mineral resources
Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DRAFT ENVIRONMENTAL MANAGEMENT PLAN

FOR LISTED ACTIVITIES ASSOCIATED WITH MINING RIGHT AND/OR BULK SAMPLING ACTIVITIES INCLUDING TRENCHING IN CASES OF ALLUVIAL DIAMOND PROSPECTING

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

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QUALITY MANAGEMENT

Report Title	**Environmental Management Plan for the Integrated Paardeplaats Section**		
Project Number	CIG/ENVSOL/19/PROJ/0001		
	Draft Report	**Final Report**	**Revision 1**
Date	**27 May 2021**		
Author	Renee Janse van Rensburg		
Reviewed By	Jacques Harris		
Authorised By	Jacques Harris		

DISCLAIMER

Information contained in this report is based on information received from the client and other external sources. Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Commodity Inspections Group (Pty) Ltd (CIGroup) for incomplete or inaccurate data supplied by others. We are aware that there might have been project or operational changes since this report was submitted, however this report and its findings is based on the last information received from the client and/or the site visit undertaken. To the best of our knowledge the assumptions and findings are correct at the time of submission of the report. Should any of the assumption or findings prove to be incorrect subsequent to submission of the report we as the specialist cannot be held accountable. Note that whilst CIGroup has made every effort to obtain the correct information and to carry out an appropriate, independent, impartial and competent study, CIGroup cannot be held liable for any incident which directly or indirectly relates to the work in this document, and which may influence the client or on any other third party.

CONFIDENTIALITY

DECLARATION OF INDEPENDENCE

Commodity Inspections Group (Pty) Ltd (CIGroup), as the Environmental Assessment Practitioner specialists, were appointed to undertake a Section 102 Consolidation Process and an Integrated Environmental Authorisation (EA) application Scoping and Environmental Impact Reporting (S&EIR) Process and to develop the Environmental Scoping Report (ESR), Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Reports for the North Block Complex (Pty) Ltd Integrated Paardeplaats Section Project. CIGroup does not have a vested interest in the proposed activity proceedings, will not engage in and have no conflicting interest in the undertaking of the activity. CIGroup has provided all information at their disposal regarding the Scoping Report, whether such information is favourable to the Client or not.

_____ 27 May 2021

Renee Janse van Rensburg Date

Environmental Compliance and Assessment Manager

Environmental Solutions Division

Commodity Inspections Group (Pty) Ltd

IMPORTANT NOTICE

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

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

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

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

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

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PART B
ENVIRONMENTAL MANAGEMENT PLAN

1 DETAILS OF THE EAP WHO PREPARED THE REPORT

In terms of Regulation 13 of the NEMA Environmental Impact Assessment (EIA) Regulations, 2014 (GNR. 982), as amended, an independent Environmental Assessment Practitioner (EAP) must be appointed by the applicant to manage the application. Commodity Inspections Group (Pty) Ltd (CIGroup) has been appointed by NBC as the independent environmental assessors responsible for conducting the required Environmental Licensing Processes and will be responsible for Report Development, Specialist Assessments, requisite Stakeholder Engagement Processes (SEP), and Authority and Government Department Liaison.

CIGroup's Environmental Compliance and Assessment Manager, Renee Janse van Rensburg, will be the project EAP are her contact details are provided in **Table 1.1**.

Table 1.1: Contact Details of the EAP.

NAME OF COMPANY	Commodity Inspections Group (Pty) Ltd
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2 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

2.1 Current Activities

2.1.1 Glisa Section

Mining started at the Glisa Section in 1890 using underground mining methods. From 2006 mining was undertaken by opencast mining methods with underground pillars being reclaimed. This opencast mining method is still in force at the Glisa Section. Coal is crushed and screened at stationary plants whilst other coal products are processed at the main Crushing, Screening and Washing Plant (CSWP) located in the Glisa Section. In addition to mining and coal processing, the

Glisa Section also consists of infrastructure such as roads, offices, workshops, stockpiles, pipelines, and a Water Treatment Plant (WTP).

NBC has an existing supply agreement with Eskom to supply steady and secure coal for selected Eskom coal fired power stations. The Glisa Section has been the source of this coal for many years; however the Glisa Section Life of Mine (LoM) is nearing its end and a resultant reduction in Run of Mine (RoM) coal is occurring. In order to meet its contractual obligations to Eskom, NBC intend to supply Eskom with coal from the adjoining Paardeplaats Section.

NBC, through the utilisation of the Glisa Section infrastructure, intends to limit the disturbance of additional natural areas in the Paardeplaats Section. In so doing, the utilisation of the existing infrastructure at the Glisa Section is paramount. Existing infrastructure at the Glisa Section is licensed in terms of the MPRDA and the NEMA and all of the existing infrastructure at the Section will continue to be used in support of mining activities in the Integrated Paardeplaats Section. The infrastructure that will continued to be used and which does not require licensing in terms of this application includes, the following (**Figure 2.1**):

- RoM stockpile areas at the crushing and screening plants, e.g. Gijima, and the main CSWP;
- Product stockpiles at the crushing and screening plants and main CSWP;
- Haul roads, including existing river diversions, culverts, and drains;
- Stormwater management infrastructure, including existing dams and channels;
- Magazine and explosives area;
- Workshops, administrative offices, mining contractor offices, and security offices, including ablution facilities, septic tanks, and French drains;
- Fuel bays, above and below ground diesel storage tanks, wash bays, and salvage areas; and
- Waste management areas.

2.1.2 Water Treatment Plant

The WTP for the Glisa Section spans an area of approximately 0.67 ha on Portion 24 of Paardeplaats 380JT and is fully operational. The design treatment capacity of the WTP is 1.5 megalitres per day (Ml/d) on average over a 30-day cycle, equating to an average of 62.5 cubic metres per hour (m^3/h). Proxa designed and constructed the WTP on behalf of the previous mine owner, Exxaro, and have been operating the WTP since 2017. The WTP processes (**Figure 2.2**) entail chemical precipitation in combination with Ultrafiltration (UF) and Reverse Osmosis (RO) technologies. Additional brine treatment is designed for to ensure a zero-brine discharge.

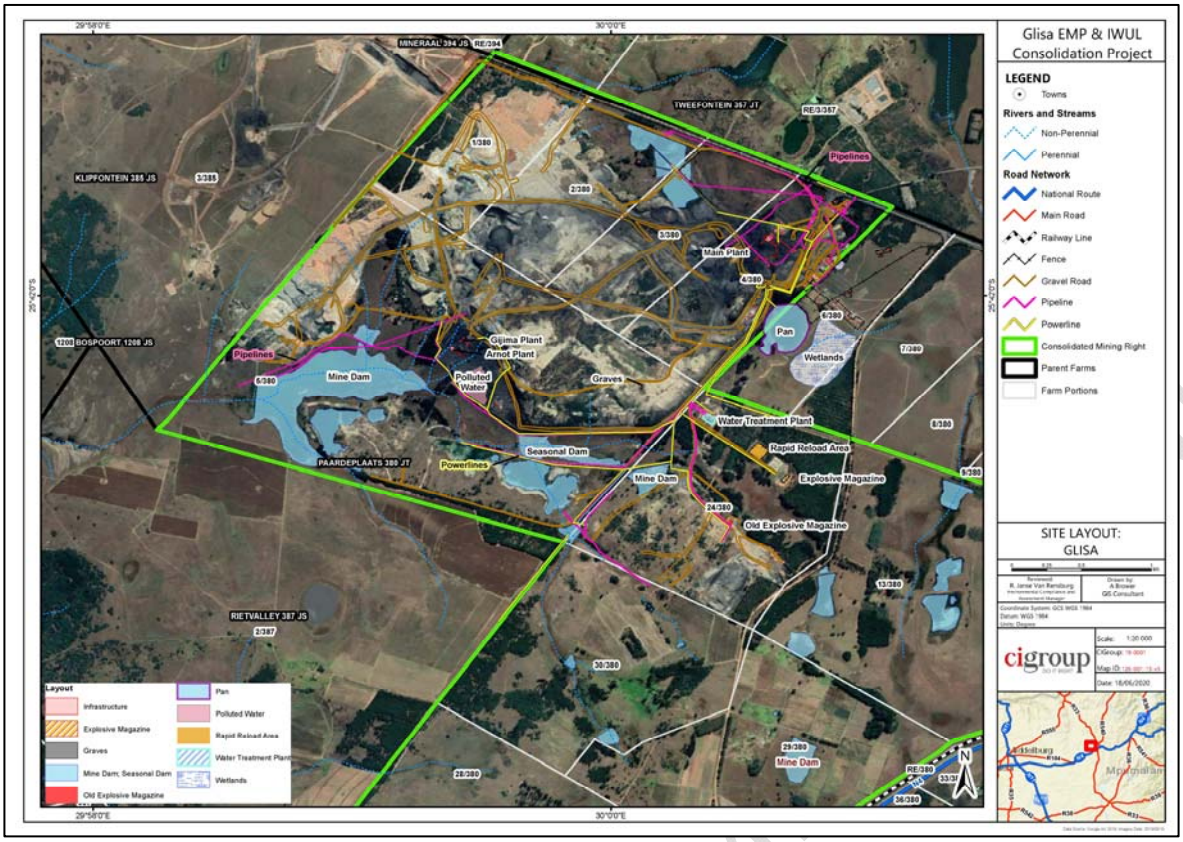

Figure 2.1: Existing Infrastructure Layout at the Glisa Section.

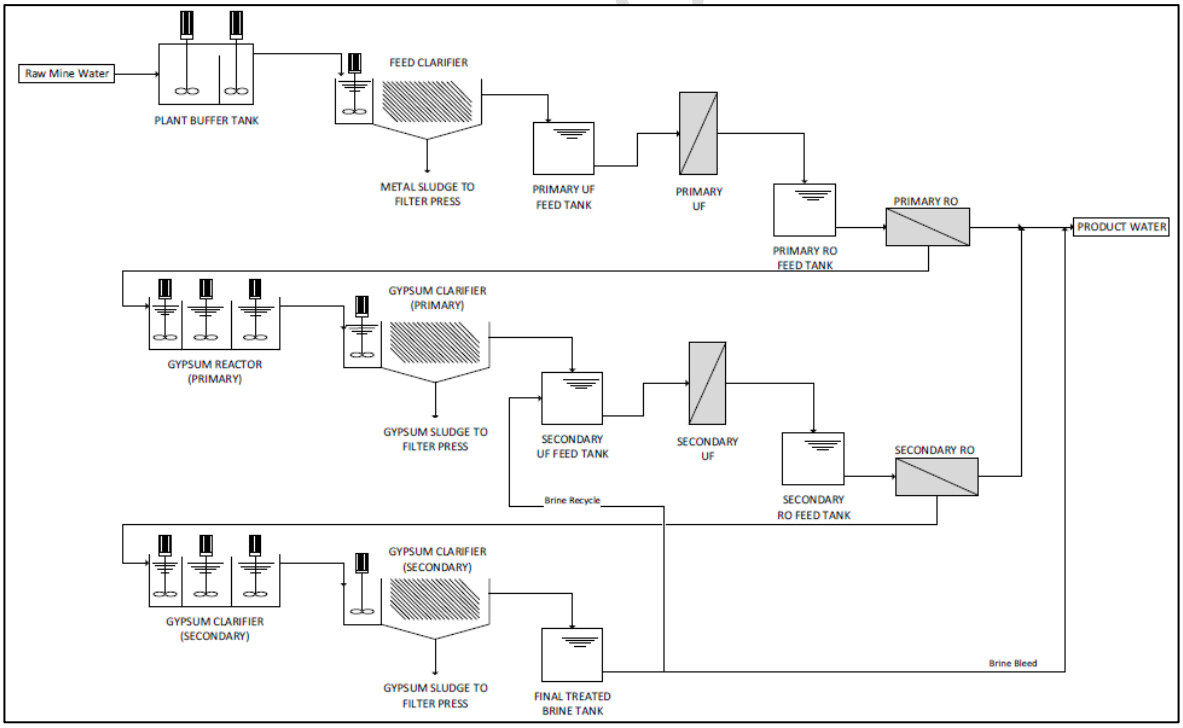

Figure 2.2: Overview of the WTP Process (Proxa, 2013).

RO is a water treatment process whereby dissolved salts, such as sodium, chloride, calcium carbonate, and calcium sulphate may be separated from water by forcing the water through a semi-permeable membrane under high pressure. The water diffuses through the membrane and the dissolved salts remain behind as the liquid by-product. The liquid by-product generated by the WTP process is routed to a filter press which produces *Gypsum by-product* (25% moisture content) which is stored within a concrete based, bunded storage area on site.

The process water pipelines (dirty water collection and product water pipelines) traverse Portions 2, 3, 4, 5 and 24 of Paardeplaats 380JT. The purpose of the WTP is to treat water within the dams and voids at the Glisa and Paardeplaats Sections which have been impacted on by historical and current mining activities. The WTP is supported by a significant pipeline network to transfer feed water from the collection points to the WTP for treatment, as well as the pipeline routes from the plant to the discharge point and clean water storage locations. The location of the WTP and the layout of the associated pipelines are shown in **Figure 2.3**. The collection points, represented by the red dots in **Figure 2.3**, are referred to as:

- Blue Gum Evaporation Dam;
- Block B, Void B1;
- Block C, Void C1; and
- Mahim Dam.

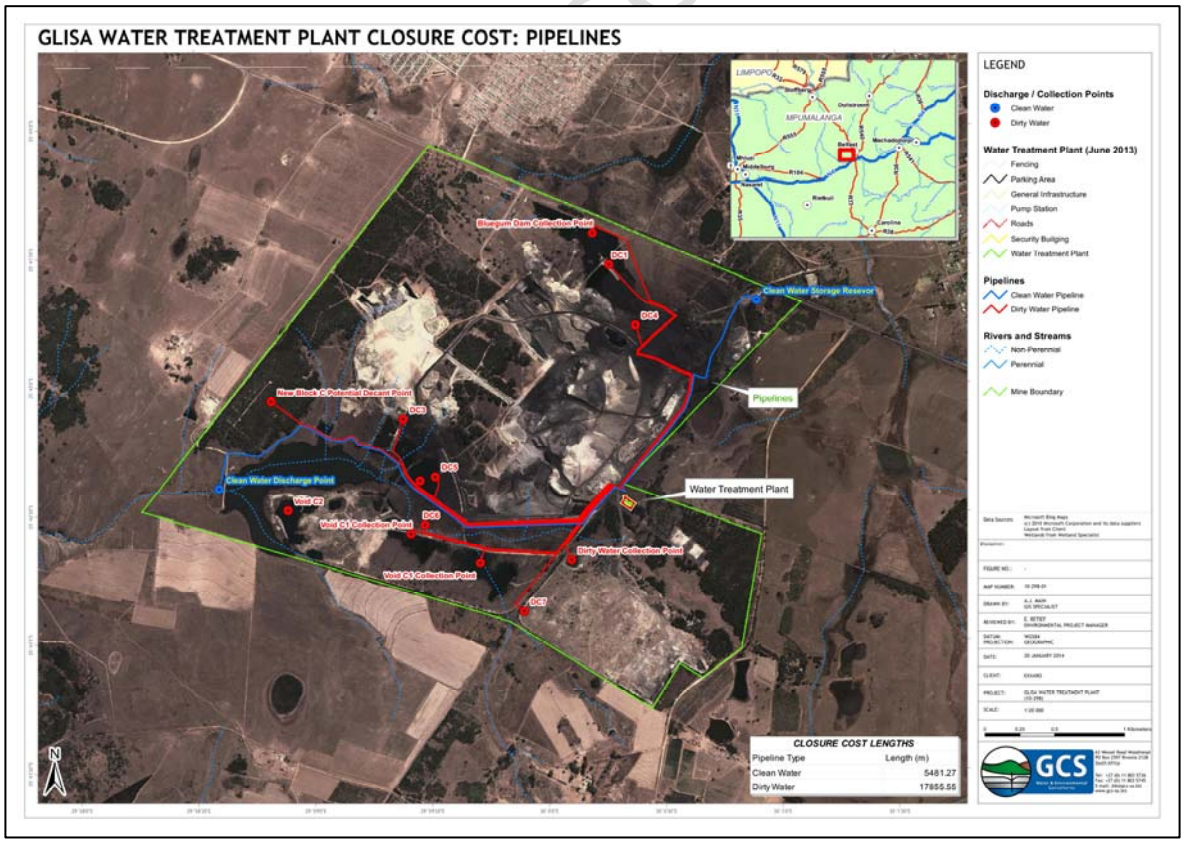

Figure 2.3: WTP and Pipeline Location (GCS, 2014).

The collection points are located within un-rehabilitated voids from historical opencast mining by previous owners of the mine. These voids contain poor quality water mainly from runoff. The voids are licensed in terms of the current Glisa IWUL (License No.: 06/B41A/ABCFGIJ/1002; File No.: 27/2/2/B141/3/9) Water is collected from the collection points by means of sumps within which pumps are located.

Existing infrastructure at the WTP in the Glisa Section is licensed in terms of the MPRDA and the NEMA and all of the existing infrastructure for the WTP will continue to be used in support of the Paardeplaats Section mining activities. The infrastructure that will continued to be used and which does not require licensing in terms of this application includes, the following (**Figure 2.4**):

- WTP and pipeline reticulation system, including discharge pipeline and electrical supply through a 500 Kilovolt Ampere (kVA) mini-substation;
- Gypsum storage areas at the WTP; and
- Waste management areas.

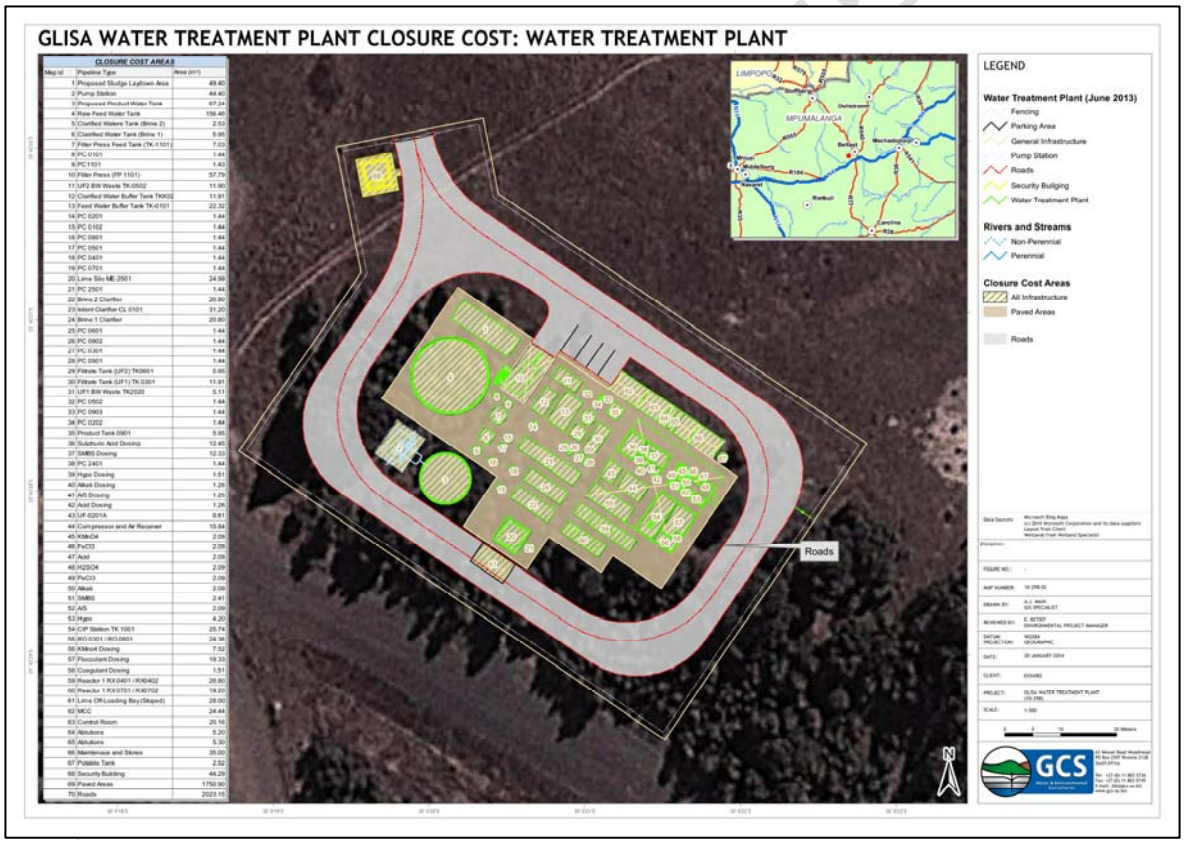

Figure 2.4: Existing Infrastructure Layout for the WTP (GCS, 2014).

2.1.3 Paardeplaats Section

The Paardeplaats Section is an operational section which adjoins the Glisa Section. Mining is undertaken by opencast mining methods. Mining at the Paardeplaats Section will focus on Portion

30 of the farm Paardeplaats 380 JT for the first ten (10) years of the MR, before expanding to other farm portions.

As RoM reduces at the Glisa Section, the shortfall will be addressed through coal mined at the Paardeplaats Section. The Paardeplaats Section is an open cast mining operation where bench mining techniques are employed to access the coal seams. The 2 Seam Burden is removed with Dozers doing roll-over of the 2 seam burden into the previous 2 seam voids, and the upper burden seams are removed with the truck and shove mining method. Coal seams 4, 3 and 2 will be mined for processing. Seam 1 appears in certain areas only and is highly weathered and contaminated with inseam shales and is not suitable to mined and will be left in situ in the pit. The Paardeplaats Section has an estimated RoM supply rate of 4.2 – 4.4 mtpa which relate to 2.4 – 2.6 mtpa of product, supplying Eskom's Komati and Arnot power stations, as well as an estimated RoM supply rate of 1.7 mtpa of export coal which equates to 1.0 mtpa of export product.

2.1.3.1 Resource Details

The Integrated Paardeplaats Section falls within the Witbank Coal Field which is close to the north-eastern edge of the Karoo Basin. The Karoo sequence is represented by the Dwyka Formation consisting of diamictite and the overlaying Ecca Group. The coal seams of the Witbank Coal Field are found at the base of the Vryheid Formation of the Ecca Group and the strata in which coal seams occur consist predominantly of fine, medium and course grained sandstone with subordinate mudstone, shale, siltstone, and carbonaceous shale.

All five coal seams of the Witbank Coal Field occur within the Integrated Paardeplaats Section. The number 2 and 4 seams are more extensively developed than seams 1, 3 and 5. In the far north–east portion of the Paardeplaats Section a dolerite sill, likely a post depositional feature related to the Lesotho Basalts, is believed to have completely displaced coal seams (EIMS, 2014). The coal seams are relatively flat-lying, and the average seam thickness is as follows:

- The Number (No.) 1 seam has an average thickness of 0.34 metres (m);
- The No. 2 seam has an average thickness of 5.37 m;
- The No. 3 seam has an average of 0.78 m;
- The No. 4 seam has an average thickness of 3.04 m; and
- The No. 5 seam has an average thickness of 0.62 m.

The No. 1, 2, 4 and 5 seams can be mined whilst the No. 3 seam, although persistent across the entire coal filed, has been determined to be too thin to be considered an economically viable resource.

2.1.3.2 Mining Method

Mining at the Paardeplaats Section entails opencast mining. The open cast mining method was selected due to the shallowness of the target coal seams present within the MR area. The open cast mining will be undertaken as a hybrid of roll-over and bench/box cut mining techniques. The use of the two respective techniques is dependent on the number of seams present as well as the overburden thickness. The roll-over technique will be utilised where only a single seam is present and where the overburden has a corresponding thickness of less than 20 m. The bench/box-cut technique will be utilised where two or more seams are present, and the overburden has a thickness of greater than 20 m.

The creation of the opencast was initiated through a stripping operation which removes topsoil and exposes the overburden of the first proposed cut. Initial topsoil was hauled to a designated area and stored for use in rehabilitation. When steady state is reached, topsoil will be replaced in a continuous operation. The overburden is then drilled and blasted. The removal of overburden is undertaken in two phases namely, the top portion will be loaded and hauled, and the lower portion dozed. This will ensure that backfilling is adequately addressed, and that concurrent rehabilitation may take place.

Once the overburden has been removed and dozed, the coal seams are drilled and blasted and then transferred to the Glisa Section for mineral processing by means of standard load and hauls operations. It is anticipated that after the first four (4) cuts, a steady state will be reached. The mining method is as follows:

1. A section through the general stratigraphic sequence;
2. The box cut is excavated after removal of the topsoil and subsoil;
3. Coal is removed from the box cut, subsoil from cut 2 and topsoil from cut 3;
4. The overburden from cut 2 is drilled and blasted;
5. The topmost part of the overburden is loaded and hauled to a stockpile due to insufficient pit room availability;
6. The bottom part is dozed over;
7. Coal is removed from cut 2 and subsoil from cut 3;
8. Cut 3 overburden is blasted;
9. The top part of the blasted overburden is hauled and placed at the beginning of the low wall;
10. The bottom part of cut 3 is dozed over and the cleaned coal face;
11. Coal is removed from cut 3 and subsoil from cut 4; and
12. Overburden from cut 4 is blasted.

At this point the pit is now in a ready state and no more material is stockpiled as it can now be accommodated in the pit. Concurrent rehabilitation can now logically follow as soon as the subsoil gets stripped in the front and replaced in the back. The same is true for the topsoil which gets placed over the subsoil in a continuous process.

Due to the proximity of the Glisa and Paardeplaats Sections, all mineral processing and waste disposal for the Paardeplaats Section is being undertake at the Glisa Section. For this reason NBC require the consolidation of the Sections into the Integrated Paardeplaats Section to align with the Paardeplaats Section LoM which currently extends until 25 September 2038. Coal will be crushed at stationary plants prior to processing being undertaken at the main CSWP located in the Glisa Section. Water treatment will also be undertaken at the WTP in the Glisa Section.

2.2 Proposed Activities

2.2.1 Existing Infrastructure Changes

NBC require the following changes to existing infrastructure:

- Expansion of the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- Expansion of the existing WTP pipeline network on all farm portions associated with the Integrated Paardeplaats Section; and
- Widening of haul roads between the mining sections and processing plants.

2.2.2 New Infrastructure Required

In order to ensure the continuation of mining, mineral processing and water treatment activities for the Integrated Paardeplaats Section in support of the mining activities taking place, NBC require new infrastructure within the Integrated Paardeplaats Section in support operation activities in the Section. This new infrastructure includes the following:

- A RoM pad on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- A PCD at the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- Additional stormwater management infrastructure including diversion channels around the CSWP, and diversion channels around the administrative, contractor, workshop, and security offices on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- Rerouting of a powerline at the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT to ensure a clear footprint area for the PCD;
- A RoM pad on Portion 24 of the farm Paardeplaats 380 JT;
- An additional crushing and screening plant on Portion 24 of the farm Paardeplaats 380 JT;
- A mining contractors office, workshop, and conservancy tank on Portion 24 of the farm Paardeplaats 380 JT;

- A PCD on Portion 24 of the farm Paardeplaats 380 JT;
- Stormwater management infrastructure, including diversion channels, for the above-mentioned infrastructure on Portion 24 of the farm Paardeplaats 380 JT;
- A powerline extension from the existing network to supply power to the infrastructure on Portion 24 of the farm Paardeplaats 380 JT;
- Pipelines between the PCD, Plant and the WTP on Portion 24 of the farm Paardeplaats 380 JT;
- A conveyor between the RoM Pad on Portion 24 of the farm Paardeplaats 380 JT and the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- An emulsion silo adjacent to the magazine yard on Portion 24 of the farm Paardeplaats 380 JT;
- Haul roads and a dewatering pipeline within the active mining area on Portion 30 of the farm Paardeplaats 380 JT and planned mining areas on Potion 13, 28, 29 and 40 of the the farm Paardeplaats 380 JT and Portion 2 and Remaining Extent of the farm Paardeplaats 425 JS;
- Backfill areas on Portion 1, 3, 4 and 5 of the farm Paardeplaats 380 JT; and
- Discard Management Facility (DMF) on Portion 24 of the farm Paardeplaats 380 JT.

Figure 2.5 presents the expansion, upgrade and new infrastructure that are required in and around the CSWP located in the Glisa Section. **Figure 2.6** presents the expansion and new infrastructure that are required on Portion 24. **Figure 2.7** presents the backfill areas in the Glisa Section and the proposed DMF on Portion 24. Finally, **Figure 2.8** presents the gravel roads and dewatering pipeline in the active mining area (Portion 30) and planned mining areas (Potion 13, 28, 29 & 40 of the the farm Paardeplaats 380 JT and Portion 2 & RE of the farm Paardeplaats 425 JS).

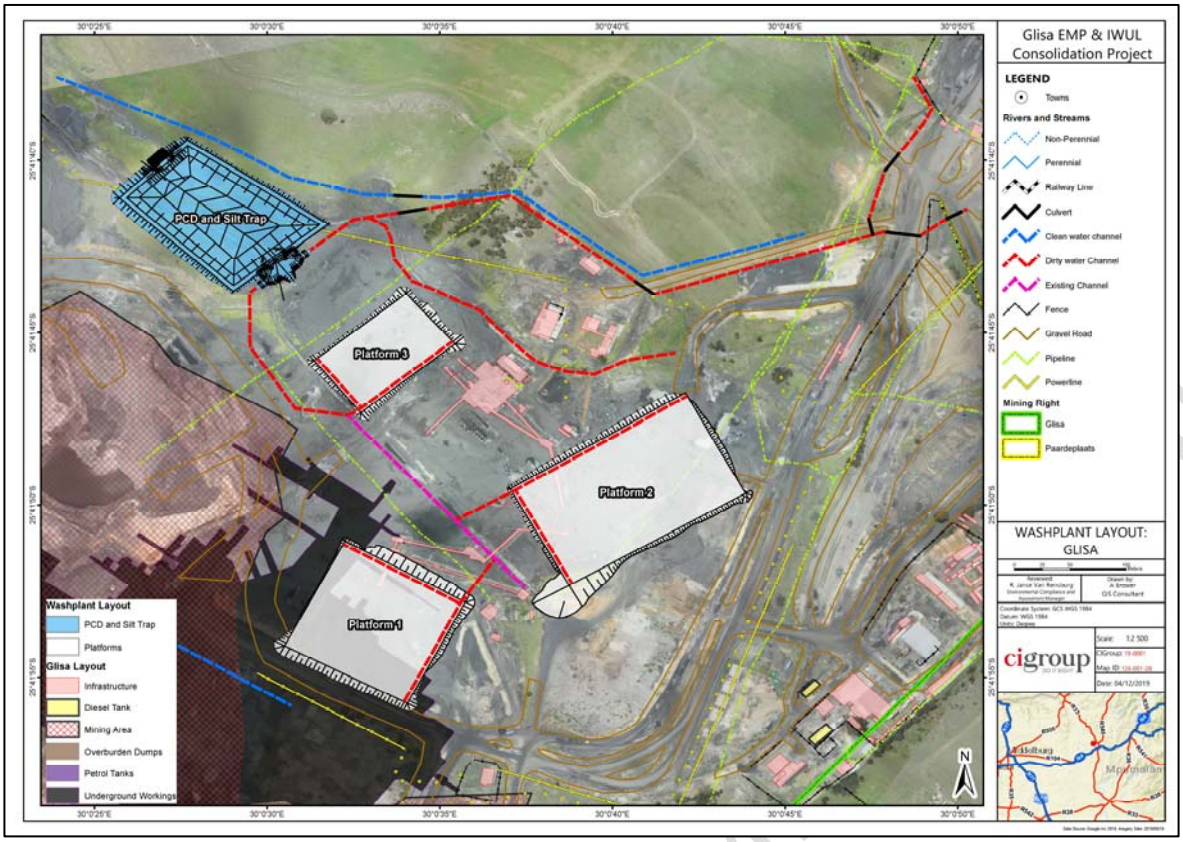

Figure 2.5: Proposed Site Layout around the Glisa Section CSWP.

Figure 2.6: Proposed Site Layout on Portion 24.

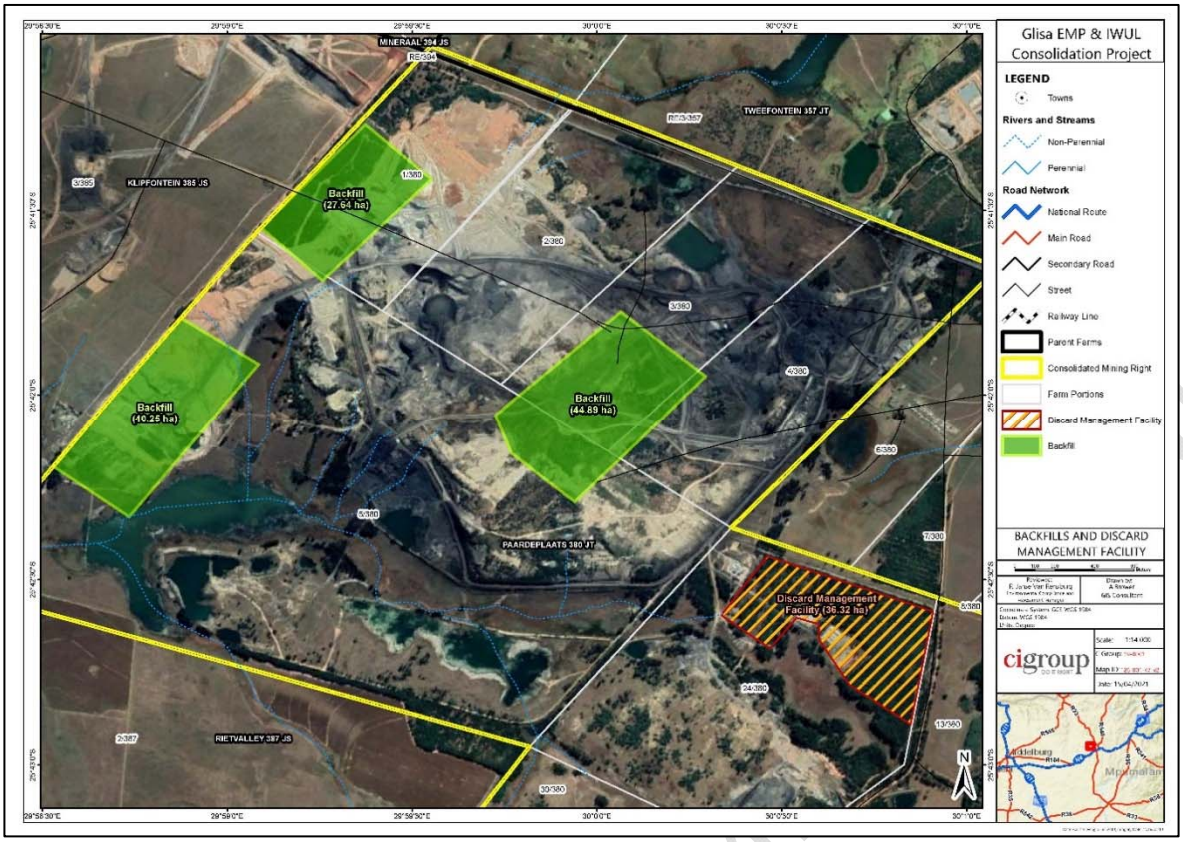

Figure 2.7: Proposed Backfill Areas in the Glisa Section and DMF on Portion 24.

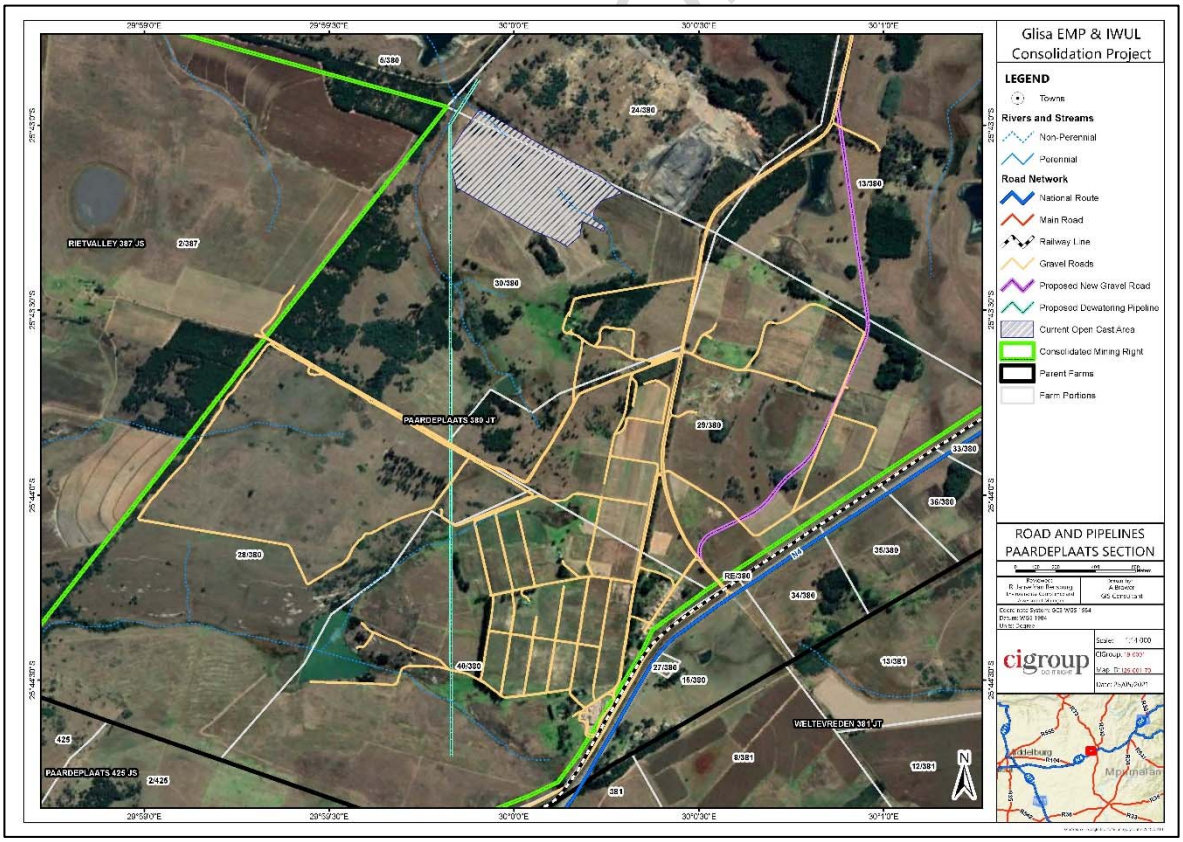

Figure 2.8: Proposed Gravel Roads and Dewatering Pipeline in the Active and Planned Mining Areas.

3 COMPOSITE MAP

The final site layout plan as presented in **Figure 3.1**, includes all planned infrastructure and activities that are required to ensure the continuation of mining, mineral processing and water treatment activities for the Integrated Paardeplaats Section.

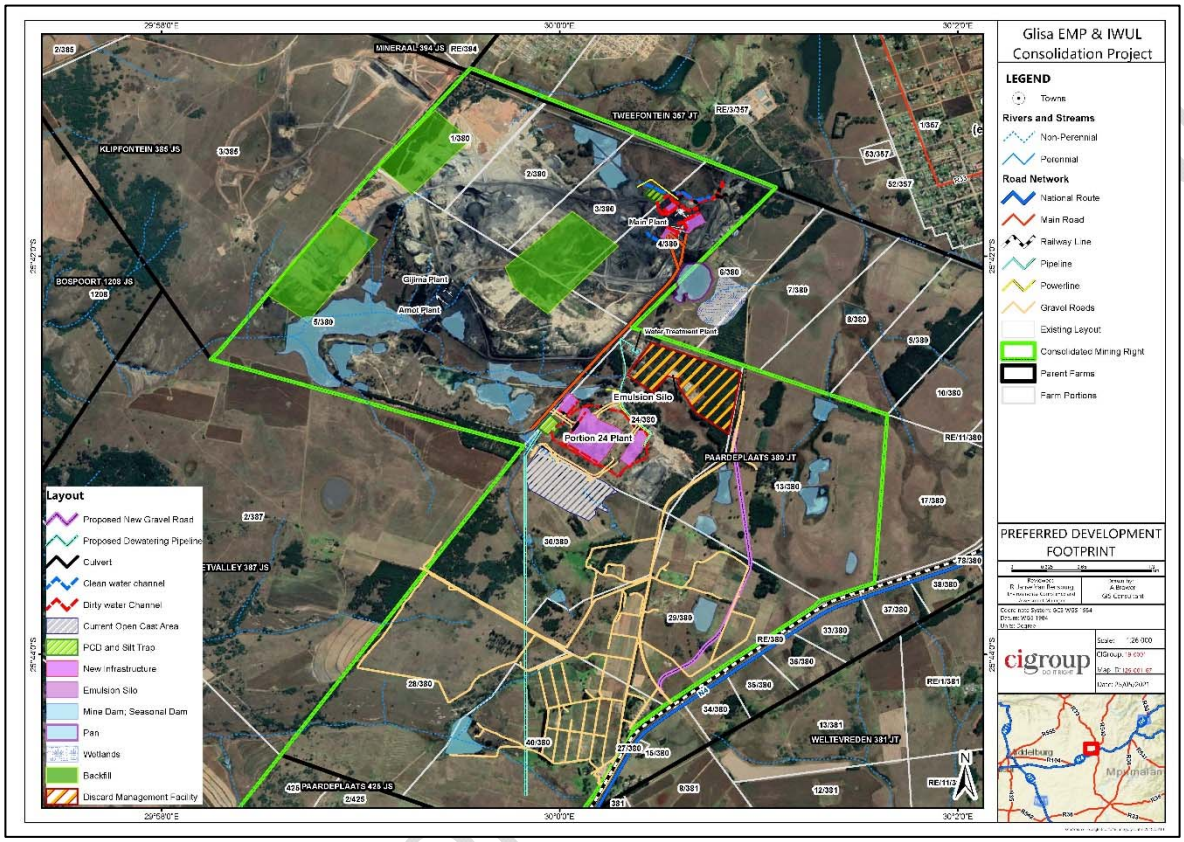

Figure 3.1: Preferred Development Footprint.

4 IMPACT MANAGEMENT OBJECTIVES

4.1 Determination of Closure Objectives

The overall closure objectives are outlined below:

1. **Suitable Land Capability and Land Use Post-closure:** To rehabilitate all disturbed land to a state that is suitable for its post closure use to be determined in consultation with I&APs and other key stakeholders.
2. **Health and Safety:** To ensure that affected areas are safe, secure, and non-polluting for both human and animal activities.
3. **Physical and Chemical Stability:** The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated or adequately minimised.

4. **Ecological Sustainability:** To rehabilitate all disturbed land to a state where limited or preferably no post closure management is required.
5. **Environmental Compliance:** To rehabilitate all disturbed land to a state that facilitates compliance with current environmental quality objectives.
6. **Stakeholder Management:** To follow an appropriate stakeholder engagement process with all I&APs and authorities.

4.2 Process for Managing Environmental Impacts as a Result of Undertaking A Listed Activity

The EMP applies to each aspect identified during the construction, operational and decommissioning/closure phases. The onus for the implementation of the EMP lies with NBC. NBC shall ensure that all environmental legal requirements and specific EMP requirements are disclosed to all employees, contractors, and visitors through induction or environmental awareness campaigns. It is imperative that all employees, contractors, and visitors are aware of the environmental obligations NBC have in order to promote environmentally conscious behaviour at the mine.

NBC must identify training needs for employees and contractors to ensure that all personnel whose work may have an impact on the receiving environment receive appropriate training. The Environmental Awareness Plan included herewith describes the training available and the manner in which environmental training needs are identified and continually reassessed.

4.3 Potential Risk of Acid Mine Drainage

Due to mine dewatering activities, groundwater flow directions will be directed towards the mining area at the Integrated Paardeplaats Section. Therefore, contamination will be contained within the mining area, and limited contamination will be able to migrate away from the mining area.

Once active mining at the Integrated Paardeplaats Section has ceased, the opencasts and the infrastructure will be rehabilitated. The surface contaminant sources (plant areas, dams, and stockpiles) will be decommissioned and should no longer act as a pollution source. However, Acid Rock Drainage/Neutral Mine Drainage (ARD/NMD) and Saline Drainage (SD) is still likely to form given the unsaturated conditions in the mining areas and contact of water and oxygen through natural process including rainfall. Therefore, groundwater contaminant plumes are likely to migrate from the mining areas once the water level in the rehabilitated pits have reached long term steady state conditions (i.e. each pit water level has reached the decant level).

Decanting will occur when the mine water level in the rehabilitated and backfilled workings rebounds to a level above the topographic elevation, resulting in mine water discharging onto surface. Surface decanting refers to direct discharge of mine water to surface through backfilled material, voids, shafts, adits, boreholes and other direct paths. Decant takes place at the lowest topographic level that intersects the flow path and/or opencast. The location of the decant positions can be seen in **Figure 4.1**.

In the 2019 assessment, the decanting water quality was predicted not to become acidic but will contain a high salt content with Sulphate (SO_4) being the main constituent of concern. However based on the proposed mine plan for the Integrated Paardeplaats Section (NBC, 2021), this assumption that the water will not acidify may not be valid. Decant water will flow to surface water drainage channels and dams. Decant from the Glisa Section opencasts will flow towards the Mahim Dam, while at the Paardeplaats Section the decant will flow towards a tributary of the Steelpoort River. Based on the geochemical modelling (GCS, 2011a) decant is expected to continue from the operational phase into closure from the existing backfilled areas at the Glisa Section at SO_4 concentrations between 1,100 – 1,600 mg/l. SO_4 values could however reach 2,200 mg/l in the long term.

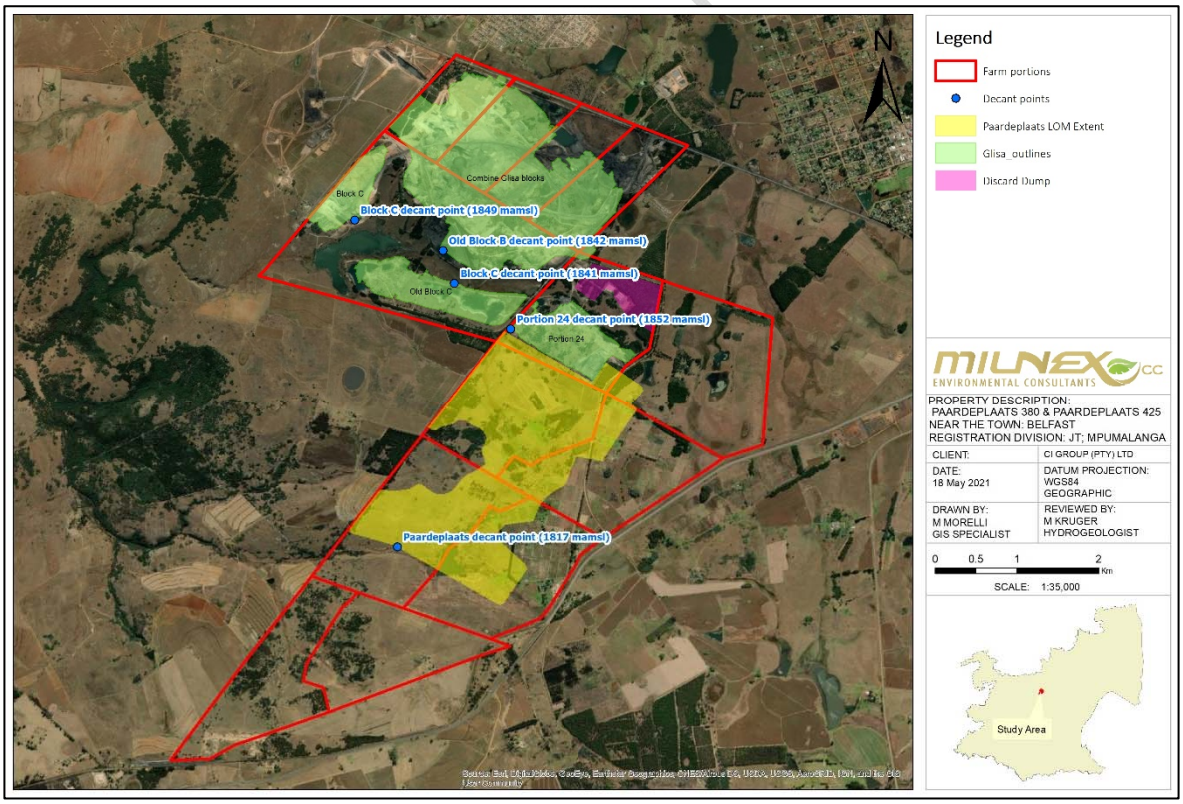

Figure 4.1: : Location of Potential Decant Positions.

The migration of contaminated water from the opencasts has been simulated for 50 and 100 years after closure (i.e. it is assumed that all opencasts have been rehabilitated and backfilled). The contaminant plumes could migrate ±600 m down gradient of the rehabilitated Integrated Paardeplaats Section opencast areas in the weathered and fractured karoo aquifer 50 years post closure (after decant level has been reached). The plumes are likely to extend further 100 years post closure and could extend ±800 m from the Integrated Paardeplaats Section opencast areas.

4.4 Steps Taken to Investigate, Assess, and Evaluate the Impact of Acid Mine Drainage

Geochemical characterisation of eight lithological units and coal slurry (nine samples in total) was conducted by GCS in 2011 for the Glisa Section. In 2012, Aqua Earth Consulting collected six samples for the Paardeplaats Section for Acid Base Accounting (ABA). In 2021 a geochemical assessment on two coal discard samples from the CSWP was undertaken by Milnex cc. In addition, monitoring of groundwater, surface water and process water is also being conducted at NBC ensuring that the presence of AMD is being monitored at a number of locations.

The information from the ABA assessments together with available monitoring data was used as an input into the groundwater flow and contaminant transport model to assess and quantify risks of AMD on the groundwater and surface water environment (Milnex, 2021).

During construction of the new mining block at the Paardeplaats Section and the DMF minimal additional impacts to the groundwater system are expected. The main activities that could impact on groundwater in this phase include the construction and clearing of footprint areas.

The environmental impact significance is expected to be moderate to low for the Integrated Paardeplaats Section during the operational phase. Given the current occurrence of mine water decant at the Glisa Section, the impacts are currently high but reduce to low with mitigation (collection and treatment/reuse of mine water decant). In addition, the construction of a Class C liner for the DMF reduces the potential impact significance from high to low.

During the operational phase, it is expected that the main impact on the groundwater environment will be dewatering of the surrounding aquifer. Based on the model simulation, it is expected that several boreholes and springs could be impacted by mining. Only the following springs will be mined out: VSFTN1, VSFTN2 and Dick Farm Fountain. The boreholes BH1B, HBH, BH15 and GMBH2 could potentially become affected in varying degrees by dewatering activities. HBH and GMBH2 are used for domestic and drinking water purposes, while BH1B and BH15 are monitoring boreholes.

The life of mine for the mining at the Glisa Section has come to an end so for the purposes of pollution identification it was assumed that the opencasts at the Glisa Section are fully rehabilitated and flooded. This allows sufficient time for chemical reactions to take place in the mined-out areas, overburden dumps and other potential pollution sources to produce ARD/NMD conditions. Based on monitoring data, SO_4 contaminant plume is migrating from New Block B towards the south. A general increasing trend of SO_4 were noted since 2015 in BH1, which could be expected after rehabilitation of North Block and movement of mine contaminants in a northerly direction, downgradient of the site. Based on the water quality data of BH7, mine water was moving away from the rehabilitated Portion 24 towards the decant point in the southwestern corner. Due to mine dewatering activities, groundwater flow directions will be directed towards the mining area at the Integrated Paardeplaats Section. Therefore, contamination will be contained within the mining area, and limited contamination will be able to migrate away from the mining area. Effective lining of the water balancing dam and pollution control dams should be ensured, thereby preventing contamination of the underlying aquifers.

The proposed DMF is planned to be constructed on the northern side of the stream near the Portion 24 rehabilitated opencast. Although no monitoring boreholes are currently located upgradient or directly down gradient of the proposed DMF, it is likely that the groundwater quality below the DMF footprint is good and similar to background levels. The proposed DMF is likely to be in operation while Paardeplaats Section is being mined. The coal discard material is likely to have a large contaminant load that could negatively impact on the groundwater and surface water resources if no mitigation measures were put in place. However, the installation of a Class C liner below the DMF could result in the impact significance reducing from high to low. The impact of the groundwater quality underlying the DMF is thus low due to the negligible seepage through the liner system. The correct installation of the liner is important to ensure the liner integrity stays intact and the impact remains low.

However, it must be noted that holes could arise in the liner from a variety of causes, including manufacturing defects, handling of the GM rolls, on-site placement and seaming, the placement of drainage gravel over the liner system, traffic over the liner or the overlying protection layer, placement of the waste in a landfill or cleaning of residue from a leachate lagoon, and stress cracking as the GM ages. A scenario was thus simulated assuming minor leakage through the liner. A seepage rate of ±127 litres/ha/day was estimated for a Class C liner with 1 wrinkle with holes per hectare, calculated as ±0.64% of MAP. The sulphate concentrations still appear to be below 1,000 mg/l at closure (2035). The adjacent stream is likely to be negatively impacted on by contaminated seepage emanating from the DMF should leakage through the liner occur. The Glisa opencast areas (such as Portion 24 and old Block C rehabilitated opencast) are however larger contaminant sources and are likely to contribute proportionally larger sulphate loads to the stream.

During the post-closure phase water and oxygen will likely react with the backfilled material and as a result ARD/NMD could peak during this phase. The environmental impact significance is expected to be moderate to high if not mitigated. In general, it is expected that the rehabilitated and backfilled pits will only be partially flooded, due to the nature of the mine/coal floor elevation and topography. The old Block C area is already reported to be decanting for some time. It is likely that decant occurs as diffuse seepage across a large area near the decant position. Portion 24 backfilled pit is also thought be decanting on the western most boundary on the pit.

The (new) Block C is also likely to decant near Mahim Dam. The Combined Glisa Blocks are likely to decant near the old Block B decant position. At the Paardeplaats Section, decant will occur at the south western part of the pit in proximity to where lower seam 2 sub-outcrops. The lowest surface elevation based on the current mining extent is 1,818 metres above mean sea level (mamsl), this is the area where the coal seam 2 sub-outcrops. The No. 2 lower coal seam in the Paardeplaats Section ranges from 1,888 - 1816 mamsl. The rehabilitated Paardeplaats Section opencast is thus likely to be largely unsaturated. The coal floor also dips towards the decant point in the south west. It is thus likely that the mine water quality emanating from Paardeplaats will be significantly impacted by the mining activities. A final void in this section could assist in reducing the post closure decant rate for the Paardeplaats Section but should be verified once mining commences to ensure proper planning for closure could be achieved.

In general, it is expected that the rehabilitated and backfilled areas will only be partially flooded, due to the nature of the mine/coal floor elevation and topography. It is for this reason that certain mining areas are likely to start decanting sooner that others (as the void space to fill is less due to the decant position). Based on the current mining extent the Paardeplaats Sections will start decanting soon after mining ceases.

The contaminant plume emanating from the Glisa section old Block C and Portion 24 migrate in a north and north westerly direction toward the Mahim stream. The contaminant plume migrating from Block C and the combined Glisa section blocks (Block B, Block A north pit etc.) will move in a southern and south western direction, while the plume will also migrate from the northern part of the combined Glisa blocks (Block B, Block A north pit etc.) toward the north. For the Paardeplaats Section mining area, the contaminant plume migrates in a westerly direction towards the unnamed tributary of the Steelpoort River.

The contaminant plumes could migrate ±600 m down gradient of the rehabilitated opencast areas (at Glisa and Paardeplaats) in the weathered and fractured karoo aquifer 50 years post closure (after decant level has been reached). The plumes are likely to extend further 100 years post closure and could extend ±800 m from the Glisa and Paardeplaats opencast areas.

The tributary feeding the Mahim dam is likely to be impact by shallow contaminated seepage emanating from the Glisa Section rehabilitated opencast areas. Similarly, the non-perennial stream west of the Paardeplaats Section could also be impacted by shallow contaminated seepage emanating from the Paardeplaats Section rehabilitated opencast area. The stream located north of the Glisa Section draining into Belfast Dam could also be impacted by shallow contaminated seepage emanating from the Glisa Section combined block rehabilitated opencast area.

The impact of the proposed DMF if the liner and cover of the DMF stays intact is expected to be minimal. However, should the liner be compromised, then a contaminant plume with elevated sulphate concentrations ±3,000 mg/l could impact on the adjacent stream and contribute to the salt load of the stream. Both the Glisa and the Paardeplaats Sections will contribute to the salt loads in the streams mentioned above if decant mitigation measures are not implemented. It is recommended to conduct surface wate blending model to assess the risk associated with the salt load contribution of the base flow.

4.5 Solutions to be Implemented to Avoid or Remedy Acid Mine Drainage

The following solutions should be considered for implementation to avoid of remedy AMD:

- To minimise the extent of groundwater pollution plume migration and decant volumes, all mining areas should be backfilled and rehabilitated as much as possible to ensure the decant volumes are reduced;
- A Class C liner should be installed for the proposed DMF;
- Mine water must be used or pumped to dirty water dams or pollution control facilities in order to avoid deterioration of the mine water. The longer the mine water resides in the pit the higher the TDS will be. It is not foreseen that mine water in contact with the pit material will acidify during the operational phase;
- As much coal as possible must be removed from the opencast mine during the operational phase;
- Carbonaceous rocks and discard should be placed in the deepest part of the pit (as far as practical possible) and below the long-term pit water level in order to ensure that it is flooded, and that pyrite oxidation is minimised;
- Soft overburden and weathered rock should be placed at the top of the backfill in order to minimise oxygen diffusion into the pit;
- The mined-out sections of the pit should be backfilled, compacted and rehabilitated where practically possible. Concurrent rehabilitation is practiced by NBC. Rehabilitation can include covering the backfill with a topsoil layer as well as vegetation thereof. Installation of a soil cover could significantly decrease water infiltration and contamination. If less water

is infiltrating it will likely not have a negative effect on mine water quality (increasing TDS) as the salt content is controlled by mineral saturation rather than straightforward dilution;

- Adequately sized pollution control facilities should be constructed;
- Minimise the footprint of dirty water areas like the pollution control dams and coal stockpiles, workshops and oil and diesel storage areas;
- Proper storm water management should be implemented. Berms should also be constructed to ensure separation of clean water and dirty water areas;
- Contain poor quality runoff from dirty areas and divert this water to pollution control dam for re-use or to the WTP for treatment;
- Static groundwater levels should be monitored to ensure that any deviation of the groundwater flow from the idealised predictions is detected in time;
- The numerical model should be updated every two (2) years by using the measured water ingress and water levels to re-calibrate and refine the impact predictive scenario;
- The monitoring results must be interpreted annually by a qualified hydrogeologist and the adequacy of the network should be assessed annually to ensure compliance;
- The rehabilitated opencasts should be free draining away from the pit to reduce drainage into the pit;
- Sewage effluent emanating from latrines or ablution blocks should be treated to acceptable levels before discharge into the environment;
- Boreholes should be drilled into the mine workings so that the rate of flooding and water level recovery and quality can be established. Stage curves should be made which would aid in the management prior to the closure phase. The location of these boreholes can be established based on the coal floor elevations and should generally be placed in the deeper sections of the rehabilitated opencasts;
- A detailed mine closure plan should be prepared during the operational phase, including a risk assessment, water resource impact prediction etc.;
- It is recommended that the geochemical assessment previously undertaken in 2001 is updated during the life of the mine in order to calibrate and validate its results and to construct an effective closure plan. Geochemical samples should be collected and analysed annually. A geochemical model should be performed to assess the effectiveness of potential mitigation measures. The model can then be updated every two years with the new data; and
- Mine water decant should be actively managed by reuse of the water or treatment and release to the environment under acceptable contaminant levels.

4.6 Measures to Remedy Any Residual or Cumulative Acid Mine Drainage Impact

The following measures to remedy residual or cumulative AMD are proposed:

- A site assessment re-calculating the decant volumes using numerical model results and spreadsheet calculations should be carried out every 2 years based on the rehabilitation design of each opencast;
- Re-estimations of the recharge based on the used capping and determination of the backfill porosity into each pit should be assessed when backfilling is complete. This will improve the accuracy of the decant volumes and time-to-decant to be expected and therefore to verify if the water treatment plant is properly designed;
- Delineations of mining areas, contribution of each of those mining areas to the constructed decant points and anticipated decant volumes (average and seasonal variations) should be assessed and/or confirmed and these volumes should correspond to values in the site water balance;
- All boreholes to be mined out should be grouted and sealed to prevent cross contamination of aquifers; and
- If it can be proven that the mining operation is indeed affecting the quantity of groundwater available to certain users, the affected parties may need to be compensated. This may be done through the installation of additional boreholes for water supply purposes, or an alternative water supply, however this should be assessed on an individual basis to determine the most appropriate solution for all affected;

4.7 Measures to Remedy Any Residual or Cumulative Wetland Impacts

It is recommended that a detailed wetland mitigation and offset strategy be developed for the mine in order to ensure long-term wetland functioning within the catchment. Such a strategy must consider the feasibility of rehabilitation of the remaining wetlands on site, as well as the offsetting of the residual wetland loss resulting from the proposed mining through of wetlands.

4.7.1 General Principles of Offset Design and Implementation

A set of eight widely accepted principles for high quality biodiversity design and implementation which are based on a synthesis of best global practice have been published by the Business and Biodiversity Offset Programme (BBOP, 2009), and should be considered during the investigation of possible offsets. These include:

- Adherence to the mitigation hierarchy (i.e., offsets should only be considered as a last resort to address significant residual impacts).

- There are limits to what can be offset (areas where offsets are limited include Freshwater Ecosystem Priority Areas, Critical Biodiversity Areas or Ecological Support Areas, Critically Endangered or Endangered wetland types, species, habitats or ecosystems, focus areas for Protected Area expansion, etc.).
- Catchment context: offsets should be designed and implemented in the context of the broader landscape.
- No net loss: this overarching principle implies that losses due to project impacts and offset gains need to be balanced out. This essentially means:
    - Offsets need to target all values (pattern, process and ecosystem services) that are residually affected by a project's direct, indirect and cumulative impacts;
    - Offset policies usually require a like-for-like offset, although out-of-kind (trading up to areas of higher significance) may be considered in exceptional circumstances; and
    - Ideally, offsets should the established prior to project impacts.
- The size of the offset should consider the risks and uncertainties about the success or performance of planned offset measures.
- Additional conservation outcomes – offsets need to be new contributions to conservation outcomes.
- Ensuring conservation outcomes – offsets need to be established preferably in perpetuity to ensure sustainable conservation outcomes, or at least for as long as the residual impact is present.
- Stakeholder participation – offsets should be designed and implemented in a transparent manner and with engagement of interested and affected parties.

4.7.2 Phased Approach

The process of deciding whether an offset would be appropriate, designing an offset and providing for its successful implementation, is therefore best conducted in a phased approach.

During Phase 1, the primary focus of the proposed approach would be on trying to avoid having to provide an offset through application of the mitigation hierarchy and exploring alternatives, checking that the residual impacts are offsetable and, if so, determining the size of the offset required considering the full range of potentially significant residual impacts on direct and indirect ecosystem services. Following this, the feasibility of an offset is investigated, with consideration as to satisfying requirements, ensured security of the site, etc.

During Phase 2, the focus is on finding the most appropriate offset sites and activities to meet offset targets, comparing potentially suitable offset sites to achieve the desired outcomes and taking into consideration associated management and cost implications and any potential impacts

on existing users of these sites. The outcome of Phase 2 would be the development of a draft Offset Report and associated Management Plan/Programme.

The wetland mitigation and offset strategy must consider the following:

- Onsite mitigation: the rehabilitation of wetlands that lie within the boundary of the mine but have been excluded from the mining footprint in order to ensure hectare equivalent gains;
- Offsite mitigation: the identification of suitable wetland habitat outside the boundaries of the mining area, and the implementation of rehabilitation measures that result in an additional gain in hectare equivalents in order to try meet any deficit in terms hectare equivalent targets;
- The creation of new wetlands on previously terrestrial/non-wetland areas; and
- The reintroduction of wetlands to the post-mining landscape. These wetlands may be within previously existing wetland habitat, but the catchment drivers and topography would have been completely transformed. The wetlands are therefore constructed to be compatible with the new landscape.

4.8 Volumes and Rate of Water Use Required for the Mining Operation

4.8.1 Process Water

4.8.1.1 Process Flow Diagram

A Process Flow Diagram (PFD) was drafted to provide insight into all water flow processes within the existing (Glisa Section) and the proposed mine infrastructure (Paardeplaats Section). Information was also obtained from NBC personnel on the operational philosophy of both sections and the CSWP area, and this was used to develop the water balance model. The philosophy and assumptions are summarised as follows:

- A mine schedule plan was provided indicating a LoM for the Glisa Section until 2020 and the Paardeplaats Section (Portion 30 only) until 2030.
- Total water make-up requirement for the CSWP was provided and estimated at 0.15 cubic metres per ton (m^3/t) of RoM. Based on a maximum projected RoM of 333 333 tons/month (t/m) until 2030, a daily make-up requirement was calculated as 1,644 cubic metres per day (m^3/d).
- Based on current pump rates from Mahim Dam to the WTP at 0 m^3/d, it was assumed that Mahim Dam will not have to return pump to the WTP, and that water quality in Mahim Dam will improve substantially during the process of rehabilitation at the Glisa Section.
- Dirty water runoff from the CSWP area will be captured in the proposed Glisa Section PCD (still to be constructed). After mining ceases at the Glisa Section, decant volumes will need

to be pumped to the Glisa Section PCD for re-use in the CSWP. Excess water will be pumped to the WTP.

- Dirty water runoff from Portion 24 (RoM pad area) and dewatering from the Paardeplaats Section opencast pit will be captured in the proposed Paardeplaats Section PCD or pumped to the Block C void.
- Potable/raw water is supplied from the WTP with a throughput capacity of 1,500 m^3/d (1.5 megalitres per day (Ml/d)). According to water consumption data, 66% of the throughput can be used as product (potable water) and 34% ends up in the gypsum product system.
- Dewatering is taking place from the current Glisa Section opencast pit areas and dewatering will also be required for Paardeplaats Section. It is therefore assumed that all rainfall into the opencast pit areas will either runoff into working areas, recharge into spoils, or evaporate/seep into the ground.
- Projected groundwater inflow into the opencast area of Paardeplaats Section was determined by Milnex (2019). It was assumed that rollover mining with concurrent rehabilitation would be undertaken. Maximum inflows that are expected from groundwater are ±692 m^3/d (Milnex, 2019).
- No dewatering and groundwater inflow volumes into the Glisa Section Block C, Block C Void and the combined blocks of Block A, D, B & E and Ramp 4 were provided (Table 6.1). Estimated inflow into the Glisa opencast areas were determined based on runoff calculations in the working areas, assumed at a maximum of 3 ha, and recharge into spoils. Dewatering volumes were assumed based on volumes provided in Milnex (2019) and these include post-closure decant volumes that were calculated under different recharge rates into the backfilled spoils depending on the level of rehabilitation.
- Total potable and raw water make-up (workshop) at the Glisa Section were estimated at 526 m^3/d based on consumption figures provided by NBC personnel on the 9th September 2019. The Paardeplaats Section potable water make-up requirement was estimated at 39 m^3/d.
- Total dust suppression water requirements from Gijima Dam at the CSWP area were estimated at 43 m^3/d or 5-6 cubic metres per hour (m^3/hr) based on raw water consumption volumes provided by NBC. Other estimated daily water requirements for mine dust suppression were assumed from the IWUL at 27 m^3/day taken from the proposed Glisa Section PCD for the CSWP area and 27 m /d from the Paardeplaats Section PCD.
- Sewage effluent will be disposed of in septic tanks. It is common that 80% of potable and raw water usage will end up in septic tank systems.

The final PFD for both Sections was confirmed by NBC personnel and is provided in **Figure 4.2** overleaf.

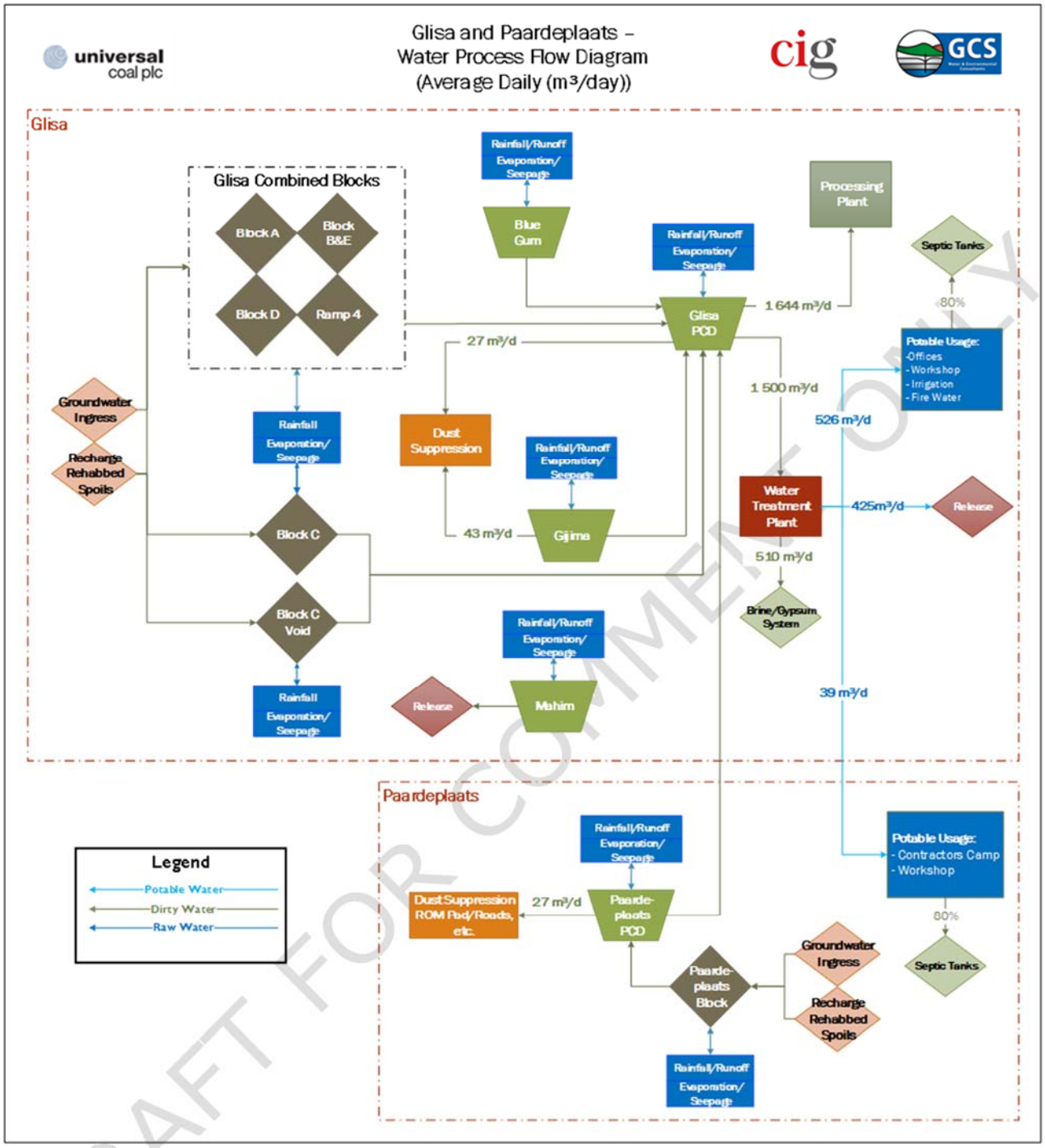

Figure 4.2: Process Flow Diagram for the Glisa and Paardeplaats Sections (GCS, 2019).

4.8.1.2 Water Balance

Three (3) water balances were calculated for the Integrated Paardeplaats Section for two (2) scenarios and provide general insight into the overall total water use and consumption of the Integrated Paardeplaats Section. The first scenario was based on high inflows into the opencast pits assuming limited rehabilitation performed on the backfilled spoils until 2030 (recharge assumed at 22%). The second scenario (low inflows) determined the water balance if recharge rates onto

backfilled spoils are assumed at 10%, which is the upper infiltration rate of rehabilitated spoils according to Hodgson & Kranz (1998) and Milnex (2019). These water balances include an annual average, monthly average and daily average water balance for the two (2) scenarios. Only the annual average water balances are presented herewith.

Scenario 1: High Inflows (recharge assumed at 22%)

The calculated water balance volumes include an annual average year (**Table 4.1**). An excess water balance was calculated of 1,405 m^3/d (excess term indicated under Glisa Section PCD outflow), despite water being re-used water for dust suppression and the CSWP at maximum rates. Due to high recharge rates onto backfilled spoils, not all decant water from the Glisa Section and dewatering volumes from the Paardeplaats Section can be re-used or treated in the WTP. Annual releases into the environment from the WTP were calculated at a rate of 154 950 cubic meters per year (m^3/yr).

Scenario 2: Low Inflows (recharge assumed at 10%)

No excess water balance was calculated in the annual average year (**Table 4.2**) and an average throughput to the WTP was determined at 1 097 m^3/d. All return water from the opencast pits was able to be re-used for dust suppression, the CSWP and WTP. It was calculated that the total clean annual releases form the WTP into the environment are 57 854 m^3/yr.

It is recommended that the water balance be updated annually.

4.8.1.3 Salt Loads

The salt mass balance approach provides for Glisa and Paardeplaats Sections a simple mechanism for tracking changes of volume of water and specific elements in the water system depending on the loads that are flowing between various storage areas. This approach provides a good indication of the general water quality in a water system.

Input mass loads were simulated by multiplying the assumed concentrations by the volumes of water generated in the water balance for those specific areas. The concentrations at the dam element outflows (C-end) were simulated using the principle of the equation below and entails that load "in" would be equal to load "out" plus any changes in load due to rainfall, runoff, PCD return flows, seepage and evaporation:

$$Cend = \frac{load_{in} + \Delta load_{dam}}{volume_{end}}$$

Table 4.1: Average Annual Water Balance (High Inflows).

Annual Average Water Balance for Glisa/Paardeplaats (High Volumes)					
Facility Name		**Water In**		**Water Out**	**Balance**
Glisa/Paardeplaats	**Water Circuit/stream**	**Quantity (m^3/year)**	**Water Circuit/stream**	**Quantity (m^3/year)**	
Paardeplaats Opencast Pit Area	From: Direct Rainfall	1 072	To: Evaporation	2 250	
	From: Pit Runoff	8 148	To: Paardeplaats PCD	814 454	
	From: Recharge/Runoff Spoils	554 904			
	From: Groundwater Inflow	252 580			
		816 704		**816 704**	-
Paardeplaats PCD	From: Direct Rainfall	3 507	To: Evaporation	7 361	
	From: Runoff	33 641	To: Dust Suppression	9 900	
	From: Paardeplaats Pit Area	814 454	To: Glisa PCD	878 507	
	From: Portion 24	44 165			
	Total	**895 768**		**895 768**	-
Glisa PCD	From: Direct Rainfall	2 144	To: Evaporation	4 500	
	From: Runoff	40 960	To: Dust Suppression	9 900	
	From: Paardeplaats PCD	878 507	To: Processing Plant	600 000	
	From: Glisa Block C	124 893	To: Water Treatment Plant	547 500	
	From: Combined Blocks	597 870	To: Excess	512 745	
	From: Bluegum Dam	30 270			
	Total	**1 674 645**		**1 674 645**	-
Mahim Dam	From: Direct Rainfall	237 649	To: Evaporation	498 750	
	From: Runoff/Seepage	444 278	To: Overflow	183 177	
		681 927		**681 927**	-
Gijima Dam	From: Direct Rainfall	23 479	To: Evaporation	49 275	
	From: Runoff	41 650	To: Dust Suppression	15 854	
		65 129		**65 129**	-
Bluegum Dam	From: Direct Rainfall	66 470	To: Evaporation	139 500	
	From: Runoff	103 300	To: Glisa PCD	30 270	
		169 770		**169 770**	-
Glisa Block C	From: Direct Rainfall	1 072	To: Evaporation	2 250	
	From: Pit Runoff	8 148	To: Glisa PCD	124 893	
	From: Recharge/Runoff Spoils	56 603			
	From: Groundwater Inflow	61 320			
		127 143		**127 143**	-
Glisa Combined Blocks (Block A, B&E, Block D and Ramp 4)	From: Direct Rainfall	2 716 208	To: Evaporation/Seepage	2 118 338	
	From: Groundwater Inflow	0	To: Decant to Glisa PCD	597 870	
		2 716 208		**2 716 208**	-
Block C Void	From: Direct Rainfall	198 267	To: Evaporation/Seepage	247 907	
	From: Recharge/Ingress	49 640			
		247 907		**247 907**	-
Processing Plant	From: Glisa PCD	600 000	To: Make-Up	600 000	
		600 000		**600 000**	-
Water Treatment Plant	From: Glisa PCD	547 500	To: Glisa Potable Users	192 000	
			To: Paardeplaats Potable Users	14 400	
			To: Release to Environment	154 950	
			To: Brine/Losses	186 150	
		547 500		**547 500**	-
Total Water Balance		**8 542 702**		**8 542 702**	-

Table 4.2: Average Annual Water Balance (Low Inflows - Rehabilitated Spoils).

Annual Average Water Balance for Glisa/Paardeplaats (Low Volumes)					
Facility Name		**Water In**		**Water Out**	**Balance**
Glisa/Paardeplaats	**Water Circuit/stream**	**Quantity (m^3/year)**	**Water Circuit/stream**	**Quantity (m^3/year)**	
Paardeplaats Opencast Pit Area	From: Direct Rainfall	1 072	To: Evaporation	2 250	
	From: Pit Runoff	8 148	To: Paardeplaats PCD	511 779	
	From: Recharge/Runoff Spoils	252 229			
	From: Groundwater Inflow	252 580			
		514 029		**514 029**	-
Paardeplaats PCD	From: Direct Rainfall	3 507	To: Evaporation	7 361	
	From: Runoff	33 641	To: Dust Suppression	9 900	
	From: Paardeplaats Pit Area	511 779	To: Glisa PCD	575 832	
	From: Portion 24	44 165			
	Total	**593 093**		**593 093**	-
Glisa PCD	From: Direct Rainfall	2 144	To: Evaporation	4 500	
	From: Runoff	40 960	To: Dust Suppression	9 900	
	From: Paardeplaats PCD	575 832	To: Processing Plant	600 000	
	From: Glisa Block C	94 019	To: Water Treatment Plant	400 386	
	From: Combined Blocks	271 560	To: Excess	0	
	From: Bluegum Dam	30 270			
	Total	**1 014 786**		**1 014 786**	-
Mahim Dam	From: Direct Rainfall	237 649	To: Evaporation	498 750	
	From: Runoff/Seepage	444 278	To: Overflow	183 177	
		681 927		**681 927**	-
Gijima Dam	From: Direct Rainfall	23 479	To: Evaporation	49 275	
	From: Runoff	41 650	To: Dust Suppression	15 854	
		65 129		**65 129**	-
Bluegum Dam	From: Direct Rainfall	66 470	To: Evaporation	139 500	
	From: Runoff	103 300	To: Glisa PCD	30 270	
		169 770		**169 770**	-
Glisa Block C	From: Direct Rainfall	1 072	To: Evaporation	2 250	
	From: Pit Runoff	8 148	To: Glisa PCD	94 019	
	From: Recharge/Runoff Spoils	25 729			
	From: Groundwater Inflow	61 320			
		96 269		**96 269**	-
Glisa Combined Blocks (Block A, B&E, Block D and Ramp 4)	From: Direct Rainfall	2 716 208	To: Evaporation/Seepage	2 444 648	
	From: Groundwater Inflow	0	To: Decant to Glisa PCD	271 560	
		2 716 208		**2 716 208**	-
Block C Void	From: Direct Rainfall	198 267	To: Evaporation/Seepage	247 907	
	From: Recharge/Ingress	49 640			
		247 907		**247 907**	-
Processing Plant	From: Glisa PCD	600 000	To: Process Make-Up	600 000	
		600 000		**600 000**	-
Water Treatment Plant	From: Glisa PCD	400 386	To: Glisa Potable Users	192 000	
			To: Paardeplaats Potable Users	14 400	
			To: Release to Environment	57 854	
			To: Brine/Losses	136 131	
		400 386		**400 386**	-
Total Water Balance		**7 099 503**		**7 099 503**	-

Sulphate was chosen as an indicated constituent because it is the main constituents in process water typically present in a coal mine. It is furthermore a relatively good tracer constituent with acceptable chemical losses/gains in the system, although not 100 percent conservative. The salt

mass balance results were used to quantify salt loads within the mining operations. Salt balance input data of estimated sulphate concentrations from the water quality analysis results received (data from Golder Associates Africa (2018)) and the hydrogeological specialist study (Milnex, 2019) are listed in **Table 4.3**.

Table 4.3: Assumed Sulphate (SO_4) Concentrations from GCS (2020).

PROCESS	MEAN (mg/l)
Direct rainfall	1
Runoff and in opencast pit	300
Recharge through backfilled spoils	800
Raw water (deep groundwater seepage into opencast pit, borehole water and Rand Water supply)	20
Runoff from processing plant area	500
ROM and product moisture	2 000
Seepage from overburden/discard	1 500
Potable water after treatment	250

Static mean annual salt balances of sulphates (expressed in tons per year (t/yr)) for the Glisa and Paardeplaats Sections are presented in **Table 4.4** and **Table 4.5**. Highest salt loads/concentrations emanate from all backfilled spoils in the opencast pits, CSWP and PCDs.

It is recommended that the salt balance be updated annually.

Table 4.4: Average Annual Salt Load Balance (High Inflows).

Facility Name		Water In		Water Out	Balance
Glisa/Paardeplaats	Water Circuit/stream	Quantity (tonnes/year)	Water Circuit/stream	Quantity (tonnes/year)	
Paardeplaats Opencast Pit Area	From: Direct Rainfall	0	To: Paardeplaats PCD	840	
	From: Pit Runoff	2			
	From: Recharge/Runoff Spoils	832			
	From: Groundwater Inflow	5			
		840		**840**	-
Paardeplaats PCD	From: Direct Rainfall	0	To: Dust Suppression	10	
	From: Runoff	17	To: Glisa PCD	869	
	From: Paardeplaats Pit Area	840			
	From: Portion 24	22			
	Total	**879**		**879**	-
Glisa PCD	From: Direct Rainfall	0	To: Dust Suppression	19	
	From: Runoff	20	To: Processing Plant	1 170	
	From: Paardeplaats PCD	869	To: Water Treatment Plant	1 068	
	From: Glisa Block C	49	To: Excess	1 009	
	From: Combined Blocks	2 173			
	From: Bluegum Dam	155			
	Total	**3 266**		**3 266**	-
Mahim Dam	From: Direct Rainfall	0	To: Overflow	222	
	From: Runoff/Seepage	222			
		222		**222**	-
Gijima Dam	From: Direct Rainfall	0	To: Dust Suppression	62	
	From: Runoff	62			
		62		**62**	-
Bluegum Dam	From: Direct Rainfall	0	To: Glisa PCD	155	
	From: Runoff	155			
		155		**155**	-
Glisa Block C	From: Direct Rainfall	0	To: Glisa PCD	49	
	From: Pit Runoff	2			
	From: Recharge/Runoff Spoils	45			
	From: Groundwater Inflow	1			
		49		**49**	-
Glisa Combined Blocks (Block A, B&E, Block D and Ramp 4)	From: Direct Rainfall	2 173	To: Decant to Glisa PCD	2 173	
	From: Groundwater Inflow	0			
		2 173		**2 173**	-
Block C Void	From: Direct Rainfall	0	To: storage	40	
	From: Recharge/Ingress	40			
		40		**40**	-
Processing Plant	From: Glisa PCD (Make-Up)	1 170	To: Product	366	
	From: ROM	367	To: Discard	238	
			To: Evaporation/Losses	934	
		1 537		**1 537**	-
Water Treatment Plant	From: Glisa PCD	1 068	To: Glisa Potable Users	48	
			To: Paardeplaats Potable Users	4	
			To: Release to Environment	39	
			To: Brine/Losses	978	
		1 068		**1 068**	-
Total Water Balance		**10 292**		**10 292**	-

Table 4.5: Average Annual Salt Load Balance (Low Inflows - Rehabilitated Spoils).

Facility Name		Water In		Water Out	Balance
Glisa/Paardeplaats	Water Circuit/stream	Quantity (tonnes/year)	Water Circuit/stream	Quantity (tonnes/year)	
Paardeplaats Opencast Pit Area	From: Direct Rainfall	0	To: Paardeplaats PCD	386	
	From: Pit Runoff	2			
	From: Recharge/Runoff Spoils	378			
	From: Groundwater Inflow	5			
		386		**386**	-
Paardeplaats PCD	From: Direct Rainfall	0	To: Dust Suppression	5	
	From: Runoff	17	To: Glisa PCD	420	
	From: Paardeplaats Pit Area	386			
	From: Portion 24	22			
	Total	**425**		**425**	-
Glisa PCD	From: Direct Rainfall	0	To: Dust Suppression	17	
	From: Runoff	20	To: Processing Plant	1 001	
	From: Paardeplaats PCD	420	To: Water Treatment Plant	668	
	From: Glisa Block C	24	To: Excess	1 108	
	From: Combined Blocks	2 173			
	From: Bluegum Dam	155			
	Total	**2 793**		**2 793**	-
Mahim Dam	From: Direct Rainfall	0	To: Overflow	222	
	From: Runoff/Seepage	222			
		222		**222**	-
Gijima Dam	From: Direct Rainfall	0	To: Dust Suppression	62	
	From: Runoff	62			
		62		**62**	-
Bluegum Dam	From: Direct Rainfall	0	To: Glisa PCD	155	
	From: Runoff	155			
		155		**155**	-
Glisa Block C	From: Direct Rainfall	0	To: Glisa PCD	24	
	From: Pit Runoff	2			
	From: Recharge/Runoff Spoils	21			
	From: Groundwater Inflow	1			
		24		**24**	-
Glisa Combined Blocks (Block A, B&E, Block D and Ramp 4)	From: Direct Rainfall	2 173	To: Decant to Glisa PCD	2 173	
	From: Groundwater Inflow	0			
		2 173		**2 173**	-
Block C Void	From: Direct Rainfall	0	To: storage	40	
	From: Recharge/Ingress	40			
		40		**40**	-
Processing Plant	From: Glisa PCD (Make-Up)	1 001	To: Product	366	
	From: ROM	367	To: Discard	238	
			To: Evaporation/Losses	765	
		1 368		**1 368**	-
Water Treatment Plant	From: Glisa PCD	668	To: Glisa Potable Users	48	
			To: Paardeplaats Potable Users	4	
			To: Release to Environment	14	
			To: Brine/Losses	602	
		668		**668**	-
Total Water Balance		**8 316**		**8 316**	-

4.9 Has a Water Use Licence Been Applied For

NBC holds two (2) Integrated Water Use Licenses (IWULs) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), for the Integrated Paardeplaats Section. The first IWUL applies to the Paardeplaats Section and is valid for a period of twenty (20) years until 21 February 2039, and the second IWUL applies to the Glisa Section and is valid for a period of twenty (20) years until 4 October 2040. The IWULs accommodate the new activities at the Integrated Paardeplaats Section, however if the IWULs need to be amended for any reason to accommodate the new activities, this will be done in the form of an amendment application on the applicable IWUL.

NBC are authorised by the DHSWS to undertake the following NWA Section 21 water uses:

- **Glisa Section (License No.: 06/B41A/ABCFGIJ/1002; File No.: 27/2/2/B141/3/9)**
  - Section 21(a): taking water from a water resource;
  - Section 21(b): storing water;
  - Section 21(c) & 21(i): impeding or diverting the flow of water in a watercourse and altering the bed, banks, course, or characteristics of a watercourse;
  - Section 21(f): discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
  - Section 21(g): disposing of waste in a manner which may detrimentally impact on a water resource; and
  - Section 21(j): removing, discharging, or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.
- **Paardeplaats Section (06/B41A/CGIJ/8880)**
  - Section 21(c) & (i): impeding or diverting the flow of water in a watercourse and altering the bed, banks, course or characteristics of a watercourse;
  - Section 21(g): disposing of waste in a manner which may detrimentally impact on a water resource; and
  - Section 21(j): removing of water found underground for the efficient continuation of an activity or for the safety of people.

4.10 Impacts to be Mitigated in their Respective Phases

The impacts that are to be mitigated in their respective phases is presented in **Table 4.6**.

Table 4.6: Impacts to be Mitigated.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Air Quality					
Construction	Site Clearance	Dust-fall rates exceeding the residential guideline of 600 mg/m²/day, beyond the mine boundary. Elevated PM 10 levels beyond the mine boundary. Elevated PM 2.5 levels beyond the mine boundary.	Dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers. Use of water sprayers at crushers. Establish wind breaks where possible.	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Construction Operational Decommissioning Closure Rehabilitation	Vehicular and Machinery movement	Dust liberation as a result of vehicular and machinery use and movement.	Dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers. Exhaust pipes of vehicles should be directed so that they do not raise dust.	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Dust liberation as a result of dust accumulation on surfaces.	Hard surfaced haul roads or standing areas should be swept or washed down to remove accumulated dust.	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Dust liberation as a result of wind.	Revegetation of exposed areas with indigenous vegetation as an erosion control option. Keep soil stockpiles moist or vegetated to lessen dust liberation.	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	As soon as possible. Maintained. throughout LoM.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Dust liberation as a result of soil handling.	Handling of soil should be undertaken on less windy days.	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Soil, Land Use and Land Capability					
Construction Operational	Site clearance	Loss of fertile topsoil due to vegetation clearance. Increased susceptibility to erosion due to removal of vegetation cover. Increased soil erosion due to vegetation clearance.	Retain maximum surface vegetation cover. Restrict vegetation clearance as far as possible. Restrict vegetation clearance to a minimum footprint area. Undertake vegetation clearance in as short a duration as possible.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Construction Operational	Infrastructure establishment and open cast mining	Loss or reduction in soil fertility due to activities connected to mine infrastructure establishment and opencast mining.	Retain maximum surface vegetation cover. Restrict vegetation clearance to a minimum footprint area.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Construction Operational Decommissioning Closure Rehabilitation	Vehicular and Machinery movement	Compaction of soil surface due to various activities and vehicular and machinery use and movement.	Restrict vehicular and machinery use and movement as far as possible.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Construction Operational Decommissioning Closure Rehabilitation	Chemical and water use	Contamination of soil due to chemical or affected water spillages.	Implement correct procedures for chemical handling and storage to minimise spillages. Implement management procedures for clean and dirty water handling and storage to minimise spillages. Address chemical and water spillages promptly through accepted corrective actions.	NEM:WA. Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Construction	Construction activities	Alteration in prevailing terrain due to construction activities.	Keep excavation to minimum and avoid, where possible, wetlands and depression areas.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Construction Operational	Removal of soils	Loss of soil with an arable agricultural potential due to the removal and storage of soils.	Ensure that soil is correctly removed and stockpiled. Stockpile soil for the shortest duration possible. Retain topsoil.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Operational	Stockpiled soils	Increased tendency for stockpiled soils to erode.	Stockpile soil for the shortest duration possible. Ensure that stockpile slopes are not too steep. Implement management procedures to ensure that erosion due to water is minimised.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Operational	Stockpiled soils	Increased compaction of stockpiled soils.	Stockpile soil for the shortest duration possible. Restrict vehicular and machinery use and movement as far as possible.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Operational	Open cast mining	Excess pollution and runoff due to opencast mining.	Implement stormwater management procedures for clean and dirty water handling within and around the opencast pit area. Control drainage of water from the opencast pit area through the use of berms, collection areas, and the dewatering pipeline.	SWMP. Soil Utilisation and Management Plan.	Immediately. Maintained throughout LoM.
Operational	Soil and spoil removal	Change in natural landscape due to soil and spoil removal.	Minimise changes to natural landscape as far as practically implementable.	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Construction Operational	Infrastructure development	Loss of pre-mining potential due to use of land for infrastructure. Increased soil compaction due to use of soil for infrastructure. Increased potential for soil erosion after removal of infrastructure.	Remove all infrastructure down to foundations. Loosen areas where infrastructure was removed prior to topsoil replacement. Replace with suitable topsoil to optimum depth. Fertilise and revegetate as soon as possible after topsoil replacement.	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.
Construction Operational	Infrastructure development	Reduction in ability of soil profile to be used for arable agriculture.	Ensure that soil is replaced evenly, then loosened prior to seeding.	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Rehabilitation	Soil replacement	Increased compaction of soil profile after replacement.	Ensure that soil is replaced evenly, then loosened prior to seeding. Restrict vehicular and machinery use and movement as far as possible.	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.
Rehabilitation	Altering of pre mining patterns	Alteration of pre-mining terrain patterns due to rehabilitation. Natural soil fertility decreases after rehabilitation. Increased occurrence of soil erosion after rehabilitation.	Rehabilitate in accordance with the final landform design plan factoring the original contours of the area into the plan. Fertilise and revegetate as soon as possible after topsoil replacement. Revegetate as soon as possible to minimise erosion due to wind and water. Monitor revegetation to ensure that bare areas are minimised.	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.
Heritage					
Construction	DMF construction	Impact on heritage sites due to DMF construction.	No heritage impact is expected as a result of the DMF construction. No mitigation required.	NHRA Palaeontological and Heritage Management Plan	Not applicable.
Construction Operational	Construction and operational activities	No impact is expected on low significant sites (PP 1, PP 7, PP 8, PP 9, PP 18, PP 19, PP 20, PP 23, PP 24, PP 34, PP 35, PP 38, PP 39, PP 41, PP 42, PP 43, PP 44 & PP 45).	No mitigation required.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction Operational	Construction and operational activities	Impact on Graves and Burial Grounds (PP 2, PP 3, PP 4, PP 5, PP 10, PP 16, PP 28, PP 31 and PP 37).	The best option is to change the mining development footprint to allow for the in situ preservation of these sites. Should in situ preservation not be possible then the following mitigation measures will apply: A grave relocation process must be undertaken. A detailed social consultation process, at least 60 days in length, consisting of the attempted identification of the next-of-kin in order to obtain their consent for the relocation. Bilingual site and newspaper notices indicating the intent of the relocation. Permits from all the relevant and legally required authorities. An exhumation process that keeps the dignity of the remains and family intact. An exhumation process that safeguards the legal rights of the families as well as that of the mining company. The exhumation process must be done by a reputable company well versed in the mitigation of graves.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction Operational	Construction and operational activities	Impact on historic homesteads and structures with the possible risk for unmarked graves (PP 6, PP 11, PP 15, PP	A social consultation process to assess whether any local residents or the wider public is aware of the presence of graves at sites PP 6, PP 11, PP 15, PP 16, PP 21, PP 22, PP	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
		16, PP 21, PP 22, PP 25, PP 26, PP 29, PP 32 and PP 40).	25, PP 26, PP 29, PP 32 and PP 40. Depending on the outcome of the social consultation process, three different outcomes would be the result, namely: Outcome 1: The social consultation absolutely confirms that no graves are located here. Outcome 2: The social consultation absolutely confirms that graves are located here. Outcome 3: The social consultation does not yield any confident results. The following mitigation measures would be required for sites falling under Outcome 1: No further grave-related mitigation would be required. The following mitigation measures would be required for sites falling under Outcome 2: A grave relocation process must be undertaken. 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. Bilingual site and newspaper notices indicating the intent of the relocation. Permits from all the relevant and legally required authorities. An exhumation process that keeps the dignity of the remains and family intact. An exhumation process that safeguards the legal rights of the families as well as that of the mining company. The process must be done by a reputable company well versed in the mitigation of graves. The following mitigation measures would be required for sites falling under Outcome 3: Test excavations to physically confirm the presence or absence graves. If no evidence for graves is found, the site will fall within Outcome 1 as outlined above. This means that no further mitigation measures would be required. If evidence for graves is found, the site will fall within Outcome 2 as outlined above. This means that a full grave relocation process must be implemented. All structures and site layouts from each site must be recorded using standard survey methods. The end result would be site layout plans for all these sites. A mitigation report must be compiled for these sites within		

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			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.		
Construction Operational	Construction and operational activities	Impact on historic farmsteads and historical structures (PP 27 and PP 30).	An architectural historical specialist must be appointed to undertake a specialist assessment of these sites. The recommendations made by the specialist must be implemented.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction Operational	Construction and operational activities	Possible rock art site (PP 4).	A suitably qualified rock art specialist must be appointed to undertake a specialist assessment of the site. The recommendations made by the specialist must be implemented.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction Operational	Construction and operational activities	Historic coal mine shafts and associated structures (PP 12, PP 13, PP 17, PP 33 and PP 36).	Due to the uniqueness of these historic coal mine shafts, every attempt must be made to preserve them in situ. The following general mitigation measures, which forms part of the in situ management measures of these sites, must be undertaken: Mine shafts must be recorded by way of site plans and photographs. Archival and historical research must be undertaken on the history of these very old mine shafts. A mitigation report must be compiled for these sites within which the recorded drawings, photographs and history of these shafts must be compiled. The completed mitigation report must be submitted to the relevant heritage authorities.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction Operational	Construction and operational activities	Chance finds of a potential grave during construction.	All activities must be halted in the area of the discovery and a qualified archaeologist contacted. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Construction Operational	Construction and operational activities	Accidental discovery of graves during construction.	Upon the accidental discovery of graves, a buffer of at least 20 m should be implemented. All activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains, a permit must be applied for from SAHRA and other relevant authorities. The local South African Police Services must immediately be notified of the find. Where it is recommended that the graves be relocated, a full grave relocation process that includes a comprehensive social consultation must be followed.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction Operational	Construction and operational activities	Impact on paleontological (fossil) finds.	When fossiliferous material is found an appropriate palaeontological expert must be appointed so that the material can be thoroughly assessed, recorded and professionally excavated or sampled. Inspections should be performed during any excavations that disturb bedrock, and between blasting cycles in opencast mines, when the face wall and floor of the pit are exposed for evidence of fossil floras. In the event that lenses of sedimentary rocks containing well-preserved fossil floras are found, a palaeontological expert must be afforded the opportunity to excavate a representative sample of the flora, and to document the depositional context as reflected by the adjacent rocks and coal seams. A scientifically useful palaeobotanical collection must be made. A strategy of bulk collecting must be employed, whereby a relatively large and unbiased sample of the flora is collected, with collectors not giving undue attention to those elements that are attractive, well-preserved or rare. The associated geology, which will also be destroyed during mining must be documented photographically (with scale). Floras with no context are increasingly coming to be considered of limited palaeontological value. To avoid delays, the mine must be prepared to assist in the removal of blocks containing high quality plant fossil material, and in the storage on the mine property of unprepared fossiliferous blocks until such a time as the material can be properly processed by a palaeontological expert.	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			Storage facilities must be such that the blocks are not exposed directly to the elements.		
Traffic					
Construction Operational	Traffic	An increase in heavy vehicle traffic on the adjacent road network.	All lanes must have minimum width of 4 m on approach to any intersection. Ensure that all roads are clearly marked and sign-posted with warning signs and speed limit signs as required.	Traffic Management Plan	Immediately. Maintained throughout LoM.
Construction Operational	Mining	Additional heavy traffic on bridges and culverts over watercourses within the mining right area.	Avoid environmentally sensitive areas, where possible, by designing the mine layout in such a way that the routes between the opencast pit and processing plants and other areas are the shortest route possible. If it is not possible to avoid environmental sensitive areas, then river crossings, bridges and culverts should be designed to have the minimum impact on the environment as possible. Bridges and culverts should, where practically possible, be temporary structures that can be removed once the section of the road is not required.	Traffic Management Plan	Immediately. Maintained throughout LoM.
Construction Operational	Mining	Additional heavy vehicles on gravel haul roads within the mining right area.	Enforce a speed limit to minimise vehicle entrained dust liberation. Dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers.	Traffic Management Plan	Immediately. Maintained throughout LoM.
Construction Operational	Mining	Additional heavy vehicles travelling through communities or urban areas.	Ensure that transportation contractors are instructed to avoid all communities and urban areas unless absolutely necessary to get to/from their destinations.	Traffic Management Plan	Immediately. Maintained throughout LoM.
Noise					
Construction Operational	Mining	Noise disturbance and noise nuisance at urban and rural noise sensitive receptors	Construction site yards, maintenance facilities, and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites. All vehicles and equipment are to be kept in good repair. Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds (proper sound insulation can reduce noise by up to 20 dBA). Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators and drilling associated preparation for blasting in the pit). Activities, and particularly the noisy ones, are to be confined to reasonable hours during the day and early evening.	SANS 10328: 2008 SANS 10103: 2008 SANS 10210: 2004 Noise Management Plan	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			Where possible, very noisy activities should not take place at night (between the hours of 20h00 - 06h00). Blasting should be restricted to the period between 08h00 - 16h00. Particularly noisy equipment must be insulated. With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact. Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum. Staff working in areas where the 8-hour ambient noise levels exceed 75 dBA should wear ear protection equipment. The stockpiles of spoil rock and overburden (berms) from the opencast pit excavations should, where possible, be used as interim or long-term noise attenuation barriers. Berms should particularly be considered around the whole periphery of the pit.		
Blast and Vibration					
Construction Operational	Mining	Ground vibration could cause damage to structures and upset the community	Ensure that blasting operations are designed to reduce ground vibration. Develop a detailed blast design for each blast with consideration of the effects from blasting i.e. ground vibration, air blast and fly rock. Calculate the expected ground vibration levels for the planned blast and, if necessary, redesign the plan to minimise ground vibration through one of the following methods: Reduce the change mass per delay; Use electronic initiation of blast; or Drill smaller diameter blastholes that will reduce the charge per blasthole and per delay.	Blast and Vibration Management Plan	Prior to blasting activities. Maintained throughout operational phase.
Construction Operational	Mining	Air blast could cause damage to structures and induce effects that will upset homeowners	Ensure that blasting operations are designed to reduce air blast. Develop a detailed blast design for each blast with consideration of the effects from blasting i.e. ground vibration, air blast and fly rock. Use of proper stemming lengths of between 25 - 30 blasthole diameters. Use of crushed aggregate of 10% the blasthole diameter as stemming material.	Blast and Vibration Management Plan	Prior to blasting activities. Maintained throughout operational phase.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			Record stemming lengths for each blast and correct if necessary, prior to every blast blasted. Monitor each blast done.		
Construction Operational	Mining	Fly rock could cause damage to structures, injure people or animals	Ensure that blasting operations are designed to reduce fly rock. Develop a detailed blast design for each blast with consideration of the effects from blasting i.e. ground vibration, air blast and fly rock. Use of proper stemming lengths of between 25 - 30 blasthole diameters. Use of crushed aggregate of 10% the blasthole diameter as stemming material. Record stemming lengths for each blast and correct if necessary, prior to every blast blasted. Monitor each blast done.	Blast and Vibration Management Plan	Prior to blasting activities. Maintained throughout operational phase.
Visual					
Construction Operational	Mining	Day-time visual impact on the surrounding sensitive receptors	Paint buildings and structures with colours that reflect and complement the natural colours of the surrounding landscape. Avoid pure light colours and pure blacks. Reduce the potential of glare, external surfaces of buildings and structures should be articulated or textured to create interplay of light and shade. Rehabilitate exposed areas as soon as possible after construction or mining activities are complete.	Visual Impact Management Plan	Immediately. Maintained through LoM.
Construction Operational	Mining	Night-time visual impact on the surrounding sensitive receptors	Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area. Illuminate public movement areas (pathways and roads) with low level 'bollard' type lights and avoid post top lighting.	Visual Impact Management Plan	Immediately. Maintained through LoM.
Construction Operational	Mining	Visual intrusion	Create a visual barrier between construction and operational areas and sensitive receptors. When using vegetation such as trees as a visual barrier be aware that they are not immediately effective so should be used in conjunction with other visual barriers such as earth berms. Plant indigenous vegetation on the slopes of the DMF.	Visual Impact Management Plan	Immediately. Maintained through LoM.
Construction Operational	Mining	The visual impact of dust on the surrounding sensitive receptors	Dust suppression techniques should be in place at all times during all phases. Limit site clearance to the smallest footprint area possible.	Visual Impact Management Plan	Immediately. Maintained through LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			As much vegetation as possible should be kept during site clearance. Rehabilitate exposed areas as soon as possible after construction or mining activities are complete.		
Social					
Construction Operational	Mining opportunities	The potential for social unrest and conflict between local residents and newcomers to the area due to income discrepancies and opportunities provided by the mine.	Implement a community relations strategy. Ensure that local SMMEs are utilised for direct ancillary service provision. Implement local procurement policy and encourage employees to live locally.	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.
Operations	Mining role	Expectations about the role of the mine in the provision of services to the community and the benefits to the community from the mine over the short and long term.	Implement a community relations strategy. Communicate with the community to ensure that they understand the role of the mine in meeting their expectations to ensure that they do not develop unrealistic expectations.	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.
Construction Operational	Mine transportation	Transportation activities have a negative impact on shared road infrastructure.	Ensure that transportation contractors adhere to speed limits and general road rules. Maintain the entrance to the mine to ensure it is operating at an acceptable level of service.	Social Management Plan. Social and Labour Plan. Traffic Management Plan.	Immediately. Maintained through LoM.
Operations	Mine blasting	Cracks in houses surrounding the mine due to the blasting operations of the mine.	Adhere to the blast and vibration management plan. Conduct a pre-blast baseline survey including photographic inspections of privately owned structures within 1,500 m of the identified blast area.	Social Management Plan. Social and Labour Plan. Blast and Vibration Management Plan.	Immediately. Maintained through LoM.
Operations	Community health	Impact of dust fallout on the livelihoods of the agricultural community. Health impacts such as asthma, sinusitis, allergies and other respiratory diseases attributed to dust generated by the operation of the mine.	Undertake dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers. Effective monitoring of ambient air quality, including nuisance dust-fall and PM 10.	Social Management Plan. Social and Labour Plan. Air Quality Management Plan.	Immediately. Maintained through LoM.
Operations	Community health	Increase of HIV/AIDS due to labour influx.	Implement an HIV/AIDS awareness programme for all mine employees and contractors. Offer HIV/AIDS counselling to all employees and contractors as required.	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.
Operations	Mining	Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage.	Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage. Undertake surface and groundwater monitoring to determine the impact the mine is having on the quality and quantity of water in the project area. Implement mitigation measures for surface and groundwater as proposed. - -	Social Management Plan. Social and Labour Plan. Surface Water Management Plan. Groundwater Management Plan.	Immediately. Maintained through LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Operations	Mining	Impact on existing settlements within the mining right area and mining footprint.	Impact should be avoided if possible. If not possible, a Resettlement Action Plan (RAP), in line with international best practice standards, should be developed. The RAP must be monitored and audited and implemented by an experienced specialist.	Social Management Plan. Social and Labour Plan. Palaeontological and Heritage Management Plan.	Immediately. Maintained through LoM.
Operations	Mining	Impact on graves, burial grounds and heritage features.	Implement all mitigation measures as proposed by the heritage specialist.	Social Management Plan. Social and Labour Plan. Palaeontological and Heritage Management Plan.	Immediately. Maintained through LoM.
Operations	Mine governance	Non-adherence to the Social and Labour Plan.	Ensure that the commitments in the SLP are implemented. Update the SLP regularly to align with the needs of the local and labour-sending communities. Align the SLP with the requirements of the local and district municipality and the associated IDP. Ensure that skills development and training is implemented as specified in the SLP.	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.
Surface Wat					
Operations	Mine dewatering	Dewatering of the aquifer closest to the pits and inflow of groundwater into the pit will result in a drop in water levels and it is anticipated that many springs and wetlands will be drained.	No mitigation measures are possible or this impact.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. SANS 241: 2015. Surface Water Management Plan. Groundwater Management Plan.	Immediately. Maintained through operational phase.
Operations	Mining	Pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and location restrictions stipulated in GN 704 of the NWA. All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillage. Storage areas must be kept as dry as is practically possible and all storm and rainwater collected in storage areas must be removed and disposed of in the PCDs. Waste handling and storage facilities must be constructed away from surface water resources and drainage lines. All vehicles and equipment must be kept in good working order and regularly serviced. Should a spill occur then the incident management procedure of the mine should be followed.	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Construction	Dams, trenches, channels and berms	The construction and operation of dams, trenches, channels and berms have the potential to alter the sites natural, pre-existing surface water drainage patterns influencing the volume of water that enters the receiving environment.	Areas should be sloped to allow for free runoff toward either clean and dirty water separation systems infrastructure and appropriately re-directed depending on whether water is either clean or dirty. Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA. Clean and dirty water system infrastructure must allow for clean water to re-enter the receiving environment and dirty water to be contained in PCDs. Ensure that clean and dirty water system infrastructure is operating effectively and efficiently to separate clean and dirty water. Clean and dirty water system infrastructure must be located away from surface water resources and drainage lines. Restrict the use and/or abstraction of surface water.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.
Operations	Alterations to natural drainage patterns	Alteration of the natural pre-existing surface water drainage patterns and slopes of the area may result in increased erosion and sedimentation which may enter receiving surface water bodies.	No development should occur within the 1:100 year flood line of any drainage line, unless authorised. Vegetation clearance and soil disturbances should be limited to the smallest footprint area possible and erosion control measures implemented. Movement of machinery and vehicles must be limited to identified roads and must avoid soil stockpiles. Clean and dirty water system infrastructure must be installed prior to any activities and take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA. Areas should be sloped to allow for free runoff toward either clean and dirty water separation systems depending on whether water is dirty or clean. Clean and dirty water system infrastructure must be located away from surface water resources and drainage lines. PCDs must be lined and equipped with a silt trap that is regularly cleaned and maintained.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.
Operations	Open cast mining	Opencast mining and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal. Clean surface water may enter the opencast	Clean and dirty water system infrastructure must be maintained and kept in good working order. Upstream clean and dirty water system infrastructure must be installed close to the edge of the pit in order to effectively deviate clean water flow around the pit and prevent it from entering.	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP.	Immediately. Maintained through LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
		pit and become contaminated and may also become contaminated through contact with pollutants on site as a result of spills, seepages, leaks and improper waste handling.	Upstream clean and dirty water system infrastructure must be protected from erosion through the installation of surface water energy disruptors to reduce storm water velocity. Dirty water contained and pumped from the pit must be stored in lined PCDs equipped with silt traps. All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillages. Storage areas must be kept as dry as is practically possible and all storm and rainwater collected in storage areas must be removed and disposed of in the PCDs. Waste handling and storage facilities must be constructed away from surface water resources and drainage lines. All vehicles and equipment must be kept in good working order and regularly serviced. Should a spill occur then the incident management procedure of the mine should be followed. Undertake concurrent rehabilitation and backfilling to keep the open pit as small as is practically possible to reduce the amount of surface water able to come in contact with the pit and contaminated water.	GN 704. Surface Water Management Plan.	
Operations	Open cast mining	Due to the close proximity to drainage lines the risk of flooding exists.	Implementation of storm water management plan.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.
Decommissioning	Decommissioning	Decommissioning activities related to the removal of infrastructure and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations with regard to GN 704 of the NWA. All hazardous substances must be stored and handled on impervious substrates and bunded areas in order to handle potential spillages. All hazardous substances must be stored in designated areas constructed to ensure their safe storage. All vehicles and equipment must be kept in good working order and regularly serviced.	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Once decommissioning and closure begin. Maintained throughout LoM.
Operations Rehabilitation	Groundwater decant	Groundwater decanting from the opencast pit will be contaminated and will flow down	Decant must be collected in dedicated lined PCD for treatment at the WTP. Continued maintenance of all dams to ensure that there are	NWA. IWUL conditions. IWWMP.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
		gradient, likely to enter and contaminate surface water resources.	no spills, seepage or leakage. Continued maintenance of clean and dirty water system infrastructure. Pipelines and sumps to be kept clean and in good working order. Continue to investigate various water treatment options including pH adjustment, controlled release and further containment options. Ensure that proper backfilling is undertaken throughout the operation to ensure less recharge of oxygen rich water and reduction in AMD produced. Align with the AMD Strategy.	SWMP. GN 704. Surface Water Management Plan.	
Groundwater					
Operations	Clearing topsoil	Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system.	Ensure that footprint clearance is kept to a minimum and that the area is not over-cleared.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Operations	Waste handling and building material transportation	Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate of the groundwater system.	Waste should be discarded in the allocated waste area. The waste area should be bunded. Spills should be cleaned up immediately. Solid waste must similarly either be stored at site on an approved waste disposal area or removed by credible contractors.	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Operations	Opencast dewatering	Opencast mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings.	Keeping the workings dry is necessary for mining and mitigation is not possible. No users are currently likely to be affected. Should any external users be impacted, then an alternative water supply should provided by the mine.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Operations	Coal stockpiling	Stockpiling of coal will expose coal to water and oxygen, resulting in ARD from roads and stockpiles. Contamination of the groundwater system will occur from these sites, although at a lower significance than the opencast pits.	Clean water needs to be kept away from the stockpiling area to minimise water infiltrating from the site. Keep stockpiles as small as possible, to minimise their footprint.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Operations	Opencast exposure to geological strata	Exposure of geological strata in the opencast areas will result in a deterioration in quality of groundwater flowing into the opencast areas.	Disturbing geological strata is a result of mining. Pits need to be kept as dry as possible to reduce contact time of water and oxygen with exposed rock and therefore keep contamination to a minimum. Mine water must be contained, re-used, and/or treated.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Operations	Dirty water pumped to pollution control dams	Dirty water from the opencast pit should be pumped to pollution control dams. Unlined dams will contribute highly to contamination of the groundwater system, while lined dams might still contaminate but to a lesser degree.	Pollution control dams should be lined and maintained in a good operating state ensuring that no overflow of dirty water occurs	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Construction and operation	Handling of waste	Handling of waste can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and cause contamination of the groundwater system.	All vehicles and machinery shall be kept in good working order and inspected on a regular basis for possible leaks and shall be repaired as soon as possible if required. Repairs shall be carried out in a dedicated repair area only, unless in-situ repair is necessary as a result of a breakdown. Drip trays shall at all times be placed under vehicles that require in-situ repairs. Drip trays shall be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility. Accidental spills (concrete, chemicals, process water, hydrocarbons, waste, sewage) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented. Soil that is contaminated by fuel or oil spills, for example, from vehicles, must be collected to be treated at a pre-determined and dedicated location, or must be treated in situ, using sand, soil or cold coal-ash as absorption medium.	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Operations Rehabilitation	Decant of water from old opencast areas	Decant of mine water from old opencast areas will continue. Decant water will flow into surface water drainage channels.	Rehabilitation of opencast areas must be completed to minimise infiltration and prevent ponding of surface water. Management and treatment of decant water will be undertaken where applicable through the use of the treatment plant and pit water management levels. Ongoing rehabilitation of existing mine areas must be undertaken. A decant management level can however also be established to reduce seepage to streams from the rehabilitated opencast.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plans. Surface Water Management Plan.	0

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Operations Rehabilitation	Groundwater seepage to streams	Groundwater seepage to streams (salt load).	Surface water monitoring of the streams will be essential. Quarterly groundwater sampling is recommended to establish a database of plume movement trends, to aid eventual mine closure. The contaminated seepage can be managed, and the water pumped to the water treatment plant. A decant management level can however also be established to reduce seepage to streams and associated salt load contribution from the Rehabilitated opencast. Should the Class C liner below the proposed DMF remain intact then the impact associated with the DMF is likely to be low.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Operations Rehabilitation	Groundwater seepage to streams	Contaminated groundwater seepage to streams (salt load).	Groundwater levels in the backfilled pits and underground workings will recover. Pollution plumes may migrate to surface water bodies. All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite. Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The seepage can be collected in the Mahim dam and be treated via the WTP.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Operations Rehabilitation	Groundwater contamination plume	Groundwater contaminant plume.	Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The drilling of boreholes into mining areas is recommended so that recovery of water in mining areas can be monitored. The presence of groundwater users should be assessed bi-annually.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Once decommissioning and closure begin. Maintained throughout LoM.
Operations Rehabilitation	Groundwater seepage to streams	Decant from opencast operations.	Decant can be managed in pit and then pumped to the WTP for treatment to an acceptable water quality for discharge or re-use.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Operations Rehabilitation	Groundwater seepage to streams	Contaminated groundwater seepage to streams (salt load).	Groundwater levels in the backfilled pits and underground workings will recover. Pollution plumes may migrate to surface water bodies. All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite.	NWA. IWUL conditions. IWWMP. SWMP.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The seepage can be collected in the Mahim dam and be treated via the WTP.	GN 704. Groundwater Management Plan.	
Operations Rehabilitation	Groundwater contamination plume	Groundwater contaminant plume.	Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The drilling of boreholes into mining areas is recommended so that recovery of water in mining areas can be monitored. The absence of groundwater users should be assessed bi-annually.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Once decommissioning and closure begin. Maintained throughout LoM.
Operations Rehabilitation	Groundwater seepage to streams	Decant from opencast operations.	Decant can also be managed in pit and then pumped to the WTP for treatment to an acceptable water quality for discharge or re-use.	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Freshwater Ecosystems					
Operations	Wetland an aquatic habitat protection	Loss of wetland and aquatic habitat.	Ensure that as far as possible and additional infrastructures are placed outside of delineated watercourse areas and their associated zones of regulation. Ensure that sound environmental management is in place during the planning phase. Design of infrastructure should be environmentally and structurally sound and all possible precautions taken to prevent spillage and/or seepage to the surface and groundwater resources present. It must be ensured that the design and construction of all infrastructures prevents failure. Limit the footprint area of the construction and operational activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils. Wetland areas outside of the opencast footprint should be fenced off and should be designated as No-go areas for all unauthorised personnel. Clean and dirty water separation systems to be implemented prior to the commencement of activities and to be maintained throughout the life of the proposed project.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. SWMP.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			Loss of wetland habitat, with special mention of Critical Biodiversity Areas will need to be mitigated with the implementation of a suitable wetland offset strategy.		
Operations	Fragmentation of watercourses.	Fragmentation of watercourses.	Pipe culverts are not to be allowed at any watercourse crossings to limit opportunities of flow confinement and channel incision of the wetland units and drainage lines.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. SWMP.	Immediately. Maintained throughout LoM.
Operations	Wetland an aquatic habitat protection	Disturbance and degradation of wetland and aquatic habitat.	Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation. All erosion noted within the project footprint should be remedied immediately and included as part of an ongoing rehabilitation plan. Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction and operational activities. Implement and maintain alien vegetation management programme. All delineated watercourses and their associated 100 m zones of regulation in terms of GN 704 should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel, with the exception of approved construction and operational areas. No vehicles or heavy machinery may be allowed to drive indiscriminately within any delineated watercourses. All vehicles must remain on demarcated roads and within the project footprint. No material may be dumped or stockpiled within delineated watercourses. A suitable dust control program should be put in place.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. GN 704. Soil Management and Utilisation Plan. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Operations	Wetland an aquatic habitat protection	Increased sediment transport and deposition in wetland and aquatic habitat.	Measures must be put in place to attenuate water from infrastructure areas and reduce runoff. Attenuation measures during construction are to include but are not limited to - the use of sandbags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes. All stockpiles must be protected from erosion, stored on flat areas where runoff will be minimised, and be surrounded by	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Soil Management and Utilisation Plan.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			bunds. Stockpiles must also only be stored for the minimum amount of time necessary. Delay vegetation clearing and clear only the minimum area required at any one time. Ensure soil management and stormwater management programmes are implemented and maintained to minimise erosion and sedimentation. All erosion noted within the project footprint should be remedied immediately and included as part of an ongoing rehabilitation plan. Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction and operational activities. Ensure that no incision and canalisation of the wetland features present takes place as a result of the proposed activities. Erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources.		
Operations	Wetland an aquatic habitat protection	Water quality deterioration.	Clean and dirty water separation systems to be implemented prior to the commencement of activities and to be maintained throughout the life of the proposed project. Ensure that as far as possible that all operational infrastructures are placed outside of wetland/riparian areas and their associated 32 or 100 m zones of regulation, respectively. All vehicles must be regularly inspected for leaks. Vehicles are to be maintained in good working order so as to reduce the probability of leakage of fuels and lubricants. Storage of potentially hazardous materials (including but not limited to fuel, oil, cement, bitumen etc.) must be above any 100-year flood line or outside the designated watercourse buffer, whichever is greater. A walled concrete platform, dedicated store with adequate flooring or bermed area must be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas. Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil.	NEM:WA. NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. Groundwater Management Plan. Surface Water Management Plan. CITES.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			All spills should be immediately cleaned up and treated accordingly. Provide sufficient storage capacity to contain contaminated waters i.e., adopt a zero-discharge policy. Should contaminated water due to spillages or other unforeseen circumstances enter identified wetland or watercourse, a wetland/aquatic specialist must be consulted regarding implementation of suitable mitigation and/or rehabilitation measures. Surface water draining off contaminated areas containing hydrocarbons are required to be channelled towards a sump which will separate the chemicals and oils. No uncontrolled discharges to any surface water resources are permitted. Any discharge points need to be approved by the relevant authority. In the case of pollution of any surface or groundwater, the Regional Representative of the DHSWS must be informed immediately. Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility. Under no circumstances may ablutions occur outside of the provided facilities.		
Operations	Wetland an aquatic habitat protection	Impact on provincial freshwater conservation targets.	A suitable wetland offset strategy may assist in mitigating this impact to some extent. Ongoing rehabilitation, mitigation of impacts and monitoring should be carried out to identify emerging impacts and trends so that the necessary preventative measures can be timeously implemented.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES.	Immediately. Maintained throughout LoM.
Operations	Wetland an aquatic habitat protection	Water quality deterioration.	During rehabilitation, no vehicles, heavy machinery or unauthorised personnel may be allowed to drive indiscriminately within any delineated watercourses. All vehicles must remain on demarcated roads and within the project area footprint. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil. All spills should be immediately cleaned up and treated accordingly. To mitigate the potential impacts of decant, appropriate	NEM:WA. NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. Groundwater Management Plan. CITES.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			wetland rehabilitation design and implementation must ensure that wetland functionality of remaining wetlands is maintained and where necessary, restored. In the event of decant occurring and water quality and/or quantity negatively affecting the associated aquatic biota (as determined through routine biomonitoring activities), water must be pumped to the WTP that will treat the water to a quantity and quality appropriate to be released back into the receiving aquatic ecosystem. It must be ensured that decant is of an acceptable water quality to meet the ecological requirements of the Steelpoort River as set in the Reserve and to prevent deviation from the RQOs.		
Operations	Wetland an aquatic habitat protection	Increased surface water runoff into wetland and aquatic habitat.	Good soil management should take place taking care not to mix topsoil and subsoils during stripping. Care should be taken to follow the soil management plan closely. Topsoil should not be stockpiled for extended periods and should be utilised in ongoing rehabilitation activities within 3 years or as indicated in the soil management program to prevent loss of soil viability. Topsoil depths on rehabilitated areas should be maximised as far as possible. Replaced soils should be appropriately shaped and profiled to the natural landscape profile and should be free draining. Steep slopes should be avoided to prevent erosion. As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum. All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses endemic to the region. Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed study area and appropriate wetland monitoring techniques must take place on an annual basis during the summer/wet season in order to identify any emerging issues, and to make recommendations on any trends, declines or improvements in the receiving environment.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Soil Management and Utilisation Plan.	Immediately. Maintained throughout LoM.
Operations	Invasive alien plant species control	Invasive alien plant species encroachment.	An alien vegetation management plan to be implemented and managed for the life of the proposed project.	NWA. IWUL conditions.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			The alien vegetation management plan should remain in place for a period of at least five (5) years post-closure. Bi-annual vegetation surveys and alien vegetation clearing activities should take place to remove saplings of alien trees. Saplings should ideally be removed before they reach 1 m in height.	NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	
Operations	Buffer zone control	Buffer zone impacts.	No activities, roads or infrastructure are to be located within the final designated buffer zone areas. Indigenous vegetation cover within the designated buffer zones are to be maintained at a minimum of 80% to ensure that the buffer remains functional, and must be assessed annually. Alien vegetation establishment within these buffer zone areas is to be strictly controlled through the development and implementation of a detailed alien management plan developed in accordance with the legislative requirements that considers management actions to be taken during all phases of the lifecycle of the mine, including post-closure management requirements.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial Biodiversity					
Operations	Terrestrial biodiversity protection	Loss of plant communities including floral SCC; Loss of biodiversity. Increased erosion. Potential for AIP proliferation. Loss of faunal habitat including faunal SCC. Loss of vegetation types including Grassland, Rocky Outcrop and Wetland vegetation units.	Keep site clearing to a minimal, and restrict vehicle movement outside of dedicated areas, specifically close to wetlands (pans). Keep site clearing and impacts to the Mining Right Application. Alien plant management strategy should be implemented. Make use of existing roads to encourage minimal impacts/footprint. Adhere to 100 m protective buffers around pans. Replacement of removed protected species during rehabilitation.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Removal of vegetation and basal layer. Increased proliferation of AIPs. Increased faunal casualties. Increased dust pollution.	Keep site clearing to a minimum. If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events. Staff of the mine must adhere to policies within the operation of the mine, such as adhering to designated speed limits. Restoration and rehabilitation of removed vegetation and SCC during rehab phase. Construction must be kept within the infrastructure footprint area, to reduce as much fragmentation as possible.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			AIPs should be continuously monitored and controlled throughout the life of the mine and thereafter.		
Operations	Terrestrial biodiversity protection	Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal. Blasting will increase loss of habitat, faunal casualties, loss of ecosystem functioning and encourage habitat fragmentation. Natural vegetation will be removed for the Open Pits working promoting edge effects and AIP proliferation. Increased dust pollution and erosion.	Restoration and rehabilitation of removed vegetation and SCC during rehab phase. Construction must be kept within the infrastructure footprint area, to reduce as much fragmentation as possible. Alien invasive plants should be continuously monitored and controlled throughout the life of the mine and thereafter. Corridors (infrastructure and ecological) set aside within the mine area would mitigate fragmentation substantially, especially if this could be managed with the community over an extended period of time.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Habitat destruction by removal of vegetation. Increase in dust production. AIP spread. Increased compaction, erosion, and consequently sedimentation potential. Increased faunal casualties.	The footprint of the mine should be kept as small as possible with only necessary areas being cleared. Existing roads should be used with no new roads constructed, if new roads need to be constructed, these should be done outside of the identified vegetation communities and as close as possible to the existing roads. Access should be restricted to already impacted areas (haul roads, open pits and dumps) by rehabilitating these areas as soon as possible by removal of infrastructure and planting. To minimise loss of Faunal SCC, awareness campaigns with activated anti-poaching units incorporated during the mine life cycle. Security patrols to prevent snaring. Create a sanctuary for faunal species identified within the Project area during the operational phase (See measures for Grey Crowned Crane conservation in Land Management Plan). Alien invasive plants should be continuously monitored and controlled throughout the life of the mine and thereafter. It is recommended that AIP programme be established to control the spread. Monitoring of the vegetation communities present must be completed every 2 years to document to impacts of the edge effect and fragmentation.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Removal of vegetation, habitats and increased soil erosion and compaction. Loss of faunal SCC. Destruction of and changes to the habitats. Increased dust pollution due to erosion and	Monitoring of alien invasive sprawl during the operation is recommended as the surrounding vegetation is relatively intact and free from alien invasive plants. Ensure no loss of faunal SCC by activating anti-poaching units that will be incorporated during the mine life cycle. Monitor dust pollution.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
		vehicular activity. Risk of AIP proliferation.	Keep sight clearing to a minimal, and restrict vehicle movement outside of dedicated areas, specifically close to wetlands (pans). Vegetate stockpiles to prevent soil loss, organic material loss, erosion, and sedimentation.	Terrestrial Biodiversity Management Plan.	
Operations	Terrestrial biodiversity protection	Contamination of soil, water and surrounding areas / habitats (pan vegetation) from Hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	All spills should be immediately cleaned up and treated accordingly. Re-fuelling must take place on a sealed surface area away from sensitive habitats such as the pan vegetation to prevent the ingress of hydrocarbons into the topsoil.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Compaction of soil. Potential faunal casualties. Increased runoff potential. Increased erosion and decline in revegetation potential.	Rehabilitate the compacted, eroded areas by deep ripping to loosen the soil and revegetate the area as soon as possible. Ensure proper stormwater management designs are in place to ensure no run-off or pooling occurs. Adhere to health and safety protocols within the operations of the mine and adhere to speed limits to minimise faunal casualties. Only designated access routes are to be used to reduce any unnecessary compaction.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Disturbance of soils, and subsequent erosion by wind, and water. Increased vehicle movement in the area, increasing soil erosion and habitat destruction. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds. AIP proliferation. Unexpected changes in topography and landscape.	Continue with Concurrent Rehabilitation, begin with stockpiles, open pits and dumps, implement rehabilitation measures. Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible to prevent AIP sprawl. Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged. Ensure proper stormwater management designs are in place to ensure no run-off or pooling occurs. Only designated access routes are to be used to reduce any unnecessary compaction.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Exposure of soils, and subsequent compaction, erosion, and sedimentation. Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs. AIP proliferation. Loss of organic material, basal layer and	During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season to ensure adequate plant recruitment. Address eroded and compacted areas by deep ripping to loosen the soil and revegetate the area as soon as possible. Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
		vegetation cover. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil.	Only designated access routes are to be used to reduce any unnecessary compaction.	Terrestrial Biodiversity Management Plan.	
Operations	Terrestrial biodiversity protection	Minimal negative impacts on the environment. Environmental Monitoring Plan.	During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season to ensure adequate plant recruitment. Stockpiles, open pits and dumps are to be rehabilitated. Ensure sufficient irrigation (can use water cart) and fertilizing of newly planted vegetation to facilitate a rapid establishment. Replant with species identified within each vegetation community.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Leaking or spillage of hazardous substances from pipelines and waste storage.	If a spill occurs, it is to be cleaned up immediately (Drizit/Zupazorbtype spill kits) and consequently reported to the authorities. All infrastructure carrying or transporting such substances is to be checked frequently and maintained. Ensure all staff are adequately informed and safety measures are in place for such instances.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Hydrocarbon spillage from vehicles.	If leak occurs from vehicle, place drip trays below the leak. All vehicles are to be serviced on concrete areas and off site. Machines must be parked upon hard parking surfaces and checked daily for leaks.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Infrastructure malfunction leading towards dirty water spillage or spontaneous combustion.	All infrastructure, machinery and associated setups are to be serviced and checked throughout the project life cycle. All staff are to be informed about potential hazards and consequently prepared for malfunctioning. Protocols are to be induced at every phase of the project life cycle. If such hazards were to incur, the appropriate authorities are to be notified and the incident recorded.	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Operations	Terrestrial biodiversity protection	Excess dust pollution.	Excess dust in construction sites is mitigated via various methods and are site specific. The recommended methods for this site would be spraying of water, tackifiers and soil stabilisers that do not harden the soils.	NWA. IWUL conditions. NEM:BA. GNR 1020.	Immediately. Maintained throughout LoM.

PHASE	ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION MEASURES	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
				MNCA. CITES. Terrestrial Biodiversity Management Plan.	

5 IMPACT MANAGEMENT OUTCOMES

The impact management outcomes, identifying the standard of impact management required for the aspects identified is provided in **Table 5.1**.

Table 5.1: Impact Management Outcomes.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Air Quality					
Construction	Site Clearance	Liberation of dust	Dust-fall rates exceeding the residential guideline of 600 mg/m²/day, beyond the mine boundary. Elevated PM 10 levels beyond the mine boundary. Elevated PM 2.5 levels beyond the mine boundary.	Control	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.
Construction Operational Decommissioning Closure Rehabilitation	Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of vehicular and machinery use and movement.	Control	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of dust accumulation on surfaces.	Manage	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of wind.	Remedy	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of soil handling.	Manage	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.
Soil, Land Use and Land Capability					
Construction Operational	Site clearance	Loss of Fertile topsoil	Loss of fertile topsoil due to vegetation clearance. Increased susceptibility to erosion due to removal of vegetation cover. Increased soil erosion due to vegetation clearance.	Control	Soil Utilisation and Management Plan
Construction Operational	Infrastructure establishment and open cast mining	Loss of Fertile topsoil	Loss or reduction in soil fertility due to activities connected to mine infrastructure establishment and opencast mining.	Manage	Soil Utilisation and Management Plan
Construction Operational Decommissioning Closure Rehabilitation	Vehicular and Machinery movement	Soil surface compaction	Compaction of soil surface due to various activities and vehicular and machinery use and movement.	Control	Soil Utilisation and Management Plan
Construction Operational Decommissioning	Chemical and water use	Soil contamination	Contamination of soil due to chemical or affected water spillages.	Control	NEM:WA. Soil Utilisation and Management Plan

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Closure Rehabilitation					
Construction	Construction activities	Terrain alterations	Alteration in prevailing terrain due to construction activities.	Control	Soil Utilisation and Management Plan
Construction Operational	Removal of soils	Agricultural potential loss	Loss of soil with an arable agricultural potential due to the removal and storage of soils.	Manage	Soil Utilisation and Management Plan
Operational	Stockpiled soils	Stockpiled soils erosion	Increased tendency for stockpiled soils to erode.	Manage	Soil Utilisation and Management Plan
Operational	Stockpiled soils	Stockpiled soils compaction	Increased compaction of stockpiled soils.	Control	Soil Utilisation and Management Plan
Operational	Open cast mining	Water pollution	Excess pollution and runoff due to opencast mining.	Control	SWMP. Soil Utilisation and Management Plan.
Operational	Soil and spoil removal	Altered landscape	Change in natural landscape due to soil and spoil removal.	Manage	Soil Utilisation and Management Plan
Construction Operational	Infrastructure development	Soil potential, compaction and erosion	Loss of pre-mining potential due to use of land for infrastructure. Increased soil compaction due to use of soil for infrastructure. Increased potential for soil erosion after removal of infrastructure.	Control	Soil Utilisation and Management Plan
Construction Operational	Infrastructure development	Arable agriculture	Reduction in ability of soil profile to be used for arable agriculture.	Manage	Soil Utilisation and Management Plan
Rehabilitation	Soil replacement	Soil compaction	Increased compaction of soil profile after replacement.	Control	Soil Utilisation and Management Plan
Rehabilitation	Altering of pre mining patterns	Soil fertility and erosion	Alteration of pre-mining terrain patterns due to rehabilitation. Natural soil fertility decreases after rehabilitation. Increased occurrence of soil erosion after rehabilitation.	Manage	Soil Utilisation and Management Plan
Heritage					
Construction	DMF construction	Heritage sites impact	Impact on heritage sites due to DMF construction.	Manage	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	Low significant sites impact	No impact is expected on low significant sites (PP 1, PP 7, PP 8, PP 9, PP 18, PP 19, PP 20, PP 23, PP 24, PP 34, PP 35, PP 38, PP 39, PP 41, PP 42, PP 43, PP 44 & PP 45).	Manage	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	Graves and burial grounds impact	Impact on Graves and Burial Grounds (PP 2, PP 3, PP 4, PP 5, PP 10, PP 16, PP 28, PP 31 and PP 37).	Control	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	Homestead and structures impact	Impact on historic homesteads and structures with the possible risk for unmarked graves (PP 6, PP 11, PP 15, PP 16, PP 21, PP 22, PP 25, PP 26, PP 29, PP 32 and PP 40).	Manage	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	Historic farmsteads and structures impact	Impact on historic farmsteads and historical structures (PP 27 and PP 30).	Remedy	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	Rock art site impact	Possible rock art site (PP 4).	Remedy	NHRA Palaeontological and Heritage Management Plan

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Construction Operational	Construction and operational activities	Historic coal shafts and structures impact	Historic coal mine shafts and associated structures (PP 12, PP 13, PP 17, PP 33 and PP 36).	Remedy	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	New graves discovery	Chance finds of a potential grave during construction.	Stop	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	New graves discovery	Accidental discovery of graves during construction.	Stop	NHRA Palaeontological and Heritage Management Plan
Construction Operational	Construction and operational activities	Palaeontology finds	Impact on paleontological (fossil) finds.	Control	NHRA Palaeontological and Heritage Management Plan
Traffic					
Construction Operational	Traffic	Heavy traffic on adjacent road network	An increase in heavy vehicle traffic on the adjacent road network.	Control	Traffic Management Plan
Construction Operational	Mining	Heavy traffic on bridges and culverts	Additional heavy traffic on bridges and culverts over watercourses within the mining right area.	Manage	Traffic Management Plan
Construction Operational	Mining	Heavy vehicles on gravel roads	Additional heavy vehicles on gravel haul roads within the mining right area.	Control	Traffic Management Plan
Construction Operational	Mining	Heavy vehicles through communities and urban areas	Additional heavy vehicles travelling through communities or urban areas.	Manage	Traffic Management Plan
Noise					
Construction Operational	Mining	Noise nuisance urban and rural	Noise disturbance and noise nuisance at urban and rural noise sensitive receptors	Control	SANS 10328: 2008 SANS 10103: 2008 SANS 10210: 2004 Noise Management Plan
Blast and Vibration					
Construction Operational	Mining	Vibration on structures	Ground vibration could cause damage to structures and upset the community	Control	Blast and Vibration Management Plan
Construction Operational	Mining	Air blasts on structures	Air blast could cause damage to structures and induce effects that will upset homeowners	Control	Blast and Vibration Management Plan
Construction Operational	Mining	Fly rock damage and safety	Fly rock could cause damage to structures, injure people or animals	Control	Blast and Vibration Management Plan
Visual					
Construction Operational	Mining	Day-time visual on sensitive receptors	Day-time visual impact on the surrounding sensitive receptors	Remedy	Visual Impact Management Plan
Construction Operational	Mining	Night-time visual on sensitive receptors	Night-time visual impact on the surrounding sensitive receptors	Remedy	Visual Impact Management Plan

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Construction Operational	Mining	Visual intrusion	Visual intrusion	Control	Visual Impact Management Plan
Construction Operational	Mining	Visual on sensitive receptors	The visual impact of dust on the surrounding sensitive receptors	Manage	Visual Impact Management Plan
Social					
Construction Operational	Mining opportunities	Social unrest and conflict	The potential for social unrest and conflict between local residents and newcomers to the area due to income discrepancies and opportunities provided by the mine.	Manage	Social Management Plan. Social and Labour Plan.
Operations	Mining role	Services to community	Expectations about the role of the mine in the provision of services to the community and the benefits to the community from the mine over the short and long term.	Manage	Social Management Plan. Social and Labour Plan.
Construction Operational	Mine transportation	Transportation shared activities	Transportation activities have a negative impact on shared road infrastructure.	Manage	Social Management Plan. Social and Labour Plan. Traffic Management Plan.
Operations	Mine blasting	Cracks in houses	Cracks in houses surrounding the mine due to the blasting operations of the mine.	Manage	Social Management Plan. Social and Labour Plan. Blast and Vibration Management Plan.
Operations	Community health	Health impact	Impact of dust fallout on the livelihoods of the agricultural community. Health impacts such as asthma, sinusitis, allergies and other respiratory diseases attributed to dust generated by the operation of the mine.	Control	Social Management Plan. Social and Labour Plan. Air Quality Management Plan.
Operations	Community health	HIV/AIDS impact	Increase of HIV/AIDS due to labour influx.	Manage	Social Management Plan. Social and Labour Plan.
Operations	Mining	Water quantity and quality	Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage.	Remedy	Social Management Plan. Social and Labour Plan. Surface Water Management Plan. Groundwater Management Plan.
Operations	Mining	Existing settlements	Impact on existing settlements within the mining right area and mining footprint.	Remedy	Social Management Plan. Social and Labour Plan. Palaeontological and Heritage Management Plan.
Operations	Mining	Graves, burial grounds and heritage features	Impact on graves, burial grounds and heritage features.	Manage	Social Management Plan. Social and Labour Plan. Palaeontological and Heritage Management Plan.
Operations	Mine governance	Social and labour Plan	Non-adherence to the Social and Labour Plan.	Manage	Social Management Plan. Social and Labour Plan.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Surface Water					
Operations	Mine dewatering	Aquifer impact	Dewatering of the aquifer closest to the pits and inflow of groundwater into the pit will result in a drop in water levels and it is anticipated that many springs and wetlands will be drained.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. SANS 241: 2015. Surface Water Management Plan. Groundwater Management Plan.
Operations	Mining	Surface water pollution	Pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Control	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.
Construction	Dams, trenches, channels and berms	Surface water drainage patterns and slopes altered	The construction and operation of dams, trenches, channels and berms have the potential to alter the sites natural, pre-existing surface water drainage patterns influencing the volume of water that enters the receiving environment.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.
Operations	Alterations to natural drainage patterns	Erosion and sedimentation entering receiving surface water bodies	Alteration of the natural pre-existing surface water drainage patterns and slopes of the area may result in increased erosion and sedimentation which may enter receiving surface water bodies.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.
Operations	Open cast mining	Contamination of clean water	Opencast mining and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal. Clean surface water may enter the opencast pit and become contaminated and may also become contaminated through contact with pollutants on site as a result of spills, seepages, leaks and improper waste handling.	Manage	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.
Operations	Open cast mining	Flooding risk at drainage lines	Due to the close proximity to drainage lines the risk of flooding exists.	Control	NWA. IWUL conditions. IWWMP. SWMP.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
					GN 704. Surface Water Management Plan.
Decommissioning	Decommissioning	Surface water	Decommissioning activities related to the removal of infrastructure and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Manage	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.
Operations Rehabilitation	Groundwater decant	Contamination of clean water	Groundwater decanting from the opencast pit will be contaminated and will flow down gradient, likely to enter and contaminate surface water resources.	Control	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.
Groundwater					
Operations	Clearing topsoil	Infiltration to groundwater system	Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations	Waste handling and building material transportation	Infiltration to groundwater system	Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate of the groundwater system.	Manage	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations	Opencast dewatering	Groundwater dewatering	Opencast mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations	Coal stockpiling	ARD influencing groundwater	Stockpiling of coal will expose coal to water and oxygen, resulting in ARD from roads and stockpiles. Contamination of the groundwater system will occur from these sites, although at a lower significance than the opencast pits.	Control	NWA. IWUL conditions. IWWMP. SWMP. GN 704.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
					Groundwater Management Plan. Surface Water Management Plan.
Operations	Opencast exposure to geological strata	Deterioration of quality of groundwater	Exposure of geological strata in the opencast areas will result in a deterioration in quality of groundwater flowing into the opencast areas.	Control	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations	Dirty water pumped to pollution control dams	Groundwater contamination from unlined dams	Dirty water from the opencast pit should be pumped to pollution control dams. Unlined dams will contribute highly to contamination of the groundwater system, while lined dams might still contaminate but to a lesser degree.	Remedy	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.
Construction and operation	Handling of waste	Groundwater contamination	Handling of waste can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and cause contamination of the groundwater system.	Control	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations Rehabilitation	Decant of water from old opencast areas	Groundwater contamination	Decant of mine water from old opencast areas will continue. Decant water will flow into surface water drainage channels.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plans. Surface Water Management Plan.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Groundwater seepage to streams (salt load).	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Contaminated groundwater seepage to streams (salt load).	Manage	NWA. IWUL conditions. IWWMP. SWMP.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
					GN 704. Groundwater Management Plan.
Operations Rehabilitation	Groundwater contamination plume	Groundwater contamination plume	Groundwater contaminant plume.	Remedy	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Decant from opencast operations.	Control	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Contaminated groundwater seepage to streams (salt load).	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations Rehabilitation	Groundwater contamination plume	Groundwater contamination plume	Groundwater contaminant plume.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Decant from opencast operations.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.
Freshwater Ecosystems					
Operations	Wetland an aquatic habitat protection	Loss of wetland and aquatic habitat.	Loss of wetland and aquatic habitat.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
					CITES. SWMP.
Operations	Fragmentation of watercourses.	Fragmentation of watercourses.	Fragmentation of watercourses.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. SWMP.
Operations	Wetland an aquatic habitat protection	Disturbance and degradation of wetland and aquatic habitat.	Disturbance and degradation of wetland and aquatic habitat.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. GN 704. Soil Management and Utilisation Plan. Air Quality Management Plan.
Operations	Wetland an aquatic habitat protection	Sediment transportation and deposition	Increased sediment transport and deposition in wetland and aquatic habitat.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Soil Management and Utilisation Plan.
Operations	Wetland an aquatic habitat protection	Water quality deterioration	Water quality deterioration.	Manage	NEM:WA. NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. Groundwater Management Plan. Surface Water Management Plan. CITES.
Operations	Wetland an aquatic habitat protection	Provincial freshwater conservation targets.	Impact on provincial freshwater conservation targets.	Remedy	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Operations	Wetland an aquatic habitat protection	Water quality deterioration	Water quality deterioration.	Manage	NEM:WA. NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. Groundwater Management Plan. CITES.
Operations	Wetland an aquatic habitat protection	Increased surface water runoff	Increased surface water runoff into wetland and aquatic habitat.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Soil Management and Utilisation Plan.
Operations	Invasive alien plant species control	Invasive alien plant species encroachment.	Invasive alien plant species encroachment.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Buffer zone control	Buffer zone impacts.	Buffer zone impacts.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Terrestrial Biodiversity					
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Loss of plant communities including floral SCC; Loss of biodiversity. Increased erosion. Potential for AIP proliferation. Loss of faunal habitat including faunal SCC. Loss of vegetation types including Grassland, Rocky Outcrop and Wetland vegetation units.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Removal of vegetation and basal layer. Increased proliferation of AIPs. Increased faunal casualties. Increased dust pollution.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal. Blasting will increase loss of habitat, faunal casualties, loss of ecosystem functioning and encourage habitat fragmentation. Natural vegetation will be removed for the Open Pits working promoting edge effects and AIP proliferation. Increased dust pollution and erosion.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Habitat destruction by removal of vegetation. Increase in dust production. AIP spread. Increased compaction, erosion, and consequently sedimentation potential. Increased faunal casualties.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Removal of vegetation, habitats and increased soil erosion and compaction. Loss of faunal SCC. Destruction of and changes to the habitats. Increased dust pollution due to erosion and vehicular activity. Risk of AIP proliferation.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Contamination of soil, water and surrounding areas / habitats (pan vegetation) from Hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Compaction of soil. Potential faunal casualties. Increased runoff potential. Increased erosion and decline in revegetation potential.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Disturbance of soils, and subsequent erosion by wind, and water. Increased vehicle movement in the area, increasing soil erosion and habitat destruction. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds. AIP proliferation. Unexpected changes in topography and landscape.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Exposure of soils, and subsequent compaction, erosion, and sedimentation. Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs. AIP proliferation. Loss of organic material, basal layer and vegetation cover. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Minimal negative impacts on the environment. Environmental Monitoring Plan.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Hazardous substance leaks and spillages	Leaking or spillage of hazardous substances from pipelines and waste storage.	Remedy	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	STANDARDS TO BE ACHIEVED
Operations	Terrestrial biodiversity protection	Hydrocarbon spillage from vehicles.	Hydrocarbon spillage from vehicles.	Remedy	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Infrastructure malfunction	Infrastructure malfunction leading towards dirty water spillage or spontaneous combustion.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.
Operations	Terrestrial biodiversity protection	Dust pollution	Excess dust pollution.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.

6 IMPACT MANAGEMENT ACTIONS

A description of the impact management actions is provided in **Table 6.1**.

Table 6.1: Impact Management Actions.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Air Quality				
Site Clearance	Dust-fall rates exceeding the residential guideline of 600 mg/m²/day, beyond the mine boundary. Elevated PM 10 levels beyond the mine boundary. Elevated PM 2.5 levels beyond the mine boundary.	Control	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Vehicular and Machinery movement	Dust liberation as a result of vehicular and machinery use and movement.	Control	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Site Clearance and Vehicular and Machinery movement	Dust liberation as a result of dust accumulation on surfaces.	Manage	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Site Clearance and Vehicular and Machinery movement	Dust liberation as a result of wind.	Remedy	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	As soon as possible. Maintained. throughout LoM.
Site Clearance and Vehicular and Machinery movement	Dust liberation as a result of soil handling.	Manage	NEM:AQA. GNR 827. SANS 1929: 2011. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Soil, Land Use and Land Capability				
Site clearance	Loss of fertile topsoil due to vegetation clearance. Increased susceptibility to erosion due to removal of vegetation cover. Increased soil erosion due to vegetation clearance.	Control	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Infrastructure establishment and open cast mining	Loss or reduction in soil fertility due to activities connected to mine infrastructure establishment and opencast mining.	Manage	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Vehicular and Machinery movement	Compaction of soil surface due to various activities and vehicular and machinery use and movement.	Control	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Chemical and water use	Contamination of soil due to chemical or affected water spillages.	Control	NEM:WA. Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Construction activities	Alteration in prevailing terrain due to construction activities.	Control	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Removal of soils	Loss of soil with an arable agricultural potential due to the removal and storage of soils.	Manage	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Stockpiled soils	Increased tendency for stockpiled soils to erode.	Manage	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Stockpiled soils	Increased compaction of stockpiled soils.	Control	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Open cast mining	Excess pollution and runoff due to opencast mining.	Control	SWMP. Soil Utilisation and Management Plan.	Immediately. Maintained throughout LoM.
Soil and spoil removal	Change in natural landscape due to soil and spoil removal.	Manage	Soil Utilisation and Management Plan	Immediately. Maintained throughout LoM.
Infrastructure development	Loss of pre-mining potential due to use of land for infrastructure. Increased soil compaction due to use of soil for infrastructure. Increased potential for soil erosion after removal of infrastructure.	Control	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.
Infrastructure development	Reduction in ability of soil profile to be used for arable agriculture.	Manage	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.
Soil replacement	Increased compaction of soil profile after replacement.	Control	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.
Altering of pre mining patterns	Alteration of pre-mining terrain patterns due to rehabilitation. Natural soil fertility decreases after rehabilitation. Increased occurrence of soil erosion after rehabilitation.	Manage	Soil Utilisation and Management Plan	Once decommissioning and closure begin. Maintained throughout LoM.
Heritage				
DMF construction	Impact on heritage sites due to DMF construction.	Manage	NHRA Palaeontological and Heritage Management Plan	Not applicable.
Construction and operational activities	No impact is expected on low significant sites (PP 1, PP 7, PP 8, PP 9, PP 18, PP 19, PP 20, PP 23, PP 24, PP 34, PP 35, PP 38, PP 39, PP 41, PP 42, PP 43, PP 44 & PP 45).	Manage	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction and operational activities	Impact on Graves and Burial Grounds (PP 2, PP 3, PP 4, PP 5, PP 10, PP 16, PP 28, PP 31 and PP 37).	Control	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction and operational activities	Impact on historic homesteads and structures with the possible risk for unmarked graves (PP 6, PP 11, PP 15, PP 16, PP 21, PP 22, PP 25, PP 26, PP 29, PP 32 and PP 40).	Manage	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction and operational activities	Impact on historic farmsteads and historical structures (PP 27 and PP 30).	Remedy	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction and operational activities	Possible rock art site (PP 4).	Remedy	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Construction and operational activities	Historic coal mine shafts and associated structures (PP 12, PP 13, PP 17, PP 33 and PP 36).	Remedy	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction and operational activities	Chance finds of a potential grave during construction.	Stop	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction and operational activities	Accidental discovery of graves during construction.	Stop	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Construction and operational activities	Impact on paleontological (fossil) finds.	Control	NHRA Palaeontological and Heritage Management Plan	Immediately. Maintained throughout operational phase.
Traffic				
Traffic	An increase in heavy vehicle traffic on the adjacent road network.	Control	Traffic Management Plan	Immediately. Maintained throughout LoM.
Mining	Additional heavy traffic on bridges and culverts over watercourses within the mining right area.	Manage	Traffic Management Plan	Immediately. Maintained throughout LoM.
Mining	Additional heavy vehicles on gravel haul roads within the mining right area.	Control	Traffic Management Plan	Immediately. Maintained throughout LoM.
Mining	Additional heavy vehicles travelling through communities or urban areas.	Manage	Traffic Management Plan	Immediately. Maintained throughout LoM.
Noise				
Mining	Noise disturbance and noise nuisance at urban and rural noise sensitive receptors	Control	SANS 10328: 2008 SANS 10103: 2008 SANS 10210: 2004 Noise Management Plan	Immediately. Maintained throughout LoM.
Blast and Vibration				
Mining	Ground vibration could cause damage to structures and upset the community	Control	Blast and Vibration Management Plan	Prior to blasting activities. Maintained throughout operational phase.
Mining	Air blast could cause damage to structures and induce effects that will upset homeowners	Control	Blast and Vibration Management Plan	Prior to blasting activities. Maintained throughout operational phase.
Mining	Fly rock could cause damage to structures, injure people or animals	Control	Blast and Vibration Management Plan	Prior to blasting activities. Maintained throughout operational phase.
Visual				
Mining	Day-time visual impact on the surrounding sensitive receptors	Remedy	Visual Impact Management Plan	Immediately. Maintained through LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Mining	Night-time visual impact on the surrounding sensitive receptors	Remedy	Visual Impact Management Plan	Immediately. Maintained through LoM.
Mining	Visual intrusion	Control	Visual Impact Management Plan	Immediately. Maintained through LoM.
Mining	The visual impact of dust on the surrounding sensitive receptors	Manage	Visual Impact Management Plan	Immediately. Maintained through LoM.
Social				
Mining opportunities	The potential for social unrest and conflict between local residents and newcomers to the area due to income discrepancies and opportunities provided by the mine.	Manage	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.
Mining role	Expectations about the role of the mine in the provision of services to the community and the benefits to the community from the mine over the short and long term.	Manage	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.
Mine transportation	Transportation activities have a negative impact on shared road infrastructure.	Manage	Social Management Plan. Social and Labour Plan. Traffic Management Plan.	Immediately. Maintained through LoM.
Mine blasting	Cracks in houses surrounding the mine due to the blasting operations of the mine.	Manage	Social Management Plan. Social and Labour Plan. Blast and Vibration Management Plan.	Immediately. Maintained through LoM.
Community health	Impact of dust fallout on the livelihoods of the agricultural community. Health impacts such as asthma, sinusitis, allergies and other respiratory diseases attributed to dust generated by the operation of the mine.	Control	Social Management Plan. Social and Labour Plan. Air Quality Management Plan.	Immediately. Maintained through LoM.
Community health	Increase of HIV/AIDS due to labour influx.	Manage	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.
Mining	Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage.	Remedy	Social Management Plan. Social and Labour Plan. Surface Water Management Plan. Groundwater Management Plan.	Immediately. Maintained through LoM.
Mining	Impact on existing settlements within the mining right area and mining footprint.	Remedy	Social Management Plan. Social and Labour Plan. Palaeontological and Heritage Management Plan.	Immediately. Maintained through LoM.
Mining	Impact on graves, burial grounds and heritage features.	Manage	Social Management Plan. Social and Labour Plan. Palaeontological and Heritage Management Plan.	Immediately. Maintained through LoM.
Mine governance	Non-adherence to the Social and Labour Plan.	Manage	Social Management Plan. Social and Labour Plan.	Immediately. Maintained through LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
Surface Water				
Mine dewatering	Dewatering of the aquifer closest to the pits and inflow of groundwater into the pit will result in a drop in water levels and it is anticipated that many springs and wetlands will be drained.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. SANS 241: 2015. Surface Water Management Plan. Groundwater Management Plan.	Immediately. Maintained through operational phase.
Mining	Pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Control	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.
Dams, trenches, channels and berms	The construction and operation of dams, trenches, channels and berms have the potential to alter the sites natural, pre-existing surface water drainage patterns influencing the volume of water that enters the receiving environment.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.
Alterations to natural drainage patterns	Alteration of the natural pre-existing surface water drainage patterns and slopes of the area may result in increased erosion and sedimentation which may enter receiving surface water bodies.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.
Open cast mining	Opencast mining and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal. Clean surface water may enter the opencast pit and become contaminated and may also become contaminated through contact with pollutants on site as a result of spills, seepages, leaks and improper waste handling.	Manage	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained through LoM.
Open cast mining	Due to the close proximity to drainage lines the risk of flooding exists.	Control	NWA. IWUL conditions. IWWMP. SWMP.	Immediately. Maintained through LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			GN 704. Surface Water Management Plan.	
Decommissioning	Decommissioning activities related to the removal of infrastructure and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Manage	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Once decommissioning and closure begin. Maintained throughout LoM.
Groundwater decant	Groundwater decanting from the opencast pit will be contaminated and will flow down gradient, likely to enter and contaminate surface water resources.	Control	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Groundwater				
Clearing topsoil	Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Waste handling and building material transportation	Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate of the groundwater system.	Manage	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Opencast dewatering	Opencast mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Coal stockpiling	Stockpiling of coal will expose coal to water and oxygen, resulting in ARD from roads and stockpiles. Contamination of the groundwater system will occur from these sites, although at a lower significance than the opencast pits.	Control	NWA. IWUL conditions. IWWMP. SWMP.	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			GN 704. Groundwater Management Plan. Surface Water Management Plan.	
Opencast exposure to geological strata	Exposure of geological strata in the opencast areas will result in a deterioration in quality of groundwater flowing into the opencast areas.	Control	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Dirty water pumped to pollution control dams	Dirty water from the opencast pit should be pumped to pollution control dams. Unlined dams will contribute highly to contamination of the groundwater system, while lined dams might still contaminate but to a lesser degree.	Remedy	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Handling of waste	Handling of waste can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and cause contamination of the groundwater system.	Control	NEM:WA. NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Decant of water from old opencast areas	Decant of mine water from old opencast areas will continue. Decant water will flow into surface water drainage channels.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plans. Surface Water Management Plan.	0
Groundwater seepage to streams	Groundwater seepage to streams (salt load).	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Groundwater seepage to streams	Contaminated groundwater seepage to streams (salt load).	Manage	NWA. IWUL conditions.	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			IWWMP. SWMP. GN 704. Groundwater Management Plan.	
Groundwater contamination plume	Groundwater contaminant plume.	Remedy	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Once decommissioning and closure begin. Maintained throughout LoM.
Groundwater seepage to streams	Decant from opencast operations.	Control	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Groundwater seepage to streams	Contaminated groundwater seepage to streams (salt load).	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Immediately. Maintained throughout LoM.
Groundwater contamination plume	Groundwater contaminant plume.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan.	Once decommissioning and closure begin. Maintained throughout LoM.
Groundwater seepage to streams	Decant from opencast operations.	Manage	NWA. IWUL conditions. IWWMP. SWMP. GN 704. Groundwater Management Plan. Surface Water Management Plan.	Immediately. Maintained throughout LoM.
Freshwater Ecosystems				
Wetland an aquatic habitat protection	Loss of wetland and aquatic habitat.	Manage	NWA. IWUL conditions.	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			NEM:BA. GNR 1020. MNCA. CITES. SWMP.	
Fragmentation of watercourses.	Fragmentation of watercourses.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. SWMP.	Immediately. Maintained throughout LoM.
Wetland an aquatic habitat protection	Disturbance and degradation of wetland and aquatic habitat.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. GN 704. Soil Management and Utilisation Plan. Air Quality Management Plan.	Immediately. Maintained throughout LoM.
Wetland an aquatic habitat protection	Increased sediment transport and deposition in wetland and aquatic habitat.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Soil Management and Utilisation Plan.	Immediately. Maintained throughout LoM.
Wetland an aquatic habitat protection	Water quality deterioration.	Manage	NEM:WA. NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. Groundwater Management Plan. Surface Water Management Plan. CITES.	Immediately. Maintained throughout LoM.
Wetland an aquatic habitat protection	Impact on provincial freshwater conservation targets.	Remedy	NWA. IWUL conditions.	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			NEM:BA. GNR 1020. MNCA. CITES.	
Wetland an aquatic habitat protection	Water quality deterioration.	Manage	NEM:WA. NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. Groundwater Management Plan. CITES.	Immediately. Maintained throughout LoM.
Wetland an aquatic habitat protection	Increased surface water runoff into wetland and aquatic habitat.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Soil Management and Utilisation Plan.	Immediately. Maintained throughout LoM.
Invasive alien plant species control	Invasive alien plant species encroachment.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Buffer zone control	Buffer zone impacts.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial Biodiversity				
Terrestrial biodiversity protection	Loss of plant communities including floral SCC; Loss of biodiversity. Increased erosion.	Manage	NWA. IWUL conditions. NEM:BA.	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
	Potential for AIP proliferation. Loss of faunal habitat including faunal SCC. Loss of vegetation types including Grassland, Rocky Outcrop and Wetland vegetation units.		GNR 1020. MNCA. CITES.	
Terrestrial biodiversity protection	Removal of vegetation and basal layer. Increased proliferation of AIPs. Increased faunal casualties. Increased dust pollution.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal. Blasting will increase loss of habitat, faunal casualties, loss of ecosystem functioning and encourage habitat fragmentation. Natural vegetation will be removed for the Open Pits working promoting edge effects and AIP proliferation. Increased dust pollution and erosion.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Habitat destruction by removal of vegetation. Increase in dust production. AIP spread. Increased compaction, erosion, and consequently sedimentation potential. Increased faunal casualties.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Removal of vegetation, habitats and increased soil erosion and compaction. Loss of faunal SCC. Destruction of and changes to the habitats. Increased dust pollution due to erosion and vehicular activity. Risk of AIP proliferation.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Contamination of soil, water and surrounding areas / habitats (pan vegetation) from Hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	Control	NWA. IWUL conditions. NEM:BA.	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	
Terrestrial biodiversity protection	Compaction of soil. Potential faunal casualties. Increased runoff potential. Increased erosion and decline in revegetation potential.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Disturbance of soils, and subsequent erosion by wind, and water. Increased vehicle movement in the area, increasing soil erosion and habitat destruction. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds. AIP proliferation. Unexpected changes in topography and landscape.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Exposure of soils, and subsequent compaction, erosion, and sedimentation. Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs. AIP proliferation. Loss of organic material, basal layer and vegetation cover. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Minimal negative impacts on the environment. Environmental Monitoring Plan.	Control	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Leaking or spillage of hazardous substances from pipelines and waste storage.	Remedy	NWA. IWUL conditions.	Immediately. Maintained throughout LoM.

ACTIVITY	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	MITIGATION TYPE	COMPLIANCE STANDARD	TIME PERIOD FOR IMPLEMENTATION
			NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	
Terrestrial biodiversity protection	Hydrocarbon spillage from vehicles.	Remedy	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Infrastructure malfunction leading towards dirty water spillage or spontaneous combustion.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.
Terrestrial biodiversity protection	Excess dust pollution.	Manage	NWA. IWUL conditions. NEM:BA. GNR 1020. MNCA. CITES. Terrestrial Biodiversity Management Plan.	Immediately. Maintained throughout LoM.

7 FINANCIAL PROVISION

7.1 Determination of the Amount of Financial Provision

7.1.1 Describe the Closure Objectives and the Extent to Which These are Aligned to the Baseline Environment

Mine closure is not a single event but rather a process. The mine closure stages outline the closure processes which are separated by the activities within these. Closure implications for each of these periods will be considered within the Rehabilitation, Decommissioning and Mine Closure Plan (RDMCP). The mine closure stages are illustrated and defined in **Figure 7.1**.

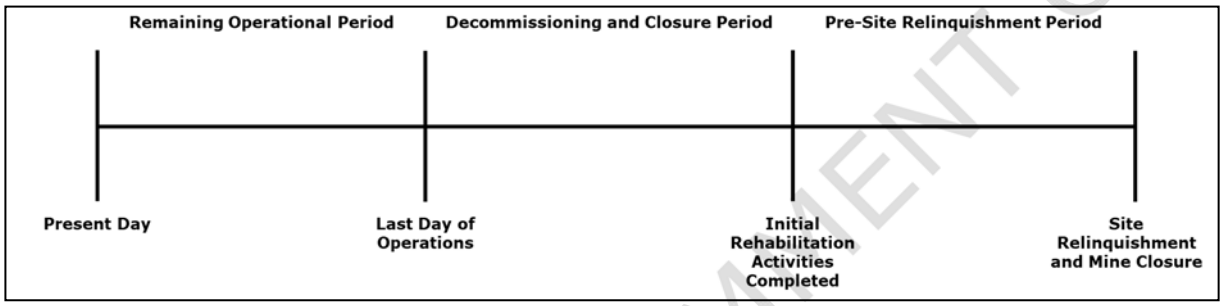

Figure 7.1: Mine Closure Stages.

Remaining Operational Period: This period covers the time which mining activities are expected to continue, commonly referred to as the LoM. In this period, closure planning will be refined and updated as stakeholders are engaged, studies are implemented to close knowledge gaps, technology changes or learnings from other operations are noted. Operational rehabilitation must also be carried out within this period to minimise the liability at the end of operations.

Decommissioning and Closure Period: The operational mining team would have left the site and the site would be handed over to closure contractors, whether these be external contractors, under the MR holder's supervision, or in-house personnel. The closure measures would be implemented and legal transfer of infrastructure to third parties would take place as per the detailed closure plan. The initial rehabilitation measures are completed at the end of this period, but the closure process is still not completed.

Pre-Site Relinquishment Period: For a period, the closure measures and state of the site will have to be monitored and maintenance undertaken if needed to ensure that rehabilitation was completed to pre-determined targets. The closure targets or site relinquishment criteria are developed prior to closure and serve as a measure to determine whether the long-term environmental, social, physical, and economic risks have been adequately addressed. Site

relinquishment is when ownership and responsibility of the site can be transferred, and the mine is considered closed.

All activities on site will continue for the remaining operational period, after which decommissioning of infrastructure will be undertaken. Initial rehabilitation activities will continue until completed, and a period of monitoring and maintenance implemented prior to the site relinquishment and ultimate mine closure.

It is essential that closure objectives are identified prior to closure of the mine to ensure that long-term mine plans can be generated to accommodate the end use proposals, where necessary. The factors that influence the closure of a mine change through time, the RDMCP must always adhere to the environmental and socio-economic requirements at the time of closure. The closure vision is to leave behind a mine site which is safe, stable and non-polluting. The post-mining landscape must be sustainable over the long term and achieve the desired end land use as agreed with stakeholders. The overall closure objectives are outlined below:

1. **Suitable Land Capability and Land Use Post-closure:** To rehabilitate all disturbed land to a state that is suitable for its post closure use to be determined in consultation with I&APs and other key stakeholders.
2. **Health and Safety:** To ensure that affected areas are safe, secure, and non-polluting for both human and animal activities.
3. **Physical and Chemical Stability:** The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated or adequately minimised.
4. **Ecological Sustainability:** To rehabilitate all disturbed land to a state where limited or preferably no post closure management is required.
5. **Environmental Compliance:** To rehabilitate all disturbed land to a state that facilitates compliance with current environmental quality objectives.
6. **Stakeholder Management:** To follow an appropriate stakeholder engagement process with all I&APs and authorities.

Specific closure objectives set in support of the overall closure vision include:

- Return land, mined by opencast methods, as far as possible to a land capability similar to that which existed prior to mining;
- Ensure that as little water as possible seeps out of the various sections of the mine and where this is unavoidable, ensure that the water is contained. Water then should be treated if the volume is significant and if it does not meet statutory water quality requirements;

- Remove mine infrastructure that cannot be used by a subsequent landowner or a third party. Where buildings can be used by a third party, arrangements will be made to ensure their long-term sustainable use;
- Clean up all coal stockpiles and loading areas and rehabilitate these as far as possible to a land capability similar to that which existed prior to mining;
- Follow a process of closure that is progressive and integrated into the short and long term mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- Rehabilitate the disturbed land to a state that facilitates compliance with applicable environmental quality objectives;
- Landscape the rehabilitated areas in alignment with the surrounding topography to prevent the unnecessary pooling of water which will recue the runoff in the catchment;
- Implement progressive rehabilitation measures;
- Physically and chemically stabilise any remaining structures to minimise residual risks;
- Leave a safe and stable environment for both humans and animals;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements;
- Form active partnerships with local communities to take care of management of the land after mining, where possible; and
- To maintain and monitor all rehabilitated areas following re-vegetation or capping (placement of a layer of material, e.g. clay or sandstone, which prevents/limits capillary movement of water between soil and pollution source) and, if monitoring shows that the objectives have been met, making an application for closure.

7.1.2 Confirm that the Environmental Objectives in Relation to Closure Have Been Consulted with Landowner and I&APs

A comprehensive Stakeholder Engagement Process (SEP) was undertaken for the Section 102 and IEA application and all aspects of the project were discussed with landowners and I&APs.

7.1.3 Rehabilitation Plan and Closure Actions

The site specific rehabilitation and closure actions for the Glisa and Paardeplaats Sections are presented in **Table 7.1** and **Table 7.2** respectively.

Table 7.1: Site Specific Rehabilitation and Closure Measures – Glisa Section.

AREA	REHABILITATION MEASURE
Area 1: Infrastructure (Plant, Security, Offices & Workshop)	Infrastructure demolitions and clean-up: - Demolish and remove all concrete structures to 1 m below ground level - Demolish all brick buildings - Demolish concrete bund wall - Dismantle streel structures and store in designated salvage yard prior to removal/selling off - Dispose of inert building rubble in the open pits within a 2 km hauling distance - Remove transformers prior to closure - Remove wire fence - Remove all contractor containers from site prior to closure General rehabilitation: - Shape and level all areas where infrastructure is removed to align surface water runoff with the site wide drainage framework - Replace 300 mm of topsoil across the reshaped contractor yard footprint - Rip all replaced topsoil to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix
Area 2: Mining area (Pit, Dumps and Disturbed areas)	General rehabilitation: *Pits (Block C, Old Block C Voids, Pit A, Pillar Pit, Portion 24)* - Shape void edge and ramps - Load and haul material within 2 km - Construct Earth bund wall - Excavate trench at toe of earth bund wall *Block D, Blesbok Pit* - Shape void edge and ramps

AREA	REHABILITATION MEASURE
	- Load and haul material within 1 km - Reshape disturbed area to be free draining - Rip all replaced topsoil to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix *Unshaped/unprofiled areas, Shaped/profiled areas* - Reshape disturbed area to be free draining - Replace topsoil cover - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix *Generally Disturbed areas* - Rip all replaced topsoil to alleviate compaction - Apply lime amelioration - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix *All dumps (Hards, Softs, Topsoil & Berms)* - Replace topsoil cover - Rip all replaced topsoil to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix *Contaminated areas (Carbonations Spills)* - Remove sacrificial coal layer to a depth of 500 mm - Shape and level footprint areas to align storm water runoff with the surrounding drainage framework - Replace 150 mm of topsoil across the reshaped footprint - Rip all areas to alleviate compaction

AREA	REHABILITATION MEASURE
	- Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Area 3: Dams	General rehabilitation: *Pollution Control Dam (Gijima, Dirty Water Dam)* - Remove contaminated sediment - Desilt PCD and Silt traps - Breach wall and reshape to at least 1:5 (V:H) where ancillary dam structures were removed to align storm water runoff with the surrounding surface water drainage framework - Replace 300 mm of topsoil across the reshaped footprint - Rip all areas to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix *Mahim Dam* - Load and haul embankment material - Shaping of dam embankment wall - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix
Area 4: Linear Infrastructure	Haul roads and gravel roads: - • There are no tarred roads at Glisa - • Rip all gravel roads t:o break compaction Pipelines and Powerlines - Remove all wire fencing - Demolish and remove all surface pipelines - Remove all powerlines General rehabilitation:

AREA	REHABILITATION MEASURE
	- Replace 300 mm of topsoil only on gravel and tar roads - Rip all areas to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix
Area 5: Water Treatment Plant	- No rehabilitation require since it is assumed that the water treatment plant will remain post closure to treat water for all three operations.
Area 6: Explosive Magazine	<u>Infrastructure demolitions and clean-up:</u> - Remove all mobile containers prior to closure - Remove all wire fencing <u>General rehabilitation:</u> - Reshape and levelling of areas where infrastructure were removed to align storm water runoff with the surrounding surface water drainage framework - Replace 300 mm of topsoil across the reshaped footprint - Rip all areas to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix
Monitoring and maintenance	- Water monitoring costs are included and assumed to take place bi-annually at existing monitoring points - 16 surface points and 6 groundwater points, for at least five (5) years after mine closure. - Vegetation monitoring and maintenance on rehabilitated areas is assumed to take place for three (3) years after closure over 25 % of the rehabilitated area

Table 7.2: Site Specific Rehabilitation and Closure Measures – Paardeplaats Section.

AREA	REHABILITATION MEASURE
Area 1: General Mining Right Area	Infrastructure demolitions and clean-up: - Demolish and remove all concrete structures to 1 m below ground level - Demolish Wash bay - Dismantle streel structures and store in designated salvage yard prior to removal/selling off - Remove wire fence General rehabilitation: - Shape and level all areas where infrastructure is removed to align surface water runoff with the site wide drainage framework - Replace 300 mm of topsoil across the reshaped yard footprint - Rip all replaced topsoil to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix
Area 2: Mining area	Infrastructure demolitions and clean-up: - Decommission Conveyor Belt - Remove HDPE lining General rehabilitation: - Breach Dam Walls - Load and haul material within 1 km - Shape and level disturbed areas to align surface water runoff with the site wide drainage framework - Replace 300 mm of topsoil across the reshaped yard footprint - Rip all replaced topsoil to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix

AREA	REHABILITATION MEASURE
Area 3: Dams	-
Area 4: Linear Infrastructure	Infrastructure demolitions and clean-up: *Haul roads and gravel roads* - Rip all gravel roads to break compaction General rehabilitation - Replace 300 mm of topsoil only on gravel and tar roads - Rip all areas to alleviate compaction - Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix
Area 5: Water Treatment Plant	-
Area 6: Explosive Magazine	-
Monitoring and maintenance	- Water monitoring costs are included and assumed to take place bi-annually at existing monitoring points - 16 surface points and 6 groundwater points, for at least five (5) years after mine closure. - Vegetation monitoring and maintenance on rehabilitated areas is assumed to take place for three (3) years after closure over 25 % of the rehabilitated area

7.1.4 Confirmation that the Rehabilitation Plan is Compatible with the Closure Objectives

The rehabilitation plan has been developed to align with and is compatible with the overall and specific closure objectives for the Integrated Paardeplaats Section.

7.1.5 Quantum of the Financial Provision Required to Manage and Rehabilitate the Environment

The financial provision estimate was calculated in terms of the Financial Provisioning Regulations, 2015 (GNR 1147), as amended. The estimated financial provision for the unscheduled closure of the Glisa Section is **R 442,931,626.00 (excluding VAT)**. The estimated financial provision for the unscheduled closure of the Paardeplaats Section is **R 26,537,686.00 (excluding VAT)**. The 2020 unscheduled financial provision breakdown and comparison with the 2019 estimate for the Glisa Section is presented in **Table 7.3** whilst the 2020 unscheduled financial provision for the Paardeplaats Section is presented in **Table 7.4**. The 2021 financial provision updated is scheduled for the latter half of 2021.

7.1.6 Confirmation that the Financial Provision Will be Provided as Determined

The financial provision can and will be provided for from operational expenditure.

Table 7.3: Unscheduled Financial Provision Summary – Glisa Section.

AREA AND DESCRIPTION	UNSCHEDULED CLOSURE (2020)	PREVIOUS ASSESSMENT (2019)	DIFFERENCE 2019-2020		REASON FOR CHANGE
Infrastructure and Rehabilitation					
Area 1: Infrastructure (Plant, Security, Offices & Workshop)	R 5,755,945.00	R 4,940.285.00	R 815,660.00	16.5%	- New ancillary infrastructure was added since 2019. CPI rate adjustment.
Area 2: Mining area (Pit, Dumps and Disturbed areas)	R 202,357,468.00	R 189,446,958.00	R 12,910,509.00	6.8%	- Mining areas (i.e. Voids and dumps) were revised and Block D void was included as per the new survey data received from the mine. CPI rate adjustment.
Area 3: Dams	R 5,569,443.00	R 5,345,468.00	R 223,975.00	4.2%	- CPI rate adjustment
Area 4: Linear Infrastructure	R 627,589.00	R 645,541.00	R 27,048.00	4.2%	- CPI rate adjustment
Area 5: Water Treatment Plant	R 0.00	R 1,160,590.00	-R 1,160,590.00	-100.0%	- Assumed that the water treatment plant will remain at LoM for post closure water treatment.
Area 6: Explosive Magazine	R 42,728.00	R 41,010.00	R 1,718.00	4.2%	- CPI rate adjustment
Sub-Total	**R 214,398,172.00**	**R 201,579,852.00**	**R 12,818,320.00**		
Monitoring and Maintenance					
Monitoring Costs (Groundwater and Surface water)	R 8,394,029.00	R 1,627,200.00	R 6,766,829.00	415.9%	- Base on values received from Universal Coals. It is assumed that water monitoring will be done for 5 years.

AREA AND DESCRIPTION	UNSCHEDULED CLOSURE (2020)	PREVIOUS ASSESSMENT (2019)	DIFFERENCE 2019-2020		REASON FOR CHANGE
Monitoring Costs (Vegetation)	R 270,537.00	R 159,024.00	R 111,514.00	70.1%	- Due to changes above
Maintenance Costs (Vegetation)	R 10,701,290.00	R 9,981,962.00	R 719,328.00	7.2%	- Due to changes above
Sub-Total	**R 19,365,856.00**	**R 11,768,185.00**	**R 7,597,670.00**		
Water Treatment Costs					
Water Treatment (30 years)	R 162,000,000.00	R 151,446,161.00	R 10,553,839.00	7.0%	- Values based on operational cost recalculated for 30 years. - The water treatment costs include Glisa, Paardeplaats and Eerstelingsfontein.
Sub-Total	**R 162,000,000.00**	**R 151,446,161.00**	**R 10,553,839.00**		-
Project Management (12%)	R 25,727,781.00	R 12,094,791.00	R 13,632,990.00	112.7%	- Preliminary and General Costs were changes to 12%, the proposed amendments to the GN R.1147 that states that P&G's must be market related. The current market related P&G's are 20% or higher. In future updates the 12% will have to be increased.
Contingency (10%)	R 21,439,817.00	R 20,157,985.00	R 1,281,832.00	6.4%	- Due to changes above
GRAND TOTAL	**R 442,931,626.00**	**R 397,046,974.00**	**R 45,884,652.00**	**11.6%**	

Table 7.4: Unscheduled Financial Provision Summary – Paardeplaats Section.

AREA AND DESCRIPTION	UNSCHEDULED CLOSURE (2020)	NOTE
Infrastructure and Rehabilitation		
Area 1: General Mining Right Area	R 336,760.00	- New Infrastructure on site. Workshop, Silt Trap and Washbay was added in 14/05/2020.
Area 2: Mining Area	R 19,001,587.00	- Mining activities starter in 2019 and mining area was revised as per survey data received at 30/04/2020 by the mine.
Area 4: Linear Infrastructure	R 561,804.00	- Roads were added
Sub-Total	**R 19,900,151.00**	
Monitoring and Maintenance		
Monitoring Costs (Groundwater and Surface water)	R 51,995.00	- Due to changes above
Monitoring Costs (Vegetation)	R 1,863,798.00	- Due to changes above
Maintenance Costs (Vegetation)	R 343,708.00	- Due to changes above
Sub-Total	**R 2,259,501.00**	
Project Management (12%)	R 2.388.018.00	- Due to changes above
Contingency (10%)	R 1.990.015.00	- Due to changes above
GRAND TOTAL	**R 26,537,686.00**	

8 MECHANISMS FOR MONITORING COMPLIANCE WITH AND PERFORMANCE ASSESSMENT AGAINST THE ENVIRONMENTAL MANAGEMENT PLAN AND REPORTING THEREON

8.1 Specific Monitoring and Management Plans

8.1.1 Climate Change

No specific mechanisms for monitoring apply.

8.1.2 Air Quality

A comprehensive monitoring campaign does exist for the Integrated Paardeplaats Section; however it is highly recommended that this eb expanded with 2 more monitoring locations as presented in **Figure 8.1**. Managing dust fallout effectively will result in the reduction of respiratory diseases that are as a result of air pollution, reduced risk of damage to property, improved visibility, and fewer disturbances to existing flora and fauna habitats.

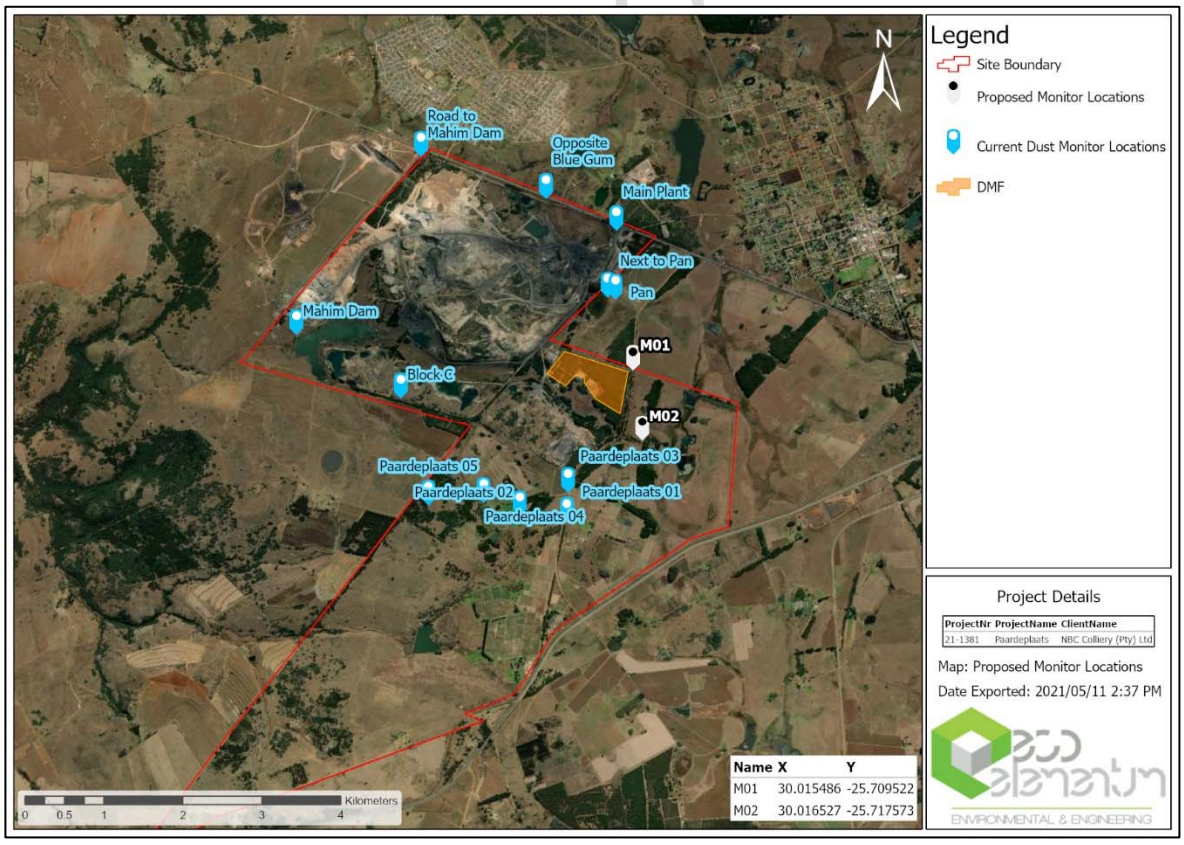

Figure 8.1: Existing and Proposed Air Quality Monitoring Locations.

8.1.2.1 Gravimetrical Dust Fallout

The existing monitoring locations allow for the eight main compass directions to be addressed. The existing monitoring locations and equipment placement is be done in accordance with the ASTM standard, D 1739 – 2010. At each gravimetric dust fallout gauge/receptor point there is a stand built according to specification containing the dust sample collection bucket. Samples are collected after a 1 month running period (±30 day's exposure). After sample collection, the samples are taken to a South African National Accreditation System (SANAS) accredited laboratory for analysis. A visual site investigation is done where after correlations are drawn and findings are identified and reported on.

Dust buckets of a standard size and shape are prepared and set up at locations related to the eight main compass points on the borders of the property so that dust can settle in them for periods of 30+/-2 days. The dust buckets are then sealed and replaced with new empty ones and sent away to the SANAS accredited laboratory for analysis. The masses of the water-soluble and –insoluble components of the material collected are then determined and results are reported as milligrams per square metre per day (mg/m²/day). This methodology is described according to South African National Standards (SANS) 1929:2004 and the American Society for Testing and Materials (ASTM) Designation: D 1739-98 (2010). The results for this method of testing are obtained by gravimetrical weighing. The apparatus required include open top buckets/containers not less than 150 millimetres (mm) in diameter with a height not less than twice its diameter. The buckets are be placed on a stand at a height of 2 +/-0.2 m above the ground.

8.1.2.2 Particulate Matter PM 10

It is recommended that NBC establish a fine particulate monitoring programme, which would include one particulate instrument to monitor PM 10 and preferably PM 2.5 specifically at the problem areas shown by the passive sampling campaign at residential areas. Handheld sampling instruments not only allows for sampling in the 8 main wind directions, but also on-site sampling down-wind of potential dust sources to quantify and determine impacts that need to be managed. It is advised to conduct this sampling on a monthly basis but also when the need arise during periods of elevated dust concentrations being emanated from the site.

8.1.3 Soils

No specific mechanisms for monitoring apply.

8.1.4 Terrestrial Biodiversity

A monitoring programme is essential as a management tool to detect negative impacts and variations as they arise and ensure that the necessary mitigation measures are implemented together with the effectiveness of the management measures in place. XX describes the monitoring plan that is to be implemented from the construction phase through to monitoring after decommissioning. The program includes each element, frequency of monitoring and the person responsible thereof.

Table 8.1: Terrestrial Biodiversity Monitoring Plan.

MONITORING ELEMENT	COMMENT	FREQUENCY	RESPONSIBILITY
Alien Invasive Management	During the operational phase the presence if AIPs should be detected and monitored. An active programme of weed management, to control the presence and spread of invasive weeds, will need to be instituted so that encroaching weeds (from edge effects and fragmentation) are controlled by means appropriate to the species. This should run for the life of the mine and five years after rehabilitation.	Annually during the wet season for the first five years after rehabilitation.	Environmental Officer
Vegetation Cover Monitoring	The natural vegetation cover established on the disturbed areas needs to be monitored annually for the first five years after rehabilitation has been carried out, to ensure that the rehabilitation work has been successful in terms of stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces), and that the newly established vegetation cover is trending towards convergence with the original vegetation cover found on the areas prior to disturbance (and on adjacent undisturbed areas). Parameters to be followed during monitoring: • Plant species present/absent; • Weed species composition; • Species density (number of individuals);	Annually during the wet season for the first five years after rehabilitation.	Botanist / Flora Specialist

MONITORING ELEMENT	COMMENT	FREQUENCY	RESPONSIBILITY
	• Species frequency (number of times species is recorded); • Basal cover; and • Biomass for ground cover.		
Red Data listed fauna and flora	All protected and Red Data plant and animal species must be marked prior to any construction taking place.	Monitored every 6 months from rehabilitation	Field Specialist
Fauna monitoring	This will be closely linked to the flora monitoring to enable scientific conclusions and comparisons. To successfully monitor faunal and floral biodiversity with a Savannah biome, a solid baseline (pre-construction) will be established through the first round of monitoring. This needs to be supplemented with regular repeats to compile a reasonable comparison between the pre-construction faunal communities present and faunal communities found in the same areas during various stages of construction and operation of the proposed project. It is recommended that this monitoring be carried out through the life of the mine and concurrently during rehabilitation.	Monitored every 6 months from rehabilitation	Field Specialist

8.1.5 Freshwater Ecosystems

A long-term biomonitoring program has been in place at the Glisa Section of the Integrated Paardeplaats Section, for some time already. With expansion of mining operations into the Paardeplaats Section, it is recommended that the biomonitoring program be expanded. The co-ordinates and a brief description of each site included in the current biomonitoring program together with the proposed new sites are presented in **Figure 8.2** and **Table 8.2**. Biomonitoring must be undertaken for the wet and dry season annually.

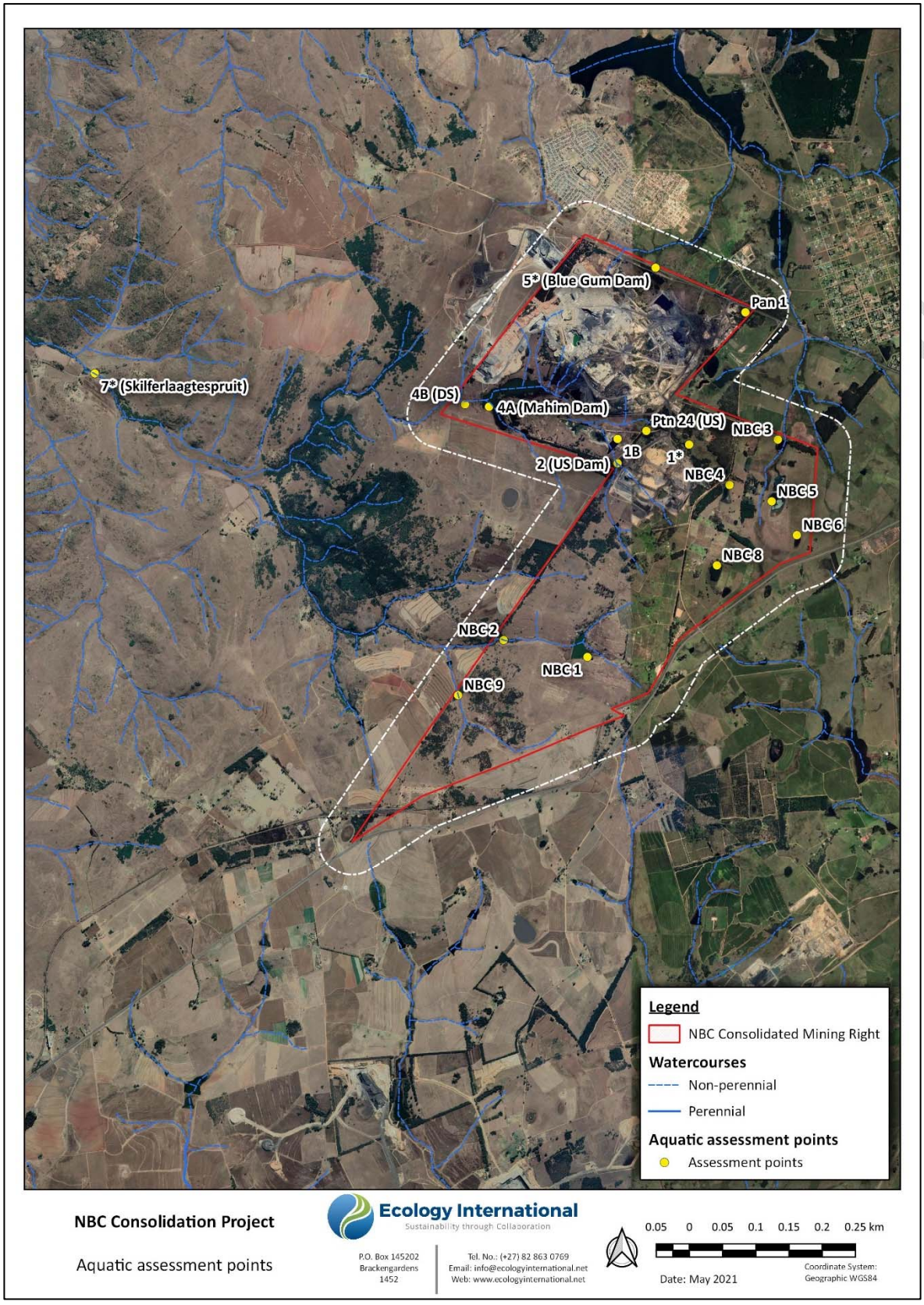

Figure 8.2: Current and Proposed Biomonitoring Sites.

Table 8.2: Current and Proposed Biomonitoring Sites.

	SITE	CO-ORDINATES	DESCRIPTION	PROTOCOLS
Existing Sites	Ptn 24 (US)	25°42'39.12"S 30° 0'6.21"E	Upstream wetland draining Portion 24	Water quality, habitat integrity, diatoms
	2 (US Dam)	25°42'54.92"S 29°59'50.65"E	Dam at inflow into existing Glisa Coal Mine study area and should exclude most potential Glisa impacts (mining and river diversion).	Water quality, habitat integrity, macroinvertebrates, fish, diatoms
	1B	25°42'43.02"S 29°59'53.94"E	Upstream part of Mahim Dam	Diatoms
	4A (Mahim Dam)	25°42'27.35"S 29°58'41.13"E	Mahim Dam, downstream of most Glisa Coal Mine potential and existing impacts.	Water quality, habitat integrity, macroinvertebrates, fish
	4B (DS)	25°42'26.22"S 29°58'28.13"E	Tributary draining away from Mahim Dam and exiting the western boundary of the Glisa property.	Water quality, habitat integrity, macroinvertebrates, fish, diatoms
	5* (Blue Gum Dam)	25°41'19.60"S 30° 0'11.20"E	Site in stream draining in northerly direction, downstream of all existing Glisa Coal Mine impacts.	Water quality, habitat integrity, macroinvertebrates, diatoms
	7* (Skilferlaagtespruit)	25°42'11.10"S 29°55'8.00"E	Site in Skilferlaagtespruit (Steelpoort) some distance downstream of Glisa study area. This site is downstream of existing and potential future Glisa Coal Mine activities, and has good potential as a biomonitoring site.	Water quality, habitat integrity, macroinvertebrates, fish
	Pan 1	25°41'41.30"S 30° 0'59.76"E	Non-perennial pan in NE corner of study area	Water quality, habitat integrity, macroinvertebrates, diatoms
Additional sites	NBC 1	25°44'29.37"S 29°59'34.33"E	Water storage dam located on a channelled valley bottom wetland	Water quality, macroinvertebrates, diatoms
	NBC 2	25°44'21.08"S 29°58'49.00"E	Channelled valley bottom flowing into an unnamed tributary of the Steelpoort River.	Water quality, macroinvertebrates, diatoms

	SITE	CO-ORDINATES	DESCRIPTION	PROTOCOLS
	NBC 3	25°42'43.37"S 30° 1'17.29"E	Farm dam in valley bottom wetland draining into the Langspruit	Water quality, macroinvertebrates, diatoms
	NBC 4	25°43'5.52"S 30° 0'51.16"E	Farm dam in a valley bottom wetland	Water quality, macroinvertebrates, diatoms
	NBC 5	25°43'13.49"S 30° 1'13.99"E	Farm dam in valley bottom wetland draining into the Langspruit	Water quality, macroinvertebrates, diatoms
	NBC 6	25°43'29.97"S 30° 1'27.60"E	Seasonal depression	Water quality, diatoms
	NBC 8	25°43'44.70"S 30° 0'44.37"E	Seasonal pan modified into a permanent storage dam	Water quality, diatoms
	NBC 9	25°44'47.96"S 29°58'24.45"E	Unchannelled valley bottom flowing into an unnamed tributary of the Steelpoort River	Water quality, diatoms

Due to the presence of numerous wetland areas within the study area, the Wet-health and Wet-Ecoservices tools are to be used to re-evaluate PES and eco-services on an annual basis by a suitably qualified wetland specialist for the life of the proposed project and for a period of at least 5 years after the decommissioning and closure of the proposed project during the summer/wet monitoring season. In addition to these tools, vegetation transect monitoring of the various HGM units should take place on an annual basis by a suitably qualified wetland specialist with a strong botanical background to monitor any changes to the vegetation structure of the wetlands as a result of subsidence or moisture stress.

Thereafter, monitoring is recommended every two years until the system is deemed appropriately rehabilitated. If monitoring results necessitate corrective action in terms of re-profiling of areas affected by subsidence, alien vegetation removal and erosion control, these corrective measures should be implemented immediately.

The Environmental Officer (EO) must be present on-site during decommissioning and rehabilitation phases and must ensure that the wetland areas and their associated zones of regulation are clearly demarcated and that no unnecessary clearing of vegetation takes place.

8.1.6 Surface Water and Groundwater

Golder Associates Africa (Pty) Ltd (Golder) conducts surface and groundwater monitoring and analysis for the NBC Glisa and Paardeplaats coal mines to ensure compliance to certain conditions of their approved IWULs, 04/B11B/ABCGIJ/2508 (Glisa) and 06/B41A/CGIJ/8880 (Paardeplaats). The monitoring campaigns run for a full calendar year, in this case January 2020 – December 2020. It should be noted NBC was issued with a new approved IWUL for the Glisa Section on 5 October 2020 (06/B41A/ABCGIJ/10002), however since the monitoring campaign was already underway compliance to the previous Glisa IWUL was continued with and reported in conjunction with the new IWUL.

The primary objectives for the 2020 surface and groundwater monitoring programme were:

- To assess, monthly, the quality of the surface and groundwater resources in and around the Integrated Paardeplaats Section;
- To ensure compliance to Appendix V, condition 2 and 4 and Appendix VI, condition 3 of the Glisa Sections previous IWUL (04/B11B/ABCGI/2508), and Appendix II, condition 3.2 and 5 and Appendix III, conditions 3.1 and 4 of the Paardeplaats Section IWUL (06/B41A/CGIJ/8880);
- To comment on the risk associated with using water for specific water uses and provide data relevant to human and environmental health impact assessments; and
- To comment on the impacts of mining operations on water sources in and around the mine.

8.1.6.1 Existing Monitoring Sites

Surface water (process and receiving water) and groundwater sampling locations for the Integrated Paardeplaats Section are listed in **Table 8.3** and **Table 8.4** respectively, and presented in **Figure 8.3**. It must be noted that water from BH 7 and BH 13 is no longer collected due to lack of a safe access route to the sites. Access to BH 7 is down a steep embankment and through thick bush and tall grass, in a wetland area, while BH 13 is in the middle of a wetland and access is by walking on a pipe that crosses the wetland.

Table 8.3: Existing Surface Water Sampling Sites.

MAP ID	SAMPLING POINTS	LATITUDE	LONGITUDE
GLISA PROCESS WATER SITES			
E1	Decant point	-25.70400	29.98906
E2	Gijima Dam	-25.70548	29.99183
E3	Block C Main Void	-25.71275	29.99739
E4	Blue Gum dam	-25.68972	30.00350

MAP ID	SAMPLING POINTS	LATITUDE	LONGITUDE
E5	Siding Dam	-25.70275	30.06275
E6	Wash bay	-25.69936	30.01265
E7	Portion 24 Evaporation Dam	-25.71110	30.00199
GLISA SURFACE WATER RECEIVING ENVIRONMENT SITES			
E8	Upstream from Block C Main	-25.71491	29.99668
E9	Downstream from Block C Main	-25.71115	30.00086
E10	Belfast Dam	-25.67160	30.01362
E11	Lewis Dam Wall	-25.68086	30.02216
E12	Lewis Dam Upstream	-25.69592	30.02485
E13	Poach Dam	-25.68313	30.00983
E14	West WQ point on Mahim dam Wall	-25.70650	29.97705
E15	Small wetland created from overflow from Mahim Dam	-25.70799	29.97663
E16	Northern WQ point on Mahim Dam	-25.70292	29.98384
E17	Downstream channel below Mahim dam wall	-25.70644	29.97524
E18	Water treatment plant discharge	-25.70592	29.97601
E19	Wetland in old mine area	-25.70555	30.05941
E20	Wetland at BH 1	-25.68881	30.00290
E21	River Division 1	-25.71097	30.00082
E22	River Division 2	-25.71023	29.99435
E23	Water monitoring Point 1	-25.70319	30.01086
E24	Water monitoring Point 2	-25.70361	30.00914
E25	Water monitoring Point 3	-25.70483	30.01210
E26	Water monitoring Point 4	-25.70255	30.01476
E27	Skilferlaagtespruit	-25.70328	29.91959
E28	Wetland 2 of Poach Dam	-25.68651	29.99760
E29	Wetland 1 of Poach Dam	-25.68867	30.00302
PAARDEPLAATS SURFACE WATER RECEIVING ENVIRONMENT SITES			
E30	MP6	-25.70606	29.97367
E31	MP8	-25.71245	29.98384
E32	SV Dam 1 (Wilky Farm Dam)	-25.71781	30.01469
E33	SV Dam 2 (Dick Farm Fountain)	-25.72905	29.99961
E34	SV Dam 3 (Hadeco Dam)	-25.74032	29.99290
E35	Hadeco Spring	-25.74632	30.00234

Table 8.4: Existing Groundwater Sampling Sites.

MAP ID	BOREHOLE ID	LATITUDE	LONGITUDE
GLISA MONITORING SITES			
E36	BH 1	-25.68909	30.00288
E37	BH 2	-25.68829	30.00082

MAP ID	BOREHOLE ID	LATITUDE	LONGITUDE
E38	BH 8	-25.71575	30.01235
E39	BH 12	-25.70339	29.98662
E40	BH 14	-25.71085	30.00154
E41	BH 15	-25.71379	29.99259
E42	GW02	-25.68523	29.99218
E43	GW01	-25.70386	29.97695
PAARDEPLAATS MONITORING SITES			
E44	BH 1B	-25.72572	29.98929
E45	BH 2A	-25.75587	29.96758
E46	BH 2B	-25.75583	29.96768

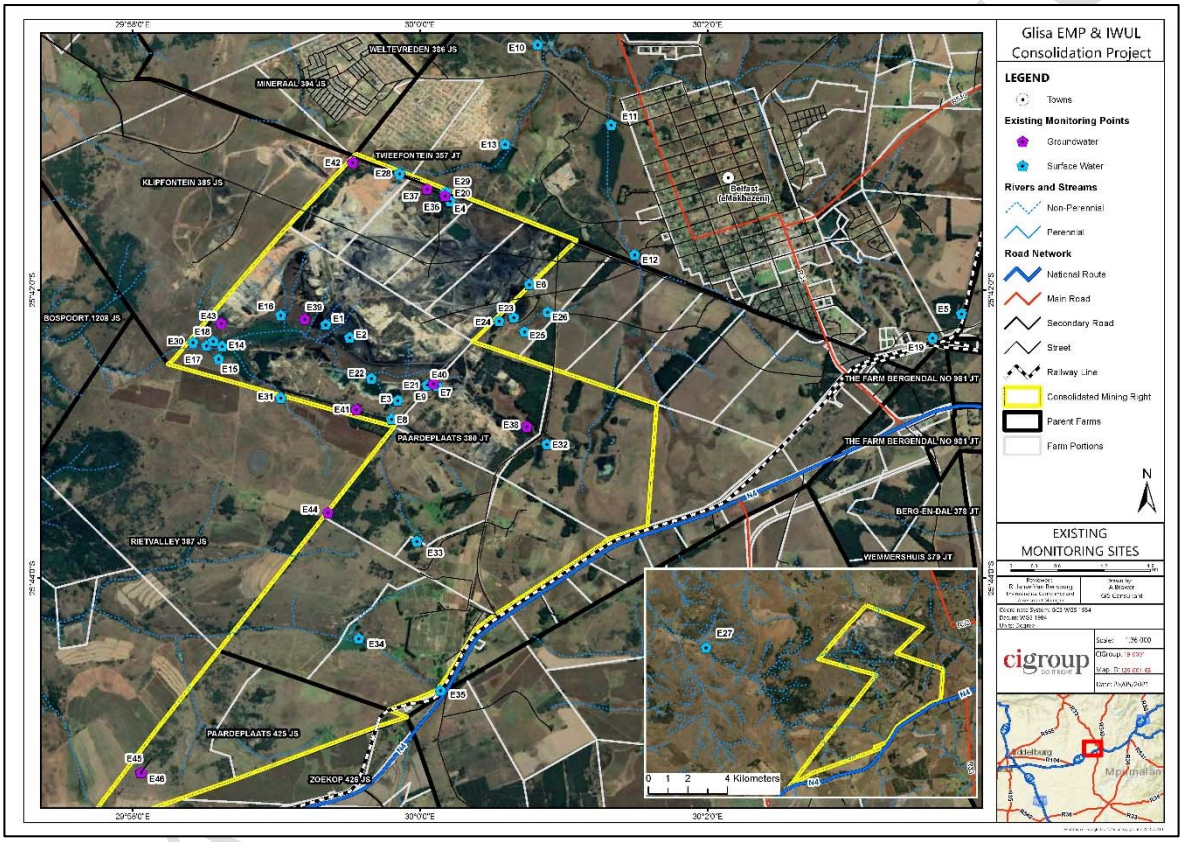

Figure 8.3: Location of Existing Surface and Groundwater Monitoring Sites.

8.1.6.2 Proposed Additional Monitoring Sites

Based on the surface water and groundwater assessments, additional surface and groundwater monitoring sites are proposed. **Figure 8.4** presents the current monitoring programme sites together with the proposed additional sites, whilst **Table 8.5** and **Table 8.6** present the proposed additional surface and groundwater sites, respectively.

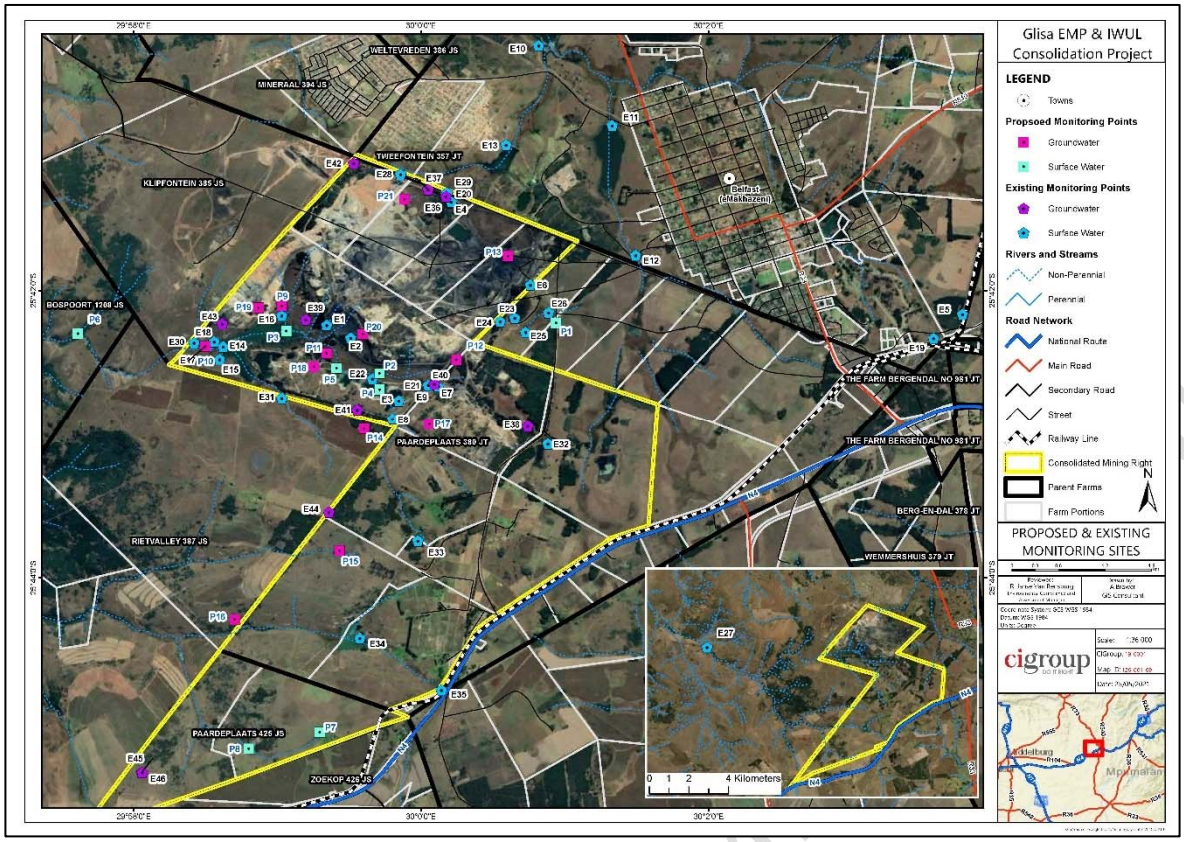

Figure 8.4: Location of Existing and Proposed Additional Surface and Groundwater Monitoring Sites.

Table 8.5: Proposed Additional Surface Water Sampling Sites.

MAP ID	SAMPLING POINTS	LATITUDE	LONGITUDE
P1	LMDam 1	-25.70376	30.015664
P2	MP1	-25.7096	29.9952
P3	MP2	-25.7047	29.9844
P4	MP3	-25.7115	29.9952
P5	MP4	-25.709	29.9902
P6	MP7	-25.705	29.9602
P7	WPDam 1	-25.751196	29.988268
P8	WPDam 2	-25.753101	29.980048

Table 8.6: Proposed Additional Groundwater Sampling Sites.

MAP ID	BOREHOLE ID	LATITUDE	LONGITUDE
P9	GMBH1	-25.70178	29.983875
P10	GMBH2	-25.706485	29.974985
P11	GMBH3	-25.707283	29.989054
P12	GMBH4	-25.708052	30.004098

MAP ID	BOREHOLE ID	LATITUDE	LONGITUDE
P13	GMBH5	-25.695997	30.010074
P14	GMBH6	-25.716047	29.993421
P15	GMBH7	-25.73019	29.990556
P16	GMBH8	-25.738153	29.978422
P17	Inpit BH 1	-25.715487	30.000942
P18	Inpit BH 2	-25.708847	29.987577
P19	Inpit BH 3	-25.70202	29.981168
P20	Inpit BH 4	-25.705052	29.993258
P21	Inpit BH 5	-25.689431	29.998088

8.1.6.3 Water Quality Parameters and Compliance Values

The water quality parameters and standards against which the water quality for potable water, surface water receiving environment and groundwater samples collected at the Integrated Paardeplaats Section are compared, are set out in **Table 8.7**. There are no set limits for Glisa process water in the IWUL. Soap oils and grease in wash bay water is compared against general wastewater limits applicable to discharge of wastewater into a water resource (DWA General Notice 169 of 2013, Section 21 (f) and (h)). **Table 8.7** references both the new (2020) and the older (2015) Glisa IWULs and the different water quality limits prescribed therein for surface water. Groundwater quality limits are the same in the 2020 and 2015 IWULs.

Laboratory analysis techniques must comply with South African Bureau of Standards (SABS) guidelines. The groundwater monitoring database must be updated on a quarterly basis as information becomes available. The database should be used to analyse the information and evaluate trends noted. An annual compliance report should be compiled and submitted to the authorities for evaluation and comment. This report should be submitted annually for the construction, operational and decommissioning phases.

Table 8.7: Water Quality Parameters And Standards for the Integrated Paardeplaats Section.

PARAMETERS	UNITS	GLISA SECTION			PAARDEPLAATS SECTION
		GROUNDWATER	SURFACE WATER		SURFACE/GROUNDWATER
		2015 & 2020 IWUL	2015 IWUL	2020 IWUL	2019 IWUL
pH	pH units	≤ 6-9.5	5.5-9.5	5.5-8.4	5.5-9.5
Electrical Conductivity (EC)	mS/m	≤ 150	≤150	≤ 40	≤ 170
Total Dissolved Solids (TDS)	mg/L	nr	nr	≤ 260	1 550
Dissolved Oxygen Saturation	%	nr	≥8	nr	≥8
Suspended Solids	mg/L	nr	nr	25	nr
Calcium (Ca)	mg/L	≤ 150	≤50	≤ 32	215
Magnesium (Mg)	mg/L	≤ 100	≤80	≤ 30	135
Sodium (Na)	mg/L	≤ 200	≤100	≤ 70	≤ 100
Potassium (K)	mg/L	nr	nr	nr	5
Total alkalinity as $CaCO_3$	mg/L	nr	nr	nr	<44
Chloride (Cl^-)	mg/L	≤ 200	≤ 150	nr	≤ 150
Sulphate (SO_4^{2-})	mg/L	≤ 400	≤ 200	≤ 200	930
Fluoride (F^-)	mg/L	≤ 1	nr	nr	≤ 1
Nitrate (NO_3^-) as N	mg/L	≤ 10	≤ 40	≤6	(as NO_3^-)
Nitrate as NO_3^-	mg/L	(as N)	(as N)	(as N)	≤ 40
Nitrite as (NO_2^-) as N	mg/L	nr	nr	nr	nr
Ammonia (NH_3) as N	mg/L	nr	nr	≤ 1	nr
Orthophosphate as PO_4^{3-}	mg/L	nr	nr	nr	nr
Zinc as Zn	mg/L	nr	nr	nr	<0.003
Antimony as Sb	mg/L	nr	nr	nr	nr
Arsenic as As	mg/L	nr	nr	nr	nr

PARAMETERS	UNITS	GLISA SECTION			PAARDEPLAATS SECTION
		GROUNDWATER	SURFACE WATER		SURFACE/GROUNDWATER
		2015 & 2020 IWUL	2015 IWUL	2020 IWUL	2019 IWUL
Barium as Ba	mg/L	nr	nr	nr	nr
Boron as B	mg/L	nr	nr	nr	nr
Cadmium as Cd	mg/L	nr	nr	nr	nr
Total Chromium as Cr	mg/L	nr	nr	nr	<0.0015
Copper as Cu	mg/L	nr	nr	nr	nr
Iron as Fe	mg/L	nr	nr	≤ 0.1	<0.02
Lead as Pb	mg/l	nr	nr	nr	nr
Manganese as Mn	mg/L	nr	nr	nr	0.03
Mercury as Hg	mg/L	nr	nr	nr	nr
Nickel as Ni	mg/L	nr	nr	nr	nr
Selenium as Se	mg/L	nr	nr	nr	nr
Uranium as U	mg/L	nr	nr	nr	nr
Aluminium as Al	CFU/100ml	nr	nr	nr	<0.02
Escherichia coli	CFU/100ml	nr	nr	nr	nr
Total coliforms	CFU/1ml	nr	nr	nr	nr
Heterotrophic plate count	CFU/100ml	nr	nr	nr	nr
Faecal coliforms	mg/L	nr	nr	0	nr

*# operational; * aesthetic; ac acute health; ch chronic health; nr parameter not required per IWUL and SOW*

The frequency and type of monitoring proposed for rainfall, surface water, potable water and groundwater is presented in **Table 8.8**.

Table 8.8: Proposed Water Monitoring Frequency and Type.

SAMPLING POINT	PARAMETER	SAMPLE TYPE	MEASUREMENT	FREQUENCY
Rainfall	-	Measurement	ml rainfall	Daily
Surface Water Points	Standard Full Suite	Grab	Flow	Quarterly Annually
Potable Water Points	Standard Full Suite	Grab	Flow Water Level	Quarterly Annually
Groundwater/Boreholes Points	Standard Full Suite	Grab	Flow Water Level	Quarterly Annually

8.1.7 Heritage

No specific mechanisms for monitoring apply.

8.1.8 Traffic

No specific mechanisms for monitoring apply.

8.1.9 Blast and Vibration

It is highly recommended that a monitoring program be put in place. This will also qualify the expected ground vibration and air blast levels and assist in mitigating these aspects properly. This will also contribute to proper relationships with the neighbours.

Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. Additionally assistance may be sought when blasting is done close to the highways. This will bring about unbiased evaluation of levels and influence from an independent group. Monitoring could be done using permanent installed stations. Audit functions may also be conducted to assist the mine in maintaining a high level of performance with regards to blast results and the effects related to blasting operations.

A detailed list of boreholes must be compiled. Necessary data for each borehole must be logged including, location, condition, qualities, levels etc. Detail of recordings required must be confirmed with the groundwater consultant. Ground vibration levels at boreholes must be maintained below 50 mm/s at surface of the borehole.

8.1.10 Noise

No specific mechanisms for monitoring apply.

8.1.11 Visual

No specific mechanisms for monitoring apply. Refer to the terrestrial biodiversity mechanisms.

8.1.12 Social

No specific mechanisms for monitoring apply.

Table 8.9 presents the mechanisms for monitoring compliance with and performance against the environmental management plan including the impact requiring monitoring, the functional requirement for monitoring, the responsible person(s) for executing the monitoring programme, and the monitoring and reporting frequency.

Table 8.9: Mechanisms to Monitor Compliance and Performance against the EMP.

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
Construction Operational Decommissioning Closure Rehabilitation	Dust Fallout	Gravimetric Dust Fallout and PM10	Field specialist SANAS accredited laboratory	Monthly
Construction Operational Decommissioning Closure Rehabilitation	Alien Invasive Management	Implement an active programme of weed management, to control the presence and spread of invasive weeds. This should run for the life of the mine and five years after rehabilitation.	Environmental Officer	Annually during the wet season for the first five years after rehabilitation.
Construction Operational Decommissioning Closure Rehabilitation	Vegetation Cover Monitoring	The natural vegetation cover established on the disturbed areas needs to be monitored annually for the first five years after rehabilitation has been carried out. Parameters to be followed during monitoring: • Plant species present/absent; • Weed species composition; • Species density (number of individuals);	Botanist/Flora Specialist	Annually during the wet season for the first five years after rehabilitation.

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
		• Species frequency (number of times species is recorded); • Basal cover; and • Biomass for ground cover.		
Construction Operational Decommissioning Closure Rehabilitation	Red Data listed fauna and flora	All protected and Red Data plant and animal species must be marked prior to any construction taking place.	Field Specialist	Monitored every 6 months from rehabilitation
Construction Operational Decommissioning Closure Rehabilitation	Fauna monitoring	This will be closely linked to the flora monitoring. To successfully monitor faunal and floral biodiversity with a Savannah biome, a solid baseline (pre-construction) will be established through the first round of monitoring. It is recommended that this monitoring be carried out through the life of the mine and concurrently during rehabilitation.	Field Specialist	Monitored every 6 months from rehabilitation
Construction Operational Decommissioning Closure Rehabilitation	Biomonitoring	Water quality, habitat integrity, macroinvertebrates, fish, diatoms	Aquatic Ecologist	Twice a year for the wet and dry season

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
Construction Operational Decommissioning Closure Rehabilitation	Wetlands	Wet-health and Wet-Ecoservices tools are to be used to re-evaluate PES and eco-services.	Wetland Specialist	Annual basis for the life of the project and for a period of at least 5 years after the decommissioning and closure during the summer/wet monitoring season. Thereafter, monitoring is recommended every two years until the system is deemed appropriately rehabilitated
Construction Operational Decommissioning Closure Rehabilitation	Wetlands	Vegetation transect monitoring of the various HGM units.	Wetland Specialist	Annual basis
Construction Operational Decommissioning Closure Rehabilitation	Surface Water Quality	ISO 5667 Grab Samples Water quality parameters as per IWUL	Field specialist	Quarterly

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
Construction Operational Decommissioning Closure Rehabilitation	Water Balance	Water balance to be updated annually. Flow meter readings and update of datasheet.	Hydrologist SHEQ/Engineering	Annually Flow meter readings daily
Construction Operational Decommissioning Closure Rehabilitation	Groundwater Quality	Water quality parameters as per IWUL	Field specialist	Quarterly
Construction Operational Decommissioning Closure Rehabilitation	Groundwater Levels	Depth meters Determine the groundwater fluctuation over LoM	Field Specialist	Quarterly
Construction Operational Decommissioning Closure Rehabilitation	Storm Water Management	Visual Inspection Check the system for blockages and possible spillage areas	SHEQ/Engineering	After heavy rainfall
Construction Operational Decommissioning	Blast and Vibration	Implement blast management plan	Independent Specialist (Noise Specialist)	Annually

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
Closure Rehabilitation				
Construction Operational Decommissioning Closure Rehabilitation	Visual inspection of receptors	Implement monitoring schedule in-house physical census. Any incidents of cracking must be recorded and addressed.	SHEQ/ Engineering	Before and after each blasting event

9 FREQUENCY OF THE SUBMISSION OF PERFORMANCE ASSESSMENT OR AUDIT REPORT

The NEMA EIA Regulations, 2014 (as amended) state that a performance assessment or audit should be conducted by an external independent person throughout the life of mine at intervals stipulated in the IEA. The performance assessment or audit is a tool used to assess compliance to the EMP and IEA, with specific focus on the adequacy of the mitigation outcomes and objectives. Any amendments to the EMP that may be required following the performance assessment or audit will be undertaken in terms of the NEMA EIA Regulations, 2014 (as amended).

NBC commits to undertake the performance assessment or audit for the Integrated Paardeplaats Section 5-yearly.

10 ENVIRONMENTAL AWARENESS PLAN

An environmental awareness plan is a dynamic plan that will be used by NBC to ensure that all personnel, contractors, and visitors to the mine undertake their tasks in an environmentally conscious manner. The aim of the plan is to inform all personnel, contractors, and visitors of environmental policies and procedures applicable to activities within the Integrated Paardeplaats Section. The plan addresses how NBC will communicate environmental aspects regarding the Integrated Paardeplaats Section with everyone who comes to the mine.

10.1 Communication, Participation and Consultation

NBC have adopted a Standard Operating Procedure (SOP) relating to communication, participation and consultation (SP-NBC-SHE 008). The purpose of the SOP is to outline the processes/methods regarding communication, consultation and participation, to be followed by NBC to encourage participation in good Safety, Health and Environment (SHE) practices and support for NBCs SHE policy and SHE objectives from those affected by its activities or interested in NBCs SHE management system. The SOP is provided in **Appendix A**.

10.1.1 Method of Communication

10.1.1.1 Induction

All full time personnel and contractors are required to attend an induction session. Personnel are inducted when they start on the project. Any contractor who works on the project for a period of

24 hours or more is required to undergo the prescribed induction training. This induction will form part of the health and safety induction.

Environmental issues and aspects related to the project will be addressed in the induction sessions. All environmental impacts and aspects and their mitigatory measures will be discussed, explained, and communicated to employees. The induction sessions will be modified according to the level of employee attending the induction session so that all employees gain a suitable understanding of environmental issues and pollution.

The records of all individuals attending induction sessions to be kept; the records to be kept include names, identity numbers, contact details, designation, and signature.

10.1.2 On the Job Training

On the job training is an essential tool in environmental awareness. Employees will be given details of the expected environmental issues and concerns specifically related to their occupation. Employees will be trained on how to respond if an environmental problem or source of environmental pollution arises. The training will be on-going, and all new employees will be provided with the same standard of training as existing employees.

The records of all individuals receiving on the job training to be kept; the records to be kept include names, employee number contact details, designation and signature.

10.1.2.1 Hazardous Substances

Individuals dealing with potential hazardous situations and risks that could lead to hazardous spills, pollution incidents, excessive dust, or other forms of environmental damage to receive appropriate job specific training on the risks and potential consequences of their appointment and work situation, how to avoid environmental impacts and how to respond during an environmental incident or emergency situation. All these actions will be done in accordance with NBC procedures on management of hazardous substances.

10.1.2.2 Delivery of Hazardous Substances

All hazardous substances must be delivered directly to the the specified department that placed the order. Personnel responsible for the supervision of delivery, collection, and transport of hazardous substances to receive appropriate job-specific training on the risks and potential consequences of their appointment and work situation, how to avoid environmental impacts and how to respond during an environmental incident or emergency situation. This all makes part of competency

declaration for use. Material Safety Data Sheets (MSDSs) of each hazardous substance delivered must be kept at the and maintained by the responsible Head of Department (HOD) of that area as well as at the point of distribution. Prior to any use of a new chemical, the Material Safety Data Sheet of each substance must be delivered to the Safety, Health, Environment and Quality department of NBC for approval of use.

10.1.2.3 Dust Mitigation

Individuals dealing with potential situations and risks that could lead to excessive dust to receive appropriate job-specific training on the risks and potential consequences of their appointment and work situation, how to avoid environmental impacts and how to respond during an environmental incident or emergency situation.

10.1.2.4 Fire Incidents

Individuals dealing with potential hazardous situations and risks that could lead to fire incidents or emergencies to receive appropriate job-specific training on the risks and potential consequences of their appointment and work situation, how to avoid environmental impacts and how to respond during an environmental incident or emergency situation.

10.1.2.5 Pollution Incidents or Forms of Environmental Damage

Any incident or form of environmental damage must be dealt with in accordance with an incident management procedure.

Individuals dealing with potential situations and risks that could lead pollution incidents or other forms of environmental damage to receive appropriate job-specific training on the risks and potential consequences of their appointment and work situation, how to avoid environmental impacts and how to respond during an environmental incident or emergency situation.

10.1.2.6 Waste Management

Mining personnel and contractors responsible for the operation and safe handling of the various waste streams will receive appropriate job-specific training on the risks and potential consequences of their appointment and work situation, how to avoid environmental impacts and how to respond during an environmental incident or emergency situation. Ensure that training and awareness programmes cover the safe transportation, handling, storage, transfer, handling, use and disposal of all waste streams, and the location of waste receptacles for each waste stream. All waste

management activities must be done in accordance to NBC procedures and in terms with registers dealing with storage of waste in specific areas.

Staff awareness training programme will accommodate training, on which bin to use for organic waste and on sealing the lid on the bin once organic waste has been discarded.

10.1.2.7 Water Management

All persons responsible for active water management will receive appropriate job-specific training on the risks and potential consequences of their appointment and work situation, how to avoid environmental impacts and how to respond during an environmental incident or emergency situation.

10.1.2.8 Water Consumption and Use

All staff will receive awareness training on minimising water consumption and how to use water sparingly.

10.1.3 Environmental Communication Strategies

Mine management has established procedures for the internal communication between the various levels and functions of the organisation, and receiving, documenting, and responding to environmental risks for each phase of the project will take place for the management, administrative and worker sectors of the project, as well as contractors. The organisation shall conduct processes for external communication on its significant environmental aspects and record its decision in line with the NBC communication policy as well as conditions stated in any authorisation.

10.1.3.1 Internal Communication

Internal communication is done within the Administrative Sector.

10.1.3.2 External Communication Strategies

The following communication channels will/can be used to communicate environmental issues to individuals who are not employed by NBC or their subcontractors:

- **Environmental Stakeholder Engagement Meeting:** An environmental stakeholder engagement meeting may be established and used as a forum to keep interested and affected parties informed of the significant environmental aspects identified through the Environmental Impact Assessments and Management Plans. This is also the forum where

interested and affected parties get the opportunity to raise environmental concerns. Records are kept of all decisions and concerns. The environmental stakeholder engagement meeting should be chaired by the Mine Manager, or another appropriately appointed competent individual.

- **Publications:** Selected publications should be produced and used to communicate environmental issues to outside parties. Examples include newsletters and Annual Reports.
- **Communication from External Parties and Employees:** A clear communication point is established within the company through the SOP that determines who is responsible for liaison with the media in respect of any crisis that may arise. Communication from external interested and affected parties may be received by email, fax, or telephonically. Where required, a written response will be sent, on receiving such communication, by the appropriately appointed individual under signature of the Mine Manager, to the respective interested and/or affected party. All telephonic or facsimile correspondence received on the mine must be forwarded to the relevant department for action. All events or concerns will be captured and actioned on an existing and/or future database.
- **E-mail:** E-mail communication received must be stored, with replies, in an appropriate folder on a server. E-mail messages, relevant to environmental management, should be kept for a minimum of two years before deletion.
- **Mail:** Correspondence received by mail must be filed, along with the response (where relevant), within the relevant department's filing system for a minimum period of two (2) years. Paper correspondence will be archived in this department.
- **Telephone:** A register of telephonic environmental queries should be kept by the relevant department detailing caller, contact details, date, query, action taken and response. Furthermore, the person answering the call will be responsible for logging their particulars against the call, as well as ensuring that all communication that leads to an aspect or an impact, is entered on the database.
- **Storage of Correspondence:** All original correspondence must be retained by the Mine Manager for a minimum period of two years.
- **Environmental Reports:** Copies of relevant specialist study reports and Environmental Impact Assessments will be available on request from an external party by the Mine Manager.
- **Queries from Interested and Affected Parties:** Response to queries about environmental impacts and aspects will be addressed by the relevant department and approved by the Mine Manager.
- **Queries and Requests from the Media:** Requests for articles from the media on environmental issues regarding the road construction will be co-ordinated by the Corporate Communication manager according to the public communication strategy, with input from the relevant department, as approved by the General Manager, in line with community

communication and liaison strategies. Due to the environmental awareness generated by induction, on the job training etc., employees are able to identify environmental problems, issues, concerns, and pollution timeously.

10.2 Evaluation of the Environmental Awareness Plan

The evaluation of the environmental awareness and training plan will be conducted by NBC. This evaluation will entail the auditing of the operation in the construction phase once activity has commenced. The environmental awareness and training plan described above is sufficient to make all those involved in the project aware of those risks that may occur as well as the necessary mitigation required to minimise these risks.

The environmental awareness and training plan indicates that NBC is serious about the environments well-being and empowerment of the local people. Environmental issue will be highlighted at monthly meetings scheduled at the mine.

10.3 Emergency Preparedness and Response

The purpose of the Emergency Preparedness and Response SOP (SP-NBC-SHE 010) is to provide a framework to ensure that potential emergency situations are identified and responded to, as to prevent or mitigate associated adverse SHE effects. The SOP is provided in **Appendix A**.

10.4 Emergency Incident Reporting

Environmental incident reporting is a vital part of communication at NBC. Employees are required to report any and all environmentally related problems, incidents, and pollution, so that the appropriate litigator action can be implemented timeously. In the event of an environmental incident, the incident must be reported according to the Incident, Nonconformity and Corrective Action SOP (SP-NBC-SHE 012). This SOP outlines the process for reporting, assessing, investigating, implementing and evaluating action(s) taken to prevent reoccurrence. The reporting and investigation of accidents, incidents and nonconformities without undue delay can enable hazards to be eliminated and associated SHE risks being minimised as soon as possible. The SOP is provided in **Appendix A**.

11 ADDITIONAL INFORMATION DISCLOSED TO THE COMPETENT AUTHORITY

Additional information of importance to the Competent Authority includes the following:

- The Quantum of the Financial Provision will be reviewed on an annual basis in line with the NEMA Financial Provisioning Regulations, 2015 (as amended) (GNR 1147) and submitted to the Department of Mineral Resources and Energy (DMRE) once finalised. This will be supported by the Annual Rehabilitation Plan, Final Rehabilitation, Decommissioning and Mine Closure Plan, and the Environmental Risk Assessment reports as contemplated in the Regulations.
- The approved IWULs for the Integrated Paardeplaats Sections will be audited on an annual basis and submitted to the Department of Human Settlements, Water and Sanitation (DHSWS) once finalised. This will include an audit of conditions in terms of the Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources, 1999 (GN 704).

12 UNDERTAKING

The EAP herewith confirms-

a) the correctness of the information provided in the reports ☑
b) the inclusion of comments and inputs from stakeholders and I&APs ☑
c) the inclusion of inputs and recommendations from the specialist reports where relevant; and ☑
d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed. ☑

Appendix A: Standard Operating Procedures

Appendix B: Maps and Plans