HYDROLOGICAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED SOUTH3 OPENCAST MINING ACTIVITIES AT MODIKWA PLATINUM MINE, SEKHUKHUNE DISTRICT MUNICIPALITY, LIMPOPO PROVINCE

Report Prepared for

MODIKWA PLATINUM MINE

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EXECUTIVE SUMMARY

Segope Water and Environmental Services (Segope Consulting) has been appointed by the Modikwa Platinum Mine to conduct a Hydrological Impact (Surface Water) Assessment study for the proposed South 3 opencast mining activities on Farm Winterveld 293 KT in Limpopo Province of South Africa. A Hydrological Impact Assessment of the site is undertaken to form part of the Environmental Impact assessment (EIA), the associated Environmental Management Plan (EMP) as well as the Water Use License Application (WULA).

The objective of a Hydrological Impact Assessment is to characterize the surface water resources in the affected catchment/s and to provide the specialist hydrological input required for the WULA.

The scope of work included the following:

- Site visit on the 25th of April 2024;
- A water user assessment during the site visit;
- Assessment of the 1:100 and 1:50 year floodlines;
- Assessment of the potential impacts and risks of the proposed activities on the surface water resources;
- Development of a site-specific surface water management plan to mitigate the identified impacts.
- Preparation of a site map that marks the limits of disturbance to the watercourse and recommended erosion and sediment controls.
- Compiling the Hydrological Impact Assessment Report to inform the design criteria of the river diversions, energy dissipation and erosion protection measures.

Water quality sampling was conducted downstream of the proposed mine to gather baseline information of Tubatsane River prior to the proposed mining project. A monitoring plan was recommended for the sampling sites and other additional points.

Floodline delineation was conducted for 1:50 and 1:100 return periods. The result indicates areas which should be avoided due to risk of inundation during the flood period.

Conceptual stormwater management plan was conducted for the project area. Both clean and dirty water areas were identified with their expected runoff.

Risk assessment as a result of the proposed activity was determined for the construction, operation and decommissioning phase of the project. This process indicated the possible impacts and also proposed mitigation measures for impacts. It is recommended that the mitigation measures be implemented to protect the environment. Findings of this report are to be used to aid the client in preliminary planning of all required river diversions and stormwater control structures based on the to-date envisaged mine pit layout.

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LIST OF ABBREVIATIONS

DEM	Digital Elevation Model
DWS	Department of Water and Sanitation
MAE	Mean Annual Evaporation
MAMSL	Meters Above Mean Sea Level
MAP	Mean Annual Precipitation
MAP	Mean Annual Precipitation
WMA	Water Management Area
MAR	Mean Annual Rainfall
IWRM	Integrated Water Resource Management
IWWMP	Integrated Waste Water Resource Management
NFEPA	National Freshwater Ecosystems Priority Areas
WUL	Water Use Licence
EA	Environmental Authorization
GN	Government Notices
mamsl	Meters Above Mean Sea Level
NEMA	National Environmental Management Act, Acy 107 of 1998
NWA	National Water Act, Act 36 of 1998
NWRS	National Water Resources Strategy
WMA	Water Management Area
WR2012	Water Resources of South Africa 2012 Study
PCD	Pollution Control Dam
WRD	Waste Rock Dump
EMPr	Environmental Management Program
MAR	Mean Annual Runoff
SANS241:2015	South African National Standard for drinking water
SAWQG	South African Water Quality Guidelines

1. INTRODUCTION

1.1 Background

Segope Water and Environmental Services has been appointed by Modikwa Platinum Mine to undertake a Hydrological (Surface Water) Impact Assessment to support the Water Use Licence (WUL) application for the proposed opencast mining project called the South 3. The South 3 project is to be located on portion 0 of farm Winterveld 293 KT within the Fetakgomo-Tubatse Local Municipality at the Sekhukhune District Municipality.

The MPM is situated in the Limpopo province within quaternary catchment B41J. The mine is located approximately 20 km west of Burgersfort and 18 km north of Steelport on the Eastern Limb of the Bushveld Complex. MPM currently has mining rights on Portions of farms: Maandagshoek 254 KT, Driekop 253 KT, Hendriksplaats 281 KT, Overwatch 292 KT, Winterveld 293 KT and Doornbosch 294 KT (**Figure 1.1**). The mine has both open pits and underground mining operations.

The mine is proposing to develop openpit mining activities on farm Winterveld 293 KT which will follow the conventional opencast methods. This will include stripping of 40 to 60 thousand tonnes per month (ktpm) with concurrent backfilling. The ore from the open pit will be extracted by a combination of excavation, crushing, washing and concentration and then be transported by truck to the primary crusher stockpile. Waste will be disposed to waste dumps on the surface.

The methodogy followed to conduct the hydrological study is detailed in Section 1.4 of this report. The study was commenced first by an intrusive investigation to address technical gaps, followed by a solution driven process, focused particularly on the mitigation of surface water impacts from mine facilities and associated infrastructures.

The format and content of this report follows the listed items as stipulated for an Integrated Waste Water Management Plan (IWWMP) in the Regulations regarding the procedural requirements for Water Use License (WUL) applications and appeals, Government Notice (GN) R267, Government Gazette 40713 24 March 2017. The general site layout plan is presented in **Figure 1.2** below.

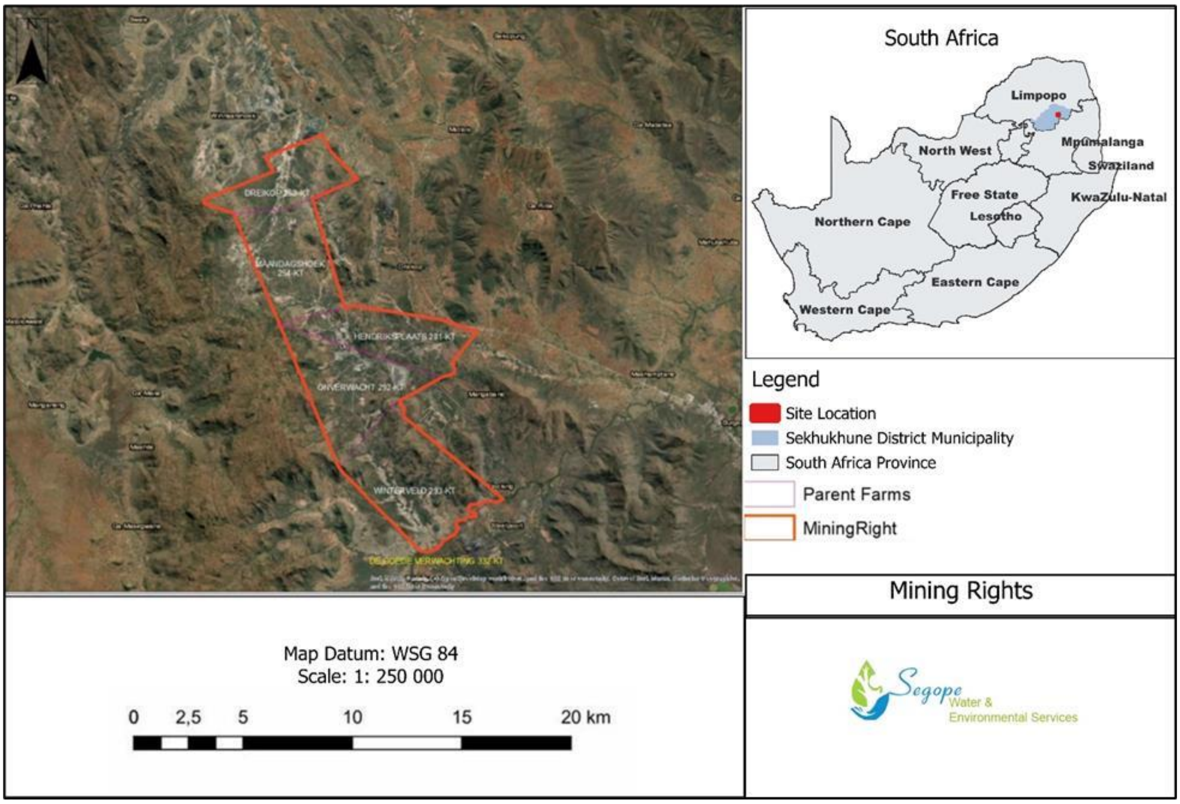

Figure 1.1: Mining Rights

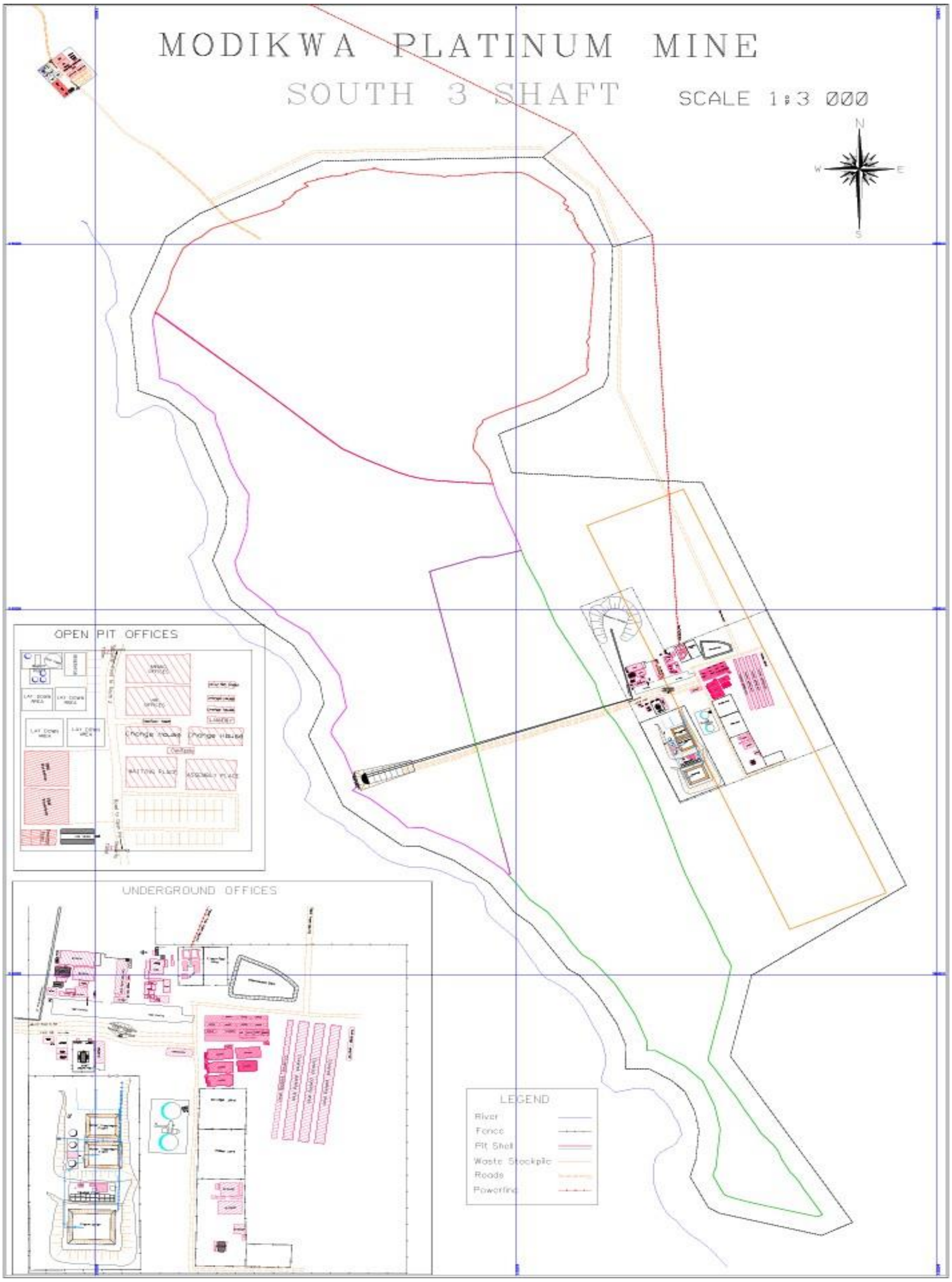

Figure 1.2: Proposed site layout plan

1.2 Property Description and Locality of the Activity

The proposed South 3 opencast project is to be located on farm Winterveld 293 KT, which is owned by the Samancor Chrome Mine, and for which MPM has a lease agreement. The site locality is indicated in **Figure 1.3**. Access to South 3 project area will be through a gravel road which joins a tarred road leading to R555 in Steelpoort town, which then joins the regional road (R37) from Burgersfort.

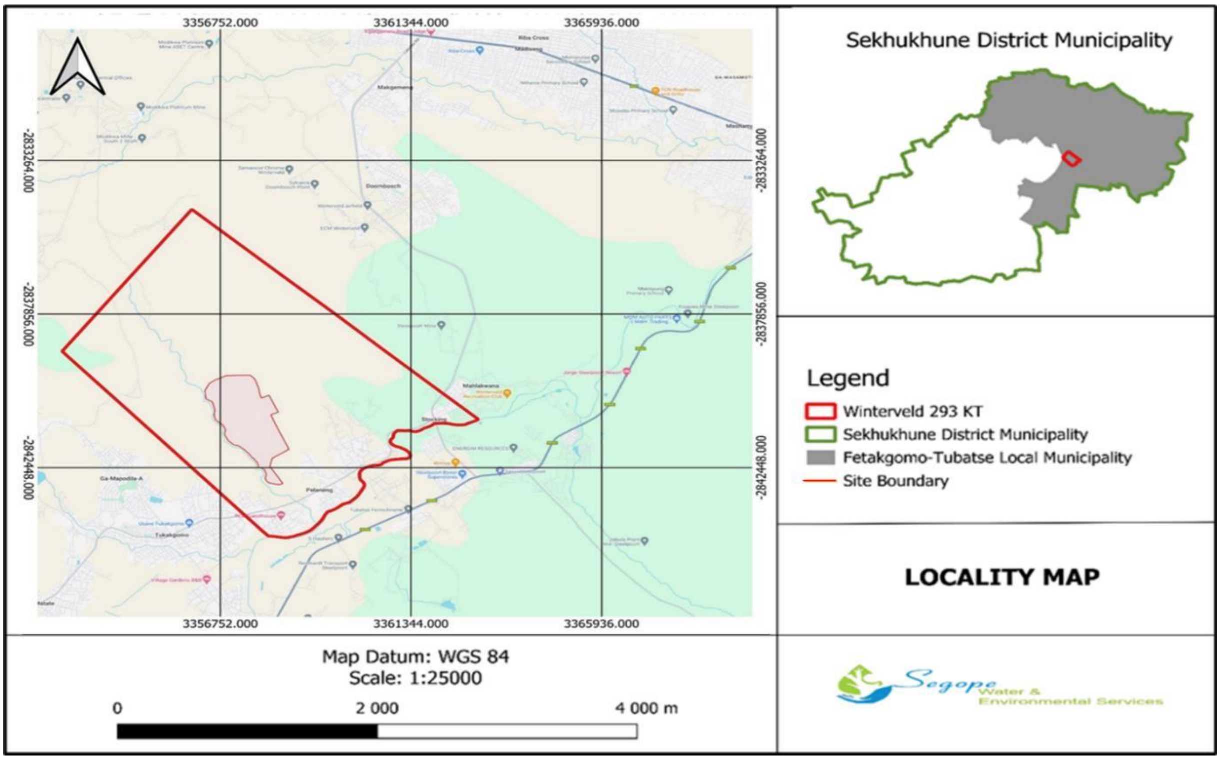

Figure 1.3: Site Locality Map

1.3 Property Description

The total extent of the proposed project area is approximately 273 hectares (**ha**). The property full description is given in **Table 1.1**.

Table 1.1: Property Description

Latitude	Longitude	Property Portion	Area(ha)	21 Digit Surveyor General Code
24°38'31"S	30°8'13"E	0	273	T0KT00000000029300000

1.4 Scope of work

The terms of reference of the report included the analysis of 1:50-year and 1:100-year flood lines and stormwater management plan which were developed by the civil engineers, as well as conducting the general hydrological impact assessment to assess and identify potential impacts that may arise from the mining and associated activities; *i.e.* this report assesses the impact to surface water resources by the proposed mining project. As part of the proposed activities on properties described in **Table 1.1** in the earlier Section 1.3, it is a requirement that the 1:50 year and 1:100-year flood lines be delineated to meet the National Water Act (36 of 1998) standards.

The floodline and impact assessment on surface water resources followed the following process:

- The site visit was conducted on the 24th of April 2024;
- The regional setting was defined in terms of the hydrology and the climatic conditions;
- The quaternary scale surface water drainage was described and evaluated using historic records;
- The local scale drainage was derived and delineated using hydrological spatial tools;
- The baseline water quality of the area was assessed through water sampling and analysis;
- The design rainfall of the study area was determined;
- The appropriate method for calculation of design flood peak discharge values for the derived watercourses was selected.
- The 2-dimensional hydraulic model of the areas inundated by the 1:50 and 1:100-year design flood events was assessed;
- Impacts to the surface water resources and drainage network were evaluated for the project against the defined catchment status;
- Management measures were recommended for reduction of the risk of impacts and the resultant impacts re-assessed.

1.5 Study Approach

The following approach was adopted for this study:

a) Literature Review

A review of the literature of previous studies on the project's catchment was conducted, this provided information to enable proper assessments and substitution of data where there are limitations.

b) Hydrological Impact Assessment and Flood Delineation

The hydrological impacts of the open-cast mining were assessed and quantified for all phases of the project which are the construction, operational and decommissioning phases, with the following factors addressed:

- The proposed project footprint was assessed and its impact on hydrology was determined;
- Flood peaks were evaluated for the 1:50yr and 1:10yr recurrence intervals;
- The project impact on Mean Annual Runoff (MAR) was determined;

- Surface water quality issues were identified and quantified;
- Flood lines were assessed for both the 50- and 100-year recurrence interval design rainfall.

c) Hydrological Impacts Reporting

The report was compiled on the following with regard to hydrological impacts:

- Identification and mapping of sensitive areas, affected receptors and areas of influence.
- Direct, indirect, irreversible and cumulative impact of anticipated activities on the surface water resources.
- Compliance with legal and policy framework;
- Recommendation of mitigating and monitoring measures.

d) Rehabilitation Plan for operation and post-mining operations

1.6 Assumptions and Limitations

- This study is limited to floodlines determined and a hydrological assessment;
- In-situ water quality data taken is representative of the study area;
- This study assumes that the project proponents will always strive to avoid, mitigate or off-set potential negative project-related impacts on the water resources.
- Impact avoidance is regarded as the best form of mitigation and should be prioritized as the primary means of mitigation;
- The study further assumes that the project proponents will seek to enhance potential positive impacts on the environment.

1.7 Legislative Framework

Water management is controlled by the National Water Act (NWA), 1998 (Act 36 of 1998), which is the primary statute providing the legal basis for water resource management in South Africa and has to ensure ecological integrity, economic growth and social equity when managing and using water. The Acts and Regulations that pertain to surface water include:

- The Constitution of the Republic of South Africa (Act 108 of 1996);
- The National Water Act, Act 36 of 1998 (hereafter referred to as NWA);
- The NWA introduced the concept of Integrated Water Resource Management (IWRM), comprising all aspects of the water resource, including water quality, water quantity and aquatic ecosystem quality. The Integrated Water Resource Management (IWRM) approach provides for both resource directed and source directed measures. Resource directed measures aim to protect and manage the receiving environment, whilst source directed measures aim to control the impacts at source;
- The National Environmental Management Act, Act 107 of 1998 (hereafter referred to as NEMA);
- National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM: WA);

- Government Notice (GN) R991 of 18 May 1984: Requirements for the purification of waste water or effluent.

2. HYDROLOGICAL DETERMINANTS OF THE STUDY SITE

2.1 Topography

The topography of the project area is rugged and characterized by steep hills and mountains in the north and north-eastern regions, with a broad relatively flat land towards the south and western parts. The lower-lying flat plain areas are at an average height of 750 metres above mean sea level (mamsl). The highest ridges have elevations of approximately 1 300 mamsl at the northeastern parts of the project site. The topography of the project site is highly influenced and, is directly related to the underlying geology, past and present climatic/drainage conditions. The investigation area falls on 1:25 000 map sheets 2430 CA.

The floodline and stormwater management plan and related analysis were performed mostly using Laser Imaging Detection and Ranging (LIDAR) data. The Digital Terrain Model (DTM) for LIDAR dataset was evaluated with a 0.5 m resolution by using the LAS point cloud provided by MPM. The topography of the study area in vicinity of the mine site is presented in **Figure 2.1**.

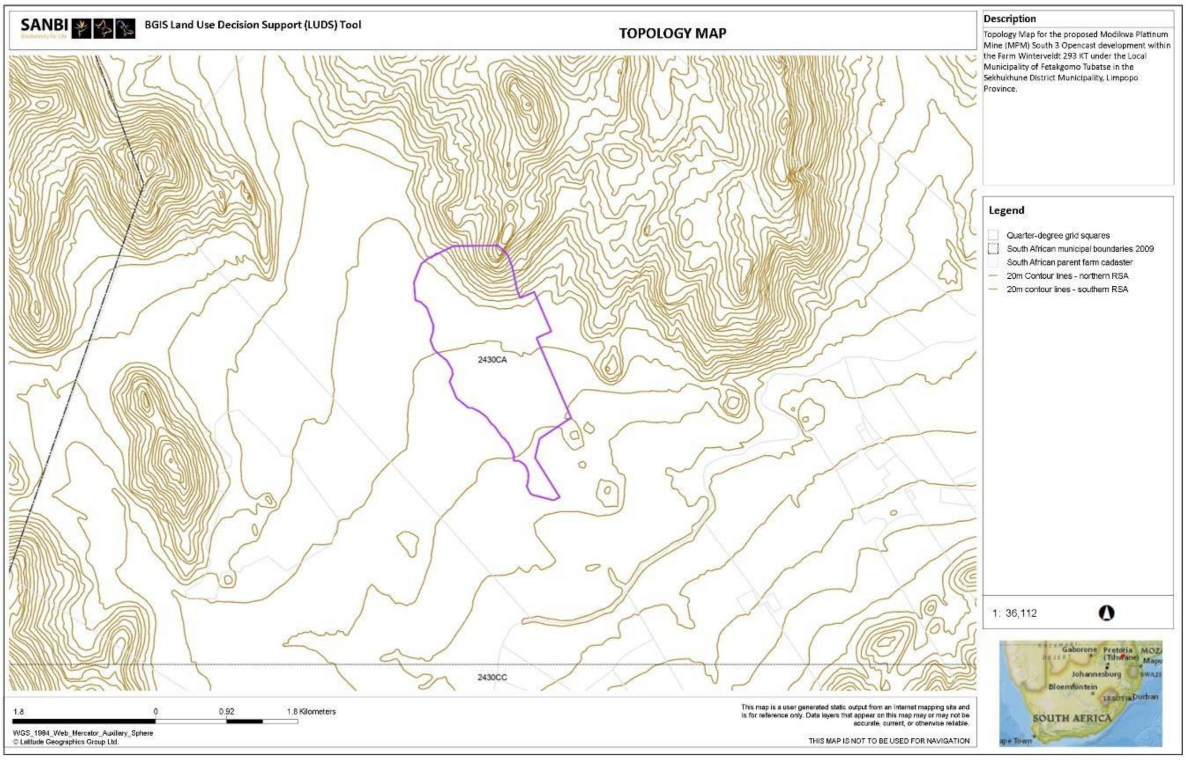

Figure 2.1: Topography map

2.2 Climate

Modikwa Platinum Mine is situated in Limpopo province, which is a summer rainfall area, with warm to hot climate and a relatively high humidity in summer. Average daily temperatures vary from 32°C in January to 24°C in July. The wind direction is mostly from south-southeast to north-northwest. The Mean Annual Precipitation (MAP) for this area is approximately 705.85 mm, with the highest concentrations of rainfall between October and March (**Table 2.1**). The winter months contribute very little to the annual rainfall. **Figure 2.2** depicts the long-term annual average climatic conditions throughout the year.

Table 2.1 : Temporal Distribution of Rainfall and Evapotranspiration in the Study Site

Month	Mean Monthly Rainfall (mm)	Mean Monthly Evaporation(mm)
January	128.65	229.6
February	123.8	198.7
March	72.6	198.1
April	51.3	162.4
May	11.3	151.2
June	11.35	129.7
July	7.95	119.8
August	10.15	173.2
September	28.9	192.7
October	41.35	228.1
November	102.75	215
December	115.75	216.9
Annual	705.85	2201.5

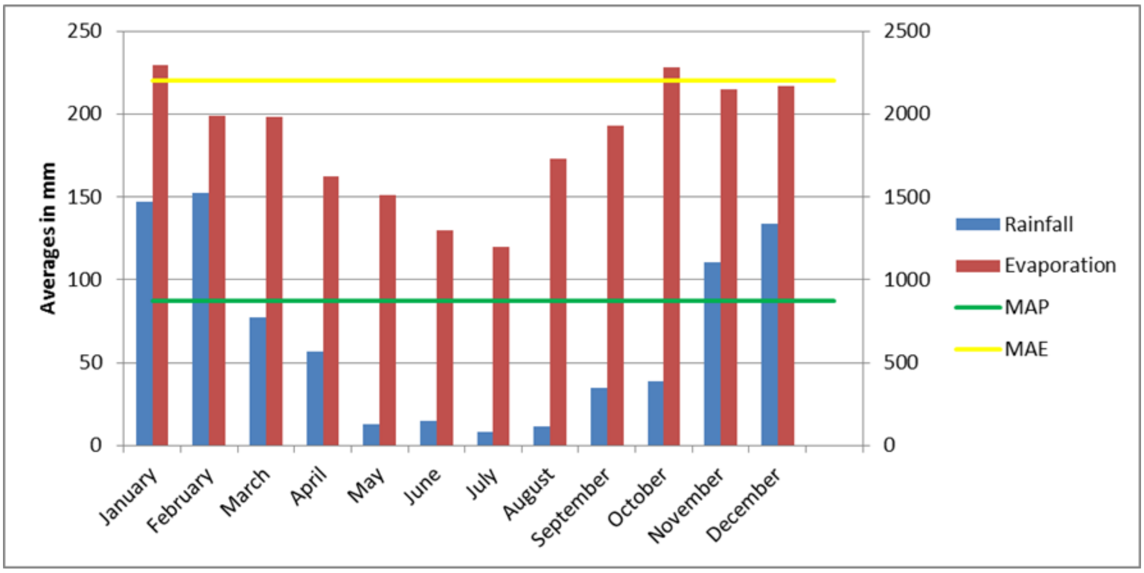

Figure 2.2: Summary of climatic information

2.3 Land Use/Land Cover

Significant correlation between land use /landcover (LULC) and hydrology has been proven by several studies. Changes in LULC may alter the hydrological and geomorphological processes of a catchment. As a result, these changes tend to alter the water balance components through enhanced or reduced evaporation, peak flow, flooding, and modified river morphology. The proposed project site is predominately a naturally vegetated area, covered mainly by natural wooded grasses, with areas along the water courses eroded. The LULC cover map of the project area is given in **Figure 2.3** below (DFFE,2022).

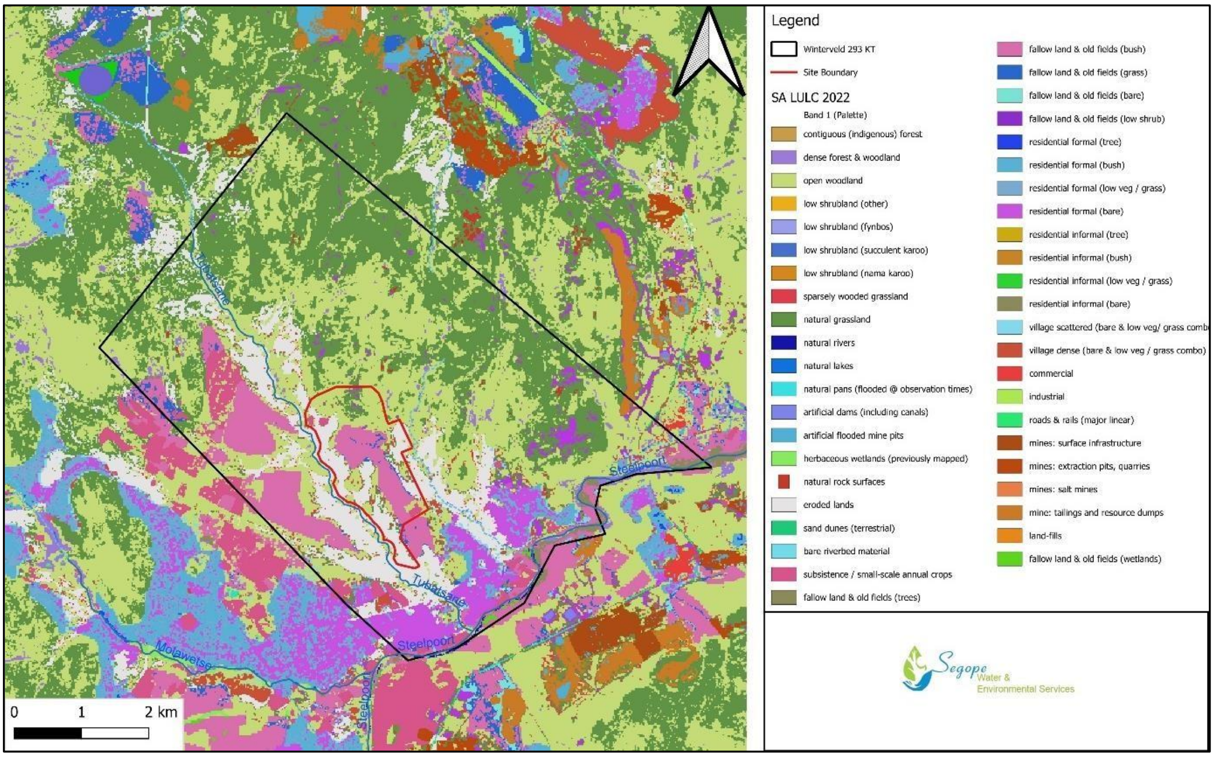

Figure 2.3: LULC map

2.4 Surface Water

The regional hydrological setting of the project site is shown in **Figure 2.4** below.

2.4.1 Water Management Area

South Africa is divided into nine water management areas (WMA), managed by their separate Catchments Management Agencies (CMAs) according to the second edition of the National Water Resource Strategy (NWRS2) (National Water Resource Strategy, 2013). The South 3 project area falls within the Olifants WMA with the major rivers in the WMA being the Steelpoortrivier, Elands, Wilge, and the Olifants River. All of the runoff from the project area is eventually drained into the Olifants River.

2.4.2 Quaternary Catchment

Each of the WMA is made up of quaternary catchments which relate to the drainage regions of South Africa, ranging from A – X (excluding O). These drainage regions are subdivided into four known divisions based on size. For example, letter B represents the primary drainage catchment, B2 for example, will represent the secondary catchment, B21 represents the tertiary catchment and B21D would represent the quaternary catchment, which is the lowest subdivision in the Water Resources 2012 Study (WR2012) manual. Each of the quaternary catchments have associated hydrological parameters including area, mean annual precipitation (MAP) and mean annual runoff (MAR), to name a few.

The mining lease area of the proposed project falls within quaternary catchment B41J with an area on 69100 ha and a net mean annual runoff (MAR) of 13.30 million cubic meters (mcm). The area comprises mainly of a relatively flat terrain and undulating valleys with areas of significant erosion associated with wide, open and eroded drainage lines.

2.4.3 Site Specific Water Resources

The project area is drained by the Tubatsane River (perennial river) and the Mofafa River (non-perennial, intermittent river). These two streams, one on each side of the proposed South 3 project area, do not have a confluence with each other. All runoff from the project area flow in a south-easterly direction to join the Steelpoort River downstream of the project area, which is a major tributary of the Olifants River System.

2.4.4 Surface Water Quality

Water quality sampling was undertaken for physical, chemical and microbiological quality on a downstream point at the Tubatsane River. During the time of site visit, the non-perennial Mofafa River was not flowing and therefore, no sample could be taken from it. The water samples were only taken downstream of the project site on the Tubatsane River to determine the baseline surface water conditions and impacts of land use activities on the river before the project starts.

Water quality samples were collected on the 12th of June 2024 and sent to The Elements (Pty) Ltd laboratory for analysis. The quality results were compared to the SANS 241-1:2015 drinking water standard (SANS, 2015) as well as the DWS/WRC 1998 domestic water supplies standard as indicated in **Table 2.3** below.

Table 2.2: DWS/WRCw Classification System of Suitability for Domestic Water Use

Class 0	Ideal water quality-suitable for lifetime use.
Class 1	Good water quality-suitable for use, rare instances of negative effects.
Class 2	Marginal water quality condition. Negative effects may occur in some sensitive groups.
Class 3	Poor water quality-unsuitable for use without treatment. Chronic effects may occur.
Class 4	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

Water sample results are summarised below while the sample certificates are attached to this report as Appendix **A**:

2.4.5 Wetlands

For the purpose of this report, the location of wetlands on the property was determined based on a database of National Freshwater Ecosystems Priority Areas (NFEPA) wetland types for South Africa by Van Deventer *et al*. (2010). No wetlands were identified based on this desktop assessment.

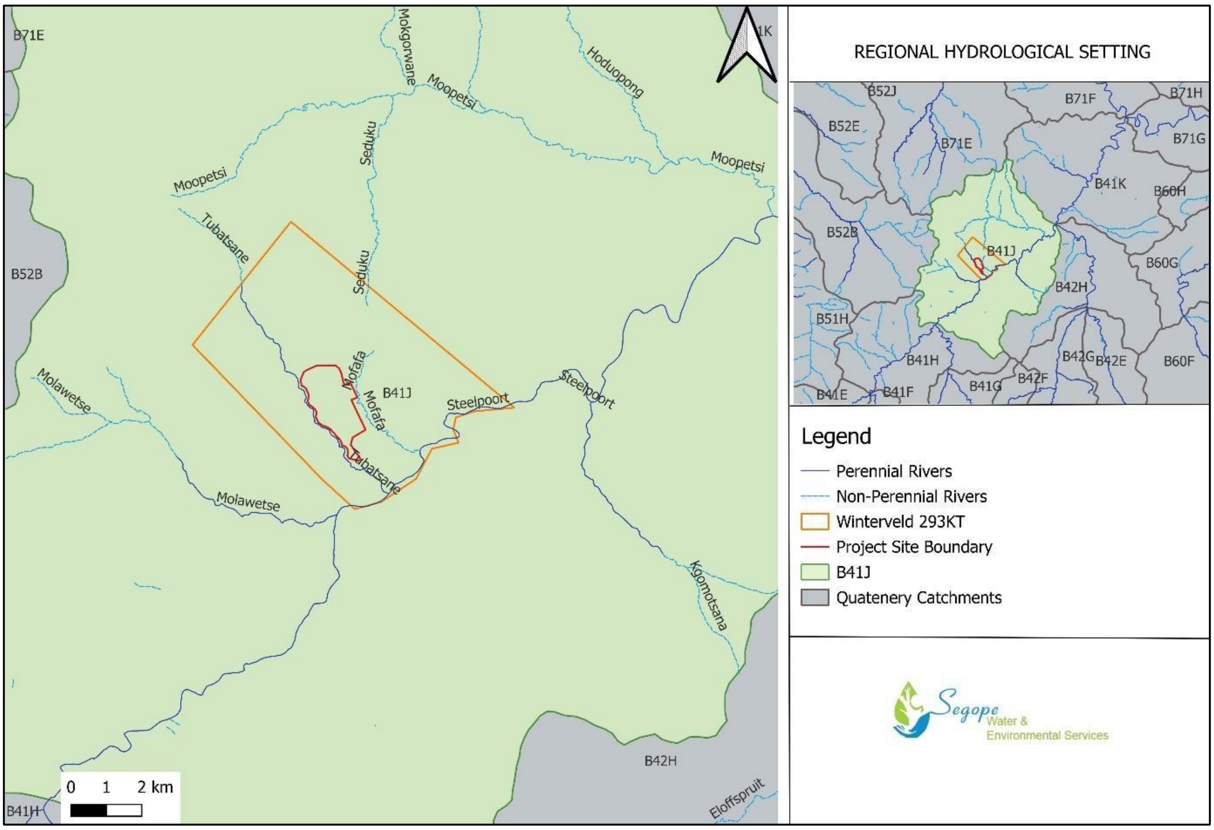

Figure 2.4: Regional Hydrological Setting

3. FLOODLINE DELINEATION

The aim of flood modelling undertaken as part of this study was to fulfil the requirements of the National Water Act (Act 36 of 1998) and more particularly, Government Notice 704 (Government Gazette 20119 of June 1999) (hereafter referred to as GN 704). The final mining plan will need to consider the specific provisions of GN704.

In order to satisfy the Gazette Notice referred to above, it was necessary to determine the peak flows for the design floods with return periods of 1:50 and 1:100. The flood lines were then delineated for Tubatsane and Mofafa River to arrive at a determination if the mining location meets the Gazette conditions of being located at more than 1:100 m flood line and 100 metres away from the watercourse.

3.1 Design Rainfall

The design rainfall depths of 24-hour to 7-day duration storm events for return periods from 2-years to 200-years were obtained from the design rainfall database (Smithers and Schulze, 2002) for the closest rainfall station.

3.2 Design Flood Hydrology

3.3 Hydraulic Modelling

3.3.1 Model software

HEC-RAS 6.0 software was used for the purposes of routing the peak flows resulting from the 1:50 year and 1:100-year storm event through the identified watercourses/rivers. HEC-RAS is a hydraulic programme used to perform 1/2-dimensional hydraulic calculations for a range of applications, from a single watercourse to a full network of natural or constructed channels. The software is used worldwide and has consequently been thoroughly tested through numerous case studies.

The input required to run the model included:

- Cross sections from the lidar dataset provided by the client;
- "Roughness" of the watercourse which is obtained from a site visit;
- Mixed flow regime for both subcritical and supercritical flows;
- Calculated peak flow data.

3.3.2 Roughness Coefficient

The Manning's n roughness factor is used to describe the frictional characteristics of a specific surface. Selection of the Manning's n roughness factor is based on the surface characterization of the river section being modelled. The surface characteristics investigated includes vegetation cover and also the meandering of the rivers. According to (Chow, 1959), meandering rivers can increase the Manning's roughness factor by as much as 30 percent.

Therefore, based on the vegetation cover identified from areal imagery, an average Manning's n factor ranging of 0.05 was selected to best represent the frictional characteristics of the surface of both Tubatsane and Mofafa Rivers, which includes the main channels and floodplains.

4. FLOOD DETERMINATION RESULTS

4.1 Design Flood Estimation

The graphical representations of the current and future floodlines for rivers are shown in **Figure 4.1-4.3**. Details of the HECRAS model output data are given in **Appendix B**.

4.2 Flood Delineation

5. STORMWATER MANAGEMENT PLAN

A stormwater management plan is required to ensure that there is a satisfactory clean and dirty water separation. All clean water emanating from the upstream environment is required to be diverted away to the nearest watercourse or downstream environment. All dirty water emanating from the pit area needs to be captured and contained within a sump where the water can be re-used within the mine operations.

The conceptual SWMP has been prepared according to the following guidelines and legislative requirements:

- DWS Best Practice Guideline G1: Storm Water Management,
- DWS BPG A4: Pollution Control Dams,
- DWS BPG A5: Water Management for Surface Mines, and
- GN704: Regulations on the use of water for mining and related activities aimed at the protection of water resources.

5.1 Government Notice 704

The regulation which allows for the management of clean and dirty water within a mining environment is the GN 704 (Government Gazette 20118 of June 1999). GN704 was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources. The five main principal conditions of GN 704 applicable to this project are:

- ***Condition 4*** *which define the area in which mine workings or associated structures may be located with reference to a watercourse and associated flooding. The 50-year flood-line* *and 100-year flood line are used for defining suitable locations for mine workings (mining, underground mining or excavations) and associated structures respectively. Where the flood line is less than 100 metres away from the watercourse, then a minimum watercourse buffer distance of 100 metres is required for both mine workings and associated structures.*

- ***Condition 5*** *which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource.*
- ***Condition 6*** *which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level.*
- ***Condition 7*** *which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable.*

5.2 The Stormwater Management Plan

5.3 The Stormwater Maintenance Plan

The main purpose of the stormwater maintenance plan is to ensure proper functioning of stormwater controls. The stormwater maintenance plan is to be carried out during specific periods of the year, these periods include pre-wet season, peak-wet season and during the peak-dry season months.

The rationale behind these key periods is described below:

- **Pre-wet season**: During the period leading up to the wet season various activities are required to ensure that all stormwater controls are functioning effectively. These activities include undertaking a site inspection to assess blockages/debris within key locations including main channels (clean water). The pre wet season site inspection should occur towards the end of September.
- **Peak-wet season**: During this period site inspections should be undertaken as a follow up on the initial pre wet season site inspection. This is undertaken to determine if the preceding rains resulted in any damages to the stormwater controls, and if any blockages had occurred at key locations mentioned. Peak wet season month site inspections should occur towards the end of December and January.
- **Pre-dry season**: During this period, a site inspection should be undertaken to assess and rectify any damages as a result of the rainfall for the remainder of the wet season following January. Although during the dry season no major rainfall is anticipated, there may be short duration high intensity rainfall events that could produce high peak flows at the stormwater control outlets. It is therefore necessary to undertake a site visit to ensure all stormwater controls are functioning correctly. Pre dry season site inspection should be undertaken towards the end of April.

The summary of the stormwater maintenance plan is indicated below:

Table 5.1: The stormwater maintenance plan

Months	Dry Season	Wet Season	SITE INSPECTION AND REMEDIATION		
			Pre-Wet Season	Peak-Wet Season	Pre-Dry Season
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

6. SURFACE WATER IMPACTS

Any mining activity in a natural system will have an impact on the surrounding environment, usually in a negative way. However, the risks of impacts to the environment can potentially be prevented were possible and/or mitigated where it occurs.

The following key issues have been identified as potential impacts for the South 3 opencast project from a hydrological perspective. These impacts are discussed in this Chapter, while the associated risks and possible mitigating measures are discussed in the proceeding chapter.

6.1 Changes in Catchment Characteristics

The characteristics of the catchment is likely to be altered by the proposed development. **Table 6.1** provides a list of proposed mining activity infrastructure affecting surface water hydrology. Infrastructure has been classified as "dirty" or "clean" in terms of the DWA Best Practice Guidelines (BPG). Every effort must be made to keep "clean" areas clean and to collect and contain runoff from "dirty" areas. The total area of infrastructure will be approximately 273 ha with areas of each specific infrastructure units still to be determined.

Table 6.1: Proposed South 3 infrastructures

Description	Dirty or Clean
Water abstraction pumps	Clean
Water Pipelines	Clean
Water Reservoir Tank	Clean

Description	Dirty or Clean
Conveyor Belts	Dirty
Domestic Waste Facility	Dirty
Explosive storage and waste explosive materials and packaging destruction areas	Dirty
Access Road from South 3 to South2	Moderate
Excavators	Moderate
Fencing	Moderate
Topsoil stockpile area	Moderate
Vehicle Parking	Moderate
Wash Bay and Service Area	Moderate
Front End loaders	Dirty
Fuel and material storage and handling facilities	Dirty
Pollution control dam (PCD)	Dirty
Salvage Transfer yard	Dirty
Septic Sewage System	Dirty
South 3 Open pits	Dirty
Stockpiled top soil	Dirty
Waste rock dump (WRD)	Dirty
Waste Rock Dumps	Dirty
Water Recycling puddle	Dirty

Surface water runoff from clean areas should be discharged directly to natural watercourses and not contaminated. Clean storm water should only be contained if the volume of the runoff poses a risk (for attenuation purposes), if the water cannot be discharged to watercourses by gravitation, or when the clean area is small and located within a large dirty area.

Surface water runoff from dirty areas should be collected and contained in order to ensure that the following objectives are met:

- Minimisation of contaminated areas and reuse of dirty water (wherever possible);
- Prevention of overflows and minimisation of seepage losses from storage facilities (such as pollution control dams);
- Prevention of further deterioration of water quality;
- Separation of dirty water in terms of degree of contamination (very dirty water should be kept separate from moderately dirty water)

6.2 Reduction in Catchment Yield

Certain infrastructure, such as the pollution control dams, and waste rock dump would cause an increase in hydrologically ineffective areas. Being dirty, surface water emanating from these areas would be captured and treated to a quality level as close to source as possible. Consequently, the MAR would decrease as shown in **Table 6.2.**

The mining associated infrastructure is estimated to take-up approximately 273 ha of the effective catchment area. For this project, WR2012 quaternary runoff data (Middleton and Bailey, 2012) was estimated for the 273-ha area to be taken up by the project in order to obtain runoff volume that will be reduced. The Mean Annual Runoff (MAR) to be reduced was calculated relative to B41J catchment area using the following equation:

$$Q_1 = \sqrt{\frac{A_1}{A_2}} \times Q_2$$

Where: Q_1 is the MAR reduced by activity (mcm); $A_1$is the project infrastructure area (km²); A_2 is the area for quaternary catchment B41J; and Q_2 is the natural MAR of B41J.

Results of the calculated project site MAR made using the equation above is given in **Table 6.2**. The percentage reduction of MAR of B41J due to the proposed opencast mining activity and its associated surface infrastructure with an area of approximately 273 ha is given in **Table 6.3**. The Quaternary Catchment B41J net natural MAR will be reduced by 6.3% due to the proposed activities.

Table 6.2: Project site MAR

Quaternary Catchment B41J Area (ha)	Baseline Quaternary Catchment B41J MAR (mcm)	Project site Area (ha)	% of B41J covered by the Project Site	Project Site MAR (mcm)
69100	13.30	273	0.40	0.84

Table 6.3: Anticipated Post Development Reduction in MAR

Project Site MAR (mcm)	Post Development B41J MAR (mcm)	Reduction in B41J MAR (%)
0.84	12.46	6.3

6.3 Removal or Alteration of Natural Water Courses

The natural water courses as derived in this report may not be altered; however, mitigation measures will be put in place to ensure that the stability of the water courses is maintained.

6.4 Change in Peak Runoff and Discharge Volumes

Peak runoff for the catchment has been determined. Most of the areas with mining infrastructure will be ineffective to produce runoff or produce little runoff, therefore resulting in reduction of catchment discharge volumes.

6.5 Increased Sediment Yield

The proposed mine infrastructure would require removal of vegetation, the stripping of topsoil and the excavation of pits for mining. This would increase the erosion potential of the catchment and subsequently result in increased sediment in to the Steelport River. Furthermore, the construction access roads to general mining activities such as excavation would increase the quantity of airborne dust. This dust would settle on the ground surface where it would present an additional source of sediment during rain events.

6.6 Increase in Pollutant Load

Mining processes are dirty by nature, and are therefore potential major source of pollutants. Whilst the proposed mining infrastructure has been classified as either “clean” or “dirty,” it is imperative that surface water runoff from the dirty areas is captured and adequately treated. Wherever possible, treated water should be reused in the mining process. Hydrocarbons, such as oils and petroleum fuels, represent a potential threat to surface water quality. As such, the potential impact of accidental spillages should be assessed and mitigated.

7. IMPACT IDENTIFICATION AND MITIGATION

This exercise of impact identification and mitigation involves identification of water courses within the proposed project properties as well as the description of the identified risks that might occur in the environment during the various phases of the project. This section provides an overview of the impact assessment methodology and findings as per the Environmental Impact Assessment and Environmental Management Programme Report (Segope Report No.0072024/EIA DEIA/EMPr,2024).

Findings of the impact assessment phase include both positive and negative impacts on the water resources which were identified for various phases of the project (pre-construction, construction, operation and decommissioning and closure). For all existing infrastructure, the impacts from infrastructures within 1:50 and 1:100 flood lines and 100 m from the watercourse/s have been assessed for the operational, closure and post-closure phases only as construction is not applicable. Impacts from the construction phase have however been assessed for the proposed infrastructure together with anticipated impacts from the operational, closure and post-closure phases.

7.1 Risk Assessment Matrix

The risk rating matrix methodology used is based on the following quantitative measures:

- **Magnitude (M)** of the impact occurrence - This indicates whether the impact is likely to be destructive or have a lesser effect;
- **Duration (D)** of impact occurrence - This refers to the period of time that the impact may be operative for (i.e. the lifetime of the impact);
- **Extent/Scale (S)** of impact occurrence - This indicates the spatial extent that may be affected by the impact and further describes the possibility that adjoining areas may be impacted upon. (The area in which the impact will be expressed); and
- **Probability (P)** of impact occurrence - This refers to the likelihood of the impact actually occurring.

The significance of potential impacts that arise or may arise from both existing and proposed infrastructure within the 1:50 and 1:100 flood lines and 100 m from the watercourse/s are included to assist the Department of Water and Sanitation (DWS) with a decision. The significance of an impact is defined as a combination of the consequence of the impact occurring (described as magnitude) and the probability that the impact will occur.

The impact assessment methodology used has been formalised to comply with Regulation 31(2)(I) of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), which states the following:

"(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision and must include:

(i) An assessment of each identified potentially significant impact, including –

(i) Cumulative impacts;

(ii) The nature of the impact;

(iii) The extent and duration of the impact;

(iv) The probability of the impact occurring;

(v) The degree to which the impact can be reversed;

(vi) The degree to which the impact may cause irreplaceable loss of resources; and

(vii) The degree to which the impact can be mitigated."

To enable the environmental significance (importance) of each identified potential impact to be quantified, a numerical value has been linked to each factor. The ranking scales applicable are shown in **Table 7.1**. The ratings are then combined to determine the risk significance value for the impact according to the following equation:

Risk significance value = (magnitude + duration + extent) x probability

Table 7.1: Risk Rating Matrix

Status of Impact	
+: Positive (A benefit to the receiving environment) **N:** Neutral (No cost or benefit to the receiving environment) **-:** Negative (A cost to the receiving environment)	
Magnitude: = M	**Duration: = D**
10: Very high/don't know 8: High 6: Moderate 4: Low 2: Minor 0: Not applicable/none/negligible	5: Permanent 4: Long-term (ceases with the operational life) 3: Medium-term (5-15 years) 2: Short-term (0-5 years) 1: Immediate 0: Not applicable/none/negligible
Extent/Scale: = S	**Probability: = P**
5: International 4: National 3: Regional 2: Local 1: Site only 0: Not applicable/none/negligible	5: Definite/don't know 4: Highly probable 3: Medium probability 2: Low probability 1: Improbable 0: Not applicable/none/negligible

The maximum risk significance value that can be achieved is 100 and ratings are scaled from high, medium to low with respect to their environmental impact as shown in **Table 7.2** below.

Table 7.2: Risk assessment significance values

The maximum value that can be achieved is 100 Significance Points (SP). Environmental effects were rated as follows:		
Significance	**Environmental Significance Points**	**Color Code**
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	<30	L
Neutral	0	N
Low (negative)	< -30	L
Medium (negative)	-30 to -60	M
High (negative)	> -60	H

To assess the degree to which the potential impact can be reversed and mitigated, each identified potential impact will need to be assessed twice.

- Firstly, the potential impact will be assessed and rated before implementing any mitigation and management measures; and
- Secondly, the potential impact will be assessed and rated after the proposed mitigation and management measures have been implemented.

The purpose of this dual rating of the impact before and after mitigation is to indicate that the significance rating of the initial impact is and should be higher in relation to the significance of the impact after mitigation measures have been implemented. To assess the degree to which the potential impact can cause irreplaceable loss of resources, the following classes (%) will be used:

- 5: 100% (Permanent loss)
- 4: 75% - 99% (Significant loss)
- 3: 50%-74% (Moderate loss)
- 2: 25%-49% (Minor loss)
- 1: 0% -24% (Limited loss)

7.2 Summary of Identified Environmental and Social Impacts

Table 7.3: Expected impacts arising from project-related activities during different project phases as a result of existing and proposed infrastructure at MPM mine.

Project Phase	Activity
Pre-construction	Disturbance of soils due to site clearing and preparation sedimentation of rivers due to preparation of the site for clearing.
Construction	Natural vegetation loss, loss of habitat, impact on the flows of rivers located in close proximity to proposed infrastructure areas, impact on migration options for animals and birds in the area; Possible impacts to groundwater from seepage, reduced recharge of groundwater due to increased run-off; Pollution to rivers from hydrocarbon spills from construction, machinery, and deterioration of surface water quality.
Operation	Natural vegetation loss, loss of habitats, impact on the flows of rivers located in close proximity to proposed infrastructure areas, impact on migration options for animals and birds in the area; Possible impacts to groundwater from seepage and spillages such as hydrocarbons and tailings slurry; Flooding of the river could potentially cause erosion; Reduced availability of water to downstream water users Sedimentation of water courses due to operational activities.

Closure/Rehabilitation	Pollution to surface water from hydrocarbon spillage from rehabilitation equipment
Post-closure	Post-closure surface water and groundwater quality impacts

7.3 Environmental and social impacts and mitigation measures

The identified impacts associate with proposed infrastructure are provided in **Table 7.4** to **Table 7.8.** The rating of impacts, as per the methodology described in section 4.1 is also provided. In addition, mitigation measures that may alleviate or result in avoidance of the potential impacts have been included.

The following sections provide further details on the potential impacts (negative and positive), in terms of the various existing and proposed infrastructure. The potential identified impacts were rated, as discussed in terms of the Probability, Duration, Extent and Magnitude that may be associated with the potential impact. The following abbreviations were used in the impact assessment tables to indicate the said impact assessment aspects:

- Pr → Probability;
- D → Duration;
- E → Extent;
- M → Magnitude; and
- LoR → Loss of Resource.

Table 7.4 lists the main project related activities and their associated impacts and management measures during the pre-construction phase. Applicable infrastructure includes the Pollution Control Dam (PCD) and the openpit.

Table 7.4: Pre-construction surface water impacts applicable to all the proposed activities/infrastructure at MPM mine

Proposed project related activities during pre-construction phase of the project	Site clearing and grubbing of the footprint areas associated with the proposed infrastructure in preparation of the construction of these infrastructures.

Aspect	Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
			P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Pre-construction impacts applicable to the relocation of Pollution Control Dam (PCD)																		
Surface water	Increased erosion from areas of exposed soils during site clearing resulting in potential increase in sedimentation of surface water resources.	-	4	2	2	6	2	40	Medium	Where practical activities should be limited to months of low rainfall (dry season) to reduce probability of potential impact. Areas disturbed by activities should be rehabilitated immediately on completion of each area. Erosion control measures in the form of temporary erosion prevention berms should be implemented during construction.	2	2	2	4	2	16	Low	60.0
Pre-construction impacts applicable to the Open-Pit																		
Surface water Surface water	Impact on water quality due to an increase in runoff from cleared and stripped areas in close proximity to water courses	-	4	2	2	8	3	48	Moderate	The footprint of the proposed infrastructure area must be clearly demarcated to restrict vegetation clearing activities as far as practically possible Vegetation clearing activities will be restricted to demarcated infrastructure footprint area Vegetation clearance will be undertaken in a phased manner	3	2	2	4	2	24	Low	50.0

										Clean water diversion bunds will be constructed upstream of the construction site prior to clearing areas for new infrastructure Areas disturbed by pre-construction activities, which will not be required for construction, will be rehabilitated immediately on completion of construction area Bunded containment and settlement facilities will be provided for hazardous materials, such as fuel and oil Spill-sorb or a similar product will be kept on site and used to clean up hydrocarbon spills in the event that they will occur The groundwater and surface water quality monitoring programme will continue in line with requirements of the Water Use License Sufficient on-site ablution, sanitation and waste management facilities will be provided								
	Increased erosion from areas of exposed soils during site clearing resulting in potential increase in sedimentation to surface water resources	-	4	2	2	8	3	48	Moderate	Where practical activities should be limited to months of low rainfall (dry season) to reduce probability of potential impact Areas disturbed by activities should be rehabilitated immediately on completion of each area Erosion control measures in the form of temporary erosion prevention berms should be implemented during construction.	2	2	1	4	2	14	Low	70.8

Table 7.5 lists the main project related activities and management measures during the construction phase. Applicable infrastructure includes construction of the Pollution Control Dam (PCD), and the open-pits at South 3 site.

Table 7.5: Construction surface water impacts applicable to all proposed activities/infrastructure at MPM mine

	Construction of the Pollution Control Dam and associated infrastructure including water management and containment and protection infrastructure.

Aspect	Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
			P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Construction impacts associated with Pollution Control Dam (PCD)																		
Surface water	Increased erosion from areas of exposed soils during site clearing resulting in loose materials being washed into the surface water resources and reducing water quality	-	4	2	2	6	2	40	Moderate	Vegetation clearing activities will be restricted to the demarcated infrastructure footprint area	2	2	2	4	2	16	Low	-150
										Activities should be limited to months of low rainfall (dry season) to reduce probability of potential impact								
										Erosion control measures in the form of temporary erosion prevention berms should be implemented during construction								
	Contamination of surface water from potential hydrocarbon spills from construction machinery reducing water quality	-	2	2	1	4	2	14	Low	Contaminated runoff should be contained and reused as necessary e.g. for dust suppression	2	2	1	4	2	14	Low	0.0
										Emergency action plans should be developed to deal with spillages								
										Contractors should be made aware of the WUL conditions that apply during construction and made liable for environmental damages caused by spillages								
										All machinery and substances used on the site will be checked for leaks and otherwise properly maintained. Where leaks are found immediate action must be taken to stop leaks. All contamination from leaks will be immediately removed and remediated								

	Increased potential for damming and flooding and subsequent damage to property and infrastructure due to hard standing.	-	4	4	2	8	2	56	Moderate	Areas should be appropriately graded to prevent ponding. Stormwater measures should be appropriately designed to allow for free flow of water as per the Stormwater Management Plan Paddocks should be constructed to minimize uncontrolled runoff from the site entering the clean water system	2	4	2	4	1	20	Low	-180.0
Construction impacts associated with Open-Pit																		
Surface water	Increased erosion from areas of exposed soils during site clearing resulting in loose materials being washed into the surface water resources and reducing water quality	-	4	2	2	8	3	48	Moderate	Vegetation clearing activities will be restricted to the demarcated infrastructure footprint area Activities should be limited to months of low rainfall (dry season) to reduce probability of potential impact Erosion control measures in the form of temporary erosion prevention berms should be implemented during construction Areas disturbed by construction activities should be rehabilitated immediately on completion of construction of each area	2	2	2	4	2	16	Low	-200.0
	Contamination of Tubatsane and Mofafa Rivers from potential hydrocarbon spills from construction machinery reducing surface water quality	-	3	2	3	6	2	33	Moderate	Contaminated runoff should be contained and reused as necessary e.g. for dust suppression Emergency action plans should be developed to deal with spillages Contractors should be made aware of the WUL conditions that apply during construction and made liable for environmental damages caused by spillages	2	2	2	4	2	16	Low	106.3

Table 7.6 lists the main project related activities and their associated impacts and management measures during the operation phase. Applicable infrastructure includes the operation of the attenuation dams, the Pollution Control Dam (PCD) and the open-pits at South 3 site.

Table 7.6 : Operations surface water impacts applicable to all proposed activities/infrastructure at MPM mine.

Operation	Operation of the attenuation dams
	Operation of the open-pits South 3
	Operation of the Pollution Control Dam (PCD)

Aspect	Nature of the impact	Significance of potential impact BEFORE mitigation							Mitigation measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Operation phase impacts applicable to Pollution Control Dam (PCD)																	
Surface water	Potential of flooding following an extreme rainfall event which could exceed the storage capacity of the PCD	4	4	2	8	2	56	Moderate	The PCD should be designed to hold a 1:50 year event with a minimum freeboard of 0.8 metres above the fill supply level.	2	4	2	4	2	20	Low	64.3
	Reduced availability of water to downstream water users due to dirty runoff from site	3	4	3	6	2	39	Moderate	During normal operations dirty water should be contained in (pollution control dams) PCDs designed to handle the 1:50 year event and enable settlement of solids in the contained water prior to reuse Clean water diversions, designed to handle the 1:50 year storm event, should be constructed to divert water away from PCD and return it to the natural environment	2	4	2	4	2	20	Low	48.7
Operation phase impacts applicable to Open-Pit																	
Surface water	Reduced availability of water to downstream water users due to changes in MAR and potential decreased water quality	4	4	3	8	4	60	High	During the operational phase of the mine, implement a storm water management plan which adheres to GN 704 requirements in terms of separation of clean and dirty water is required so as to ensure no mixing of clean	3	4	3	6	3	39	Moderate	35.0

										and dirty water occurs. Maintain all channels to prevent any obstruction of flow.								
	Potential flooding of the open-pit due to surface runoff, exposure to rainfall, and increased expansion across the water course exposing the open-pit to a higher groundwater table	-	4	4	2	8	3	56	Moderate	Construction of attenuation dams to prevent the flooding of the pit following an extreme rainfall event.	3	4	2	4	2	30	Moderate	46.4
										Design and implementation of storm water management plan to divert all water away from the open-pit								
										Design and implement a pumping strategy of sufficient capacity to pump out the intruding ground water, surface water and direct rainfall out of the pit.								

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Table 7.7 lists the main project related activities and management measures during the closure and rehabilitation phase. Applicable infrastructure includes the closure and rehabilitation of areas impacted by the Pollution Control Dam and the open-pit.

Table 7.7: Closure and rehabilitation surface water impacts applicable to all proposed activities/infrastructure at MPM mine

Closure/Rehabilitation	Decommissioning and demolition of project related infrastructure
	Handling of contaminated soils

Aspect	**Nature of the impact**		**Significance of potential impact BEFORE mitigation**							**Mitigation measures**	**Significance of potential impact AFTER mitigation**							**Degree of mitigation (%)**
			P	**D**	**E**	**M**	**LoR**	**Significance**			**P**	**D**	**E**	**M**	**LoR**	**Significance**		
Closure/Rehabilitation phase impacts applicable to of Pollution Control Dam (PCD)																		
Surface water	Infrastructure not required after closure should be removed and the footprint areas rehabilitated. All rehabilitation activities should be monitored until vegetation is well established	-	3	4	2	6	2	36	Moderate	All rehabilitation activities should be monitored until vegetation is well established and no further surface water quality impacts are deemed likely.	2	1	2	4	1	14	Low	61.1
Closure/Rehabilitation phase impacts applicable to Open-Pit																		
Surface water	Infrastructure not required after closure should be removed and the footprint areas rehabilitated. All rehabilitation activities should be monitored until vegetation is well established	-	3	4	2	6	2	36	Moderate	All rehabilitation activities should be monitored until vegetation is well established and no further surface water quality impacts are deemed likely.	2	1	2	4	1	14	Low	61.1

Post closure is a period of maintenance and monitoring of the various structures and infrastructure closed during the time of rehabilitation. The activities are limited to monitoring activities and maintenance or repairing or erosion and vegetation if necessary. **Table 7.8** lists the post-closure impacts and management measures associated with the project related activities.

Table 7.8: Post-closure surface water impacts applicable to all the proposed activities and infrastructure at MPM mine.

Aspect	Nature of the impact	Significance of potential impact BEFORE mitigation							Mitigation measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR	Significance			P	D	E	M	LoR	Significance		
Post-closure impacts associated with Pollution Control Dam (PCD)																	
Surface water	All infrastructure will have been removed; therefore, the surface water quality should not be further impacted by any of the post-closure activities.	2	1	2	2	1	10	Low	Surface water quality should not be further impacted by any of the post closure activities. Implemented post closure monitoring.	2	1	1	2	1	8	Low	20.0
Post-closure impacts associated with Open-Pit																	
Surface water	All infrastructure will have been removed; therefore, the surface water quality should not be further impacted by any of the post-closure activities.	3	1	2	2	1	15	Low	Surface water quality should not be further impacted by any of the post closure activities. Implemented post closure monitoring.	2	1	1	2	1	8	Low	46.7

8. SURFACE WATER MONITORING PLAN

The proposed site-specific water monitoring programme is provided in **Table 8.1**, with the suggested monitoring locations, implementation periods, monitoring frequencies and analytical schedules for the suggested programmes. **Figure 8.1** provides the location of the monitoring points.

Surface water monitoring plan is required for MPM for water quality sampling and analyses, and comparison against the DWA guidelines for irrigation, livestock watering and aquatic ecosystems, including the SANS241 guidelines for drinking water. For the surface water component, monitoring of the operation of the stormwater system to ensure storage tanks and associated infrastructure are adequately designed and operated is important. **Table 8.1** sets out the proposed monitoring framework that includes:

- Monitoring of impact management actions;
- Monitoring and reporting frequency;
- Responsible persons;
- Time period for implementing impact management actions; and
- Mechanisms for monitoring compliance.

Table 8.1: Proposed Surface Water Monitoring Plan

Source activity/ element	Required monitoring	Functional requirement	Responsible	Frequency
Streams, rivers	Sedimentation and surface water quality	Nearby upstream and downstream water quality monitoring	Environmental Officer/ SHEQ Manager	Monthly or quarterly, sampling and analyses
Earth works, WRDs, PCDs and dams	Sedimentation, spills, leaks, overflows and surface water contamination	Assess area for erosion and spillages.	Environmental Officer/ SHEQ Manager	Weekly or monthly, during high rainfall periods until construction and decommissioning are complete.
Operations	Contamination to the stormwater management system	Monitor and maintain stormwater containment systems; Clean and dispose in accordance with legislation. Take samples as necessary if stormwater is to be discharged and analyse for hydrocarbons and metals to assess level of contamination.	SHEQ Manager	Weekly or Monthly; inspection during high rainfall periods.
Water quality	Ensure surface water and groundwater quality monitoring as per sampled and proposed monitoring locations. Parameters should include but not limited to pH; Electrical Conductivity; Sulphate; major cations (K, Ca, Mg & Na); trace metals (Al, Fe, Zn, Cu, Mn, Co, Se, Mo, Cd, Ni, Cr (VI), Pb, Hg & As); Anions (NO_3, NO_2, NH_4, Cl, F, PO_4); Total Dissolved Solids; Total Suspended solids.	Water quality monitoring within the mine water dams or water containment facilities to determine the concentration levels in case of an overflow or need for discharge.	Environmental Officer	Monthly monitoring during construction, operation, decommissioning and for at least three (3) years after closure, or until rehabilitation has reached a sustainable state with no further changes

It should be clear that by reducing the amount of water leaving the site boundary through evaporation, evapotranspiration, returns to the surface water resource, seepage losses, water in the product or water in waste materials, the amount of water transported across the site boundary may be reduced. Rainwater harvesting and the re-use of process water are examples of actions that could be taken to achieve this. The other key to reducing water use on site is to reduce the amount of water used by water-demanding processes at point-of-use. To ensure separation of clean and dirty water (as stipulated in regulation 704 of on the National Water Act), the recommended stormwater management plan should be strictly implemented. Separation of clean and dirty water should be done through recommended storm water management infrastructures which include storm water drains or channels, clean water diversion berms, silt traps and PCDs. Surface water monitoring regimes should be implemented for continuous water quality monitoring as prescribed by WUL. The following surface water management strategies are recommended:

- Minimize/prevent accidental spills;
- Prevent /minimize the deterioration of surface water quality due to spillages, incidental discharges and diffuse sources, such as groundwater seepage;
- Avoid or where not possible, minimize and remedy pollution of surface water during construction and operation;
- Prevent/minimize the deterioration of stormwater quality by ensuring the separation of clean and dirty water and compliance to GN704 by diverting clean water runoff and containing contaminated runoff;
- Minimize soil erosion and loss of soil;
- Minimize the potential for flooding and subsequent damage to property and infrastructure; and
- Minimize the impact of loss of water resources due to wellfield development and loss of MAR.

9. REHABILITATION PLAN

The main aim of a rehabilitation plan for the project site is to restore as far as possible the area back to its natural condition. In terms of continuous rehabilitation during operation, there is a plan that topsoil (where available) from the area that is cleared will be stored next to the excavations and used for concurrent and final rehabilitation. Waste rock will also be stored in the waste rock dump area. After backfilling, the pit will be covered with topsoil to ensure that natural vegetation re-establishes.

The main closure objective for the mining site is to rehabilitate the whole mining site in such a way to ensure that the new man-made topographical landscape would blend in with the surrounding landscape, not pose a safety hazard to humans and animals, while at the same time allow for alternative land uses. Establish a self-sustaining and stable vegetation cover in order to mitigate the visual impact, to control erosion and to create some habitat for animals. The rehabilitated environment also needs to be aesthetically acceptable according to the principle of BPEO. Another main objective is to manage the surface water in such way that an acceptable water standard is achieved when a closure certificate is issued.

The applicant will ensure that the Mining Operation/Sites are:

- Neither a danger to public health and safety nor to animal health and safety;
- Not a source of any pollution;
- Stable (ecological and geophysical);
- Rehabilitated to the state that is suitable for the predetermined and agreed land use;
- Compatible with the surrounding biophysical environment;
- A sustainable environment;
- Aesthetically acceptable;
- Not an economic, social or environmental liability to the local community or the state now or in the future.

The applicant will furthermore:

- ensure that the physical and chemical stability of the rehabilitated mining site will be such that risk to the environment is not increased by naturally occurring forces to the extent that such increased risk cannot be contended with by the installed measures;
- subscribe to the optimal exploitation and utilization of South Africa’s mineral resources,
- ensure that the mining site is closed efficiently and cost effectively;
- ensure that the operation is not abandoned but closed in accordance with the relevant requirements; and
- ensure that all relevant legislation regarding mine closure will be adhered to, and all relevant application procedures followed.

It is also important to note that, as the proposed site for mining infrastructure will be used, this rehabilitation plan will need to be implemented on the area which was previously mined by the community.

9.1 Rehabilitation of Access Roads

Whenever a mining right is suspended, cancelled or abandoned or if it lapses and the holder does not wish to renew the permit or right, any access road or portions thereof, constructed by the holder and which will no longer be required by the landowner/tenant, shall be removed and/or rehabilitated.

- Any gate or fence erected by the holder which is not required by the landowner / tenant, shall be removed and the situation restored to the pre-mining situation.
- Roads shall be ripped or ploughed, and if necessary, appropriately fertilised (based on a soil analysis) to ensure the regrowth of vegetation. Imported road construction materials which may hamper regrowth of vegetation must be removed and disposed of in an approved manner prior to rehabilitation.
- If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, it may require that the soil be analysed and any deleterious effects on the soil arising from the prospecting operation, be corrected and the area be seeded with a seed mix.

9.2 Rehabilitation of the surface trench/pitting site

On completion of operations, all buildings, structures or objects on the camp/office site shall be dealt with in accordance with section 44 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002), which states:

1) When a prospecting right, mining right, retention permit or mining permit lapses, is cancelled or is abandoned or when any prospecting or mining operation comes to an end, the holder of any such right or permit may not demolish or remove any building, structure, object:

- (A & B) which may not be demolished in terms of any other law;
- (C) which has been identified in writing by the Minister for purposes of this section; or
- (D) which is to be retained in terms of an agreement between the holder and the owner or occupier of the land, which agreement has been approved by the Minister in writing.

(2) The provision of subsection (1) does not apply to bona fide mining equipment which may be removed

After all the foreign matter has been removed from the mining sites, the excavations shall be backfilled with subsoil, compacted and levelled with previously stored topsoil. No foreign matter such as cement or other rubble shall be introduced into such backfilling.

On completion of mining operations, the above areas shall be cleared of any contaminated soil. The surface shall then be ripped or ploughed to a depth of at least 300mm and the topsoil previously stored adjacent the site, shall be spread evenly to its original depth over the whole area. The area shall then be fertilized if necessary (based on a soil analysis). The site shall be seeded, if practicably possible, with a vegetation seed mix adapted to reflect the local indigenous flora species. Where the site has been rendered devoid of vegetation/grass or where soils have been compacted owing to traffic, the surface shall be scarified or ripped.

Photographs of the site offices, before and during the mining operation and after rehabilitation, should be taken at selected fixed points and kept on record for the information of the relevant authority.

The rehabilitation of the new topographical landscape will be in such a way that it would blend in with the surrounding landscape and allow normal (controlled) surface drainage to continue.

Implement water control systems in order to prevent erosion. Seed the area as far as practicably possible. Visual impact would be addressed by means of;

- Re-vegetation (grasses);
- Removal of any building, scrap, domestic waste, etc. that would otherwise contribute to a negative visual impact.

If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the Regional Manager from the DMR may require that the soil be analyzed and any deleterious effects on the soil arising from the mining operation be corrected and the area be seeded with a seed mix to his or her specification.

The eventual seed mixture takes into account the availability of seed, different soil situations and the prevailing climatic conditions of the area.

9.3 Demolition of Infrastructure/building

On completion of operations, all buildings, structures or other infrastructure on the mining terrain shall be dealt with in accordance with section 44 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).

9.4 Invasive and alien control programme

Develop and implement an invasive and alien control programme to control the spread of weeds and other invasive species. Eradicate exotic weeds and invader species if it invades the terrain. All illegal invader plants and weeds shall be eradicated as required in terms of Regulation 15 & 16 of the Act on Conservation of Agricultural Resources, 1983 (Act no. 43 of 1983) which list the plants.

10. CONCLUSIONS AND RECOMMENDATIONS

The MPM proposed to further develop a project site (Winterveld 293 KT) for an open cast mining activity. The mining operations will follow the conventional opencast methods, which include stripping of 40 to 60 thousand tonnes per month (ktpm) with concurrent backfilling. The ore from the open pit will be extracted by a combination of excavation, crushing, washing and concentration and then be transported by truck to the primary crusher stockpile. Waste will be disposed to waste dumps on the surface.

The project area is situated in Limpopo province, which is a summer rainfall area, with warm to hot climate and a relatively high humidity in summer. Average daily temperatures vary from 32°C in January to 24°C in July. The wind direction is mostly from the south-south east to north-north west. The Mean Annual Precipitation (MAP) for this area is approximately 705.85 mm, with the highest concentrations of rainfall between October and March. The winter months contribute very little to the annual rainfall.

The ground clearing, top soil removal, and depressions from excavations activities were found to have a high risk of impact during the development phase. Stockpiles and pollution control dams pose a higher risk of surface water contamination during the operational phase. There are also risks on failure of the pollution control dams during the operation phase. During the decommissioning phase runoff from pollution control dams if it continues to yield polluted water would pose a risk to pollution of surface water.

The following recommendations are made:

- The excavations and pit diggings (Section 21 C & I water uses) for the purpose of mining must be allowed outside the floodplain wetland, but if they are within the floodplain buffer, this should be allowed under strict regulated conditions, such a condition of concurrent rehabilitation, erosion and sediments control.
- The proposed infrastructure site which is outside of the delineated 1:50yr and 1:100yr floodlines, outside the 100 m buffer from the streams; and outside the riparian and wetland buffers must be used.
- The rehabilitation plan provided must be implemented on the sites already degraded by previous illegal mining activities before the commencement of the mining.
- A concurrent and continuous rehabilitation plan of the excavated trenches and pits must be adhered to during the operation of the mining.
- A specie plan for rehabilitation must be provided before the commencement of the mining activity
- The Biomonitoring and Water quality monitoring plan proposed must be implemented as soon as it's practically possible.
- The storm water management plan must be implemented to contain at least 1:50 year rainfall event and minimise dirty water area before commencement of mining.
- It must be ensured that clean and dirty water separation infrastructure is in place prior to the commencement of the development;
- Storm water infrastructure must be maintained, and if possible, ensure that sediments are effectively captured and returned on-site to minimise sediment loss and siltation of the water resource;
- Ensure regular inspection and maintenance of the pollution control dams to avoid failure;

- Dirty water separation systems must be maintained until the site is rehabilitated and free draining.

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