, trenching or bulk sampling operation

1.4.7.1. Construction phase

During the construction phase, it is estimated that a peak number of 250 construction personnel would work on the site. Assuming 10 ℓ per person per day, the potable water demand is 2.5 kℓ per day. Further to this, allowance has been made for concrete mixing at a peak of 25 kℓ per day. Potable water for the construction phase is to be taken from the existing potable water supply systems at SKS.

In addition, water for the compaction of earthworks materials, to ensure that optimum compaction is achieved, is estimate at approximately 80 kℓ/day. Non-potable water for earthworks will be sourced from the SKS water bowser filling point (Worley, 2019).

1.4.7.2. Operational phase

The water consumption requirements for the VDDC mining project is as follows:

- Potable water for human consumption, or use in restrooms will be supplied from the existing potable water supply at the SKS complex;
- Wash water for wash-down, either of vehicles, workshops or conveyor bunds. The water make from the upfront No. 2 Seam dewatering makes this a water positive operation. Therefore, the required volumes of process water and service water are adequately catered for;
- Water for dust suppression on bulk materials handling systems which will be sourced from mine impacted water, i.e. the Vleishaft PCD. The estimated volume required from the Vleishaft PCD for this purpose is 2 400 m³/day;
- Water for dust suppression on haul roads which will be sourced from mine impacted water;
- Fire water supplies are required at the new workshops at the SKS complex and will be taken from the existing fire water network.

1.4.8 Has a water use licence has been applied for?

An IWULA will be submitted to the DWS (report number reference JW219/19/G535-012). The water uses applied for are summarised in **Table 1-2**.

Table 1-2: Water uses included in IWULA for VDDC mining and infrastructure development project (J&W, 2019g)

Description of water use	Property
S21(c) Impeding or diverting the flow of water in a watercourse and/or S21(i) altering the bed, banks, course or characteristics of a watercourse	
Infrastructure area 1: Develop infrastructure within 500 m of a watercourse: Modular WTP and portion of overburden dump on SKS void	Ptn 2 of Steenkoolspruit 18 IS Ptn 4 of Kleinkopje 15 IS
Infrastructure area 2: Develop infrastructure within 500 m of a watercourse: Portion of overburden dump on SKS void	Ptn 2 of Steenkoolspruit 18 IS
Infrastructure area 3: Develop infrastructure within 500 m of a watercourse: Infrastructure within servitude, including haul road, service road, stormwater drains and berms and clean water pipeline	Ptn 2 of Steenkoolspruit 18 IS RE/3 of Vandyksdrift 19 IS
Infrastructure area 4: Develop infrastructure within a watercourse and within 500 m of watercourse: portion of VDDC boxcut, portion of dragline spoils, mixed ROM coal and slurry stockpile areas, portion of topsoil dump, proposed hard park, contractors laydown area, overburden dump as well as infrastructure within servitude (haul road, stormwater drains and berms).	Ptn 2 of Steenkoolspruit 18 IS RE/3 of Vandyksdrift 19 IS
Opencast mining extension	RE/3 of Vandyksdrift 19 IS
Explosives magazine	RE of Wolvekrans 17 IS
Discharge of treated water from modular WTP: new section of pipeline within 500 m of watercourse	Ptn 6 of Wolvekrans 17 IS
S21(f): Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit	
Discharge of water from modular WTP into seepage wetland via existing northern canal	Ptn 6 of Wolvekrans 17 IS
Section 21(g): Disposal of waste in a manner that could detrimentally impact on a water course	
Dust suppression with mine impacted water	RE/3 of Vandyksdrift 19 IS Ptn 2 of Steenkoolspruit 18 IS Ptn 4 of Kleinkopje 15 IS
Eastern Overburden dump (with silt trap)	RE/3 of Vandyksdrift 19 IS Ptn 9 of Vandyksdrift 19 IS

Description of water use	Property
Overburden dump on SKS void	Ptn 2 of Steenkoolspruit 18 IS Ptn 4 of Kleinkopje 15 IS
Dragline spoils dump 1	Ptn 2 of Steenkoolspruit 18 IS
Dragline spoils dump 2	Ptn 2 of Steenkoolspruit 18 IS
Dragline spoils dump 3	Ptn 2 of Steenkoolspruit 18 IS RE/3 of Vandyksdrift 19 IS
Dragline spoils dump 4	RE/3 of Vandyksdrift 19 IS
Secondary Mixed ROM coal and slurry stockpile area with silt trap (south of Vleishaft PCD)	Ptn 2 of Steenkoolspruit 18 IS
Primary Mixed ROM coal and slurry stockpile area with silt trap (next to ramps)	Ptn 2 of Steenkoolspruit 18 IS
4 Seam ROM stockpile	RE/3 of Vandyksdrift 19 IS
5 Seam ROM stockpile	RE/3 of Vandyksdrift 19 IS
4 Seam ROM stockpile	RE/3 of Vandyksdrift 19 IS
Section 21(j): Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people	
Dewatering of pit as mining proceeds	RE/3 of Vandyksdrift 19 IS Ptn 10 of Vandyksdrift 19 IS Ptn 2 of Steenkoolspruit 18 IS

1.4.9 Impacts to be mitigated in their respective phases

Refer to the impact assessment summarised in **section 18** of **Part A**, summarised per project phase in **Tables 18-6** to **Table 18-8**. The detailed assessment (with ratings) is attached as **Appendix 9**.

1.5 Impact Management Outcomes

(A description of impact management outcomes, identifying the standard of impact management required for the aspects contemplated

Refer to the impact assessment summarised in **section 18** of **Part A**, summarised per project phase in **Tables 18-6** to **Table 18-8**. The proposed mitigation measures are provided, and the expected impact class post mitigation is also provided.

The timeframe for implementation of the proposed measures, the standards to be achieved and the proposed indicators are indicated in **Table 1-3** to Table 1-5 below.

1.6 Impact management actions

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

The timeframe for implementation of the proposed measures, the standards to be achieved and the proposed indicators are indicated in **Table 1-3** to **Table 1-5** below.

Table 1-3: Impacts to be mitigated, impact management outcome and standards to be achieved: Construction phase

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Wetlands							
Loss of wetland ecosystem services, or degradation of these services. A considerable cumulative impact considering the extent of mining and development in the area, and the already lost wetland areas and associated services.	1.1	Use of existing access routes where possible. Minimising the disturbance footprint area, and the duration of the construction phase	Control by limiting disturbed area	Throughout	Contractor & ECO		Wetland PES and EIS does not deteriorate compared to baseline conditions[2] for wetlands that are not authorised to be mined
	1.2	Demarcate footprint areas to be cleared to avoid unnecessary vegetation clearing. Exposed areas must be ripped and vegetated to increase surface roughness		Prior to construction	Contractor & ECO		
	1.3	Strip and stockpile topsoil and subsoil separately	Stop by following correct procedures	During construction	Contractor & ECO		
	1.4	Implement dust suppression such as wetting of roads	Control by limiting dust generation	Throughout	Contractor & ECO		
	1.5	Adhere to mine driving rules to limit speed and therefore the generation of dust. Vehicles must be in good working order.	Control by training		Contractor		
The exposed soils are susceptible to erosion due to wind and runoff, resulting in sedimentation of downstream wetlands. Stockpiles and dumps are also susceptible to erosion.	1.6	Separate clean and dirty water. Clean water must be diverted and directed around working areas, and measures implemented to manage the discharge and avoid scouring and erosion. Compile a suitable stormwater management plan, which must be implemented from the onset of the project and continued for the life of the project. Create energy dissipation at discharge areas to prevent scouring.	Stop and control by implementing Stormwater Management Plan	Throughout	Contractor & ECO		
	1.7	All personnel and contractors must undergo Environmental Awareness Training. A signed register of attendance must be kept as proof	Stop by training	Once-off prior to construction	ECO		
Flora & Fauna							
Destruction and fragmentation of the vegetation community (including portions of an Endangered vegetation type (Eastern Highveld Grassland), a Vulnerable ecosystem type, corridors and areas classified as ESAs (wetlands)).	1.8	Demarcate areas to be developed so that only these areas are disturbed and to prevent movement of construction personnel and vehicles into sensitive surrounding environments	Control by limiting disturbed area	Prior to construction	Contractor & ECO	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	The encroachment of alien invasive species decreases compared to baseline conditions.
	1.9	Demarcate and declare sensitive areas outside of the project area as no-go area and restrict access to this area as far as possible. This should be implemented with the					

[2] "Baseline conditions" refer to the baseline condition as described in the specialist studies and EIAR at the time of the assessments in support of this application (not the pre-mining baseline conditions)

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
		exception of those mining areas in which authorisation for mining has already been granted				Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)	Successful implementation of rescue and relocation plan.
	(1.1)	Where possible, existing access routes and walking paths must be used and the development of new routes limited		Throughout			
	1.10	All laydown and storage areas should be restricted to within the project area					
	1.11	A qualified ECO must be on site when construction begins to identify species (specifically SCCs) that will be directly disturbed and to relocate flora that is found during construction.	Stop by relocating SCCs	Prior to construction	Contractor & ECO		
	1.12	Areas that are denuded during construction and where no future mining will occur, need to be re-vegetated with indigenous vegetation. This will also reduce the likelihood of encroachment by alien invasive plant species;	Remedy by revegetating	Post construction	Contractor & ECO		
	1.13	Compile and implement an alien vegetation management plan for the entire site. The use of herbicide needs to be monitored and only be used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded	Control by alien invasive vegetation management	Prior to construction	Contractor & ECO		
	1.14	Implement appropriate fire breaks to restrict the impact fire might have on the endangered vegetation.	Control with procedures	During construction			
Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust and vibration), destruction of corridors and/or direct mortalities.	1.15	During vegetation clearance, methods should be employed to minimise potential harm to faunal species. Clearing must take place in a phased manner and to maximise the potential for mobile species to move to adjacent areas.	Control with procedures & training	During site establishment	Contractor & ECO	National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations Mpumalanga Bio diversity Sector Plan (MBSP) Mpumalanga Nature Conservation	Successful implementation of rescue and relocation plan.
	1.16	Prior and during site clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery		Prior & during site establishment	Contractor & ECO		
	1.17	Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site	Control and stop through proper waste management	Throughout			
	1.18	Maintain mine driving rules to restrict speed. Lights must be turned on in all vehicles (day and night)	Stop and control with procedures & training		Contractor & ECO		
	1.19	Drivers must attend driver awareness training to prevent the unnecessary road killing of animals					

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	1.20	No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals				Act, 1998 (Act No. 10 of 1998)	
	1.21	Noise and vibrations must be kept to a minimum to reduce the impact of the development on the fauna residing on the site					
	1.22	Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered					
	1.23	Wherever possible, corridor areas (which links the CBA, ONA and ESAs to the north of the project areas) must be maintained to facilitate the movement of wildlife within and between any natural areas and wetlands	Control with maintenance				
	(1.34 & 1.35)	All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas	Control and stop with proper maintenance		Contractor		
	1.25	Two SCCs were observed on the project area: Serval (*Leptailurus serval*) and Cape Clawless Otter (*Aonyx capensis*). Implement an ad hoc monitoring programme to record sightings and to track their breeding success and distribution.	Control with monitoring	As required	ECO, Environmental Specialist		
Soils, Land Capability and Land Use							
Clearing of soil will result in loss of land capability. Vehicle movement will result in compaction of soils. Soil contamination by hydrocarbons.	1.26	Excavated soils should be stockpiled	Control and stop with proper maintenance	During construction	Contractor	Rehabilitation, Decommissioning and Closure Plan. National Norms and Standards for the remediation of contamination land and soil quality in the RSA (GN467 of 2013).	Topsoil is preserved for future use in rehabilitation. Stormwater runoff does not contain a significant increase in sediment as a result of topsoil stockpile erosion.
	1.27	Stockpiles are to be clearly demarcated on site layout plans. Also indicate the material in each stockpile to ensure that topsoil and spoils are not mixed					
	1.28	Soil stockpiles are to be maintained in a fertile, vegetated, and erosion free state. If this can't be achieved due to design of stockpiles, then financial provision must be made to reinstate soil chemistry (fertiliser, lime, organic material) and physical structure (placement of topsoil, no compaction) and the associated specialist studies to inform these measures prior to the start of rehabilitation	Control and remedy with maintenance	Throughout prior to rehabilitation	Contractor, HSE Lead		
	1.29	Ensure proper storm water management measures are in place at stockpiles.	Stop and control by implementing Stormwater Management Plan		Project Engineer		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	1.30	Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles.	Stop and control with restrictions & training		Contractor		
	1.31	Stockpiled soil to be reserved for rehabilitation purposes only.					
	1.32	If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place	Control with erosion correction measures	Throughout	Project Engineer Contractor		
	1.33	Prevent any spills from occurring. If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities as required	Control and remedy with maintenance		Contractor		
	1.34	All vehicles are to be serviced in designated areas	Control and stop with proper maintenance		Contractor		
	1.35	Leaking vehicles, equipment and machinery should have drip trays placed under them where the leak is occurring and be repaired as soon as possible or removed from site. A maintenance log must be kept.			Contractor		
Heritage							
Damage to the historical structures identified (i.e. Douglas Pump Station, SAR Pump Station, and Vandyksdrift Railway) due to construction activities.	1.36	Chance-find procedures (refer to Appendix A) must be implemented. If any employee finds any heritage resources during any developmental activity, all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site.	Stop and control with procedures & training	Throughout	HSE Lead	National Heritage Resources Act, 1999 (Act No. 25 of 1999) Regulations relating to the management of human remains (GNR363 of 2013)	The condition of the existing historical structures does not deteriorate as a result of construction activities compared to baseline conditions.
Damage to the graves due to construction activities	1.37	GY02 will not be impacted as a result of the infrastructure development but must be exhumed and relocated before opencast mining is done in the area.	Stop by relocating	Prior to construction	HSE Lead		Graves are not damaged, or its status deteriorated compared to baseline conditions.
	1.38	For GY01: Demarcate the graveyard with a fence or wall and fit with an access gate. Relatives of the deceased must be located by means of social consultation and to obtain permission for fencing or walling the cemetery	Control with demarcation				
	1.39	For GY01: Regulated visitor hours must be implemented that is compatible with safety rules. This will not be necessary if the graveyard is located next to a public or national road which can provide direct access to the graveyard.	Control with procedures	Throughout	Mine Stakeholder liaison officer		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	1.40	For GY01: Corridors of at least 100m should be maintained between the graveyard's border fences and any developmental components such as roads or other infrastructure that may be developed in the future. This buffer zone must be maintained at all times.	Control and stop with proper maintenance		HSE Lead		
	1.41	For GY01: The graveyard should be inspected every three months and noted in an inspection register. The register should outline the state of the graveyard during each inspection. Reports on damages to any of the graves or to the graveyards (fences, walls, gates) should be followed with the necessary maintenance work. Maintenance work should be recorded in the inspection register	Control with maintenance & monitoring	Every three months			
	1.42	The graveyards should be kept tidy from any invader weeds and any other refuse		As required			
Palaeontology							
Loss of fossils and other palaeontological significant artefacts	1.43	It is very unlikely that any fossils would be impacted upon by the excavations for the proposed infrastructure since the fossils would occur in the shales associated with the coal seams at greater depth. No mitigation required.					
Groundwater							
Hydrocarbon spillages may seep into the underlying aquifer systems and result in the contamination of groundwater	(1.35)	Avoid soil contamination by hydrocarbons or concrete-containing water. Supply vehicles, machinery and equipment with drip trays when leaking	Control and stop with proper maintenance	Throughout	Contractor & ECO	RQOs for the Olifants River Catchment	No major spills, leaks or contamination takes place during construction.
	(1.35)	Equipment, machinery, and vehicles must be repaired immediately or removed from site if it is leaking. A maintenance log must be kept.					
	1.44	Hazardous material to be stored in appropriate waste skips	Stop with proper storage				
	1.45	Contaminated soil must be removed and disposed of at a licenced facility.	Remedy with removal				
Surface water							
Pollution of rivers/streams due to discharge of contaminated water as a result of erosion of soils during rainfall	1.46	Minimise the disturbed footprint area as far as possible.	Control by limiting disturbed area	Throughout	Contractor & ECO	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality
	(1.9)	Delineate "No-go" zones where the construction plant and personnel are in close proximity to the Olifants River	Control and stop by demarcation	Prior to construction			

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
events, as well as hydrocarbon spillages from machinery, vehicles and equipment.	1.47	Spill-sorb or a similar product will be kept on site, and used to clean up hydrocarbon spills in the event that they should occur	Control and remedy with maintenance	Throughout	Contractor		as a result of construction activities compared to baseline conditions/ RQOs
	1.48	The construction area will largely be within the existing dirty water management area of the mine. Manage storm water in terms of the existing storm water management system	Stop and control by implementing Stormwater Management Plan	During construction	Contractor		
	1.49	Construct surface water management infrastructure, such as storm water canals and silt traps first at the Eastern overburden stockpiles and dirty water management infrastructure area, to ensure that contaminated runoff and dirty water spills are contained.					
	(1.34 & 1.35)	Servicing of construction vehicles may take place only in dedicated areas that are equipped with drip trays.	Control and stop with proper vehicle maintenance	Throughout	Contractor r		
	(1.35)	Repair leaking equipment immediately or remove from site to facilitate repair.					
	(1.44)	Bunded containment and settlement facilities will be provided for hazardous materials, such as fuel and oil.	Stop with proper storage		Contractor		
	(1.45)	Remove all contaminated soil and place in appropriate containers. Contaminated soil may only be disposed of in a licenced facility;	Remedy with removal				
	(1.32)	Implement appropriate erosion protection measures at steep areas and soil stockpiles.	Control with erosion measures		Contractor		
	1.50	Develop and implement a waste management plan for the construction phase.	Control with proper waste management	Prior to construction	Contractor & ECO		
	1.51	Appropriate sewage management will be implemented during the construction phase that would tie into the existing sewage management strategy at Wolvekrans Colliery, i.e. portable chemical toilets which are regularly serviced.		During construction			
	1.52	Continue with existing water quality monitoring up- and downstream of the construction areas, before and during construction where practical, in order to detect any increase in suspended solids or turbidity.	Control with monitoring	Prior to and during construction	HSE Lead		
Spills and leaks from machinery, equipment and vehicles entering wetlands and impact on water quality within these systems. The storage and mixing of substances on site also pose a risk to wetlands.	1.53	Divert clean upslope runoff around the development footprint. The clean water diversion is to be constructed first, before establishment of the boxcut.	Stop and control by implementing Stormwater Management Plan	During construction	Contractor & Project Engineer		
	1.54	Review water management around the construction areas if erosion is evident, or if the water quality monitoring indicates an increase in suspended solids.	Control with maintenance & monitoring		Project Engineer & Contractor		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	(1.4 & 1.5)	Implement dust suppression measures and adhere to mine driving rules to prevent excessive dust generation;	Control by limiting dust generation & training		Contractor		
Reduction in catchment yield as a result of containment of contaminated runoff water emanating from the site, with no release to the catchment. Change in surface flow characteristics.	(1.46)	Minimise the aerial extent of disturbed areas and potentially contaminated areas as far as possible.	Control by limiting disturbed area	Throughout	Contractor		Dirty water management areas are limited to the areas approved and do not exceed the calculated decrease in catchment yield.
	1.55	Minimise areas where dirty construction activities are carried out (e.g. servicing areas and workshops, fuel storage areas, waste storage areas) and ensure appropriate bunding of these areas.		During construction			
	1.56	Divert upslope runoff around the construction activities to minimise the volume of dirty water generated and contained.	Stop and control by implementing Stormwater Management Plan		Project Engineer		
	1.57	Pump surplus dirty water to existing mechanical evaporators for disposal or re-use on the mine in terms of existing authorisations.	Remedy with treatment				
Discharge of contaminated water into water resources as a result if erosion of spoil stockpiles during rainfall events, deposition of sediments in local watercourses, and an increase in sulphate and TDS from overburden stockpiles.	1.58	Direct runoff and seepage from the overburden dumps located in between the proposed ramps to Vleishaft PCD	Stop and control by implementing Stormwater Management Plan	During construction	Project Engineer	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of construction activities compared to baseline conditions / RQOs
	1.59	Direct runoff and seepage from the overburden dumps located at the SKS pit to the SKS void					
	1.60	Divert runoff and seepage from the Eastern overburden dump via a canal and berm system to silt traps and a set of boreholes which will take all runoff into the underground workings					
Pollution of surface water resources by deposition of sediments in the local watercourses and discharging mine-impacted water into the environment.	1.61	Contain water on site, at in-pit sumps and pumped from here to either Vleishaft PCD for reuse in the existing mining operations or to existing mechanical evaporators for disposal.	Stop and control by implementing Stormwater Management Plan	During construction	Project Engineer	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of construction activities compared to baseline conditions/ RQOs
	(1.6)	Implement surface water management measures, such as clean water diversion canals and berms to divert runoff from clean catchment away from mine workings.		Throughout			
	1.62	Comply with the conditions of the water use licence for the dewatering of the opencast pit.	Stop and control by complying with authorisations				

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Noise							
Increased noise levels	1.63	Keep all diesel-powered equipment and plant vehicles at a high level of maintenance. This should particularly include the regular inspection of and, if necessary, the replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.	Control and stop with proper maintenance	During construction	Contractor	IFC guidelines and SANS 10103	Indicators monitored. Noise levels below acceptable levels at sensitive receptors
	1.64	Continue selecting equipment with lower sound power levels. Vendors should be required to guarantee optimised equipment design noise levels.	Stop with effective equipment				
	1.65	In managing noise specifically related to truck and vehicle traffic, efforts should be directed at (i) Minimising individual vehicle engine, transmission, and body noise/vibration through the implementation of an equipment maintenance program; (ii) Maintain road surface regularly to avoid corrugations, potholes etc; (iii) Avoid unnecessary idling times.	Control and stop with procedures, training, and maintenance				
	1.66	Where possible, other non-routine noisy activities such as construction should be limited to day-time hours.					
	1.67	A complaints register must be kept.	Control by communicating with I&APs	Throughout	Mine Stakeholder Liaison Officer		
Visual							
Visual disturbance due to dust generated from construction activities, as well as views of the activities themselves	(1.2)	Only clear vegetation when and where necessary;	Control by limiting disturbed area	Prior to construction	Contractor	National Ambient Air Quality Standards (GN1210 of 2009)	Rehabilitation is done according to GNR 1147.
	1.68	Only remove topsoil when and where necessary.					
	(1.28)	Topsoil stockpiles should be vegetated where possible to lessen the visual intrusion.	Control and remedy by maintenance	Throughout prior to rehabilitation			
	1.69	Ensure that stockpiles are placed away from surface water and drainage lines, where possible.	Control and stop with planning and demarcation	Prior to construction			
	(1.32)	Monitor and fix any erosion in the landscape or on stockpiles;	Control with erosion measures	Throughout	Contractor ECO		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	1.70	If possible, rehabilitate dumps concurrently			Contractor & Project Engineer		
	1.71	Ensure that construction and operations are undertaken in line with GNR1147(as amended), or any other applicable legislation at the time of implementation.	Control by complying with closure plan	During construction and operation			
Air quality							
Increased particulate matter (PM_{10}) as a result of construction activities	1.72	Implement dust suppression (e.g. wetting or chemical suppression) at materials storage, handling and transfer operations, as well as spoils handling areas and earthmoving operations (continuous as required) where feasible	Control with dust suppression	During construction	Contractor	National Ambient Air Quality Standards (GN1210 of 2009) National Dust Control Regulations (GNR827 of 2013)	PM_{10} deposition does not exceed baseline conditions / limits prescribed in the National Ambient Air Quality Standards at sensitive receptors
	(1.4)	Implement dust suppression (e.g. wetting or chemical suppression) on unpaved roads	Control by limiting dust generation	Throughout			
Increased particulate matter ($PM_{2.5}$) as a result of construction activities	1.73	Restrict haul trucks to specified haul roads using the most direct route	Control with training & restrictions	Throughout	Contractor r		$PM_{2.5}$ deposition does not exceed baseline conditions/ limits prescribed in the National Ambient Air Quality Standards
	1.74	Reduce unnecessary traffic that can generate dust.					
	(1.5)	Implement strict on-site speed control according to the mine driving rules					
Increased dust generation as a result of construction activities	1.75	Reduce the extent of open area to minimise the time between clearing and construction of infrastructure	Control by limiting disturbed area	During construction			Dust deposition does not exceed the baseline conditions/ limits for non-residential areas in the National Dust Control Regulations
	1.76	Implement stabilisation such as chemical, rock cladding or vegetation of disturbed soils	Remedy with stabilisation				
	(1.12)	Re-vegetate areas that will not be mined in future	Remedy by revegetating	Post construction			
Social environment							
Employment opportunities, procurement and inflow of workers	1.77	Give preference to communities within close proximity to the mining activities if any new employment opportunities are created	Control by communicating with I&APs	When required	Contractor	Not applicable	Procurement and employment is done according to approved processes and structures
	1.78	Procurement and recruitment of individuals should be undertaken through formalised structures and according to processes that are in line with international best-practice standards	Control with procedures				

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	1.79	Procurement of goods, services, material and equipment should be focused on the local area where economically feasible					
	1.80	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration					
Inflow of jobseekers	1.81	The communication strategy with regards to the recruitment process and use of contractors to the local residents should ensure that unrealistic employment expectations are not created.	Control by communicating with I&APs	When required	Mine Stakeholder Liaison Officer	Not applicable	Employment is done according to approved processes and structures
	(1.77)	Maximise the use of local labour if required and where possible			Contractor		
	1.82	South32 should support efforts of the ELM to limit in-migration to the area and the subsequent development or extension of informal settlements in the area			Mine Stakeholder Liaison Officer		
	(1.80)	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration	Control with procedures		Contractor		
Impact on daily living and movement patterns	(1.5)	Strict adherence by contractors to mine driving rules should be enforced	Control by training	Throughout	Contractor	Not applicable	Strict implementation of HSE protocol/policy
	1.83	Disciplinary action for reckless driving within the mining area should be implemented	Control with procedures		SHE Manager		
Residential proximity	1.84	Adhere to mitigation measures proposed by specialists and relevant regulations to limit noise and dust pollution	Control through implementation of mitigation measures	Throughout	Contractor & ECO	Not applicable	Monitoring conducted and dust levels are below acceptable standards at sensitive receptors
	1.85	Heavy vehicles should be in good working order to limit any noise and dust pollution	Control and stop with proper maintenance		Contractor		
	(1.4)	Dust suppression methods should be strictly implemented	Control by limiting dust generation				
	1.86	Possible negative impacts on the surrounding landowners and nearby residents should be limited to minimise any possible negative impacts on these residents' quality of life.	Control by communicating with I&APs	When required	Mine Stakeholder Liaison Officer		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	1.87	Also refer to mitigation measures for impact for sense of place, safety and security risks, health risks, and noise related impacts.	Control through implementation of mitigation measures		Contractor & ECO	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	
Impact on Agricultural Activities	1.88	Effective management of the mining activities associated with the infrastructure development would be required to avoid any environmental pollution (e.g. water) and limiting any increase in dust levels.	Control through implementation of mitigation measures	Throughout	Contractor & ECO		No complaints from I&APs received.
Impact on Sense of Place	1.89	Undertake appropriate site management as stipulated by the specialist to limit the visual impact	Control through implementation of mitigation measures	Throughout	Contractor & ECO	Not applicable	No complaints from I&APs received.
Safety and Security Risks	1.90	Risks of accidents should be recognised. Safety training should continue and focus on the designated drivers (employees) of heavy vehicles. The mine driving rules should be adhered to.	Control and stop with procedures & training	During construction	SHE Manager	Occupational Health and Safety Act, 1993 (Act. No. 85 of 1993)	
	1.91	Strict codes of conduct should be implemented for personnel operating heavy and light vehicles to minimize traffic hazards within the mining area					
	1.92	Construction and upgrade of roads within the mining area should be done in a manner which would facilitate safe and efficient movement of material, employees, as well as other mining vehicles			Contractor		
	1.93	Maintain roads to ensure safety	Control and stop with maintenance	During construction and operation	Mine Manager		No incidents reported.
	1.94	Emergency procedures should be established that provide immediate response should an accident occur within the mining area	Stop with training & procedures	Throughout	SHE Manager		
	1.95	Appropriate firefighting equipment should be on site and construction workers, as well as permanent employees should be appropriately trained for fire fighting					
Health Risks	1.96	Gaseous emissions should be minimised through proper operation and maintenance of vehicles	Control with maintenance	During construction	Contractor	National Health Act, 2003 (Act No. 61 of 2003)	Monitoring conducted and dust levels are below acceptable
	(1.5)	Vehicles should be in a good working order and adhere to mine driving rules	Control by training		Contractor		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	(1.4)	Implement dust suppression measures	Control by limiting dust generation			Occupational Health and Safety Act, 1993 (Act. No. 85 of 1993)	standards at sensitive receptors.
	1.97	Fugitive dust emissions should be controlled through the implementation of appropriate mitigation measures e.g. ongoing rehabilitation	Control with concurrent rehabilitation		Contractor		
	1.98	Possible negative impacts on the surrounding landowners and nearby residents should be limited by ensuring that health risks are minimised and mitigation measures are implemented as stipulated in the Air Quality Impact Assessment and EMPr	Control through implementation of mitigation measures	Throughout	Contractor		
Noise Related Impacts	(1.84)	Mitigation measures to limit any increase in noise as recommended by the noise specialist should be adhered to.	Control through implementation of mitigation measures	Throughout	Contractor	National Ambient Air Quality Standards (GN1210 of 2009 National Dust Control Regulations (GNR827 of 2013)	No complaints from I&APs are received.
	(1.67)	A noise monitoring program should be implemented to ensure noise from activities and equipment meet or fall below noise guidelines Keep a complaint register.	Control by communicating with I&APs		Mine Stakeholder Liaison Officer		

Table 1-4: Impacts to be mitigated, impact management outcome and standards to be achieved: Operational phase

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Wetlands							
Further loss of wetland ecosystem services, or degradation of these services.	2.1	Separate clean and dirty water. Clean water must be diverted and directed around working areas and overburden dumps, and measures or structures created to manage the discharge to avoid scouring and erosion	Stop and control by implementing Stormwater Management Plan	Throughout	Mine Engineering & HSE Lead	RQOs for the Olifants River Catchment	Wetland PES and EIS does not deteriorate compared to baseline conditions for wetlands that are not authorised to be mined
	2.2	Ablution facilities must be provided for all staff and maintained for proper and correct use	Control with proper waste management		Mine Manager & HSE Lead		
	2.3	Waste must be collected in appropriate containers to accommodate volumes, these bins must be serviced. Recycling of waste must be encouraged, and in the event that waste cannot be recycled, the waste must be disposed of at a licenced facility. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.		Continuous	HSE Lead		
	2.4	Dust suppression must be implemented, and mine driving rules must be maintained. Vehicles must be in good working order.	Control by limiting dust generation	Throughout			
	2.5	Spills of hydrocarbons must be prevented as far as possible. Spill kits containing spill-sorb or a similar type product must be available and on hand to clean spills and should be reported to the appropriate authorities as required	Control and stop with procedures and remediation				
	2.6	All personnel and contractors to undergo Environmental Awareness Training, including topics such as wetland, faunal and flora importance and the procedure to follow should fauna be encountered. A signed register of attendance must be kept for proof	Stop by training				
	2.7	Implement an alien vegetation management plan for the site. The use of herbicide needs to be monitored and only used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded	Control by alien invasive vegetation management				

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	2.8	Implement and maintain a suitable stormwater management plan, including stormwater measures at stockpiles	Control by stormwater management		Mine Engineering & HSE Lead		
	2.9	Dirty water must be contained in suitable containment facilities and re-used or treated before it is discharged into the water resource.					
Spills and leaks from machinery, equipment and vehicles as well as the storage and mixing of substances on site, pose a risk to wetlands if contaminated runoff or material with pollution potential enters wetlands.	2.10	Where applicable, hazardous materials, chemicals and additives must be stored in appropriate waste skips. Materials must also be stored in bunded areas which can accommodate the required volumes	Stop with proper storage and waste management		HSE Lead		
	2.11	Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when leaking or when being serviced. A maintenance log must be kept.	Control and stop with proper maintenance				
	2.12	No servicing of equipment on natural or rehabilitated areas					
	2.13	Leaking equipment shall be repaired immediately or be removed from site to facilitate repair			Mine Manager & HSE Lead		
	2.14	All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages. All re-fuelling and servicing of equipment is to take place in demarcated areas.					
	2.15	All contaminated soil shall be removed and be placed in appropriate containers. Contaminated soil may only be disposed of in a licenced facility	Remedy with removal and remediation		HSE Lead		
	2.16	A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site.		As required			
Aquatic ecosystem							
Habitat inundation as a result of additional water volumes	2.17	Maintain erosion protection and energy dissipating measures at the discharge point.	Control with erosion protection measures	Throughout	Mine Engineering	National Water Act, 1998 (Act No. 36 of 1998)	No significant deterioration in ASPT, SASS5 or IHAS scores compared to baseline conditions.
	2.18	The quality of the water discharged will be closely monitored to ensure that it complies with the specified RQO at all times.	Control by monitoring		HSE Lead		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Flora & Fauna							
Continued fragmentation of an Endangered vegetation community (Eastern Highveld Grassland) including portions of wetlands and areas classified as ESA due to the activities, as well as encroachment by alien invasive plant species.	2.19	Highly sensitive areas outside of the project area should be declared a no-go area and access to this area must be prevented as far as possible. This should be implemented with the exception of those mining areas for which authorisation for mining has already been granted	Control and stop by demarcation	Prior to mining commences	HSE Lead	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)	The encroachment of alien invasive species decreases compared to baseline conditions
	(2.7)	Implement an alien vegetation management plan for the site. The use of herbicide needs to be monitored and only be used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded	Control by alien invasive vegetation management	Throughout	HSE Lead		
Continued removal and fragmentation of an Endangered vegetation community (including portions of wetlands and areas classified as ESA) due to the activities and potential encroachment by alien invasive plant species.	2.20	Implement appropriate fire breaks to restrict the impact fire might have on the endangered vegetation	Control with procedures				
Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	2.21	Implement an ad hoc monitoring programme to record sightings and to track the breeding success and distribution of the two SCCs observed on the project area: Serval (*Leptailurus serval*) and Cape Clawless Otter (*Aonyx capensis*)	Control with monitoring	As required	HSE Lead	National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations Mpumalanga Bio diversity Sector Plan (MBSP) Mpumalanga Nat ure Conservation Act, 1998 (Act No. 10 of 1998)	Successful implementation of rescue and relocation plan.
	(2.3)	Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.	Control with proper waste management	Continuous			
	2.22	No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals	Stop and control with procedures & training	Throughout			
Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	2.23	Noise and vibrations must be kept to a minimum to reduce the impact of the development on the fauna residing on the site					
	(2.6)	Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered.		Throughout			
	2.24	Wherever possible, corridor areas (which links the CBA, ONA and ESAs to the north) must be maintained to facilitate					

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
		the movement of wildlife within and between any natural areas	Control and stop with proper maintenance				
	(2.14)	All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas			Mine Manager & HSE Lead		
Soils, Land Capability and Land Use							
Stockpiling on top of soil will continue in loss of soil resource land capability. Vehicle movement will result in compaction of soils. Soil contamination by hydrocarbons, waste stockpiles and evaporators	2.25	Excavated soils should be stockpiled.	Control and stop with proper maintenance	During operation	Mine Manager & HSE Lead	Rehabilitation, Decommissioning and Closure Plan. National Norms and Standards for the remediation of contamination land and soil quality in the RSA (GN467 of 2013).	Topsoil is preserved for future use in rehabilitation. Stormwater runoff does not contain a significant increase in sediment as a result of topsoil stockpile erosion.
	2.26	Stockpiles are to be clearly demarcated on site layout plans. Also indicate the material in each stockpile to ensure that topsoil and spoils are not mixed.					
	2.27	Soil stockpiles are to be maintained in a fertile, vegetated, and erosion free state. If this can't be achieved due to design of stockpiles, then financial provision must be made to reinstate soil chemistry (fertiliser, lime, organic material) and physical structure (placement of topsoil, no compaction) and the associated specialist studies to inform these measures prior to the start of rehabilitation	Control and remedy with maintenance	Throughout prior to rehabilitation			
	(2.8)	Ensure proper storm water management measures are in place at stockpiles.	Control by stormwater management		Mine Engineering & HSE Lead		
	2.28	Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles.	Stop and control with restrictions & training		HSE Lead		
	2.29	Stockpiled soil to be reserved for rehabilitation purposes only.					
	2.30	Monitor and fix any erosion in the landscape or on stockpiles. If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place.	Control with monitoring & erosion correction measures	Throughout	Mine Engineering & HSE Lead		
	(2.5)	Prevent any spills from occurring. If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities as required	Control and stop with procedures and remediation		HSE Lead		
	(2.14)	All vehicles are to be serviced in designated areas					

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	(2.11 & 2.13)	Leaking vehicles, equipment and machinery should have drip trays placed under them where the leak is occurring and be repaired as soon as possible or removed from site. A maintenance log must be kept.	Control and stop with proper maintenance		Mine Manager & HSE Lead		
Heritage							
Damage to the historical structures identified (i.e. Douglas Pump Station, SAR Pump Station, and Vandyksdrift Railway) due to construction activities.	2.31	Implement a chance-find procedure (refer to Appendix A). If any employees find any heritage resources during any developmental activity all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site.	Stop and control with procedures & training	Throughout	Mine Manager & HSE Lead	National Heritage Resources Act, 1999 (Act No. 25 of 1999) Regulations relating to the management of human remains (GNR363 of 2013)	The condition of the existing historical structures does not deteriorate compared to baseline conditions.
Damage to the graves due to construction activities	2.32	GY02 must be exhumed and relocated before opencast mining is done in the area.	Stop by relocating	Prior to mining commences	HSE Lead		GY02 successfully exhumed and relocated prior to mining (exhumation to be done before mining progresses within 500 m from the graveyard). Buffer of 100 m to be maintained until the relocation is completed. GY01 will not be damaged or its status deteriorated compared to baseline conditions.
	2.33	For GY01: Demarcate the graveyard with a fence or wall and fit with an access gate. Relatives of the deceased must be located by means of social consultation and to obtain permission for fencing or walling the cemetery.	Control with demarcation	Throughout			
	2.34	Regulated visitor hours must be implemented that is compatible with safety rules. This will not be necessary if the graveyard is located next to a public or national road which can provide direct access to the graveyard.	Control with procedures		Mine Stakeholder liaison officer		
	2.35	For GY01: Corridors of at least 100m should be maintained between the graveyard's border fences and any developmental components such as roads or other infrastructure that may be developed in the future. This buffer zone must be maintained at all times.	Control and stop with proper maintenance		HSE Lead		
	2.36	The graveyard should be inspected every three months. Inspections should be noted in an inspection register. The register should outline the state of the graveyard during each inspection. Reports on damages to any of the graves or to the graveyards (fences, walls, gates) should be followed with the necessary maintenance work. Maintenance work should be recorded in the inspection register.	Control with maintenance & monitoring	Every three months			

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	2.37	The graveyards should be kept tidy from any invader weeds and any other refuse		As required			
Palaeontology							
Loss of fossils and other palaeontological significant artefacts	2.38	Implement Chance Find Protocol as included in Appendix B.	Stop and control with procedures & training	Throughout	Mine Manager & HSE Lead	National Heritage Resources Act, 1999 (Act No. 25 of 1999)	All palaeontological significant artefacts identified are reported to a palaeontologist.
	2.39	If recognisable fossils are found by the responsible person monitoring the excavated sediments, then a palaeontologist should be approached to do an assessment.					
Groundwater							
Potential deterioration in quality of baseflow to rivers and water abstracted from boreholes as a result of seepage from the following facilities: - Overburden dumps and Dragline Spoils - Mixed ROM and slurry stockpile areas - Mechanical evaporators - Final Rejects Dump - No. 5 Seam and No. 4 Seam Stockpiles - Vleishaft PCD	2.40	The Eastern overburden dump and Mixed ROM coal and slurry areas must be lined with at least compacted clay to prevent contamination from entering the aquifer system	Stop with planning and design	During operation	Mine Manager & Mine Engineering	RQOs for the Olifants River Catchment	Measurement of inorganic constituents of water qualities to quantify impacts.
	2.41	Groundwater monitoring must be instituted upgradient and downgradient of these facilities to monitor and intercept any potential contamination timeously	Control with monitoring		HSE Lead		
	2.42	Groundwater monitoring boreholes must continue at designated positions based on infrastructure layout, as recommended					
	2.43	Evaporation sprayers are likely to cause significant contaminant build-up over time at the selected discharge points. However, this contamination is likely to be similar to the geochemical nature of backfill material where the sprayers will be constructed. Modelling indicates no impact to sensitive receptors and it is likely that mobilised contamination will move into the VDDC opencast. No actions are therefore required in the vicinity of the sprayers during mining except occasional removal of salt build-up and disposal at an appropriate facility.	Remedy with removal and disposal	As required			
Dewatering of the surrounding aquifer as a result of pumping from the pit as opencast mining proceeds. Surrounding water users may experience a decrease	(2.1)	Separate clean and dirty water to limit the dirty water make.	Stop and control by implementing Stormwater Management Plan	Throughout	Mine Engineering & HSE Lead	National Water Act, 1998 (Act No.36 of 1998	Water level does not decrease significantly compared to

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
in available volumes such as baseflow to rivers, borehole abstraction availability and dewatering of wetland areas.	2.44	Monitor static groundwater levels on a quarterly basis in all boreholes within a zone of one kilometre surrounding the mine to ensure that any deviation of the groundwater flow from the idealised predictions is detected in time and can be reacted on appropriately.	Control with monitoring	Quarterly during operation	HSE Lead	Water Services Act, 1997 (Act No. 108 of 1997	baseline conditions for boreholes located in surrounding aquifers.
	2.45	Should surface water monitoring show that the Olifants River or its tributaries are affected by mine dewatering, discharge of clean water from the modular WTP (if implemented) into the watercourses should be considered.	Control with clean water discharge	As required	Mine Engineering & HSE Lead		
	2.46	The monitoring results must be interpreted annually by a qualified hydrogeologist and the monitoring network should be audited every 5 years.	Control with interpretation and auditing	Annual interpretation; auditing every 5 years	HSE Lead		
	2.47	Update the numerical model using measured inflows, water levels and any potential future drilling and pump test information, to re-calibrate and refine the impact prediction. This should be done every 5 years during operation of the opencast	Control with updating of model	Every 5 years during operation			
	2.48	Dewatering and groundwater abstraction for mining purposes should be monitored so as to prevent negative impacts on the underlying aquifer	Control with monitoring	Throughout			
	2.49	Areas in the opencast where the defunct underground is intersected could be sealed with blasted overburden with engineered designs to limit groundwater ingress	Control with planning and designs	As required	Mine Engineering		
Surface water							
Pollution of surface water resources by spillage of dust suppression water into the watercourses, and contaminated runoff from these areas entering watercourses, with resultant deterioration of water quality in terms of elevated salinity and sulfate	2.50	Develop and implement a formal procedure for dust suppression to ensure that dust suppression application rates are carefully controlled to prevent the excessive application of water, ponding and excessive runoff of dust suppression water into the watercourses	Control with procedures	Continuous	HSE Lead	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of operational activities compared to baseline conditions/ RQOs
	2.51	No dust suppression should be carried out on surfaces that are already moist.	Control with restrictions				
	2.52	Dust suppression with contaminated water should be confined to isolated dirty water management areas.					

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Pollution of surface water resources by contaminated stormwater runoff entering watercourses, contaminated seepage from overburden dumps, leakage of contaminated water from pipelines, erosion at clean canal discharge points, and clean water runoff entering the dirty water management area.	2.53	All infrastructure areas with the potential to generate dirty storm water runoff, including washdown water will be located within the designated dirty water areas.	Control with restrictions	Continuous	Mine Manager		
	2.54	Divert clean runoff around the designated dirty areas by means of cut-off canals, sized to accommodate at least the 1:50 year peak flow event	Control with water management infrastructure	Throughout	Mine Engineering		
	(2.17)	Install and maintain adequate erosion protection at the clean canal discharge locations	Control with erosion protection measures				
	2.55	Manage general and hazardous wastes according to the existing waste management plan for Wolvekrans Colliery.	Control with waste management		HSE Lead		
	2.56	Inspect all pipeline routes regularly to enable early detection of leaks.	Control with inspections	During operation	Mine Engineering & HSE Lead		
	2.57	Collect all contaminated storm water and dirty water generated at the proposed activities and pump to Vleishaft PCD, Re-use water, or evaporate at mechanical evaporators and treat surplus water at mobile WTP if required.	Control with water management infrastructure		Mine Engineering		
	(2.1)	Divert runoff from clean catchments draining towards the Eastern overburden dump, around the dump.	Stop and control by implementing Stormwater Management Plan				
	2.58	Implement an inspection and maintenance plan on the storm water system to ensure that all silt traps are maintained, and that storm water canals and pipelines remain unblocked and free flowing (monthly inspections will be carried out)	Control with inspections		Mine Engineering & HSE Lead		
	(2.5)	Spill-sorb or a similar type product must be kept on site and used to clean up hydrocarbon spills in the event that they should occur.	Control and stop with procedures and remediation		HSE Lead		
	2.59	Use the overburden material in the concurrent rehabilitation of the opencast pit.	Remedy by rehabilitation	Upon cessation of activities	Mine Manager & HSE Lead		
Spillage of contaminated water and coal particulates resulting in pollution of surface water resources	(2.57)	The majority of haul roads is located within the dedicated dirty water management area, and haulage of coal will therefore take place within the dirty water management area. Runoff will drain either to the opencast pit or to Vleishaft PCD, where it will be contained.	Control with water management infrastructure	During operation	Mine Engineering	RQOs for the Olifants River Catchment	Dirty water management areas are limited to the areas approved and do not exceed the

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	2.60	All dirty water containment facilities should be designed, operated and maintained to have a risk of spill of 2% or less (1:50 year recurrence interval) in any one year.					calculated decrease in catchment yield.
	2.61	As far as is practical, ROM coal should be allowed to drain within the pit before being loaded onto the haul trucks, to prevent spillage of water from the haul truck load boxes onto the haul roads.	Control with procedures		Mine Manager		
	2.62	Loading of trucks will be carefully controlled to ensure that overloading will not take place.					
Wind-blown contamination results in the release of contaminated water into the catchment, with resultant deterioration in water quality. Salinisation of water to be evaporated over time due to combined evaporation of brine from WTP.	2.63	Consideration to be given to temporarily halt mechanical evaporation during high wind conditions.	Control with restrictions	During operation	Mine Manager	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
	2.64	Where forced evaporation occurs over seeded areas, it is recommended that monitoring of soils by a soil specialist be undertaken.	Control with monitoring		HSE Lead		
	2.65	Limit forced evaporation to spray only over pits. Where evaporators are in close proximity to watercourses (i.e. evaporators at SKS void) monitoring should be implemented and corrective action taken if monitoring show an impact on water quality			Mine Manager & HSE Lead		
	2.66	Monitor salination of water managed through the evaporation system due to the combined evaporation with brine from the WTP and take corrective action if needed.			Mine Engineering		
Pollution of surface water resources by spillage of chemical additives, water treatment waste products, and discharge of water that does not meet the discharge standards.	2.67	The modular WTP will be isolated within a designated dirty water management area and containerised.	Control with water management infrastructure	During operation	Mine Engineering	RQOs for the Olifants River Catchment (GN932 of 2018)	Indicators monitored do not indicate a significant impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
	2.68	All spills from the WTP will be collected in a sump, from where water will be directed to the Vleishaft PCD or SKS Pit.			Mine Engineering HSE Lead		
	(2.10)	All chemicals and additives will be stored in dedicated bunded areas, where any spills will be contained.	Stop with proper storage and waste management		HSE Lead		
	2.69	An inspection and maintenance plan will be implemented to ensure that the water treatment plant and brine storage tanks always operate within specification.	Control with inspection		Mine Engineering		
	(2.18)	Discharge water quality will be continuously monitored for early detection of water quality non-compliant with the discharge standard.	Control by monitoring	Continuous	Mine Engineering & HSE Lead		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	2.70	Should upset conditions occur, or poor discharge water quality be detected, the WTP discharge will be directed to the Vleishaft PCD or SKS Pit.	Control with water management infrastructure	As required			
Pollution of surface water resources by: • Spillage of brine onto the ground or into water resources • Inadequate containment where brine is stored • Leakage from containment facilities for brine	2.71	Brine will be stored in existing closed tanks at the SKS pit and are located within the designated dirty water management area.	Control with stormwater management	During operation	Mine Engineering	RQOs for the Olifants River Catchment (GN932 of 2018)	Indicators monitored do not indicate a significant impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
	2.72	Spills will enter the SKS pit or will be pumped to the Vleishaft PCD.					
	(2.69)	An inspection and maintenance plan will be implemented to ensure that the water treatment plant and brine storage tanks always operate within specification.	Control with inspection				
Release of surplus treated water into the catchment will influence the water quality of the receiving resource. Due to the current impacted state of the Olifants River, the quality of water due is expected to improve due to the dilution effects. Some erosion may occur at the discharge point.	(2.17)	Install and maintain dissipating structure at the discharge point as required. Install and maintain erosion protection measures at the discharge point.	Control with erosion protection measures	Throughout	Mine Engineer & HSE Lead	RQOs for the Olifants River Catchment (GN932 of 2018)	Indicators monitored do not indicate a significant impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
Release of surplus treated water into the catchment will increase in yield, which is regarded as positive. The change in the water quantity of the receiving resource and may impact on the aquatic ecology by changing the seasonal flow patterns in the river system and also result in altered hydrology of the wetland into which the discharge form the Northern Canal takes place.	(2.18)	The quality of the water discharged will be closely monitored to ensure that it complies with the specified RQO at all times.	Control by monitoring	Continuous		RQOs for the Olifants River Catchment (GN932 of 2018)	Indicators monitored do not indicate a significant negative impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
Containment of runoff from dirty water management area alters the infiltration of the catchment, reduces the availability of water and changes surface flow characteristics of wetlands.	2.73	The site layout has been designed to minimise the dirty footprint, and therefore to minimise the impact on the catchment yield. The site layout may not be changed without obtaining the necessary approvals.	Control with restrictions	As required	Mine Manager & HSE Lead	GNR 704	Dirty water management areas are limited to the areas approved and do not exceed the calculated decrease in catchment yield.
	2.74	Rehabilitate areas no longer in use, or that will not be mined in future, to increase the footprint of the clean water management area from which clean runoff is discharged into the environment.	Remedy with rehabilitation	Upon cessation of activities	Mine Engineer		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Change in flow resulting in change in aquatic ecosystem	(2.1)	Divert clean runoff around the working areas	Stop and control by implementing Stormwater Management Plan	Throughout			No significant deterioration in ASPT, SASS5 or IHAS scores compared to baseline conditions.
Local reduction in catchment yield (i.e. immediately downstream at the Witbank Dam)	2.75	Concurrent rehabilitation will take place as far as practicable, once the mining direction changes. Rehabilitated area will be shaped to be free draining.	Remedy with rehabilitation	Upon cessation of activities			Dirty water management areas are limited to the areas approved and do not exceed the calculated decrease in catchment yield.
	2.76	Where rehabilitated areas are sloped towards the active opencast pit, berms and canals will be constructed to maximise the area that is free draining.					
Regional reduction in catchment yield (i.e. Loskop Dam)	2.77	Discharge treated water from the modular WTP to compensate for loss	Remedy with treated water discharge	As required	Mine Engineer & HSE Lead		
Flooding of mine or mine infrastructure during extreme flood events with an impact on mining operations	2.78	No mining will take place within the 1:100 year floodline areas without the relevant authorisations, in terms of GN R704 exemptions and Section 21(c) and (i) water use licenses (in terms of the NWA).	Control with restrictions	During operation	Mine Manger	National Water Act, 1998 (Act No. 36 of 1998) GNR 704	Mining infrastructure and mine pit do not become flooded to the extent that mining operations are impacted.
	2.79	Conduct an investigation into the status of Attenuation Dam 1 dam wall, to determine any required upgrading or stabilisation to reduce the potential risk to mining in this area before mining commences.	Control with investigation	Prior to mining commences	Mine Engineer		
Pollution of surface water resources by runoff entering mining areas and coming into contact with carbonaceous material, and dirty runoff and mine water make discharging into the environment.	(2.57)	Pumping of all dirty water generated at the VDDC workings and proposed infrastructure areas to Vleishaft PCD	Control with water management infrastructure	During operation	Mine Engineer	RQOs for the Olifants River Catchment (GN932 of 2018)	Indicators monitored do not indicate a significant impact to surface water quality as a result of construction activities compared to baseline conditions/ RQOs
	2.80	Reuse of dirty water in the operations at VDDC	Control with reuse				
	2.81	Treatment of excess dirty water (water pumped from Vleishaft PCD to the mobile water treatment plant or evaporators).	Control with treatment				
	2.82	Provide water management facilities with a risk of spill that is lower than 2% in any one year as per the Golder water balance.	Control with planning and design				

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	2.83	Continue with the surface water quality monitoring programme and expand the existing network as per the specialist recommendation.	Control with monitoring	Continuous	Mine Engineer & HSE Lead		
	2.84	Implement a water balance monitoring programme to enable calibration of the water balance.			Mine Engineer		
Noise							
Increased noise levels	2.85	Keep all diesel-powered equipment and plant vehicles at a high level of maintenance. This should particularly include the regular inspection of, and if necessary, the replacement of, intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.	Control and stop with proper maintenance	During operation	Mine Engineer & Mine Manager	IFC guidelines and SANS 10103	Monitoring implemented and noise levels are below acceptable levels at sensitive receptors.
	2.86	Continue selecting equipment with lower sound power levels. Vendors should be required to guarantee optimised equipment design noise levels.	Stop with effective equipment				
	2.87	In managing noise specifically related to truck and vehicle traffic, efforts should be directed at (i) Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program; (ii) Maintain road surface regularly to avoid corrugations, potholes etc; (iii) Avoid unnecessary idling times.	Control and stop with procedures, training, and maintenance				
	2.88	Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.					
	2.89	A complaints register must be kept on site.	Control by communicating with I&APs	Throughout	Mine Stakeholder Liaison Officer & HSE Lead		
Visual							
Visual disturbance due to dust generated from construction activities, as well as views of the activities themselves	(2.27)	Topsoil stockpiles should be vegetated where possible to lessen the visual intrusion	Control and remedy with maintenance	During operation	HSE Lead	National Ambient Air Quality	Monitoring implemented and dust levels are below

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	2.90	Ensure all stockpiles are placed away from surface water and drainage lines where possible	Control and stop with planning and demarcation			Standards (GN1210 of 2009)	acceptable levels at sensitive receptors.
	(2.30)	Monitor and fix any erosion in the landscape or on stockpiles	Control with monitoring & erosion correction measures	Throughout	Mine Engineer		
	2.91	Ensure that operations are undertaken in line with the applicable GNR1147 Annual Rehabilitation Plan.	Control by complying with closure plan	During operation			
Air quality							
Increased particulate matter (PM10) as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	2.92	Regular wetting of exposed areas and haul ramps	Control by limiting dust generation	During operation	HSE Lead	National Ambient Air Quality Standards (GN1210 of 2009 National Dust Control Regulations (GNR827 of 2013)	PM_{10} deposition does not exceed baseline conditions / limits prescribed in the National Ambient Air Quality Standards at sensitive receptors
	2.93	Water sprays and/or chemical stabilisation of on- and offsite haul roads					
Increased particulate matter (PM2.5) as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	2.94	Water sprays on drilling operations			Mine Manager & Mine Engineer		$PM_{2.5}$ deposition does not exceed baseline conditions/ limits prescribed in the National Ambient Air Quality Standards
Increased dust generation as a result of operational activities associated with infrastructure management, including transport of coal.	2.95	Regular wetting of exposed areas and haul ramps. Water sprays and/or chemical stabilisation of haul roads. Enclosure or covering of haul trucks.			Mine Manager		Dust deposition does not exceed the baseline conditions/ limits for non-residential areas in the National Dust Control Regulations
Increased particulate matter (PM_{10}) generated from operational activities associated with opencast mining.	2.96	Reduce the drop height of the dragline			Mine Manager & Mine Engineer		PM_{10} deposition does not exceed baseline conditions / limits prescribed in the National Ambient Air Quality Standards at sensitive receptors

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Increased particulate matter ($PM_{2.5}$) generated from operational activities associated with opencast mining.							$PM_{2.5}$ deposition does not exceed baseline conditions/ limits prescribed in the National Ambient Air Quality Standards
Increased dust generation from operational activities associated with opencast mining	2.97	Rehabilitation and revegetation of the mined areas as soon as practical, with the option of using watering to suppress dust emissions during dry and windy conditions	Stop and control with rehabilitation	Upon cessation of activities	Mine Engineer		Dust deposition does not exceed the baseline conditions/ limits for non-residential areas in the National Dust Control Regulations
Social environment							
Employment opportunities, procurement and inflow of workers	2.98	Give preference to communities within close proximity to the mining activities if any new employment opportunities are created	Control by communicating with I&APs	As required	Mine Manager & Mine Stakeholder Liaison Officer	Not applicable	Procurement and recruitment achieved through formalised structures and processes.
	2.99	Procurement and recruitment of individuals should be undertaken through formalised structures and according to processes that are in line with international best-practice standards.	Control with procedures				
	2.100	Procurement of goods, services, material and equipment should be focused on the local area where economically feasible					
	2.101	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration					
Inflow of jobseekers	2.102	The communication strategy with regards to the recruitment process and use of contractors to the local residents should ensure that unrealistic employment expectations are not created	Control by communicating with I&APs	As required	Mine Stakeholder Liaison Officer	Not applicable	Recruitment achieved through formalised structures and processes.
	(2.98)	Maximise the use of local labour if required and where possible			Mine Manager & Mine Stakeholder Liaison Officer		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	2.103	South32 should support efforts of the ELM to limit in-migration to the area and the subsequent development or extension of informal settlements in the area			Mine Stakeholder Liaison Officer		
	(2.101)	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration	Control with procedures		Mine Manager & Mine Stakeholder Liaison Officer		
Impact on daily living and movement patterns	(2.4)	Strict adherence by contractors to mine driving rules should be enforced	Control by limiting dust generation	Throughout	Mine Manager & HSE Lead	Not applicable	Strict implementation of HSE protocol/policy
	2.104	Disciplinary action for reckless driving within the mining area should be implemented	Control with procedures				
Residential proximity	2.105	Adhere to mitigation measures proposed by specialist and relevant regulations to limit noise and dust pollution	Control through implementation of mitigation measures	During operation	HSE Lead	Not applicable	Monitoring conducted and dust and noise levels are below acceptable standards at sensitive receptors
	2.106	Heavy vehicles should be in good working order to limit any noise and dust pollution	Control and stop with proper maintenance		Mine Manager		
	(2.4)	Dust suppression methods should be strictly implemented	Control by limiting dust generation		HSE Lead		
	2.107	Possible negative impacts on the surrounding landowners and nearby residents should be limited to minimise any possible negative impacts on these residents' quality of life.	Control by communicating with I&APs	When required	Mine Stakeholder Liaison Officer		
	2.108	Also refer to mitigation measures for impact for sense of place, safety and security risks, health risks, and noise related impacts	Control through implementation of mitigation measures		Mine Stakeholder Liaison Officer & HSE Lead		
Impact on Agricultural Activities	2.109	Effective management of the mining activities associated with the infrastructure development would be required to avoid any environmental pollution (e.g. water) and limiting any increase in dust levels.	Control through implementation of mitigation measures	Throughout	HSE Lead	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	Refer to performance indicators for water quality and air quality
Impact on Sense of Place	2.110	Undertake appropriate site management as stipulated in the EMPr to limit the visual impact	Control through implementation of mitigation measures	Throughout	HSE Lead	Not applicable	Refer to relevant performance indicators listed above

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Safety and Security Risks	2.111	Risks of accidents should be recognised. Safety training should again be implemented focused on the designated drivers (employees) of heavy vehicles. The mine driving rules should be adhered to.	Control and stop with procedures & training	During operation	SHE Manager	Occupational Health and Safety Act, 1993 (Act. No. 85 of 1993)	No accidents or incidents reported.
	2.112	Strict codes of conduct should be implemented for personnel operating heavy and light vehicles to minimize traffic hazards within the mining area					
	2.113	Construction and upgrade of roads within the mining area should be done in a manner which would facilitate safe and efficient movement of material, employees, as well as other mining vehicles			Mine Engineer		
	2.114	Maintain roads to ensure safety	Control and stop with maintenance				
	2.115	Emergency procedures should be established that provide immediate response should an accident occur within the mining area	Stop with training & procedures	Throughout	SHE Manager		
	2.116	Appropriate firefighting equipment should be on site and construction workers, as well as permanent employees should be appropriately trained for firefighting.					
Health Risks	2.117	Gaseous emissions should be minimised through proper operation and maintenance of vehicles	Control with maintenance	During operation	Mine Manager & Mine Engineer	National Health Act, 2003 (Act No. 61 of 2003) Occupational Health and Safety Act, 1993 (Act. No. 85 of 1993)	Monitoring conducted and dust levels are below acceptable standards at sensitive receptors.
	(2.4)	Implement dust suppressant measures on roads within the mining area.	Control by limiting dust generation		HSE Lead		
	(2.4)	Vehicles should be in a good working order and adhere to mine driving rules.					
	2.118	Fugitive dust emissions should be controlled through the implementation of appropriate mitigation measures e.g. ongoing rehabilitation	Control with concurrent rehabilitation	Upon cessation of activities	Mine Engineer & HSE Lead		
	2.119	Possible negative impacts on the surrounding landowners and nearby residents should be limited by ensuring that health risks are minimised and mitigation measures are implemented as stipulated in the Air Quality Impact Assessment and EMPr	Control through implementation of mitigation measures	Throughout	HSE Lead		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Noise Related Impacts	2.121	Mitigation measures to limit any increase in noise as recommended by the noise specialist should be adhered to.	Control through implementation of mitigation measures	Throughout	Mine Engineer	National Ambient Air Quality Standards (GN1210 of 2009 National Dust Control Regulations (GNR827 of 2013)	Monitoring conducted and levels are below acceptable standards at sensitive receptors.
	(2.89)	Keep a complaint register	Control by communicating with I&APs		Mine Stakeholder Liaison Officer & HSE Lead		
Blasting							
Ground vibration	2.122	Do blast design that considers the actual blasting and the ground vibration levels to be adhered to.	Control through planning and design	Prior to blasting	Blasting Superintendent	Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Explosives Act, 2003 (Act No. 15 of 2003)	Monitoring implemented and indicate ground vibration below acceptable levels at sensitive receptors.
	2.123	Consider where practical to apply electronic initiation systems to facilitate single hole firing.	Control with restrictions				
	2.124	Consider where practical to design for smaller diameter blast holes that will use fewer explosives per blast hole.	Control through planning and design				
	2.125	Relocate the POI / acquire the POI of concern – mined owned.	Stop by relocating		Blasting Superintendent & Mine Manager		
Air blast Fly rock	2.126	Use proper charging methodology irrespective of the blast hole diameter and patterns used	Control with procedures	During blasting	Blasting Superintendent	Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Explosives Act, 2003 (Act No. 15 of 2003)	No complaints from I&APs are received and no POIs are damaged during the operational phase.

Table 1-5: Impacts to be mitigated, impact management outcome and standards to be achieved: Decommissioning, closure and post-closure phase

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Wetlands							
Sedimentation from rehabilitated areas. Spills and leaks from machinery, equipment and vehicles will also impact on water quality of wetlands.	3.1	Make use of existing access routes where possible.	Control by limiting disturbed area	Throughout	Contractor & Mine Manager	RQOs for the Olifants River Catchment	Wetland PES and EIS does not deteriorate compared to baseline conditions for wetlands that are not authorised to be mined.
	3.2	Any possible spills of hydrocarbons, concrete or concrete water must be avoided. Spill kits containing spill-sorb or a similar type product must be available and on hand to clean these spills before infrastructure is demolished.	Control and stop with procedures and remediation	During decommissioning	HSE Lead		
	3.3	Where applicable, hazardous materials must be stored in leak-proof, sealable containers or packaging. Materials must also be stored in bunded areas which can accommodate the required volumes.	Stop with proper storage and waste management				
	3.4	Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when leaking or when being serviced.	Control and stop with proper maintenance				
	3.5	No servicing of equipment on natural or rehabilitated areas.					
	3.6	Leaking equipment shall be repaired immediately or be removed from site to facilitate repair.			Mine Manager & HSE Lead		
	3.7	All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages.					
	3.8	All contaminated soil shall be removed and be placed in containers. Contaminated soil may only be disposed of in a licenced facility placed on the discard facilities prior to their rehabilitation.	Remedy with removal and remediation	Upon cessation of activities	HSE Lead		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Altered and lost hydrodynamics and flow regime for the catchment area	3.9	Decommission cut-off berms, drains and other stormwater management structures last to restore surface flow dynamics.	Control with stormwater management	During decommissioning	Contractor & Mine Engineer	RQOs for the Olifants River Catchment	Wetland PES and EIS does not deteriorate compared to baseline conditions for wetlands that are not authorised to be mined.
Exposed soils during decommissioning of infrastructure are susceptible to wind and runoff erosion, resulting in sedimentation of wetlands.	3.10	Separate clean and dirty water. Develop and implement a storm water management plan for the decommissioning phase.	Stop and control by implementing Stormwater Management Plan	During decommissioning	Mine Engineer	RQOs for the Olifants River Catchment	Wetland PES and EIS does not deteriorate compared to baseline conditions for wetlands that are not authorised to be mined.
	3.11	Implement dust suppression measures.	Control by limiting dust generation		HSE Lead		
	(3.9)	Decommission cut-off berms and drains last to restore surface flow dynamics.	Control with stormwater management		Contractor & Mine Engineer		
Aquatic ecosystem							
Change in water quality resulting in deterioration of aquatic ecosystem	3.12	Heavy vehicles must not be allowed to indiscriminately drive within riparian habitats.	Control with restrictions	During decommissioning	Contractor & HSE Lead	National Water Act, 1998 (Act No. 36 of 1998)	No significant deterioration in ASPT, SASS5 or IHAS scores compared to baseline conditions.
	3.13	Any watercourse crossings of roads must be outside of the riparian and instream areas, unless authorised.					
	3.14	Rehabilitate diversion berms and/or trenches where they are no longer required	Remedy with rehabilitation	Upon cessation of activities			
	3.15	Rip and re-vegetate the disturbed areas as soon as possible.					
	3.16	Implement appropriate water treatment measures after decommissioning, which could include passive measures	Control with planning and design	Post closure according to water management strategy developed	Mine Engineer		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Flora & Fauna							
Continued encroachment by alien invasive plant species, as well as erosion due to disturbed soils.	3.17	Highly sensitive areas outside of the project area, including the Olifants River, should be declared a no-go area and access to this area must be prevented as far as possible.	Control and stop by demarcation	Prior to decommissioning	Mine Manager & HSE Lead	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)	The encroachment of alien invasive species decreases compared to baseline conditions.
	(3.1)	Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited;	Control by limiting disturbed area	Throughout	Contractor & Mine Manager		
	3.18	All laydown, storage areas etc should be restricted to within the disturbed mining area			Contractor		
	3.19	Compile and implement an alien vegetation management plan. The use of herbicide needs to be monitored and only be used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded; and	Control by alien invasive vegetation management		HSE Lead		
	3.20	Appropriate fire breaks should be implemented to restrict the impact fire might have on the endangered vegetation	Control with procedures				
Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing disturbances (noise, dust and vibrations).	3.21	Two SCCs were observed on the project area: Serval (*Leptailurus serval*) and Cape Clawless Otter (*Aonyx capensis*), an ad hoc monitoring programme should be implemented with sightings recorded for these two species to specifically monitor their breeding success and distribution.	Control with monitoring	As required	HSE Lead	National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations Mpumalanga Bio diversity Sector Plan (MBSP) Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)	Successful implementation of rescue and relocation plan.
	3.22	An appropriate waste management plan must be developed for the decommissioning phase	Control with proper waste management	Prior to decommissioning			
	3.23	No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals;	Stop and control with procedures & training	Throughout			
	3.24	Noise and vibrations must be kept to a minimum to reduce the impact of the development on the fauna residing on the site					
	3.25	Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered;					

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	3.26	Wherever possible, corridor areas (which links the CBA, ONA and ESAs to the north) must be established to facilitate the movement of wildlife within and between any natural areas;	Control and stop with proper maintenance				
	(3.7)	All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas.			Mine Manager & HSE Lead		
Soils, Land Capability and Land Use							
Positive impact: Rehabilitation of soil, land capability and land use by replacing stockpiled soils over disturbed areas and bringing back a form of land capability that can support an alternative end use	3.27	Ensure that the rehabilitation changes the land use from mining back to grazing.	Remedy with rehabilitation	During decommissioning and rehabilitation	Contractor & HSE Lead	Rehabilitation, Decommissioning and Closure Plan. National Norms and Standards for the remediation of contamination land and soil quality in the RSA (GN467 of 2013).	End land use requirements are met.
	3.28	The spoil should be shaped taking the pre-mining landscape into consideration			Contractor		
	3.29	The designed post mining landforms should be modelled to establish the post mining landscape stability by using a combination of GIS and erosion modelling techniques by a suitably qualified expert using site specific soil quality data			Mine Engineer		
	3.30	Soil compacted under stockpiles to be ripped at least 300mm deep and rehabilitated as per the end land use requirements			Contractor		
	3.31	The soil quality should be investigated once stockpiled material will be used as part of rehabilitation, but prior to establishing vegetation through representative sampling and laboratory analysis		During decommissioning and rehabilitation	HSE Lead		
	3.32	The analytical data should be evaluated by a suitably qualified expert and vegetation fertility and or soil acidity problems should be corrected					
	3.33	Clear targets incorporating medium to long term post mining land capability influencing land use, should be part of a potentially successful closure plan.	Control with planning and design	Throughout			

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Groundwater							
Contaminated water may impact surrounding watercourses	3.34	Following mine closure and rehabilitation of the pit, the backfill will form an artificial aquifer which is likely to discharge. A decant management plan should be developed and should include measures such as the containment of seepage or decant water in appropriate facilities.	Control with planning and design	Throughout	Mine Manager & HSE Lead	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
	3.35	All sulphate-containing waste material should be stored at the bottom of the opencast pit and should be left to be flooded as soon as possible to exclude oxygen.	Control with procedures		Contractor		
	3.36	Backfill material should be compacted and surface water flow should be routed around the backfillled opencast to reduce recharge to a maximal extent.					
	3.37	Groundwater monitoring boreholes should be sited at designated positions based on infrastructure layout, to comply with the design requirements of a groundwater monitoring system, as recommended.	Control with monitoring	Throughout	Environmental Specialist HSE Lead		
	3.38	The monitoring results must be interpreted annually by a qualified hydrogeologist and the monitoring network should be audited every 5 years.	Control with interpretation and auditing	Annual interpretation and auditing			
	3.39	The water level in the backfilled opencast should be controlled by implementing effective water management strategies or pumping to not exceed 1530mamsl to prevent decant. The water level in the pit should be maintained approximately 5m below the sub-surface discharge elevation as a safe management level. Alternatively, an interception trench must be constructed to capture contaminated subsurface seepage.	Control with pumping	Continuous	Mine Engineer		
Potential deterioration in quality of baseflow to rivers and water abstracted from boreholes as a result of seepage from the following facilities: • Mechanical evaporators • Final Rejects Dump	3.40	Vleishaft PCD, mechanical evaporators (and associated salt build-up), to be removed and the area remediated the area as per the rehabilitation plan.	Remedy with rehabilitation	During decommissioning and rehabilitation	Contractor	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of
	3.41	Capping of the final rejects dump must be implemented as per approved rehabilitation designs					

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
• Vleishaft PCD	3.42	Maintain monitoring and contaminated seepage management at the final rejects dump to minimise contamination of groundwater.	Control with monitoring and seepage management	Continuous	HSE Lead		activities compared to baseline conditions/ RQOs
Surface water							
Pollution of surface water resources as a result of: • Erosion of soils during rainfall events resulting in elevated suspended solids in watercourses • Hydrocarbon spillages from machinery, vehicles, and equipment.	(3.1)	Minimise the disturbed footprint area as far as possible.	Control by limiting disturbed area	Throughout	Mine Manager & HSE Lead	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
	(3.17)	Delineate "no-go" zones where the decommissioning activities are near the Olifants River	Control and stop by demarcation	Prior to decommissioning			
	(3.9)	Decommission the storm water management measures last, if at all, to ensure adequate storm water management during the rehabilitation phase.	Control with stormwater management	During decommissioning	Contractor & Mine Engineer		
	(3.4)	Equipment, machinery, and vehicles will only be serviced in dedicated areas that are bunded and equipped with drip trays	Control and stop with proper maintenance		HSE Lead		
	(3.3)	Hazardous material to be stored in sealable containers within bunded areas	Stop with proper storage and waste management				
	(3.2)	Spill-sorb or a similar product will be kept on site and used to clean up hydrocarbon spills in the event that they should occur.	Control and stop with procedures and remediation				
	3.43	Erosion protection measures will be implemented at steep areas as determined by a surface water specialist.	Control with erosion protection measures		Mine Engineer		
	(3.22)	A waste management plan will be developed for the decommissioning phase, which will include the handling of contaminated materials / soils found on site.	Control with waste management	Prior to decommissioning	HSE Lead		
	(3.2)	All traces of hydrocarbons and residual waste will be removed before infrastructure is demolished.	Control and stop with procedures and remediation		Contractor & HSE Lead		
	(3.8)	Contaminated soils will be excavated and placed on the discard facilities prior to their rehabilitation or removed from site by an appropriately licensed waste contractor.	Remedy with removal and remediation	During decommissioning	Contractor		

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
	3.44	An appropriate sewage management strategy will be implemented during the decommissioning phase.	Control with waste management	During decommissioning	HSE Lead		
	3.45	Water quality monitoring will be undertaken downstream of the decommissioning areas, before and during decommissioning where practical, in order to detect any increase in suspended solids or turbidity.	Control with monitoring	Continuous			
	3.46	If erosion is evident, or the water quality monitoring indicates an increase in suspended solids, water management around the decommissioning areas will be reviewed.	Control with monitoring & erosion correction measures	As required	Mine Engineer & HSE Lead		
Pollution of surface water resources by decanting acid mine drainage. The water balance indicates that an average water make in the order of 5 800 m3/day can be expected. Based on a sulphate concentration of around 3 000 mg/ℓ, this equates to around 17.4 tons SO4 per day, or around 6 351 tons SO4 per year.	3.47	The pit will be backfilled without a final void, rehabilitated and made free draining in order to minimise the post closure water make.	Remedy with rehabilitation	During rehabilitation	Contractor	RQOs for the Olifants River Catchment	Indicators monitored do not indicate a significant impact to surface water quality as a result of activities compared to baseline conditions/ RQOs
	3.48	Monitoring of water levels in the mine and the associated water quality is committed to. This will allow both calibration of the post mining water quality and water volumes.	Control with monitoring	Continuous	HSE Lead		
	(3.34)	A water management strategy, including a decant management plan will be developed five (5) years prior to mine closure which will consider passive treatment.	Control with planning and design	Five years prior to closure	HSE Lead		
Noise							
Increased noise levels	3.49	Keep all diesel-powered equipment and plant vehicles at a high level of maintenance. This should particularly include the regular inspection of and, if necessary, the replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.	Control and stop with proper maintenance	During decommissioning	Contractor & Mine Manager	IFC guidelines and SANS 10103	Monitoring implemented and levels are below acceptable levels at sensitive receptors.
	3.50	Select equipment with lower sound power levels. Vendors should be required to guarantee optimised equipment design noise levels.	Stop with effective equipment				
	3.51	In managing noise specifically related to truck and vehicle traffic, efforts should be directed at (i) Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program; (ii) Maintain road surface regularly to	Control and stop with procedures, training, and maintenance				

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
		avoid corrugations, potholes etc; (iii) Avoid unnecessary idling times.					
	3.52	Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.					
	3.53	A complaints register must be kept.	Control by communicating with I&APs	Throughout	Mine Stakeholder Liaison Officer & HSE Lead		
Visual							
Positive impact: Decommissioning/dismantling of infrastructure and replacing stockpiled soils over disturbed areas and returning to a natural mimicking topography that can support an alternative end use	3.54	Ensure that rehabilitation takes place in line with the Land and Rehabilitation Management Plan (Old_Wvk_Prod_Sop_035) for Wolvekrans, or the rehabilitation plan developed in terms of GNR1147.	Remedy with rehabilitation	Decommissioning and rehabilitation	Contractor & HSE Lead	National Ambient Air Quality Standards (GN1210 of 2009)	End land use requirements are met.
	3.55	Ensure that all unnecessary infrastructure/dumps or stockpiles are demolished/removed.	Remedy with removal				
	3.56	Rehabilitate all areas where infrastructure/stockpiles/dumps have been removed.	Remedy with rehabilitation				
Air quality							
Increased particulate matter (PM10) as a result of decommissioning activities associated with infrastructure management, including stockpiles and overburden dumps.	3.57	Regular wetting of exposed areas, temporary stockpiles and haul ramps.	Control by limiting dust generation	During decommissioning	HSE Lead	National Ambient Air Quality Standards (GN1210 of 2009 National Dust Control Regulations (GNR827 of 2013)	PM_{10} deposition does not exceed baseline conditions / limits prescribed in the National Ambient Air Quality Standards at sensitive receptors
Increased particulate matter (PM2.5) as a result of decommissioning activities associated with infrastructure management, including stockpiles and overburden dumps.	3.58	Chemical stabilisation of on- and offsite haul roads.					$PM_{2.5}$ deposition does not exceed limits prescribed in the National Ambient Air Quality Standards

Potential impact	Ref	Mitigation measures	Mitigation type	Time period	Roles & responsibilities	Compliance with standard	Performance indicator
Increased dust generation as a result of decommissioning activities associated with infrastructure management, including stockpiles and overburden dumps.	3.59	Rehabilitation and revegetation of the cleared areas as soon as practical, with the option of using watering to suppress dust emissions during dry and windy conditions.	Stop and control with rehabilitation	Upon cessation of activities	Contractor & HSE Lead		$PM_{2.5}$ deposition does not exceed baseline conditions/ limits prescribed in the National Ambient Air Quality Standards

1.7 Financial provision

1.7.1 Determination of the amount of Financial Provision

1.7.1.1. Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22(2)(d) as described in 2.4 herein

Table 1-6: Closure objectives for VDDC and their alignment to baseline conditions

Aspect	Closure objective (refer to 1.4.1)	Alignment with baseline conditions
Land use	To mimic regional geomorphological features by maintaining a free-draining topography across the rehabilitated MRA.	The land use will be restored to grazing. This corresponds to the pre-development land use which is cultivated commercial fields and open grasslands.
	To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over 80% of the rehabilitated portions of the MRA, that can sustain between 2.4 ha/LSU and/or 5t/ha carrying capacity.	
	To maintain a productive vegetation cover that supports a regional pasture-related carrying-capacity of 2.4 ha/LSU and/or 5t/ha of hay, at a vegetal cover of > 75%.	
	To achieve creation of habitats for local fauna expected to occur within the rehabilitated areas on which a grazing land use is taking place.	
	To maintain the visual landform as aligned to the approved surface rehabilitation landform design of the rehabilitated landscape, that blend into the surrounding areas.	
Water	To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions.	Rehabilitating the disturbed land to be free draining will ensure that the baseline catchment yield is not significantly reduced.
	To guide appropriate groundwater abstraction within the MRA to an authorised quantity.	Limited groundwater abstraction is taking place in the project area by private owners. The closure objectives recognise the need to manage this aspect should it be required.
	To have implemented an alternative, agreed-on landowner/user-maintained groundwater supply or source for predefined landowner/user/s who were supplied water during mining operations.	
	To limit the impact on the quality of the aquifer adjacent to the rehabilitated open pits by not exceeding the predefined groundwater quality objectives.	

Aspect	Closure objective (refer to 1.4.1)	Alignment with baseline conditions
	To not exceed agreed-on, predefined surface water quality objectives, as stipulated in the RWQOs[3] for the following catchments: B11B, B11F and B11G.	The baseline conditions in terms of water quality is poor due to historic mining activities; hence, the closure objective commits to remaining within the RQOs for the Olifants Catchment. This is aligned with the DWS' vision for the area.
Air quality	To maintain local air quality parameters to agreed-on, predefined human health-related standards, in terms of national ambient air quality the Highveld Priority Area.	The project is situated in an area of poor air quality within the Highveld Priority Area. The closure objectives are aligned with the need to maintain ambient air quality levels within this area to acceptable levels.
Social	To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives.	The aim is to rehabilitate the area to sustainable, productive farming land use (grazing) which limits health and safety risks to the people and animals using the land and is therefore aligned with the baseline conditions.
	To have completed implementation of the closure-related projects agreed-on in the mine's approved Social and Labour Plan, focusing on personal skills development and local economic development.	
Substitute Economics	To have developed a plan for care-and-maintenance of remaining mining-related surface infrastructure that has a beneficial re-use, for hand-over to- and accountability by the next landowner.	The closure objectives are aligned with ensuring that the rehabilitated area will have economic value after mining has ceased.
	To have removed or demolished other infrastructure (non-mining related), except for those facilities that have been identified as having a beneficial post-mining use potential (e.g. powerlines, water pipelines, boreholes etc.)	
	To have identified public-private partnerships accountable for management and maintenance of the rehabilitated landscape as its long-term use/s.	
	To leave behind a rehabilitated landscape that will retain long-term economic value for future landowners.	

1.7.1.2. Confirm specifically that the environmental objectives in relation to closure have been consulted with landowners and interested and affected parties

The closure objectives, as determined in the most recent closure plan, are described in **section 1.4.1**. This EIAR/EMPr will be made available to the public for review for a period of thirty (30) days. Interested and affected parties are encouraged to comment on any sections of the report. Any comments, concerns or queries should be submitted to the

[3] National Water Act (Act No. 36 of 1998) Classes and Resource Quality Objectives of Water Resources for the Olifants Catchment

EAP and these will be addressed and responded to before incorporated into the final EIAR/EMPr.

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

The rehabilitation plan was compiled by Golder Associates (2019) and is attached as **Appendix 10**.

1.7.1.4. Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The rehabilitation plan is aligned to the closure objectives for the mining right under which the VDDC section is included. This means that the post-mining landform has been designed to be free draining, where the rehabilitated area is similar to the surrounding landscapes. Furthermore, there are no contradictions in the rehabilitation plan when compared to the commitments in the closure objectives.

1.7.1.5. Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

The preliminary closure liability for the proposed infrastructure development component of the VDDC Project was calculated at R 20 151 105 (which includes the removal of the infrastructure, and the rehabilitation and maintenance of the disturbed areas).

The opencast rehabilitation associated with the proposed VDDC infrastructure project was calculated based on the end of LoOP volumes and rehabilitation designs provided by Golder & Associates and is R 296 165 229.

The combined financial provision estimate for the proposed VDDC infrastructure and mining project is therefore R 316 316 334.

These costs exclude VAT, P&Gs and contingencies.

Refer to **Appendix 8.12** for the details of the Financial Provision.

1.7.1.6. Confirm that the financial provision will be provided as determined

The closure liability for the proposed infrastructure development will be funded from operational capital budget and will be provided as determined.

1.8 Monitoring

Mechanisms for monitoring compliance are provided in **Table 1-7**. To limit repetition, the aspects that are affected by potential impacts are included in the table below, as opposed to the actual impacts themselves, which have been identified in **section 18** of **Part A**.

Table 1-7: Monitoring programme for the VDDC project

Aspects requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring frequency	Reporting frequency	Potential source activities
Flora	• Visual assessment of extent of establishment and spread of invasive alien plant species	Environmental Specialist HSE Lead	Bi-annually, during the wet and dry seasons.		• Site preparation, topsoil stripping and stockpiling, and construction • Operation of surface infrastructure associated with opencast mining (such as stockpiles, overburden dumps, and driving) • Decommissioning and rehabilitation activities (including use and maintenance of vehicles and machinery, shaping of rehabilitated land).
Fauna	• Ad hoc, visual observations of Serval (L*eptailurus serval*) and Cape Clawless Otter (*Aonyx capensis*) activity (i.e. droppings, prints, sightings, etc.) • Photographic record, if possible	Environmental Specialist HSE Lead	*Ad hoc*		• Site preparation, topsoil stripping and stockpiling, and construction • Operation of surface infrastructure associated with opencast mining (such as stockpiles, overburden dumps, and driving) • Decommissioning and rehabilitation activities (including use and maintenance of vehicles and machinery, shaping of rehabilitated land).
Aquatic ecosystem	• Monitoring locations as per **Table 1-9** and **Figure 1-2** • Indices as indicated in **Table 1-9**	Environmental Specialist HSE Lead	Bi-annually, during the wet and dry seasons.	Annually to DWS	• Operation and activities associated with the modular WTP • Decommissioning and rehabilitation activities (including use and maintenance of vehicles and machinery, shaping of rehabilitated land).
Topsoil stockpiles	**Fertility:** • Macro nutrients, • pH, • EC	Environmental Specialist HSE Lead	When rehabilitation commences		• Topsoil stockpiling

Aspects requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring frequency	Reporting frequency	Potential source activities
	Erosion and stormwater control: • Visual inspection • Photographic record	Environmental Specialist HSE Lead	Weekly		
Soils associated with evaporators	Indicators: • Metals (As, Cr, Cu, Pb, Mn, Hg, Ni, and Zn) • Anions (Chlorides, Fluoride, Nitrates – Nitrite, and Sulphates)	Environmental Specialist HSE Lead	Once-off prior to the top-soiling and vegetating of the area		• Mechanical evaporation of mine impacted water on unrehabilitated spoils of SKS pit *(Note: should evaporation be conducted on rehabilitated (i.e. top-soiled and vegetated) backfill spoils), bi-annual monitoring of the listed parameters should be conducted at two monitoring points within 50 m of the front of the evaporators, with additional points at 100 m and a further two at 150m)*
Graves	• Visual inspection of GY01	Environmental Specialist HSE Lead	Every 3 months	Inspection register after each inspection	• Site preparation, topsoil stripping and stockpiling, and construction • Activities associated with opencast mining not previously authorised
Noise	• Monitoring points: noise sensitive receptors R5, R7, R10 and R11 (see **Figure 1-4**); • Duration of noise sampling: 15 – 30 minutes per site • Acoustic indices to be recoded and reported: L_{Aeq} (T), L_{Aleq} (T), statistical noise level L_{A90}, L_{AFmin} and L_{AFmax}, octave band or 3rd octave band frequency spectra.	Environmental Specialist HSE Lead	• Once-off during construction • Once-off during operational phase • When complaints are received	After monitoring has been conducted	• Site preparation, topsoil stripping and stockpiling, and construction; • Activities associated with opencast mining not previously authorised; • Decommissioning and rehabilitation activities (including use and maintenance of vehicles and machinery, shaping of rehabilitated land).

Aspects requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring frequency	Reporting frequency	Potential source activities
	• Short term (24-hour) ambient noise measurements if noise related complaints are received		• When noise related complaints are received	After monitoring has been conducted	
Air quality	• Revise existing dustfall monitoring network as follows, as indicated on **Figure 1-4** and **Table 1-11:** o Addition of 3 additional dust buckets o Relocation of single dust bucket at Vandyksdrift Plant and Vandyksdrift Village • Consider placement of PM_{10} sampler at any of the recommended dust bucket locations, if security considerations allow it	Environmental Specialist HSE Lead	Monthly	Monitoring report to be submitted to local air quality officer when exceedances of dustfall standards occur.	• Site preparation, topsoil stripping and stockpiling, and construction; • Operation of surface infrastructure associated with opencast mining (such as stockpiles, overburden dumps, and driving); • Decommissioning and rehabilitation activities (including use and maintenance of vehicles and machinery, shaping of rehabilitated land.
Groundwater quality	• Monitoring locations as per **Table 1-10** and **Figure 1-3** • Parameters as indicated in **Table 1-10**	Environmental Specialist HSE Lead	Quarterly	Annually to DWS	• Construction laydown areas, construction works, movement of materials and construction equipment; • Operation of surface infrastructure associated with opencast mining (such as stockpiles, overburden dumps, and driving); • Waste management and storage; • Decant.
Groundwater levels	• Monitoring locations as per **Table 1-10** and **Figure 1-3**	Environmental Specialist HSE Lead	Quarterly	Annually to DWS	• Dewatering of opencast mining areas

Aspects requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring frequency	Reporting frequency	Potential source activities
Surface water quality	• Monitoring locations as per **Table 1-9** and **Figure 1-2** • Parameters as indicated in **Table 1-9**	Environmental Specialist HSE Lead	Monthly	Annually to DWS	• Construction laydown areas, construction works, movement of materials and construction equipment • Dewatering of water ingress to boxcut • Operation of surface infrastructure associated with opencast mining (such as stockpiles, overburden dumps, and driving) • Operation and activities associated with the modular WTP • Removal of material from the boxcut • Operation of surface infrastructure associated with opencast mining (such as stockpiles, overburden dumps, and driving) • Operation and activities associated with the modular WTP • Decommissioning and rehabilitation activities (including use and maintenance of vehicles and machinery, shaping of rehabilitated land) • Decant of mine water make
Surface water quantity for purpose of mine water balance	• Rainfall • Monthly • Dam water levels • Flows: o Mine water make pumped from the opencast workings; o Inflows to the Vleishaft PCD; o Water pumped from the	Environmental Specialist HSE Lead	• Daily • Not essential • Monthly • Monthly	Annual update of operational water balance. Update of predictive mine water and salt balance every 5 years	• Construction laydown areas, construction works, movement of materials and construction equipment; • Operation and activities associated with the modular WTP; • Isolation of dirty catchment as a result of containment of runoff from dirty water management areas; • Mining and infrastructure development within

Aspects requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring frequency	Reporting frequency	Potential source activities
	Vleishaft PCD for reuse in the operations; o Water managed at the mechanical evaporators; o Volume treated in the WTP; • Volume of treated water discharged from the WTP.				floodlines.
Ground vibrations	• Seismograph • Monitoring locations as per **Figure 1-5** (not all points will be required at once but active monitoring and observation of where blasting is done will dictate the requirements for the areas around the pit)	Blasting superintendent	During each blast		Blasting at opencast pit.
Air blast	• Meteorological information • Monitoring locations as per **Figure 1-5** and **Table 1-12** (not all points will be required at once but active monitoring and observation of where blasting is done will dictate the requirements for the areas around the pit)				
Fly rock	• Visual observation				

Table 1-8: Bio-monitoring (aquatic ecosystem) sampling points and indices

Monitoring point	Description	Coordinates		Indices
Site 1	On the Olifants River, approximately 1 km downstream of the Koringspruit confluence and directly downstream of the R544 regional bridge crossing.	S 26°06'28.20"	E 29°19'23.25"	*In situ* water quality: pH, EC, temperature, dissolved oxygen Invertebrate Habitat Assessment System (IHAS) SASS5 Fish survey
Site 2	On the Olifants River, south of VDDC section.	S 26°05'31.52"	E 29°16'56.77"	
Site 5	On the Olifants River downstream of an old low-level river crossing and upstream of a major haul road bridge crossing.	S 26°05'06.83"	E 29°16'06.12"	
Site 6	On the Olifants River directly after the confluence with the Steenkoolspruit,	S 26°03'43.51"	E 29°15'00.14"	
Site 7	On the Olifants River, approximately 1.5 km downstream of the Tweefonteinspruit confluence.	S 26°00'25.07"	E 29°15'14.19"	
Site 8	On the Olifants River, approximately 2 km upstream of the Witbank Dam and directly upstream of the R544 bridge crossing.	S 26°00'04.79"	E 29°17'30.05"	
Site 9	On an unnamed tributary of the Olifants River and near the main entrance to the SKS section.	S 26°00'52.63"	E 29°18'04.45"	

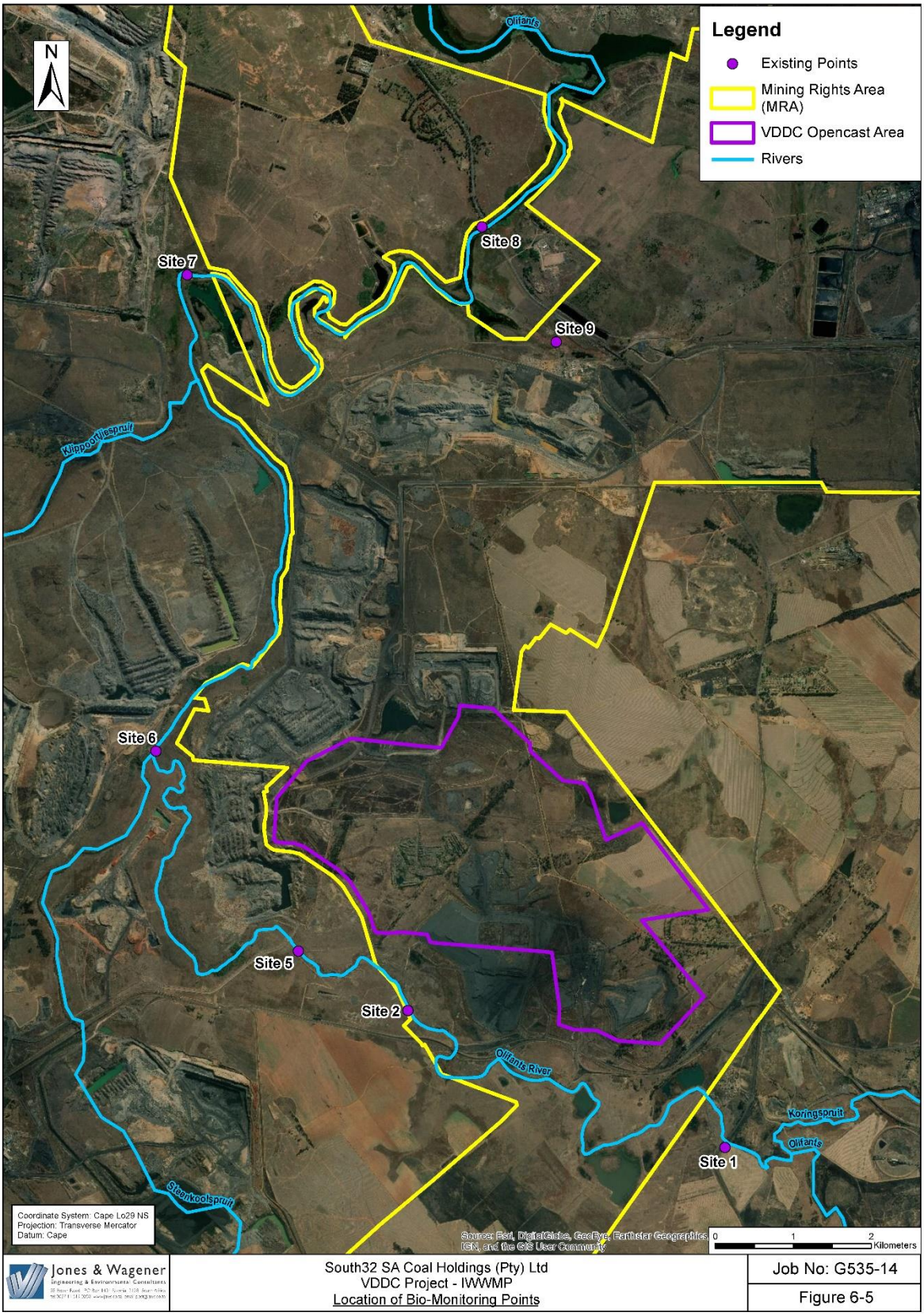

Figure 1-1: Position of bio-monitoring points (J&W, 2019g)

Table 1-9: Surface water monitoring locations and parameters

Monitoring point name	Coordinates		Constituents
Existing monitoring points			pH Value at 25°C Electrical Conductivity Total Dissolved Solids Suspended Solids Iron as Fe Total Alkalinity as $CaCO_3$ Calcium as Ca Chloride as Cl Magnesium as Mg Nitrate & Nitrite as N Ortho Phosphate PO_4 as P Potassium as K Sodium as Na Sulphate as SO_4 Aluminium as Al Fluoride as F Zinc as Zn (total and dissolved) Ammonia as N Aluminum as Al (total and dissolved) Iron as Fe (total and dissolved) Manganese as Mn (total and dissolved)
V01 Springbokspruit @ entrance to mine property	S 26° 06' 02.72"	E 29° 19' 08.97"	
V09 Oxbow 9 ponded water	S 26° 06' 08.94"	E 29° 18' 13.00"	
V16 Olifants downstream of PSS discard dump	S 26° 05' 08.29"	E 29° 16' 25.24"	
V22 Douglas Upstream Betal Bridge	S 26° 06' 23.24"	E 29° 19' 22.36"	
V30 Olifants downstream of confluence with Steenkoolspruit	S 26° 03' 41.65"	E 29° 15' 04.08"	
V31 Olifants upstream of Steenkoolspruit confluence	S 26° 03' 47.70"	E 29° 15' 10.80"	
V32 Olifants downstream tributary near defunct pit U/S pit	S 26° 05' 06.65"	E 29° 16' 07.24"	
V40 Plant water u/g railway boreholes @ small bridge	S 26° 05' 50.74"	E 29° 17' 18.59"	
V11 Olifants @ DWAF Weir U/S PSS discard dump	S 26° 05' 30.41"	E 29° 16' 58.14"	
Attenuation dam1**	S 26° 04' 05.26"	E 29° 18' 29.75"	
W02 Olifants River at Wolwekrans Weir.	S 26° 00' 24.96"	E 29° 15' 14.72"	
Proposed monitoring points once relevant infrastructure is operational			
P1 Discharge from modular WTP into northern canal	S 26° 01' 30.88"	E 29° 16' 05.44"	
P2 At clean water diversion canal at Eastern overburden dump	S 26° 04' 54.72"	E 29° 18' 54.69"	
P3 At dirty water canal at Eastern overburden dump	S 26° 05 17.17	E 29° 19 23.50	
P4 On the Olifants River, downstream of discharge from modular WTP at the R544 bridge (this correspond with bio-monitoring Site 8)	S 26° 00'04.79"	E 29°17'30.05"	

** Note: Co-ordinates for *"2603 Attenuation dam 1"* as per the South32 monitoring programme plots on Attenuation Berm 1. Co-ordinates provided in this table have therefore been revised to reflect the correct position on Attenuation Dam 1.

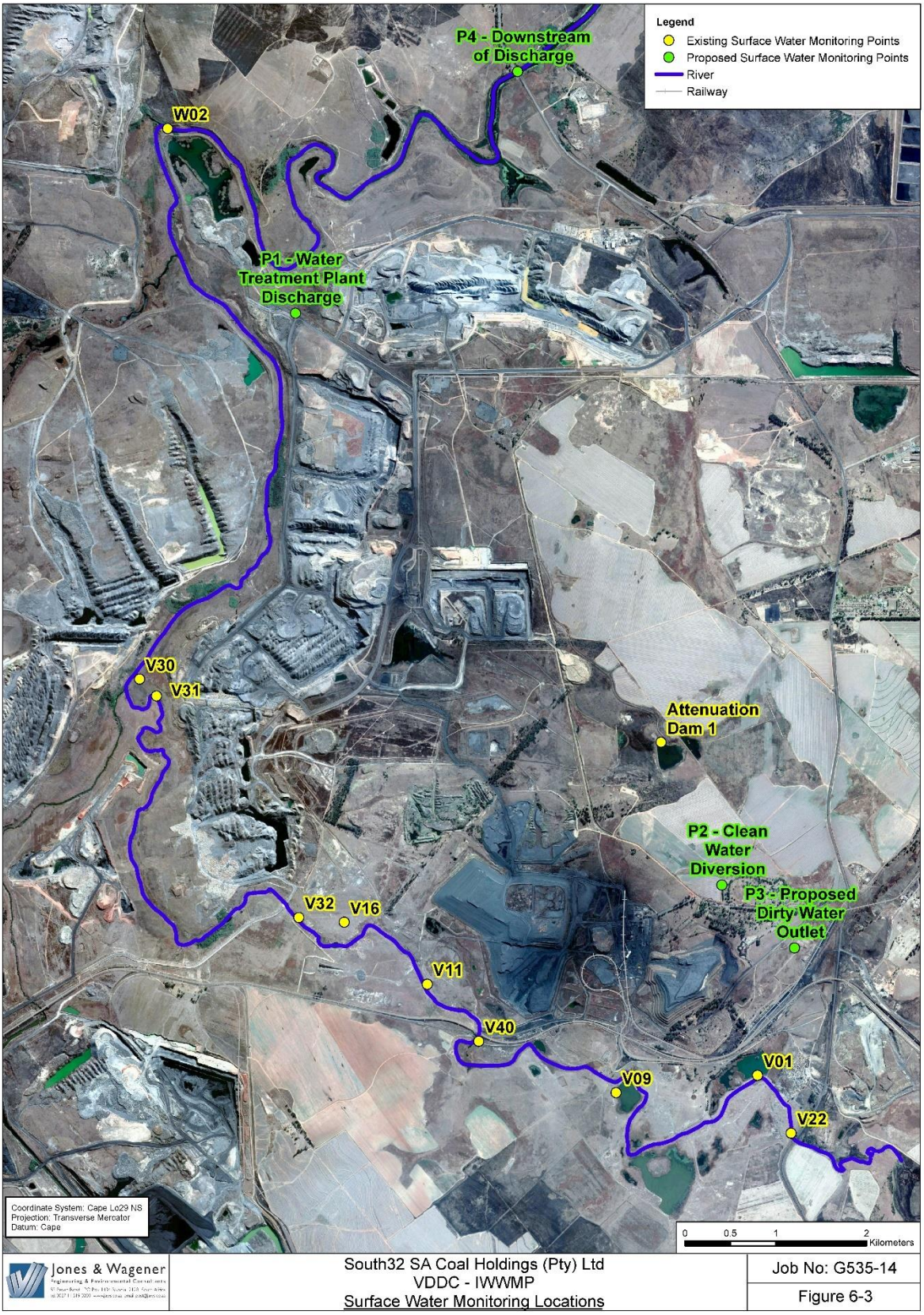

Figure 1-2: Surface water monitoring locations (J&W, 2019g)

Table 1-10: Groundwater quality monitoring points and parameters

Monitoring point name	Co-ordinates		Constituents
Existing monitoring points			
WBH2S5	S 26° 03' 53.21"	E 29° 16' 37.08"	
WBH2S6	S 26° 04' 13.25"	E 29° 16' 23.15"	
WBH2S7	S 26° 04' 34.32"	E 29° 18' 40.26"	
WBH2S8	S 26° 03' 45.23'	E 29° 18' 20.21"	
WBH2S10	S 26° 04' 18.46"	E 29° 17' 54.84"	
UB11	S 26° 05' 47.81'	E 29° 17' 45.78"	
UB72	S 26° 03' 47.09"	E 29° 17' 49.20"	
UB88	S 26° 02' 03.12"	E 29° 17' 23.99"	Field measurements: pH Electrical Conductivity Laboratory analyses: Total Alkalinity as $CaCO_3$ Calcium as Ca Chloride as Cl Magnesium as Mg Potassium as K Sodium as Na Sulphate as SO_4 Nitrate expressed as N Fluoride as F Iron as Fe Manganese as Mn (total and dissolved) Aluminium as Al pH at 25°C Electrical Conductivity Total Dissolved Solids
UB110	S 26° 04' 14.27"	E 29° 17' 55.50"	
UB113	S 26° 04' 57.78"	E 29° 18' 28.19"	
UB114	S 26° 05' 51.36"	E 29° 17' 25.26"	
UB115	S 26° 06' 19.61"	E 29° 17' 52.38"	
BB34	S 26° 05' 43.37"	E 29° 17' 21.89"	
BB132	S 26° 04' 58.18"	E 29° 18' 51.53"	
SB84	S 26° 02' 01.54"	E 29° 17' 17.88"	
SB122	S 26° 05' 01.67"	E 29° 16' 57.78"	
SB123	S 26° 05' 28.63"	E 29° 18' 02.94"	
SB124	S 26° 05' 22.54"	E 29° 17' 55.43"	
RB9	S 26° 06' 00.82"	E 29° 17' 37.38"	
UGS4S	S 26° 01' 55.74"	E 29° 18' 13.18"	
VD1N	S 26° 04' 14.97"	E 29° 18' 46.59"	
VD3N (BH1)	S 26° 04' 05.59"	E 29° 17' 55.44"	
VD4N	S 26° 03' 57.65"	E 29° 16' 44.72"	
VD6N	S 26° 04' 02.83"	E 29° 16' 35.34"	
VD7N	S 26° 05' 13.46"	E 29° 16' 59.91"	
VD8N	S 26° 05' 14.98"	E 29° 17' 00.09"	
VD9N	S 26° 05' 01.73"	E 29° 16' 57.83"	
VD10N	S 26° 01' 53.85"	E 29° 18' 00.36"	
BB127	S 26° 03' 09.38"	E 29° 15' 45.26"	

Monitoring point name	Co-ordinates		Constituents
BB128	S 26° 03' 34.88"	E 29° 15' 13.58"	
P1	S 26° 05' 43.17"	E 29° 17' 26.21"	
P2	S 26° 05' 41.51"	E 29° 17' 24.52"	
P3	S 26° 05' 39.96"	E 29° 17' 22.71"	
P4	S 26° 05' 38.11"	E 29° 17' 20.52"	
Proposed new points			
JW1	S 26° 05' 21.13"	E 29° 19' 32.18"	
JW2	S 26° 05' 45.44"	E 29° 18' 32.16"	

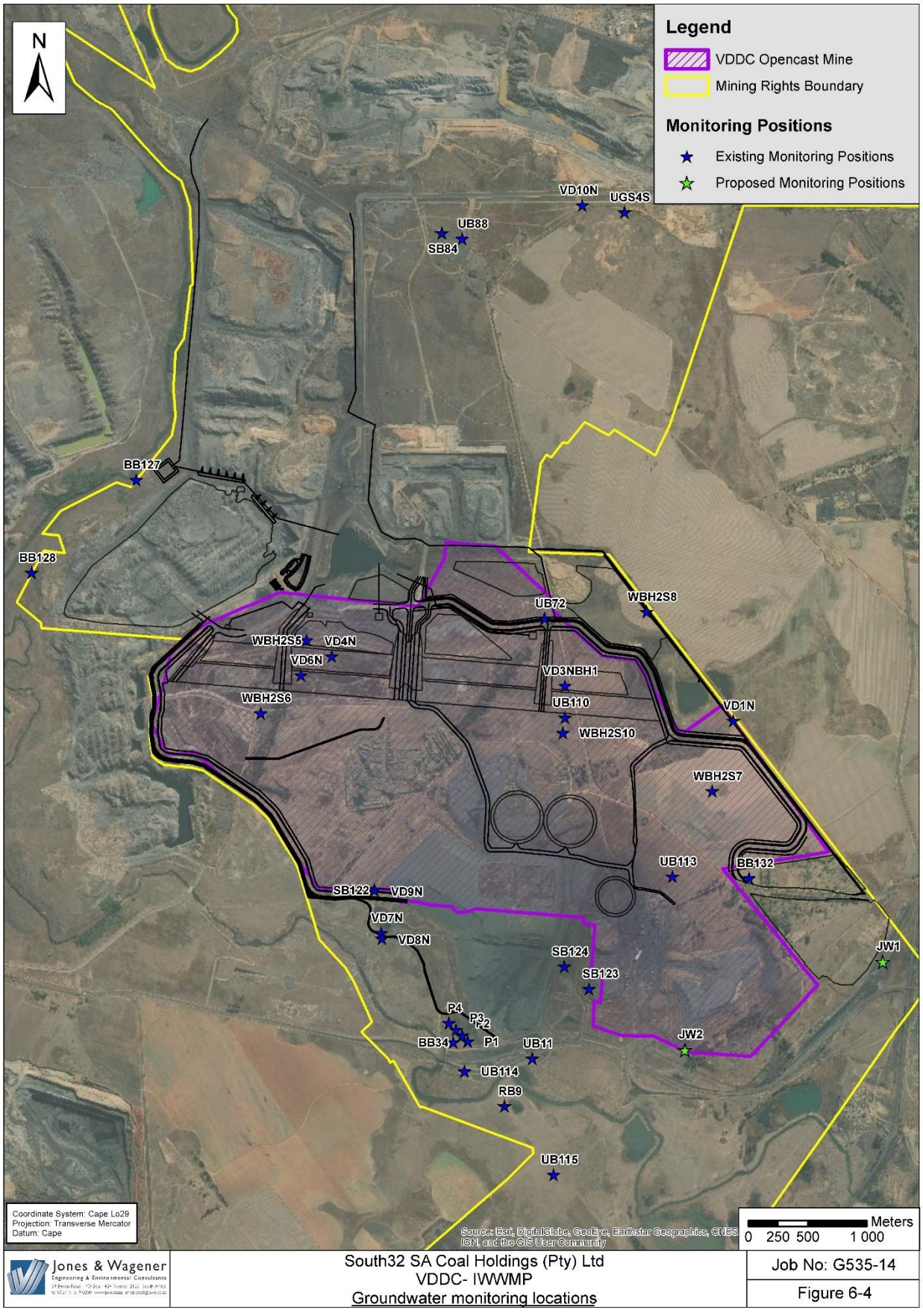

Figure 1-3: Position of groundwater monitoring points (J&W, 2019g)

Table 1-11: Description of dust bucket monitoring points

Sample Location	Bucket Type	Y	X
Vandyksdrift Plant (relocated)	Single Bucket	S 26°05'56.93"	E 29°18'10.96"
Vandyksdrift Village (relocated)		S 26°05'36.49"	E 29°19'20.10"
BCP10		S 26°03'30.42"	E 29°16'42.60"
SKS Prefab Offices		S 26°03'17.10"	E 29°17'09.30"
DGS Next to Anglo (single bucket)		S 26°03'16.02"	E 29°15'28.14"
Pit Haul Road		S 26°01'31.20"	E 29°18'40.74"
New bucket 1: West of mine boundary, near proposed haul road		S 26°05'0.93"	E 29°16'16.50"
New bucket 2: Southwest of mine boundary, near service road and railway line		S 26°05'43.55"	E 29°17'23.88"
New bucket 3: Northeast of proposed topsoil dumps.		S 26°03'49.64"	E 29°18'33.64"
DGS21	Directional Buckets	S 26°03'48.90"	E 29°15'13.62"
DGS Next to Anglo		S 26°03'16.02"	E 29°15'28.14"

Table 1-12: Details of monitoring locations for blasting related monitoring (BMC, 2019)

Tag	Description	Co-ordinates	
6	Springbok Mining Town Houses	S 26°03'18.03"	E 29°19'40.72"
15	Heritage Site (Railway Station)	S 26°05'36.89"	E 29°19'15.27"
78	Power lines/Pylons	S 26°04'30.52"	E 29°19'01.24"
202	Informal Settlement (Lindokhule)	S 26°05'56.02"	E 29°19'26.28"
216	Road	S 26°04'59.93"	E 29°18'48.63"
221	Informal Housing	S 26°04'50.21"	E 29°19'46.50"
228	Mine Buildings/Structures	S 26°03'28.09"	E 29°17'06.55"
230	Mine Buildings/Structures	S 26°03'41.22"	E 29°16'47.81"
231	Dam	S 26°03'41.98"	E 29°16'23.15"
240	Building/Structure	S 26°05'58.44"	E 29°18'55.06"
256	Power lines/Pylons	S 26°03'47.53"	E 29°18'05.19"
265	Power lines/Pylons	S 26°05'42.41"	E 29°18'03.52"

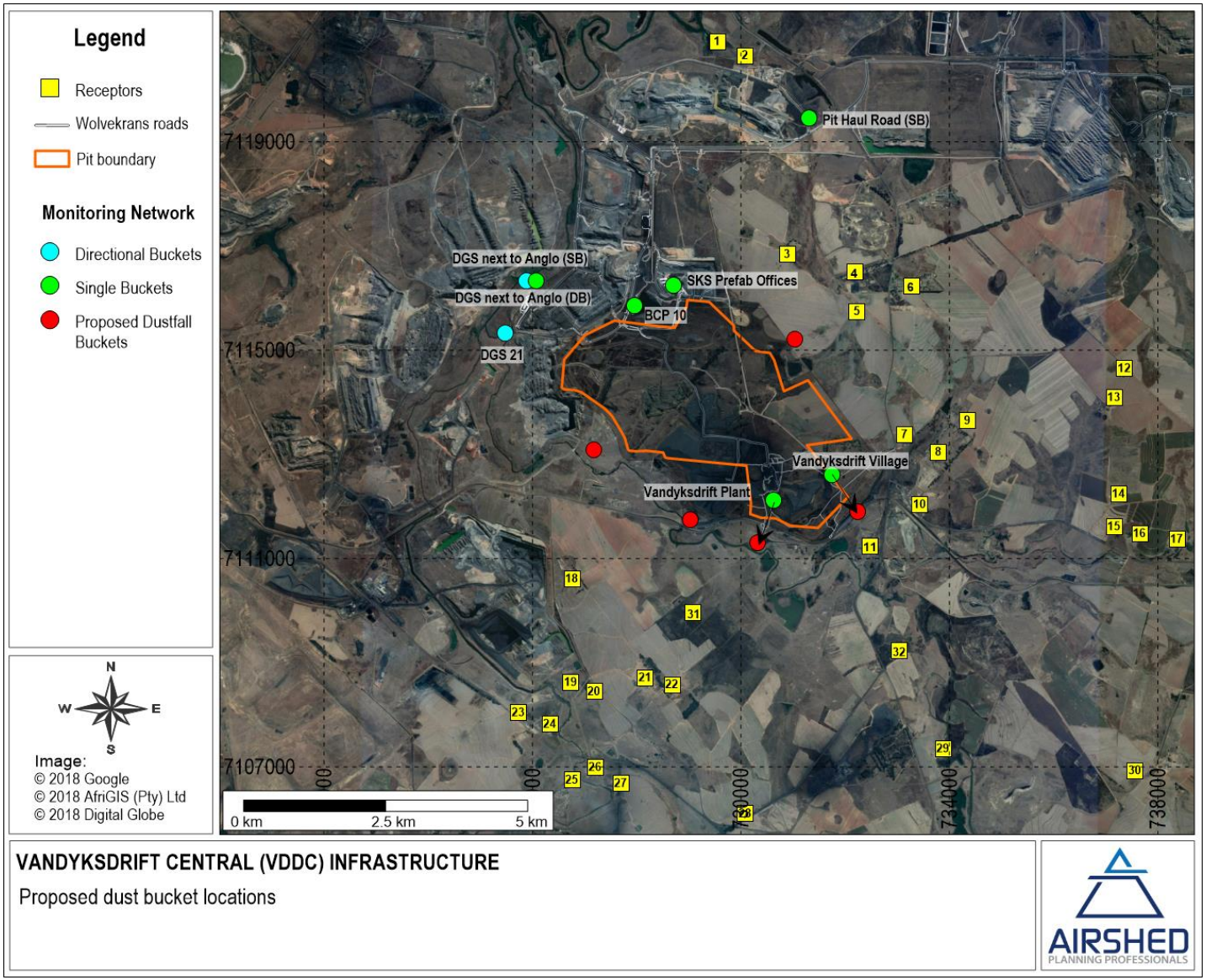

Figure 1-4: Proposed location of revised dustfall sampling locations (Airshed, 2019a)

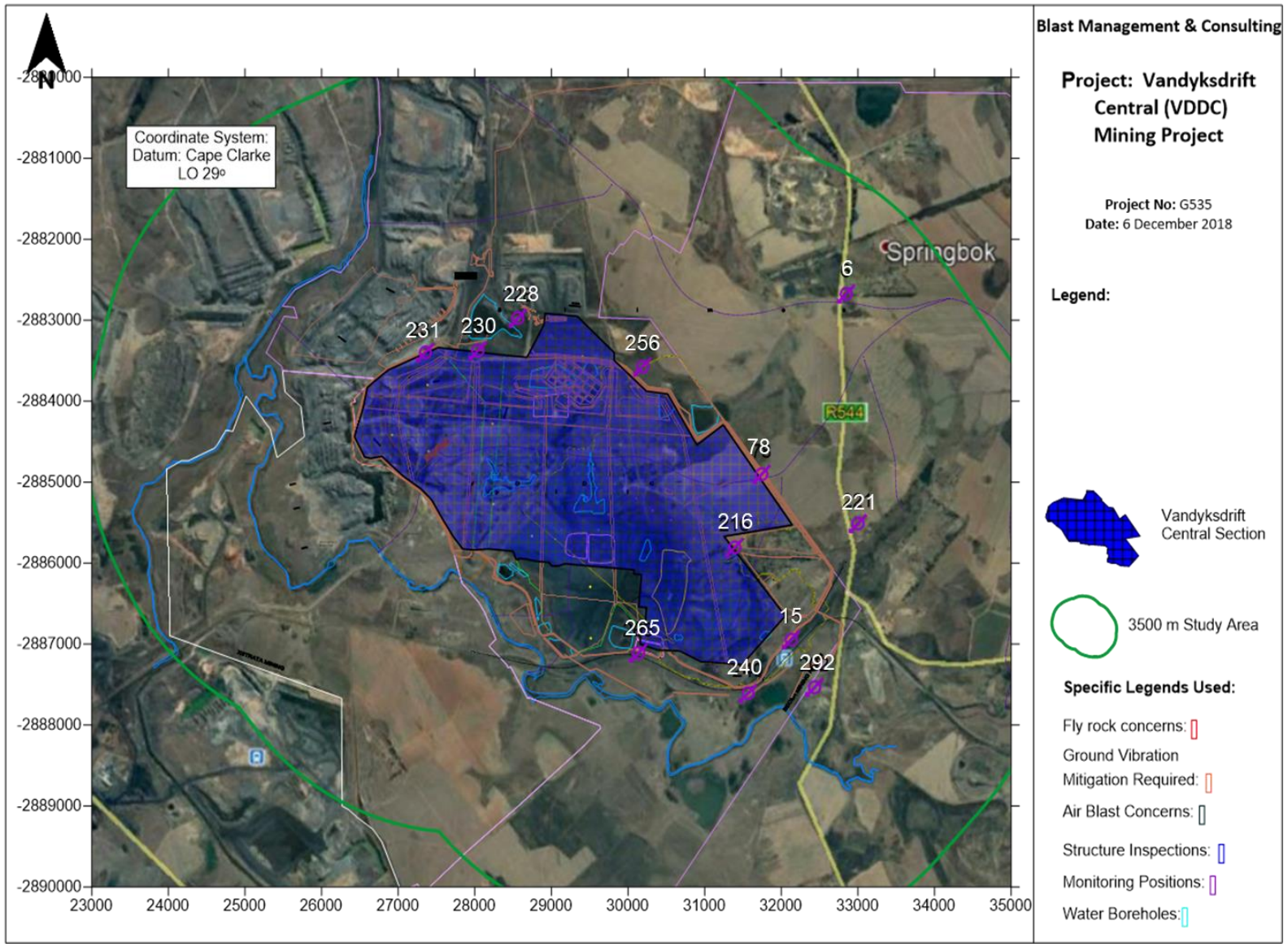

Figure 1-5: Suggested monitoring locations for blasting related monitoring (BMC, 2019)

1.9 Indicate the frequency of the submission of the performance assessment report

Environmental compliance audits for this EMPr should be undertaken on a biennial basis, unless specified otherwise in the integrated environmental authorisation. The performance assessment audit reports must be submitted to the DMR and must comply with the relevant legislative requirements.

1.10 Environmental Awareness Plan

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

Environmental Induction for Employees and Service Providers

The induction training for employees, contractors and service providers is to take the form of a presentation including:

- A description of environmental sensitivities on site;
- A description of environmental legal requirements and South32's commitment to comply with these requirements;
- A description of broad-based objectives of environmental management;
- A discussion of how individual actions can impact on the environment;
- A discussion of how individual actions can assist in the successful implementation of the EMPr;
- The Code of Conduct.

All employees are to sign that they have understood and will comply with the Code of Conduct. Employees are to be re-inducted on an annual basis (after returning from their annual leave).

Requirements:

- Environmental induction material (posters, power point presentations etc.);
- Code of Conduct;
- Register of inducted employees, service providers and contractors.

Environmental Awareness Programme

The purpose of the general environmental awareness programme is to promote on-going environmental awareness amongst the workforce. It will focus on addressing particular environmental issues which have been identified as problematic through the Performance Assessment Programme and EMPr compliance monitoring. All members of the project workforce and contractors are to be incorporated into the general environmental awareness programme

Environmental Topics

Environmental awareness topics are to be chosen by management based on the outcomes of internal audits as well as topics of general environmental interest. The topic is to be communicated to the workforce through:

- Discussions at all SHE meetings (to be itemised on the agenda);
- Posters on notice boards.

Monthly environmental topics could include:

- What is the environment;
- The project environment;
- You and the environment;
- The Code of Conduct;
- Reporting environmental incidents;
- Environmental risks;
- Environmental emergency training;
- Preventing and cleaning up spills;
- Reduce, reuse and recycle;
- General versus hazardous waste;
- Alien vegetation control;
- Saving water;
- Saving energy;
- Heritage sites.

Requirements:

- Environmental topics to be included on the agenda of relevant meetings;
- Environmental awareness material to be produced and posted.

Job Specific Environmental Awareness Training

The purpose of the job specific environmental awareness training is to ensure that employees within the specific management units are equipped to implement the actions committed to in the EMPR. All members of the workforce are to be subject to job specific environmental training. This training is to undertaken by the managers of each of the management units. Supervisors will be trained to assist with the implementation and training of the work force.

Environmental Risk Identification

The environmental risks associated with each management area are to be identified by the manager and supervisors together with the technical services manager. The risks are to be documented and actions to reduce these risks should be developed. The actions are to ensure overall compliance with the commitments of the EMPr. The findings of the performance assessment audits and EMPr compliance monitoring will assist in identifying risks.

Training

All members of the workforce (mining, plant workers, administration etc.) are to be subject to job specific training. This may include, but not be limited to:

- Preventing pollution;
- Spill prevention and clean-up procedures;
- The location and purpose of material safety data sheets (MSDSs)
- Managing waste;
- No-go areas;
- Incident reporting.

The aspects to be covered however are dependent on the findings of the individual risk assessments. This is to be undertaken for each management area initially. Thereafter all new members of the workforce are to undergo environmental training as part of the training required to do their particular job.

Corrective Action

- Any actions undertaken by a worker that pose a risk to the environment are to be stopped immediately;
- The worker is to be instructed in how to correct the action;
- Non-compliance is to be incorporated into the standard disciplinary procedure applicable to the project.

Requirements:

- Risk assessment and action plan for each area at the mine;
- Training of the workforce within each management area;
- Training of new members of the workforce;
- Records of appropriate training conducted.

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

Wolvekrans Colliery, which includes the VDDC section, has an existing Emergency Preparedness and Response Procedure which covers:

- Reporting of incidents;
- Containment of spills;
- Clean-up procedures;
- Handling and disposal of cleaning equipment.

This will continue to be implemented and revised and updated as may be necessary.

The EMPr requires that environmental awareness training be conducted with employees and site personnel to ensure that all parties are aware of sensitive environmental aspects.

1.11 Specific information required by the Competent Authority

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

The financial provision will be reviewed and updated (where necessary) on an annual basis and according to the requirements of GNR 1147, which will be audited by an external auditor.

2. REFERENCES

Airshed Planning Professionals (Pty) Ltd (August 2019a). Vandyksdrift Central (VDDC) Infrastructure: Baseline Air Quality Report. Report No: 17JAW07AQa.

Blast Management & Consulting. (2019). Blast Impact Assessment, Proposed Vandyksdrift Central (VDDC) Mining Project (Reference JAWS~Vandyksdrift Central~VDDC Project~EIAReport~181206V03).

Golder Associates (2018). Geochemical Characterisation for Wolvekrans Colliery. (Report number 1660807-317000-1).

Golder Associates (2019). Inclusion of VDDC water management into Wolvekrans site wide water management plan. Vandyksdrift Central Feasibility Study. (Report number 19124625-327233-1_ DRAFT).

Jacana Environmentals (2019). Memo: Vandyksdrift Central (VDDC) Project: Mine Residue Facilities: Waste Classification and Barrier Design.

Jones & Wagener (2019a). Vandyksdrift Central (VDDC) Mining: Infrastructure Development, Hydrogeological Investigation, Final Report. (Report number: JW120/19/G535-300).

Jones & Wagener. (2019d). Vandyksdrift Central Mining: Infrastructure Development Soil, Land Capability and Land Use Assessment Impact Assessment Report. (Report number JW200/18/G535-07).

Jones & Wagener. (2019g). Vandyksdrift Central Project. Integrated Water Use Licence Application. Draft Technical Report. (Report number: JW219/19/G535-012).

Worley. (2019.) Van Dyksdrift Central Feasibility Study; Mine Water Management Report. (Report reference C00820-000-CI-REP-0001, Rev0).

3. UNDERTAKING

The EAP herewith confirms

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

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

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

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

Signature of the EAP

DATE: 29 November 2019

APPENDIX A

CHANCE FIND PROCEDURE: HERITAGE RESOURCES

Chance-find procedures for heritage resources

The initial procedure to follow whenever heritage resources are uncovered during development is aimed at avoiding any further possible damage to the heritage resources, namely:

- The person or group (identifier) who identified or exposed the heritage resource or burial ground must cease all activity in the immediate vicinity of the site.
- The identifier must immediately inform the senior on-site manager of the discovery.
- The senior on-site manager must make an initial assessment of the extent of the find and confirm that further work has stopped and ensure that the site is secured and that controlled access is implemented.
- The senior on-site manager will inform the Environmental Officer (EO) and Health and Safety (HS) officers of the chance find and its immediate impact on the VDDC Project. The EO will then contact the project archaeologist.
- The project archaeologist will do a site inspection and confirm the significance of the discovery, recommend appropriate mitigation measures to the mine and notify the relevant authorities.
- Based on the comments received from the authorities the project archaeologist will provide the mine with a Terms of Reference and associated costs if mitigation measures have to be implemented.

Chance-find Procedures for burials and graves

In the event that unidentified burial grounds or graves are identified and/or exposed during any of the developmental phases of the VDDC Project the following steps must be implemented subsequent to those outlined above:

- The project archaeologist must confirm the presence of graveyards and graves and follow the following procedures.
- Inform the local South African Police Service (SAPS) and traditional authority.
- The project archaeologist in conjunction with the SAPS and traditional authority will inspect the possible graves and make an informed decision whether the remains are of forensic, recent, cultural-historical or archaeological significance.
- Should it be concluded that the find is of heritage significance and therefore protected in terms of heritage legislation the project archaeologist will notify the relevant authorities.
- The project archaeologist will provide advice with regard to mitigation measures for the burial grounds and graves.

APPENDIX B

CHANCE FIND PROCEDURE: PALAEONTOLOGICAL RESOURCES

Chance Find Protocol and examples of fossil plants from the Vryheid Formation

Monitoring Programme for Palaeontology – to commence once the mining activities have begun.

1. The following procedure is required when deep excavations commence. The surface activities most likely would not impact on the fossil heritage as the coal and any associated fossil plants are below ground.
2. When mining operations commence the shales and mudstones (of no economic value) that will be cut through in order to reach the coal seam must be given a cursory inspection by the mine geologist or designated person before being added to the waste rock dump used by the mine. Any fossiliferous material should be put aside in a suitably protected place. This way the mining activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the mine to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 1 and 2). This information will be built into the mine's training and awareness plan and procedures.
4. On a regular basis, to be determined by the mine management, the responsible person should examine a representative sample of non-coal material and look for fossil plants and take digital photographs of them to send to a qualified palaeontologist/ palaeobotanist sub-contracted for this project to get an opinion on their scientific value.
5. Fossil plants that are considered to be of good quality or scientific interest by the palaeobotanist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the mine property a SAHRA permit must be obtained. A report must be submitted to SAHRA as required by the relevant permits.
6. If any open pit inspection is deemed necessary then the normal safety procedures that the mine management endorses, must be followed by the palaeontologist and associated mine employees.
7. If no good fossil material is recovered then no site visits will be required by the palaeontologist.

Table 1: List of Vryheid Formation flora and fauna (Aitken, 1994; Anderson & Anderson, 1985; Barbolini et al., 2016; Plumstead, 1969; Rubidge et al., 1995).

Flora - macroplants	Flora – microfossils	Fauna
Azaniodendron fertile, Cyclodendron leslii, *Sphenophyllum hammanskraalensis,* *Annularia sp.,* *Raniganjia sp.,* *Asterotheca spp.,* *Liknopetalon enigmata*, *Glossopteris* > 20 species, *Hirsutum 4 spp.,* *Scutum 4 spp.,* *Ottokaria 3 spp.,* *Estcourtia sp.,* *Arberia 4 spp.,* *Lidgetonia sp., Noeggerathiopsis sp. Podocarpidites sp*	*Protohaploxypinus microcarpus* *Praecolpatities sinuous* *Microbaculispora trisina* *Striatopodocarpites cancellatus* *Striatopodocarpites fusus* *Pseudoreticulatispora pseudoreticulata* *Pseudoreticulatispora confluens* Taeniate bisaccate pollen	*Mesosaurus* in the lowest part

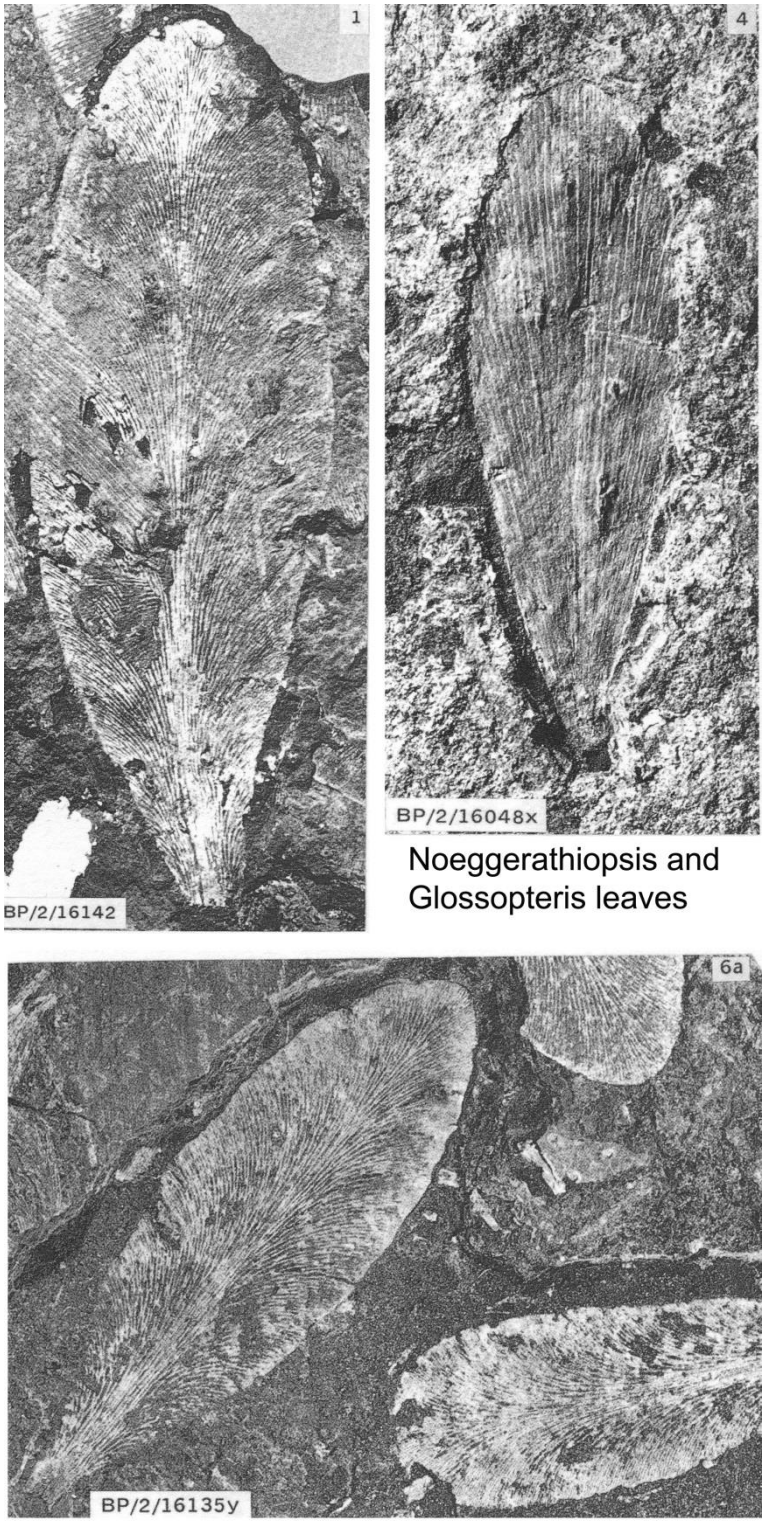

Figure 1: **examples of fossils from the Vryheid Formation, *Glossopteris* sp. and *Noeggerathiopsis* sp.**

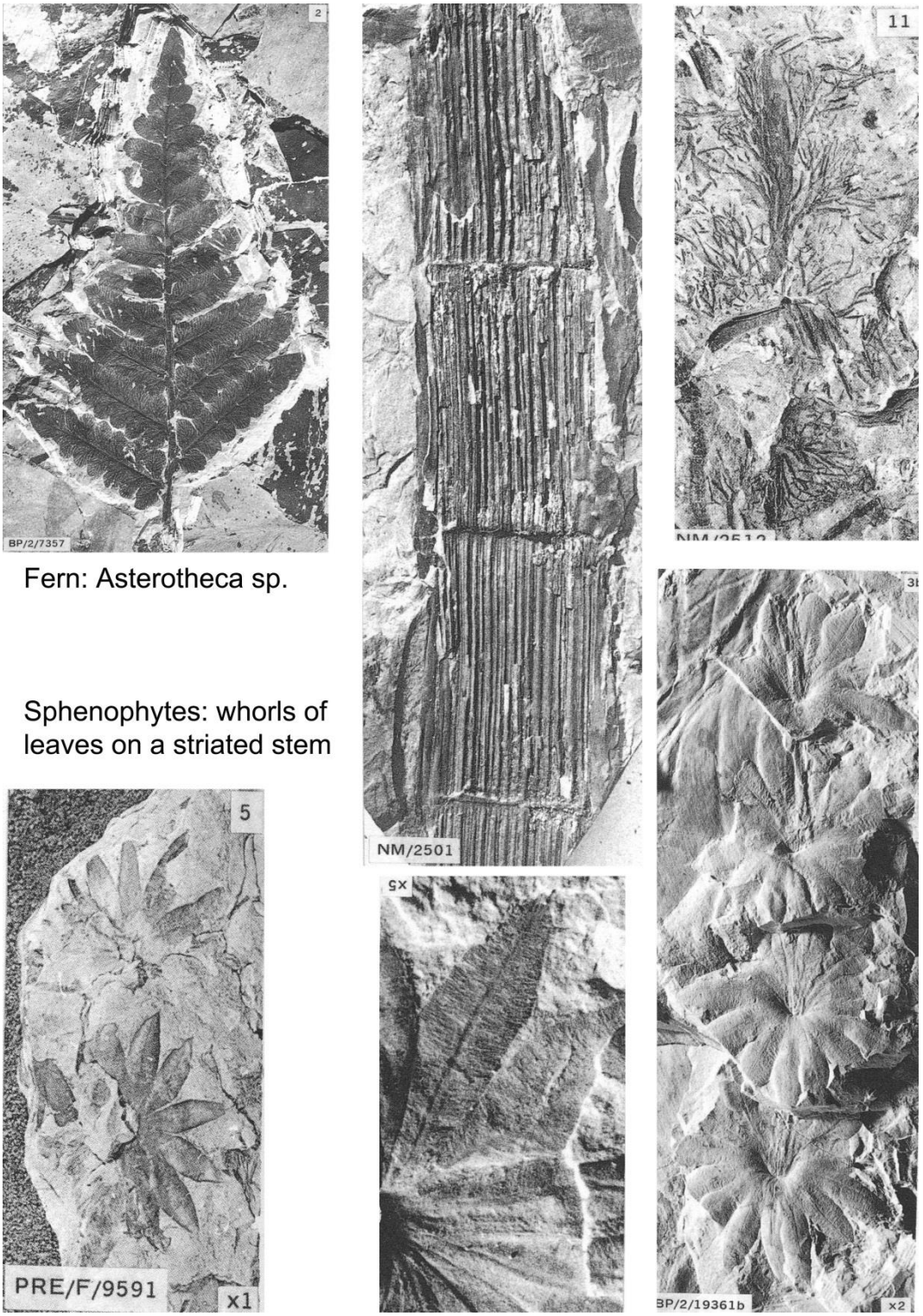

Figure 2: Examples of ferns and sphenophytes (horsetails) from the Vryheid Formation.