Appendix F
Draft Environmental Management Programme

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Draft Environmental Management Programme (EMPr) for Kareerand Tailings Storage Facility Expansion Project

Version – Draft for Public Review

August 2020

Mine Waste Solutions (Pty) Ltd
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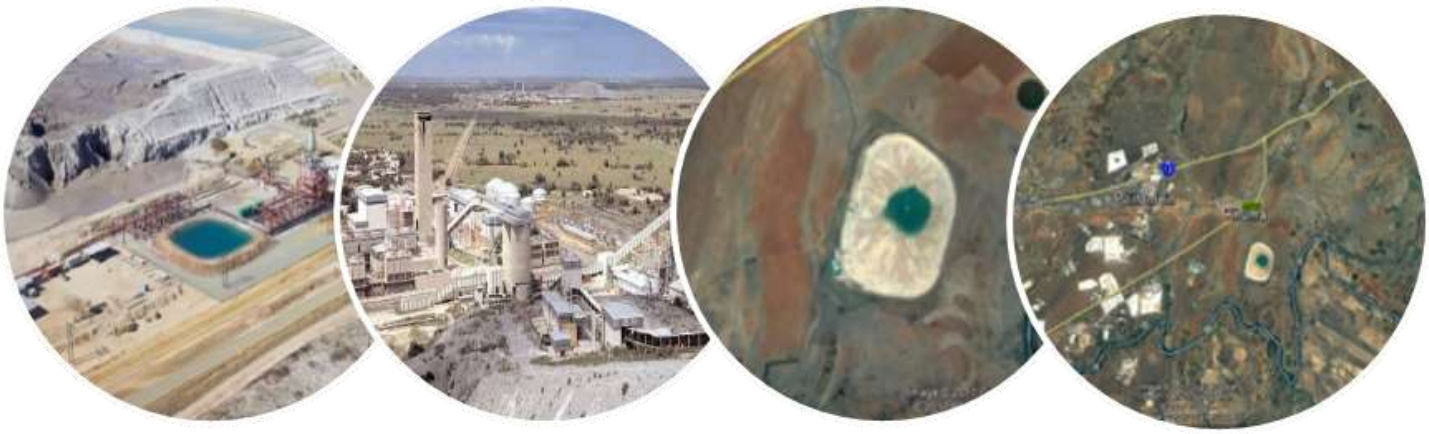

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Revision 0

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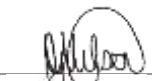
Author	Georgina Wilson		August 2020
Reviewer	Sharon Meyer		August 2020
MWS Project Manager	Conrad Freese		August 2020
Environmental Director	Adam Gunn		August 2020

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ABBREVIATIONS

AGA	AngloGold Ashanti
AIS	Alien Invasive Species
AIMP	Alien Invasive Management Plan
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CBMA	Critical Biodiversity Management Area
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EO	Environmental Officer
ESA	Ecological Support Area
DEA	Department of Environmental Affairs
DM	District Municipality
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
GCS	GCS Water & Environmental Consultants (Pty) Ltd
IA&P	Interested and Affected Parties
IPCC	International Panel on Climate Change
km	Kilometres
LM	Local Municipality
LoM	Life of Mine
MPRDA	Mineral and Petroleum Resources Development Act
MWS	Mine Waste Solutions
NEMA	National Environmental Management Act

NEM:BA	National Environmental Management: Biodiversity Act
NEM:WA	National Environmental Management: Waste Act
NDCR	National Dust Control Regulations
NHRA	National Heritage Resources Act
NNR	National Nuclear Regulator
NWA	National Water Act
PM	Particulate Matter
RWD	Return Water Dam
SCC	Species of Conservation Concern
SPLUMA	Spatial Planning and Land Use Management Act
SWD	Storm Water Dam
TOPS	Threatened or Protected Species
TSF	Tailings Storage Facility
TSP	Total Particulate Matter
S&EIR	Scoping and Environmental Impact Reporting
WML	Waste Management Licence
WMP	Waste Management Plan

1 INTRODUCTION

1.1 Project Background

Mine Waste Solutions (MWS), also known as Chemwes (Pty) Ltd (Chemwes), has been in business since 1964, and conducts its operations over a large area of land to the east of Klerksdorp, within the area of jurisdiction of the City of Matlosana and JB Marks Local Municipalities (LM), which fall within the Dr Kenneth Kaunda District Municipality (DM) in the North-West Province. The MWS Operations are located primarily to the south of the N12, east of the town of Stilfontein. The closest town is Khuma, located about 3 km northwest of the facility, and other nearby towns include Stilfontein (10 km from facility) and Klerksdorp (19 km from facility).

The operations at Mine Waste Solutions entail the reclamation and processing of gold mine tailings that were previously deposited on tailings storage facilities (TSFs) in order to extract gold and uranium. High pressure water cannons are used to slurry the tailings on the Source TSFs, then slurry is pumped by a number of pump stations and pipelines to the MWS Processing Plant and the residues from the Processing Plants are pumped to the current Kareerand TSF. Once a source TSF has been completely recovered, it is cleaned-up and rehabilitated.

The current Kareerand TSF was designed with an operating life of 14 years, taking the facility to 2025, and total design capacity of 352 million tonnes. Subsequent to commissioning of the TSF, MWS was acquired by AngloGold Ashanti and the tailings production target has increased by an additional 485 million tonnes, which will require operations to continue until 2042. The additional tailings to be reclaimed therefore require the expansion of the design life of the current Kareerand TSF.

This project entails the expansion of the current Kareerand TSF to accommodate the increased tailings and final design capacity, along with supporting infrastructure such as additional pump stations and pipelines from old source TSFs. The Kareerand TSF expansion is proposed on the western edge of the current facility, and the final height of the combined facility (both expansion and current) will be 122 m. The expansion footprint will add 380 ha to the current Kareerand TSF and approximately 93 additional ha will be cleared for supporting infrastructure.

GCS Water and Environmental Consultants (Pty) Ltd (GCS) has been appointed as the Environmental Assessment Practitioner (EAP) to undertake the required Scoping and Environmental Impact Reporting (S&EIR) process.

1.2 Purpose of the EMPr

Section 23 of the NEMA Environmental Impact Assessment (EIA) Regulations of 2014, as amended (GN R982 in GG 38282, December 2014), requires that the Applicant submit an Environmental Management Programme (EMPr), which has been subject to a public participation process, to the Competent Authority.

Furthermore, the EMPr is an important environmental management tool, developed in line with best practices under NEMA and other environmental legislation, and informed by the EAP's professional experience as well as input from various specialists. The EMPr provides management guidance for activities undertaken at the development site. If correctly followed, the EMPr ensures that any adverse environmental impacts which could result from the development are adequately managed and mitigated for.

The EMPr outlines all environmental management and monitoring actions required throughout the project lifecycle. The EMPr is legally binding and any person who contravenes the provisions herein is liable for imprisonment or a fine. This document should be viewed as "live" and thus, should be updated as and when necessary. The purpose of this document is therefore to guide environmental management throughout the various lifecycle phases of the proposed development.

The objectives of the EMPr are as follows:

- Ensure compliance with the relevant environmental legislation and conditions of EA;
- Ensure that development activities are appropriately managed;
- Verify environmental performance through information on impacts as they occur;
- Respond to changes or unforeseen events; and
- Provide feedback on the continual improvement in environmental performance.

1.3 Content of the EMPr

According to Appendix 4 of the NEMA EIA Regulations of 2014, as amended (GN R982 in GG 38282, December 2014), the EMPr for a project must include certain information. Table 1.1 below describes how this report meets those requirements.

Table 1.1: Contents of this Environmental Management Programme (EMPr)

REQUIREMENT	SECTION IN THIS REPORT
Details of— (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.4

A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 2.3
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 should be avoided, including buffers;	Section 2.2
A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including— (i) Planning and design; (ii) Pre-construction activities; (iii) Construction activities; (iv) Rehabilitation of the environment after construction and where applicable post closure; and (v) Where relevant, operation activities;	Section 4
A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated above will be achieved, and must, where applicable, include actions to— (i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) Comply with any prescribed environmental management standards or practices; (iii) Comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) Comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Section 4
The method of monitoring the implementation of the impact management actions;	Section 3
The frequency of monitoring the implementation of the impact management actions;	Section 3
An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 3
The time periods within which the impact management actions must be implemented;	Section 4
The mechanism for monitoring compliance with the impact management actions;	Section 3

A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 3
An environmental awareness plan describing the manner in which— (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 4
Any specific information that may be required by the competent authority.	NA

1.4 Details of Applicant and EAP

The details of the applicant are provided in **Table 1.2.**

Table 1.2: Name and address of applicant.

ITEM	DETAILS
Company Name	Mine Waste Solutions (Pty) Ltd
Company Representative	Rollet Masakona
Contact Persons	Nicky Strydom/ John van Wyk
Telephone No.	011 637 6691/ 018 478 6519
Facsimile No.	NA
E-mail Address	nstrydom@anglogoldashanti.com jvwyk@anglogoldashanti.com
Postal Address	Mine Waste Solutions, 3 Stilfontein Road, Stilfontein, 2551

GCS Water and Environment (Pty) Ltd (GCS) have been appointed as the independent Environmental Assessment Practitioners (EAP) to undertake the environmental processes required to obtain approval for the proposed listed activities, as requested by the relevant competent authorities. The contact details of the EAP are provided in **Table 1.3** and the EAP's CV is attached as **Appendix A**.

Table 1.3: Name and address of Environmental Assessment Practitioner (EAP).

ITEM	DETAILS
Company Name	GCS Water and Environment (Pty) Ltd
Company Representative	Sharon Meyer

ITEM	DETAILS
Telephone No.	+27 (0)11 803 5726
Facsimile No.	+27 (0)11 803 5745
E-mail Address	info@gcs-sa.biz
Postal Address	PO Box 2597, Rivonia, 2128

Sharon Meyer has over 20 years of experience as a Principal Environmental Assessment Practitioner. The work experience that she has ranges from small urban development projects to large projects with multi-disciplinary team input on projects of national importance. She has worked on various projects and her focus has been on mining, industrial waste management and power generation projects. Sharon has focused on innovation in industrial waste management in the mining and electricity generation sectors. Sharon's skills and experience include project management, strategic environmental assessment, resource management and allocation, technical review, business development, impact assessment, conservation planning, sustainability reporting and auditing and environmental management and mitigation.

Recent key project experience as Project Manager and Principal Environmental Assessment Practitioner includes Medupi Power Station Flue Gas Desulphurisation Retrofit ESIA, Waste Management Licence and WULA (South Africa), Chitima Integrated Coal Power Project ESIA and RAP (Tete Province, Mozambique), Okatji Marble Mine Monitoring, Water Use Licensing and Authorisation (Namibia), Kendal Power Station Continuous Ash Disposal Facility ESIA, Waste Management Licence and WULA (South Africa), Richards Bay Combined Cycle Power Project EIA (South Africa), Koffiefontein Diamond Mine New Tailings Facility EIA (South Africa) and Kangra Water Liability Assessment and Reporting for Closure (South Africa).

1.5 Assumptions and Limitations

This EMPr has been drafted with the acknowledgment of the following assumptions and limitations:

- The mitigation measures recommended in this EMPr document are based on the risks/impacts identified by specialists and outlined in the Environmental Impact Report (EIR). These impacts were identified according to the activities described and the receiving environment investigated by the specialists. Should the development expand to include additional activities not covered in the S&EIR process, the risks will have to be reassessed and mitigation measures updated accordingly.
- This EMPr takes into account mitigation measures described in the previous EMPr (2009, GCS) and applicable mitigation measures have been brought forward into this report.

1.6 Legal Requirements

The EMPr has been developed using knowledge of relevant South African legislation as well as best practice guidelines. The Applicant is legally required to adhere to the laws laid out below, throughout the life-cycle of the project. Error! Reference source not found. below lists the r elevant legislation and guidelines applicable to the development and operation of the Kareerand TSF Expansion.

Table 1.4: Applicable legislation and best practice guidelines used to develop this EMPr and to be considered by the Applicant.

LEGISLATION/ GUIDELINES	APPLICABILITY
The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	The Constitution is the supreme act to which all other acts must speak to and sets out the rights for every citizen of South Africa and aims to address past social injustices. With respect to the environment, Section 24 of the constitution states that: "Everyone has the right: a) To an environment that is not harmful to their health or well-being; 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 justifiable economic and social development".

LEGISLATION/ GUIDELINES	APPLICABILITY
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	Framework law giving effect to the constitutional environmental right. Provides the framework for regulatory tools in respect of environmental impacts. Section 24 of NEMA regulates environmental authorisations. Section 24P of NEMA sets out the requirements for financial provision for remediation of environmental damage, Section 24Q refers to the monitoring and performance assessments required for those holding an environmental authorization. Section 24S establishes that residue stockpiles and deposits should be managed according to NEM:WA. Section 28(1) 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, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment". *MWS will be responsible for the rehabilitation of the Kareerand Tailings Storage Facility and the expansion thereof, in accordance with the NEMA Regulations. MWS will be responsible for the Duty of Care of the affected receiving environment during the construction, operation, decommissioning and closure phases of the project.*
National Environmental Management: Waste Act, 2008 (Act No 59 of 2008) (NEM:WA)	Regulates inter alia the duty of care, management, transport and disposal of waste including mining waste such as residue deposits and residue stockpiles. Furthermore, this Act regulates the rehabilitation of contaminated land and waste disposal facilities including mining waste facilities. Section 16(1) of the NEM:WA provides that: "A holder of waste must, within the holder's power, take all reasonable measures to – a) avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated; b) reduce, re-use, recycle and recover waste; c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner; d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts; e) prevent any employee or any person under his or her supervision from contravening this Act; and f) prevent the waste from being used for an unauthorised purpose." The NEM:WA also provides for a licensing regime specific to waste management activities. Category A activities require a BA process to be undertaken, whilst Category B activities require a S&EIR process to be undertaken. *This project requires a Waste Management Licence.*

LEGISLATION/ GUIDELINES	APPLICABILITY
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA)	Regulates activities which may have a detrimental effect on ambient air quality including certain processes and dust generating activities such as tailings deposition. *However, an Air Emissions Licence is not required.*
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA)	Regulates the protection of biodiversity and the management of invasive species, including the use of alien and invasive species on mining sites. Section 73 speaks to duty of care with respect to listed invasive species and states that "A person authorised by permit in terms of section 71(1) to carry out a restricted activity involving a specimen of a listed invasive species must take all the required steps to prevent or minimise harm to biodiversity". *A permit will only be required should there be a direct impact to a conservation area or protected species.*
Conservation of Agricultural Resources Act 43 of 1983 (CARA)	Regulates the eradication of weeds and invader plants, including those occurring on development sites.
National Water Act, 1998 (Act No. 36 of 1998) (NWA)	Regulates the protection of the water resources and the use of water, including on inter alia mining areas. Furthermore, the Act contains provisions relevant to mine closure with regard to water resource protection form pollution and environmental degradation. Section 19(1) states that "An owner of land, a person in control of land or a person who occupies or uses the land on which – a) any activity or process is or was performed or undertaken; or b) any other situation exists, which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring." *A Water Use Licence is being applied for under a separate process.*
The National Heritage Resources Act, (Act No. 25 of 1999) (NHRA)	Section 34(1) of NHRA states that "No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority." *A Heritage Licence will be required if the project disturbs any heritage structures/resources.*
Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA)	The aim of SPLUMA is to provide a uniform system of spatial planning and land use management throughout the country. SPLUMA places emphases on the fundamental role municipal planning and municipalities have on effective spatial planning and development. In 2012, a judgement handed down by the Constitutional Court found that mining constitutes a land use and can only be conducted lawfully if the said activity corresponds with the purpose for which land has been zoned in terms of the application Town Planning/Land Use Management Scheme (the "Scheme").

LEGISLATION/ GUIDELINES	APPLICABILITY
	Based on the above use is primarily governed by the applicable land use or zoning scheme and land may not be used in contravention of such a scheme. Despite any issued environmental authorisation, mining and associated activities can only be executed on land with the appropriate zoning permitting such activities.
Guidelines	Handbook of Guidelines for Environmental Protection, Chamber of Mines (CEM (SA)) (Chamber of Mines of South Africa, 1979) • Volume 2/1979: The vegetation of residue deposits against water and wind erosion; Volume 7: Statutory requirements for environmental management.
	Mine Residue – Code of Practice (SABS 0286:1998).
	Framework for the Management of Contaminated Land, DEA 2010.
	Mining and Biodiversity Guideline – Mainstreaming biodiversity into the mining sector, 2013 (DEA, DMR, CM, South African Mining and Biodiversity Forum and South African National Biodiversity Institute, 2013).
	Water Conservation and Water Demand Management (WC/WDM) Guideline for the Mining Sector in South Africa, June 2011 (DWA, 2011).
	Guideline Document for the implementation of Regulations on use of water for Mining and related activities aimed at the protection of Water Resources, Second Edition, May 2000.
	Best Practice Guidelines for Water Resource Protection in the South African Mining Industry (Department of Water Affairs, 2006): Series A: Best Practice (BP) Guidelines • A2: Water Management for Mine Residue Deposits, July 2008; • A4: Pollution Control Dams, August 2007; Series G: BP Guidelines • G1: Storm Water Management, August 2006; • G2: Water and Salt Balances, August 2006; • G3: Water Monitoring Systems, July 2007; • G4: Impact Prediction, December 2008; • G5: Water Management Aspects for Mine Closure, December 2008; Series H: BP Guidelines • H1: Integrated Mine Water Management, December 2008; • H2: Pollution Prevention & Minimization of Impacts, July 2008; • H3: Water Reuse & Reclamation, June 2006; and

LEGISLATION/ GUIDELINES	APPLICABILITY
	• H4: Water Treatment, September 2007.

2 PROJECT DESCRIPTION

2.1 Site Description

The MWS reprocessing operations are located to the east of Klerksdorp, within the City of Matlosana and JB Marks Local Municipalities (LM), which fall within the Dr Kenneth Kaunda District Municipality (DM) in the North-West Province (see **Figure 2-1**). The MWS Operations are located primarily to the south of the N12, east of the town of Stilfontein. The closest town is Khuma, located about 3 km northwest of the facility, and other nearby towns include Stilfontein (10 km from facility) and Klerksdorp (19 km from facility).

The site is mostly surrounded by agricultural lands and other mining activities, with the Vaal River running to the south and east of the proposed Kareerand TSF expansion.

2.2 Site Sensitivity

2.2.1 Environmental Sensitivity

According to the Department of Agriculture, Forestry and Fishery land capability raster data layer of 2017 (DAFF, 2017), the areas that will be affected by the TSF expansion area as well as the RWDs, access roads and the solution trench have Moderate (Class 08) to Moderate-High (Class 09) land capability. Smaller areas with Low Moderate (Class 06 and Class 07) land capability is also considered to be present. Following the site survey, it was concluded that the area of the proposed TSF expansion, largely consists of land with Moderate-High (Class 09) land capability, with small pockets of land with Low-Very low (Class 04) and Class 07 (Low-Moderate) land capability in between.

The surface drainage of the area includes the Koekemoerspruit on the western boundary of the site, the Vaal River on the southern and eastern boundaries and the Droëspruit and Brakspruit on the north-eastern boundary. There is also a small, unnamed, non-perennial river that runs along the western side of the current TSF. The Vaal River is situated approximately 2 km to the south of the proposed TSF expansion. According to the natural contour elevations, surface runoff from this site will naturally flow towards the Vaal River.

The local geology comprises of four geological zones alternating with heterogeneous zones of inter layered rocks of both sedimentary and igneous origin.

The wind field is dominated by winds from the north-northeast. The strongest winds (>6 m/s) occur mostly from the north-west and north-north-west. Calm conditions occur approximately 0.4% of the time, with the average wind speed over the period of 3.06 m/s. Wind speeds increase during the day with a slight decrease in calm conditions (from 0.32% during the day to 0.48% during the night). Strong winds in excess of 6 m/s occur most frequently during spring months. Calm conditions occurred most frequently during winter months.

2.2.2 Ecological Sensitivity

The North West Biodiversity Sector Plan (NWBSP) indicates that some portions of the site correspond with a terrestrial Critical Biodiversity Area (CBA) 2 and some portions are listed as Ecological Support Areas (ESAs). The Kareerand TSF Expansion site is also located within an aquatic CBA 1 (majority of the study site) and CBA 2 (small section in the west). Nine wetlands were identified on site.

2.2.3 Socio-Economic Sensitivity

Baseline monitoring indicated current day-time noise levels at all seven monitoring locations are compliant with the SANS guideline rating levels, with the highest day-time LAeq (equivalent continuous sound pressure level) noise level recorded at KR03 (on site). The R502 road is currently the main source of noise identified at both KR05 (Khuma) and KR06 (Hostel), while very quiet conditions were noted at KR07 (house south of the current Kareerand TSF site). Night-time noise levels at all locations, other than KR05 (Khuma) and KR06 (Hostel) (not sampled), remained well below their respective guideline levels. The highest night-time LAeq noise level was recorded at KR01 (on-site).

There is a larger labour force (i.e. portion of the population aged 15-64 years that offer their services on the labour market) and higher unemployment rate in the City of Matlosana Local Municipality (LM) in comparison to JB Marks LM. Ward 2 of JB Marks LM, within which the project is located, shows lower unemployment rates than those experienced in the greater JB Marks LM and much lower rates than in the City of Matlosana in general or in the wards of the municipality directly adjacent to the project. Youth unemployment rate in the province is on average much higher than the general unemployment rate in 2011, the national youth unemployment rate was approximately 49%, whereas the North West provincial rate was 41%. Youth unemployment is especially high in the City of Matlosana LM (43%) while JB Marks LM is below the provincial rate at 32%.

2.2.4 Cultural Sensitivity

The heritage study indicated that the study area is located in surroundings characterised by a long and significant history. Forty-eight (48) archaeological and heritage sites were identified across the site.

The topography of the surrounding environment includes semi-mountainous terrain, while the proposed development itself lies in a greater valley of this terrain. The area surrounding the study site comprises mainly of farmland and remnants of old mine workings.

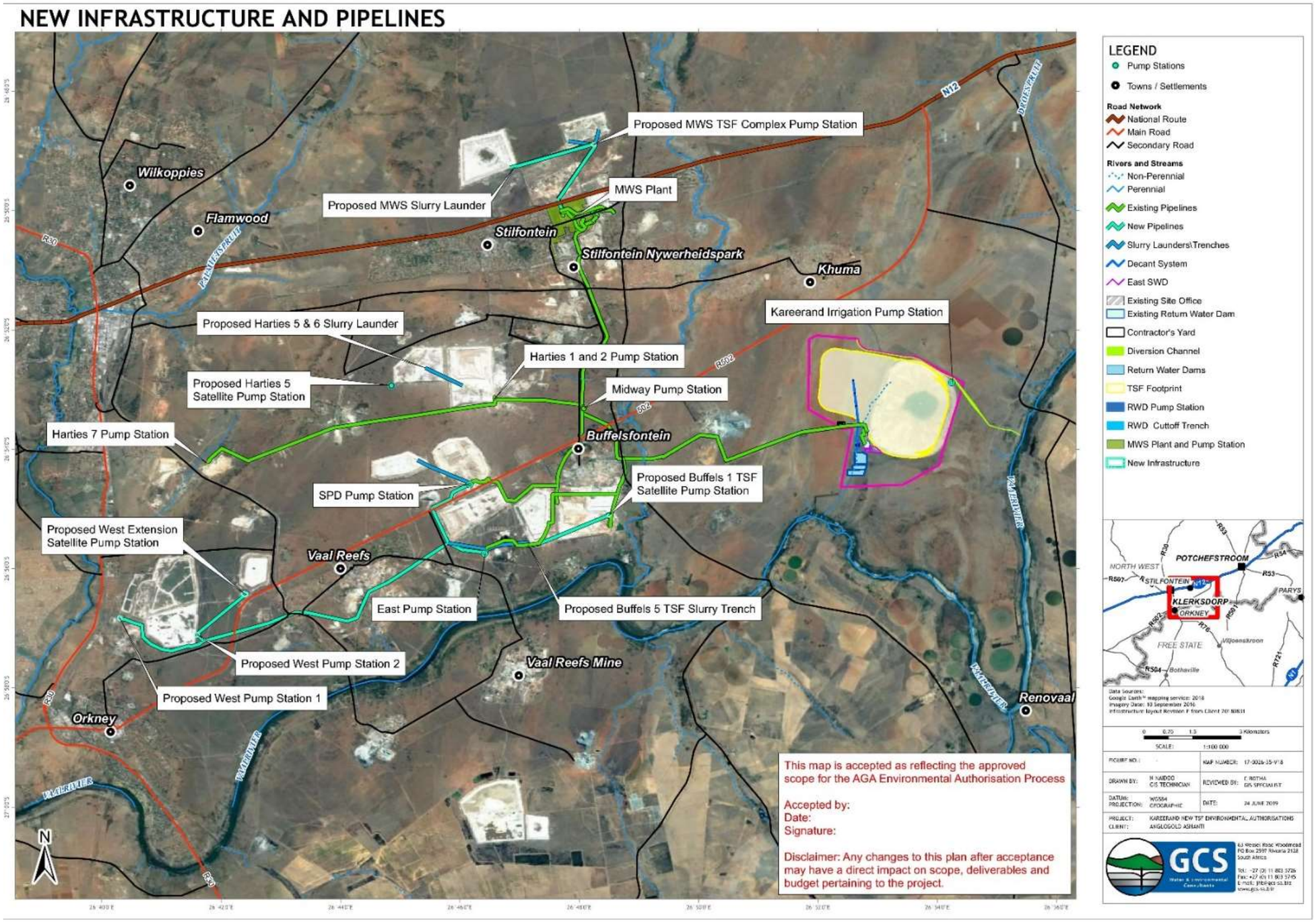

Figure 2-1: Location of project site.

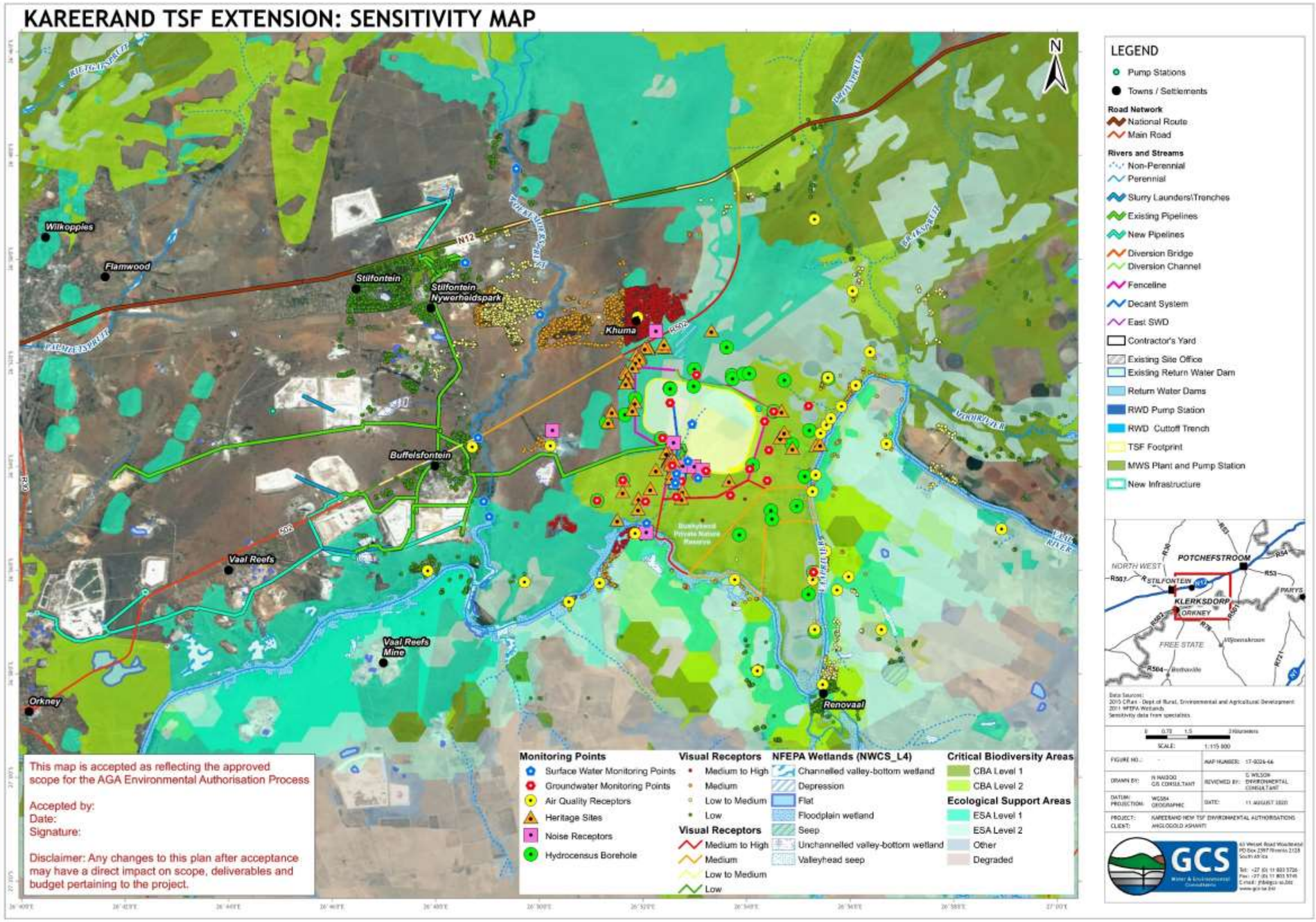

Figure 2-2: Environmental sensitivity of the receiving environment

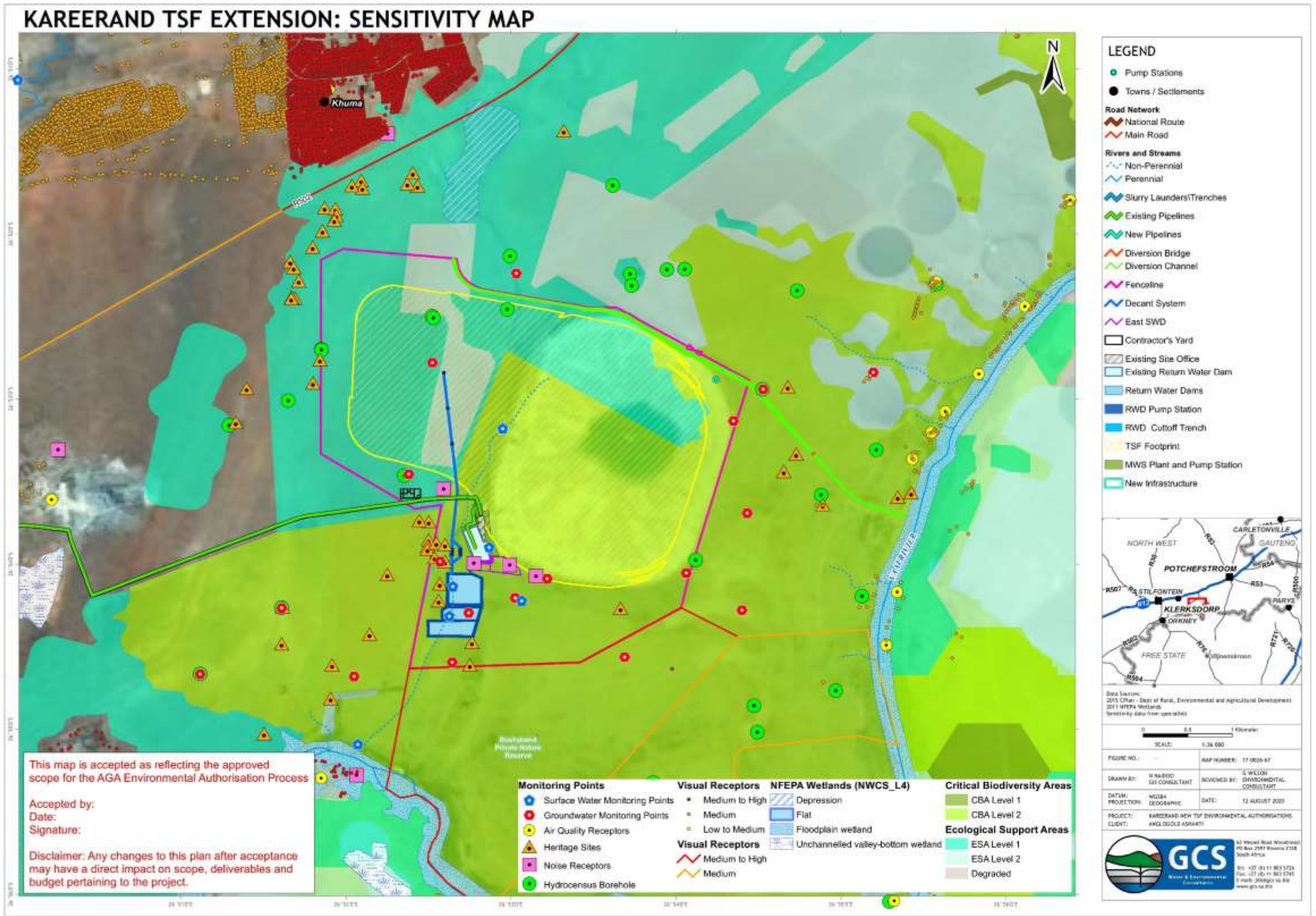

Figure 2-3: Environmental sensitivity of the receiving environment directly adjacent to the TSF expansion.

2.3 Activity Description

The proposed project will make use of the existing facilities as well as additional supporting infrastructure. A detailed breakdown of the expansion-related infrastructure which will be developed during the construction phase is included in **Table 2.1** below.

Table 2.1: Expansion-related infrastructure.

TSF Expansion	• TSF will be expanded by 380 ha; • The expanded footprint will be lined as per DWS requirements;
Fence	• 2.4 m high game fence with appropriate signage will be installed around the perimeter of the new TSF (length of new fence = 7 km); • This will tie into the existing fence and is the same type of fence;
Roads	• New main access road and perimeter access road; • 8 m wide gravel access road around perimeter of TSF, to the RWDs (return water dams), pump stations (western perimeter of TSF extension) and offices; • Total combined distance of new roads will be 11 km; • Access ramps provide access onto tailings dam;
Topsoil bund wall	• A bund wall will be constructed around the TSF, next to the access road; • The wall will be 6 m at highest point and 2 m at lowest point, crest width is 8 m; • The bund wall will also be used as access road on northern side of TSF;
Stormwater diversion channels	• A trench on the northern side of the TSF, 6 km in length, to divert clean storm water running from the north, towards the east in the direction of the Vaal River: o Trapezoidal in shape with side slopes of 1v:2h and base width of 9m. o Designed to accommodate the 1:50 year storm event. o Peak flow velocity will be 125 m^3/s during 1:50 year storm events. • A second unlined trench next to the RWD will divert clean storm water runoff away from the RWD and solution trench and prevent it from mixing with the dirty water;

	• Diversion channels will assist to minimise the water quality impact from the TSF;
Delivery pipeline	• Three steel 500 mm tailings delivery pipes located at the toe of the facility (western edge); 13.5 km in total length; • Will deliver slurry to the northern, western and southern side of the TSF extension;
Solution trench	• Trench lined with 100 mm thick mesh reinforced concrete; • Around northern, western and southern side of TSF; • Will convey decant water and storm water from the side slopes, filter discharge (seepage water) from the outer drains and surface runoff from the side slopes to the RWD;
Seepage and dirty water collector sump	• Constructed on northern side of TSF; • Will collect seepage water and dirty storm water running off the TSF walls from solution trench before it is pumped back to the north-western corner;
Catchment paddocks	• Constructed around perimeter of facility at final outer wall toe location; • Constructed using material from solution trench excavations and paddock basins- will be nominally compacted; • Paddocks will be 50 m long and 20 m wide; • Designed to contain run-off from a 1:50 year storm event;
Starter wall	• The starter wall will contain tailings deposition during early development of TSF; • Constructed using clay-based material from basin or other construction areas;
Drainage system	• Under drainage system located within TSF footprint, consisting of toe, intermediate and central drains and drain outlets; • Drain outlets constructed at approximately 50-100m intervals to collect seepage water from filter drains and convey it to solution trench;

	• The existing drain outlets will connect to a collector drain system then discharge into the solution trench on the southern flank where the two facilities connect;
Decant system	• Gravity pipe decant system to ensure water does not accumulate on top of TSF; • Includes permanent double intake structure and intermediate intake structures; • Intermediate penstock intake structures positioned at different elevations along the penstock outlet pipeline: o Ensure effective decanting of supernatant water during the development phase of TSF; o Minimise delay in water returned to the reclamation sites;
Catwalk	• Timber catwalk and floating walkway structure for access from pool wall to penstock intermediate and permanent intake structures respectively;
Silt trap	• Concrete-lined silt trap with twin compartments between penstock outlet and RWD; • Should reduce volume of suspended solids flowing into RWD;
Storm water dam	• Storm water dam will be located between TSF and RWDs and will contain dirty water running off the TSF; • Capacity will be 155 000 m3 and will cover 6.6 Ha;
RWD and related infrastructure	• New RWDs with a combined capacity of 837 000 m^3 (area of 60 ha), south of the TSF and existing RWD complex; • RWD will have three compartments (one for operation, the other two for dirty water containment); • Will be lined with double HDPE liner system and leakage-detection material (Hi-drain); double liner will consist of 2 mm geomembrane and 1.5 HDPE geomembrane; • RWD will be sunk below ground level, maximum wall height of <2 m above normal ground level;
Contractors yard	• Contractor's yard will be located on the south western side of the TSF extent on the right of the access road travelling south; and

	• Contractor's yard will include the following infrastructure: site office, workshop, fuel storage facilities, wash bays, change houses, septic tanks.

The additional infrastructure required across the operational footprint will include new pump stations, new satellite pump stations, slurry launders and connecting slurry and process water pipelines. In the centre of operations, existing infrastructure (pump stations and main slurry and process water pipelines) will be utilised to process adjacent resources. Buffels 5 TSF will be connected to the East Complex Pump Station via a new slurry trench and Buffels 1 TSF will be pumped via a satellite pump station to the Buffels 5 TSF slurry trench feed.

Tailings from Harties 5 & 6 TSF will be directed via a slurry launder to the Harties 1 & 2 pump stations. A satellite pump station may be required at a later stage, to aid in reclamation of tailings that cannot be gravity fed. In the west, three new pump stations (West Pump Station 1, West Pump Station 2 and a satellite pump station) will be constructed. Main slurry and process water pipelines extending from the existing SPD and East Complex Pump Stations in the east to the west, will allow for the use of the SPD and East Complex Pump Stations as booster pump stations.

In the north, the MWS 4 & 5 TSF's will be reclaimed and directed to a new pump station via slurry launders. New process water and slurry piping will be installed between the MWS 4 & 5 Pump Station and the MWS plant. In total, three new main pump stations and three new satellite pump stations will be built.

The details of the supporting infrastructure for the TSF expansion are as follows:

- Pump Stations:
    - Three main pump stations: one at the MWS complex, two at the outlying western TSFs;
    - Three satellite pump stations: one at the Harties TSFs (probably at a later stage), one at the outlying western TSFs and one at the Buffels TSFs;
- Process water pipelines:
    - Extended from the existing SPD and East Complex pump stations to the western outlying TSFs;
    - Connecting MWS TSFs and MWS plant;
- Slurry pipelines:
    - Extended from the existing SPD and East Complex pump stations to the western outlying TSFs;

- Connecting MWS TSFs and MWS plant;

- Slurry launders:
  - Connecting the Buffels TSF to the East Complex pump station;
  - Connecting Harties TSFs with the Harties 1 & 2 pump station; and
  - Connecting MWS TSFs to the proposed MWS pump station.

Throughout the project lifecycle, the construction, operating and decommissioning teams must be prepared for unplanned emergencies or incidents threatening human health or the environment.

3 ROLES AND RESPONSIBILITIES

The Applicant (Mine Waste Solutions) is responsible for the implementation of the EMPr on site throughout all phases of the project's lifecycle. During the construction phase, this responsibility may be delegated to the Engineer/Construction Contractor or a representative thereof. However, the Applicant is still responsible for ensuring that the EMPr is correctly implemented.

3.1 Environmental Officer

During the construction phase, a representative for the Applicant (the Environmental Officer, or EO) must be on site every day in order to oversee and manage the environmental (and other) aspects of development. Throughout other phases of the project lifecycle, the representative must visit the site at least once a week to manage environmental aspects.

This individual will be responsible for overseeing all environmental aspects on site, including sub-contractors or service providers. The representative should undertake weekly site inspections to ensure that the EMPr is being effectively implemented on site. The representative's responsibilities include the following:

- Managing and facilitating communication and training to all staff on the content of this EMPr;
- Ensuring that a copy of this EMPr is always available on site;
- Conducting and reporting on weekly site inspections (by way of a checklist) to document the implementation of this EMPr;
- Identifying and assessing previously unforeseen, actual or potential impacts on the environment;
- Facilitating any monitoring required;
- Advising the Site Manager regarding the removal of person(s) and/or equipment not complying with the provisions of this EMPr;
- Making recommendations to the Site Manager with respect to the issuing of fines for contraventions of the EMPr; and
- Continually reviewing the EMPr and recommending additions and/or changes to this document as necessary.

3.2 Environmental Control Officer (ECO)

The Applicant must appoint an Environmental Control Officer (ECO) to assess (on a bi-monthly basis during construction and every two (2) years in operational phase) the implementation of the EMPr on site. The Applicant may decide to assign this role to one person for all phases or may assign a different ECO for each phase. The ECO will have the following responsibilities:

- Managing and facilitating communication between the Applicant, EO, contractors and Interested and Affected Parties (I&APs) with regard to this EMPr;
- Conducting bi-monthly site inspections and audits during construction phase to assess the implementation of this EMPr on site;
- Conducting inspections and audits every 2 (two) years during operational phase to assess the implementation of this EMPr on site;
- Submitting audit reports to the Applicant and Competent Authority for review;
- Assisting the EO in finding solutions with respect to matters pertaining to the implementation of this EMPr;
- Advising the EO regarding the removal of person(s) and/or equipment not complying with the provisions of this EMPr;
- Making recommendations to the EO with respect to the issuing of fines for contraventions of the EMPr; and
- Continually reviewing the applicability of the EMPr and recommending additions and/or changes to this document.

4 ENVIRONMENTAL MANAGEMENT PLAN ACTIONS

4.1 Key Environmental Impacts

4.1.1 Construction Phase

Table 4.1: Construction phase impacts.

ENVIRONMENTAL ASPECT	IMPACTS
Ecology	• Destruction and fragmentation of flora and fauna habitats in CBMAs 1 and 3, isolation between terrestrial and aquatic habitats, loss of vegetation • Increased presence of people on site • Exposure to fauna of dangerous areas, excavations and hazardous substances • Dust, noise, human activity and emissions • Introduction of AIS / exacerbation of existing AIS (fauna and flora) • Contamination of faunal habitat, loss of the plant soil seed bank
Wetlands	• Changes in water flow regime, increased high energy surface water runoff, decreased vegetation germination potential, sediment pollution • Changes in sediment deposition and high energy flows causing erosion • Introduction and spread of alien plants
Soil	• Destruction of current land capability • Loss of agricultural production and agricultural-related employment within the fenced-off area • Loss of soil ecosystem services and soil fertility • Soil contamination with hydrocarbons and solid waste
Air Quality	• Potential impact on human health from increased pollutant concentrations • Increased nuisance dustfall rates
Noise	• Disturbance to residential receptors due to construction noise
Heritage	• Disturbance/damage to the sites AGA-MWS-WBP-2, AGA-MWS-MGD-5 and AGA-MWS-MGD-6

	• Disturbance/damage to the site AGA-MWS-WGD-7 • Disturbance/damage to palaeontological artefacts
Surface Water	• Increased surface water runoff, resulting in sedimentation due to soil erosion • Increased surface water runoff, resulting in reduced surface water quality • Lack of hydrocarbon management, resulting in reduced surface water quality • Lack of hydrocarbon management, resulting in soil contamination • Soil compaction, resulting in increased runoff leading to potential erosion • Lack of clean and dirty water separation, resulting in reduced surface water quality (mixing of clean and dirty water areas) • Increase surface water runoff, resulting in sedimentation due to soil erosion • Uncontrolled release would reduce surface water quality • Incorrect stockpiling and poor rehabilitation may result in loss of topsoil and sedimentation due to erosion • Incorrect stockpiling and poor rehabilitation may result in reduced surface water quality • Impact of waste generation (general waste) on surface water quality • Increase surface water runoff (roofs, paved areas) may result in sedimentation due to soil erosion and reduced surface water quality • Inadequate handling, storage & disposal of hydrocarbons may impact surface water quality • Inadequate handling, storage & disposal of chemicals may impact surface water quality
Groundwater	• Decreased groundwater quality and quantity • Groundwater quality deterioration

Socio-Economic	• Employment opportunities through temporary job creation (positive) • Nuisance factors of traffic, dust, noise
Visual	• Negative Impacts on aesthetics • Change of Visual Character • Dust creation • Landscape visual change

4.1.2 Operational Phase

Table 4.2: Operational phase impacts.

ENVIRONMENTAL ASPECT	IMPACTS
Ecology	• Destruction and fragmentation of flora and fauna habitats in CBMAs 1 and 3 • Isolation between terrestrial and aquatic habitats • Loss of vegetation • Increased presence of people on site • Exposure to fauna of dangerous areas, excavations and hazardous substances • Dust, noise, human activity and emissions • Introduction of AIS / exacerbation of existing AIS (fauna and flora) • Contamination of fauna habitat • Loss of the plant soil seed bank
Wetlands	• Permanent changes to the catchment of waterbodies in terms of water infiltration and surface water flow rates • Changes in sediment and stormwater entering the system • Changes in water quality due to foreign materials and increased nutrients
Soil	• Soil pollution/ contamination with hydrocarbons and solid waste • Soil compaction of topsoil bund wall and access roads

Air Quality	• Potential impact on human health from increased pollutant concentrations • Increased nuisance dustfall rates
Noise	• Nuisance noise impacts (disturbance) to residential receptors due to continual rehabilitation activities
Heritage	• Damage to archaeological/ palaeontological sites within the vicinity of operations
Surface Water	• Insufficient hydrocarbon management may impact surface water quality • Insufficient hydrocarbon management resulting in soil contamination • Soil compaction resulting in increased runoff leading to potential erosion • TSF overtopping would reduce surface water quality • TSF failure would reduce surface water quality • Pipeline failures would result in reduced surface water quality • Lack of operational storage capacity/ freeboard may result in spillage, which would reduce surface water quality • Inadequate clean/ dirty water separation may result in reduced surface water quality • Insufficient storage capacity design may result in reduced surface water quality • Insufficient infrastructure design (spillage) may result in reduced surface water quality • Insufficient process water availability resulting in sourcing alternative water sources, such as raw water abstraction from the catchment area • Lack of concurrent rehabilitation may result in increased surface runoff from side slopes • Lack of care and maintenance may result in siltation of trenches/ dams • Incorrect rehabilitation may reduce surface water quality

	• Loss of infrastructure availability due to (power failure, sabotage, inclement weather) may result in reduced surface water quality • Inadequate handling, storage & disposal of waste may impact surface water quality • Inadequate handling, storage & disposal of hydrocarbons may impact surface water quality • Inadequate handling, storage & disposal of chemicals may impact surface water quality
Groundwater	• Dewatering of the surrounding aquifers • Impact on groundwater quality (contamination) from current TSF and expansion and potential for poor contaminant seepage into the Vaal River
Socio-Economic	• Employment opportunities and additional job creation (positive) • Jobs to low-income households, thus reducing poverty (positive) • Sustained income for social development by company (positive) • Reduced economic diversity due to over-reliance on mining sector • Intensive use of water and energy • Economic costs for community resulting from environmental degradation • Nuisance factors in the form of traffic, dust, noise • Risk of failure, illegal miners, health risks, environmental risks impacting on community safety
Visual	• Change of Visual Character • Dust creation • Landscape visual change • Light Pollution (Glare, spill light, sky glow)
Human Health	• Impact of dispersed dust from TSF to human health • Non-cancer (systemic) health effects in humans caused by dispersion of particulate matter from TSF • Risk of systemic health effects and cancer in humans due to seepage of contaminated water into drinking water supply

Radiology	• Inhalation of the radon gas contributes to the total effective dose, potentially impacting human health over the long-term • The airborne dust (PM_{10}) and deposited dust contribute to the total effective dose through inhalation, ingestion and external radiation exposure routes • Controlled or uncontrolled water releases may lead to an increase in concentration of radioactive elements in the soil and/or water

4.1.3 Decommissioning Phase

Table 4.3: Decommissioning phase impacts

ENVIRONMENTAL ASPECT	IMPACTS
Ecology	• Increased presence of people on site • Dust, noise, human activity and emissions • Introduction of AIS / exacerbation of existing AIS (fauna and flora) • Poor plant selection and habitat creation
Air Quality	• Potential impact on human health from pollutant concentrations • Nuisance dustfall rates • Potential impact on human health from pollutant concentrations associated with closure activities • Nuisance dustfall rates associated with closure activities
Noise	• Nuisance noise impacts on nearby communities
Heritage	• Damage to archaeological/ palaeontological sites within the vicinity of decommissioning activities (with emphasis on the site impacted by the TSF fence)
Surface Water	• Insufficient hydrocarbon management may impact surface water quality • Increase in soil compaction may result in increased surface runoff • Lack of care and maintenance & monitoring may result in increased surface runoff from side slopes • Lack of care and maintenance & monitoring may result in siltation of trenches / dams

	• Lack of care and maintenance & monitoring may impact surface water quality • Inadequate clean/ dirty water separation may impact surface water quality • Insufficient storage capacity (1:50;1:100 rain event) may impact surface water quality • Reduction of catchment yield (run-off) monitoring may result in a decrease in catchment water quantity • Lack of maintenance monitoring may result in increased surface runoff from side slopes • Lack of maintenance monitoring may result in siltation of trenches/ dams • Lack of maintenance monitoring may impact surface water quality
Groundwater	• Impact on groundwater quality from TSF and potential seepage of poor quality base-flow into the Vaal River
Socio-Economic	• Employment loss through permanent job losses • Loss of social funds through termination of social projects • Permanent loss of land • Loss of visual sense of place • Dust and noise nuisance factors • Risk of failure, illegal miners, health risks, environmental risks and their impacts on community safety
Visual	• Change of Visual Character • Dust creation • Landscape visual Change
Human Health	• Impact of dispersed dust from TSF to human health • Non-cancer (systemic) health effects in humans caused by dispersion of particulate matter from TSF • Risk of systemic health effects and cancer in humans due to seepage of contaminated water into drinking water supply

Radiology	• The execution of the decommissioning plan involves a site-wide plan to demolish, decontaminate and remove all the surface infrastructure that may contain or that are contaminated with radionuclides. These areas will be rehabilitated and cleaned for clearance by the NNR (positive) • Inhalation of the radon gas contributes to the total effective dose through inhalation, ingestion and external radiation exposure routes • Abstraction and use of the contaminated water contribute to the total effective dose through the ingestion and possible external radiation exposure routes

4.1.4 Cumulative and Residual Impacts

The cumulative and residual impacts that have been identified for the project include:

Table 4.4: Cumulative and residual impacts of the project.

ENVIRONMENTAL ASPECT	IMPACTS
Ecology	Residual impacts: • Fragmentation of habitat and loss of ecological corridors • Any destruction of threatened or protected species (TOPS) • Introduction of AIS/ exacerbation of existing AIS • Contamination and complete degradation of faunal habitat without remedy Cumulative impacts: • Contamination and complete degradation of fauna habitat without remedy
Soil	Residual impacts: • Destruction of current land capability of the areas where infrastructure will be constructed • The progressive loss of areas grazing and arable land capability that can be used for livestock grazing, game farming as well as other agricultural enterprises

	• Loss of agricultural production and agricultural-related employment within the fenced-off area • A reduction of the volume of food produced within the district municipality • Loss of soil ecosystem services and soil fertility in areas where topsoil is stripped • The progressive loss of soil ecosystem services results in the progressive degradation of soil quality and the services provided such as water and nutrient cycling • Soil pollution from slurry spillages pumped through pipelines to the Kareerand TSF complex for processing • Gradual or sudden enrichment of soil with soil contaminants will result in bioaccumulation of the contaminants in vegetation and increased contamination levels of groundwater, surface water and air. This has negative human and environmental health impacts • Soil pollution from storage of processed mine tailings waste in the proposed expanded TSF • Gradual or sudden enrichment of soil with soil contaminants will result in bioaccumulation of the contaminants in vegetation and increased contamination levels of groundwater, surface water and air. This has negative human and environmental health impacts Cumulative impacts: • Destruction of current land capability of the areas where infrastructure will be constructed • Other mining activities in the area not related to the Kareerand TSF Expansion • Expansion of settlement areas into areas with arable and grazing land capability when work opportunities created by the Kareerand TSF result in a population influx of migrant workers in search of employment opportunities • Loss of agricultural production and agricultural-related employment within the fenced-off area

	• Other mining activities in the area not related to the Kareerand TSF Expansion • Loss of soil ecosystem services and soil fertility in areas where topsoil is stripped • Other mining activities in the area not related to the Kareerand TSF Expansion that impact on soil ecosystem services and soil fertility • Soil pollution from pumping of waste slurry through pipelines to the Kareerand TSF complex for processing • Any existing soil contamination as a result of previous spills and leaks from the existing pipeline network • Sabotage of the pipelines by artisanal miners in search of gold-containing material that they can process • Other mining activities in the area not related to the Kareerand TSF Expansion • Soil pollution from storage of processed mine tailings waste in the proposed expanded TSF • Other mining activities in the area not related to the Kareerand TSF Expansion • Any existing soil contamination present as a result of the site being part of a larger gold mining area • Extreme weather events such as major floods and wind storms that increase the distance and severity of contaminant transport from the TSF
Visual	• Landscape visual change

4.2 Management Actions

The following management actions of this EMPr (**Table 4.5)** have been developed in order to avoid the potential impacts listed above as far as possible. Where impacts cannot be avoided, measures are provided to mitigate for and reduce the significance of these impacts.

The Applicant's signature on this document indicates that the Applicant acknowledges their responsibility to uphold the specific management actions detailed below.

Table 4.5: EMPr management actions throughout the project lifecycle.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
4.2.1 CONSTRUCTION PHASE		
4.2.1.1 GENERAL		
Environmental awareness	Lack of awareness may result in environmental harm and/or non-compliance to the EMPr/EA	• Comprehensive induction of all employees on site, including an environmental section which outlines as a minimum the following: o Explanation of the importance of complying with the EMPr; o Discussion of the potential environmental impacts of development activities; o Employees' roles and responsibilities, including emergency preparedness; and o Explanation of the mitigation measures that must be implemented when particular work groups carry out their respective activities. • Daily safety talks should include environmental topics (at least one environmental topic per week) to increase general and site-specific environmental awareness.
Monitoring of compliance	Lack of monitoring may result in environmental harm and/or non-compliance to the EMPr/EA	• The construction site should be informally monitored on a continual basis by the EO to ensure compliance to the EMPr and thus reduce environmental harm. • Implementation of the EMPr and conditions of the EA must be formally monitored (audited) on a bi-monthly basis by an appropriately qualified and experienced ECO.
Emergencies/Incidents	Incidents/Emergencies could impact health and safety or the environment	• All incidents and emergencies should be dealt with in line with the Emergency Response Plan for the site. • A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Environmental incidents must be reported timeously to the relevant regulator's Regional office.
4.2.1.2 ECOLOGY		
Site clearing / preparation	Destruction and fragmentation of flora and fauna habitats in CBMAs 1 and 3 Isolation between terrestrial and aquatic habitats Loss of vegetation	• No activities are to commence within riverine (+100m buffer) and wetland areas until the necessary authorisations are obtained under the National Water Act (NWA) and NEMA. • No activities are to commence within the dolomitic grassland or within 300m buffer areas of *Pearsonia bracteata* and *Lithops lesliei* subsp. *Lesliei* as guided by 2018 botanical survey (de Castro and Brits). • TOPS and provincially protected plant species should be conserved on site as far as possible. • A suitably qualified person (e.g. botanist / horticulturist) should survey the final layout within the growing season of the plants (summer months, preferably between November and February), in order to confirm whether these plants occur within the development footprint. • No TOPS plant species or provincially protected plant species should be removed without the required permit. • All employees should be made aware of the presence of red data species through induction. • All contractors should be aware of the protected species present on site and should undergo training in how to identify and relocate the protected plant species, as part of the induction.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• No open fires are permitted. • The grasses can be removed as sods and re-established after construction is completed. • Areas designated as having low and moderate sensitivity in terms of fauna and flora should be considered for all activities rather than areas designated as highly sensitive where possible. • Maintain areas as ecological corridors to provide fauna means for escape from development area, where possible. • Any plant species of conservation concern (SCC) should remain conserved in situ where possible. • Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activities, the plants should be removed (if it could survive this process) by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority). • Relocation of plant SCC (species of conservation concern) to similar habitats unaffected by the proposed activities should be considered and a relocation plan should be developed and submitted to the relevant authorities. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area. • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Protect all areas susceptible to erosion (especially the sloped rocky grassland) and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • Colonisation of the disturbed areas by plants species from the surrounding natural vegetation must be monitored to ensure that vegetation cover is sufficient within one growing season. If not, then the areas need to be rehabilitated with a grass seed mix containing species that naturally occur within the study area. • Ecological corridors with a minimum width of 700m should be maintained with Wildebeestpan, the Vaal River and highly sensitive terrestrial habitats, which must also consider regional ecological connectivity. • Plan and implement a proper storm-water management plan from the onset at all activity areas, which must allow for controlled storm-water diversion and silt traps to prevent impact to surrounding areas. • Slopes of the diversion trench must be shallow enough for fauna to cross. • Any new fencing or linear structures erected in areas of high and moderate sensitivity must provide for small animal migration and unimpeded movement, as far as practicable. • The infrastructure proposed south of the existing TSF will limit east-west movement of fauna such as threatened or protected cat species, between two sensitive habitats and provision should be made to allow for connectivity between these two sensitive areas and the sensitive habitat further south of the RWDs and eucalyptus plantation or an ecological corridor established south of the fence line. This is in line with MWS's Biodiversity Conservation Management Plan.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Peg out and demarcate areas for development and no-go areas before commencing with any activities to prevent disturbance to areas not targeted for development and maintain indigenous habitat in these areas. • Maintain all areas of physical disturbance as small and compact as possible to limit the area of disturbance. • Existing roads will be utilised as a first priority to limit the need for additional roads where possible. • No construction or project related activities may be undertaken outside of the demarcated areas. • Erosion control structures should be installed prior to construction. • No land use changes or other disturbances of animals outside of the study area should be allowed. Signs should be erected on mine roads limiting the speed to no more than 40 km/hour. • The presence of mammals must be indicated on warning signs. • Where areas not targeted for development are inadvertently impacted and damaged, clear any material dumped and rehabilitate the site as soon as possible. • After construction is completed, rehabilitate all areas no longer required for operational phase to a state similar to the local indigenous character of the area and ensure animals can move through and around new infrastructure areas unencumbered. • No additional activity / development should be allowed outside that approved in the EMPr.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Area must be regularly monitored and rehabilitated as needed and ecological connectivity maintained at all times. • The biodiversity management and monitoring plan must be adhered to.
	Concentrated run-off could lead to erosion, which will reduce the fertility of soils and the subsequent establishment of flora.	• Sustainable erosion control measures (wind and water erosion) will be implemented and maintained where necessary in areas disturbed by the operations and the existing infrastructure will be maintained. • Surface water diversion and management measures and designs must incorporate the geomorphological components of the area in order to ensure that as far as practically possible the man-made structures have the least impact on the environmental processes in the area.
General construction activities	Increased presence of people on site	• Identified TOPS will leave the area upon disturbance if unimpeded. • Implement a monitoring plan for all TOPS confirmed on site and with a high likelihood to occur on site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species. • No domestic animals (other than local stock animals) will be allowed on site; where absolutely necessary domestic animals will be adequately restrained and not be allowed to run freely on the property. • Only contractors that have completed environmental awareness training, including the details of this report, are allowed to conduct activities on site. • No deliberate killing or trapping of indigenous fauna is allowed on site, unless trapping is done by a specialist to remove the specimen from the area.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Ensure all drivers and staff on site are informed of the importance of threatened or protected (TOP) species through environmental awareness training. • Maintain speed limits that will allow for adequate response time to any animals that may wonder onto the road. Current speed limits of 40km/hr are adequate, but consideration should be given to reducing speed limits to 30km/hr near pans, wetlands and rocky areas. • Should any indigenous fauna be trapped or killed by staff, appropriate reprimand/fine must be implemented. This must be specified in contractual agreements.
General construction activities	Exposure to fauna of dangerous areas, excavations and hazardous substances	• Identified TOPS will leave the area if unimpeded. • Where possible sufficient time will be provided for animals to relocate from the areas designated for construction activities. • Implement a monitoring plan for all TOPS confirmed on site and with a high likelihood to occur on site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species. • Only contractors that have completed environmental awareness training, including the details of this report, are allowed to conduct activities on site. • No poisons against fauna are to be brought on site; where this is not possible any substance that could be toxic to fauna will be stored and handled in a manner that will prevent exposure of the substance to the environment and animals. • Plan activities as far as possible outside the breeding season of TOPS that are likely to occur on site.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Should overhead-lines need to be erected in highly sensitive areas (once all other options have been investigated), this should be done with the site's sensitivity in mind and following appropriate precautionary measures. Overhead-lines which have to be erected in highly sensitive areas must be fitted with bird flappers. • All activities should proceed in a linear manner as far as possible to provide fauna the opportunity to escape the area, rather than conducting activities in a manner that may result in fauna getting trapped within the development footprint. • Ensure all drivers and staff on site are informed of the importance of TOP species through environmental awareness training. • Should any indigenous fauna be trapped within development / activity areas, activities will cease, and the necessary qualified and permitted specialists will be brought to site to trap and relocate the species. • Where areas not targeted for development are inadvertently impacted and damaged, clear any material dumped and rehabilitate the site as soon as possible. • After construction is completed, rehabilitate all areas no longer required for operational phase to a state similar to the local indigenous character of the area and ensure animals can move through and around new infrastructure areas unencumbered. • No additional activity / development should be allowed outside that approved in the EMPr. • Area must be regularly monitored and rehabilitated as needed and ecological connectivity maintained at all times.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
General construction activities	Dust, noise, human activity and emissions	• Utilise quieter equipment where feasible. • Ensure dust suppression, through water sprinkling, is applied at time of high dust generation. • Vegetate exposed soils. • Any noisy point-sources utilised on site should be enclosed, and all equipment / machinery fitted with silencers where applicable. • All equipment / machinery will be serviced and maintained within operating specifications to prevent excessive noise. • Where noise becomes a nuisance management measures will be investigated and implemented to address these. • Monitor and maintain radiation, dust, emissions and noise within applicable national standards and manage as per specialists' recommendations. • Ensure environmental awareness training informs staff, contractors and visitors of noise, dust and vibration impacts on fauna. • Ensure monitoring plans in terms of the various "emissions" are applied as per specialist recommendations and apply necessary actions if issues arise. • Lights will be strategically placed where necessary and in such a way to ensure the least light spillage/nuisance occurs.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Disturbance of soil/general construction activities	Introduction of AIS / exacerbation of existing AIS (fauna and flora)	• Train staff and contractors on the identification of AIS. • Ensure that prior to any site clearing all listed plant AIS are cleared and removed from site. • Maintain the highly sensitive areas and connectivity on site as far as possible. Maintaining and improving local indigenous populations could assist in reducing alien species numbers on site through competition and predation. • Ensure the necessary permits are obtained for the establishment of declared AIS plantation for the passive treatment area. • Alien invasive species, in particular category 1 species that were identified within the study area should be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation • Compile and implement an alien invasive management plan (AIMP) in line with the municipal management plan, which must include measures to prevent attracting additional alien avifauna and mammals to site. This should include not feeding wildlife and ensuring that all food and food waste, including domestic waste, is placed in sealed containers and not exposed on site. The plan should include an AIS eradication programme, which must be implemented. Where possible local people should be utilised to undertake the eradication project. • Where possible indigenous plant species will be utilised to eradicate the problem of invader species (i.e. pampas grass, pronkgras, etc.), which have in the past be utilised for the rehabilitation of TSFs.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Ongoing monitoring must be undertaken (recommended for every two weeks) to identify areas impacted by AIS. • All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO. • Inspect outside areas regularly and clear all domestic and food waste from site. • All alien seedlings and saplings must be removed as they become evident for the duration of construction.
Spills (chemical, tailings, dirty water)	Contamination of fauna habitat. Loss of the plant soil seed bank	• Construction and operation of TSF and RWDs can only commence once the authorisations under NEMA and NWA are obtained. • Tailings and contaminated water can only be disposed to the TSF expansion area and RWDs when these sites and related infrastructure have been prepared as per approved engineered designs. • Stormwater and mine water separation, containment and treatment will be established in the areas before any potential contaminating activities commence. • Ensure emergency response procedures for spills from the TSF and RWD are in place before any activities commence, and ensure any equipment required for emergency response is readily and quickly available on site. • Monitor and audit and address all issues identified immediately.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Implement emergency response procedures immediately should spills and leaks be noted, which must focus initially on containment and prevention of spread. Once safe to do so, initiate and complete clean-up as soon as possible. • Regularly monitor and audit (annual internal audit and annual external audit), the development of the TSF and operation of the RWDs against the engineered designs and codes of practice and in accordance with the EA and IWULA requirements
Hydrocarbon spills	Contamination of fauna habitat. Loss of the plant soil seed bank	• Discontinue use of all faulty machinery / equipment on site until properly repaired. • Ensure a waste management plan has been compiled in line with the National Environmental Management: Waste Act (NEM:WA) highlighting handling and storage of various wastes on site, including used hydrocarbons, in line with prescribed standards before any activities commence on site. • Regularly audit the implementation of the waste management plan. • Hydrocarbons and hydrocarbon drums/cans/bottles, all hazardous substances and cement is to be stored in such a manner so as to prevent spills and contamination and should include measures such as appropriately lined and bunded areas; undercover areas where possible, etc. Such storage facilities must be provided before any substances are brought to site. • All equipment / machinery will be serviced and maintained within a designated workshop area with hydrocarbon management and collection system. • All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• New and used hydrocarbons must be properly stored and handled according to prescribed manner to prevent spills onto bare ground. • Any machinery or equipment parked on site will either be parked on a concrete slab or have pans placed under them to collect all drips and potential leaks. • All hydrocarbons spills on bare ground will be cleared immediately. This will include the lifting of the contaminated soil for bioremediation or disposal to a hazardous waste facility. • Continue to measure and monitor leaks of any hydrocarbons as well as chemicals as per current ISO system schedule.
Waste generation	Contamination of faunal habitat	• Ensure a waste management plan has been compiled in line with NEM:WA highlighting handling and storage of various wastes on site, in line with prescribed standards before any activities commence on site. • Regularly audit the implementation of the waste management plan. • Train staff and contractors on the waste management plan before allowing persons on site. • Hydrocarbons and hydrocarbon drums/cans/bottles, all hazardous substances and cement is to be stored in such a manner so as to prevent spills and contamination and should include measures such as appropriately lined and bunded areas; undercover areas where possible, etc. Such storage facilities must be provided before any substances are brought to site. • All waste (domestic, hydrocarbon, hazardous) must be managed in line with the prescribed waste management plan.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Refuse bins with properly secured lids will be placed around site to collect waste for separation, recycling and disposal. • Waste (domestic, construction, hazardous) should be recycled as far as possible and sold/given to interested contractors. • Recyclable waste should not be stored for excessive periods. • Waste will be stored according to the Norms and Standards for Storage of Waste. • Inspect and clear all litter and waste from the site and surrounds.
Septic tank operation	Contamination of faunal habitat	• Provide for adequate portable toilets for the number of staff on site, provide for male and female staff and keep all facilities outside the riverine and wetland buffer zones. • Keep toilet facilities operational, clean and hygienic. • Toilets and associated plumbing and septic tanks will be properly managed to prevent overflow and leaks. • Toilets and general plumbing must be regularly checked for leaks. • Repair and clean any sewage leaks immediately.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
4.2.1.3 WETLANDS		
Compaction of soil and the clearing of vegetation during construction of pipelines, berms and access roads	Changes in water flow regime, increased high energy surface water runoff, decreased vegetation germination potential, sediment pollution	• Effective stormwater and sediment management should be implemented during construction phases to ensure that no polluted, sediment laden or high energy water is directed into the watercourses or waterbodies. • Changed overland water flows should be accommodated to ensure that water input from adjacent slopes occurs in a diffuse manner and does not cause scouring or downstream erosion. • Control of alien invasive plants should form part of the maintenance plan. • Corrective action should take into account hydrological analysis of flow energy and water quality where required.
Compaction of soil and the clearing of vegetation during construction of pipelines and access roads	Changes in sediment deposition and high energy flows causing erosion	• Effective stormwater and sediment management should be implemented during construction phases to ensure that no polluted, sediment laden or high energy water is directed into the watercourses or waterbodies. • Changed overland water flows should be accommodated to ensure that water input from adjacent slopes occurs in a diffuse manner and does not cause scouring or downstream erosion. • Control of alien invasive plants should form part of the maintenance plan. • Corrective action should take into account hydrological analysis of flow energy and water quality where required.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Preparation of the footprint of all new infrastructure	Introduction and spread of alien plants	• Ensure the implementation of an effective AIMP.
Pipeline crossing of watercourse	Pipeline crossing could lead to concentration of flows and increased erosion risk as well as impounding upslope of the crossing.	• Where feasible, use should be made of existing crossings
4.2.1.4 SOILS AND AGRICULTURE		
Construction of infrastructure	Destruction of current land capability	• The project infrastructure footprint should be kept to the project layout as provided in the Environmental Impact Assessment (EIA) report. • Prevent overgrazing and soil erosion around the site, as far as practicable. • Areas of construction must be clearly demarcated. No construction or project related activities may be undertaken outside of the demarcated areas. • Existing roads will be utilised as a first priority to limit the need for additional roads where possible. • Where necessary, access or safe road crossings to existing areas will be provided.
Fencing of site	Loss of agricultural production and agricultural-related employment within the fenced-off area	• The project infrastructure footprint should be kept to the project layout as provided in the Environmental Impact Assessment report. • Investigate the introduction of alternative agricultural projects in the area. • The design of the new TSF will take into consideration the natural land topography

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Open channel of communication will be initiated and maintained between the Mine Waste Solutions and interested parties. • Contact details of relevant personnel will be made available to interested parties. • Indigenous vegetation and trees will be established around the site.
Stripping of topsoil	Loss of soil ecosystem services and soil fertility	• The project infrastructure footprint should be kept to the project layout as provided in the Environmental Impact Assessment report and not spread outside of the fenced-off area. • Prior to construction, topsoil must be stripped and placed on a soil stockpile. • Topsoil, whether present in stockpiles or as part of the topsoil bund wall, should be protected against wind and water erosion until vegetation has established on the exposed topsoil surfaces. • If natural revegetation does not occur, natural vegetation should be established on the topsoil stockpiles. • Implement the topsoil procedure.
General construction activities	Soil contamination with hydrocarbons and solid waste	• The storage, handling and transportation of the hazardous materials procedure must be strictly enforced. • High level maintenance must be undertaken on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills. • Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on. • Site surface water and wash water must be contained and treated before reuse or discharge from site.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material. • Spill kits should be available on all working areas of site and should be serviced regularly. • Employees will be trained in the utilisation of the spill kits. If any other minor spillage occurs the spillage will be cleaned immediately and the contaminated area will be rehabilitated, as appropriate. • Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices. • A rapid response team should be available on 24-hour notice to deal with hazardous spills. • Waste disposal at the construction site and during operation must be managed by separating, trucking out and recycling of waste. • Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations. • Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols.
	Erosion due to the change in the geomorphology and surface drainage of the area.	• Sustainable erosion control measures (wind and water erosion) will be implemented and maintained where necessary in areas disturbed by the construction activities. • Erosion control measures will be implemented as part of the designs of linear infrastructure to limit the development of erosion and the associated siltation potential.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Existing infrastructure will be maintained. • Surface water drainage diversions (as part of the clean and dirty water systems and associated culverts), management measures and designs must incorporate the geomorphological components of the area in order to ensure that as far as practically possible the man-made structures have the least impact on the environmental processes in the area. • Where soil stockpiles exceed 1.5 m during construction, they should be equipped with erosion control measures (i.e. terraces, etc.). • All stockpiles should be sloped to limit erosion and be constructed to encourage vegetation.
Presence of dolomites	Sinkhole development	• The company will ensure that the necessary geotechnical investigations are undertaken to ensure that all infrastructure is constructed on stable foundations. • Emergency preparedness measures will be produced and available that deal specifically with possible subsidence. • Continuous monitoring of the surrounding area will be undertaken to investigate the status of the area. • Should sinkholes occur, sinkholes will be rehabilitated to conform to the surrounding environment, as soon as possible.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
4.2.1.5 AIR QUALITY		
General construction activities	Potential impact on human health from increased pollutant concentrations	• Reduction of fugitive PM emissions through the watering of roads, stockpiles and inactive open areas and the use of screens. • Reductions of vehicle exhaust emissions through the use of better quality diesel; and inspection and maintenance programs.
General construction activities	Increased nuisance dustfall rates	• Reduction of fugitive PM emissions through the watering of roads, stockpiles and inactive open areas and the use of screens. • Reductions of vehicle exhaust emissions through the use of better-quality diesel; and inspection and maintenance programs. • Implement a Dust Management Plan in consultation with the Project Manager and include dust suppression as part of the contractors' responsibility. • Monitor and ensure the dust suppression is well managed
4.2.1.6 NOISE		
General construction activities	Construction phase impacts of noise on residential receptors	• Construction activities should be planned taking cognisance of local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. • When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible. • Use noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines, if required.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Select equipment with the lowest possible sound power level. • Ensure equipment is well-maintained to avoid additional noise generation. • Where noise becomes a nuisance management measures will be investigated and implemented to address these. • Construction activities will be limited to the hours of 07h00 to 18h00, during weekdays and on weekends as far as practicable. • Workers should be equipped with appropriate gear to ameliorate the effects of noise levels.
4.2.1.7 HERITAGE		
General construction activities	Disturbance/damage to the sites AGA-MWS-WBP-2, AGA-MWS-MGD-5 and AGA-MWS-MGD-6	• A social consultation process must be undertaken to assess whether any local residents or the wider public is aware of the presence of graves at these sites (refer to EIA report or Heritage report). • Should the social consultation absolutely confirm that no graves are located at these sites, no further mitigation with regards to the unmarked stillborn graves would be required. • Should the social consultation absolutely confirm that graves are located at one of the sites, a grave relocation process must be undertaken, including: o A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin in order to obtain their consent for the relocation. o Bilingual site and newspaper notices indicating the intent of the relocation. o Permits from all the relevant and legally required authorities.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		○ An exhumation process that keeps the dignity of the remains and family intact, safeguards the legal rights of the families and those of the company. ○ The process must be done by a reputable company well versed in the mitigation of graves. • Should the social consultation not yield any confident results, the excavations must be tested to physically confirm the presence or absence graves. • If no evidence for graves are found, no further mitigation measures would be required. • If evidence for stillborn babies are found, a full grave relocation process must be implemented. The following general mitigation measures must be undertaken for all four of these sites: • All structures and site layouts from each site must be recorded using standard survey methods and/or measured drawings. The end result would be a site layout plan. • A mitigation report must be compiled for these sites within which all the mitigation measures and its findings will be outlined. The recorded drawings from the previous item must also be included in this mitigation report. • The completed mitigation report must be submitted to the relevant heritage authorities.
General construction activities	Disturbance/damage to the site AGA-MWS-WGD-7	• The site must be fenced before construction commences. The closest distance between the possible graves and the fence must be at least 2m. • Signposts must be erected that clearly indicate the fenced area as containing possible graves.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• The position of the possible graves must be shown on all the construction and operation maps to ensure that all individuals associated with construction and mining activities are aware of the presence of these sites.
General construction activities	Disturbance/damage to palaeontological artefacts	• In the unlikely event that fossil remains are discovered during any phase of construction, on the surface or exposed by excavations the Chance Find Protocol outlined in the palaeontological report must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (in situ) and the ECO must report to SAHRA (contact details provided in the specialist report) so that correct mitigation (recording and collection) can be carry out. • Preceding any collection of fossil material, the palaeontologist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA. • An archaeological and heritage monitoring process must be implemented for three sites containing cemeteries and possible graves located approximately 50m from the proposed development footprint areas. Although these sites are not expected to be directly impacted upon by the proposed development, this monitoring process will ensure that no peripheral impacts take place. These three sites are AGA-MWS-MGD-2, AGA-MWS-MGD-3 and AGA-MWS-MGD-8.
4.2.1.8 SURFACE WATER		
Site clearing / preparation	Increased surface water runoff, resulting in sedimentation due to soil erosion	• Clean and dirty water separation by means of bunded areas and upstream grader cuts (to be constructed prior to infrastructure construction as far as practically possible).

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Erosion control measures will be implemented as part of the designs of linear infrastructure to limit the development of erosion and the associated siltation potential. • Refer to construction method statement & storm water management plan.
Site clearing / preparation	Increased surface water runoff, resulting in reduced surface water quality	• Clean and dirty water separation by means of bunded areas and upstream grader cuts. • The construction method statement & storm water management plan must be implemented, as well as the surface water monitoring programme.
Vehicle movement	Lack of hydrocarbon management, resulting in reduced surface water quality	• MWS Hazardous Substance Management Plan and Traffic Management Plan must be implemented. • Construction vehicles must be parked, refuelled and serviced in the dedicated vehicle areas.
Vehicle movement	Lack of hydrocarbon management, resulting in soil contamination	• Drip trays to be used under all construction vehicle when parked. • Spill kits to be present on all working areas of site, regularly inspected and maintained. • The AGA hydrocarbon management plan must be implemented.
Vehicle movement	Soil compaction, resulting in increased runoff leading to potential erosion	• Only identified travel routes to be utilised. • The construction method statement & Traffic management plan must be implemented.
Storm water management	Lack of clean and dirty water separation, resulting in reduced surface water quality (mixing of clean and dirty water areas)	• North diversion channel must be built to divert clean water away from the TSF (designed for 1:50 year). • Clean and dirty water separation by means of bunded areas and upstream grader cuts.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• The construction method statement & storm water management plan must be implemented, as well as the surface water monitoring programme.
Storm water management	Increase surface water runoff, resulting in sedimentation due to soil erosion	• Clean and dirty water separation by means of bunded areas and upstream grader cuts. • Refer to construction method statement & storm water management plan.
Wastewater management (sewage)	Uncontrolled release would reduce surface water quality	• Chemical toilets must be utilised during construction. These should be inspected and cleaned regularly. • A contractor should remove waste off site regularly. • A chemical management plan must be implemented.
Topsoil stockpiling	Incorrect stockpiling and poor rehabilitation may result in loss of topsoil and sedimentation due to erosion	• Revegetation of topsoil stockpiles. • Dedicated topsoil stockpile areas must be designated and protected from construction activity. • The construction guideline for the stockpiling of topsoil must be adhered to. • A topsoil management plan must be developed and implemented.
Topsoil stockpiling	Incorrect stockpiling and poor rehabilitation may result in reduced surface water quality	• A clean and dirty water separation system must be constructed. • Dedicated topsoil stockpile areas must be designated and protected from construction activity. • The construction guideline for the stockpiling of topsoil must be adhered to. • A topsoil management plan must be developed and implemented.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• The surface water monitoring programme must be implemented.
Establishment of infrastructure (offices, workshops etc.)	Impact of waste generation (general waste) on surface water quality	• The Waste Management Plan and MWS Waste Management Procedure must be implemented and adhered to on site. • Site must be regularly inspected for good housekeeping. • All domestic waste and hazardous waste will be stored in designated areas. • A detailed waste management strategy will be in place, which will clearly demarcate the containments for different waste types (e.g. glass, plastic, oils, wood, etc.). These containments will be colour coded as per the ISO 14001 procedures in place. • Waste management will form a detailed component as part of the induction process provided by the mine. • All domestic and hazardous wastes will be removed by a licensed company to a licensed waste disposal site for either domestic and/or hazardous waste. • MWS will adopt the cradle to grave principle to ensure that the waste is removed and disposed of in a prescribed and correct manner.
	Increase surface water runoff (roofs, paved areas) may result in sedimentation due to soil erosion and reduced surface water quality	• Clean and dirty water must be separated. • The construction method statement & storm water management plan must be adhered to. • The surface water monitoring programme must be implemented. • The integrity of the surface run off control systems must be essential for the effective separation of clean and dirty water systems.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Contaminated runoff, which is likely to contain suspended solids and sediments, should be routed to the RWDs and not allowed to create sedimentation in surface water resources.
	Alteration of natural drainage patterns	• Surface water drainage diversions (as part of the clean and dirty water systems and associated culverts), management measures and designs must incorporate the geomorphological components of the area in order to ensure that as far as practically possible the man-made structures have the least impact on the environmental processes in the area. • All culverts required will be constructed to accommodate the 1:50 year storm event. • Access roads on the operation area will be maintained adequately. • Restrict construction activities to as narrow servitude as possible.
Hydrocarbon Management	Inadequate handling, storage & disposal of hydrocarbons may impact surface water quality	• The MWS Hazardous Substance Management Procedure must be implemented and adhered to. • Plant areas should be surfaced. • All chemicals, contaminated water and/or hydrocarbons will be stored in designated areas. • All materials presenting a potential contamination threat will be stored in an area with a bunded capacity of 110% of the volume stored. • MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised. • Spill kits will be available at all areas where hydrocarbons are utilised. • Employees will be trained in the utilisation of the spill kits.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• If any other minor spillage occurs the spillage will be cleaned immediately and the contaminated area will be rehabilitated, as appropriate. • Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices. • A rapid response team should be available on 24-hour notice to deal with hazardous spills. • All vehicles and equipment will be serviced regularly and will be kept in good working order.
Chemical Management	Inadequate handling, storage & disposal of chemicals may impact surface water quality	• The MWS Hazardous Substance Management Procedure must be implemented and adhered to. • All chemicals, contaminated water and/or hydrocarbons will be stored in designated areas. • All materials presenting a potential contamination threat will be stored in an area with a bunded capacity of 110% of the volume stored. • MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised. • Spill kits will be available at all areas where hydrocarbons are utilised. • Employees will be trained in the utilisation of the spill kits. • If any other minor spillage occurs the spillage will be cleaned immediately and the contaminated area will be rehabilitated, as appropriate.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices.
4.2.1.9 GROUNDWATER		
Vegetation clearance, topsoil stripping and stockpiling	Decreased groundwater quality and quantity	• Prepare detailed clearance and construction schedules. • Limit the vegetation clearance and topsoil stripping to the smallest area possible.
Construction material and waste handling	Groundwater quality deterioration	• Construction waste needs to be discarded at prescribed (bunded) areas (machinery and oils). • Spills must be cleaned up immediately according to standard operating procedures (machinery and oils). • If applicable, the appropriate authorities should be notified in the event of a significant spill (tailings from current operations, oils, etc). • Provide appropriate waste skips for different types of waste in a designated area. • Ensure regular removal of waste by an external accredited installer. • Provide spill kits at all working areas on site, which should be regularly inspected and maintained. • Employees will be trained in the utilisation of the spill kits. If any other minor spillage occurs the spillage will be cleaned immediately and the contaminated area will be rehabilitated, as appropriate.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices. • Remediated areas must be monitored. • All vehicles and equipment will be serviced regularly and will be kept in good working order. • All chemicals, contaminated water and/or hydrocarbons will be stored in designated areas. • All materials presenting a potential contamination threat will be stored in an area with a bunded capacity of 110% of the volume stored.
TSF management	Impact on groundwater quality (contamination) from current TSF and expansion and potential for poor contaminant seepage into the Vaal River	• Footprint preparation: compacting of foundation with Class C Liner during construction.
4.2.1.10 SOCIO-ECONOMIC		
General construction activities	Employment opportunities through temporary job creation (positive)	• Recruit unskilled workers from local areas. • Up-skill workers during construction works.
	Influx of job-seekers	• The company will ensure to provide detailed information on the procurement procedures in the area. • The mine will ensure to work closely with the stakeholders in the area to eliminate the potential for the establishment of informal settlements.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
	Nuisance factors of traffic, dust, noise	• Communicate with affected parties regarding construction activities that will affect them: clear notices will be erected detailing times and dates for construction activities. • Limit dust, noise and movement of vehicles as far as possible, as per the air quality and noise management section of the EMPr. • Where necessary the company will ensure to make use of traffic officers to guide traffic to limit the potential nuisance and road safety issues.
4.2.1.11 VISUAL		
Removal of vegetation for site clearing/preparation for all proposed infrastructure	Negative Impacts on aesthetics	• Limit the construction footprint as per the EIA report. • Remove vegetation in a "natural manner", avoiding any harsh lines. • Maintain the construction site in a neat and orderly condition at all times.
Movement of construction vehicles and heavy machinery for site clearance	Change of Visual Character	• Limit construction footprint. • Maintain the construction site in a neat and orderly condition at all times
Movement of construction vehicles and heavy machinery for site clearance	Dust creation	• Employ dust suppression measures. • Regulate the speed at which construction vehicles and heavy machinery move by implemented speed limitations (40km/h). • Maintain the dust monitoring programme.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Architectural design of the RWD's and SWD	Landscape visual change	• Ensure that the outer material/colour of structures is not white and will not result in any glare/reflection. Utilize colours that complement the surrounding landscape and vegetation. • Maintain the construction site in a neat and orderly condition at all times. • As far as practically possible the designs will ensure that the infrastructure blends into the surrounding environment where possible. • The necessary clean and dirty water systems will be implemented and maintained to limit the impact on the topography. • Indigenous vegetation and trees will be planted around the plant area, especially towards the direction of the N12 to limit the visibility of the plant infrastructure.
4.2.2 OPERATIONAL PHASE		
4.2.2.1 GENERAL		
Environmental Awareness	Lack of awareness may result in environmental harm and/or non-compliance to the EMPr/EA	• Comprehensive induction of all employees on site, including an environmental section which outlines as a minimum the following: o Explanation of the importance of complying with the EMPr; o Discussion of the potential environmental impacts of development activities; o Employees' roles and responsibilities, including emergency preparedness; and o Explanation of the mitigation measures that must be implemented when particular work groups carry out their respective activities.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Daily safety talks should include environmental topics (at least one environmental topic per week) to increase general and site-specific environmental awareness.
Monitoring of Compliance	Lack of monitoring may result in environmental harm and/or non-compliance to the EMPr/EA	• The operation should be informally monitored on a continual basis by the Applicant's representative or Site Manager to ensure compliance to the EMPr. • Implementation of the EMPr and conditions of the EA must be formally monitored (audited) every two (2) years by an appropriately qualified and experienced ECO.
Emergencies/Incidents	Incidents/Emergencies could impact health and safety or the environment	• All incidents and emergencies should be dealt with in line with the Emergency Response Plan for the site. • A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times. • Environmental incidents must be reported to relevant authority.
4.2.2.2 ECOLOGY		
General operational activities	Increased presence of people on site	• Identified TOPS will leave the area upon disturbance if unimpeded. • Implement a monitoring plan for all TOPS confirmed on site and with a high likelihood to occur on site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species. • No domestic animals (other than local stock animals) will be allowed on site; where absolutely necessary domestic animals will be adequately restrained and not be allowed to run freely on the property.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Only contractors that have completed environmental awareness training, including the details of this report, are allowed to conduct activities on site. • No deliberate killing or trapping of indigenous fauna is allowed on site, unless trapping is done by a specialist to remove the specimen from the area. • Employees will be educated by means of training and the Environmental Awareness Plan to make them aware that the plants should not be harvested. • Ensure all drivers and staff on site are informed of the importance of TOP species through environmental awareness training. • Maintain speed limits that will allow for adequate response time to any animals that may wonder onto the road. Current speed limits of 40km/hr are adequate, but consideration should be given to reducing speed limits to 30km/hr near pans, wetlands and rocky areas. • Should any indigenous fauna be trapped or killed by staff, appropriate reprimand/fine must be implemented. This must be specified in contractual agreements.
General operational activities	Exposure to fauna of dangerous areas, excavations and hazardous substances	• Identified TOPS will leave the area if unimpeded. • Implement a monitoring plan for all TOPS confirmed on site and with a high likelihood to occur on site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species. • Only contractors that have completed environmental awareness training, including the details of this report, are allowed to conduct activities on site.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• No poisons against fauna are to be brought on site; where this is not possible any substance that could be toxic to fauna will be stored and handled in a manner that will prevent exposure of the substance to the environment and animals. • Ensure all drivers and staff on site are informed of the importance of TOP species through environmental awareness training. • Should any indigenous fauna be trapped within development / activity areas, activities will cease, and the necessary qualified and permitted specialists will be brought to site to trap and relocate the species. • Where areas not targeted for development are inadvertently impacted and damaged, clear any material dumped and rehabilitate the site as soon as possible. • No additional activity / development should be allowed outside that approved in the EMPr. • Area must be regularly monitored and rehabilitated as needed and ecological connectivity maintained at all times.
General operational activities	Dust, noise, human activity and emissions	• Utilise quieter equipment where feasible. • Ensure dust suppression, through water sprinkling, is applied at time of high dust generation. • Vegetate exposed soils. • Any noisy point-sources utilised on site should be enclosed, and all equipment / machinery fitted with silencers where applicable.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• All equipment / machinery will be serviced and maintained within operating specifications to prevent excessive noise. • Monitor and maintain radiation, dust, emissions and noise within applicable national standards and manage as per specialists' recommendations. • Ensure environmental awareness training informs staff, contractors and visitors of noise, dust and vibration impacts on fauna. • Ensure monitoring plans in terms of the various "emissions" are applied as per specialist recommendations and apply necessary actions if issues arise. • Road signs will be put up along the roads to inform drivers of the presence of animals. • Traffic signs indicating a speed limit of 40 km/h will be put up and be adhered to. • Lights will be strategically placed where necessary and in such a way to ensure the least light spillage/nuisance occurs.
General operational activities	Introduction of AIS / exacerbation of existing AIS (fauna and flora)	• Train staff and contractors on the identification of AIS. • Maintain the highly sensitive areas and connectivity on site as far as possible. Maintaining and improving local indigenous populations could assist in reducing alien species numbers on site through competition and predation. • Ensure the necessary permits are obtained for the establishment of declared AIS plantation for the passive treatment area.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Alien invasive species, in particular category 1 species that were identified within the study area should be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation • Compile and implement an alien invasive management plan (AIMP) in line with the municipal management plan, which must include measures to prevent attracting additional alien avifauna and mammals to site. This should include not feeding wildlife and ensuring that all food and food waste, including domestic waste, is placed in sealed containers and not exposed on site. A monitoring programme will be implemented that will ensure that all AIS will be eradicated in and around the project area. Measures will also be implemented to prevent the spreading of these species. • Where possible indigenous plant species will be utilised to eradicate the problem of invader species (i.e. pampas grass, pronkgras, etc.), which have in the past be utilised for the rehabilitation of TSFs. • All vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO. • Inspect outside areas regularly and clear all domestic and food waste from site. • All alien seedlings and saplings must be removed as they become evident for the duration of construction.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Spills (chemical, tailings, dirty water)	Contamination of fauna habitat. Loss of the plant soil seed bank	• Monitor and audit and address all issues identified immediately. • Implement emergency response procedures immediately should spills and leaks be noted, which must focus initially on containment and prevention of spread. Once safe to do so, initiate and complete clean-up as soon as possible. • Regularly monitor and audit (annual internal audit and annual external audit), the development of the TSF and operation of the RWDs against the engineered designs and codes of practice and in accordance with the EA and IWULA requirements
Hydrocarbon spills	Contamination of fauna habitat. Loss of the plant soil seed bank	• Discontinue use of all faulty machinery / equipment on site until properly repaired. • Ensure implementation and compliance to MWS Waste Management Plan. • Regularly audit the implementation of the waste management plan. • Hydrocarbons and hydrocarbon drums/cans/bottles, all hazardous substances and cement is to be stored in such a manner so as to prevent spills and contamination and should include measures such as appropriately lined and bunded areas; undercover areas where possible; etc. Such storage facilities must be provided before any substances are brought to site. • All equipment / machinery will be serviced and maintained within a designated workshop area with hydrocarbon management and collection system. • All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• New and used hydrocarbons must be properly stored and handled according to prescribed manner to prevent spills onto bare ground. • Any machinery or equipment parked on site will either be parked on a concrete slab or have pans placed under them to collect all drips and potential leaks. • All hydrocarbons spills on bare ground will be cleared immediately. This will include the lifting of the contaminated soil for bioremediation or disposal to a hazardous waste facility. Continue to measure and monitor leaks of any hydrocarbons as well as chemicals as per current ISO system schedule.
Waste generation	Contamination of faunal habitat	• Regularly audit the implementation of the waste management plan. • Train staff and contractors on the waste management plan before allowing persons on site. • Hydrocarbons and hydrocarbon drums/cans/bottles, all hazardous substances and cement is to be stored in such a manner so as to prevent spills and contamination and should include measures such as appropriately lined and bunded areas; undercover areas where possible; etc. Such storage facilities must be provided before any substances are brought to site. • All waste (domestic, hydrocarbon, hazardous) must be managed in line with the prescribed waste management plan. • Refuse bins with properly secured lids will be placed around site to collect waste for separation, recycling and disposal. • Waste (domestic, construction, hazardous) should be recycled as far as possible and sold/given to interested contractors.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Recyclable waste should not be stored for excessive periods. • Waste will be stored according to the Norms and Standards for Storage of Waste. • Inspect and clear all litter and waste from the site and surrounds.
Septic tank operation	Contamination of faunal habitat	• Provide for adequate portable toilets for the number of staff on site, provide for male and female staff and keep all facilities outside the riverine and wetland buffer zones. • Keep toilet facilities operational, clean and hygienic. • Toilets and associated plumbing and septic tanks will be properly managed to prevent overflow and leaks. • Toilets and general plumbing must be regularly checked for leaks. • Repair and clean any sewage leaks immediately.
4.2.2.3 WETLANDS		
Permanent location of tailing facilities in the catchment of the waterbodies	Permanent changes to the catchment of waterbodies in terms of water infiltration and surface water flow rates	• Effective stormwater management plan should ensure that no sediment pollution or erosion results from inappropriate high energy water flows. • The Alien Invasive Species Management Plan should be implemented to prevent colonisation of waterbodies. • A wetland rehabilitation plan with plant species plan should be implemented to ensure that ecological function equal to the current habitat is returned. • Corrective action should take into account hydrological analysis of flow energy and water quality where required.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Independent water quality testing should inform the management plan of corrective action required where pollution or sedimentation is recorded.
Permanent presence of pipelines and access roads	Changes in sediment and stormwater entering the system	• Changed overland water flows should be accommodated to ensure that water input from adjacent slopes occurs in a diffuse manner and does not cause scouring or downstream erosion. • The Alien Invasive Species Management Plan should be implemented to prevent colonisation of waterbodies. • Corrective action should take into account hydrological analysis of flow energy and water quality where required.
Inadequate infrastructure and maintenance of vehicles	Changes in water quality due to foreign materials and increased nutrients	• Corrective action should take into account hydrological analysis of flow energy and water quality where required. • Independent water quality testing should inform the management plan of corrective action required where pollution or sedimentation is recorded
4.2.2.4 SOILS AND AGRICULTURE		
Pumping of waste slurry through pipelines to the Kareerand TSF complex for processing	Soil pollution	• Regular maintenance of the pipelines is required to prevent waste leaks and spill events. • Continually monitor flows within the pipelines and install early warning systems to detect leakages. • All pipelines must be checked regularly in order to detect any if there are any leaks of waste product.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Should any leaks or waste spillage from the pipelines be detected, the soil directly affected by the spill as well as in a radius of 20 m around the spill area, must be assessed by a soil pollution expert. • Any soil pollution assessment following on a leak or spill from the pipelines should be accompanied by recommendations with proven soil remediation techniques. • The soil polluted by any leaks and spills from the pipelines should be remediated directly after detection to avoid migration of pollutants into the groundwater or air as emission particles.
Storage of processed mine tailings waste in the proposed expanded TSF	Soil pollution	• An assessment of the current soil contamination status of the area around the proposed Kareerand TSF Expansion must be conducted prior to the construction phase. • This assessment must inform a detailed soil contamination monitoring plan for the operational phase that include bi-annual monitoring of the comprehensive range of contaminants that are present in the processed tailings waste as well as any other soil contaminant that are the by-product of operations at the Kareerand TSF. • Any increase in soil contamination levels detected must be addressed as soon as possible through soil remediation. • All areas that had undergone soil remediation must continually be monitored to ensure that the soil remediation measures were effective.
General operational activities	Soil contamination with hydrocarbons and solid waste	• High level maintenance must be undertaken on all vehicles and maintenance machinery to prevent hydrocarbon spills. • Impermeable and bunded surfaces must be used for storage tanks and vehicle parking.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• All chemicals, contaminated water and/or hydrocarbons will be stored in designated areas. All materials presenting a potential contamination threat will be stored in an area with a bunded capacity of 110% of the volume stored. • Spill kits will be available at all areas where hydrocarbons are utilised. • Employees will be trained in the utilisation of the spill kits. If any other minor spillage occurs the spillage will be cleaned immediately and the contaminated area will be rehabilitated, as appropriate. • Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices. • Water management measures will be implemented. • Site surface water and wash water must be contained and treated before reuse or discharge from site. • Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with absorbent material. • Spill kits should be available at all working areas on site and should be inspected and serviced regularly. • Waste disposal must be managed by separating, trucking out and recycling of waste. • Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols. • Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices. • A rapid response team should be available on 24-hour notice to deal with hazardous spills. • If a major spillage occurs the supplying contractor or area supervisor will be called out to clean the contaminated area and rehabilitated the soils, as appropriate.
	Erosion due to the change in the geomorphology and surface drainage of the area.	• Sustainable erosion control measures (wind and water erosion) will be implemented and maintained where necessary in areas disturbed by operational activities. • Surface water drainage diversions (as part of the clean and dirty water systems and associated culverts), management measures and designs must incorporate the geomorphological components of the area in order to ensure that as far as practically possible the man-made structures have the least impact on the environmental processes in the area.
	Subsidence- Subsidence has occurred in the past due to the past and present underground mining operations, especially in the areas of the tailings facilities.	• MWS will ensure the implementation of monitoring methods to monitor the surface stability throughout the operation. • MWS will ensure to backfill area of subsistence as soon as possible after it occurred. • MWS will ensure that surface activities that might lead to artificial infiltration, are adequately addressed by means of implementing an effective clean and dirty water management practices and general water management.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Vehicular movement	Soil compaction of topsoil bund wall and access roads	• Restrict traffic and vehicle movement to access roads. • Demarcate parking areas and monitor that vehicles and equipment are not parked outside of these areas. • Areas of compacted soils need to be ripped and vegetation re-established as soon as possible. • No vegetation should be disturbed outside the development footprint. • Bare soil areas should be ripped and revegetated. • Monitor re-vegetated areas to ensure successful establishment of vegetation; remove alien invasive species.
4.2.2.5 AIR QUALITY		
General operational activities	Potential impact on human health from increased pollutant concentrations	• Sides of TSF and dams should be vegetated and/or covered with nets to prevent wind-blown dust migration, as far as possible. • Materials handling operations will be effectively managed to curb the release of fugitive dust. • Detailed air quality monitoring will be performed. MWS must take part in the Klerksdorp-Orkney- Stilfontein- Hartebeestfontein Air Quality Forum or other such forums established in the region.
General operational activities	Increased nuisance dustfall rates	• Sides of TSF and dams should be vegetated and/or covered with nets to prevent wind-blown dust migration as far as possible. • Dust suppression measures should be employed on dirt roads on site.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Materials handling operations will be effectively managed to curb the release of fugitive dust. • Detailed air quality monitoring will be performed. MWS must take part in the Klerksdorp-Orkney- Stilfontein- Hartebeestfontein Air Quality Forum or other such forums established in the region.
4.2.2.6 NOISE		
Continual rehabilitation	Rehabilitation noise impacts of noise on residential receptors	• Rehabilitation activities should be planned taking cognisance of local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. • When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible. • Use noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines, if required. • Select equipment with the lowest possible sound power level. • Ensure equipment is well-maintained to avoid additional noise generation. • Workers should be equipped with appropriate gear to ameliorate the effects of noise levels.
4.2.2.7 HERITAGE		
General operational activities	Damage to archaeological/ palaeontological sites within the vicinity of operations	• The heritage site layout plan must be available on site. • The sites must be avoided by the operational team.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
4.2.2.8 SURFACE WATER		
Vehicle movement	Insufficient hydrocarbon management may impact surface water quality	• MWS Hazardous Substance Management Plan and Traffic Management Plan should be adhered to. • Construction vehicles must be parked, refuelled and serviced in the dedicated vehicle areas.
Vehicle movement	Insufficient hydrocarbon management resulting in soil contamination	• Drip trays to be used under all construction vehicle when parked. • Spill kits need to be located in all working areas of site and must be regularly inspected and maintained. • MWS Hazardous Substance Management Plan and Traffic Management Plan should be adhered to.
Vehicle movement	Soil compaction resulting in increased runoff leading to potential erosion	• Only identified travel routes to be utilized. • The traffic management plan should be adhered to.
Tailing Deposition	TSF overtopping would reduce surface water quality	• Maintain minimum pool on the TSF and ensure that it is centralised. • Maintain minimum freeboard. • Monitor pool level daily. • Implement and adhere to the AGA Code of Practice for TSFs. • Develop an Operating Manual, which should be available on site at all times. • The integrity of the surface run off control systems must be essential for the effective separation of clean and dirty water systems.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Contaminated water must be treated to acceptable quality levels prior to the discharge into the natural watercourses • Runoff, which is likely to contain suspended solids and sediments, should be routed through a settling pond to enable sediment to settle prior to discharge. • The company must ensure that the necessary water licenses are in place. • Dirty water and process water will be recycled as far as practically possible.
Tailing Deposition	TSF failure would reduce surface water quality	• National and International design standards should be adhered to. • SANS 10286 should be implemented and adhered to during the operational phase of the TSF. • AGA tailings management framework should be implemented. • Monitoring equipment must be inspected regularly to ensure functionality. • Stability assessments must be undertaken regularly. • Implement and adhere to the AGA Code of Practice for TSFs. • Develop an Operating Manual, which should be available on site at all times.
Tailing Deposition	Pipeline failures would result in reduced surface water quality	• Secondary containment must be available in case of emergencies. • Pipelines must be regularly inspected and maintained, as per a maintenance and replacement program. • The pipeline maintenance plan and containment risk assessment guidelines must be adhered to.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Continually monitor flows within the pipelines and install early warning systems to detect leakages. • Put in place a shut-down procedure should a pipe leakage be detected. • The pipeline should be inspected regularly, and early warning systems should be regularly tested. A detailed log of all inspections should be kept. • The spillage will be cleaned as soon as possible, and the contaminated area will be rehabilitated, as appropriate. • Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices. • A rapid response team should be available on 24-hour notice to deal with hazardous spills. • If a major spillage occurs the supplying contractor or area supervisor will be called out to clean the contaminated area and rehabilitated the soils, as appropriate. • Replacement pipes should be available in the event of theft to ensure immediate replacement.
Water Management (RWD and SWD)	Lack of operational storage capacity / freeboard may result in spillage, which would reduce surface water quality	• Dam level control philosophy should be adhered to, to ensure that there is always enough capacity in case of a large rainfall event. • The water balance should be calculated regularly. • Applicable design criteria should be applied to the dams. • An emergency spillway must be constructed and maintained in functional condition.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Prescribed operating levels must be monitored and adhered to. • RWD's and trenches must be regularly inspected and desilted when necessary. • Silt traps and paddocks must be constructed and maintained in a functional condition to manage stored water. • Maximize water return to reclamation sites (water re-use and circulation). • The TSF operating manual must be adhered to. • The company must ensure that all releases into the natural watercourses adhere to the DHSWS (Department of Human Settlements, Water and Sanitation) requirements and water registration conditions.
Storm water management	Inadequate clean / dirty water separation may result in reduced surface water quality	• North diversion channel must be maintained in functional condition. • A bund wall should be constructed and maintained in a functional condition around the TSF. • Solution trench must be concrete lined. • Dirty water storage facilities (RWD) should be maintained in a functional condition with enough capacity to prevent overflow of dirty water into the environment. • Operating manual & design report must be adhered to.
Storm water management	Insufficient storage capacity design may result in reduced surface water quality	• Dams designs to 1:50 yr flood event • Operating manual & design report

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• The integrity of the surface run off control systems must be essential for the effective separation of clean and dirty water systems. • Contaminated water must be treated to acceptable quality levels prior to the discharge into the natural watercourses • Runoff, which is likely to contain suspended solids and sediments, should be routed through a settling pond to enable sediment to settle prior to discharge. • The company must ensure that the necessary water licenses are in place. • Dirty water and process water will be recycled as far as practically possible. • Equipment should be adequately maintained
Climate change	Insufficient infrastructure design (spillage) may result in reduced surface water quality	• Impact of climate change has been considered in the designs of the infrastructure • Refer to water balance and design report
Climate change	Insufficient process water availability resulting in sourcing alternative water sources, such as raw water abstraction from the catchment area	• Optimise, re-use and recycle Investigate water saving technologies • Refer to TS operating manual; Investigate water saving technologies
TSF Concurrent Rehabilitation	Lack of concurrent rehabilitation may result in increased surface runoff from side slopes	• Prioritise rehabilitation is undertaken concurrently • Refer to Kareerand Rehabilitation Plan
TSF Concurrent Rehabilitation	Lack of care and maintenance may result in siltation of trenches / dams	• Prioritise rehabilitation is undertaken concurrently • Refer to Kareerand 1 TSF concurrent cover design

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
TSF Concurrent Rehabilitation	Incorrect rehabilitation may reduce surface water quality	• Prioritise rehabilitation is undertaken concurrently • Refer to Kareerand 1 TSF concurrent cover design
Uninterrupted operation	Loss of infrastructure availability due to (power failure, sabotage, inclement weather) may result in reduced surface water quality	• Emergency Response plans 1:50 year containment capacity designs • Refer to operating manual, COP, applicable standards & emergency response plan.
Waste management	Inadequate handling, storage & disposal of waste may impact surface water quality	• The MWS Waste Management Procedure must be implemented and adhered to. This will clearly demarcate the containments for different waste types (e.g. glass, plastic, oils, wood, etc.). These containments will be colour coded. • All domestic waste and hazardous waste will be stored in designated areas. • Waste management will form a detailed component as part of the induction process provided by the company. • All domestic and hazardous wastes will be removed by a licensed company to a licensed waste disposal site for either domestic and/or hazardous waste. • The company will adopt the cradle to grave principle to ensure that the waste is removed and disposed of in a prescribed and correct manner.
Hydrocarbon Management	Inadequate handling, storage & disposal of hydrocarbons may impact surface water quality	• MWS Hazardous Substance Management Procedure must be implemented and adhered to. • All chemicals, contaminated water and/or hydrocarbons will be stored in designated areas. • All materials presenting a potential contamination threat will be stored in an area with a bunded capacity of 110% of the volume stored.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Spill kits will be available at all areas where hydrocarbons are utilised. • Employees will be trained in the utilisation of the spill kits. • If any other minor spillage occurs the spillage will be cleaned immediately and the contaminated area will be rehabilitated, as appropriate. • Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of the good housekeeping practices. • MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised.
Chemical Management	Inadequate handling, storage & disposal of chemicals may impact surface water quality	• The AGA Hydrocarbon management procedure must be implemented and adhered to.
4.2.2.9 GROUNDWATER		
Interception of tailings seepage from upper weathered aquifer south and east as indicated in the groundwater study (GCS, 2020)	Dewatering of the surrounding aquifers	• Monitoring of tailings seepage interception system using pre-identified monitoring boreholes, to ensure that optimal groundwater levels are maintained during the interception process. • Monthly reporting and upgrading of tailings seepage interception system. • Implement water quantity and quality monitoring programme. • Compile annual water quality and quantity reports to assess potential impacts and implement mitigation measures if required. • Install flow meters to monitor the amount of water extracted, ensure the meters are maintained regularly.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Update numerical model every three years. • Maintain/update centralised monitoring database (for surface water and groundwater).
TSF management	Impact on groundwater quality (contamination) from current TSF and expansion and potential for poor contaminant seepage into the Vaal River	• Footprint preparation: compacting of foundation with Class C Liner during construction. • Implement tailings seepage interception system to maintain sulfate plume and re- use water for operational purposes. • Appoint a qualified groundwater specialist to undertake quarterly monitoring and annual numerical groundwater calibration. • Maintain/update centralised monitoring database (for surface water and groundwater) and continuous improvement of interception system. Continuously consider alternative and additional intervention. • Should it be determined by external geohydrological studies that activities have an impact on the surrounding groundwater users the MWS will put a plan in place to accommodate these users.
4.2.2.10 SOCIO-ECONOMIC		
General operation activities	Employment opportunities and additional job creation (positive)	• Prioritise local recruitment and procurement. • Encourage upskilling of employees. • Supplier development: prioritise local supplier.
General operation activities	Jobs to low-income households, thus reducing poverty (positive)	• Local recruitment of unskilled labour

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
General operation activities	Reduced economic diversity due to over-reliance on mining sector	• Focus on non-core goods and services in local procurement and enterprise development programmes. • Focus on post mining resilience in social development programmes. • Commence early on with portable skills programme for unskilled workers.
General operation activities	Intensive use of water and energy	• Formulate resource use plan; support local renewable energy programmes.
General operation activities	Economic costs for community resulting from environmental degradation	• Implement specialist mitigation measures as per the EMPr. • Establish an independent environmental forum that meets quarterly.
General operation activities	Visual, noise, environmental impacts resulting in a loss of sense of place	• Implement visual screening, dust control and water quality monitoring as per the EMPr. • Ensure efficient environmental management through implementation of the EMPr and assessment of implementation success (internal and external audits).
General operation activities	Nuisance factors in the form of traffic, dust, noise	• Ensure a functional communication system is in place with the affected communities. • Communicate with affected parties should an activity outside of normal operation occur, so as to warn them of increased nuisance factors. • Ensure efficient environmental management through implementation of the EMPr and assessment of implementation success (internal and external audits). • The company will ensure that the existing transportation system is effectively implemented to reduce the potential impact on the roads.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
General operation activities	Risk of failure, illegal miners, health risks, environmental risks impacting on community safety	• Ensure a functional communication system is in place with the affected communities. • Communicate with affected parties should an activity outside of normal operation occur, so as to warn them of increased safety risk factors. • Ensure efficient environmental management through implementation of the EMPr and assessment of implementation success (internal and external audits).
4.2.2.11 VISUAL		
Expansion/Reshaping of TSF - Accumulation of residue from the processing plant	Landscape visual change	• Utilize the topsoil bund, to an extent, as a visual screen to the TSF. • Plant indigenous trees around the perimeter fence to break structural forms and provide visual screens. • Expand and reshape the TSF such that it simulates the natural topography, as far as possible. • Ongoing rehabilitation will be undertaken through the life of the project. • The TSF will be designed with the aim of closure in mind. • The gradient of the side slopes will be designed to accommodate self-succession of natural vegetation. • The necessary clean and dirty water systems will be implemented and maintained to limit the impact on the topography.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Movement of construction vehicles and heavy machinery for the TSF expansion	Change of Visual Character	• Regulate the speed at which vehicles and heavy machinery move by implementing speed limitations (40 km/h). • Maintain the operational site in a neat and orderly condition at all times.
Movement of construction vehicles and heavy machinery for the TSF expansion	Dust creation	• Implement dust suppression activities. • Mitigation measures will be implemented to control wind erosion, i.e. wind breaks. • Regulate the speed at which vehicles and heavy machinery move by implementing speed limitations (40 km/h). • Maintain the dust monitoring programme. • MWS must take part in the Klerksdorp- Orkney- Stilfontein- Hartebeestfontein Air Quality Forum or other such forums established in the region.
Temporary stockpiling of topsoil bund for rehabilitation	Landscape visual change	• Reshape the stockpile so that it simulates the natural topography of the surrounding landscape. • Ensure that the topsoil stockpile slope promotes revegetation.
24/7 Night lighting for security and operational activities	Light Pollution (Glare, spill light, sky glow)	• Choose suitable types of lighting that minimize glare. • Only focus light sources on where it is needed. • Direct light sources downwards. • Minimize the number of night-time lights used. • Utilize mobile lights to prevent constant lighting in one position, where possible.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Use blinds/blinkers if necessary. • Implement timers on light sources to avoid unnecessary lighting. • Vehicles should be manufactured at Original Equipment Manufacturer (OEM) Standards. • All vehicles should undergo a pre-use checklist. • Implement a lighting management plan through consultation with a qualified lighting engineer or lighting specialist.
Architectural design of the RWD's and SWD	Landscape visual change	• Maintain the condition of the structures to ensure that glare/reflection levels are always as minimal as possible. • Utilize colours that complement the surrounding landscape and vegetation
4.2.2.12 HEALTH		
Dispersion of dust from TSF	Impact to human health	• Implement source and ambient air quality monitoring.
Dispersion of particulate matter (PM) from TSF	Non-cancer (systemic) health effects in humans	• Implement source and ambient air quality monitoring.
Seepage of contaminated water into the drinking water system	Risk of systemic health effects and cancer in humans	• Seepage and runoff from the tailings must be contained as far as possible through the implementation of the proposed groundwater interception system for the existing Kareerand TSF, concurrent side wall rehabilitation and the proposed Class C lining system for the extension.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Regular groundwater and surface water quality monitoring must be established and maintained in the areas potentially affected by seepage and runoff from the TSFs. • Any groundwater abstraction boreholes in use by members of the neighbouring communities should be closely monitored for deterioration of water quality. • Once the trend of baseline water quality variation is understood, any observed increase in the concentrations of elements and ions, especially arsenic, uranium or lead, should be immediately investigated and the use of groundwater from the affected borehole must be suspended.
4.2.2.13 RADIOLOGICAL		
Exhalation and dispersion of radon gas from tailings material to the atmosphere	Inhalation of the radon gas contributes to the total effective dose, potentially impacting human health over the long-term	• Ensure that radiation exposure is below the regulatory compliance criteria. • Optimise the radiation protection by applying the ALARA principle (As Low As Reasonable Achievable, economic and social factors taken into consideration). • The most effective way to reduce the radon exhalation rate is to provide a covering layer. This will increase the diffusion length to allow for the decay of the radon progeny before being released from the tailings surface.
Emission and dispersion of PM to the atmosphere as a result of wind erosion	The airborne dust (PM_{10}) and deposited dust contribute to the total effective dose through inhalation, ingestion and external radiation exposure routes.	• Ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint). • Optimise the radiation protection by applying the ALARA principle.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• From a dose optimisation perspective, the following mitigation measures can be applied and will contribute to a reduction in the total effective dose if applied for the duration of the operational period: o Develop and implement a dust management plan for the TSF. o Apply wetting agents, dust suppressant or binders on the exposed areas of the TSF. o Vegetate exposed areas of the TSF as soon as possible.
Controlled and uncontrolled releases of water containing radionuclides into the environment	Controlled or uncontrolled water releases may lead to an increase in concentration of radioactive elements in the soil and/or water	• Ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint). • Optimise radiation protection by applying the ALARA principle. • The following mitigation measures can be applied for uncontrolled releases and will contribute to a reduction in the total effective dose if applied for the duration of the operational period: o A surface water management plan should be developed to ensure that all runoff from dirty areas is directed to the existing stormwater management infrastructure and should not be allowed to flow into any of the nearby watercourses; o Discharge of water that can potentially contain radionuclides to the nearby watercourses should only be allowed if discharge authorisation has been granted by the relevant authorities (including the NNR);

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		○ The dirty water dams and dirty water channels should be lined either by concrete or High-Density Polyethylene (HDPE) to prevent contamination of groundwater through seepage; and ○ Water quality monitoring should continue downstream and upstream of the site, and within all surface water circuits at the site to detect any contamination arising from operational activities.
4.2.3 DECOMMISSIONING & CLOSURE PHASE		
4.2.3.1 GENERAL		
Environmental Awareness	Lack of awareness may result in environmental harm and/or non-compliance to the EMPr/EA	• Comprehensive induction of all employees on site, including an environmental section which outlines as a minimum the following: ○ Explanation of the importance of complying with the EMPr; ○ Discussion of the potential environmental impacts of development activities; ○ Employees' roles and responsibilities, including emergency preparedness; and ○ Explanation of the mitigation measures that must be implemented when particular work groups carry out their respective activities. Daily safety talks should include environmental topics (at least one environmental topic per week) to increase general and site-specific environmental awareness.
Monitoring of Compliance	Lack of monitoring may result in environmental harm and/or non-compliance to the EMPr/EA	• The operation should be informally monitored on a continual basis by the Applicant's representative or Site Manager to ensure compliance to the EMPr.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Implementation of the EMPr and conditions of the EA must be formally monitored (audited) every two (2) years by an appropriately qualified and experienced ECO.
Emergencies/Incidents	Incidents/Emergencies could impact health and safety or the environment	• All incidents and emergencies should be dealt with in line with the Emergency Response Plan for the site. • A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times. • Environmental incidents must be reported to relevant regulatory authority.
4.2.3.2 ECOLOGY		
Decommissioning/ closure/ rehabilitation activities	Increased presence of people on site	• Identified TOPS will leave the area upon disturbance if unimpeded. • Implement a monitoring plan for all TOPS confirmed on site and with a high likelihood to occur on site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species. • No domestic animals (other than local stock animals) will be allowed on site; where absolutely necessary domestic animals will be adequately restrained and not be allowed to run freely on the property. • Only contractors that have completed environmental awareness training, including the details of this report, are allowed to conduct activities on site. • No deliberate killing or trapping of indigenous fauna is allowed on site, unless trapping is done by a specialist to remove the specimen from the area.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Ensure all drivers and staff on site are informed of the importance of TOP species through environmental awareness training. • Maintain speed limits that will allow for adequate response time to any animals that may wonder onto the road. Current speed limits of 40km/hr are adequate, but consideration should be given to reducing speed limits to 30km/hr near pans, wetlands and rocky areas. • Should any indigenous fauna be trapped or killed by staff, appropriate reprimand/fine must be implemented. This must be specified in contractual agreements.
Decommissioning, closure, and rehabilitation activities	Dust, noise, human activity and emissions	• Utilise quieter equipment where feasible. • Ensure dust suppression, through water sprinkling, is applied at time of high dust generation. • Vegetate exposed soils. • Any noisy point-sources utilised on site should be enclosed, and all equipment / machinery fitted with silencers where applicable. • All equipment / machinery will be serviced and maintained within operating specifications to prevent excessive noise. • Monitor and maintain radiation, dust, emissions and noise within applicable national standards and manage as per specialists' recommendations. • Ensure environmental awareness training informs staff, contractors and visitors of noise, dust and vibration impacts on fauna.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Ensure monitoring plans in terms of the various "emissions" are applied as per specialist recommendations and apply necessary actions if issues arise.
Disturbance of soil/ Decommissioning, closure, and rehabilitation activities	Introduction of AIS / exacerbation of existing AIS (fauna and flora)	• Train staff and contractors on the identification of AIS. • Maintain the highly sensitive areas and connectivity on site as far as possible. Maintaining and improving local indigenous populations could assist in reducing alien species numbers on site through competition and predation. • Ensure the necessary permits are obtained for the establishment of declared AIS plantation for the passive treatment area. • Alien invasive species, in particular category 1 species that were identified within the study area should be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation • Compile and implement an alien invasive management plan (AIMP) in line with the municipal management plan, which must include measures to prevent attracting additional alien avifauna and mammals to site. This should include not feeding wildlife and ensuring that all food and food waste, including domestic waste, is placed in sealed containers and not exposed on site. • All construction vehicles and equipment, as well as rehabilitation material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the rehabilitation areas. This should be verified by the ECO.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Inspect outside areas regularly and clear all domestic and food waste from site. • All alien seedlings and saplings must be removed as they become evident for the duration of rehabilitation.
Revegetation	Poor plant selection and habitat creation	• Rehabilitation and revegetation must be done in line with an approved closure and rehabilitation plan, which must include a plot plan for proposed plant species to be used in revegetation. Only local indigenous flora must be utilised in rehabilitation and mixed species must be utilised with the aim of obtaining habitat characteristics similar to the current state. • Compile, implement and monitor the closure and rehabilitation plan and attend to any issues immediately.
4.2.3.3 AIR QUALITY		
General decommissioning activities	Potential impact on human health from pollutant concentrations	• Reduction of fugitive PM emissions through the watering of roads and the use of screens. • Reduction of vehicle exhaust emissions through the use of better quality diesel; and inspection and maintenance programs.
General decommissioning activities	Nuisance dustfall rates	• Reduction of fugitive PM emissions through the watering of roads, stockpiles and inactive open areas and the use of screens. • Reductions of vehicle exhaust emissions through the use of better quality diesel; and inspection and maintenance programs.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Closure activities	Potential impact on human health from pollutant concentrations associated with closure activities	• Reductions of vehicle exhaust emissions through the use of better quality diesel; and inspection and maintenance programs.
Closure activities	Nuisance dustfall rates associated with closure activities	• Reduction of fugitive PM emissions through the watering of roads, stockpiles and inactive open areas and the use of screens, if required.
4.2.3.4 NOISE		
Decommissioning, closure, and rehabilitation activities	Nuisance noise impacts on nearby communities	• Plan noisy decommissioning activities (e.g. demolition) in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding noisy rehabilitation activities should be provided to all local communities. Such information includes: o Proposed working times; o Anticipated duration of activities; o Explanations on activities to take place and reasons for activities; and o Contact details of a responsible person on site should complaints arise. • When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible. • Use noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines. • Select equipment with the lowest possible sound power levels.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Ensure equipment is well-maintained to avoid additional noise generation.
4.2.3.5 HERITAGE		
Decommissioning, closure, and rehabilitation activities	Damage to archaeological/ palaeontological sites within the vicinity of decommissioning activities (with emphasis on the site impacted by the TSF fence)	• The heritage site layout plan must be available on site and rehabilitation team must be made aware of the heritage sites. • The sites must be avoided by the rehabilitation team. • If decommissioning activities occur within close proximity of a heritage site, it must be protected using barricading and warning signs.
4.2.3.6 SURFACE WATER		
Vehicle movement	Insufficient hydrocarbon management may impact surface water quality	• Implement MWS Hazardous Substance Management Plan and Traffic Management Plan. • Decommissioning/rehabilitation vehicles must be parked, refuelled and serviced at the dedicated vehicle area.
Vehicle movement	Increase in soil compaction may result in increased surface runoff	• Only identified travel routes identified may be utilised • Implement the traffic management plan.
Rehabilitation	Lack of care and maintenance & monitoring may result in increased surface runoff from side slopes	• A rehabilitation maintenance program must be developed and adhered to, post decommissioning and closure. • Continual monitoring and inspections of rehabilitated TSF must take place. • The Kareerand TSF Rehabilitation Plan must be implemented.
Rehabilitation	Lack of care and maintenance & monitoring may result in siltation of trenches / dams	• A rehabilitation maintenance program must be developed and adhered to, post decommissioning and closure.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Continual monitoring and inspections of rehabilitated TSF must take place. • The Kareerand TSF Rehabilitation Plan must be implemented.
Rehabilitation	Lack of care and maintenance & monitoring may impact surface water quality	• A rehabilitation maintenance program must be developed and adhered to, post decommissioning and closure. • Continual monitoring and inspections of rehabilitated TSF must take place. • The Kareerand TSF Rehabilitation Plan must be implemented. • The surface water monitoring programme must be implemented.
Storm water management	Inadequate clean / dirty water separation may impact surface water quality	• The Kareerand TSF Rehabilitation Plan must be implemented. • The surface water monitoring programme must be implemented.
Storm water management	Insufficient storage capacity (1:50;1:100 rain event) may impact surface water quality	• The Kareerand TSF Rehabilitation Plan must be implemented. • The surface water monitoring programme must be implemented.
Storm water management	Reduction of catchment yield (run-off) monitoring may result in a decrease in catchment water quantity	• The Kareerand TSF must be correctly rehabilitated to allow for discharge of surface water post closure. • Water quality must be assessed before release. • The Kareerand TSF Rehabilitation Plan must be implemented.
Post closure infrastructure maintenance	Lack of maintenance monitoring may result in increased surface runoff from side slopes	• The Kareerand TSF Rehabilitation Plan must be implemented. • The surface water monitoring programme must be implemented.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Post closure infrastructure maintenance	Lack of maintenance monitoring may result in siltation of trenches / dams	• The Kareerand TSF Rehabilitation Plan must be implemented. • The surface water monitoring programme must be implemented.
Post closure infrastructure maintenance	Lack of maintenance monitoring may impact surface water quality	• The Kareerand TSF Rehabilitation Plan must be implemented. • The surface water monitoring programme must be implemented.
4.2.3.7 GROUNDWATER		
Operation and ultimate rehabilitation of TSF	Impact on groundwater quality from TSF and potential seepage of poor quality base-flow into the Vaal River	• Expand and continue with groundwater interception at prescribed positions and time frames (time frames will be confirmed routinely as monitoring data is assessed). Adjust pump rates according to seepage volumes continuously (reduction assumed annually). • Minimise infiltration on TSF by active phytoremediation and pond control. • Groundwater interception water evaporated on top of TSF. • Groundwater monitoring should be conducted as per the prescribed frequency. • Follow closure and rehabilitation plan. • Continue with water monitoring programme as per legislation/guideline requirements at the time. • Calibrate the numerical mass transport model at least every 2 years.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
4.2.3.8 SOCIO-ECONOMIC		
Decommissioning of the Kareerand operation	Employment loss through permanent job losses	• Develop mechanisms to assist employees to find alternative jobs, focus on non-core related local supply links during the operational phase.
Decommissioning of the Kareerand operation	Loss of social funds through termination of social projects	• Follow clear communication strategy. • Investigate the funding of self-sustaining projects or hand over to other entities.
Decommissioning of the Kareerand operation	Permanent loss of land	• Commence discussions related to post-closure land-use in consultation with local community and finalise alternative land-use plan during operational phase.
Decommissioning of the Kareerand operation	Loss of visual sense of place	• Implement visual screening measures such as re-vegetation and rehabilitation.
Decommissioning of the Kareerand operation	Dust and noise nuisance factors	• Implement a low risk end-use, as well as dust suppression and pollution control measures during decommissioning activities.
Decommissioning of the Kareerand operation	Risk of failure, illegal miners, health risks, environmental risks and their impacts on community safety	• Implement a low risk end-use, as well as dust suppression and pollution control measures during decommissioning activities. • Implement re-vegetation and rehabilitation, as well as monitoring programmes.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
4.2.3.9 VISUAL		
Movement of construction vehicles and heavy machinery for the reshaping and revegetation of the TSF and for the removal of infrastructure	Change of Visual Character	• Regulate the speed at which decommissioning/ rehabilitation vehicles and heavy machinery move by implement speed limitations (40 km/h). • Maintain the site in a neat and orderly condition at all times. • Minimise duration of disturbing decommissioning activities such as demolition.
Movement of construction vehicles and heavy machinery for the reshaping and revegetation of the TSF and for the removal of infrastructure	Dust creation	• Implement dust suppression measures. • Regulate the speed at which decommissioning/ rehabilitation vehicles and heavy machinery move by implement speed limitations (40 km/h). • Minimise duration of disturbing decommissioning activities such as demolition. • Maintain the dust monitoring programme until complete closure.
End of operation - Reshaping and revegetation of the TSF	Landscape visual Change	• Shape the final TSF landform such that it emulates the natural topography. • Shape the final TSF landform with a gradient/slope that will prevent erosion and promote maximum vegetation growth. • Revegetate the TSF with indigenous vegetation that complements the surrounding natural vegetation, whilst encouraging maximum vegetation growth.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
End of operation - Removal of the RWD's and SWD	Landscape visual Change	• Ensure that areas exposed by demolition of infrastructure are sufficiently rehabilitated and revegetated with suitable vegetation. • Reshape impacted areas such that they resemble the topography prior to construction, where possible (with exception of TSF and water pollution management infrastructure). • Maintain the site in a neat and orderly condition at all times.
4.2.3.10 HEALTH		
Dispersion of dust from TSF	Impact to human health	• Implement source and ambient air quality monitoring.
Dispersion of PM from TSF	Non-cancer (systemic) health effects in humans	• Implement source and ambient air quality monitoring.
Seepage of contaminated water into the drinking water system	Risk of systemic health effects and cancer in humans	• Seepage and runoff from the tailings must be contained as far as possible through the implementation of the proposed groundwater interception system for the existing Kareerand TSF, concurrent side wall rehabilitation and the proposed Class C lining system for the extension. • Regular groundwater and surface water quality monitoring must be established and maintained in the areas potentially affected by seepage and runoff from the TSFs. • Any groundwater abstraction boreholes in use by members of the neighbouring communities should be closely monitored for deterioration of water quality.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Once the trend of baseline water quality variation is understood, any observed increase in the concentrations of elements and ions, especially arsenic, uranium or lead, should be immediately investigated and the use of groundwater from the affected borehole must be suspended.
4.2.3.11 RADIOLOGICAL		
Implementation of the decommissioning plan	The execution of the decommissioning plan involves a site-wide plan to demolish, decontaminate and remove all the surface infrastructure that may contain or that are contaminated with radionuclides. These areas will be rehabilitated and cleaned for clearance by the NNR (positive)	• Implement final rehabilitation and mitigation measures at the TSF. • A gamma radiation survey must be performed at the infrastructure sites, followed by rehabilitation and clean-up for conditional or unconditional clearance from the NNR. • Any area that becomes contaminated during or because of operational activities must be rehabilitated and clean-up for conditional or unconditional clearance. • Establish of vegetation to reduce dust emissions. • Install of a covering layer to reduce dust emissions and radon exhalation rates during the post-closure period.
Exhalation of radon gas and PM from the remaining TSFs to the atmosphere through wind erosion	Inhalation of the radon gas contributes to the total effective dose through inhalation, ingestion and external radiation exposure routes.	• Ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint). • Optimise the radiation protection by applying the ALARA principle. • Vegetate exposed area of the Kareerand TSF to reduce wind erosion. • Install a covering layer over the exposed area of the TSF to reduce wind erosion and radon exhalation.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Leaching and migration of radionuclides from the TSFs	Abstraction and use of the contaminated water contribute to the total effective dose through the ingestion and possible external radiation exposure routes.	• Ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint). • Optimise the radiation protection by applying the ALARA principle. • Implement a passive groundwater remediation system downstream of the Kareerand TSF to capture the contaminant plume. Note that active remediation systems, such as cut-off trenches or a pump and treat system, might also be effective in the short to medium term.
4.2.4 RESIDUAL/CUMULATIVE IMPACTS		
4.2.4.1 ECOLOGY		
Site clearing / preparation	Fragmentation of habitat and loss of ecological corridors – residual impacts	• No activities are to commence within riverine (+100m buffer) and wetland areas until the necessary authorisations are obtained under the National Water Act (NWA) and NEMA. • No activities are to commence within the dolomitic grassland or within 300m buffer areas of *Pearsonia bracteata* and *Lithops lesliei* subsp. *lesliei*. • TOPS and provincially protected plant species should be conserved in site as far as possible. • A suitably qualified person (e.g. botanist / horticulturist) should survey the final layout within the growing season of the plants (summer months, preferably between November and February), in order to confirm whether these plants occur within the development footprint. • No TOPS plant species or provincially protected plant species should be removed without the required permit.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• All contractors should be aware of the protected species present on site and should undergo training in how to identify and relocate the protected plant species. • No open fires are permitted. • The grasses can be removed as sods and re-established after construction is completed. • Areas designated as having low and moderate sensitivity in terms of fauna and flora should be considered for all activities rather than areas designated as highly sensitive where possible. • Maintain areas as ecological corridors to provide fauna means for escape from development area. • Any plant SCC should remain conserved in situ where possible. • Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activities, the plants should be removed (if it could survive this process) by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority). Relocation of plant SCC to similar habitats unaffected by the proposed activities should be considered and a relocation plan should be developed and submitted to the relevant authorities. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area. • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Protect all areas susceptible to erosion (especially the sloped rocky grassland) and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • Colonisation of the disturbed areas by plants species from the surrounding natural vegetation must be monitored to ensure that vegetation cover is sufficient within one growing season. If not, then the areas need to be rehabilitated with a grass seed mix containing species that naturally occur within the study area. • Ecological corridors with a minimum width of 700 m should be maintained with Wildebeestpan, the Vaal River and highly sensitive terrestrial habitats, which must also consider regional ecological connectivity. • Plan and implement a proper storm-water management plan from the onset at all activity areas, which must allow for controlled storm-water diversion to prevent impact to surrounding areas. • Slopes of the diversion trench must be shallow enough for fauna to cross. • Any new fencing or linear structures erected in areas of high and moderate sensitivity must provide for small animal migration and unimpeded movement, as far as practicable. • The infrastructure proposed south of the existing TSF will limit east-west movement of fauna such as threatened or protected cat species, between two sensitive habitats and provision should be made to allow for connectivity between these two sensitive areas and the sensitive habitat further south of the RWDs and eucalyptus plantation or an ecological corridor established south of the fence line. This is in line with MWS's Biodiversity Conservation Management Plan.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Peg out and demarcate areas for development and no-go areas before commencing with any activities to prevent disturbance to areas not targeted for development and maintain indigenous habitat in these areas. • Maintain all areas of physical disturbance as small and compact as possible to limit the area of disturbance. • Where areas not targeted for development are inadvertently impacted and damaged, clear any material dumped and rehabilitate the site as soon as possible. • After construction is completed, rehabilitate all areas no longer required for operational phase to a state similar to the local indigenous character of the area and ensure animals can move through and around new infrastructure areas unencumbered. • No additional activity / development should be allowed outside that approved in the EMPr. • Area must be regularly monitored and rehabilitated as needed and ecological connectivity maintained at all times. • The Biodiversity management and monitoring plan must be implemented.
All activities	Any destruction of TOPS – residual impacts	• Identified TOPS will leave the area upon disturbance if unimpeded. • The Biodiversity management and monitoring plan must be adhered to. • Implement a monitoring plan for all TOPS confirmed on site and with a high likelihood to occur on site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• No activities are to commence within riverine (+100m buffer) and wetland areas until the necessary authorisations are obtained under the National Water Act (NWA) and NEMA. • No activities are to commence within the dolomitic grassland or within 300m buffer areas of *Pearsonia bracteata* and *Lithops lesliei subsp. lesliei*. • TOPS and provincially protected plant species should be conserved in site as far as possible. • A suitably qualified person (e.g. botanist / horticulturist) should survey the final layout within the growing season of the plants (summer months, preferably between November and February), in order to confirm whether these plants occur within the development footprint. • No TOPS plant species or provincially protected plant species should be removed without the required permit. • All contractors should be aware of the protected species present on site and should undergo training in how to identify and relocate the protected plant species. • No open fires are permitted. • The grasses can be removed as sods and re-established after construction is completed. • No domestic animals (other than local stock animals) will be allowed on site; where absolutely necessary domestic animals will be adequately restrained and not be allowed to run freely on the property. • Only contractors that have completed environmental awareness training, including the details of this report, are allowed to conduct activities on site.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• No deliberate killing or trapping of indigenous fauna is allowed on site, unless trapping is done by a specialist to remove the specimen from the area. • Areas designated as having low and moderate sensitivity in terms of fauna and flora should be considered for all activities rather than areas designated as highly sensitive where possible. • Maintain areas as ecological corridors to provide fauna means for escape from development area. • Any plant SCC should remain conserved in situ where possible. • Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activities, the plants should be removed (if it could survive this process) by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority). Relocation of plans SCC to similar habitats unaffected by the proposed activities should be considered and a relocation plan should be developed and submitted to the relevant authorities. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area. • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. Protect all areas susceptible to erosion (especially the sloped rocky grassland) and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Colonisation of the disturbed areas by plants species from the surrounding natural vegetation must be monitored to ensure that vegetation cover is sufficient within one growing season. If not, then the areas need to be rehabilitated with a grass seed mix containing species that naturally occur within the study area. • Ecological corridors with a minimum width of 700 m should be maintained with Wildebeestpan, the Vaal River and highly sensitive terrestrial habitats, which must also consider regional ecological connectivity. • Plan and implement a proper storm-water management plan from the onset at all activity areas, which must allow for controlled storm-water diversion to prevent impact to surrounding areas. • Slopes of the diversion trench must be shallow enough for fauna to cross. Any new fencing or linear structures erected in areas of high and moderate sensitivity must provide for small animal migration and unimpeded movement, as far as practicable. • The infrastructure proposed south of the existing TSF will limit east-west movement of fauna such as threatened or protected cat species, between two sensitive habitats and provision should be made to allow for connectivity between these two sensitive areas and the sensitive habitat further south of the RWDs and eucalyptus plantation or an ecological corridor established south of the fence line. This is in line with MWS's Biodiversity Conservation Management Plan. • Peg out and demarcate areas for development and no-go areas before commencing with any activities to prevent disturbance to areas not targeted for development and maintain indigenous habitat in these areas.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Maintain all areas of physical disturbance as small and compact as possible to limit the area of disturbance. • Ensure all drivers and staff on site are informed of the importance of TOP species through environmental awareness training. • Maintain speed limits that will allow for adequate response time to any animals that may wonder onto the road. Current speed limits of 40km/hr are adequate, but consideration should be given to reducing speed limits to 30km/hr near pans, wetlands and rocky areas. • Where areas not targeted for development are inadvertently impacted and damaged, clear any material dumped and rehabilitate the site as soon as possible. • After construction is completed, rehabilitate all areas no longer required for operational phase to a state similar to the local indigenous character of the area and ensure animals can move through and around new infrastructure areas unencumbered. • No additional activity / development should be allowed outside that approved in the EMPr. • Area must be regularly monitored and rehabilitated as needed and ecological connectivity maintained at all times. • Should any indigenous fauna be trapped or killed by staff, appropriate reprimand/fine must be implemented. This must be specified in contractual agreements.
All activities	Introduction of AIS / exacerbation of existing AIS (residual impacts)	• Maintain the highly sensitive areas and connectivity on site as far as possible. Maintaining and improving local indigenous populations could assist in reducing alien species numbers on site through competition and predation.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Ensure the necessary permits are obtain for the establishment of declared AIS plantation for the passive treatment area. • Compile and implement an AIMP in line with the municipal management plan, which must include measures to prevent attracting additional alien avifauna and mammals to site. This should include not feeding wildlife and ensuring that all food and food waste, including domestic waste, is placed in sealed containers and not exposed on site. • Inspect outside areas regularly and clear all domestic and food waste from site.
Spills (hydrocarbon, chemical, tailings, dirty water) & dumping of waste	Contamination and complete degradation of fauna habitat without remedy (cumulative impacts)	• Construction and operation of TSF and RWDs can only commence once the authorisations under NEMA and NWA are obtained. • Tailings and contaminated water can only be disposed to the TSF expansion area and RWDs when these sites and related infrastructure have been prepared as per approved engineered designs. • Stormwater and mine water separation, containment and treatment will be established in the areas before any potential contaminating activities commence. • Ensure emergency response procedures for spills from the TSF and RWD are in place before any activities commence, and ensure any equipment required for emergency response is readily and quickly available on site. • Discontinue use of all faulty machinery / equipment on site until properly repaired. • Ensure a waste management plan has been compiled in line with NEM:WA highlighting handling and storage of various wastes on site, including used hydrocarbons, in line with prescribed standards before any activities commence on site.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Hydrocarbons and hydrocarbon drums/cans/bottles, all hazardous substances and cement is to be stored in such a manner so as to prevent spills and contamination and should include measures such as appropriately lined and bunded areas; undercover areas where possible; etc. Such storage facilities must be provided before any substances are brought to site. • Regularly monitor and audit (annual internal audit and annual external audit), the development of the TSF and operation of the RWDs against the engineered designs and codes of practice and in accordance with the EA and IWULA requirements. • All equipment / machinery will be serviced and maintained within a designated workshop area with hydrocarbon management and collection system. • All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak. • New and used hydrocarbons must be properly stored and handled according to prescribed manner to prevent spills onto bare ground. • Any machinery or equipment parked on site will either be parked on a concrete slab or have pans placed under them to collect all drips and potential leaks. • Implement emergency response procedures immediately should spills and leaks be noted, which must focus initially on containment and prevention of spread. Once safe to do so, initiate and complete clean-up as soon as possible. • All hydrocarbon spills on bare ground will be cleared immediately. This will include the lifting of the contaminated soil for bioremediation or disposal to a hazardous waste facility.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Continue to measure and monitor leaks of any hydrocarbons as well as chemicals as per current ISO system schedule.
Spills (hydrocarbon, chemical, tailings, dirty water), dumping of waste & radiation	Contamination and complete degradation of faunal habitat without remedy (residual impacts)	• Construction and operation of TSF and RWDs can only commence once the authorisations under NEMA and NWA are obtained. • Tailings and contaminated water can only be disposed to the TSF expansion area and RWDs when these sites and related infrastructure have been prepared as per approved engineered designs. • Stormwater and mine water separation, containment and treatment will be established in the areas before any potential contaminating activities commence. • Ensure emergency response procedures for spills from the TSF and RWD are in place before any activities commence, and ensure any equipment required for emergency response is readily and quickly available on site. • Discontinue use of all faulty machinery / equipment on site until properly repaired. • Ensure a waste management plan has been compiled in line with NEM:WA highlighting handling and storage of various wastes on site, including used hydrocarbons, in line with prescribed standards before any activities commence on site. • Hydrocarbons and hydrocarbon drums/cans/bottles, all hazardous substances and cement is to be stored in such a manner so as to prevent spills and contamination and should include measures such as appropriately lined and bunded areas; undercover areas where possible; etc. Such storage facilities must be provided before any substances are brought to site.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
		• Regularly monitor and audit (annual internal audit and annual external audit), the development of the TSF and operation of the RWDs against the engineered designs and codes of practice and in accordance with the EA and IWULA requirements • All equipment / machinery will be serviced and maintained within a designated workshop area with hydrocarbon management and collection system. • All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak. • New and used hydrocarbons must be properly stored and handled according to prescribed manner to prevent spills onto bare ground. • Any machinery or equipment parked on site will either be parked on a concrete slab or have pans placed under them to collect all drips and potential leaks. • Implement emergency response procedures immediately should spills and leaks be noted, which must focus initially on containment and prevention of spread. Once safe to do so, initiate and complete clean-up as soon as possible. • All hydrocarbon spills on bare ground will be cleared immediately. This will include the lifting of the contaminated soil for bioremediation or disposal to a hazardous waste facility. • Continue to measure and monitor leaks of any hydrocarbons as well as chemicals as per current ISO system schedule.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
4.2.4.2 SOILS AND AGRICULTURE		
Construction and operation of the TSF and its supporting infrastructure	Cumulative impacts: • Destruction of current land capability of the areas where infrastructure will be constructed • Other mining activities in the area not related to the Kareerand TSF Expansion • Expansion of settlement areas into areas with arable and grazing land capability when work opportunities created by the Kareerand TSF result in a population influx of migrant workers in search of employment opportunities.	• The project infrastructure footprint should be kept to the project layout as provided in the EIA report. • Prevent overgrazing and soil erosion around the site, as far as practicable.
Construction and operation of the TSF and its supporting infrastructure	Residual impacts: • Destruction of current land capability of the areas where infrastructure will be constructed • The progressive loss of areas grazing and arable land capability that can be used for livestock grazing, game farming as well as other agricultural enterprises.	• The project infrastructure footprint should be kept to the project layout as provided in the EIA report. • Prevent overgrazing and soil erosion around the site, as far as practicable.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Construction and operation of the TSF and its supporting infrastructure	Cumulative impacts: • Loss of agricultural production and agricultural-related employment within the fenced-off area • Other mining activities in the area not related to the Kareerand TSF Expansion	• The project infrastructure footprint should be kept to the project layout as provided in the EIA report. • MWS to investigate the introduction of alternative agricultural projects in the area.
Construction and operation of the TSF and its supporting infrastructure	Residual impacts: • Loss of agricultural production and agricultural-related employment within the fenced-off area • A reduction of the volume of food produced within the district municipality	• The project infrastructure footprint should be kept to the project layout as provided in the EIA report. • MWS to investigate the introduction of alternative agricultural projects in the area
Construction and operation of the TSF and its supporting infrastructure	Cumulative impacts: • Loss of soil ecosystem services and soil fertility in areas where topsoil is stripped • Other mining activities in the area not related to the Kareerand TSF Expansion that impact on soil ecosystem services and soil fertility.	• The project infrastructure footprint should be kept to the project layout as provided by the EIA report and not spread outside of the fenced-off area. • Topsoil, whether present in stockpiles or as part of the topsoil bund wall, should be protected against wind and water erosion until vegetation has established on the exposed topsoil surfaces. • If natural revegetation does not occur, natural vegetation should be established on the topsoil stockpiles.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
Construction and operation of the TSF and its supporting infrastructure	Residual impacts: • Loss of soil ecosystem services and soil fertility in areas where topsoil is stripped • The progressive loss of soil ecosystem services results in the progressive degradation of soil quality and the services provided such as water and nutrient cycling.	• The project infrastructure footprint should be kept to the project layout as provided by the EIA report and not spread outside of the fenced-off area. • Topsoil, whether present in stockpiles or as part of the topsoil bund wall, should be protected against wind and water erosion until vegetation has established on the exposed topsoil surfaces. • If natural revegetation does not occur, natural vegetation should be established on the topsoil stockpiles.
Construction and operation of the TSF and its supporting infrastructure	Cumulative impacts: • Soil pollution from pumping of waste slurry through pipelines to the Kareerand TSF complex for processing • Any existing soil contamination as a result of previous spills and leaks from the existing pipeline network. • Sabotage of the pipelines by artisanal miners in search of gold-containing material that they can process. • Other mining activities in the area not related to the Kareerand TSF Expansion.	• Regular maintenance of the pipelines is required to prevent waste leaks and spill events. • All pipelines must be checked regularly in order to detect any if there are any leaks of waste product. • Should any leaks or waste spillage from the pipelines be detected, the soil directly affected by the spill as well as in a radius of 20 m around the spill area, must be assessed by a soil pollution expert. • Any soil pollution assessment following on a leak or spill from the pipelines, should be accompanied by recommendations with proven soil remediation techniques. • The soil polluted by any leaks and spills from the pipelines should be remediated directly after it is detected to avoid migration of pollutants into the groundwater or air as emission particles.
Construction and operation of the TSF	Residual impacts:	• Regular maintenance of the pipelines is required to prevent waste leaks and spill events.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
and its supporting infrastructure	• Soil pollution from pumping of waste slurry through pipelines to the Kareerand TSF complex for processing • Gradual or sudden enrichment of soil with soil contaminants will result in bioaccumulation of the contaminants in vegetation and increased contamination levels of groundwater, surface water and air. This has negative human and environmental health impacts.	• All pipelines must be checked regularly in order to detect any if there are any leaks of waste product. • Should any leaks or waste spillage from the pipelines be detected, the soil directly affected by the spill as well as in a radius of 20 m around the spill area, must be assessed by a soil pollution expert. • Any soil pollution assessment following on a leak or spill from the pipelines, should be accompanied by recommendations with proven soil remediation techniques. • The soil polluted by any leaks and spills from the pipelines should be remediated directly after it is detected to avoid migration of pollutants into the groundwater or air as emission particles.
Construction and operation of the TSF and its supporting infrastructure	Cumulative impacts: • Soil pollution from storage of processed mine tailings waste in the proposed expanded TSF • Other mining activities in the area not related to the Kareerand TSF Expansion. • Any existing soil contamination present as a result of the site being part of a larger gold mining area.	• An assessment of the current soil contamination status of the area around the proposed Kareerand TSF Expansion, must be conducted prior to the construction phase. This assessment must inform a detailed soil contamination monitoring plan for the operational phase that include bi-annual monitoring of the comprehensive range of contaminants that are present in the processed tailings waste as well as any other soil contaminant that are the by-product of operations at the Kareerand TSF. • An increase in soil contamination levels detected, must be addressed immediately through soil remediation. • All areas that had undergone soil remediation must continually be monitored to ensure that the soil remediation measures were effective.

ACTIVITY	IMPACT	MANAGEMENT ACTIONS
	Extreme weather events such as major floods and wind storms that increase the distance and severity of contaminant transport from the TSF.	
Construction and operation of the TSF and its supporting infrastructure	Residual impacts: • Soil pollution from storage of processed mine tailings waste in the proposed expanded TSF • Gradual or sudden enrichment of soil with soil contaminants will result in bioaccumulation of the contaminants in vegetation and increased contamination levels of groundwater, surface water and air. This has negative human and environmental health impacts.	• An assessment of the current soil contamination status of the area around the proposed Kareerand TSF Expansion, must be conducted prior to the construction phase. This assessment must inform a detailed soil contamination monitoring plan for the operational phase that include bi-annual monitoring of the comprehensive range of contaminants that are present in the processed tailings waste as well as any other soil contaminant that are the by-product of operations at the Kareerand TSF. • An increase in soil contamination levels detected, must be addressed immediately through soil remediation. • All areas that had undergone soil remediation must continually be monitored to ensure that the soil remediation measures were effective.
4.2.4.3 VISUAL		
After closure rehabilitation	Landscape visual change	• Monitor rehabilitation for a year after rehabilitation activities are complete. • Ensure that alien & invasive plant species are eradicated.

4.3 Monitoring Programme

The following monitoring programme (**Table 4.6**Table 4.5**)** has been developed in order to monitor the impact of this project on the environment. Monitoring actions have been guided by specialist input and current monitoring undertaken by the mine.

The Applicant's signature on this document indicates that the Applicant acknowledges their responsibility to uphold the specific monitoring commitments detailed below.

Table 4.6: Monitoring actions required throughout project lifecycle.

ASPECT	PARAMETERS	FREQUENCY
Compliance	Compliance to EMPr conditions	EO: Daily during construction Weekly during operation and decommissioning ECO: Bi-monthly during construction Biennially during operation and decommissioning
Ecology and Wetlands	Spread of invasive species	Monthly
	TOPS	Daily (informal- presence only) and annual (formal)
	Surrounding natural areas	Weekly
	Biomonitoring (SASS5, Fall, habitat, water quality, toxicity, diatom analysis) according to aquatic biodiversity monitoring plan	Bi-annually
	Monitoring of *Pearsonia bracteata* and *Lithops lesliei* subsp *lesliei*. (photograph, count, impacts)	Annually
	Vegetation monitoring	Annually- fixed point photography of sensitive habitat Every three years- quantitative vegetation monitoring

Soil	Soil contamination Pipelines- leakages	Bi-annual Daily
Air Quality	Dust, as per Air Quality Monitoring programme Emissions	Monthly Monthly, as per National Atmospheric Emission Inventory System requirements
Heritage	Monitoring of AGA-MWS-MGD-2, AGA-MWS-MGD-3 and AGA-MWSMGD-8 to ensure no impact	Monthly
Surface Water	As per surface water monitoring programme- quality and quantity	Monthly
Groundwater	As per groundwater monitoring programme – quality and groundwater level, borehole flow rates	Quarterly & bi-annually
Socio-Economic	Use of local labour, goods and services, enhancement of economic diversity, minimization of resource use impact Minimisation of negative impacts associated with inflow of workers	Annually
Visual	Rehabilitation	Monthly for one year after rehabilitation is complete
Radiation	<u>Surface water, sediments, and groundwater</u> Full-spectrum analysis (U-238, U-235, Th-232 and progeny) Total Uranium and Thorium, and Ra-226	Annually Quarterly for surface water, bi-annually for groundwater, biennially for sediments.
	<u>Radon Gas</u> Environmental radon using Radon Gas Monitors (RGMs)	Quarterly, for a period of 2-3 months.

	Dust fallout Total Uranium and Thorium, and Ra-226	Annually

5 CONCLUSION

This EMPr contains practical mitigation measures for all activities that will occur throughout the lifecycle of this project. Should the measures provided within this EMPr be implemented effectively, environmental impacts will be mitigated as far as possible. In signing this EMPr, Mine Waste Solutions (Pty) Ltd accepts responsibility to ensure the measures outlined above are implemented.

APPENDIX A

CV of Environmental Assessment Practitioner (EAP)

Sharon Lee Meyer

International Environmental Group Manager

CORE SKILLS

- Project Management.
- Technical Report Writing.
- Technical Supervision and Review.
- Environmental and Social Impact Assessment.
- Client engagement.
- Stakeholder Engagement.
- Resource management and integration.
- Resettlement Action Plans and Livelihood Restoration Planning.

DETAILS

Qualifications

- BSc Zoology and Geography (University of Witwatersrand) 1999
- BSc Honours Environmental Management (University of Witwatersrand) 2000
- MSc Zoology and Environmental Education (University of Witwatersrand) 2007

Memberships

SACNASP – *Pr. Sci. Nat.*

International Association for Impact Assessment – Gauteng Branch Committee

Languages:

English (Excellent)

Afrikaans (Good)

Countries worked in:

South Africa
Mozambique
Namibia

PROFILE

Sharon joined GCS has over 18 years' experience as a Principal Environmental Assessment Practitioner within the consulting field. The work experience that she has ranges from small urban development projects to large projects with multi-national team input. She has worked on various projects and her focus has been on coal and diamond mining, industrial waste management and power generation projects. Sharon has focused on innovation in industrial waste management in the mining and electricity generation sectors. She has worked in power generation on coal fired power stations, combined cycle gas plants, wind and hydroelectric scheme projects. Sharon has worked on site and linear projects, managing biophysical and socio-economic impact assessments.

Sharon has skills and experience in the following areas:

- Project management
- Strategic environmental assessment
- Resource management and allocation
- Technical review
- Business development
- Impact assessment
- Conservation planning
- Sustainability reporting and auditing
- Environmental management and mitigation

Sharon has managed multi-disciplinary teams on projects of national and strategic importance, to comply with international funding requirements. She works closely with the client and authorities to identify practical and sustainable solutions to address business challenges.

Recent key project experience as Project Manager and Principal Environmental Assessment Practitioner includes the following projects:

- Medupi Power Station Flue Gas Desulphurisation Retrofit ESIA, Waste Management License and WULA, South Africa.
- Chitima Integrated Coal Power Project ESIA and RAP in Tete Province, Mozambique.
- Okatji Marble Mine Monitoring, Water Use Licensing and Authorisation, Namibia.
- Kendal Power Station Continuous Ash Disposal Facility ESIA, Waste Management License and WULA, South Africa.
- Richards Bay Combined Cycle Power Project EIA, South Africa.
- Koffiefontein Diamond Mine New Tailings Facility EIA, South Africa.
- Kangra Water Liability Assessment and Reporting for Closure, South Africa.

Previous Experience

Year	Employer	Project description	Roles and responsibilities
November 2017- June 2018	Savannah Environmental (Pty) Ltd	Principal Environmental Consultant	Technical Report Writing Impact Assessment Project Management Technical Review Auditing and Monitoring Client Liaison Stakeholder Engagement Management and Coordination of Multi-Disciplinary Teams
September 2013 – October 2017	Zitholele Consulting (Pty) Ltd	Divisional Lead and Senior Environmental Scientist	Resource Allocation and Management Project Management Marketing Technical Review Technical Report Writing Impact Assessment Client Liaison Stakeholder Engagement Management and Co-ordination of Multi-Disciplinary Teams

Previous Experience

September 2009 – August 2013	Envirokey Management Services CC	Director and Senior Scientist	Resource Allocation and Management Project Management Client Liaison Marketing Technical Review Impact Assessment Project Management Technical Report Writing Stakeholder Engagement
July 2007 – August 2009	Holgate, Meyer and Associates CC	Partner and Senior Environmental Scientist	Resource Allocation and Management Project Management Impact Assessment Marketing Technical Review Client Liaison Technical Report Writing Stakeholder Engagement

Previous Experience

May 2005 – June 2007	Cymbian Environmental Services (Pty) Ltd	Environmental Consultant	Technical Report Writing Impact Assessment Project Management Stakeholder Engagement Client Liaison
May 2003 – April 2005	Oryx Environmental Consulting CC	Junior Environmental Consultant	Technical Report Writing Impact Assessment Environmental Management Planning Biodiversity Action Plans Strategic Environmental Management Plans
January 2001 – April 2003	Eskom Enterprises - TSI	Environmental Officer	Environmental Management Plans Animal Interaction Investigations Waste Management Committee Impact Assessment Technical Writing