mineral resources & energy

Department:
Minerals Resources and Energy
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

And

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT	Kusile Invest 133 (Pty) Ltd
CONTACT PERSON	Mzamani Mdaka
EMAIL:	mzamanim@vodamail.co.za
POSTAL ADDRESS:	P O Box 4603, Weltevreden Park, 1715
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FILE REFERENCE NUMBER DMRE:	LP 30/5/1/2/2 10188MR

Available for comment from the 4th of May 2021- 3rd of June 2021

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining “will not result in unacceptable pollution, ecological degradation or damage to the environment”.

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2017, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the Competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the Competent Authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

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

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process—

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the—-

    (i) Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

    (ii) Degree to which these impacts—

        (AA) can be reversed;

        (Bb) may cause irreplaceable loss of resources, and

        (cc) can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

(g) identify suitable measures to manage, avoid or mitigate identified impacts; and

(h) Identify residual risks that need to be managed and monitored.

TABLE OF CONTENTS

LIST OF FIGURES

<u>**LIST OF TABLES**</u>

LIST OF SPECIALIST REPORTS

ANNEXURES

ANNEXURE 1- - INTEGRATED WATER USE LICENCE APPLICATION AND INTEGRATED WATER AND WASTE MANAGEMENT PLAN (IWWMP)

ANNEXURE 2 - HYDROGEOLOGICAL ASSESSMENT

ANNEXURE 3 - STORMWATER MANAGEMENT PLAN

ANNEXURE 4 – BIODIVERSITY ASSESSMENT

ANNEXURE 5 - ARCHAEOLOGICAL ASSESSMENT

ANNEXURE 6 - SOIL AND LAND CAPABILITY ASSESSMENT

ANNEXURE 7 - VISUAL IMPACT ASSESSMENT

ANNEXURE 8 - SOCIAL IMPACT ASSESSMENT

ANNEXURE 9 - NOISE IMPACT ASSESSMENT

ANNEXURE 10 - AIR QUALITY IMPACT ASSESSMENT

ANNEXURE 11 – TRAFFIC IMPACT ASSESSMENT

LIST OF ABBREVIATIONS

AIA	Archaeological Impact Assessment
ASAPA	Association of Southern African Professional Archaeologists
BID	Background Information Document
CA	Competent Authority
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CSA	Constitution of South Africa (Act No. 108 of 1996)
DEA	Department of Environmental Affairs
LEDET	Limpopo Department of Economic Development, Environment and Tourism
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GN	Government Notice
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IEM	Integrated Environmental Management
IWULA	Integrated Water Use License Application
IWWMP	Integrated Water and Waste Management Plan
MPRDA	Minerals and Petroleum Resources Development Act (Act No. 28 of 2002) (as amended)
NEMA	National Environmental Management Act (EIA regulations of 4 Dec 2014)
NEMAQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMWA	National Environmental Management: Waste Act (Act No. 59 of 2008)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act (Act No. 85 of 1993)
PPP	Public Participation Process
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute

GLOSSARY OF TERMS

Anthropogenic: Change induced by human intervention.

Applicant: Any person who applies for an authorisation to undertake an activity or undertake an Environmental Process in terms of the Environmental Impact Assessment (EIA) Regulations – National Environmental Management Act (EIA regulations of April 2017) as contemplated in the scheduled activities listed in Government Notice (GN) No 983, 984 and 985.

Archaeological resources: This includes:

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

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

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

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

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

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

Environmental Impact Assessment Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an EIA and follows on the Scoping Report (SR).

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

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

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

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

PART A

1 SCOPE OF ASSSSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1.1 Contact Person and correspondence address

1.1.1 Details of the EAP

i) Details of the EAP

Kusile Invest 133 (Pty) Ltd has appointed Archean Resources (Pty) Ltd, an independent consulting company, to conduct an Environmental Impact Assessment (EIA) process to evaluate the potential environmental and social impacts of the proposed project. The project is referred to as the Giyani Gold Mine Project. The applicant Kusile Invest has lodged a mining right on Un-Surveyed State land of Greater Giyani 891 LT and a portion of portion 0 of the farm 246 located within the town of Giyani, Limpopo Province. The details of the Environmental Assessment Practitioner (EAP) are provided below:

Table 1: Environmental Assessment Practitioner Details

Company:	**ARCHEAN RESOURCES (PTY) LTD**
Contact Person (s)	Yvonne Gutoona
Address	5 Villa Serring, Wapadrand Road, Wapadrand, Pretoria
Cell Phone	082 970 1513
Fax Number	0866955990
Email:	yvonne@archeanresources.com;moses@archeanresources.com

ii) Expertise of the EAP.

(1) **The qualifications of the EAP**

(with evidence).

Yvonne Gutoona

B.Sc. Geology and Geography (University of Zimbabwe (UZ))

Membership of Professional Associations:

Registered as a Natural Scientist (Cert.Sci.Nat.), with the South African Council for Natural Scientific Professions (SACNASP)

Member of the Geological Society of South Africa

2) **Summary of the EAP's past experience**.

(In carrying out the Environmental Impact Assessment Procedure)

The EAPs combined have over twenty years' experience. A summary of the EAPs experience in Environmental aspects is presented below:

- Environmental Impact Assessments;

- Basic assessments, WULA reports;
- Water use license application;
- Waste use license application;
- Soil Assessment, Specialist Studies;
- Prospecting and Mining right Authorizations;
- Environmental Management Plans;
- Public Participation; and
- Environmental Authorizations.

1.2 Description of the property.

The Giyani gold mine is located within the town of Giyani, approximately 140 km to the northeast of the N1 National Road from Polokwane. A well-maintained R 81 road, from the N1 will provide as the main access to the mine. The proposed Giyani Gold Mine Pty (Ltd) is a mining operation on un-surveyed state land of Greater Giyani 891 LT and a portion of portion 0 of the farm 246 located within the town of Giyani, and intends to establish an open cast mine.

The project area covers a surface area of 13894.66 hectares and the extent of the area required for the infrastructure, roads and servitudes is 150 Hectares within Mopani District Municipality in Limpopo Province. The mining area will be accessed through existing tarred roads that will link the mine to the various villages such as Thomo, Mnginginisi, Mbatlo, Mavalani and Shikukwani. The existing town roads will be utilized for trucking of ore to the processing plant which will be located within a 20km radius from various mining pits.

Table 2: Property Description

Farm Name:	Un-Surveyed State land of Greater Giyani 891 LT and a portion of portion 0 of the farm 246.
Application area (Ha)	The project area covers a surface area of 13894.66 hectares (Extent of surface area required for mining is 1000 Hectares and extent of the area required for infrastructure, roads, servitudes etc. is 150 Hectares)
Magisterial district:	Greater Giyani Municipality, within Mopani District Municipality in Limpopo Province
Distance and direction from nearest town	The application area is located approximately 10km North East town of Giyani and approximately 140 km north-east of Polokwane, accessible along the R81 road from the N1 National Road in Polokwane.
21-digit Surveyor General Code for each farm portion	T0LT00000000089100000 T0LT00000000024600000

1.3 Locality map
(Show nearest town, scale not smaller than 1:250000).

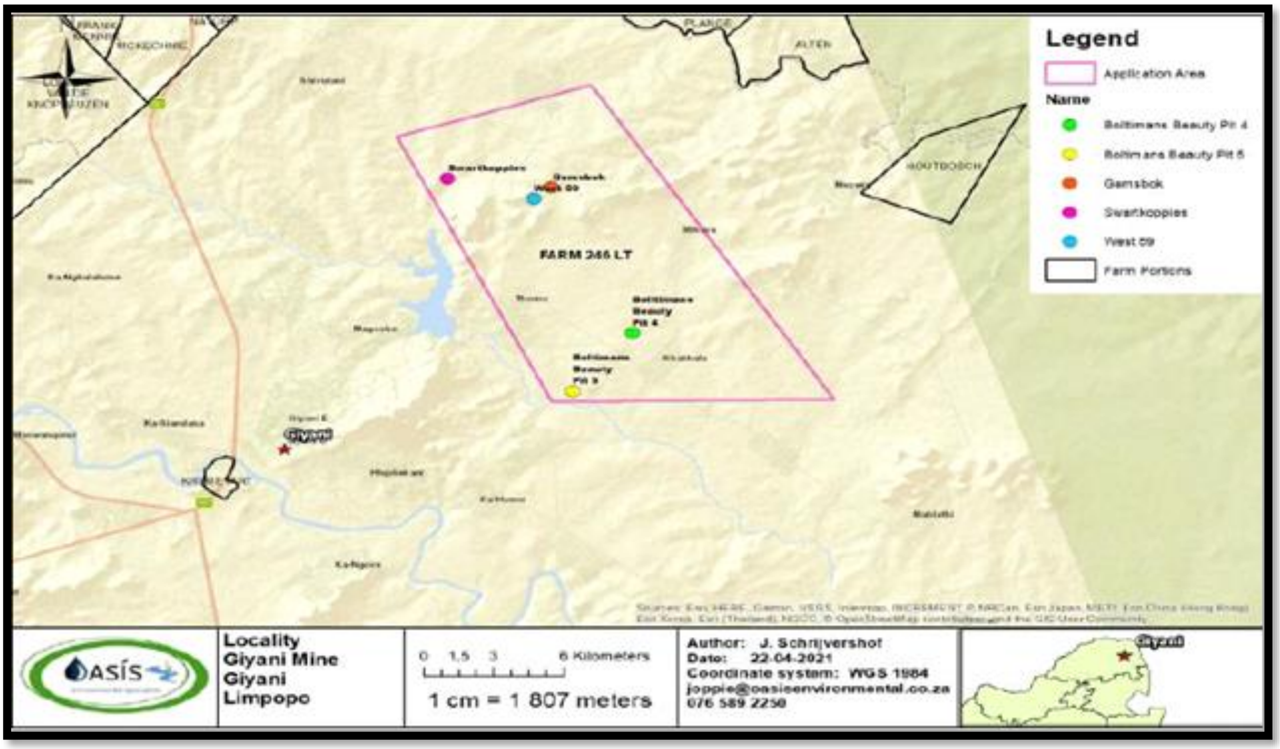


Figure 1: Project Locality

1.4 Description of the scope of the proposed overall activity.

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site.

The map below shows the plan contemplated in Regulation 2(2) of the MPRDA, showing the land to which application relates. The map also denotes the directly affected farms and the boundary coordinates of the application area.

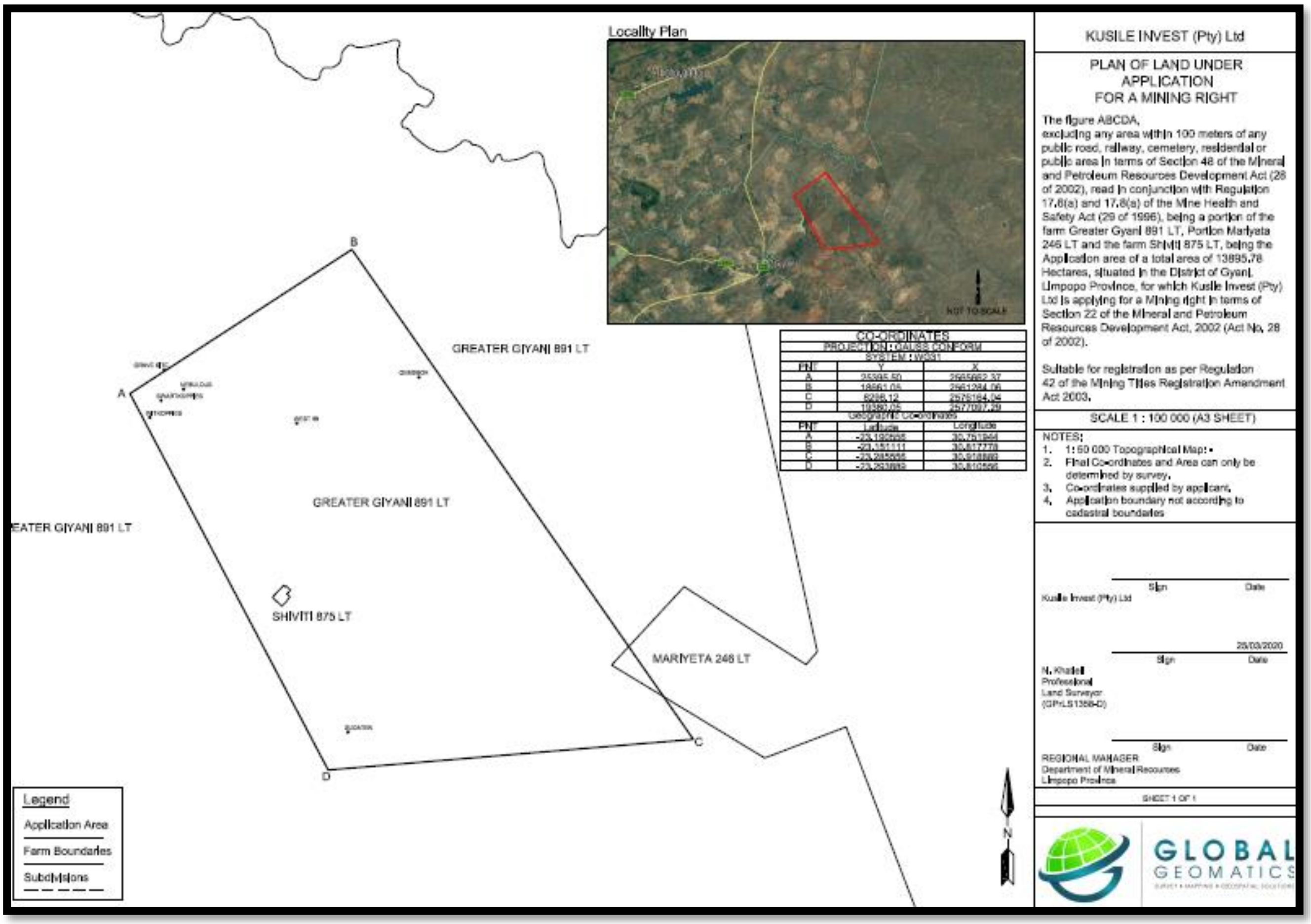


Figure 2: Mining Right Application Area- Regulation 2.2 Map

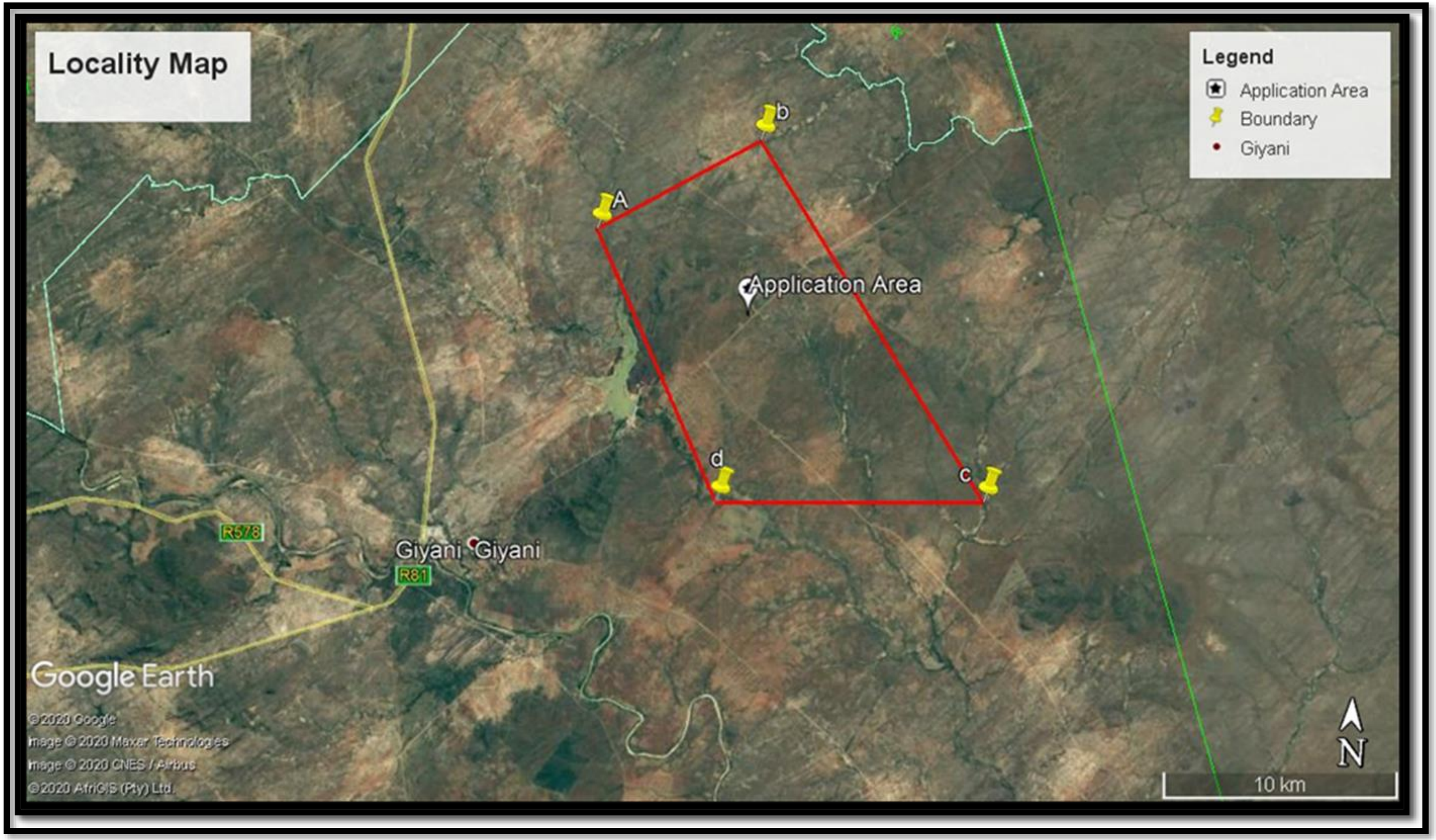


Figure 3: Locality Map of the proposed mining area

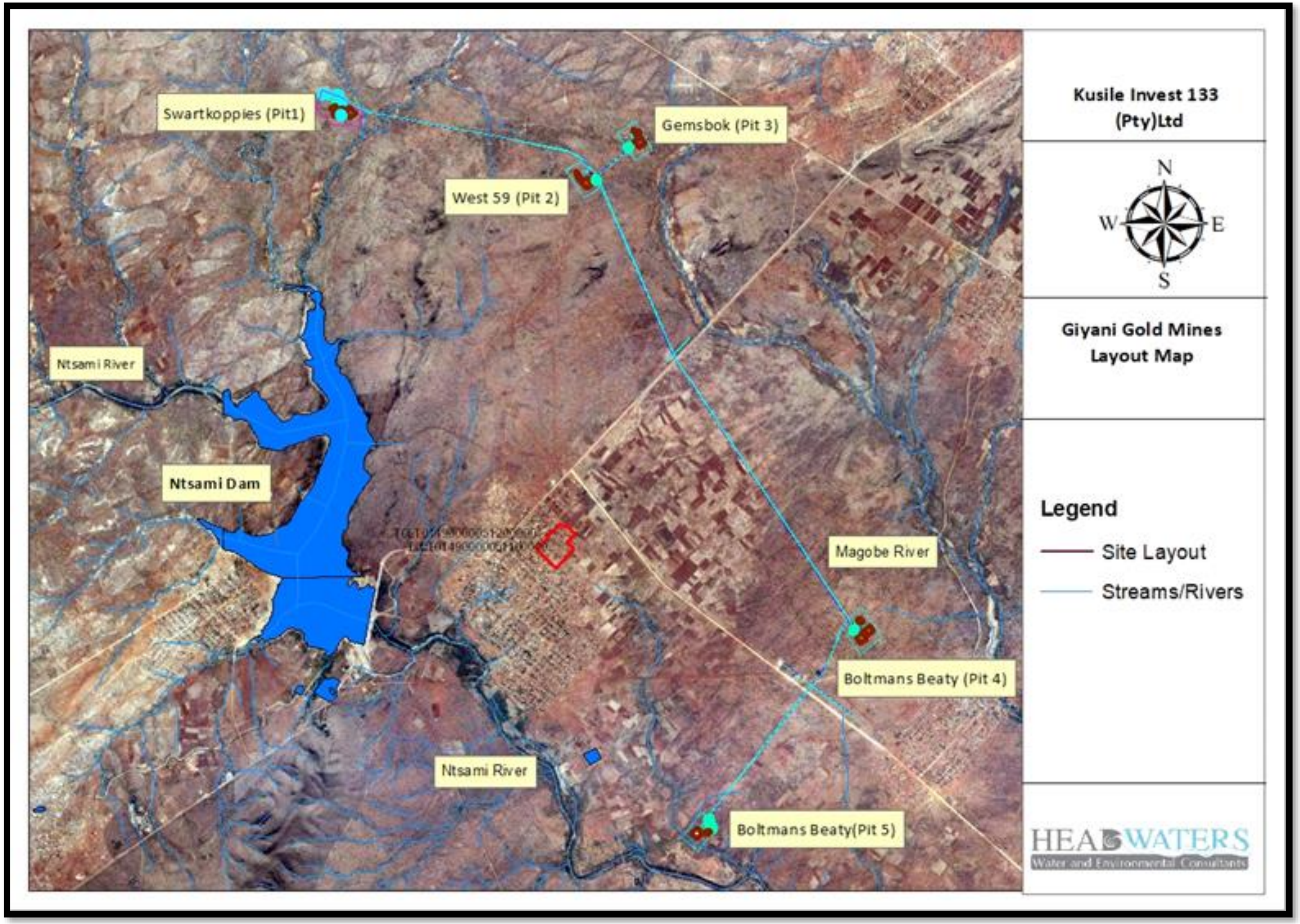


Figure 4: Site Layout and proposed infrastructure

1.4.1 Listed and specified activities

Table 3: Listed Activities

NAME OF ACTIVITY **(E.g. For prospecting -** drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route **etc…etc…etc** **E.g. for mining**,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**Aerial extent of the Activity Ha or m²**	**LISTED ACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** **(*GNR 983, 984, 985***	**WASTE MANAGEMENT AUTHORISATION** (Indicate whether an authorisation is required in terms of the Waste Management Act). **(Mark with an X)**
GNR 983 Listing Notice 1: Activities requiring an environmental authorisation subject to a Basic Assessment				
The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; Relevance: A power distribution switch yard will be constructed (substation).	2ha	X	**GNR 983 Listing Notice 1:** Activity 11	N/A
The development of – (ii) channels exceeding 100 square metres in size (iv) dams where the dam including infrastructure and water surface area, exceeds 100 square meters in size (vi) bulk storm water outlet structures exceeding 100 square metres in size; (xii) Infrastructure or structures with a physical footprint of 100 square meters or more. ***Relevance: A pollution control dams will be constructed.***	20 ha	X	**GNR 983 Listing Notice 1:** Activity 12	N/A
The development of a road where no reserve exists where the road is wider than 8 meters but excluding roads which are identified and included in activity 27 in listing Notice 2 of 2014. ***Relevance: Access roads will be upgraded, and mine haul roads constructed.***	20km	X	**GNR 983 Listing Notice 1:** Activity 24	N/A
GNR 984Listing Notice 2: Activities requiring an environmental authorisation subject to a Scoping and Environmental Impact Assessment.				
The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres. ***Relevance: Hydrocarbon fuels and explosives***	1000m³	X	**GNR 984 Listing 2:** Activity 4	N/A
The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution, or effluent. Relevance: Processing of gold (smelting)	20ha	X	**GNR 984 Listing 2: Activity 6**	N/A
The clearance of an area of 20 hectares or more of indigenous vegetation ***Relevance: clearing of mining area***	1200 Ha.	X	GNR 984 Listing 2: Activity 15	N/A

Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource.. ***Relevance: Mining activity***	13894.66 hectares	X	GNR 984 Listing 2: Activity 17	N/A
Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening, and washing	20 ha	X	GNR 984 Listing 2: Activity 21	N/A
GNR 983 Listing Notice 3: Activities requiring an environmental authorisation subject to a Basic Assessment				
The development of-(xii) infrastructure or structures with a physical footprint of 10 square metres or more in Limpopo. (a) within a watercourse (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse. Relevance: Drainage and watercourses on site	1200ha	X	**GNR 985 Listing Notice 3:** Activity 14	N/A
The clearance of an area of 300 square metres or more of indigenous vegetation in Limpopo where: iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning. Relevance: The application area is zoned open space.	1200ha	X	**GNR 985 Listing Notice 3:** Activity 12	N/A

1.4.2 Description of the activities to be undertaken

(Describe Methodology or technology to be employed, including the type of commodity to be mined and for a linear activity, a description of the route of the activity)

The planned mining methods will include both open cast/surface mining and conventional stoping underground. Mining activities will be carried out on the reef horizon by means of excavating, drilling, blasting, and cleaning of ore using heavy earth moving equipment and blasting using commercial explosives scraper cleaning operations and truck loading or hoisting.

The broken ore will be loaded on to trucks and transported through the declines which will be developed below the reef horizon/stoping area for transporting to surface by conveyor belts. For underground mining, the excavation that remains after blasting and cleaning of ore on reef is supported by installing roof bolting to ensure a safe working environment.

Exploitation of the gold bearing ore using the techniques above is associated with costs for procurement of diesel; equipment maintenance; explosives; rock support material and transport costs, in addition to labour costs. Other costs related to general stores and consumables, water, electricity, and compressed air. During the build-up phase, it is expected that a high unit cost will be incurred for each ton of broken ore produced due to initial high fixed and variable costs compared to low production rate when establishing the working areas. The unit cost will gradually decrease and stabilize as production rate increases to reach a steady state.

The planned conventional open cast mining and stope mining methods will utilize compressed air powered rock-drills and electricity powered scraper winches. This equipment will increase electricity consumption and inefficient use of equipment will negatively impact on the operating cost for the mine.

1.4.2.1 Mining Right: Description of Mining Method

Mining operations will commence from five open cast pits which will later be developed into underground workings and expand into four working levels to reach the steady state production of 12 000 tons per month. Additional working areas will be established for sustainability and to replace the depletion of ore reserves being mined from the start-up working areas.

The open pit mine design shows the orebody being located centrally to the pit outer walls or pit shell. The waste surrounding the orebody will be stripped, with topsoil stored separately from waste rock for re-use during rehabilitation of the pit at closure of mining operations. The stripping will include the removal of surrounding topsoil and waste rock to fully expose the orebody and have enough area for movement of machinery inside the pit.

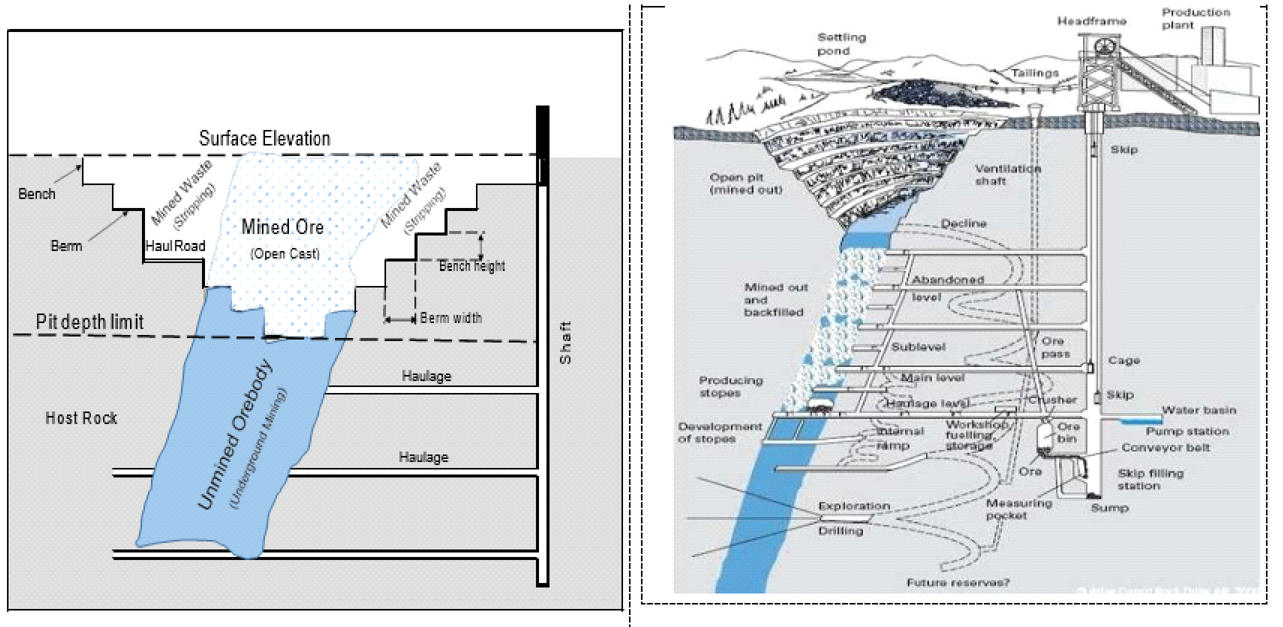
The sidewalls of the excavation, surrounding the orebody, referred to as Benches, will be excavated at intervals to a maximum depth 12 metres and must be slanted to ensure slope stability as per specifications determined by the project's Rock Engineering expert. The pit development will include the creation of Berms, representing the flat area or horizontal distance of approximately 5 metres in width, when measured from the bottom of the preceding or top bench to the edge of the next bench as the pit goes dipper. An access ramp and haul road will also be created from the top bench on the outer limits of the pit, traversing the lower benches in order to have mining equipment and personnel accessing the pit floor where excavating or blasting of the ore bearing rock will be conducted.
The pit will be excavated to an optimal operating final depth of 400 metres below surface level, thereafter, the conversion of the mining operation from open pit to underground mining operation will be affected. The timing for the development of the underground mining infrastructure will be scheduled to reach its completion such that the commencement of underground operations will overlap with the final phase of the open pit mining operation for a period of 6 months. The basic design or layout for the underground mining operation, entails the conventional use of shafts and declines, with the development of footwall haulages, cross-cuts and raise-lines to establish conventional steep stoping and cut and fill mining panels.

1.4.2.1.1 Mining – Mining Method

The basic mining methods to be utilised for the Giyani gold mining operation are both surface mining using open pit and conventional stoping methods applied underground to excavate hard rock or ore containing gold and associated minerals such as copper, zinc, nickel and lead and uranium. The existing mine shafts in the area, which form part of the project, were generally mined by conventional breast stoping mining until they were mothballed during the mid-1990's.

Mining will commence using open pits on outcrops and later develop into underground workings. Typically, underground working areas are accessed through a vertical shaft positioned a distance away from the reef horizon to be mined. A mine shaft is vertical excavation sunk and equipped with conveyances to transport men, material, and rock when mining operations are being conducted. A number of horizontal haulages are developed from the shaft at equal vertical intervals of approximately 60m, to access and intersect the reef horizon by developing a tunnel referred to as a crosscut. A raise development is then carried out from the cross-cut intersection on true dip or angle of inclination of the reef plane to make a holing on the cross-cut developed on the haulage above. Instead of using the shaft system, an option exists to utilize a decline system, where inclines are developed from the bottom of surface pit limit to provide underground access to deeper lying orebodies. Separate declines will be developed for men and material access and rock handling. Footwall haulages will be developed from the declines to create crosscuts and raise lines similar to those used in a shaft system.

Stoping or conventional breast mining commences from the raise line with mining panels laid out at 20 - 30m lengths. The rock breaking process or excavation entails drilling of blast holes and charging of holes. Blasting of ore is done from both sides of the raise advancing on strike along the reef horizon. The broken ore will be loaded by LHD's on to trucks and transported through the declines which will be developed below the reef horizon/stoping area for transporting to surface by conveyor belts. In a typical SA gold mine, cleaning of broken ore is conducted by scraper winches to collect ore from the panel into an ore-pass for loading onto a hoppers on the haulage below the stope. The development of the access haulage and the on-reef development is carried out using hand-held rock-drills and pneumatic loaders employed for cleaning of the broken rock into hoppers. The broken rock loaded onto the hoppers is transported/trammed by a locomotive into an ore-pass or rock handling system for hoisting to surface.
One of the most important aspects of underground hard rock mining is ventilation. Ventilation is required to clear toxic fumes from blasting. In deep hot mines ventilation is also required for cooling the workplace for miners. Ventilation raises are excavated to provide ventilation for the workplaces and can be modified to be used as escape routes in case of emergency. The main sources of heat in underground hard rock mines are virgin rock temperature, machinery, auto compression, and fissure water although other small factors contribute like people breathing, inefficiency of machinery, and blasting operations. Each mining area will have a dedicated ventilation shaft to extract hot air and underground fumes to keep the working places free of nauseous fumes and keep the temperature to within statutory requirements.



Section View: Open Pit Mining Method Layout

Section View: Underground Mining Method Layout

Figure 5: Schematic Diagram of Proposed Mining Methods (Open Cast and Underground)

1.4.2.2 High level description of the processing plant

Gold ore mined will be transported by Articulated Dump Truck (ADT) from open cast pits and hoist skips or conveyor belts from underground to stockpiles and storage areas, where it will be transported to the central processing plant by side tipper trucks for stockpiling onto a ROM pad in front of a crusher unit. A ramp will be utilized to provide access for the loading and dumping of ore on the tipping station for crusher feed. A conveyor belt will carry the ore from the tipping station and feed the load on top of a grizzly above the feed bin of a crusher.

The key installations and stages of the processing plant for gold recovery are crushing, milling, gravity concentration, flotation, leaching or cyanidation, concentration/elution and smelting. Summarized below is a high-level description of the processing plant:

Crushing - ore extracted from the mine will be trucked and delivered to the ROM pad where it will be stockpiled. It will then be fed through a two-stage crushing process. The Primary Crusher will be a single toggle jaw crusher with the Secondary Crusher being a cone crusher.

Milling – the process is used to further agglomerate the crushed ore being fed into a semi autogenous grinding (SAG) mill with lime, water and steel balls to liberate the gold contained in the rock. The larger particles from this mill are returned to the SAG mill for more grinding. The finer particles receive more grinding in a ball mill and are size classified to give a final product of 80% <70 microns. Crushed ore will be ground using a 4.2m diameter, 5.3m long primary ball mill with 1650kw motor.

Gravity concentration – this stage of the process separates gold from the milling process using the metal's higher specific gravity to settle in a solution and separate from other metals and material. This will be done in two centrifugal concentrators installed as part of the plant.

Flotation – a process for producing a mineral concentrate through the use of chemical conditioning agents followed by intense agitation and air sparging of the agitated ore slurry to produce a mineral rich foam concentrate. The installation comprises a bank of eight forced air, mechanically agitated cells ($8m^3$ each).

Cyanidation/leaching - this process involves the dissolution of gold containing ores in dilute cyanide solution in the presence of lime and oxygen contained in acid resistant leach tank.

Concentration/elution – this process is called Carbon in Pulp (CIP) and is applied to control the gold precipitation from the cyanide solution by use of activated charcoal (carbon). The final loaded carbon then is removed and washed before undergoing "elution" desorption of gold cyanide at high temperature and pH

Smelting - The rich eluate solution that emerges from the elution process is passed through electro-winning cells where gold and other metals are precipitated onto the cathodes. After precipitation, the product is treated with dilute sulfuric acid to dissolve residual zinc and most of the copper. The gold precipitate is then filtered out of the solution, mixed with fluxes and smelted to form crude and impure bars which are sent to a refinery to separate the copper; PGMs; silver and other associated base metal minerals

Basic plant design. (supported by a process flow diagram, of the plant).

The basic plant design and anticipated process flow diagram (see diagram below) is based on the proven metallurgical technology currently being used by mines in South Africa and represents a typical free milling carbon-in-leach (CIL)/carbon-in-pulp (CIP) gold processing circuit comprising:

- Two stage crushing.
- Single stage milling designed for a grind size of 105 micron;
- Knelson Concentrator or Gravity recovery cyclone;
- Thickeners.
- CIL/CIP leaching and adsorption with a retention requirement of only 16 hours.
- Elution, gold smelting and carbon regeneration.
- Tailings disposal.

The modular nature of the proposed process plant layout will allow for modifications, including increasing plant throughput, to be undertaken when required. The process flow diagram of the processing plant showing the key components of the plant is as below:

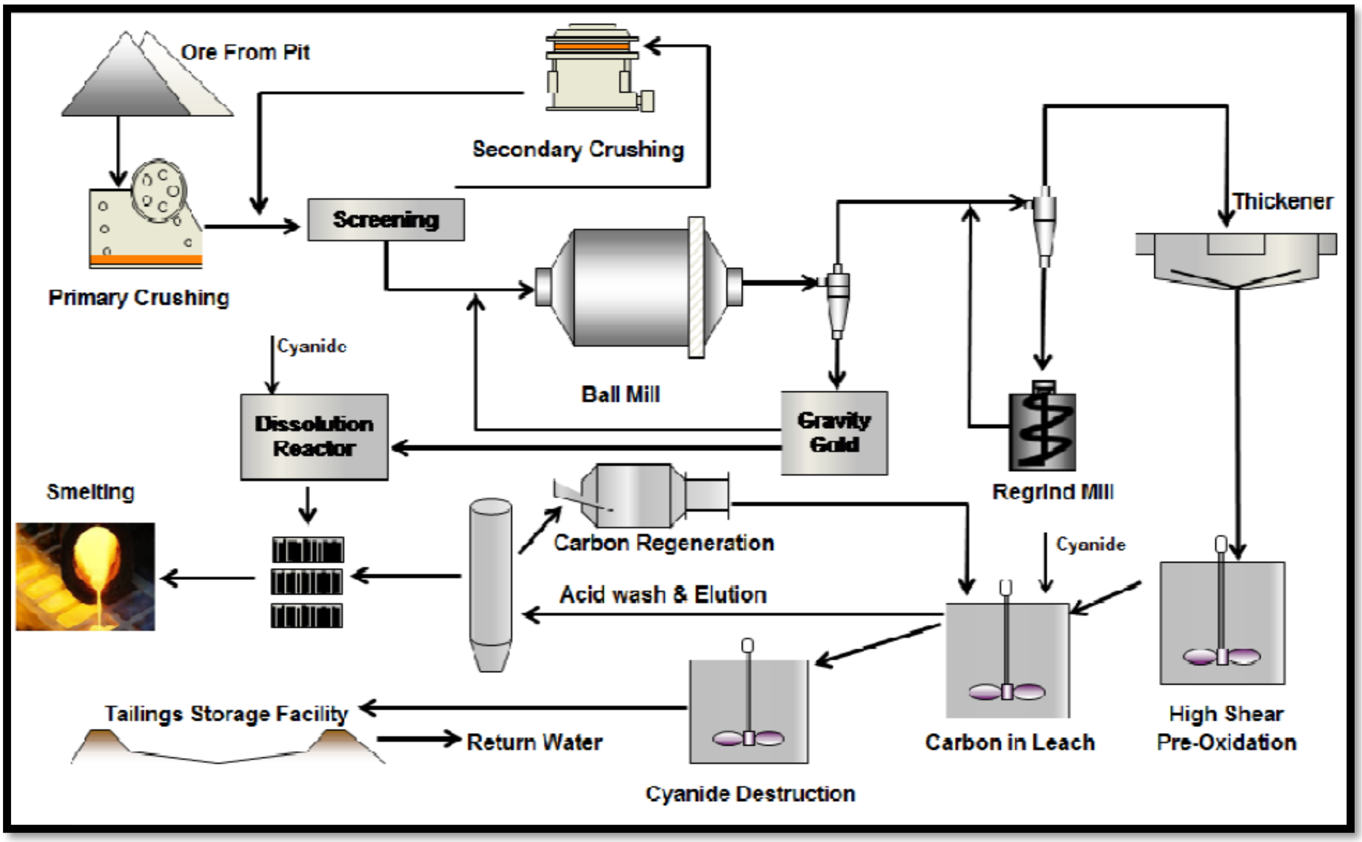


Figure 6: Schematic layout of processing plant

1.4.2.3 Summary of infrastructure such as roads, rail, electricity and water

1.4.2.3.1 Access roads

The Giyani gold mine is located within the town of Giyani, approximately 140 km to the north- east of the N1 National Road from Polokwane. A well maintained R81 road, from the N1 will provide as the main access to the mine. The mining area will be accessed through existing tarred roads that will link the mine to the various villages such as Thomo, Mninginisi, Mbatlo, Mavalani and Shikukwani.

The existing town roads will be utilized for trucking of ore to the processing plant which will be located within a 20km radius from various mining pits and shafts. These roads will form part of the road infrastructure to be utilized for the development of the mine. The initial capital costs to be incurred by the company will be limited to re-establishment and maintenance costs for the access roads within the pits and shaft areas and this will be provided for by the mine.

1.4.2.3.2 Rail Infrastructure

The Giyani mine is located approximately 80km to the east of the Soekmekaar-Polokwane railway line, with the nearest station at Soekmekaar. The mine will not utilise any rail for the transport of ore or delivery of mine material as these will be done by means of trucking to and fro the mine to the central processing plant.

1.4.2.3.3 Power Supply - Electricity

There is an existing powerline located some 4km from the central processing area. A dedicated power feeder will be obtained by establishing a connection to this existing powerline. A new sub-station connection will installed at the central processing plant as a step-down transformer to reduce the voltage from the high tension overhead power line to 6.6kV, where this will be reduced further to levels suitable for use in the plant and nearby shafts and mine offices. The planned power usage at the mine is as summarized below:

Table 4: Planned mine power usage

Area	Usage
Processing Plant	500kVA
Mine Shafts/Winding Engine Room	500kVA
Surface Compressors	300kVA
Engineering Workshops	200kVA
Mine Offices	100kVA
Total	**1600kVA**

1.4.2.3.4 Water Supply

1.4.2.3.4.1 Potable Water Supply

Potable water for the mine will be sourced from an abstraction borehole drilled on site (see table below). Approximately 80 m^3 per day of potable water per each site will be required at Giyani Gold Mine (Swartkoppies (Pit - 1), West 59 (Pit - 2), Gemsbok (Pit - 3), Boltmans Beaty (Pit – 4); and Boltmans Beaty (Pit – 5). The water will be used for domestic purposes in the mine office, change house, workshop, processing plant and pit area. In keeping with the Mine Health and Safety Regulations, a purification plant will be established for treatment of raw water to ensure compliance with drinking water quality standards prescribed in the South African National Standard (SANS) 241: 2015.

1.4.2.3.4.2 Process Water

Process water at Giyani Gold Mine Swartkoppies farm includes water used in and recovered from the ore/gold processing plant, treated sewage effluent, as well as return water from the TSF. However, the primary water source for the mine is groundwater boreholes.

The proposed mining operation will utilize a two-stage dense medium separation (DMS) plant with make-up water requirements estimated at 545 m^3/day. The processing plant will be located on Swartkoppies area only.

A high-rate thickener and clarifier will be used to recover water from the slimes produced by the gold processing plant. The thickener increases the density of the solution slimes material to facilitate solid- liquid separation through gravity settling of the thickened material. The overflow from the clarifier will then be returned to the process water tank for reuse, which reduces make-up water demand from the primary source (groundwater abstraction boreholes).

Underflow slimes from the thickener and clarifier will be disposed on TSF. The facility will be equipped with a penstock, which will allow for recover of supernatant to the process water tanks (via a return water dam or dirty storm water dam (i.e. pollution control dam)).

Table 5**: Process Make-up Water Supply Sources**

Facility	Source of Supply	Quantity (m^3/day)
Raw water reservoir	Groundwater abstraction boreholes	1000
Pollution Control Dam 1	Package sewage treatment plant	223
	Return water from TSF	
Pollution Control Dam	Tailings Facility	100

1.4.2.3.5 Site Offices

To minimize the establishment cost and due to the relatively short life of mine plan for the envisaged mine operation, pre-fabricated buildings will be erected to function as workshops and mine offices, change houses, laboratories, first aid rooms, and warehousing.

1.4.2.3.6 Underground Infrastructure

- Decline lateral;
- Exhaust raises;
- Footwall drives;
- Ventilation lateral access;
- Cross cuts from decline;
- Sumps;
- Escapeway access;
- Escapeway raise;
- Decline rehandle bays;
- Production rehandle bays;
- Other lateral waste;
- Backfill tipping bay;
- Truck loop/loading access;
- Diamond drill chambers;
- Ore pass;
- Upper ventilation drive connection to surface;
- Intake Raise vertical;
- Main pump station;
- Longitudinal stope access;
- Transverse stope access lateral; and
- Exploration drive.

1.4.2.3.7 Surface infrastructure

The proposed project would comprise of the design and construction of all building structures, related earthworks and building services, electrical and mechanical installations. This would include *inter alia*:

- Central Plant and Mobile Process plant
- Loading area
- Stockpile areas
- Site clearing and storm water berms and trenches;
- Administration building and first aid;
- Change house and laundry;
- Lamp room, self-rescuer and proto room;
- Access control and security centre;

- TMM Maintenance workshop, services, lubrication, bays;
- Wash bay and oil skimmer;
- Bulk fuel storage area;
- Refueling bay;
- Tyre storage, repair and pump area;
- LVD workshop;
- Fitting, electrical and boiler making workshop;
- Main stores and yard;
- Salvage yard;
- External parking, shade ports and walkways;
- Electrical, water and sewage reticulation;
- Terraces, pavements, access, internal and haul roads;
- Perimeter and internal fencing; and
- Explosives off-loading, storage and distribution.
- One Slimes Dam and PCD"s

1.4.2.3.8 Minerals applied for:

- Gold Ore/Bearing Minerals: Code: (Au),
- Copper Ore/Bearing minerals: Code: (Cu),
- Silver Ore/Bearing minerals: Code: (Ag),
- Nickel Ore/Bearing minerals: Code: (Ni),
- Platinum Group Minerals: Code: (PGM),
- Zinc Ore/Bearing Minerals: Code: (Zn),
- Lead Ore/Bearing Minerals: Code: (Pb),
- Uranium Ore/Bearing Minerals: Code: (U),
- Chrome Ore/Bearing Minerals: Code (Cr),
- Aggregate Material

1.5 Policy and Legislative Context

1.5.1.1 The South African Constitution

This section provides an overview of the legislative requirements applicable to this project and it includes the Acts, guidelines and policies considered in the compilation of this report. The legislative motivation for this project is underpinned by the Constitution of South Africa, 1996 (Act No. 108 of 1996), which states that:
The State must, in compliance with Section 7(2) of the Constitution, respect, protect, promote and fulfil the rights enshrined in the Bill of Rights, which is the cornerstone of democracy in South Africa. Section 24 of the Constitution:

24. Environment

-Everyone has the right-

(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecologically sustainable development and use of natural resources while promoting a justifiable economic and social development.

Section 24 of the Constitution of South Africa (Act No. 108 of 1996) requires that all activities that may significantly affect the environment and require authorisation by law must be assessed prior to approval. In addition, it provides for the Minister of Environmental Affairs or the relevant provincial Ministers to identify:

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

Section 28(1) of the Constitution of South Africa (Act No. 108 of 1996) states that: *"every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring".* If such pollution or degradation cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution or degradation. These measures may include:

- Assessing the impact on the environment;
- Informing and educating employees about the environmental risks of their work and ways of minimising these risks;
- Ceasing, modifying or controlling actions which cause pollution/degradation;
- Containing pollutants or preventing movement of pollutants;
- Eliminating the source of pollution or degradation; and
- Remedying the effects of the pollution or degradation.

Applicability: Public participation process and consultation at every stage of the EIA phase. A public participation process is being followed and consultations will be done regarding the proposed project. An EMP and awareness plan will be designed according to the issues raised during this process

1.5.1.2 National Environmental Management Act

The NEMA Act under sections 24(2), 24(5), 24D and 44, read with section 47A (1) (b) of National Environmental Management Act (107/1998): Environmental Impact Assessment Regulations, 2017, is regarded as one of the important pieces of general environmental legislation as it provides a framework for environmental law reform. The main objective of this act is to ensure that ecosystem services and biodiversity are protected and maintained for sustainable development. Furthermore, Section 28 (1) of the NEMA requires that “every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring”.

NEMA strives to regulate national environmental management policy and is focussed primarily on co-operative governance, public participation and sustainable development. NEMA makes provisions for co-operative environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by Organs of State and to provide for matters connected therewith.

A scoping report addressing the requirements of GN R 982 of the NEMA was compiled and submitted to the DMRE and accepted on the 6th of January 2021. The Scoping Report contained information necessary for the understanding of the process, including all preferred alternatives location alternatives, the scope of the assessment. A description of the consultation process undertaken during the Scoping phase and to be undertaken through the environmental impact assessment process was also included. The DMRE accepted the Scoping Report and Plan of study contained therein and requested that the applicant commence with the EIA phase of the assessment, including the detailed specialist studies.

(a) details of-

- I. *the EAP who prepared the report; and*
- II. *the expertise of the EAP, including a curriculum vitae;*

(b) the location of the activity, including-

- I. *the 21 digit Surveyor General code of each cadastral land parcel;*
- II. *where available, the physical address and farm name;*
- III. *where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;*

(c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is-

- I. *a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or*
- II. *on land where the property has not been defined, the coordinates within which the activity is to be undertaken*;

(d) a description of the scope of the proposed activity, including-

- I. *all listed and specified activities triggered;*
- II. *a description of the activities to be undertaken, including associated structures and infrastructure;*

(e) a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;

(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;

(h) a full description of the process followed to reach the proposed preferred activity, site and location within the site, including-

I. *details of all the alternatives considered;*
II. *details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;*
III. *a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;*
IV. *the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;*
V. *the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts-*
    a) *can be reversed;*
    b) *may cause irreplaceable loss of resources; and*
    c) *can be avoided, managed or mitigated;*
VI. *the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;*
VII. *positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;*
VIII. *the possible mitigation measures that could be applied and level of residual risk;*
IX. *the outcome of the site selection matrix;*
X. *if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and*
XI. *a concluding statement indicating the preferred alternatives, including preferred location of the activity;*

Applicability: Baseline environmental information of the project area has been assessed in form of specialist reports. Mitigation measures and recommendations where provided according to best practice standards. This scoping and EIA/EMP report complies with the requirements of the NEMA act.

1.5.1.3 Mineral and Petroleum Resources Development Act

The MPRDA makes provision, for persons to apply for a mining right. A mining right granted in terms of the MPRDA is a limited real right in respect of the type of resources and the land to which the right relates. The holder of a mining right is entitled to the rights referred to in the MPRDA or any other law.

The applicant requires a mining right and environmental authorisation from the DMRE. Acceptance of the application by DMRE only permits the applicant to continue with the necessary process and does not constitute authorisation. The acceptance details the outstanding requirements for the application, which includes:

(a) the submission of an EMP; and

(b) notification and consultation with IAPs, including land owners or lawful occupiers of land, on which the proposed mining is to be conducted;

(c) Details on how the applicant will substantially and meaningfully expand opportunities for historically disadvantaged persons**.**

Applicability: A mining right was lodged with the DMRE and is still pending.

1.5.1.4 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

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

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

As part of its implementation strategy of NEMBA, the National Spatial Biodiversity Assessment was developed. This assessment classifies areas as worthy of protection based on its biophysical characteristics, which are ranked according to priority levels. The approach used for biodiversity planning is systematic and entails the following three key principles:

- *The need to conserve a representative sample of biodiversity pattern, such as species and habitats (the principle of representation);*
- *The need to conserve the ecological and evolutionary processes that allow biodiversity to persist over time (the principle of persistence); and*
- *The need to set quantitative biodiversity targets that quantifies the degree of conservation required for each biodiversity feature in order to maintain functioning landscapes and seascapes.*

Furthermore, the South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (*inter alia*) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems. NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 8 of the Act. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established.

It is also appropriate to undertake an Ecological (Fauna and Flora) Impact Assessment for developments in an area that is considered ecologically sensitive and which requires environmental authorisation in terms of NEMA, with such assessment taking place during the Scoping or EIA phase. The Applicant is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity, to obtain permits if required.

1.5.1.5 National Forest Act, 1998 (Act 84 of 1998)

The purposes of National Forest Act, 1998 (act 84 of 1998) (NFA) includes *inter alia:*

(*c) provide special measures for the protection of certain forests and trees:*

(d) promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes.

Applicability: Biodiversity Assessment has been done (refer to Annexure 4) to determine the species in the project area and specify if there are any endangered species. A permit for the removal / destruction of protected trees will be applied for with the relevant department in terms of Section 15 of the NFA before construction.

1.5.1.6 National Environmental Management: Air Quality Act (Act No 39 of 2004)

Section 28 (1) of NEMA places a general duty of care on any person who causes pollution, to take reasonable measures to prevent such pollution from occurring. The objective of the National Environmental Management: Air Quality Act, 2004 (NEM:AQA) is to regulate air quality in order to protect, restore and enhance the quality of air in the Republic, taking into account the need for sustainable development. Furthermore, the provision of national norms and standards regulating air quality monitoring, management and the control by all spheres of government determine that specific air quality measures should be adhered to. Dust created during the construction and operational phases of the proposed Kusile's Giyani Gold Mine could influence air quality and thus make this legislation relevant to this development. Air quality management and mitigation measures during the mining phase will be considered to be a measure to exercise this duty of care, since it aim to minimise volumes of dust emissions emanating from the operational activities.

An air emission license will not be required for the application process, but air quality monitoring will be implemented.

Applicability: All phases of the project will result in dust production which will have an impact on ambient air quality. Refer to Annexure 10 - Air Quality Impact Assessment.

1.5.1.7 Conservation of Agricultural Resources Act (Act 43 of 1983)

The aim of the Conservation of Agricultural Resources Act,1983 (Act 43 of 1983) (CARA) is to provide for control over the utilisation of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants and for matters connected therewith. The EIA phase of the project will take into account the requirements of CARA as well as determine the potential direct and indirect impacts on agricultural resources as a result of the proposed mining development.

Applicability: The project will impact on soils and land use in the area. A soil and land capability impact study has been conducted as part of the application. Annexure 6 - Soil and Land Capability Assessment.

1.5.1.8 National Environmental Management: Waste Act (Act 59 of 2008)

The National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM:WA) and Waste Classification and Management Regulations, 2003 (GNR: 634 – 635): To reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

The operational activities associated with the proposed mining program shall be in accordance with the requirements of National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM:WA) and Waste Classification and Management Regulations, 2003 (GNR: 634 – 635). Kusile's Giyani Gold Mine will manages its waste in a legally compliant manner, tailings – will be returned to the pit as backfill and is excluded from NEM:WA).

Applicability: Waste classification and an Integrated Water and Waste Management Plan will be compiled as part of the Water use licence and will be integrated in the Draft EIAr which will be available for public review during the EIA phase. A waste licence application will be applied for which will require a separate NEMWA process.

1.5.1.9 Occupational Health and Safety Act (Act 85 of 1993)

The aim of the Occupational Health and Safety Act, 1993 (act 85 of 1993) (OHSA) is to provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery ; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety as well as to provide for matters connected therewith.

Section 8 which deals with the general duties of employers and their employees states that:

1) *"Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of the employees."*
2) *''Without derogating from the generality of an employer's duties under subsection (1), the matters to which those duties refer include in particular:*
   a. *The provision and maintenance of systems of work, plant and machinery that, as far as reasonably practicable, are safe and without risk to health;*

   b. *Taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety and health of employees;*

   c. *Making arrangement for ensuring as far as reasonably practicable, the safety and absence of risks to health in connection with the production, processing, use, handling, storage and transport of articles or substances;*

   d. *Establishing, as far as reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and* *he shall, as far as reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures;*

e. *Providing such information, instruction, training and supervision as may be necessary to ensure, as far as reasonably practicable, the health and safety of employees;*

f. *As far as reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store, or transport any article or substance or to operate any plant or machinery, unless precautionary measures contemplated in paragraph (b) and (d), or any precautionary measures which may be prescribed, have been taken;*

g. *Taking all necessary measures to ensure that the requirements of this act are complied with by every person in his employment or on the premises under his control where plant and machinery is used;*

h. *Enforcing such measures as may be necessary in the interest of health and safety;*

i. *Ensuring that work is performed and that plant and machinery is used under the general supervision of a person trained to understand the hazards associated with it and who has the authority to ensure that precautionary measures taken by the employer are implemented and*

j. *Causing any employees to be informed regarding the scope of their authority as contemplated in section 37(1)(b).''*

1.5.1.10 National Heritage Resources Act

National Heritage Resource Act, 1999 (Act No. 25 of 1999)

The proposed Kusile's Giyani Gold Mine project must comply with the requirements stipulated in the National Heritage Resources Act, 1999 (Act 25 of 1998) (NHRA). The NHRA legislates the necessity for cultural and Heritage Impact Assessment (HIA) in areas earmarked for development, which exceed 0.5 ha or linear development exceeding 300 metres in length. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

Section 38(1) of NHRA, subject to the provisions of subsections (7), (8) and (9), requires that any person who intends to undertake a development categorised as:

(a) *The construction of **a road**, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
(b) *The construction of a bridge or similar structure exceeding 50m in length;*
(c) *Any development or other activity which will change the character of a site-*
(i)Exceeding 5 000 m^2 in extent; or

(ii)Involving three or more existing erven or subdivisions thereof; or

(iii)Involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv)The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) The re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Archaeological impact assessments (AIAs) are often commissioned as part of the heritage component of an EIA and are required under Section 38(1) of the NHRA of 1999, Section 38(8) of the NEMA and the MPRDA.

The process of archaeological assessment usually takes the form of:

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

Phase 1: Archaeological Impact Assessment (refer to Annexure 5 - Phase 1 Archaeological Impact Assessment).

A Phase 1 AIA generally involves the identification and assessment of sites during a field survey of a portion of land that is going to be affected by a potentially destructive or landscape altering activity. The locations of the sites are recorded and the sites are described and characterised. The archaeologist assesses the significance of the sites and the potential impact of the development on the sites and makes recommendations. It is essential that the report supply the heritage authority with sufficient information about the sites to assess, with confidence, whether or not it has any objection to a development, indicate the conditions upon which such development might proceed and assess which sites require permits for destruction, which sites require mitigation and what measures should be put in place to protect sites that should be conserved.

Minimum standards for reports, site documentation and descriptions are clearly set out by the SAHRA and supported by the Association of Southern African Professional Archaeologists (ASAPA). The sustainable conservation of archaeological material (*in situ*) is always the best option for any sites that are deemed to be of importance. The report needs to indicate which sites these are, explain why they are significant and recommend management measures. In certain kinds of developments which involve massive intervention (mining, dam construction, etc.), it is not possible to reach a conservation solution other than to develop a programme of mitigation which is likely to involve the total or partial "rescue" of archaeological material and its indefinite storage in a place of safety.

Phase 2: Archaeological Mitigation Proposal

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

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

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

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

On occasion Phase 2 may require a Phase 3 program involving one of the following:

- The modification of the site;
- The incorporation of the site into the development itself as a site museum;
- A special conservation area; or
- A display.

Alternatively, it is often possible to re-locate or plan the development in such a way as to conserve the archaeological site or any other special heritage significance the area may have. For example in a wilderness or open space areas where such sites are of public interest, the development of interpretative material is recommended since it adds value to the development. Permission for the development to proceed can be given only once the heritage resources authority is satisfied that measures are in place to ensure that the archaeological sites will not be damaged by the impact of the development or that they have been adequately recorded and sampled. Careful planning can minimise the impact of archaeological surveys on development projects by selecting options that cause the least amount of inconvenience and delay. The process as explained above allows the rescue and preservation of information relating to our past heritage for future generations. It balances the requirements of developers and the conservation and protection of our cultural heritage as required of SAHRA and the provincial heritage resources authorities.

Applicability: A Phase One Heritage study has been conducted (Annexure 5 - Phase 1 Archaeological Impact Assessment) and it is recommended that prior to construction of infrastructure and the open cast pits that a Paleontological Study be done and a phase 2 Heritage Study when applicable.

1.5.1.11 National Water Act, 1998 (Act No.36 of 1998)

The National Water Act, 1998 (Act 36 of 1998) (NWA) aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level.

The purpose of the NWA is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways, which take into account:

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

Some of the activities of the proposed Kusile's Giyani Gold Mine fall within the ambit of water uses defined in section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), and would be permissible if authorised under the NWA. The water uses are summarized in the tabulation below.

Table 4: Summary of Key Water Uses

#	Water Use	Activity Description
•	Section 21 (a)	Groundwater abstraction through a borehole
•	Section 21 (b)	Raw water reservoir
•	Section 21 (c)	Pit 1 encroachment into 100 m buffer of a watercourse
•	Section 21 (c)	Pit 5 encroachment into 100 m buffer of a watercourse
•	Section 21 (g)	Pollution Control Dam (PCD)
•	Section 21 (g)	Tailings Storage Facility
•	Section 21 (g)	Overburden (Waste Rock) Stockpile (Swaartkoppies)
•	Section 21 (g)	Dust suppression with water containing waste
•	Section 21 (g)	Run of Mine Stockpile
•	Section 21 (g)	Backfilling of the open pit with overburden: Pit 1 (Swartkoppies)
•	Section 21 (g)	Backfilling of the open pit with overburden: Pit 2 (West 59)
•	Section 21 (g)	Backfilling of the open pit with overburden: Pit 3 (Gemsbok)
•	Section 21 (g)	Backfilling of the open pit with overburden: Pit 4 (Boltsman Beauty)
•	Section 21 (g)	Backfilling of the open pit with overburden: Pit 5 (Boltsman Beauty)
•	Section 21 (i)	Pit 1 encroachment into 100 m buffer of a watercourse
•	Section 21 (i)	Pit 5 encroachment into 100 m buffer of a watercourse

<u>Applicability: Due to the nature of the activities a water use license will be required and the IWULA process is underway.</u>

1.5.1.12 Other Applicable National legislations

- Hazardous Substances Act, 1973 (Act No. 15 of 1973);
- Roads Ordinance Amendment Act, 1998 (Act No. 17 of 1998);
- South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998).

1.5.1.12.1 Applicable Legislation and Approvals Required

The proposed project requires the following main approvals before the project may commence:

- Mining Right and Environmental authorization from the Department of Mineral Resources in terms of the MPRDA (Act 28 of 2002) and National Environmental Management Act (Act 107 of 1998) and associated Environmental Impact Assessment Regulations, as amended.

- Approval of an Environmental Management Programme, in terms of the MPRDA DMRE.

In addition to the main legal approvals, the following approvals will be required:

- The South African Heritage Resources Agency needs to approve a heritage assessment, to be conducted as part of the overall EIA process, in terms of the **National Heritage Resources Act** (No 25 of 1999). Permits will be required for the destruction or removal of any heritage resources affected by the development.

- Prior to construction, a tree removal permit will have to be obtained prior to removal, relocation or destruction of indigenous and protected species. This is in terms of the **National Environmental Management: Biodiversity Act** (No 10 of 2004).

1.6 Need and desirability of the proposed activities.

(Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location).

Mining is of great importance to the South African economy. There is a need that the environment is left in a safe manner that is not harmful to the neighbouring community. The surface are to be disturbed is minimal based on the total size of the application area, and specialist will confirm the apparent aesthetic or conservation value, in terms of heritage aspects, fauna, and flora. The shaft already exist which makes the project desirable. The project will stimulate the local and regional economy as it will facilitate refining of gold at a cheaper and time efficient. The project will create jobs both skilled, semi-skilled and unskilled. The aim of the strategic focus area is to create an economically enabling environment in which investment can grow and jobs can be created. Various initiatives and programmes are identified which will aid to stimulate economic growth and create more employment opportunities.

Gold demand is the main factor that drives the price and is in turn dependent on the underlying macroeconomic scenarios prevailing in the economies of the major gold consuming countries. When considering the economic growth trends for the main gold consuming countries, it is expected that lack of economic growth will result in reduced consumer spending and demand for gold products. Should this situation persist, the longterm gold prices will be depressed compared to current price levels.

Short-to-medium-term outlook

The short-to-medium-term course of gold prices will depend on the timing, frequency, and amount of the Fed rate hike. The Fed Reserve increased the US interest rate by 25 basis points in December 2015 for the first time since 2006. Gradual further tightening of US interest rates continued over the past 5 years, with interest rates increasing from 0,25% in 2016 and reaching a peak of 2,5% in is expected during 2019. This growing monetary policy differentials between the Federal Reserve and the rest of the world would raise the likelihood of the dollar strengthening. The strong US dollar outlook going forward is expected to add to the pressure on gold prices over the next year going into end 2022.

Factors supporting gold prices

Despite the possible price weakness expected with US interest rate hikes and dollar strength, there are multiple factors that could support the gold prices during 2020 and set a floor for future price increase depending on global economic outlook. One of the major factors supporting gold prices in the event of weak prices will be physical gold demand, especially from China and India. When gold prices begin a steady decline, physical gold buying, especially from Asian markets accelerates.

Central bank purchases are also expected to continue going forward. Political tensions, such as those prevailing in the Middle East and Europe at the moment, could also lead investors to keep a portion of their holdings in gold and other precious metals.

Long-term gold price outlook positive

In the long term, fundamental factors might take hold, pushing gold prices higher. One of the main fundamental factors is the future mine supply which is expected to shrink. Currently, gold miners are focusing on reducing costs to weather the low gold price environment. This focus has lowered the overall industry's cost curve, reducing the support price for gold in the short term. But there are some costs, such as sustaining capital, exploration, and development that can't keep falling. Also, the currency and energy benefits can't keep subsidizing costs for forever. This would lead to an eventual increase in costs, which should support long-term gold prices.

Potential impact on the social, social, cultural, and environmental aspects were identified. These impacts were assessed for their effect on the social, cultural, and environmental aspects. The significance of the impacts was also determined.

Mitigation measures are aimed at lessening negative consequences of the proposed mining operation. The mitigation measures include designs and management practises that will be embarked on, to prevent the identified impacts on the social, cultural and environmental aspects. For each significance identified, mitigation measures were specified. These mitigation measures are described in more detail in the environmental management programme.

Opportunities that exist within mining are as follows:

- Constant demand on the market for commodities;
- Establishment of a permanent working group between the Municipality and the mine managers responsible from developing local economic development initiative;

- Encourage local SMME's and entrepreneurs to take advantage of procurement;
- Develop a database of available labour and skills to encourage the employment of local people;
- Provide skills training and support programmes;
- Instigate mining procurement opportunities in consultation with the mines, develop a database of such opportunities and ensure that this information is made available to local businesses and communities.

For these to be achievable, investment and skills development, technology and infrastructure, as well as broadening of the supplier base, will need to be addressed.

The proposed mining operation will employ approximately 400 permanent employees when operating at a steady state. Most of the workforce will be recruited from the local and surrounding communities. The aggregate wages that will be paid to these employees will contribute towards poverty alleviation and improve the local economic activities. The mine will also contribute towards the development of small business enterprises and support local suppliers of capital goods and services, in so doing help create other jobs in the community.

Kusile Invest will also contribute to stimulating the economy in the area through local procurement. The mine will implement a preferential procurement policy to ensure that the bulk of its procurement spend is used for purchasing goods and services from companies that comply with the BBBEE requirements. Preference will be given to local or regional suppliers which have a broad-based empowerment shareholding.

Initiatives will be taken to promote entrepreneurship for HDSA from local communities and to provide the group with business opportunities linked to the mining operations

1.7 Motivation for the preferred development footprint within the approved site including a full description of the process followed to reach the proposed development footprint within the approved site.

NB!! – This section is about the determination of the specific site layout and the location of infrastructure and activities on site, having taken into consideration the issues raised by interested and affected parties, and the consideration of alternatives to the initially proposed site layout.

The land use of this area is dominantly natural veldt in a rural setting. However, in the development of the impact assessment and environmental management programme, the following alternatives have been considered:

1.7.1 Details of the development footprint alternatives considered.

With reference to the site plan provided as Annexure 5_Appendix 1 and the location of the individual activities on site, provide details of the alternatives considered with respect to:

1. the property on which or location where it is proposed to undertake the activity;
2. the type of activity to be undertaken;
3. the design or layout of the activity;
4. the technology to be used in the activity;
5. the operational aspects of the activity; and
6. The option of not implementing the activity.

Table 5: Alternatives Considered

TYPE OF ALTERNATIVE: property on which or location where it is proposed to undertake the activity
Develop on an alternative property No alternatives have been investigated in terms of location due to the geological formation of the area as well as relevant studies have been done and show of the availability of a deposit. Should the proposed mining site be relocated to another location the applicant will not be able to utilise the resource potential. The property is accessible via good roads from different directions. Infrastructure in the area is developed with gravel roads, electricity grid and underground water. Experienced labour is available in the area as is an extensive network of secondary industries geared towards small and large-scale mining..
TYPE OF ALTERNATIVE: type of activity to be undertaken
Mining Method- Open Cast vs Underground In most mining projects, the alternative mining options are underground or open cast methods. Due to the shallow depth the strip ratios for surface mining are regarded as favourable. **Water management infrastructure (PCDs)** The proposed PCD will be sized to accommodate all dirty storm water and mine water throughout the life of mine and post closure. No other alternatives can be considered for the PCD construction as it is essential in mine water management. **1. Activity** The basic mining methods to be utilised for the Giyani gold mining operation are both surface mining using open pit and conventional stoping methods applied underground to excavate hard rock or ore containing gold and associated

minerals such as copper, zinc, nickel and lead and uranium. The existing mine shafts in the area, which form part of the project, were generally mined by conventional breast stoping mining until they were mothballed during the mid-1990's.

2. Design

There are other possible layout design possibilities but the current design is the most efficient for this type of mining activity.

3. Technological

A detailed assessment of the deposit indicates that the quartz vein ridge is ideally suited to open pit bench mining-drilling and blasting operation where the waste to ore ratio is kept to a minimum by using excavators and articulated dump trucks. All water used by the washing sprays goes through de-gritting cyclones and is gravitated to a PVC-lined industrial water pond for sediment settling. Water will be recycled for further use at the plant. Water for the mobile crushing plant will be obtained from a nearby borehole feeding a PVC-lined water holding pond from where the water will be pumped to the crushing plant.

There are no other alternative mining method and associated technology than opencast mining of the silica vein deposit. This is the most economic viable methods currently being used.

Recycling:

The mining project will in its operational phase implement recycling policies and measures for optimal utilisation of resources and minimisation of waste generation.

Water:

Water utilisation will be maximised through recycling of dirty water within the process operations.

Energy:

Fuel types will be investigated as well as energy conserving measures will be implemented. Where solar energy can be utilised it will be implemented.

4. Operational Aspects

Kusile Invest 133 intends to make use of standard mining methods that enable safe mining which has the having the lowest risk of causing health risks or environmental degradation.

The surrounding area rely on groundwater for both domestic and livestock watering purpose. Raw water from the boreholes will be pumped into a process water tank and will be used in the processing plant (dense medium separation processing plant), mine office complex and for dust suppression. Water removed from the opencast mine workings will be used as an alternative source of supply for the mine.

TYPE OF ALTERNATIVE: No-Go, *the option of not undertaking and implementing the activity at all.*

The advantage of not implementing the activity means the project area will retain its status quo, and the advantages of the project in terms of employment creation and investment will be lost. Not implementing the mining activity will not reach a beneficiation phase where the local, regional and national socio-economic environment will not be able to benefit from the mining activities.

1.8 Details of the Public Participation Process Followed

Describe the process undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land.

This section of the report provides an overview of the tasks undertaken for the PPP to date. All PPP undertaken is in accordance with the requirements of the EIA Regulations (2017). It further provides an outline of the next steps in the PPP and makes recommendations for tasks to be undertaken during the environmental assessment phase of the environmental authorisation process.

1.8.1 Project Initiation

1.8.1.1 Landowner Information and consultation

Landowners have identified through a search conducted via online search engines accessing the Title Deed office database. Due to the size of the area municipal ward councillors will be engaged to assist with the notification and liaising with the legal occupiers of the application farms. In addition to land owners (state land), other relevant organisations have been identified and will be notified of the application. This includes municipal and State departments with jurisdiction in the area and Non-governmental Organisations (NGOs) with an interest.

1.8.1.2 Community Meetings

Meetings with members of the community were held between the 12th and 20th of March 2020 in accordance to the attendance registrar. The subsequently during the scoping phase in July and August 2020 (Refer to Attendance register and meeting minutes Appendix 15- 18). The land is owned by the government and the following communities are affected:

- Shiviti Tribal Community
- Thomo Tribal Community
- Makosha Tribal Community
- Xikukwani Tribal Community
- Mavalani Tribal Community
- Mninginisi Tribal Community
- Khakhala Tribal Community
- Muguri Village

An initial consult meeting with I&AP's was held in March with the traditional council leaders to introduce the project and identify more I&AP's. Following the DEAFCOVID consultation protocols, continuous engagement with the leaders to assist with the sharing of reports telephonically will be emphasised to address issues regarding the published draft scoping report.

The PPP tasks include:

- Identification of key Interested and Affected Parties (affected and adjacent landowners) and other stakeholders (organs of state and other parties);
- Formal notification of the application to key Interested and Affected Parties (all adjacent landowners) and other stakeholders;
- Consultation and correspondence with I&Aps and Stakeholders and the addressing of their comments; and
- Newspaper adverts.

1.8.1.3 I&AP and Stakeholder identification, registration and the creation of an electronic database

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

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

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

1.8.2 Scoping Phase

1.8.2.1 Formal notification of the application to key Interested and Affected Parties (adjacent landowners) and other stakeholders

The project was announced as follows:

1.8.2.2 Newspaper advertisement

Publication of media advertisement was placed in the Regional Herald announcing the project, the availability of the scoping report and encourage I&AP's to register and submit their comments to Archean. The advert will be published on the 16th of July 2020 in English and Tsonga.

1.8.2.3 Site notice placement

In order to inform surrounding communities and adjacent landowners of the proposed development, site notices were erected on site and at visible locations close to the site. Additional notices were placed at local post office, shops, local library, Giyani Municipality, on the 10th of July 2020 to the 15th of July.

1.8.2.4 Written notification

I&AP's and other key stakeholders where notified via email of the project and the scoping report on the 10th of July 2020. A background information document, draft scoping report and notification letters were sent out to the land claims. In addition, I&AP's have been given extra time to comment on the report so that during the EIA phase these issues can be addressed to avoid delays that may arise during consultation.

1.8.2.5 Background Information Document

A Background Information Document (BID) was distributed and The BID provides information concerning the proposed project and invites IAPs to register and submit their concerns and comments during the 30-day consultation period. IAPs are free to distribute the documents to other parties who may be interested or affected by the project. The BID will be distributed on the 10th of July 2020.

1.8.2.6 Public Meeting

Meeting with various Traditional and Tribal Leaders were held during the scoping phase. Preliminary consultation was done in March which the EAP will also utilise through the dispersion of information to registered I&AP's.

1.8.2.7 Consultation and correspondence with I&AP's and Stakeholders and the addressing of their comments (continuous).

Acknowledgements from I&APs, queries or registration requests are expected from stakeholders. A final public meeting report with minutes will be compiled.

1.8.2.8 Release of the Scoping Report to I&AP's and stakeholders for review and comment.

The Scoping Report was made available for public review for at least 30 days for review by interested and affected parties. The reports were available from the 10th July 2020 to the 17th of August 2020 via email, we transfer link and as hardcopies at the following locations:

- Greater Giyani Library
- Shiviti Tribal Office
- Thomo Tribal Office
- Makosha Tribal Office
- Xikukwani Tribal Office
- Mavalani Tribal Office
- Mninginisi Tribal Office
- Khakhala Tribal Office
- Muguri Village

1.8.3 EIA phase public Participation

1.8.3.1 Newspaper Advert

Publication of media advertisement was placed on the6th of May 2021 in the Regional Herald notifying the public of the availability of the Draft EIAR and Integrated Water and Waste Management Plan. The adverts also encouraged I&AP's to submit their comments to within 30 days of the release of the reports.

1.8.3.2 Email Notifications

I&AP's and other key stakeholders were notified on the 4th of March of the availability of the Draft EIA/EMP and IWULA report, including the specialist studies reports. This serves to notify I&AP of the availability of the reports for public review for at least 30 days for review by interested and affected parties. The reports are available from the **4th of May 2021- 3rd of June 2021** via email, we transfer link and as hard copies at the following locations:

- **Greater Giyani Library; Shiviti Tribal Office; Thomo Tribal Office; Makosha Tribal Office**
- **Xikukwani Tribal Office; Mavalani Tribal Office; Mninginisi Tribal Office; Khakhala Tribal Office**

1.8.3.3 Site Notices

Site notices notifying I&APs of the availability of the Draft EIA/EMP report, including the specialist studies reports will be erected around the project area on the 3rd and 4th of May 2021.

1.8.3.4 Public Meeting

Notice of public meeting: A public meeting will be held for the DEIR and IWULA review phase on the 28th of May 2021 at 2021 at Thomo Tribal Office at 10:00am. The issues raised and responses provided during the commenting phase are included in the final report that will be submitted to the DMRE as part of the Final EIAR.

1.8.3.5 Summary of issues raised by I&AP's

Comments and issues raised during the public participation have been attached under Comments and responses. EIA Proof of preliminary consultation is also under this annexure.

1.9 Baseline Environment

The Environmental attributes associated with the development footprint alternatives.
(The environmental attributed described must include socio-economic, social, heritage, cultural, geographical, physical and biological aspects)

1.9.1 Regional Setting

Limpopo Province is South Africa’s northernmost province which shares borders with Mozambique, Zimbabwe and Botswana, making it the ideal entrance to Africa. Named after the great Limpopo River that flows along its northern border, this province is rich in wildlife, spectacular scenery and a wealth of historical and cultural treasures. The province contains much of the Waterberg Biosphere, a designated Biosphere Reserve. The Waterberg Biosphere, a massif of approximately 15,000 km² shaped by hundreds of millions of years of riverine erosion to yield diverse bluff and butte landforms. The Waterberg ecosystem can be characterised as a dry deciduous forest or Bushveld. Within the Waterberg, archaeological finds date to the Stone Age. Nearby are early evolutionary finds related to the origin of humans.

Industry

Limpopo's rich mineral deposits include platinum group metals, iron ore, chromium high- and middle-grade coking coal, diamonds, antimony, phosphate and copper, as well as mineral reserves such as gold, emeralds, scheelite, magnetite, vermiculite, silicon and mica. Base commodities such as black granite, corundum and feldspar are also found. Mining contributes to more than a fifth of the provincial economy.

The province is a typical developing area, exporting primary products and importing manufactured goods and services. It has a high potential for development, with resources such as tourism, rain-fed agriculture, minerals and abundant labour offering excellent investment opportunities.

Agriculture

The bushveld is cattle country, where extensive ranching operations are often supplemented by controlled hunting. About 80% of South Africa's hunting industry is found in Limpopo. Sunflowers, cotton, maize and peanuts are cultivated in the Bela-Bela and Modimolle areas. Modimolle is also known for its table-grape crops. Tropical fruit, such as bananas, litchis, pineapples, mangoes and pawpaws, as well as a variety of nuts, are grown in the Tzaneen and Makhado areas. Tzaneen is also at the centre of extensive tea and coffee plantations. Limpopo, known as the "garden of South Africa" produces about the majority of South Africa's mangoes, papayas, avocados and tomatoes. As well as thousands of tons of potatoes, the province also produces tea, citrus, bananas, and litchis in abundance. Extensive forestry plantations are also found in the region, including hardwood for furniture manufacture.

In addition to commercial agriculture, subsistence farming is the mainstay of a large section of the rural population.

Figure 7: Location of the Limpopo Province of South Africa.

Limpopo Province is divided into five municipal districts, subdivided in 24 local municipalities:

Capricorn District	Mopani District	Sekhukhune District	Vhembe District	Waterberg District
Aganang	Ba-Phalaborwa	Elias Motsoaledi	Makhado	Bela-Bela
Blouberg	Greater Giyani	Fetakgomo	Musina	Lephalale
Lepele-Nkumpi	Greater Letaba	Ephraim Mogale	Mutale	Modimolle
Molemole	Greater Tzaneen	Greater Tubatse	Thulamela	Mogalakwena
Polokwane	Maruleng	Makhuduthamaga		Mookgopong
				Thabazimbi

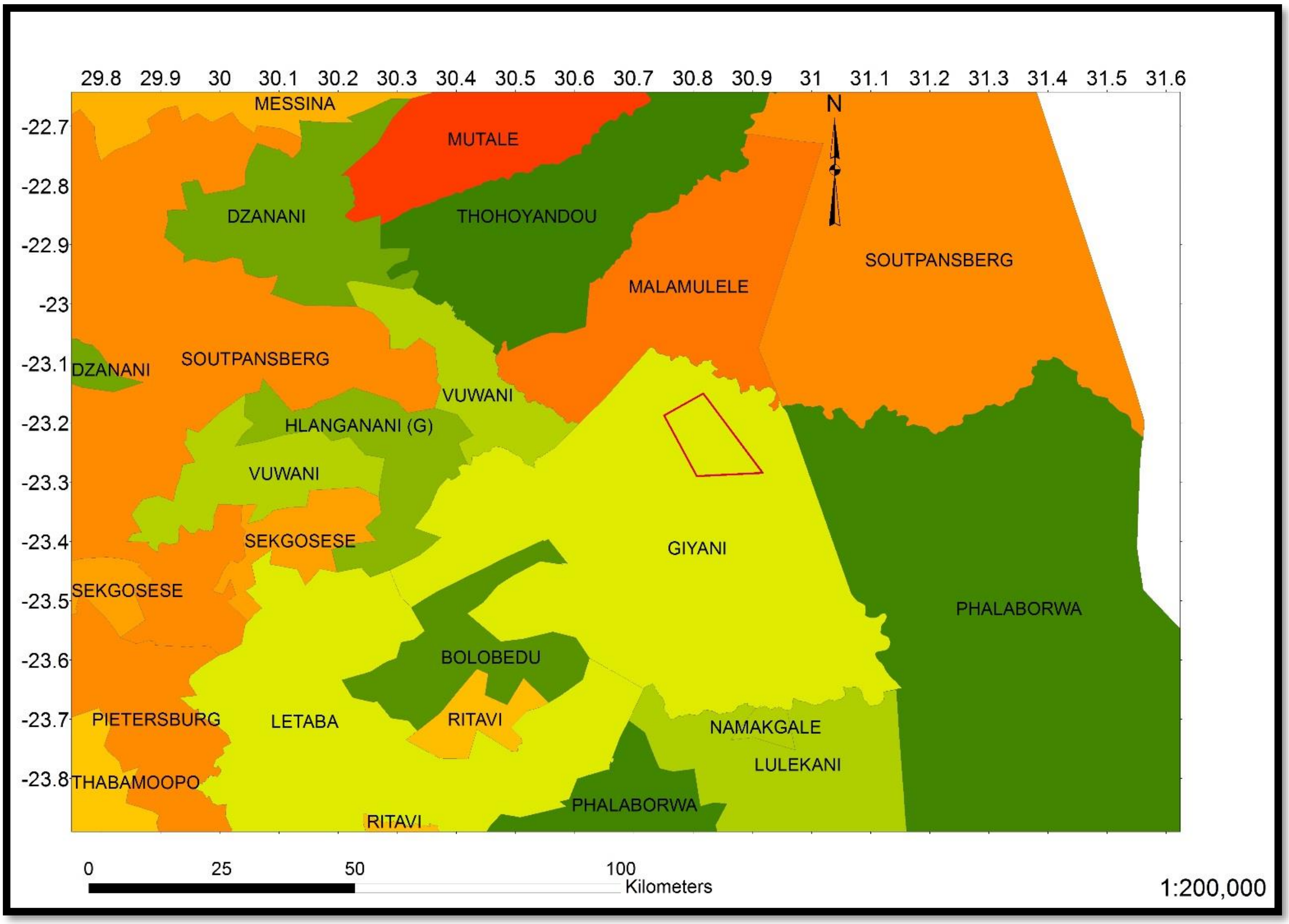


Figure 8: Location of the project in the Giyani Municipality.

The municipal area has amazing biological diversity of flora and fauna; this rich biodiversity can be attributed to its biogeographically location and diverse topography. The district falls within the greater

Savanna Biome, commonly known as the Bushveld with some small pockets of grassland and forest Biomes. These and other factors have produced a unique assortment of ecological niches which are in turn occupied by a wide variety of plant and animal species. The area is comprised of Sacred Forests.

1.9.2 Type of environment affected by the proposed activity.

(Its current geographical, physical, biological, socio- economic, and cultural character).

1.9.2.1 Site Assessment

Baseline Environmental attributes associated with the sites

Key aspects of the baseline environment that are likely to impact on the scope of the impact assessment and management measures that are implemented as well as project decisions regarding alternatives are listed below.

The mining permit is currently operational and the infrastructure setup as well as current surface disturbances are shown below:



Figure 9**:** Thick tree cover.

Figure 10**:** Thorn trees and dense grass cover.

Figure 11**:** Closed access road to Pits 02 & 03.

1.9.2.2 Climate

The climate of Giyani is characterized by low rainfalls with a very hot summer. This could be caused by its position in the Lowveld. The municipal area received between 200 – 400ml of rain annually. The general rainfall has a direct impact on development, especially on agriculture. This results in the shortage of surface water, leaving the municipality to rely on ground water.

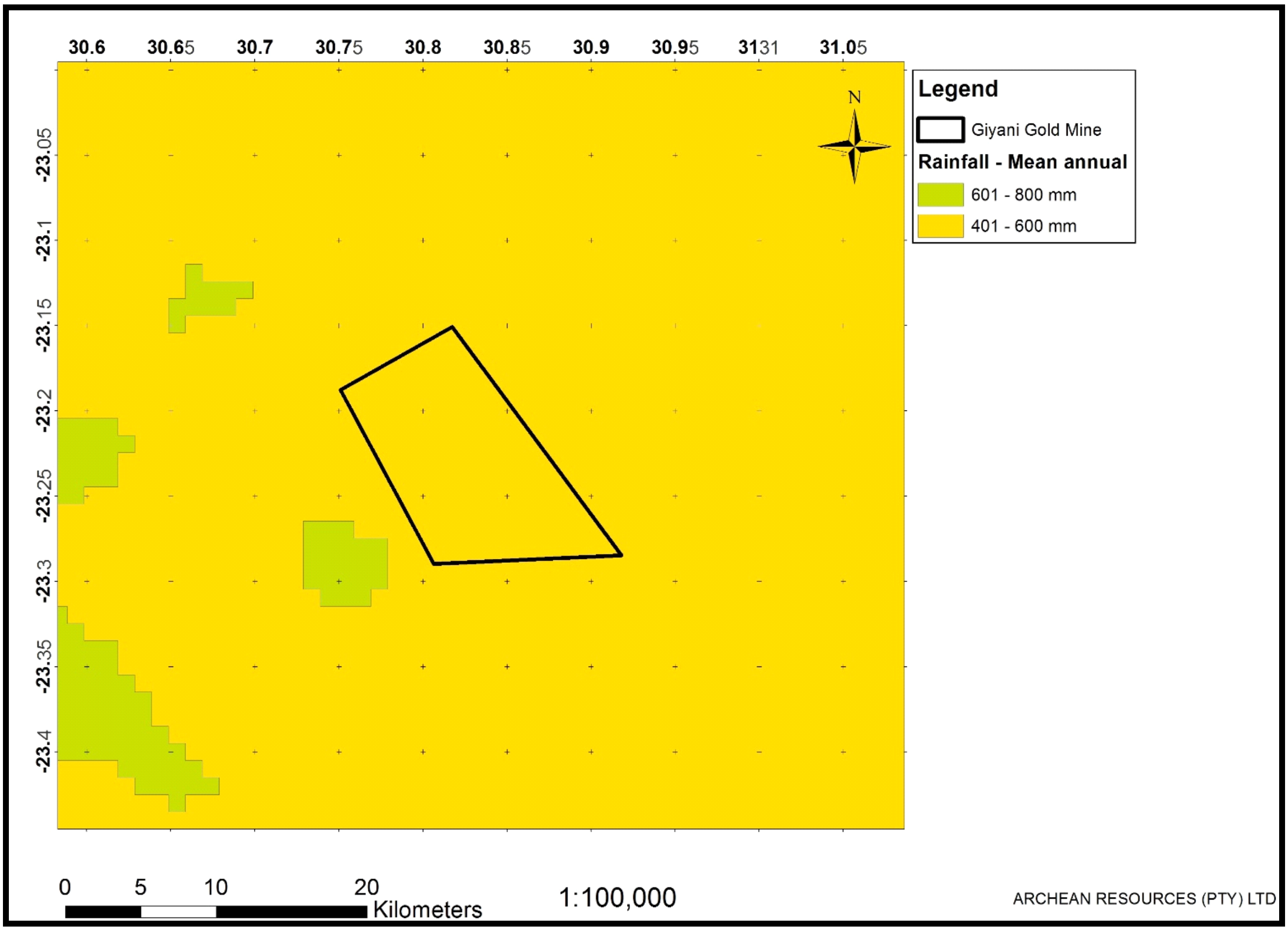


Figure 12: Rainfall Average

1.9.2.3 Regional Geology

The regional geological setting relating to the area of the mining right application is depicted by the characteristics of the Archaean crust of southern Africa, comprising the Kaapvaal Craton, the Zimbabwe Craton and the Limpopo Metamorphic Complex. The Kaapvaal Craton has three major crustal elements, namely a core of Palaeo- to Meso-Archaean metamorphic rocks termed the Kaapvaal Shield and exemplified by the Barberton granitoid-greenstone terrane; the northern and western "rims" to this shield formed by granitoid-greenstone terranes accreted to the Kaapvaal Shield in the Neoarchaean and the Cratonic Basin successions.

The northern rim to the Kaapvaal Shield comprises the Murchison, Pietersburg and Giyani greenstone belts. The Giyani Greenstone Belt (GGB) is the main focus in relation to the area of application. The rock stratigraphy within the Giyani Greenstone Belt forms part of the Kaapvaal Craton sequence. The below shows the geological setting and extent of the Kaapvaal Craton, and the northern rim in which the application area is located.

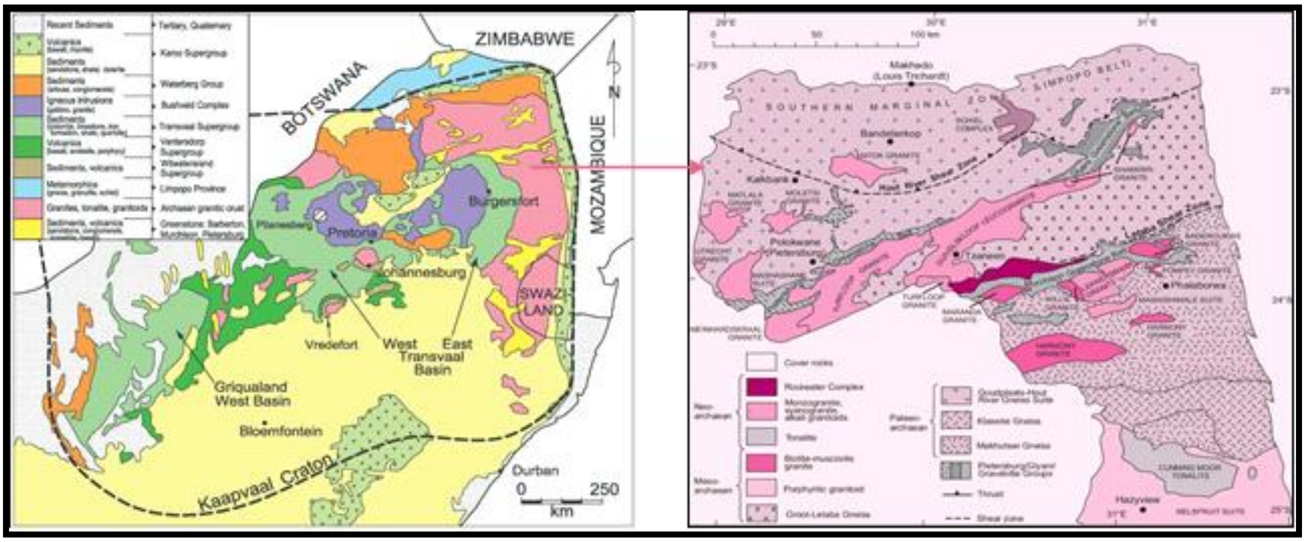


Figure 13: The Regional Geological Setting and Depositional Environment

The Cratonic Basin successions were deposited on the Kaapvaal Shield during the Mesoarchaean and are preserved as the Dominion Group and Witwatersrand Supergroup in the central part of the craton and the Pongola Supergroup in the southeast.

1.9.2.3.1 Regional Geological Structure and Stratigraphy

The regional geology depicting the area of interest comprise the Murchison, Pietersburg, Giyani, and Barberton greenstone belts. These belts are situated in the granite-gneiss terrain of the Kaapvaal Craton which is located south of the Southern Marginal Zone (SMZ). The supracrustal rocks of the GGB are classified as the Giyani Group and are dominated by mafic and ultramafic rocks with subordinate metasedimentary units but due to structural complexity, with no reliable stratigraphy being recognized within the sequence. Pillow-like structures in the tremolite schists near Klein Letaba Mine, and in amphibolite schists east of Giyani town, is evidence that the greenstone were originally volcanic rocks.

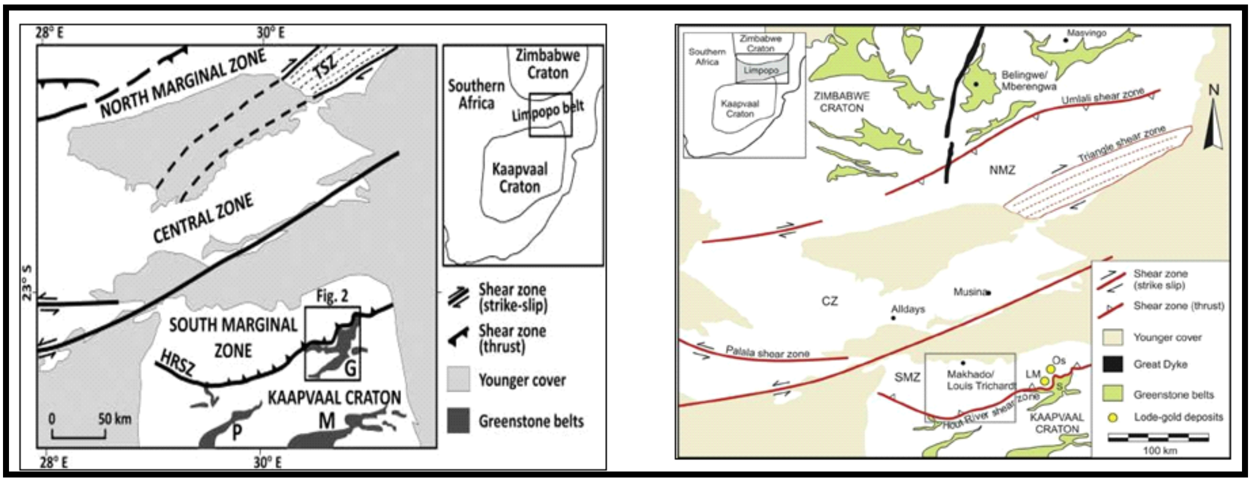


Figure 14: Regional Structure along the Giyani Greenstone Belt

1.9.2.3.2 Project Geological Setting

The GGB is approximately 17km wide and has a strike length of 70km. The belt has an overall NE-trend, but to the west, the GGB splits into a northern Khavagari arm and a southern Lwaji arm separated by granitoid gneiss (the Klein Letaba Gneiss) and younger granite. The Lwaji arm has more or less the same trend as the main part of the belt but the Khavagari arm has been rotated into an E-W orientation. The GGB is a shallow structure with a down dip extension of around 1.5km in the NW and 4km in the SE.

The predominant rocks in the project area include the ultramafic (tremolite) schists; mafic (chlorite) schists which are common throughout the belt. Also present in the area are the metasedimentary rocks which comprise Banded-Iron-Formation (BIF), quartzite, metapelite and rare dolomite. Although these formations are discontinuous, they form important structural markers throughout the belt. They are best developed in the northern sections including the Khavagari arm and the clastic metasedimentary rocks with obvious primary structures are abundant along the Nsama River in the central part of the belt.

The supracrustal rocks of the GGB have been subjected to amphibolite facies metamorphism. Peak metamorphism was followed by uplift and the influx of CO2 rich aqueous fluids. This rehydration event occurred during the exhumation of the Limpopo Complex along the Hout River Shear Zone and was responsible for shear-zone hosted alteration of the rocks in the GGB and the formation of the orogenic gold deposits.

The local geological setting and depositional environment described above is as shown in the diagram below.

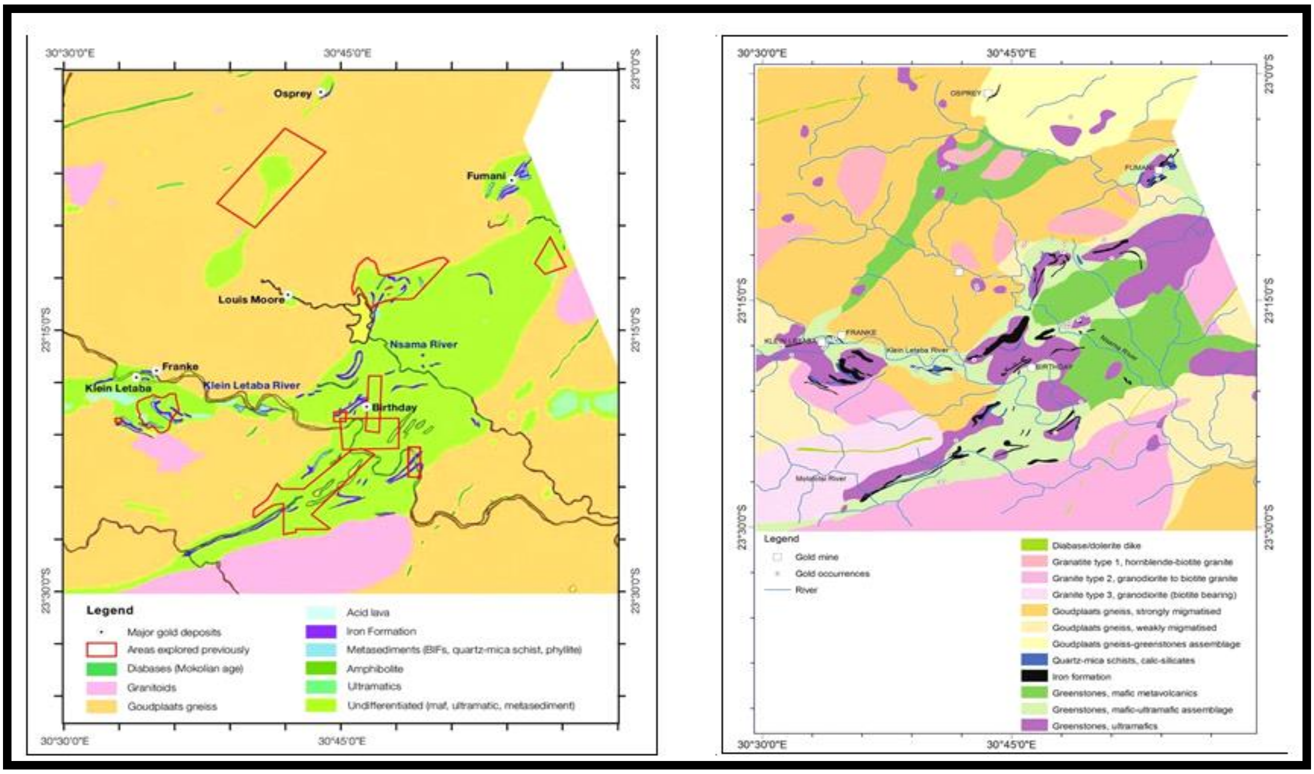


Figure 15: Local Geological Setting and Depositional Environment

The application area is located in the Greater Giyani magisterial district, Limpopo Province and covers an area known to have historical mining activities, with a number of disused mining areas found within the application area as shown in below.

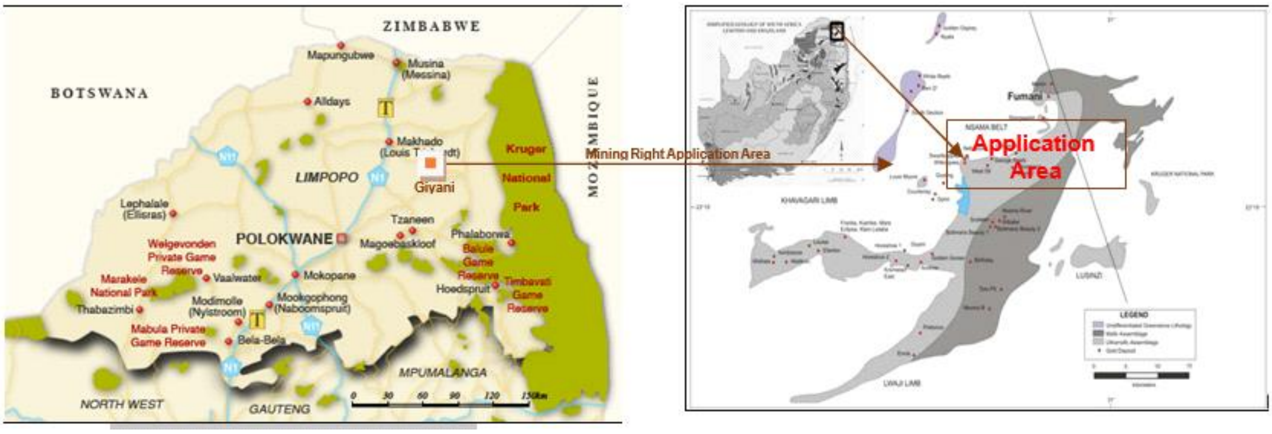


Figure 16: Giyani Gold Project Locality Plan

1.9.2.3.3 Structural Geology in Project Area

The structural configuration of the GGB is one of a north-east trending syncline forming an apex in the south-western corner of the Giyani Greenstone Belt. The established profile across the belt shows a 4km down dip extension into the crust for Lwaji and 1km depth for Khavagari arms respectively. The central portion of the belt is known to be shallow. The GGB is mainly made up of supra-crustal rocks of the Giyani Group which consists mainly of mafic-ultramafic rocks as detailed in the diagram below.

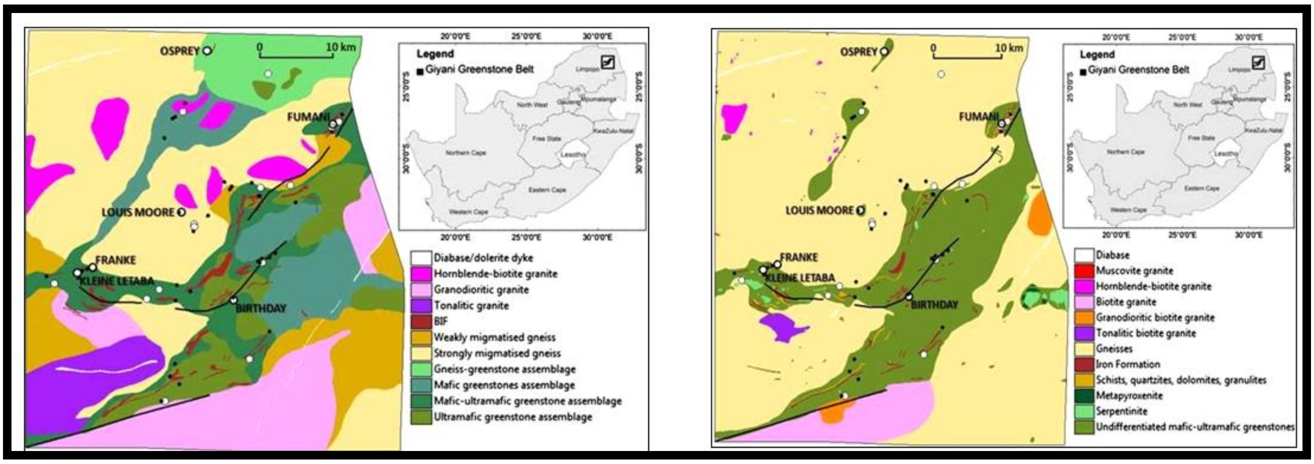


Figure 17**:** Geological Structure of the Giyani Greenstone Belt.

1.9.2.3.4 Mineralisation in the area

The origin of gold in the Giyani Greenstone Belt (GGB) can be classified into the modified placer theory, the syn-genetic theory, and the epigenetic theory. Gold mineralization in the GGB is orogenic in character and origin and can be directly linked to the exhumation phase of the Neo-archaean Limpopo Orogeny. Gold mineralization was late in the tectonic evolution of the GGB and related to the regional flow of CO2-rich aqueous fluids along foliation parallel ductile shear zones in the schists of the GGB. These fluids caused rehydration and hydrothermal alteration of suitable Fe-rich rocks in the GGB and the resultant deposition of gold. The gold occurrence is associated with hydrothermally altered mafic and ultramafic meta-volcanic schists and BIF, but is structurally controlled, due to being hosted in north-dipping anastomosing shear zones in the immediate footwall of the Hout River Shear Zone (HRSZ).

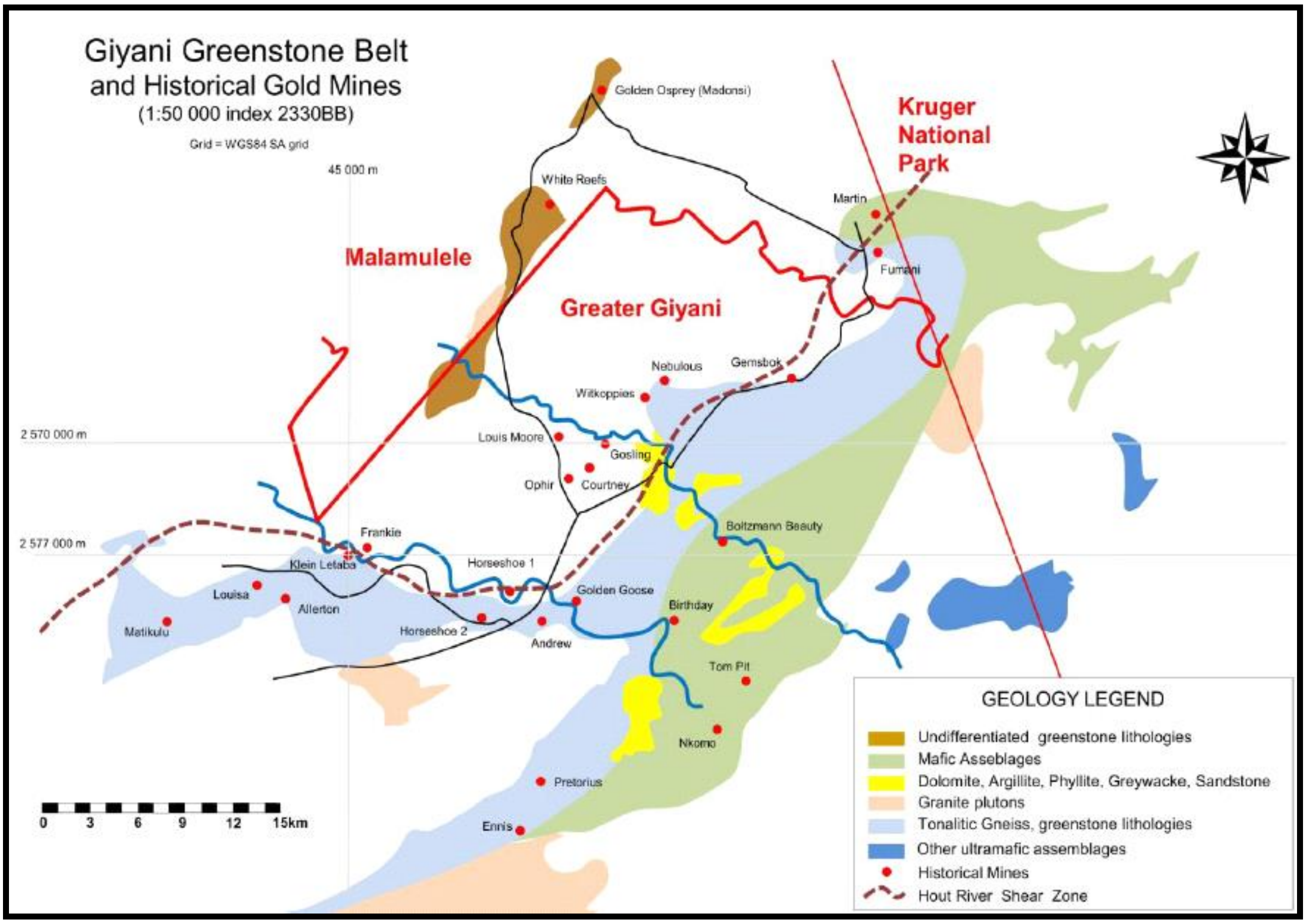


Figure 18: Depositional Environments within the Giyani Greenstone Belt

There are several known gold occurrences in the GGB and related satellite bodies to the north of the belt. A number of the occurrences were prospected and exploited in the past, evident in inactive mines which are found in the area. Six of the inactive mines (Klein Letaba, Louis Moore, Osprey, Fumani, Franke and Birthday) are known to have produced and recovered gold from the GGB. The distribution of the mineralization is strongly asymmetric with most deposits, including the main ones, located along the northern margin of the belt. Gold mineralization in the area is associated with mafic and ultramafic metavolcanic schists and BIF but is hosted in north-dipping anastomosing shear zones in the immediate footwall of the HRSZ. Gold is concentrated along the foliation in these shear zones and ore shoots plunge with the elongation lineation implying a direct relationship between mineralization and deformation along the shear zones.

1.9.2.4 SOILS

The application area has Red, massive or weakly structured soils with high base status (association of well drained Lixisols, Cambisols, Luvisols) and Soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils with (association of Leptosols, Regosols, Calcisols and Durisols. In addition one or more of Cambisols, Luvisols.

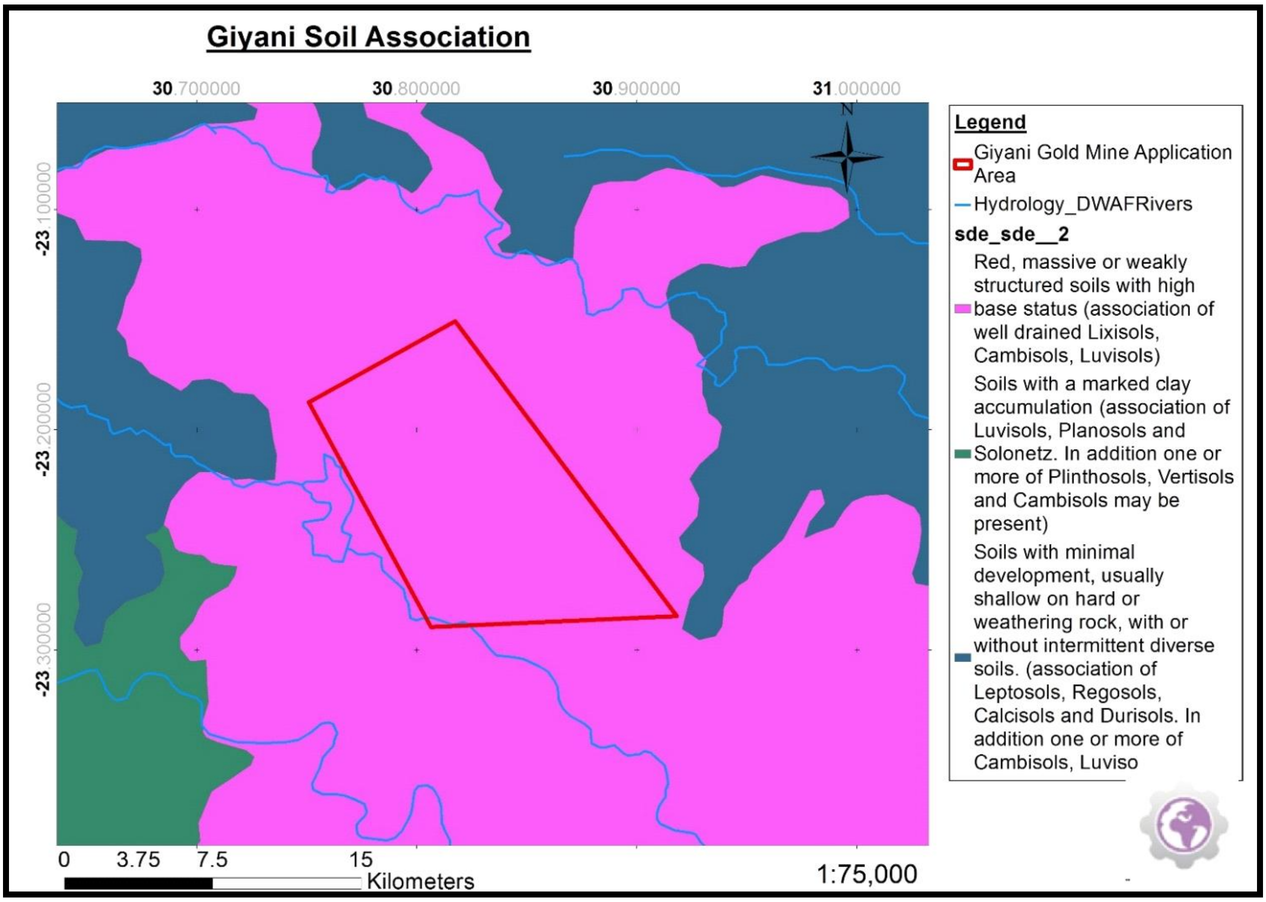


Figure 19**:** Soils

Soil is an open living ecosystem and can therefore be defined as a function of physical, chemical and biological processes. The following factors are involved in soil formation:

- Parent Material (geology, e.g. sedimentary rock (sandstone), acid igneous (granite) or basic rock dolerite) etc.;
- Topography (slope of landscape); Climate (wind, water, temperature etc.);
- Microbial Activity and microbial diversity ; and
- Time (soil formation occurs over a long time period, e.g. 1cm of topsoil is formed over 100yrs).

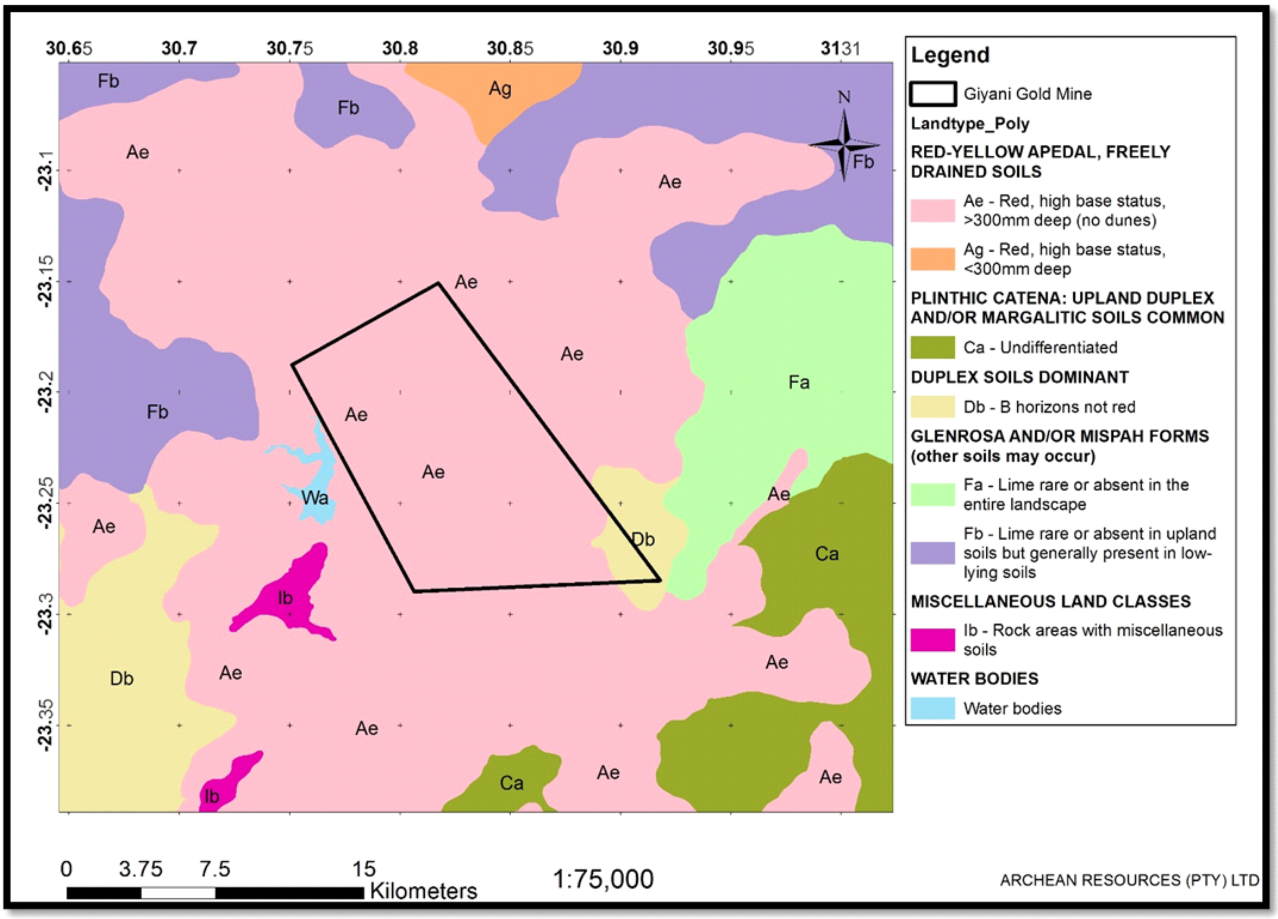


Figure 20**:** landtype

From the investigation it is conclusive the dominant soils according to the Taxonomical Soil Classification System of South Africa include;

- **Glenrosa and/or Mispah forms** (other soils may occur).
- Red-yellow apedal, freely drained soils
  - Ae - Red, high base status, >300mm deep (no dunes)

1.9.2.4.1 GENERAL INVESTIGATION OF PRESENT LAND USE

The area has soil which is suited for arable land and for agricultural purposes. The majority of the land around the municipal land falls under the local traditional authorities. Commercial farming occurs at a lesser scale only to be superseded by subsistence farming. The rest of the land is used from communal grazing.

The present land use is the following:

- The majority of land is shallow soil under thorny bush encroachment.

- There are parts of the area disturbed with roads from the existing activities emanating from rural activities and subsistence farming.

1.9.2.4.2 SCOPING METHODOLOGY

A broad soil classification and soil sampling for chemical analysis was done to get a baseline of the soil types, agricultural potential and land capability for the proposed mine. Using a soil auger a free random survey was conducted. Any differences in soil types or depth, or any other soil physical properties that can have an influence on the soil forms and agricultural potential of this land of the proposed opencast mine was identified.

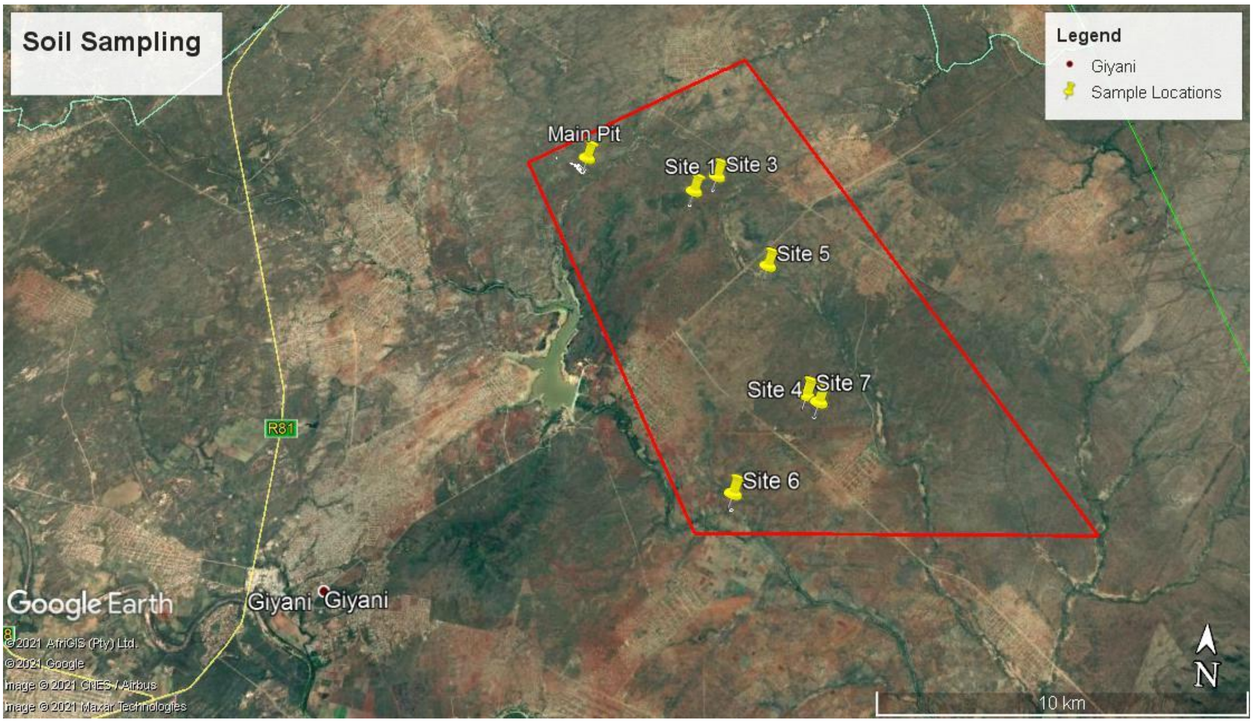


Figure 21: Sample Locations

1.9.2.4.3 OBSERVATIONS

1.9.2.4.3.1 SOIL PHYSICAL PROPERTIES

According to A Glossary of Soil Science (1995), soil (**Insertion 1**) can be defined as:

“the unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for growth of plants, or, the unconsolidated mineral matter on the surface of the earth that has been subjected to and influenced by genetic and environmental factors of parent material, climate (including precipitation and temperature effects), macro- and micro-organisms and topography all acting over the period of time and producing a product – soil – that differs from the material, which is derived in many physical, chemical, biological and morphological properties and characteristics”.

Soil is a thin surface covering the bedrock of most of the land area of the Earth. It is a resource that, along with water and air, provides the basis of human existence. Soil develops when rock is broken down by weathering and material is exchanged through interaction with the environment. Organic matter becomes incorporated into the soil as the result of the activity of living organisms. Soil also contains water, minerals, and gases. The soil system (**insertion 1**) is dynamic and it develops a distinct structure, often with recognizable layers or soil horizons arranged vertically through the soil profile.

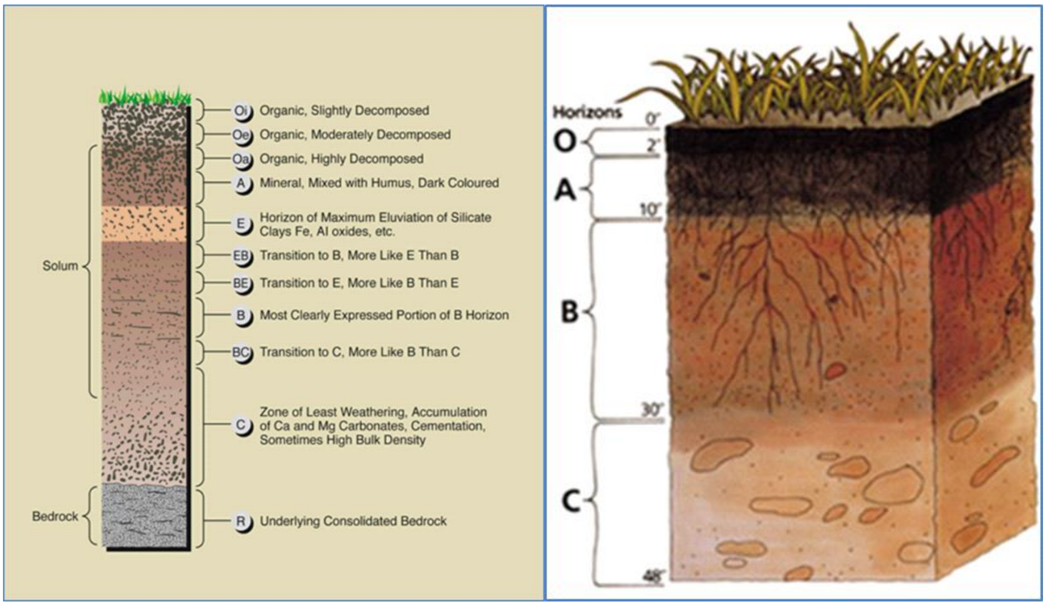


Figure 22**: Diagram of soil horizon types**

In terms of soil texture, soil type usually refers to the different sizes of mineral particles in a particular sample. Soil is made up in part of finely ground rock particles, grouped according to size as sand and silt in addition to clay, organic material such as decomposed plant matter.

Each component, and their size, plays an important role. For example, the largest particles, sand, determine aeration and drainage characteristics, while the tiniest, sub-microscopic clay particles, and are chemically active, binding with water and plant nutrients. The ratio of these sizes determines soil type: clay, loam, clay-loam, silt-loam, and so on.

In addition to the mineral composition of soil, humus (organic material) also plays an important role in soil characteristics and fertility for plant life. Soil may be mixed with larger aggregate, such as pebbles or gravel. Not all types of soil are permeable, such as pure clay.

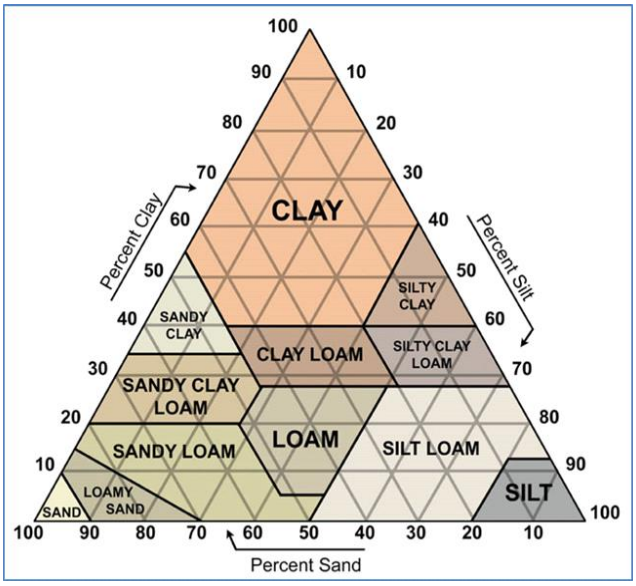


Figure 23: **Diagram of soil type classification**

The soils in the project area was classified as sandy clay loamy sands based on the Sand, Silt and Clay compositions.

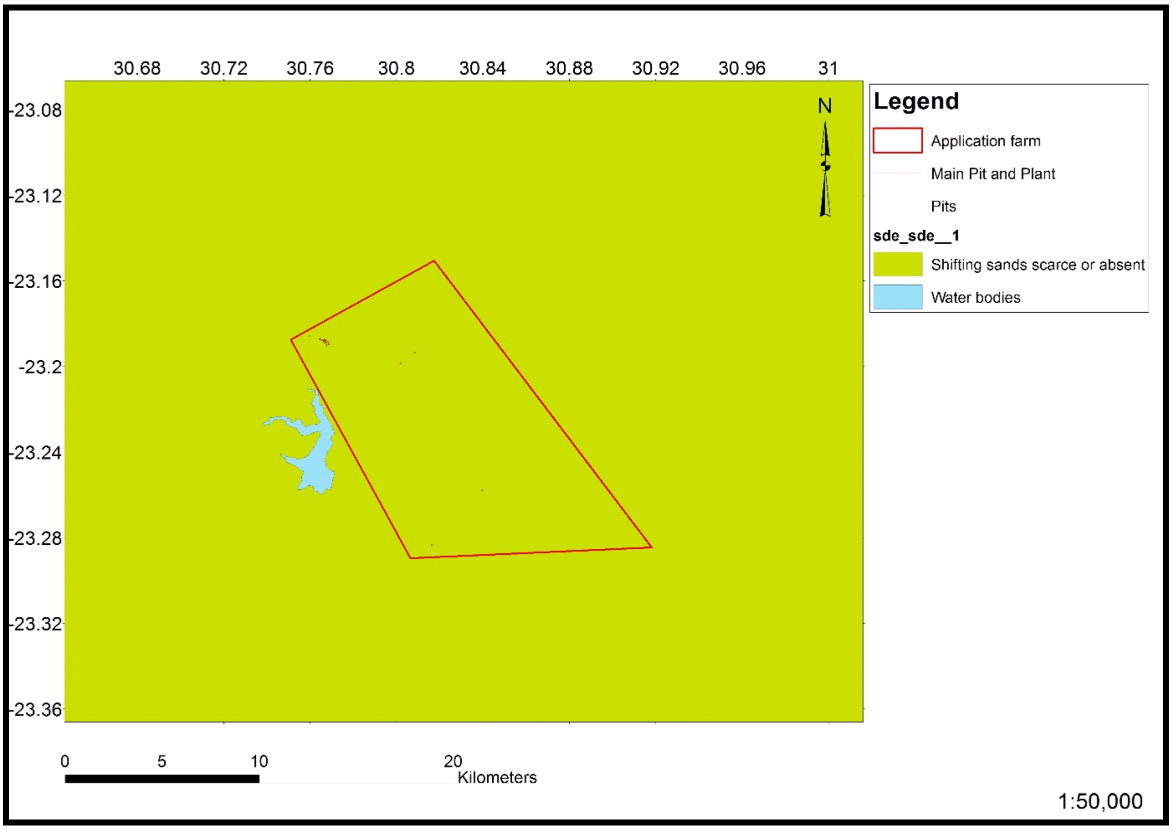


Figure 24**:** landtype

Table 6: **CLAY, SILT AND SAND COMPOSITIONS**

#	LAB No	Reference	CLAY	SILT	SAND
			%	%	%
1	G25-54361	Plant	16	17	67
2	G25-54362	Pit	10	17	73
3	G25-54363	Site 1	20	19	61
4	G25-54364	Site 2	6	8	86
5	G25-54365	Site 3	10	2	88
6	G25-54366	Site 4	10	18	72
7	G25-54367	Site 5	14	21	65
8	G25-54368	Site 6	12	2	86
9	G25-54369	Site 7	8	3	89

1.9.2.4.3.2 TEXTURAL CONTRAST

Soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils. (Association of Leptosols, Regosols, Calcisols and Durisols. In addition one or more of Cambisols, Luvisols. The strong textural contrast displayed by Solonetz, Planosols and some Luvisols renders them problematic from a plant-extractable water viewpoint. Some members (mostly Solonetz or Planosols) display an abrupt transition between the topsoil (and sandy layer beneath the topsoil) and the subsoil with respect to texture, structure and consistence.

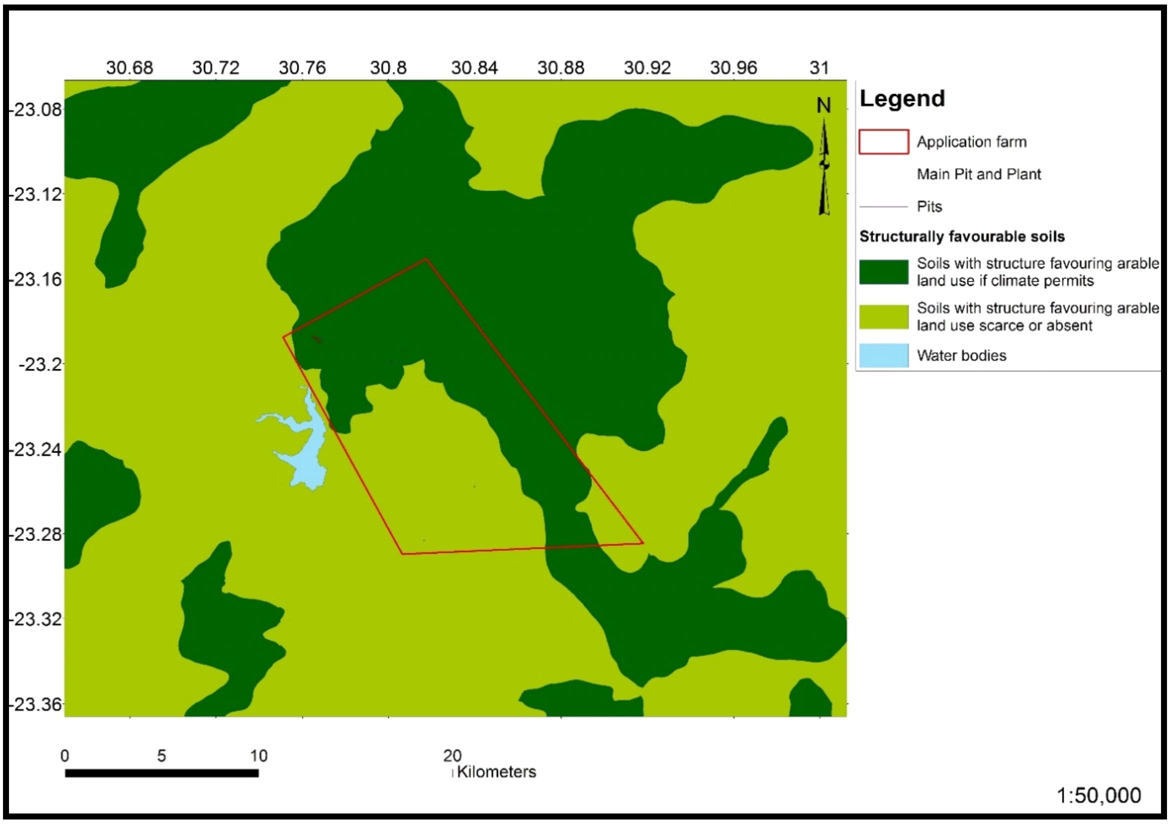


Figure 25:**Soil Structure**

The material above the transition is usually of light texture, permeable and can be penetrated readily by water and roots. The material below the transition is usually clayey, dense, and very slowly permeable and can be exploited by roots to a very limited extent Soils with structure favouring arable land use scarce or absent and Soils with structure favouring arable land use if climate permits A clear transition is found between the topsoil and the subsoil in respect of texture, structure and consistence. The topsoil is relatively sandy in relation to the subsoil, and the subsoil is clayey and dense, but commonly not to the extreme.

1.9.2.4.3.3 CHEMICAL SOIL PROPERTIES

The pH of the soil collected from sample points ranged from 5 -7.2 indicating that the soil ranges from acidic to neutral.

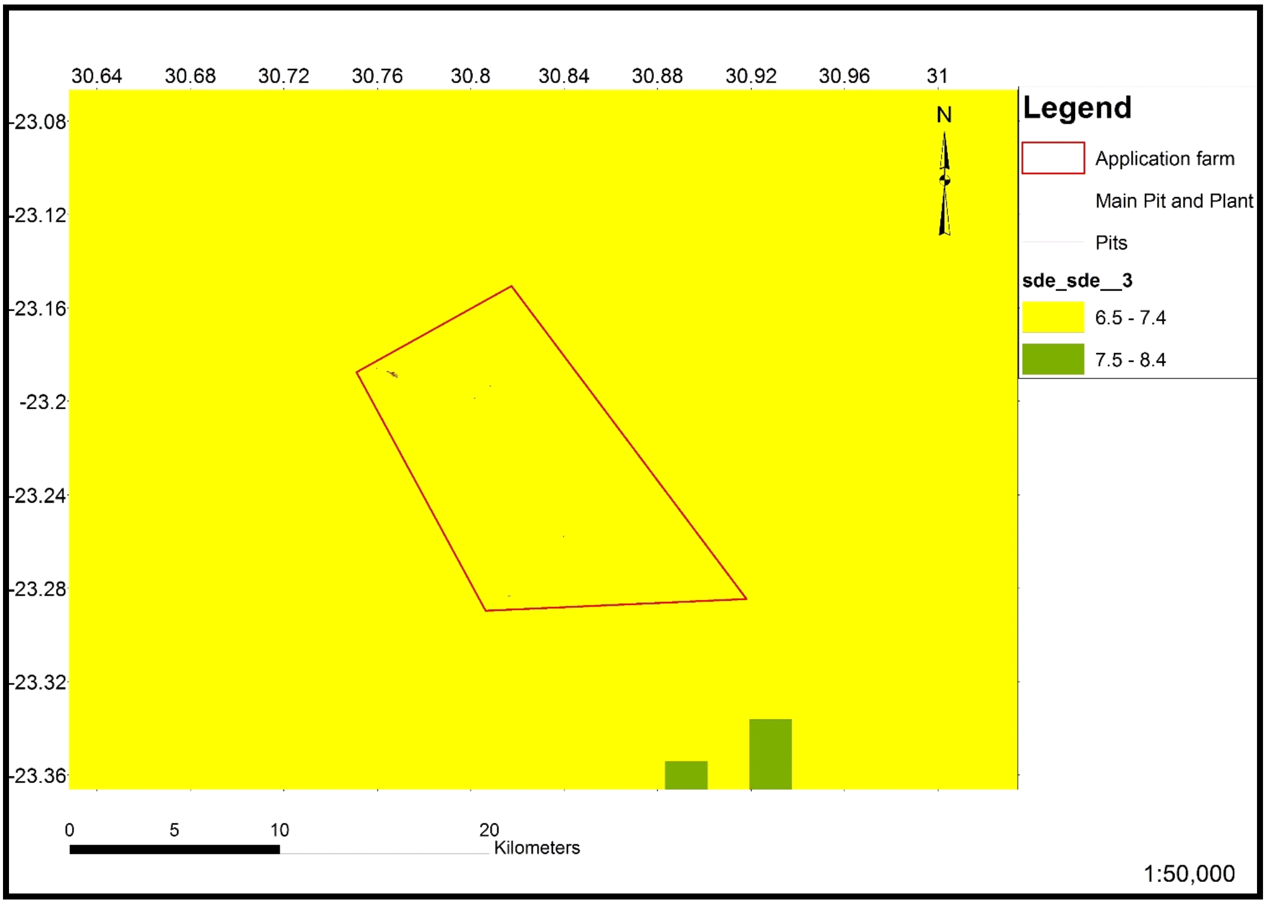


Figure 26: Soil P.H

1.9.2.5 Land Capability Evaluation

Land Capability is determined by the collective effects of soil, terrain and climate features, shows the most intensive long-term use of land for rain-fed agriculture and at the same time indicate the permanent limitations associated with the different land-use classes .Capability refers to general kinds of land use and used to allocate rationally to the different kinds of land use required i.e. rotational arable, permanent grazing, woodland etc. The main product of land capability classification of a map in which areas of land are put into capability classes ranging from I best to VIII (worst). The reason why an area is allocated to a given class is indicated by a letter suffix; thus sub class IIe indicates an erosion hazard, IIw a problem of excess water. Each class of land has the potential or capability for use in a prescribed number of ways, or with specified management techniques. Thus class I land can be put to arable use without soil conservation, measures whist class II to IV require increasingly conservation practices; classes VI to VIII should not be used for arable use.

Table 7: SOIL PHYSICAL PROPERTIES FOR THE DIFFERENT SOIL FORMS

Land Type	**Dominant soils**	**Depth(mm)**	**Characteristics**	**Agricultural Potential**
	Glenrosa + Mispah	100-600	Fb - Lime rare or absent in upland soils but generally present in low-lying soils	High: 6.0% Medium: 53.7% Low: 40.3%
Ae126	Red-Yellow Apedal, Freely Drained Soils	>300mm deep	Ae - Red, high base status, (no dunes)	Moderate

1.9.2.5.1.1 Concepts and assumptions

There are to concepts that are basic to the system. These are capability and limitation. The potential of the land for use in specified ways or with specified management practices is called capability. There is a sequence of assumed uses built in the system. These are as follows: (a) arable use for any crops and without soil conservation practices; (b) arable use with restriction on choice of crops/or with soil conservation practices;(c) grazing of improved pastures; (d) grazing of natural pastures or, at the same level, woodland; (e) and at the lowest level recreation, wildlife conservation, water catchment and aesthetic purposes (Dent and Young, 1981). Land that is allocated to any particular class has the potential for the use specified for that class and for all classes below it. Thus class I land whilst excellent for arable use can equally be put to other uses: class VI land use suited for improved pasture but also be any of the uses below it, whilst class VIII land can be only used for recreation. The capability class does not indicate what the best use for the land, nor the most profitable, it only indicates the range of uses to which each could be put.

Limitations are land characteristics, which have an adverse effect on capability. Permanent limitations are those which cannot easily be corrected. Temporary limitations can be correct, at least by minor land improvements. Land is classified mainly on the basis of permanent limitations. The general rule is that if any one limitation is of sufficient severity to lower the land to a given class it is allocated to that class, no matter how favorable all other characteristics might be.

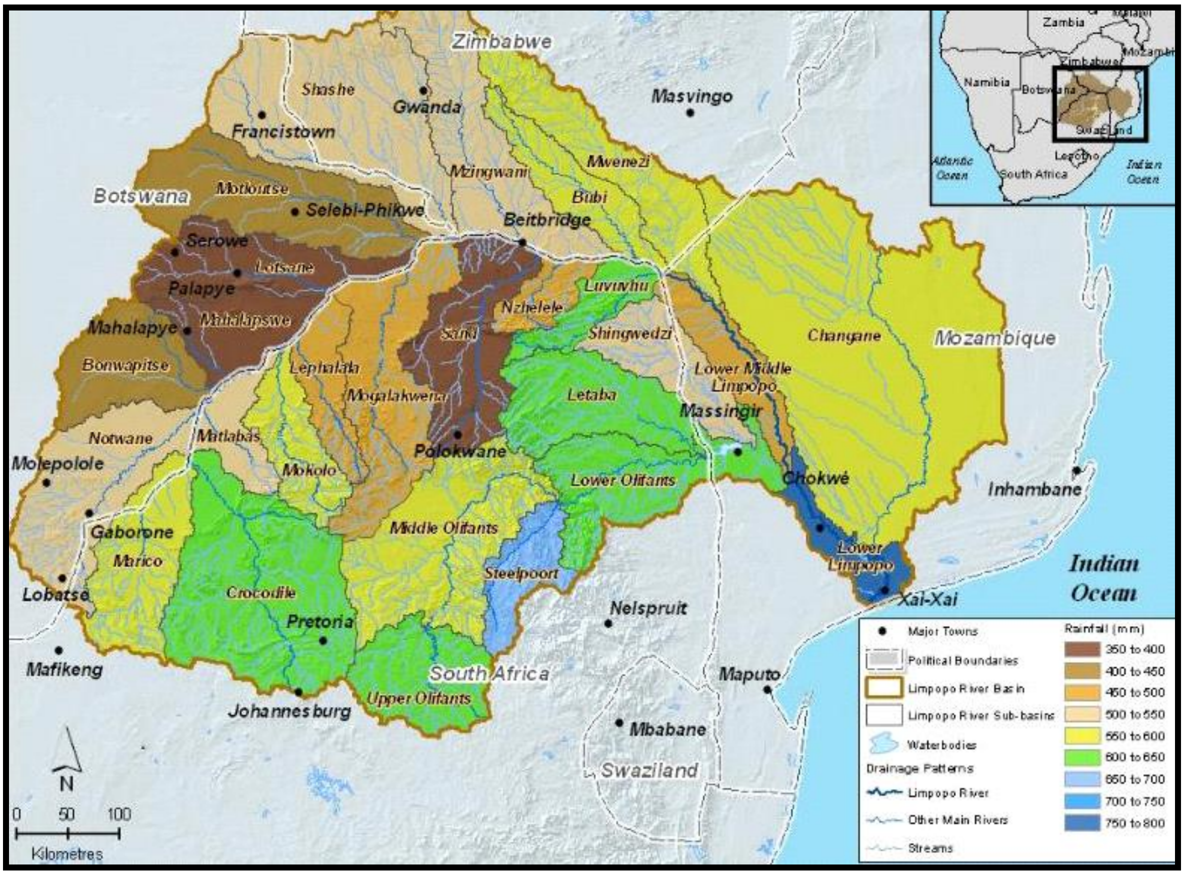


Figure 27: Average annual rain fall of the Limpopo basin

1.9.2.5.2 Land Evaluation

The interaction of two sets of factors influence land uses, there are physical factors such as geology, relief feature's, climate, soil and vegetation which limit the use of the land and secondly socio-economic factors. The unique combination of topography, geology, climate, soils and vegetation has endowed the province with incredible biodiversity, mineral and agricultural wealth. Limitations that cannot be corrected in the study area are a result from the following effects:

- Erosion or erosion hazard
- Climate
- Stones
- Low water-holding capacity

The soil loss potential prediction is high followed by moderate due to lack of grassy flora to hold the topsoil.

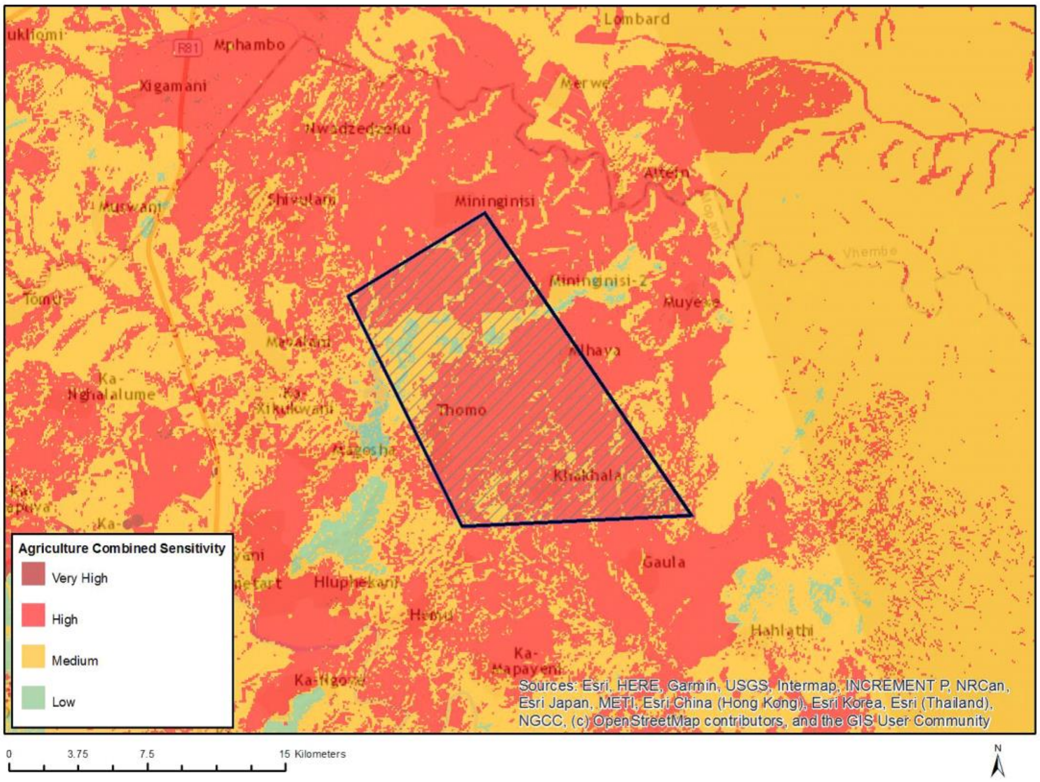


Figure 25: Combined Agriculture Sensitivity

Table 8:: Sensitivity

Sensitivity	Feature(s)
High	Land capability;09. Moderate-High/10. Moderate-High
High	Subsistence Farming;Land capability;09. Moderate-High/10. Moderate-High
High	Subsistence Farming;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Very High	Land capability;11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high
Very High	Subsistence Farming;Land capability;11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high

FRM 168 version: 01, 2018-06-29 WO 86249:105886 PAGE: 1 of 2

NviroTek Labs

Verslag / Report

Grond / Soil

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To/Aan:	ARCHEM RESOURSES	Representative/Verteenwoordiger:	
		Farm Name/Plaas Naam:	
	27828701678	Order/Bestel#:	Archem Resources
	48 KINGBOLT CRESCENT ALKANTRANT PRETORIA 0081	Email:	yvonneguttoona@archem.com, yvonnegutoona@gmail.com

Lab Nommer	Sample Reference	pH KCl *	P Bray1	K AmAc *	Na AmAc	Ca AmAc	Mg AmAc *	EXCH ACID KCl	Ca% AmAc	Mg% AmAc	K% AmAc	Na% AmAc	ACID SAT. AmAc	Ca:Mg AmAc	(Ca+Mg)/K AmAc	Mg:K AmAc	S-VALUE AmAc	Na:K AmAc	T-VALUE AmAc *	Dens. *	S AmAc
Lab Number	Monsterverwysing	-	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol(+)/kg	%	%	%	%	%				cmol(+)/kg	cmol(+)/kg	cmol(+)/kg	g/ml	mg/kg
G25-54361	Plant	5.4	4	105	25	1457	990	0.00	45.96	51.65	1.69	0.69	0.00	0.89	57.62	30.48	15.85	0.41	15.85	1.09	12.46
G25-54362	Pit	7.0	2	42	26	2811	1265	0.00	57.04	42.06	0.43	0.47	0.00	1.36	229.53	97.42	24.64	1.08	24.64	1.28	10.29
G25-54363	Site 1	5.9	2	199	25	1443	537	0.00	58.98	35.98	4.16	0.88	0.00	1.64	22.82	8.65	12.24	0.21	12.24	1.04	8.04
G25-54364	Site 2	7.0	4	238	263	1092	727	0.00	41.47	45.23	4.61	8.68	0.00	0.92	18.80	9.81	13.17	1.88	13.17	1.05	12.02
G25-54365	Site 3	5.0	2	193	25	293	153	0.00	44.03	37.77	14.88	3.32	0.00	1.17	5.50	2.54	3.32	0.22	3.32	1.38	5.40
G25-54366	Site 4	5.0	1	36	99	643	571	0.00	38.21	55.57	1.08	5.14	0.00	0.69	86.47	51.24	8.42	4.74	8.42	1.30	8.56
G25-54367	Site 5	7.2	2	80	15	3125	92	0.00	93.83	4.53	1.23	0.40	0.00	20.70	79.65	3.67	16.65	0.33	16.65	1.14	4.73
G25-54368	Site 6	5.4	2	38	46	528	256	0.00	52.44	41.67	1.94	3.96	0.00	1.26	48.52	21.48	5.03	2.04	5.03	1.26	5.28
G25-54369	Site 7	5.7	1	30	106	259	119	0.00	46.17	34.76	2.73	16.34	0.00	1.33	29.60	12.72	2.81	5.98	2.81	1.35	6.94

Lab Nommer	Sample Reference	CLAY	SILT	SAND
Lab Number	Monsterverwysing	%	%	%
G25-54361	Plant	16	17	67
G25-54362	Pit	10	17	73
G25-54363	Site 1	20	19	61
G25-54364	Site 2	6	8	86
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G25-54366	Site 4	10	18	72
G25-54367	Site 5	14	21	65
G25-54368	Site 6	12	2	86
G25-54369	Site 7	8	3	89

NOTAS / NOTES:

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Figure 28: Sample Results

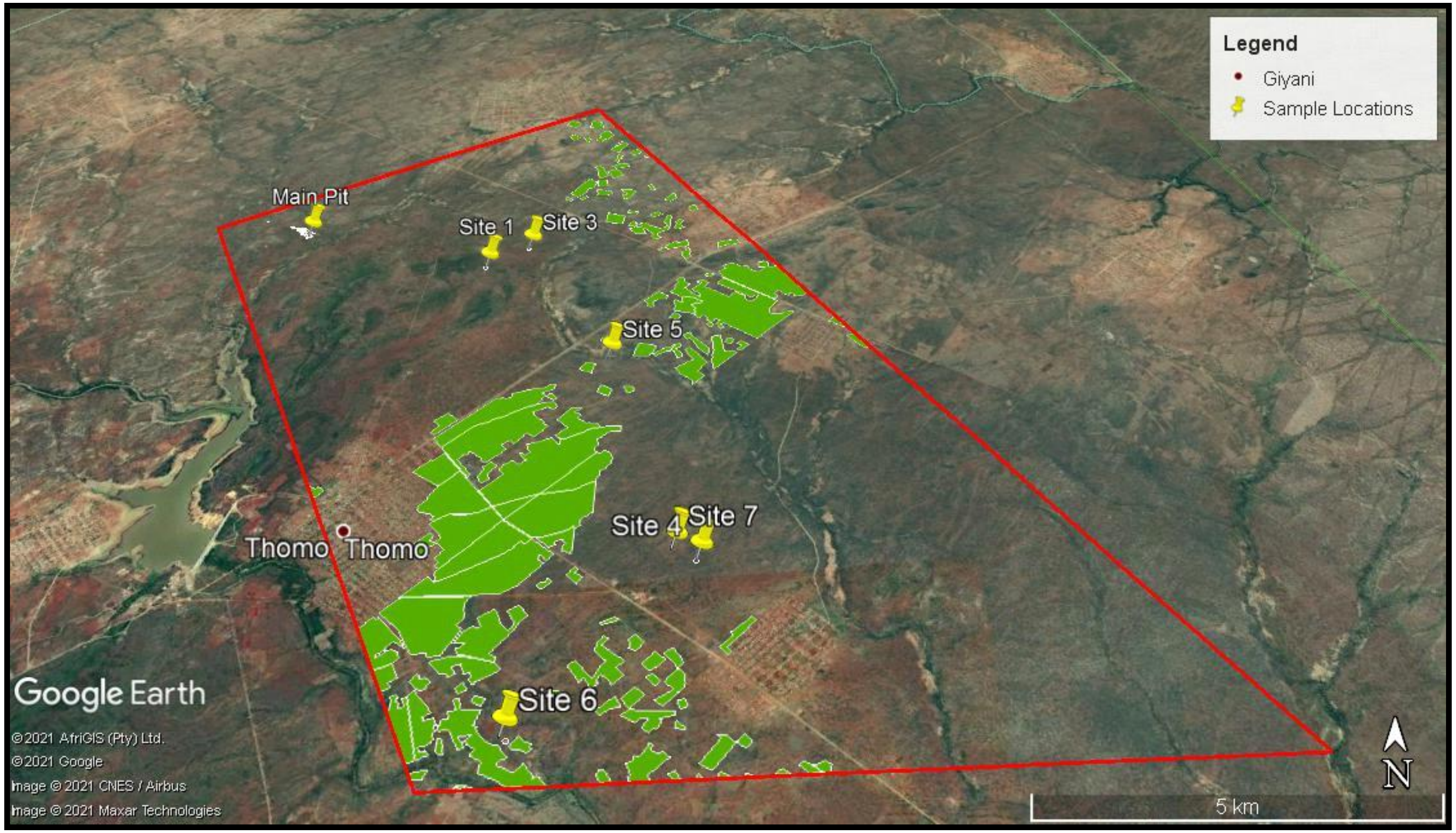

Figure 29: Sample locations with Farming and crop boundaries

1.9.3 Biodiversity

1.9.3.1 Vegetation

Lowveld Rugged Mopaneveld

Distribution ranges over Limpopo and Mpumalanga Provinces with broken veld from the area southeast of Giyani in the west to Shimuwini and Boulders Camps in the east as well as the rugged area of the Olifants River Valley south of Phalaborwa, from Grietjieberg in the west to the Maveni River tributary in the east. Altitude ranges between 250 m to 550 m.

Climate has some summer rainfall with very dry winters. Mean Annual Precipitation ranges from about 400 mm to 600 mm. Generally a frost-free area, but frost sometimes occurs in the low-lying areas (Mucina and Rutherford, 2006). Vegetation & Landscape Features are slightly too extremely irregular plains with sometimes steep slopes and a number of prominent hills. The area around the Olifants River has more dissected and steeper slopes than the northern part of this unit.

Usually dense shrubs with occasional trees and a sparse ground layer. Woody plants can become particularly dense where fire is excluded by very rocky terrain, such as in the vicinity of the Olifants River. Vegetation is more open in the northeastern parts of this unit outside the Kruger National Park (Mucina and Rutherford, 2006).

Geology & Soils from the Goudplaats Gneiss and Makhutswi Gneiss underlie most of this area, with a smaller contribution from the ultramafic metavolcanics (rocks rich in chlorite, amphibole, talc and serpentine) and metasediments of the Giyani Greenstone Belt (all Swazian Erathem). Soils are red-yellow apedal, freely drained, but also shallow and stony, especially in the east. Soil forms are mainly Hutton, Mispah and Glenrosa. Land types Ae, Fb and Fa (Mucina and Rutherford, 2006).

Plant species as describer by Mucina and Rutherford (2006) occurring within the Lowveld Rugged Mopaneveld includes:

Tall Trees include: *Senegalia nigrescens, Sclerocarya birrea subsp. caffra*.

Small Trees: *Colophospermum mopane, Combretum apiculatum, Terminalia prunioides, Vachellia exuvialis, Vachellia nilotica, Boscia albitrunca, Commiphora mollis* and *Dalbergia melanoxylon.*

Tall Shrubs: *Combretum hereroense, Dichrostachys cinerea, Grewia bicolor, G. villosa, Rhigozum zambesiacum.*

Low Shrubs: *Commiphora africana, Melhania forbesii, M. rehmannii, Solanum panduriforme. Graminoids: Aristida congesta, Enneapogon cenchroides, Melinis repens, Sporobolus panicoides, Bothriochloa radicans, Digitaria eriantha subsp. pentzii, Fingerhuthia africana* and *Panicum maximum.*

Herbs: *Crabbea velutina, Heliotropium steudneri, Hemizygia elliottii, Hibiscus sidiformis, Phyllanthus asperulatus* and *Xerophyta retinervis.*

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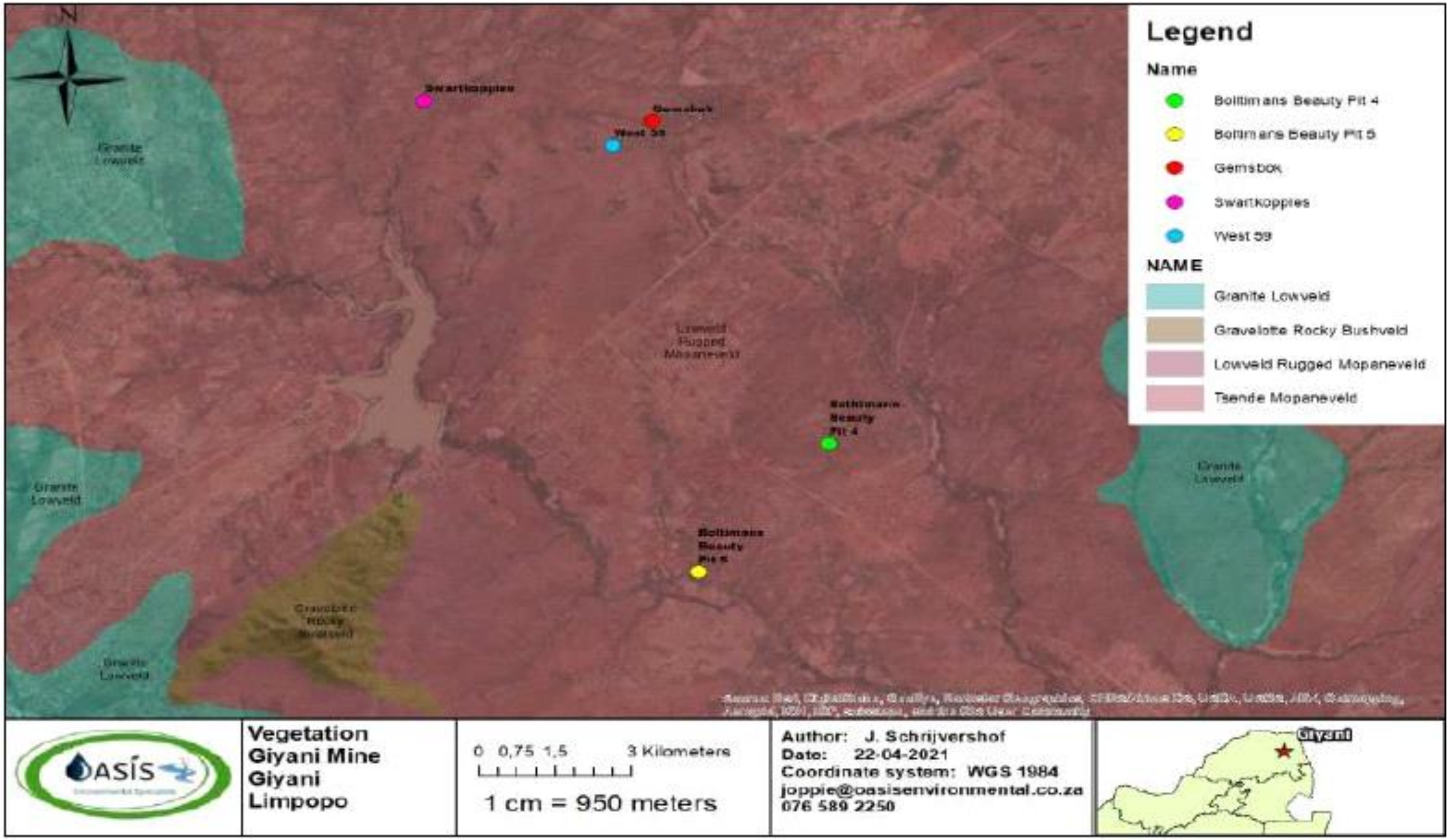

Figure 30: Vegetation map of the study site

1.9.3.2 Quaternary catchment and Land Use

Conservation is least threatened with majority being in the Kruger National Park. At least an additional 5% conserved in private reserves, such as Klaserie, Letaba Ranch and Selati Game Reserve. Some transformed landscapes occur mainly by cultivation and some urban and built-up areas (**Figure below**). This vegetation occurring outside the conserved areas is under pressure from high-density rural human population and associated urban sprawl and agricultural activities. Some areas experience moderate erosion. The southern part of this unit in the Kruger National Park contains a number of tree species that are relatively scarce elsewhere in the park, e.g. *Kirkia wilmsii* and *Hexalobus monopetalus* (Mucina and Rutherford, 2006).

1.9.3.2.1 Quaternary catchment and Land Use

Kusile Invest 133 (Pty) Ltd Gold falls within B82H quaternary catchment. The catchment is located in the Luvuvhu and Letaba Water Management area. The site can be sub-divided into secondary drainage regions comprised of smaller catchment areas and streams. The surface topography is mainly consisting of a gently undulating plateau. Tributaries and streams have their origin in this area e.g. Nsami River, sourced from springs occurring on the North East (NE). The drainage forms a dendritic pattern flowing north-east along the stream channels. This B82H quaternary catchment is mostly impacted by unregulated grazing and development in the form of village holdings, farm dams, road networks, and previous mining.

The area is classified as rural while the main land use is agriculture and farming. Agriculture and arable farming are the dominant activities overlying aquifers. Within this category agriculture and farming increases remains the main activities with potentially wide spread effect on groundwater quantity and quality.

Table 9: WMA and Quaternary Catchments Descriptions (WR2012, 2017).

WMA	Quaternary catchment	Catchment Area(km2)	MAP (mm)	PET (mm)	Hydrological sensitivity
Luvuvhu and Letaba Water Management Area(WMA)	B82H	749	400	H>	Low

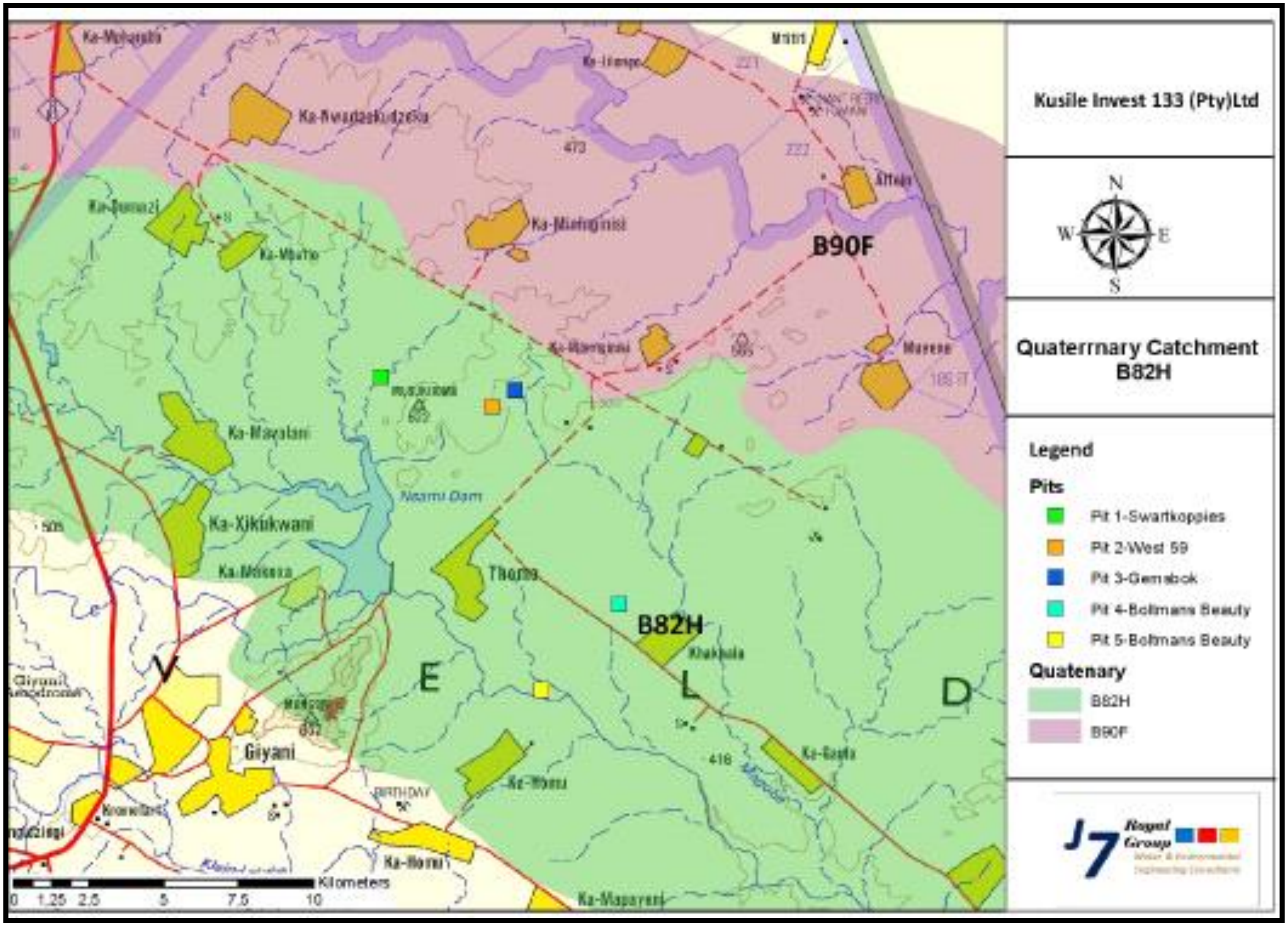

Figure 31: Quaternary Catchment..

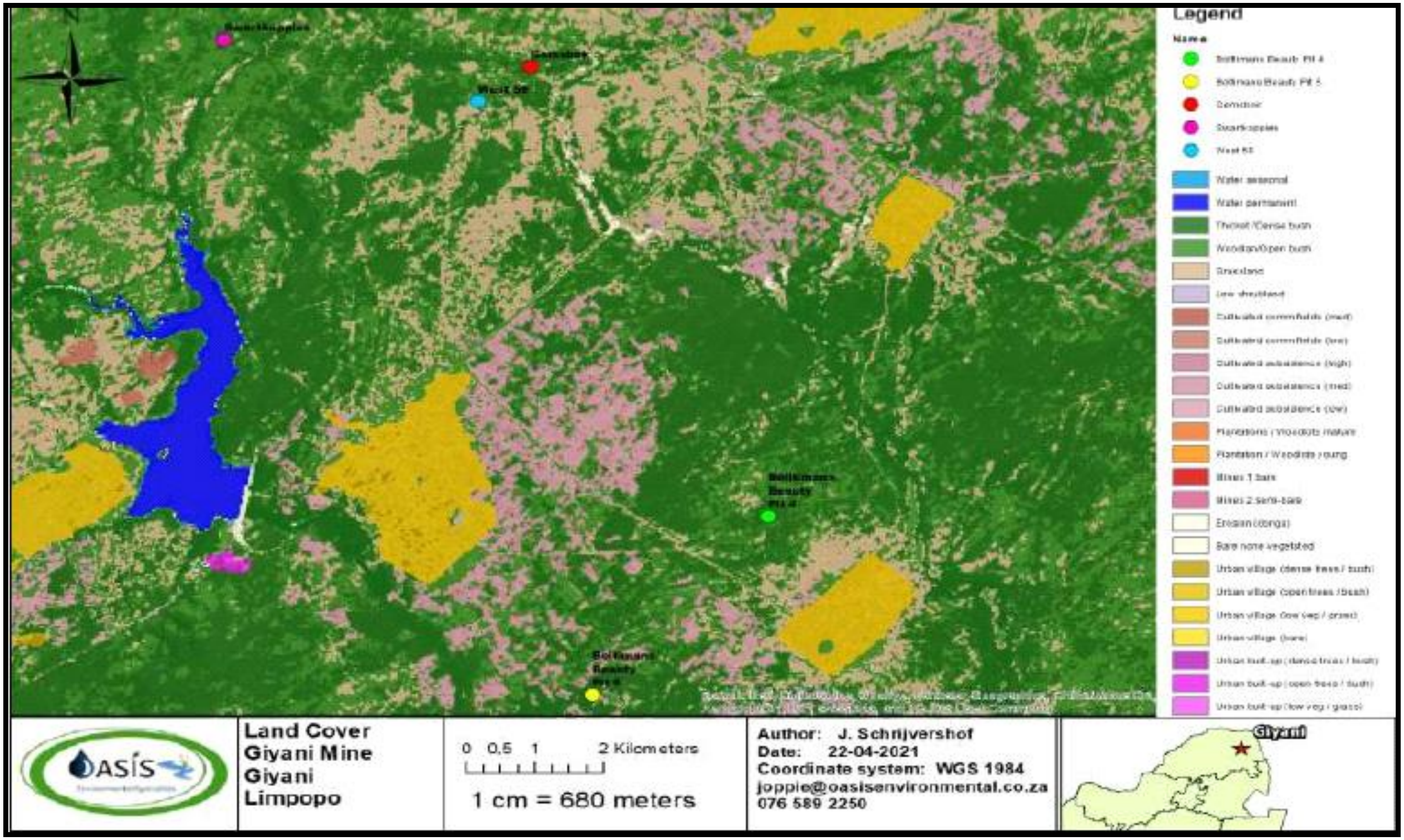

Figure 32 Proposed Kusile's Giyani Gold Mine– Land cover map

1.9.3.2.2 Ecological Assessment

1.9.3.2.2.1 Critical Biodiversity Areas

Biodiversity Areas

According to the biodiversity datasets provided by SANBI (2021), the current mining area (Swartkoppies) and the 2 western pit areas (West 59 and Gemsbok) falls within a Critical Biodiversity Area 2 as seen in **Figure 5**. These sections were confirmed to be Mopani forest and bushveld areas during the site visit. The two remaining eastern pit areas falls within an Ecological Support 1 area and the other within an Other Natural Areas. These areas had disturbance by informal settlements surrounding these areas.

Critical Biodiversity Areas (2) (CBA 2) are classified as best design selected sites and are selected to meet biodiversity pattern and/or ecological process targets. Alternative sites may be available to meet targets. Ecological Support Areas (1) (ESA 1) Natural and/or near natural and degraded areas supporting CBAs by maintaining ecological processes. Other Natural Areas are classified as natural and intact but not required to meet targets, or identified as CBA or ESA. No natural habitat remaining areas are not significant to direct biodiversity value.

1.9.3.2.3 Threatened Ecosystems and Protected areas

The mining areas does not overlap with any protected ecosystems.

1.9.3.2.4 Important Bird Areas

The proposed mining operations fall within close proximity to Important Bird Areas (IBAs), where the proposed mining area falls close to the Kruger National Park (**Figure 6**). The Kruger National Park is known to support more than 490 bird species, about 57% of the species found in the entire southern African subregion. The diversity of birds can be attributed to the numerous different habitats and the ecotonal nature of the area. There are several important populations of widespread species that do not thrive outside large protected areas.

In addition, the riverine forests constitute habitat corridors that are used by some species of the Drakensberg escarpment to move down to the Lowveld to escape the severe escarpment winters. The riverine forests also provide habitat for secretive, river-dependent species such as Pel's Fishing Owl *Scotopelia peli*, White-backed Night Heron *Gorsachius leuconotus* and African Finfoot *Podica senegalensis* (Birdlife, 2020).

The rivers, floodplains, pans, dams and vleis are important for many watercourse dependent and associated birds, such as Black Stork *Ciconia nigra* (which breeds in the gorges of the nearby Lebombo Mountains), Woolly-necked Stork *C. episcopus*, African Openbill *Anastomus lamelligerus*, Saddle-billed Stork *Ephippiorhynchus senegalensis* and White-crowned Lapwing *Vanellus albiceps*. When conditions are suitable, Pink-backed Pelican *Pelecanus rufescens*, Great White Pelican *P. onocrotalus*, Rufous-bellied Heron *Ardeola rufiventris*, Greater Flamingo *Phoenicopterus roseus*, Lesser Moorhen *Gallinulaangulata*, Allen's Gallinule *Porphyrio alleni*, Lesser Jacana *Microparra capensis*, African Marsh Harrier *Circus ranivorus*, Chestnut-banded Plover *Charadrius pallidus* and

Black Coucal *Centropus grillii* occur in small numbers. The seasonally looded grasslands to the north of Shingwedzi hold Corn Crake *Crex crex* in summer (Birdlife, 2020).

Of the wide-ranging species that are rare outside South Africa's large national parks, Marabou Stork *Leptoptilos crumeniferus*, Hooded Vulture *Necrosyrtes monachus*, White-backed Vulture *Gyps africanus*, Lappet-faced Vulture *Torgos tracheliotos*, White-headed Vulture *Aegypius occipitalis*, Martial Eagle *Polemaetus bellicosus*, Bateleur *Terathopius ecaudatus*, Tawny Eagle *Aquila rapax*, Kori Bustard *Ardeotis kori* and Southern Ground-Hornbill *Bucorvus leadbeateri* are locally common in the KNP. Cape Vulture *Gyps coprotheres* regularly forages in the park. Pallid Harrier *Circus macrourus* and African Grass Owl *Tyto capensis* occur in low numbers (Birdlife, 2020).
The varied woodland communities host a plethora of small accipiters, cuckoos, owls, kingfishers, bee-eaters, rollers, hornbills, barbets, robins, cisticolas, flycatchers, shrikes, starlings, sunbirds, weavers, finches and waxbills. The thicket and forest areas support Brown-headed Parrot *Poicephalus cryptoxanthus* and Gorgeous Bush-Shrike *Chlorophoneus viridis*, which are restricted to the East African Coast biome. The small patches of sandveld in the far north-east hold low numbers of Pinkthroated Twinspot *Hypargos margaritatus*, while the Lala palm savanna, also in the north-east, supports Lemon-breasted Canary *Crithagra citrinipectus* (Birdlife, 2020).

Near Pafuri, in the extreme north, many species reach the southern limit of their Afrotropical range and are consequently extremely rare within South Africa, although they are considerably more common and widespread just outside the country's borders. Such species include Dickinson's Kestrel *Falcobdickinsoni*, Racket-tailed Roller *Coracias spatulata*, Tropical Boubou *Laniarius major*, Mottled Spinetail *Telacanthura ussheri* and Böhm's Spinetail *Neafrapus boehmi*, as well as Greyheaded Parrot *Poicephalus fuscicollis*, which is found in the riparian forests and thickets of the far north. These species are of interest from a South African perspective, but are of little subregional or global conservation significance as the populations are small and peripheral (Birdlife, 2020).

Red-billed Oxpecker *Buphagus erythrorhynchus* is common and widespread, but Yellow-billed Oxpecker *B. africanus* was considered extinct until 1979. This species has recolonised the KNP naturally and is now considered an uncommon breeding resident, occurring throughout the park but especially in the northern half (Birdlife, 2020).

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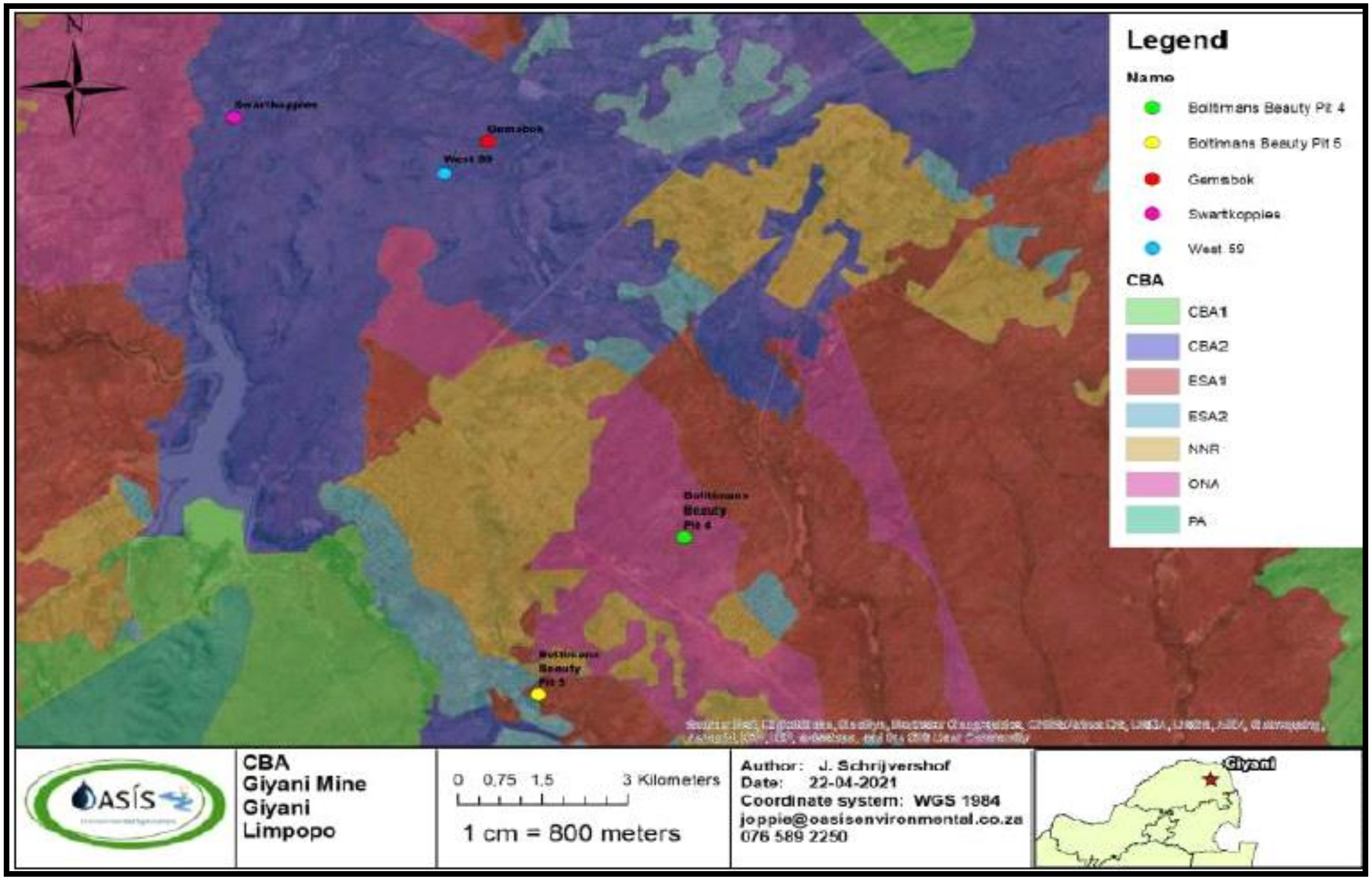


Figure 33: Kusile's Giyani Gold Mine - Critical Biodiversity Areas map.

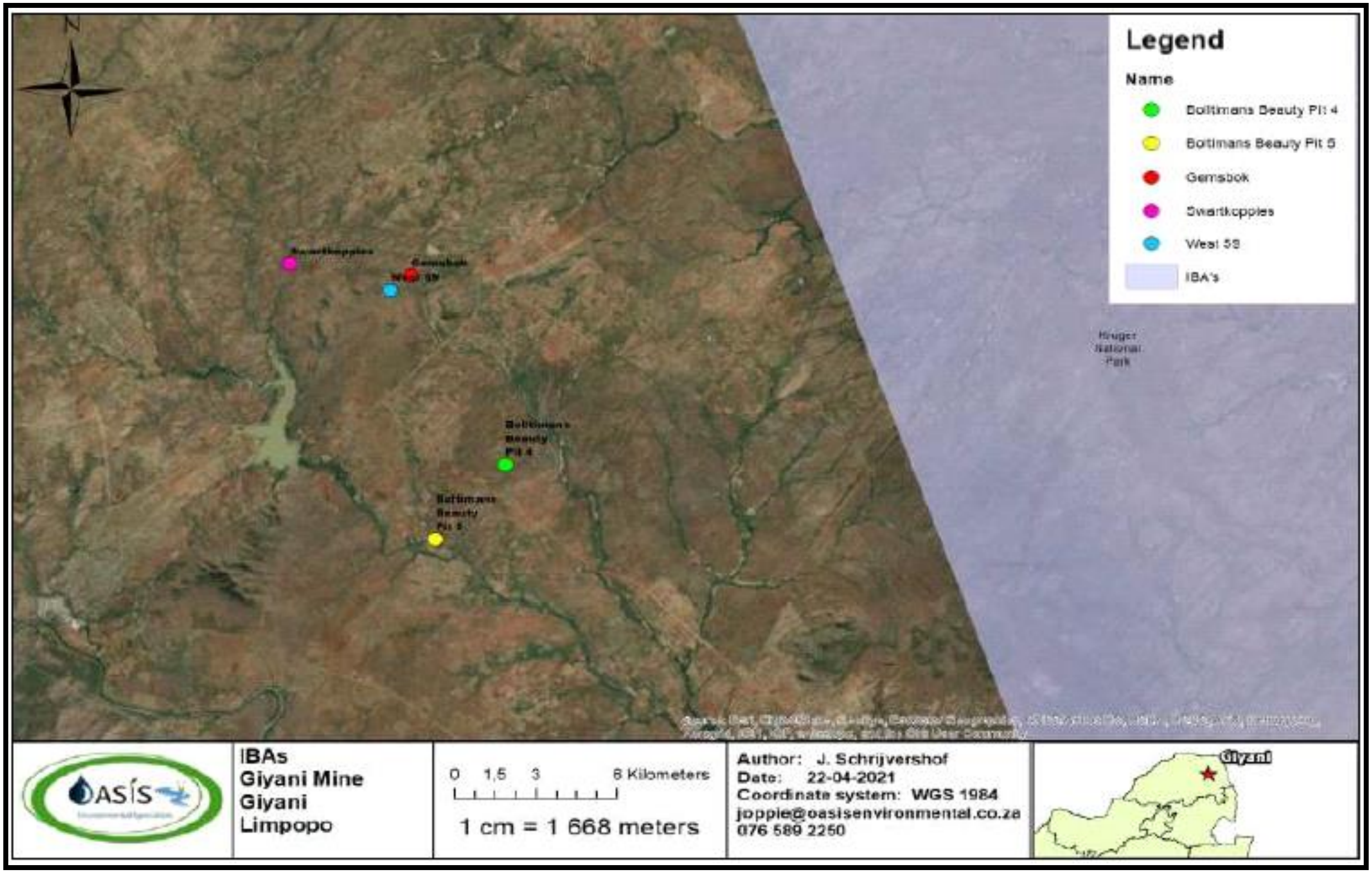


Figure 34: Kusile's Giyani Gold Mine - Important Bird Areas map.

1.9.3.2.4.1 Vegetation

The majority of the study site consisted of indigenous vegetation with some alien vegetation within the transformed areas, however vegetation normally associated with that area is listed in **Appendix B** depicted from SANBI's POSA list. Information on plant species recorded in that area was extracted from the POSA list, indicate that 221 plant species have been recorded in the area queried of which 211 are endemic species are known to occur within the area queried.

The field survey was planned to include all the different habitat types and to target threatened species that may occur in the proposed mining areas. Photographs of important features were taken and will be included in the report. Vegetation near the road is very dense as a result of increased runoff from the hard surfaces. Some areas in the private reserves have vegetation in a good condition.

There are a number of small non perennial streams that must be negotiated during construction and care must be taken to ensure the vehicles use existing roads. Erosion can increase if the heavy construction vehicles cross the streams and a rehabilitation plan must be in place prior to construction commences Trees dominated the area and included *Combretum spp.*, *Vachellia robusta*, *Vachellia tortilis*, *Senegalia nigrescens* and *Colophospermum mopane.* However, *Cissus cornifolia, Albizia harveyi, Mundulea sericea, Terminalia sericea, Terminalia prunioides, Grewia bicolor, Dichrostachys cinerea, Sclerocarya caffra, Dalbergia melanoxylon, Peltophorum africanum, Strychnos madagascariensis and Commiphora africana* are also abundantly present.

No IUCN red listed species is known occur within the Giyani area and was not observed during the site visit.

Table 10:: **Floral species summary for the area queried around the proposed Giyani Mine as per SANBI (2021)**.

Number of Families	Number of species	Endemic species	Exotic species	IUCN Red Listed Species
60	221	211	10	0

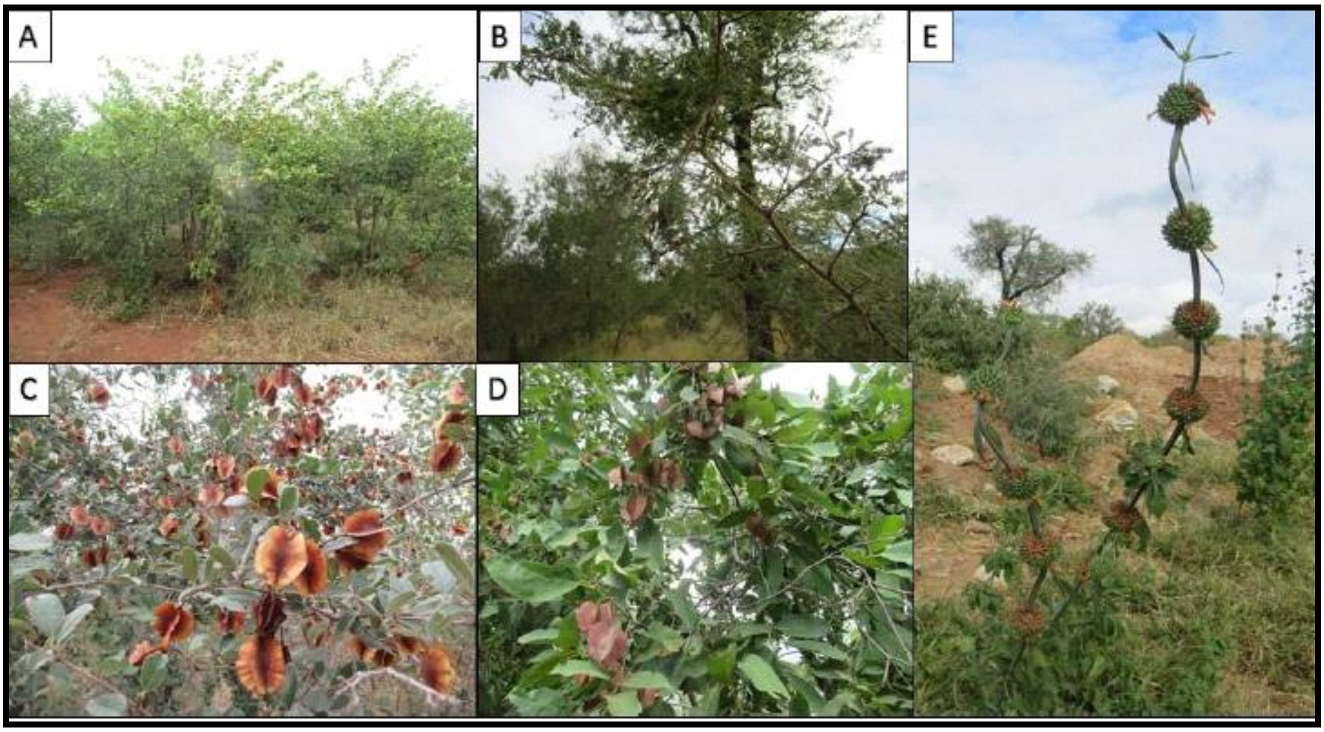


Figure 35: Giyani Mine – Some of the vegetation identified included: (A) Mopani Trees dominating the landscape (*Colophospermum mopane*), (B) Senegalia and Vachellia species w; (C) Russet Bushwillow (*Combretum hereroense.*), (D) Forest Bushwillow (*Combretum kraussii*) and (E) Lion's tail (*Leonotis leonurus*) found in the disturbed areas, these plants have medicinal properties used to treat tuberculosis, jaundice, muscle cramps, high blood pressure, diabetes, viral hepatitis, dysentery, and diarrhoea.

1.9.3.2.5 Alien Invasive Vegetation

National Environmental Management: Biodiversity Act (No. 10 of 2004) categories for invasive species according to Section 21 are as follows:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area, and;
- Category 3: Invasive species controlled by activity.

Certain species have different alien invasive categories for different provinces in South Africa. Very little alien species were identified on site. The only alien plant species observed were Morning Glory (*Ipomoea carnea*) (category 1b) and Rough Cocklebur (*Xanthium strumarium*) (not listed).

1.9.3.2.6 Fauna

The faunal component between the game farms/private reserves and open bushveld differs considerably. Within the open areas where deforestation of Mopani forest are occurring, very little evidence of faunal activity was noted as the proposed pit areas are being disturbed by anthropogenic activities such as illegal deforestation.

Cattle and goats were noted grazing within these areas. Some spoor and droppings of mammals and some smaller rodents were seen.

Limited faunal species were observed and the majority was sites near game farms and private reserves and included: Communal spider nests, sociable weaver (*Philetairus socius*), Laughing dove (*Spilopelia senegalensis*), Ring-necked dove (*Streptopelia capicola*), Cape glossy starling (*Lamprotornis nitens*), Southern red-billed hornbill (*Tockus erythrorhynchus*), Bronze winged courser (*Rhinoptilus chalcopterus*), Golden Orb Spider (*Trichonephila spp*.) (**Figure 8**).The fauna expected to occur within that area is listed in **Appendix A**.

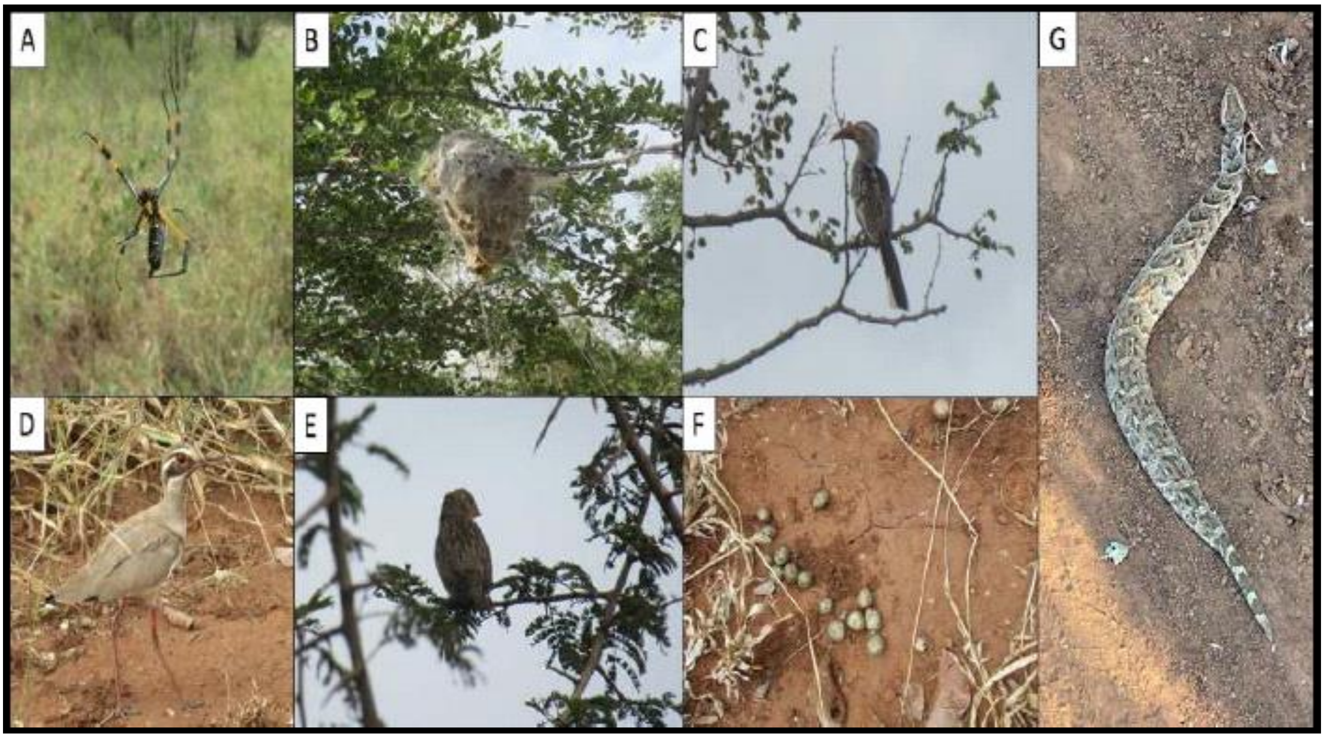


Figure 42: Giyani Mine – Identified fauna included: (A) Golden orb spider (*Trichonephila spp.*) (B) Communal spider nest; (C) Southern red-billed hornbill (*Tockus erythrorhynchus*); (D) Bronze-winged courser (*Rhinoptilus chalcopterus*); (E) Nesting areas with sociable weaver (*Philetairus socius*);) and (F) Mammalian droppings and (G) A Pufadder (*Bitis arietans*) observed a few months ago by Giyani Mine staff**.**

1.9.3.2.7 Sensitivity Mapping

All bushveld areas and watercourses still intact can be considered highly sensitive areas serves as a breeding and foraging habitat for a number of faunal species. These channel areas can be regarded as ecologically irreplaceable and covers a portion of the application area. It will be nearly impossible to imitate these areas after mining has been completed with a rehabilitation programme. Historical transformed Grasslands with cultivation which have been considered as moderately sensitive as they have been disturbed by surrounding anthropogenic activities, but some vegetation has started establishing again. Current transformed land by urbanisation and agriculture can be considered low sensitive and covers the majority of the area. These areas are illustrated below.

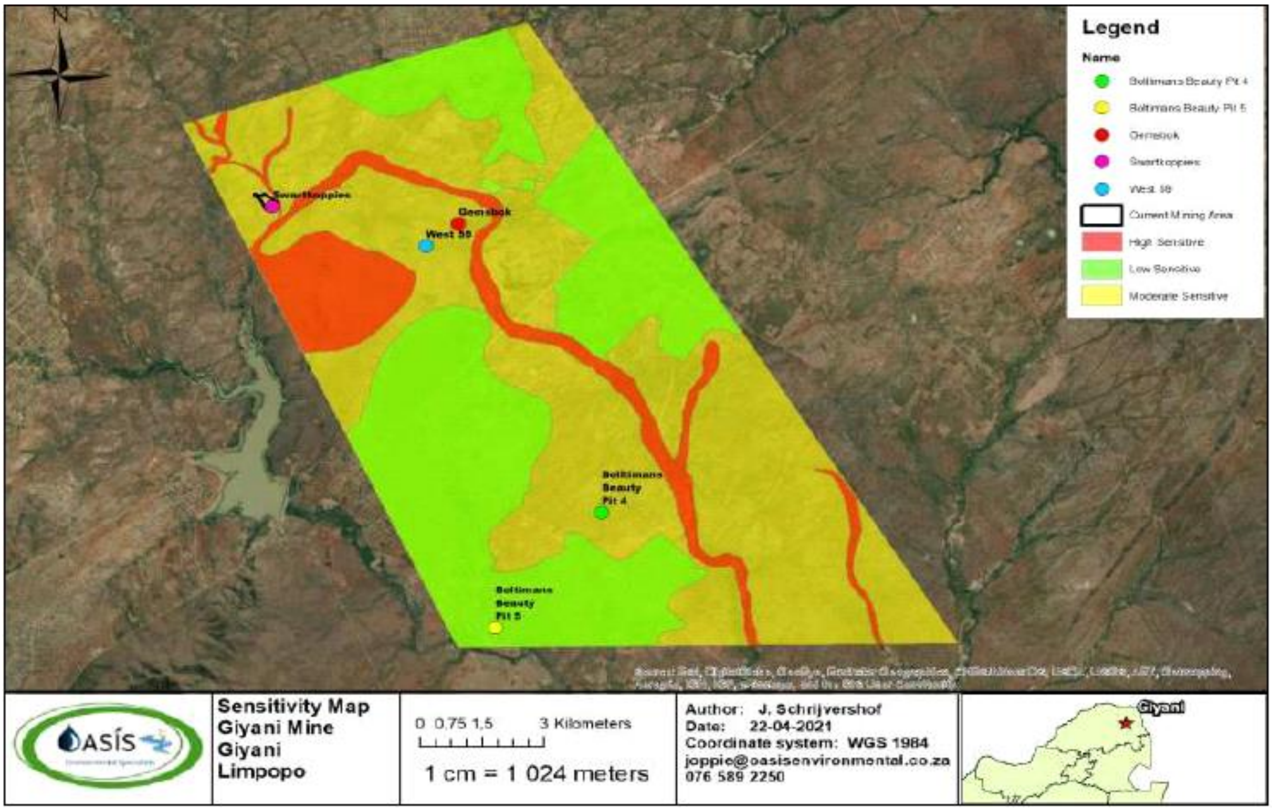


Figure 43: Kusile's Giyani Gold Mine- Sensitivity map.

1.9.3.3 Surface water hydrology

1.9.3.3.1 Water Management Area

The Luvuvhu/Letaba WMA is divided into three (3) primary catchments, namely Luvuvhu, Shingwedzi and Letaba. The town of Giyani is in the vicinity of the Middle Letaba and Nsami dams in its vicinity. The largest user of the available water resources in the WMA is irrigation, while other significant users include forestry and rural domestic water use, international requirements and transfers out of the WMA.

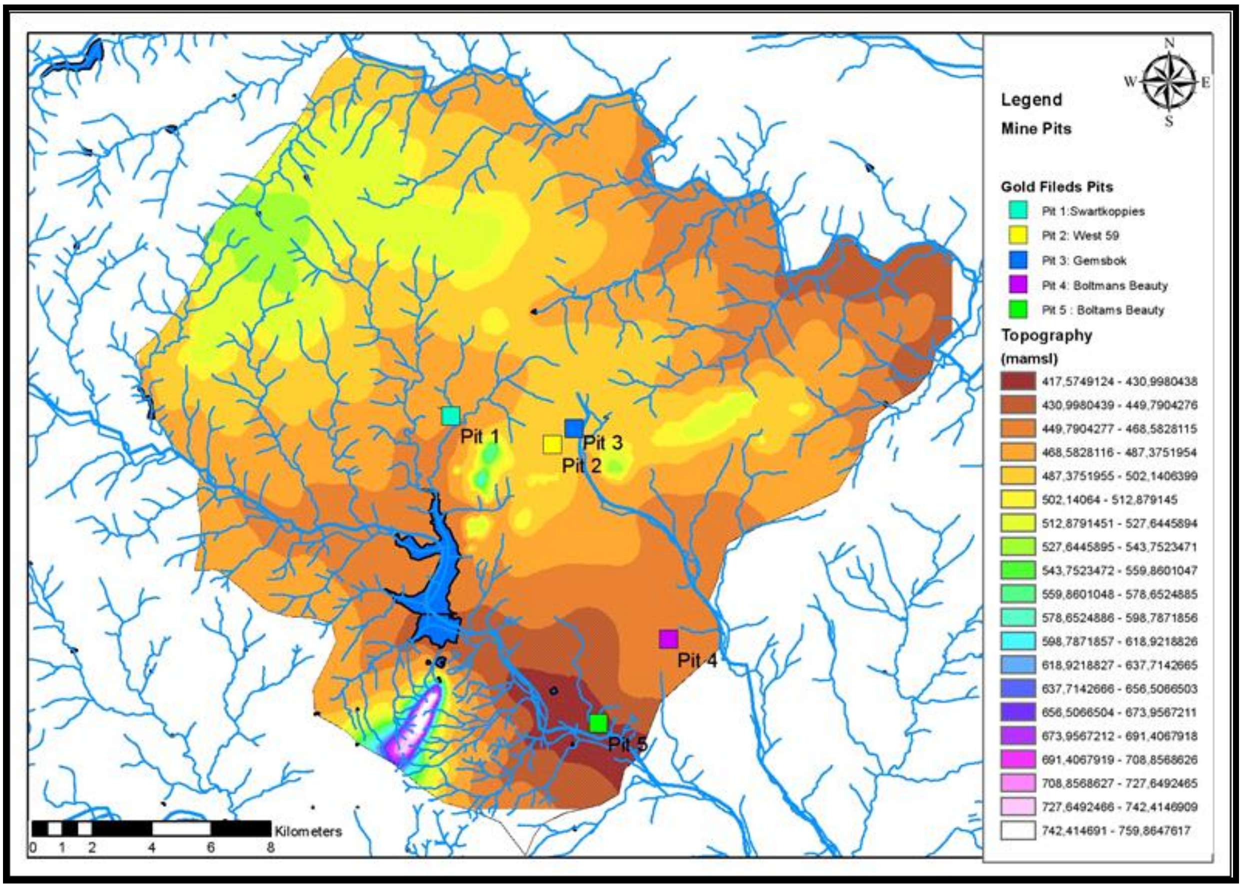


Figure 36:**Topographical Map of the Proposed Project Area**

In the Luvuvhu/Letaba WMA, irrigation accounted for nearly 75% of the total water requirements in the WMA (in 2003). Mean annual runoff depends strongly on rainfall and land use. Deep fractured aquifers occur in the high-lying areas at the base of the escarpment, where the weathered layer is thin or absent bare leucogranites are often exposed. Alluvial deposits can be found along the main rivers, where Intergranular aquifers occur overlying weathered material. Time series of climate, hydrological and groundwater data are submitted together with this report, as well as soil, geology and land cover maps for the Letaba catchment. These data can be used for setting up and calibrating hydrological models.

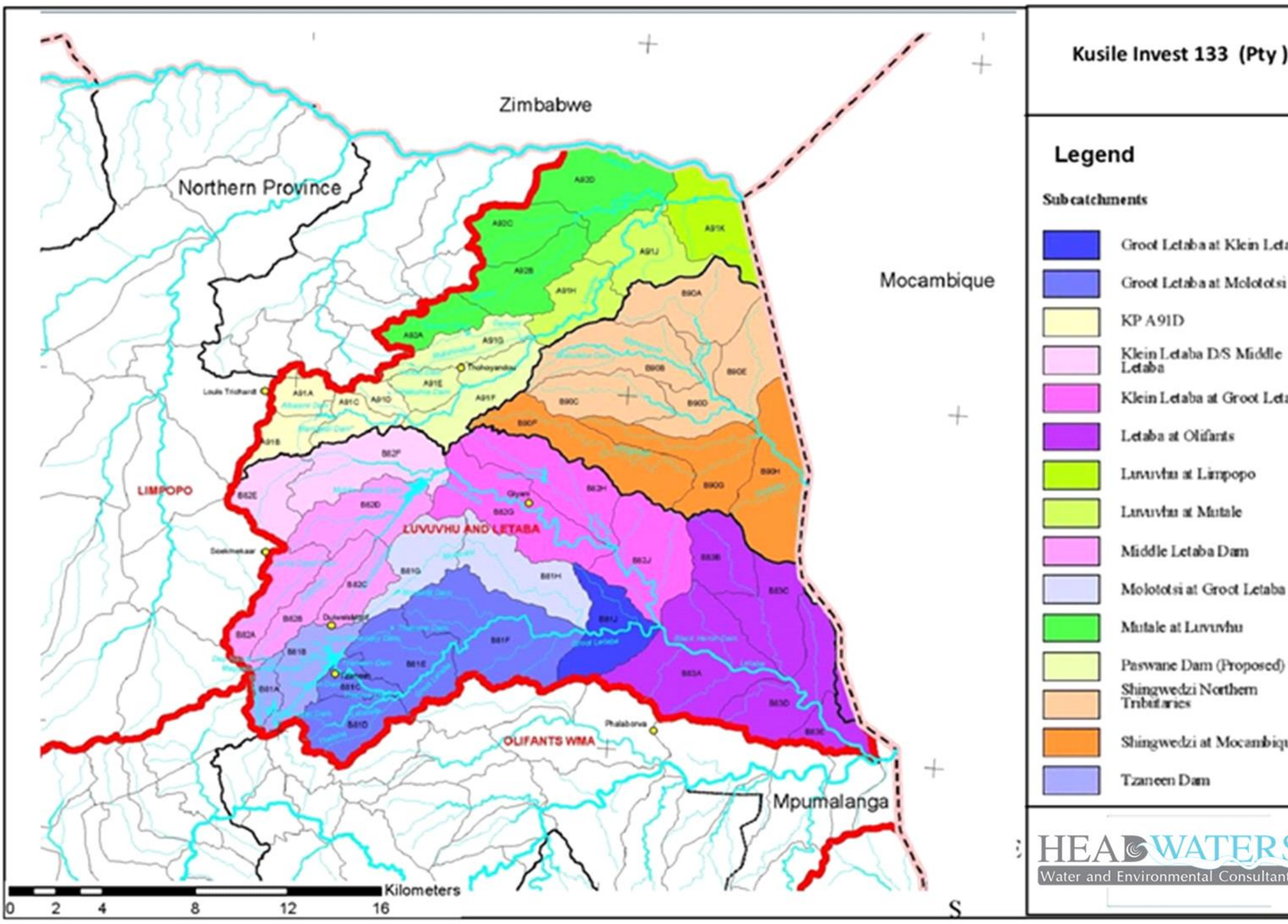


Figure 37: **Luvuvhu and Letaba Water Management Area Locality Map**

1.9.3.3.2 Surface Water Hydrology

Kusile Invest 133 (Pty) Ltd Gold falls within B82H quaternary catchment. The catchment is located in the Luvuvhu and Letaba Water Management area. The site can be sub-divided into secondary drainage regions comprised of smaller catchment areas and streams. The surface topography is mainly consisting of a gently undulating plateau. The Ntsami River flows north-eastward directions and has deep gorges through the hills and mountain ranges which resulted in spectacular landscape units. The Ntsami River is seasonal and the area is mostly dominated by Mopani veld. The Ntsami River is situated in low rainfall areas and records peak flows during wet summer times only. Tributaries and streams have their origin in this area e.g. Nsami River, sourced from springs occurring on the North East (NE) .The drainage forms a dendritic pattern flowing north-east along the stream channels. This B82H quaternary catchment is mostly impacted by unregulated grazing and development in the form of village holdings, farm dams, road networks, and previous mining.

Table 11: **WMA and Quaternary Catchments Descriptions (WR2012, 2017)**

WMA	Quaternary	Catchment	MAP	PET	Hydrological

	catchment	Area(km^2)	(mm)	(mm)	sensitivity
Luvuvhu and Letaba Water Management Area(WMA)	B82H	749	400	1700	Low

The site is located on B82H catchments where Nsami feeds into the Letaba River in the south. Several drainage depression areas are evident around the site but outside the proposed open mine. Topography is the key element affecting how land drains to a particular point and the Nsami Dam capacity is 24.4 x10^{6}m^3 and its main purposes is for irrigation and domestic use Table 4-5 and Figure 4-6 below.

Table 44 Nsami Dam

Dam Name	Capacity(10^{6}m^3)	Purpose
Ntsami Dam	24,4	Irrigation and Domestic

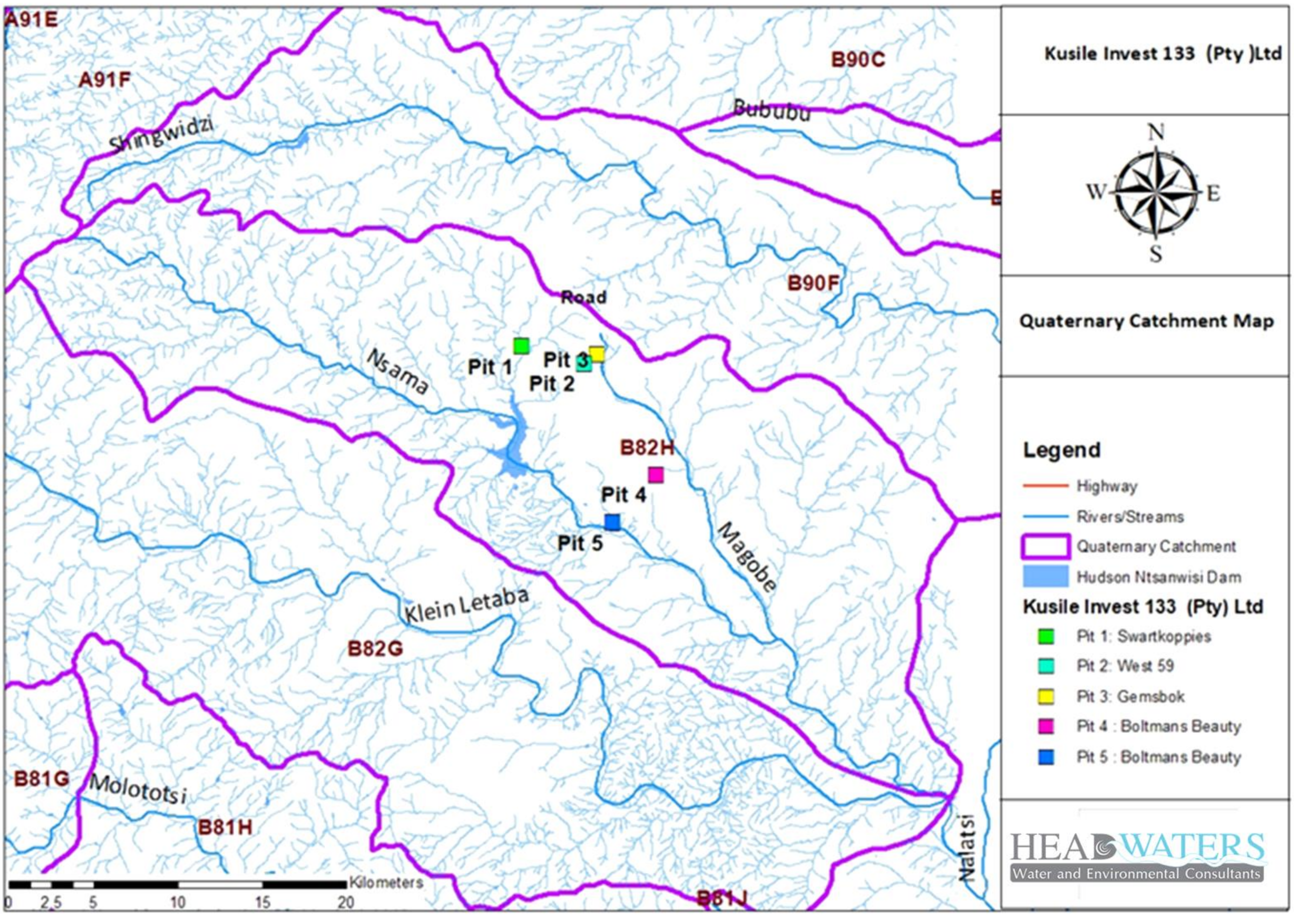


Figure 38: B82H quaternary catchment map

1.9.3.3.3 Floodline Delineation

Thus, Giyani Gold Mine (Pty)Ltd appointed Headwaters cc to conduct a floodline assessment study and recommend mitigation measures, in consideration Regulation 4 of Government Notice 704 of 1998 (GN704), which prohibits mining within the 1:50 year floodline or a under or within a horizontal distance of 100 m from a watercourse, whichever is the greatest. The floodline study included a 1:100 year flood remedial. The catchment areas for the calculations of the flood peaks were delineated using the 1:50 000 topographical map together with the 0. 5 m contours. The hydrological and hydraulic parameters of the catchments contributing towards the proposed site of development were calculated. Peak flow rates were determined along the watercourse to carry out the hydraulic modelling for the proposed development site. The magnitude of the flood peak depends on the catchment characteristics and the rainfall intensity. For the large catchment, Standard Design Flood (SDF) and Regional Maximum Flood methods were used to calculate the peak flow rates while the Rational and alternative rational methods were used for the calculation of peak flows for small catchments. The peak flow data and other relevant information were entered into the backwater model HECRAS to produce the results on the flooding extent along the river banks in the vicinity of the proposed development site.

The study results included maps depicting 1:100 year floodlines of the existing streams reporting into Ntsami Dam around Swartkoppies and Pit 5 downstream of the Ntsami Dam. The streams (watercourses) within the study area are both tributaries of the Ntsami River which is seasonal, which flows into the Letaba River.

Mapping of the floodlines shows no major challenges and that a large portion of the Giyani Gold Mine is outside the 1:100 year floodline. In this light, the study recommends and modelled a scenario with a berm constructed along a 100 m horizontal distance from the all nearby streams and sized to restrict and prevent the 1:100 year flood from flowing into the proposed open cast, and consequently prevent mining within a 1:50 year floodline. It is required that erosion prevention measures be put in place.

The study report is appended hereto, together with results of the floodline assessment. The map for the pre-extension scenario is presented, as well as that for the scenario with the extension and the berm flood control or remedial measure. The recommended minimum berm bottom width is 25 m, with varying between 3.5 and 6.3 m with a slope of about 1:2.

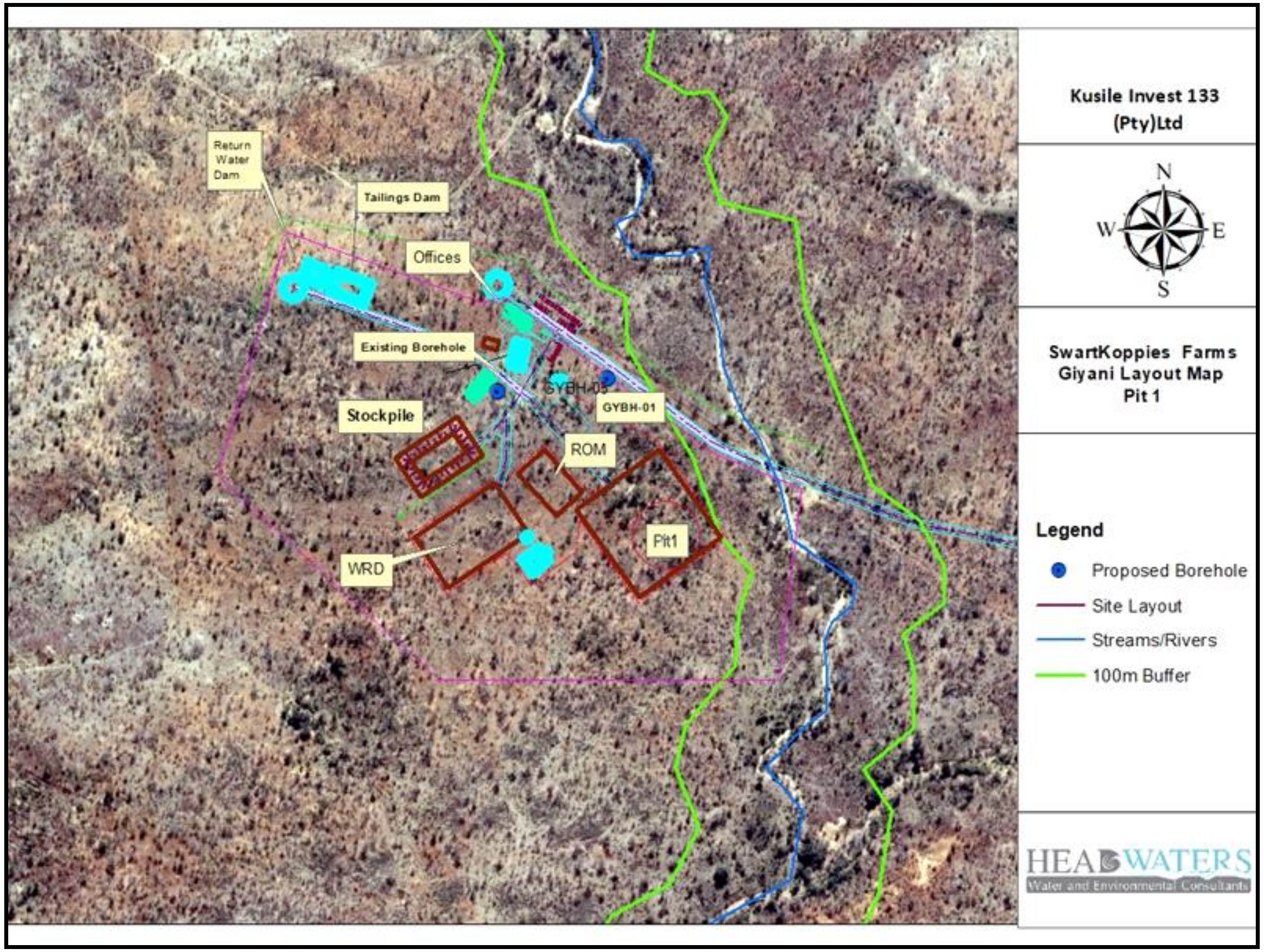


Figure 39: Floodline Map (1:100 year) Swartkoppies (Pit1)

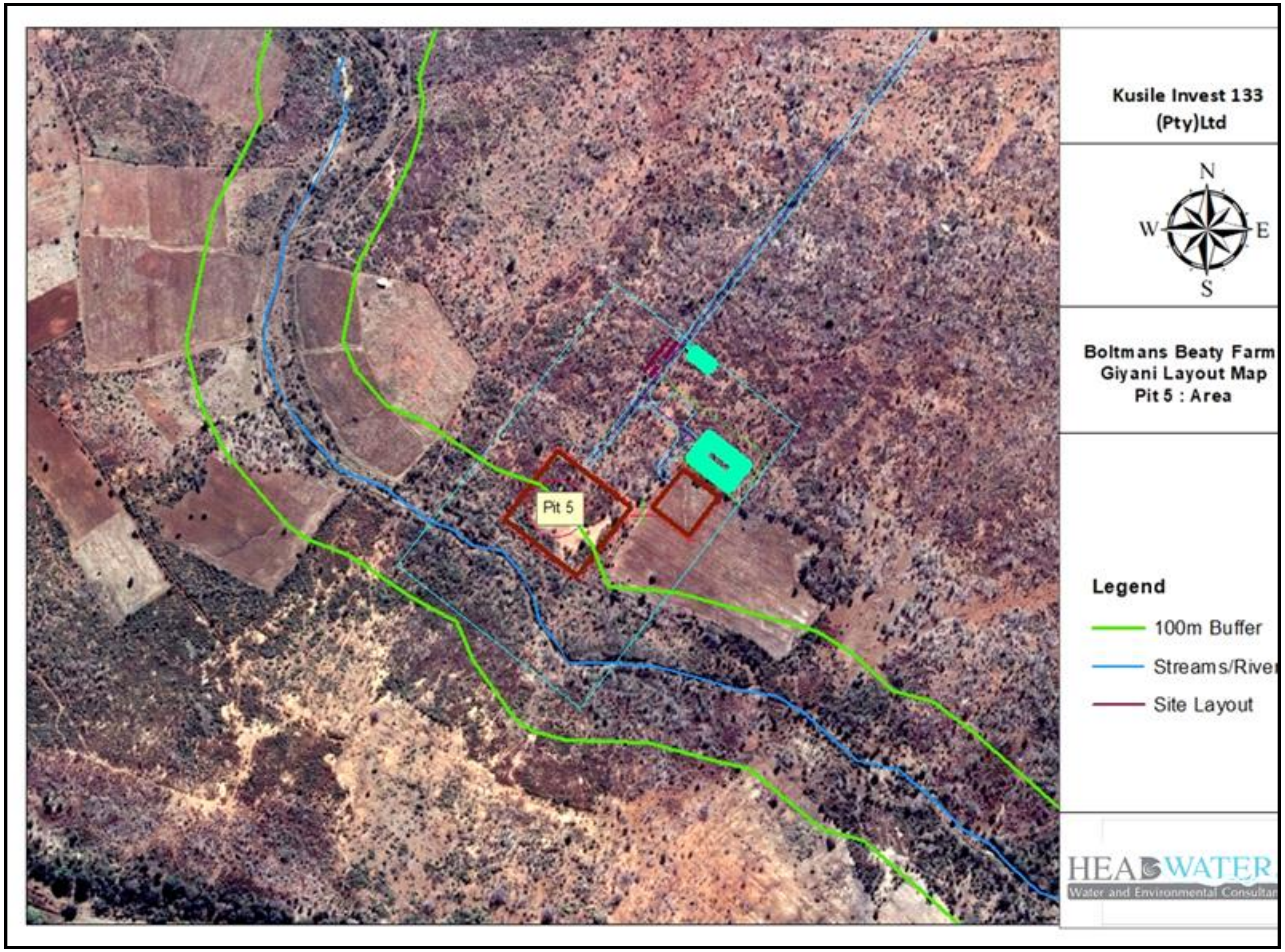


Figure 40:**Floodline Map (1:100 year) Boltmans Beaty (Pit5)**

1.9.3.4 Topography

1.9.3.4.1 Visual Character

The Project area is located in an area which is relatively flat lying (see **Photo plate 1**)at a surface elevation of 500 metres (m) to 580 metres (m) above sea level. No settlements are situated within the planned opencast mining area or the areas where the shafts are to be located.

Figure 41**: Depicting landscape with a flat low-lying visual character.**

The topography of the greater area surrounding the proposed Giyani Gold mine area is relatively flat.

The areas surrounding the proposed mine is rural land use characterised by residential settlements, agriculture, livestock grazing and subsistence farming.

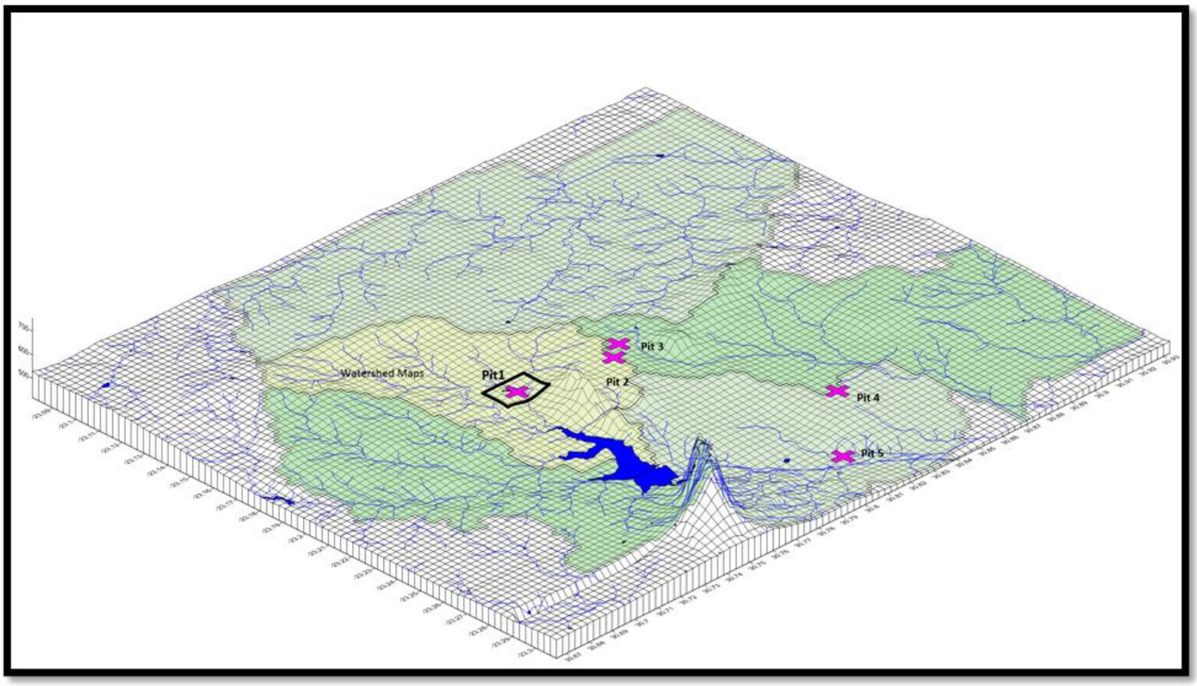


Figure 42**: Topography**

Section 4 of this report assigns a numerical value based on the land use character in which the proposed mine is located, calculated on the rating Hassell matrix tabulated in the below.

Table 12: **Land use Character Rating System**

Description	**Value**	**Typical Character / Use**
Unmodified landscape/natural	5	No / minimal impact associated with the actions of man. National parks, coastlines, pristine forest areas.
Natural transition landscape	4	A changing landscape character associated with the interface between natural areas and modified rural / pastoral or agricultural zones.
Modified rural landscape	3	Typical character is rural landscape, defined by field patterns, forestry plantations and agricultural areas and associated small-scale roads and buildings.
Transition landscape	2	Transitional landscape associated with the interface between rural, agricultural area and more developed suburban or urban zones.
Highly modified landscape, urban/industrial.	1	Substantially developed landscape. High levels of visual impact associated with buildings, factories, roads and other related infrastructure.

The land use character of study can be described as being rural settlements interspersed with mostly subsistence farming within Mopaneveld characterised by medium to high shrub dominated.
savannah, with scattered trees and a dense field layer.

In terms of the rating system presented in ***Table 1*** above, the visual character of the study area can therefore be described as being a **Modified rural landscape (3)**, attributed to the rural character of the area with small scale roads, field patterns, various rural settlements and agricultural operations in close proximity.

Figure 43**: Modified rural landscape.**

1.9.3.4.1.1 Sense of Place

Our sense of a place depends not only on spatial form and quality but also on culture, temperament, status, experience and the current purpose of the observer (Lynch, 1992). Central to the idea of 'sense of place' or *Genus*

Loci is identity. The concept of "a Sense of Place "does not equate simply to the creation of picturesque landscapes or pretty buildings but to recognise the importance of a sense of belonging. Embracing uniqueness as opposed to standardization attains quality of place. In terms of natural environment, it requires the identification, a response to and the emphasis of distinguishing features and characteristics of landscapes.

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. **Photo plate 3** shows various landscapes within the proposed mining area and these reflect that the area does not have any unique features which would visually set it apart from other areas where similar land uses are taking place. Lynch defines 'sense of place' as "the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid or unique, or at least a particular, character of its own" (Lynch, 1992:131).

Figure 44**: Landscapes within the proposed site area**

Using the above photo plate, it is clear that the natural landscape provides an aesthetically pleasing character. However, bearing in mind that sense of place centres around distinctiveness and uniqueness there are no specific visually unique that cannot be found in any other place with a similar land use landform.

1.9.3.4.2 VIEWSHED

1.9.3.4.2.1 Visual Quality

Visual quality is evaluated by identifying the vividness, intactness and unity present in the view shed. This approach to evaluating visual quality can also help identify specific methods for mitigating specific adverse impacts that may occur because of the project.

Aesthetic value is an emotional response derived from our experience and perceptions. As such, it is subjective and difficult to quantify in absolute terms. Studies in perceptual psychology have shown that humans prefer landscapes with higher complexity (Crawford, 1994). Landscape quality can be said to increase when:

- Topographic ruggedness and relative relief increase.
- Water forms are present.
- Diverse patterns of grassland and trees occur.
- Natural landscape increases and man-made landscape decreases.
- Where land use compatibility (coherence) increases.

Thus, visual quality decreases when elements defer from the natural environment and, hence, influence the wider area of influence in a negative way. Elements that decrease the visual quality of an area includes "visual clutter" and man-made features including, but not limited to:

- Roads and bridges.
- Dense developments and high buildings.
- Commercial facilities.
- Mines, factories, stacks, etc.

Visual Quality is largely subjective, therefore adapted from the United States Department of Transport: Visual Impact Assessment for Highway Projects (1981) and the Landscape Institute with the Institute of Environmental Management and Assessment (2002), visual quality can be calculated as per the Equation below:

Equation 1

Where:

<u>Vividness</u> is defined as the extent to which a landscape is memorable – this is associated with the distinctiveness, diversity, and contrast of visual elements.

<u>Intactness</u> is defined as the integrity of visual order within the landscape, as well as the extent to which the landscape is free from visual intrusions.

<u>Unity</u> is defined as the extent to which visual intrusions are sensitive to the existing landscape.

Visual Quality was calculated according to ***Equation 1***, based on the following rating criteria specified in ***Table 2*** below.

Table 13: **Visual *Quality rating criteria***

Rating	High (5)	Medium (3)	Low (1)

Vividness	The visual impression received is highly memorable, as contrasting landscape elements combine to form distinctive visual patterns.	The visual impression received is moderately. memorable, with some distinctive patterns moderately defined landscape or landforms are present.	The visual impression received is of low memorability. Little visual pattern is formed because landscape elements do not combine to from a striking or distinctive pattern.
Intactness	There is high visual integrity between the natural and man-made landscape to the extent that the landscape is free from visual encroachment.	There is an average visual integrity between the natural and man-made landscape. Some visual encroachment on to the landscape is present.	There is low visual integrity between the natural and Man-made landscape features. Visual encroachment onto the landscapes very apparent.
Unity	The visual elements of the landscape join to form a moderately coherent, harmonious visual pattern. Manmade and natural elements blend together.	The visual elements of the landscape join to form a moderately coherent, harmonious visual pattern. Manmade elements blend with natural elements; however, the visual order is disrupted.	Visual resources do not join together to form a coherent harmonious visual pattern. Manmade elements do not have a visual relationship to natural landforms or land cover patterns and visual order is lacking.

The visual quality of the study area is calculated and described in ***Table 3***, based on ***Equation 1*** above and the rating criteria presented in ***Table 2***.

Table 14:: **Visual Quality rating for the proposed Giyani Gold Mine**

Criteria	Rating	Description
Vividness	1	The study can be described as having a low memorable impression, based on the lack of a striking or distinctive pattern or unique features which would set the area apart from any other area in Limpopo. Thus, the vividness of the area is described as being **LOW.**
Intactness	3	The intactness of the area is described as **Medium**, due to the presence of scattered rural settlements and fields utilised for agriculture within the area. There is to an extent a visual integrity between the natural and man-made landscape.
Unity	3	The study area can be described as having a **Medium** unity classification, as the farming areas and natural zones are considered to be moderately coherent, although evidence of disruption in the visual order is evident.

Visual Quality 2,3 MEDIUM

1.9.3.4.3 MAGNITUDE OF THE VISUAL IMPACT

1.9.3.4.3.1 Introduction

The following section outlines the assessment that was undertaken to determine the **magnitude** of the visual impact for the proposed Gold mine. Visual impacts associated with the proposed Gold mine and the cumulative impacts of these were assessed.

Various factors were considered in the assessment, as indicated in Section 3, including:

- Visual exposure of the proposed development in terms of the view shed.
- Visibility and viewing distance.
- Visual absorption capacity (VAC).
- Integrity with existing landscape / townscape.
- The visual receptor sensitivity.

These criteria are explained further in the following sections and are used to determine the magnitude of visual impact.

1.9.3.4.3.2 Visual Exposure

1.9.3.4.3.2.1 Elements considered in determining visual exposure.

Visual exposure is determined by an objects “zone of visual influence” or how visible an object may be in the landscape. It describes the degree to which the receptor will be exposed to a proposed project and is primarily a function of distance. Receptors that are located, or that come within close proximity of a source of visual impact, are described as having a greater level of visual exposure in terms of the potential impact. The visual exposure of an object can be broken down into two elements:

- Firstly, how exposed is the object to the surrounding area? This can be determined by the topography in which the object is.
- Secondly, how exposed are viewers to the object? This can be determined through topography and land use in which the viewer is situated.

The technique to analyse visual exposure and the representation thereof on maps is referred to as ‘view shed analysis.

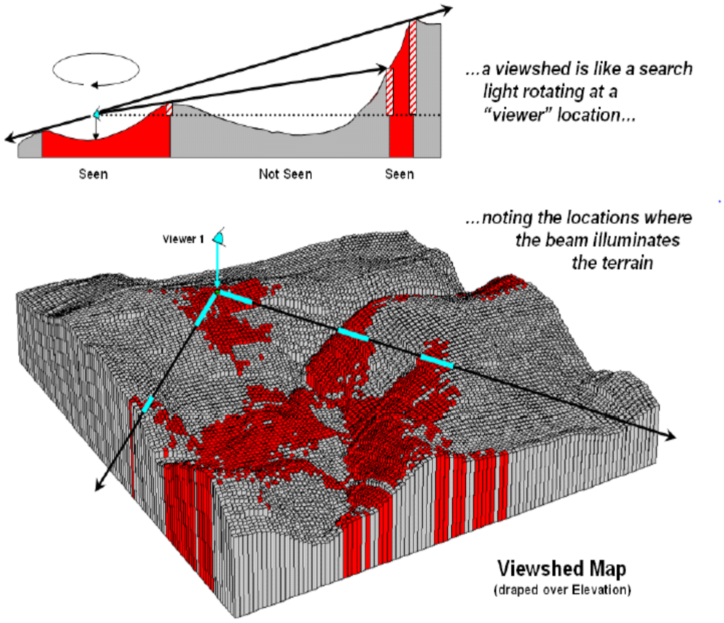


Figure 6: Conceptualisation of the viewshed analysis technique (example only)

Figure 45 **Example of the viewshed analysis technique**

The following section will outline how both of these elements were used in determining the overall visual exposure of the proposed Giyani Gold Gold Mine.

The topography of an area can limits or expose the visibility of an object. In order to assess how topography influences the visual exposure of a feature, a predictive model known as a "view shed" is used.

A view shed model uses topography datasets to predict where in the landscape a given feature may be visible. This model assumes that the surface is smooth (not taking into account vegetation and man-made objects). Due to this, site verification of the view shed is required.

Table 4 below outlines a set of Visibility Criteria that were used to rank how visible the proposed Giyani Gold Gold Mine may be from the selected viewpoints. Each of the viewpoints identified in ***Figure 7*** have been rated according to visual exposure criteria, which is a combination of ratings in ***Table 4*** and verification through a site visit. Each of the viewpoints has been rated according to the Visibility Criteria ranking.

Table 15:: **Visibility criteria (Exposure)**

Visibility Ranking – after Site Visit Verification			
Not Visible	Marginally Visible	Visible	Highly visible
Final Visibility Criteria (Exposure Rating)			
1	2	3	4

The visibility rankings were then applied to assess the visual exposure of each of the chosen viewpoints to assess what measure of screening any vegetation and man-made features may have on the visibility of the proposed Giyani Gold Gold Mine.

These viewpoints were chosen based upon their position in both the landscape and inside the visible areas of the view shed. Attempts were made to choose viewpoints from various angles and distances from the proposed Giyani

Gold Gold Mine. The findings from the Visibility Criteria are summarised in ***Table 5*** below as a combination of the rankings identified and the site visit taking into account the viewpoints depicted in the figure below.

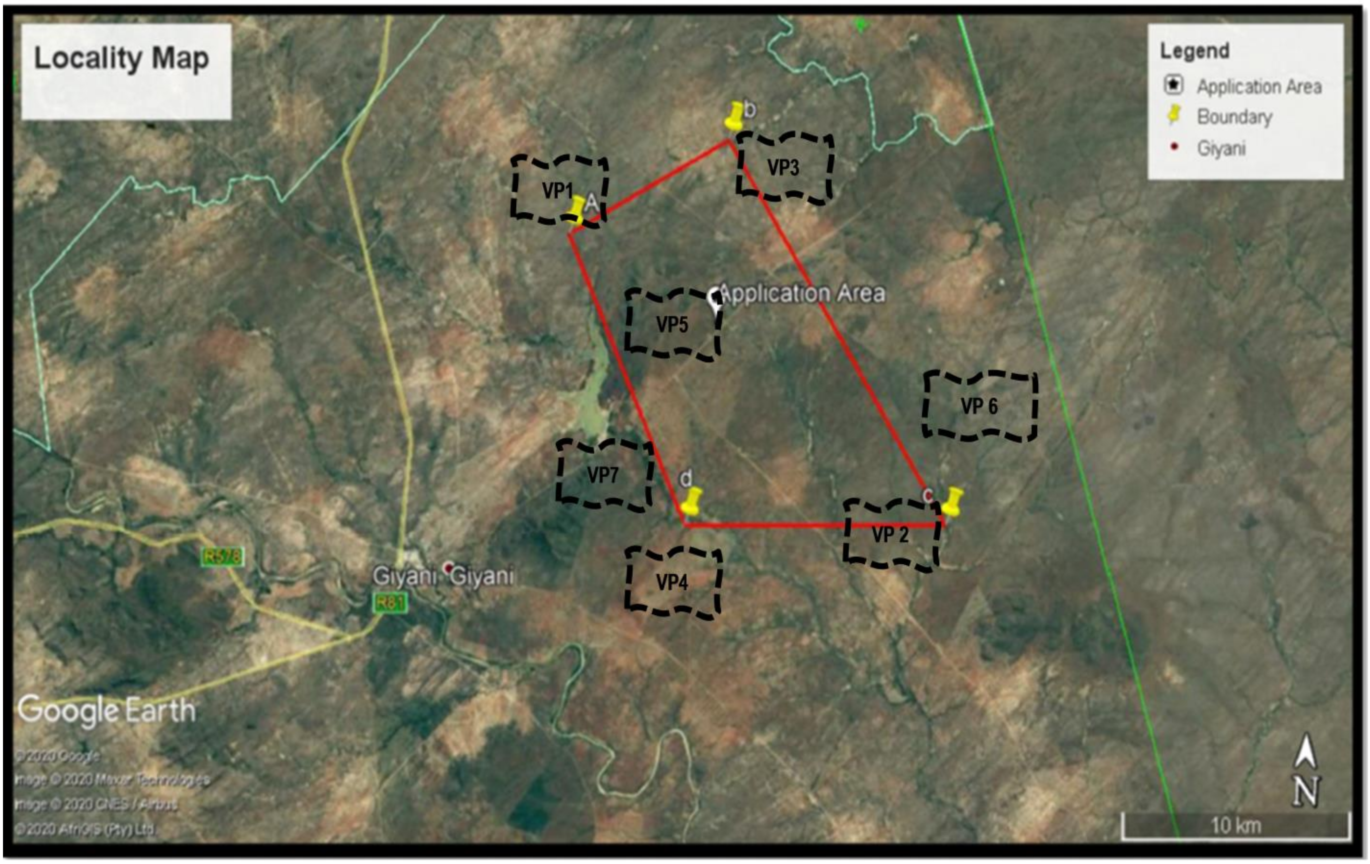


Figure 46**: location of viewpoints in the study area**

In total 7 viewpoints were used in the visual assessment for a true reflection of the potential visibility of the activities in the area. The viewpoints chosen represent a summary of the proposed Giyani Gold mine on the surrounding viewers. Appendix 2 presents the photographs taken during the site visit (18-20 April May 2021) from each of the viewpoints, highlighting the potential views towards the proposed Giyani Gold mine.

Table 16:: **Summarising the Visibility Exposure Rating for the proposed Giyani Gold Gold Mine**

Component	Approx Height (meter)	Discussion	Rating
Open Casts pits and Underground shafts		The open pit has a relatively low potential visibility, as the visibility will be restricted due to the fact that it is not a high-rise structure, and it is below natural ground level therefore only visible to viewpoints with higher elevation the view shed is concentrated within 2km radius of the mine site. The visual effect of the mine vid is created by the colour of the raw earth and exposed rock contrasting with the surrounding landscape. The open mining face also creates strong form, shape and line characteristics that differ from the existing landscape. These	**2**

		effects are greatly decreasing over distance and by atmospheric conditions such as cloud cover backlight and heat haze. Moreover, not all the dense vegetation in the mining area will be cleared and this further obstructs the visibility.	
Stockpiles, Topsoil, Overburden and discard dump	10-15 meters	The topsoil overburden and discard dump will create a strong contrasting form in the landscape and will initially also have a strong colour contrast. This contrast and high visual effect will be reduced to moderate/low by the progressive rehabilitation of the topsoil, overburden and discard dump. The high contrast is somewhat offset by the presence of vegetation and basal cover in the vicinity of the area, this is because the average canopy size of vegetation ranges between 3-5 meters which can have a shielding effect.	**3**
Central Plant and Mobile Process plant	10-15 meters	Based on the proposed positioning and height of the proposed Gold mine, the exposure rating can be described as being visible – whereby viewers from all compass directions are expected to be able to see the mine. However, the visibility is expected to become lower as the distance between the viewer and the structure increases.	**3**
Office & Workshop Complex	5-7 meters	The presence of buildings will significantly alter the visual baseline and will also be visually intrusive. The office and workshop complex will greatly contrast with the natural surroundings in terms of colour and texture thereby making them visible. However, the use of vegetation and appropriate paint and materials can greatly reduce the impact of these to low.	**3**

The viewshed analysis was conducted to determine the project visibility i.e., to identify the locations within the study area (10 km radius of the Giyani Goldmine infrastructure such as the pits, processing plants, offices and shaft) where it may be possible to view the proposed mine infrastructure taking into account the surrounding topography.

The resulting viewshed maps below define the maximum area from which the tallest elements of the proposed mine infrastructure (i.e., the top of the headgear and vent shaft) could potentially be seen from ground-level vantage points. As the viewshed analysis is based on the maximum height of the proposed mine infrastructure and does not take into account the screening effect of vegetation or built structures, it provides a very conservative (i.e., the worst-case scenario) assessment of potential visibility.

The analysis revealed that based on the screening provided by topography alone, the proposed main pit and infrastructure has the potential to be visible from approximately 40 % of the study area (10 km radius).

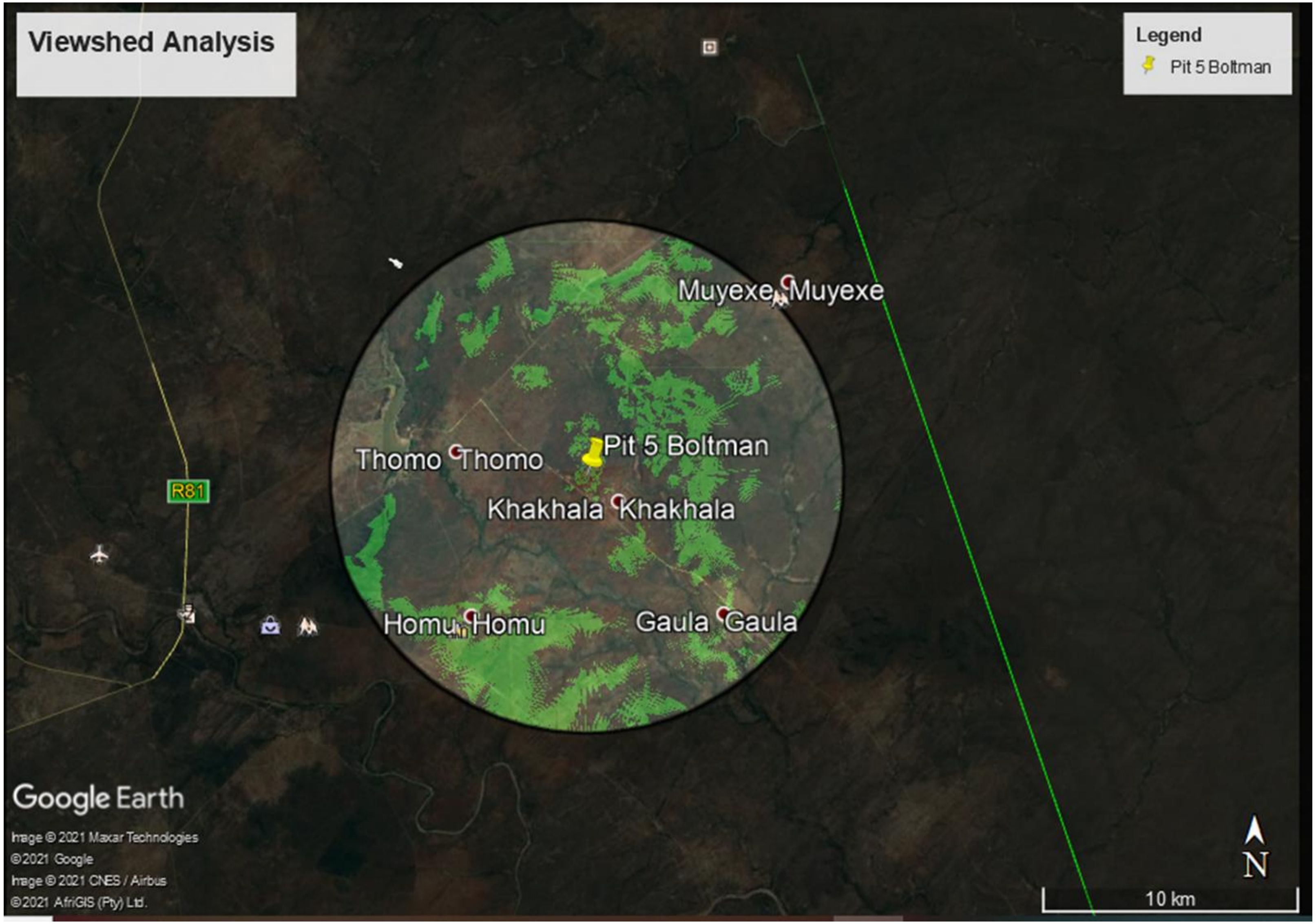
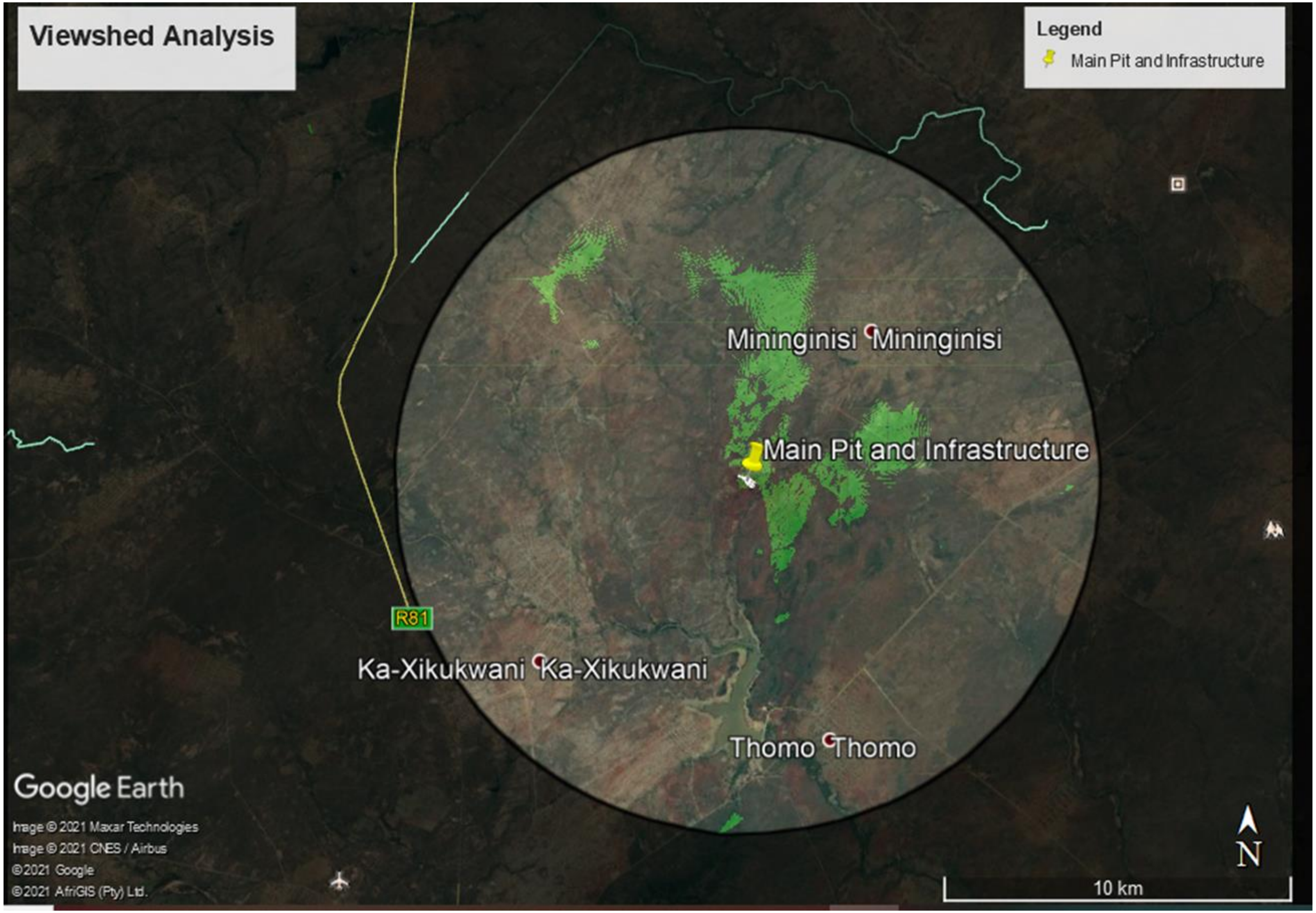


Figure 47: Possible VAC of the Landcover in a 15 km buffer area surrounding the proposed Kusile's Giyani Gold Project


Viewshed Analysis
Legend
Main Pit and Infrastructure
Mininginisi Mininginisi
Main Pit and Infrastructure
R81
Ka-Xikukwani Ka-Xikukwani
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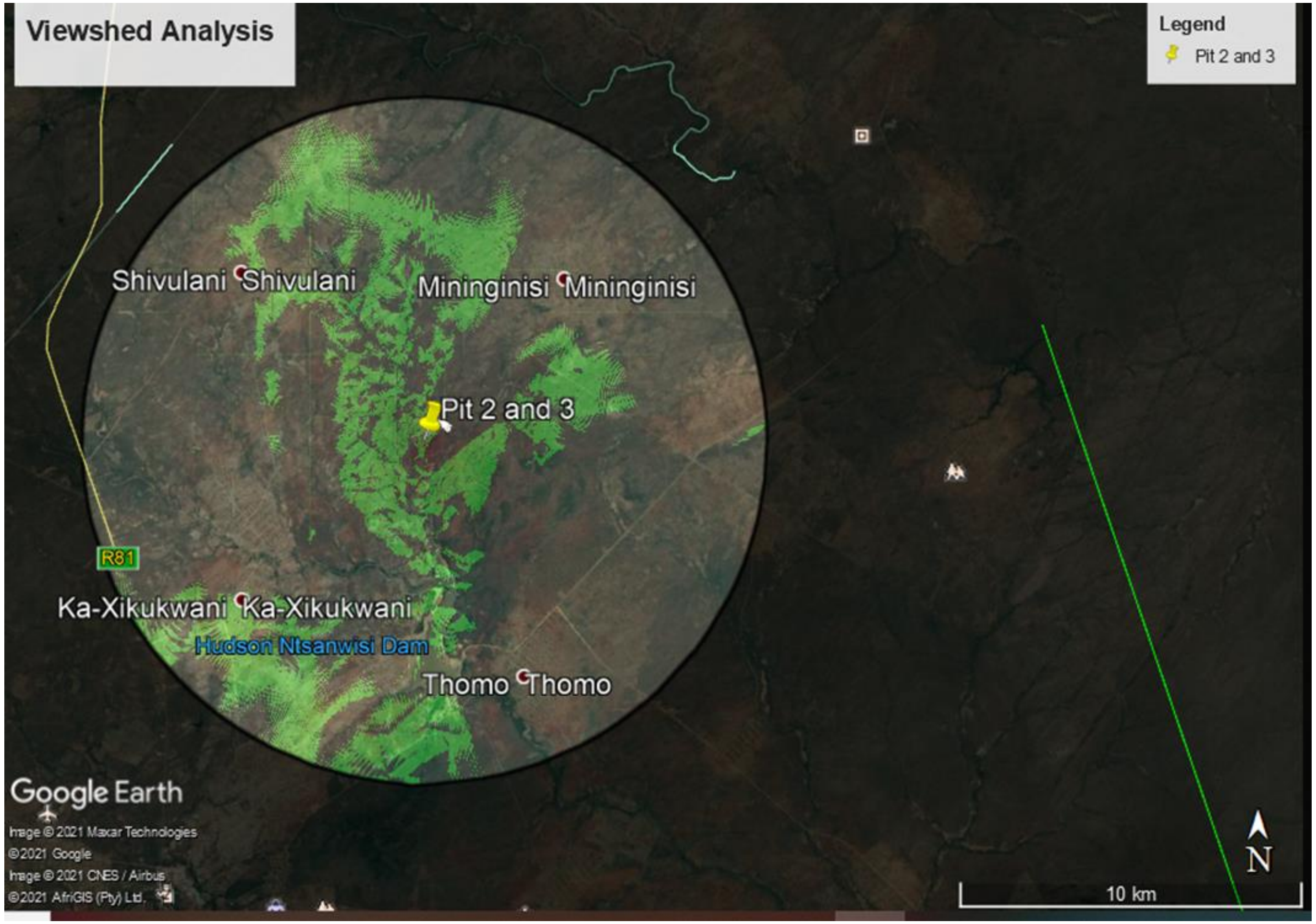

Viewshed 10 Km viewshed of various infrastructure components of Giyani Gold Mine

In spite of the 10km worst case scenario illustrated in the above viewsheds, the visual impact at this distance is expected to be low or insignificant because of the relatively small dimension of the mine in the total field of vision and the dense vegetation around the mine area, which if left relatively intact will reduce the visibility.

1.9.3.4.4 Visual Distance /Observer Proximity to the facility

The distance of a viewer from the proposed project area is an important determinant of the magnitude of the visual impact.

The visual impact of a development diminishes at an exponential rate as the distance between the observer and the object increases – refer to ***Figure 48*** below. Relative humidity and fog in the area directly influence the effect. Increased humidity causes the air to appear greyer, diminishing detail. Thus, the impact at 1 000 m would be 25% of the impact as viewed from 500 m. At 2 000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (Hull and Bishop, 1998) and was used as important criteria for this study, along with the following rating system in ***Figure 48*** which has been utilised to assess the address the factor of distance between a viewer and an object. This rating system does not however, take into account all existing features (such as vegetation and man-made structures).

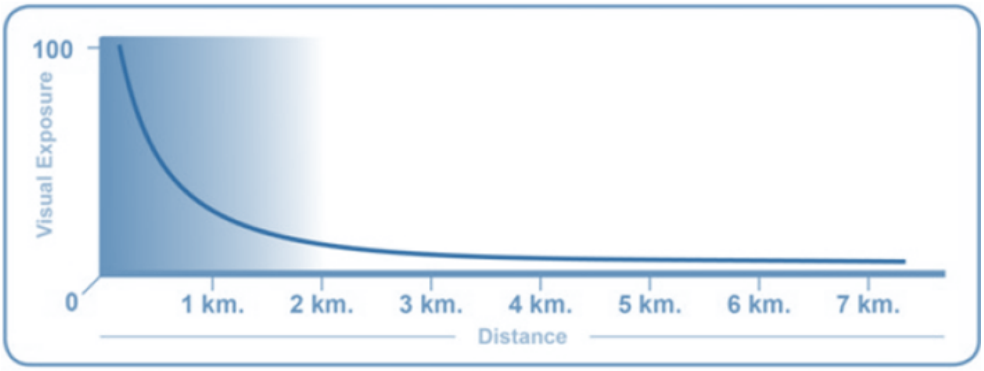

Figure 48: Visual Exposure Curve - Depicting how impact decreases with an increase in distance from a site.

Therefore, visual exposure is an expression of how close receptors are expected to get to the proposed mine on a regular basis. For the purposes of this assessment, close range views (equating to a high level of visual exposure) are views over a distance of 500 m or less, medium-range views (equating to a moderate/medium level of visual exposure) are views of 500 m to 2 km, and long-range views are over distances greater than 2 km (low levels of visual exposure).

Figure 49: Distance Rating System

Location of development from the viewpoint	Category	Value	Description
0 to 0.5 km	Adjacent	5	Adjacent – The development can clearly be seen. Usually on the property boundary or property grounds.
0.5 km to 1 km	Foreground	4	This is the zone in which details such as colour, texture and form can be appreciated. Objects in this zone are highly visible unless obscured by other landscape features, existing structures or vegetation.
1 km to 3 km	Middle ground	3	The zone which occupies the area "between" detail and indistinct colour and line discernment. Objects in this zone can be classified as visible to moderately visible unless obscured by other elements within the landscape.
3 km to 5 km	Distant middle ground	2	This zone is discerned by means of line and colour. Texture and form are generally not seen. Objects in this zone can be classified as marginally visible to not visible. Areas beyond 3 km are usually not investigated as the impact would be negligible on these areas.
5 km and greater	Background	1	Background – Not Visible (Proposed development can hardly / not be seen).

The proposed Giyani Gold Gold mine can be described as falling within the **Middle ground category (3)**, in relation to the nearest visual receptors, traveling on the nearby roads or residing in adjacent areas like Homu, Thomo, Ka Xhikuwani, Mlhava therefore it can be classified as being only visible from various areas within the study area due to the anticipated height of the Gold mine infrastructure and taking into account possible, obscuration from various points within the landscape.

1.9.3.4.5 Visual Absorption capacity (VAC)

VAC can be defined as "an estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality" (Oberholzer, 2005). The ability of a landscape to absorb development or additional human intervention is primarily determined by the nature and occurrence of vegetation cover, topographical character and human structures. Factors contributing to the VAC include:

- ❖ Topography and vegetation that is able to provide screening and increase the visual absorption capacity of a landscape.
- ❖ The degree of urbanisation compared to open space. A highly urbanised landscape is better able to absorb the visual impacts of similar developments.
- ❖ An interrelated landscape comprising a unified environment.
- ❖ The scale and density of surrounding developments.

A further major factor is the degree of visual contrast between the proposed project and the existing elements in the landscape. If, for example, a visually prominent industrial development already exists in an area, the capacity of that section of landscape to visually “absorb” additional industrial structures is higher than that of a similar section of landscape that is still in its natural state. VAC is therefore primarily a function of the existing land use and cover, in combination with the topographical ruggedness of the study area and immediate surroundings.

The VAC is rated from high (1) to low (5) based on the capacity of the environment to absorb the visual impact of the facility. The VAC will be high when the environment can hide the development and as such, the colour of a facility can also determine its VAC. The VAC will be low in areas where the topography is flat and natural features such as trees, koppies and mountains are absent.

Photoplate 1: Canopy cover >3 meters in height and dense basal cover

Photoplate 2: Prospecting area with tall savannah bush providing dense obstruction.

The immediate area surrounding the proposed development is generally flat there is however an abundance of vegetation. Due to the location and topography surrounding of the proposed project, as well as the vegetation surrounding the proposed project area, the VAC is rated as being **Medium-high (3)**. ***Photoplate 1*** and **Photoplate *2*** Substantiates the rating given as it shows the dense basal coverage provided by vegetation that can obstruct views.

1.9.3.4.6 Landscape / townscape compatibility

Landscape or townscape compatibility refers to the compatibility of the proposed infrastructure with the existing landscape or townscape. The landscape / townscape compatibility of the proposed structures and infrastructure were rated based on the following criteria specified in ***Table 17*** below.

Table 17: Landscape / townscape compatibility rating criteria

High (1)	**Moderate (3)**	**Low (5)**

The development: • *Is consistent with the existing land use of the area.* • *Is highly sensitive to the natural environment.* • *Is consistent with the urban texture and layout.* • *The buildings and structures are congruent / sensitive to the existing architecture / buildings; and* • *The scale and size of the development is similar to what exists.*	The development: • Is moderately consistent with the existing land use of the area. • Is moderately sensitive to the natural environment. • Is moderately consistent with the urban texture and layout. • The buildings and structures are moderately congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is moderately similar to what exists.	The development: • Is not consistent with the existing land use of the area. • Is not sensitive to the natural environment. • Is very different to the urban texture and layout. • The buildings and structures are not congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is different to what exists.

According to the rating methodology outlined in the table above the consistency of the proposed Giyani Gold mine with the existing land use of the area can be determined.

There are several known gold occurrences in the area. A number of the occurrences were prospected and exploited in the past, evident in inactive mines which are found in the area. Six of the inactive mines (Klein Letaba, Louis Moore, Osprey, Fumani, Ranke and Birthday) are known to have produced and recovered gold. Due to the fact that these are historical mines and not ongoing mines shows the lack of any similar mining activities in the immediate vicinity. However, in assigning the rating consideration was given that mining is not new in the area since there have been historical mining in the area.

The proposed mining land use significantly differs from existing land use and is considered to be **Low (5) in terms of** compatibility with the surrounding land use.

1.9.3.4.7 Visual receptor sensitivity

Potential viewers, or visual receptors, are people that might see the proposed development, as visual impact is primarily an impact concerned with human interest. Receptor sensitivity refers to the degree to which an activity will actually impact on receptors and depends on how many persons see the project, how frequently they are exposed to it and their perceptions regarding aesthetics. Receptors of the proposed mining development can be broadly categorised into two main groups, namely:

1. People who live or work in the area and who will frequently be exposed to the project components (resident receptors); and
2. People who travel through the area and are only temporarily exposed to the project components (transient receptors).

A comparatively small number of resident receptors are located in close range (+ - 7km) to some of the proposed infrastructure such as Pit 5 Boltmans Beauty Operation and Pit 3 Gemsbok

Due to the area being mostly serviced by minor roads it is expected that a minimal number of transient receptors may therefore be exposed to the mine, although a large percentage of persons using these roads are locals in the region and therefore fall in the resident receptor category.

The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view i.e., static views from houses would have a higher sensitivity than transient views experienced by motorists.

Residents living in close proximity to the proposed Giyani Gold Mine are considered to be the more sensitive towards the proposed development than those travelling within the study area. However, there are few dispersed and scattered residents near the site of the proposed project.

The viewer sensitivity is ranked from high (5) to low (1) based on the probable perceptions of the viewers and their willingness to change.

The viewer sensitivity related for the proposed development is rated as being **Medium (3)**. This rating is attributed to the current land use surrounding the proposed Giyani Gold mine. Residents residing in the areas adjacent to the Giyani Gold mine opencast pits are considered to be highly sensitive to the proposed development.

1.9.3.4.8 Magnitude Determination of the Visual Impacts

The following **Table *18*** combines the various factors influencing the visual impacts that the proposed development may have, thereby providing input towards calculating the magnitude of the visual impacts for the Giyani Gold Gold Mine.

Table 18: Summary of the criteria to determine the magnitude of the visual impact.

Criteria	Giyani Gold Mine Magnitude
Visibility and Distance[1]	Medium
Visual Absorption Capacity[2]	Medium-High
Landscape Compatibility[3]	Low
Viewer Sensitivity[4]	Medium
Comments	1 **Distance**: Due to the topography and vegetation cover within the study area, as well as the fact that the mine will have limited structures of a

	high-rise nature the proposed development is not expected to be visible beyond 5 km. 2 **<u>Visual Absorption Capacity:</u>** Trees and vegetation, surrounding the proposed development are expected to provide adequate shielding to portions of the proposed Giyani Gold Mine from viewers, from various directions. If substantial vegetation is left in place around the perimeter of the mine, the VAC will be enhanced. 3 **<u>Landscape Compatibility:</u>** Due to lack of ongoing similar land uses, and the fact that the area is characterised by dispersed rural households, the proposed development is expected to have a medium-low compatibility with the surrounding land uses. 4 **<u>Viewer Sensitivity:</u>** Due to the proposed Giyani Gold Mine being situated within a relatively flat landscape the viewer sensitivity is expected to be medium.

Table 19: Summary of the magnitude of the Visual Impact of the proposed Giyani Gold Mine

Criteria	Giyani Gold Mine
Visual Character	Medium -high
Visual Quality of the Environment	Medium
Visual Exposure	Medium
Visibility and Distance	Medium
Visual Absorption Capacity	Medium-High
Landscape Compatibility	Low
Viewer Sensitivity	Medium
Magnitude	
	Medium

The **magnitude** of the visual impact, which is a subjective measure, is calculated based on an average between all criteria listed in **Table *18*** and as described in Sections 3 and 4. The magnitude are used in Section 5 as the baseline without mitigation rating for the assessment of the visual impact.

1.9.3.5 General Hydrogeology

The hydrogeology of the Letaba catchment is characterized by secondary or fractured aquifers formed by mainly metamorphic basement rocks of the Goudplaats Gneiss, Giyani and Gravelotte Greenstone belts, Igneous rocks of the Lebombo Granite, Makhutzi Granite, various younger granitoid intrusions of the Vorster Suite and gabbroic intrusions of the Rooiwater Suite Timbavati Gabbro. Intergranular aquifers (unconsolidated to semi-consolidated materials, with primary porosity) occurs on the Letaba River, mainly inside the Kruger Park.

The hydrogeology of Giyani area is mostly characterised by fracture-bound aquifers formed mainly within the rocks of Goudplaats Gneiss, the Giyani Greenstone Belt and to a smaller extent the Shamariri

Granite and Schiel Alkaline Complex. Nsami is main major river in the study area which flows into easterly directions and the river forms part of the secondary drainage, which falls within the Letaba/Luvuvhu Water Management Area (WMA).The Goudplaats Gneiss rocks have a moderate to good groundwater potential and the yield varies from 0.2 to 0.5 ℓ/s.The high yield groundwater in these rocks is associated with fractured zones, pegmatites, transitional zone between weathered and solid gneiss.

1.9.3.5.1 Groundwater

1.9.3.5.1.1 Aquifer Characterization

The main aquifers are associated with fractured dyke contact zones and lithological contact zones (DWAF, 1990). Although they may be highly permeable, storage in these fractured aquifers is very limited, especially where a deep overlying weathered zone is absent. As a result they may provide high initial yields, which decline rapidly as the larger joints and fractures are dewatered

This greenstone belt region includes highly metamorphosed ultramafic to mafic schist, amphibolite, mafic metalava, quartzitic schist, quartzite and ironstone. Local fractured aquifers dominate this region as a result of the intense folding and associated fracturing.
Borehole yields typically vary between 2 and 5 ℓ/s, with the highest yields occurring in brittle quartzite. Large-scale groundwater abstraction currently takes place at Giyani (0.1 to 1.0 million m^3) for domestic purposes. Localized low yielding boreholes (0.5 to 3.0 ℓ/s) are also in use by various rural communities to meet their basic human need requirements.

1.9.3.5.2 Groundwater Quality

1.9.3.5.2.1 **Water Quality Assessment (Hydrogeochemistry)**

Characterisation of hydro geochemistry and risks to groundwater quality and knowledge of the processes that control natural water composition is a necessity for rational management of water quality. Hydrogeochemistry pursues to determine the origin of the chemical composition of groundwater and the relationship between water and rock chemistry as they relate to water resources and users. A basic and straightforward tool in hydrochemical studies used to summarize and present water quality data are graphical interpretation which are also used in this study.

1.9.3.5.3 Baseline Surface Water Quality

Water sample was collected and analysed by UIS Laboratories (Pty) Ltd Laboratories which is SANS accredited laboratory. An existing borehole(Pit 1 Area : Swartkoppies) water samples was submitted in the laboratory in March 2021.Water quality chemistry results was observed ,TDS is quite high for drinking water.The pH value remains in the neutral to slightly alkaline range, within the stipulated limits in the SANAS limits.

The water quality results was analysed using the different water quality software's which are computer program capable of displaying thematic maps with data and graphs depicting the data in a more specialized way. Specialized chemical diagrams included in this report are:

- Piper diagram (Piper, 1944);
- Durov Diagram ;
- Schoeller–Breakoff's diagram (Schoeller, 1962);
- Sodium Adsorption Ratio diagram (United States Salinity Laboratory, 1954);
- Water quality is determined by several factors including temperature, colour or clarity, taste, suspended matter, dissolved matter, organisms, pH and radioactivity.

1.9.3.5.4 Hydrochemistry Modelling –Surface Samples

Piper diagram –Groundwater Monitoring

Piper Diagrams illustrates cations and anions shown by separate ternary plots. The apexes of the cation plot are calcium, magnesium and sodium plus potassium cations. The apexes of the anion plot are sulphate, chloride and carbonate plus hydrogen carbonate anions. The two ternary plots are then projected onto a diamond, where the water type is determined. In this project water samples were collected and analysed at the UIS Laboratories (Pty) Ltd whereby the results in piper diagram were obtained.

Characteristics of piper diagram:

- Normalizes the cations and anions, separately
- Does not show absolute concentrations: waters with the same relative concentrations will plot on top of each other, no matter how different the actual salinity is
- Helps identify water types
- Can show mixing lines between water types

Based on table below and figure below, the water type table (Table 4-5) was generated as shown.

TABLE 20: Water types from piper diagram

No.	Sample Name	Water Type
1	KUBH1	Ca-Mg-SO_4 waters typical of Domestic waste dumps/Natural saline waters –indicative of high levels of TDS

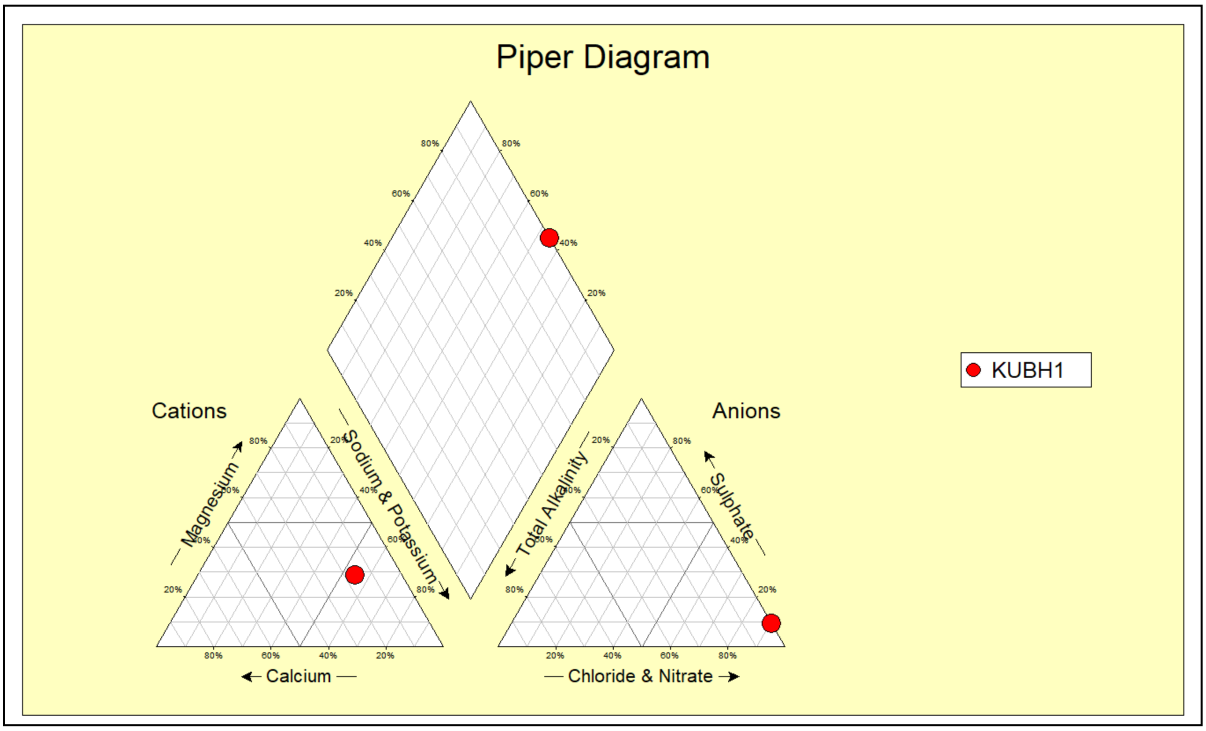

Figure 50: **Piper Diagram Ground Water Plots 2021**

Characteristics of Durov diagram:

The Durov diagrams (Figure 4-7) are basically the same as the Piper diagram with two extra legs allowing pH and EC to be included in the diagram.

Interpretation:

The table below interprets clearly the dominant water types in this Gold Mine hydrocensus program

TABLE 21 : Water type sub-fields (Durov diagram)

No.	Dominance	Interpretation	Present study
1	HCO^{3-} and Ca^{2+} dominant	Commonly Indicates recharging waters	
2	HCO^{3-} dominant and Mg^{2+} dominant	Cations indiscriminant	**KUBH1**
3	HCO^{3-} and Na^{+} dominant	Ion exchange waters	
4	SO_4^{2-} dominant and Ca 2+ dominant	Anions indiscriminate, recharge/ mixed water	
5	No dominant anion or cation (Dissolution/ mixing)		
6	SO_4^{2-} dominant and Na^{+} dominant	Anions indiscriminate, mixing influences	
7	$C\ell^{-}$ and Ca^{2+} dominant	Cement pollution or reverse ion exchange of NaCℓ waters	
8	$C\ell^{-}$ dominant and no dominant cation	Reverse ion exchange of NaCℓ waters	
9	$C\ell^{-}$ and Na+ dominant	End point water	

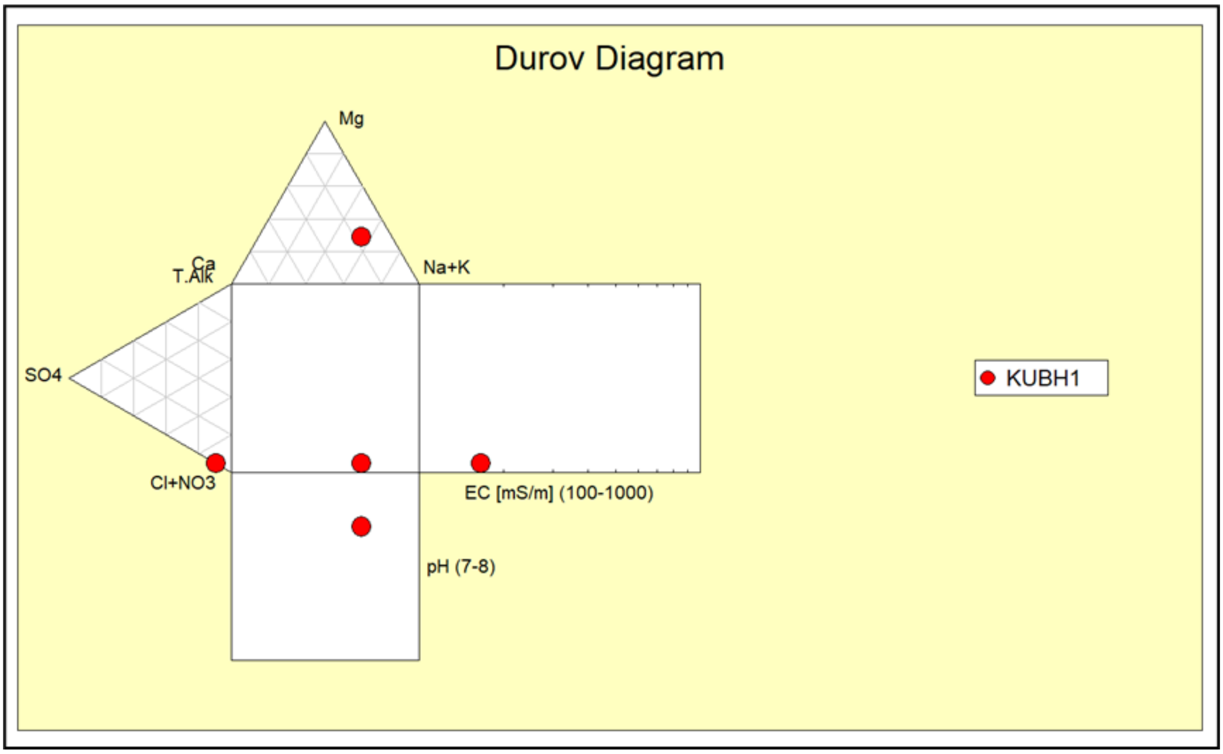

Figure 51 **Durov diagram Ground Water Plots 2021**

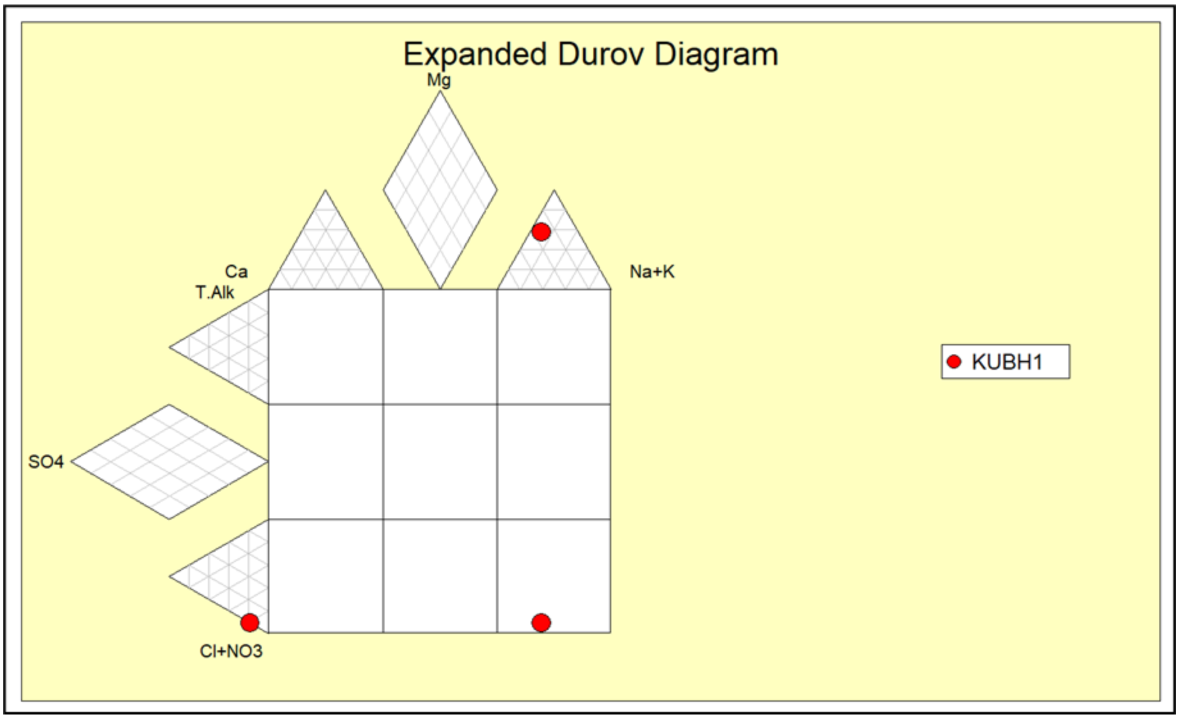

Figure 52 **Expanded Durov diagram Ground Water Plots 2021**

Expanded Durov Diagram are a combined plot consisting of two (2) ternary diagrams (cations plotted against anions) or it uses the trilinear diagram, where two triangles are split into three areas each and projected to a rectangular area with nine different zones. This helps with the exploration of chemical compositions and total dissolved solids. It provides more understanding on the hydrochemical facies by assisting in the process to identify water types and shows geochemical processes that could assist in understanding and evaluating the quality of groundwater (Bosman, 2014).

From the assessment the Durov diagram indicates the following:

- KUBH1 : -Indicates the Domestic Waste Dumps or Natural Saline Water , indicative of TDS

Schoeller-Berkaloff Diagram-Surface Monitoring

Characteristics of piper diagram

Logarithmic diagrams of major ion analyses in **meq/ℓ** demonstrate different water types on the same diagram (Figure 4-9).

- Samples concentrations not ratios are displayed and compared
- Similar waters exhibit similar "fingerprints

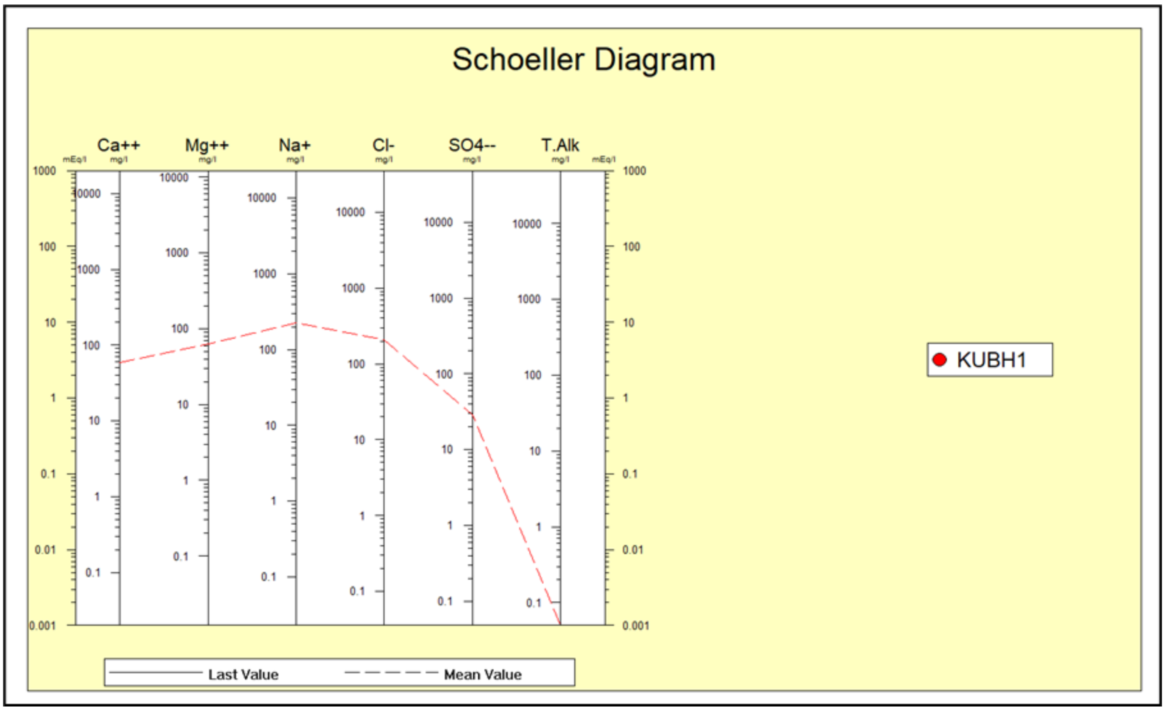

Figure 53 **Schoeller-Berkaloff Diagram (DWAS, 2017)**

Sodium Adsorption Ration diagram (S.A.R)

The SAR diagram (Figure 4-11) are used to determine if water is suitable for irrigation it uses the following equation (Driscoll, 1986):

SAR = Na / (Ca/2+Mg/2)0.5.

Where sodium, calcium and magnesium are in meq/l. Water with SAR values of 18 and above will result in an excess of sodium in the soil. Water with SAR values of 10 and below is safe and suitable for irrigation.

The KUBH1 samples for this project has SAR values are right on 10 which indicates water is unsafe and not suitable for irrigation.

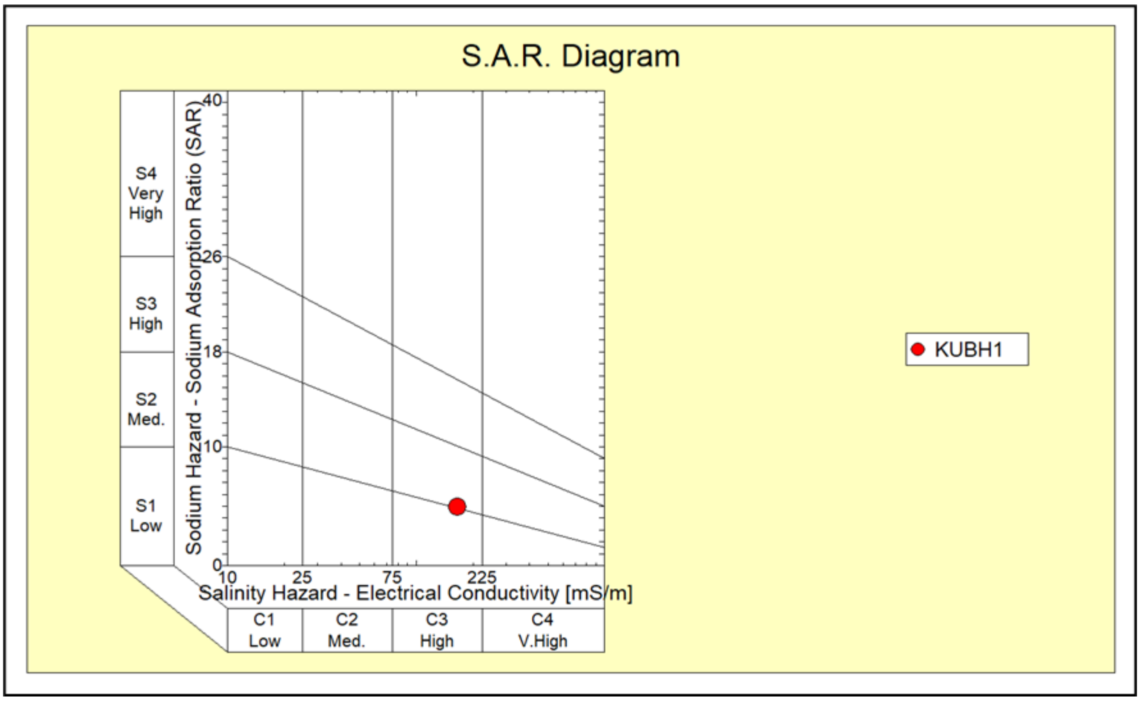

Figure 54 **SAR diagram (DWS, 2017)**

1.9.3.5.5 Hydrocensus

A detailed hydrocensus in the area was first conducted by J7 Royal in February 2021 for the Greater Giyani 891 LT and a portion of portion 0 of the farm 246 located within the town of Giyani area. The area covers Giyani Gold mine farm and surrounding farms.

TABLE 22 Hydrocensus boreholes

Type of pump	**Equipped boreholes**			**Other Boreholes**	
	Status of Boreholes	**In use**	**Not in use**	**Not equipped**	**Destroyed**
No pump	Monitoring		0	**0**	**0**
Electrical Submersible pump	Irrigation & Livestock	0	0		
Electrical Submersible pump	Domestic Water Supply	1	1		
Total		**1**		**0**	

1.9.3.5.6 Acid-Base Accounting

1.9.3.5.6.1 ABA Test Methodology

Acid-Base Accounting (ABA) is a static test where the net potential of the material to generate long-term acidic drainage when subjected to atmospheric (oxidizing) conditions is determined. It is mostly applicable to pyrite containing rock excavated and disposed of during operations. The test does not consider site-specific conditions or the timeframe for potential acidification.

The ABA test determines the percentage Sulphur (%S), the Acid Potential (AP), the Neutralization Potential (NP) and the Net Neutralization Potential (NNP) of the sample.

- If pyrite is the only Sulphide in the rock the AP (Acid Potential) is determined by multiplying the percentage Sulphur (%S) with a factor of 31.25, which is based on the oxidation reaction of pyrite. The unit of AP is kg $CaCO_3$/t rock and indicates the theoretical amount of calcite neutralized by the acid produced.
- The %S is determined through an infrared (IR) detector after sample combustion in an Eltra furnace. The total %S is determined after heating the furnace to ±2200°C and the Sulphide %S is determined at 1 000°C. The Sulphide %S is used to determine the acidification potential of the sample.
- The NP (Neutralization Potential) is determined by treating a sample with a known excess of standardized hydrochloric or sulfuric acid (the sample and acid are heated to ensure reaction completion). The paste is then back-titrated with standardized sodium hydroxide in order to determine the amount of unconsumed acid. NP is also expressed as kg $CaCO_3$/t rock as to represent the amount of calcite theoretically available to neutralize the acidic drainage.
- NNP is determined by subtracting AP from NP.

For the material to be classified in terms of their Acid Mine Drainage (AMD) potential, the ABA results could be screened in terms of its NNP, %S and NP:AP ratio as follows:

- A rock with NNP < 0 kg $CaCO_3$/t will theoretically have a net potential for acidic drainage. A rock with NNP > 0 kg $CaCO_3$/t rock will have a net potential for the neutralization of acidic drainage. Because of the uncertainty related to the exposure of the carbonate minerals or the pyrite for reaction, the interpretation of whether a rock will be net acid generating or neutralizing is more complex. Research has shown that a range from -20 kg $CaCO_3$/t to 20 kg $CaCO_3$/t exists that is defined as a "grey" area in determining the net acid generation or neutralization potential of a rock. Material with an NNP above this range is classified as *Rock Type IV - No Potential for Acid Generation*, and material with an NNP below this range as *Likely Acid Generating*.
- Further screening criteria could be used that attempts to classify the rock in terms of its net potential for acid production or neutralization. The following screening methods given in the table overleaf, as proposed by Price (1997), use the NP:AP ratio to classify the rock in terms of its potential for acid generation.
- Soregaroli and Lawrence (1998) further state that samples with less than 0.3% Sulphide sulphur are regarded as having insufficient oxidisable sulphides to sustain long-term acid generation. According to Li (2006), a material with an S% of below 0.1% has no potential for acid generation. Therefore, a material with a %S of above 0.3%, is classified as *Rock Type I - Likely Acid Generating,* 0.2-0.3% is classified as *Rock Type II,* 0.1-0.2% is classified as *Rock Type III*, and below 0.1% is classified as *Rock Type IV - No Potential for Acid Generation*.

TABLE 23: Screening methods using the NP: AP ratio (Price, 1997)

Potential for acid generation	NP: AP screening criteria	Comments
Rock Type I. Likely Acid Generating.	< 1:1	Likely AMD generating.
Rock Type II. Possibly Acid Generating.	1:1 – 2:1	Possibly AMD generating if NP is insufficiently reactive or is depleted at a faster rate than sulphides.
Rock Type III. Low Potential for Acid Generation.	2:1 – 4:1	Not potentially AMD generating unless significant preferential exposure of sulphides along fracture planes, or extremely reactive sulphides in combination with insufficient reactive NP.
Rock Type IV. No Potential for Acid Generation.	>4:1	No further AMD testing required unless materials are to be used as a source of alkalinity.

1.9.3.5.6.2 ABA Test Results

Acid Base Accounting (ABA) assessment results for samples of Waste Rock, Run of Mine (ROM) and Slimes/Tailings materials from Giyani Gold Project site are presented in the tables overleaf. The paste pH of all the materials registered a fairly alkaline values.

The NP/AP indicates the potential for the sample to generate acid drainage, whereas the %S indicated whether this drainage will be over the long term. The total Sulphur content of all samples was recorded below the 0.1 % guideline value Li (2006), indicative of no potential for acid generation in the long term (if neutralisation potential is not adequate to buffer acid formation). However, the Neutralisation Potential Ratio (NPR) is notably greater than 4:1 for all samples. Therefore, the material ABA rock classification for all the samples is Type IV Rock, which Non-Acid Forming. It is also noted that the waste rock and the ROM samples registered Net Neutralisation Potential (NNP) of +34 and +63,2, respectively, which are notably greater than +20, and thus confirming the samples as non-acid generating (Usher et al., 2003).

TABLE 24: ABA test results

Acid – Base Accounting	Run of Mine (ROM)	Tailings	Waste Rock	Duplicate (QC)
Sample Number	**767972**	**767973**	**767974**	**767972 QC**
Paste pH	8,02	9,21	8,45	8,04
Total Sulphur (%)	0,027	0,034	0,010	0,043
Acid Potential (AP) (kg/t $CaCO_3$)	0,84	1,07	0,31	1,34
Neutralization Potential (NP) (kg/t $CaCO_3$)	28,7	20,0	19,3	28,7
Nett Neutralization Potential (NNP) (kg/t $CaCO_3$)	27,8	18,9	19,0	27,3
Neutralising Potential Ratio (NPR) (NP : AP)	34,0	18,7	63,2	21,4
Total Carbon (%)	0,38	0,19	0,13	0,36
Rock Type	IV	IV	IV	IV

1.9.3.5.6.3 NAG Test Methodology

The NAG test provides a direct assessment of the potential for a material to produce acid after a period of exposure (to a strong oxidant) and weathering. The test can be used to refine the results of the ABA predictions. As with the ABA test, the NAG test does not consider site-specific conditions or the timeframe for potential acidification.

In the NAG test Hydrogen Peroxide (H_2O_2) is used to oxidize Sulphide minerals to predict the acid generation potential of the sample. The following relates to the methodology:

- In general, the static NAG test involves the addition of 25 ml of 15% H_2O_2 to 0.25 g of sample in a 250 ml wide mouth conical flask or equivalent. The sample is covered with a watch glass, and placed in a fume hood and a well-ventilated area for about 2 h.
- Once "boiling" or effervescing ceases, the solution is allowed to cool to room temperature and the final pH (NAG pH) is determined.
- A quantitative estimation of the amount of net acidity remaining (the NAG capacity) in the sample is determined by titrating it with sodium hydroxide (NaOH) to pH 4.5 (and/or pH 7.0) to obtain the NAG Value.
- In order to determine the acid generation potential of a sample, the screening method of Miller et al. (1997) is used.

TABLE 25: NAG test screening method (edited from Miller et al., 1997)

Rock Type	NAG pH	NAG Value (H_2SO_4 kg/t)	NNP ($CaCO_3$ kg/t)
Rock Type Ia. High Capacity Acid Forming.	< 4.5	> 10	Negative
Rock Type Ib. Lower Capacity Acid Forming.	< 4.5	≤ 10	-
Uncertain, possibly Ib.	< 4.5	> 10	Positive
Uncertain.	≥ 4.5	0	Negative (Reassess mineralogy) *
Rock Type IV. Non-Acid Forming.	≥ 4.5	0	Positive

** If low acid forming sulphides is dominant then Rock Type IV.*

1.9.3.5.6.4 Net Acid Generation (NAG) Screening Results

The NAG test results are presented in Table 4-10 below. The results were screened as per approach discussed above in relation to *Rock Type I to IV*. The NAG test results refine the ABA findings and indicate the sampled Waste Rock, Run of Mine (ROM) and Tailings as non-acid forming. Thus, there is sufficient neutralisation potential or capacity in the materials, which would buffer acid generation that may occur.

TABLE 26: Net Acid Generation (NAG) test results

Sample ID	NAG pH: (H_2O_2)	NAG at pH 4.5 (kg H_2SO_4 / t)	NAG at pH 7.0 (kg H_2SO_4 / t)	NNP ($CaCO_3$ kg/t)	# Rock Type
Run of Mine (ROM)	6,69	<0.01	0,44	27,8	IV
Tailings	6,25	<0.01	1,55	18,9	IV
Waste Rock	6,66	<0.01	0,47	19,0	IV
Duplicate	6,68	<0.01	0,42	27,3	IV

Rock Type IV is Non-Acid Forming

1.9.3.5.6.5 Potential Pollution Source Identification

Anticipated waste streams from the proposed Giyani Gold Mine include those listed in the tabulation below:

TABLE 27: Mine Pollution Source Identification

Infrastructure/Activity	Waste
Package sewage treatment facility	Sewage
Stockpiles	Tailings Disposal Facility Overburden waste
Offices	General waste (papers, plastic, glass bottles, food waste)
Mine operational vehicle	Hydrocarbon waste generated by spillages
Workshop	Used oil and grease, fuel contaminated material, and oil related products. Fluorescent tubes, old batteries, waste paints, and transformers. Scrap waste (scrap metals, empty chemical containers, and metal off-cuts).

1.9.3.5.7 Groundwater Model

Before the development of a flow model, the hydrology of the study area must be understood conceptually. A conceptual model includes planning and constructing an equivalent but simplified conditions. For a real world problem that are acceptable in view of the objectives of the modelling and the associated management problems. Transferring the real world situation into an equivalent model system, which can then be solved using existing program codes, is a fundamental step in groundwater modelling.

A model is a summary of:

- The known geohydrological features and characteristics of the area;
- The static water levels/piezometric heads of the study area;
- The interaction of the geology and geohydrology on the boundary of the study area;
- Any simplifying assumptions necessary for the development of a numerical model and the selection of a suitable numerical code; and

- A description of the processes and interactions taking place within the study area that will influence the movement of groundwater.

1.9.3.5.7.1 Model scale, context **and** accuracy

The regional model context and accuracy was based on existing 1:50 000 topographical GIS data with 1:250 000 scale geological data. The research was based exclusively on the assessment of existing information, the bulk of which was supplied by National Groundwater Database (NGDB) and National Groundwater Archives (NGA) of DWA. Geohydrological information was obtained from local and regional boreholes to provide an understanding of the groundwater regime.

A dynamic groundwater flow model was developed by applying the modelling package 2D-Dimensional Visual Modflow (WEN-Hsing Chiang and Wolfgang Kinzelbach, 1998). The latter will be used as planning and management tool for quantification and qualification of proposed open pit Gold activities on aquifer conditions. The model domain was delineated based on regional drainages as well as topographical highs i.e. discharge zones and no-flow zones and governed by a set of boundary conditions. The numerical model was used in steady-state and transient simulations to assess the groundwater flow directions, head gradients and flow velocity and transient simulation was then conducted after the calibration of the model. The data and assumptions used in the model are listed in Table 4-10.

TABLE 28: Model context, data, boundary conditions and assumptions

Input parameter	Scale	Source, parameter or assumption description
Topography (DTM)	1:50 000	The DTM was obtained from DWS NGA Data (Figure 2-3).
Rainfall (recharge)		Rainfall data was obtained from SAPWAT. Modelled data for the quaternary catchments the B82H
Rivers streams, drainages	1:50 000	Obtained from DWAF as GIS shape files.
Dams	1:50 000	Obtained from DWAF as GIS shape files.
Geology	1:250 000	Obtained from DWS as GIS raster image files and from the Client.
Recharge		Recharge was assumed to be 1-4.5 % of MAP for the aquifer deposits The general recharge was assumed at 2% of MAP

Input parameter	Scale	Source, parameter or assumption description
Boreholes and pumping rates		Data sourced from previous reports and Water level data was available for some few boreholes and all were used to calibrate the model to a 80 % level of assurance.
Boundary conditions		No flow represented by surface water shed
Transmissivity		Information regarding transmissivity was obtained reports provided and DWS Data.
Storativity		Assumption of 0.001 to 0.005 for aquifer zones. No field test data was available for storativity values.
Aquifer thickness		It was assumed that the deposits were 60m thick at the lowest elevation gradually decreasing as the elevation rises. The area is underlain by fractured rocks.

1.9.3.5.7.2 **Methodology**

The model was calibrated, groundwater quality and groundwater levels were used .Most of the data applied and used for the status groundwater quality was supplied by the Kusile Invest 133 (Pty) Ltd. A dynamic numerical model for the aquifer was constructed using the modelling package VISUAL MODFLOW PMWIN (WEN-Hsing Chiang and Wolfgang Kinzelbach, 1998). Considering an unconfined/confined aquifer, with a recharge to the aquifer only occurs once a year during rainy season for a period of four months.

1.9.3.5.7.3 Life of Mine (LoM)

The Gold life of mine (LoM) is 30 years. A numerical groundwater flow model was developed using the modelling package Visual MODFLOW. Details of this software are provided at Visual MODFLOW, which is a MODFLOW based software package. The detailed site layout map are shown below.

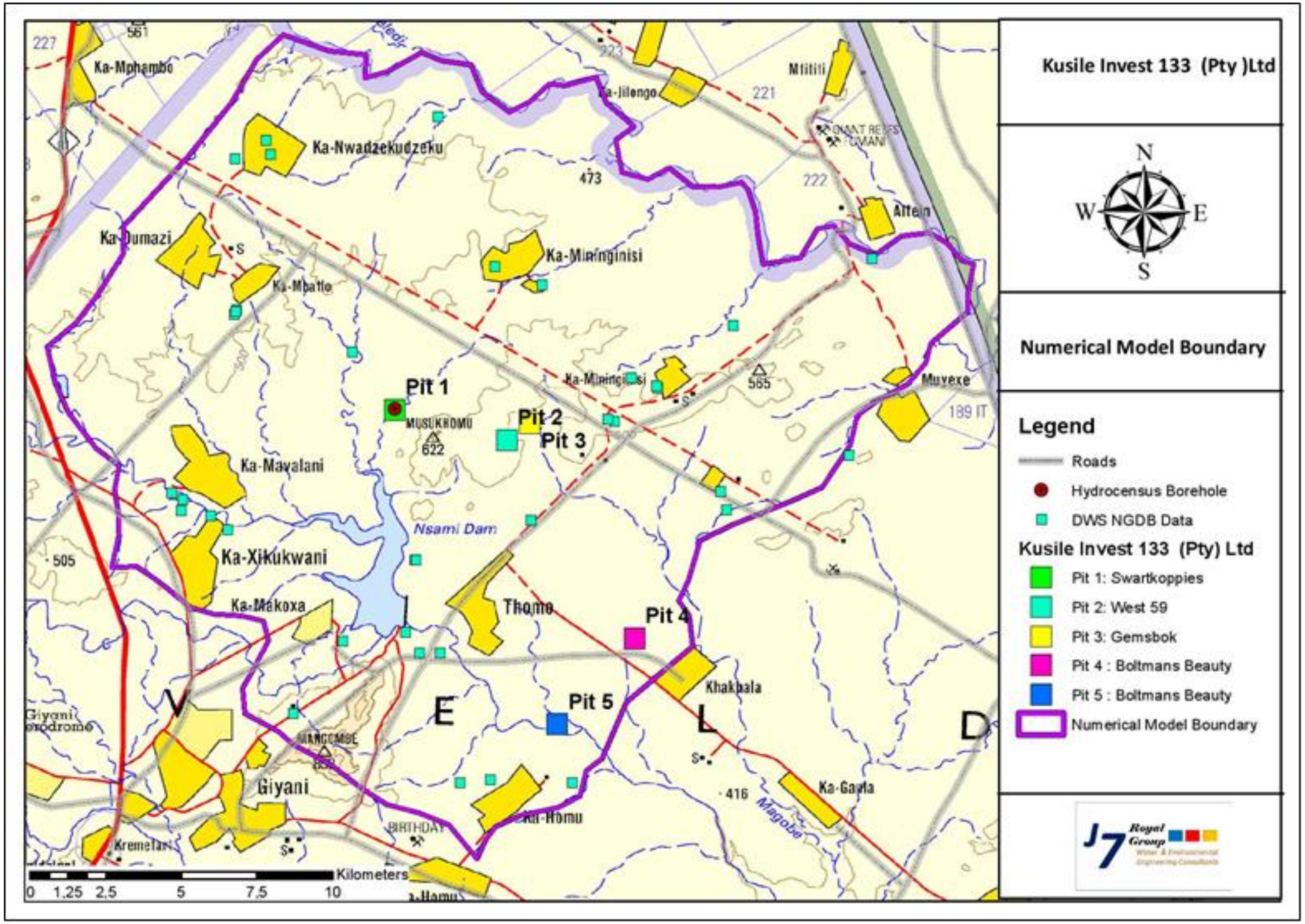

Figure 55 **Model Boundary Map**

1.9.3.5.8 Modelling Software Selection

The modelling software selected for constructing and simulating the Kusile Invest 133 (Pty) Ltd Gold Mine model is VISUAL MODFLOW PMWIN (WEN-Hsing Chiang and Wolfgang Kinzelbach, 1998).MODFLOW was selected for construction of the model because it is a highly interactive groundwater modelling system capable of simulating flow in two or three dimensions for uncoupled, variably saturated, transient or steady state flow.

1.9.3.5.8.1 Generation of the Finite Difference Numerical Model (Model Setup)

A 2D numerical groundwater flow model was developed for the sub catchment using the modelling software MODFLOW .The model domain covers an area of 429,76km².The groundwater model was developed using 27200 rows and 28200 columns to generate a mesh that discretizes the model domain into a finite difference mesh (Figure 4-14).A regular grid space of 100m is used for each column and row. An aquifer thickness of 60m was also assumed for the model; hence this thickness will follow topography. The task is to assess the aquifer under the following conditions.

Steady State, (with recharge rate):Steady state refers to an equilibrium condition whereby over long periods of time, hydrogeologic systems may achieve or approximate some non-changing conditions in which heads or concentrations do not change with further passage of time. Such systems are said to have achieved steady state. Models may deal with this in different ways. Some have "steady state" options, while others require the user to specify some long period of time and/or closure criterion beyond which changes in head are considered inconsequential.

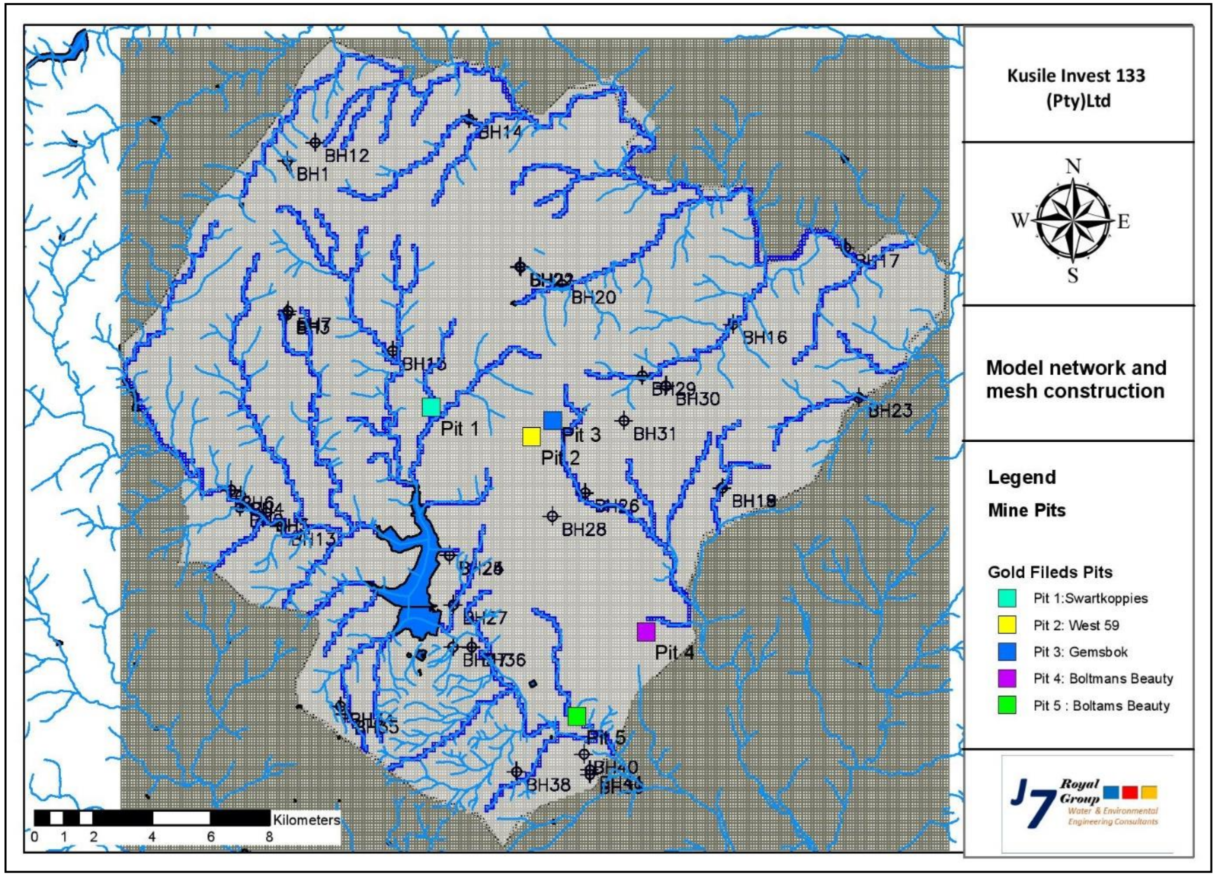

Figure 56 **Model network and mesh construction**

1.9.3.5.8.2 Model limitations and assumptions

The following assumptions were made with noted limitations:

1. The accuracy and scale of the assessment will result in deviations at specific points e.g. on the boundaries of mine layout areas however this effect is minimal and the selected mesh elements would represent the footprint of specific infrastructure.
2. For lithological units different than that of the immediate study area hydraulic parameters from literature were used for specific types of geology.
3. NGDB Data borehole data (water levels) and neighbourhood boreholes were only available around the area and the surrounding farms.
4. Sections of the model domain were therefore not thereby affecting the confidence level of the model.
5. Considering the spatial extent of the model domain and rainfall stations within the study area, rainfall data from a single station was used to represent entire study area. Once the model was calibrated, the proposed Gold Mine were incorporated into the model by applying drains to discharge water from the aquifer system.
6. The stream was constrained such that no water leaked from the streams to the groundwater system. By constraining infiltration
7. When the modelling assumptions were made or reference values used, a conservative approach was followed such that the trend was to overestimate groundwater discharges from dewatering. This gives a worst-case scenario for designing the dewatering system and impacts to the receiving environment .It should be noted that dewatering volumes should be less than those simulated by the model.

1.9.3.5.8.3 Model base boundary condition

The model domain was assigned to extend vertically to a depth of 60m. It is assumed that the base of the model is impermeable. The mine development stages were simulated as follows:

- Scenario 1: Current steady state conditions and initial groundwater regime
- Scenario 2: Transient dewatering from the proposed pit and zone of influence
- Scenario 3 : Transient mass plume transport

Scenario 1: Current steady state conditions and initial groundwater regime

The model was calibrated in steady state based on the known geological and hydraulic head distribution data for the project site. Calibration was accomplished iteratively by adjusting recharge and hydraulic conductivity values until a reasonable fit between the measured and simulated heads were obtained. The measured data consists of head elevation data from few existing boreholes around the site.

Model Calibration and Sensitivity Analysis

The objective of the model calibration process was to demonstrate that the model was capable of simulating hydraulic heads that match as close as possible the observed heads in Delmas proposed expansion open cast groundwater levels. The calibration process involved the continual adjustment of hydrogeological parameters including recharge, hydraulic conductivity and specific storage until the closest match between model predicted water levels and field measured water levels was obtained. Calibration was done into two (2) stages that is steady state calibration and transient state calibration. The aim of the steady state calibration was to represent the average (i.e. long term) groundwater conditions at the Kusile Invest 133 (Pty) Ltd aquifers.

The resulting groundwater heads of the steady state model are used to initialise the transient groundwater models for transient calibration and predictions. The aquifer parameters and boundary conditions determined during steady sate calibration were applied to the transient state model for manual calibration.

The transient state calibration satisfied an adequate match to observed groundwater levels affected by abstraction and any modifications to the model during transient calibration required a re-assessment of the steady state calibration. The numerical model was calibrated and adjusted in steady state by keeping the model complexity to minimum.

The quality of the fit between simulated and observed water levels was visually evaluated based on the elevations of the simulated hydraulic heads and by means of a statistical analysis.

The three (3) statistical analysis expressions were used to indicate the errors in calibration

1) Mean Error (ME)

Mean difference between the measured and simulated water levels

2) Mean Absolute Error (MAE)

Mean of the absolute value of the differences between the measured and simulated heads

3) Root Mean Square Error (RMSE)

RMSE measures how much **error** there is between two data sets and in other words, it compares a simulated value and a measured/observed or known value. It's also known as **Root Mean Square** The Root Mean Squared Error (RMSE) is an important statistical calculation used to determine the difference between simulated values in a model and measured values from observations. If this difference is large the model is likely to be less accurate than if the d difference is small; therefore, a modeller can calculate the RMSE and adjust other features until the RMSE is as small as possible to improve the model. The MAE addresses this problem by producing mean absolute values. However, the RMSE error is used most often by modellers in the industry to assess the adequacy of model calibration because the differences between observed and simulated water levels are normalized across the model domain. When the RMSE value is small, the errors are small relative to the overall water level and model response (Anderson and Woessner 1992).For this study, RMSE was used to assess the calibration of Tiara mining proposed open pit and RMSE error was evaluated as a ratio to the total water level change across the model domain.

For this simulation, the calibration indicators for the aquifers were 5,74 for the ME, 10,87 for the MAE on average and 5,97 for the RMSE. The RMSE value for the calibrated model is less than the typical range of **10%** used by most modellers as the threshold for a well calibrated model (Table 4-11).Based on this, the steady state model was determined to be adequately calibrated for use in adapting the model for predictive transient simulations to assess dewatering volumes and possible environmental impacts.

TABLE 29: Statistical model calibration –simulated versus measured heads

No.	Component	Statistical Analysis	Observed Heads	Simulated Heads	Mean Error(m) ME	Mean ABS Error(m) MAE	Root Mean Square Error(m) RMS
1	Boreholes	**Max.**	495,17	484,53	23,72	23,72	562,70
2		**Min.**	398,73	419,74	-20,06	0,48	0,23
3		**Average**	448,84	454,59	5,74	10,87	168,59
4		**95th Percentile**	491,12	484,08	22,75	22,75	518,17
5		**5th Percentile**	399,15	422,31	-16,36	1,22	1,50
6		**Std.Dev**	27,60	19,47	11,90	7,26	178,34
7		**∑**			**137,84**	**260,86**	**4046,25**
8		**1/n**			**0,17**	**0,17**	**0,17**
10		**RMSE (Root Mean Square Error)**					**5,97**
11		**Correlation**	**0,93**				

Below the difference between observed and simulated heads from the calibration process is shown. A negative value indicates that the observed head is lower than the head predicted by the simulation and vice versa.

The variances are due to known and/or unknown complexity in the geological environment that is not captured in the model. Once dewatering of the hydrogeological system start, then the model will be updated to reflect the major responses in hydraulic heads. The head elevation data from hydrocensus observation boreholes were used to calibrate the steady-state flow model. The steady-state calibration of the measured and the simulated water levels resulted in an acceptable correlation of **R^2 = 0.86** for the boreholes. The model was calibrated in steady state with the parameters and the measured water levels were compared with simulated water levels to get an acceptable fit which would represent a realistic aquifer system as it might be in nature (Figure 4-14). Table 4-11 indicates the fitted data as observed at all boreholes with known water levels

A preliminary regional groundwater balance is presented for the various scenarios discussed in the previous section. There is an average of less 10 m^3/d flowing into the proposed Gold Mine Pits as defined as possible overall recharge.

TABLE 30 Catchment Water Balance-Gold Dewatering

No	Component	Inflow (m^3/d)	Outflow (m^3/d)	Balance (m^3/d)
1	Catchment Recharge	2385		2385
2	Catchment Baseflow and Spring Flow		-1717	-1717
3	Mine Dewatering(LoM)			
a	Pit 1 :Swartkoppies		-180	-180
b	Pit 2: West 59		-190	-190
c	Pit 3: Gemsbok		-215	-215
d	Pit 4: Boltmans Beauty		-83	-83
e	Pit5:Boltmans Beauty			
4	**Total**	**2385**	**-2385**	**0**
5	**Imbalance (%)**			**0**

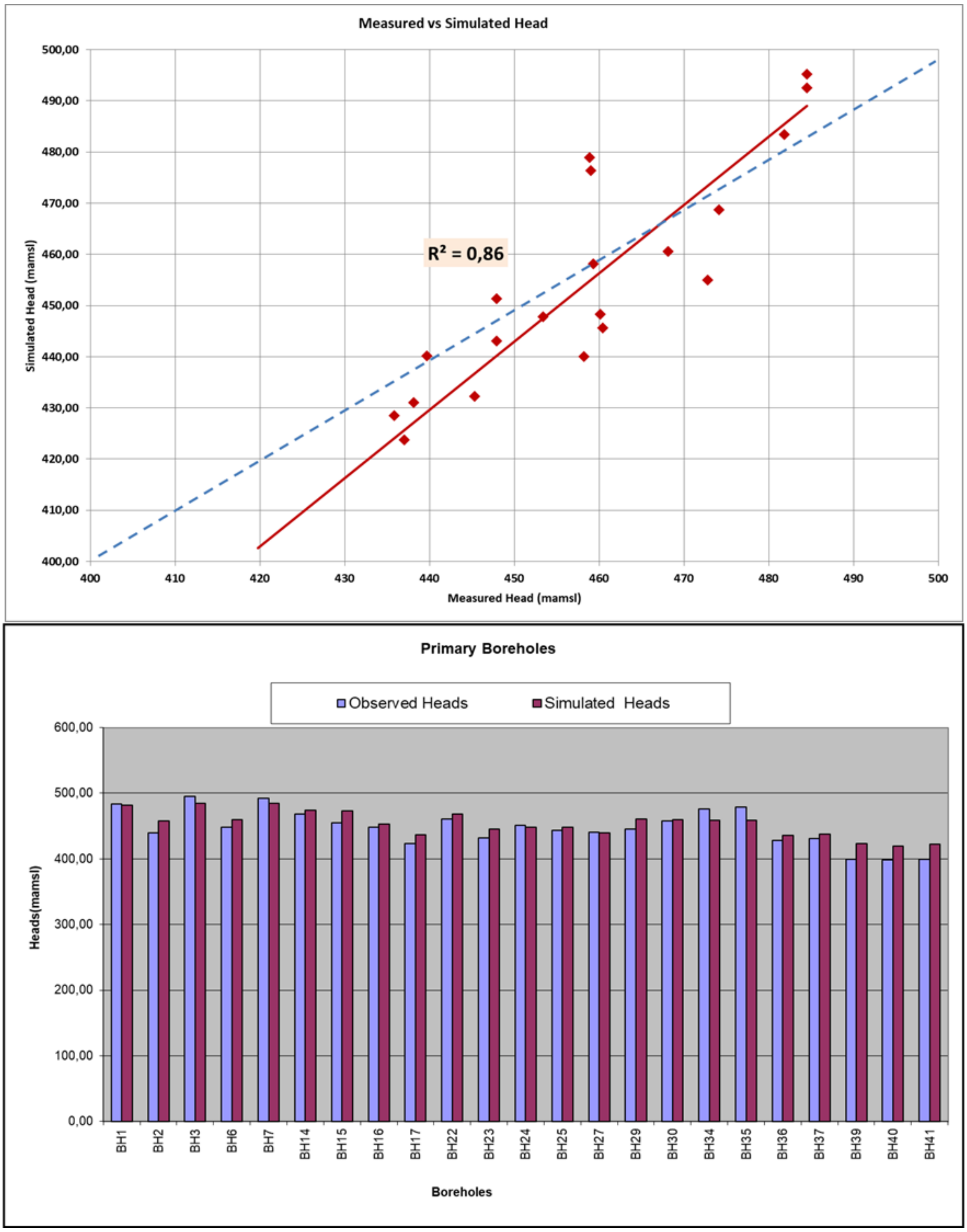

Figure 57**: Simulated versus measured calibrated heads**

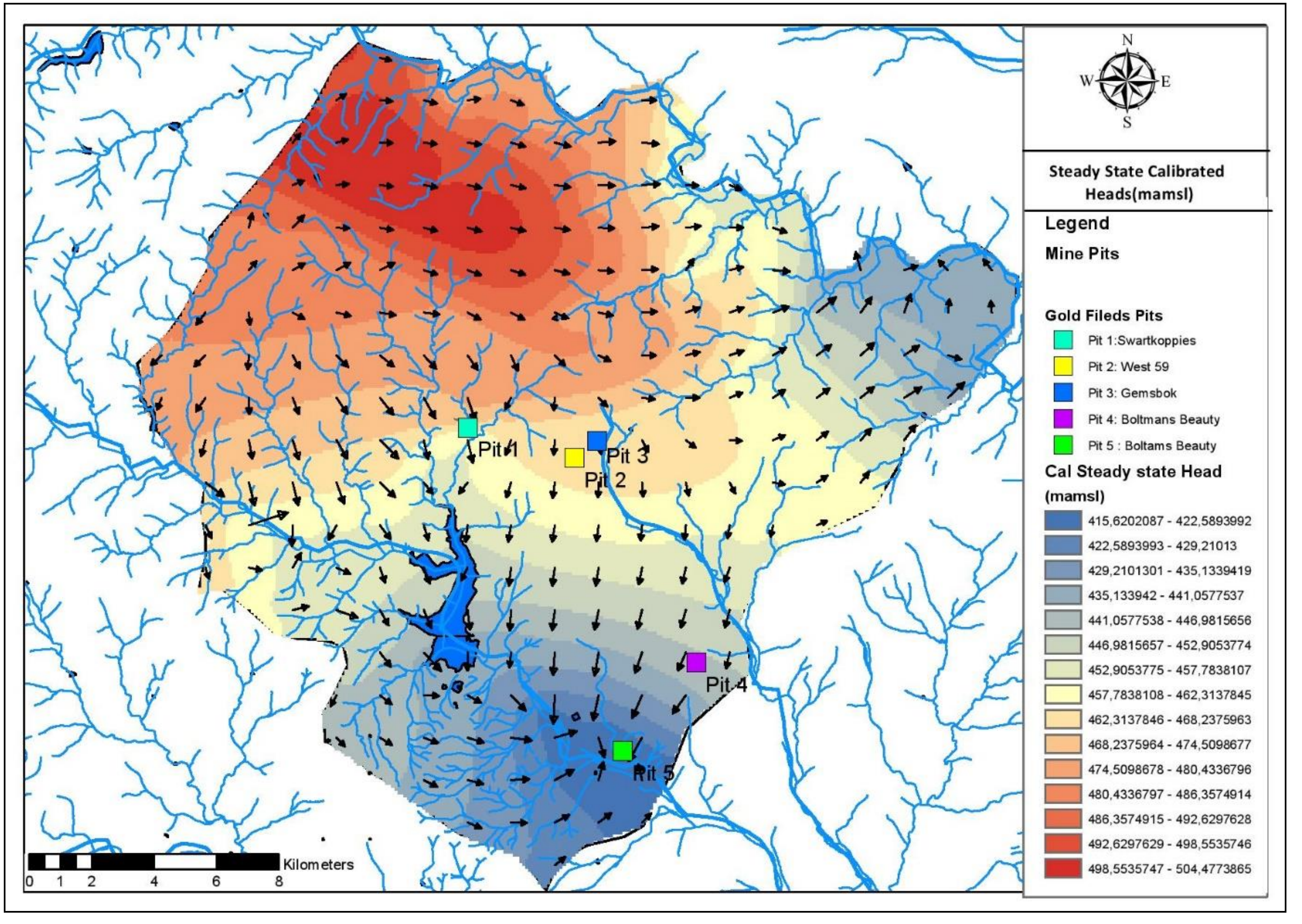

Figure 58**: Regional steady-state piezometric heads and flow direction**

1.9.3.5.8.4 Piezometric Heads and gradients

The piezometric heads and gradients for the calibrated model showed that the gradient and general flow follows the topography which is from north to east, via the perennial streams Nsami River and other non-perennial streams as shown in Figure 4-16.The general drainage direction is north to east direction in the study area and the groundwater drains in a northeren to eastern direction. The head constrained boundary conditions at both non-perennial and perennial streams influences groundwater to drain down gradient towards drainages.

1.9.3.5.8.5 Groundwater drawdown contours (Dewatering)

The level of detail provided in the mine plan was modelled as accurately as possible by dividing the model into stress periods, representing each mining strip per the mine plan .Drain cells were used to model inflows due to mining and the modelled drain elevations were set to the final pit floors and progressed through yearly increments. The LoM forecast drawdown impacts at the caused during open cast mining to a depth of 60mbgl are presented in Figure 4-18 to Figure 4-22 and cumulative impacts with respect to all five(5) proposed mines. Increases and final size in the footprint, depth and timing have indicated growth in the predicted drawdown cone resulting from the pit dewatering. The drawdown is contained within a zone of influence 1km from the centre of the mining pit and the drawdown and only small impacts are anticipated in this area.

The simulation indicated a maximum Zone of Influence (ZOI) depth located at the open pits approximately 60m in depth. The maximum lateral extent of the ZOI is approximately less than 1km from the centre positions of the pits. A cumulative impact was also considered where neighbouring mines were assumed active together the proposed mine and the impacts is still within the 1km radius of influence.

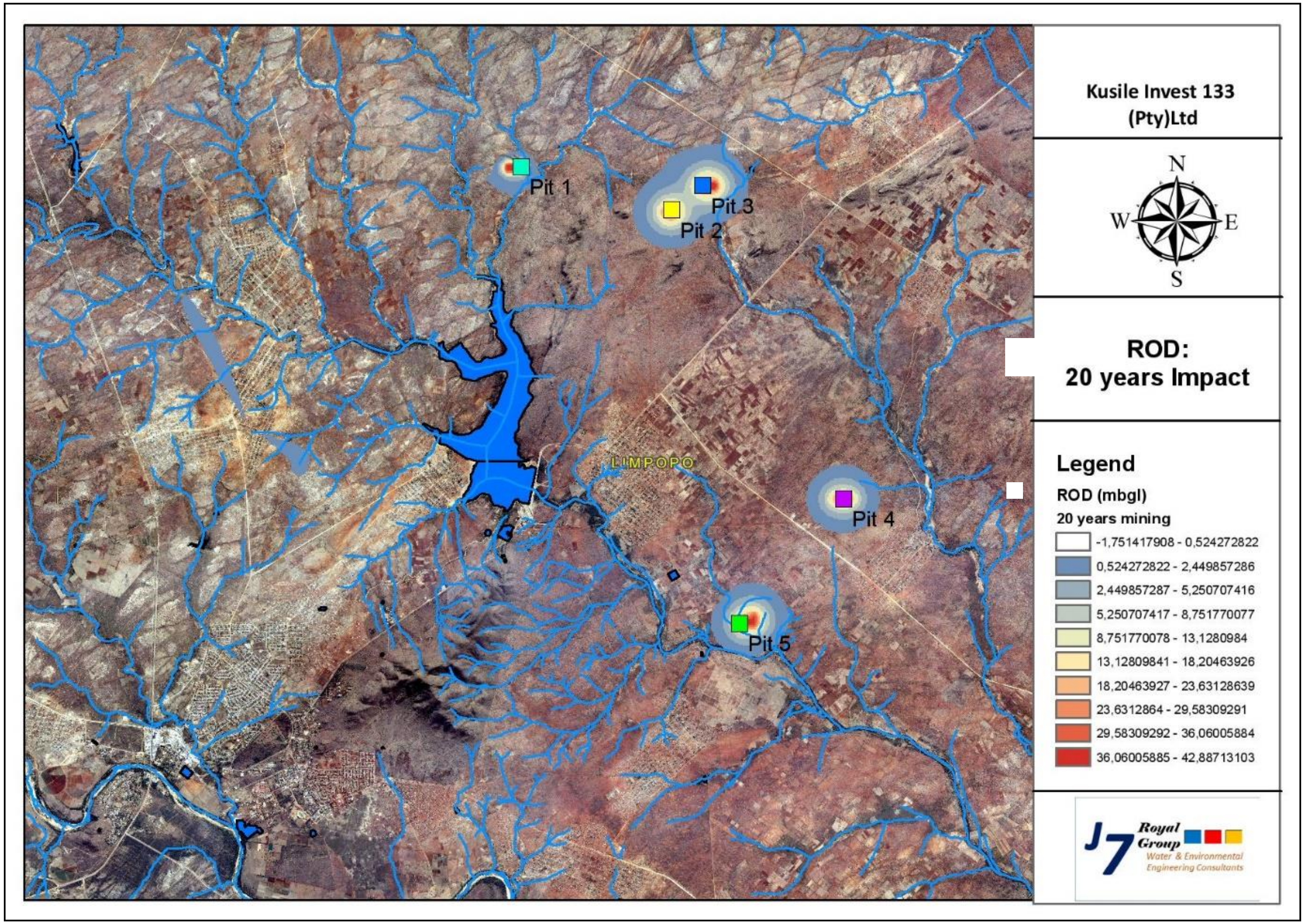

Figure 59 **Water Levels drawdown and zone of influence**

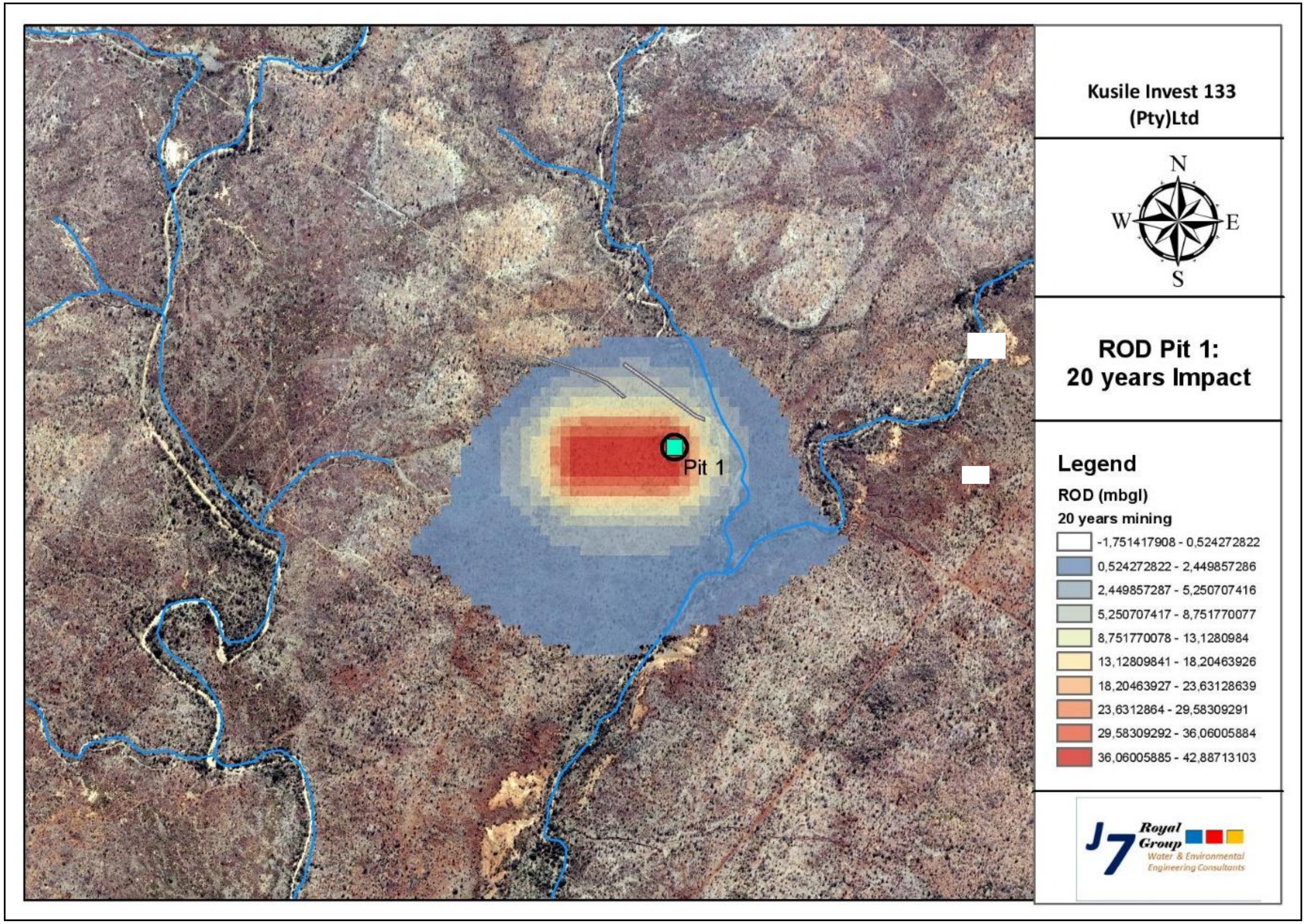

Figure 60 **Pit 1 Water Levels drawdown and zone of influence**

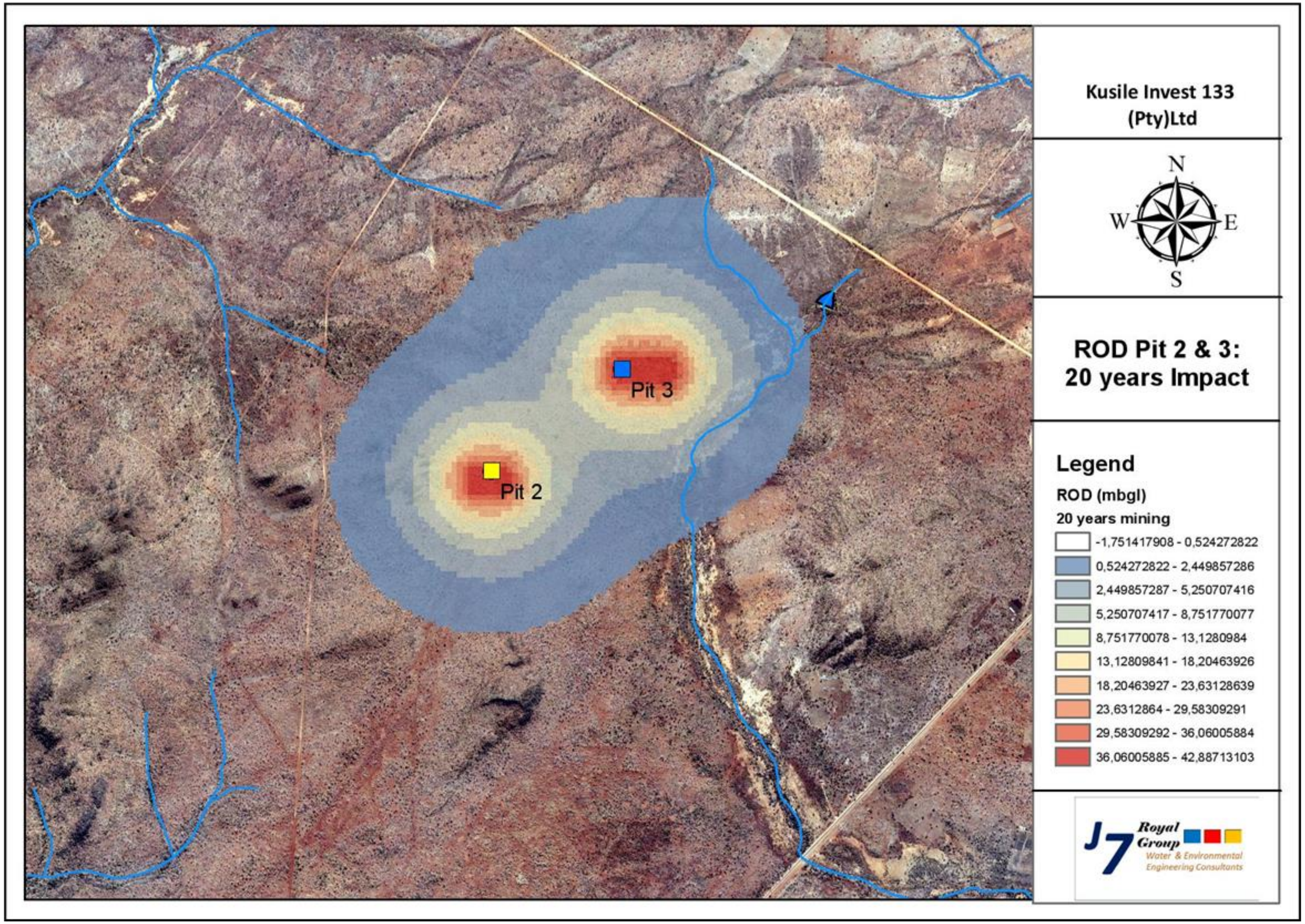

Figure 61 **Pit 2 and Pit 3 Water Levels drawdown and zone of influence**

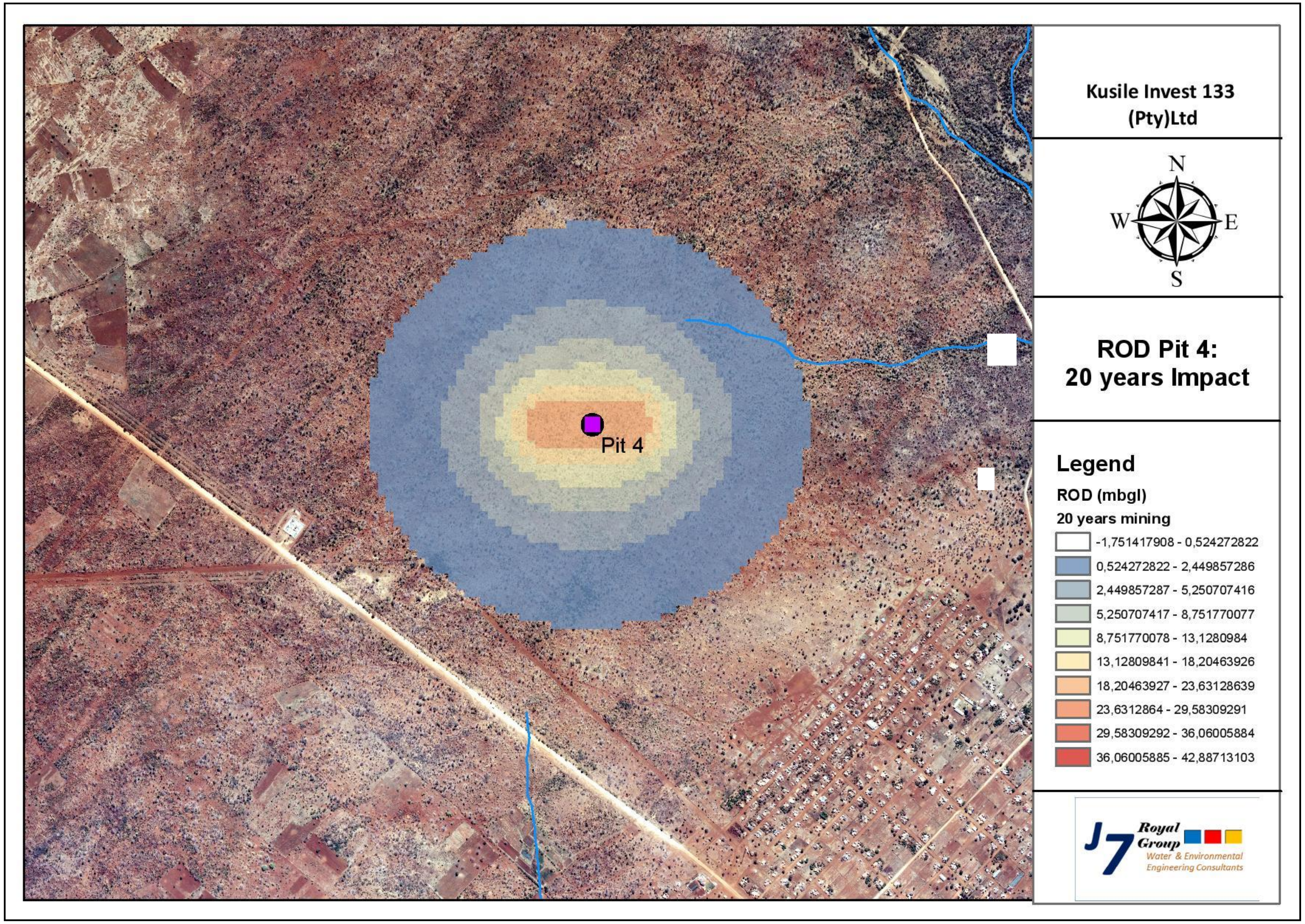

Figure 62 **Pit 4 Water Levels drawdown and zone of influence**

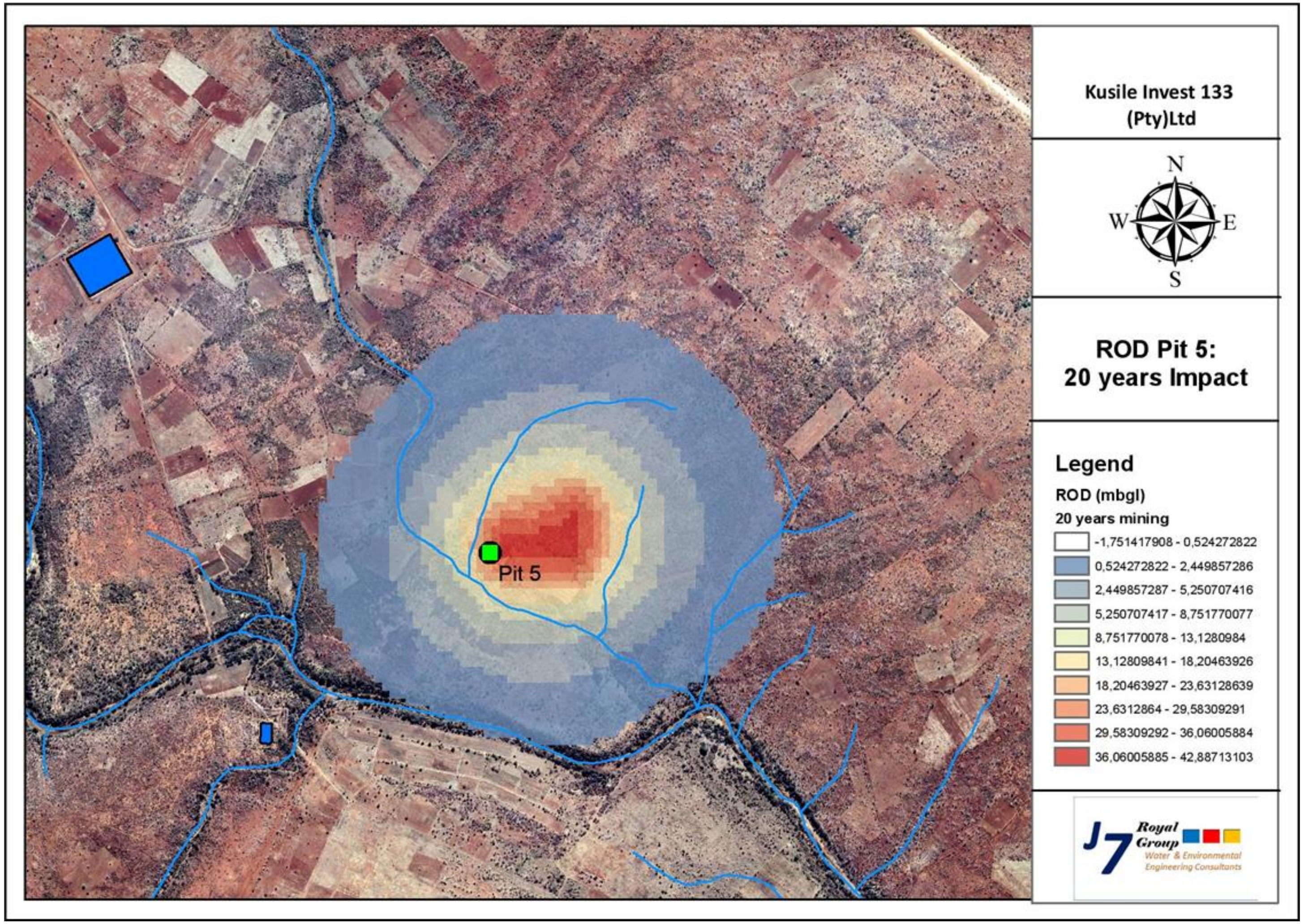

Figure 63 **Pit 5 water Levels drawdown and zone of influence**

1.9.3.5.8.6 Mass Transport with Simulated Dewatering

Following the potential post-operational water quality, the values quantified by UIS Laboratories was adapted and a conservative application of the data was applied with a TDS of 1160 mg/L (Table 4-13).

TABLE 31: mine relative abundances of acid and buffer capacity

No	Variable	TDS(mg/L)	SO4(mg/L)
1	Values used in the Model	**1160**	**0**

It has been observed from the water quality analysis that TDS is identified as the main constituent from the water quality sample. Seepage concentration of 1000mg/ℓ for TDS; were observed and used for numerical simulation as the final accumulation concentration

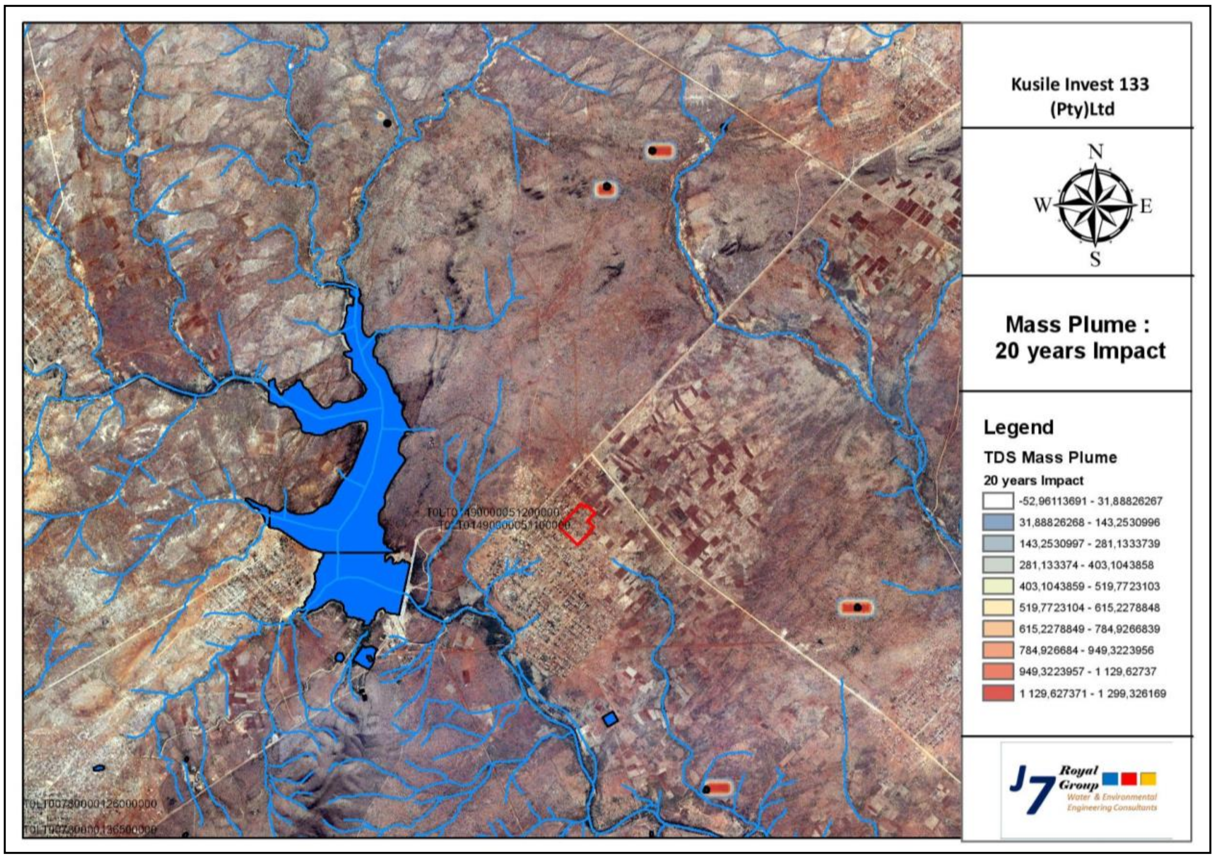

Figure 64 **Cumulative TDS mass plume in 20 years impacts**

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The mass transport model was conservatively simulated using advective transport with a regional porosity value of 2 - 3%.The background TDS concentration assigned to the regional area was 10 mg/ℓ.

The simulation results indicate a slow migration of mass from the TSF/WRD (Pit 1: Swartkoppies) and overburden stockpiles (Pit2 until Pit 5) and the following key observations:

- The TDS seepage from the TSF and overburden stockpiles is contained in the immediate facility of the rehabilitated pit,

- There is a tendency for the TDS to migrate towards the closest streams probably because of the groundwater movement directions along the drainages from the pit;
- The total migration distance towards the from TSF and overburden stockpiles is approximately 300m during the LoM and post-closure simulation. This would imply a migration rate of 0.001245m a day, without any seepage capturing methods implemented; and
- Groundwater monitoring boreholes should be drilled up gradient and down-gradient of the pit both shallow and deep boreholes to monitor the shallow and deep aquifer.
- Once monitoring data is available , numerical model must be updated

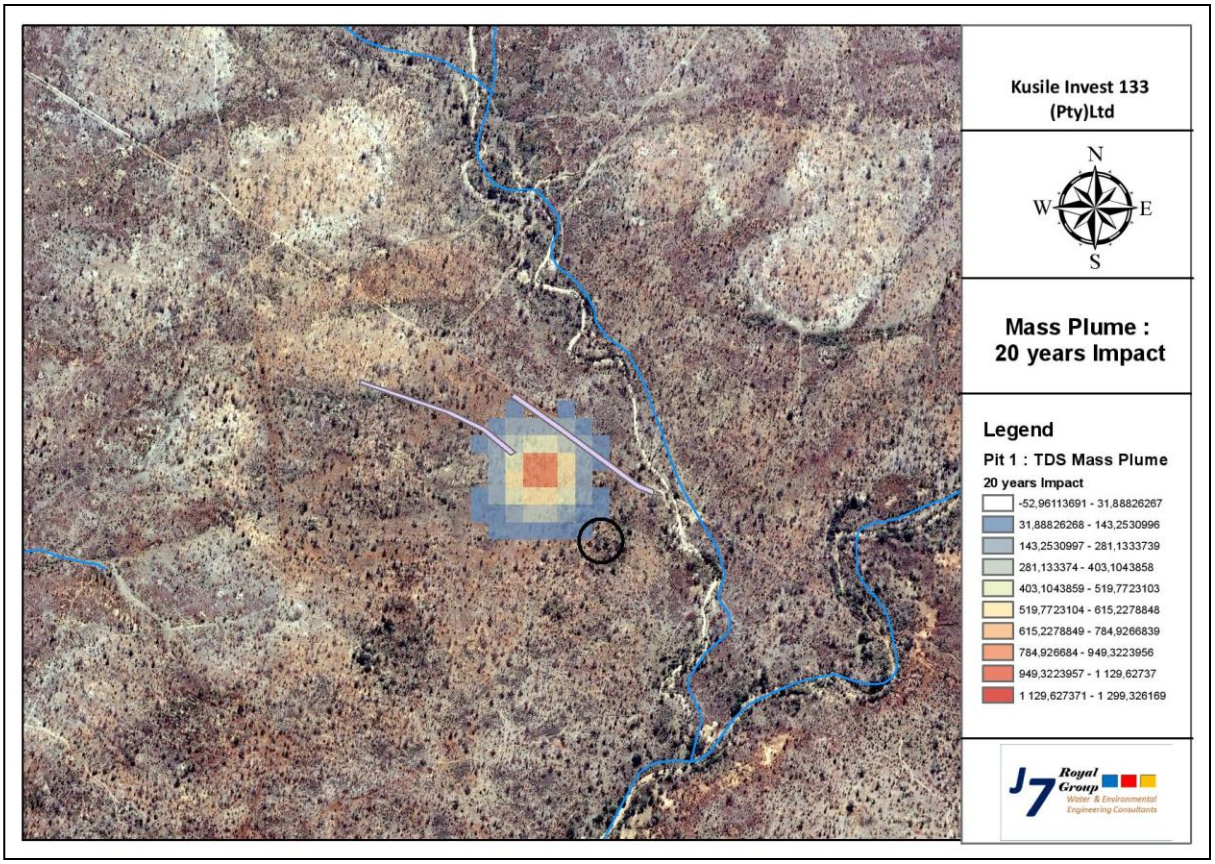

Figure 65 **Pit 1 TDS mass plume in 20years impact**

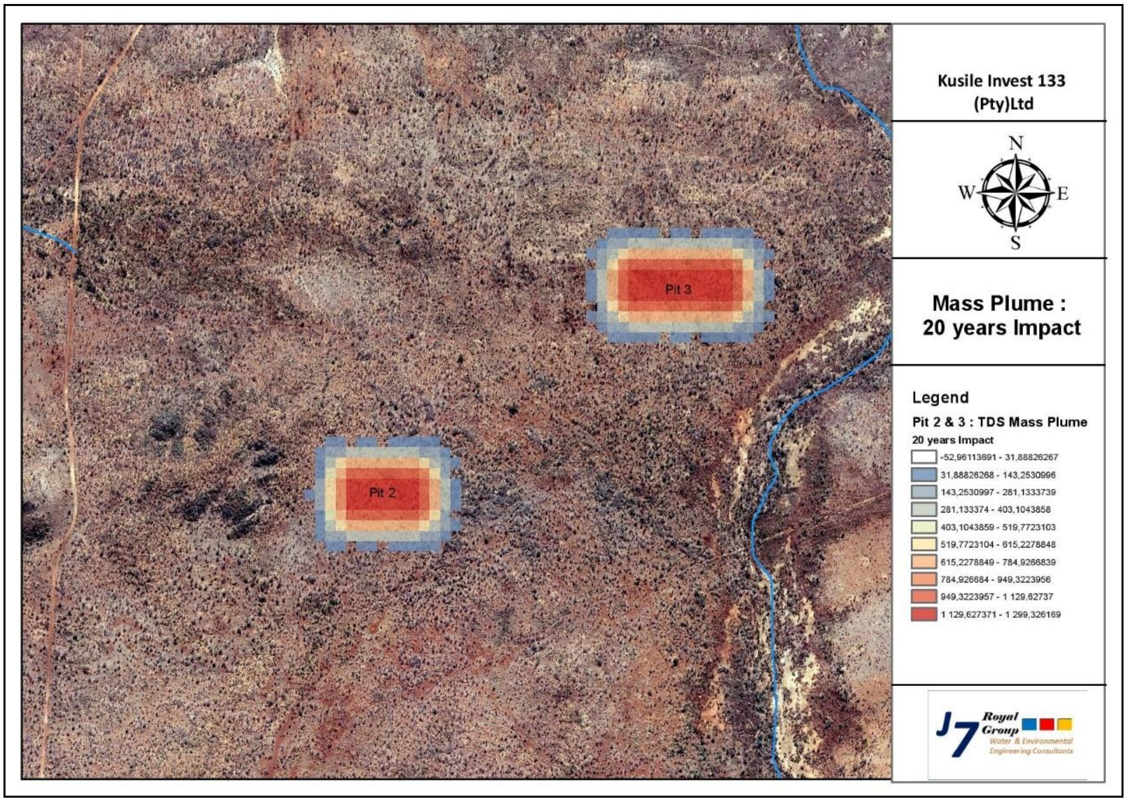

Figure 66 **Pit 2 and Pit3 TDS mass plume in 20years impact**

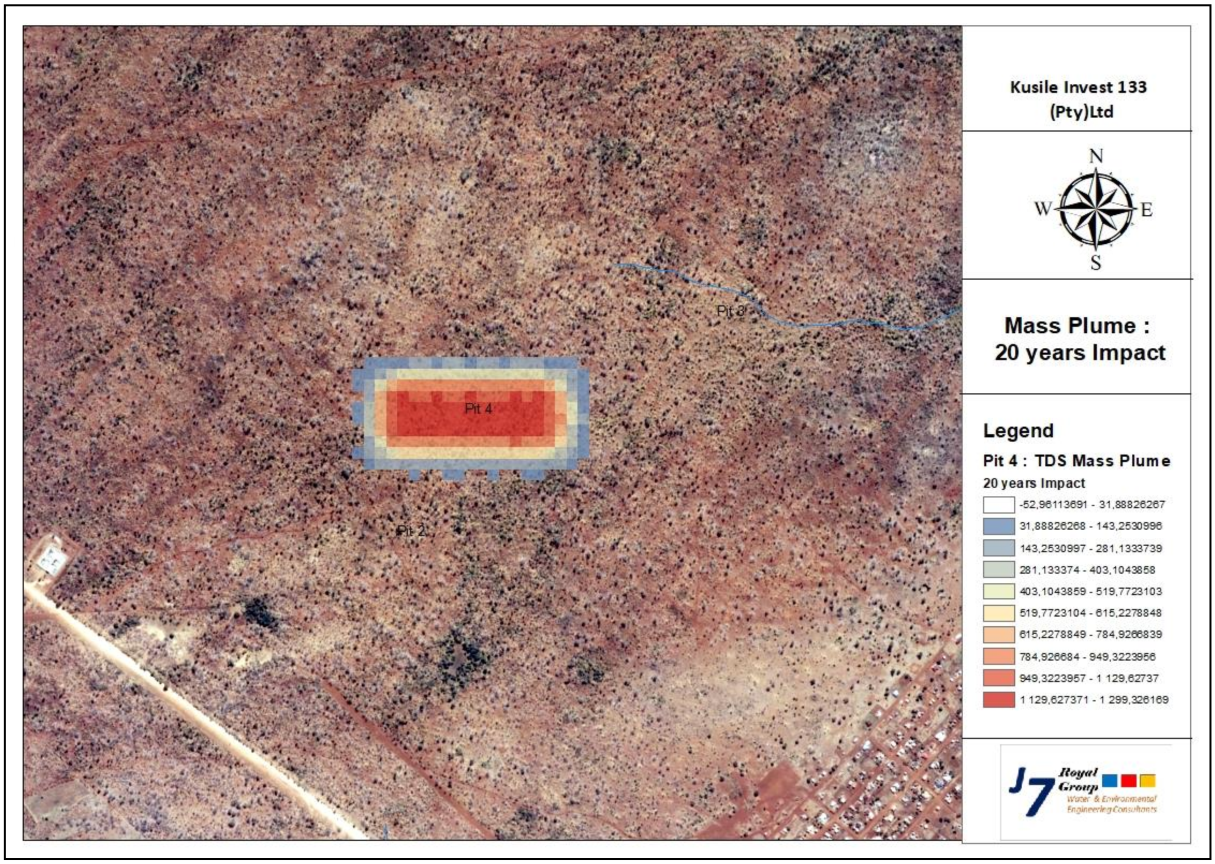

Figure 67 **Pit 4 TDS mass plume in 20years impact**

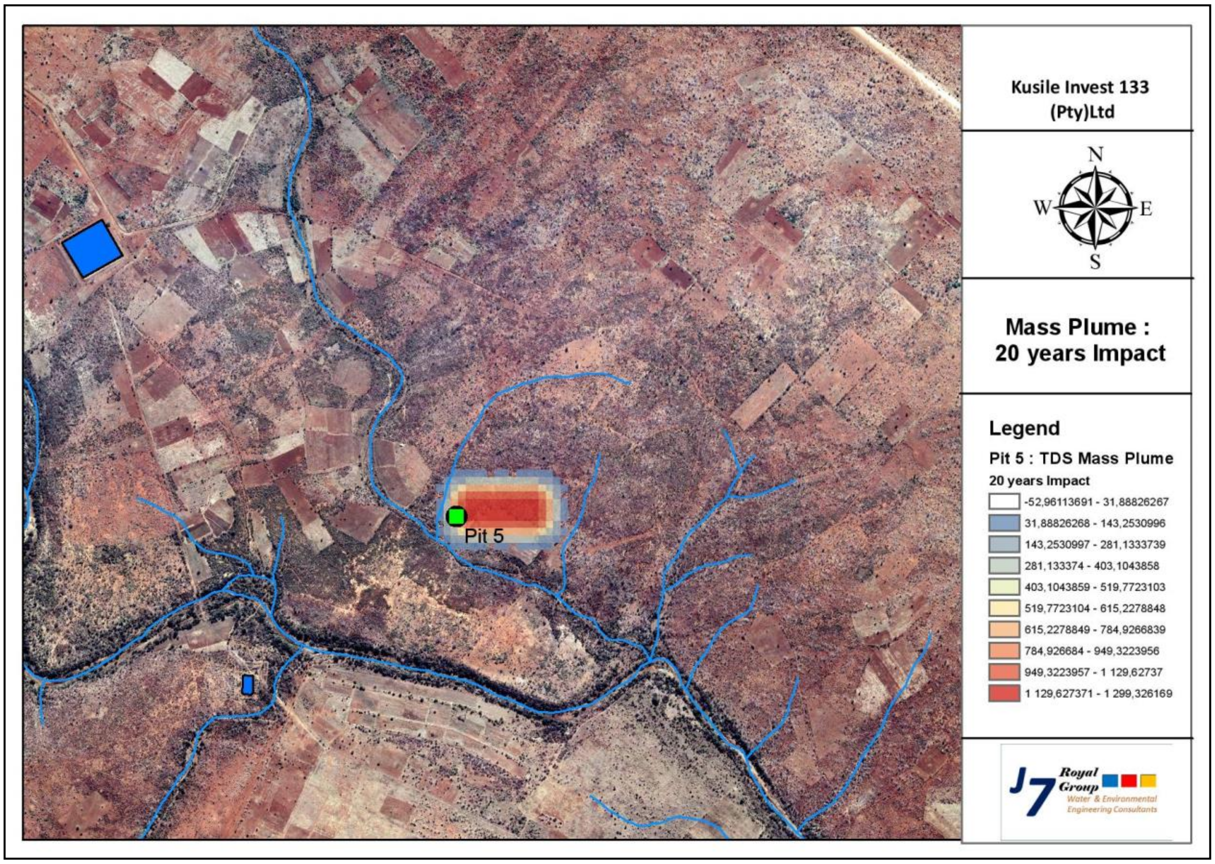

Figure 1-68 Pit 5 mass plume 20 years mining
Figure 69

1.9.3.5.8.7 WASTE ASSESSMENT

1.9.3.5.8.7.1 Standard Assessment Methodology:

Waste Classification Methodology

Assessment and classification of the coal sample was carried out according to requirements in Government Notice 635 National Norms and Standards for Assessment of Waste for Landfill. The classification is undertaken as follows:

1. Evaluation of the activities generating the waste streams and determination of relevant chemical elements and substances in relation to those listed in the Norms and Standards for Assessment of Waste for Landfill Disposal. According to the regulation, all the chemicals that could reasonably be expected to occur in the material being classified should be tested for. Hence, XRD and XRF results are taken into account.
2. Collection of samples of the relevant waste streams from the mine – in terms of the Waste Regulations and the NWA, and delivery of the samples to UIS Laboratories for analyses. Sampling was done on waste rock, tailings, as well as Run of Mine (ROM). Although ROM is not waste in terms of the NEMWA definition, it is also assessed for contextualisation of the waste stream results and since it may fall into the definition of waste in terms of the NWA.
3. Geochemical assessments of the samples and determination of Total Concentrations (TC) and Leachable Concentrations (LC) of the selected chemical elements and substances from section 6 of the Norms and Standards.
4. Determination of the type of waste based on an evaluation of the geochemical assessment results against the Total and the Leachable Concentration Threshold Limits in the Norms and Standards for assessment of waste for landfill.

Based on GNR 635, the type of waste can be determined as follows:

a. Material (or wastes) with any element or chemical substance concentration above the LCT3 or TCT2 limits (LC> LCT3 or TC> TCT2) are Type 0 Waste;

b. Wastes with any element or chemical substance concentration above the LCT2 but below or equal to the LCT3 limits, or above the TCT1 but below or equal to the TCT2 limits (LCT2 < LC ≤ LCT3 or TCT1 <TC ≤ TCT2), are Type 1 Waste;

c. Wastes with any element or chemical substance concentration above the LCT1 but below or equal to the LCT2 limits and all concentrations below or equal to the TCT1 limits (LCT1 < LC ≤ LCT2 and TC ≤ TCT1) are Type 2 Waste;

d. Wastes with any element or chemical substance concentration above the LCT0 but below or equal to the LCT1 limit and all TC concentrations below or equal to the TCT1 limits (LCT0 < LC ≤ LCT1 and TC ≤ TCT1) are Type 3 Waste;

e. Wastes with all element and chemical substance concentration levels for metal ions and inorganic anions below or equal to the LCT0 and TCT0 limits (LC ≤ LCT0 and TC ≤ TCT0), and with chemical substance concentration levels also below the corresponding limits for organics and pesticides, are Type 4 Waste.

Waste Classification Results

Total Concentrations of Arsenic (As), Barium (Ba), Copper (Cu) and Nickel (Ni) in all the samples exceeded Threshold Zero (TCT0) values, but are less than Threshold 1 (TCT0). Therefore, the materials would be classified as Type 3 Waste, based on the total concentrations of the said trace metals.

Table 5.7 presents the test results of reagent water leaching for the mono-disposed waste according to AS 4439.3 for the different materials. It is recommended that the rock samples are not strictly classified according to the TCT values because of the low TCT0 threshold values.

The AUC represents the average concentration of elements in the upper continental crust including rock (sub)-outcrops and serves as a background reference for the geochemical composition of rock near the earth's surface. The TCT0 for Ba and Cu are below the AUC; for As, Mn and Pb, the TCT0 is close to (not more than twice) the AUC. This implies that most natural rock and soils in the earth crust would classify as Type 3 waste based on the TCT0 value. Thus, for this analysis, only the LCT values will be used for classification of these materials.

For all material samples, reagent water leach LCs are below LCT0 values for the corresponding chemical elements and compounds.

- The waste rock and ROM would be classified as Type 4 Waste if only leachable concentrations are considered.
- The low leachable concentrations of constituents in the waste rock indicate that the risk from leachable constituents to contaminate the receiving environment, is low over the short term. Thus, there is a low risk of water resource pollution that may be attributable to contaminant mobilization over the short term (during operational phase).

- The slimes/tailings could be classified as Type 4 while still neutral (e.g. during operation). Since the material may acidify over the long-term upon oxidation, it should be classified as Type 3 Waste when disposed of over the long-term.
- Since the material comprises of natural rock material no organic chemicals, including petroleum hydrocarbons and pesticides, are expected to occur within it.

TABLE 32: Waste Classification Total Concentration Results (mg/kg)

Chemical Element/Substance	Waste Rock	ROM	Tailings	TCT0	TCT1	TCT2
As, Arsenic	7.48	13.4	10.8	5,8	500	2000
B, Boron	13.2	37.5	36.6	150	15000	6000
Ba, Barium	363	207	139	62,5	6250	25000
Cd, Cadmium	0.10	0.05	0.05	7,5	260	1040
Cr_{Total}, Chromium	265	1533	1097	46000	800000	N/A
Co, Cobalt	47.5	51.0	28.8	50	5000	20000
Cu, Copper	209	69.6	62.4	16	19500	78000
Hg, Mercury	0.03	0.04	0.08	0,93	160	640
Mn, Manganese	1307	878	729	1000	25000	100000
Mo, Molybdenum	0.67	0.76	0.62	40	1000	4000
Ni, Nickel	171	720	431	91	10600	42400
Pb, Lead	9.63	14.4	6.24	20	1900	7600
Sb, Antimony	0.35	0.57	2.27	10	75	300
Se, Selenium	0.51	0.23	0.18	10	50	200
V, Vanadium	217	110	111	150	2680	10720
Zn, Zinc	119	72.6	56.5	240	160000	640000
CN_{Total}, Cyanide Total	–	–	1.04	14	10500	42000

TABLE 33: Waste Classification Leachable Concentration Results (mg/L)

Analyses	Waste Rock	ROM	Tailings	LCT0	LCT1	LCT2	LCT3
As, Arsenic	0.002	0.003	0.003	0,01	0,5	1	4
B, Boron	0.070	0.097	0.058	0,5	25	50	200
Ba, Barium	0.268	0.340	0.222	0,7	35	70	280
Cd, Cadmium	<0.0001	<0.0001	<0.0001	0,003	0,15	0,3	1,2
Co, Cobalt	0.002	0.002	0.009	0,5	25	50	200
Cr_{Total}, Chromium	0.004	0.012	0.019	0.1	5	10	40
Cu, Copper	0.009	0.002	0.002	2,0	100	200	800
Hg, Mercury	<0.0001	<0.0001	<0.0001	0,006	0,3	0,6	2,4
Mn, Manganese	0.046	0.027	0.075	0,5	25	50	200
Mo, Molybdenum	0.001	0.002	0.001	0.07	3.5	7	28
Ni, Nickel	0.004	0.013	0.021	0,07	3,5	7	28
Pb, Lead	0.001	0.001	0.002	0,01	0,5	1	4
Sb, Antimony	0.001	0.001	0.003	0.02	1.0	2	8
Se, Selenium	<0.001	<0.001	<0.001	0,01	0,5	1	4
V, Vanadium	0.016	0.013	0.016	0,2	10	20	80
Zn, Zinc	0.007	0.006	0.019	5,0	250	500	2000

Analyses	Waste Rock	ROM	Tailings	LCT0	LCT1	LCT2	LCT3
Total Dissolved Solids*	60	100	148	1000	12 500	25 000	100 000
Chloride as Cl	1.37	0.92	5.23	300	15 000	30 000	120 000
Sulphate as SO_4	9.92	12.8	10.1	250	12 500	25 000	100 000
Nitrate as N	2.01	2.33	8.02	11	550	1100	4400
Fluoride as F	0.13	0.24	0.12	1,5	75	150	600
CN_{total}, Cyanide Total	–	–	<0.01	0.07	3.5	7	28

1.9.3.5.9 Waste Recovery and Reduction

Giyani Gold Mine will adopt the following principle for waste reduction and recovery in line with waste hierarchy plan as provided in the figure below.

(i) Key waste identified will be collected, handled, and disposed in accordance with the respective waste stream classification and legislation;

(ii) Opportunities for waste reduction, reuse, recycling and recovering will be regularly investigated and feasible opportunities implemented as part of the continual improvement philosophy adopted for the mining operation;

(iii) Mine residue dumps on the site will be rehabilitated in accordance with the nature of the deposited material and the contamination potential of the respective dumps as directed by legislation.

Waste reduction and recovery will be carried in the manner discussed in the tabulation below.

TABLE 34: Waste Recovery and Reduction

Waste stream	Description, management, reduction and recovery
Construction Phase	
Dirty storm water runoff	PCDs will be constructed prior to opening the box cut to contain dirty water from the box cut. Dirty water collected within the opencast pit will be pumped and channeled into a PCD located on the farm Swartkoppies. The storage capacity of the PCD will be approximately 140 000 m^3 and will accommodate 24 hr storm rainfall volume for the 1:50 year storm event. Clean storm water will be diverted around the dirty water areas using berms and channels.
Solid waste	Solid waste will be collected in bins and disposed of in existing licensed disposal sites around Giyani area. Waste will be separated into general waste, hazardous waste, metals, wood, glass and paper and recycled where possible. Certified contractors will be contracted to dispose of non-recoverable/recyclable waste into licensed waste disposal site.
Sewage	Chemical toilets will be made available on site for ablutions. These toilets will be serviced as required by a contractor. No washing facilities will be provided on site.
Construction Phase	

Waste stream	Description, management, reduction and recovery
Overburden (waste rock)	Temporary overburden stockpiles will be placed adjacent on the northern part of the open pit to facilitate concurrent backfilling of the mined-out areas. Rehabilitation will entail replacing any stockpiled blasted over-burden, inter-burden and parting material into the voids and then dressing with the sub-soil and then top-soil, contouring and re-vegetating.
Solid waste	All solid waste generated will be handled as during construction phase.
Sewage waste	Raw sewage and grey water from the mine offices and ablution facilities will be disposed of into package sewage treatment plants located on the farm Swartkoppies. The effluent from the sewage plants will be reused in the gold processing plant.
Decommissioning Phase	
Solid waste	The processing plant, offices, conveyors and other infrastructure will be removed and sold for re-use or disposed of as scrap.

1.9.3.6 Air Quality

1.9.3.6.1 Sensitive Receptors

Sensitive receptors identified in the immediate vicinity (Figure 20) of the study area and proposed project area have been listed below:

- The town of Giyani.

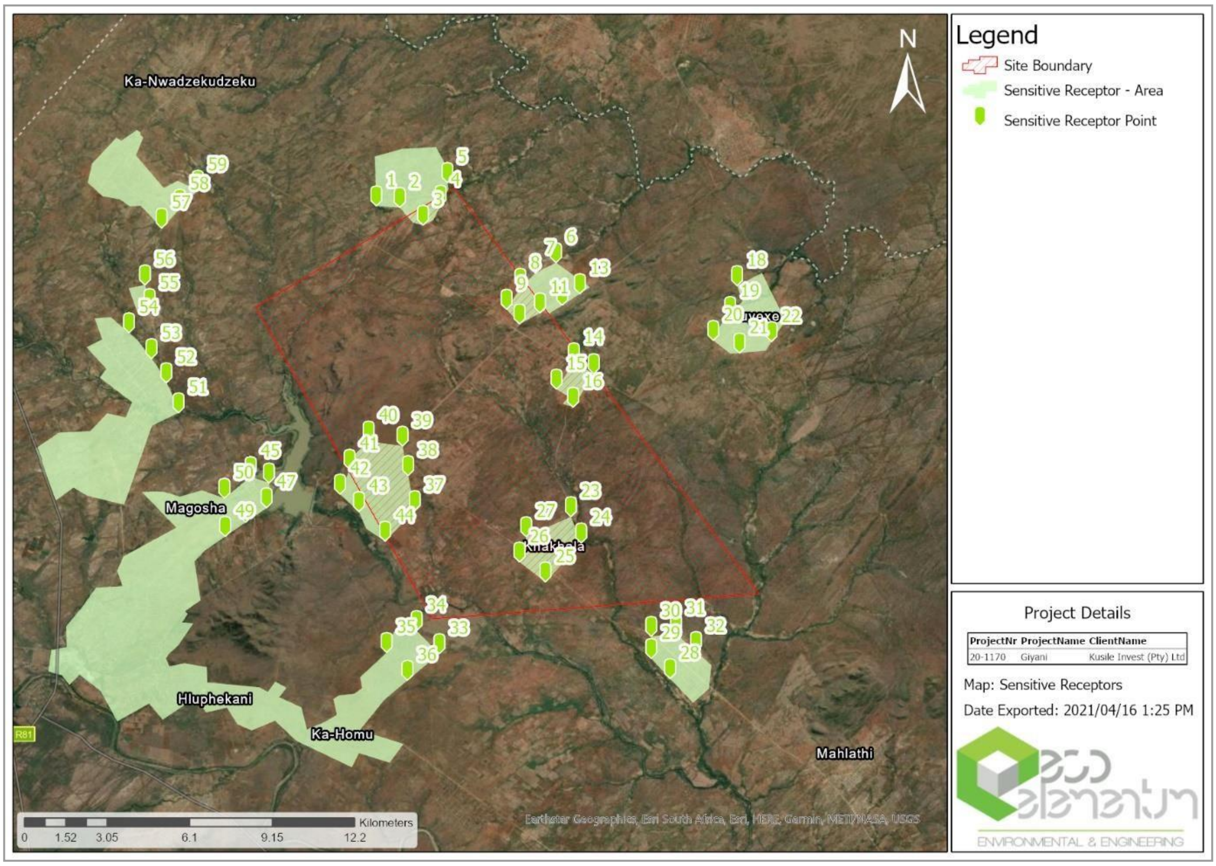

Figure 70**: Sensitive receptors in the immediate area of the mining boundary.**

1.9.3.6.2 Sources of Emissions

1.9.3.6.2.1 Vehicle Exhaust Gases

Vehicle exhausts contain a number of pollutants including carbon dioxide (CO²), carbon monoxide (CO), hydrocarbons, oxides of nitrogen (NOx), sulphur and PM10. Tiny amounts of poisonous trace elements such as lead, cadmium and nickel are also present. The quantity of each pollutant emitted depends upon the type and quantity of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed in the ambient air. Pollutant concentrations in the air can be measured or modelled and then compared with ambient air quality criteria.

1.9.3.6.2.2 Veld Fires

Veld fires are widespread across the world, occurring in autumn, winter and early spring. In addition to controlled burning for fire-breaks and veld management, many fires are set deliberately for mischievous reasons. Some are accidental, notably those started by motorists throwing cigarettes out of car windows. Emissions from veld fires are similar to those generated by coal and wood combustion. Whilst veld fire smoke primarily impacts visibility and landscape aesthetic quality, it also contributes to the degradation of regional scale air quality. Dry combustible material is consumed first when a fire starts. Surrounding live, green material is dried by the large amount of heat that is released when there are veld fires, sometimes this material also burn. The major pollutants from veld burning are particulate matter, carbon monoxide, and volatile organics. Nitrogen oxides are emitted at rates from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulphur oxides are negligible (USEPA, 1996).

1.9.3.6.2.3 Trucks Passing on the Roads, Loading and Offloading Raw Materials

Dust emissions occur when soil is crushed by a vehicle, as a result of the soil moisture level being low. Vehicles used on the roads will generate PM-10 emissions throughout the area and they carry soils onto the paved roads which would increase entrainment PM-10 emissions. The quantity of dust emissions from unpaved roads varies linearly with the volume of traffic.

1.9.3.6.2.4 Wind Erosion as a Result Of ROM Material and Topsoil Stockpiles

The topsoil and waste rock stockpiles generated during the construction phase will be minimal and probably used for construction purposes on site (berm and foundations for buildings), reason being that this will be limited to the mining areas – since the project is mainly an opencast operation. At the ROM stockpile, there will be constant transfer of ore from the opencast to the stockpile.

1.9.3.6.2.5 Material Handling (Loading, Hauling and Tipping)

Material handling during loading, hauling and tipping as mining processes has been known to have influence on dust generation in terms of increasing the fugitive dust emissions being generated. With the different kind of materials – topsoil, soft, and hard, tipping will be negligible. The tipping is mostly associated with the ROM at the processing plant vicinity. During these activities factors such as the surrounding wind regime, the material tipping rate, and the moisture content of the material all have an influence on the dust generation at the tipping transfer points.

1.9.3.6.3 DISPERSION MODEL

1.9.3.6.3.1 EMISSIONS INVENTORY

Table below describes the through put rates on which the calculations were based. In the quantification of the emissions the emission factor equations published by the US.EPA as well as the NPI compiled by the Australian Government were used. Summarised Emissions Inventory.

TABLE 35: Modelling Parameter Summary

Project Specific Information			
Type	**Spec**	**Quantity**	**Unit**
Material	ROM	12 000	tpm

Material Bulk Density	ROM	2.745	g/cm^3
Operations	Hours*	24	
	Days*	31	
Stockpile - ROM	Height*	15	m
Stockpile - OVB	Height*	30	m
Stockpile - Tailings	Height*	30	m
Haul Road – Pit 2-3-4-5	Width*	9	m
	Length*	3	km
	Trips	0.7	per h
	VKT	2.09	per h
Haul Road – Pit 2-3	Width*	9	m
	Length*	1	km
	Trips	0.35	per h
	VKT	0.35	per h
Haul Road – Pit 3	Width*	9	m
	Length*	0.87	km
	Trips	0.17	per h
	VKT	0.15	per h
Haul Road – Access, Pit 4-5	Width*	9	m
	Length*	4.8	km
	Trips	0.35	per h
	VKT	1.67	per h

Project Specific Information			
Type	**Spec**	**Quantity**	**Unit**
Haul Road – Pit 4-5	Width*	9	m
	Length*	4.6	km
	Trips	0.35	per h
	VKT	1.6	per h
Haul Road – Pit 4	Width*	9	m
	Length*	1	km
	Trips	0.17	per h
	VKT	0.17	per h
Haul Road – Pit 5	Width*	9	m
	Length*	2.5	km
	Trips	0.17	per h
	VKT	0.44	per h
Haul Trucks	Type	Bell B40D	
	Height	4.2	m
	Width	3.8	m
	Payload	37	t
Note:	* Assumed		

TABLE 36: NPI Emission Factors

NPI Emission Factors				
Operation	**TSP**	**PM10**	**Units**	**Rating**
Handling Transfering and Conveying	0.005	0.002	kg/t	U
Wind Erosion	0.4	0.2	kg/ha/h	U
Haul Road	4.23	1.25	kg/VKT	B
Primary Crushing	0.2	0.02	kg/t	C
Secondary Crushing	0.6	0.06	kg/t	D

Many published emission factors have and associated emission factor rating (EFR) code. These EFR codes are based on rating systems developed by the USEPA and by the European Environmental Agency. See Table 13 below.

TABLE 37: Emission Factor Ratings

Factor Ratings	
A	Excellent
B	Above Average
C	Average
D	Below Average
E	Poor
U	Unrated

1.9.3.6.4 Mitigation Measures

1.9.3.6.4.1 Material Handling

According to the Australian NPI, dust generation from material transfer points can be reduced by 50% where water sprays are applied. Adding wind break can reduce the dust emissions with 30%. Enclosing the operations, the emissions will become insignificant.

1.9.3.6.4.2 Opencast Pit

50% mitigation on the various operations can be achieved using water sprays according to the Australian NPI.

1.9.3.6.4.3 Stockpile

Wind erosion from stockpiles can be mitigated by 50% using water sprays according to the Australian NPI.
Revegetation of stockpiles can bring 90% mitigation.
Total enclosure of the stockpiles can mitigate erosion by 99%. (Also from the Australian NPI.)
Vegetal cover retards erosion by binding the residue with a root network, by sheltering the residue surface and by trapping material already eroded. Vegetation is considered the most effective control measure in terms of its ability to control water erosion. In investigating the feasibility of vegetation types the following properties are normally

taken into account: indigenous plants; ability to establish and regenerate quickly; proven effective for reclamation elsewhere; tolerant to the climatic conditions of the area; high rate of root production; easily propagated by seed or cuttings; and nitrogen-fixing ability.

The long-term effectiveness of suitable vegetation selected for the site will be dependent on (a) the nature of the cover, and (b) the availability of aftercare. The Department of Minerals and Energy in Western Australia in its Guidelines on the Safe Design and Operating Standards for Tailings Storages (1996), for example, stipulates a covering of a minimum of 500 mm of suitable waste rock, followed by a layer of topsoil (or growth medium) and subsequent seeding. According to these guidelines all external surfaces should have a self- generating cover compatible with the surrounding environment

1.9.3.6.4.4 Haul Road

For haul roads the Australian NPI indicate that dust emissions can be mitigated by 50% for level 1 watering (2 litres/m²/h) or 75% for level 2 watering (>2 litres/m²/h).

Sealing the road or salt-encrusted roads can mitigate 100% according to the Australian NPI.

The roads on-site were identified as the most significant source of dust emissions. Three types of measures may be taken to reduce emissions from unpaved roads:

- measures aimed at reducing the extent of unpaved roads, e.g. paving,
- traffic control measures aimed at reducing the entrainment of material by restricting traffic volumes and reducing vehicle speeds, and
- measures aimed at binding the surface material or enhancing moisture retention, such as wet suppression and chemical stabilization (EPA, 1987; Cowhert *et al.*, 1988; APCD, 1995).

Given the indication that unsurfaced roads would be watered, control efficiencies which may be achieved through wet suppression were investigated. In addition, the reduction in vehicle entrainment due to reduced vehicle kilometres travelled are also included.

Permanent improvements in travel surfaces, such as the paving of a road, results in continuous control efficiencies. The control efficiencies obtained by wet suppression and the use of chemical stabilizers are, however, cyclic rather than continuous by nature as indicated previously. The efficiency afforded by the application of water or chemicals decay over time, requiring periodic reapplication to maintain the desired average efficiency (Cowherd et al., 1988). The following empirical model for the estimation of the average control efficiency of watering, developed by the US-EPA (EPA, 1996), can be applied in the estimation of control efficiencies achievable by unpaved road watering

$$C = 100 - (\frac{0.8pdt}{i})$$

programmes:

Where,

c = average control efficiency (%)

d = average hourly daytime traffic rate (hr-1) i = application intensity (litres per m2)

t = time between applications (hr)

p = potential average hourly daytime evaporation rate (mm/hr)

TABLE 38: Calculated Source Emission Rates Summary

Emissions Released

Operation	Unmitigated			Mitigated				
	TSP	PM10	Unit	TSP	PM10	Unit	Reduction	Method
Material Handling	2.24E-02	8.96E-03	g/s	1.12E-02	4.48E-03	g/s	50%	Water Sprays
Wind Erosion	1.11E-05	5.56E-06	g/s/m²	5.56E-06	2.78E-06	g/s/m²	50%	Water Sprays
				1.11E-06	5.56E-07	g/s/m²	90%	Revegetation on OB and Topsoil

Emissions Released								
Operation	Unmitigated			Mitigated				
	TSP	PM10	Unit	TSP	PM10	Unit	Reduction	Method
Haul Road - Pit 2-3-4- 5	2.73E-04	8.07E-05	g/s/m²	2.73E-05	8.07E-06	g/s/m²	90%	Sealed or Salt-Encrusted roads
Haul Road - Pit 2-3	4.55E-05	1.35E-05	g/s/m²	4.55E-06	1.35E-06	g/s/m²	90%	Sealed or Salt-Encrusted roads
Haul Road - Pit 3	1.98E-05	5.85E-06	g/s/m²	1.98E-06	5.85E-07	g/s/m²	90%	Sealed or Salt-Encrusted roads
Haul Road - Access, Pit 4-5	2.19E-04	6.46E-05	g/s/m²	2.19E-05	6.46E-06	g/s/m²	90%	Sealed or Salt-Encrusted roads
Haul Road - Pit 4-5	2.09E-04	6.19E-05	g/s/m²	2.09E-05	6.19E-06	g/s/m²	90%	Sealed or Salt-Encrusted roads
Haul Road - Pit 4	2.28E-05	6.73E-06	g/s/m²	2.28E-06	6.73E-07	g/s/m²	90%	Sealed or Salt-Encrusted roads
Haul Road - Pit 5	5.69E-05	1.68E-05	g/s/m²	5.69E-06	1.68E-06	g/s/m²	90%	Sealed or Salt-Encrusted roads
Primary Crushing	0.90	0.09	g/s	4.48E-01	4.48E-02	g/s	50%	Water Sprays
Secondary Crushing	2.69	0.27	g/s	1.34E+00	1.34E-01	g/s	50%	Water Sprays

1.9.3.6.5 MODELLING RESULTS

Isopleth plots are shown in the images below to visually show the predicted ground level concentrations of PM10.

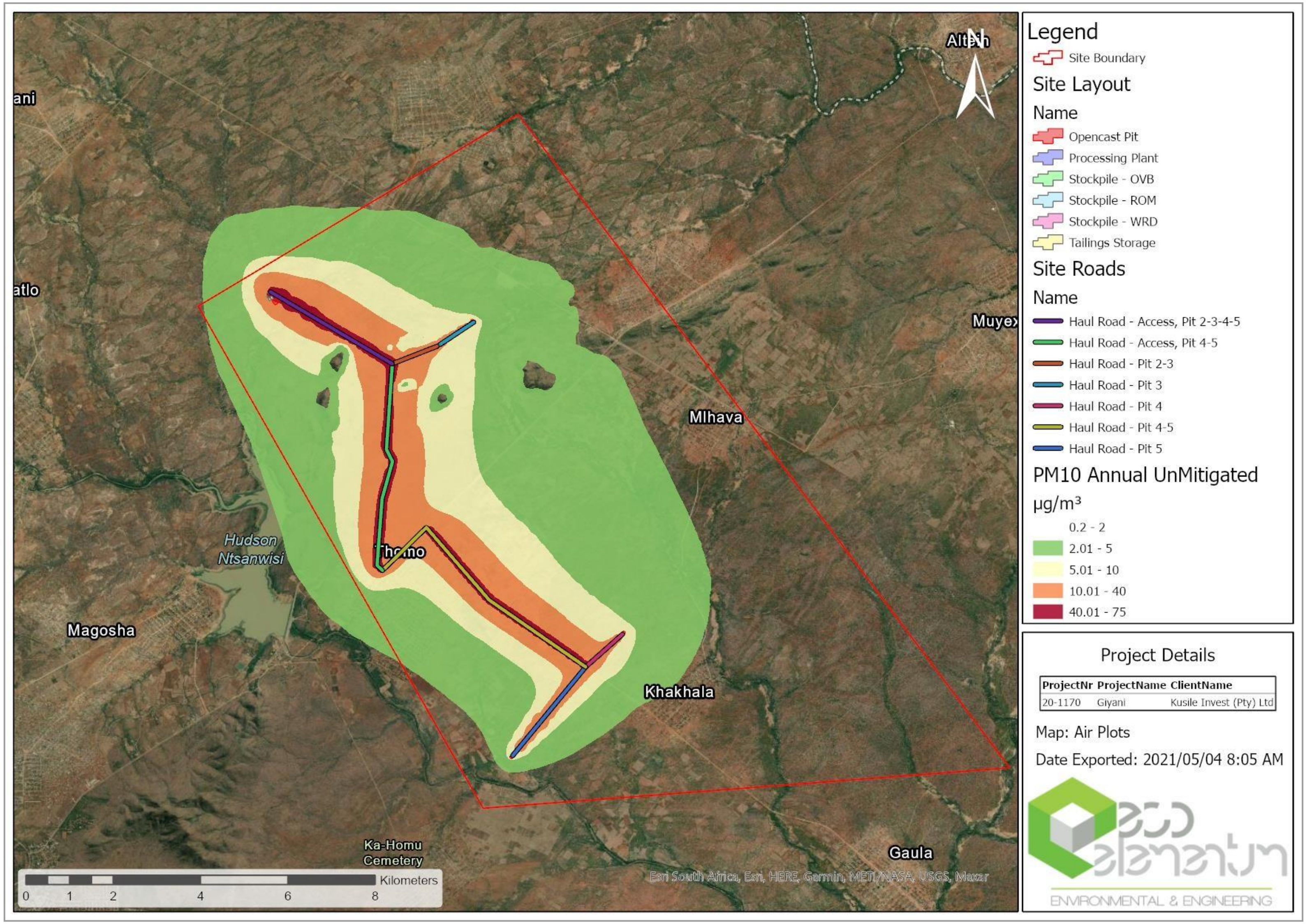

Figure 71**: Predicted average annual concentrations for PM10 for the proposed Giyani project when unmitigated.**

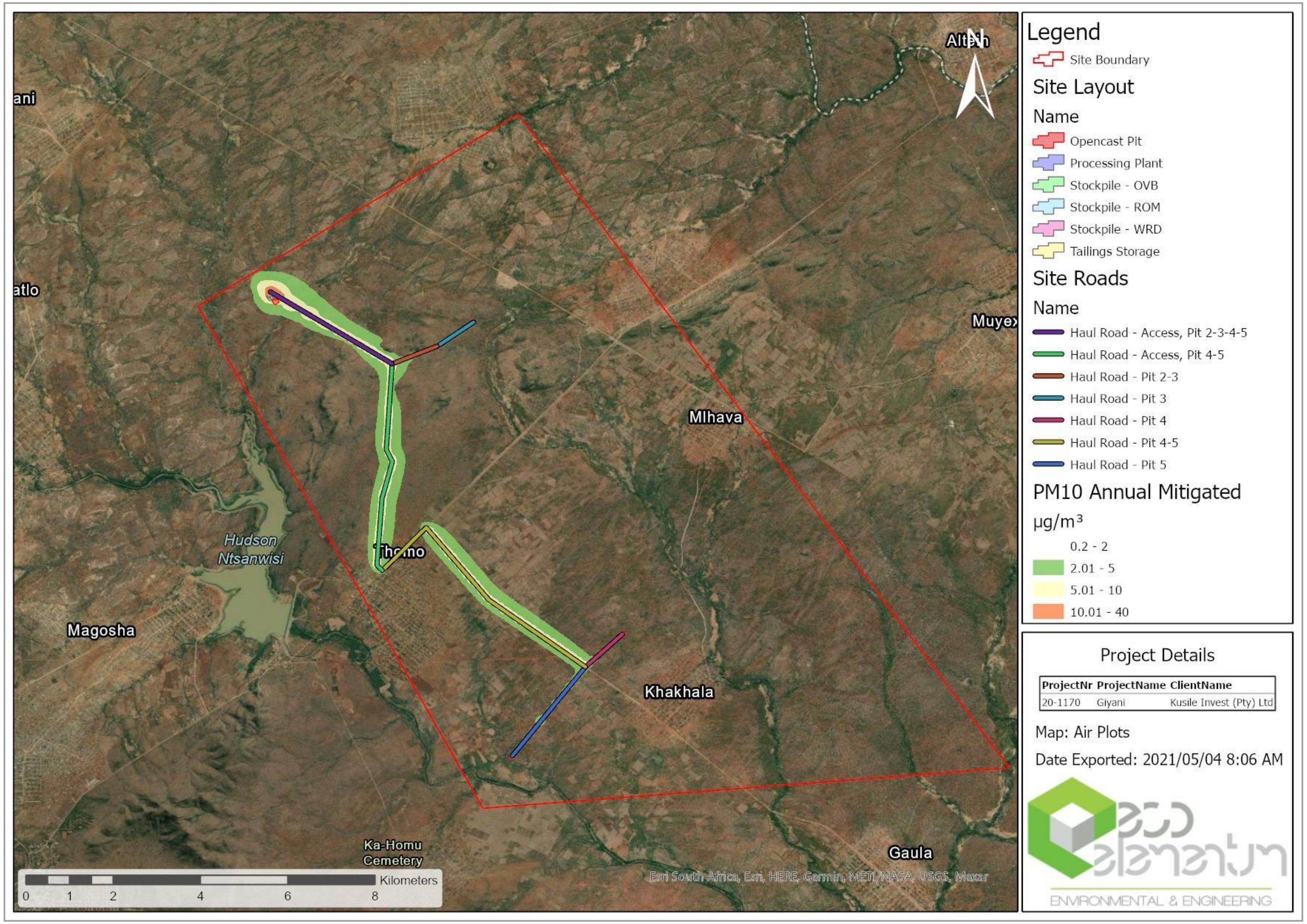

Figure 72**: Predicted average annual concentrations for PM10 for the proposed Giyani project operations when mitigated.**

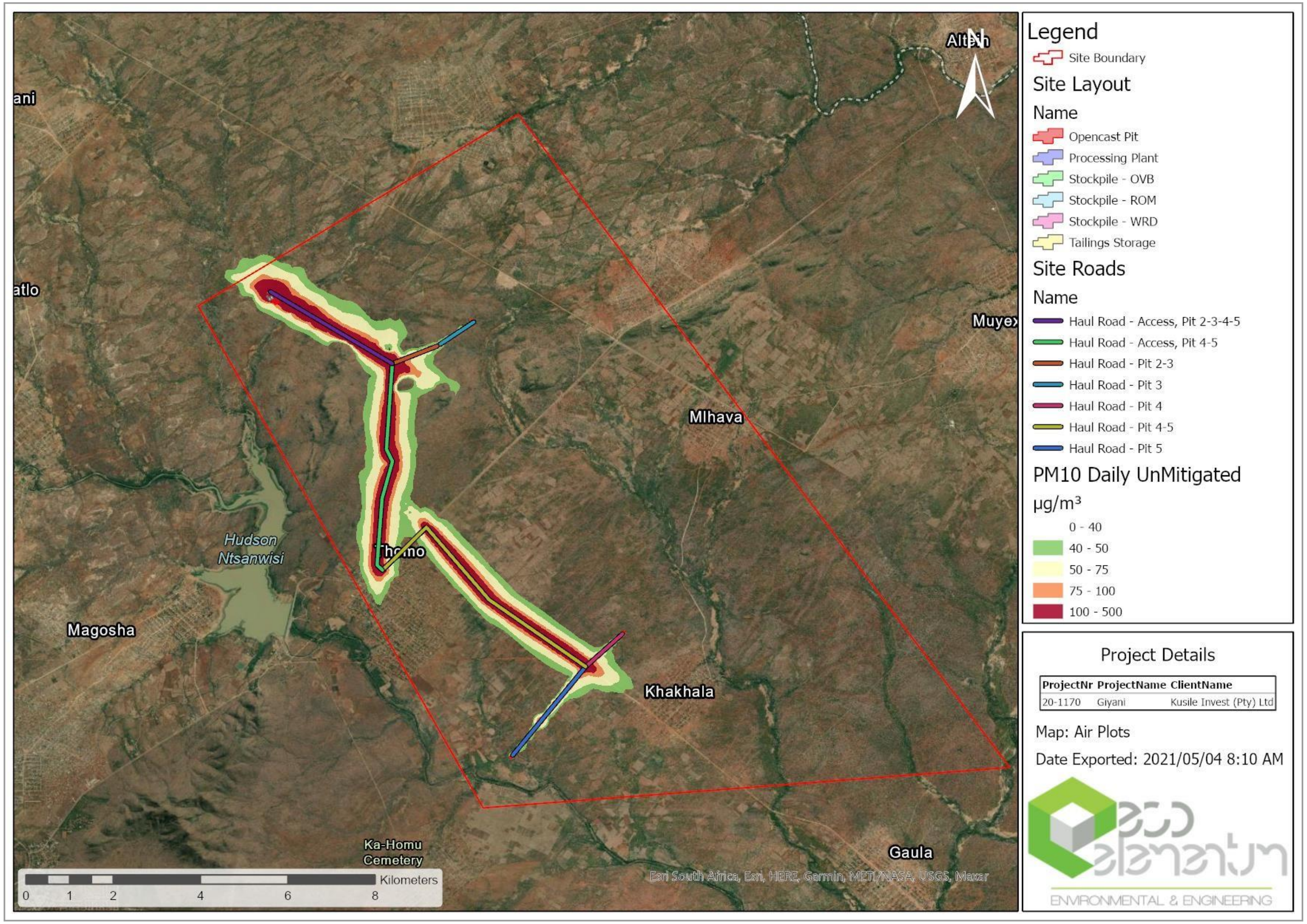

Figure 73**: Predicted 2nd Highest daily concentrations for PM10 for the proposed project operations when unmitigated.**

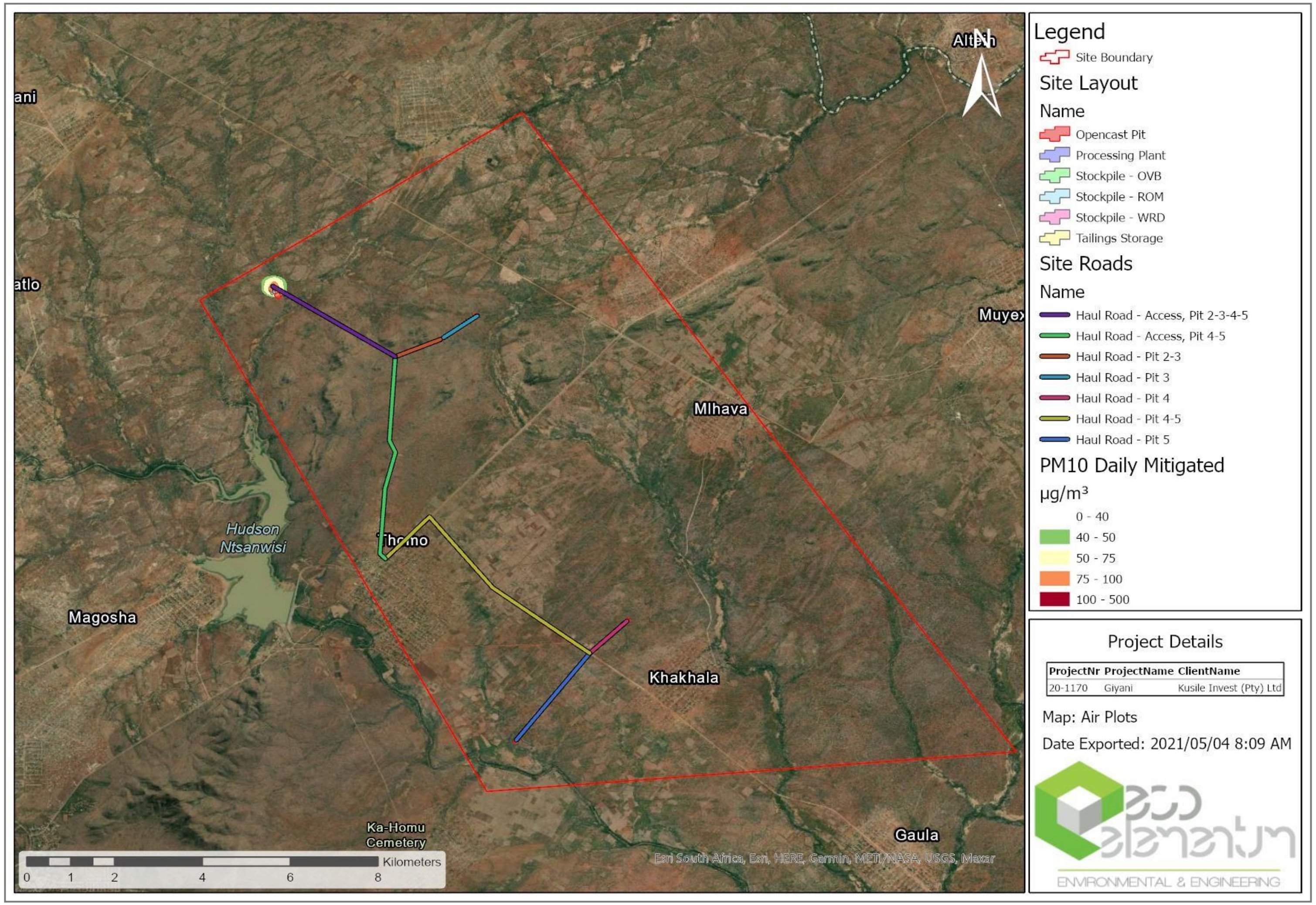

Figure 74:**Predicted 2nd Highest daily concentrations for PM10 for the proposedGiyani project operations when mitigate**

1.9.3.7 Baseline Ambient Noise

A site visit was carried out in March 2021 during the daytime as it is the busiest and most noise sources are recorded to determine the activities that takes place in an around the proposed Site that contribute to the prevailing ambient noise level of the study area. Measuring points were identified to measure and determine the prevailing ambient noise levels of the proposed Site. The noise measurements were done in terms of prescribed recommendations.

The following strategy was followed:

- Identification of sensitive receptors surrounding the project area in relation to spatial location
- Measurement of ambient noise level of the identified areas

The ambient noise levels in the affected areas were determined via noise measurements, in accordance ISO standards for:

➢ The measurement and assessment of environmental noise:

- ISO 1996-1:2003 "Acoustics – Description, assessment and measurement of environmental noise – Part 1: Basic quantities and assessment procedures."
- ISO 1996-2:2007 "Acoustics – Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels.
- ISO 1996-3:2003. "Acoustics – Description and measurement of environmental noise -- Part 3: Application to noise limits."

1.9.3.7.1 Noise sampling assessment

The existing ambient noise climate in the vicinity and on the project area was undertaken in accordance with the requirements of the South African National Standard SANS 10103:2008, *The measurement and rating of environmental noise with respect to annoyance and to speech communication*. SANS 10328:2008, *Methods for environmental noise impact assessment* were also closely adhered to.

For the noise study a Quest Technologies Sound Pro SE/DL Handheld Sound Level Meter and Real Time Frequency Analyzer which can measure both class I and class II frequencies were used. To establish ambient noise levels on the property the equivalent noise level (L_{Aeq}), the maximum sound pressure level (L_{Amax}) and the minimum sound pressure level (L_{Amin}) were recorded during the 10min running average per sampling location.

The meter was set up at each measurement site/sampling location with the microphone height at 1, 3 meters above the ground level and well clear of any reflecting surfaces (minimum of 5 meters clearance). Since there was no wind present during sampling it was not necessary for the standard wind shield cover over the microphone.

Quest Technologies Sound Pro SE/DL Sound Level Meter

In addition, the following measures were taken into account during the assessment:

- minimum duration of measurement;
- microphone positions and height above ground level;
- calibration procedures and instrument checks; and
- Supplementary weather measurements and observations.

1.1.1 Study approach

Sampling locations were chosen in such a manner to enable the researchers to achieve a holistic representation of the study site. The purpose of a baseline study is to determine the existing ambient noise in the area of future influence. For a baseline study it is necessary to not only take samples on the borders of the property but all across the site since there is not a point/source of pollution/impact on the ambient environmental climate to determine buffering sample distances. Therefore, it is imperative to understand the initial cumulative impacts and later compare the change when the proposed mine starts to operate.

The human ear is more accurate with auditory observations but the margin for human error is too large to include physical olfactory observations in a scientific study of this nature.

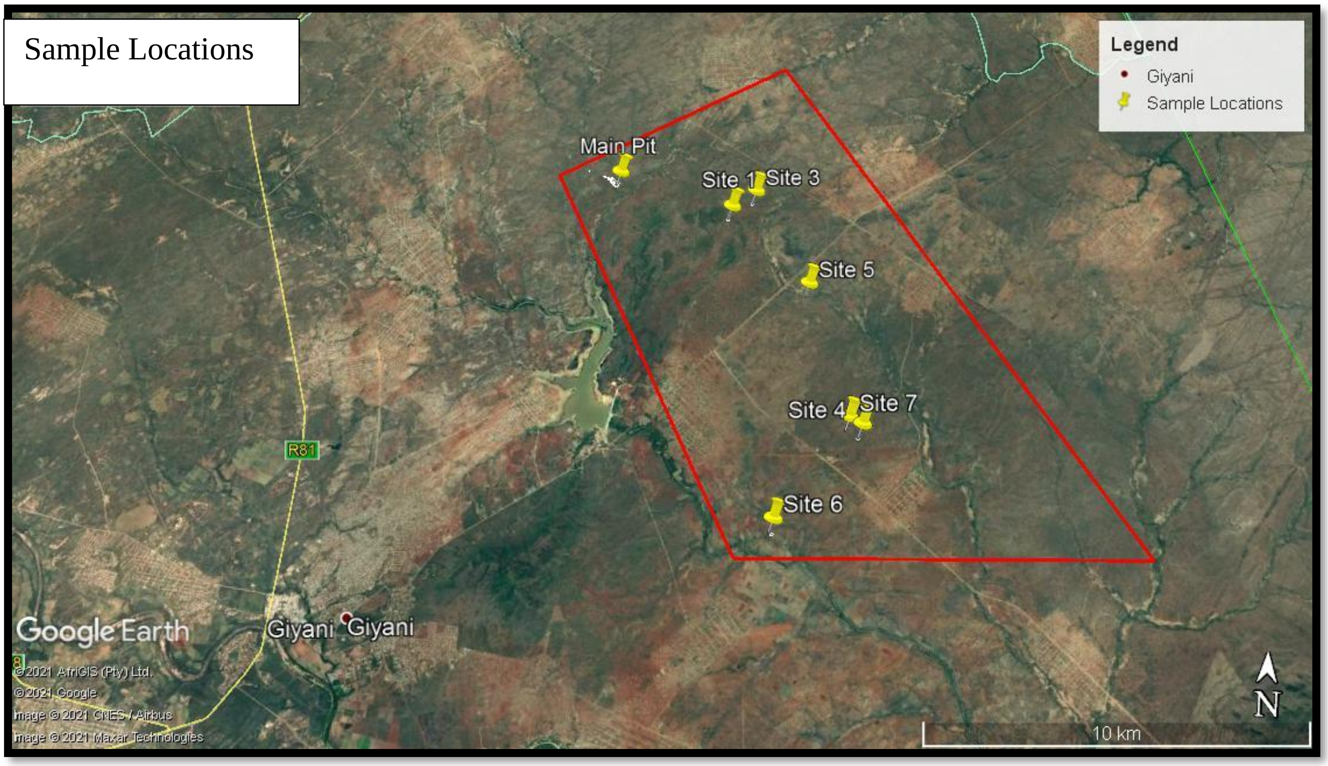

Figure 75: Map showing location of all 9 measured points close to sensitive receptors

1.9.3.7.2 Study Area Sensitivity Analysis

. This area is already a disturbed area as there is an access road which will also be used by traffic to the proposed Site. The prevailing ambient noise levels for the study area are made up from the existing activities notably from the existing road network, seasonal farming activities and fauna activities. The people living in within the area exposed to rural noise levels as notably there are villages in the area.

The following two aspects are important when considering potential noise impacts of a project:

- The increase in the noise level because of the construction (temporary increase) and operational phases (more permanent of nature); and
- The overall noise level produced by the activities on the proposed project area.

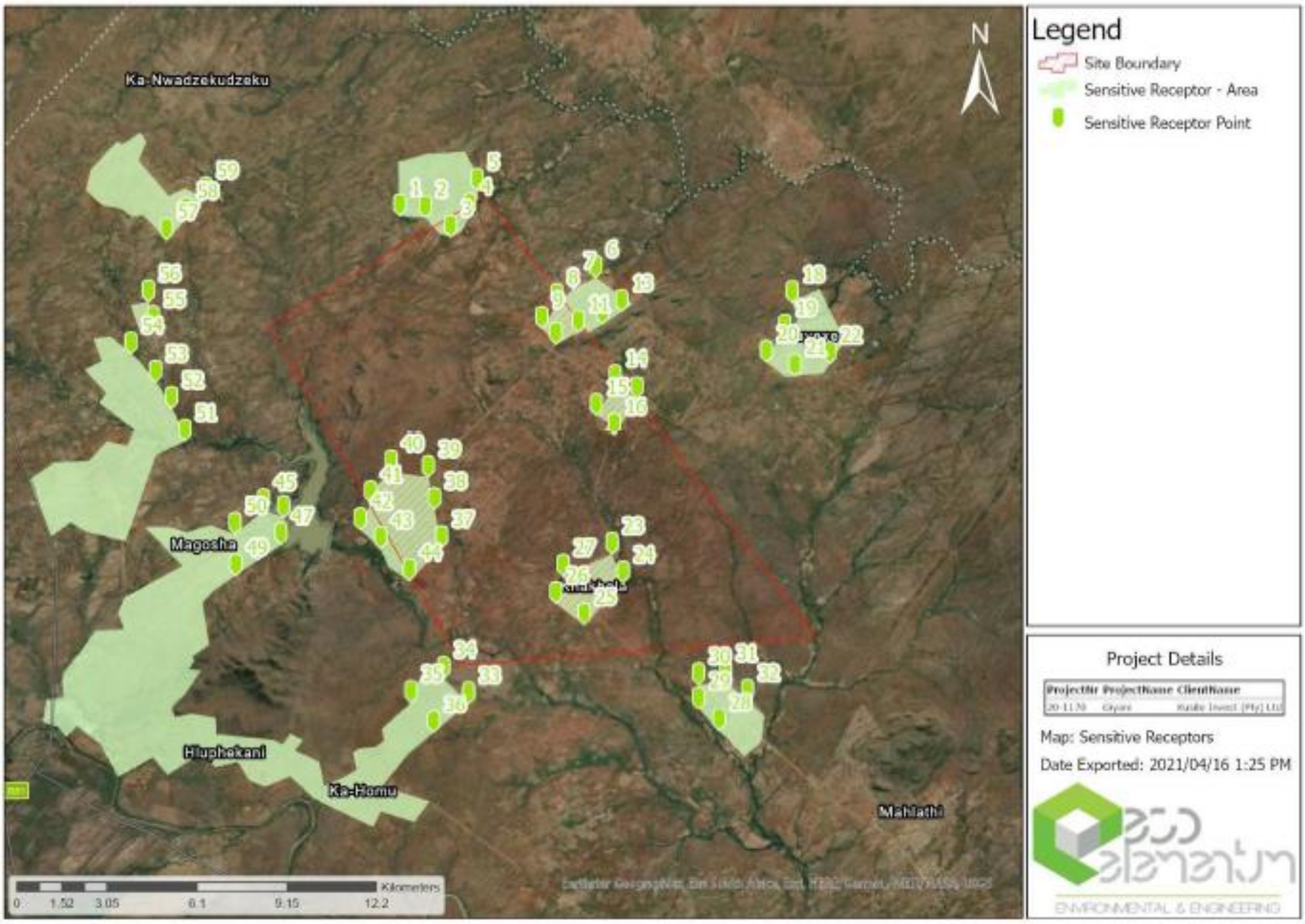

Figure 76: Sensitive areas and Population areas within the immediate vicinity of the proposed Giyani project.

1.9.3.7.3 Recorded Noise Levels

The noise levels recorded where indicative of each activity taking place in the proposed mining area. The noise levels closer to the mining permit activities where high with an average of 50dB characteristic of Urban districts. The noise levels reduce towards the townships and decreases even further at the villages (Thomo and Shiviti) with areas closer to the roads having higher noise levels but generally the noise levels range +-40dB which is consistent with rural environment.

The major sources contributing to noise levels observed where:

- Vehicle movement (commuter and light passenger vehicles)
- Mining Permit Activies
- Day to day human activities
- Seasonal farming activities
- Fauna sound

TABLE 39: NOISE LEVELS

Location	South	East	Min dB	AVG dB	Max dB
Pit)	23°11'23"S	30°46'05"E	25.00	41.90	78.90
Plant)	23°18'77"S	30°76'59"E	0.00	43.80	79.50
Site 7	23°16'47"S	30°78'21"E	25.50	33.70	55.10
Site 6	23°11'23"S	30°40'05"E	24.70	36.40	73.10
Site 5	23°27'47"S	30°80'76"E	27.20	38.00	56.50
Site 4	23°15'28"S	30°50'22"E	23.10	37.70	74.10
Site 3	23°11'37"S	30°48'30"E	22.10	35.60	69.60
Site 2	23°22'04"S	30°69'048"E	0.00	50.50	77.50
Site 1	23°11'55"S	30°48'05"E	0.00	50.50	77.50

LAeq,T - Equivalent A-weighted noise level, similar to an average noise level
LA,max - Maximum noise level measured at the point
LA, min - Minimum noise level measured at the point

1.9.3.8 Heritage

1.9.3.8.1 Archaeological and Historical Remains

1.9.3.8.1.1 Stone Age Remains

No Stone Age archaeological remains were located within the demarcated study areas.

Although no Stone Age archaeological remains were located, such artefacts might occur in the area. These artefacts are often associated with rocky outcrops or water sources. **Figures** below are examples of stone tools often associated with the Early, Middle and Later Stone Age of southern Africa.

Archaeological studies done on the surrounding areas also did not locate material pertaining to the Stone Age.

According to Bergh (1999: 5 – 6), no major Stone Age archaeological sites are located in the direct vicinity of the study area, but rock art sites are found approximately 33 km to the northwest.

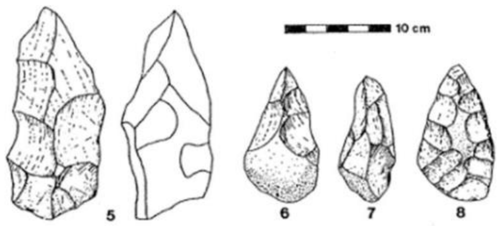

Figure 77**:** ESA artefacts from Sterkfontein (Volman 1984).

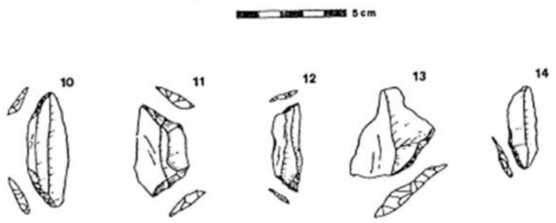

Figure 78**:** MSA artefacts from Howiesons Poort (Volman 1984).

Figure 79**:** LSA scrapers (Klein 1984).

1.9.3.8.1.2 Iron Age Farmer Remains

No Iron Age Farmer archaeological remains were located within the demarcated study areas.

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The heritage study done for the construction of the Vodacom Mast at McKechnie recorded archaeological deposits, features and structures that include potsherds, slag, daga, animal bone, fresh water mollusca and stone-walling on or near a hill (Archaeo-Info 2000).

1.9.3.8.1.3 Historical

Historical mining activity was observed at proposed Pits 04, 05 and 06. Proposed Pit 04 is associated with at least three trenches that vary in length, but are generally one metre wide and 1.2 m deep . Dense vegetation, however, hampered determining the extent of these trenches. Also, no infrastructure or artefacts were observed at proposed Pit 04. It should be noted that the mine is not indicated on the topographical maps

Proposed Pit 05 is associated with historical mining infrastructure that include a ball-mill mounting block, pieces of concrete and two very deep vertical shafts that pose a serious threat to people and animals). According to Mr Mzamani Mdaka (pers comm. 2021), the date ‘1947’ was observed on one of the structures. During the site visit, however, this date could not be located. The mine is not indicated on the topographical maps, but the Boltmans Beauty Mine is indicated on the 1947 topographical map approximately 1 km to the northwest (**Appendix A:**. Steenkamp & Clark-Mostert (2012), however, notes that Boltmans Beauty was operated prior to and around 1936.

Proposed Pit 06 consists of a relatively disturbed area close to Mininginisi-2 village. The infrastructure associated with this area include a ball-mill mounting block, two building foundations, and two rehabilitated mine shafts (**Figures 28 – 32**). The granite tops of the rehabilitated shafts, however, have been removed from the pedestals. The date of the mining infrastructure is unknown, but according to Mr Mzamani Mdaka (pers comm. 2021) this site dates to the 1980s. The mine is also not indicated on the topographical maps (**Appendix A: Figures 42, 46, 50 & 51**).

Table 4: Historical sites.

Name	Type	Source	Year	Status	Age	Estimated extent (ha)	Parcel
Pit 04	Historical mine	Survey	Unknown	Ruin	Historical	0.5	Greater Giyani 891 LT
Pit 05	Historical mine	Survey	1947	Ruin	Historical	0.5	Greater Giyani 891 LT
Pit 06	Historical mine	Survey	Unknown	Ruin	Historical	0.5	Greater Giyani 891 LT

The heritage study done by Van Schalkwyk (2006) for a development on a hill to the south of Ngove village recorded rudimentary stone-walling and noted a potential initiation site. The age of the site is unknown, but might date to historical times.

Figure 80:Historical mining activity at proposed Pit 04.

Figure 81**:** Ball-mill mounting block at proposed Pit 05.

Figure 82**:** Pieces of concrete at proposed Pit 05.

Figure 83**:** Vertical shaft at proposed Pit 05.

Figure 84**:** A second vertical shaft at proposed Pit 05.

Figure 85**:** Ball-mill mounting block at proposed Pit 06.

Figure 86**:** Building foundations at proposed Pit 06.

Figure 30: Granite top of rehabilitated shaft No 4.

Figure 87**:** Pedestal of rehabilitated shaft.

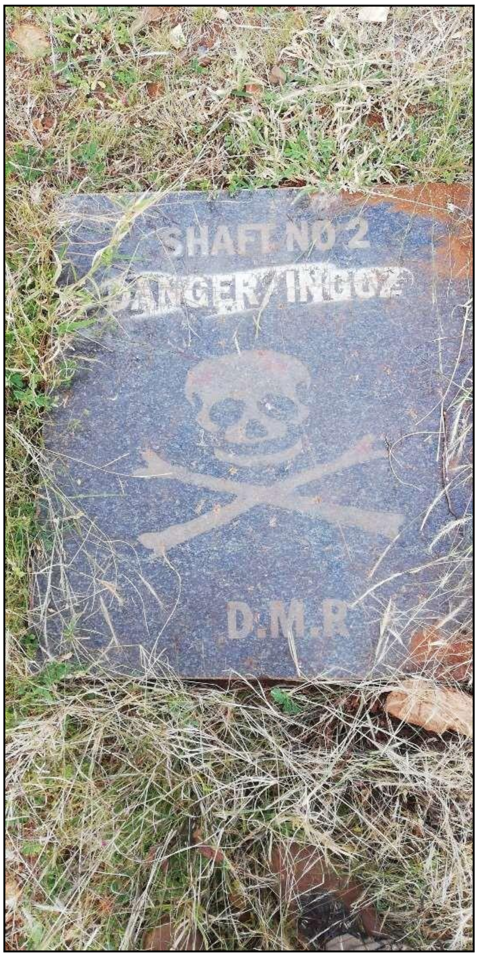

Figure 88**:** Granite top of rehabilitated shaft No 2.

1.9.3.8.1.4 Contemporary Remains

Some of the structures associated with proposed Pit 06, such as the rehabilitated mine shafts, might date to contemporary times.

Heritage studies done in the surrounding area did not record buildings or structures dating to contemporary times. See Archaeo-Info (2000), eThembeni Cultural Heritage (2006) and Van Schalkwyk (2006).

1.9.3.8.2 Graves

No graves or burial sites were located within the demarcated study areas. However, Mr Mzamani Mdaka pointed out three graves and one potential grave approximately 600 m to the southwest of the plant area . The graves consist of heavily overgrown stone cairns of which the orientation is unknown. The graves are not fenced-off and no inscriptions or grave good were observed. A painted stone is associated with Site B04, but it is unclear whether the site is associated with a burial site. Such painted stones are often used to indicate property and the stone cairn might have been used for this purpose.

Table 5: Graves.

Name	**Type**	**Source**	**Year**	**Status**	**Age**	**Parcel**

B01	Grave	Survey	Unknown	Intact	Unknown	Greater Giyani 891 LT
B02	Grave	Survey	Unknown	Intact	Unknown	Greater Giyani 891 LT
B03	Grave	Survey	Unknown	Intact	Unknown	Greater Giyani 891 LT
B04	Potential Grave	Survey	Unknown	Intact	Unknown	Greater Giyani 891 LT

Figure 89**:** Overgrown grave at B01.

Figure 90**:** Overgrown grave at B02.

Figure 91**:** Overgrown grave at B02.

Figure 92**:**Potential grave at B04.

Heritage studies done in the surrounding area did not record graves or burial sites. See Archaeo-Info (2000), eThembeni Cultural Heritage (2006) and Van Schalkwyk (2006).

1.9.3.8.3 Evaluation

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

A fundamental aspect in the conservation of a heritage resource relates to whether the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. There are many aspects that must be taken into consideration when determining significance, such as rarity, national significance, scientific importance, cultural and religious significance, and not least, community preferences.

When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research potential must be assessed and if appropriate mitigated in order to gain data / information which would otherwise be lost. Such sites must be adequately recorded and sampled before being destroyed.

1.9.3.8.4 Field Ratings

All sites should include a field rating in order to comply with section 38 of the National Heritage Resources Act (Act No. 25 of 1999). The field rating and classification in this report are prescribed by SAHRA.

Table 6: Field Ratings.

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

Table 7: Individual site ratings.

Site / Survey Point Name	Type	Rating	Field Rating/Grade	Significance	Recommendation
Plant & Pit 01	Plant & opencast pit	General Protection C	4 C	Low	No recording necessary
Pit 04	Historical mining	General Protection B	4 B	Medium	Record site
Pit 05	Historical mining	General Protection B	4 B	Medium	Record site
Pit 06	Historical mining	General Protection B	4 B	Medium	Record site
2330BB-B01	Grave	Local	Grade 3 A	High	Mitigation not advised
2330BB-B02	Grave	Local	Grade 3 A	High	Mitigation not advised
2330BB-B03	Grave	Local	Grade 3 A	High	Mitigation not advised
2330BB-B04	Potential grave	Local	Grade 3 A	High	Mitigation not advised

1.9.3.8.5 Statement of Significance & Recommendations

1.9.3.8.5.1 Statement of significance

The study area: The six demarcated portions on un-surveyed state land of Greater Giyani 891 LT, Giyani, Limpopo

The proposed opencast pit areas (Pits 01 – 06) are based on the location of previous mining activity. In terms of mining, the general area has been exposed to mining activities since 1870. Mining activities appear to have continued until the 1980s, but were constantly interrupted, abandoned and reinvestigated over the years.

Given the significance of the larger cultural landscape and heritage sites located during previous heritage studies, the general area is considered sensitive from a heritage perspective. However, significant sections of the study area has been cultivated in past years that most likely disturbed the archaeological context. Also, due to extremely dense vegetation cover, the identification of culturally significant heritage sites was significantly hampered. The demarcated plant area and Pit 01 has been disturbed by recent mining activity and no sites of heritage significance were observed within the demarcated boundary.

The area associated with proposed Pit 04 does not intersect the gradient or 500 m river buffer and no buildings or huts are indicated at this location on historical topographical maps). However, historical mining trenches of which the date is unknown, were located. No surface remains or infrastructure were noted at this site. Due to the potential age of the diggings, the site might be significant form an archaeological perspective and falls under the National Heritage Resources Act 25 of 1999.

Proposed Pit 05 intersects an area associated with huts as indicated on the 1967 topographical map, but has subsequently been disturbed by cultivation . The site is also located within the 500 m river buffer. Historical mining infrastructure associated with Pit 05 date to at least 1947 and are considered significant from and archaeological perspective. The site also falls under the protection of the National Heritage Resources Act 25 of 1999.

Proposed Pit 06 partially intersects an area marked to as previously cultivated, but mining remains found at the site might date to historical times .The rehabilitated shafts located at proposed Pit 06 might date to contemporary times, but it is likely that the initial mining activity and remaining infrastructure are much older and are considered significant from an archaeological perspective. Therefore, this site falls under the protection of the National Heritage Resources Act 25 of 1999 as well.

Although Pits 02 & 03 could not be accessed as a result of dense vegetation, it is likely that these sites are associated with similar features and infrastructure as observed at proposed Pits 04, 05 and 06. A strong possibility, therefore, exists that these sites are significant from an archaeological perspective as well.

The graves and potential grave associated with Sites B01 – B04 consist of overgrown and dilapidated stone cairns without inscriptions or visible grave goods. These sites are located approximately 600 m southwest of the plant and Pit 01 area and fall within the 500 m river buffer. Although significant from a heritage perspective, no impact on the sites is envisaged.

1.9.3.9 Baseline Traffic

1.9.3.9.1 SITE ACCESS

The Giyani gold mine is located within the town of Giyani, approximately 140 km to the northeast of the N1 National Road from Polokwane. A well-maintained R 81 road, from the N1 will provide as the main access to the mine. The mining area will be accessed through existing tarred roads that will link the mine to the various villages such as Thomo, Shiviti, Mninginisi, Mbatlo, Mavalani and Shikukwani. Limpopo. The R81 Starts at R71, in Polokwane, crosses N1 [410], stg. crosses R36(1,5km) at Mooketsi, past R578 past R529, through Giyani, ends at R524 between Thohoyandou and Punda Maria. The R81 This road can be classified as a Class 3 road (major arterial road) and falls under the jurisdiction of the South African National Roads Authority Limited (SANRAL.

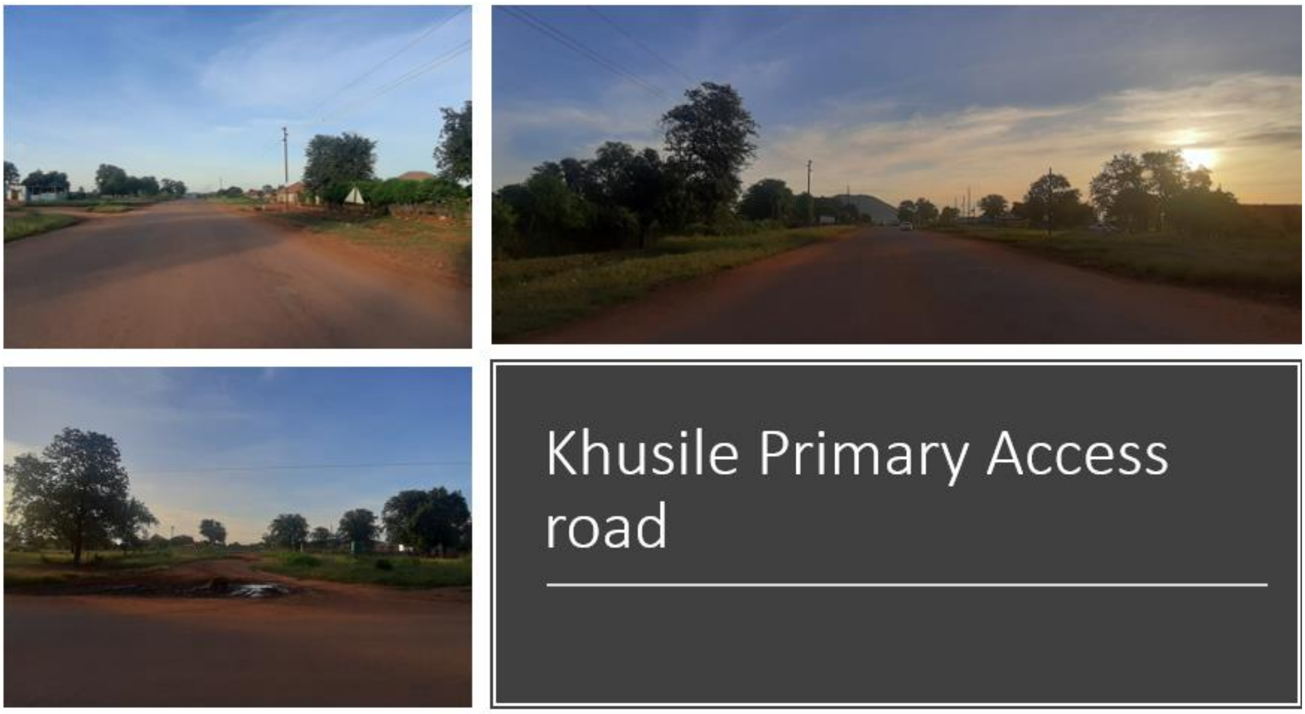

Figure 93: Primary Access Road

The R81 is a class C road with potholes and needs to be maintained. The gravel roads on site are compact due to the clay content of the soil.

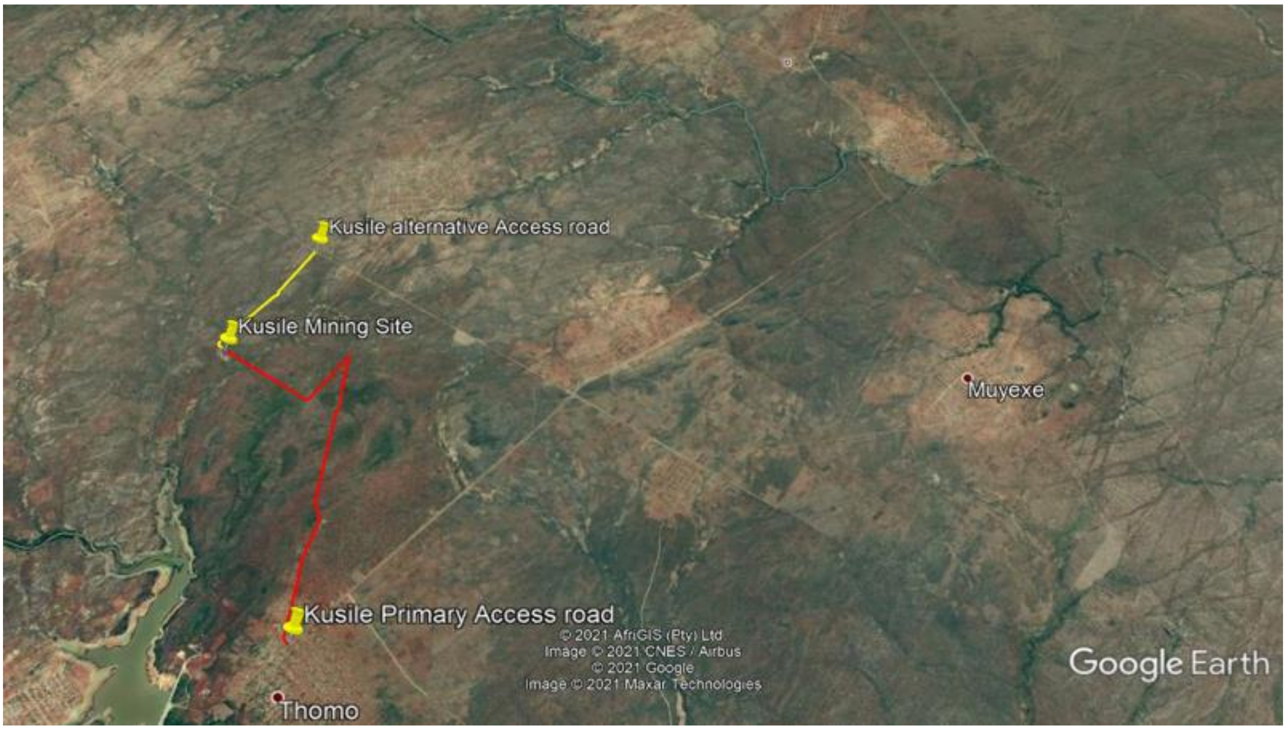

Figure 94: Access Road Alternatives

1.9.3.9.2 EXISTING TRAFFIC FLOWS

To determine the existing traffic demand on the surrounding road network weekday traffic surveys were conducted in March at the key intersection previously discussed. From this survey it was determined that the common peak traffic hours occurred between 08h00-09h00 for the AM peak hour and between 16h15-17h15 for the PM peak hour. These existing 2020 peak hour traffic volumes are shown

1.9.3.9.3 BASELINE OPERATING CONDITIONS

The Level of Service (LOS) parameter is determined by the V/C ratio (ratio between the traffic volume and traffic capacity per movement, both measured in veh/h) and delay (time delay experienced, measured in seconds) values. LOS values can vary between “A” and “F”, with “F” being the worst operating condition. A LOS of “D” or better is deemed acceptable, with a LOS of “E” acceptable for right-turn traffic movements if adequate lengths of storage lanes are provided.

Table 40**: Baseline operating conditions**

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Intersection & approach definitions	**Peak hour**	**Analysis parameters**	**Intersection capacity analysis results**					
			Approach 1		**Approach 2**		**Approach 3**	
			T	**R**	**L**	**R**	**L**	**T**
	Week AM	**V/C**	0.0	0.0	0.0	0.0	0.0	0.0

R81 /Site Access Approach			5	5	1	1	5	5
		Delay (s)	0	6	9	9	6	0
		LOS	A	A	A	A	A	A
	WeekPM	**V/C**	0.0 6	0.0 6	0.0 1	0.0 1	0.0 6	0.0 6
		Delay (s)	0	6	9	10	6	0
		LOS	A	A	A	A	A	A

Notes: L=left, T=through, R=right, V/C=volume/capacity, LOS=Level of Service, red text indicates unacceptable performance The baseline operating conditions tabulated above indicate that good traffic operating conditions are currently experienced at the key study intersection. These conditions would be influenced by the following variables:

• Traffic volumes;

• Intersection geometry, and

• Intersection traffic control

1.9.3.9.4 NON-MOTORISED AND PUBLIC TRANSPORT

A public transportation and non-motorised transport assessment were carried out as part of this study. Public transport in the study area is mainly provided by minibus taxis and busses. Taxis (mostly long-distance taxis) and busses were observed travelling along the R81.

The proposed development is expected to generate a considerable demand for non-motorised and public transport, but due to the remote location of the study site no new facilities are recommended. It is however recommended that transport for staff be provided to and from the site during both the construction and operational phases of the project.

1.9.3.10 Socio economic

Limpopo’s climate is characterised by hot summer months (October-March), while winter is characterised by chilly mornings, warm middays, dry afternoons and cool to cold nights. The Lowveld area of Limpopo can get as hot as 45º Celsius during summer.

The population of Limpopo consists of the following ethnic groups distinguished by culture, language and race:

- The Northern Sotho (Sepedi): Approximately 57%;
- The Tsonga (Shangaan): Approximately 23%;
- The Venda: Approximately 12%;
- The Afrikaner: Approximately 2.6%; and
- The English: Approximately 0.5%.

In terms of Agriculture, the province produces 75% of the country's mangoes, 65% of its papaya, 36% of its tea, 25% of its citrus, bananas and litchis, 60% of its avocados, 66% of its tomatoes and 285 000 tons of potatoes. Other products include coffee, nuts, guavas, sisal, cotton, tobacco and timber, with more than 170 plantations. Limpopo also boasts rich mineral resources, with mining contributing 22% of the GDP. Mineral resources include platinum, chromium, nickel, cobalt, vanadium, tin, limestone and uranium clay. Limpopo has 54 provincial reserves and many private game reserves, making the province a popular tourist destination. (Source: About Limpopo)

1.9.3.10.1 Demographics

Figure 4 below indicates that Limpopo's population is young, with the majority of the population aged below 35 years.

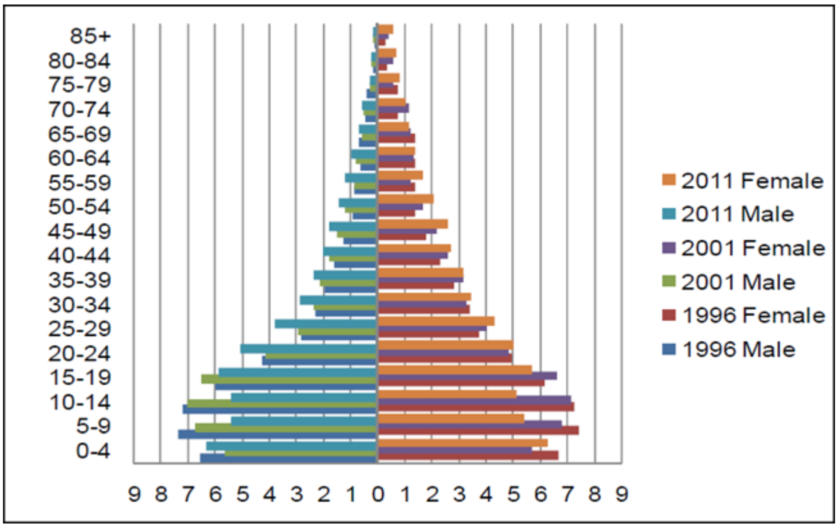


Figure 95: Distribution of population by age and sex, Limpopo - 1996, 2001 and 2011 ***Source: Census 2011 Municipal report – Limpopo***

1.9.3.10.2 Mopani District Municipality

Mopani is one of the 5 districts of Limpopo province of South Africa. The seat of Mopani is Giyani Town. Mining has been the dominant sector in Mopani since 1996, and in 2006 accounted for 31% of the gross value added. The other large sectors (in descending order) are community service (government employment), trade (which includes tourism) and finance. Mopani has almost nomanufacturing sector (just 2%). The second major industry is agriculture. There are a number of producers but ZZ2 dominates in terms of output and the major focus is on sub-tropical fruit(tomatoes, bananas, mangoes, oranges and pineapples). The main focus of both these industries is to produce for exportation. (Mopani District Municipality, 2017).

1.9.3.10.2.1 Demographics

Figure 96:Mopani District in a snapshot

The population of the Mopani District Municipality has increased from 1 061107 (Census 2001) to 1 068 569 (Community Survey 2007) to 1 092 507 (Census 2011) to 1 159 185 Community Survey 2016. Out of the entire district population, 81% reside in rural areas, 14% in urban areas and 5% stay on farms. The population densities vary from municipality to another, but the average is 23 people/ ha. Its how that people are sparsely populated with sufficient land around them. The problem of land shortage for economic development is perpetrated by the vast land occupied for dwelling purposes, leaving much little for economic growth. A move towards reduction of stands sizes may need due consideration. Portion of Kruger National park is mainly occupied by animals with very few people employed.

1.9.3.10.2.2 Economic Outlook of Mopani District

In 2019, there were 628 941 people living in poverty, using the upper poverty line definition, across Mopani District Municipality - higher than the 674 588 in 2009. The lowest percentage of people living in poverty can be observed in the Ba-Phalaborwa Local Municipality with a total of 58.6% living in poverty, using the upper poverty line definition This could be attributed to the mining activities providing employment opportunites within the area . The average annual household income of the regional study area (Mopani District Municipality) was R14 600, which is about the same in the Limpopo province and about half the amount in the country (R29 400).

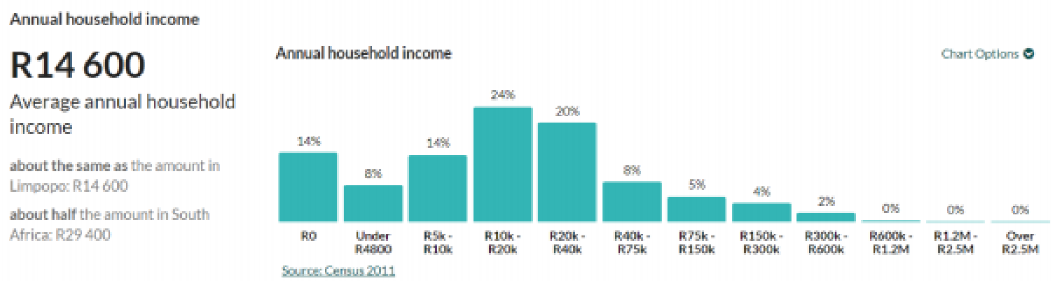


Figure 97:Annual income in the regional study area (Mopani District)

People in the Mopani district are employed in the following sectors: Farming, Industry, Mining, Trade, Government, Transport, Tourism, Manufacturing, Construction and Energy. The Government Sector is the largest employer in the district e.g. 39% of the employed in Greater pg. 18 Giyani work for government. The second largest employer in Mopani district is the farming sector with 25, 9% of the employed people. This is however, not the case when considering the municipalities separately with the mining sector employing the second largest portion of the Ba-Phalaborwa population (19, 5%). The number of people unemployed as a percentage of the total employable population of the District (287 405) is 39%. It is however important to note that of the unemployed people in the district, about 60% are women.

1.9.3.10.2.3 Education and Literacy

The literacy levels in the Mopani District are very low. Only 12.7% of the adult population in the district has completed their matric and 6.5% any form of higher education. Existence of the ABET programme in the district made substantial impact since the illiteracy rate from 37.8% to 27.1%.

1.9.3.10.2.4 Crime

According to the South African Police Services there are not enough law enforcement officers in the Mopani district to adequately serve the community. The highest crime rate within the district is experienced in Greater Tzaneen , followed by Ba-Phalaborwa and Greater Giyani the area where Giyani Gold Mines is to be located. The top ten crimes in Mopani District Municipality are Theft, Burglary at residential premises, Assault with the intent to inflict grievous bodily harm, Common assault, Malicious damage to property, Burglary at non-residential premises, Sexual Crimes, Shoplifting, Commercial crime, Theft out of or from motor vehicle.

1.9.3.10.2.5 Health

The provision of health facilities to all settlements in the district is a problem because of the large number of settlements (varying in size), with the majority of them being relatively small and scattered throughout the district.

District Hospital Services are provided in six district hospitals, namely; Maphutha LM Malatjie hospital in Ba-Phalaborwa, Sekororo hospital in Maruleng, Kgapane Hospital in Greater Letaba, Nkhensani Hospital in Greater Giyani, Van Velden and Dr CN Phatudi hospitals in Greater Tzaneen Sub district.vThe hospitals provide services to across municipal boundaries and international refugees. Prevalent Diseases in Mopani District include diarrhoea; Pneumonia; Tuberculosis; HIV and AIDS; Malaria; and Sexually Transmitted Infections (STI).

1.9.3.10.3 Giyani Local Municipality

1.9.3.10.3.1 Demographics

Figure 98:Snapshot of Greater Giyani Municipality

The total population of Giyani is 256, 300 with a total number of households of 70,537. The municipality has 31wards grouped into 5 clusters. In most wards, the population exceeds 5000 people. In the past few years, the population has shown a slight decline. In the 2011 census, the population was counted at 247 565but according to the 2011 census, it has declined by almost 3000 people. The decline may be attributed to migration to other urban centers, such as Polokwane, Gauteng and Tzaneen in which the migrants search for better working conditions.

The sex ratio distribution provides an indication of the gender breakdown in an area, and it is suggestive of the composition of the labour force. Sex ratios will be affected by sex-selective out-migration such as men migrating. Migrant labour-receiving areas usually have higher sex ratio figures (i.e. more males to females) as the migrants are usually male. South Africa's average sex ratio is around 0,95, that is 95 men to 100 women. Lower sex ratios are found in areas with a higher number of female-headed households, where household sizes are generally larger, with higher dependency levels this is the case for Giyani and it could be attributed to Men leaving the area in search of economic opportunities.

1.9.3.10.3.2 Educational Levels

The level of education determines the mix of skilled labour within an area. Furthermore, a population that is skilled does not necessarily aspire to employment but to entrepreneurship, which will add businesses to the area, increase economic activity and consequently increase the number of available jobs.
Approximately 22.6% of adults are without education in Greater Giyani, and an estimated 74.4% have attended school but not proceeded to attend tertiary institutions. The percentage of the population that acquired higher education with tertiary certificates; diplomas and degrees is very low at 0.7%. The possible factors that could negatively contribute to low education levels and enrolment amongst young population group could include accessibility to higher learning institutions and affordability. The prevailing low levels of education will result in low levels of absorption into the labour market, thus resulting in increased levels of unemployment in the area.

1.9.3.10.3.3 Economic Outlook

Giyani is the main town in the municipality and the Central Business District (CBD) is located in this town. The majority of the population lives in rural areas located on average, at a distance of some 35km away from the Giyani CBD, resulting in limited economic activities in the areas where the majority of the population lives. The majority of the economically active population residing in the area have employment in the public service, informal retail and agriculture. Greater Giyani Municipality is considered to have a relatively small economy. The public service is by far the largest sectorial contributor of employment opportunities that support the local economy. Other job opportunities are provided by economic sectors such as agriculture, wholesale & retail trade. Other business activities in the area include transport, construction, electricity and water supply, catering, and accommodation; community, social, and other personal services and general government services.

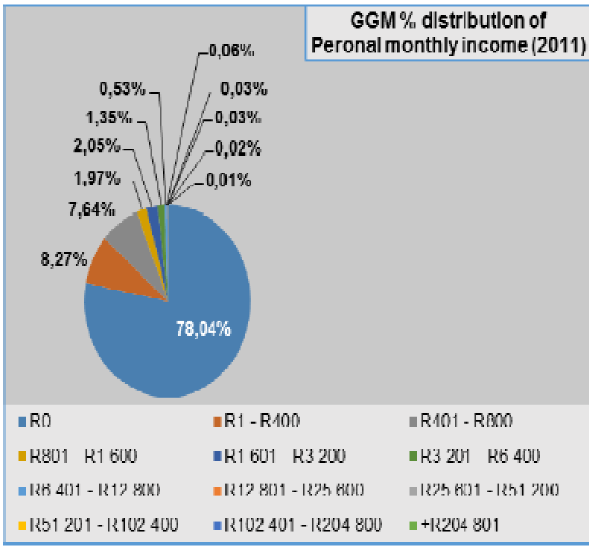
Table 41:Labour Force and Employment status

Persons	2011	%	2016	%
Employed	19979	49.3	20759	39.6
Unemployed	20534	50.7	31636	60.4
Total Labour Force	40513	100	52395	100
Not economically active			75829	

Data for Giyani indicates that the number of unemployed people has increased from 20 534 (50.7%) in 1996 to 31 636 (60.4%) in 2001. Unemployment has a negative impact on society which might eventually result in an increase in crime, grant dependency, and non-payment of services.

1.9.3.10.3.4 Income Profile

A total of 78% of the individuals in Greater Giyani municipality had no recordable income in 2011 compared to 53.7% in 2016. There has also been significant growth in the income bracket earning from R400 - R800 per to the next category of R800– R1600 income per month, indicating a positive upward migration of residents from low income levels. The number of low income earners between no income and R1600 has significantly decreased between 2011 and 2016. Most importantly the number of residents with no income has reduced by more than 29%. This is considered to be an indication of the improvement of socio-economic condition of the population in Greater Giyani.



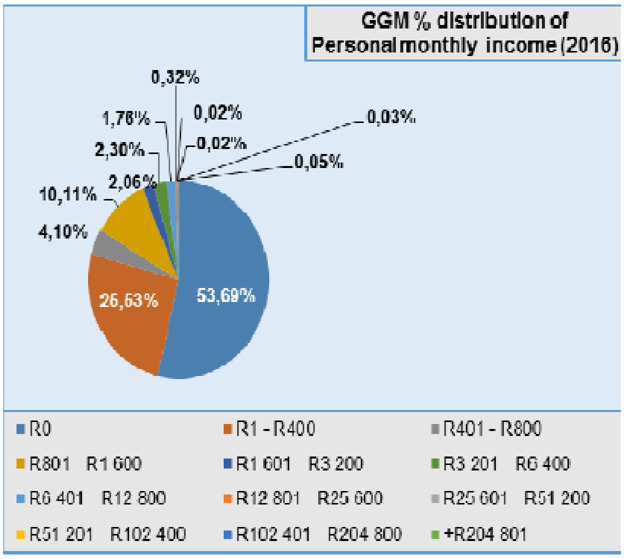


Figure 99:Household Income Profile

1.9.3.10.3.5 Health Profile

The health services concerning the primary healthcare for the general population is provided by the provincial government and the municipality through local hospitals and clinics as well as private health practitioners that are found in the different locations within the Greater Giyani Municipality. Some of the challenges related to health services include inaccessibility to clinics by communities due to the distance travelled to visiting points, and the frequency of the service being provided. In addition, the number of clinics and hospitals are inadequate and mostly overcrowded. Emergency medical services are not readily available during emergencies and the response time is at times slow. The availability of medicine in clinics is problematic due to inadequate control and poor distribution.

As an already established fact, South Africa is more affected by the HIV and AIDS epidemic than any other country in the world. The key challenge with respect to public health within Greater Giyani Municipality is managing with the levels of HIV & Aids prevalence in the area.

As an already established fact, South Africa is more affected by the HIV and AIDS epidemic than any other country in the world. The key challenge with respect to public health within Greater Giyani Municipality is managing the levels of HIV & Aids prevalence to keep new infection rates low in the area.
According to statistics reflected in the Mopani District Revision of the IDP for 2016 - 2019 the District's HIV prevalence was 24.6% in 2017, after having shown a decline from similar level in 2008 to reach an average of 24,46% over 10 years from 2008 to 2017.

1.9.3.10.3.6 Infrastructure

The availability of infrastructure within towns and communities is essential for economic development of local areas and provision of basic services. Greater Giyani municipality has a well-established road infrastructure; comprising regional and provincial roads such as the R81; R578; R529 which form the road network that link the town of Giyani and its surrounding villages with other main towns like Polokwane; Tzaneen; Palaborwa; Louis Trichardt; Malamulele; Thohoyandou and access to the Kruger National Park. In addition, a landing strip is available in the area to connect Giyani by air travel to major regional and national industrial and urban centres. The main roads linking Giyani to other provincial towns are mostly surfaced and those in the villages are gravel roads, with current work to upgrade the roads from gravel to surfaced road being rolled out in some of the villages.

There is no rail network that passes through Giyani. The nearest rail connection is in the small town of Moeketsi, Duiweskloof and Soekmekaar. The roads provide the necessary transport infrastructure for the population using busses; taxis and private vehicles. The public transport system mostly used in Greater Giyani is privately owned taxis and buses.

The longer distances between the town and various villages in the municipality make all communities dependent on the regional distribution roads for social as well as economic functioning. A number of these roads are however require need to be upgraded and maintained to support the local economy. Other infrastructure related to telecommunications, water and electricity supply are well established within the town of Giyani, with villages mainly relying on bulk water supply with no sanitation.

1.9.4 Description of the current land uses.

The majority of the application areas is predominantly covered by thick woodland grass and trees, with gravel roads, rural settlements and substance farming

1.9.5 Description of specific environmental features and infrastructure on and around the site.

- The proposed gold mine falls within B82H quaternary catchment. The catchment is located in the Luvuvhu and Letaba Water Management area (WMA).There are two(2) main rivers within the quaternary catchment which are Ntsami River on the western side of the proposed mine and Magobe River on the eastern side of the proposed mine site. These rivers are seasonal and the area is mostly dominated by Mopani veld .The streams on the western side of proposed gold mine Ntsami River drains into Ntsami Dam with some streams nearby Swartkoppies farm (Pit 1).These streams drains directly into Ntsami Dam which is 2km downstream of the site, while Gemsbok Pit 3 is located at the headwaters of Magobe River 350 meters away which joins Ntsami River downstream into Klein Letaba River.
- According to the biodiversity datasets provided by SANBI (2021), the current mining area (Swartkoppies) and the 2 western pit areas (West 59 and Gemsbok) falls within a Critical Biodiversity Area 2. These sections were confirmed to be Mopani forest and bushveld areas during the site visit. The two remaining eastern pit areas falls within an Ecological Support 1 area and the other within Other Natural Areas. These areas had disturbance by informal settlements surrounding these areas. Critical Biodiversity Areas (2) (CBA 2) are classified as best design selected sites and are selected to meet biodiversity pattern and/or ecological process targets. Alternative sites may be available to meet targets.

Ecological Support Areas (1) (ESA 1) Natural and/or near natural and degraded areas supporting CBAs by maintaining ecological processes. Other Natural Areas are classified as natural and intact but not required to meet targets, or identified as CBA or ESA. No natural habitat remaining areas are not significant to direct biodiversity value. The mining areas does not overlap with any protected or endangered ecosystems. The proposed mining operations fall within close proximity to Important Bird Areas (IBAs), where the proposed mining area falls close to the Kruger National Park.

1.9.6 Environmental and current land use map.

(Show all environmental, and current land use features)

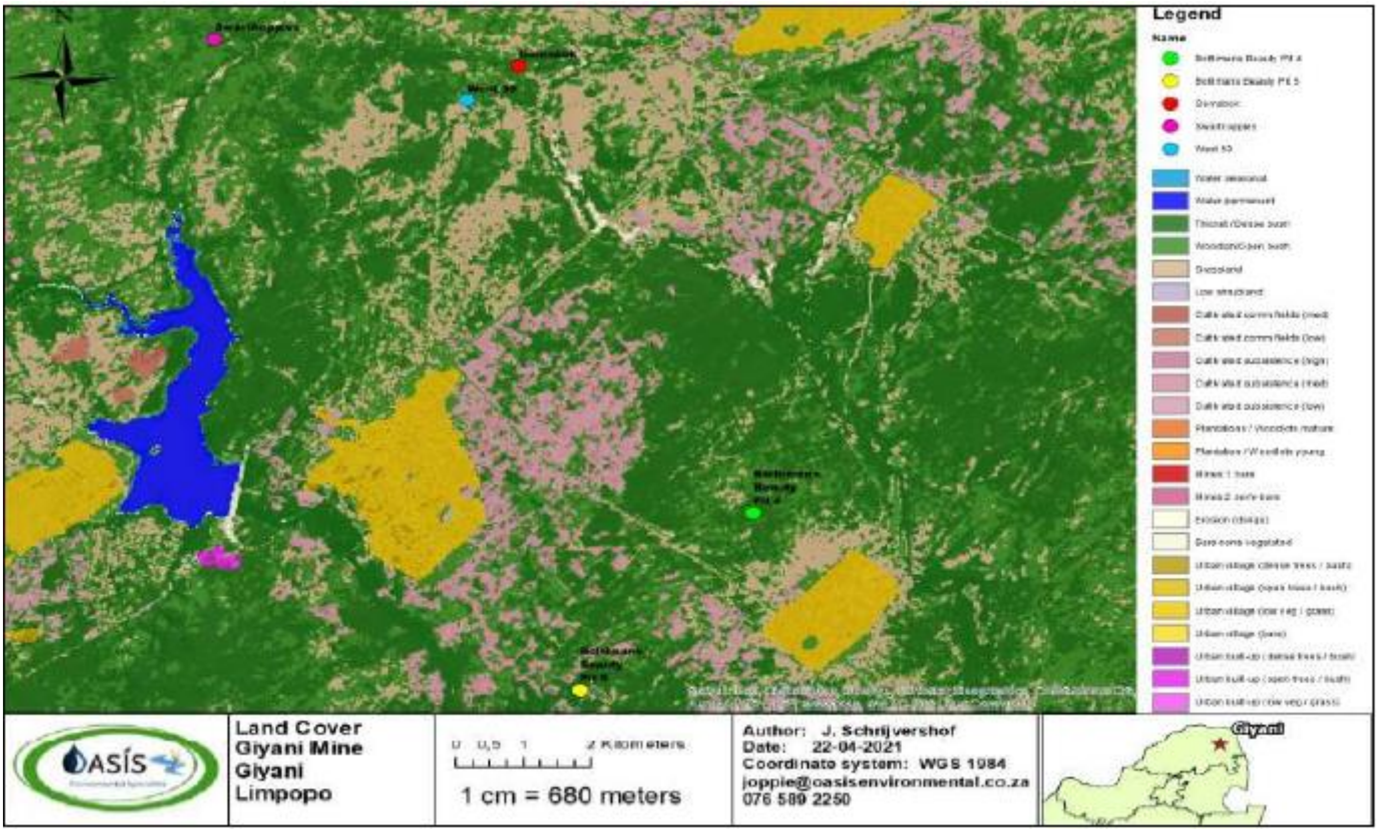


Figure 100: Current Land use Map

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

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated).

The table below describes the potential impacts for the proposed Kusile's Giyani Gold Project. The following phases are applicable for the Kusile's Giyani Gold Mine:

The proposed open pits will be located on the following farms

- Swartkoppies (Pit - 1),
- West 59 (Pit - 2),
- Gemsbok (Pit - 3),
- Boltmans Beaty (Pit – 4); and
- Boltmans Beaty (Pit – 5)

The project area covers a surface area of 13894.66 hectares (ha) .Extent of surface area required for mining is 1000 hectares and extent of the area required for infrastructure, roads, servitudes etc. is 150 hectares. The site is delineated on the site layout plan depicted on the figure below. The proposed mining activities are outside the 1:50 and 1:100 year floodlines. The site layout plan depicts positions of the mining activity and related infrastructure including the following:

- Mine opencast workings (pits area)
- Ore/gold processing plant area
- Mine office complex
- Tailings Storage Facility
- Overburden dump
- Topsoil stockpiles
- Access and haul roads

- The Construction Phase: This phase entails soil stripping of the Open Cast pits, construction of new infrastructure (PCDs, associated water and waste management infrastructure, as well as the processing plant).
- The Operational Phase: relates to the operation of the PCDs, Sewage Treatment Plant and Processing Plant. This phase also includes concurrent backfilling of mined out areas.
- The Decommissioning Phase. The decommissioning of the mining area and mining-associated infrastructure (such as the plant and workshop area).
- The Post-closure Phase will commence once the mine has obtained Closure under the applicable legislation.

Potential impacts identified for the project include but not limited to:

- sterilization of mineral resources
- hazardous excavations/structures/surface subsidence
- loss of soil resources and land capabilities through contamination
- loss of soil resources and land capabilities through physical disturbance
- physical destruction of biodiversity
- general disturbance of biodiversity
- Poaching and killing of biodiversity

- pollution of surface water resources
- alteration of drainage patterns
- contamination of groundwater
- dewatering
- air pollution
- disturbing noise levels
- visual impacts
- impacts on heritage, cultural and paleontological resources
- land use impacts
- blasting impacts
- project-related road use and traffic safety
- economic impacts
- inward migration

This section provides a list of potential impacts on environmental aspects separately in respect of each of the main project actions / activities and processes. The potential impacts are presented for each of the project phases in tabular format.

Table 42: List of Potential Impacts and significance

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Significance withot mitigation						Significance with mitigatio				
				M	D	S	P	Status	SP	M	D	S	P	SP
				intensity	extent	duration	probability	Weighinf factor	significance rating	intensity	extent	duration	probability	significance rating after mitigation
Site Establishment	Groundwater	Construction and grading could cause changes in runoff and infiltration that could reduce groundwater recharge.	Construction Phase	1	4	4	3		27 (L)	1	4	2	3	21 (L)
Site Establishment	Groundwater	Fuel & hydrocarbons leakages and spillages from the storage and transporting vehicles may cause	Construction Phase	1	4	4	3		27 (L)	1	4	2	3	21 (L)

		groundwater contamination.												
Site Establishment	Groundwater	Open cast mining below the water table will result in pit inflows	Construction Phase	1	4	2	4		28 (L)	1	4	2	4	28 (L)
Site Establishment	Groundwater	Baseflow reduction caused by mining	Construction Phase	2	2	2	1		6 (L)	2	2	2	1	6 (L)
Site Establishment	Groundwater	Groundwater abstraction for water supply purposes could reduce groundwater levels in the area	Construction Phase	2	4	6	4		48 (M)	1	3	4	4	32 (M)
Site Establishment	Surface Water	Increased potential for groundwater contamination due to seepages from the overburden stockpiles	Construction Phase	1	2	2	2		10 (L)	1	2	2	2	10 (L)
Site Establishment	Surface Water	Water contained in dirty water dams may impact on groundwater quality	Construction Phase	1	4	4	4		36 (M)	1	2	2	2	10 (L)
Site Establishment	Surface Water	Increased sediment loads from vegetation clearance and soil compaction.	Construction Phase	1	2	2	4		20 (L)	1	2	2	3	15 (L)
Site Establishment	Surface Water	Water resources pollution due to spillage of oils, fuel and chemicals.	Construction Phase	1	2	2	4		20 (L)	1	2	2	3	15 (L)

Site Establishment	Stream Resource Quality	• Changing the quantity and fluctuation properties of the watercourse; • Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount); • Alteration of water quality – increasing the amounts of nutrients and toxins; and • Changing the physical structure within a water resource (habitat).	Construction Phase	2	2	8	4		48 (M)	2	2	6	4	40 (M)
Mining	Groundwater	Construction and grading could cause changes in runoff and infiltration that could reduce groundwater recharge.	Operational Phase	1	4	4	3		27 (L)	1	4	2	3	21 (L)
Mining	Groundwater	Fuel & hydrocarbons leakages and spillages from the storage and transporting vehicles may cause groundwater	Operational Phase	1	4	4	3		27 (L)	1	4	2	3	21 (L)

		contamination.												
Mining	Groundwater	Open cast mining below the water table will result in pit inflows	Operational Phase	1	4	2	4		28 (L)	1	4	2	4	28 (L)
Mining	Groundwater	Baseflow reduction caused by mining	Operational Phase	2	2	2	1		6 (L)	2	2	2	1	6 (L)
Mining	Groundwater	Groundwater abstraction for water supply purposes could reduce groundwater levels in the area	Operational Phase	2	4	6	4		48 (M)	1	3	4	4	32 (M)
Mining	Groundwater	Increased potential for groundwater contamination due to seepages from the overburden stockpiles	Operational Phase	1	2	2	2		10 (L)	1	2	2	2	10 (L)
Mining	Groundwater	Water contained in dirty water dams may impact on groundwater quality	Operational Phase	1	4	4	4		36 (M)	1	2	2	2	10 (L)
Mining	Surface Water	Pollution of watercourses from general waste and sewage effluent due to hiring of mine workers.	Operational Phase	2	5	4	3		33 (M)	2	5	2	2	18 (L)
Mining	Surface Water		Operational Phase											
Mining	Surface Water		Operational Phase											
Mining	Surface Water	Increased runoff due to soil compaction	Operational Phase	2	4	6	3		36 (M)	2	4	2	2	16 (L)

Mining	Surface Water	and increased paved surfaces.	Operational Phase											
Mining	Resource Quality	• Hydrocarbon (oil, petrol and diesel) spills and/or leakages could occur from vehicles and/or equipment. These spills could contaminate the surface and ground water should they occur simultaneously with a heavy rainfall event. • Operational activities such as the establishment of increased hard surfaces could cause erosion which will lead to high volumes of sediment entering streams. This could again lead to increased silt loads entering the water bodies, especially under flood conditions (decreasing storage capacity). The mine's pollution	Operational Phase	2	4	8	4		56 (M)	1	4	6	3	33 (M)

		control dams also pose a risk of contamination of surface water during flood events.												
Closure	Groundwater	Salt Load contribution towards Ntsami Dam or other streams	Decommission Phase	1	2	2	2		10 (L)	1	2	2	2	10 (L)
Closure	Groundwater	Aquifer contamination caused by backfill	Decommission Phase	2	5	8	4		60 (H)	2	5	6	4	52 (M)
Closure	Groundwater	Rebound water levels within backfill material may cause decant	Decommission Phase	2	5	6	4		52 (M)	2	5	6	3	39 (M)
Closure	Surface Water	Compacted surfaces could lead to increased runoff into the nearby streams.	Decommission Phase	2	5	6	4		52 (M)	2	5	2	3	27 (L)
Closure	Surface Water	Contamination from leakage and spillage of chemicals, oils and grease.	Decommission Phase	2	2	6	3		30 (M)	1	2	2	2	10 (L)
Closure	Surface Water	Acid mine drainage problems and problems associated with the disposal of other waste material when the mine is decommissioned	Decommission Phase	2	2	6	4		40 (M)	2	2	6	2	20 (L)
Setting up infrastructure and	Biobiversity	Loss of Species of Conservation Concern	Operational Phase	5	4	2	8		70H	4	4	2	6	48M

moving onto site														
Setting up infrastructure and moving onto site	Biobiversity	Loss of indigenous vegetation, floral and faunal habitat and ecological structure of water resources and soil	Operational Phase	5	4	2	8		70H	4	4	2	6	48M
Setting up infrastructure and moving onto site	Biobiversity	Alien Invasive Species	Operational Phase	5	4	2	8		70H	4	4	2	6	48M
	Visual	Reinstatement of visual resource value due to dismantling of infrastructure and subsequent rehabilitation of footprint areas	Closure	4	3	3	8		68M	2	2	6	2	20 (L)
Clearing of vegetation and earthworks	Visual	Clearing of vegetation and earthworks	Construction Phase	4	3	3	8		68M	2	2	6	2	20 (L)
Lighting at night	Visual	Reduction in visual resource value	Construction Phase	4	3	3	8		68M	2	2	6	2	20 (L)
Construction of offices, plant infrastructure, workshops and other associated mine infrastructure	Visual	Reduction in visual resource value	Construction Phase	4	3	3	8		68M	2	2	6	2	21 (L)

Fugitive dust	Visual	Reduction in visual resource value	Construction Phase	4	3	3	8		68M	2	2	6	2	22 (L)
presence of topsoil, Run of Mine, product and overburden stockpiles and discard dumps. processing plant and other mining infrastructure;	Visual	Operational Phase Reduction in visual resource value due to presence of physical structures on site	Operational Phase	4	3	3	8		68M	4	4	2	6	48M
presence of topsoil, Run of Mine, product and overburden stockpiles and discard dumps;	Visual	Operational Phase Reduction in visual resource value due to Fugitive dust	Operational Phase	4	3	3	8		68M	2	2	6	2	20 (L)
mining infrastructure	Visual	Operational Phase Reduction in visual resource value due to Night-time illumination	Operational Phase	4	3	3	8		68M	2	2	6	2	21 (L)
Mine establishment	Soil and land capability	SOIL STRIPPING	Construction	4	3	3	4	4	64	4	2	1	4	38
Excavation, opein pit mining,Run of Mine product and overburden stockpiles and	Soil and land capability	SOIL STRIPPING	Operation	4	3	4	4	4	60	4	2	4	4	52

discard dumps;														
Rehabilitation	Soil and land capability	SOIL STRIPPING	Decommissioning	4	3	4	3	4	64	4	2	4	3	39
Preparation of the foot print area	Noise	Increased noise levels on the proposed site	construction	2	2	6	2		20 (L)					Low
Preparation of the foot print area	Noise	Increased noise levels off the proposed Site	construction	2	2	6	2		20 (L)					Low
Civil construction	Noise	Increased noise levels along the boundary of	construction	2	2	6	2		20 (L)					Low
	Noise	Increased noise levels at the mining area	construction	Short term	Low	Site	Reversible	Low	High					Moderate
Grading and building of new	Noise	Increased noise levels along the boundary of	construction	2	2	6	2		20 (L)					Low
	Noise	Increased noise levels at the mine area	construction	2	2	6	2		20 (L)					Low
	Noise		construction	2	2	6	2		20 (L)					Low
Construction of buildings and/or plant	Noise	Increased noise levels along the boundary of	construction	2	2	6	2		20 (L)					Low
	Noise	Increased noise levels at the mine area	construction	4	3	4	4	4	60					Low
Mining activities area	Noise	Increased noise levels on the proposed Site	operation	Short term	Low	Site	Reversible	Low	High					Moderate
	Noise	Increased noise levels off the proposed Site	operation	4	3	4	4	4	60	2	2	6	2	20 (L)

Hauling of ore	Noise	Increased noise levels along the feeder	operation	4	3	4	4	4	60	2	2	6	2	21 (L)
Excavations	Noise	Increased noise levels off the proposed	operation	4	3	4	4	4	60	2	2	6	2	22 (L)
Processing Plant	Noise	Increased noise levels off the proposed	operation	4	3	4	4	4	60	2	2	6	2	23 (L)
Covering of underground and surface mining with capping layer and top soil	Noise	Increased noise levels on the proposed Site	closure	2	2	6	2		23 (L)	2	2	6	2	23 (L)
	Noise	Increased noise levels off the proposed Site	closure	2	2	6	2		23 (L)	2	2	6	2	23 (L)
Removal of buildings and infra-	Noise	Increased noise levels along the feeder	closure	2	2	6	2		23 (L)	2	2	6	2	23 (L)
Rehabilitation	Noise	Increased noise levels along the feeder	closure	2	2	6	2		23 (L)	2	2	6	2	23 (L)
	Noise	Increased noise levels on the proposed Site	closure	2	2	6	2		23 (L)	2	2	6	2	23 (L)
Plant & Pit	Heritage	Plant & opencast pit	All Phases	2	2	6	2		24 (L)					24 (L)
1	Heritage			2	2	6	2		25 (L)					25 (L)
Pit 04	Heritage	Historical mining	All Phases						Medium					Medium
Pit 05	Heritage	Historical mining							Medium					Medium
Pit 06	Heritage	Historical mining	All Phases						Medium					Medium
2330BB-B01	Heritage	Grave							High					High
2330BB-B02	Heritage	Grave	All Phases						High					High
2330BB-B03	Heritage	Grave							High					High

2330BB-B04	Heritage	Potential grave	All Phases						High					High
Construction activities.	Socio-economic.	Creation of a number of local employment opportunities.	Construction Phase	h	s	r	l		L	h	s	r	m	M
Construction activities.	Socio-economic.	Investment into the local economy through purchase of goods and services.	Construction Phase	h	s	n	l		M	h	s	n	m	M
Site clearance activities.	Socio-economic.	Exposure to dust and fine particulates with the stripping of vegetation cover.	Construction Phase	h	s	l	d		M	m	s	l	m	L
Construction activities.	Socio-economic.	Exposure to noise from construction activities.	Construction Phase	m	s	l	d		M	m	s	l	l	L
Construction vehicles	Socio-economic.	Increase the risk of an accident with pedestrian and/or another vehicle, resulting in a serious injury or death.	Construction Phase	vh	i	l	hp		M	vh	i	l	l	L
Rapid workforce influx	Socio-economic.	Social tension, and possibly violence.	Construction Phase	h	s	r	hp		M	h	s	r	l	L
Establishment of mine	Socio-economic.	Conflict between supporters and opponents of the proposed mining activity	Construction Phase	h	s	r	vp		M	h	s	r	l	L
Significant change in land use	Socio-economic.	Extensive change in land-use may result in a change to	Construction Phase	h	s	r	vp		M	h	s	r	l	L

		community selfidentification, which could have an effect on community spirit until the change is socialised or accepted. Highly visible land-use change to residents traversing a project area, associated with a single or multiple projects, may support a perception that the landscape is being ‘industrialised’. This type of perception, if strongly held or persistent, may contribute to a change in community identity that is not welcomed by either long-term residents or businesses that depend on a particular perception												
Operational activities	Socio-economic.	Creation of a number of local employment opportunities.	Operational activities	l	m	r	l		L	l	m	r	m	M
Operational activities	Socio-economic.	Investment into the local economy through purchase of	Operational activities	l	m	r	l		L	l	m	r	m	M

		goods and services												
National economic development	Socio-economic.	Service current and future clean fuels demand.	Operational activities	l	m	r	l		L	l	m	r	m	M
Noise generating operational activities.	Socio-economic.	Increase in baseline ambient noise levels at sensitive receptors.	Operational activities	l	m	r	l		L	l	m	r	m	M
Vehicles travelling to and from the proposed mine.	Socio-economic.	Increased the risk of an accident with a pedestrian and/or another vehicle, resulting in a serious injury or death.	Operational activities	l	m	r	hp		M	l	m	r	hp	M
Storage and handling of flammable liquids and explosives.	Socio-economic.	Risk to individuals (employees and members of the public) as a result of a fire or an explosion	Operational activities	m	l	l	l		l	m	l	l	im	L
Storage and handling of flammable liquids.	Socio-economic.	Risk to society as a result of a fire or an explosion.	Operational activities	vh	m	l	m		M	h	m	l	l	L
Demolition activities.	Socio-economic.	Creation of a number of local employment opportunities.	Closure Phase	vh	m	l	m		M	h	m	l	l	L
Decommissioning and closure of the facility	Socio-economic.	Loss of permanent employment opportunities.	Closure Phase	h	s	r	l		M	h	r	l	m	M
Demolition activities.	Socio-economic.	Dust and fine particulates affecting ambient air quality.	Closure Phase	h	s	r	d		H	h	s		m	M

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

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision).

Assessment Criteria

The assessment of the impacts will be conducted according to a synthesis of criteria required by the integrated environmental management procedure.

Extent

The physical and spatial scale of the impact is classified as:

a) Footprint

The impacted area extends only as far as the activity, such as footprint occurring within the total site area.

b) Site

The impact could affect the whole, or a significant portion of the site.

c) Regional

The impact could affect the area including the neighbouring properties, the transport routes and the adjoining towns.

d) National

The impact could have an effect that expands throughout the country (South Africa).

e) International

Where the impact has international ramifications that extent beyond the boundaries of South Africa.

Duration

The lifetime of the impact, that is measured in relation to the lifetime of the proposed development.

a) Short term

The impact would either disappear with mitigation or will be mitigated through natural processes in a period shorter than that of the construction phase.

b) Short to Medium term

The impact will be relevant through to the end of the construction phase.

c) Medium term

The impact will last up to the end of the development phases, where after it will be entirely negated.

d) Long term

The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter.

e) Permanent

This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient,

Intensity

The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. The intensity is rated as:

a) Low

The impact alters the affected environment in such a way that the natural processes or functions are not affected.

b) Medium

The affected environment is altered, but functions and processes continue, albeit in a modified way.

c) High

Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Probability

This describes the likelihood of the impacts actually occurring. The impact may occur for any length during the life cycle of the activity, and not at any given time. The classes are rated as follows:

a) Impossible

The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0%).

b) Possible

The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25%.

c) Likely

There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50%.

d) Highly likely

It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75%.

e) Definite

The impacts will take place regardless of any provisional plans, and or mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100%.

Mitigation

The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.

Determination of significance – Without Mitigation

Significance is determined through a synthesis of impacts as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact “without mitigation” is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, significance is noted as “positive”. Significance is rated on the following scale:

a) No significance

The impact is not substantial and does not require any mitigation action.

b) Low

The impact is of little importance, but may require limited mitigation.

c) Medium

The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.

d) High

The impact is of major importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

Determination of significance – With Mitigation

Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. Significance with mitigation is rated on the following scale:

a) No significance

The impact will be mitigated to the point where it is regarded as insubstantial.

b) Low

The impact will be mitigated to the point where it is of limited importance.

c) Low to Medium

The impact is of importance however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.

d) Medium

Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.

e) Medium to High

The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.

f) High

The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

Assessment weighting

Each aspect within the impact description was assigned a series of quantitative criteria. Such criteria are likely to differ during the different stages of the project's life cycle. In order to establish a defined base upon which it becomes feasible to make an informed decision, it is necessary to weigh and rank all criteria.

Ranking, Weighting and Scaling

For each impact under scrutiny, a scale weighting Factor is attached to each respective impact (refer to Figure 101: Description of biophysical assessment parameters with its respective weighting), The purpose of assigning such weight serve to highlight those aspects considered most critical to the various stakeholders and ensure that each specialist's element of bias is taken into account. The weighting factor also provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspects criteria.

Simply, such a weighting factor is indicative of the importance of the impact in terms of the potential effect that it could have on the surrounding environment. Therefore, the aspects considered to have a relatively high value will score a relatively higher weighting than that which is of lower importance.

Extent	Duration	Intensity	Probability	Weighting Factor (WF)	Significance Rating (SR)	Mitigation Efficiency (ME)	Significance Following Mitigation (SFM)
Footprint 1	Short term 1	Low 1	Probable 1	Low 1	Low 0-19	High 0,2	Low 0-19
Site 2	Short to medium 2		Possible 2	Low to medium 2	Low to medium 20-39	Medium to high 0,4	Low to medium 20-39
Regional 3	Medium term 3	Medium 3	Likely 3	Medium 3	Medium 40-59	Medium 0,6	Medium 40-59
National 4	Long term 4		Highly Likely 4	Medium to high 4	Medium to high 60-79	Low to medium 0,8	Medium to high 60-79
International 5	Permanent 5	High 5	Definite 5	High 5	High 80-100	Low 1,0	High 80-100

Figure 101: Description of biophysical assessment parameters with its respective weighting

Identifying the Potential Impacts without Mitigation (WOM)
Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

Identifying the Potential Impacts with Measures (WM)
In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it was necessary to re-evaluate the impact.

a) Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact.

Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2:

Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency

Or WM = WOM x ME

b) Significance Following Mitigation (SFM)

METHODOLOGY FOR ASSESSING ENVIRONMENTAL ISSUES AND ALTERNATIVES

According to National Environmental Management Act (107/1998): Environmental Impact Assessment Regulations, 2020), the environment is described as the surrounding within which human exist and that are made up of:

(i) the land, water and atmosphere of the earth;

(ii) micro-organisms, plant and animal life;

(iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and

(iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Impact Assessment Methodology

(a) Nature of the impact

The NATURE of an impact can be defined as: "a *brief description of the impact being assessed, in terms of the proposed activity or project, including the socio-economic or environmental aspect affected by this impact*".

(b) Extent of the impact

The EXTENT of an impact can be defined as: "*a brief description of the spatial influence of the impact or the area that will be affected by the impact*".

EXTENT Extent or spatial influence of impact	**Footprint**	Only as far as the activity, such as footprint occurring within the total site area
	Site	Only the site and/or 500m radius from the site will be affected
	Local	Local area / district (neighbouring properties, transport routes and adjacent towns) is affected
	Region	Entire region / province is affected
	National	Country is affected

(a) Magnitude of the impact

The MAGNITUDE of an impact can be defined as: "*a brief description of the intensity or amplitude of the impact on socio-economic or environmental aspects".*

MAGNITUDE Magnitude / intensity of impact (at the specified scale)	**Zero**	Natural and/or social functions and/or processes remain *unaltered*
	Very low	Natural and/or social functions and/or processes are *negligibly* altered
	Low	Natural and/or social functions and/or processes are *slightly* altered
	Medium	Natural and/or social functions and/or processes are *notably* altered
	High	Natural and/or social functions and/or processes *severely* altered

(b) Duration of the impact

The DURATION of an impact can be defined as: "*a short description of the period of time the impact will have an effect on aspects*".

DURATION Duration of the impact	**Short term**	Construction phase up to 3 years after construction
	Medium term	Up to 6 years after construction

	Long term	More than 6 years after construction

(c) Probability of the impact occurring

The PROBABILITY of an impact can be defined as: "the *estimated chance of the impact happening*".

PROBABILITY	**Unlikely**	*Unlikely* to occur (0 – 25% probability of occurring)
	Possible	*May* occur (26 – 50% chance of occurring)
	Probable	*Likely* to occur (51 – 75% chance of occurring)
	Definite	Will *certainly* occur (76-100% chance of occurring)

(d) Degree to which impact can be reversed

The REVERSABILITY of an impact can be defined as: *"the ability of an impact to be changed from a state of affecting aspects to a state of not affecting aspects*".

REVERSABILITY	**Reversible**	Impacts can be reversed through the implementation of mitigation measures
	Irreversible	Impacts are permanent and can't be reversed by the implementation of mitigation measures

(e) Degree to which impact may cause irreplaceable loss of resources

The IRREPLACEABILITY of an impact can be defined as:" the amount of resources that can (not) be replaced".

IRREPLACEABILITY Irreplaceable loss of resources	**No loss**	*No* loss of any resources
	Low	*Marginal* loss of resources
	Medium	*Significant* loss of resources
	High	*Complete* loss of resources

(f) Degree to which the impact can be mitigated

The degree to which an impact can be MITIGATED can be defined as: "the effect of mitigation measures on the impact and its degree of effectiveness".

MITIGATION RATING	**MITIGATED** Degree impact can be mitigated	**High**	*Impact 100% mitigated*
		Medium	*Impact >50% mitigated*
		Low	*Impact <50% mitigated*

(g) Confidence rating

CONFIDENCE in the assessment of an impact can be defined as the:" *level of certainty of the impact occurring*".

CONFIDENCE RATING	**CONFIDENCE**	**Unsure**	Amount of information on and/or understanding of the environmental factors the potentially influence the impact is *limited*.
		Sure	Amount of information on and/or understanding of the environmental factors the potentially influence the impact is *reasonable and relatively sound.*
		Certain	Amount of information on and/or understanding of the environmental factors the potentially influence the impact is *unlimited and sound*.

(h) Cumulative impacts

The effect of CUMULATIVE impacts can be described as:" the effect the combination of past, present and "reasonably foreseeable" future actions have on aspects".

CUMULATIVE RATING	**CUMULATIVE EFFECTS**	**Low**	*Minor* cumulative effects
		Medium	*Moderate* cumulative effects
		High	*Significant* cumulative effects

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account. The significance of the impact assessment was taken into consideration by assessing areas of high conservation value. These areas will either be excluded from any disturbances including buffer zones being implemented. In cases where the areas cannot be exempted relevant applications will be applied for.

1.10.2 The positive and negative impacts that the proposed activity (In terms of the initial site layout) and alternatives will have on the environment and the community that may be affected.

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties)

This section focuses specifically on the alternatives relating directly to the proposed mining project, further impacts are detailed in the section below, and therefore not repeated here. The alternatives discussed are:

- Processing plant area
- RoM stockpile area

- Access and haul roads
- Pollution Control Dams/Return Water Dam
- Mobile offices (including ablution facilities)
- Overburden stockpiles
- Tailings storage facility
- Opencast and underground mine workings
- No Go Option

Table 43: Positive and negative impacts considering the alternatives described for the proposed Kusile's Giyani Gold Mine

Activity	Alternative	Aspect	Positive and negative impacts
Open Cast and underground Mining	Type of mining and areas mineable	Geology	(-) Due to the shallow nature of ore body it is only feasible to mine opencast (-) Including the areas within 100m of tributaries will increase areas impacted by the mining and increases the extent to which the geology is altered
		Groundwater	(-) The excavation of the open pit will lead to dewatering and decanting. (-) groundwater quality will also be affected by polluting elements
		Surface water	(-) Increased sedimentation due to erosion
		Topography	(-) The topography or the area is veld and the open pits will leave a depression even after rehabilitation (-) temporary storage of stockpiles, discard dumps and topsoil will temporarily distort the topography
		Soil	(-) Excluding floodline and riparian areas from the open pit mining will reduce the footprint of the mining area. (-) Soil will be lost during excavations and erosion even if mitigation measures are implemented
		Land Capability	(-) The land capability will be lost in areas where excavation and open pits will be located. (-) the chemical properties of the soil will be altered due to pollution from hydrocarbons, oils, overspills from PCDs
		Land Use	(-) the land use will be lost from that of a conservation value, however with proper mitigation the land can be rehabilitated to an acceptable level
		Flora	(-) Not mining in the riparian areas minimises impacts on flora (-) the vegetation clearing will lead to significant loss of indigenous species (-) increased encroachment of alien invasive species on cleared land
		Fauna	(-) the loss of these vegetation leads to loss of habitats for birds, mammals and herpetofauna (-) displacement of fauna due to increased human activity like noise, blasting, vehicles, human behaviour and poaching
		Air	(-) Increased air pollution from the blasting activities, site clearing, vehicle movement and fumes and fugitive dust
		Noise	(-) Increased noise polluting from earthmoving equipment, heavy vehicles and machinery, processing plant, conveyor belts and blasting
		Heritage	(-) Artefacts unearthed during construction and operations can be lost if no proper heritage induction is undertaken and proper mitigation measures are not put in place

Activity	Alternative	Aspect	Positive and negative impacts
		Climate change	(-) Due to vegetation clearing, particulate matter from vehicles and machinery, increased fugitive dust it is expected that the climate will be locally affected by the increase in aerosols in the atmosphere as well as increased reflective surfaces
		Socio- Economic	(-) excluding areas within floodlines reduces the total amount of ore to be mined (-) I&AP's concerned over the pollution plume of the mining activity, reduction in groundwater levels to scarcity in a water strained area (+) the proposed mine create employment (skilled and unskilled during construction) (+)There will be infrastructure development as part of the SLP (+) Through local hiring and promoting of local SME's the project will have a positive impact on the local economy (this has been noted but I&AP"s requesting to supply fuel for the mine)
Pollution control dam	Location and size	Geology	(-) The excavations will remove certain bedrock which will be discarded or used to rehabilitate the open pits but will be lost to the original stratigraphy
		Groundwater	(-) The excavation of the area will change drainage patterns as well as infiltration and runoff
		Surface water	(-) The PCD with a 110% capacity will be located at least 500m from the rivers with a dirty water containment system in place in case of spillage
		Topography	(-) The PCD will be constructed in a low lying flat area and will not alter the topography
		Soil	(-) Soil loss through clearing of land for the pollution control dam
		Land Capability	(-) Land capability lost for the pollution control dam
		Land Use	(-) Current land use lost as land capability is directly affected by the reduction in area due to infrastructure as well as loss in visual appearance land for infrastructure and roads
		Flora	(-) Vegetation will be lost during site clearing and construction. However it is recommended that the plant be constructed on already existing clearances to minimise vegetation loss
		Fauna	(-) The clearance of vegetation will lead to a loss in habitat for birds, mammals and herpetofauna (-) displacement of fauna due to increased activity and noise
		Air	(-) increased dust levels, PM10, fumes during the construction phase
		Heritage	(-) The PCD will be located at least a 100m from heritage buffer zones. (-)loss of archaeological artefacts might be lost due to poor environmental management during the construction phase
		Noise	(-)Increased noise levels are expected during construction
		Social	(-) Increased visual disturbance to the residents on the site from the PCD (-) I&AP concerns for overspills and spillages contaminating the groundwater (-) I&AP's raising concern about waste license management application. As part of an integration application a waste license was applied for during the EA application phase. The inputs of the IWWMP which is part of the IWULA also running concurrently with this process feeds into the waste licence application authorisation (+) Potential local economy growth through hiring of architectural and engineering companies in the areas to provide the services (+) Skilled and unskilled labour creations

Activity	Alternative	Aspect	Positive and negative impacts
Storm Water Management features (Clean and dirty water separation)		Geology	(0) the stormwater management features will have negligible effect on the geology as there will be no alterations to the bedrock
		Groundwater	(+) The stormwater management features will contain contaminated water separating it from clean water which is released to rivers. This contains contaminated water in a localised area
		Surface water	(+) The stormwater management features will contain contaminated water separating it from clean water which is released to the rivers (-) the construction of the stormwater management features will alter drainage patterns
		Soil	(-) Soils will be lost albeit in minimal quantities where the features will be built
		Land Capability	(-)There will be minimal land use lost due to the infrastructure
		Land Use	(-)There will be minimal land capability lost due to the infrastructure
		Flora	(-)Where possible the features will be constructed around vegetation of high conservation value. In cases where this is not possible there will be loss in flora
		Fauna	(-) the construction of the features will cause a loss in vegetation therefore habitats are lost (-) changes in animal routine might be affected by the features
		Air	(-) Aside from temporary fugitive dust and PM10 emissions during construction no residual air quality impacts are anticipated
		Heritage	(0) Storm water features will be designed around heritage features
		Noise	(-) There will be temporary noise pollution during construction but this will subside once complete
		Social	(+) Potential local economic growth through hiring of architectural and engineering companies in the areas to provide the services (+) Skilled and unskilled labour creations
Processing plant		Geology	(+) The processing plant will not affect the geology
		Groundwater	(-) Construction of the processing plant will lead the clearance of vegetation altering infiltration and runoff patterns. There are open areas on the project site and it is proposed by the EAP that Kusile choose one of those areas as an alternative
		Surface water	(-) the vegetation clearing, compaction and infrastructure will change drainage patterns and rates of infiltration
		Topography	(0) The plant will be constructed on relatively low flat land which has already been disturbed and this will not impact the topography
		Soil	(-)There will be soil loss during construction of the plant
		Land Capability	(-) The land capability of the plant foot print will be altered and lost
		Land Use	(-) The current land use is not compatible with mining, a rezoning certificate will need to be applied for prior to commencement of the activity.
		Flora	(-) Vegetation will be lost during site clearing and construction. However it is recommended that the plant be constructed on already existing clearances to minimise vegetation loss
		Fauna	(-) The clearance of vegetation will lead to a loss in habitat for birds, mammals and herpetofauna (-) displacement of fauna due to increased activity and noise
		Heritage	(0) The wash processing plant will be located at least a 100m away from any areas of cultural significance
		Air	(-) Air emissions from the use of chemicals and generators

Activity	Alternative	Aspect	Positive and negative impacts
		Noise	(-) Increased noise levels from the processing plant
		Social	(-) Increased visual disturbance to the communities from the plant (-) Increase noise levels in the area might disturb the community (+) Potential local economy growth through hiring of architectural and engineering companies in the areas to provide the services (+) Skilled and unskilled labour creations
Sewage treatment Plant	Phase of construction and implementation	Geology	(+) The water treatment plant will not affect the geology
		Groundwater	(-) Construction of the water plus the sewage treatment plant will lead the clearance of vegetation. There are open areas on the project site and it is proposed by the EAP that KUSILE choose one of those areas as an alternative(-) the sewage treatment plant should be designed as a bio-filtration process instead of chemicals, possibility of effluent spillages affecting the groundwater quality
		Surface water	(-) the vegetation clearing, compaction and infrastructure will change drainage patterns and rates of infiltration
		Topography	(0) The plant will be constructed on relatively low flat land which has already been disturbed and this will not impact the topography
		Soil	(-)There will be soil loss during construction of the plant
		Land Capability	(-) The land capability of the plant foot print will be altered and lost
		Land Use	(-) The current land use is not compatible with mining, a rezoning certificate will need to be applied for prior to commencement of the activity.
		Flora	(-) Vegetation will be lost during site clearing and construction. However it is recommended that the plants be constructed on already existing clearances to minimise vegetation loss
		Fauna	(-) The clearance of vegetation will lead to a loss in habitat for birds, mammals and herpetofauna (-) displacement of fauna due to increased activity and noise
		Heritage	(+) The water plus sewage treatment plant will be located at least a 100m away from any areas of cultural significance
		Air	(-) Air emissions from the use of chemicals and generators (-) Increased “bad smell” from the sewage treatment plant
		Noise	(-) Increased noise levels from the water and waste treatment plant due to increased activity and at the plants.
		Social	(+) Increased potential to supply water to the communities treated from the plant (-) Increased noise levels in the area might disturb the community (+) Potential local economy growth through hiring of architectural and engineering companies in the areas to provide the services (+) Skilled and unskilled labour creations
Mine related Infrastructure including Roads, Workshops, powerlines, substation, workshops etc.	Location on site and route options	Geology	(+) The construction of infrastructure and roads will not affect the geology
		Groundwater	(-) increased compaction will negatively impact runoff and infiltration which impacts the groundwater recharge. (-) Oils spillages during construction and use of roads will negatively impact the groundwater quality
		Surface water	(+) All of the infrastructure and roads will not be constructed within 500m of the river
		Topography	(+) The infrastructure will be constructed on relatively low flat land which has already been disturbed and this will not impact the topography

Activity	Alternative	Aspect	Positive and negative impacts
			(+) To minimise vegetation clearance it is proposed that Kusile make use of the road networks on and off the site
		Soil	(-) Soil loss through clearing of land for infrastructure and roads
		Land Capability	(-) Land capability lost for infrastructure and roads
		Land Use	(-) Current land use lost as land capability is directly affected by the reduction in area due to infrastructure as well as loss in visual appearance land for infrastructure and roads
		Flora	(-) Loss of vegetation through site clearing for infrastructure (+) To minimise vegetation clearance it is proposed that Kusile make use of road networks on and off the site
		Fauna	(-) The clearance of vegetation will lead to a loss in habitat for birds, mammals and herpetofauna (-) displacement of fauna due to increased activity and noise (-) Electrocution of birds by power lines and at substations
		Heritage	(+) The infrastructures will be located at least a 100m away from any areas of cultural significance
		Air	(-) Increased air pollution during construction activities, site clearing and during the operation phase from vehicle movement and fumes and fugitive dust
		Noise	(-) Temporary increase in levels during construction (-) Noise level increases from haul trucks on and off the site as well as conveyer belts on site
		Social	(-) The I&AP's see the infrastructure as a disturbance to the visual character of the area. (+) Potential local economy growth through hiring of architectural and engineering companies in the areas to provide the services (+) Skilled and unskilled labour creations
No-go project option (Not implementing the mining activity)	Not implementing the mining activity	Air	(0) Air quality would not be compromised during the construction, operations and rehabilitation through the proposed mining activities by the generation of dust from exposed surfaces as well as the generation of exhaust fumes from machinery.
		Noise	(+) Noise would not be generated during the construction, operations and rehabilitation through the mining related activities.
		Topography, groundwater and surface water	(+) Sensitive landscapes will not be compromised including groundwater or surface water quality or quantity
			(+) The landscape will not be altered by the depressions which will be caused by the open pits mining and removal of ore however successfully rehabilitated.
		Flora and Fauna	(+) No Loss of indigenous vegetation and habitats
		Soil and Land Capability	(+)The arable and wildlife land capability will not be changed and no soil losses through the construction, operations and rehabilitation through the mining related activities
		Visual aspects	(+) The visual landscape and sense of place attributes would not be compromised.
		Land Use	(0) The current land use is arable subsistence farming and rural landscape. The statu quo would remain unchanged
		Heritage	(+) The sites of historical and cultural importance would not be affected by the construction, operations and rehabilitation through the mining related activities
		Social and Economic Impacts	(-)Loss of potential investment opportunities in the project area and income generated from the sale of the product
			(-) Loss of potential employment creation and opportunities for local service providers

Activity	Alternative	Aspect	Positive and negative impacts
			(-) Loss of infrastructure development for the proposed SLP programs for the surrounding community
			(-)Loss of income already invested in the prospecting activities as well as related regulatory applications
			(-) Loss of training programs for HDSA including bursaries, mentorship programs and career development plans
			(-) There would be direct losses to government through a loss in revenue from the mine (through taxes).
			(-) There would be direct losses to government through a loss in revenue from the mine (through taxes).
			(-) The land claimants will also stand to lose out on the BEE partnership to be gained from the project.
		I&APs	(-) / (+) I&APs may be positively or negatively affected by the various impacts described above

1.10.2.1 The possible mitigation measures that could be applied and the level of risk.

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ discussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered).

The impacts of the proposed project have been detailed in **Table 44: Assessment of each identified potentially significant impact and risk**

1.10.2.1.1 Motivation where no alternative sites were considered.

Alternative locations of various developments and infrastructure within the application area have, where possible, been considered, and are described in **Table 43: Positive and negative impacts considering the alternatives described for the proposed Kusile's Giyani Gold Mine** above.

1.10.2.1.2 Statement motivating the alternative development location within the overall site.

(Provide a statement motivating the final site layout that is proposed)

The proposed locations of pits and related infrastructure were influenced by the following factors:

- Open Cast Areas
  - The quantifiable availability and location of the resources and appropriate mining method
  - The location of open cast areas in relation to environmentally sensitives features
- Water management Infrastructure
  - Pollution control dams- to be located on already disturbed areas, low lying flat areas, at least 500m from the river, outside the 1:100 year floodline, away from riparian areas. 110% containment capacity and to be located within the dirty water bunded areas.

  - Storm water management infrastructure- Location of drains in relation to hills and areas of high conservation value
- Processing Plant
  - Design- the processing plant has been designed according to the standards required for the beneficiation process.
  - Location- The location of the plant will be finalised based on finding a location on site which is low lying and flat to minimise visual impact as well as already cleared areas to reduce the destruction of indigenous vegetation
- Sewage treatment plant
  - Location- The location of the plant will be finalised based on finding a location on site which is low lying and flat to minimise visual impact as well as already cleared areas to reduce the destruction of indigenous vegetation. Raw sewage and grey water from the mine offices and ablution facilities will be disposed of into a package sewage treatment. Treated effluent from the sewage plant will be drained to a PCD and then reused.
- Infrastructure and road (offices, buildings, sub stations, discard dump, workshops, road, powerlines)
  - Existing road network- on and off site there is a good network of road that can be utilised for the project to minimise additional disturbances
  - Areas of high visual view shed- Infrastructure to be constructed in low lying areas to minimise the view shed. Screening with indigenous vegetation is also crucial which can be reached by reducing the tree removal around the boundary of the project site to limit the visual impact to the site
  - High ecology sensitivity areas- Construct on already disturbed areas to limit destruction of indigenous vegetation.
  - Existing power lines around the project site

1.10.3 Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity.

(Including (i) a description of all environmental issues and risks that where identified during the environmental impact assessment process and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.)

The methodology used to determine and rank the nature, significance, consequences, extent, duration and probability of each of the potential impacts and risks that have been identified was described in detail in 1.10.1: Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; of this report. Impacts are assessed below in terms of the following summarised criteria (for details refer to 1.10.1: Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;):

- Nature of impact –proposed listed activity or project.
- Extent – Spatial Influence of the impact (site only, local, regional, national, international).
- Magnitude- Intensity of the impact (zero, very low, lo, medium, high)
- Duration – Period of time the impact will affect an aspect (immediate, short term, medium term, long term, permanent).
- Probability of occurrence- The estimated chance of the impact happening (improbable, low, medium, high, definite).
- Significance = (Magnitude + Duration + Extent) x Probability. (Low, medium, high).
- Reversibility of the impact – the ability of an impact to be changed from affecting an aspect to not affecting an aspect (reversible, partially reversible, irreversible).
- Irreplaceability loss of resources- The amount of resource that can or cannot be replaced (replaceable, partially replaceable, irreplaceable).

Other aspects considered is the degree to which the impact can be mitigated and the confidence rating which is the level of certainty of an impact occurring.

The significance of each identified impact described in **Table 43: Positive and negative impacts considering the alternatives described for the proposed Kusile's Giyani Gold Mine** has been assessed based on the criteria and is tabulated in **Table 44: Assessment of each identified potentially significant impact and risk**.

1.10.4 Assessment of each identified potentially significant impact and risk (as rated by the specialist reports)

(This section of the report must consider all the known typical impacts of each of the activities (including those that could or should have been identified by knowledgeable persons) and not only those that were raised by registered interested and affected parties).

Table 44: Assessment of each identified potentially significant impact and risk

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	Significance without mitigation	Mitigation type	Significance with mitigation
				SP		SP
				significance rating		significance rating after mitigation
Site Establishment	Groundwater	Construction and grading could cause changes in runoff and infiltration that could reduce groundwater recharge.	Construction Phase	27 (L)	·Construction stage will be planned to minimize the removal of vegetation and opportunities for re-vegetation will be maximized.	21 (L)
Site Establishment	Groundwater	Fuel & hydrocarbons leakages and spillages from the storage and transporting vehicles may cause groundwater contamination.	Construction Phase	27 (L)	· All storage areas containing hazardous materials will have secondary containments capable of containing the volume of the largest tank or container plus 10%. Resort to immediate clean-up after accidental spillages. Divert run-off from haul roads that may contain hydrocarbons into lined pollution control dams.	21 (L)
Site Establishment	Groundwater	Open cast mining below the water table will result in pit inflows	Construction Phase	28 (L)	· Pit inflows cannot be mitigated (required to enable a safe work environment). Provision needs to be made within the mine water balance for the reuse or treatment of pit inflows. In case the water should be discharged, treatment will be required before discharge.	28 (L)
Site Establishment	Groundwater	Baseflow reduction caused by mining	Construction Phase	6 (L)	· Rivers and other streams in the project area are non-perennial and there are no baseflow into them. The baseflow into the streams and River won't be affected by mining activities	6 (L)

Site Establishment	Groundwater	Groundwater abstraction for water supply purposes could reduce groundwater levels in the area	Construction Phase	48 (M)	· Groundwater abstraction. The extent of the zone of influence will not extend beyond 1 000m and the maximum drawdown in the affected areas will range between 1 and 5 m, thereby not expected to impact on the yields of any supply boreholes around the mining area. Possible mitigation against such an impact is temporary water supply by the mine.	32 (M)
Site Establishment	Surface Water	Increased potential for groundwater contamination due to seepages from the overburden stockpiles	Construction Phase	10 (L)	· Compact footprint area of the overburden stockpiles to minimize groundwater infiltration. Storm water run-off from the overburden stockpiles will be diverted into dirty water dams. A groundwater resources monitoring program will be implemented during to detect the groundwater contamination	10 (L)
Site Establishment	Surface Water	Water contained in dirty water dams may impact on groundwater quality	Construction Phase	36 (M)	· Pollution control dams need to be lined and designed to comply with NEMA and NWA requirements (Act 36 of 1998). Manage any leakages and spills to prevent groundwater contamination. Implement groundwater monitoring to detect groundwater contamination	10 (L)
Site Establishment	Surface Water	Increased sediment loads from vegetation clearance and soil compaction.	Construction Phase	20 (L)	· Progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff;· Implementation of the proposed basic storm water management plan is recommended at the mine site to channel and contain storm runoff;· Traffic and movement over stabilized areas should be controlled (minimized and kept to designated paths), and damage to stabilized areas should be repaired timeously and maintained; andThe total footprint area to be cleared for the development of mine infrastructure should be kept to a minimum by demarcating the construction areas and restricting removal of vegetation to the footprint areas only.	15 (L)

Site Establishment	Surface Water	Water resources pollution due to spillage of oils, fuel and chemicals.	Construction Phase	20 (L)	· Oil recovered from any vehicle or machinery on site should be collected, stored and disposed of by accredited vendors for recycling.	15 (L)
Site Establishment	Stream Resource Quality	• Changing the quantity and fluctuation properties of the watercourse; • Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount); • Alteration of water quality – increasing the amounts of nutrients and toxins; and • Changing the physical structure within a water resource (habitat).	Construction Phase	48 (M)	• Centralize the mine layout to affect as few surface watercourses as possible. • Capture and contain all dirty water from the construction operations. • Management of on-site water use and prevent storm water or contaminated water directly entering the watercourse (thus treat and reuse dirty water within construction activities). • Treat all surplus dirty water. Consider this water for treatment and discharge to receiving streams, or to third party users. • Given the sensitive nature of the receiving watercourses and the potentially far reaching effects within the River system, these recommendations should be coupled with the requirements of GN704. • If possible construction should preferably take place during the dry season. • All construction vehicles should be kept in good working condition to avoid. • All construction vehicles should be parked in demarcated areas when not in use and drip trays should be placed under vehicles to collect any spillages/ leaks. • Formalize access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed. • Monitor the establishment of alien invasive	40 (M)

					species within the areas affected by the construction and maintenance of the proposed infrastructure and take immediate corrective action where invasive species are observed to establish. • During the construction phase, measures must be put in place to control the flow of excess water so that it does not impact on the surface vegetation. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • Demarcate the riparian areas and buffer zones to limit disturbance, clearly mark these areas as no-go areas. • Provision of adequate sanitation facilities located outside of the riparian area or its associated buffer zone. • Establishment of buffer zones to reduce nutrient inputs in diffuse flow • Implementation of appropriate storm water management measures around the excavation to prevent the ingress of run-off into the excavation. • Any activities within 50m of riparian areas are subject to authorization by means of a water use license. • Construction in and around watercourses must be restricted to the dryer winter months where responsible. • A temporary fence or demarcation must be erected around the works area to prevent access to sensitive environs. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the infrastructure • Planning of the construction site must include eventual rehabilitation / restoration of	

					indigenous vegetative cover • Have oil/diesel spill kits on site. • Confirm surface water monitoring protocol and plans. Recommended that surface water monitoring be undertaken on a quarterly basis.	
Mining	Groundwater	Construction and grading could cause changes in runoff and infiltration that could reduce groundwater recharge.	Operational Phase	27 (L)	· Construction stage will be planned to minimize the removal of vegetation and opportunities for re-vegetation will be maximized.	21 (L)
Mining	Groundwater	Fuel & hydrocarbons leakages and spillages from the storage and transporting vehicles may cause groundwater contamination.	Operational Phase	27 (L)	· All storage areas containing hazardous materials will have secondary containments capable of containing the volume of the largest tank or container plus 10%. Resort to immediate clean-up after accidental spillages. Divert run-off from haul roads that may contain hydrocarbons into lined pollution control dams.	21 (L)
Mining	Groundwater	Open cast mining below the water table will result in pit inflows	Operational Phase	28 (L)	· Pit inflows cannot be mitigated (required to enable a safe work environment). Provision needs to be made within the mine water balance for the reuse or treatment of pit inflows. In case the water should be discharged, treatment will be required before discharge.	28 (L)
Mining	Groundwater	Baseflow reduction caused by mining	Operational Phase	6 (L)	· Rivers and other streams in the project area are non-perennial and there are no baseflow into them. The baseflow into the streams and Rivers won't be affected by mining activities	6 (L)
Mining	Groundwater	Groundwater abstraction for water supply purposes could reduce groundwater levels in the area	Operational Phase	48 (M)	· The extent of the zone of influence will not extend beyond 1 000m and the maximum drawdown in the affected areas will range between 1 and 5 m, thereby not expected to impact on the yields of any supply boreholes around the mining area. Possible mitigation against such an impact is temporary water supply by the mine.	32 (M)

Mining	Groundwater	Increased potential for groundwater contamination due to seepages from the overburden stockpiles	Operational Phase	10 (L)	· Compact footprint area of the overburden stockpiles to minimize groundwater infiltration. Storm water run-off from the overburden stockpiles will be diverted into dirty water dams. A groundwater resources monitoring program will be implemented during to detect the groundwater contamination	10 (L)
Mining	Groundwater	Water contained in dirty water dams may impact on groundwater quality	Operational Phase	36 (M)	· Pollution control dams need to be lined and designed to comply with NEMA and NWA requirements (Act 36 of 1998). Manage any leakages and spills to prevent groundwater contamination. Implement groundwater monitoring to detect groundwater contamination	10 (L)
Mining	Surface Water	Pollution of watercourses from general waste and sewage effluent due to hiring of mine workers.	Operational Phase	33 (M)	· A reticulated sewage disposal facility at the proposed mine site should mitigate potential water quality issues that may arise due to population increase;	18 (L)
Mining	Surface Water		Operational Phase		· General waste should be collected and disposed of adequately; and	
Mining	Surface Water		Operational Phase		· A water quality monitoring plan needs to be produced and implemented to determine any changes in the water quality.	
Mining	Surface Water	Increased runoff due to soil compaction and increased paved surfaces.	Operational Phase	36 (M)	· Compacted surfaces at the mine should be kept to a minimum and vegetation rehabilitation must be implemented within the mine setup; and	16 (L)
Mining	Surface Water		Operational Phase		· Proposed storm water drains should be designed to channel clean runoff to a single discharge point into the nearby watercourses while dirty water should be channeled to a central PCD.	

Mining	Resource Quality	• Hydrocarbon (oil, petrol and diesel) spills and/or leakages could occur from vehicles and/or equipment. These spills could contaminate the surface and ground water should they occur simultaneously with a heavy rainfall event. • Operational activities such as the establishment of increased hard surfaces could cause erosion which will lead to high volumes of sediment entering streams. This could again lead to increased silt loads entering the water bodies, especially under flood conditions (decreasing storage capacity). The mine's pollution control dams also pose a risk of contamination of surface water during flood events.	Operational Phase	56 (M)	• Centralize the mine layout to affect as few surface watercourses as possible, and ideally only one; • Capture and contain all dirty water from the operations activities; • Treat and reuse dirty water within construction activities; • Treat as a water resource all surplus dirty water. Consider this water for treatment and discharge to receiving streams, or to third party users; • All operational vehicles should be kept in good working condition, and should be parked in demarcated areas when not in use and drip trays should be placed under vehicles to collect any spillages/ leaks. • Keep dirty areas like stockpiles, workshops and oil and diesel storage areas as small as possible; and • Contain poor quality runoff from dirty areas and divert this water to pollution control dam for re-use. • Have oil/diesel spill kits on site. • Confirm surface water monitoring protocol and plans. Recommended that monitoring be conducted on a quarterly basis.	33 (M)
Closure	Groundwater	Salt Load contribution towards Ntsami Dam or other streams	Decommission Phase	10 (L)	· The dominant direction of migration of contaminants from the surface facilities will be towards the pits and Ntsami Dam or any nearby streams won't be affected.	10 (L)
Closure	Groundwater	Aquifer contamination caused by backfill	Decommission Phase	60 (H)	· Pollution plume migration will be towards the mine pits and around the stockpiles areas and the plume won't affect the nearby farms. The final backfilled opencast topography should be engineered in such that runoff is diverted away from the opencast area.	52 (M)

Closure	Groundwater	Rebound water levels within backfill material may cause decant	Decommission Phase	52 (M)	· Decant positions are located within the mining area. In case there is decant, an impermeable layer can be applied below the topsoil cover, which will need to be compacted to prevent the ingress of water. Install water monitoring boreholes closer to the decant points to monitor the water level and water quality.	39 (M)
Closure	Surface Water	Compacted surfaces could lead to increased runoff into the nearby streams.	Decommission Phase	52 (M)	· Progressive rehabilitation of disturbed land should be carried out to minimise the compacted surfaces at the decommissioned mine.	27 (L)
Closure	Surface Water	Contamination from leakage and spillage of chemicals, oils and grease.	Decommission Phase	30 (M)	· Chemical and oil recovered from any vehicle or machinery on site should be collected, stored and disposed of by accredited vendors for recycling.	10 (L)
Closure	Surface Water	Acid mine drainage problems and problems associated with the disposal of other waste material when the mine is decommissioned	Decommission Phase	40 (M)	· Implement phytoremediation measures to correct contamination of water resources. Employ new technologies which are recently being developed to treat acid mine drainage to usable water quality levels.	20 (L)
Setting up infrastructure and moving onto site	Biobiversity	Loss of Species of Conservation Concern	Operational Phase	70H	The mining footprint should be kept as small and as linear as possible for the pit areas. · During the construction phase, workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled. · The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area. No activities are to infringe upon any channels and/or rivers. · Edge effects of all phases, such as erosion and alien plant species proliferation, which will affect faunal habitats adjacent to the development area, need to be	48M

						strictly managed. This can be achieved through the chemically and mechanically removing alien invasive vegetation within the mining footprint. The removal of this vegetation will provide job opportunities for community members. · Any natural areas beyond the development footprint, which have been affected by the construction activities, must be rehabilitated using indigenous plant species. Rehabilitation must take place concurrent to operations, and postclosure. · The clearing of vegetation, during the construction phase, must be kept to a minimum and must be within theproject boundaries. · Harvesting and collection of any flora must be strictly prohibited. · Erosion control measures must be implemented in areas sensitive to erosion such as exposed soil, edges of slopes (including trenches cut for construction) etc. These measures include but are not limited to - the use of sand bags, hessian sheets, silt fences and retention or replacement of vegetation. · Avoid known areas of faunal and floral species of special concern as indicated on the relevant maps. · Avoidance of sensitive areas, as these areas are ecologically irreplaceable. · Maintain top soil biological activity by stockpiling soils without compacting them. This keeps the seed bank in the topsoil viable if the topsoil is replaced within a year. This viable seedbank will create an effective basis for rehabilitated areas where these soils are used.	

					· Education and awareness campaigns on faunal species and their habitat are recommended to help increase awareness, respect and responsibility towards the environment for all staff and contractors. · Disturbed areas must be rehabilitated immediately after construction has been completed in that area by planting appropriate indigenous plant species. · If mining is permitted, rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas to a ground of cover of at least 85%. · Once pegged, a qualified botanist must walk the site to identify all conservation-important species. These species must be translocated to a suitable habitat outside of the construction footprint, prior to any construction activities. · Plant permits must be obtained from the relevant authorities prior to any construction activities commencing. · Any protected plants that are removed must be replaced at a ratio of 1:10 (10 plants must be planted for every 1 plant removed). · It is highly recommended that a speed limit of 30km/h is implemented on all roads running through the proposed mining area during all phases in order to minimise risk to fauna from vehicles and that signage is erected to this effect. Should an animal be killed by a vehicle, the incident must be reported immediately to the ECO and to the Endangered Wildlife Trust (www.ewt.org.za), to monitor road kills. EWT Wildlife and Roads project has been set up to monitor and investigate the effects of	

					road kills in South Africa. · Any bird nests that are found during the construction period must be reported to the Environmental Control Officer(ECO). · It is essential that as transformation takes place on site, a qualified herpetologist must be present on site to identify and safely remove all reptiles or other slow moving species, should they occur on the proposed development site. · No trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place. · Where possible, species should be left in their natural environment. · Should any Red Data faunal species be noted within the development footprint areas, these species must be relocated to similar habitat with the assistance of a suitably qualified ecologist. · Any species directly threatened by the construction activities must be removed to a safe location by the ECO or qualified Ecologist. Floral species of special concern must be relocated or placed in a nursery. · If the proposed Giyani Mine proceeds, it must contribute meaningfully to conservation in the region. Conservation of natural land and the creation of corridors in the area would aid ecosystems, and fauna and flora. Corridors and conservation areas should be identified by qualified ecologists for a Biodiversity Action Plan (BAP). · Avoidance of river and channel areas as far as possible (100 m buffer), these areas are regarded as highly sensitive	

					areas. · Search and rescue for reptiles and other vulnerable species, before areas are cleared. · Environmental induction for all staff and contractors on-site. · Any disturbed areas should be rehabilitated in line with the rehabilitation guidelines, this includes the clearing of alien vegetation, following the guidelines of a suitable alien invasive plant management plan. · The site must be regularly monitored for re-growth of alien invasive species, and any new seedlings etc. eradicated using methods appropriate for the particular species, whether mechanical, chemical or biological. · Protect as much indigenous vegetation as possible. · An alien invasive management programme must be incorporated into an Environmental Management Programme. · Ongoing alien plant control must be undertaken in the disturbed areas as these areas will quickly be colonised by invasive alien species, especially in the riparian zone, which is particularly sensitive to AIP infestation. · Herbicides must be carefully applied, in order to prevent any chemicals from entering the river. Spraying of herbicides within or near to the channel and river areas is strictly forbidden.· Re-instate indigenous vegetation (grasses and indigenous trees) in disturbed areas directly after mining ceases so as to stabilise against erosion and sedimentation.	

Setting up infrastructure and moving onto site	Biobiversity	Loss of indigenous vegetation, floral and faunal habitat and ecological structure of water resources and soil	Operational Phase	70H		48M
Setting up infrastructure and moving onto site	Biobiversity	Alien Invasive Species	Operational Phase	70H		48M
	Visual	Reinstatement of visual resource value due to dismantling of infrastructure and subsequent rehabilitation of footprint areas	Closure	68M	Permanent alteration of site topographical and visual character of mined areas	20 (L)
Clearing of vegetation and earthworks	Visual	Clearing of vegetation and earthworks	Construction Phase	68M	v Erosion control measures must be put in place if vegetation is to be cleared. v Where possible, all the natural vegetation around the Gold mine should be retained, especially vegetation surrounding the perimeter and boundary areas within the Pit5 Boltman and Pit 3Gemsbok area as these are in relatively close proximity to residential settlements.	20 (L)
Lighting at night	Visual	Reduction in visual resource value	Construction Phase	68M	v Where possible, all the natural vegetation around the Gold mine should be retained, especially vegetation surrounding the perimeter and boundary areas. v During construction, selective lighting for the construction camps and other secured areas should be employed. Up-lighting of structures should be avoided. v Avoid unnecessary illumination, but safety/security and operational requirements may limit the extent to which this can be implemented. v Provide lights with cover fittings that limit lateral and upwards "light spill", and position	20 (L)

					lights to shine towards the intended areas of illumination rather than using floodlights. v Limit the heights at which lights are positioned where possible will reduce “light spill”. v Make use of Low-Pressure Sodium lighting or other types of low impact lighting. v Low wattage bulbs can be used to further reduce the impact; and v Motion sensor activated lighting may be used instead of lights that illuminate continuously.	
Construction of offices, plant infrastructure, workshops and other associated mine infrastructure	Visual	Reduction in visual resource value	Construction Phase	68M	External signage should be kept to a minimum, were possibly shielding material should be utilised to fence of the construction site. Where possible, all the natural vegetation around the Gold mine should be retained, especially vegetation surrounding the perimeter and boundary areas	21 (L)
Fugitive dust	Visual	Reduction in visual resource value	Construction Phase	68M	v Dust control measures must be implemented. v If clearing of vegetation or construction is to occur during the night, all lighting should be placed to ensure that excessive lighting does not escape the site. v When necessary, and particularly during the dry season, efficient watering of areas where construction activities result in dust creation and vehicular movements occur will should be used; and v There must be an enforcement of low vehicle speeds on site	22 (L)
presence of topsoil, Run of Mine, product and overburden stockpiles and discard dumps. processing plant	Visual	Operational Phase Reduction in visual resource value due to presence of physical structures on site	Operational Phase	68M	v Where possible, natural vegetation around the Giyani Gold Mine should be retained. v Progressive rehabilitation of the Gold mine should be undertaken. v Mine dumps and stockpiles should not exceed 15m of height. v Litter control measures should be kept in place to ensure that the site is maintained in a	48M

and other mining infrastructure;					neat and tidy condition. v Employ ‘smart architecture’ on physical infrastructure to mimic natural elements and traditional building forms. v External signage should be kept to a minimum (with the exception of safety notifications). v Designated areas for material storage, waste sorting and temporary storage batching and other potentially intrusive activities will be created and screened off to the extent is feasible and v Where feasible trees must be transplanted to locations adjacent to the mine where they will not be affected by mining activities.	

presence of topsoil, Run of Mine, product and overburden stockpiles and discard dumps;	Visual	Operational Phase Reduction in visual resource value due to Fugitive dust	Operational Phase	68M	v Where possible, natural vegetation around the Giyani Gold Mine should be retained. v Institute a rigorous planting regime along the project site boundaries to act as bio-filters. v Areas where vegetation has been cleared on site should have erosion control measures in place. v The planting of trees must be instituted along the entire access route to prevent dust plumes spreading. v Progressive rehabilitation of the Gold mine should be undertaken. v Dust control must be implemented by reducing and controlling dust through the use of approved dust suspension techniques as and when required. v Consider fitting drills with dust collection systems. v All stockpiles of material that maybe blown away during windy spells (such as sand, soil, and excavated material etc.) will be suitably covered or other measures taken to prevent such occurrence. Suitable measures will be determined by the environmental control officer or site engineer based on the nature of the material, its use etc.	20 (L)

mining infrastructure	Visual	Operational Phase Reduction in visual resource value due to Night-time illumination	Operational Phase	68M	A number of measures can be implemented to further reduce the impact of lighting at night. These include: v Outdoor lighting must be strictly controlled so as to prevent light pollution. v All lighting must be installed at downward angles. v Sources of light must as far as possible be shielded by physical barriers such as a planted trees and shrubs or built structures, where possible, natural vegetation around the Giyani Gold Mine should be retained so as reduce unnecessary illumination and “light spill”. v Consider the application of motion detectors to allow the application of lighting only where and when it is required. v The height of poles and masts determines how broadly the light is dispensed. If the lights are mounted at an appropriate height, they will provide maximum illumination while minimizing light pollution into the surrounding area. v providing lights with cover fittings that limit lateral and upwards light “spill”, and positioning lights to shine towards the intended areas of illumination rather than using floodlights. v The use of outdoor fixtures high up on tall structures should be limited or avoided. v Consider installing anti-reflective coating on metal surfaces to reduce the sunlight that is reflected and increase the amount of sunlight that is absorbed during daytime, to reduce the effect of glare and reflection of metal infrastructure. v Consider installing all electrical lines underground, to mitigate the potential impact of glare of such lines.	21 (L)

Mine establishment	Soil and land capability	SOIL STRIPPING	Construction	64	• It is recommended that all usable soil is stripped and replaced after final removal of the mining infrastructure. The soils are overall fairly shallow 30-120cm on Glenrosa and Mispah soils. • During the construction phase it is recommended that the topsoil be stripped and stockpiled in advance of construction activities that might contaminate the soil. Due to the shallow nature of the soils it is recommended to strip only 40-60cm of the soil. These estimates take into consideration a possible 10% topsoil loss through compaction and allow the rehabilitated areas to be returned to the pre-mining land capability. • The stripped soils should be stockpiled upslope of areas of disturbance or mining development to prevent contamination of stockpiled soils by dirty runoff or seepage. Topsoil stripped should also be protected by a bund wall to prevent erosion of stockpiled material and deflect water runoff. • Care should be taken that stockpiles do not to block too many drainage lines to prevent erosion due to intense high rainfalls that often occur in the region • Soils within 100m of watercourses should be kept undisturbed. • Any soil that might possibly be contaminated during the construction phase should be stripped and stockpiled in advance of construction activities.	38
Excavation, opein pit mining,Run of Mine product and overburden stockpiles and discard dumps;	Soil and land capability	SOIL STRIPPING	Operation	60	• Stockpiles can be used as a barrier to screen operational activities. If stockpiles are used as screens, the same preventative measures described above should be implemented to prevent loss or contamination of soil. • The stockpiles should not exceed a maximum height of 6m and it is recommended that the	52

					side slopes and surface areas be vegetated in order to prevent water and wind erosion and to keep the soils biologically active. • If used to screen mining operations, the surface of the stockpile should not be used as roadway as this will result in excessive soil compaction	
Rehabilitation	Soil and land capability	SOIL STRIPPING	Decommissioning	64	The following issues need to be taken into consideration before, during mining operations, with closure and rehabilitation: • Loss of topsoil and usable soil o Strip all usable soil and stockpile. o Vegetate long-term soil stockpiles • Contamination of topsoil and stockpiled soil o Prevent contamination of topsoil and stockpiled soil. o Site all soil stockpiles upslope from any mining / development activities o Position stockpiles upslope of mining areas, or as screens to restrict visibility of the mining operation provided that in doing so, the stockpile is not exposed to the risk of seepage or dirty water contamination. • Erosion of stockpiled soil o Ensure that all stockpiles have a storm water diversion berm for protection against erosion and contamination by dirty water.	39
Preparation of the foot print area	Noise	Increased noise levels on the proposed site	construction	20 (L)		Low
Preparation of the foot print area	Noise	Increased noise levels off the proposed Site	construction	20 (L)	Ø Due to the thick vegetation in the area, tree removal should be minimised so that the natural cover acts as berms with a potential to act as a noise barrier around surface operations, the plant and other mining activities with the barrier being built as close as possible to the operations or at receptors as is feasible as possible.	Low
Civil construction	Noise	Increased noise levels along the boundary of the proposed Site	construction	20 (L)		Low

	Noise	Increased noise levels at the mining area	construction	High	Ø This should also be implemented at stockpile areas, although the higher the berm/barrier the better acoustical screen it will be. Certain heavy vehicles have their exhaust ports above the cabin of the vehicle and needs to be considered as the noise source point. Ø The barrier should be sufficiently long to block the line of sight from receptors to the sides of the mining operations; Ø Minimize any work that needs to take place at night. Night-time construction work should be limited to localities that are further than 2km from a noise-sensitive community when there is a direct line of sight (no barrier between the activity and receptor); Ø 1km from a noise-sensitive community when there exists a barrier between the activity and receptor; Ø Using the smallest/quietest equipment when operating near receptors; Ø Ensuring that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Acoustical mufflers (or silencers) should be considered on equipment exhausts on open cast pits and stockpile areas.	Moderate
Grading and building of new roads	Noise	Increased noise levels along the boundary of the proposed Site	construction	20 (L)		Low
	Noise	Increased noise levels at the mine area	construction	20 (L)		Low
	Noise		construction	20 (L)		Low
Construction of buildings and/or plant	Noise	Increased noise levels along the boundary of the proposed Site	construction	20 (L)		Low
	Noise	Increased noise levels at the mine area	construction	60		Low
Mining activities area	Noise	Increased noise levels on the proposed Site	operation	High	Ø Mitigation measures as identified for construction phase still valid (berms barriers around open cast/stockpile boundaries); Ø Environmental awareness training should include a noise component, allowing employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding	Moderate
	Noise	Increased noise levels off the proposed Site	operation	60		20 (L)

Hauling of ore	Noise	Increased noise levels along the feeder roads	operation	60	environment. All employees and contractors should receive this training; Ø The use of white-noise generators instead of reverse alarms on heavy vehicles operating on roads, in mine pits and at stockpile areas; Ø Minimize equipment or processes at high levels, such as the development of the material tip being significantly higher than the surrounding landscape. It limits the mitigation of this noise using berms or barriers. The developer may consider keeping the material tip at ground height or even slightly below ground level;	21 (L)
Excavations	Noise	Increased noise levels off the proposed Site	operation	60		22 (L)
Processing Plant	Noise	Increased noise levels off the proposed Site	operation	60		23 (L)
Covering of underground and surface mining with capping layer and top soil	Noise	Increased noise levels on the proposed Site	closure	23 (L)		23 (L)
	Noise	Increased noise levels off the proposed Site	closure	23 (L)		23 (L)
Removal of buildings and infra- structure	Noise	Increased noise levels along the feeder roads	closure	23 (L)		23 (L)
Rehabilitation	Noise	Increased noise levels along the feeder roads	closure	23 (L)		23 (L)
	Noise	Increased noise levels on the proposed Site	closure	23 (L)		23 (L)

Plant & Pit	Heritage	Plant & opencast pit	All Phases	24 (L)	No recording necessary	24 (L)
1	Heritage			25 (L)		25 (L)
Pit 04	Heritage	Historical mining	All Phases	Medium	Record site	Medium
Pit 05	Heritage	Historical mining		Medium	Record site	Medium
Pit 06	Heritage	Historical mining	All Phases	Medium	Record site	Medium
2330BB-B01	Heritage	Grave		High	Mitigation not advised	High
2330BB-B02	Heritage	Grave	All Phases	High	Mitigation not advised	High
2330BB-B03	Heritage	Grave		High	Mitigation not advised	High
2330BB-B04	Heritage	Potential grave	All Phases	High	Mitigation not advised	High
Construction activities.	Socio-economic.	Creation of a number of local employment opportunities.	Construction Phase	L		M
Construction activities.	Socio-economic.	Investment into the local economy through purchase of goods and services.	Construction Phase	M		M
Site clearance activities.	Socio-economic.	Exposure to dust and fine particulates with the stripping of vegetation cover.	Construction Phase	M		L
Construction activities.	Socio-economic.	Exposure to noise from construction activities.	Construction Phase	M		L

Construction vehicles	Socio-economic.	Increase the risk of an accident with pedestrian and/or another vehicle, resulting in a serious injury or death.	Construction Phase	M		L
Rapid workforce influx	Socio-economic.	Social tension, and possibly violence.	Construction Phase	M		L
Establishment of mine	Socio-economic.	Conflict between supporters and opponents of the proposed mining activity	Construction Phase	M		L
Significant change in land use	Socio-economic.	Extensive change in land-use may result in a change to community selfidentification, which could have an effect on community spirit until the change is socialised or accepted. Highly visible land-use change to residents traversing a project area, associated with a single or multiple projects, may support a perception that the landscape is being ‘industrialised’. This type of perception, if strongly held or persistent, may contribute to a change in community identity that is not welcomed by either long-term residents or businesses that depend on a particular perception	Construction Phase	M		L
Operational activities	Socio-economic.	Creation of a number of local employment opportunities.	Operational activities	L	A summary of the identified mitigation measures is presented here: Stakeholder engagement program that	M

Operational activities	Socio-economic.	Investment into the local economy through purchase of goods and services	Operational activities	L	facilitates good, two-way communication, and provides access to information of relevance and concern to landholders and the wider community on project developments. Operating protocols to manage interactions between project workers and adjoining landholders and their properties, developed in consultation with landholders, incorporating as much as possible, specifications and requirements considered important by landholders in minimizing inconvenience to them. System of advanced notification of major activities or disruptions that may affect landholders or the broader communities. Include advanced notice, nature of, reason for, duration and severity of the activity or disruption. System for identifying, monitoring and responding to landholder and community concerns. Must be well publicised, accessible and easy to use for landholders and the wider community The above-mentioned mitigation measures will ensure that: Complaints are addressed quickly and effectively to complainant's satisfaction. Minimise inconvenience and disruption to landholders and the broader community A summary of the identified mitigation measures is presented here: Set appropriate targets for employment of people with the relevant skills or experience from the Mopani District , that is considerate of both the desire to maximize the economic benefits of the Project without depleting the region of skilled workers in other industries / businesses. Training and education programs (as per the	M
National economic development	Socio-economic.	Service current and future clean fuels demand.	Operational activities	L		M
Noise generating operational activities.	Socio-economic.	Increase in baseline ambient noise levels at sensitive receptors.	Operational activities	L		M
Vehicles travelling to and from the proposed mine.	Socio-economic.	Increased the risk of an accident with a pedestrian and/or another vehicle, resulting in a serious injury or death.	Operational activities	M		M
Storage and handling of flammable liquids and explosives.	Socio-economic.	Risk to individuals (employees and members of the public) as a result of a fire or an explosion	Operational activities	I		L
Storage and handling of flammable liquids.	Socio-economic.	Risk to society as a result of a fire or an explosion.	Operational activities	M		L
Demolition activities.	Socio-economic.	Creation of a number of local employment opportunities.	Closure Phase	M		L
Decommissioning and closure of the facility	Socio-economic.	Loss of permanent employment opportunities.	Closure Phase	M		M
Demolition activities.	Socio-economic.	Dust and fine particulates affecting ambient air quality.	Closure Phase	H		M

					Social and Labour Plan) that give preference to participation by people from the Mopani District, in order to maximise local employment and human capital development. Appropriate targets for the employment of, and participation in training programs by, under privileged and vulnerable people, where possible. Training and education programs in order to maximize the ‘pool’ of skilled labour in the region for employment at the Project. Where appropriate, Tiara Granville Mine will offer non-mine employees the opportunity to participate in training and education programs in order to increase the ‘pool’ of skilled labour available to other businesses/industries once the mine starts entering the end of its life. Procedures for the identification of potential workforce reductions and appropriate communication of such to the workforce and local communities. Strategies to minimise the potential impact of workforce reductions on local communities. The above-mentioned mitigation measures will ensure that: Promote and create local employment opportunities Equal employment opportunities resulting in diverse workforce Appropriate goals encourage, women, school leavers, and unemployed to seek opportunities Provision of increased access to formal structured training programs such as apprenticeships and traineeships promote skill development and increased employment opportunities Ongoing up-skilling and professional development of staff	

						Policies, practices and procedures to provide for the safety, health and wellbeing of the workforce. A summary of the identified mitigation measures to enhance these impacts is presented here: Engage with, local government and other employers to plan, on a regional scale, to maximize the regional skilled labour pool. Identify goods and services provision capacity in the region and develop and implement a policy of preferential regional procurement. Conduct training and awareness sessions for small businesses in the region to assist them to understand the potential supply opportunities to the Project and the Project's procurement requirements (ie, HSSE and quality standards). Engage with agencies, local government, industry associations and other businesses to develop strategies to mutually benefit industries in the region. The above-mentioned mitigation measures will ensure that: There is a maximising of local business Opportunity from the mine by: providing full and fair opportunity for local businesses to tender on contracts, assisting in equipping local businesses to access supply chain opportunities.	

The impact assessment was derived from the specialist studies undertaken taking into account the current environment of the area and the potential impact posed by the proposed mining project. Mitigation measures have been identified and will be critical to the management objectives of the project. In cases where the specialist did not quantify the significance of each impact before and after mitigation the EAP used a higher WOM significance so as not to understate the potential of the impact.

1.10.5 Cumulative Impacts

Cumulative effects are caused by the accumulation and interaction of multiple stresses affecting the parts and the functions of ecosystems. Of particular concern is the knowledge that ecological systems sometimes change abruptly and unexpectedly in response to apparently small incremental stresses. For purposes of this report, cumulative impacts have been defined as “the changes to the environment caused by an activity in combination with other past, present, and reasonably foreseeable human activities”.

Concern has been expressed on the mining project about the cumulative impact of mining on water resources, air, noise, and traffic, loss in biodiversity, tourism and agriculture. The current impact of human activity on agricultural, water and other resources has not been quantified or the information is not freely available from authorities to accurately quantify the additional impact of the mine. Consequently, the following cumulative assessment is purely qualitative and relies on conclusions about the extent of impacts from the mine in relation to other activities in the immediate vicinity of the area.

The table below serves as a summary of the main cumulative environmental impacts and state whether they are positive or negative in nature. The cumulative assessment takes into account the fact that there are mining right applications pending within the catchment however due to the fact that none are operational, the full extent of the cumulative impacts of MINING within the area are purely speculative.

Noise

Cumulative Impact:

The construction of the proposed Kusile’s Giyani Gold Project with its associated infrastructure will increase the cumulative noise impact within the region.

The construction of the proposed Kusile’s Giyani Gold Project with its associated infrastructure will increase the cumulative noise impact within the region.

Air Quality Assessment

The proposed Kusile's Giyani Gold Project area are located in an area with other mining/quarry operations. These mining/quarry operations will also generate fugitive dust and particulate matter emissions. The Kusile's Giyani Gold Project will contribute to the cumulative air quality impacts of the region.

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. Cumulative impacts refer to the incremental effect of several projects that may have an individually minor, but collectively significant, impact on air quality.

Cumulative impact can be defined as:

- Two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts, and

- The change in the environment which results from the incremental impact of the project when added to other closely related past, present, or reasonably foreseeable future projects, and can result from individually minor, but collectively significant, projects taking place over a period of time.

This section describes the potential impacts of the project that are cumulative. There are three separate levels of cumulative impacts considered: project site localised cumulative impacts; regional cumulative impacts; and global cumulative impacts.

- Project site localised cumulative impacts

These are the cumulative impacts that result from mining operations in the immediate vicinity of the project site. Project site localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers. These include mainly dust deposition. From this air impact assessment conducted for the proposed project the modelling indicates the cumulative pollution plume emanating from this site as a combination of activities and shows that the impacts will be mainly localised around and in the vicinity of the operations.

- Regional cumulative impacts

Regional cumulative impacts include the project's contribution to impacts that are caused by mining operations throughout the region. Each mining operation in itself may not represent a substantial impact, however the cumulative effect on air quality in the region may warrant consideration. The mining sector in South Africa is growing steadily as the requirement for electricity also grows and therefore this project will also contribute to the larger regional impact that will be experienced.

- Global cumulative impacts

The only impact from the project that is potentially global is the generation of potential greenhouse gas emissions. However, the level of emissions from the project represents a very minor and insignificant contribution at this scale.

Recommendations to limit cumulative impacts:

Adoption of a combination of engineering controls, dust suppression measures, rehabilitation of exposed surfaces, operational procedures, and measurement of ambient air quality is expected to result in adequate management of dust emissions from the project, and the cumulative impacts from these emissions. An ambient air monitoring program has been developed to monitor the impact of dust-generating emission sources at sensitive receptor locations around the project site. The information obtained from the monitoring program will feed into the operational management of site-based dust emission sources.

Therefore, the overall impact on the air quality as a result of the project would not be cumulatively considerable and would be less than significant if the sound implementation of mitigation measures identified reducing emissions are implemented. If emissions are kept below the relevant threshold levels by ensuring the management and mitigation measures prescribed are adhered to there is no significant cumulative impacts expected as the air quality impacts would be limited to the site level.

Visual Impact Assessment Cumulative Impacts

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise of a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the inter-visibility (visibility) of a range of developments and / or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effects on visual receptors within their combined visual envelopes. Inter-visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions.

(Institute of Environmental Assessment and The Landscape Institute, 1996). The visual impact and impact on sense of place of the proposed project will contribute to the cumulative negative effect on the aesthetics of the study area. It is recommended however, that the environmental authorities consider the overall cumulative impact on the agricultural and scattered mining character and the areas sense of place before a final decision is taken with regard to the optimal number of mining activities in the area.

Groundwater

It can be deduced from the calculations depicting drawdown during mining of the proposed underground reserve that the cumulative groundwater drawdown at the streams close to the underground will have an impact. Drawdown is expected as a result of the mining operations. Groundwater abstraction. The extent of the zone of influence will not extend beyond 1 000m and the maximum drawdown in the affected areas will range between 1 and 5 m, thereby not expected to impact on the yields of any supply boreholes around the mining area. Possible mitigation against such an impact is temporary water supply by the mine

Social

Positive cumulative impacts that can emanate from mining in the district included:

- Relatively high incomes of people working in the mining industry and of business people servicing the mines
- More employment, business and training
- Population growth and diversification in communities
- Increased financial support in towns through substantial contributions by mining companies to community infrastructure development
- Infrastructure improvements such as roads and communications.

Potential cumulative Negative impacts could included:

- Increased mobility of local residents resulting in economic stimulus flowing away from the communities in the immediate vicinity of the mine to other regional centres.
- Population growth, which in turn can lead to antisocial behavior and an increase in crime.
- The cumulative effects of new and continuing mining projects have put increasing pressure on transport networks, emergency services and health care in the locality. Traffic is a particular issue for public safety.

- Cumulative impact of the proposed Project on ambient noise levels;

Dependency on mining to sustain the local economy

Mining creates a much larger number of jobs than the services sector, and because mine workers tend to earn better salaries than those employed in most other sectors but all mines have a finite lifespan. Inevitably, mining operations in the area will at some point in the future begin to scale down and close affecting dependant industries. Unless significant investment is made into economic diversification, the area is destined for a considerable economic slump once this process commences.

1.11 Summary of specialist reports.

The following specialist investigations were undertaken as part of the project:

- Annexure 1- IWWMP
- Annexure 2 - Hydrogeological Assessment
- Annexure 3 - Stormwater Management Plan
- Annexure 4 – Biodiversity Assessment
- Annexure 5 - Archaeological Assessment
- Annexure 6 - Soil and Land Capability Assessment
- Annexure 7 - Visual Impact Assessment
- Annexure 8 - Social Impact Assessment
- Annexure 9 - Noise Impact Assessment
- Annexure 10 - Air Quality Impact Assessment
- Annexure 11 – Traffic Impact Assessment

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form):-

Table 45: Recommendations of specialist reports

LIST OF STUDIES UNDERTAKEN	**RECOMMENDATIONS OF SPECIALIST REPORTS**	**SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT**
Biodiversity Assessment	The mining areas falls within the Lowveld Rugged Mopaneveld vegetation type as per Mucina and Ritherford (2006). According to the biodiversity datasets provided by SANBI (2021), the current mining area (Swartkoppies) and the 2 western pit areas (West 59 and Gemsbok) falls within a Critical Biodiversity Area 2. These sections were confirmed to be Mopani forest and bushveld areas during the site visit. The two remaining eastern pit areas falls within an Ecological Support 1 area and the other within a Other Natural Areas. These areas had disturbance by informal settlements surrounding these areas. Critical Biodiversity Areas (2) (CBA 2) are classified as best design selected sites and are selected to meet biodiversity pattern and/or ecological process targets. Alternative sites may be available to meet targets. Ecological Support Areas (1) (ESA 1) Natural and/or near natural and degraded areas supporting CBAs by maintaining ecological processes. Other Natural Areas are classified as natural and intact but not required to meet targets, or identified as CBA or ESA. No natural habitat remaining areas are not significant to direct biodiversity value. The mining areas does not overlap with any protected or endangered ecosystems. The proposed mining operations fall within close proximity to Important Bird Areas (IBAs), where the proposed mining area falls close to the Kruger National Park Trees dominated the area and included *Combretum spp.*, *Vachellia robusta*, *Vachellia tortilis*, *Senegalia nigrescens* and *Colophospermum mopane.* However, *Cissus cornifolia, Albizia harveyi, Mundulea sericea, Terminalia sericea, Terminalia prunioides, Grewia bicolor, Dichrostachys cinerea, Sclerocarya caffra, Dalbergia melanoxylon, Peltophorum africanum,*	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	Strychnos madagascariensis and Commiphora africana are also abundantly present Limited faunal species were observed and the majority was sites near game farms and private reserves and included: Communal spider nests, sociable weaver (*Philetairus socius*), Laughing dove (*Spilopelia senegalensis*), Ring-necked dove (*Streptopelia capicola*), Cape glossy starling (*Lamprotornis nitens*), Southern red-billed hornbill (*Tockus erythrorhynchus*), Bronze winged courser (*Rhinoptilus chalcopterus*), Golden Orb Spider (*Trichonephila spp*.). Leopard and African elephant listed as vulnerable are though to occur within this areas according to SANBI (2021), but is found within the Kruger National Park and is unlikely to occur within this area. All expected faunal species are listed in **Appendix A** for QDS 2330BB and 2330BD and all floral species are listed in A**ppendix B** for the Giyani area. A number of potential ecological impacts relating to proliferation of alien invasive species, loss of species of conservation concern, loss of indigenous vegetation, floral and faunal habitat and ecological structure of water resources and soil, loss of floral diversity and ecological integrity. The significance of potential impacts on biodiversity within the area was rated as **high significance without mitigation and moderate with mitigation** as the proposed areas lies in Mopani bushveld areas. During construction it will be important to liaise with the landowners off the game farms and private reserves. Where dangerous animals are present, it will be important to ensure that game is moved to other camps where possible. A ranger from the farm must be present during construction to ensure the safety of man and animals. Provided mitigation measures are to be implemented within an environmental management programme (EMPr) and the significance of any negative impacts reduced should the mining commence. Potential impacts associated with the construction and operational phase include:	

	- Increased sedimentation and water quality impairment due to runoff from waste dumps; - Water quality contamination due to runoff or seepage from any tailings storage facility; - Alteration of natural flow regime due to discharge of pit water; - Increased utilisation of aquatic resources by local population; and - Habitat loss associated with the stream diversion. Should mining commence the following mitigation measures, aimed at minimising the afore-mentioned impacts, include (but are not limited to): - Design and implementation of a suitable stormwater system; - Rehabilitation of the disturbed areas; - Limiting instream sedimentation; - Minimising pollutants entering the watercourse; - Implement a programme for the clearing/eradication of alien species including long term control of such species; and - A 100 m buffer was implemented for the channel and river systems (Sensitive areas)	
Floodline Delineation as per the IWWMP	. The floodline study included a 1:100 year flood remedial. The catchment areas for the calculations of the flood peaks were delineated using the 1:50 000 topographical map together with the 0. 5 m contours. The hydrological and hydraulic parameters of the catchments contributing towards the proposed site of development were calculated. Peak flow rates were determined along the watercourse to carry out the hydraulic modelling for the proposed development site. The magnitude of the flood peak depends on the catchment characteristics and the rainfall intensity. For the large catchment, Standard Design Flood (SDF) and Regional Maximum Flood methods were used to calculate the peak flow rates while the Rational and alternative rational methods were used for the calculation of peak	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	flows for small catchments. The peak flow data and other relevant information were entered into the backwater model HECRAS to produce the results on the flooding extent along the river banks in the vicinity of the proposed development site. The study results included maps depicting 1:100 year floodlines of the existing streams reporting into Ntsami Dam around Swartkoppies and Pit 5 downstream of the Ntsami Dam. The streams (watercourses) within the study area are both tributaries of the Ntsami River which is seasonal, which flows into the Letaba River. Mapping of the floodlines shows no major challenges and that a large portion of the Giyani Gold Mine is outside the 1:100 year floodline. In this light, the study recommends and modelled a scenario with a berm constructed along a 100 m horizontal distance from the all nearby streams and sized to restrict and prevent the 1:100 year flood from flowing into the proposed open cast, and consequently prevent mining within a 1:50 year floodline. It is required that erosion prevention measures be put in place. The study report is appended hereto, together with results of the floodline assessment. The map for the pre-extension scenario is presented, as well as that for the scenario with the extension and the berm flood control or remedial measure. The recommended minimum berm bottom width is 25 m, with varying between 3.5 and 6.3 m with a slope of about 1:2.	
Stormwater Management Plan (as in the IWWMP)	Detailed stormwater management plan (SWMP) is to be developed as part of the mine infrastructure planning and development. The plan will incorporate engineering design aspects and stormwater runoff calculations contained in the Hydrological Assessment Report for Giyani Gold Mine. The SWMP will be developed to separate clean (e.g. mine administrative buildings) and dirty water (e.g. plant area and residue stockpiles) emanating from the mine in line with the requirements of regulations in Government Notice 704 (GN704). The stormwater channels, berms, and pollution control dams will make provision for 1:50 year recurrence flood as required in terms of GN704.	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	The BPG for stormwater management will be consulted as part of development of the pollution control infrastructure. Clean stormwater diversion infrastructure will allow for unaffected runoff to flow away from dirty areas and drain through dedicated channels, berms, and culverts to natural drainage system. Cut-off drains/berms will be established around facilities such as TSF and overburden dumps as part of pollution prevention by isolation of dirty areas. ▪ **Dirty Stormwater Management** Giyani Gold Mine proposes to develop three pollution control dams (PCDs) on the farms Swartkoppies. All dirty storm water runoff from the processing plant area (gold product and RoM stockpiles) will be collected in two (2) PCDs situated on the farm Swartkoppies with gross cumulative storage capacity of approximately 140 000 m^3. All PCDs will be lined with the potential to accommodate 1: 50 year flood and with freeboard of at least 0.8 m above its full capacity. The construction of berms will be carried out in phases, growing progressively as the need arises. All stormwater management measures will be designed to meet the requirements of the Regulations GN 704, dated June 1999, under the National Water Act, 1998 (Act 36 of 1998) and the DWS's Best Practice Guideline (Department of Water and Sanitation, 2006. Best Practice Guideline G1: Stormwater Management).	
Waste Classification as per IWWMP	**Waste Classification Results** Total Concentrations of Arsenic (As), Barium (Ba), Copper (Cu) and Nickel (Ni) in all the samples exceeded Threshold Zero (TCT0) values, but are less than Threshold 1 (TCT0). Therefore, the materials would be classified as Type 3 Waste, based on the total concentrations of the said trace metals. Table 5.7 presents the test results of reagent water leaching for the mono-disposed waste according to AS 4439.3 for the different materials. It is recommended that the rock	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each**

	samples are not strictly classified according to the TCT values because of the low TCT0 threshold values. The AUC represents the average concentration of elements in the upper continental crust including rock (sub)-outcrops and serves as a background reference for the geochemical composition of rock near the earth's surface. The TCT0 for Ba and Cu are below the AUC; for As, Mn and Pb, the TCT0 is close to (not more than twice) the AUC. This implies that most natural rock and soils in the earth crust would classify as Type 3 waste based on the TCT0 value. Thus, for this analysis, only the LCT values will be used for classification of these materials. For all material samples, reagent water leach LCs are below LCT0 values for the corresponding chemical elements and compounds. • The waste rock and ROM would be classified as Type 4 Waste if only leachable concentrations are considered. • The low leachable concentrations of constituents in the waste rock indicate that the risk from leachable constituents to contaminate the receiving environment, is low over the short term. Thus, there is a low risk of water resource pollution that may be attributable to contaminant mobilization over the short term (during operational phase). • The slimes/tailings could be classified as Type 4 while still neutral (e.g. during operation). Since the material may acidify over the long-term upon oxidation, it should be classified as Type 3 Waste when disposed of over the long-term. • Since the material comprises of natural rock material no organic chemicals, including petroleum hydrocarbons and pesticides, are expected to occur within it.	**identified potentially significant impact and risk**
Kusile Hydrogeological Report	**Recommendations** The following actions are to be implemented:	Specialist Findings are included in 1.9:Baseline Environment

	➢ Drill monitoring boreholes up-gradient to lower gradient before operations starts, measure the water levels; and ➢ Use monitoring programme to confirm/validate the predicted impacts on groundwater availability and quality during and after mine closure. ➢ Water levels in the surrounding boreholes must be measured on a monthly basis before and after mining commenced. ➢ Water levels in boreholes up to 1 km from the mine must be monitored on a monthly basis before and after mining activities commenced to determine the decrease in water level. ➢ Data must be used to update the numerical groundwater model ➢ The monitoring protocol and mitigation measures should be adhered to. The monitoring programme must include all the metal ions above total concentration threshold zero. ➢ Flow meters should be installed to obtain legal water supply and water use information.	Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**
Visual Impact Assessment	The role of mitigation is critical in finding a design / rehabilitation solution that will be visually acceptable. Potential mitigation measures have been taken into consideration during the design phase, as discussed above and are also provided by natural features in the area. Only effective, economically feasible, appropriate and visually acceptable mitigation measures are recommended, and these should form part of an Environmental Management Plan to be implemented should the project be approved. Preliminary and conceptual mitigation recommendations include: **a. Primary measures** These are measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered. Mining or closure is one of concepts that	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	are used. The mine closure and rehabilitation, final landform and land use must be planned before the opencast mining is initiated. Primary measure that will be implemented will mainly be measures that will minimise the visual impact by softening the visibility of the mining activities by blending with the surrounding areas. Such measures will include concurrent rehabilitation of the mining area by re-vegetation of the mining site and surrounding area. **b. Secondary measures** These are designed to specifically address the remaining negative effects of the final development proposals. Secondary measures will include the final rehabilitation, after care and maintenance of the vegetation to ensure that the final land reform is maintained. ❖ **Management Guidelines** In considering mitigating measures three rules were considered: **1)Economic feasibility.** 2)**Effectiveness**- meaning how long it will take to implement and what provision is made for the management and maintenance; and 3)**Acceptability** within the framework of the existing landscape and land use policies for the study area. To address these, the following principles have been considered: I. Mitigation measures should be designed to suit the existing landscape character and needs of the locality. They should respect and built landscape distinctiveness. II. Mitigation measures would be feasible and effective in reducing the visual impact on some residential views from adjacent farms, tourist areas and local farm roads.	

	In order to allow for ease of understanding of the proposed mitigation measures during the varying phases at the proposed development, the following section below will present some guidelines to aid in managing the visual impacts as a result of the proposed development. **Visual Management Guidelines** **1. Pre-Construction** All topsoil removed from the site, prior to construction activities should be stored for rehabilitation purposes at the site. **2. Construction** • Ensure, wherever possible all existing natural vegetation is retained and incorporated into the site rehabilitation to ensure views towards the proposed Gold mine are impeded. • Dust suppression techniques should be in place at all the times during the construction and operational phases to ensure that undue interest is not drawn to the site. • If vegetation is to be cleared on site, erosion control measures should be kept in place to ensure that excessive scarring of the landscape is reduced. • If construction is to occur during the night, all lighting should be kept facing inward. This is to ensure that excessive light does not escape from the construction area. • Investigation into the establishment of vegetation and/or the construction of man-made barriers between the sensitive viewers and the proposed development must be undertaken during the construction and operational phases.	

	• During construction, litter control measures should be kept in place to ensure that the site is maintained in a neat and tidy condition. • External signage should be kept to a minimum. **3. Operation** • The mine must ensure low foot level lighting as possible, if it is possible where it is deemed safe, lighting should be avoided. Lighting pollution should be carefully considered and kept to a minimum wherever possible as light at night travels great distance. • Physical barriers could be used as shielding or cover to prevent excess light leaving the site. It is also important to ensure that where possible, lighting should be faced/ shielded inward away from the viewer. Areas of high reflective surfaces should be covered in an attempt to reduce the reflection from the development. • During operations, litter control measures should be kept in place to ensure that the site is maintained in a neat and tidy condition. • The re-vegetation of the site during the operational phase should be considered only if it does not interfere with operations or pose a risk to the health and safety of people and animals. Vegetation around a structure tends to break the outline of the structure against the landscape and will therefore allow for the structure to be less pronounced. Vegetation can be used to reduce the visual scarring of the landscape and potentially reduce the visual impacts of the proposed development. • Stockpiles should not exceed 15m in height. • Blasting should be done under controlled conditions (i.e., windy days must be avoided and must be done in such a way that must be minimised).	

4. Decommissioning and closure

- Re-establish vegetation within the development footprint areas to allow for the VAC of the area to be increased.

All infrastructure used should be disassembled and removed from site to ensure the site resembles a natural state and the environment be restored to a condition whereby the natural functioning of the ecosystem can take place.

No potential visual impact, associated with the development of the proposed Giyani Gold mine, has been identified during this study which could be seen as a fatal flaw in terms of sensitive visual receptors located in close proximity to the proposed project area. The project therefore is considered to be acceptable from a visual perspective provided recommended mitigation measures are implemented.

The proposed project components will have a significant impact on the visual environment, the significance of the impact will generally be moderate. This is due to the fact that the proposed project, although unique to the area and the project being of a visually detrimental nature, the availability of mitigation measures can reduce the impact to within acceptable ranges.

The most significant visual impacts are expected to be caused during operations and will be caused by the appearance of the physical infrastructure, mine dumps, stockpiles and plant. However, a number of visual mitigation measures have been identified to address the anticipated visual impacts. The moderating factors of the visual impact of the facility in the close range are the following:

❖ Short exposure time of road users

❖ The time the structure will be visual due to roll-over mining.

	❖ Number of human inhabitants located in the area. ❖ Natural topography and vegetation ❖ Mitigation measures that will be implemented such as the establishment of barriers or screens. ❖ The size of the operation ❖ Medium to high absorption capacity of the landscape Subsequently, from a visual perspective, it is recommended that the proposed project goes ahead, provided that the recommended mitigation measures are implanted in a diligent manner.	
Archaeological Impact Assessment	The demarcated plant area and Pit 01 has been disturbed by recent mining activity and no sites of heritage significance were observed within the demarcated boundary. The area associated with proposed Pit 04 does not intersect the gradient or 500 m river buffer and no buildings or huts are indicated at this location on historical topographical maps (Figure 39). However, historical mining trenches of which the date is unknown, were located. No surface remains or infrastructure were noted at this site. Due to the potential age of the diggings, the site might be significant form an archaeological perspective and falls under the National Heritage Resources Act 25 of 1999. Proposed Pit 05 intersects an area associated with huts as indicated on the 1967 topographical map (Appendix A: Figure 46), but has subsequently been disturbed by cultivation (Figure 40). The site is also located within the 500 m river buffer. Historical mining infrastructure associated with Pit 05 date to at least 1947 and are considered significant from	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	and archaeological perspective. The site also falls under the protection of the National Heritage Resources Act 25 of 1999. Proposed Pit 06 partially intersects an area marked to as previously cultivated, but mining remains found at the site might date to historical times (Figure 41). The rehabilitated shafts located at proposed Pit 06 might date to contemporary times, but it is likely that the initial mining activity and remaining infrastructure are much older and are considered significant from an archaeological perspective. Therefore, this site falls under the protection of the National Heritage Resources Act 25 of 1999 as well. Although Pits 02 & 03 (Figure 38) could not be accessed as a result of dense vegetation, it is likely that these sites are associated with similar features and infrastructure as observed at proposed Pits 04, 05 and 06. A strong possibility, therefore, exists that these sites are significant from an archaeological perspective as well. The graves and potential grave associated with Sites B01 – B04 consist of overgrown and dilapidated stone cairns without inscriptions or visible grave goods. These sites are located approximately 600 m southwest ofthe plant and Pit 01 area and fall within the 500 m river buffer. Although significant from a heritage perspective, no impact on the sites is envisaged. Recommendations The following recommendations are made in terms with the National Heritage Resources Act (25 of 1999) inorder to avoid the destruction of heritage remains associated with the areas demarcated for development:	

	Plant and Pit 01 ➢ The area demarcated for the expansion of the plant and Pit 01 has to a large extent been disturbed by contemporary mining activity and no sites of heritage significance were noted within the demarcated boundary. No further action is required. ➢ Proposed Pits 02 & 03 ➢ Pits 02 & 03 could not be accessed due to dense vegetation cover. Because the Giyani Gold Mining Project is based on the location of previous mining activity, a strong possibility exists that proposed Pits 02& 03 are associated with historical mining activity. Therefore, it is recommended that the vegetation at these sites be cleared and a qualified archaeologist inspect the areas prior to any development to prevent the accidental damage and destruction of heritage resources. Care, however, must be exercised not to disturb any potential shafts, structures or any other archaeological features when clearing the vegetation. Proposed Pit 04 ➢ Due to the potential archaeological significance of the mining activity at proposed Pit 04, it is recommended that the vegetation hampering visibility and access to the trenches be cleared and that a qualified archaeologist document and map the site prior to any development. Care must be exercised not to disturb the trenches or any other archaeological features when clearing the vegetation. Proposed Pit 05 ➢ The historical mining activity associated with proposed Pit 05 is significant from an archaeological perspective since the site is associated with infrastructure that date to at least 1947. Dense vegetation, however, hampered determining the extent and	

	location of all the features and structures. Therefore, it is recommended that the vegetation hampering access and visibility be cleared and that a qualified archaeologist document and map the site prior to any development. Care must be exercised not to disturb the shafts, structures or any other archaeological features when clearing the vegetation. It is also recommended that the historical mining structures associated with this site be fenced-off and avoided by development. The mine’s ECO should inspect the structures during the proposed mining development and should any impact be observed, or if impact cannot be avoided, a destruction permit will have to be obtained from the relevant heritage authority. Pit 06 ➢ Although the rehabilitated mining shafts associated with proposed Pit 06 might date to the 1980s, the associated buildings and structures likely date to earlier times and are considered significant from an archaeological perspective. Due to the rehabilitated and disturbed nature of the site, the recording done during this study is regarded as sufficient. However, it is also recommended that the historical mining structures associated with this site be fenced-off and avoided by development. The mine’s ECO should inspect the structures during the proposed mining development and should any impact be observed, or if impact cannot be avoided, a destruction permit will have to be obtained from the relevant heritage authority. Graves ➢ Grave sites 2330BB-B01 – B04 are located approximately 600 m southwest of the pant and Pit 01 area. No impact is envisaged and no further action is required.	

	General Recommendations • The recommendations made are based on the specific project activities, as well as surface boundaries as indicated in this report. Should the proposed surface impact areas be altered, a qualified archaeologist must survey the altered areas and amend the report accordingly. • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)). • From a heritage point of view, development may proceed on the demarcated areas, subject to the abovementioned conditions, recommendations and approval by the South African Heritage Resources Agency.	
Noise Impact Assessment	Ambient sound levels were measured at 9 locations during a site visit conducted in March 2021. The noise levels recorded where indicative of each activity taking place in the proposed mining area. The noise levels closer to the **mining permit activities** where high with an average of **5**0dB characteristic of Urban districts. The noise levels reduce towards the townships and decreases even further at the villages (**Thomo** and **Shiviti**) with areas closer to the roads having higher noise levels but generally the noise levels range +-4**0**dB which is consistent with rural environment. The major sources contributing to noise levels observed where: • Vehicle movement (commuter and light passenger vehicles)	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	• Mining permit activities • Day to day human activities • Seasonal farming activities • Fauna sound Mining operations generate noise that can be heard in the surrounding community. In terms of the South African National Standards, residential daytime ambient noise levels should not exceed 55 dBA; and night-time ambient noise levels should not exceed 45dBA. The noise-related aspects of a public involvement program are aimed at presenting project-related information to the public and obtaining public views and input. During the earlier phases of project development, the project's purpose and need is presented to regulatory agencies and the public. Both have opportunities to comment and provide input related to purpose and need. Presentations are made of the range of alternatives under consideration. Broad-scale corridor-type alternatives are usually presented in the earlier stages of project development when no or limited data is available related to noise effects. As such, any discussions related to project-related and construction-related noise are typically qualitative in nature at this stage. The control measures should be introduced at the plant and along the haul route, especially closer to the sensitive receptors (the villages). For the wind speed reduction screens, consideration should be given to minimized tree removal of the zones around the potential sources with trees. Quarterly noise monitoring is recommended to be conducted by an acoustical consultant or approved noise inspection authority for the first year of operation. A noise monitoring programme should be designed considering the locations of the closest noise-sensitive developments as well as any other areas identified by other specialist studies (fauna, avifauna, macro-invertebrates, etc).	

	• Construction activities during the construction phase to take place during daytime only; • Biannual noise assessments during construction and operation along the boundaries of the proposed Site to take place to identify noise intrusions; • Using acoustic silencers on noisy equipment, all machinery and/or plant, which radiate noise levels exceeding 85.0dBA to be acoustically screened off; • All vehicles operational at the proposed site to conform with the following health and safety standards, Operational procedures such as speed limits on roads on site; • Selecting equipment with lower sound power levels; • Installing acoustic enclosures for machinery and/or parts causing radiating noise; • Conformance to the prevailing ambient noise level along the boundary of the proposed project area; • Plant and equipment design and selection, replacing older equipment with new technology that is often quieter; • House crushing plants within buildings, Enclosing conveyor systems; • Reducing impact noise by lining chutes with hard wearing rubber and polyurethane materials; • Using terrain to acoustically shield the operations, placing noisy equipment behind noise barriers; • Alternate safety systems on mobile equipment to replace reversing alarms and horns • Monitoring systems to reduce the impact of weather conditions and regular monitoring should also be implemented. All equipment that has belts, gears, bearings, drive motors, and other moving components has a “normal” range of vibration during operating cycles. Change in equipment vibration serves as an early	

	warning of a decline in operating function and signals the need for maintenance to avoid more serious faults and/or failure.	
Soil and land capability	The proposed mining area has le than 10% of low to moderate and more than 85% of medium to high agricultural land use capability. The area is mostly used for Subsistence Farming Annual Crop Cultivation / Planted Pastures Rotation, most notably maize is the commonly planted crop. Mining activities will irreversibly impact the land capability of the soil hence proper management measures need to be implemented during construction, operations and decommissioning to prevent soil loss due to contamination. Soils need to be stock piled so that they can be used for rehabilitation. Concurrent rehabilitation of open pits is expected to be complied with. After completion of each pit complete rehabilitation will be implemented to allow for substantial time for the normalisation of soils and proper monitoring of the rehabilitation whilst the company is still in operation. It is not possible to restore the soil potential and initial characteristics to its original state but huge improvements can be made in the methodology of stripping and re-dressing of soil material to ensure sustainability of rehabilitation. Over time these soils can produce proper agricultural yield production. The majority of the application areas is predominantly covered by thick woodland grass and trees, with gravel roads, rural settlements and substance farming. Impacts on the environment must be minimized or limited on construction sites. The following is recommended if the area will be used for mining purposes: ➢ During the construction phase top soil should be removes and stockpiled in a designated area and vegetated to avoid loss of the soil due to wind and water erosion	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	➢ Topsoil stockpiled areas should be no go zones for vehicles and no waste can be stored in this area to avoid contamination ➢ Monthly surface water monitoring and quarterly groundwater monitoring will be implemented as an on-going process with high priority. High quality irrigation is present in some areas and should be kept in that state. If any changes are observed, the source of pollution should be determined and eliminated. ➢ For monitoring purposed specialist should be used to evaluate the erosion and other possible impacts during the entire mining process. The entire area should be vegetated throughout the entire duration of mining due to the possibility of wind erosion and relative dry conditions (low clay contents in the top soils). ➢ Specific control measures are needed to control water erosion and run-off to prevent excessive surface run-off from the site ➢ Limit impacts to the footprints to keep physical impacts as small as possible ➢ Areas for road and site lay-out should be minimized. There are already existing roads on the site, these roads should be used, as well as upgraded and maintained Dust generation and vehicle associated pollution must be minimized.	

Social Impact Assessment	As is typical for mining projects, there is more potential for people living in the immediate surroundings of the Project site to experience negative impacts, however, local benefits may also be experienced as a result of the mine's investments in local communities. At a regional level, negative social impacts are likely to be minimal, and benefits due to employment and business opportunities are likely to be experienced. Therefore, from a social perspective based on the initial assessment of the receiving environment, there will be no fatal flaws associated with the proposed development that can have grave social consequences. The majority of the negative social impacts can respond to well-orchestrated mitigation measures, since they are general construction related problem, such as inflow of workers and jobseekers, possible impacts on farming and conservation activities, noise pollution, increased vehicle movement, as well as safety and security issues. It is the opinion of this specialist that the proposed Project should be authorised, subject to the implementation of the recommended mitigation measures and mechanisms for monitoring compliance. The success of mitigation measures aimed to reduce the socio-economic impact of the expected influx largely depends on Giyani Gold Mines developing and implementing the programmes proposed in their Social and Labour Plan. These measures include; • Local Labour Employment Policy • Human Resource Development Programme • Local Economic Development Programme which incorporates; A Programme improving Nutrition amongst the workforce; Infrastructure Projects and Poverty Eradication Projects, Community Participation and Communications Programme, and • Risk Management Plan	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

	Within these programmes, it would be necessary to understand how Giyani Gold Mines will; • Collaborate with the Tribal Authorities and Local Government to develop appropriate community monitoring programmes to identify and evaluate socioeconomic impacts resulting from the mining operations. These programmes ought to collect data reflecting economic, fiscal, and social impacts of the development at both the tribal and local government level. Parameters to be evaluated could include impacts on local labour and housing arrangements, local consumer product prices and availability, local public services (e.g., police, fire, and public health), and educational initiatives. Monitoring the indicators of social disruption (e.g., crime, alcoholism, drug use, and mental health) and the effectiveness of community welfare programmes in addressing these problems, will also be beneficial. • Define clear targets for the employment of local people. The targets and details need to be well communicated to the local communities and their leaders. Care needs to be taken that opportunities offered by the mine are not syphoned off by prominent or influential individuals. • Improve literacy through their ABET Programme. • Commit to establishing vocational training programmes for the local workforce to develop skills required during operation of the mine;	
Air Quality Assessment	Based on the results presented the following further recommendations are outlined: - It is recommended that ambient air quality monitoring be established to get a baseline condition prior to the onset of the operations and in order to establish the level at which the proposed operations are noted to impact on the ambient air quality.	Specialist Findings are included in 1.9:Baseline Environment Recommendations have been included in the impact assessment and management measures as well as monitoring program

	- Fallout monitoring should be continued for the life of mine to better assess the level of nuisance dust associated with both mining and process related operations. Sampling of fallout should be undertaken within the neighbouring areas as well as on-site. Dust fallout monitoring is recommended at the locations as shown. - PM10 and PM2.5 dust monitoring must also be undertaken at the same sites as mentioned under the previous bullet but also in and around potential fugitive emission sources to determine mitigation measures and focus management efforts. - If it is found that dust and PM10 levels are measured to be exceeding limits, it is highly recommended to establish a Real-Time indicative monitoring network to quantitatively help identify the sources and to assist in the management of the mitigation of these sources. The impacts from dust fallout and Particulate matter can be reduced by implementing dust control measures. The highest intensity of the construction work should be carried out during the summer months and not over the harsh winter months as can result in increased dispersion of fugitive dust. The mine should ensure that unpaved roads are continuously watered and treated with dust binding additive products to reduce the volume of fugitive dust emitted from unpaved roads. Mitigation and management measures for mining operation as discussed in this report should be sufficient to ensure the mining operation can be conducted with minimal impact on the receiving environment and therefore not have a detrimental effect and can go ahead.	included in these sections:1.10.4:**Assessment of each identified potentially significant impact and risk**

Attached are copies studies undertaken under Annexures – Specialist Reports

1.12 Environmental impact statement

1.12.1 Summary of the key findings of the environmental impact assessment;

The key finding of the Environmental Impact Assessment are categorised into sections

1. The Baseline environment:
    a. The mining areas falls within the Lowveld Rugged Mopaneveld vegetation type as per Mucina and Rutherford (2006). According to the biodiversity datasets provided by SANBI (2021), the current mining area, Swartkoppies and the 2 western pit areas (West 59 and Gemsbok) falls within a Critical Biodiversity Area 2. These sections were confirmed to be Mopani forest and bushveld areas during the site visit.
    b. The two remaining eastern pit areas falls within an Ecological Support 1 area and the other within an Other Natural Areas. These areas had disturbance by informal settlements surrounding these areas.
    c. The mining areas does not overlap with any protected or endangered ecosystems. The proposed mining operations fall within close proximity to Important Bird Areas (IBAs), where the proposed mining area falls close to the Kruger National Park..
    d. The area has severe water restrictions due to the low rainfall and high temperatures
    e. The site has a very rich flora and fauna diversity
2. Positive and negative Impacts of the project and proposed layout.

(The positive and negative impacts have been discussed in 1.10.2: The positive and negative impacts that the proposed activity (In terms of the initial site layout) and alternatives will have on the environment and the community that may be affected.)

1.12.2 Final Site Map

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

The final composite map is included under_ 2.3 :Composite Map.

1.12.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives;

Refer to **Table 43: Positive and negative impacts considering the alternatives described for the proposed Kusile's Giyani Gold Mine** .

1.12.4 Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr;

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

A detailed assessment of the impacts as well as the Management objectives have already been included in the summary of specialist recommendation as well as in 1.10.4: **Assessment of each identified potentially significant impact and risk**. The impact management outcomes have been summarised as follows:

- Prevent impacts from occurring where possible (e.g. prevent the contamination of the surrounding environment through effective clean and dirty water separation and management at the site).
- Limit / control impacts and the severity thereof where possible (e.g. control impacts by limiting the area of disturbance; limit the severity of impacts to the surrounding environment by ensuring that PCD and storm water control measures are designed and operated at 110% capacity.
- Remedy impacts that could not be prevented / limited / controlled and / or avoided (e.g. remedy impacts caused by spillages by cleaning up of any spillages and the associated affected areas).
- Enhance positive impacts in whatever manner may be possible to increase the positivity thereof (e.g. if / when any positions become available at the mine, source employment locally).

1.12.5 Final proposed alternatives.

(Provide an explanation for the final layout of the infrastructure and activities on the overall site as shown on the final site map together with the reasons why they are the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment)

The final layout of infrastructure has been chosen based on the best and most practical Site Layout. The alternatives in terms of the project at hand have been identified and investigated in depth in this report. The following information regarding alternatives has been included in various parts of this EIAR as indicated:

- The project alternatives (including the no-project alternative) were identified and described, along with the advantages and disadvantages of each alternative
- The positive and negative impacts of the proposed alternatives
- The risks associated with the identified alternatives
- A motivation where no alternative sites were considered was provided
- A statement motivating the alternative development location within the overall site was provided

1.12.6 Aspects for inclusion as conditions of Authorisation.

Any aspects which have not formed part of the EMPr that must be made conditions of the Environmental Authorisation

Due to the fact that the layout design is conceptual it is expected that the knowledge gaps for the project at hand (and therefore aspects where information may be considered insufficient) revolve around exact designs, and in some cases, locations. Therefore the following conditions of authorisation are proposed:

- The environmental authorisation will be subject to the availability of an approved water use license or proof that the said application process is underway.
- Prior to construction a tree removal, relocation or destruction permit must be applied for detailing the species being affected and as such the permit must be submitted to the DMRE.
- A detailed paleontological study focusing on all the areas where earthworks and construction will take place will need to be undertaken and the report should be submitted to both SAHRA and DMRE for assessment and record keeping.
- Detailed designs of the proposed PCD must be compiled in line with the design criteria stipulated in the water reports and IWWMP. The final as-built designs plans will be provided to the DMRE who are the competent authority for record keeping purposes once construction has been completed.
- Detailed designs of the associated water management infrastructure (silt trap, berms, trenches, pumps, etc.) must be compiled in line with recommendation made by DWS, the Visual Study and the Flora Assessment. The final as-built designs will be provided to the DMRE who are the competent authority for record keeping purposes once construction has been completed.
- The exact locations of the proposed infrastructure may still need to be moved in the future. Any such infrastructure must be confined to the dirty water management area. Prior to and after completion of construction of any such infrastructure, the Competent Authority should be informed of the location thereof for record keeping purposes.

1.12.7 Description of any assumptions, uncertainties and gaps in knowledge.

(Which relate to the assessment and mitigation measures proposed)

Specialists appointed to conduct assess the baseline information and in-depth studies for the Kusile's Giyani Gold Mine , were provided with (at least) the following information:

- Site layout plan
- Scoping Report
- Mine works program
- Specialist studies were also shared among specialists

Each specialist conducted site visits on the farm to do on-site testing, sampling, visual observations, as required for their specialist investigation.

A summary of the assumptions and limitations noted by specialists has been noted below:

- **Biodiversity Assessment**

Assumptions and Limitations

- It is difficult to apply pure scientific methods within a natural environment without limitations, and consequential assumptions need to be made. The findings, results, observations, conclusions and recommendations provided in this report are based on the author's best scientific and professional knowledge as well as available information regarding the perceived impacts on the watercourses and biodiversity. It is important to note that although this report describes the regional vegetation, vegetation previously recorded for the area (POSA) and the conservation status of the project area, where some of the areas are private land, therefore limiting access to them..

- **Floodline Delineation**

Assumptions and Limitations

- This study is limited to a Floodline Determination
- This study assumes that the project proponents will always strive to avoid, mitigate or offset potentially negative project-related impacts on the water resources. Impact avoidance is regarded as the best form of mitigation and should be prioritised as the primary means of mitigation. It further assumes that the project proponents will seek to enhance potential positive impacts on the environment

- **Groundwater Modelling**
- **Model Limitations and Assumptions**

Model Limitations and Assumptions

The following assumptions were made with noted limitations:

1. The accuracy and scale of the assessment will result in deviations at specific points e.g. on the boundaries of mine layout areas however this effect is minimal and the selected mesh elements would represent the footprint of specific infrastructure.

2. For lithological units different than that of the immediate study area hydraulic parameters from literature were used for specific types of geology.

3. NGDB Data borehole data (water levels) and neighbourhood boreholes were only available around the area and the surrounding farms.

4. Sections of the model domain were therefore not thereby affecting the confidence level of the model.

5. Considering the spatial extent of the model domain and rainfall stations within the study area, rainfall data from a single station was used to represent entire study area. Once the model was calibrated, the proposed Gold Mine were incorporated into the model by applying drains to discharge water from the aquifer system.

6. The stream was constrained such that no water leaked from the streams to the groundwater system. By constraining infiltration

7. When the modelling assumptions were made or reference values used, a conservative approach was followed such that the trend was to overestimate groundwater discharges from dewatering. This gives a worst-case scenario for designing the dewatering system and impacts to the receiving environment. It should be noted that dewatering volumes should be less than those simulated by the model.

- ❖ **Visual Assessment**

The following limitations, constraints and assumptions are applicable to this study:

- Visual perception is by nature a subjective experience, as it is influenced largely by personal values. For instance, one viewer experiences as an intrusion in the landscape, another may regard as positive. Such differences in perception are greatly influenced by culture, education and socio-economic background. A degree of subjectivity is therefore bound to influence the rating of visual impacts. To limit such subjectivity, a combination of quantitative and qualitative assessment methods has been used. A high degree of reliance has been placed on analysis based on GIS view shed and visibility analysis and on making transparent assumptions and value judgements where assumptions or judgements are necessary.

- The purpose of this visual impact assessment study is to identify the visual impact of the project in relation to the existing landscape setting. However, while an effort is made to be rigorous and logical in the assessment process, the element of subjectivity does influence the ratings. It has nevertheless been reported in McCool, S.F. et al (1986) that the professional visual assessor is more critical than the public.

- The view shed generated in GIS is not 100% accurate and has therefore been ground truth during the site visit. Some viewpoints which are indicated on the view shed as being inside of the view shed, can be outside of the view shed. This is due to the modification of the natural environment surrounding the study area. Natural vegetation also plays a significant role and can have a positive or negative influence on the view shed.

- Determining a visual resource in absolute terms is not achievable. Evaluating a landscapes visual quality is both problematic and complex. Sundry approaches have been developed, but they all have one problem in common; unlike noise or air pollution which can be measured in a relatively simple way, for the visual landscape mainly qualitative standards apply. Therefore, subjectivity cannot be excluded in the assessment procedure (Lange, 1994). Individually there is a great variation in the evaluation of the visual landscape based on different experiences, social level and cultural background. Exacerbating the situation is the inherent variability in natural features. Climate, season, atmospheric conditions, region, sub region, all affect the attributes that comprises the landscape. What is considered scenic to one person may not be to another (NLA, 1997)

- The layouts as provided by the applicant were used to undertake the VIA analysis and were assumed to be up to date and accurate when this study commenced.
- The view shed illustrates the areas from which the proposed development is likely to be visible. It does not take local undulations, existing vegetation and man-made structures into account. Due to the interval of the contours, many of the undulations or natural landscape features smaller than 20 m tall in the surrounding areas could be lost. This means that the proposed development may not be visible from everywhere within the view shed, as the development may be obscured by other existing infrastructure, vegetation or small/localised variations in the topography. It therefore indicates a "worst case" scenario.

❖ **Archaeological Impact Assessment**

The area associated with the plant that has already been developed was accessed without any constraints. The undeveloped sections of the plant area and Pit 01, as well as the remaining proposed Pits, are characterised by extremely dense vegetation that severely restricted free movement and visibility during the time of surveying (April 2021). The type of vegetation consisted of thick mopane tree cover, thorn bushes and grass cover. The access road to proposed Pits 02 & 03 was completely inaccessible due to extremely dense vegetation . These proposed pits could therefore not be visited.

❖ **Soil Assessment and Land Capability Report**

There are to concepts that are basic to the system. These are capability and limitation. The potential of the land for use in specified ways or with specified management practices is called capability. There is a sequence of assumed uses built in the system. These are as follows: (a) arable use for any crops and without soil conservation practices; (b) arable use with restriction on choice of crops/or with soil conservation practices;(c) grazing of improved pastures; (d) grazing of natural pastures or, at the same level, woodland; (e) and at the lowest level recreation, wildlife conservation, water catchment and aesthetic purposes (Dent and Young, 1981). Land that is allocated to any particular class has the potential for the use specified for that class and for all classes below it. Thus class I land whilst excellent for arable use can equally be put to other uses: class VI land use suited for improved pasture but also be any of the uses below it, whilst class VIII land can be only used for recreation.

The capability class does not indicate what the best use for the land, nor the most profitable, it only indicates the range of uses to which each could be put. Limitations are land characteristics, which have an adverse effect on capability. Permanent limitations are those which cannot easily be corrected. Temporary limitations can be correct, at least by minor land improvements. Land is classified mainly on the basis of permanent limitations. The general rule is that if any one limitation is of sufficient severity to lower the land to a given class it is allocated to that class, no matter how favorable all other characteristics might be.

❖ **Social impact Assessment**

Assumptions and Limitations

- It is acknowledged that the SIA has been developed based on certain assumptions and bounded by limitations which were outside the scope of influence of the SIA team. Some of the key assumptions and limitations are listed below:
- The relevant IAIA SIA principles have been adapted for this study, including the precautionary and uncertainty principle when predicting social impacts. Any predicted social impact may change as more information about the Project is known, and the Project is being constructed and operated. Therefore actual social impacts of the Project were not known with certainty when writing this report. A monitoring program has been developed in order to provide information on whether potential social impacts actually occur or not.
- Social impacts are highly contextual and the social impacts of a particular project may be influenced by a range of social, socio-economic and economic trends that are outside the control of the proponent. Additionally, Provincial, State, Regional and local policy and planning frameworks may change considerably over time and this will necessarily affect the identification and management of social impacts. This introduces an unavoidable level of uncertainty into predictions of future impacts which necessitates ongoing monitoring and an adaptive management approach. Conclusions presented in this report are derived primarily from results of previous research and secondary sources.
- Workforce numbers and characteristics of the workforce are based on estimates only and may change as the Project moves into detailed design phase and operations phase.
- This study was carried out with the information available to the specialist at the time of executing the study, within the available timeframe and budget. The sources consulted are not exhaustive and additional information, which might strengthen arguments or contradict information in this report might exist.
- The absence of up-to-date census data on the local population. The last comprehensive census was

undertaken in 2011 and the next one is only scheduled for 2021. While census data used is not up-to- date, it does provide sufficient detail to establish a baseline that is relatively accurate in terms of orders of magnitude and allows for the establishment of trends; and

- The absence of a comprehensive, up-to-date database of educational facilities, health care facilities, places of worship, and cultural historical sites. While not every facility or site may have been accounted for, the data does provide sufficient detail to determine quantity, in terms of order of magnitude, and the relative distribution of the facilities and/or sites within the regional study area.

1.12.8 Reasoned opinion as to whether the proposed activity should or should not be authorised

1.12.8.1 Reasons why the activity should be authorized or not.

The factors taken into consideration when assessing whether authorisation should be granted or note the need and desirability, positive impacts and impact management measures needs to be weighed up against the identified potential negative impacts, to see whether the benefits of the project could justify the negative impacts.

It is the opinion of the EAP that the majority of impacts will have medium significance before mitigation. It is recommended that if clearances are kept at a minimum and relevant permit be applied for as well as potential replanting, re-seeding and nurseries of indigenous and protected species form part of the mitigation measures.

With the extensive specialist information generated to establish the baseline environmental conditions of the project area the EAP recommends that the activity be authorised subject to all relevant legislation. The EAP has also made available in the report stating the water restrictions, critical biodiversity area and the pristine nature of the area. This report was subject to relevant commenting authorities and their recommendations should be taken into cognisance during the authorisation process.

1.12.8.2 Conditions that must be included in the authorisation

- No new NEMA, NEMWA, NWA listed activity which is not included in this application may not be undertaken without prior legislative authorisation.
- Annual environmental reports should be submitted to the department including water monitoring reports.
- An EMP Performance Assessment must be undertaken every two years by an external, independent, suitably qualified person. A copy of the Performance Assessment report must be submitted to the DMRE.

1.12.8.2.1 Specific conditions to be included into the compilation and approval of EMPr

The EMPr has been compiled and is under Part B of this EIAR document. The EMPR includes all aspects associated with the proposed new mining activities and related infrastructure. The EMPr includes items identified and recommended in the specialist report which were undertaken to assess potential impacts and mitigation measures for the project.

1.12.8.2.2 Rehabilitation requirements

The concurrent rehabilitation requirements are as follows:

- All open pit areas and shafts should be rehabilitated as soon as the mining in that section has been finalised;
- Slopes of rehabilitated areas must be gentle sloped to minimise loss of topsoil due to erosion of topsoil;
- Re-vegetation of rehabilitated areas must be done immediately;
- Rehabilitated areas must be free-draining;
- Rehabilitation activities must be actively monitored on a regular basis to ensure the long-term sustainability thereof; and
- The rehabilitation and closure objectives should be implemented as described in 2.8.4.1: Rehabilitation Plan and 2.8.4.2:Final Closure

1.12.9 Period for which the Environmental Authorisation is required.

The Environmental Authorisation is required for the life of mine which is 30 years. Taking into account the maximum timeframes allocated for a mining right it is therefore expected that KUSILE will need to renew their mining right once the 30years expire.

1.12.10 Undertaking

Confirm that the undertaking required to meet the requirements of this section is provided at the end of the EMPr and is applicable to both the Scoping and the Environmental Management Programme report.

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises EMP compiled in accordance with the guideline

on the Departments official website and the directive in terms of sections 29 and 39 (5) in that regard, and the applicant undertakes to execute the Environmental management programme as proposed.	
Full Names and Surname	Mr. Mzamani Mdaka
Identity Number	

1.13 Financial Provision

State the amount that is required to both manage and rehabilitate the environment in respect of rehabilitation.

The value of the financial provision that will be required to rehabilitate the environment in respect of rehabilitation, including the proposed mining activities is R1 285 893.

1.13.1 Explain how the aforesaid amount was derived.

The financial provision has been compiled in line with the DMRE and NEMA guidelines and requirements. The breakdown of the financial provision are included in the EMPR in table **Error! Reference source not found.** which forms part of this report.

1.13.2 Confirm that this amount can be provided for from operating expenditure.

(Confirm that the amount, is anticipated to be an operating cost and is provided for as such in the Mining work programme, Financial and Technical Competence Report or Prospecting Work Programme as the case may be).

The amount required for the financial provision will be provided in the form of a bank guaranteed cheque or into a rehabilitation trust.

1.13.3 Deviations from the approved scoping report and plan of study.

1.13.3.1 Deviations from the methodology used in determining the significance of potential environmental impacts and risks.

(Provide a list of activities in respect of which the approved scoping report was deviated from, the reference in this report identifying where the deviation was made, and a brief description of the extent of the deviation).

No deviation has been made from the plan of study provided for in the Scoping Report. The layout was amended but this only served to minimise negative impacts on watercourses and floodline areas.

1.13.3.2 Motivation for the deviation.

No deviation has been made from the plan of study provided for in the Scoping Report, and therefore no additional motivation is required

1.13.4 Other Information required by the competent Authority

Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998). the EIA report must include the:-

1.13.4.1 Impact on the socio-economic conditions of any directly affected person.

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any directly affected person including the landowner, lawful occupier, or, where applicable, potential beneficiaries of any land restitution claim, attach the investigation report as **Appendix 2.19.1** and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).
Refer to Annexure 1 – Appendix 12 Social Impact Assessment

The landowners will be directly affected by the mining activities. The impacts that will affect the landowners include but not limited to:

- Loss of land capability where the open its will be developed
- Loss of land where the roads and infrastructure will be constructed
- Increased noise and visual disturbances
- Loss of aesthetic due to the change in the natural scenic environment
- Loss of indigenous vegetation and sensitive habitats
- Suffer losses due to increased criminal activity (poaching)

In order to mitigate specific risks of criminal activity to directly affected and neighbouring landowners, it is recommended that:

- Fence off servitudes and access roads and provide for strict access control measures to service roads and patrol service roads regularly;
- Utilize sufficient mine security to regularly patrol the fences of the mine infrastructure, especially;
- Liaise with the South African Police Service to enhance police patrol activity in the project area;
- Support the community watch of the directly affected and neighboring landowners which can report criminal or suspicious activity; and
- Employment of local people on the mine to improve the poverty levels in the host and neighboring communities.

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

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) with the exception of the national estate contemplated in section 3(2)(*i*)(vi) and (vii) of that Act, attach the investigation report as **Appendix 2.19.2** and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

Refer to Annexure 5 – Archaeological Impact Assessment

In terms of section 38 of the National Heritage Resources Act, 1999 (Act no. 25 of 1999), a comprehensive heritage impact assessment (HIA) investigation in accordance with the provisions of Sections 38(1) and 38(3) of the *said act* and focuses on the survey results from a cultural heritage survey.

The following recommendations are made in terms with the National Heritage Resources Act (25 of 1999) in order to avoid the destruction of heritage remains associated with the areas demarcated for development:

The study area: The six demarcated portions on un-surveyed state land of Greater Giyani 891 LT, Giyani, Limpopo. The proposed opencast pit areas (Pits 01 – 06) are based on the location of previous mining activity. In terms of mining, the general area has been exposed to mining activities since 1870. Mining activities appear to have continued until the 1980s, but were constantly interrupted, abandoned and reinvestigated over the years. Given the significance of the larger cultural landscape and heritage sites located during previous heritage studies, the general area is considered sensitive from a heritage perspective. However, significant sections of the study area has been cultivated in past years that most likely disturbed the archaeological context. Also, due to extremely dense vegetation cover, the identification of culturally significant heritage sites was significantly hampered.

The demarcated plant area and Pit 01 has been disturbed by recent mining activity and no sites of heritage significance were observed within the demarcated boundary.

The area associated with proposed Pit 04 does not intersect the gradient or 500 m river buffer and no buildings or huts are indicated at this location on historical topographical maps (Figure 39). However, historical mining trenches of which the date is unknown, were located. No surface remains or infrastructure were noted at this site. Due to the potential age of the diggings, the site might be significant form an archaeological perspective and falls under the National Heritage Resources Act 25 of 1999.

Proposed Pit 05 intersects an area associated with huts as indicated on the 1967 topographical map (, but has subsequently been disturbed by cultivation. The site is also located within the 500 m river buffer. Historical mining infrastructure associated with Pit 05 date to at least 1947 and are considered significant from and archaeological perspective. The site also falls under the protection of the National Heritage Resources Act 25 of 1999.

Proposed Pit 06 partially intersects an area marked to as previously cultivated, but mining remains found at the site might date to historical times. The rehabilitated shafts located at proposed Pit 06 might date to contemporary times, but it is likely that the initial mining activity and remaining infrastructure are much older and are considered significant from an archaeological perspective. Therefore, this site falls under the protection of the National Heritage Resources Act 25 of 1999 as well.

Although Pits 02 & 03 (Figure 38) could not be accessed as a result of dense vegetation, it is likely that these sites are associated with similar features and infrastructure as observed at proposed Pits 04, 05 and 06. A strong possibility, therefore, exists that these sites are significant from an archaeological perspective as well.

The graves and potential grave associated with Sites B01 – B04 consist of overgrown and dilapidated stone cairns without inscriptions or visible grave goods. These sites are located approximately 600 m southwest ofthe plant and Pit 01 area and fall within the 500 m river buffer. Although significant from a heritage perspective, no impact on the sites is envisaged.

Recommendations

The following recommendations are made in terms with the National Heritage Resources Act (25 of 1999) inorder to avoid the destruction of heritage remains associated with the areas demarcated for development:

Plant and Pit 01

- The area demarcated for the expansion of the plant and Pit 01 has to a large extent been disturbed by contemporary mining activity and no sites of heritage significance were noted within the demarcated boundary. No further action is required.
-

Proposed Pits 02 & 03

- Pits 02 & 03 could not be accessed due to dense vegetation cover. Because the Giyani Gold Mining Project is based on the location of previous mining activity, a strong possibility exists that proposed Pits 02& 03 are associated with historical mining activity. Therefore, it is recommended that the vegetation at these sites be cleared and a qualified archaeologist inspect the areas prior to any development to prevent the accidental damage and destruction of heritage resources. Care, however, must be exercised not to disturb any potential shafts, structures or any other archaeological features when clearing the vegetation.

Proposed Pit 04

- Due to the potential archaeological significance of the mining activity at proposed Pit 04, it is recommended that the vegetation hampering visibility and access to the trenches be cleared and that a qualified archaeologist document and map the site prior to any development. Care must be exercised not to disturb the trenches or any other archaeological features when clearing the vegetation.

Proposed Pit 05

- The historical mining activity associated with proposed Pit 05 is significant from an archaeological perspective since the site is associated with infrastructure that date to at least 1947. Dense vegetation, however, hampered determining the extent and location of all the features and structures. Therefore, it is recommended that the vegetation hampering access and visibility be cleared and that a qualified archaeologist document and map the site prior to any development. Care must be exercised not to disturb the shafts, structures or any other archaeological features when clearing the vegetation. It is also recommended that the historical mining structures associated with this site be fenced-off and avoided by development. The mine's ECO should inspect the structures during the proposed mining development and should any impact be observed, or if impact cannot be avoided, a destruction permit will have to be obtained from the relevant heritage authority.

Pit 06

- Although the rehabilitated mining shafts associated with proposed Pit 06 might date to the 1980s, the associated buildings and structures likely date to earlier times and are considered significant from an archaeological perspective. Due to the rehabilitated and disturbed nature of the site, the recording done during this study is regarded as sufficient. However, it is also recommended that the historical mining structures associated with this site be fenced-off and avoided by development. The mine's ECO should inspect the structures during the proposed mining development and should any impact be observed, or if impact cannot be avoided, a destruction permit will have to be obtained from the relevant heritage authority.

Graves

- Grave sites 2330BB-B01 – B04 are located approximately 600 m southwest of the pant and Pit 01 area.

No impact is envisaged and no further action is required.

General Recommendations

- The recommendations made are based on the specific project activities, as well as surface boundaries as indicated in this report. Should the proposed surface impact areas be altered, a qualified archaeologist must survey the altered areas and amend the report accordingly.
- Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).

- From a heritage point of view, development may proceed on the demarcated areas, subject to the abovementioned conditions, recommendations and approval by the South African Heritage Resources Agency.

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

(the EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 22(2)(h), exist.

Section 24(4)(b)(i) of the NEMA (1998) states the following "*Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment must include, with respect to every application for an environmental authorisation and where applicable investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity*"

The alternatives in terms of the project at hand have been identified and investigated in depth in this report. The following information regarding alternatives has been included in various parts of this EIR as indicated:

Mapping of the floodlines shows no major challenges and that a large portion of the Giyani Gold Mine is outside the 1:100 year floodline. In this light, the study recommends and modelled a scenario with a berm constructed along a 100 m horizontal distance from the all nearby streams and sized to restrict and prevent the 1:100 year flood from flowing into the proposed open cast, and consequently prevent mining within a 1:50 year floodline. It is required that erosion prevention measures be put in place.

The study report is appended hereto, together with results of the floodline assessment. The map for the pre-extension scenario is presented, as well as that for the scenario with the extension and the berm flood control or remedial measure. The recommended minimum berm bottom width is 25 m, with varying between 3.5 and 6.3 m with a slope of about 1:2.

Water use activities within 100 m from the watercourse are subject to section 21 (c) and (i) water use authorisation and would be controlled through licence conditions.

- The alternatives for the current layout plan were considered in detail with the aim to minimise impacts and protect natural resources.
- The project alternatives (including the no-project alternative) were identified and described,
- The positive and negative impacts of the proposed alternatives have been described,
- The risks associated with the identified alternatives have been described,

- A motivation where no alternative sites were considered was provided , and
- A statement motivating the alternative development location within the overall site was provided.

The alternatives, descriptions, motivations, assessments, etc have all been considered in detail in this report and are therefore not repeated here.

1.13.5.1 Waste Streams and Management

1.13.5.1.1 Solid Waste Management

Waste management is a key component of an IWWMP, particularly owing the potential impacts of waste disposal on resource water quality. Waste management at Giyani Gold Mine will be guided by the hierarchy for waste management, which supports sustainable development through promoting sustainable and cleaner production, waste minimisation, reuse, recycling and waste treatment. Disposal is regarded as a last resort, and practiced in an environmental sound and socially acceptable manner, and subject to the NEMWA and applicable regulations.

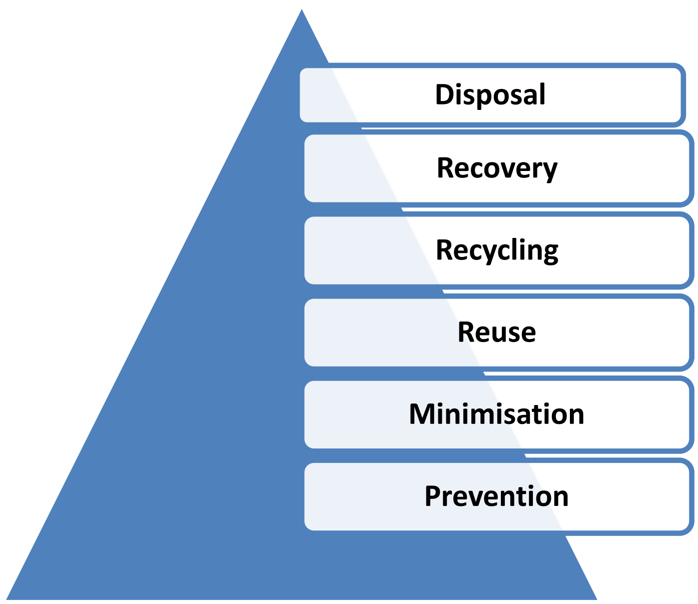


Figure 102: Waste Hierarchy

Hazardous wastes such as chemical containers, spent oil, diesel and grease will be stored in dedicated containers and collected at regular intervals by a registered sub-contractor and disposed of at a licensed disposal site. No hazardous waste streams will be disposed of on the mine premises, except authorised under the NEMWA, e.g. in the case of TSF. Spillages will be cleaned up and disposed of in an appropriate manner.

Scrap material that have salvageable value will be collected, sorted and reused where possible. However, if quantities of this waste stream are significant, Giyani Gold Mine will work with local communities through the established structures in SLP programmes, to establish a local-based organisation to recover and sell or reuse the scrap metal. General waste is collected in marked containers and removed from the premises by a registered contractor on a weekly basis. Safe disposal certificates will be retained for record-keeping, for all waste streams disposed off-site.

1.13.5.1.2 Waste Stream Identification

Anticipated waste streams from Kusile's Giyani Gold Mine include those listed in the tabulations below.

Table 46: Kusile's Giyani Gold MIne Waste Stream Identification

Infrastructure /Activity	Waste	Waste Categorization
Ablution	Sewage Sullage (grey water)	Hazardous
Stockpiles	Overburden stockpiles Tailings Disposal Facility (TSF)	Hazardous
Offices	Waste papers, plastic, glass bottles, food waste	General waste
Mine vehicles	Hydrocarbon waste generated by spillages; Operations of vehicle and diesel generators	Hazardous waste
Workshop	Fluorescent tubes, old batteries, waste paints, and transformers; Oily and grease waste, petrol contaminated material, and oil related products	Hazardous waste
	Scrap metals, empty chemical containers, metal off-cuts), used tyres	Hazardous waste

1.13.5.1.3 Waste Stream Classification

Assessment and classification of the coal sample was carried out according to requirements in Government Notice 635 National Norms and Standards for Assessment of Waste for Landfill. The classification is undertaken as follows:

5. Evaluation of the activities generating the waste streams and determination of relevant chemical elements and substances in relation to those listed in the Norms and Standards for Assessment of Waste for Landfill Disposal. According to the regulation, all the chemicals that could reasonably

be expected to occur in the material being classified should be tested for. Hence, XRD and XRF results are taken into account.

6. Collection of samples of the relevant waste streams from the mine – in terms of the Waste Regulations and the NWA, and delivery of the samples to UIS Laboratories for analyses. Sampling was done on waste rock, tailings, as well as Run of Mine (ROM). Although ROM is not waste in terms of the NEMWA definition, it is also assessed for contextualisation of the waste stream results and since it may fall into the definition of waste in terms of the NWA.
7. Geochemical assessments of the samples and determination of Total Concentrations (TC) and Leachable Concentrations (LC) of the selected chemical elements and substances from section 6 of the Norms and Standards.
8. Determination of the type of waste based on an evaluation of the geochemical assessment results against the Total and the Leachable Concentration Threshold Limits in the Norms and Standards for assessment of waste for landfill.

Based on GNR 635, the type of waste can be determined as follows:

f. Material (or wastes) with any element or chemical substance concentration above the LCT3 or TCT2 limits (LC> LCT3 or TC> TCT2) are Type 0 Waste;
g. Wastes with any element or chemical substance concentration above the LCT2 but below or equal to the LCT3 limits, or above the TCT1 but below or equal to the TCT2 limits (LCT2 < LC ≤ LCT3 or TCT1 <TC ≤ TCT2), are Type 1 Waste;
h. Wastes with any element or chemical substance concentration above the LCT1 but below or equal to the LCT2 limits and all concentrations below or equal to the TCT1 limits (LCT1 < LC ≤ LCT2 and TC ≤ TCT1) are Type 2 Waste;
i. Wastes with any element or chemical substance concentration above the LCT0 but below or equal to the LCT1 limit and all TC concentrations below or equal to the TCT1 limits (LCT0 < LC ≤ LCT1 and TC ≤ TCT1) are Type 3 Waste;
j. Wastes with all element and chemical substance concentration levels for metal ions and inorganic anions below or equal to the LCT0 and TCT0 limits (LC ≤ LCT0 and TC ≤ TCT0), and with chemical substance concentration levels also below the corresponding limits for organics and pesticides, are Type 4 Waste.

Waste Classification Results

Total Concentrations of Arsenic (As), Barium (Ba), Copper (Cu) and Nickel (Ni) in all the samples exceeded Threshold Zero (TCT0) values, but are less than Threshold 1 (TCT0). Therefore, the materials would be classified as Type 3 Waste, based on the total concentrations of the said trace metals.

Table 5.7 presents the test results of reagent water leaching for the mono-disposed waste according to AS 4439.3 for the different materials. It is recommended that the rock samples are not strictly classified according to the TCT values because of the low TCT0 threshold values.

The AUC represents the average concentration of elements in the upper continental crust including rock (sub)-outcrops and serves as a background reference for the geochemical composition of rock near the earth's surface. The TCT0 for Ba and Cu are below the AUC; for As, Mn and Pb, the TCT0 is close to (not more than twice) the AUC. This implies that most natural rock and soils in the earth crust would classify as Type 3 waste based on the TCT0 value. Thus, for this analysis, only the LCT values will be used for classification of these materials.

For all material samples, reagent water leach LCs are below LCT0 values for the corresponding chemical elements and compounds.

- The waste rock and ROM would be classified as Type 4 Waste if only leachable concentrations are considered.
- The low leachable concentrations of constituents in the waste rock indicate that the risk from leachable constituents to contaminate the receiving environment, is low over the short term. Thus, there is a low risk of water resource pollution that may be attributable to contaminant mobilization over the short term (during operational phase).
- The slimes/tailings could be classified as Type 4 while still neutral (e.g. during operation). Since the material may acidify over the long-term upon oxidation, it should be classified as Type 3 Waste when disposed of over the long-term.
- Since the material comprises of natural rock material no organic chemicals, including petroleum hydrocarbons and pesticides, are expected to occur within it.

Table 47: Waste Classification Total Concentration Results (mg/kg).

Chemical Element/Substance	Waste Rock	ROM	Tailings	TCT0	TCT1	TCT2
As, Arsenic	7.48	13.4	10.8	5,8	500	2000
B, Boron	13.2	37.5	36.6	150	15000	6000
Ba, Barium	363	207	139	62,5	6250	25000
Cd, Cadmium	0.10	0.05	0.05	7,5	260	1040
Cr_{Total}, Chromium	265	1533	1097	46000	800000	N/A
Co, Cobalt	47.5	51.0	28.8	50	5000	20000
Cu, Copper	209	69.6	62.4	16	19500	78000
Hg, Mercury	0.03	0.04	0.08	0,93	160	640
Mn, Manganese	1307	878	729	1000	25000	100000
Mo, Molybdenum	0.67	0.76	0.62	40	1000	4000
Ni, Nickel	171	720	431	91	10600	42400
Pb, Lead	9.63	14.4	6.24	20	1900	7600
Sb, Antimony	0.35	0.57	2.27	10	75	300
Se, Selenium	0.51	0.23	0.18	10	50	200
V, Vanadium	217	110	111	150	2680	10720
Zn, Zinc	119	72.6	56.5	240	160000	640000
CN_{Total}, Cyanide Total	–	–	1.04	14	10500	42000

Waste Classification Leachable Concentration Results (mg/L)

Analyses	Waste Rock	ROM	Tailings	LCT0	LCT1	LCT2	LCT3
As, Arsenic	0.002	0.003	0.003	0,01	0,5	1	4
B, Boron	0.070	0.097	0.058	0,5	25	50	200
Ba, Barium	0.268	0.340	0.222	0,7	35	70	280
Cd, Cadmium	<0.0001	<0.0001	<0.0001	0,003	0,15	0,3	1,2
Co, Cobalt	0.002	0.002	0.009	0,5	25	50	200
Cr_{Total}, Chromium	0.004	0.012	0.019	0.1	5	10	40
Cu, Copper	0.009	0.002	0.002	2,0	100	200	800
Hg, Mercury	<0.0001	<0.0001	<0.0001	0,006	0,3	0,6	2,4
Mn, Manganese	0.046	0.027	0.075	0,5	25	50	200
Mo, Molybdenum	0.001	0.002	0.001	0.07	3.5	7	28
Ni, Nickel	0.004	0.013	0.021	0,07	3,5	7	28
Pb, Lead	0.001	0.001	0.002	0,01	0,5	1	4
Sb, Antimony	0.001	0.001	0.003	0.02	1.0	2	8
Se, Selenium	<0.001	<0.001	<0.001	0,01	0,5	1	4
V, Vanadium	0.016	0.013	0.016	0,2	10	20	80
Zn, Zinc	0.007	0.006	0.019	5,0	250	500	2000
Total Dissolved Solids*	60	100	148	1000	12 500	25 000	100 000

Analyses	Waste Rock	ROM	Tailings	LCT0	LCT1	LCT2	LCT3
Chloride as Cl	1.37	0.92	5.23	300	15 000	30 000	120 000
Sulphate as SO_4	9.92	12.8	10.1	250	12 500	25 000	100 000
Nitrate as N	2.01	2.33	8.02	11	550	1100	4400
Fluoride as F	0.13	0.24	0.12	1,5	75	150	600
CN_{total}, Cyanide Total	–	–	<0.01	0.07	3.5	7	28

1.13.5.1.4 Waste Recovery and Reduction

Giyani Gold Mine will adopt the following principle for waste reduction and recovery in line with waste hierarchy plan as provided in the figure below.

(iv) Key waste identified will be collected, handled, and disposed in accordance with the respective waste stream classification and legislation;

(v) Opportunities for waste reduction, reuse, recycling and recovering will be regularly investigated and feasible opportunities implemented as part of the continual improvement philosophy adopted for the mining operation;

(vi) Mine residue dumps on the site will be rehabilitated in accordance with the nature of the deposited material and the contamination potential of the respective dumps as directed by legislation.

Waste reduction and recovery will be carried in the manner discussed in the tabulation below.

Table 48: Waste Recovery and Reduction

Waste stream	Description, management, reduction and recovery
Construction Phase	
Dirty storm water runoff	PCDs will be constructed prior to opening the box cut to contain dirty water from the box cut. Dirty water collected within the opencast pit will be pumped and channeled into a PCD located on the farm Swartkoppies. The storage capacity of the PCD will be approximately 140 000 m^3 and will accommodate 24 hr storm rainfall volume for the 1:50 year storm event. Clean storm water will be diverted around the dirty water areas using berms and channels.
Solid waste	Solid waste will be collected in bins and disposed of in existing licensed disposal sites around Giyani area. Waste will be separated into general waste, hazardous waste, metals, wood, glass and paper and recycled where possible. Certified contractors will be contracted to dispose of non-recoverable/recyclable waste into licensed waste disposal site.
Sewage	Chemical toilets will be made available on site for ablutions. These toilets will be serviced as required by a contractor. No washing facilities will be provided on site.
Construction Phase	
Overburden (waste rock)	Temporary overburden stockpiles will be placed adjacent on the northern part of the open pit to facilitate concurrent backfilling of the mined-out areas. Rehabilitation will entail replacing any stockpiled blasted over-burden, inter-burden and parting material into the voids and then dressing with the sub-soil and then top-soil, contouring and re-vegetating.
Solid waste	All solid waste generated will be handled as during construction phase.

Waste stream	Description, management, reduction and recovery
Sewage waste	Raw sewage and grey water from the mine offices and ablution facilities will be disposed of into package sewage treatment plants located on the farm Swartkoppies. The effluent from the sewage plants will be reused in the gold processing plant.
Decommissioning Phase	
Solid waste	The processing plant, offices, conveyors and other infrastructure will be removed and sold for re-use or disposed of as scrap.

1.13.5.1.5 Waste Management

The National Environmental Management Waste Act (NEMWA), 2008 (Act No. 59 of 2008) under the NEMA, 1998 (Act No. 107 of 1998) is the statutory regulator of all hazardous waste generated by any form of development. All waste (solid, liquid or gases) at Kusile's Giyani Gold Mine will be managed in accordance with provisions and prescripts in the NEMWA and relevant Regulations. Kusile's Giyani Gold Mine will develop waste management procedures as part of the ISO 14001 Environmental Management Systems (EMS) for the operation. These procedures will outline steps to be followed during handling, storage, transportation and disposal or reuse of all waste streams emanating from the activities, products and services of the mine. These procedures will also give an overview of different types of waste generated within the mine and will classify these accordingly. Furthermore, it will provide provision for reclamation and recycling of waste.

1.13.5.1.5.1 Waste Separation and Handling

General domestic waste will be disposed through a colour coded bin system at Kusile's Giyani Gold Mine for different types of material. Domestic waste and scrap metals will be collected in rubbish bins. All domestic waste, commercial waste, industrial waste, and other waste classified as General Waste under the South African Minimum Requirements for Waste Disposal by Landfill (DWS, 1998) will be removed from the site by an appropriate licensed water removal contractor and disposed of at a licensed general waste facility.

Hazardous Waste

Hazardous waste such as grease, used oils, acids, fluorescent tubes, medical waste will be stored in containers at the mine. Care will be taken not to mix different hazardous chemicals within one container. Full, sealed hazardous waste containers will be removed from the site to the Temporary Hazardous Storage Facility within 48 hours and once sizeable loads are attained, they will be dispatched to an authorized hazardous waste disposal facility. There are no known authorised hazardous waste disposal sites in Limpopo Province.

Safe Disposal Certificates will be obtained and kept in record at the mine. Recyclable hazardous waste such as oils will be collected by an authorised contractor such as Oilkol and Kia-Ora Oils for recycling purposes.

Raw sewage and grey water from the mine offices, change house facility including ablution, and workshops will be handled by a package sewage treatment plant. The sewage system will have capacity for 68 people and thus has sufficient capacity to also handle the increased demand for the mine. Effluent from the sewage treatment plant will be drained into the pollution control dam and will be reused for dust suppression of haul and access roads. In addition, chemical mobile toilets will be provided for at the opencast mine workings and the raw sewage will be collected by authorised contractors for disposal into a licensed wastewater treatment works. Safe Disposal Certificates will be obtained and kept in record at Kusile's Giyani Gold Mine.

1.13.5.1.6 Waste Management Facilities

Reclamation Yard

This area will be used for separation of domestic or industrial waste to be converted into energy and reusable materials resulting in savings of natural resources. The area will be barricaded to ensure that there is no litter and upkeep at all times. Only recyclables non-hazardous waste will be brought to this area from the different sites on the mine for sorting purposes.

Hazardous Waste Storage Facility

All hazardous waste generated on site will be temporarily stored at this facility. Hazardous waste will be removed by a contractor to a licensed off-site hazardous waste disposal facility.

Bio-remediation Facility

Soils that have been contaminated with hydrocarbons (oils, grease, diesel, petrol) and are to be taken to the designated bio-remediation facility for temporary storage before being dispatched to an off-site authorized hazardous waste facility or treated *in-situ*. Should it be deemed necessary in future, a bioremediation facility may be built to treat these materials on site using the proposed methodology below. However, it is currently anticipated that only limited quantities will be generated as the fleet required running a mine of this magnitude is minimal and thus expecting little waste soil generation.

Bio-remediation procedure:

The process of bio-remediation will be completed according to the following steps:

- **STEP 1:** For larger spills (covering a surface area of more than 1 m^2), contain the spill using equipment provided in the spill kit/absorbent materials. For smaller spills (covering a surface area of less than 1 m^2);
- **STEP 2:** Lift contaminated soils/ gravels and place them on a concreted surface/ plastic lining/drum where storm water run-off collected on this surface is contained;
- **STEP 3:** Apply selected bio-remediation product to the contaminated soils/ materials. The volume of product used will depend on the volume of the contamination in the soils and should be guided by the manufacturer's instructions;
- **STEP 4:** Wet the contaminated soils/ gravels. The volume of water used should be guided by the manufacturer's instructions;
- **STEP 5:** Till the soils/ gravels to mix in the bio-remediation products, ensure all contaminated material is wet and to aerate the contaminated material;
- **STEP 6:** Cover the contaminated soils/gravel with plastic to contain moisture and heat;
- **STEP 7:** Repeat steps 3 to 6 once a week until the soils appear and/or feel clean;

- **STEP 8:** Send a sample of the contaminated material for testing to determine the hydrocarbon contamination, in parts per million. As there is no guideline as to the allowable levels of hydrocarbons occurring in soils (due to the varying natural levels), a soil/ gravel sample from an un-polluted area of the site must be sent away for testing to determine the baseline condition which must be attained;
- **STEP 9:** If the soils/ gravels are still contaminated, repeat steps 3 to 7 until the hydrocarbon content of the soils/ gravels equals the baseline condition described above;
- **STEP 10:** Make use of the cleaned soils during concurrent rehabilitation.

1.13.5.1.7 Strategies and Performance Objectives/Goals

The purpose of this document is to clearly outline control strategies that link with agreed performance criteria for those potential environmental impacts as identified, be it public or worker related or specific to the broader surrounding environment. This is addressed through linkage to the following closure objectives:

- Leave rehabilitated ground to ensure blending with the surrounding environment.
- Minimization of environmental damage or impacts to the extent that they are acceptable to stakeholders involved;
- Safeguarding of the safety and health of people and other organisms from hazards associated with operations;
- To leave the sensitive areas untouched and intact as they were prior to the mining activity;
- The elimination of the risk to the environment due to naturally occurring forces by ensuring physical and chemical stability of all structures;
- Mine closure is achieved efficiently, cost effectively, and in compliance with the relevant legal requirements;
- The social impacts resulting from mine closure are managed in such a way that establishment of a socially stable community in line with the principles of sustainable development is facilitated;
- Comprehensive monitoring takes place and that sound environmental standards have been followed;
- The Best Practical Guidelines that are available at the time of closure will be used;

1.13.5.1.8 Measures to achieve and sustain performance objectives

Kusile's Giyani Gold Mine intends to operate in line with the principles of ISO14001 Environmental Management System during all mining phases. The mine will develop an Environmental Management System (EMS) that will aim at ensuring that all possible impacts associated with activities or processes undertaken at the mine are identified and mitigation measures implemented to avoid or minimise environmental degradation and to promote a healthy and safe working environment.

The EMS will incorporate environmental procedures to manage aspects that will have the potential to pose a risk of environmental pollution or degradation. These procedures will include water and waste management procedures. Environmental procedures will be updated regularly as aspect change or when there is a need for operational and technological advancement. The EMS will provide the mine with reporting requirements and conditions of the issued licenses form an integral part of the system. This inadvertently ensure that mitigation measures for impacts associated with mining activities or processes on neighbouring communities and other stakeholders are undertaken with due consideration of the relevant stakeholders interests. The ISO 14001 system is based on the Deming`s management approach (Plan-Do-Check-Act) (PDCA), and all systems, procedures and documents are reviewed regularly to ensure that objectives of the system are being met, and that the system is continually improved.

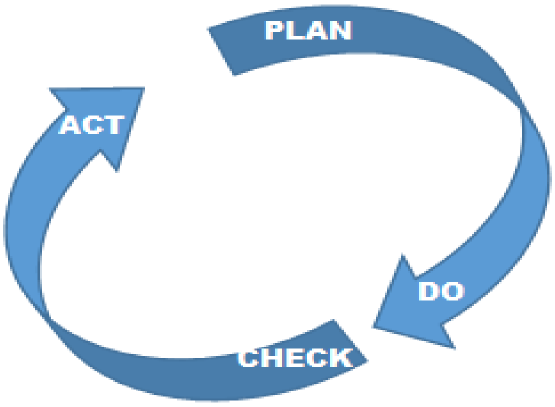


Figure 103: Deming`s Management Approach

In order for Kusile's Giyani Gold Mine to measure their compliance with the closure objectives they require to:

- Remove all infrastructure from the site in such a manner that no contamination of soils and water takes place
- Slope the TSF to such an angle (24 degrees in most cases) that the site drains naturally after rainfall events.
- Re-place all topsoil stripped from the site and vegetate slopes with naturally occurring indigenous vegetation
- Continue with monitoring activities (surface and groundwater) during post-closure until the quality of the environment has returned to an acceptable state as agreed with appropriate stakeholders

Provide skills and training to the local community that will allow for sustainable job creation after mining has been completed.

1.13.5.1.9 Waste Management Plan

Table 49: **Kusile Waste Management Plan**

PURPOSE AND SCOPE	
An essential part of an Environmental Management Plan is the development and implementation of a Waste Management Plan to identify, classify, store and dispose of hazardous, non-hazardous and other wastes generated on site.	
RESPONSIBILITY	
It is the responsibility of management, employees, contractors and visitors to Kusile Mine, to ensure that waste is kept to a minimum and the environment is not polluted or contaminated. Attention will be given to the requirements as laid down in the National Environment Management Act (Act 107 of 1998),	All employees and contractors
DEFINITION/REFERENCE	

Waste is as specified in Section 20, ECA 1998 (Act No 73 of 1989). Waste will include waste that: minimum requirements for Waste Disposal by Landfill is discarded by any person; or is accumulated and stored by any person with the purpose of eventually discarding it with or without prior treatment connected with the discarding thereof; or is stored by any person with the purpose of recycling, re-using or extracting a usable product from such matter. Waste means any matter, whether gaseous, liquid or solid or any combination thereof, which is from time to time designated by the Minister by notice in the Gazette as an undesirable or superfluous by-product, omission residue or remainder of any processor activity.	
Non Hazardous waste which is not reused or recycled will only be disposed of at a designated and permitted site (NEMA, 1998 (Act 107 of 1998).	
PROCEDURE	
General	RESPONSIBILITY
All employees and contractors at/to Kusile's Giyani Gold Mine must: Adhere to the relevant safety and health codes of practices in the work place, in respect to waste handling and disposal. Take reasonable care to protect his/her health and safety and the health and safety of his/her fellow employees and also use and take proper care of protective clothing and other health and safety equipment that is provided for the protection against the identified risks.	All
Kusile's Giyani Gold Mine has an obligation to adhere to all environmental legislation and has implemented a waste management system to manage all waste streams to reduce the environmental impact thereof.	All
Safe Disposal Certificates forms part of the management of hazardous waste streams to ensure that the hazardous waste has been disposed of correctly.	Appointed Waste Contractor
An emergency procedure must form part of the action plan on spillages of the hazardous waste streams. Such incidents must be reported and dealt with immediately.	SHE Manager
The movement of hazardous waste must be traceable at all times and documentation is to be kept for a minimum period of 3 (three) years.	SHE Manager
An effective system to be implemented and kept in place to measure quantities of waste generated and disposed of.	SHE Manager
Waste Management Approach	Responsibility
To ensure the effectiveness of waste management, it is essential that waste is separated at source according to Kusile's Giyani Gold Mine waste stream classification Hazardous waste - BLACK General waste - GREEN Scrap Metal - WHITE Toxins - BLUE Garden refuse - YELLOW Medical waste – RED (if any)	Appointed Waste Contractor

After separation, waste is to be stored in designated areas where pollution from waste is minimised.	All
To minimise disposal, waste products are to be re-used or recycled as far as reasonably practical.	All
A contractor will removes all waste from site for safe disposal. All waste collected from the Mine must have gate passes from Security before being removed from the Mine. The gate pass will indicate the type of waste collected, registration number of a vehicle and a driver's name. Gate pass must have the Security personnel and Environmental officer's / SHE Manager's signature.	Appointed Waste Contractor SHE Manager
Documentation confirming the safe disposal of all waste and supporting reports will be submitted to the Environmental Manager for record keeping.	SHE Manager
Hazardous Waste	
Liquids Definition: The following Waste matter is included but is not limited to: Used machine/motor oils Degreasers/Solvents Pesticides/herbicides Paint, Old/redundant paint, left over paint, Paint tins Acids / expired chemicals Expired medicines	All employees/contractors
Used Oil	RESPONSIBILITY
This includes but is not limited to engine oil, transmission oil, hydraulic oil and transformer oil.	
All used oil generated at Kusile Granville Mine, will be pumped into storage containers/drums, at all times taking into account the protection of the environment and the risk of pollution.	All employees/contractors
Under no circumstances may any oil be premeditatedly released directly onto the ground or to negatively impact the environment.	All employees/contractors
When transporting containers, care will be exercised at all times to prevent pollution or contamination of the environment.	All employees/contractors Appointed Waste Contractor
All used oil (in containers) should be stored in a designated, bunded storage area for safe collection and subsequent disposal by an authorized, permitted contractor, at an authorized, permitted recycling/disposal site.	Appointed Waste Contractor SHE Manager
The design, construction and operation of all equipment and facilities, required for the effective collection, containment, control and disposal of used oils will at all times comply with legislation to prevent pollution and/or contamination of the environment.	All contractors SHE Manager
Suitable spill kits and absorbent materials will be available at all times for the containment and clearing of any spills.	All employees/contractors

Attention should be given to: The risk of fire Contamination/Pollution Use of correct Personal Protective Equipment Safety of personnel	All employees/contractors
In the event of a spillage the emergency response procedure will be followed to ensure prompt action.	All employees/contractors
Degreasers and Solvents	Responsibility
This includes all current and obsolete solvents or degreasers that may be in use.	
All redundant or obsolete degreasers and/or solvents will be placed in sealed drums and sent to an allocated waste site for disposal.	Appointed Waste Contractor SHE Manager All employees/contractors
No redundant or obsolete degreasers and/or solvents will be discarded or washed into drains, sewerage or storm water systems.	All employees/contractors
All redundant/degreasers/solvents must be stored separately to prevent: a) Chemical reaction b) Toxic fumes/gases c) Contamination/Pollution of the environment.	All employees/contractors
Herbicides, Pesticides and Fertilisers	Responsibility
This includes all weed killers, insect sprays and their empty containers.	
All redundant/expired weed killers and insect sprays will be placed in separate marked, sealed containers and sent to the allocated waste site.	Gardening contractor
No redundant/expired weed killers and insect sprays will be discarded into any drain, sewage system, in any field or pit.	Gardening contractor
All redundant/expired weed killers and insect sprays will be stored separately in demarcated areas.	Gardening contractor
Only permitted, authorized waste removal contractors will be allowed to remove redundant/expired, herbicides/pesticides from the waste separation site to an authorized, permitted hazardous waste disposal site.	Waste contractor Environmental Manager
Storage facilities will be designed and constructed so as to prevent pollution to the environment.	All employees/contractors
Containers (except aerosol cans) which contained pesticides/herbicides will be punctured, flattened and properly disposed of by an authorized and permitted waste contractor at an approved hazardous waste disposal site.	Waste contractor
Attention will be given to Safe Handling Risk of fire or explosion Correct use of Personal Protective Equipment	

Paint and Cleaning liquids	Responsibility
This includes left over paint that cannot be used, redundant and old paint, cleaning liquids, such as turpentine or any other brush cleaners, rags and empty paint tins.	All employees/contractors
Left over, old paint, liquid cleaners, cleaning rags or empty paint tins will be placed in hazardous waste containers.	All employees/contractors
These items may not be discarded into a pit, buried or disposed of in any manner that could cause pollution or contamination to the environment.	All employees/contractors
No empty paint/cleaning liquid containers, cleaning materials etc. are to be left in the field, but must be returned to the workshops for correct disposal, to the waste separation site.	All employees/contractors
No paint or cleaning liquids will be discarded onto the ground or disposed of into any sewer, drain or storm water system.	All employees/contractors
Washing and cleaning of painting equipment will be done in such a manner that the discharge water will go through a dirty water system	All employees/contractors
All left over, redundant, old paint and cleaning materials will only be disposed of by a permitted and authorized waste disposal contractor to a permitted hazardous waste disposal site.	All employees/contractors Waste contractor
The design and construction of all facilities required for the collection, containment and disposal of paint and liquid cleaners must always be kept separate.	All employees/contractors
All storage facilities will always comply and conform to the legislation to prevent pollution or contamination of the environment.	All employees/contractors
Attention will be given to: The risk of fire. Required ventilation. Use of applicable Personal Protective Equipment	All employees/contractors
Acids	**Responsibility**
This includes battery acid and other corrosive liquids.	
All redundant/old acids will be stored in separate containers away from other chemicals and hazardous substances.	All employees/contractors
All containers should be marked “corrosive and poisonous”	All employees/contractors
No old or redundant acid will be disposed of into any drain, sewer or storm water system or disposed of into the domestic waste stream.	All employees/contractors
Only an authorized and permitted waste removal contractor will be allowed to remove these to a hazardous waste disposal site	Waste contractor
A recognized neutralizing agent such as agricultural lime will be kept available to neutralize any spills that might occur.	SHE Manager
Safety shower facilities should be provided at storage/handling sites.	SHE Manager
Batteries	**Responsibility**
This includes all batteries.	

Designated storage facilities for scrap batteries will be designed and constructed to prevent pollution to the environment in case of accidental leakage or spillage in the case of automotive batteries.	All employees/contractors
Scrap batteries will be stored and kept separate from other chemicals to prevent a possible chemical reaction, chemical fire, toxic fumes and burns. All health and safety aspects will therefore be taken into consideration during the handling/storing of scrap batteries. Personal Protective Equipment to be utilized and worn.	All employees/contractors
Scrap batteries may not be discarded at a landfill site, or into a pit.	All employees/contractors
All scrap battery removal contractors will conform to the applicable legislation to prevent pollution or contamination of the environment.	Waste Contractor
Contaminated Soil	Responsibility
This includes soil contaminated by oil, diesel, petrol, chemicals, and any other hazardous substances that could pose a health hazard or pollute the environment.	
Only an authorized and permitted hazardous waste removal contractor shall be allowed to remove this type of hazardous waste to a hazardous waste disposal site, should it be so decided	All employees/contractors Waste contractors
Fluorescent Tubes / Lamps	Responsibility
This includes fluorescent tubes, sodium vapour lamps and mercury vapour lamps.	
All used fluorescent tubes/lamps will be crushed and placed in sealed drums.	All employees/contractors
All drums will be sent to the Waste disposal Site for disposal.	Waste contractor
Only an authorized and permitted waste removal contractor may remove these containers to a licensed waste disposal site.	Waste contractor
Emergency treatment will be given in the case of lacerations, etc.	Occupational Health Practitioner
Oily/Greasy rags	Responsibility
This includes all used rags containing grease and oil, or any other hazardous substance.	
All contaminated rags will be discarded in hazardous waste bins.	All employees/contractors
No contaminated rags may be washed, buried or burned.	All employees/contractors
An authorized and permitted waste contractor will remove the greasy/oily rags at an authorized and permitted waste disposal site for disposal.	All employees/contractors Waste contractors
All used Aerosol cans	Responsibility
This includes spray paint cans, furniture polish, solvents, quick start and other products contained in aerosol containers.	
No aerosol cans may be dumped in scrap metal containers.	All employees/contractors
No aerosol cans may be incinerated or punctured.	All employees/contractors
No aerosol cans will be left lying in the field or dumped in the workings.	All employees/contractors

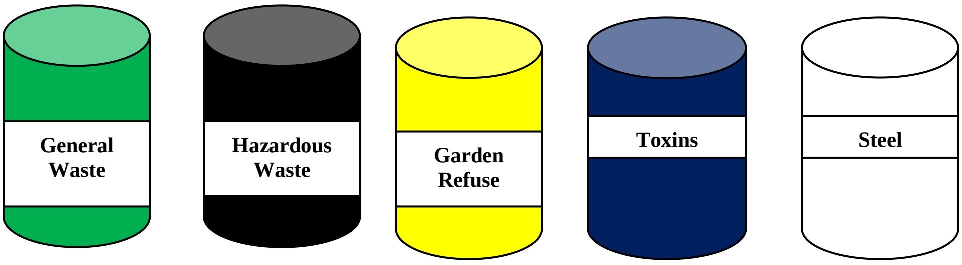
No empty aerosol cans may be discarded except by an authorized and permitted waste disposal contractor to an authorized and permitted disposal site. It's hazardous and must be disposed of in a hazardous bin to be collected by waste disposal contractor.	Waste Contractor
Attention will be given to risk of explosion.	All employees/contractors
Empty Drums	Responsibility
All empty containers i.e. oil drums, electric cleaner drums, solvent drums and other 5, 25 or 210 litre drums, regardless of what the contents were.	
No Empty drums will: Be washed out in the working place; Be left in the field, discarded into the workings; Be discarded on to any dump; Be stored or discarded in any manner that will cause pollution to the environment; Be used to contain water or any other substance, other than the original substance.	All employees/contractors
Containers will be removed by an authorized and permitted waste removal contractor to an authorized and permitted waste disposal site.	All employees/contractors Waste Contractor
No site manager will permit any empty container to be purchased or removed from the mine property by any employee or contractor, except the waste collection company.	Management
Used machine/vehicle filters	Responsibility
This includes oil, air and fuel filters.	
No filters of any description will be disposed: Into any domestic refuse bins Into any scrap metal containers Into the workings Into a waste disposal/landfill site.	All employees/contractors
Care will be taken to eliminate spills from filters, to prevent pollution or contamination of the environment.	All employees/contractors
Used filters will be transported to the workshops for disposal into hazardous waste containers.	All employees/contractors
Hazardous waste will be disposed of by an authorized and permitted contractor, at an authorized and permitted waste disposal site.	Waste Contractor
Contaminated PPE	Responsibility
This includes all used PPE.	
Used PPE will be disposed of into hazardous waste containers.	All employees/contractors
No used PPE will be discarded: Into any domestic refuse bins; Into any scrap metal containers; Into the workings; or Onto a non-hazardous waste disposal/ landfill site.	All employees/contractors

All used PPE will be discarded by an authorized and permitted waste disposal contractor, at an authorized and permitted waste disposal site.	Waste Contractor
Scrap rubber hydraulic oil pipes	
This includes all scrap and used hydraulic oil pipes. All scrap hydraulic oil pipes shall be disposed of into designated Hazardous Waste Bins, for removal by an authorised, permitted waste disposal contractor. This waste stream shall not be discarded into scrap metal bins, buried or burned. Care shall be taken when disposing of hydraulic oil pipes that any oil left in the pipes is run out into a container before disposal. Care shall be taken not to contaminate the soil when running and tapping out the hydraulic oil from scrap hydraulic oil pipes. Any oil spills must be cleaned up immediately using the available absorbent materials. Designated holding facilities for scrap tyres, rubber bands, conveyor belt and rubber products shall be designed and constructed so as not to contaminate/pollute the environment. All safety, health and environmental risk requirements shall be considered and adhered to, to prevent: (a) Fires (b) Burns (c) Damage to company property. (d) Inhalation of noxious and toxic fumes and gases. (e) Air pollution as a result of the toxic smoke generated when burning (f) Ground pollution	Waste Contractor
Electronic Waste (E-Waste)	
Electronic waste include: computers (central processing units (CPU), monitors, printers and miscellaneous peripheral devices such as the keyboard, mouse, scanner, CD writers, loudspeakers, web cameras), cell phones, typical electronic household appliances, medical electronic and electrical equipment. No used E-Waste of shall be disposed of into any domestic and or hazardous refuse bins or scrap metal containers. E-Waste shall be disposed of into the enclosed and lockable disposal bin allocated for E-Waste. All E-Waste shall only be recycled by an authorized contractor approved and appointed by Kusile	All employees/contractors Waste contractor
Sewage Sludge	
This includes sludge from the Sewage Treatment Plant. This also includes the dried sewage sludge together with the waste from the manual operated inlet screen. The dried sludge should be taken off the sludge drying beds and then disposed off in a Hazardous container for removal by the relevant waste contractor.	Waste contractor
Non Hazardous Waste	Responsibility

Surface Solids Scrap Metal Domestic Waste Recyclable Waste Garden refuse Un-used, damaged sample bags (Plastic) Building Rubble.	
Scrap Metal	Responsibility
Scrap metal will be sent to the scrap yard/ workshop area where it will be stored for not more than one month and removed by the responsible contractors	All Contractors
Plastic Containers	Responsibility
All empty plastic containers will be collected at the workplace and sent to the waste separation site on a continual basis for disposal.	Contractor
No empty plastic containers will be: Discarded into any scrap metal containers. Buried Burned Destroyed in any manner Discarded into the pit	All employees/contractors
No empty plastic containers will be sold or given, to any employees or any other parties except authorized / permitted waste disposal contractors or an original supplier.	All employees/contractors Waste contractor
Domestic Waste	Responsibility
This includes cans, plastic, bottles and kitchen refuse.	
All domestic waste will be removed by an authorized and permitted contractor, to an authorized and permitted waste disposal site.	Waste Contractor
Garden Refuge	Responsibility
Include all garden refuse	
A waste disposal contractor will dispose all garden waste, which is not re-used, at an authorized and permitted landfill site.	Waste Contractor
Scrap Tyres	Responsibility
All scrap tyres will: Be stored at a designated site allocated for scrap tyres. Not be discarded onto any refuse dump or landfill site. Not be discarded into scrap metal bins. Not be burned. Not be left behind or dumped in the field.	All employees/contractors
An authorized removal contractor will dispose of all surplus scrap tyres.	Waste Contractor
Building rubble	Responsibility

This includes bricks, cement, sand & stone, but does not include other types of waste as described above.	
No building rubble may be dumped at the scrap yard.	All employees/contractors
All building rubble will be discarded by an authorized and permitted waste disposal contractor, at an authorized and permitted waste disposal site.	Waste Contractor
Scrap electrical cable	Responsibility
This includes all types of electrical cable. No scrap electrical cable may be left after a task has been completed. All scrap electrical cable shall be held in a designated disposal facility for possible re-use. All health, safety and risk requirements shall be considered and adhered to by all employees and contractors at all times. Attention shall be given to his/her risk of fire, correct/safe storage and the use of Personal Protective Equipment.	All employees/contractors Waste contractor
WASTE DISPOSAL SITES (LANDFILL SITES)	
There will be no waste disposal / landfill sites on site	All employees/contractors
All waste material or substances; Hazardous or non-Hazardous will be removed by an authorized and permitted waste disposal contractor to an authorized and permitted disposal site via the waste separation site.	Waste Contractor
WASTE REMOVAL FROM WASTE SEPARATION SITE	
Waste will only be removed by an authorized and permitted contractor from the waste separation site.	Waste Contractor
A permitted contractor will empty/remove all Green Skips on a 48-hour call for service.	Waste Contractor
All hazardous bins, fluorescent tube containers and toxic bins at the waste separation site will be emptied/removed on a 48-hour call for service by an authorized and permitted contractor.	Waste Contractor
The contractor will be advised by telephone to empty the full skips.	All employees/contractors
TRAINING	Responsibility
The employees should be made aware of the potential hazards associated with waste disposal and removal. Regular, documented, internal training sessions / checks on the employees involved will ensure an understanding of what is needed to comply with this guideline.	
All employees/contractors will be involved in the management of waste. Supervisors will need to be well aware on what are required in order to comply to waste management legislation. Employees will need to be well informed by their superiors on what should to be done concerning waste, and how it must be done.	Environmental Manager Waste Contractor
RECORDS	Responsibility
Waste disposal contract Waste disposal certificates / Safe disposal records	Environmental Manager

WASTE STREAMS



General Waste	Hazardous Waste	Garden refuse	Toxins	Steel
Cans/ tins	Oil/grease/lubricants contaminated		Herbicides	
Office waste	Contaminated PPEs		Pesticides	
Bottles	Degreasers solvents		Fluorescent tubes	
Plastic containers	Oil rags	Garden refuse only	Asbestos	Steel
Papers	Contaminated absorbents		Paint tins	Scrap metals steel
			Acid contaminated	
			Batteries	
			Aerosol tins	

PART B

2 ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

2.1 Draft environmental management programme.

a) **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).

The details of the EAP were included in Section A (1) in Part A of this report, and is therefore not repeated in this section.

2.2 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).

The aspects of the activity are described in Section D in Part A of this report and are therefore not repeated here.

2.3 Composite Map

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

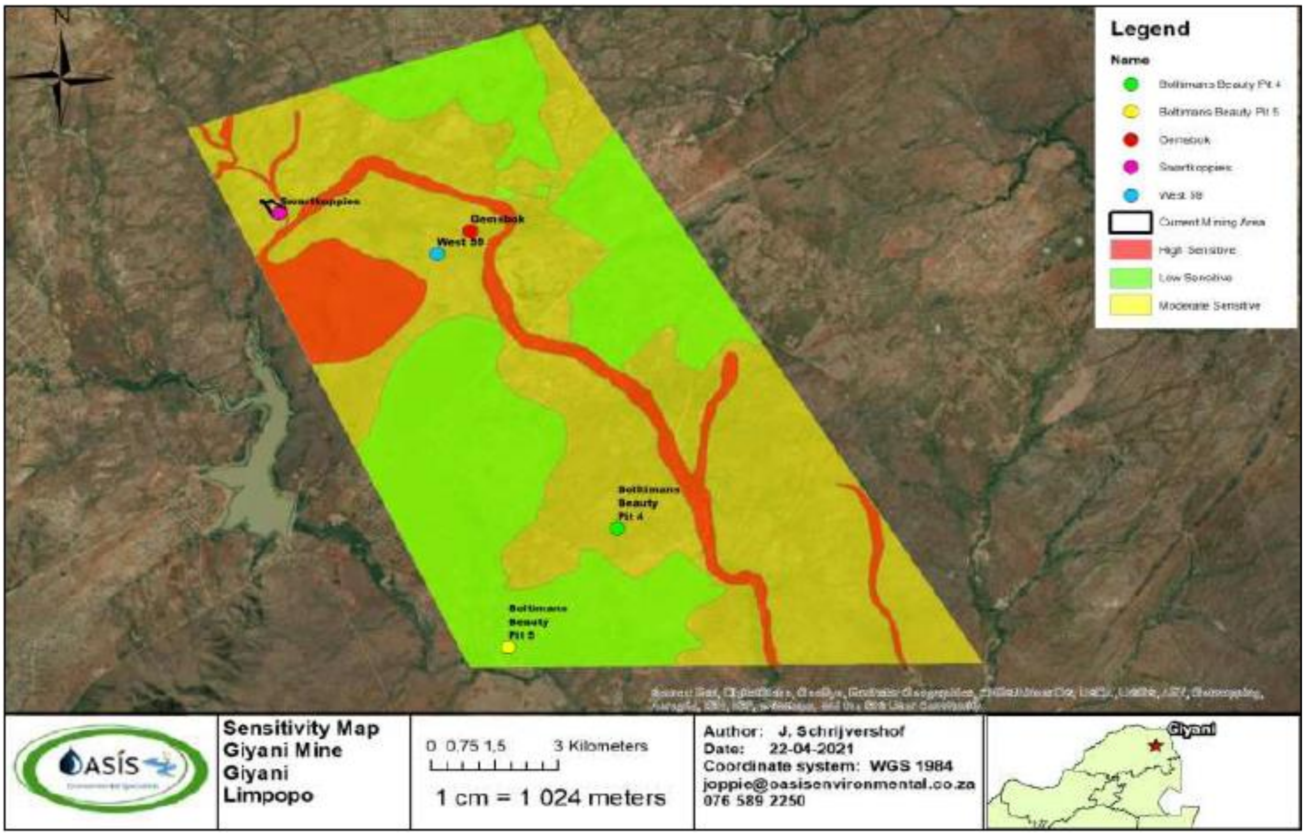


Figure 104: Sensitivity Map

2.4 Description of Impact management objectives including management statements

The EIR provides a detailed assessment of the impacts as well as the Management objectives. The impact management outcomes for the site have been described in 2.7: Impact Management Actions section in the EMPR, and included the following aspects:

- Prevention.
- Limitation / control.
- Remedying.
- Enhancement.

2.4.1 Determination of closure objectives.

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

The mitigation measures should all be implemented in order to limit the impacts the mining and mining-related activities may have on the environment, as well as to restore the environment as far as practicably possible to pre-mining conditions. Mitigation measures and rehabilitation work should be conducted throughout the LOM. There are four key objectives that should be considered in terms of mine Closure; these are:

- To protect public health and safety.
- To alleviate or eliminate environmental damage.
- To achieve a productive use of the land, or a return to its original condition or an acceptable alternative.
- To the extent achievable, provide for sustainability of social and economic benefits resulting from mine development and operations.

The main objects in terms of mine Closure are:

- To protect health and safety of any person and / or animal that enters the mine boundary area.
- To rehabilitate, alleviate and eliminate environmental damage as far as practically possible.
- To rehabilitate land to a level that would (at least) support wildlife or grazing land use.
- To generate sustainable projects, that will continue to have benefits and supply jobs to the local community, but also provide a service as well as (possibly) fund itself.

2.4.1.1 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.

In addition to mitigation measure to manage impact on the project site, the monitoring program and remediation measures should be complied with. A detailed monitoring program is represented in **Table 55: Impacts requiring monitoring programmes and reporting frequency**.

The monitoring program should focus on the following aspects but not limited to:

- Groundwater;
- Flora and Fauna;
- Blasting and ground vibrations;

- Noise and Air quality; and
- Surface movement and subsidence

The following aspects should be monitored regularly:

- Pollution control dams, clean and dirty water separation structures;
- Oil and water Spillages;
- Clean Water holding facilities;
- Fugitive Dust and sedimentation;
- Discard dump and waste management areas;
- Stockpiles.

In addition to monitoring the emergency response and remediation procedure has developed has to be implemented. The purpose of this procedure is to anticipate the occurrence of environmental crises, which may occur due to unforeseen circumstances. Since these events cannot be accurately predicted or prevented, a procedure has been prepared that must be followed should such an incident occur, which will assist in the mitigation, remediation and conservation of the environment and contribute to the safety of workers and the surrounding communities.

2.4.1.2 Potential risk of Acid Mine Drainage.

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

Acid Base Accounting (ABA) assessment results for samples of Waste Rock, Run of Mine (ROM) and Slimes/Tailings materials from Giyani Gold Project site are presented in the tables overleaf. The paste pH of all the materials registered a fairly alkaline value. The NP/AP indicates the potential for the sample to generate acid drainage, whereas the %S indicated whether this drainage will be over the long term. The total Sulphur content of all samples was recorded below the 0.1 % guideline value Li (2006), indicative of no potential for acid generation in the long term (if neutralisation potential is not adequate to buffer acid formation). However, the Neutralisation Potential Ratio (NPR) is notably greater than 4:1 for all samples. Therefore, the material ABA rock classification for all the samples is Type IV Rock, which Non-Acid Forming. It is also noted that the waste rock and the ROM samples registered Net Neutralisation Potential (NNP) of +34 and +63,2, respectively, which are notably greater than +20, and thus confirming the samples as non-acid generating (Usher et al., 2003).

2.4.1.3 Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage.

The PCD will be lined with a modified CLASS C lining as per Regulation 36784, a composite of HDPE and clay material so as to avoid exchange of flows between the dam and the environment. The design life of the HDPE lining is assumed at 20 years. The liner is also protected from direct sunlight along the slopes by means of a Geo-cell filled with cement stabilised sand. The lining specifications must also satisfy the GRI-GM 13. The use and application of the HDPE lining must comply with SANS 1526:2003 while the installation adheres to SANS 10409:2004.

2.4.1.3.1 Pollution control dam

2.4.1.3.1.1 Pollution Control Dam (or Return Water Dam)

The PCD allows for a 2 m unsaturated zone as geohydrological report that the shallow aquifer is at a depth between 4 – 12 metres. The PCD is also located more than 100 metres from the nearest non perennial stream..

2.4.1.4 Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage.

Acid mine drainage problems and problems associated with the disposal of other waste material when the mine is decommissioned. Implement phytoremediation measures to correct contamination of water resources. Employ new technologies which are recently being developed to treat acid mine drainage to usable water quality levels..

2.4.1.4.1 Groundwater residual impacts and management actions

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

The water balance is detailed in the table below:

Table 50: Kusile's Giyani Gold Mine Preliminary Water Balance

No.	Facility Name	Water In(m³/d)		Water Out(m³/d)		Balance(m³/d)	Comment
		Water Circuit/stream	Quantity (m³/d)	Water Circuit/stream	Quantity (m³/d)	Balance(m³/d)	
1	**Mining Component**	Groundwater influx	0,00	Pit dewatering through pumping to PCD	0,00		
		Total	**0,00**		**0,00**		
2	**Gold/Ore Processing Plant**	Raw feed (ROM) water	545,00	Product gold/ore moisture	163,50		
		Recycled water from PCD					
		Process water tank (primary water supply)					
				Slimes from processing plant	113,69		
		Total	**545,00**		**277,19**	**267,813**	
3	**TSF Facility**	Slimes from processing plant	113,69	Flow to pollution control dam	113,69		
		Rainfall on paddocks catchment area		Evaporation	10,00		
				Seepage losses	10,00		
		Total	**113,69**		**133,69**	**(20,000)**	
4	**Pollution Control Dam (PCD)**	Inflow from dewatering of Pit	0,00	Return water to processing plant	100,00		
		Inflow from TSF Facility	113,69	Evaporation	10,00		

No.	Facility Name	Water In(m³/d)		Water Out(m³/d)		Balance(m³/d)	Comment
		Water Circuit/stream	Quantity (m^3/d)	Water Circuit/stream	Quantity (m^3/d)	Balance(m^3/d)	
		TSF paddocks inflow	113,69	Seepage	10,00		
		Rainfall on PCD catchment area		Dust suppression	282,00		
		Return flows from sewage treatment plant	65,15				
		Total	**292,52**		**402,00**	**(109,476)**	
5	**Sewage Package Plant**	Sewage from mine office and change house	123,00	Treated sewage effluent to RWD	65,15		
		Total	**123,00**		**65,15**	**57,850**	
6	**Raw Water Tank**	Groundwater Abstraction (Boreholes)	1000,00	Potable water tank (domestic water use)	50,00		
				Processing plant	545,00		
		Total	**1000,00**		**595,00**	**405,000**	
	Total Water Balance		**2074,21**		**1473,02**	**601,187**	**Deficit / + Surplus**

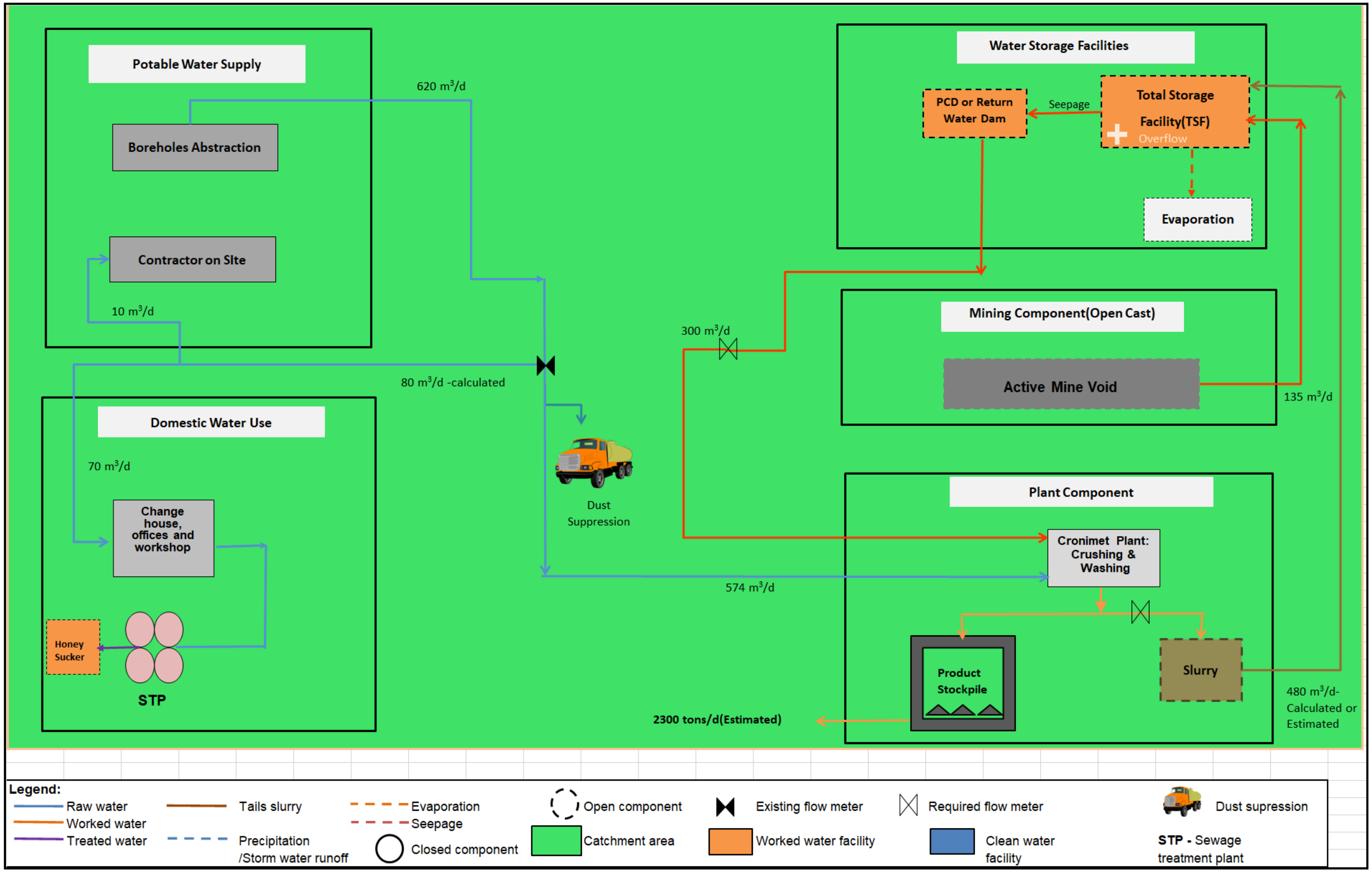


Figure 105: Kusile's Giyani Gold MIne Schematic Water Flow Diagram

2.4.1.6 Has a water use licence has been applied for?

A water use license application process has been initiated with Department of Water and Sanitation. An IWWMP has been compiled for the integrated water Use license Application and has been made privy to the public participation process in conjunction with the DEIR process.

2.5 Impacts to be mitigated in their respective phases

The impacts to be mitigated have been identified in the EIR, and are described in **Table 44: Assessment of each identified potentially significant impact and risk**. Identified impacts to be mitigated have been included in Heading 2.6 below thus not repeated in this section**.**

2.6 Impact Management Outcomes

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

The impact management outcomes have been described in detail in Section 2.7 Below.

2.7 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).

Table 51: Impact Management objectives, outcomes and standards to be achieved.

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase	Air pollution from blasting, wind erosions and vehicle movement	Vegetation	Increase in dust generation settling on adjacent vegetation. Continued increased levels of dust in the air has an effect on faunal species, particularly birds, but also on fauna species	Control through a dust suppression programme. This program should include (but not be limited to) the following measures: a) Shield stockpiles from predominant wind directions; b) vegetate areas and ensure continual capping and vegetation of the sides of mine residue facilities; c) regular spraying; d) reduce long-term stockpiling	Construction phase	Minimisation of air pollution, particularly windborne particles.	Legal Compliance with : Compliance with National Dust Control Regulations (GNR 827). National Environmental Management: Biodiversity Act 10 of 2004

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			feeding on the vegetation.				
Construction phase	Alien Invasive plant species on cleared areas	Vegetation	Alien invasive plant species will encroach into disturbed areas. It is expected that extensive area will be disturbed, natural vegetation totally destroyed.	Control through Management and Monitoring and implementation of an alien invasive management plan. - Remediation Alien species removal programme must be developed and implemented	Construction phase	Removal of alien invasive species including managing the distribution of weeds and invasive species avoided.	Compliance with the National Environmental Management: Biodiversity Act 10 of 2004 and the Alien and Invasive Species Lists, 2020.

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase	Change in land use (site clearing)	Loss of avian habitats.	Avian habitats, and open areas will be destroyed by the proposed mine. This will represent a significant loss of habitat in a region of high conservation significance, and will affect a number of red-listed species, including several raptors.	Control through legislative compliance: Tree removal permit. Prevention. A specialist must be engaged to check the entire property for active nests of red-listed species. Any such nests will need a buffer zone of 500 m radius around them to ensure that breeding birds are not disturbed	Construction phase	No unauthorised vegetation clearing. Areas cleared for mining operations must be minimised.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).
Construction Phase	Change in land use (site clearing)	mammal and herpetofauna Habitat	Site clearing and removal of indigenous vegetation will lead to a loss of faunal habitat. This has widespread impact on ecological function and health of sensitive ecosystems. Displacement of extraordinary high vertebrate species richness	Control and management Mitigating the impacts is impossible, although higher authorities may enforce statutory preconditions for five Red Listed trees and waterways, such as buffer zones.	Construction phase	No unauthorised vegetation clearing. Areas cleared for mining operations must be minimised.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase	Civil construction	Baseline Noise Levels	Increased noise levels along the boundary of the proposed Site	Construction activities will take place during between 07:00 and 15:00 on weekdays only to limit the impact on adjacent landowners. Construction vehicles and machinery will be regularly maintained to minimise noise generation.	Construction phase	Minimization through noise limitation and control	Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996), SABS 083, SANS 10083 National Environmental Management Act, Air Quality Act (NEMAQA) (Act No. 39 of 2004)
Construction Phase	Clearing of vegetation and earthworks	Visual	Visual impacts are expected to result from the stripping of vegetation and earthworks associated with the pre-construction and construction phases. The stripping of vegetation will result in the bare soil being exposed, creating a visual scar within the area, and a contrasting colours in the landscape	Control and Minimise Site clearances and Erosion control measures must be put in place if vegetation is to be cleared.	Construction phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase	Construction of buildings and/or plant	Baseline Noise Levels	Increased noise levels along the boundary of the proposed Site. Increased noise levels at open pit and plants	Control and Minimisation Construction activities will take place during between 07:00 and 15:00 on weekdays only to limit the impact on adjacent landowners. Construction vehicles and machinery will be regularly maintained to minimise noise generation.	Construction phase	Minimization through noise limitation and control	Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996) and National Environmental Management Act, Air Quality Act (NEMAQA) (Act No. 39 of 2004)
Construction Phase	Construction of offices, plant infrastructure ,workshops and other associated mine infrastructure	Visual Resource	The process of construction equipment and related works in the construction of the plant and associated mining areas (e.g. storage areas, access roads) will introduce visually intrusive elements into the landscape and locally result in increased traffic. The construction of the project plant and infrastructure will require removal of vegetation and alteration of the existing topography that will result in a change in the	Control by construction in low lying areas to reduce the view shed and minimise tree removal for screening effect. External signage should be kept to a minimum, were possibly shielding material should be utilised to fence of the construction	Construction phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			existing landscape character.				
Construction phase	Construction of surface infrastructure (e.g. access roads, pipes, storm water diversion berms, change houses, admin blocks, drilling, blasting and development of pits for mining, etc.)	Air Quality	. Activities of vehicles on access roads, levelling and compacting of surfaces, as well localised drilling and blasting will have implications on ambient air quality. The above mentioned activities will result in fugitive dust emissions containing TSP (total suspended particulate, giving rise to nuisance impacts as fallout dust)Bulldozing, excavation, drilling and blasting operations will result in the emission of dust to atmosphere	- Minimisation: Working areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only. - Remediate: Disturbed areas should be rehabilitated as soon as possible to limit the development of erosion. timed blasting when there is no wind, dust suppression on roads, dampening of materials being transported, timeously completion of construction to reduce increased exposure time,	Construction phase	Minimisation of air pollution, particularly windborne particles.	Legal Compliance with : Compliance with National Dust Control Regulations (GNR 827).
Construction Phase	Earthworks and construction of plant infrastructure	Visual	Night-time lighting will be required during construction. Due to the level of screening provided by the existing vegetation cover the	Control: Consider the application of motion detectors to allow the application of lighting only where and when it is required. - Minimising Sources of light must as far as possible be shielded by physical	Construction phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			impact of light pollution is expected to be limited, but may increase as construction progresses and more cranes and large plant are housed on site.	barriers such as a planted trees and shrubs or built structures, where possible, natural vegetation around mine should be retained so as reduce unnecessary illumination and “light spill”. All lighting must be installed at downward angles.			
Construction Phase	Fuel storage and Vehicular Movement Use and maintenance of haul roads (incl. transportation of minerals to plant	Surface Water	Water resources pollution due to spillage of oils, fuel and chemicals	Control and manage: Oil recovered from any vehicle or machinery on site should be collected, stored and disposed of by accredited vendors for recycling.	Construction phase	Compliance with proper waste management for hazardous and non-hazardous waste	National Environmental Management: Waste Act (2008) (Act 59 of 2008) and Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Construction Phase	Fugitive dust from construction and vehicle movement	Visual Resource	Fugitive dust	Control and remediation Institute a rigorous planting regime along the project site boundaries to act as bio-filters. Remediating Progressive rehabilitation of the mine should be undertaken.	Construction phase and rehabilitation	Minimisation of air pollution, particularly windborne particles.	Legal Compliance with : Compliance with National Dust Control Regulations (GNR 827).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase	Grading and building of new roads	Baseline Noise Levels	Increased noise levels along the boundary of the proposed Site	Minimisation Construction activities will take place during between 07:00 and 15:00 on weekdays only to limit the impact on adjacent landowners. Construction vehicles and machinery will be regularly maintained to minimise noise generation. Ensuring that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Acoustical mufflers (or silencers) should be considered on equipment exhausts.	Construction phase	Minimization through noise limitation and control	Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996), SABS 083, SANS 10083 National Environmental Management Act, Air Quality Act (NEMAQA) (Act No. 39 of 2004)
Construction Phase	Human activities	Fauna	In addition to direct habitat loss, the disturbance of birds and other vertebrate fauna species in the surrounding areas will increase. This impact will be manifested both directly (e.g., increased poaching pressure and disturbance of nests) and indirectly (changes in prey availability, nesting	Minimisation and monitoring: Measures must be put in place to ensure that no illegal hunting of birds takes place on the mine property or in surrounding areas.·	Construction phase	Manage and control illegal hunting activities. A specialist must be engaged to check the entire property for active nests of red-listed species, such as White-back Vulture, Martial Eagle and Tawny Eagle. Any such nests will need to be relocated.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).National Environmental Management: Waste Act (2008) (Act 59 of 2008) and Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			material, etc.). Given the limited background information available, the impact assessment here pertains to the worst case scenario.				
Construction phase	Mining processing activities	Ground and surface water pollution.	Pollution generated by the mine (e.g., acid mine drainage, accidental fuel spillages, as well as pollutants such as mercury and lead) has the potential to severely affect avian habitats and therefore bird species along the rivers downstream of the mine)	Minimising and Monitoring, Implement a rigorous pollution prevention program as part of a comprehensive Environmental Management Plan (EMP)	Construction phase, operation , decommissioning and post closure	Groundwater monitoring will be done quarterly with the groundwater model updated every 2 years. Implementation of the IWWMP	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Construction Phase	Powerline	Birds	The impact of such lines on birds will depend on the route the new line will follow, the size and configuration of the towers and lines, and the impacts cannot be evaluated without this information. The issue is particularly	Minimise: Any power line linking the mine to the existing grid will need a stand-alone impact assessment that can only be completed once specific routes have been identified. Such as assessment needs to include an evaluation of alternative routes, and careful assessment of the risks posed to birds, in particular vultures and other large raptors.	Construction phase	Tap into the already existing powerlines on the site.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			pertinent in view of the number of species occurring in the area that are known to be vulnerable to collisions and electrocution risks, including vultures and large eagles				
Construction Phase	Preparation of the foot print area	Baseline Noise Levels	Increased noise levels on the proposed site	- Minimisation Construction activities will take place during between 07:00 and 15:00 on weekdays only to limit the impact on adjacent landowners. Biannual noise assessments along the boundaries of the site to take place to identify noise intrusions; Berms with a potential to act as a noise barrier should be constructed as soon as possible around open cast pits and other mining activities with the barrier being built as close as possible to the operations or at receptors as is feasible as possible. Construction vehicles and machinery will be regularly maintained to minimise noise generation. Ensuring that equipment is well maintained and fitted with the	Construction phase	Noise control through stipulated working hours. Impacts on aspects outside of the demarcated areas reduced. Noise levels on site reduced.	All machinery and/or plant which radiate noise levels exceeding 85.0dBA to be acoustically screened off; SABS083, SANS 10083 Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996)

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
				correct and appropriate noise abatement measures. Acoustical mufflers (or silencers) should be considered on equipment exhausts on open cast pits and stockpile areas			
Construction Phase	Preparation of the foot print area	Baseline Noise Levels	Increased noise levels off the proposed Site	- Minimisation: It is recommended that the height of the berms/barriers be at least 2 m higher than the line of sight to the highest noise source from open cast pits and stockpile areas, although the higher the berm/barrier the better acoustical screen it will be. Certain heavy vehicles have their exhaust ports above the cabin of the vehicle and needs to be considered as the noise source point.	Construction phase	Impacts on aspects outside of the demarcated areas reduced. Noise levels on site reduced. All machinery and/or plant which radiate noise levels exceeding 85.0dBA to be acoustically screened off;	SABS083, SANS 1 0083. Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996)
Construction phase	Site clearing, removal of topsoil and vegetation	Air Quality	Variable Dust generation from as land clearing, topsoil removal, loading of material, hauling, grading, stockpiling, bulldozing and compaction	- Minimisation: Working areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only. - Remediate: Disturbed areas should be rehabilitated as soon as possible to limit the development of erosion.	Construction phase	Minimisation of air pollution, particularly windborne particles.	Impacts on aspects outside of the demarcated areas reduced. Compliance with National Dust Control Regulations (GNR 827).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
				timed blasting when there is no wind, dust suppression on roads, dampening of materials being transported, timeously completion of construction to reduce increased exposure time,• Topsoil should not be removed during windy months (August, September and October) due to associated wind erosion heightening dust levels in the atmosphere.			
Construction phase	Site construction and grading	Groundwater quantity	Changes in runoff and infiltration that could reduce groundwater recharge	Control and minimise : limit the removal of vegetation and opportunities for revegetation will be maximised	Construction phase	Reduced runoff, soil compaction and revegetation to increase infiltration	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Construction phase	Vegetation clearing for open pit excavation, clearing for construction of buildings, roads and other infrastructure, waste	Vegetation	The area for the proposed development will be cleared of vegetation. This will result in the loss of indigenous species, disturbance of species of conservation concern and the fragmentation of plant communities. The removal of vegetation will also expose soil	- Compliance: Application for a tree removal permit and Avoid planting of exotic plant species	Construction phase	Conservation of protected species, relocation, nursery establishment	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004). National Forests Act, 1998 (Act No. 84 of 1998)

Phase	**Activity**	**Potential Impact**	**Aspect Affected**	**Mitigation measure**	**Time Period For Implementation**	**Standard to be achieved**	**Compliance With Standards**
	dumps etc.		increasing the risk of erosion				
Construction phase and decommissioning phase	Stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation	Soil	Loss of topsoil	Prevention: Minimising During the construction phase it is recommended that the topsoil be stripped and stockpiled in advance of construction activities that might contaminate the soil Rehabilitation: Due to the shallow nature of the soils it is recommended to strip only 40-60cm of the soil. These estimates take into consideration a possible 10% topsoil loss through compaction and allow the rehabilitated areas to be returned to the pre-mining land capability, i.e. wildlife and natural veld	Construction phase and decommissioning phase	Vegetation of topsoil stockpiles, covering the stockpiles and implement concurrent rehabilitation to reduce the exposure of the soil to erosion elements	Rehabilitation targets, closure objectives and end-use objectives are met. Conservation of Agricultural Resources Act (No 43 of 1983). Environment Conservation Act (No 73 of 1989).
Construction Phase and operation	Stockpiling of topsoil	Soil	Loss of topsoil through erosion.	Control, Minimise and rehabilitate Stockpiles can be used as a barrier to screen operational activities. If stockpiles are used as screens, the same preventative measures described above should be implemented to prevent loss or contamination of soil.	Construction, operation, rehabilitation and closure	Vegetation of topsoil stockpiles, covering the stockpiles and implement concurrent rehabilitation to reduce the exposure of the soil to erosion elements	Conservation of Agricultural Resources Act (No 43 of 1983).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase and operation phase	Fuel storage and Vehicular Movement Use and maintenance of haul roads (incl. transportation of minerals to plant	Groundwater quality	Fuel and hydrocarbon leakages and spillages from the transporting vehicles may cause groundwater contamination	Control and Management: All storage areas containing hazardous material will have secondary containments of containers the volumes of the largest tank or container plus 10%. Resort to immediate clean up after accidental spillage. Divert runoff from haul roads that may contain hydrocarbons into lined pollution control dams.	Construction, operation, rehabilitation and closure	Implement a rigorous pollution prevention program as part of a comprehensive environmental management plan (EMP) and ensure that no pollution whatsoever enters local ground or surface water.	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Construction Phase and operation phase	Mine development	Institutional and Empowerment Changes Processes	Attitude formation against project	The attitude formation variable seeks to assess changes relating to attitude formation that can be attributed to the mine specifically. Attitudes and interest group activity would not constitute impacts per se. It would rather be associated with an appraisal by I&APs of the proposed project, change events and perceived impacts. If such appraisal about the objects of thought (being the project; changes processes or impacts), includes evaluative judgments - positive, negative or neutral, these are by definition, attitudes (in short, how we feel about things).	Construction Phase and operation phase	Increase awareness and community engagement Appointment of a community liaison officer	National Environmental Management Act (107/1998).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase and operation phase	Mine development	Institutional and Empowerment Changes Processes	Negotiation process	- Management: A Community Liaison Officer should be appointed to assist with stakeholder engagement.	Construction Phase and operation phase	Conform to the guidelines of the SLP	Mining Charter and Mineral and Petroleum Resources Development Act, Act 28 of 2002.
Construction Phase and operation phase	Mine development	Socio-cultural change process	Crime, Safety and Security	Control and Prevention: Fence off servitudes and access roads and provide for strict access control measures to service roads and patrol service roads regularly; Management: Liaise with the South African Police Service to enhance police patrol activity in the project area;	Construction Phase and operation phase	Conform to the guidelines of the SLP, Neighbourhood watch, liaise with SAPS	Mining Charter and Mineral and Petroleum Resources Development Act, Act 28 of 2002. National Environmental Management Act (107/1998).
Construction Phase and operation phase	Mine development	Socio-cultural change process	Integration with local community	Awareness: Launch aggressive culturally appropriate STI and HIV/AIDS awareness campaigns; Enhance people's knowledge through awareness campaigns on site, schools and community forums; access control, increased female hires to reduce financial vulnerability	Construction Phase and operation phase	Conform to the guidelines of the SLP, Community engagement, SHEQ management objectives	Mining Charter and Mineral and Petroleum Resources Development Act, Act 28 of 2002. National Environmental Management Act (107/1998). Occupational Hygiene Regulations, MHSAct (29 of 1996)
Construction Phase and operation phase	Mine development	Socio-cultural change process	Quality of life and sense of place	• Manage Establishment of an anti-poaching unit available to adjacent land owners, and establishing a security forum in collaboration with these land	Construction Phase and operation phase	Conform to the guidelines of the SLP, Neighbourhood watch, liaise with SAPS	Mining Charter and Mineral and Petroleum Resources Development Act, Act 28 of 2002. National Environmental

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
				owners. Land owners are to be actively involved in the selection of the contracting company employed to conduct anti-poaching in the area. Increased security measures (fencing, access control and monitoring) on mine premises;			Management Act (107/1998).
Construction Phase and operation phase	Site development and mining	Demographic change process	Influx of workers	Manage: Local hiring and HR implementing the SLP, stakeholder engagement	Construction Phase and operation phase	Conform to the guidelines of the SLP	Mining Charter and Mineral and Petroleum Resources Development Act, Act 28 of 2002
Construction Phase and operation phase	Stockpiling of topsoil	Soil	Mixing of deep and surface soils during handling, stockpiling and subsequent placement. Change to soil's physical, chemical and biological properties due to operational contamination of oils and dust	Design and management: The stockpiles should not exceed a maximum height of 6m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion and to keep the soils biologically active.	Construction Phase and operation phase	Vegetation of topsoil stockpiles, covering the stockpiles and implement concurrent rehabilitation to reduce the exposure of the soil to erosion elements	Conservation of Agricultural Resources Act (No 43 of 1983).
Construction phase	General transportation, hauling and vehicle movement on site	Air Quality	Transportation of the workers and materials in and out of mine site will be a constant feature during the construction phase. This will however result in the production of	- Minimisation: Working areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only. - Remediate: Disturbed areas should be rehabilitated as soon as possible	Construction phase	Minimisation of air pollution, particularly windborne particles.	Compliance with National Dust Control Regulations (GNR 827).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			fugitive dust (containing TSP, as well as PM10 and PM2.5) due to suspension of friable materials from earth roads. dust emissions from haul track,	to limit the development of erosion. timed blasting when there is no wind, dust suppression on roads, dampening of materials being transported, timeously completion of construction to reduce increased exposure time,			
Operational phase	Air pollution excavations and construction	Vegetation	The anticipated increase in haul traffic and opencast mining operations will lead to an increased settling of dust on adjacent vegetation. Continued increased levels of dust in the air has an effect on faunal species, particularly birds, but also on fauna species feeding on the vegetation.	Control through a dust suppression. Minimising and monitoring: This program should include (but not be limited to) the following measures: a) Shield stockpiles from predominant wind directions; b) vegetate areas and ensure continual capping and vegetation of the sides of mine residue facilities; c) regular spraying; d) continuously remove ore frm site and reduce long-term stockpiling; e) clear spillages from site	Operational Phase	Minimisation of air pollution, particularly windborne particles.	Impacts on aspects outside of the demarcated areas reduced. Compliance with National Dust Control Regulations (GNR 827).
Operational phase	Alien Invasive plant species on cleared areas (Haulage	Vegetation	Alien invasive plant species will encroach into disturbed areas. It is expected that extensive area will be disturbed, natural	Control through Management and Monitoring and implementation of an alien invasive management plan. Remediation Alien species removal programme must be developed and implemented	Operational phase	Removal of alien invasive species including managing the distribution of weeds and invasive species avoided.	The distribution of weeds and invasive species avoided. Compliance with the National Environmental Management: Biodiversity Act 10 of 2004 and the Alien and Invasive Species Lists, 2014. Compliance with the

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
	vehicles and human activities)		vegetation totally destroyed.				National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Operational phase	Change in land use (Open cast and underground mining)	Loss of avian habitats.	Avian habitats, scrub and open areas will be destroyed by the proposed mine. The area required. This will represent a significant loss of habitat in a region of high conservation significance, and will affect a number of red-listed species, including several raptors.	Control through legislative compliance: Tree removal permit. Prevention. A specialist must be engaged to check the entire property for active nests of red-listed species.	Operational phase	No unauthorised vegetation clearing. Areas cleared for mining operations must be minimised.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).
Operational phase	Change in land use (Open cast and underground mining)	mammal and herpetofauna	Total or near-total irreplaceable loss of mammal and herpetofauna species is anticipated	- Minimise: Limit all developments to the minimum area required, and leave as much as possible natural vegetation intact.	Operational phase	No unauthorised vegetation clearing. Areas cleared for mining operations must be minimised.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Operational phase	Generation of stockpiles and associated mining waste	Air Quality	dust generated from waste rock, evaporation of hydrocarbon fuels from storage tanks and spillages, waste oils chemicals plus hazardous waste	Control and Minimisation through the demarcated of operational areas, and vehicular movement must be limited to designated haul roads and construction areas only. - Remediate: Reduce stockpiles and ROM exposure time and dampening of materials being transported		Minimisation of air pollution, particularly windborne particles through rehabilitated as soon as possible to limit the development of erosion.	Impacts on aspects outside of the demarcated areas reduced. Compliance with National Dust Control Regulations (GNR 827).
Operational phase	Hauling of ore to plant or via road	Baseline Noise Levels	Increased noise levels along the feeder roads	Manage: To mitigate the impact of over mass and overweight deliveries to the Site, a suitable entrance should be constructed that complies with RTA requirements for site access. Following site construction, the specialized intersection would be utilised for emergency vehicle access only.	Operational phase	An individual Traffic Control Plan would be developed and implemented for each over mass and overweight delivery taking into account the specialized mine route requirements	National Environmental Management Act, Air Quality Act (NEMAQA) (Act No. 39 of 2004); Southern African Road Safety Manual (National Department of Transport 1999)
Operational phase	Mining activities area	Baseline Noise Levels	Increased noise levels on the proposed site	Minimise operation to day time 6am to 6pm	Operational phase	Noise control through stipulated working hours. Impacts on aspects outside of the demarcated areas reduced. Noise levels on site reduced	No noise impact after hours. Impacts on aspects outside of the demarcated areas reduced.
Operational phase	mining infrastructure	Visual Impact of night time Illumination	Operational Phase Reduction in visual resource value due to Night-time illumination	Control: Consider the application of motion detectors to allow the application of lighting only where and when it is required. Minimising :	Operational phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
				Sources of light must as far as possible be shielded by physical barriers such as a planted trees and shrubs or built structures, where possible, natural vegetation around the mine reduce unnecessary illumination and "light spill". All lighting must be installed at downward angles.			
Operational phase	Mining processing activities	Ground and surface water pollution.	Pollution generated by the mine (e.g., acid mine drainage, accidental fuel spillages etc	Minimising and Monitoring, Implement a rigorous pollution prevention program as part of a comprehensive environmental management plan (EMP) and ensure that no pollution whatsoever enters local ground or surface water.	Operational phase	Groundwater monitoring will be done quarterly or as required by the Water Use Licence, with the groundwater model updated every 2 years. Implementation of the IWWMP	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Operational phase	Open cast and underground mining	Groundwater	Open cast mining below the water table will result in pit inflows	Pit inflows cannot be mitigated. Provision needs to be made within the mine water balance for the reuse or treatment of pit inflows.	Operational phase	Boreholes will be drilled around the pit for abstraction lowering the water table hence minimising decant. This water will then be used at the processing plant.	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Operational phase	Open cast and underground mining	Groundwater quality	increased potential for groundwater contamination due to seepages from the overburden stockpiles	Minimise: Compact footprint area of the overburden stockpiles to minimise ground water infiltration. Stormwater run-off from the overburden stockpiles will be diverted into dirty water	Operational phase	Groundwater monitoring will be done quarterly with the groundwater model updated every 2 years. Implementation of the IWWMP	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License and National Environmental

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
				dams. A groundwater resource monitoring program will be implemented during to detect the groundwater contamination			Management: Waste Act (2008) (Act 59 of 2008)
Operational phase	Open cast and underground mining	Groundwater quality	Water contained in dirty water dams may impact on groundwater quality	Design and Monitoring Pollution control dams need to be and designed to comply with NEMA and NWA requirements (At 36 of 1998). Manage any leakages and spill to prevent ground water contamination. Implement groundwater monitoring to detect groundwater contamination	Operational phase	Groundwater monitoring will be done quarterly with the groundwater model updated every 2 years. Implementation of the IWWMP	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License and National Environmental Management: Waste Act (2008) (Act 59 of 2008)
Operational phase	Open cast and underground mining	Groundwater quality	Mine dewatering and groundwater abstraction for water supply purposed could reduce groundwater levels in the area	Control and management Groundwater abstraction. The extent of the zone of influence will not extend beyond 1 000m and the maximum drawdown in the affected areas will range between 1 and 5 m, thereby not expected to impact on the yields of any supply boreholes around the mining area. Possible mitigation against such an impact is temporary water supply by the mine.	Operational phase	Possible mitigation against such an impact is temporary water supply by the mine	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Operational phase	Open cast and underground mining	Vegetation	The area for the proposed development will be cleared of vegetation. This will result in the loss of	Compliance: Application for a tree removal permit and avoid planting of exotic plant species	Operational phase	No unauthorised vegetation clearing. Areas cleared for mining operations must be minimised.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			indigenous species, disturbance of species of conservation concern and the fragmentation of plant communities. The removal of vegetation will also expose soil increasing the risk of erosion				
Operational phase	Powerline	Birds	The impact of such lines on birds will depend on the route the new line will follow, the size and configuration of the towers and lines, and the impacts cannot be evaluated without this information. Given the limited background information available, the impact assessment here pertains to the worst case scenario, where the lines generate high collision and electrocution risks.	Minimise: Any power line linking the mine to the existing grid will need a stand-alone impact assessment that can only be completed once specific routes have been identified. Such as assessment needs to include an evaluation of alternative routes, and careful assessment of the risks posed to birds, in particular vultures and other large raptors.	Operational Phase	Tap into the already existing powerlines on the site.	Legal Compliance National Environmental Management: Biodiversity Act (No 10 of 2004).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Operational phase	presence of topsoil, Run of Mine, product and ,overburden stockpiles and discard dumps;	Visual impact of fugitive dust	Operational Phase Reduction in visual resource value due to Fugitive dust	Remediate and Management: Institute a rigorous planting regime along the project site boundaries to act as bio-filters. Remediating Progressive rehabilitation of the mine should be undertaken.	Operational phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005). Compliance with National Dust Control Regulations (GNR 827).
Operational phase	Presence of topsoil, Run of Mine, product and ,overburden stockpiles and discard dumps;	Visual impact of physical structures	Operational Phase Reduction in visual resource value due to presence of physical structures on site	Minimising: Where possible, natural vegetation around mine should be retained.	Operational phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP.
Operational phase	processing plant and other mining infrastructure	Visual impact of fugitive dust	Operational Phase Reduction in visual resource value due to Fugitive dust	Managing: Institute a rigorous planting regime along the project site boundaries to act as bio-filters. Remediating Progressive rehabilitation of the mine should be undertaken.	Operational phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005). Compliance with National Dust Control Regulations (GNR 827).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Operational phase	processing plant and other mining infrastructure	Visual impact of physical structures	Operational Phase Reduction in visual resource value due to presence of physical structures on site	Minimising: Progressive rehabilitation of the mine should be undertaken. Mine dumps and stock piles should not exceed 15m of height and trees must be transplanted to locations adjacent to the mine where they will not affected by mining activities.	Operational phase	Reduced visual impacts on the site, adjacent landowners and residents	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP).
Operational phase	Removal of overburden, mineral extraction and backfilling when possible (including drilling/blasting hard overburden & stockpiling)	Air Quality	Drilling is an intermittent exercise that emits fugitive dust. There will be fumes from diesel trucks transporting ore to the stockpiles and conveyor belts at crushing and screening facilities. The conveyor belts deposit the minerals into the crusher, the crushing process releases fugitive dust. Activities by machinery in the mining process will lead to exhaust fumes from vehicles and dust from drilling and blasting processes. Fugitive dust (containing	Minimisation: Working areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only. Remediate: Disturbed areas should be rehabilitated as soon as possible to limit the development of erosion.	Operational phase	Minimisation of air pollution, particularly windborne particles.	Legal Compliance with National Dust Control Regulations (GNR 827).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			TSP, as well as PM10 and PM2.5) occurs as a result of the aforementioned processes.				
Operational phase	Stockpiles and general waste	Surface Water	Pollution of watercourses from general waste and sewage effluent	Control and Mitigate: A reticulated sewage disposal facility at the proposed mine site should mitigate potential water quality issues that may arise due to population increase; Management:	Construction, Operation and Decommissioning Phase	Waste management plan, surface water quality monitoring plan to monitor sedimentation	National Environmental Management: Waste Act (2008) (Act 59 of 2008) and Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Operational phase	Use and maintenance of haul roads (incl. transportation of minerals to plant	Air Quality	Transportation of the workers and materials in and out of mine site will be a constant feature during the operational phase and result in the production of fugitive dust (containing TSP, as well as PM10 and PM2.5) due to suspension of friable materials from earth roads. Substantial secondary emissions may be emitted from material moved out	Minimisation: Working areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only. Remediate: Disturbed areas should be rehabilitated as soon as possible to limit the development of erosion. As well as a dust suppression program.	Operational phase	Minimisation of air pollution, particularly windborne particles.	Compliance with National Dust Control Regulations (GNR 827).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			from the site during grading and deposited adjacent to roads				
Operational phase	Vehicular movement of haulage vehicles and passenger vehicles as well as conveyor belts	Surface Water	Increased runoff due to soil compaction and increased paved surfaces	Control and Minimisation: Working areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only.	Operational phase	Disturbed areas should be rehabilitated as soon as possible to limit the development of erosion and increased soil compaction	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Construction Phase, operation phase and decommissioning phase	Mine development	Economic Change process	Direct formal employment opportunities to local individuals	Implementation and Management: The mine intends to employ mostly local labourers during the construction phase of the proposed project, In addition to the employment opportunities, there is also potential skills transfer which will have a lasting impact on the community. SLP hiring, bursary, and retrenchment guidelines will be adopted.	Construction Phase, operation phase and decommissioning phase	Conform to the guidelines of the SLP, use of the Labour Law in Human resources, Community engagement, SHEQ management objectives	Mining Charter and Mineral and Petroleum Resources Development Act, Act 28 of 2002. National Environmental Management Act (107/1998).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Construction Phase, operation phase and decommissioning phase	Mine development	Economic Change process	Impact on existing businesses in surrounding areas	Implementation Downscaling of activities and closure applications will be according to an approved closure plan as well as the SLP guidelines. Community engagements will be paramount.	Construction Phase, operation phase and decommissioning phase	Conform to the guidelines of the SLP, use of the Labour Law in Human resources, Community engagement, SHEQ management objectives	Mining Charter and Mineral and Petroleum Resources Development Act, Act 28 of 2002. National Environmental Management Act (107/1998).
Construction Phase, operation phase and decommissioning phase	Site clearing, removal of topsoil and vegetation	Surface Water	Increased sediment loads from vegetation clearance and soil compaction	Rehabilitation and Monitoring Progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff.	Construction Phase, operation phase and decommissioning phase	Implementation of a storm water management plan is recommended at the mine site to channel and contain storm runoff;	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Construction Phase, operation phase and decommissioning phase	Vehicle movement and Transportation via road	Roads and Traffic	Heavy vehicle impact at the Intersections (congestion), increase in daily traffic	Control and Minimise Minimise delays, accident risk, safety driving conditions, responsible driving and accountability, vehicle tracking	Construction Phase, operation phase and decommissioning phase	Traffic Management plans and propose doff peak movement of vehicles off site	Southern African Road Safety Manual (National Department of Transport 1999)
Closure Phase and Decommissioning Phase	Demolition & Removal of all infrastructure	Visual Significance rating post closure	Reinstatement of visual resource value due to dismantling of infrastructure and subsequent rehabilitation of footprint areas. Permanent alteration of site topographical and	Control and Monitoring Monitoring of invasive species. Re- Shape and profile the final mining void to be free draining if possible and establish a vigorous and self-sustaining vegetation cover on the final rehabilitated landforms. A detailed post-closure land use plan be compiled for the mine, which will take into consideration all present and likely future land	Construction Phase, operation phase and decommissioning phase	Minimising Where possible, natural vegetation around the Kusile’s Giyani Gold Mine should be retained.	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
			visual character of linked areas	uses surrounding the site, to ensure that the site is successfully re-integrated into the existing visual fabric.			
Closure Phase and Decommissioning Phase	Demolition & Removal of all infrastructure (incl. transportation off site)	Air Quality	The process includes dismantling and demolition of existing infrastructure, transporting and handling of topsoil on unpaved roads in order to bring the site to its initial/rehabilitated state. Demolition and removal of all infrastructures will cause fugitive dust emissions.	Minimisation: Decommissioning areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only.	Closure Phase and Decommissioning Phase	Minimisation of air pollution, particularly windborne particles.	Impacts on aspects outside of the demarcated areas reduced. Compliance with National Dust Control Regulations (GNR 827).
Closure Phase and Decommissioning Phase	Open pit backfill	Groundwater	aquifer contamination caused by backfill	Minimising and Monitoring, Implement a rigorous pollution prevention program as part of a comprehensive environmental management plan (EMP) and ensure that no pollution whatsoever enters local ground or surface water.	Closure Phase and Decommissioning Phase	Groundwater monitoring will be done post closure to monitor the water levels and quality	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Closure Phase and Decommissioning Phase	Open pit backfill	Groundwater	rebound water levels within backfill material may cause decant	Minimising and Monitoring, Implement a rigorous pollution prevention program as part of a comprehensive environmental management plan (EMP) and ensure that no pollution whatsoever enters local ground or surface water.	Closure Phase and Decommissioning Phase	Groundwater monitoring will be done post closure to monitor the water levels and quality	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Closure Phase and Decommissioning Phase	Rehabilitation (spreading of soil, revegetation & profiling/contouring)	Air Quality	. Topsoil can be imported to reconstruct the soil structure. There is less transfer of soil from one area to other therefore negligible chances of dust through wind erosion. Profiling of dumps and waste rock dump to enhance vegetation cover and reduce wind erosion from such surfaces post mining.	Rehabilitation- Re-vegetation of topsoil Minimisation: Working areas should be limited to the demarcated construction area only, and vehicular movement must be limited to designated haul roads and construction areas only Remediate: Disturbed areas should be rehabilitated as soon as possible to limit the development of erosion. Timeously completion of rehabilitation to reduce increased exposure time.	Closure Phase and Decommissioning Phase	Minimisation of air pollution, particularly windborne particles.	Impacts on aspects outside of the demarcated areas reduced. Compliance with National Dust Control Regulations (GNR 827).

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Closure Phase and Decommissioning Phase	Rehabilitation of open pits and removal of infrastructure	Groundwater quality	salt load contribution towards tributaries	Audits (internal and external)	Closure Phase and Decommissioning Phase	Install water monitoring boreholes closer to the decant points to monitor the water level and quality	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Closure Phase and Decommissioning Phase	Rehabilitation of stockpile areas, PCD's and discard dump	Surface Water	Acid mine drainage problems and problems associated with general waste disposal	Management and rehabilitation Implement phytoremediation measures to correct contamination of water resources. Employ new technologies which are recently being developed to treat acid mine drainage to usable water quality levels.	Closure Phase and Decommissioning Phase	Surface water monitoring, Implementation of the IWWMP. Employ new technologies which are recently being developed to treat acid mine drainage to usable water quality levels.	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Closure Phase and Decommissioning Phase	Rehabilitation: Covering of open pit with capping layer and top soil	Baseline Noise Levels	Increased noise levels on the proposed Site	Minimisation Rehabilitation activities will take place during between 07:00 and 15:00 on weekdays only to limit the impact on adjacent landowners.	Closure Phase and Decommissioning Phase	No noise impact after hours. Impacts on aspects outside of the demarcated areas reduced. Noise levels on site reduced	SABS 083, SANS 10083 Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996)

Phase	Activity	Potential Impact	Aspect Affected	Mitigation measure	Time Period For Implementation	Standard to be achieved	Compliance With Standards
Closure Phase and Decommissioning Phase	Rehabilitation: Covering of open pit with capping layer and top soil	Baseline Noise Levels	Increased noise levels off the proposed Site	Rehabilitation Rehabilitation activities will take place during between 07:00 and 15:00 on weekdays only to limit the impact on adjacent landowners.	Closure Phase and Decommissioning Phase	No noise impact after hours. Impacts on aspects outside of the demarcated areas reduced. Noise levels on site reduced	SABS 083, SANS 10083 Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996)
Closure Phase and Decommissioning Phase	Removal of buildings and infra-structure	Baseline Noise Levels	Increased noise levels along the feeder roads	Rehabilitation Rehabilitation activities will take place during between 07:00 and 15:00 on weekdays only to limit the impact on adjacent landowners.	Closure Phase and Decommissioning Phase	No noise impact after hours. Impacts on aspects outside of the demarcated areas reduced. Noise levels on site reduced	SABS 083, SANS 10083 Noise Induced Hearing Loss Regulations, Occupational Health and Safety Act, 1993); (Act No. 85 of 1993 and the Occupational Hygiene Regulations, MHSAct (29 of 1996)
Closure Phase and Decommissioning Phase	Vehicular movement of haulage vehicles ,passenger vehicles, workshops	Surface Water	Contamination from leakage and spillage of chemicals, oils and grease	Management and rehabilitation Implement phytoremediation measures to correct contamination of water resources.	Closure Phase and Decommissioning Phase	Employ new technologies which are recently being developed to treat acid mine drainage to usable water quality levels.	Compliance with the National Water Act (36 of 1998) as well as compliance with the conditions and requirements of the Water Use License.
Decommissioning Phase	Backfilling and profiling	Soil	Change in natural surface topography due to re-profiling of surface after stripping	Remediation Through the rehabilitation and backfilling of open pit will return to as close as possible, to pre-mining conditions	Closure Phase and Decommissioning Phase	Rehabilitation targets and closure objectives are met.	Conservation of Agricultural Resources Act (No 43 of 1983). Environment Conservation Act (No 73 of 1989).

2.8 Financial Provision

2.8.1 Determination of the amount of Financial Provision.

The financial provision to achieve the total quantum for rehabilitation and remediation of environmental impacts, damage as well as final mine Closure will be provided for by one or more of the following methods:

- A financial guarantee from a South African registered bank or any other bank or financial institution approved by the Minister guaranteeing the financial provision relating to the environmental management programme.
- A cash deposit to be deposited at the office of the Regional Manager in whose region the application was lodged.
- Approved contribution(s) to a dedicated trust fund as provided for in terms of Section 10(1)(cH) of the Income Tax Act, 1962.
- Any other manner the Minister may determine.

A breakdown of the costs for, including amongst others, dismantling of redundant infrastructure, rehabilitation, provision of Post Closure groundwater management measures etc., for the Kusile's Giyani Gold Mine have been determined and included in the DEIR for consideration by the regulating authority. The determination of the financial provision calculation as well as the breakdown of the financial provision was done in terms of the requirements of the NEMA (1998) and the MPRDA (2002), as contained in the DMRE Operational Guideline for Financial Provision Determination.

The Closure Cost Assessment will be reviewed in such a manner so that the quantum of the financial provision includes the requirements of Section 54 (1) of the MPRDR (2004), under the MPRDA (2002), which stipulates that "the quantum of the financial provision should include a detailed itemization of all actual costs required for –

(a) Premature closure regarding –
   (i) The rehabilitation of the surface of the area,
   (ii) The prevention and management of pollution of the atmosphere,
   (iii) The prevention and management of pollution of water and the soil,
   (iv) The prevention of leakage of water and minerals between subsurface formations and the surface.
(b) Decommissioning and final Closure of the operation, and post-closure management of residual and latent environmental impacts

The financial provision calculation and breakdown is annually revised and the required provision lodged with the DMRE. A breakdown of the costs including but not limited to, dismantling of redundant infrastructure, rehabilitation, provision of post-closure groundwater management measures etc., for the project will also be included in the Final EMP Amendment (including public comment).

2.8.2 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.

The objectives for mine closure for the Kusile's Giyani Gold Project are all included in the impact tables in Section E of this EMP (above) and described as mitigation measures. The mitigation measures should all be implemented to limit the impacts the mining and mining-related activities may have on the environment, as well as to restore the environment as far as practicably possible to pre-mining conditions. Mitigation measures and rehabilitation work should be conducted throughout the life of mine.

Post-mining regeneration priorities for South Africa, in the light of the county's developmental context, include:

- restoration of land surface of sufficient quality to support pre-mining land use potential,
- restoration of the ecological function of mined land and in the case of previously degraded land, the ecological function must be improved,
- efficient alternative use of mine infrastructure should be encouraged where this can be economically justified; where no economic alternative uses exist, mine infrastructure must be removed and the site rehabilitated to pre-mining condition,
- Southern Africa in general, and South Africa in particular, experiences water shortages and therefore minimisation of current and potential future impacts on water quality and supply is imperative,
- job creation through education and stimulation of economic activity,
- development projects to enable equitable participation in post mining economies by all members of the community, especially marginalized groups,
- enhancement of leadership capacity within the community and local government may be required to ensure that development continues post closure,
- Skills and literacy training for community members, (Cooke & Limpitlaw, 2003).

The main objectives for the project in terms of mine closure are:

- To protect health and safety of any person and / or animal that enters the mine boundary area.
- To rehabilitation, alleviate and eliminate all environmental damage as far as practically possible.
- To rehabilitate land to a level that would (at least) support gaming or grazing land use.
- To generate sustainable projects, such as the water treatment facility, that will continue to have benefits and supply jobs to the local community, but also provide a service as well as fund itself.

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

This DEIAR includes details pertaining to the environmental objectives in relation to closure. As part of the Public Participation Process, this DEIAR has been made available for public review and comments. Details pertaining to the

Public Participation Process is available under Part A of the DEIAR. Furthermore, the environmental objectives in relation to closure have been consulted with I&AP's as part of the public participation process

2.8.4 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.

2.8.4.1 Rehabilitation Plan

The directive mine manager and Environmental Control Officer (ECO) from Kusile's Giyani Gold Mine is responsible and will play a major role in ensuring that this rehabilitation plan and mine closure is effectively managed and implemented. This plan is environmental legally binding and must be implemented to fulfil the requirements of relevant legislations and recommendations.

Kusile's Giyani Gold Mine will be responsible for the appointment of the ECO, Dam Engineers and relevant specialists to perform rehabilitation and monitoring activities as well as alien vegetation removal and control. The rehabilitation works have to be signed off by a suitably qualified environmental specialists.

The hardened surfaces adjacent to watercourses will only marginally increase the velocity and volume of stormwater entering the channel and river areas. However, one must take into account the steepness of the topography of the surrounding area. Stormwater will increase in velocity substantially before entering the channel and river areas at the base of these steep adjacent hills. The root cause of absence of offsite stormwater management must therefore be addressed in order to begin to protect, rehabilitate and manage the watercourse areas. The current lack of adequate stormwater control impacting can create erosion in all the channel and riverine areas. Failure to address this is likely to lead to the complete destruction of the majority of the river systems in the future.

Findings from the rivers assessed that are associated with the causes of degradation can be summarised as relating to three fundamental issues:

- Soil erosion and gully formation, either as a result of a lack of stormwater management in the larger catchment or as a result of local activities including mining, overgrazing and crops in all watercourses; and
- The dominance of alien invasive plant species in large areas of the channel and river systems.

In order to address these impacts a channel and river management plan that establishes favourable hydrological conditions in the delineated channel and river systems and allows for the regeneration of the functional integrity of the channel and rivers is needed.

2.8.4.1.1 Soil Erosion and Gully Formation

The soil-vegetation interplay is generally in equilibrium with the energy expanded on them by the surface waters that flow through them. Stability is maintained as long as conditions in the catchment remain static and in a good state of conservation (Russel, 2009).

The first step in addressing soil erosion and gully formation in a channel and river is therefore to look at the impacts causing this degradation in the channel and river's catchment area. It is important to note that a channel and river is a mirror of its catchment; a degraded catchment equals a degraded channel and river. Overgrazing is one of the two major contributions to soil erosion, the other being a lack of stormwater control; it should be noted that the former is an important contributor to the latter.

The approach to watercourse conservation and sustainable use therefore needs to take into account the current pressures and threats facing the watercourses and provide a general recognition. The first step in reversing the effects of overgrazing is therefore the removal of livestock from these areas for a predetermined period of time.

A number of governmental and poverty-relief organisations can be utilised to provide education to the surrounding community on the benefits associated with rehabilitating these areas and stopping the overgrazing of these areas as well as providing job opportunities in conducting the actual rehabilitation works.

2.8.4.1.2 Watercourse Rehabilitation

2.8.4.1.2.1 Fix any erosion points created

- Any erosion features created need to be stabilised.
- Earthen berms or plugs, rock packs or gabions may be used for the plugging of erosion gullies.
- For earthen structures used to fill erosion points, the soil used needs to be properly compacted.

2.8.4.1.2.2 Reinstate soils and prepare planting area

- Stockpiled soils shall be placed in the reverse order as to which it was removed (i.e. subsoil first followed by topsoil).
- Reinstated soil is not to be compacted too heavily, as this will prevent water saturation and proper plant growth during rehabilitation. Where significant soil compaction has occurred, the soil may need to be ripped in order to reduce the bulk density of the soil such that vegetation can become established at the site.
- Where good topsoil exists, no specific preparation is required.
- An average depth of 30 cm to 50 cm topsoil should be maintained across the disturbed area where possible to provide sufficient depth for rooting of indigenous plants.

2.8.4.1.2.3 Remove any waste products

- All waste products (spoils, hazardous substances and general litter) need to be removed from riparian areas and disposed of in proper local waste facilities.
- Minimise additional disturbance by limiting the use of heavy vehicles and personnel during clean-up operations.

2.8.4.1.3 Reinstate vegetation

- A specialist should be contracted to supervise the rehabilitation of channel and river/riparian areas disturbed.
- Vegetation is to be reinstated as soon as weather conditions allow for plant growth.
- A suitable replanting/re-vegetation programme should be implemented. This should comprise a mix of rapidly germinating indigenous species grasses, shrubs and trees naturally occurring in the affected habitat and adapted to stabilizing areas.
- It would be advisable to plant at the onset of the wet season (early spring – August to October) so that watering requirements are minimal.
- Do not use fertilizer, lime, or mulch unless required.
- The three main methods of re-vegetating channel and river areas include: seeding, cuttings and the transplanting of whole plants
- Monitor re-vegetation progress and administer alien plant control.
- Recovery of disturbed areas should be assessed by the ECO. Any areas that are not progressing satisfactorily must be identified (e.g. on a map) and action must be taken to actively re-vegetate these areas. If natural recovery is progressing well, no further intervention may be required.
- The use of herbicides in IAP control will require an investigation into the necessity, type to be used, effectiveness and impacts of the agent on aquatic biota.
- Implement alien invasive plant control as stipulated below to ensure that alien plants are actively managed and eradicated from the site, with adequate monitoring and follow-up measures.

2.8.4.1.4 Control of Alien Invasive and Problem Plant Species

This must be conducted by a registered pest control operator, specialising in alien invasive plant control. Alien plant invasions cause a decline in species diversity, local extinction of indigenous species and ecological imbalance. Thus, preventing the onset of an alien invasion and management of further spreading is required as they outcompete the indigenous plant species and quickly establish themselves in an area. Therefore, a national strategy has been compiled and identifies four primary categories of programs to address the management of alien invasive plant species and they are as follows:

- **Prevention**—Keep the invasive species out;
- **Early detection and rapid response**—Detect and eradicate invasive species to stop them from spreading;
- **Control and management**—Eliminate or control the problem of invasive species; and
- **Rehabilitation and restoration**—Heal, minimize, or reverse the harmful effects from invasive species.

The occurrence of alien invasive plants not only affect the growth and distribution of natural endemic plants, they also use more water than indigenous plants, some have toxic fruits or leaves which when consumed could be poisonous and lead to fatality. Therefore, alien invasive plant species need to be controlled or removed and the following section contains different methods that could be used to control AIP.

The ultimate aim of an alien invasive species management programme is to eradicate species completely. This is often very difficult as many of the species have seeds that remain viable for a very long time and even after physical removal of plants, the seeds germinate to form new infestations. An alien invasive management programme therefore must be an ongoing practice over many years and should follow the following phases:

A. The initial bulk eradication of alien invasive species by chemical or mechanical means, and in some instances biological control agents. This may also require rehabilitation if large stands of alien invasive species are removed. Local, indigenous species should be planted in the disturbed areas;

B. There should also be immediate follow up and all seedlings should be pulled out and removed. This should be done regularly, although the timeframes will vary from species to species depending on their growth forms and rates; and

C. Finally, areas that appear to be under controlled must continue to be managed and observation of these sites should continue on at least an annual basis. Rehabilitation at sites should also be monitored and action taken immediately if issues occur.

Various control methods are available for control of alien invasive species, including mechanical, chemical and biological control. In most instances, mechanical means are utilised and include physical removal of plants. Research on use of herbicides has been conducted on many species and can be applied in conjunction with mechanical methods. For some species, herbicides have not yet been fully researched and/or herbicides have not been registered and they need to be mechanically controlled.

Biological control of alien invasive species is also an ongoing process and some biological control agents have been released on various alien invasive species and show varying degrees of success. Biological control options need to be carried out with specialist advice from academic or research institutes involved in research of alien invasive species.

Control options utilised must take into account the species being controlled and should take into account the ecosystem in which the control options are being applied. Some of the herbicides registered for control of alien invasive species should not be used in riparian areas, and some should be preferably used over others in areas where natural grass cover occurs. Some herbicides should only be utilised after consultation with a Working for Water technical advisor.

The control options are discussed below as individual actions, but in many cases integrated measures (more than one (1) control measure) are taken for more effective control of alien invasive species. As already mentioned, research with regard to herbicide application and biological control is lacking for certain alien invasive species and these, especially if listed as Category 1 invasive species, need to be managed and mechanical control of these species should be considered as a default control option.

2.8.4.2 Final Closure

The closure objective is to ensure that all the significant impacts have been mitigated against. All rehabilitated areas will be left in a stable, self-sustainable state. Proof of this will be submitted at closure.

The closure objectives for the Kusile’s Giyani Mine can be summarised as follows:

- Make all areas safe for both humans and animals;
- Make all areas stable and sustainable;
- Ensure impact on any water bodies, water courses and catchment areas have been avoided or minimised;
- Rehabilitate disturbed areas as soon as possible; and
- Minimise the impact on the local community.

With specific reference to the ground water environment, the following closure objectives should be pursued:

- Rehabilitation of the surface infrastructure where necessary to minimize infiltration into the underground water regime (the philosophy of concentration and containment); and

- Rehabilitation to minimise contamination of surface water resources (the philosophy of dilution and dispersion).

When and if necessary suitable structures and or systems are to be put, and kept in place to limit contamination of water resources, and to limit parameter concentrations in accordance with the Target Water Quality Ranges for human consumption.

The goals upon decommissioning and closing of the mine will include that all significant impacts have been mitigated and that there are no alterations to the environment that are apparent as far as is practically possible. All land will be rehabilitated to a state that facilitates compliance with current national environmental quality objectives including air quality objectives and water quality guidelines.

2.8.4.2.1 Closure vision statement

To demonstrate Kusile Invest 133's values where we as a team strive to render a safe, stable and non-polluting environment aligned to regulatory and regional requirements, and ultimately provides a sustained post-closure ecosystem service or livelihood, leaving behind a positive post-mining legacy for the receiving community.

2.8.4.2.2 Principles in support of the vision

The mine closure principles that will govern the process are derived from the mine closure policy of the Department of Minerals Resources, namely:

- The safety and health of humans and animals are safeguarded from hazards resulting from mining operations.
- Environmental damage or residual environmental impacts are minimised to such an extent that it is acceptable to all involved parties.
- The land is rehabilitated to, as far as is practicable, it's natural state, or to a predetermined and agreed standard or land use which conforms to the concept of sustainable development.
- The physical and chemical stability of the remaining structures should be such that risk to the environment is not increased by naturally occurring forces to the extent that such increased risk cannot be contended with by the installed measures.
- The optimal exploitation and utilisation of South Africa's mineral resources are not adversely affected.
- Mines are closed efficiently and cost effectively.
- Mines are not abandoned but closed in accordance with this policy.

The closure plan has been compiled keeping the above-mentioned principles in mind.

2.8.4.2.3 Plans in support of the vision

The following plans are compiled in order to achieve the closure vision and objectives:

- Final Closure and decommissioning plan;
- Financial provisioning; and

- Rehabilitation plan (annual and 10-years).

The information presented in these respective plans is included in the closure plan where relevant. The rehabilitation plan focuses the actions to ensure that the closure vision and closure objectives are achieved. Detailed project plans will be developed by the respective responsible persons to ensure that the closure objectives can be achieved.

The financial provisioning report continuously reviews the mine's operations, in terms of the cost associated with the physical and bio-physical components on site. Financial provisioning ensures the availability of adequate funds to achieve the closure vision and closure objectives.

2.8.4.2.4 Closure Outcomes

The closure outcomes/alternatives for each proposed activity that forms part of the open pits and infrastructure is described in the table below.

Table 52: Closure options for proposed activities

Aspect	Closure action
Open Pits	Open pit In-fill the void by means of dragline and dozer and slope the final void to 1:5 while creating a free draining surface over the remainder of the backfilled open pit; Apply minimum of 300 mm growth medium or as per end land use for wildlife and grazing purposes; Rip area to alleviate compaction; and Establish vegetation by applying suitable seed mix. Ramp Shape ramp scars by means of dragline and dozer to slopes of 1:5; and Apply minimum of 300 mm growth medium
Haul roads	Rip and shape footprint area to be free-draining (aligned to site-wide routing), to ensure sufficient usable soil; and Establish vegetation by applying suitable seed mix.
Pollution Control Dams and Infrastructure	Rip and shape footprint area to be free-draining (aligned to site-wide routing), to ensure sufficient usable soil; and

	Establish vegetation by applying suitable seed mix. Apply minimum of 300 mm growth medium or as per end land use for wildlife and grazing purposes; Rip area to alleviate compaction; and Establish vegetation by applying suitable seed mix.

2.8.4.3 Closure objectives

In order to guide identification of key biophysical and socio-economic drivers, and aligned to the mine's current EMPR commitments, the following general closure objectives have been formulated:

- To rehabilitate mining-related disturbed areas to a land capability that will support and sustain a predetermined mix of post closure land uses;
- To reinstate a self-sustaining system over the rehabilitated mined and infrastructure areas, requiring minimum maintenance to facilitate a walk away situation;
- To ensure that the plans and actions put in place will meet specific closure-related performance objectives;
- To maximise surface runoff from the rehabilitated mine site to the nearby rivers;
- To prevent acid mine drainage;
- To limit decant from the open water bodies, as well as the amount of contaminated water seeping from the rehabilitated pits;
- To remove all surface infrastructure that cannot be beneficially re-used and return the associate disturbed land to the planned final land use;
- To in-fill and slope ramps and voids to be free draining;

To limit adverse effect on local catchment yield; and

- To limit the recharge of rainfall to the rehabilitated pits to reduce the amount of water to be abstracted to maintain the in-pit water levels to prevent surface and/or near surface contaminated excess mine water decant.

All alternatives have been reviewed but none are practical therefore the mine has selected the following closure objectives:

2.8.4.3.1 Physical stability

To remove and/or stabilise surface infrastructure, unavoidable mining residue and open pits which are present on the mine to facilitate the implementation of the planned land use, by:

- Closing, dismantling, removing and disposing of all surface infrastructure that has no beneficial post closure use;
- Ensuring remaining water treatment plant and associated facilities are fully functional and operating in line with design specifications; and

- Ripping, shaping, and vegetating of access and/or haul roads with no beneficial post-closure use and integrating these into the surrounding surface topography.

2.8.4.3.2 Environmental quality

To ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the mine site as well as to sustain catchment yield as far as possible after closure, by:

- Ensuring that the rehabilitated mine site is free-draining with limited recharge to rehabilitated spoils and run-off is routed to local/natural drainage lines as far as possible;
- Maintaining on-going treatment of contaminated decant water arising after pit in-filling, and discharge of this water into the rivers;
- Cleaning up of the sources of possible surface water contamination still present on the mine site and along the conveyor route (fugitive spillages) to protect the downstream receiving environment;
- Removing off-site hazardous material and disposing of it at the closest hazardous waste disposal facility. As removal is an on-going process, no hazardous waste build-up on-site should occur; and
- Limiting dust generation on the rehabilitated mine site that could cause nuisance and/or health effects to surrounding landowners/communities.

2.8.4.3.3 Health and safety

To limit the possible health and safety threats to humans and animals using the rehabilitated mine site as it becomes available, by:

- In-filling mining voids by ensuring that proper material balances and associated movement analyses are conducted to make material for this purpose available during open pit rehabilitation;
- Planning land use/s such that the rehabilitated pits can be integrated within surrounding land use/s;
- Demonstrating by means of suitable sampling and analysis that the threshold levels of salts, metals and other potential contaminants over the rehabilitated sites allocated in terms of the land use planning for human habitation are acceptable;
- Removing, for safe disposal, all potential process-related contaminants to ensure that no hazardous waste is present on the respective sites once these have been rehabilitated; and Demonstrating through a review of monitoring data that no possible surface and/or groundwater contaminant sources remain on the rehabilitated mine site that could compromise the planned land use and/or pose health and safety threats.

2.8.4.3.4 Land capability/land-use

To re-instate suitable land capabilities over the various portions of the mine site to facilitate the progressive implementation the planned land use/s, by:

- Upfront zoning of the overall mine site and obtaining agreement with stakeholders on this;
- Ensuring that the rehabilitated portions of the mine site are safe and stable in the long-term;

- -up and rehabilitating of contaminated soil areas, if applicable; and
- Limiting the possible loss of topsoil by committing the available topsoil to suitable concurrent rehabilitation practices.

2.8.4.3.5 Landscape viability

To create a landscape that is self-sustaining and over time will converge to the desired ecosystem structure, function and composition, by:

- Establishing rehabilitated slopes and drainage lines that will preserve vital resources such as growth medium and nutrients as far as possible;
- Ensuring that drainage lines created on the rehabilitated surfaces will not scour and be sources of head cuts;;
- Placing suitable growth medium of sufficient depths to indigenous vegetation growth in line with identified end land uses; and
- Ensuring that the growth medium has the required organic content and the potential to sustain microbial activity to ensure infiltration, limit runoff and improved soil stability.

2.8.4.3.6 Aesthetic quality

To leave behind a rehabilitated mine site that, in general, is not only neat and tidy giving an acceptable overall aesthetic appearance, but which in terms of this attribute is also aligned to the respective land use/s, by:

- Tidying-up the rehabilitated mine sites by removing demolition waste, rubble, etc.;
- Shaping and levelling rehabilitated areas to create landforms that emulate the surroundings and would facilitate surface drainage;
- Ensuring that the rehabilitated mine site is free draining and disturbed areas are suitably vegetated where feasible;
- Shaping of haul roads and hard stand (compacted) areas to roughly emulate the surrounding surface topography; and
- Vegetating the above rehabilitated areas, as required, to be aesthetically pleasing.

2.8.4.3.7 Biodiversity

To encourage, where appropriate, the re-establishment of indigenous vegetation on the rehabilitated mine sites such that the ecological integrity of the surrounding terrestrial and aquatic environments are enhanced, by:

- Stabilising disturbed areas to prevent erosion in the short- to medium-term until a suitable vegetation cover has established;
- Establishing viable self-sustaining vegetation communities that will encourage the re-introduction of local fauna, as far as possible; and
- Assessing whether the rehabilitated facilities, with limited intervention and change, could be adapted to provide suitable habitats for small mammals, improving the overall biodiversity; and
- Identifying those aspects/obstacles, once site rehabilitation has been completed, which could inhibit and/or deter animal life from returning to the rehabilitated mine site and removing/correcting where possible.

2.8.4.3.8 Social

To ensure that measures and/or contributions made by the mine towards the long-term socio-economic benefit of both employees and local communities are sustainable, by:

- Ensuring a lasting net socio-economic benefit to host communities over the project lifestyle and beyond through the operation of our core business in addition to social investment;
- Communicating and negotiating with local communities, farmers and related civil structures on the closure of the mine and the possible land use/s options available for re-instatement post-closure;
- Identifying services/utilities to local farmers and/or the land claimants that are dependent on the mine that would need to be addressed prior to decommissioning; and
- Transferring appropriate skills to employees and inhabitants to enable them to sustain alternative post-mining livelihoods.

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

The rehabilitation plan is in alignment of the closure objectives targeting the decommissioning and rehabilitation of the mining area (opencast pits), and the decommissioning of the plant area (including all remaining disturbed areas within the site).

Table 53: Rehabilitation of mining areas at Kusile Granville Mine

No	Activity	Description	NEMA 1998 listed activity
1	Decommissioning and rehabilitation of the mining area.	Removal of any infrastructure no longer required.	R. 983 (2014) Listed activity 22 (ii)
		Backfilling of the opencast pit with remaining overburden.	
		Shaping and compaction of the surface area to ensure that it is free draining.	
		Placement of topsoil over the backfilled void.	
		Monitoring and maintenance of all environmental aspects to ensure effective rehabilitation.	

2.8.4.4.1 Rehabilitation of the plant and associated infrastructure

The final decommissioning that will take place during the Decommissioning Phase of the Kusile's Giyani Gold Mine is the rehabilitation of the plant area and related infrastructure, including all remaining disturbed areas, this phase is detailed in the table below. Only infrastructure that is intended to form part of the long term end land use will be left intact.

Table 54: Decommissioning of the remaining surface infrastructure at Kusile Granville

No	Activity	Description	NEMA listed activity
1	Decommissioning and rehabilitation of remaining infrastructure.	Removal of infrastructure (processing plant, process water dam, workshop, weighbridge, waste yard, salvage yard, haul roads, one PCD, etc.)	R. 983 (2014) Listed activity 31
		Removal and appropriate disposal of any contaminated land.	
		Shaping of the land to ensure it is free draining (if necessary).	
		Placement of topsoil over the remaining area to be rehabilitated.	
		Monitoring and maintenance of all environmental aspects to ensure effective rehabilitation.	

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

Addendum 2- financial quantum

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

The Financial Provision for the closure liability will be provided for over the life of the mine as required by DMRE. The application will submit a bank guarantee to the Department of Mineral Resources. The financial provision and the closure cost is also updated on an annual basis and submitted to the DMRE for approval.

2.9 Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including:

Monitoring of Impact Management Actions, Monitoring and reporting frequency, Responsible persons; Time period for implementing impact management actions and Mechanism for monitoring compliance

The existing management team at Kusile Invest 133 will oversee the proposed mining operations. The key personnel to ensure compliance with this EMP report will be the operations executive, the environmental manager and the stakeholder development manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- environmental site manager:
  - ensure that the monitoring programmes and audits are scoped and included in the annual mine budget;
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes;
  - appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards;
- Human Resource department:
  - manage labour-related aspects for the mine;
  - liaise with the relevant structures in terms of the commitments in the SLP;
  - ensure that commitments in the SLP are developed and implemented in a timeously fashion;
  - establish and maintain good working relations with surrounding communities and landowners;
  - facilitate stakeholder communication and information-sharing mechanisms (quarterly stakeholder meetings will be held as a minimum); and
  - Facilitate grievance mechanisms.

Table 55: Impacts requiring monitoring programmes and reporting frequency

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
SOURCE ACTIVITY: Construction, Operation and decommissioning of the proposed open pit and underground mining and related activities.				
• Constructions Phase: The clearance of vegetation and establishment of the pits will alter drainage patterns of the surface water runoff. • Operational phase: The operation and utilisation of diversion berms and trenches (around the plant area, the opencast area and the workshop area) will redirect surface water either to dirty water management or clean water management area. Oil and hydrocarbon spillages may pollute the surface water runoff. Decommissioning phase: As the water management infrastructure will only be decommissioned after all the other infrastructure has been decommissioned.	Surface water	Surface water monitoring: Sampling Swartkoppies farm – located on non-perennial up streams Swartkoppies – located on non-perennial down streams West 59 and Gemsbok farms- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial downstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site	Hydrology and Ecology specialists should be appointed to undertake the monitoring and result of such monitoring should be submitted to the Environmental Manager	Monitoring & Sampling Frequency: During the operational and construction phase, Sample localities of the biomonitoring points on the Mulati River and the Selati River will be sampled on a monthly basis. Sampling for Aquatic Ecological Monitoring of the pans not destroyed during the mining will occur twice per annum Reporting: Monthly: Internal data report. Quarterly: Data report to authorities (DWS). Annually: Annual status report.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction Phase: The clearance of vegetation and establishment of the pits will alter drainage patterns, runoff and infiltration. The removal of soils and hard's will affect the water table. • Operational phase: The groundwater table will be lowered due to water ingress in the opencast pit. Surface water runoff that may come into contact with hydrocarbon material or any unattended to spillage may infiltrate and contaminate groundwater resources, in the event of any spillages. The ingress water in pits will be treated at the water plant prior to release into the environment. • Decommissioning phase: Oils and hydrocarbons from vehicles will act as pollutants which may infiltrate and pollute the groundwater. Rehabilitation of the open pits can lead to decanting of water into the pits.	Groundwater	Ground water monitoring: Sampling of boreholes (quality and quantity). There are a number of boreholes on and off the site.	A groundwater specialist should be appointed to conduct the water monitoring as well as use of an accredited lab. Result of the water monitoring will be submitted to the Environmental Manager	Monitoring & Sampling Frequency: Quarterly sampling of boreholes. Additional specifications will be added as conditions from the WULA. In terms of flow, all water uses and discharges will be measured on an on-going basis and the total calculated on the last day of every month. Reporting: Quarterly: Ground water monitoring report to Kusile from the appointed specialist and Kusile will report the findings to DWS. Annually: An annual report with evaluated results from the cumulative monitoring result on groundwater quality and quantity should be submitted.
• Construction Phase: There will be extensive vegetation clearance, dust generation from the construction activities and increased vehicle movement on grave roads will affect the indigenous vegetation on site. Cleared areas will be prone to alien invasive species • Operational & Decommissioning phase: Dust may be generated from the utilisation of the haul roads and during the backfilling- and decommissioning process, which may settle on the vegetation and affect the natural plant functions.	Flora	Prior to construction a tree removal permit will be required. Flora monitoring: monitoring and inspections of undisturbed indigenous flora, vegetation cover on disturbed areas, growth of invasive species and weeds, Endangered & Red data species.	Ecology specialist to be appointed to undertake the permit application. An alien invasive management plan should be designed and implemented by the ECO and Environmental Manager	Monitoring Frequency: ECO to monitor tree removal including illegal tree removal by employees, vegetation clearances and alien invasive plant growth. This should be done monthly during construction and after that quarterly or on a seasonal basis. Reporting: Annually: Internal reporting on the status of the vegetation cover. Internal audits to be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: The increase in human activities, site clearances, construction vehicles and machinery will destroy habitats as well as cause displacement of animals due. Poaching is also highly likely due to the increase in population of construction workers and job seekers. It is expected that most of the game animals will be relocated from the site. • Operational phase: The increased human activity, noise generation and lighting from the processing plant may frighten the fauna on the farms. Poaching is also highly likely dude to the increase in population of workers and job seekers. • Decommissioning phase: Human activities including poaching and decommissioning activities on site may frighten fauna.	Fauna	Animal monitoring: Field assessments to investigate displacement of fauna, a record of accidental animal killings and poaching, investigate and record unauthorised snares and traps. Relocation, catch and release for injured fauna as well as relocation to conservation areas and habitat reconstruction where possible	Suitably qualified personnel must assist in the relocation of the game animals to areas of conservation. The ECO and employees will be responsible for the safety of fauna on the site and reporting will be done to the Environmental Manager	Monitoring: an Ecologist should be appointed to conduct regular surveys throughout the life of mine. Daily siting's must be recorded on an incident basis. Reporting: Annually: The ecology survey report will be used in conjunction with the faunal reports and submitted to management. Internal audits and incident reports should be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction: During sit establishment soils will be stripped and soil stockpiles, these stockpiles will be vulnerable to alien invasive species, oil and hydrocarbon spillages will pollute the soils and alter the structure and functioning of the soils. • Operational phase: As mining progresses and more soil stockpiles are created, the soil will be prone to weeds establishing which will compromise the integrity of the soil, even when replaced for rehabilitation. Vehicles and machinery may leak or spill hydrocarbons in areas of use. This will pollute the soils and alter the structure and functioning of the soils. • Decommissioning phase: The topsoil will be places after the open pit areas have been backfilled. Rehabilitation activities will result in compaction due to the movement of vehicles and machinery dismantling which will lead to the degradation of soils and the land capability if not monitored and properly managed. A soil specialist must be appointed post rehabilitation to monitor the rehabilitation efforts.	Soil	Soil monitoring: Visual inspection of soils on roads, topsoil stockpiles and construction sites. Revegetation of topsoil's should be done immediately to avoid loses due to wind and water erosion as the area is prone to flash floods.	ECO and Environmental Manager	Monitoring: Inspections of soil for spillages, signs of erosion and alien invasive and weed encroachment should be conducted on a weekly basis. Reporting: Monthly: SHEQ Inspection reports. Internal audits to be included in the EMP performance assessment conducted every two years.
• Construction Phase: there will be extensive vegetation clearance, dust generation from the construction activities and increased vehicle movement on gravel roads will affect the indigenous vegetation on site • Operational phase: Blasting, stripping and haulage will generate dust at the open pit which on windy days will migrate from the pit to the surrounding areas. • Decommissioning phase: Dust may be generated as a result of the decommissioning (removal of redundant infrastructure) and rehabilitation activities and may migrate to surrounding areas.	Air Quality	Air Quality Monitoring: Dust Monitoring on the site using dust buckets and PM10 monitoring, regular internal monitoring by SHEQ. Fallout dust should be tested for particulates at an accredited laboratory	Air Quality Specialist who will submit the reports to the Environmental Manager. The SHEQ team will also conduct regular internal checks	Sampling and Monitoring Frequency: Dust samples will be taken on a monthly basis. Reporting: Monthly: Internal reporting. External submissions: Audit Report and Data report submitted to DMRE as part of the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction Phase: Increased noise levels due to vehicle movement and hauling of material. • Operational phase: The major sources of noise relating to mining including blasting of the overburden, conveying of ore and traffic within and off the site. • Decommissioning phase: Activities anticipated to cause noise impacts during the decommissioning phase include the demolishing of infrastructure, loading, hauling, placing and shaping of any remaining waste and discard dumps; loading, hauling, placing and shaping of topsoil (all disturbed areas, including stockpile sites and demolished infrastructure).	Noise	Noise monitoring at the open pit areas and baseline noise measurement of the whole area as all activities within the mining area will add to the cumulative increase in noise levels	SHEQ and a specialist who will assess the nose levels at the plant will submit their report to the Environmental Manager	Monitoring: Noise sampling will be conducted on a monthly basis. Reporting: The results and findings should be documented in monthly reports and be utilised for the annual internal EMP PA and the EMP performance assessment conducted every two years.
• Operational phase: Removal and construction of temporary overburden stockpiles as mining progresses (this may include the drilling and blasting of hard overburden)	Geology	Blasting: Ground vibrations monitoring	Environmental Manager	Monitoring: Ground vibrations will be measured annually. Reporting: Results must be included external EMP performance assessment conducted every two years
	Geology	Subsidence and earth movement monitoring.	Environmental Manager	Monitoring: Concurrently with mining activities throughout the entire LOM until closure has been obtained. Reporting: Results must be included in external EMP performance assessment conducted every two year
SOURCE ACTIVITY: Construction, operation and decommissioning of the Processing Plant				

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Potential Spillages, leakages of hydrocarbon materials from construction vehicles and machinery, loosening of soil and dust will increase sedimentation. • Operational phase: Rivers can be polluted by dirty water runoff from the processing plant if the water is adequately contained and channelled through dirty water channels or berms into the pollution control dam. • Decommissioning phase: Due to spillages of oils and hydrocarbons surface water runoff might be contaminated. Should surface water runoff become contaminated with spillages resulting from decommissioning activities, it should be directed to the PCD.	Surface	Surface water monitoring: Swartkoppies farm – located on non-perennial up streams Swartkoppies – located on non-perennial down streams West 59 and Gemsbok farms- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial downstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site	Hydrology and Ecology specialists should be appointed to undertake the monitoring and result of such monitoring should be submitted to the Environmental Manager	Monitoring & Sampling Frequency: During the operational and construction phase. Reporting: Monthly: Internal data report. Quarterly: Data report to authorities (DWS). Annually: Annual status report.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Oils and hydrocarbon spillages from construction vehicles or machinery (should they occur) will affect the groundwater quality. The removal of vegetation and increased soil compaction will impact on infiltration rates and increased runoff. • Operational phase: Groundwater may become contaminated in cases where polluted surface water is not remediated immediately and left to pond for extended periods of time • Decommissioning phase: Oil and hydrocarbon Spillages from vehicles and machinery utilised during decommissioning may contaminate groundwater through seepage	Groundwater	Ground water monitoring: Sampling of boreholes (quality and quantity). There are a number of boreholes on and off the site.	A groundwater specialist should be appointed to conduct the water monitoring as well as use of an accredited lab. Result of the water monitoring will be submitted to the Environmental Manager	Monitoring & Sampling Frequency: Quarterly sampling of boreholes. Additional specifications will be added as conditions from the WULA Reporting: Quarterly: Ground water monitoring report to Kusile from the appointed specialist and Kusile will report the findings to DWS. Annually: An annual report with evaluated results from the cumulative monitoring result on groundwater quality and quantity should be submitted.
• Construction phase: Vegetation clearance, dust generation from the construction activities and increased vehicle movement on gravel roads will affect the indigenous vegetation on site. Cleared areas will be prone to alien invasive species • Operational phase: Increased alien invasive species growth in the disturbed surface areas and via transportation of seeds on clothing etc. if not appropriately managed or prevented alien invasive vegetation may thrive in the cleared areas impacting on the natural vegetation. • Decommissioning phase: Rehabilitated if not properly managed and monitored areas will be vulnerable to the establishment of alien invasive vegetation	Flora	Prior to construction a tree removal permit will be required. Flora monitoring: monitoring and visual inspections of undisturbed indigenous flora, vegetation cover on disturbed areas, growth of invasive species and weeds, Endangered & Red data species.	Ecology specialist to be appointed to undertake the permit application. An alien invasive management plan should be designed and implemented by the ECO and Environmental Manager	Monitoring Frequency: ECO to monitor tree removal including illegal tree removal by employees, vegetation clearances and alien invasive plant growth. This should be done monthly during construction and after that quarterly or on a seasonal basis. Reporting: Annually: Internal reporting on the status of the vegetation cover. Internal audits to be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: The increase in human activities, site clearances, construction vehicles and machinery will destroy habitats as well as cause displacement of animals due. Poaching is also highly likely dude to the increase in population of construction workers and job seekers. It is expected that most of the game animals will be relocated from the site. • Operational phase: The increased human activity, noise generation and lighting from the processing plant may frighten the fauna on the farms. Poaching is also highly likely dude to the increase in population of workers and job seekers. • Decommissioning phase: Human activities including poaching and decommissioning activities on site may frighten fauna.	Fauna	Animal monitoring: Field assessments to investigate displacement of fauna, a record of accidental animal killings and poaching, investigate and record unauthorised snares and traps. Relocation, catch and release for injured fauna as well as relocation to conservation areas and habitat reconstruction where possible	Suitably qualified personnel must assist in the relocation of the game animals to areas of conservation. The ECO and employees will be responsible for the safety of fauna on the site and reporting will be done to the Environmental Manager	Monitoring: an Ecologist should be appointed to conduct regular surveys throughout the life of mine. Daily siting's must be recorded on an incident basis. Reporting: Annually: The ecology survey report will be used in conjunction with the faunal reports and submitted to management. Internal audits and incident reports should be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Soil stripped to clear land for the construction of the plant will be removed and stockpiled. Operational phase: Soils may be affected by spillages from the plant. Oils and Hydrocarbon spillages from operational vehicles may contaminate the soils if not removed and bio-remediated timeously. It is crucial to bio remediate soils to minimise top soil loss. Contamination of soils may also occur during regular standard maintenance of the plant • Decommissioning phase: Soils may be contaminated by spillages from the plant. Rehabilitation activities will result in compaction due to the movement of vehicles and machinery dismantling which will lead to the degradation of soils and the land capability if not monitored and properly managed. A soil specialist must be appointed post rehabilitation to monitor the rehabilitation efforts	Soil	Soil monitoring: Visual inspection of soils on roads, topsoil stockpiles and construction sites. Revegetation of topsoil's should be done immediately to avoid loses due to wind and water erosion as the area is prone to flash floods.	ECO and Environmental Manager	Monitoring: Inspections of soil for spillages, signs of erosion and alien invasive and weed encroachment should be conducted on a weekly basis. Reporting: Monthly: SHEQ Inspection reports. Internal audits to be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Construction activities including movement of vehicles on gravel roads, site clearances will expose surfaces through the removal of vegetation will increase the rates of erosion, dust generation and vulnerability to natural forces like wind and surface water runoff. • Operational phase: Vehicles movement as well as the operation of the plant will generate dust. Intensive dust suppression on gravel roads should be implemented and haul vehicles should follow designated pathways. • Decommissioning phase: Dust will be generated by the operation of vehicles and machinery used for the rehabilitation and decommissioning activities. Un-vegetated soils in rehabilitated areas will be vulnerable to wind and water erosion, reducing their potential through loss of minerals. Re-Vegetation should be implemented immediately after rehabilitation.	Air Quality	Air Quality Monitoring: Dust Monitoring on the site using dust buckets and PM10 monitoring, regular internal monitoring by SHEQ. Fallout dust should be tested for particulates at an accredited laboratory	Air Quality Specialist who will submit the reports to the Environmental Manager. The SHEQ team will also conduct regular internal checks	Sampling and Monitoring Frequency: Dust samples will be taken on a monthly basis. Reporting: Monthly: Internal reporting. External submissions: Audit Report and Data report submitted to DMRE as part of the EMP performance assessment conducted every two year
• Construction phase: Construction vehicles will generate noise, and the noise generated may pose a nuisance to nearby farm owners and surrounding land occupants. • Operational phase: Noise levels will increase at the plant and due to operation of the plant which will increase ambient noise levels in the area. The increase in noise levels at the plant can pose health issues for the employees working at the plant should proper PPE not be used and the increase in noise level may pose as a nuisance to surrounding community and residents. • Decommissioning phase: Noise will be generated by the operation of vehicles and machinery used for the rehabilitation and decommissioning activities	Noise	Noise monitoring at the plant and baseline noise measurement of the whole area as all activities within the mining area will add to the cumulative increase in noise levels	SHEQ and a specialist who will assess the nose levels at the plant will submit their report to the Environmental Manager	Monitoring: Noise sampling will be conducted on a monthly basis. Reporting: The results and findings should be documented in monthly reports and be utilised for the annual internal EMP PA and the EMP performance assessment conducted every two years.
SOURCE ACTIVITY: Construction, operation and decommissioning of the PCD and water management infrastructure				

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Site clearance of vegetation and levelling of land for the construction of the PCD may alter drainage patterns of the surface water runoff. Surface water quality may also be impacted on through the spillages and leakages of hydrocarbon materials from construction vehicles and machinery. • Operational phase: Surface water may be polluted should there be an incident where PCD spillage from the dam is not contained within the stormwater management infrastructure	Surface water	Surface water monitoring: Swartkoppies farm – located on non-perennial up streams Swartkoppies – located on non-perennial down streams West 59 and Gemsbok farms- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial downstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site	Hydrology and Ecology specialists should be appointed to undertake the monitoring and result of such monitoring should be submitted to the Environmental Manager	Monitoring & Sampling Frequency: During the operational and construction phase, the Mulati River and the Selati River will be sampled on a monthly basis. The water levels of the proposed PCDs will also be surveyed on a monthly basis, once they become operational Reporting: Monthly: Internal data report. Quarterly: Data report to authorities (DWS). Annually: Annual status report.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Oils and hydrocarbon spillages from construction vehicles or machinery (should they occur) will affect the groundwater quality. The removal of vegetation and increased soil compaction will impact on infiltration rates and increased runoff. Operational phase: Should the PCD appropriate lining materials or should a breach in the lining occur, seepage from the PCDs may contaminate the groundwater regime. Seepage to groundwater may also occur in the unlikely event of a spillage from one or both of the PCD.	Groundwater	Ground water monitoring: Sampling of boreholes (quality and quantity). There are a number of boreholes on and off the site.	A groundwater specialist should be appointed to conduct the water monitoring as well as use of an accredited lab. Result of the water monitoring will be submitted to the Environmental Manager	Monitoring & Sampling Frequency: Quarterly sampling of boreholes. Additional specifications will be added as conditions from the WULA. In terms of flow, all water uses and discharges will be measured on an on-going basis and the total calculated on the last day of every month. Reporting: Quarterly: Ground water monitoring report to Kusile from the appointed specialist and Kusile will report the findings to DWS. Annually: An annual report with evaluated results from the cumulative monitoring result on groundwater quality and quantity should be submitted.
• Construction phase: Vegetation clearance, dust generation from the construction activities and increased vehicle movement on gravel roads will affect the indigenous vegetation on site. Cleared areas will be prone to alien invasive species • Operational phase: Increased alien invasive species growth in the disturbed surface areas and via transportation of seeds on clothing etc. if not appropriately managed or prevented alien invasive vegetation may thrive in the cleared areas impacting on the natural vegetation. • Decommissioning phase: Rehabilitated if not properly managed and monitored areas will be vulnerable to the establishment of alien invasive vegetation	Flora	Prior to construction a tree removal permit will be required. Flora monitoring: monitoring and visual inspections of undisturbed indigenous flora, vegetation cover on disturbed areas, growth of invasive species and weeds, Endangered & Red data species.	Ecology specialist to be appointed to undertake the permit application. An alien invasive management plan should be designed and implemented by the ECO and Environmental Manager	Monitoring Frequency: ECO to monitor tree removal including illegal tree removal by employees, vegetation clearances and alien invasive plant growth. This should be done monthly during construction and after that quarterly or on a seasonal basis. Reporting: Annually: Internal reporting on the status of the vegetation cover. Internal audits to be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: The increase in human activities, site clearances, construction vehicles and machinery will destroy habitats as well as cause displacement of animals due. Poaching is also highly likely dude to the increase in population of construction workers and job seekers. It is expected that most of the game animals will be relocated from the site. Operational phase: .Poaching is also highly likely dude to the increase in population of workers and job seekers. Decommissioning phase: Human activities including poaching and decommissioning activities on site may frighten fauna.	Fauna	Animal monitoring: Field assessments to investigate displacement of fauna, a record of accidental animal killings and poaching, investigate and record unauthorised snares and traps. Relocation, catch and release for injured fauna as well as relocation to conservation areas and habitat reconstruction where possible	Suitably qualified personnel must assist in the relocation of the game animals to areas of conservation. The ECO and employees will be responsible for the safety of fauna on the site and reporting will be done to the Environmental Manager	Monitoring: an Ecologist should be appointed to conduct regular surveys throughout the life of mine. Daily siting's must be recorded on an incident basis. Reporting: Annually: The ecology survey report will be used in conjunction with the faunal reports and submitted to management. Internal audits and incident reports should be included in the EMP performance assessment conducted every two year
• Construction phase: Soil stripped to clear land for the construction of the pollution control dam will be removed and stockpiled. • Operational phase: Soils may be affected should a spillage occur from PCD. Soils may be affected by spillages from the plant. Oils and Hydrocarbon spillages from operational vehicles may contaminate the soils if not removed and bio-remediated timeously • Decommissioning phase: Soils may be contaminated by spillages from the. Rehabilitation activities will result in compaction due to the movement of vehicles and machinery dismantling which will lead to the degradation of soils and the land capability if not monitored and properly managed.	Soil	Soil monitoring: Visual inspection of soils on roads, topsoil stockpiles and construction sites. Revegetation of topsoil's should be done immediately to avoid loses due to wind and water erosion as the area is prone to flash floods.	ECO and Environmental Manager	Monitoring: Inspections of soil for spillages, signs of erosion and alien invasive and weed encroachment should be conducted on a weekly basis. Reporting: Monthly: SHEQ Inspection reports. Internal audits to be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Construction activities including movement of vehicles on gravel roads, site clearances will expose surfaces through the removal of vegetation will increase the rates of erosion, dust generation and vulnerability to natural forces like wind and surface water runoff. • Operational phase: Vehicles accessing the PCD may generate dust, intensive dust suppression on gravel roads should be implemented and haul vehicles should follow designated pathways. • Decommissioning phase: Dust will be generated by the operation of vehicles and machinery used for the rehabilitation and decommissioning activities. Un-vegetated soils in rehabilitated areas will be vulnerable to wind and water erosion, reducing their potential through loss of minerals. Re-Vegetation should be implemented immediately after rehabilitation.	Air Quality	Air Quality Monitoring: Dust Monitoring on the site using dust buckets and PM10 monitoring, regular internal monitoring by SHEQ. Fallout dust should be tested for particulates at an accredited laboratory	Air Quality Specialist who will submit the reports to the Environmental Manager. The SHEQ team will also conduct regular internal checks	Sampling and Monitoring Frequency: Dust samples will be taken on a monthly basis. Reporting: Monthly: Internal reporting. External submissions: Audit Report and Data report submitted to DMRE as part of the EMP performance assessment conducted every two years.
• Construction phase: Construction vehicles will generate noise, and the noise generated may pose a nuisance to nearby farm owners and surrounding land occupants. Decommissioning phase: Noise will be generated by the operation of vehicles and machinery used for the rehabilitation and decommissioning activities	Noise	Noise monitoring at the plant and baseline noise measurement of the whole area as all activities within the mining area will add to the cumulative increase in noise levels	SHEQ and a specialist who will assess the nose levels at the plant will submit their report to the Environmental Manager	Monitoring: Noise sampling will be conducted on a monthly basis. Reporting: The results and findings should be documented in monthly reports and be utilised for the annual internal EMP PA and the external EMP performance assessment conducted every two year.
SOURCE ACTIVITY: Construction, operation and decommissioning of the plant and sewage treatment plant				

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Rivers may be impacted on through the spillages and leakages of hydrocarbon materials from construction vehicles and machinery. The pans on site may be impacted on by the construction of the water treatment plant and sewage plant through contaminated water seepage. • Operational phase: Rivers may be polluted should any polluted water spillages occur from the water treatment plant or sewage treatment plant if the channels and berms designed to transport and contain dirty water to the water treatment plant are compromised. The bunding at the sewage treatment plant should be designed to contain 110% capacity should there be a malfunction the plant • Decommissioning phase: Should surface water runoff come into contact with oil and hydrocarbon spillages resulting from decommissioning activities and is not contained contamination rivers will occur.	Surface water	Surface water monitoring: Swartkoppies farm – located on non-perennial up streams Swartkoppies – located on non-perennial down streams West 59 and Gemsbok farms- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial downstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site	Hydrology and Ecology specialists should be appointed to undertake the monitoring and result of such monitoring should be submitted to the Environmental Manager	Monitoring & Sampling Frequency: During the operational and construction phase, Sample localities of the biomonitoring points on the Mulati River and the Selati River will be sampled on a monthly basis. Sampling for Aquatic Ecological Monitoring of the pans not destroyed during the mining will occur twice per annum Reporting: Monthly: Internal data report. Quarterly: Data report to authorities (DWS). Annually: Annual status report.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Oils and hydrocarbon spillages from construction vehicles or machinery (should they occur) will affect the groundwater quality. The removal of vegetation and increased soil compaction will impact on infiltration rates and increased runoff. • Operational phase: Groundwater may become contaminated in cases where polluted surface water is not remediated immediately and left to pond for extended periods of time • Decommissioning phase: Oil and hydrocarbon Spillages from vehicles and machinery utilised during decommissioning may contaminate groundwater through seepage	Groundwater	Ground water monitoring: Sampling of boreholes (quality and quantity).	A groundwater specialist should be appointed to conduct the water monitoring as well as use of an accredited lab. Result of the water monitoring will be submitted to the Environmental Manager	Monitoring & Sampling Frequency: Quarterly sampling of boreholes. Additional specifications will be added as conditions from the WULA. In terms the water balance all flows to the plant, all water uses and discharges will be measured on an ongoing basis and the total calculated on the last day of every month. The water quality at the water plant will also be tested prior to release into the environment Reporting: Quarterly: Ground water monitoring report to Kusile from the appointed specialist and Kusile will report the findings to DWS. Annually: An annual report with evaluated results from the cumulative monitoring result on groundwater quality and quantity should be submitted.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Vegetation clearance, dust generation from the construction activities and increased vehicle movement on gravel roads will affect the indigenous vegetation on site. Cleared areas will be prone to alien invasive species • Operational phase: Increased alien invasive species growth in the disturbed surface areas and via transportation of seeds on clothing etc. if not appropriately managed or prevented alien invasive vegetation may thrive in the cleared areas impacting on the natural vegetation. • Decommissioning phase: Rehabilitated if not properly managed and monitored areas will be vulnerable to the establishment of alien invasive vegetation	Flora	Prior to construction a tree removal permit will be required. Flora monitoring: monitoring and visual inspections of undisturbed indigenous flora, vegetation cover on disturbed areas, growth of invasive species and weeds, Endangered & Red data species.	Ecology specialist to be appointed to undertake the permit application. An alien invasive management plan should be designed and implemented by the ECO and Environmental Manager	Monitoring Frequency: ECO to monitor tree removal including illegal tree removal by employees, vegetation clearances and alien invasive plant growth. This should be done monthly during construction and after that quarterly or on a seasonal basis. Reporting: Annually: Internal reporting on the status of the vegetation cover. Internal audits to be included in the EMP performance assessment conducted every two years.
• Construction phase: The increase in human activities, site clearances, construction vehicles and machinery will destroy habitats as well as cause displacement of animals due. Poaching is also highly likely due to the increase in population of construction workers and job seekers. It is expected that most of the game animals will be relocated from the site. • Operational phase: The increased human activity, noise generation and lighting from the plants may frighten the fauna on the farms. Poaching is also highly likely dude to the increase in population of workers and job seekers. • Decommissioning phase: Human activities including poaching and decommissioning activities on site may frighten fauna.	Fauna	Animal monitoring: Field assessments to investigate displacement of fauna, a record of accidental animal killings and poaching, investigate and record unauthorised snares and traps. Relocation, catch and release for injured fauna as well as relocation to conservation areas and habitat reconstruction where possible	Suitably qualified personnel must assist in the relocation of the game animals to areas of conservation. The ECO and employees will be responsible for the safety of fauna on the site and reporting will be done to the Environmental Manager	Monitoring: an Ecologist should be appointed to conduct regular surveys throughout the life of mine. Daily siting's must be recorded on an incident basis. Reporting: Annually: The ecology survey report will be used in conjunction with the faunal reports and submitted to management. Internal audits and incident reports should be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Soil stripped to clear land for the construction of the plant will be removed and stockpiled. • Operational phase: Soils may be affected should any polluted water spillages occur sewage treatment plant or through breaches in channels to transport dirty water to the plant. Hydrocarbon spillages from operational vehicles may contaminate the soils if not removed timeously. • Decommissioning phase: Soils on surface may be contaminated through polluted water spillages from the pilot water treatment plant. Rehabilitation activities may result in some erosion of, compaction of and / or degradation of soils, if not managed	Soil	Soil monitoring: Visual inspection of soils on roads, topsoil stockpiles and construction sites. Revegetation of topsoil's should be done immediately to avoid loses due to wind and water erosion as the area is prone to flash floods.	ECO and Environmental Manager	Monitoring: Inspections of soil for spillages, signs of erosion and alien invasive and weed encroachment should be conducted on a weekly basis. Reporting: Monthly: SHEQ Inspection reports. Internal audits to be included in the EMP performance assessment conducted every two years.
• Construction phase: Construction activities including movement of vehicles on gravel roads, site clearances will expose surfaces through the removal of vegetation will increase the rates of erosion, dust generation and vulnerability to natural forces like wind and surface water runoff. • Operational phase: Vehicles movement well as the operation of the plant will generate dust. Intensive dust suppression on gravel roads should be implemented and haul vehicles should follow designated pathways. • Decommissioning phase: Dust will be generated by the operation of vehicles and machinery used for the rehabilitation and decommissioning activities. Un-vegetated soils in rehabilitated areas will be vulnerable to wind and water erosion, reducing their potential through loss of minerals. Re-Vegetation should be implemented immediately after rehabilitation.	Air Quality	Air Quality Monitoring: Dust Monitoring on the site using dust buckets and PM10 monitoring, regular internal monitoring by SHEQ. Fallout dust should be tested for particulates at an accredited laboratory	Air Quality Specialist who will submit the reports to the Environmental Manager. The SHEQ team will also conduct regular internal checks	Sampling and Monitoring Frequency: Dust samples will be taken on a monthly basis. Reporting: Monthly: Internal reporting. External submissions: Audit Report and Data report submitted to DMRE as part of the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Construction phase: Construction vehicles will generate noise, and the noise generated may pose a nuisance to nearby farm owners and surrounding land occupants. • Operational phase: Noise levels will increase at the water and waste plants and due to operation of the plants which will increase ambient noise levels in the area. The increase in noise levels at the plant can pose health issues for the employees working at the plants should proper PPE not be used and the increase in noise level may pose as a nuisance to surrounding community and residents. • Decommissioning phase: Noise will be generated by the operation of vehicles and machinery used for the rehabilitation and decommissioning activities	Noise	Noise monitoring at the plant and baseline noise measurement of the whole area as all activities within the mining area will add to the cumulative increase in noise levels	SHEQ and a specialist who will assess the nose levels at the plant will submit their report to the Environmental Manager	Monitoring: Noise sampling will be conducted on a monthly basis. Reporting: The results and findings should be documented in monthly reports and be utilised for the annual internal EMP PA and the EMP performance assessment conducted every two years.
Source Activity: Concurrent Rehabilitation				
• Concurrent rehabilitation: Potential Spillages, leakages of hydrocarbon materials from construction vehicles and machinery, loosening of soil and dust will increase sedimentation into rivers.	Surface water	Surface water monitoring: Swartkoppies farm – located on non-perennial up streams Swartkoppies – located on non-perennial down streams West 59 and Gemsbok farms- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-perennial upstream of the site Longford Beaty farm(Pit 4)- located non-	Hydrology and Ecology specialists should be appointed to undertake the monitoring and result of such monitoring should be submitted to the Environmental Manager	Monitoring & Sampling Frequency: During the operational and construction phase, the Mulati River and the Selati River will be sampled on a monthly basis. Sampling for Aquatic Ecological Monitoring of the pans not destroyed during the mining will occur twice per annum Reporting: Monthly: Internal data report. Quarterly: Data report to authorities (DWS). Annually: Annual status report.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
		perennial downstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site Longford Beaty farm(Pit 5)- located non-perennial upstream of the site		
• Concurrent Rehabilitation: The backfilling of the open cast areas will see an increase in the potential for seepage contamination into the groundwater regime and possible decanting in the pits. This may impact on / add to the development of a pollution plume. Oil spillages and hydrocarbon spillages from vehicles and machinery used to backfill the pits may contaminate groundwater through seepage.	Groundwater	Ground water monitoring: Sampling of boreholes (quality and quantity). There are a number of boreholes on and off the site	A groundwater specialist should be appointed to conduct the water monitoring as well as use of an accredited lab. Result of the water monitoring will be submitted to the Environmental Manager	Monitoring & Sampling Frequency: Quarterly sampling of boreholes. Additional specifications will be added as conditions from the WULA Reporting: Quarterly: Ground water monitoring report to Kusile from the appointed specialist and Kusile will report the findings to DWS. Annually: An annual report with evaluated results from the cumulative monitoring result on groundwater quality and quantity should be submitted.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
• Concurrent rehabilitation: The mined areas in the open cast pits may be susceptible to alien invasive species growth. Dust generated by the rehabilitation activities (vehicle and machinery movement), as well as the backfilling and placing of soils in rehabilitated areas may impact vegetation growth by settling on plants.	Flora	Prior to construction a tree removal permit will be required. Flora monitoring: monitoring and visual inspections of undisturbed indigenous flora, vegetation cover on disturbed areas, growth of invasive species and weeds, Endangered & Red data species.	Ecology specialist to be appointed to undertake the revegetation process. An alien invasive management plan should be designed and implemented by the ECO and Environmental Manager	Monitoring Frequency: ECO to monitor tree removal including illegal tree removal by employees, vegetation clearances and alien invasive plant growth. This should be done monthly during construction and after that quarterly or on a seasonal basis. Reporting: Annually: Internal reporting on the status of the vegetation cover. Internal audits to be included in the EMP performance assessment conducted every two years.
• Concurrent rehabilitation: Increase in vehicle movement and human activity during the backfilling and rehabilitation activities on site may frighten and displace fauna. Animals can also fall into voids not fully rehabilitated. The areas should be properly demarcated and temporary fencing might be implemented.	Fauna	Animal monitoring: Field assessments to investigate displacement of fauna, a record of accidental animal killings and poaching, investigate and record unauthorised snares and traps. Relocation, catch and release for injured fauna as well as relocation to conservation areas and habitat reconstruction where possible	Suitably qualified personnel must assist in the relocation of the game animals to areas of conservation. The ECO and employees will be responsible for the safety of fauna on the site and reporting will be done to the Environmental Manager	Monitoring: an Ecologist should be appointed to conduct regular surveys throughout the life of mine. Daily siting's must be recorded on an incident basis. Reporting: Annually: The ecology survey report will be used in conjunction with the faunal reports and submitted to management. Internal audits and incident reports should be included in the EMP performance assessment conducted every two years.

IMPACTS REQUIRING MONITORING PROGRAMMES	ASPECT TO BE AFFECTED	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY
Concurrent rehabilitation: Hydrocarbon leakages from vehicles and machinery used to backfill the open cast pits may contaminate the surrounding soils. Soil in the vicinity of the backfilled open cast areas can be compacted by rehabilitation activities.	Soil	Soil monitoring: Visual inspection of soils on roads, topsoil stockpiles and construction sites. Revegetation of topsoil's should be done immediately to avoid loses due to wind and water erosion as the area is prone to flash floods.	ECO and Environmental Manager	Monitoring: Success of indigenous revegetation and alien invasive and weed encroachment should be conducted on a weekly basis. Reporting: Monthly: SHEQ Inspection reports. Internal audits to be included in the EMP performance assessment conducted every two years.
Concurrent Rehabilitation: Dust will be generated by the operation of vehicles and machinery used for the rehabilitation and backfilling of the pits. Soil in the backfilled areas under rehabilitation will be vulnerable to erosions due the elements (wind). The soil is placed in rehabilitation areas will need to be re-vegetated immediately.	Air Quality	Air Quality Monitoring: Dust Monitoring on the site using dust buckets and PM10 monitoring, regular internal monitoring by SHEQ. Fallout dust should be tested for particulates at an accredited laboratory	Air Quality Specialist who will submit the reports to the Environmental Manager. The SHEQ team will also conduct regular internal checks	Sampling and Monitoring Frequency: Dust samples will be taken on a monthly basis. Reporting: Monthly: Internal reporting. External submissions: Audit Report and Data report submitted to DMRE as part of the EMP performance assessment conducted every two year
Decommissioning phase: Noise from vehicles and machinery operations used for the rehabilitation and decommissioning activities.	Noise	Noise monitoring	Environmental Manager	Monitoring: Noise sampling will be conducted on a monthly basis. Reporting: The results and findings should be documented in monthly reports and be utilised for the annual internal EMP PA and the EMP performance assessment conducted every two years.

2.9.1 Quantitative Monitoring Parameters

2.9.1.1 Surface Water Monitoring

The major objective of surface water monitoring is to ensure that mining activities have a limited adverse effect on surface water resources. The broad objective of the surface water monitoring system is to ensure that water management systems perform according to specifications, to act as a pollution early warning system, to check compliance with legal requirements and for reporting purposes.

Table 56: Surface water flow monitoring

Aspect	Point	Frequency	Coordinates
Surface water flows	Slimes to TSF	Monthly	S 23° 11' 53.17" E 30° 48' 2"
	Process water to the processing plant	Monthly	S 23° 11' 51.90" E 30° 48' 5.84"
	Sewage return flows	Monthly	S 23° 11' 54.18" E 30° 47' 58.92"

Table 57: Surface water quality monitoring

Points	Frequency	Coordinates	Variables
Swartkoppies farm – located on non-perennial up streams	Monthly	S 23° 11' 5.32" E 30°46'26.94"	• pH • Electric Conductivity (EC) • Turbidity • Total Hardness • Total Suspended Solids • Total Dissolved Solid (TDS) • Calcium (Ca)
Swartkoppies – located on non-perennial down streams	Monthly	S 23° 11' 36.16" E 30°45'52.67"	
West 59 and Gemsbok farms- located non-perennial upstream of the site	Monthly	S 23° 12' 23.80" E 30° 48' 51.6"	
Longford Beaty farm(Pit 4)- located non-perennial upstream of the site	Monthly	S 23° 16' 7.19" E 30° 50' 14"	

Longford Beaty farm(Pit 4)- located non-perennial downstream of the site	Monthly	S 23° 15’ 4.73” E 30° 51’ 33.36”	• Magnesium (Mg) • Sodium (Na) • Potassium (K) • Iron (Fe) • Lead (Pb) • Manganese (Mn) • Chloride (Cℓ) • Sulphate (SO_4) • Fluoride (F) • Nitrate (NO_3) • Ammonia (NH_3) • Phosphate (PO_4) • Chemical Oxygen Demand (COD) • Total Cyanide • WAD Cyanide • Total Uranium • Bicarbonate (HCO_3) • Carbonate (CO_3) • E.Coli • Faecal Coliforms
Longford Beaty farm(Pit 5)- located non-perennial upstream of the site	Monthly	S 23° 16’ 55.62” E 30° 48” 23.34”	
Longford Beaty farm(Pit 5)- located non-perennial upstream of the site	Monthly	S 23° 17’6.84” E 30° 49” 29.73”	

Laboratory Analysis

Analysis must be done by a lab that has SANS (South African Bureau of Standards) accreditation in terms of the Standard Act, 1982 (Act No. 30 of 1982) for all the required water quality determinants.

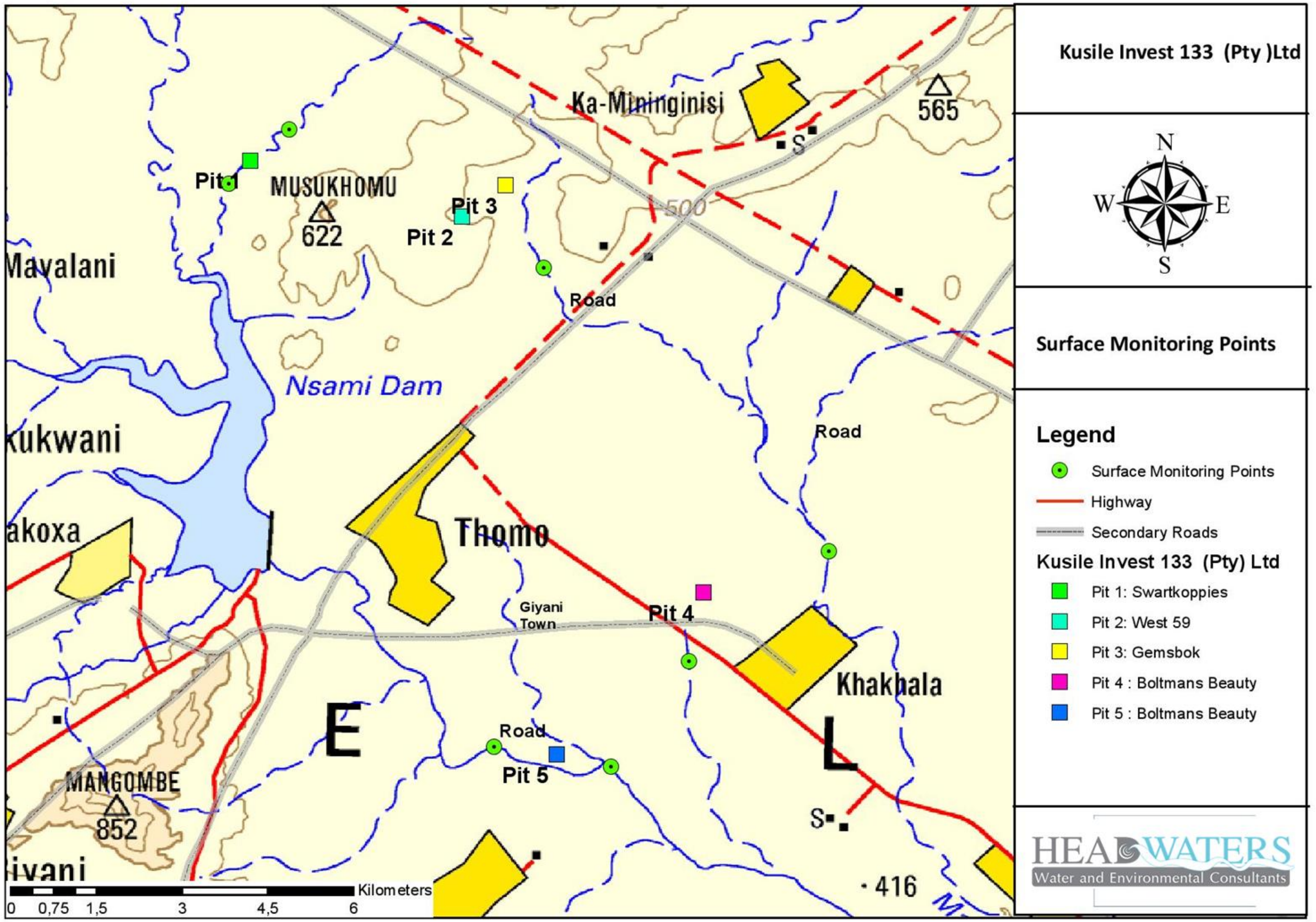


Figure 106: Surface Water Monitoring Locality Map

2.9.1.2 *Groundwater Monitoring*

Giyani Gold Mine will develop and implement groundwater monitoring programme for the proposed Giyani Gold Mine. The main objective of the programme is to ensure that mining activities have limited adverse effect on local groundwater resources. The following key aspects will form part of the monitoring programme:

- Generation of information regarding groundwater quality and quantity
- Determination and quantification of impacts as a result of the mining activities on site
- Managing the impacts on groundwater at the mine. These include development of monitoring response protocol. This protocol will describe the procedures to be followed in the event pertinent issues arise on groundwater resources;
- Prevention of potential pollution on groundwater resources;
- Updating and verification of the groundwater flow model;
- Reviewing the mine water balance model and compilation of annual compliance reports.

Table 58: Groundwater Monitoring

Aspect	Points	Frequency
Groundwater quality	Boreholes	Quarterly
Groundwater levels	Boreholes	Monthly

The tabulation below sets out groundwater quality and levels monitoring points.

Table 59: **Groundwater Monitoring Points**

Borehole Name/Number	Coordinates
GYBH - 01	S 23° 11’ 17.61” E 30° 45’ 58.97”
GYBH - 02	S 23° 11’ 17.36” E 30° 46’ 2.79”
GYBH - 03	S 23° 11’ 32.23” E 30° 48’ 32.37”
GYBH - 04	S 23° 15’ 25.08” E 30° 50’ 21.11”
GYBH - 05	S 23° 16’ 57.87” E 30° 49’ 3.74”

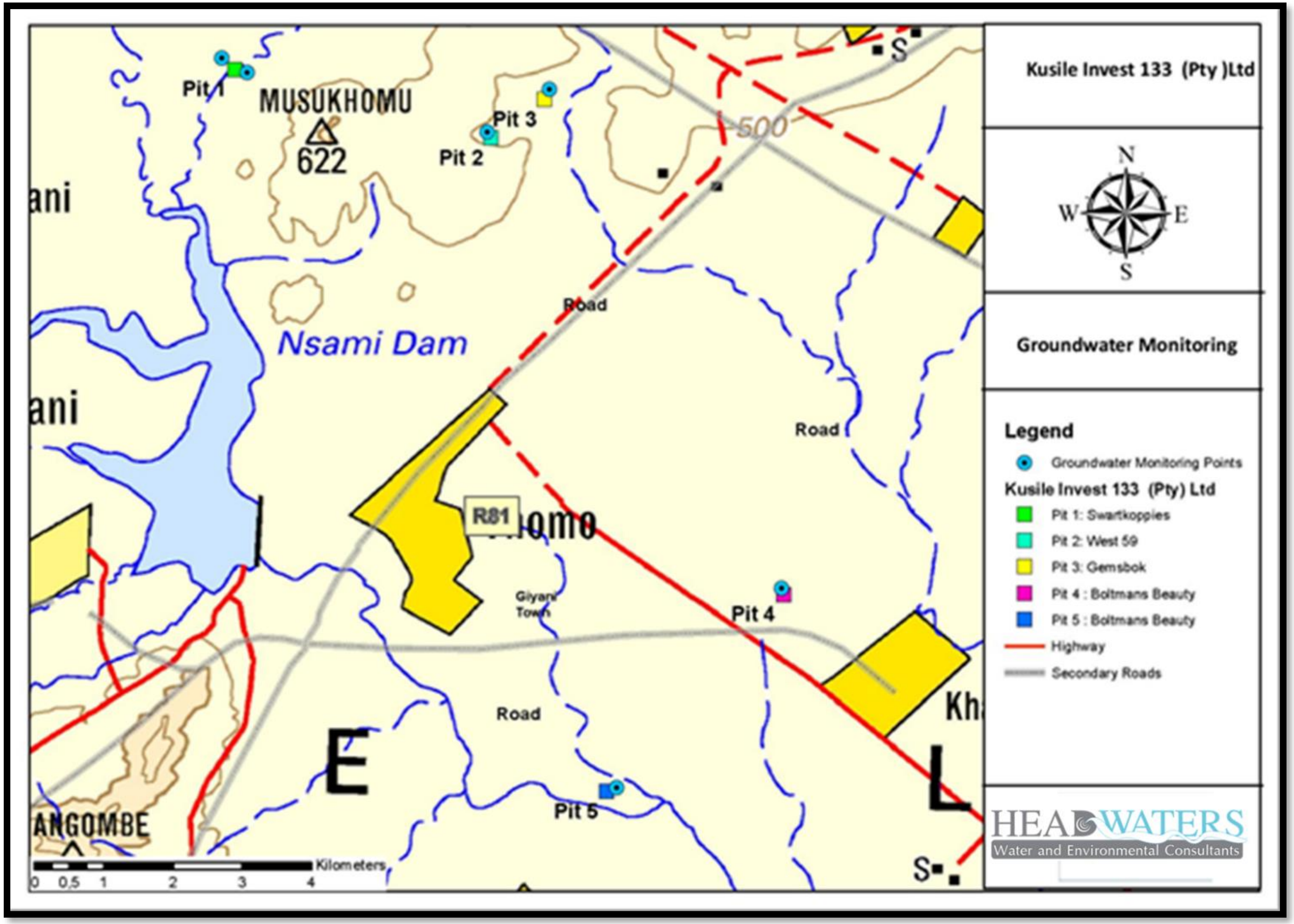


Figure 107: Groundwater Monitoring Locality Map

According to the Geohydrological assessment undertaken by J7 Royal Group (2021), additional recommended groundwater monitoring boreholes must be drilled on site. The groundwater quality monitoring determinants are listed. Furthermore, baseline groundwater monitoring must be undertaken for a period not less than one year prior to commencement with mining or related activities.

Table 60: Groundwater Quality Monitoring

Water Quality Parameters	Unit of Measurements	Timeframes for Measurement		
		Monthly	Quarterly	Annually
pH	pH units		✓	
Electric Conductivity (EC)	mS/m		✓	
Turbidity	NTU		✓	
Total Dissolved Solid (TDS)	mg/l		✓	
Total Suspended Solid (TSS)	mg/l		✓	
Total Hardness	mg/l		✓	
Calcium (Ca)	mg/l		✓	
Magnesium (Mg)	mg/l		✓	
Sodium (Na)	mg/l		✓	
Potassium (K)	mg/l		✓	
Iron (Fe)	mg/l		✓	
Lead (Pb)	mg/l		✓	
Manganese (Mn)	mg/l		✓	
Chlorine (Cℓ)	mg/l		✓	
Sulphate (SO_4)	mg/l		✓	
Fluoride (F)	mg/l		✓	
Nitrate (NO_3)	mg/l		✓	

Water Quality Parameters	Unit of Measurements	Timeframes for Measurement		
		Monthly	Quarterly	Annually
Phosphate (PO_4)	mg/l		✓	
Carbonate (CO_3)	mg/l		✓	
Chemical Oxygen Demand (COD)	mg/l		✓	
Total Cyanide	mg/l		✓	
WAD Cyanide	mg/l		✓	
Total Uranium	µg/l		✓	
Bicarbonate (HCO_3)	mg/l		✓	
E.Coli	cfu/100 ml		✓	
Faecal Coliforms	cfu/100 ml		✓	

Monitoring procedure

The mine water monitoring programme will be developed and implemented using the following guidelines and standards:

- DWS, 2007. Best Practice Guideline for Protection of Water Resources in the South African Mining Industry. G3: Water Monitoring Systems;
- DWS, 2003. Quality of Domestic Water Supplies, Volume 2: Sampling Guide;
- ISO 5667-3: 2006 Part 1: Guidance on the design of sampling programmes and sampling techniques;
- ISO 5667-3: 2003 Part 3: Guidance on sample preservation and sample handling;
- ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams;
- ISO 5667-11: 2006 Part 11: Guidance on sampling of groundwater.

Laboratory Analysis

Analysis must be done by a lab that has SANAS (South African National Accreditation System) accreditation for all the required water quality determinants.

2.9.1.2.1 Audit and report on relevance of action plan

Audits of the water and waste management programmes will be undertaken in line with licence requirements. They will include assessments of performance in relation to the action plan, whilst reviewing the relevance of all provisions or commitments in the plan. Best practice assessments in relation to regulations in GN704 will also be undertaken.

2.9.1.3 Air Quality

2.9.1.3.1 GRAVIMETRICAL DUST FALLOUT – (MILLIGRAM/SQUARE METER/DAY) OR (MG/M2/DAY) (MONTHLY 8 SAMPLES)

Site layout for sampling points must be carried out according to the eight main compass directions; the site layout and equipment placement must be done in accordance with the ASTM standard, D 1739 – 2010, thereafter relevant sampling reference numbers will be allocated to the receptors accordingly. At each gravimetric dust fallout gauge/receptor point there is a stand built according to specification containing the dust sample collection bucket. Samples will be collected after a 1 month running period (+-30 day's exposure). After sample collection, the samples are taken to a SANAS accredited laboratory as required. A visual site investigation is done where after correlations are drawn and findings are identified and reported on.

Dust buckets of a standard size and shape are prepared and set up at locations related to the eight main compass points on the borders of the property so that dust can settle in them for periods of 30+/-2 days. The dust buckets are then sealed and replaced with new empty ones and send away to the SANAS accredited laboratory for analysis. The masses of the water-soluble and –insoluble components of the material collected are then determined and results are reported as mg/m²/day. This methodology is described according to South African National Standards 1929:2004 and the American Society for Testing and Materials (ASTM) Designation: The results for this method of testing are obtained by gravimetrical weighing. The apparatus required include open top buckets/containers not less than 150 mm in diameter with a height not less than twice its diameter. The buckets must be placed on a stand at a height of 2 +/-0.2 m above the ground.

2.9.1.3.2 PARTICULATE MATTER PM10 (MONTHLY 8 SAMPLES)

It is recommended that the client should establish a fine particulate monitoring programme, which should include one particulate instrument to monitor PM10 and preferably PM2.5 specifically at the problem areas shown by the passive sampling campaign at the residential areas. Handheld sampling instruments not only allows for sampling in the 8 main wind directions, but also on-site sampling down-wind of potential dust sources to quantify and determine impacts that need to be managed. It is advised to conduct this sampling on a monthly basis but also when the need arise during periods of elevated dust concentrations being emanated from the site.

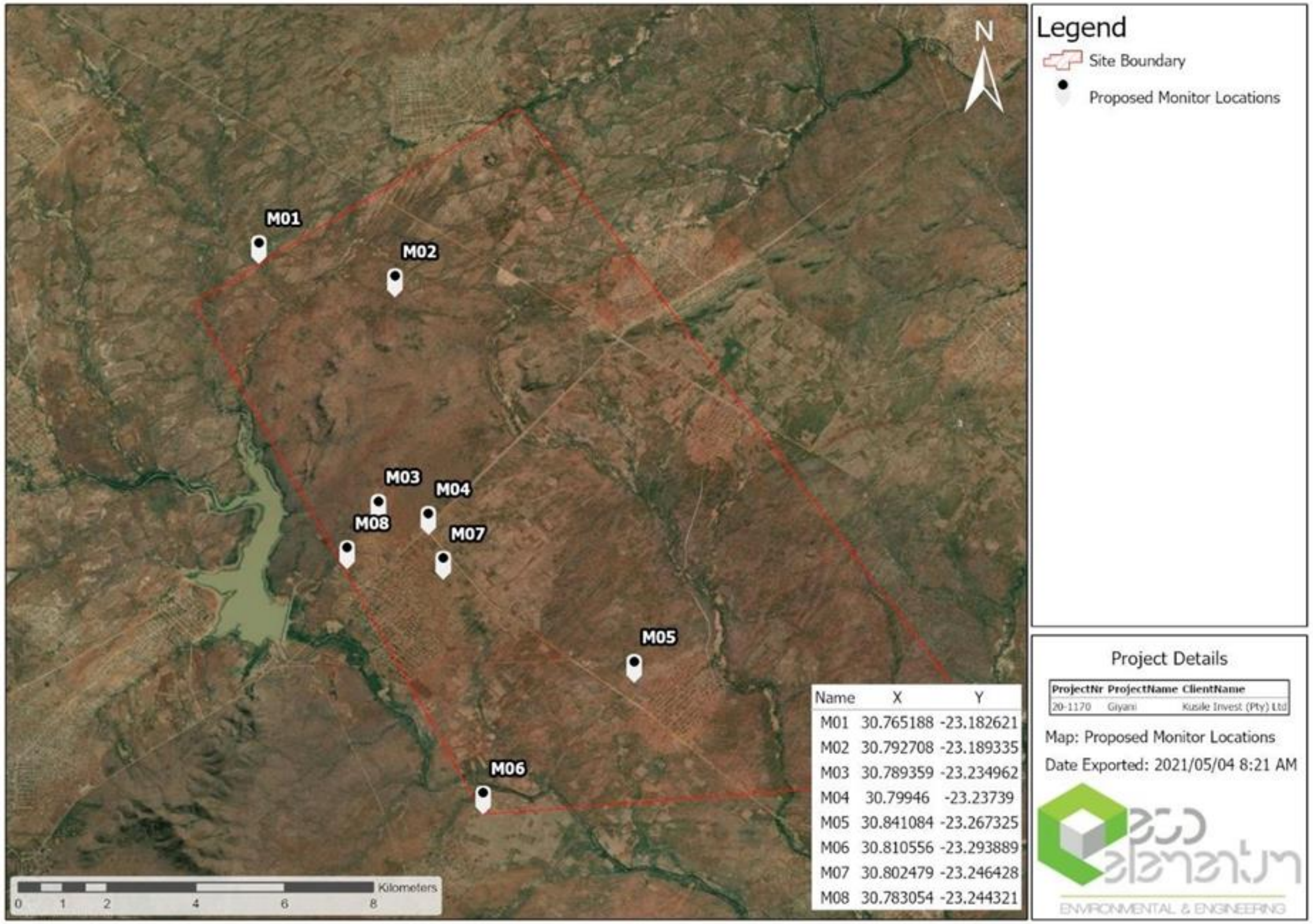


Figure 108: Air Quality Monitoring locations

2.10 Indicate the frequency of the submission of the performance assessment report.

Kusile Invest 133's environmental management team will conduct internal performance assessments of the EMP on an annual basis and they will appoint an independent suitably qualified specialist to conduct an EMP performance assessment and compile a report, every two years.

The performance assessment will include the following:

- A desktop assessment of the approved EMP.
- Site inspection.
- Evaluation of management measures.
- Information gathering and collation.
- Verification of compliance status.
- Compilation of a performance assessment report.

The performance assessment report will include:

- Method and procedure statement.
- Qualifications and experience of audit team.
- Percentage compliance with EMP measures.
- Motivation of findings.
- Recommendations pertaining to major non-compliances noted.

The performance assessment report will provide:

- Provision of appropriate information to the management of the mine.
- The establishment and updating of the financial provision.
- Recommendations for the initiation of corrective action plans.

The independently compiled performance assessment report will be reviewed by the environment management team and once finalised a copy of the report will be submitted to the DMRE and proof of submission should be received. The environmental manager should ensure corrective actions are implemented in order to rectify areas of non- compliance.

2.11 Environmental Awareness Plan

1st) Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work.

This section includes an environmental awareness plan for the mine. The plan describes how employees will be informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and the training required for general environmental awareness and the dealing of emergency situations and remediation measures for such emergencies.

All contractors that conduct work on behalf of Kusile Invest 133 are bound by the content of the EMP and a contractual condition to this effect will be included in all such contracts entered into by the mine. If contractors are used, the responsibility for ensuring compliance with the EMP will remain with Kusile Invest.

The purpose of the environmental awareness plan is to ensure that all personnel and management understand the general environmental requirements of the site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities which can have a significant impact on the environment and ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience. The environmental awareness plan should enable Kusile Invest 133 to achieve the objectives of the environmental policy.

- On a regular basis, all aspects of the operation will be checked against the prescripts of the EMP and its supporting procedures and, if established that certain of the aspects are not addressed or impacts on the environment are not mitigated properly, it will be immediately communicated to the operational team by management.
- Should the mitigation measure not be in line with the prescripts, amendments will be made and the employees will be made aware of the changes and encouraged to adhere to such.
- All site personnel will be inducted at the site and will be taken through the EMP and other relevant legal requirements to familiarize them with same.
- Simplified signalling will be placed on site to sensitize the workers of the legal requirements attached to this EMP.

Table 61: Awareness Training Plan

Item	Aspects / Content	Timeframes
Induction & refresher training (Basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site;	EMP document Legal requirements First Aid Safety	Before commencement of works Upon return to work after more than a 3-week vacation
Task briefings and weekly review meetings.	Allocation of tasks with environmental-related themes Review of achievement and implementation	Daily and weekly
SHE induction (Safety, Health and Environment)	personnel who will be on site for more than five days must undergo the SHE induction training; and	Before commencement of works Upon return to work after more than a 3-week vacation
Signage awareness (aide memoire)	Manual / List of signs	Monthly

Item	Aspects / Content	Timeframes
	Newsletters	
specific environmental awareness training	Procedures and standards: Training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc.).	Once every quarter

To achieve the objectives of the environmental awareness plan the general contents of the training plans are as follows:

- Module 1 – Basic training plan applicable to all personnel entering the site:
    - short (15min) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts; and
    - Individuals to sign off with site security on completion in order to gain access to the site.
- Module 2 – General training plan applicable to all personnel at the site for longer than five days:
    - general understanding of the environmental setting of the mine (e.g. fauna and flora);
    - Understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, noise, etc);
    - indicate potential site specific environmental aspects and their impacts;
    - Kusile Invest 133's environmental management strategy;
    - identifying poor environmental management and stopping work which presents significant risks;
    - reporting incidents;
    - examples of poor environmental management and environmental incidents; and
    - Procedures for emergency response and cleaning up minor leaks and spills.
- Module 3 – Specific training plan:
    - Environmental setting of the workplace (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities and industries, etc);
    - specific environmental aspects such as:
        - ✓ spillage of hydrocarbons at workshops;
        - ✓ spillage of explosive liquids in the open pits;
        - ✓ poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling large amounts of waste;
        - ✓ poor housekeeping practices;
        - ✓ poor working practices (e.g. not carrying out oil changes in designated bunded areas);
        - ✓ excessive noise generation and unnecessary use of hooters; and
        - ✓ Protection of heritage resources (including palaeontological resources).

- impact of environmental aspects, for example:
    - ✓ hydrocarbon contamination resulting in loss of resource (soil, water) to downstream users;
    - ✓ groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects; and
    - ✓ Dust impacts on local communities (nuisance and health implications).
- Kusile Invest 133's duty of care (specifically with respect to waste management); and purpose and function of Kusile Invest 133's environmental management system

Individuals required to complete Module 3 (Specific training module) will need to complete Modules 1 and 2 first. On completion of the Module 3, individuals will be subject to a short test (written or verbal) to ensure the level of competence has been achieved. Individuals who fail the test will be allowed to re-sit the test after further training by the training department. The actual contents of the training modules will be developed based on a training needs analysis.

Key personnel will be required to undergo formal, external environmental management training (e.g. how to operate the environmental management system, waste management and legal compliance).
In addition to the above Kusile Invest 133 will:

- conduct refresher training/presentations on environmental issues for mine employees (permanent and contractors) at regular intervals.
- Promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine. These topics will be changed monthly, and will be reviewed annually by the Environmental Manager to ensure relevance; and
- Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbour Week, World Environment Day and National Water Week.

2.11.1 Environmental awareness training

This training will be provided to the various sections of the mine including processors and operators during the safety toolbox sessions and hence it will be on-going. The training programme and subsequently the training will be updated as and when necessary to keep everyone informed of latest developments.

Table 62:Training Targets & Standards

Type of training	Training Targets	Standards

• Induction programme – legal aspects • Specific environmental aspects: waste, water, hydrocarbons, dust, material handling rehabilitation • Competency • Health and safety – dust management, emergency preparedness, first aid COVID 19 protocols. • Fauna and flora protection	• Management • Supervisors • Operators • Visitors • Contractors	• Records • Standard operating procedures • Signage • Personal Protection Equipment

2.11.1.1 The Induction Programme

The mine will develop an induction programme that will include the EAP. Various topics will be covered during the training sessions/induction e.g. Environmental housekeeping, Dust minimisation, etc. It will be the responsibility of the mine manager to ensure that all employees are inducted and this will include *inter alia*;

- Administrative requirements and procedures including environmental emergency procedure
- Resource conservation and environmental reporting including other general environmental issues that require awareness raising

All new employees joining the mine after operations have started shall undergo induction as well. The induction programme (including the environmental section) shall be updated on an annual basis to ensure that trends are followed and latest developments e.g. policies are also included.

2.11.1.2 Description of solutions to risks

The above-mentioned management measures will be adhered to and all necessary action will be taken to immediately implement corrective action when an incident occurs. Each activity and associated risks are linked in aspect and impact register to relevant procedure to prevent incidental impacts. Compliance to these procedures should be seen as the duty of all staff and contractors. Management will monitor that these procedures are adhered to and the EMP is implemented.

Table 63: Risk and Mitigation

Risk	Cause	Controls / Mitigation Action
Veld fires	Smoking and discarding matches in the field	Maintain visual awareness of surroundings; smoking only in designated areas; keep a fire extinguisher on site
Property damage	Reckless driving; driving over vegetation;	Follow designated routes / pathways Awareness training Proper signage
Damage to field equipment and tools	Vehicles getting stuck in loose sands Improper use of equipment	Follow designated routes / pathways Awareness training Proper signage Training on use of equipment
Stock / agricultural produce theft/ illegal hunting by employees	Trespassing of employees onto agricultural land	Constant supervision of staff Staff will not live on site Also prevent access by public

Soil erosion on site	Trampling by employees and vehicles	Personnel will be restricted to 25m radius of borehole, away from gullies, wetlands or river banks
Damage to vegetation	Off-road driving to camp and borehole sites	Where off road driving is necessary, attempts will be made to follow existing fence lines and animal track at every possible opportunity
Flooding	Times of high runoff Climate change	Establish camp on high ground away from river or water courses
Illnesses	Contaminated water	Supply to safe drinking water

2.11.1.3 Training Records

Environmental awareness and training records will be kept at a safe and accessible place within the mine.

2.11.1.4 Review of Awareness and Training Material

The contents of all awareness and training material shall be reviewed and updated at least once a year**.**

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

Health, safety, environmental and community issues were considered as part of the development of the emergency and remediation procedures:

- Health issues: Water pollution, creation of dust, gases, chemicals, radiation and noise, as well any ergonomic problems associated with the equipment used at the mine.
- Safety issues: Revealing hazards, which may be present in the equipment, operating procedures, and work systems which could result in physical harm to mine employees or visitors.
- Environmental issues: Identification of all hazardous substances, hydrocarbon spillage and contamination, uncontrolled discharge, pollution, soil erosion, poor water management, overloading of trucks, poor maintenance of equipment and infrastructure.
- Community issues: Any adverse effects that site operations may have on the surrounding communities e.g. water quality, water quantity, noise, dust, erosion, etc**.**

The objectives of the Emergency Procedures are:

- To ensure emergency preparedness and a quick response in case of any emergency (the emergency and remediation procedures should be followed immediately after an unforeseen event to minimise any additional damage to the environment).
- To provide guidance to Kusile Invest 133's operations in order to meet the minimum legal framework to ensure effective environmental management whereby environmental impacts are minimised and environmental obligations are met.
- To co-ordinate the activities of all persons that have duties to perform during the emergency.
- To ensure compliance with all applicable environmental legislation.

2.11.2.1 Legal Requirements

The legal requirements represent the relevant legislation applicable, at the time of compilation of this EMPR, to the formation of this emergency procedures plan. The content of this section of the EMPR will be reviewed in terms of its applicability to legislation and changes thereto, every two (2) years.

Table 64: Applicable legislation to the emergency preparedness and response procedure.

Act / Regulation	Descripti
NEMA (1998) as amended	Section 28 of the NEMA (1998) describes the duty of care of individuals and the remediation of environmental damages.
NEMA (1998)	Section 30 of the NEMA (1998) stipulates specific requirements with regards to the control of emergency incidents.
NWA (1998)	Section 19 of the NWA (1998) describes pollution prevention and remedying the effects of pollution.
NWA (1998)	Section 20 of the NWA (1998) stipulates specific requirements with regards to the control of emergency incidents.
GN 704 under the NWA (1998)	Regulation 2 of GN 704 describes the actions to be undertaken in the event of an environmental incident.
Part IV of the MPRDA (2004) under the MPRDA (2002)	Part IV of the MPRDR (2004) details the pollution control and waste management Regulations under the MPRDA (2002) in terms of: • Pollution control and waste management. • Fire prevention. • Soil pollution and erosion control.

Possible Environmental Emergency Situations

An environmental incident can be defined as an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to employees, the public or potentially serious pollution which may impact on the environment.

Possible emergency scenarios that may occur at Kusile's Giyani Gold Project and lead to evacuation include but not limited to the following:

- Uncontrolled / controlled fires.
- Damage or threat of damage to buildings, plant and / or workshops.
- Any threat to property or persons.
- Natural disaster (including heavy rainfall event, COVID-19).
- Evacuation drills.
- Bomb and bomb threat.
- Possible hazardous chemical spill (including hydrocarbons).
- Blasting incidents.

Any other occupational SHE hazards. Several possible occupational SHE hazards that may affect the environment that may occur at Kusile Invest 133's Granville Project have been identified and include, but are not limited to:

- Transport related spillage of carbonaceous materials.
- Slope instability / collapse of high walls.
- Contamination of drinking water.
- Failure of water and / or waste management infrastructure.
- Dusty conditions.
- Blockages of clean water diversion berms / trenches resulting in clean water entering the dirty
- Water management areas, or not allowed to freely leave the mine boundary area.

Response to, and Managing of, Environmental Emergency Situations Environmental emergency situations, such as those mentioned above, are effectively managed through:

- Annual safety induction training.
- On-going safety representative training.
- Annual revision of safety induction programme.
- Annual revision of standard operating procedures.
- Immediate reporting of emergency situations.
- Immediate action to contain or minimise the effects of an incident.
- Quality of remediation actions.
- Accurate reporting and data management.

To avoid injury in the event of an emergency Kusile will establish an exit orderly procedure which all personnel will be inducted on.

2.11.2.2 Response to Emergencies

Kusile standard operating procedure should describe the procedure to be followed by the emergency coordinator, in response to an emergency, and is detailed below:

Diary of events:

- ➢ Note down all calls made / received, as well as the time;
- ➢ Note down all instructions given and time; and
- ➢ Note sequence of events.

The nature and extent of every emergency may differ and minor adaptations, changes, or additions will have to be made, as the situation dictates.

Response to identified possible emergencies has been described below.

- Fire and emergency:
  - ➢ Establish risk to life and property;
  - ➢ Receive and evaluate the situation;

- Decide on the shutdown of the building and order the evacuation of key operational personnel;
- Keep in constant contact with the environmental Co-ordinator in order to establish mechanical and electrical shutdown procedures;
- Advise and maintain contact with management;
- Be responsible for notification to law enforcement agencies;
- Notify and direct the activities of emergency officials and teams;
- Maintain a status list showing each area of the plant, and record the current status of each area;
- Despatch support services as required;
- Where possible, arrange for a nominated company photographer to record photographs of the damage caused;
- Hand in diary of events; and
- When deemed safe, have employees resume their normal duties.

- Uncontrolled / Controlled fires

In the event of a fire (including veld-fires), the following procedure should be followed by personnel on site:

- Sound the emergency alarms - location of the emergency alarms should be included in the induction program;
- If it is a small non electrical fire, try to put it out by use water or the nearest fire extinguisher or water. If it is an electrical fire, turn of the power and use the nearest fire extinguisher;
- Advise and maintain contact with management;
- Identify injuries and / or a risk to life / property (Risk Assessment should form part of safety induction);
- Contact emergency services, if required;
- In the case of a fire inside a building close all windows and office doors; and
- Exit the building quickly via the nearest exit point to the nearest assembly point.

- Bomb and bomb threat:
  - Stop all machines;
  - Open all doors and windows;
  - Proceed to designated assembly point;
  - Do not run;
  - Do not shout;
  - Do not push past other personnel;
  - Report to the designated assembly point; and
  - Do not return to the office / plant until instructed by the emergency co-ordinator.

- Natural disaster / heavy rainfall event (larger than the design capacity of related infrastructure)

The following preparations may be put in place in case of heavy rainfall events:

- Sound the emergency alarms;
- Advise and maintain contact with management;
- Identify injuries and / or a risk to life / property;
- Contact emergency services, if required;
- Inform downstream / downslope users;
- Proceed to the nearest assembly point; and
- Should an emergency develop at the pollution control dam, report the emergency to the DWS. A written report shall be provided to the DWS within 14 days (as per GN 704).

It is however important to note that should an emergency (spill from a PCD or PCD wall failure) occur, all contaminated water will remain within the dirty water management area and flow towards the opencast pit areas.

- Possible hazardous chemical spills.

The following procedure should be followed as an initial (immediate) response to any spill:

- Sound the emergency alarms;
- Advise and maintain contact with management;
- Identify injuries and / or a risk to life / property;
- Contact emergency services, if required;
- Identify areas likely to be affected by the spill;
- Evacuate the area; and
- Proceed to the nearest assembly point.

The following procedure must be followed by an appropriately trained and designated person to manage and remediate the spill as soon as such a person becomes available:

- Remove as much of the spill as possible;
- Prevent further movement of the spill;
- Utilise bioremediation agents and spill kits to remediate the area;
- Dispose of contaminated soils, in accordance with the EMP Amendment and other legislative requirements; and
- Never rinse any hydrocarbons, or any other chemicals that will contribute to pollution of resources, into a natural drainage systems.

- Blasting incidents.

The following procedure must be followed in case of a Blasting incident:

- Sound the emergency alarms;
- Advise and maintain contact with management;
- Identify injuries and / or a risk to life / property;
- Contact emergency services, if required; and

- Proceed to the nearest assembly point.

- Blockages of clean water management infrastructure

The following Procedure must be followed in the initial (immediate) response to the identified blockage:

- Advise and maintain contact with management;
- Identify a risk to life / property;
- Sound the emergency alarm, if required; and
- Proceed to the nearest assembly point, if required.

The following procedure should be followed by an appropriately trained and designated person to manage and remediate the blockage, as soon as such a person becomes available to assist:

- Identify the material causing the blockage;
- Remove as much of the blockage as possible; and
- Inspect clean and dirty water management infrastructure to ensure that there are no further blockages exist.

- Transport related spillage of carbonaceous materials

The following procedure should be followed as an initial (immediate) response to a transport related spillage of carbonaceous materials:

- Advise and maintain contact with management;
- Identify injuries and / or a risk to life / property;
- Contact emergency services, if required; and
- Proceed to the nearest assembly point, if required

The following procedure must be followed by an appropriately trained and designated person to manage and remediate the spill as soon as such a person becomes available:

- Prevent further movement of the spill;
- Remove and recover as much of the spill as possible;
- Dispose of contaminated soils, in accordance with the Amendment and other legislative requirements; and
- Never rinse any carbonaceous materials, or any other substances that will contribute to pollution of resources, into a water system.

- Slope instability / collapse of high walls

Procedure to be followed in the initial (immediate) response to the identified instability / collapse:

- Advise and maintain contact with management;
- Identify a risk to life / property;

- Sound the emergency alarm, if required; and
- Proceed to the nearest assembly point, if required.

Procedure to be followed by an appropriately trained and designated person to manage instability / collapse, as soon as such a person becomes available to assist (external specialist assistance may be required, depending on the nature of the incident):

  - Identify the instable area / collapsed area;
  - Prevent unauthorised access to this area; and
  - Initiate the appropriate techniques to make this area safe.

- Contamination of drinking water

Procedure to be followed in the initial (immediate) response to contamination of drinking water at the site:

- Advise and maintain contact with management;
- Identify injuries and / or a risk to life; and
- Contact emergency services, if required.

Procedure to be followed by an appropriately trained and designated person to manage the contamination of drinking water:

  - Advise employees not to utilise the contaminated drinking water;
  - Ensure notices are placed at each location where such contaminated water might be available;
  - Supply an additional source of clean drinking water;
  - Initiate an emergency sampling and analysis of the contaminated drinking water;
  - Inform employees of water sampling results; and
  - Advise employees when it is safe to continue to utilise the drinking water.

- Failure of water and / or waste management infrastructure

Procedure to be followed in the event that water and / waste management infrastructure fails:

- Sound the emergency alarms;
- Advise and maintain contact with management;
- Identify injuries and / or a risk to life / property;
- Contact emergency services, if required;
- Inform downstream / downslope users;
- Proceed to the nearest assembly point; and
- Should an emergency develop at a PCD, report the emergency to the DWS. A written report shall be provided to the DWS within 14 days (as per GN 704).

- Dusty conditions

Procedure to be followed in severely dusty conditions:

- Advise and maintain contact with management;
- Sound the emergency alarms;
- Identify injuries and / or a risk to life / property;
- Contact emergency services, if required; and
- Management to advise employees on the safety of continuing with duties.

- Damage or any threat to property or persons

The mine may, in the case of damage or any threat to property or persons:

- Sound the emergency alarms;
- Advise and maintain contact with management;
- Identify injuries and / or a risk to life / property;
- Contact emergency services, if required;
- Leave the building quickly via the nearest exit point; and
- Proceed to the nearest assembly point.

2.11.2.3 Communication of Environmental Emergencies

- **Internal Communication of Environmental Emergencies**

Each emergency incident will be reported immediately, clearly, objectively and has its own route of communication. The general communication systems to be implemented:

- Two-way radios that are situated at the workshop and all supervisor vehicles.
- Telephones, as well as cell phones that are situated in designated areas or on persons.

- **External Communication of Environmental Emergencies**

Information regarding environmental emergencies at Giyani Gold Mine, should they occur, is disclosed to various external bodies, and includes:

- Relevant authorities (e.g. DMRE, DWS, LEDET)
- I&AP's:
- Landowners and adjacent landowners.
- Registered I&AP's (if applicable).
- Stakeholders.

- **Communication of environmental emergencies with relevant authorities**

In the event of an environmental emergency, the appropriate procedures will be followed. The SHE manager will report to the mine management and identify whether or not the DMRE (in the event of serious injury or fatality) or the DWS (in the event of serious spillages or pollution) are required to be notified. The SHE manager will then conduct an in-situ investigation to gather all the relevant detail and an enquiry will be held to compile an accident / incident report, which will be provided to the DMRE / DWS if required.

- **Communication of environmental emergencies with I&AP's**

As mentioned above, information regarding environmental emergency situations is made available to I&AP's should the environmental emergency have an impact on the said I&AP's. This information made available includes, but not limited to:

- The type of environmental emergency (e.g. serious spillages).
- The duration of the environmental emergency.
- Impacts related to the environmental emergency.
- Anticipated duration of the impacts.
- Remediation actions to be undertaken.
- Anticipated remediation completion

2.12 Specific information required by the Competent Authority (Among others, confirm that the financial provision will be reviewed annually).

- No additional / specific information has been requested by the Competent Authority to date.
- It is noted that the Financial Provision will be updated on an Annual Basis

2.13 Undertaking

The EAP herewith confirms

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

c) the inclusion of comments and inputs from stakeholders and I&AP's ; ☒

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

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

-END-