Makganyane Iron Ore Mine

Rehabilitation, Decommissioning & Closure Plan

3rd September 2025

Prepared by: Afzelia Environmental Consultants

Prepared for: greenmined environmental

Declaration

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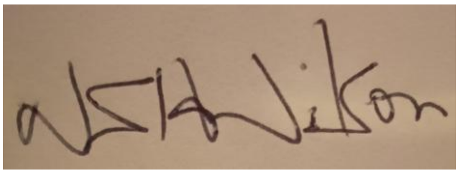
I, **Neil Samuel Hugh Wilson,** declare that:

- I act as the independent specialist for this rehabilitation, decommissioning and closure plan;
- I have performed the work relating to the specialist assessment in an objective manner;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist input and confirming statement relevant to this request for registration, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the proponent all material information in my possession that reasonably has or may have the potential of influencing compliance with the Standards Registration Process; and
- all the particulars furnished by me in this form are true and correct.

Signature of the specialist:



Name of Company: Afzelia Environmental Consultants (Pty) Ltd

Date: 03 September 2025

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SPECIALIST REPORT REQUIREMENTS

Specialist reports are required to be undertaken in line with Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act (NEMA, Act No. 107 of 1998) when Applying for Environmental Authorisation, dated 20 March 2020. The Protocol for the specialist assessment and impacts on the terrestrial ecology and biodiversity applies.

1 INTRODUCTION

1.1 Background

Afzelia Environmental Consultants (Pty) Ltd was appointed by Greenmined Environmental Consultants (Pty) Ltd to compile a Rehabilitation, Decommissioning and Closure Plan for the proposed Makganyane iron ore mine. This plan is a requirement for the proposed Mining Right and Water Use License Applications.

The Makganyane Iron Ore Mine does not yet exist, although it has a Prospecting Right which expired on 10th April 2021. The Right was renewed with the expiration date extending to the 18th November 2024. In terms of section 18 (4) of the Mineral and Petroleum Resources Development Act, No. 28 of 2002, a prospecting right can only be renewed once. Therefore, in order to maintain tenure over the prospecting area, the applicant, Assmang (Pty) Ltd, is applying for a Mining Right over the same prospecting area.

The proposed mine is located approximately 24km north-west of Postmasburg alongside the provincial road, R385, in the Northern Cape Province of South Africa (Figure 1).

The proposed Makganyane Mining Right Area lies within four land parcels, namely:

- Portion 1 (Remaining Extent) of the farm Makganyene No. 667.
- Portion 2 (Portion of Portion 1) of the farm Makganyene No. 667.
- Portion 3 of the Farm Makganyene No. 667.
- Remaining Extent of the farm Makganyene No. 667.

1.2 Rehabilitation Area

After examination of all available information for the proposed Makganyane iron ore mine, including all the specialist studies, it is proposed that rehabilitation focuses on the 264 ha rehabilitation area (Figure 2). The following areas will require intensive rehabilitation due to the direct significant negative impacts of mining activities (Figure 2):

- Pit 1 and 2.
- Waste Rock Dump.
- Stockpile Area.
- Site Camp.
- Nursery.
- Haulage Roads.

Updated information about the location of the haulage and internal roads was not available when this Rehabilitation, Decommissioning and Closure Plan was prepared, but in terms of minimising negative impacts, they should follow existing roads in the Makganyane mining right area.

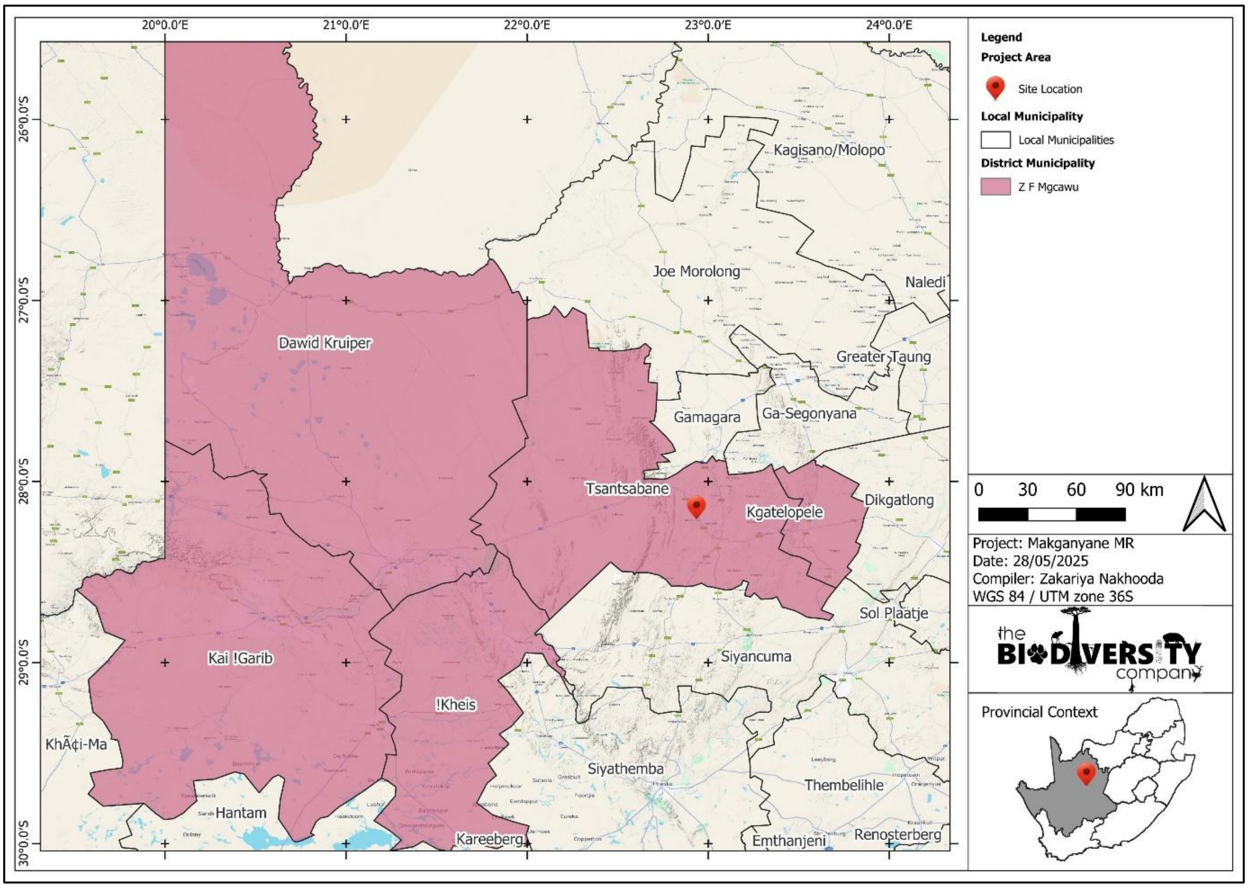


Figure 1: Locality of the proposed Makganyane iron ore mine (TBC, 2025a).

1.3 Recommended Post-Closure Land Use

Land capability refers to the potential of the land to support one or more land uses, and is determined mainly by the numerous chemical, physical and biological properties of the soil and other factors like climatic and topographical constraints. There are four categories into which land can be classified, namely wilderness, wetland, grazing and arable. The pre-mining land capability provides the basis on which the post-mining land use capability targets are set. The mine operator is expected to ensure that mining operations do not reduce land capability and should aim to have the same proportion of wilderness, wetland, grazing and arable areas as the pre-mining state (LRSSA, CoalTech & MCSA, 2018).

In order to adequately identify site specific rehabilitation activities, the post-mining land use must be defined. The preferred post-mining land use for the proposed Makganyane mining area has been determined through consideration of the Soil, Land Use and Land Capability Assessment (ZRC, 2025), the Freshwater Ecosystem Assessment (SAS, 2025), the Biodiversity Assessment (STS, 2025a), the Terrestrial Biodiversity Floristic Assessment (STS, 2025b) and the Terrestrial Biodiversity Faunal Assessment (STS, 2025c) which are summarised in Section 3. Analysis of these assessments indicates that the target post-mining and closure land use should be a wilderness ecosystem with its component terrestrial and freshwater ecosystems that are present in the pre-mining footprint. The Makganyane Rehabilitation, Decommissioning and Closure Plan has been prepared with the target land use being a wilderness ecosystem which is similar to the pre-mining wilderness ecosystem.

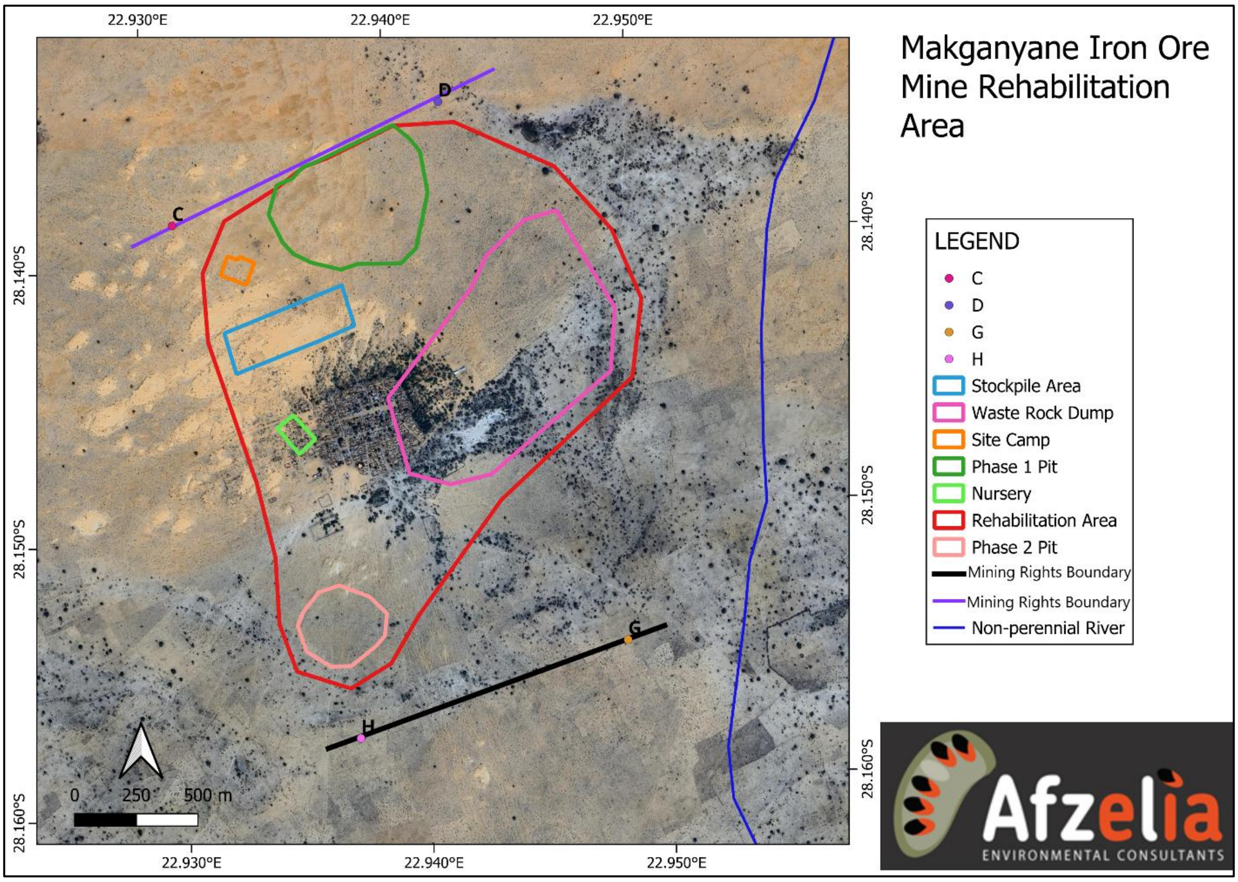


Figure 2: The Rehabilitation Area on which the Rehabilitation, Decommissioning and Closure Plan is based.

1.4 Aim & Objectives of the Rehabilitation, Decommissioning & Closure Plan

The aim of the Rehabilitation, Decommissioning and Closure Plan is the successful rehabilitation of the 264 ha mine rehabilitation area to its wilderness post-closure ecosystem that existed in the pre-mining footprint (Figure 2). This aim has the following objectives:

- Minimise negative impacts within the clearly demarcated mining footprint.
- Prevent negative impacts outside of the clearly demarcated mining footprint.
- Remove all equipment, infrastructure and materials that were introduced during the mining operation.
- Reshape mining footprint topography that is similar to the pre-mining footprint with gradients and other topographical features which are within the natural range and constitute a stable sustainable landscape, suitable for a wilderness ecosystem. This excludes pit 1 and 2 and the waste rock hill which will be new topographical features.
- Shape and develop pit 1 and 2 and the waste rock hill to form stable sustainable landscape features with acceptable gradients that minimise erosion and maximise development of the wilderness ecosystem.
- Remove unsafe edges in pit 1 and 2 and on the waste rock hill.
- Ensure adequate ameliorated (non-toxic and unpolluted) non-compacted topsoil and subsoils that enable the growth and prosperity of indigenous plants from the nursery found in the pre-mining footprint. Recommended soil physical and chemical testing and possible amelioration during final rehabilitation will ensure that this component is satisfied.

- Ensure absence of visible erosion in the mining area or downslope of the area as a result of mining, and absence of significant erosion risk after successful implementation of the recommended erosion risk assessment and management plan.
- Ensure absence of water pollution or toxicity in pit 1 and 2.
- Ensure absence of water pollution or toxicity in monitoring boreholes in the mining right area and in boreholes on neighbouring farms.
- Eradicate all alien and invasive plants in the 264 ha rehabilitation area.
- Effectively implement all mitigation and management measures recommended in this rehabilitation plan, including those recommended by specialists: Soils (Appendix 1), waste rock (Section 3.6), geohydrology (Appendix 2), surface hydrology (Appendix 3), storm water management plan (Section 3.8), freshwater ecosystem (Appendix 4), terrestrial floristic biodiversity (Appendix 5), and terrestrial faunal biodiversity (Appendix 6).
- Address potential ongoing, residual and latent rehabilitation risks through the effective implementation of mitigation and management measures to minimise or preferably prevent their occurrence after mine closure.
- Attain the rehabilitated 264 ha rehabilitation area in terms of a stable sustainable wilderness ecosystem with its terrestrial and freshwater ecosystems, habitats, and indigenous plant and animal species that are representative of and similar to those in the pre-mining footprint with respect to diversity, richness and quality. The recommended vegetation, faunal and ecosystem assessment before closure will determine when this ecological state has been attained.

1.5 Assumptions & Limitations

The following assumptions and limitations are applicable to the Makganyane Rehabilitation, Decommissioning and Closure Plan:

- It is assumed that all information received from the client, Greenmined (Pty) Ltd, is relevant, accurate and correct.
- It is assumed that all the specialist reports are accurate and correct.
- It is assumed that assumptions used to generate models, for example in the geohydrological and surface water hydrological assessments, are realistic and accurate.
- It is assumed that the impact or risk assessments contained in the various specialist reports are accurate and that mitigation measures are realistic and implementable.
- The Rehabilitation Area has been determined based on the accuracy and correctness of information provided by the client and information contained in the specialist reports (Figure 2).
- Essential detailed information is lacking for topsoil and subsoils in the Rehabilitation Area that is vital for the success of the Makganyane Rehabilitation, Decommissioning and Closure Plan, such as the quantity of available topsoil and subsoils.
- No information has been provided for the extremely difficult operation of extracting very shallow topsoil and subsoils from the mining footprint.
- No information has been provided for the updated location of haulage and internal roads.

2 MINE PLAN & INFRASTRUCTURE

The following description is based on the undated Mining Work Programme submitted for a mining right application for the Makganyane iron ore mine by Assmang (Pty) Ltd to the Department of Minerals and Petroleum Resources (Assmang, undated).

Assmang (Pty) Ltd intends to mine iron ore through open pit mining methods. The iron ore is located 40 m below the surface. The property area to be included in the mining application is 1,549.64 ha which is inclusive of all associated infrastructure and roads.

Mining will take place in two phases encompassing a total of two open pits, pit 1 and pit 2 (Figure 2). The waste rock dump (WRD) has been designed to impound the total waste volumes for pit 1 (phase 1) and 2 (phase 2) and for possible future mining in phase 3 and 4. A 35% swell factor has been assumed for the waste rock. Pit 1 will be mined first along with the establishment of the WRD. The extent of pit 1 is approximately 25.38 ha. Once mining in pit 1 has been completed, pit 2 will be mined, with the WRD expanding. The extent of pit 2 is 8.39 ha. The mining of pit 1 and 2 will be completed in 38 months. The pits will require aggressive waste stripping to reach the ore horizon. Waste stripping will continue up to 28 months. Thereafter stripping will decline to month 38, which marks the end of the life of the mine.

The preliminary layout of the mining area is as follows:

- Internal roads: The location and layout of internal roads, including haulage roads, needs updating.
- Site Camp and Office Complex (±1 ha): To be rehabilitated.
  - Ablution facilities: Draining into a closed system septic tank that will be removed during the closure phase.
  - Diesel depot: Diesel tank with bund.
  - Equipment workshop: Container.
  - Office containers.
  - Parking area with possible car ports.
  - Planning / meeting rooms: Containers.
  - Security access control: Control hut is already present at the Makganyane farm gate.
  - Water reservoir: Water tanks.
  - Wash bays: Draining into an oil separator that will be cleaned and decommissioned during the closure phase.
- Stockpile Area (±9 ha): To be rehabilitated.
  - Crushing plant: To be demolished during the closure phase.
  - Weigh bridge and control room: To be demolished during the closure phase.
- Excavations (±36 ha): To be rehabilitated.
  - Pit 1 (±25.38 ha).
  - Pit 2 (±8.39 ha).
- Waste Rock Dump (±61 ha): To be rehabilitated.
- Stormwater Structures: To be removed during the closure phase.

- Stockpile area evaporation dam (±0.3 ha; 12.057 ML capacity.
- Waste Rock Dump evaporation dam (±1.7 ha; 67.723 ML capacity.
- Stormwater sump in pit 1 and in pit 2.
- Diversion channels.
- Silt fences.

The following methodology will be employed for the open pit mining:

- Bush-clearing and topsoil stripping: The area to be mined will be cleared by a tracked dozer for ground levels to be established. Topsoil will be stripped and placed in stockpile berms on the highwall side. Any topsoil which cannot be dozed will be removed by load and haul using an excavator and dump trucks.
- Establishment of ramps: Ramps will be developed to establish the initial access to the ore body and will be inclined at 8% for each pit.
- Removal of overburden: Overburden will be excavated using large excavators and dump trucks and will be transported to the waste rock dump which lies between pit 1 and pit 2 (Figure 2).
- Within the mining boundary, internal and haul roads will be developed to establish access between the operational areas and the ore bodies. Where possible, the existing road network developed during the prospecting phase will be utilised for the mining operation. Certain sections of the road network will however require upgrading, which will involve the placement of suitable material sourced from the waste rock dump, end-tipped in a single layer, and then levelled and graded. Topsoil and subsoils must be stripped first and stored in the stockpile area. No tipping of material on topsoil will be conducted. Road development will adhere to the mitigation measures applicable to the operation and maintenance of crossings withing the episodic drainage lines (EDLs) proposed by the specialists and incorporated into the environmental management programme (EMPr). It is proposed that the internal roads will have an approximate width of 9 m. The Water Use Licence Application will include the crossing of EDLs as part of the DWS application.
- Drilling and blasting: Hard overburden will be drilled and blasted in 10 m benches. All blasted material will be excavated and transported to the waste rock dump.
- Ore mining: This will take place in three shifts per day using excavators and dump trucks for hauling. Drilling and blasting will take place using vertical drills and explosives.
- Ore which has been mined will be screened for size on site via a mobile crusher located in the stockpile area. The screened ore will be stored in the stockpile area temporarily until it is transported via the R385 road to the Beeshoek crushing plant. This plant is located approximately 18 km south-east of the proposed Makganyane mining area. Once processed at the Beeshoek plant, the concentrate will be transported from the Postmasburg area to ArcelorMittal's Vanderbijlpark and Newcastle operations through a combination of rail and road transport.
- Rehabilitation: This will take place progressively and has been appropriately costed for in the financial provisioning.
- A water tanker will be available to water the haulage roads for dust suppression. Some water will also be used by the offices for general application.

- Vital water in this semi-arid area will be required for the nursery and during the entire revegetation phase until the target wilderness ecosystem has been established during rehabilitation.
- The mining operation will make extensive use of diesel operated machinery such as cranes, trucks, excavators, graders, forklifts and service trucks.
- The workshop in the site camp will hold spare parts for the maintenance of machinery and will include hand tools, lubricants, cleaning materials, paints, gland packing, fasteners, hydraulic hoses, test instruments, safety equipment and office stationery.

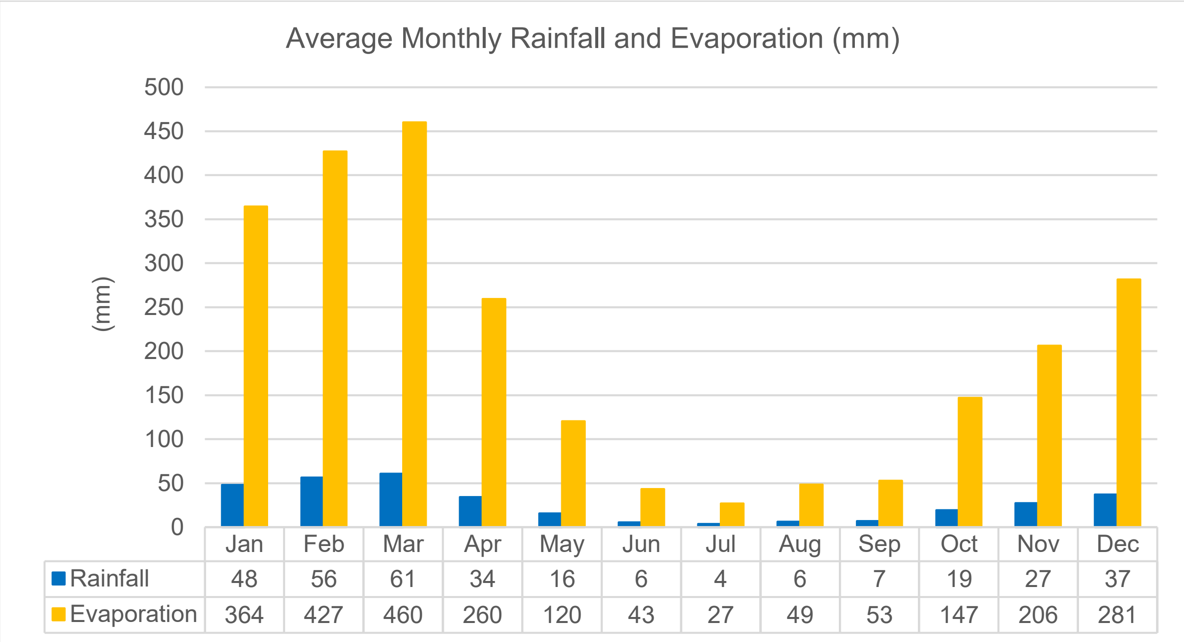
3 ENVIRONMENT

3.1 Topography

Analysis of satellite imagery shows that the proposed mining area and rehabilitation area (Figure 2) are composed of low hilly terrain with lower lying areas towards the north-east, notably the north-eastern waste rock dump area (Google Earth, 17/03/2023). The hilly terrain ranges from 1,244 in the south-west to 1,376 meters above sea level (MASL) in the vicinity of pit 1, which is the highest point in the area (TBC, 2025a). Moderate slopes dominate the area, interspersed with gently sloping topography. Three episodic drainage lines are found in the central-western and south-western areas that drain westwards, while seven preferential flow paths are present from the north to the south, five of which drain eastwards, and two of which drain north-westwards (TBC, 2025a).

3.2 Climate

The proposed mining and rehabilitation area has a semi-arid climate which is critically important to emphasise in terms of rehabilitation challenges, especially revegetation.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	48	56	61	34	16	6	4	6	7	19	27	37
Evaporation	364	427	460	260	120	43	27	49	53	147	206	281

Figure 3: Mean monthly rainfall and evaporation for the proposed mining and rehabilitation area (TBC, 2025a).

Summers (October – March) are sunny and hot (Mean daily maxima: 28-31˚C), while mild cooler and sunny conditions prevail during winters (May – August: Mean daily maxima: 19-22˚C). Cold days and nights with frost occur during winters (Mean daily minima: 3-7˚C). A low mean annual precipitation (MAP) of 323 mm is recorded for the area (TBC, 2025a). The following important information is evident in Figure 3: Rain falls predominantly during hot summers as brief afternoon electric storms (October – March: 19 mm – 61 mm), with autumn (April) also recording 34 mm (Figure 3). Low rainfall occurs during winter (May – August) and during spring (September).

A very high mean annual evaporation (MAE) of 2,450 mm characterises the area (TBC, 2025a), with increasing high values during the advancing summer (October – March: 147 – 460 mm), and an appreciable level in autumn (April: 260 mm; Figure 3). It is clear that far greater evaporation occurs in the area than rainfall during all months of the year, when a net environmental moisture deficit prevails. Evapo-transpiration is very high in excess of 2,200 mm/year (Groundwater Complete, 2025).

3.3 Geology

Assmang (undated) provides the following geological description of the proposed mining area: The area consists of a basement of the Campbellrand Subgroup of the Maremane dome dolomites. In the core of the dome, erosion has laid bare to the Gamagara quartzites, which are overlain on all sides by banded jaspers of the Koegas Subgroup. The quartzites have been crushed and turned into a glassy-looking purplish rock near the contact with the over-riding banded jaspers, which are at least 30 m thick. The latter have been finely granulated along the contact and pass upwards through more and less brecciated varieties onto the normal banded or thickly bedded jaspers, dipping gently to the west and to the east. The Gamagara quartzites represent remnants, originally laid down on the Dolomite or Koegas beds and which have probably taken part in previous horizontal movement. Most of the iron ore occurs as hematite clasts in the lower Doornfontein Member of Gamagara Formation overlaying the blinkklip breccia and Cambellrand dolomite. Manganese mineralization with a high iron percentage content occurs most often below the iron ore and in a few areas above the iron ore.

Numerous faults and/or igneous intrusions (dykes) occur throughout the proposed mining and rehabilitation area with drilled exploration boreholes intersecting highly brecciated areas composed mainly of the banded iron formation, shale and quartzite at depths of between ±30 and 300 meters below the surface (Groundwater Complete, 2025).

3.4 Soils & Land Capability

The Soil, Land Use and Land Capability Assessment Report for the proposed Makganyane iron ore mine reveals the following information that is important for the Rehabilitation, Decommissioning and Closure Plan (ZRC, 2025).

Purpose

The study evaluates the impact on the soil, land use, land capability, and land potential associated with the proposed Makganyane iron ore mine. It assesses agricultural and environmental aspects by analysing dominant soil forms, soil physical properties, current landscapes, land uses, and climatic conditions in the context of land potential, agricultural potential and productivity.

Study Area & Environmental Setting

The overall mining right area (MRA) is approximately 1,549.61 ha, consisting of multiple portions of the farm Makganyane No. 667, located approximately 24 km northwest of Postmasburg, ZF Mgcawu district, Northern Cape Province, South Africa. This assessment focuses on pre-selected areas within the farm boundaries, including a 200 m buffer area. The MRA has a semi-arid climate (Mean Annual Rainfall - MAR: ~ 300 mm, Mean Annual Evaporation - MAE: > 2400 mm).

Soil & Land Capability Classification & Outcomes

The site assessment and soil survey were conducted without specific dates provided, where the focus area was found to be dominated by bushveld vegetation, wilderness/wildlife, and open grasslands. No commercial agricultural activities were observed within a 5 km radius of the focus area. Soil forms identified within the focus area include Mispah/Glenrosa, Mispah, Glenrosa, Clovelly, Witbank, and Cullinan; of which Mispah/Glenrosa and Mispah soil forms were most dominant, occupying 69.62% and 18.24%, respectively. These soils are typically shallow and not adequate for agricultural use. Hutton soils were observed to cover only 1.51% or 5.5 ha. Mispah/Glenrosa soils dominate the proposed mining footprint followed by Mispah soils and then Glenrosa soils (Figure 16, ZRC, 2025).

According to the Natural Agricultural Resources Atlas of South Africa (NAR Atlas Manual), the MRA is not located within any protected agricultural areas and the grazing potential of the focus area was found to be insufficient to support commercialized livestock farming (~14 ha/LSU). Google Earth imaging revealed no previous agricultural cultivation in the focus area for the past 5 years. Although some soil forms display good agricultural potential (e.g., Hutton), the climatic constraints (low MAR, high MAE) of the MRA limit the viability of the soils. The Glenrosa and Mispah soil forms dominate the MRA, comprising of approximately 85% of the focus area, making it more suitable for wilderness. This has little impact on agricultural productivity or food security on local, regional, or national scales.

Overall Conclusion

The Department of Fisheries, Forestry, and the Environment (DFFE) national screening tool initially flagged the focus area as having medium sensitivity to impact. However, the field survey found a low agricultural sensitivity due to factors such as poor soil quality and climatic conditions which restrict potential agricultural productivity. Therefore, the overall impact of the proposed Makganyane iron ore mine is expected to be low in terms of soil and agricultural land capability. Although the impact may not be significant in a local or regional setting, the proposed Makganyane iron ore mine will impose effects on the environment over time. As a result, recommendations were made for implementation of mitigation measures to minimise impacts on the soil.

Mitigation measures for the Soil, Land Use and Land Capability Assessment are shown in Appendix 1.

3.5 Erosion Potential

With substantial substrates being exposed without indigenous vegetation cover during the mining operation, the water and wind erosion potential will be high, despite the low rainfall.

3.6 Waste Rock Classification

The Waste Classification and Assessment Report for the proposed Makganyane iron ore mine provides the following information that is important for the Rehabilitation, Decommissioning and Closure Plan (IQS, 2025).

Purpose & Scope

The assessment evaluates the expected waste rock from the Makganyane iron ore mine to determine classification, leachability, and environmental risk. The findings inform risk-based design, operational controls, and monitoring requirements for rehabilitation and closure.

Material Characteristics & Geochemistry

The waste rock is predominantly quartz and hematite with minor iron-bearing phases; one composite includes approximately 5% MnO. Importantly, acid generation potential is low: total sulphur is <0.13%, and both ABA/NAG tests confirm non-acid forming material (NAG pH 6.3–6.5; NAG at pH 4.5 ≈ 0 kg H2SO4/t). Leachability is generally low, with ASLP leachates largely below detection and South African water quality guideline thresholds; manganese exceeded guidelines in a single sample (MK0240) only.

Classification Outcome & Implications

Under GHS, the material is not hazardous. For South African waste regulations (GN R. 635 as amended by GN 5522 of 2024), some total concentrations exceed TCT0 (Ba, Co, Ni, Mn; with Mn >TCT1 in MK0240), yet all leachables are ≤LCT0. Consequently, the waste classifies as Type 4. Practically, this supports a risk-based barrier design and indicates that no acid drainage controls are required beyond standard stormwater and seepage management.

Environmental Setting & Receptors

The site lies in a semi-arid climate (MAP 300–400 mm; MAE >2400 mm) over a minor aquifer system with groundwater typically ~25 m below ground level. The nearest surface receptor is an unnamed stream roughly 750 m east of the proposed waste rock dump. No sensitive watercourses intersect the footprint, although local groundwater supports domestic and livestock use and should be protected accordingly.

Risk Evaluation

Considering the low leachability, arid conditions, and distance to receptors, the overall risk to groundwater, surface water, and human/ecosystem health is assessed as low across construction, operation, and decommissioning. Short-term runoff and leachate are expected to meet domestic, agricultural, and aquatic guidelines, noting a watchpoint for localised manganese mobilisation.

Rehabilitation & Closure Controls

To keep risks low and verifiable through time, the following mitigation and monitoring measures are recommended:

- Design and infrastructure:
  - Implement risk-based lining/seepage control consistent with Type 4 waste and local hydrogeology.
  - Separate clean and dirty water; provide robust stormwater diversions and erosion control; maintain stable dump geometry.
- Monitoring:
  - Install and monitor down gradient groundwater boreholes; sample the unnamed stream when feasible.
  - Track manganese as a watch list parameter given the isolated exceedance.
- Adaptive management:
  - Update numerical/geochemical models every 2–3 years using monitoring data.
  - Define triggers and corrective actions if trends indicate rising risk.
- Closure outcomes:
  - Shape the final landform and cap to limit infiltration and erosion.
  - Maintain post closure water quality monitoring to confirm long term performance.

Overall Conclusion

In conclusion, the rehabilitation strategy will prioritise stable landforms, reduced infiltration, and sustained protection of groundwater and surface water, consistent with the material's Type 4, non-acid forming profile.

The waste rock is non-acid forming, non-hazardous, and classified as Type 4 with low leachability. With standard engineered controls, effective stormwater management, and routine monitoring, environmental risks are low and manageable throughout operations and into closure. Continued verification and targeted response, particularly for manganese, will ensure performance remains within acceptable limits.

3.7 Geohydrology

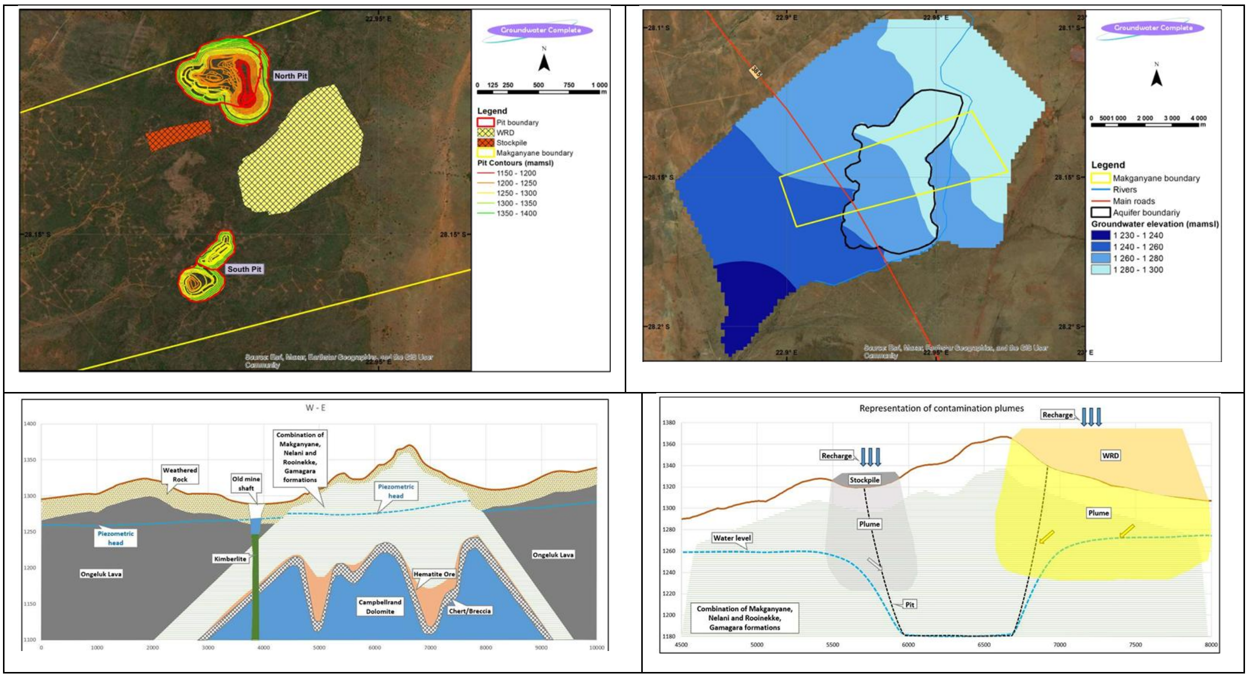
Geohydrological Report for the proposed Makganyane iron ore mine provides the following information that is important for the Rehabilitation, Decommissioning and Closure Plan (Groundwater Complete, 2025).

- The lowest surface elevation of approximately 1,250 meters above mean sea level (mamsl) occurs near a tributary to the south/south-west of the proposed mining area, while the highest elevations are found in the hills in the centre of the farm at approximately 1,360 mamsl.
- The Soutloop River and its numerous tributaries that cut through the project area are non-perennial and only experience any flow during and directly after a significant rainfall event.
- The project area is located within the D73A quaternary catchment, which covers an area of just over 3,200 km^2.
- The mean annual precipitation for the project area is in the region of 320 mm.
- Evapotranspiration is very high in excess of 2,200 mm/year.
- The project area has a net environmental moisture deficit for the entire year.
- Numerous faults and/or igneous intrusions (dykes) occur throughout the project area and are of significant importance to the geohydrology. Few of the structures seemed to act as either prominent barriers for horizontal groundwater flow, or as preferred flow paths for extended distances.
- Exploration boreholes drilled in the Makganyane area intersected highly brecciated areas (mainly banded iron formation, shale and quartzite) at depths of between ±30 and 300 meters below surface. From a geohydrological perspective, these areas are of significant importance as they have the potential to yield significant volumes of groundwater.
- A total of 98 boreholes were located during the hydrocensus.
- Agriculture and livestock watering are the main water uses in the area.
- The Makganyane area is underlain by two distinct and very different aquifers.
- The first of the aquifers exists in the eastern and western flatter areas of the Makganyane property. The host rocks of the aquifer are the andesitic lavas of the Ongeluk Formation.
- The second aquifer present in the Makganyane area is the aquifer that exists mainly in the planned mining area. This aquifer exists predominantly in a specific layer, namely the chert-breccia layer.
- Topographical highs and lows were used to approximate no-flow boundaries for the model.
- In the Makganyane area, surface topography does not have a linear relationship with groundwater elevation.

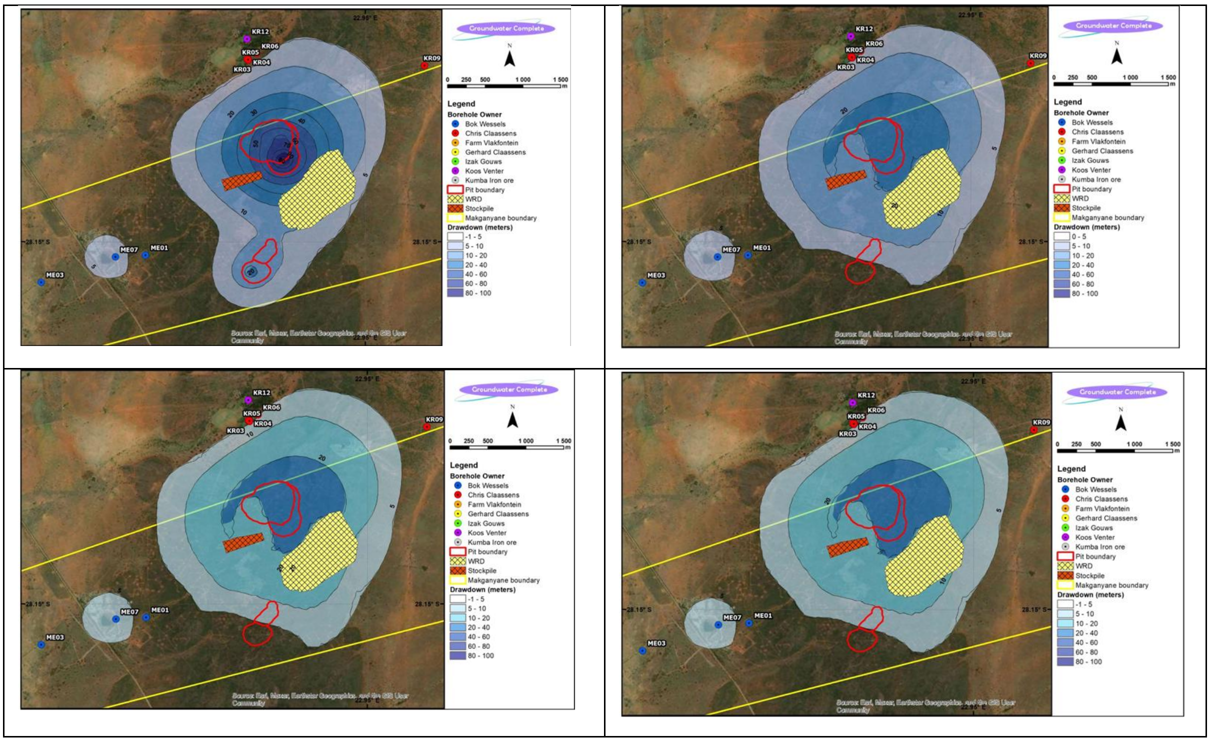
- Groundwater levels in the flatter areas to the west of the hills varied between 7 and 22 meters below surface (mbs), while the water levels to the east of the hills varied between 18 and 28 mbs.
- The groundwater levels in the hilly proposed mining area were markedly deeper, ranging between 30 and 100 mbs.
- The lowest measured static groundwater elevation of approximately 1,237 meters above mean sea level (mamsl) occurs in the down gradient groundwater flow direction towards the south/south-west, while the highest elevation of ±1,289 mamsl is found in the hills in the centre of the mining rights area.
- By substituting the hydraulic head difference over lateral distance, average hydraulic gradients were calculated to be in the order of 0.0042 or 0.42%, which were then used to calculate the rate of groundwater movement (the so-called 'Darcy flux') in the project area.
- By making use of these values, the average rate of flux in the project area was calculated to be in the order of 4.8 meters per year.
- Due to the highly varying nature of aquifers that are present in the Makganyane area, the groundwater flow calculated for this report only represents a regional average flow velocity and direction. Flow velocity and direction both vary significantly if tested more specifically on a smaller scale.
- The project area achieved a score of 6 and the underlying aquifer can therefore be regarded as having a medium vulnerability.
- The GQM rating for Makganyane is 8, which indicates a high level of protection.
- After consideration of all the data collected by conducting the slug tests and constant rate tests, the following summary of conclusions was drawn:
  - Two different aquifers exist in the Makganyane area.
  - The aquifer where mining activities will be concentrated is a highly heterogeneous aquifer with hydraulic parameters varying significantly over short distances.
  - The aquifer to the east and west of the hills has shallower water levels and is expected to have a higher groundwater yield, however, very few boreholes were pump tested. The two aquifers are poorly connected to each other.
  - The matrix transmissivities of the aquifer in the hills range from 0.08 to 57 m^2/d.
  - The aquifer provides little to middling volumes of water.
- An average recharge of 2% was calculated with the Chloride Method, which is in line with the 1.8 - 2.4% range of Vegter.
- Based on all the gathered information and experience from previous studies in similar areas, the mean annual recharge to the aquifer regime in the Makganyane area was assumed to be in the order of 2% or 6.5 mm/a.
- Groundwater is considered to be of good quality and also suitable for human consumption according to the South African National Standards for drinking water (SANS 241:2015).
- Groundwater samples were collected from a total of 20 boreholes located on and around the Makganyane property.
- Groundwater samples were taken from 10 of the pump testing boreholes.
- Among the hydrocensus boreholes, samples were taken from 10 boreholes in use for domestic or livestock watering purposes and located closer to mining operations.

- Two samples were taken from the old Kimberlite shaft at different depths.
- Groundwater total dissolved solid concentrations measured in the site-specific groundwater user boreholes vary between 330 mg/l and 590 mg/l and are within the normal range for this arid region.
- The highest nitrate concentrations measured during this study are around 7 mg/l.
- Groundwater magnesium concentrations are relatively low and vary between ±27 mg/l and 64 mg/l.
- Boreholes display groundwater chloride concentrations of between approximately 8 mg/l and 68 mg/l.
- Since no mining occurs within the immediate vicinity of any of the hydrocensus boreholes, the elevated nitrate concentrations are believed to originate from areas where livestock congregate in significant numbers (feedlot, kraal, etc.).
- Groundwater within the Makganyane area is dominated by calcium and magnesium cations, while bicarbonate alkalinity dominates the anion content.
- The concentrations of groundwater parameters measured in the old Kimberlite pit were largely similar to the qualities measured in the other Makganyane boreholes.
- None of the concentrations exceeded the SANS 241:2015 guidelines for drinking water purposes.
- The only difference between the concentrations measured in the Kimberlite pit versus the surrounding area is slightly higher concentration of sodium, magnesium and potassium which are likely due to higher evaporation.
- For a negative groundwater quality impact to be registered, the following three components should be present:
    - A source to generate and release the contamination.
    - A pathway along which the contamination may migrate.
    - A receptor to receive the contamination.

In the figure below, the following aspects are shown: Envisaged contours of the mine voids (top left), modelled aquifer extent with groundwater elevation (top right), vertical cross section through the project area (bottom left), and conceptual vertical pollution plume with groundwater level of the final mining void (bottom right).

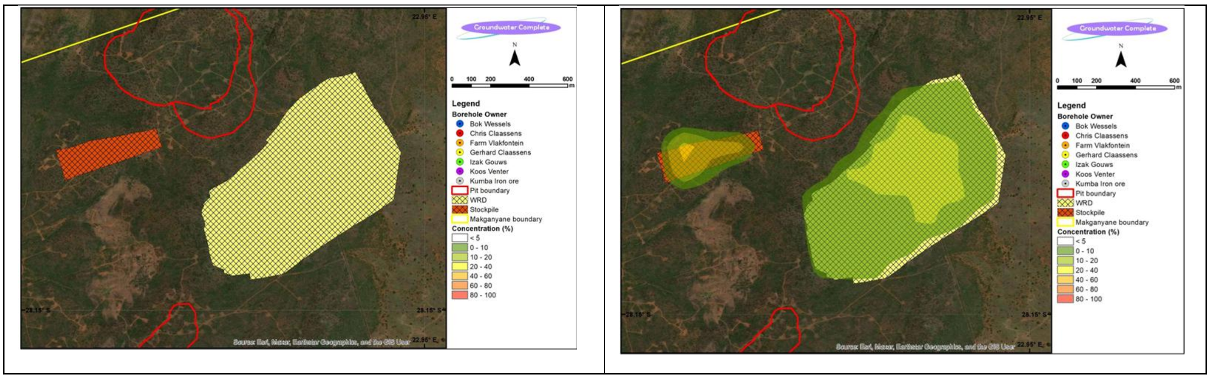


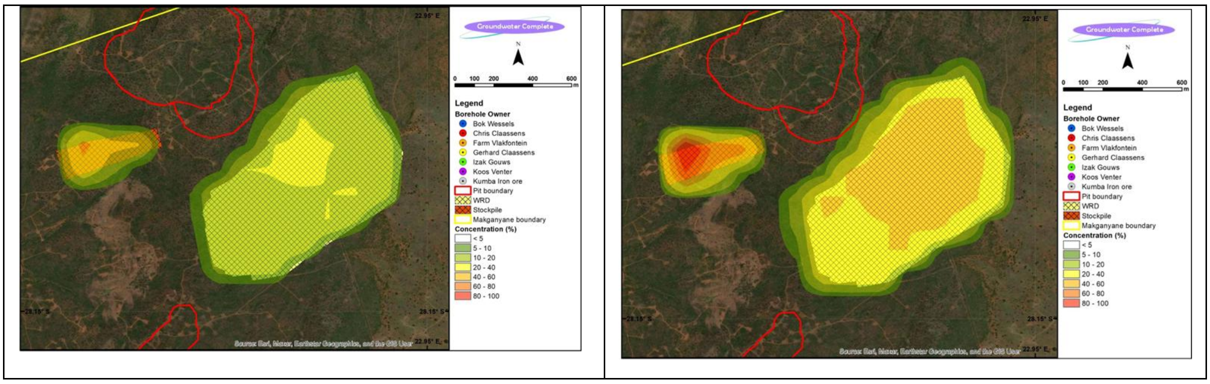
The impact on groundwater levels is presented in the figure below showing the model simulated groundwater depression cone at mine closure (top left), at 20 years (top right), at 40 years (bottom left), and 100 years after closure (bottom right).



The dewatering design accounts for 307 m³/d and 110 m³/d for the direct rainfall runoff of pit 1 (north pit) and pit 2 (south pit) respectively. The dewatering design volumes for pit 1 start at 460 m³/d, peak at 991 m³/d, and end with 668 m³/d over 7 annual quarters, compared to pit 2 where the amounts start at 28 m³/d, peak at 187 m³/d and end with 156 m³/d over four annual quarters.

In the figure below, groundwater quality is modelled showing a simulated contamination plume at mine closure (top left), at 20 years (top right), at 40 years (bottom left), and 100 years after closure (bottom right).





The main activities of the proposed mine that may have an effect on groundwater quality and/or quantity include:

- Generation of stockpile and waste rock dump (deposition of potential leachate forming material) – LOW RISK
- Excavation of the pits (creation of a void for groundwater to flow into) – MEDIUM RISK
- Waste water generation and management (Production of waste in the form of sewage) – LOW RISK

	Generation of stockpile and WRD		Excavation of the pits		Waste water generation and management	
	No mitigation	With mitigation	No mitigation	With mitigation	No mitigation	With mitigation
Significance/Risk	6.4	4.8	32	N/A	6.4	3.2
Risk Class	Low risk	Low risk	Medium risk	N/A	Low risk	Low risk

No cumulative adverse groundwater quality and/or quantity impacts are expected because of the following reasons:

- The hydraulic groundwater flow parameters are too low; and
- The short four-year life-time proposed for the mine will cause flow or mass transport impacts to reach a steady state well before they reach the surrounding mining operations.

The groundwater monitoring program includes monitoring areas for pit 1 (north pit), pit 2 (south pit), waste rock dump, and stockpile area, focusing on monitoring water levels for the pits and inorganic compounds. The office latrine requires an additional borehole for bacteriological monitoring. Borehole water analysis should be performed every six months by a SANAS accredited laboratory. Maintenance principles for monitoring boreholes are provided, including the removal of vegetation around the boreholes on a regular basis.

Geohydrological mitigation measures are shown in Appendix 2.

3.8 Surface Hydrology & Storm Water Management

The Hydrological Assessment (TBC, 2025a) and Storm Water Management Plan (TBC, 2025b) for the proposed Makganyane iron ore mine provide the following information that is important for the Rehabilitation, Decommissioning and Closure Plan.

Surface Hydrology

General

Limitations to the study include caution being drawn to the use of overall low-resolution elevation data utilized (supplied by the client), as well as the generated flood line, which is only to be used for indicative and environmental planning purposes and not for engineering designs. Approximately 116 ha, excluding the road network, will be directly impacted. A site visit was conducted in April 2025.

The site is located within the Quaternary Catchment D73A in the Vaal-Orange Water Management Area (WMA 4); has mean annual precipitation of 323 mm and evapotranspiration demand of 2,450 mm; and falls within the D7C rainfall zone and the 7A evaporation zone. Elevation ranges from 1,244 in the south-west to 1,376 MASL in the vicinity of Pit 1. Natural precipitation is drained immediately following significant rainfall events via a non-perennial tributary in the east, draining southwards into the Soutloop River some 57 km downstream, and smaller non-perennial drainage lines and preferential flow paths radially draining outwards from the centre of the site.

The design rainfall, a probabilistic representation, was determined using the Rainfall Utility Tool providing the output rainfall, of which the 90 percent upper value was utilised, sensitising risks accounted for by climate change variability and type of infrastructure of the proposed mine. The 24-hour design rainfall depth of 134.9 mm utilized was that of the 1:50-year recurrence interval.

Water quality analysis presented elevated levels of Chlorine and Ammonium within the Kimberlite shaft, the only surface water resource containing any water during the survey period.

Design flood peaks were derived from elevations extracted from Google Earth and run through the PCSWMM, applying the watershed delineation function, revealing the site representing the headwaters crest to mid-slope of the western catchment extent.

Table 5-1: Catchment Parameters (from hydrological report).

Catchment Parameters	C1
Catchment Area (km^2)	39.38
Length of Longest watercourse (km)	8.2
Mean Annual Precipitation	323
Slope (m/m)	0.015
% of catchment underlain by dolomite	0
Curve Number (HEC-HMS Method)	83
Rainfall Distribution (HEC- HMS Method)	Type 3
SDF Basin Used	13
Kovacs Region Used	K1

Design flood peaks to determine the 100-year flood lines included the Rational Method, HEC-HMS model, and SCS-SA Empirical methods (RMF and M&P). The highest peaks were utilised. Only the non-perennial tributary was afforded a 100-year flood line delineation.

Table 5-3: Design Flood Values (from hydrological report).

Catchment	Return Interval	HEC-HMS (m^3/s)	SCS-SA (m^3/s)	SDF (m^3/s)
C1	1:100-year	49.64	75.48	**81.87**

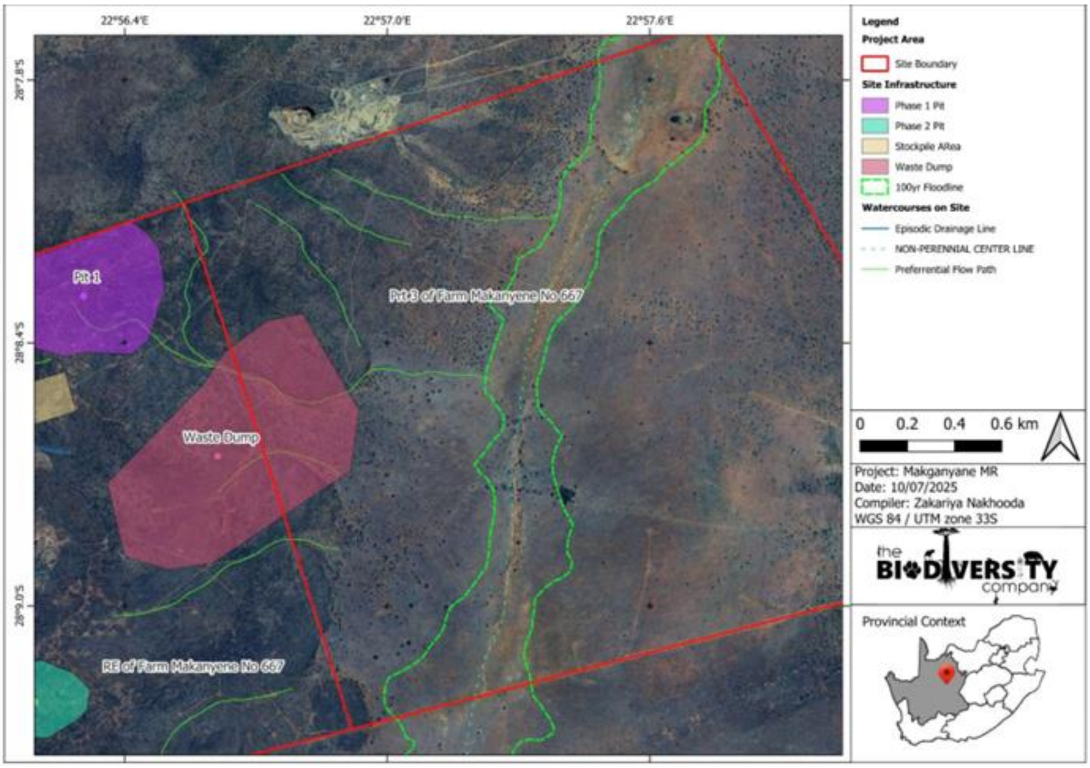


Figure 6-1: 1:100-year Floodline (from hydrological report).

Surface Hydrological Impact Assessment

The hydrological impact assessment covered the following potential impacts during the construction phase: (i) clearing of vegetation for mining operations; (ii) water quality including (a) sedimentation, (b) domestic waste and sewage, and (c) hydrocarbons and hazardous materials; (iii) destruction of riverine habitat; and (iv) alterations to the natural hydrological flow regime. After applying mitigation measures, the significance of potential impacts is as follows respectively:

i) Medium
ii) (a) Low-Medium
(b) Low
(c) Low
(iii) Medium
(iv) Low-Medium

Operational phase potential impacts are as follows: (i) water quality due to (a) sedimentation, (b) discharge from operations, (c) domestic waste and sewage, (d) hydrocarbons and hazardous materials; and (ii) alterations to the natural hydrological flow regime (a) increased runoff. After applying mitigation measures, the potential impacts respectively are as follows:

i) (a) Low-Medium
(b) Low
(c) Low
(d) Low
ii) (a) Low-Medium

Recommendations

These include:

- The installation of a competent Environmental Control Officer to oversee the construction, operation and rehabilitation phases of the project with watercourse as a priority.
- An erosion Risk Assessment and Management Plan is completed and implemented to facilitate for erosion risk management throughout the entirety of the project lifecycle.
- The implementation of an active rehabilitation plan during the life of the mine and post-decommissioning.
- The implementation of an active remediation plan that encompasses all types of pollution events associated with a mine.

Conclusion

No activities should be undertaken within the 1:100-year flood line area which must be clearly marked. The risk and impact statement identified "Low" and "Medium" post-mitigation risks to the identified watercourses. Achieving "Low" ratings depends on effective mitigation measures, addressing stormwater management, erosion and sedimentation prevention, proper chemical use and storage, rehabilitation of disturbed areas, prevention of runoff into water resources and their buffers, and restricting heavy vehicle operations within specified zones.

Surface hydrology mitigation measures are shown in Appendix 3.

Storm Water Management Plan

Project Scope

A Stormwater Management Plan (SWMP) was commissioned for the proposed Makganyane iron ore mine, located on the farm Makganyane (approximately 24 km northwest of Postmasburg, Tsantsabane Municipality, Northern Cape Province, South Africa). The purpose of the SWMP is to mitigate potential impacts of the proposed mining project on surface water resources by managing and preventing contamination of water sources from surface runoff generated onsite, through separation or containment of runoff. This was achieved in compliance with the National Water Act (Section 2, NWA, Act No. 36 of 1998). The NWA ensures water resource management achieves sustainable use and protection of the nation's quality water resources for the benefit of all water users.

Legislation

The desktop review aimed to identify areas that are potentially categorized as clean or dirty relative to surface runoff generated onsite and their consequent isolation. Therefore, the SWMP was developed considering the following guidelines which support the NWA, Section 26, regulating activities that impact a water resource and its conservation and protection:

- Department of Water and Sanitation (DWS) Government Notice No. 704 (GN704) (June 1999), with specific reference to the following:
- Regulation 4: Indicates the regulated distance to a water course (100-year flood line or 100 m)
- Regulation 6: Describes capacity requirements of clean and dirty water systems for 1:50 year floods and freeboard of 0.8 above full storage capacity of retention features.
- Regulation 7: Measures which must be taken to protect water resources, such as not permitting contamination of water resources.
- DWAF (now DWS) Best Practice Guidelines (BPGs).
- BPG G1 - Storm Water Management.
- BPG A4 - Pollution Control Dams.

Assumptions & Limitations

The results were based on outcomes from a standardized hydrological assessment and historical information of the catchment. It was assumed that run-off from the pit area will flow towards the lowest points of the pit, forming a sump. The pit sump design accounts for both surface runoff and decant, but were mainly sized considering the larger volume (surface runoff), assuming the sump is kept empty (full storage capacity). It is important to note that the report has been compiled based on information provided by the client, and that stormwater infrastructure herein is for the purpose of environmental planning, not engineering designs.

Hydrological Assessment & Outcomes

A site walkover was conducted on April 2nd, 2025, to confirm site conditions and information obtained at the review stage. The site falls within the Quaternary Catchment D73A within the Vaal-Orange Management Area (WMA 4) and the Molopo sub-WMA (Area = 3,238 km^2; MAP = 323 mm; MAE = 2450 mm). The PCSWMM storm water drainage model was used to determine the stormwater management infrastructure. This is a hydrological rainfall-runoff numerical simulation model. Rainfall intensity was estimated using a design rainfall statistic (Smithers & Schulze, 2002). The ninetieth upper bound percentile was used in the PCSWMM modelling (1:50-year, 134.9 mm). Additionally, a Digital Elevation Model (DEM) was created to identify low lying regions, highlighting preferential flow paths, allowing for topography and drainage analyses.

Proposed Stormwater Infrastructure

- Dirty stormwater channels around the waste rock dump (WRD), stockpile area and the site camp.
- Two evaporation dams were proposed, with one being located at the WRD and the other at the stockpile area. These dams were proposed to act as containment facilities for the dirty water emanating from the respective catchment areas. It has been assumed that the runoff from these dams will be utilised across the mining operations, specifically dust suppression, water for the nursery and vital water for revegetation.
- Sumps were proposed for pit 1 and 2. The location of the sumps would be at the lowest point within the respective pit. These sumps would collect runoff from within the pits as well as any decant as a result of the mining operations. It is assumed that the sumps within the pits will be kept as low as possible to cater for any runoff generated during rainfall events. The water contained within these sumps will be utilised across the mining operations, specifically dust

suppression, water for the nursery and vital water for revegetation. Furthermore, given the nature of the works envisaged within the respective pits, silt fences have been proposed downgradient of the respective pits with the aim of reducing sedimentation of the nearby watercourses or drainage lines.

- Dirty stormwater channels were proposed around the site camp, diverting runoff towards a sump with an oil separator. Excess water from the sump can be considered clean after passing through the oil separator and can be allowed to flow away from the site into the nearby drainage line.
- Clean stormwater diversion channels were proposed for the area between pit 1 and the WRD with the aim of diverting clean water away from operations towards the drainage line located towards the east.
- The proposed dimensions of the evaporation dams and sumps are at the discretion of the consulting engineer. However, it is recommended that the flow volumes presented in Table 7-2 below are considered.

Table 7-2: Flow Rate and Volume Reporting to the Containment Facilities (from SWMP report)

Description	Avg. Flow (m^3/s)	Max. Flow (m^3/s)	Total Flow (ML)	Total Flow (m^3/s)
Clean Water Outfall	0.628	5.23	15.254	15 254
Pit 1 Sump	1.001	15.929	25.093	25 093
Pit 2 Sump	0.33	5.711	8.234	8 234
Stockpile Evap Dam	0.407	6.688	12.057	12 057
Sump 1	0.04	0.731	1.069	1 069
Waste Dump Evap Dam	2.717	35.333	67.723	67 723

Recommendations

The following recommendations were made for stormwater infrastructure:

- The proposed containment facilities should be designed to incorporate a 0.8m freeboard.
- The SWMP should be revisited after any major changes to the current operations or design changes.
- It is recommended that stone pitching channels are used to transfer runoff. Stone pitching is advocated to reduce high runoff velocities in channels.
- To prevent clogging of the grated channel covers and maintain channel capacity, best practice and proper housekeeping practices must be ensured.

- All channels must be checked after any major rainfall events to ensure that there are no blockages and that the water flow will not be restricted in any way.
- Sediment that accumulates within channels and retention facilities needs to be removed directly after the storm events and appropriately disposed of to ensure design capacity is maintained.
- The storm water attenuation facilities should be operated on empty or at a storage level low enough to accommodate storm water inflows, whilst meeting the required spillage frequency (1:50-year Return Period) and freeboard requirements.

Conclusion

The modelling revealed a total of sixteen dirty, two moderately dirty and two clean sub-catchments based on the topographical layout of the site, where most of the site boundary was considered clean since project operations are limited to specific areas on site. The report proposed stormwater infrastructure layouts including clean and dirty water systems. The plan incorporates mitigation measures such as separate stormwater channels, lined evaporation dams, suggestions for dust suppression, etc. In addition, recommendations were made for infrastructure design, maintenance, monitoring, and pollution prevention.

3.9 Aquatic Biodiversity

The Freshwater Ecosystem Assessment (SAS, 2025) for the proposed Makganyane iron ore mine provides the following information that is important for the Rehabilitation, Decommissioning and Closure Plan.

Background

This assessment was only undertaken in certain pre-selected areas, within the farm boundaries, associated with (i) an historical mining operational area, (ii) the proposed mining operation and (iii) a freshwater feature identified by the background databases. These areas along with a 200 m buffer assessment area is hereafter collectively referred to as the 'focus area'. The aim of the study was to define the ecology of the freshwater ecosystems associated with the focus area, including the freshwater ecosystems associated with the focus area 500 m regulated area surrounding these.

Pertinent information from the mining work programme submitted for a mining right application highlighted here includes (i) proposed mining operations to include two open cast pits, stockpile area, waste rock dump and site camp (ii) a general water authorisation for 30 m³ per day.

Methodology

This involved mapping of the freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS) and defining the Present Ecological State (PES) of the freshwater ecosystems associated with the study area. In addition, the methodology involved defining the socio-cultural and ecological service provision of the freshwater ecosystems and outlining the Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) for the freshwater ecosystems.

A field study was conducted from 1st – 3rd April 2025 to confirm the desktop assessment.

Results

Two Episodic Drainage Lines (EDLs) without riparian vegetation were identified in the western assessment area. Numerous artificial features were also identified, including Preferential Flow Paths (PFPs), as well as a recharge zone associated with the "desktop database defined freshwater feature". Neither PFPs nor the recharge zone met the criteria of freshwater ecosystems from an ecological perspective as defined by the National Water Act. The assessment indicates that PFPs lack riparian and wetland characteristics and may potentially only convey surface water for a short period of time after rainfall events. The recharge zone was afforded legislative compliancy by including the assigned 100-year flood line in the assessment (Hydrological Assessment, TBC, 2025a)

Table A: Summary of the assessment results (from Freshwater Ecosystem report).

Freshwater Ecosystem	Present Ecological State (PES) / Ecostatus	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
EDLs	Largely Natural	Moderate to Very Low	Moderate	REC Category: B BAS Category: B RMO: Maintain

REC 'B': largely natural; BAS 'B': Maintain

The Department of Water and Sanitation risk assessment matrix (2023) and environmental assessment practitioner (EAP) Impact Assessment provided for predominantly "low" degree of risk for the proposed mining activities. By reshaping and redesigning of disturbance areas in consultation with the freshwater specialist and in line with the mitigation hierarchy (Department of Environmental Affairs, 2011), risks were adequately reduced according to legislation. The exception is the "moderate" risk rating during construction and operation for the EDL next to pit 2. This EDL is located in the 48 m protective ecological buffer. This would result in numerous indirect impacts which will need to be appropriately managed according to recommendations in the report.

Buffers are assigned to the EDL at 27 m for the construction phase, and 48 m during the operational phase, affording a final aquatic impact buffer of 48 m. The following implications/considerations must be determined by the EAP: (i) Limitations to activities according to activities outside urban areas within critical biodiversity areas (CBAs) or ecosystem service areas (ESAs); (ii) A portion of the proposed Waste Rock Dump is located within the 1 km NFEPA river buffer area.

The DFFE screening tool designation of very high freshwater sensitivity, being located within a NFEPA sub-catchment and containing wetlands and rivers, to the entirety of the focus and investigation areas is disputed. For parts of the focus and investigation areas located outside of the delineated freshwater ecosystem boundaries which are designated by the web-based screening tool as areas of very high sensitivity, a designation of low sensitivity has been awarded by the specialist.

Consideration of Impacts

- The proposed dirty water channel and sump at pit 1 which is located within the GN 4167 100 m zone of regulation (ZoR) and which is also likely to be within the 48 m ecological buffer of the EDLs. The remaining stormwater infrastructure (evaporation ponds, clean water channels and pit 1 sump) has been suitably placed outside the GN 4167 100 m ZoR.
- The proposed release of treated clean water from the site camp area (via the oil separator) into the "nearby system" refers to the PFP, south of the site camp area. As the PFP is not considered a true watercourse, impacts to the system were not included in the risk assessment matrix. Furthermore, the PFP does not form part of a flow path or watercourse network and as such no indirect or latent impacts are envisioned.

Significant Mitigations

In line with the mitigation hierarchy, the stockpile area has been reshaped and redesigned to avoid the 48 m non-development buffer area as well as the 100 m GN 4167 ZoR, thereby limiting the potential indirect impacts as a result of catchment-wide activities.

It was however not deemed feasible or practically possible to reshape or redesign the pit 2 area. Recommended mitigation measures have been suitably designed to best limit potential indirect impacts.

The existing road network will require an upgrade if it is to be used as haulage roads or other mining operation roads. This upgrade is envisaged to involve widening and lining with gravel (if available). Suitable mitigation measures are provided.

Cumulative and Residual Impacts

As the proposed mining operation has been suitably designed to best avoid the EDLs and associated ecological buffers, along with the knowledge that the EDL systems are isolated and not connected to a larger surface water system, no significant cumulative impacts are envisioned. However, the recommended mitigation measures must be strictly adhered to.

Residual impacts could also result from the change in runoff and interflow characteristics from the catchment of the freshwater ecosystems in which the mining operation is proposed (includes open cast pits and the waste rock dump). Runoff is likely to occur in a modified way from the catchment of the systems once mining has occurred, even if rehabilitated.

Aquatic ecology mitigation measures are covered in Appendix 4.

3.10 Terrestrial Flora

The Terrestrial Assessment and Floral Compliance Statement for the proposed Makganyane iron ore mine provides the following information that is important for the Rehabilitation, Decommissioning and Closure Plan (STS, 2025b).

Project Scope

A Terrestrial Impact Biodiversity Assessment was conducted as part of the Environmental Authorisation (EA) required for the proposed Mining Rights Application (MRA) for Makganyane Iron Ore Mine. The MRA comprises of 1,549 ha located across multiple portions of the Farm Makganyane No. 667 (approximately 24 km northwest of Postmasburg, District of Kuruman, Northern Cape, South Africa). This assessment focused on pre-selected areas within the farm boundaries, including a 200 m buffer area (referred to as the Focus Area). The purpose of this assessment is to define the floral ecology of the Focus Area, identifying areas of Ecological Importance and Sensitivity (EIS), and to describe the Present Ecological State (PES). The main objective is to provide a full description of all the vegetation within the Focus Area by ensuring sufficient data is available and to assess habitat suitability. This ensures adequate detection of current and potential species of conservation concern (SCC) (SANBI, 2020) within the area of concern.

Assumptions and Limitations

Field assessments and verification were limited to the Focus Area only and does not include any adjacent portions of the Farm (including parts of the MRA). Not all areas of the Focus Area could be assessed due to restrictions on the field such as dense thornveld. Areas of proposed new development were prioritized during the field assessment due to time constraints.

Existing impacts

The site verification and field assessments (1-3 April 2025) confirmed a low plant species theme sensitivity and a very high terrestrial biodiversity theme sensitivity for the Focus Area and the greater MRA, as identified by the DFFE Nation Web-based Screening Tool. Previous prospecting impacts have significantly impacted the vegetation communities, driving an imbalance of species and a general decline in population abundance within the Focus Areas. To the west of the Focus Area, anthropogenic activity, namely a diamond mine, and associated lack of rehabilitations, has heavily compromised the vegetation structure, habitat, and ecological function. These modifications are irreversible. To the east of the Focus Area, the use of pesticides to reduce alien plant species is now also impacting native species.

Site Ecological Importance and Impact assessment

An envisaged 116.65 ha proposed habitat loss will occur of the total 539.13 ha.

Habitat Unit	SEI	Total Extent	Proposed Loss	Impact including mitigation recommendations		
				Pre-construction and planning phase	Mining phase	Decommissioning and rehabilitation phase
Kuruman Mountain Bushveld	Low	273.83	108.36	Low-Medium	Medium high	Low-Medium
Olifantshoek Plains Thornveld	Low	118.65	5.03	Low-Medium	Medium	Low-Medium
Freshwater Habitat: Recharge Zone	Low	32.46	NA			
Freshwater Habitat: EDLs	Medium	3.34	0.10	Low-Medium	Low-Medium	Low
Freshwater Habitat: PFP	Very Low	102.52	3.15	Low	Medium	Low-Medium
Transformed Habitat	Very Low	8.31	NA			
Ecological Support Area	-	-	115	Low	Medium	Low-Medium

The proposed activities will largely impact on semi-intact habitat (i.e., Kuruman Mountain Bushveld), the impacted habitats within the Focus Areas are not regarded as sensitive floral communities though supporting confirmed populations of protected species, and the loss of floral species (and associated habitat) will not result in significant, negative residual impacts.

Minimisation and rehabilitation mitigation measures are the key focus in these habitats, ensuring that 1) loss of any remaining indigenous vegetation is reduced, 2) areas where mining-related disturbances took place outside of the mining footprints are rehabilitated and revegetated, and 3) additional, or potential cumulative, impacts to surrounding habitats (especially if more sensitive) must be managed and prevented.

For the Recharge area, which is a medium SEI minimisation and restoration mitigation are recommended followed by appropriate restoration activities, however no activities are currently planned within the habitat unit therefore should any expansion be considered the development constraints should be followed. Permits from the Northern Cape Environmental Department and from the DFFE should be obtained to remove, cut, or destroy any of the above-mentioned protected and/or threatened species before any vegetation clearing may take place.

Of the threatened species assessed (i.e., VU, EN, CR, or NT species), none were recorded within the Focus Areas. Several species protected under the NCNCA, TOPS and NFA were recorded or are likely to occur within the Focus Areas. These species will require marking as part of final site walkdowns prior to vegetation clearing activities.

The following points highlight the key residual impacts that have been identified:

- Permanent loss of and altered floral species diversity;

- Edge effects such as further habitat fragmentation and AIP proliferation;
- Permanent loss of floral SCC and suitable habitat for such species; and
- Disturbed areas not rehabilitated to an ecologically functioning state with resulting significant loss of floral habitat, species diversity, and SCC/protected floral species likely to be permanent.

Three (report says 4, but only three listed) areas of concern were identified:

- Habitat fragmentation: The proposed project will result in fragmentation of the landscape (including ESA habitat);
- Spread of AIPs: Numerous AIPs were recorded within the current Focus Areas and these species pose a considerable risk to the habitat integrity of the remaining areas of natural, intact habitats. Potential poor AIP management from the mine as well as additional disturbances from mining edge effects may contribute to the spread of such species and a consequent cumulative decrease in habitat integrity within the Focus Areas and surrounds. Leading to possible degradation of important biological features such as ESAs and CBAs; and
- Impacts to SCC population dynamics: Should the proposed application be authorised and granted, the habitat for of provincially and nationally protected species will be impacted upon, and cumulative loss of these species are anticipated.

Floral Monitoring

A floral monitoring plan must be designed and implemented throughout all phases of the proposed mining project, should it be approved. Guidelines to the floral monitoring plan are provided and must be updated and refined for site-specific requirements. These include:

- Permanent monitoring plots;
- Monitoring of all natural areas;
- Stockpile slope monitoring;
- The rehabilitation plan must be executed under adaptive management for optimal rehabilitation;
- A BAP must be drafted for the focus areas with monitoring and auditing thereof;
- A nursery be established for SCC’s, and where upon rehabilitation such species experience establishment success.
- Negative impacts be mitigated as soon as they become apparent;
- Monitoring methodology must be repeatable to ensure consistent results.

Ecological overview of fine scale habitats

Through the site assessment four (4) broad habitat units were identified within the Focus Area based on vegetation types:

Habitat Unit	Area ha	Description	Noteworthy species recorded	Biodiversity priority Areas / Conservation Significance
Kuruman Mountain Bushveld	~ 274	Represented by short closed thornveld and various terrain including rocky hills and valleys	Protected species *Boscia albitrunca* (POC = Confirmed; Status = LC): *Gomphocarpus tomentosus* (POC = Confirmed; Status = LC); *Gymnosporia buxifolia* (POC = Confirmed; Status = LC); *Vachellia erioloba* (POC = Confirmed; Status = LC); *Boscia albitrunca* (POC = Confirmed; Status = LC).	The Kuruman Mountain Bushveld and Olifantshoek Plains Thornveld are considered to be representatives of the reference vegetation types, the presence of ESA is confirmed in these Habitat units. Furthermore, the EDLs which are confirmed watercourses are also confirmed as ESA habitat. Some eastern extent falls within the CBA described below.
Olifantshoek Plains Thornveld	~ 114	Associated with the east of the Focus Area with a tall open to semi-closed thornveld, a sparse woody layer, and well-developed grass layer.	*Gomphocarpus fruticosus* (POC = Confirmed; Status = LC); *Oxalis sp.* (POC = Confirmed Status = LC); *Bulbine abyssinica* (POC = Confirmed; Status = LC); *Boscia albitrunca* (POC = Confirmed; Status = LC); *Kalanchoe rotundifolia* (POC = Confirmed; Status = LC); *Boscia albitrunca* (POC = Confirmed; Status = LC); *Vachellia erioloba* (POC = Confirmed, Status = LC).	The entire eastern section of the Focus Area is considered a CBA 1: Irreplaceable Area; this area must remain in a good ecological condition in order to meet biodiversity targets for ecosystem types, species of special concern or ecological processes.
Freshwater Habitat	~ 114	Associated with two watercourses and a recharge area comprising of vegetation identical to that of the Kuruman Mountain Bushveld, and predominantly grasses, forbs, and shrubs, respectively.	*Bulbine abyssinica* (POC = Confirmed; Status = LC); *Gomphocarpus fruticosus* (POC = Confirmed; Status = LC); *Oxalis sp.* (POC = Confirmed; Status = LC); *Vachellia erioloba* (POC = Confirmed; Status = LC).	Although the extreme eastern area is not described as a watercourse, this area affords a hydrological sump and recharge to downslope/stream systems hydropedologically and is considered as a CBA.
Transformed Habitat	~33	Represented by historic mining areas, infrastructure, and farmhouses. Anthropogenic disturbance has significantly altered this habitat, leaving is no clear trace of vegetation structure.	As a result, the habitat is now dominated by alien and invasive species and is no longer suitable for threatened floral SCC.	None.

Note: Permits from the Northern Cape Environmental Department and from the DFFE should be obtained to remove, cut, or destroy any of the above-mentioned protected and/or threatened species before any vegetation clearing may take place; * Comprehensive habitat and species overviews are available within the report.

A total of 16 AIP species were recorded during the March 2024 field assessment. Of the 16 AIPs recorded, eight (8) species are listed under NEMBA Category 1b, one (1) listed as NEMBA Category 3. The remaining seven (7) species are not listed

(NL) under NEMBA, but these species are identified as problem plants as they can have a negative impact on the indigenous floral communities within and surrounding the Focus Areas.

3.11 Terrestrial Fauna

The Terrestrial Faunal Assessment for the proposed Makganyane iron ore mine provides the following information that is important for the Rehabilitation, Decommissioning and Closure Plan (STS, 2025c).

The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, general invertebrates and arachnids. Faunal species likely to occur within the Focus Areas are indicated and briefly discussed within each of the relevant dashboards, along with their probability of occurrence (POC).

The field assessment results of the faunal species within the focus areas is presented in the Table below:

Faunal category	Species	Conservation Listing	POC
Mammals	*Atelerix frontalis* (Southern African Hedgehog)	NT	Medium
	Felis nigripes (Black footed Cat)	VU	Medium
	Smutsia temminckii (Temminck's Ground Pangolin)	VU	Confirmed
	Mellivora capensis (Honey Badger)	P - TOPS	Medium
	Vulpes chama (Cape Fox)	P - TOPS	Medium
Avifauna	*Gyps africanus* (White-backed Vulture)	CR	Medium
	Cursorius rufus (Burchell's Courser)	VU	Medium
	Sagittarius serpentarius (Secretarybird)	EN	High
	Falco biarmicus (Lanner Falcon)	VU	Medium
	Polemaetus bellicosus (Martial Eagle)	EN	Medium
	Aquila rapax (Tawny Eagle)	EN	Medium
	Coracias garrulus (European Roller)	NT	Medium
	Neotis ludwigii (Ludwig's Bustard)	EN	Medium
	Ardeotis kori (Kori Bustard)	NT	High
Herpetofauna	*Pyxicephalus adspersus* (Giant Bullfrog)	P - TOPS	Medium
Invertebrates	*Opistophthalmus carinatus* (Robust Burrowing Scorpion)	P - TOPS	Medium
	Opistophthalmus wahlbergii (Kalahari Burrower)	P – TOPS	Medium
	Harpactira sp. (Common Baboon Spiders)	P - TOPS	Medium

A summary of the sensitivity of each habitat unit and the implications for the proposed activities is presented in the below Table:

Habitat unit	Conservation Importance	Functional Integrity	Biodiversity Importance	SEI	Development constraints
Kuruman Mountain Bushveld	*Smutsia temminckii* (Temminck's Ground Pangolin, VU)	Medium	Medium	High	Avoidance & mitigation
Olifantshoek Plains Thornveld	*Smutsia temminckii* (Temminck's Ground Pangolin, VU); *Sagittarius serpentarius* (Secretarybird, EN) & *Ardeotis kori* (Kori Bustard, NT).	Medium	Medium	Medium	Minimization and restoration mitigation
Freshwater Habitat: Recharge Area		High	High	High	Avoidance & mitigation
Freshwater Habitat: PFP & EDL	*Smutsia temminckii* (Temminck's Ground Pangolin, VU)	Medium	Medium	Medium	Minimization and restoration mitigation

*Only *Smutsia temminckii* (Temminck's Ground Pangolin, VU) **confirmed**.

An aspects and activities register considering faunal ecology during the pre-construction and planning phase, mining phase and decommissioning phase is presented in Table 7 of the report. Impacts on the faunal habitat, diversity, and SCC from the proposed activities are presented in the below Table:

Habitat Unit	Impact including mitigation recommendations		
	Pre-construction and planning phase	Mining phase	Decommissioning and rehabilitation phase
Faunal Habitat and Diversity			
Kuruman Mountain Bushveld	Low-Medium	Medium-High	Low-Medium
Olifantshoek Plains Thornveld	Low-Medium	Medium-High	Low-Medium
Freshwater Habitat: PFP & EDL	Low-Medium	Medium-High	Low-Medium
Faunal SCC			
Kuruman Mountain Bushveld	Low-Medium	Medium-High	Low-Medium
Olifantshoek Plains Thornveld	Low-Medium	Medium-High	Low-Medium
Freshwater Habitat: PFP & EDL	Low-Medium	Medium-High	Low-Medium
Mitigation measures are detailed in the report.			

According to the impact discussion, primarily the loss of habitat due to vegetation clearing and earthworks will negatively impact on faunal species. The impact assessment is divided between impacts on 1) faunal habitat and diversity and 2) threatened faunal SCCs and/or their associated habitat. The post-closure rehabilitation goal was not provided at the time of assessment. Search and rescue initiatives for threatened species must still be attempted if proposed activities are approved but cannot be regarded as a mitigation measure as faunal habitat will still be lost. It is unlikely that faunal species will be affected at a population level if strict mitigation measures and a thorough rehabilitation plan are implemented.

The following points highlight the key residual impacts that have been identified:

- Continued degradation of natural habitat adjacent to the site as a result of edge effects;
- Continued decrease of faunal diversity and abundance in the Focus Areas;
- Continued loss of potential and confirmed SCCs in the Focus Areas; ➢ Edge effects such as further habitat fragmentation and AIP proliferation; and
- Disturbed areas are highly unlikely to be rehabilitated to baseline levels of ecological functioning and loss of faunal habitat and species diversity will most likely be long term.

Cumulative impacts include: As a result of habitat loss historically and currently, the proposed mining impact will result in fauna being forced to move into surrounding vegetated areas, leading to more competition for territories and breeding sites. This displacement could lead to increased competition for resources, potentially resulting in higher mortality rates and reduced species diversity. SCCs have potential foraging and breeding habitat within the Focus Areas, as such, uncontrolled development/activities within the respective habitats (particularly the Kuruman Mountain Bushveld and Olifantshoek Plains Thornveld Habitat) will potentially result in the loss of breeding or foraging habitat for these species.

4 LEGISLATION & LEGAL REQUIREMENTS

South African legislation imposes a clear obligation on mining companies to prevent environmental damage and defines definitive unambiguous statutory obligations and responsibilities for mine rehabilitation, decommissioning and closure. Rehabilitation activities must be guided and controlled by legislative and legal requirements contained in the following Acts and their Regulations:

- Constitution of the Republic of South Africa, Act No. 108 of 1996.
- Mineral and Petroleum Resources Development Act, No. 28 of 2002.
- National Environmental Management Act, No. 107 of 1998.
- National Water Act, No. 36 of 1998.
- National Environmental Management: Biodiversity Act, No. 10 of 2004.
- National Forests Act, No. 84 of 1998.
- Conservation of Agricultural Resources Act, No. 43 of 1983.
- National Environmental Management Waste Act, No. 59 of 2008.
- National Environmental Management Air Quality Act, No. 39 of 2004.
- Mine Health & Safety Act, No. 29 of 1996.
- Northern Cape Provincial Conservation Legislation.

The essence of the legislative and legal requirements is contained in the following Acts and is elaborated on below:

- Constitution of the Republic of South Africa, Act No. 108 of 1996.
- Mineral and Petroleum Resources Development Act, No. 28 of 2002.
- National Environmental Management Act, No. 107 of 1998.
- National Water Act, No. 36 of 1998.

Constitution of the Republic of South Africa, Act No. 108 of 1996

According to this Act, the mining company (Applicant) has an obligation to ensure that the operation to mine will not result in pollution and/or ecological degradation at the site; and ensure that the mine is ecologically sustainable and will improve local economic and social conditions.

The mining right activities must be conducted in such a manner that significant environmental impacts are avoided. Where significant impacts cannot all together be avoided, they must be minimised and mitigated in order to protect the environment and environmental rights of South Africans.

Section 24 of the Constitution states that Everyone has the right:

(a) to an environment that is not harmful to their health or wellbeing; and

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

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

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

Mineral and Petroleum Resources Development Act, No. 28 of 2002 (MPRDA)

This Act covers the application for a Mining Right which is being submitted by the Applicant, Assmang (Pty) Ltd for the proposed Makganyane iron ore mine to the Department of Minerals and Petroleum Resources (DMPR). The Environmental Impact Assessment and Environmental Management Programme reports for the proposed mine will have been compiled in accordance with the MPRDA.

Section 37 of MPRDA establishes the requirement for holders of prospecting rights or mining permits to submit an environmental management plan (EMP). This plan must adhere to the aims and principles of the National Environmental Management Act, No. 107 of 1998 (NEMA) to integrate social, economic, and environmental factors to ensure sustainable development of mineral resources for present and future generations. Section 37 confirms that the principles set out in the NEMA apply to all prospecting and mining operations and that these operations must be carried out in accordance with the generally accepted principles of sustainable development. This is further supported by the stated objective of the MPRDA being *"to give effect to Section 24 of the Constitution by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development*".

Section 38 of the MPRDA stipulated that the general objectives of integrated environmental management must be applied in accordance with NEMA, and this will include the assessment and management of impacts identified as part of the EMP process laid out in Section 39. However, Section 38 was repealed and replaced by sections 38A and 38B following the MPRDA Amendment Act in 2014. Furthermore, the more recent National Environmental Management Waste and Minerals Acts Amendment Act (NEMLA) repealed sections 38A and 38B in favour of a unified environmental management system. In addition, Section 39 which previously provided for the approval of environmental management plans (EMPs) and environmental management programmes (EMPrs) for prospecting and mining activities, was repealed by the MPRDA Amendment Act in 2014. Environmental authorizations for mining are now regulated under the NEMA.

Regulation R527 of the MPRDA specifies that the EMP must include environmental objectives and specific goals for mine closure. The applicant of a mining permit/right must make prescribed financial provision for the rehabilitation or management of negative environmental impacts.

R527 provides principles for mine closure which state that the holder of a mining permit/right must ensure the following:

- The closure of its mining operation incorporates a process which starts at the commencement of the operation and continues throughout the life of the mine.
- Risks pertaining to environmental impacts are quantified and managed proactively, which includes gathering relevant information throughout the mine's operations.
- Safety and health requirements of the Mine Health and Safety Act (No. 29 of 1996) are complied with.
- Residual and possible latent environmental impacts are identified and quantified.

- The land is rehabilitated, as far as practical, to its natural state, or to a predetermined and agreed standard or land use which conforms to the concept of sustainable development.
- Mining operations are closed efficiently and cost effectively.
- Key objectives for mine closure to guide project design development and management of environmental impacts are included in the EMP. These include broad future land use objectives, and proposed closure and rehabilitation costs.

As with other environmental legislation, there is a provision in Section 45 of the MPRDA for the DMRE to direct an operation to investigate, evaluate, assess and report on the impact of any pollution or environmental degradation and take such measures as may be specified within a certain time period. If the operation fails to carry out such a direction, the DMRE can initiate the necessary actions and recover the costs from the mining company (Applicant). However, Section 45 has been interpreted in two different contexts: In the initial consolidation of the Act, it pertains to the Minister's power to recover costs in the event of urgent remedial measures to address environmental damage, but amendments to the Act later renumbered sections, and a different "Section 45" now refers to the reporting of social and labour plans by mining right holders to the Minister. Therefore, the meaning of "Section 45 of the MPRDA" depends on the version of the Act or its Regulations being referenced. It is crucial to specify whether reference is being made to the original text (cost recovery) or the amended regulations (social and labour plan reporting).

National Environmental Management Act, No. 107 of 1998 (NEMA)

The NEMA is the overarching and enforceable body of environmental legislation in South Africa and ensures that the environmental impact assessment process is followed to assess listed activities that may have a harmful impact on the environment. The NEMA aims to establish overarching guidelines and principles to help facilitate environmental management and emphasises the following aspects:

- Sustainable development through integration of environmental, social and economic factors.
- The “polluter-pays” principle and environmental justice.

The Applicant is obliged to adhere to the requirements of Section 28 of the NEMA (Duty of Care and Remediation of Environmental Damage) which states that: “Duty of care and remediation of environmental damage: "(1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".

All parties involved in the establishment and operation of Makganyane Mine and associated infrastructures (including contractors, engineers, and administrators) are, in terms of the NEMA’s “Duty of Care” and “Remediation of Damage” requirements (Section 28), required to prevent any pollution or degradation of the environment, be responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

The NEMA’s Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (DEA, 2015) mandate applicants and holders of mining, prospecting, or production rights to provide financial guarantees for the future rehabilitation and remediation of environmental impacts during their operations, including latent and residual impacts. Furthermore, the following aspects contained in the 2015 Regulations are relevant to this Rehabilitation, Decommissioning and Closure Plan:

- Appendix 3 provides the minimum content of an annual rehabilitation plan on which Section 6 of the plan is based.
- Appendix 4 provides the minimum content of a final rehabilitation, decommissioning and mine closure plan on which Section 7 of the plan is based.
- Appendix 5 provides the minimum content of an environmental risk assessment report on which Section 8 of the plan is based.

It is important to emphasise that environmental authorizations for mining are now regulated under the NEMA.

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

The provision of water in South Africa is divided into public water and private water, and its use is regulated by the National Water Act (NWA) under the directorship of the Department of Water and Sanitation (DWS). Various other acts also make provision for the management of water: The MPRDA regulations have general requirements for water management; the Conservation of Agricultural Resources Act, No. 43 of 1983, contains water management guidelines; and the National Health Act, No. 61 of 2003 is concerned with effective water management.

In terms of the NWA, it is an offence to pollute public and/or private water to render it unfit for the propagation of fish and aquatic life, including rainwater, seawater, and subterranean water. All water in South Africa is under the trusteeship of the national government.

Section 19 of the NWA sets out the principles for "an owner of land, a person in control of land or a person who occupies or uses land" to:

- Cease, modify or control any act or process causing pollution.
- Comply with any prescribed waste standard or management practice.
- Contain or prevent the movement of pollutants.
- Eliminate any source of pollution.
- Remedy the effects of the pollution.
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

Regulation 9 of GN R704 promulgated in terms of the NWA, which deals with temporary or permanent mine closure, provides that any person in control of a mine or related activity must at the cessation of mining operations and its related activities, ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with the regulations contained in GN 704. Furthermore, the in-stream and riparian habitat of any water resource, which may have been affected or altered by the mine or activity, must be rehabilitated in accordance with the regulations contained in GN 704.

5 LAND PREPARATION FOR MINING: PLANNED AREAS & ACTIVITIES

The key factors to consider during the preparation for mining (planning, construction/site establishment) phase are to minimise the affected area, minimise negative impacts including potential future contact of toxic or polluting materials with the environment, and maximise the recovery and effective storage of mining profile materials that will be most useful during the rehabilitation process after mining is complete (CMSA & CoalTech, 2007).

5.1 Demarcation of the Mining Footprint

Geo-referencing and clear demarcation of the mining footprint must be undertaken at the beginning of site establishment with appropriate sign-posting so that all mine personnel and contractors are aware of the precise limits of the footprint and where special limitations prevail, e.g., no-go areas and ecologically sensitive areas. The following areas must be clearly demarcated: Nursery, site camp, pit 1 and 2, stockpile area, waste rock dump, and haulage and other internal roads.

5.2 Photographic Record of Pre- & Post-Mining Footprint Areas

High quality photographs of proposed pit 1 and 2, the stockpile area, waste rock dump, site camp, nursery and mine roads, including haulage roads, should be taken from suitable geo-referenced fixed locations to provide a comprehensive photographic record before mining starts and after mining ends, once rehabilitation is well established. Geo-referencing will enable a return to the same observation reference locations after mining ends, once rehabilitation is well established.

5.3 Post-Mining Conceptual Land Form Development

After mining and rehabilitation are complete, the land will be returned to wilderness and the final land form and topography should be as close to the original land form and topography as possible. The final topography will be a function of original topography, open-pit mining method and reshaping strategy (CMSA & CoalTech, 2007).

Basic requirements and principles for topographical reshaping are to minimise slopes, maximise potential land capability, i.e., wilderness, and minimise erosion risk. One of the key uncertainties in final landform prediction is the bulking or swell factor. Soft materials frequently compact by as much as 15%, while hard materials may expand by as much as 25% (CMSA & CoalTech, 2007). A 35% swell factor has been assumed for the Makganyane mine waste rock (Assmang, undated).

5.4 Nursery

A plant nursery will be established for the propagation of indigenous plants rescued from the mining footprint. These plants will be vital for rehabilitation of the footprint and will be grown from seeds and cuttings gathered from plants in the footprint. The nursery will also function for the protection and propagation of Species of Conservation Concern, Protected Species, keystone species and seedlings that are possible to translocate as whole plants, and for the safe and dry storage of seeds gathered from the mining footprint. No alien and invasive plant species or their seeds or cuttings should be transferred to the nursery (Section 6.2.21).

An experienced competent nursery manager and a suitable complement of nursery staff will have to be appointed before nursery establishment. The nursery manager will be responsible for the training of the staff and ensuring effective nursery establishment, management and operation. The nursery manager will also be responsible for managing the collection of indigenous plant material for propagation in the nursery and for contributing to vital revegetation of mined areas during progressive rehabilitation. Other responsibilities of the nursery manager are referred to in later sections of the Rehabilitation, Decommissioning and Closure Plan.

5.4.1 Nursery Establishment

The collection of plant seeds, cuttings and whole plants should start at least TWO YEARS before mining commences, which means that the nursery needs to be established before this collection takes place.

The nursery site should have the following characteristics (Wilman, 2019):

- It should be close to the area being rehabilitated.
- It should offer protection from drying winds.
- Plants should be grown where there is a favourable microclimate. This will involve the construction of protective structures such as a seed house, shade house and open area for growing and hardening plants.
- The site should be relatively level with a very slight slope.
- There must be good drainage.
- There should be good road access for deliveries.
- The site must be close to a clean water source such as a raised water tank.
- The site must be large enough to hold the number of plants necessary and for potential expansion.

The following resources will be needed for establishing the nursery (Wilman, 2019):

- A seed house for germinating seeds and propagating cuttings. This house should be constructed from transparent material with strong supports that will allow sunlight to enter. The seed house should contain the following:
    - A potting area for potting plants with storage areas for equipment.
    - Extensive tables with at least two porous shelves for the placement of trays and pots for propagating seeds and cuttings. The porous shelves will enable the free drainage of excess water.
    - Rooting medium, potting soil, plug trays, pots, trays and planting bags for propagating seeds, cuttings and plants.
    - An irrigation system that will enable watering of plants with a gentle spray. A raised water tank will provide gravity-fed water for this system; very fine rose watering can.
    - Safe and dry seed storage areas and seed storage containers. Fungicides and insecticides will be kept here for treating the seeds and ensuring their viability over time.
    - Various other items that may be required are included in the discussion below in Sections 5.2-5.8.
- A shade house for hardening off seedlings after transplanting them into suitable containers. The shade house can be constructed from poles and shade fabric.
- An open growing area for growing and hardening plants before transporting them to rehabilitation areas.
- Rest and ablution facility for nursery staff.

5.4.2 Collection of Indigenous Plant Seeds

Propagation from seeds relies on seed production by the 'mother' plant according to the season, compared to propagation from cuttings which can be done all-year round. Seed propagation results in genetically more varied plants which are often stronger, while propagation from cuttings results in plant replicas or clones. The most appropriate seed collection technique will depend on the species, and in particular, how the seeds disperse (Wilman, 2019):

- Seeds should be collected from different plants of the same species in the mining footprint to ensure a good gene pool in the actively and ecologically restored populations.
- Trees, grasses, bulbs, groundcover and herbaceous perennials can be grown from seed.

- Hand picking which applies to many species in the mine's footprint, is appropriate where seeds are shed over a long time period and where fruits are easily accessible. Containers are strapped around the picker's waist, leaving both hands free for collecting.
- The cluster pruning technique is used when collecting seeds from trees or species that produce clusters of seeds at the ends of branches. Long tree pruners are used to remove entire clusters from the tree.
- For species that disperse their seeds via the trigger or ballistic (bursting) mechanism, bagging of the seed heads may be needed. A mesh bag or a bag made from a material that will let air and light through, is fixed loosely over the seed heads and tied in place around the branch. The seeds are captured in the bags as they are shed.
- Shaking the branches of trees or shrubs will dislodge ripe seeds that can be collected on a tarpaulin or sheet laid on the ground beneath the plant.
- Grass seeds and the seeds of other species with erect flower stalks are collected by stripping. The seed heads are grasped at the base and the hand is pulled upwards, gently dislodging the seeds, which then are transferred to a collecting bag.
- Some seeds can be collected from the ground beneath the plant, but care must be taken not to collect seeds that have been damaged by insects. However, it may sometimes be beneficial to collect seeds from the ground especially where birds and fruit-bats have roosted. These seeds have been naturally scarified and will germinate easily.
- Once collected, seeds should be stored in paper or cloth bags in a dry area and never in plastic bags. Seeds with fleshy fruits can be stored initially in plastic bags or in buckets while collecting but the flesh should be removed as soon as possible.
- A record must be kept of the seed collection locations. In the nursery, plants from the same area should be grown in the same part of the seed house.

5.4.3 Seed Cleaning

This involves separating the seed from the outer seed coat, and separating seed from chaff or other non-seed plant material that invariably is collected with the seed (Wilman, 2019):

- The seed material needs to be dry.
- Hand sorting is the simplest method of seed cleaning and is mostly used to clean large seeds or seeds with minimal chaff, such as seeds that are in pods, which only need to be taken out of the pods. Depending on the seed, it can be lightly crushed to break up the outer seed coat, e.g., dried Aloe seeds, or it can be rubbed through wire mesh to separate the seed from capsules.
- If further cleaning is needed, the resultant mix can then be winnowed or screened by passing it through various sizes of mesh sieves. With certain seeds, the chaff can be removed by pouring it back and forth from one container to another.
- Grass seeds can be rubbed over a ribbed rubber mat to remove the seeds from the husks. The seeds fall into the grooves in the mat and can then be tipped into a tray.
- Sticky seeds can be rolled in fine wood ash or talcum powder and wiped with a piece of coarse hessian. The ash or powder absorbs a great amount of the sticky mucilage and both are wiped off the seed.

- Fleshy fruit or berries require a different treatment to dry fruits. With ripe fruits, the flesh must be removed from the seeds before the seeds are stored and sown. The berries can be squashed and the seeds extracted by hand. They can be trodden on in tubs, or they can be soaked in water to soften the flesh. The seeds are then removed in the water or rubbed through screens or sieves under running water.

5.4.4 Overcoming Seed Dormancy

Dormancy refers to the period in a plant's life cycle when growth, development and physical activity are temporarily stopped. Seeds become dormant because environmental conditions are not suitable for germination and growth. Environmental conditions in the seed house must be suitable for seed germination in terms of sufficient water, light and a favourable temperature. Many plant seeds will germinate when these environmental conditions are suitable, but the seeds of some species may require one of the following additional stimuli to germinate (Wilman, 2019). Specialist advice for seeds of species from the mining footprint will have to be obtained from a horticulturalist or specialist who is familiar with this matter.

- Acid Scarification

Acid treatment can be used to break hard seed coat dormancy and is used for particularly thick and impermeable seed coats. Dry seeds are placed in concentrated sulphuric acid (H_2S0_4) for a length of time, depending on the species and the thickness of the seed coat. The ratio is about one part seed to two parts acid and the amount of seed treated at any one time should not be more than 10kg. The acid should be at room temperature and containers should be glass or ceramic, never plastic or metal. The seeds and acid can be stirred occasionally with a glass rod, although too much stirring should be avoided as it can cause the acid to heat. The seeds are removed from the acid after the allotted time, which can be from 10 minutes to 6 hours or more depending on the species, or before the acid penetrates the seed coats. After removal, the seeds can be placed in a large amount of water with a small amount of sodium bicarbonate (baking soda) to neutralise any remaining acid, or they can be washed thoroughly for 10 minutes under running water. After the acid treatment, seeds may either be sown immediately, or dried and stored.

- Dry Heat Treatment

Seeds of some species are adapted to germinate in response to direct and indirect cues provided by fire. Heat from flames may break the coats of hard-seeded species. Dry heat improves germination in species with hard, nut-like seeds. For this treatment, seeds should be placed in a shallow container in a pre-heated incubator or oven. The specific temperature and time span will depend on the species and the size of the seed. Heat treatment can also be done in a microwave oven. After the treatment, seeds should be cooled and sown.

- Mechanical Scarification

Seeds with hard seed coats can be tumbled in containers lined with sandpaper or mixed with coarse sand or gravel in a revolving container. They can be rolled on a cement floor using a brick or board, or rubbed with sandpaper by hand. Seed coats can be nicked with a knife or cracked gently. Care must be taken not to injure the embryo and it may be necessary to open a couple of seeds to see where the embryo is located to avoid damaging it.

- Hot Water Treatment

For small to medium-sized seeds or large quantities of seeds, hot water treatment may be more practical. Seeds should be dropped into about four to six times their volume of water pre-heated to 77–100°C. The seeds should be left in the gradually cooling water for 12 to 24 hours and then planted. Seeds that have not swollen can be subjected to another treatment.

- Pre-chilling or Cold Treatment

Seeds that require cold treatment can be placed on moistened germination substrate and kept at 3–5°C in a refrigerator for seven days. The treatment may be extended to 14 days for seeds showing more dormancy. After the cold period, the seeds can be sown and allowed to germinate in the (warmer) conditions recommended for the species.

- Leaching

For seeds with chemical inhibitors in the fleshy fruit and seed-covering tissues, it is necessary to leach or wash these chemicals out. The fruit pulp should be removed first and any inhibiting chemicals left can be removed by soaking the seeds in tap water or by placing them in slowly running tap water for various lengths of time before soaking. When soaking seeds, the water should be changed every 12 to 24 hours. The seeds are sown directly after the treatment.

- Light and Temperature Dormancy

Seeds that require light should not be covered when sown but merely sown on the surface and watered in. Certain temperatures may be required to 'tell' the seeds that the season is good for germination. The range of temperatures required may be very narrow and specific. Temperature and duration of light and dark can both be required. If the recommended temperatures are not available naturally, they must be artificially reproduced in the seed house.

- Smoke Treatment

Seeds of some species are adapted to germinate in response to direct and indirect cues provided by fire. Smoke treatments can cue germination in some species by placing previously sown seed trays in a polythene tent in which smoke is emitted. A mixture of dry and green vegetation from the mining footprint is ignited in a small metal drum and then dampened to create smoke. The drum is placed inside the tent which is sealed while the chemicals in the smoke settle onto the soil in the trays. The trays can be removed after two hours and watered.

5.4.5 Seed Sowing & Germination

The following method is recommended for the sowing and germination of seeds (Wilman, 2019):

- Germination is the process where seeds absorb water and start to grow and develop after a period of dormancy. There are four main environmental factors that affect germination and plant growth: Water, oxygen, light and temperature.
- Seed trays should be cleaned, sterilised and placed in the sun to dry before filling with growing medium which can be purchased from suppliers.
- The trays are filled to a level about 10–20mm from the rim to prevent the water and the growing medium from spilling over the rim during watering. The medium should be levelled and patted down gently to create a uniform surface.
- The medium is watered with a very fine rose watering can before sowing the seeds.
- Seeds are sown evenly and sparingly over the surface of each tray. Seeds sown too densely become overcrowded. Seedlings that have to compete for resources in an overcrowded environment are more prone to disease:
    - Very fine seeds can be mixed with sand and scattered over the surface.

- Fine seeds can be gently patted down to give them good contact with the growing medium.
  - Medium-sized seeds can be scattered or sown in furrows.
  - Large seeds can be sown in rows and pushed gently into the medium.
  - Seeds that require light for germination should be sown on the surface and either left or covered only lightly with fine bark or vermiculite.
  - Seeds requiring darkness for germination should be sown deeper and can also be placed in a dark area until germination has started.
  - Unless they require light to germinate, seeds should generally be planted to a depth of three to four times their diameter.
- The seeds can be covered with vermiculite, sifted bark or sifted growing medium.
- Seeds should be watered with a very fine rose watering can. There should be enough water continuously available for the germinating seeds as the first part of the germination process is the absorption of water.
- The seed trays should be kept moist enough for the seeds to germinate without becoming waterlogged.
- Seeds need more oxygen during germination, so the growing medium in which the seeds are sown should be well aerated. Germination can be severely hindered by sodden, oxygen-poor environments.
- Some seeds will germinate over a large range of temperatures, whereas others require a narrow range. Some seeds have minimum, maximum and optimum temperatures at which they germinate. Suitable temperatures need to be reproduced in the seed house.
- Seed trays should be labelled as follows:
  - Name of the plant species.
  - Date of propagation and potting.
  - Name of the propagator.
  - Name of the rehabilitation area.
  - Area where the seeds were collected.
- Seed trays are then placed in the seed house.
- Seed trays containing seeds from the same rehabilitation area should be kept together.

5.4.6 Collection & Propagation of Indigenous Plant Cuttings

The collection of indigenous plant cuttings should start at least two years before mining commences, which means that the nursery needs to be established before cutting collection starts. The following methods are relevant (Wilman, 2019):

- Stem cuttings may either be softwood, herbaceous, semi-hardwood or hardwood cuttings.
- Stem cuttings are segments of shoots that have lateral (side) or terminal (main tip) buds and the potential for adventitious roots to develop.
- Stem cuttings can be taken from the tip of the stem with a terminal bud or from other parts of the stem. Many plants root best from tip cuttings.
- Groundcover and herbaceous perennials can be grown from tip cuttings.
- Sharp, sterilised secateurs should be used when taking cuttings of species in the mining footprint.
- Stems are cut just below a node and all but the top few leaves are removed neatly with the sharp secateurs.

- Softwood cuttings are prepared from the soft, succulent new growth of stems and are usually tip cuttings:
  - Groundcover and herbaceous perennials can be grown from softwood cuttings.
  - The cuttings should not be too soft and tender, as these tend to rot. The best material should be flexible but mature enough to break when bent sharply. Softwood cuttings generally root easier and quicker than other types, but require more attention.
  - The cuttings are made by cutting a shoot that includes at least four nodes, two for roots and two for shoots.
  - The basal or lower cut is made just below the node. In the case of middle-of-the-stem cuttings without a terminal shoot, the upper cut is made just above the node.
  - The leaves on the lower two-thirds of the stem are removed.
  - The cutting should be sterilised by dipping it into a diluted bleach solution, a disinfectant like Sporkill or various broad-spectrum fungicides.
  - The bottom or basal end of the cutting can then be dipped into a rooting hormone for softwood cuttings, such as Seradix 1.
  - A hole is made in the rooting medium in the plug tray and the cutting is placed into the hole. The medium is pushed firmly against the stem. The cutting is then watered to settle it down and placed in the seed house.
- Herbaceous cuttings are made from succulent, non-woody plants:
  - Succulents can be grown from herbaceous cuttings.
  - These cuttings can be from 8 to 13 cm long with a few leaves retained at the tips, but they will grow even without leaves.
  - Succulent herbaceous cuttings are often left to callus or ‘seal’ for a few days to a week before inserting them into the rooting medium.
  - Rooting hormones are not always required but can be beneficial for the development of heavier root systems.
  - Herbaceous cuttings can be rooted under the same conditions as softwood cuttings.
- Semi-hardwood cuttings are usually taken in summer from new shoots that have been allowed to partially mature, after flowering and just after a flush of growth has taken place:
  - Shrubs and climbers can be grown from semi-hardwood stem cuttings.
  - They are made 7,5–15 cm long and two-thirds of the leaves of the lower portion are removed.
  - If the leaves are very large, they may lose too much water and be unable to photosynthesise and make food, which is necessary for root formation as softwood and semi-hardwood cuttings depend on food produced while in propagation. Large leaves may be trimmed to a third or half their size to reduce the leaf surface area, lowering water loss.
  - The bottom or basal cut for semi-hardwood cuttings can be made at a slant, or cuttings can be wounded to expose more cambium (the green layer just under the bark). This is where rooting takes place and it will create a greater surface area from which rooting hormones can be absorbed. It may also improve the contact area between the cutting and the medium.
  - The rest of the cutting-making process is the same as for softwood cuttings.

- Hardwood cuttings are generally made from deciduous (plants that lose their leaves in winter or summer) or semi-deciduous species and are made using hard, woody material:
    - Three different types of hardwood cuttings can be made:
        - A mallet cutting includes a short entire section of stem of the older wood while a heel is pulled off the old stem, taking with it a small piece of the older wood.
        - Heel cuttings are usually made from semi-hardwood and hardwood cuttings by tearing a side shoot off the main stem so that a part of the main stem remains attached to the base of the cutting. This is the heel. Rooting takes place at the callus tissue that forms around the heel. The lower leaves are removed and the cuttings are rooted under the same conditions as for softwood and semi-hardwood cuttings.
        - A straight cutting is the most commonly used and does not include any older wood. The straight bottom or basal cut is made just below a node while the top of the cutting is made above a node and is cut at an angle to make it easier to distinguish between the top and the bottom of the cutting.
    - Hardwood cuttings are taken before the end of winter when the sap is rising and the buds are about to swell.
    - The wood is usually from the previous season's growth, but for a few species older wood can also be used.
    - The wood should not have abnormally long internodes, nor be from small, weak interior shoots.
    - In general, hardwood-cutting material is ready when the leaves can be removed without tearing the bark.
    - Hardwood cuttings can be from 10 to 76 cm long. The smaller cuttings should have a diameter of 0,6 to 2,5 cm. Very long cuttings, whose diameter can be more than 40 mm, are called truncheons.
    - Hardwood cuttings can also be wounded as in semi-hardwood cuttings.
    - Deciduous cuttings are made without leaves, but hardwood cuttings can also be made from narrow-leaved evergreen species, in which case some leaves remain on the tip of the cutting.
    - Cuttings can be treated with a hormone such as IBA at 2 500 to 5 000 ppm or Seradix 3 for hardwood.
    - Hardwood cuttings can be rooted in the seed house and should not be allowed to dry out.
- Some plants can be grown by means of leaf cuttings, where the leaf blade or the leaf blade and petiole (leaf stalk) are used as cutting material:
    - Adventitious buds, shoots and roots form at the base of the leaf and develop into a new plant.
    - The leaf is removed from the mother plant by slicing cleanly through the petiole so that about 5cm of stalk is attached to the leaf. A small hole is made in the propagating medium and the leaf petiole is inserted into the medium at a shallow angle so that the leaf blade lies almost flat on the medium and the stalk is close to the surface. The medium is pressed down firmly around the stalk. New plantlets will form on the cut surface of the leaf stalk.
    - In one method, species with long tapering leaves are cut into horizontal sections of 8 to 10 cm long. Three-quarters of the leaf section is inserted into the rooting medium and after some time, a new plant forms at the base of the leaf piece.
    - Plants with fleshy and hairy leaves can be propagated by making incisions into the large veins on the underside of the leaf. The leaf is laid flat on the surface of the propagating medium and pinned or held down

with the upper surface of the leaf exposed. New plants form at the place where each vein was cut and the old leaf gradually disintegrates.
  - Some leaf cuttings can be made by cutting large leaves into triangular sections, each with a section of a large vein. These leaf pieces are then inserted upright into the propagating medium with the pointed end down. The new plant develops from the large vein at the base.
  - Well-developed, healthy leaves should be used and leaf cuttings should be rooted under the same conditions as softwood cuttings.
- Cuttings should be collected in the cool, early mornings and must immediately be placed in plastic bags containing a tiny amount of water to keep the cuttings moist.
- In the seed house, cuttings are placed in plug trays that have been filled with a rooting medium. The medium should be well aerated and well drained while being able to retain moisture. The main functions of the medium are to hold the cutting in place, to provide moisture to the cutting, to allow an exchange of air at the rooting zone and to create a dark environment for the cutting base.
- Rooting hormones can be applied to cuttings to speed up rooting and are sometimes necessary for hard-to-root species. An inexpensive, easy-to-use and effective rooting hormone is Seradix, which comes in various strengths: Seradix 1, 2 and 3. The cutting is dipped into the powdered rooting hormone to form a thin layer on the open cut part of the stem and then placed in the rooting medium in the plug tray.
- The plug trays are placed in the seed house and labelled as follows:
  - Name of the plant species.
  - Date of potting.
  - Name of the propagator.
  - Name of the rehabilitation area.
  - Area where the cuttings were collected.
- Plug trays containing cuttings from the same rehabilitation area should be kept together.

5.4.7 Propagation by Offsets

Some plants can be propagated vegetatively by separating or dividing them such as in aloes and many bulbs. These divisions are offsets which are lateral or side shoots or branches that develop from the main stem (Wilman, 2019):

- Offsets can be removed by cutting them off close to the main stem with a sharp knife.
- Some offsets may have already produced roots and can be planted directly.
- If the offsets are not sufficiently rooted, they can be placed in a rooting medium and treated in the same way as a leaf cutting.
- Many herbaceous perennials and grasses produce their new shoots from crowns at the surface or just below ground level. These can be increased by division:
  - The plant is lifted out of the ground, usually in the spring just before new growth begins.
  - It is either separated by hand or cut into sections with a knife or other sharp instrument.
  - These divisions can then be planted straight into grow bags and placed in the shade house.

5.4.8 Further Plant Propagation

Once seeds have been sown and germination has occurred, and cuttings have been planted in plug trays, the following methods are pertinent (Wilman, 2019):

- Once roots have developed in cuttings, they are transferred from the plug trays into planting bags or pots with potting soil.
- Once seedlings have established, they are transferred from the seed trays into planting bags or pots with potting soil.
- Once the seedlings or plants are growing well in the seed house, they are placed in shade in the shade house for a few weeks of hardening off until they are ready to be moved out into the sun for further hardening.
- Proper hygiene and cleanliness throughout the nursery are essential during all stages of propagation.
- Plants in the nursery should always be well maintained and kept weed free.
- The correct watering regime must be maintained throughout the propagation process so as to provide sufficient water and avoid too much watering or too little watering. Watering is reduced at each stage to harden the plants off and prepare them for planting on site.

5.4.9 Transfer of Whole Plants to the Nursery

Species of Conservation Concern & Protected Species

Provincially protected plant species, NEMBA TOPS plant species and nationally protected tree species that occur (confirmed occurrence) or are likely to occur (medium or high potential of occurrence) in the mining footprint will have to be identified and geo-referenced for possible translocation to the nursery during a search and rescue operation by a contracted plant specialist who is familiar with the indigenous vegetation of the mining footprint (Section 6.2.21). Those plants which are possible to translocate should be translocated and maintained in a healthy state in the nursery. This process should begin once the nursery is established. Permits will have to be applied for plants which are possible to translocate and those which are not possible to translocate from the provincial and national authorities.

Keystone Species

Keystone species that are present in the mining footprint will have to be identified and geo-referenced for possible translocation to the nursery. Those plants which are possible to translocate should be translocated and maintained in a healthy state in the nursery. This process should begin once the nursery is established.

Seedlings

Seedlings of indigenous plants or plants small enough to translocate should be translocated and maintained in a healthy state in the nursery. This process should begin once the nursery is established.

5.5 Rescue of Fauna

A faunal specialist will be contracted to conduct a search and rescue operation of the mining footprint just before the clearing of vegetation for slow fauna that are not able to move out of the area in good time, such as tortoises and chameleons. Translocation to suitable safe nearby areas will be undertaken.

5.6 Soil Management

Soil management is the key process in determining rehabilitation effectiveness and hence attention must be focused on this aspect (CMSA & CoalTech, 2007).

Soil Plan

A soil plan is necessary for the mining footprint showing soil form, soil depth, diagnostic horizon, area of extent and spatial extent characteristics that determines the nature of soils to be removed, stockpiled and used in later rehabilitation (Section 3.4). It is evident that soil depth in most of the mining footprint is extremely limited (ZRC, 2025), and hence very limited vital topsoil is potentially available for the rehabilitation process, which places intense emphasis on stringent topsoil conservation during the stripping, stockpiling and replacement phases of rehabilitation.

Soil Stripping

Soil stripping guidelines should be developed for the construction crews which clearly define the soil horizons to be removed and how to store them in the stockpile area. The soil stripper must easily understand the guidelines. Regular review of performance by the rehabilitation specialist is required to ensure that stripping is done correctly (CMSA & CoalTech, 2007).

Significant losses of soil materials can occur during the stripping and replacement processes. Planning the removal and stockpiling of soils will increase effectiveness of the rehabilitated end product (CMSA & CoalTech, 2007). This is critically important as very limited topsoil and subsoils exist in the mining footprint (ZRC, 2025).

5.7 Access, Internal & Haulage Roads

Existing roads should be used and widened if necessary. The indigenous vegetation for any new roads or widened roads must be cleared and taken to the stockpile area for shredding as stockpiled mulch. Topsoil and subsoils should be stripped and stored in the stockpile area. The nursery manager should manage the clearance, shredding and stockpiling of indigenous vegetation. The rehabilitation specialist should manage the stripping and stockpiling of the topsoil and subsoils.
Sensitive ecological areas should be avoided such as the two episodic drainage lines and preferential flow paths (SAS, 2025; TBC, 2025a; TBC, 2025b).

6 ANNUAL REHABILITATION PLAN: PROGRESSIVE REHABILITATION, MAINTENANCE & MONITORING

Appendix 3 of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations provides the minimum content of an annual rehabilitation plan on which Section 6 is based (DEA, 2015). According to Appendix 3, the objectives of the annual rehabilitation plan are as follows:

a) Review concurrent rehabilitation and remediation activities already implemented.
b) Establish rehabilitation and remediation goals and outcomes for the forthcoming 12 months, which contribute to the gradual achievement of the post-mining land use, closure vision and objectives identified in the holder's final rehabilitation, decommissioning and mine closure plan.
c) Establish a plan, schedule and budget for rehabilitation for the forthcoming 12 months.
d) Identify and address shortcomings experienced in the preceding 12 months of rehabilitation.
e) Evaluate and update the cost of rehabilitation for the 12-month period and for closure, for purposes of supplementing the financial provision guarantee or other financial provision instrument.

6.1 Timeframe Implementation & Rehabilitation Activity Review

According to the DEA (2015), this involves timeframes of implementation of current rehabilitation activities and review of previous rehabilitation activities. The annual rehabilitation plan will be applicable for one year, commencing from the date of approval by the Department of Minerals and Petroleum Resources (DMPR), after which the plan will be updated by Assmang (Pty) Ltd to reflect progress relating to rehabilitation and remediation activities in the preceding 12 months, and to establish a plan, schedule and budget for the forthcoming 12 months. Assmang (Pty) Ltd will review and update the annual rehabilitation plan during the 11th month to ensure punctual submission to the DMRE for its annual review.

6.2 Monitoring Results

According to the DEA (2015), this involves results of monitoring of risks identified in the final rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities. Since mining has not yet been authorised and has not yet commenced, no monitoring results are available. Hence, this section covers activities and aspects which should be monitored, together with the monitoring rationale and supporting information.

The objective of monitoring is to ensure that the rehabilitation process remains on track during the construction (site establishment), operational, decommissioning and closure phases by carefully monitoring the progress of the physical aspects such as nursery establishment, vegetation removal, soil stripping and stockpiling, overburden handling, landform shaping, soil replacement and vegetation establishment, together with re-establishment of the desired final wilderness ecosystem (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Monitoring is critically and vitally important to successful rehabilitation and should include the following aspects which form part of progressive rehabilitation over the life-time of the mining operation and cover a succession of annual rehabilitation plans. All monitoring activities should be managed by the rehabilitation specialist and he/she should be responsible for delegating activities to competent relevant individuals like the environmental control officer (ECO) or nursery manager.

Fixed point geo-located photographs of the mining footprint that will have been taken in the pre-mining natural wilderness footprint, must continue to be taken during annual progressive rehabilitation to provide comparative reference information and document rehabilitation.

6.2.1 Nursery Establishment & Management

The experienced competent nursery manager must regularly monitor the establishment and management of the nursery which will provide healthy indigenous plants from the pre-mining footprint for the vital establishment of vegetation during rehabilitation and the return of the mining area to a wilderness ecosystem. The nursery manager must ensure that the nursery is established more than two years before mining commences so that seeds and cuttings can be grown and plant species of conservation concern, protected species, seedlings and small plants can be translocated to the nursery. The growing and translocation of plants require at least two years before mining commences. The nursery manager will be responsible for training the nursery staff in the various aspects of the nursery's functions and monitoring their work. Weekly monitoring is necessary by the nursery manager.

6.2.2 Collection of Indigenous Plants

The nursery manager must ensure the following, with daily required monitoring:

- That abundant seeds, cuttings, seedlings and whole plants are collected in the mining footprint that cover the indigenous plant diversity.

- That as many plant species of conservation concern and protected plant species as possible are translocated to the nursery. Permits from the provincial and national authorities will be required for these plants and for those that cannot be saved.
- That the seeds, cuttings and seedlings of invasive alien plants are not collected.
- That plants from the same area are kept together in the nursery so that they can be translocated to the area from where they originated and that labelling of all plants is in order.

6.2.3 Rescue of Fauna

The nursery manager and staff from the nursery will also be responsible for checking the mining footprint just before the clearing of vegetation for slow fauna that are not able to move out of the mining footprint in good time and rescuing them, such as tortoises and chameleons. Translocation to suitable safe nearby areas and daily monitoring are necessary.

6.2.4 Surface Hydrology

In the hydrological impact assessment, the potential impacts associated with the mining operation during the construction and operational phases on surface water quantity and quality in the mining footprint and surrounding areas were assessed (TBC, 2025a). During the construction phase, identified impacts resulting from mining activities include the following:

- Clearing of vegetation for mining operations;
- Water Quality:
  - Sedimentation;
  - Domestic waste and sewage;
  - Hydrocarbons and hazardous materials.
- Destruction of riverine habitat; and
- Alterations to the natural hydrological flow regime.

Mitigation measures recommended in the hydrological impact assessment for the construction phase are shown in Appendix 3.

During the operational phase, identified impacts resulting from mining activities include the following:

- Water Quality:
  - Sedimentation;
  - Discharge from Operations;
  - Domestic waste and sewage;
  - Hydrocarbons and hazardous materials.
- Alterations to the natural hydrological flow regime:
  - Increased runoff;

Mitigation measures recommended in the hydrological impact assessment for the operational phase are shown in Appendix 3. The rehabilitation specialist will be responsible for implementing the mitigation measures during the construction and operational phases and monitoring their effectiveness.

In the pre-mining footprint, surface water quality samples from the Kimberlite shaft in the Makganyane mining rights area indicate elevated levels of chlorine and ammonium (TBC, 2025a). Apart from the shaft, no other surface water resources in the mining rights area contained any water, and hence extensive sampling could not be undertaken.

The hydrological assessment indicates that the mining operation poses low to medium post-mitigation risks to the identified watercourses that depend on effectively implementing the recommended mitigation measures which cover the following areas (TBC, 2025a): Stormwater management, erosion and sedimentation prevention, proper chemical use and storage, rehabilitation of disturbed areas, prevention of runoff into water resources and their buffers, and restricting heavy vehicle operations within specified zones.

The present rehabilitation plan recommends further mitigation during the decommissioning and closure phase: The functionality of the surface water drainage systems should be checked regularly by the rehabilitation specialist, preferably after the first major rains of the season, and then after any major storm to enable early repair of drainage structures that are not functioning efficiently, before they break and cause significant erosion damage, and to ensure that the drainage of the re-created land profile minimises hydrological impacts. Water quality leaving the mining area and at any other locations within the property specified by the Department of Water Affairs and Sanitation should be monitored. Samples taken should be analysed for particulate, soluble and biological contaminants.

The following recommendations were made in the hydrological assessment to ensure the conservation of aquatic resources (TBC, 2025a):

- A competent Environmental Control Officer (ECO) must oversee the construction, operation and rehabilitation phases of the project, with watercourse areas as a priority;
- An Erosion Risk Assessment and Management Plan should be completed and implemented to determine the highest erosion risk areas, which would be important for erosion management throughout the project lifecycle.
- A rehabilitation plan should be prepared and implemented during the project lifecycle to ensure that ecological integrity and ecosystem services can be restored in the event of degraded wetland and aquatic habitats.
- A remediation plan that encompasses all types of potential pollution should be prepared and implemented.

In the present rehabilitation plan, it is recommended that a competent and experienced rehabilitation specialist should manage the entire rehabilitation process during the construction, operational, decommissioning and closure phases. The ECO who is recommended in the hydrological assessment, would fall under and be managed by this specialist.

The stormwater management plan (SWMP) proposes the following stormwater infrastructure (TBC, 2025b):

- Dirty stormwater channels around the waste rock dump, stockpile area and site camp (represented in red in the SWMP's Figure 7-1);
- Two evaporation dams discussed below in Section 6.2.13;
- Sumps for pit 1 and 2 that would be located at the lowest point in each pit to collect runoff in the pits and decant from the mining operations. The sumps should be kept low to cater for runoff during rainfall. The sump water should be used for dust suppression.

- The dimensions of the evaporation dams and sumps should be at the discretion of the consulting engineer, although flow volumes in the SWMP's Table 7-2 should be considered;
- Silt fences should be installed on the downgradient of pit 1 and 2 to reduce sedimentation of the nearby watercourses or drainage lines (SWMP's Figure 7-1);
- Dirty stormwater channels should encircle the site camp to divert runoff towards a sump with an oil separator. Excess water from the sump can be considered clean after passing through the oil separator and can be allowed to flow away from the site into the nearby drainage line; and
- Clean stormwater diversion channels should be made in the area between pit 1 and the waste rock dump to divert clean water away from mining operations towards the drainage line located nearby to the east (SWMP's Figure 7-1).

The SWMP recommends the following stormwater infrastructure management measures (TBC, 2025b):

- The proposed containment facilities should be designed to incorporate a 0.8m freeboard (the vertical distance between the water's surface and the top of a hydraulic structure, such as a dam or channel);
- The SWMP should be revisited after any major changes to the current operations or design changes;
- Stone pitching channels should be used to transfer runoff and to reduce high runoff velocities in channels;
- To prevent clogging of the grated channel covers and maintain channel capacity, best practice and proper housekeeping practices must be ensured;
- All channels must be checked after any major rainfall events to ensure that there are no blockages and that the water flow will not be restricted in any way;
- Sediment that accumulates within channels and retention facilities needs to be removed directly after the storm events and appropriately disposed of to ensure design capacity is maintained; and

Storm water attenuation facilities should be operated empty or at a storage level low enough to accommodate storm water inflows, whilst meeting the required spillage frequency (1:50-year Return Period) and freeboard requirements.

6.2.5 Groundwater Quantity & Quality

The geohydrological assessment indicates that the main mining activities which may have an effect on groundwater quality or quantity availability are as follows (Groundwater Complete, 2025):

- Generation of stockpile and waste rock dump (WRD);
- Excavation of the pits;
- Waste water generation and management.

Potential impacts or risks are all of low significance before and after mitigation except for pit excavation which has medium significance before mitigation (Groundwater Complete, 2025). The study's mitigation measures are shown in Appendix 2.

The following monitoring activities are recommended by Groundwater Complete (2025) that should be managed by the rehabilitation specialist:

- Groundwater monitoring for water quality and quantity (water levels) should be conducted every three months to build up a solid time-series baseline in the mining area. The monitoring frequency should be reassessed in terms of stability of water levels and quality.

- Five areas should be monitored to focus on different aspects using existing exploration boreholes (Table 6-1, Groundwater Complete, 2025):
  - Pit 1 area: Four boreholes for water level monitoring;
  - Pit 2 area: Five boreholes for water level monitoring;
  - WRD area: Four boreholes for inorganic compound monitoring;
  - Stockpile area: Four boreholes for inorganic compound monitoring;
  - Office latrine area (site camp): New borehole needed for bacteriological monitoring.
- Important active user boreholes should be monitored within a preferable 2km radius of the mining activities. Monitoring of abstraction rates (flow meters), water levels (at least quarterly) and groundwater quality (at least 6-monthly) in these boreholes should start at least a year before commencement of construction.
- Groundwater samples should be analysed at a SANAS accredited laboratory for chemical and physical constituents normally associated with iron ore mining and related activities, such as electrical conductivity, pH, total dissolved solids, total hardness, total alkalinity, calcium, magnesium, sodium, potassium, chloride, sulphate, fluoride, nitrate, iron, manganese, aluminium and turbidity.
- The main complaint from neighbouring farmers causing the most conflict with iron ore mines in the Makganyane region is of boreholes drying up as a result of mining. Thus, aquifer testing should be conducted on actively used nearby farm boreholes before mining starts. This should provide sufficient information to address such complaints objectively when combined with the hydrocensus and water level monitoring programme.

The following maintenance principles should be adhered to (Groundwater Complete, 2025):

- Monitoring boreholes should be capped and locked at all times;
- Borehole depths should be measured quarterly and the boreholes blown out with compressed air (if required); and
- Vegetation around the boreholes should be removed on a regular basis and the borehole casings painted, when necessary, to prevent excessive rust and degradation.

6.2.6 Terrestrial Ecology & Biodiversity

The terrestrial ecology, biodiversity and floristic and faunal characteristics of the pre-mining footprint and surrounding area are described in three specialist studies which provide mitigation measures for potential impacts during the planning, mining, decommissioning and rehabilitation phases (Appendix 5 & 6; STS, 2025a; STS, 2025b; STS, 2025c). The rehabilitation specialist will manage and monitor the mitigation measures during the whole mining operation.

6.2.7 Freshwater Ecology & Biodiversity

The freshwater ecology and biodiversity of the pre-mining footprint and surrounding area are described in the Freshwater Ecosystem Assessment which provides mitigation measures for potential impacts during the planning, mining, decommissioning and rehabilitation phases (Appendix 4; SAS 2025). The rehabilitation specialist will manage and monitor the mitigation measures during the whole mining operation.

6.2.8 Vegetation Clearance & Mulch Generation

The nursery manager will be responsible for daily monitoring of the clearance of indigenous vegetation and the generation of mulch. The mining footprint must be clearly demarcated to minimise negative impacts on the indigenous vegetation and natural ecosystems in the area. The mining footprint comprises of the site camp, stockpile area, waste rock dump (WRD), pit 1 and 2 and haulage roads. Vegetation within this footprint should be cleared when necessary and not too long in advance of mining activities to minimise negative impacts. Only the western part of the proposed WRD should be cleared of vegetation to accommodate the deposit of overburden and rock containing iron ore and to prevent negative impacts on the drainage lines, indigenous vegetation and lower lying land in the eastern part (Figure 2). If and when more space is required, then more of the proposed WRD should be cleared. Existing roads in the mining footprint should be used for haulage as far as possible to minimise the clearing of natural vegetation.

The cleared indigenous vegetation should be taken to the stockpile area where it is shredded and stockpiled as mulch for the rehabilitation phase using a wood chipper and / or forestry mulcher. Organic matter in the form of mulch from shredding the indigenous vegetation in the mining footprint is vitally important for the success of rehabilitation, especially considering the extremely limited amount of topsoil and subsoils (ZRC, 2025).

6.2.9 Stripped & Replaced Soils

Lack of topsoil is one of four most common problem areas on mines (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Furthermore, because of the very shallow topsoil and subsoils in the mining footprint (ZRC, 2025), it is likely that the topsoil and subsoils will have to be stripped together, replaced together in the stockpile area, and replaced together during rehabilitation of the mining footprint before revegetation. Careful daily monitoring during the stripping and replacement phases of the following aspects is required by the rehabilitation specialist (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018):

- Recovery and effective use of all available usable topsoil and subsoils are essential especially in the mining footprint where the quantity of topsoil and subsoils is extremely limited (ZRC, 2025).
- Regular reconciliation of volumes of topsoil and subsoils stripped, stockpiled and returned to the reshaped landform is vital.
- Assessment of the stripping process is required to ensure that the correct depth of stripping has been employed.
- The stripped topsoil and subsoils must be stockpiled in their specific allocated and signposted areas in the stockpile area.
- The soil balance assessment should compare the volumes of topsoil and subsoils stripped with the volumes stockpiled and replaced. Losses in excess of 10% should be investigated immediately.
- The topsoil and subsoils should be replaced in their correct locations and to the correct depth.

6.2.10 Stockpile Management: Topsoil, Subsoils & Mulch

Once established, stockpiles should be managed to ensure that losses from the piles are minimised and that additional damage to the physical, chemical and biotic content is minimised. There are several potential agents which can harm stockpiles that include erosion, “borrowing” for use for other purposes, contamination and water logging (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018).

The topsoil and subsoil stockpiles should be enriched with mulch and revegetated with grasses from the nursery to avoid erosion losses and retain the physical, chemical and biological health of the soil. This should take place once stockpiles have attained a maximum height of four metres (Appendix 1). Relevant erosion prevention measures covered in Section 3.8, Section 6.2.4 and Appendix 3 should be implemented and monitored by the rehabilitation specialist.

Management measures must ensure that stockpiled soil is only used for its intended purpose, i.e., the rehabilitation of areas once mining operations in those areas have ended. One of the greatest causes of the loss of topsoil and subsoils is their use for other purposes. This occurs most frequently when stockpiles are not clearly demarcated with warning signposts and monitored regularly.

Risks of contamination are also possible such as the dumping of waste materials next to or on the stockpiles. A detailed management and monitoring programme and an employee awareness programme will significantly reduce the risk of stockpile "robbery" or contamination.

It is likely that topsoil will have to be imported due to the extremely limited quantity that will be available from the mining footprint. Any imported topsoil should be stockpiled separately from the mining footprint's topsoil to a maximum height of four metres and clearly sign-posted (Appendix 1).

The following aspects should be monitored regularly during the life of the mulch, topsoil and subsoil stockpiles by the rehabilitation specialist (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018):

- The stockpiles should be no-go areas except for staff directly involved.
- The stockpiles should be correctly demarcated and signposted for correct stockpiling.
- Topsoil stockpiles should have a height of no more than four metres to minimise the negative impacts on physical structure and biological properties (Appendix 1).
- Topsoil and subsoil stockpiles should be covered with a thin layer of mulch and planted with indigenous grasses grown in the nursery to stabilise the stockpiles and prevent erosion.
- The stabilising grasses should be watered and monitored daily.
- Prevention of the loss of the very limited topsoil and subsoil stockpiles is critically important.
- The stockpiles must be kept free from alien and invasive plants which have been recorded in the area (Section 6.2.21).
- The stockpiles should not be moved and should remain intact until they are deposited in the mining footprint before revegetation.

6.2.11 Waste Rock Dump Management

This rehabilitation plan recommends that overburden is deposited in the form of a hill and not a spread-out deposit in the western part of the proposed extensive 61 ha waste rock dump (WRD) to avoid preferential flow paths (Figure 3-4, TBC, 2025a) and minimise negative impacts on indigenous vegetation. The advice of a waste rock and mining specialist is being sought in terms of the feasibility (practicality, stability, safety & erosion potential) of this recommendation.

In terms of possible contamination of surface and subterranean environments by the overburden which is deposited in the WRD, waste rock presents a low environmental risk and meets the requirements for Type 4 (non-hazardous) waste when managed with standard engineered barriers and recommended monitoring (IQS, 2025). The latter assessment found that the waste rock is composed mainly of quartz and hematite with minor contributions from other minerals; is non-acid forming, with net neutralising potential and negligible risk of acid drainage; has low leachable concentrations for constituents of concern, with all but manganese below relevant guidelines for domestic, irrigation, livestock, and aquatic use; has leachable concentrations below LCT0 thresholds, although certain samples exceeded total concentration thresholds for elements such as Ba, Ni, Co, and Mn, and hence the waste is classified as Type 4 (non-hazardous) for landfill disposal; has a low risk of significant impact on surface water, groundwater, and human or ecosystem health due to low rainfall, low leachability, remote water users, and the absence of nearby sensitive ecological receptors. Key recommendations of the assessment include the following:

- Manage the WRD with standard engineered barriers;
- Ongoing surface water and groundwater quality monitoring downstream of the waste rock dump; and
- Periodic updates (every 2-3 years) of numerical and geochemical models in line with monitoring data to proactively identify changes in environmental risk, such as potential contamination.

The following aspects, including the above three items, should be monitored regularly during the life of the WRD by the rehabilitation specialist:

- The WRD should be correctly and clearly demarcated and signposted.
- The deposited overburden should be shaped in the form of a hill and not a spread-out deposit in the western part of WRD, leaving the eastern part devoid of mining impacts (The advice of a waste rock and mining specialist is being sought in terms of the feasibility of this recommendation).
- Measures to minimise erosion should be implemented (Section 3.8, Section 6.2.4 & Appendix 3; TBC, 2025a; 2025b).
- The WRD must be kept free from alien and invasive plants which have been recorded in the area (Section 6.2.21).

6.2.12 Sedimentation Control

An extensive area of the mining footprint will be devoid of an indigenous vegetation cover at any one time during the mining operation, creating a high-risk disturbed environment for water and wind erosion and ensuing sedimentation. The surrounding natural vegetation and ecosystems, especially the episodic drainage lines, preferential flow paths and possibly the non-perennial stream to the east, are most vulnerable. Erosion and sedimentation control measures are covered in Section 3.8, Section 6.2.4 and Appendix 3 and should be implemented and managed by the rehabilitation specialist.

6.2.13 Evaporation Dams

Two evaporation dams are proposed as stormwater containment measures in the stormwater management plan (Figure 7-2, TBC, 2025b): One dam measuring around 0.3 ha with a 12.057 ML capacity is proposed for the north-western corner of the stockpile area, while the other dam measuring around 1.7 ha with a 67.723 ML capacity is proposed for the north-eastern side of the waste rock dump (WRD). The dams are not expected to contain contaminated water, although the water will contain suspended sediment from the dirty water conduits which surround the stockpile area and WRD. It is recommended that the water in both dams is used for dust suppression in the mining area (TBC, 2025b). Regular monitoring of the dams should take place by the rehabilitation specialist to check on the stability and integrity of the embankments and to prevent overtopping.

6.2.14 Pollution & Waste

Treating soil contaminated by oils and other polluting liquids on mines involves various methods aimed at removing, reducing, or neutralizing the contaminants (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). These methods can be broadly categorized into physical, chemical, and bioremediation approaches. Physical methods include excavation and disposal, while chemical treatments involve using agents to break down or remove contaminants. Bioremediation utilizes microorganisms to degrade the pollutants. Oil contamination is one of four most common problem areas on mines. The contamination of soils by oil or other polluting liquids should be dealt with immediately when spillages occur and should not be left for later remedial action when the consequences are likely to be far more severe and remediation far more difficult. Physical excavation and disposal are likely to be the best and most frequently used remedial options during the mining operation. Should chemical, bioremediation or other physical options be necessary, specialists in these fields will have to be consulted as methods are highly technical and specific to the polluting agent. Pollution mitigation and management measures for dirty water, hydrocarbons, hazardous materials, domestic waste and sewage are covered in Section 6.2.4 and Appendix 3. The implementation and monitoring of these and the following measures should be managed by the rehabilitation specialist:

- Domestic/general waste will be contained in sealable refuse bins which will be kept in a designated area in the site camp until transportation to a registered landfill site.
- Hazardous spillage waste and contaminated soil will be contained in designated hazardous waste containers which will be kept in an impermeable bunded area in the site camp until transportation to a registered hazardous waste facility by a registered hazardous waste contractor.

6.2.15 Dust Suppression & Noise Control

Frequent dust suppression through the spraying of water from water tanker trucks will take place during the construction and operational phases of the mine over exposed soil areas, including haulage roads. The rehabilitation specialist will regularly monitor this activity to ensure that acceptable levels are attained. Indigenous vegetation surrounding the mining area will be checked regularly for excessive dust as well. There must be compliance with the National Dust Control Regulations, GN No R827, promulgated in terms of NEM:AQA, 2004 and ASTM D1739 (SANS 1137:2012). A qualified occupational hygienist will report on the gravimetric dust levels of the mining area every three months.

The occupational hygienist will also monitor and report on the noise exposure of the mine's personnel every three months. Monitoring will be in accordance with SANS 10083:2004 (Edition 5) sampling method and NEM:AQA 2004, SANS 10103:2008. Silencers will be fitted to all mine vehicles which will be in a road-worthy condition according to the National Road Traffic Act, 1996. Noise mufflers will be fitted to generators. The type, duration and timing of each blasting activity will be planned with due consideration of neighbouring land users and nearby structures. Blasting will be communicated to neighbouring land users and mine personnel well in advance.

6.2.16 Alien & Invasive Plant Control

The rehabilitation specialist will manage the control and monitoring of alien and invasive plants (AIPs) on the mulch, topsoil, subsoil and waste rock dump stockpiles and anywhere else in the mining footprint in accordance with an essential AIP management plan. Monitoring will take place once a month. AIPs, which were recorded in the pre-mining footprint that are likely to grow in the disturbed mining environment, are covered in Section 5.2.19. AIPs thrive in disturbed ecological conditions like those that will prevail in the mining area. One of the key objectives in the revegetation and maintenance programmes for mined land is the control and eradication of AIPs, which have proved to be a major problem in many mining areas that can threaten the rehabilitation process (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). With regular monthly monitoring, all potential IAP species should be detected during the young seedling stage and hence it should be possible to remove them by hand-pulling. The longer they are left in the soil, the more difficult they will be to control.

6.2.17 Backfilling of Overburden or Waste Rock

As much of the waste rock as possible should be backfilled into pit 1 and 2 with some being used to contour the voids.

Sufficient time should be given for the backfilled overburden to settle and stabilise on the advice of an experienced geotechnical/rock engineer. Necessary contouring of the slopes of the pits should then be undertaken so as to obtain gradients which are acceptable for revegetation and erosion mitigation, and not too steep. The backfilling of overburden into pit 1 and 2 and the attainment of acceptable gradients will be closely monitored by the rehabilitation specialist.

6.2.18 Shaping of the Land: Landform Profiling & Alignment

Before the topsoil and subsoils are deposited in the rehabilitation footprint, the areas that have been disfigured during mining such as pit 1 and 2 and the waste rock dump (WRD) containing remnant waste rock or overburden, will have to be shaped so as to be suitable for the envisaged wilderness ecosystem, which is the target land-use during rehabilitation. The following aspects will have to be closely monitored by the rehabilitation specialist:

- A rock engineer must provide advice on the slopes of pit 1 and 2 when the mine enters the decommissioning phase, but gradients should be minimised as far as possible and aimed at not exceeding the steepest gradients in the surrounding landscape.
- The gradients should be suitable for rehabilitation activities and should not be too steep.
- The surfaces should be as even as possible to enable the deposition of subsoils and topsoil so as to provide a suitable substrate for revegetation.
- The overburden in the WRD will have been gradually fashioned into a hill during excavation in the western part of the WRD (Waste rock and mining specialist advice is being sought for this recommendation). The above conditions about gradients and surfaces apply to the WRD as well.
- The final landform profile must be acceptable in terms of surface water drainage requirements and the wilderness land-use objective.
- Signoff by the rehabilitation specialist of the reshaped mining footprint is required before topsoil and subsoils are deposited.

6.2.19 Replacement of Topsoil & Subsoils

Once the slopes of pit 1 have been contoured to acceptable gradients, subsoils and topsoil from pit 1 that have been stored in the stockpile area are replaced over pit 1's slopes. Topsoil and subsoils should not be wasted on the deposited waste rock at the bottom of pit 1, as the pit will gradually fill with water. Before replacement of the subsoils and topsoil, the surface layer of mulch and grasses that was protecting the soil in the stockpile area should be removed and placed in the stockpile area for placement on the pit's slopes during the ensuing revegetation phase. The rationale is to allow the mulch and grasses that were protecting the subsoils and topsoil to form part of the biological rehabilitation process on the pit's slopes and to prevent wastage of this vital resource. The surface on the slopes will need to be made even, tilled and ripped if compacted so that it is ready for revegetation. The same process should be repeated for pit 2.

Before replacement of subsoils and topsoil takes place in the site camp and topsoil and subsoil stockpile area, the areas will have to be clear of materials so that they can be ripped and prepared for revegetation. The hill that has been formed from deposited waste rock (overburden) in the waste rock dump (WRD) should be contoured and the surface made as even as possible for the replacement of subsoils and topsoil. The remaining parts of the WRD should be cleared of any material and ripped for the replacement of subsoils and topsoil.

Because of the probable shortage of topsoil and subsoils from the pre-mining footprint, imported topsoil will most likely be necessary during the topsoiling phase of rehabilitation. Imported topsoil will have been stored separately in the stockpile area and will be used to supplement topsoil from the pre-mining footprint during the replacement of topsoil in the rehabilitation area. The replacement of subsoils and topsoil will be closely monitored by the rehabilitation specialist.

6.2.20 Soil Amelioration

The replaced soils in the rehabilitation footprint will be inferior to the natural profile due to compaction and mixing of topsoil and subsoils. Consequently, they will be less satisfactory as a plant growth medium, having lower organic matter content, reduced chemical fertility, degraded physical condition and depleted microbial populations.

Physical Properties

Replaced soils usually require physical amelioration because soil removal, stockpiling and replacement result in high levels of compaction (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Current prevention methods, equipment and replacement methods are ineffective at compaction prevention. Consequently, there is a need for reconstituted profiles to be loosened and this is usually achieved by ripping, with variable success. The stockpiling of subsoils and topsoil to a maximum height of four metres, rather than the commonly used height of five metres, will help mitigate compaction. The following mitigation measures should be implemented (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018):

- Correct soil moisture content for maximum disturbance must be established.
- Ripping must penetrate through the topsoil and subsoils into the underlying substrate to ensure free drainage and plant root penetration. The surface of the underlying substrate is usually compacted and the soil-underlying substrate interface frequently inhibits free drainage and acts as an impenetrable barrier to deep plant root penetration. Hence, ripping of the soil and underlying substrate interface is necessary. Agricultural rippers pulled by a tractor may not penetrate the soil deeply enough, and hence ripping may require the use of a dozer with one or two ripper tines, operating to the required depth of the interface between the soil and underlying substrate. The use of the latter two types of rippers may not be possible on steep slopes such as in pit 1 and 2 and on the waste rock hill in the waste rock dump during rehabilitation, and thus alternative methods may need to be used.
- Acceptable soil bulk density values must be determined and progress monitored against the target. The determination of bulk density and soil moisture should be determined in the natural pre-mining footprint so that accurate target values are already known for when rehabilitation is conducted. This procedure will apply to the deposited topsoil and subsoils from the pre-mining footprint before revegetation and to imported topsoil that may be necessary.
- Surface tillage may be necessary to provide a suitable seedbed for the indigenous vegetation to be established.

Chemical Properties

The previous soil fertility regime of the natural landscape before mining will have been preserved as much as possible in the stockpiled topsoil and subsoils. However, because of the very shallow soils in the mining footprint, the topsoil and subsoils will probably have to be stripped together and deposited in the stockpile area together. Further mixing of the topsoil and subsoils will have occurred when they are deposited in the mining footprint before revegetation. Thus, the replaced soils are likely to require chemical amelioration because nutrients will have been lost and diluted during the stripping, stockpiling and replacement stages, especially in the topsoil where they are vitally important for plant growth.

Soil fertility should be restored in the following ways (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018):

- The topsoil and subsoils in the pre-mining footprint should have been tested chemically so that an important comparative reference is established. Topsoil and subsoils that are deposited in the mining footprint before revegetation should be analysed for plant nutrient content and compared with the pre-mining soil sample chemical status.
- If necessary, fertiliser should be applied to raise soil nutrient content to the desired levels. Repeated maintenance dressings may be required until the soil fertility cycle is restored. The immobile chemical constituents such as calcium, magnesium and phosphorus are relatively easy to replace with a single application. The mobile constituents, in particular nitrogen and potassium, are not. In undisturbed soils, nitrogen fertility is a complex issue that revolves around the presence of organic matter. This emphasises the importance of applying mulch to the soil stockpiles during stockpiling and to the replaced soil before revegetation. The mobile plant nutrients, e.g., nitrogen and potassium, will leach down into the plant rooting zone, while the less mobile nutrients, e.g., calcium, magnesium and phosphorus, are less likely to do so. For full effectiveness, the latter nutrients need to be incorporated into the plant rooting zone. A single pre-planting application of fertiliser may be inadequate to restore soil fertility cycles. Soil sample chemical analyses will indicate whether repeated applications of nitrogen and potassium fertilisers are required to restore soil fertility cycles.
- The pre-revegetation testing of the topsoil and subsoils is also necessary to reveal any toxicity which would compromise successful revegetation.

Soil acidity is one of the four most common problem areas on mines (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Soils can be affected by acids either by leaching with highly acid waters, or by capillary action which raises the acidity from underlying sulphide containing materials upwards through the overlying soil profile. Acidity moving through a soil causes both chemical and physical composition changes. However, waste rock samples tested in the pre-mining footprint, indicate the prevalence of quartz and hematite with minor contributions from other minerals that are no non-acid forming, with net neutralising potential and negligible risk of acid drainage (IQS, 2025). Hence, soil acidity is unlikely, although soil tests in the pre-mining footprint and prior to revegetation will confirm this.

Metal toxicity is also one of the four most common problem areas on mines (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Soils may be naturally high in particular metals which may attain toxic levels during the removal, stockpiling and replacement process. Soil tests in the pre-mining footprint and prior to revegetation will test for this.

If the deposition of imported topsoil is necessary before revegetation, it too should be analysed for plant nutrient content and compared with the pre-mining soil sample chemical status. If necessary, fertiliser should be applied to raise soil nutrient content to the desired levels.

Biological Properties

Most of the biological properties such as micro-organisms, which are essential for plant growth, are concentrated in the topsoil. They are very difficult to sustain and maintain during long-term stockpiling, especially considering that mixing of topsoil and subsoils and ensuing dilution will probably occur during stripping and deposition in the stockpile area. Measures that can be employed to mitigate the negative impacts on the biological properties of the stockpiled soils and to ensure that they are in the best possible state in the deposited soils before revegetation, are as follows:

- Stockpiling to a maximum height of four metres to minimise compaction and to preserve as much soil structure as possible for the continued presence of biological properties.
- Covering of the stockpiles with a thin layer of indigenous mulch to enhance organic matter content.
- Planting of indigenous grasses on the soil stockpiles to protect and enhance the soil's biological properties.

The following monitoring is recommended (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018):

- The depth of replaced soil prior to revegetation should be assessed using a soil auger in a regular grid pattern, whereby the spacing of auger holes is 100m by 100m, giving coverage of one hole per hectare. Augering should be done until the underlying substrate is intercepted. In most rehabilitated profiles, this interface is clearly distinguishable. Each auger hole should be geo-referenced and the results plotted.
- Soil fertility sampling should be done independently also using a soil augur for each homogenous area of rehabilitation. This should be done initially during surface tillage prior to planting of the first grasses so that immobile nutrients such as lime and phosphorus can be applied and incorporated deep into the plant rooting. Soil fertility sampling should be done until the desired fertility status has been achieved.
- A number of soil pits should be dug in the rehabilitated profile to properly assess rehabilitation in terms of identification of compact soil layers, the degree of disturbance of the soil-overburden interface and the plant rooting pattern, provided the holes are dug at least one season after initial plant establishment. The pits should penetrate at least 100mm into the underlying substrate, and at least one should be dug for each uniform or homogeneous area of rehabilitation.

Soil amelioration will be closely monitored by the rehabilitation specialist and nursery manager.

6.2.21 Revegetation

Once topsoil and subsoils have been deposited in the rehabilitation footprint, tilled and tested to ensure that nutrients are sufficient for plant growth, and that soil toxicity is absent, the revegetation process should commence without delay. The entire process up until the indigenous vegetation is well established as a wilderness ecosystem will have to be carefully and closely monitored by the competent nursery manager and the rehabilitation specialist.

The probable need for importing topsoil is likely to complicate revegetation if the soil is not sourced locally as it probably will contain seeds of plant species that are not found in the pre-mining footprint, including alien and invasive plant species (AIPs). Mitigation for this will be difficult, but will involve removal of species not found in the pre-mining footprint as soon as they can be identified during revegetation, including AIPs.

Revegetation Objectives

The revegetation objectives are set to meet the closure land-use which is wilderness. Hence, the land in the mining footprint should be returned to its previous wilderness ecological state through the restoration of the indigenous vegetation and natural plant communities that were present in the pre-mining footprint.

The revegetation objectives are as follows (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018):

- Stabilise the soil and minimise erosion.
- Ameliorate soil physical properties.
- Re-establish nutrient cycles.
- Detection and eradication of alien and invasive plant species.
- Restore as many indigenous plant species as possible that were found in the pre-mining footprint, including keystone species, species of conservation concern and protected species.
- Prevent sedimentation of the episodic drainage lines, preferential flow paths and non-perennial watercourse.
- Protection of water resources.
- Prevent the air from being affected by excessive dust.
- Re-establish the wilderness ecosystem that was present prior to mining.

Guidelines for Rehabilitation Species Selection

All the indigenous plant species that will be used during revegetation were present in the pre-mining footprint and will have been grown in the nursery or stored as seeds in the nursery or present in the topsoil seed bank, except seeds probably present in imported topsoil, should imported topsoil be necessary. The staff in the nursery will have developed expertise in the propagation and care of the indigenous pre-mining footprint species that will be highly beneficial during revegetation. The following revegetation guidelines are pertinent (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018):

- Only use species that are well adapted to local environmental conditions, including the arid climate.
- Good quality planting material or seed must be readily available.
- Perennial species should form the basis of the revegetation programme initially.
- At least one grass species used must provide rapid and dense ground cover during the establishment season.
- Initial species should have a larger biomass and prolific root system.
- Species selected for rehabilitation establishment should provide protection from erosion and meet the biodiversity objective, which is to re-establish plant diversity that closely resembles the pre-mining footprint.
- Local experience regarding the establishment and maintenance of the species selected is important.

The plants grown in the nursery should be able to satisfy these guidelines once the topsoil is suitable for planting.

Methods of Establishing Vegetation

The following procedure is recommended:

- The topsoil surface for the planting of grasses, herbs, shrubs and trees from the nursery should be even, tilled and have a scattered covering of mulch.
- The grasses which have been grown in the nursery should be planted first at regular intervals on the slopes of pit 1 and 2 and in other areas of the mining footprint when they are ready for rehabilitation.
- Stored grass seeds should be scattered by hand in the rehabilitation areas. Grass seeds present in the topsoil will also germinate.

- Once the grasses have established, herbs, shrubs and trees that have been grown in the nursery should be planted in suitable bare soil spaces. The expertise and experience of the nursery manager will be important in determining the location and distribution of the planting of herbs, shrubs and trees in the rehabilitation footprint.
- Seeds of shrubs and trees that have been stored in the nursery should also be planted.

Timing of Planting

Planting should be done at the beginning of the summer rainfall season when climatic conditions are most likely to aid success. Although regular watering is vital for plant establishment, the summer will not only provide rainfall but also warmer temperatures, both of which will aid plant establishment (Section 3.2).

Vegetation Maintenance & Monitoring

- The main activity involves regular watering until plants are well established, especially in view of the semi-arid climate (Section 3.2).
- Further application of fertilisers may be necessary until the natural soil fertility cycle has been restored.
- Livestock should be excluded from the rehabilitation area to prevent overgrazing and jeopardising of the vital revegetation process. Seedlings and young shrubs and trees should be protected from wildlife browsing using metal shrub or tree protectors.
- The growth of alien and invasive plant species (AIPs) will have to be carefully monitored. The following 16 alien species that were found in the pre-mining footprint and any others must be removed (STS, 2025b): Six woody species (*Datura stramonium*, *Melia azedarach*, *Nicotiana glauca*, *Prosopis glandulosa var. torreyana*, *Schinus molle* and *Solanum elaeagnifolium*), eight herbaceous species (*Alternanthera pungens*, *Argemone ochroleuca subsp. ochroleuca*, *Bidens pilosa*, *Chenopodium album*, *Gomphrena celosiodes*, *Salsola kali*, *Schkuhria pinnata* and *Tagetes minuta*), one grass species (*Cenchrus setaceum*) and one succulent species (*Opuntia ficus-indica*). With regular monitoring of the re-vegetated area by the nursery manager and nursery staff, all of these alien species should be at the seedling stage and should be hand-pulled using protective gloves. Chemical control methods should not be necessary. AIPs have proved to be a major problem in many mining areas, and one of the key objectives in the revegetation and maintenance programmes for mined land is the control and eradication of AIPs (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). If imported topsoil is used, plant species not found in the pre-mining footprint must be removed as soon as they can be identified, including alien plant species and AIPs.
- The erosion status of the rehabilitated land should be monitored regularly and frequently after revegetation. Identified erosion areas must be remedied using appropriate anti-erosion measures and rehabilitated with topsoil and the planting of indigenous grasses from the nursery.

More detailed monitoring of the revegetation should take place in the following ways once every three months:

- Basal cover should be determined. Basal cover is the measure of the proportion of ground at root level that is covered by vegetation, and more specifically, by the rooting portion of the cover plants. It can be measured by the line-transect or quadrat method. Line transects should be long enough (e.g., 50-100m) or the random location of quadrats numerous enough to encompass representative variation in basal cover.

- Species composition and diversity should be measured against the species composition and diversity that characterised the indigenous vegetation prior to mining. Three natural vegetation types were recorded in the pre-mining footprint, namely Kuruman Mountain Bushveld which covers most of the mining footprint, freshwater habitat of the episodic drainage lines, and Olifantshoek Plains Thornveld which covers the eastern part of the proposed extensive waste rock dump in the lower lying area (Figure 6, STS, 2025b). Eighty-six indigenous plant species were recorded in Kuruman Mountain Bushveld, 33 species in episodic drainage line habitat and 77 species in Olifantshoek Plains Thornveld (Appendix C, STS, 2025b). These numbers do not represent absolute numbers of indigenous plant species, which will have numbered far more, but represent samples that were recorded. The plants sampled in the three natural vegetation types include the following sensitive species (STS, 2025b): Two confirmed nationally protected tree species (*Boscia albitrunca* and *Vachellia erioloba*); one nationally protected tree species with a high probability of occurrence (POC; *Vachellia haematoxylon*); one TOPS species (Threatened or Protected Species) with a high POC (*Harpagophytum procumbens*); six confirmed provincially protected species (*Gomphocarpus fruticosus*, *Gomphocarpus tomentosus*, *Bulbine abyssinica*, *Boscia albitrunca*, *Gymnosporia buxifolia* and *Kalanchoe rotundifolia*); four provincially protected species with a high POC (*Babiana bainesii*, *Babiana hypogaea*, *Moraea pallida* and *Jamesbrittenia atropurpurea*); and four provincially protected species with a medium POC (*Chasmatophyllum musculinum*, *Trachyandra saltii*, *Euphorbia crassipes* and *Oxalis lawsonii*). All these species have a Least Concern SANBI-IUCN conservation status and were not threatened with extinction when they were assessed years ago. Their present conservation status is not known, and hence the Precautionary Principle should apply.
- It is important to note that this rehabilitation plan recommends reducing the eastern part of the extensive 61 ha waste rock dump (WRD) to reduce impacts on natural vegetation, preferential drainage lines and the CBA buffer, and exclude the lower lying area where Olifantshoek Plains Thornveld is found (Figure 6 & 8, STS, 2025a; Figure 6, STS, 2025b). This reduction would be possible due to the recommendation that overburden, which is excavated from pit 1 and 2, be shaped in the form of a hill in the western part of the proposed WRD, rather than being spread out over the proposed WRD (Specialist waste rock and mining expertise is being sought for this recommendation).

Additional mitigation measures for the revegetation phase of rehabilitation are shown in Appendix 5 that the rehabilitation specialist should ensure are implemented.

When the nursery manager and rehabilitation specialist assess that the natural vegetation in the mining footprint is well established, the state of the vegetation should be assessed by a vegetation specialist who should indicate whether it is representative of the wilderness ecosystem that existed prior to mining or whether further rehabilitation is necessary.

6.2.22 Faunal Recolonisation

The priority is the establishment of the indigenous vegetation to provide habitat, habitat diversity and habitat quality which will develop gradually over time. This gradual development will attract fauna when the ecological requirements of the large number of animal species recorded in the mining footprint are satisfied (STS, 2025c). Thirteen mammal species, 69 bird species, four reptile species, seven arachnid species and 58 insect species were observed directly or evidence of their presence was seen or heard (STS, 2025c). The presence of the following TOPS species (Threatened or Protected Species) was confirmed: Vulnerable *Smutsia temminckii* (Temminck's Ground Pangolin).

Although there was no evidence of eight mammal species, nine bird species, 13 reptile species and four amphibian species, they are likely to occur in the mining footprint (STS, 2025c). The following TOPS species have a medium probability of occurrence (POC): Protected *Mellivora capensis* (Honey Badger) and *Vulpes chama* (Cape Fox); Critically Endangered *Gyps africanus* (White-backed Vulture); Endangered *Aquila rapax* (Tawny Eagle), *Neotis ludwidii* (Ludwig's Bustard) and *Polemaetus bellicosus* (Martial Eagle); and Protected *Opistophthalmus carinatus* (Robust Burrowing Scorpion). Other species of conservation concern that have a high POC are: Vulnerable *Sagittarius serpentarius* (Secretarybird); and Near Threatened *Ardeotis kori* (Kori Bustard). Other species of conservation concern that have a medium POC are: Vulnerable *Felis nigripes* (Black footed Cat); Near Threatened *Atelerix frontalis* (Southern African Hedgehog); Vulnerable *Cursorius rufus* (Burchell's Courser); Near Threatened *Falco biarmicus* (Lanner Falcon) and *Coracias garrulus* (European Roller); Protected *Pyxicephalus adspersus* (Giant Bullfrog); Protected *Opistophthalmus wahlbergii* (Kalahari Burrower) and *Harpactira* species (Common Baboon Spiders).

Ten Protected species of Tiger and Stag Beetles that may occur in the mining focal areas are Data Deficient and could not be given a POC, while the conservation status of 47 insect species and seven arachnid species that were observed have not yet been determined (STS, 2025c).

All TOPS, protected and conservation statuses in the STS faunal report (2025c) have been checked and several errors in bird conservation statuses have been corrected according to the latest regional red data book for birds (Lee, Rose, Banda, Bezeng, Maphalala, Maphisa & Smit-Robinson, 2025).

Temminck's Ground Pangolin is one of four pangolin species in Africa and one of eight pangolin species globally. Pangolins are the most trafficked animals in the world for their scales and meat and are threatened with Extinction. This highly illegal activity should be monitored carefully during the mining operation. Hunting, trapping (i.e., snaring) or capturing of any animals in the mining rights area must be outlawed and prevented, and all mining personnel should be informed accordingly.

Valuable information should be obtained by regular recording of the presence of mammals, birds, reptiles, frogs and invertebrates in the rehabilitated areas by the nursery manager and rehabilitation specialist. When the nursery manager and rehabilitation specialist assess that the natural vegetation in the mining footprint is well established, the state of the fauna should be assessed by a faunal specialist who should indicate whether it is representative of the wilderness ecosystem that existed prior to mining or whether further rehabilitation is necessary.

Mitigation measures for fauna are shown in Appendix 6 that the rehabilitation specialist should ensure are implemented.

6.2.23 Rehabilitated Land

Once mining has ended in parts of the mining footprint and rehabilitation can begin, e.g., completion of mining in pit 1, rehabilitation should be monitored daily by the rehabilitation specialist to ensure success. An accurate record of the proportion of land that is being rehabilitated and its changing status must be kept.

6.3 Identification of Shortcomings in the Preceding 12 Months

No shortcomings have been identified as this is the first Annual Rehabilitation Plan that has been compiled for the proposed Makganyane iron-ore mine in terms of the Financial Provision Regulations of 2015 (DEA, 2015).

6.4 Rehabilitation Activities for the Forthcoming 12 Months

Since mining has not started yet, details of the planned annual rehabilitation and remediation activities or measures for the forthcoming 12 months, including those which will address the shortcomings mentioned above or which were identified from monitoring in the preceding 12 months, are not applicable. Once the mining right application has been approved by the

Department of Minerals and Petroleum Resources, and environmental authorisation has been received, Assmang (Pty) Ltd will report on planned annual rehabilitation.

6.5 Review of the Previous Year's Rehabilitation

Review of the previous year's annual rehabilitation and remediation activities, indicating a comparison between activities planned in the previous year's annual rehabilitation and remediation plan and actual rehabilitation and remediation implemented, is not applicable as mining has not commenced and environmental authorisation has not been given.

6.6 Costing

Costing will be determined during preparation of the first Annual Rehabilitation Plan when reliable and definite information is known about the following aspects:

- An explanation of the closure cost methodology.
- Auditable calculations of costs per activity or infrastructure.
- Cost assumptions.
- Monitoring and maintenance costs likely to be incurred both during the period of the annual rehabilitation plan and those that will extend past the period of the final rehabilitation, decommissioning and mine closure plan. This is on condition that the monitoring and maintenance costs included in previous annual rehabilitation plans must be accumulated into subsequent versions of the annual rehabilitation plan until such time as the monitoring and maintenance obligation is discharged.

7 FINAL REHABILITATION, DECOMMISSIONING & MINE CLOSURE PLAN

Appendix 4 of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations provides the minimum content of a final rehabilitation, decommissioning and mine closure plan on which Section 7 is based (DEA, 2015). According to Appendix 4, the objectives of this plan are as follows:

a) Providing the vision, objectives, targets and criteria for final rehabilitation, decommissioning and closure of the project.
b) Outlining the design principles for closure.
c) Explaining the risk assessment approach and outcomes and link closure activities to risk rehabilitation.
d) Detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/or manage identified risks and describing the nature of residual risks that will need to be monitored and managed post closure.
e) Committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure.
f) Identifying knowledge gaps and how these will be addressed and filled.
g) Detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use.
h) Outlining monitoring, auditing and reporting requirements.

Fixed point geo-located photographs of the mining footprint that will have been taken in the pre-mining natural wilderness footprint and during annual progressive rehabilitation, will continue to be taken during the final rehabilitation, decommissioning and closure phase to provide comparative reference information and document rehabilitation.

7.1 Closure Strategy Guided by the Environmental Risk Assessment

Closure is the point in time when all decommissioning and rehabilitation activities have ceased, monitoring has been completed and Assmang (Pty) Ltd applies for a closure certificate (LRSSA, CoalTech & MCSA. 2018). In this context, the main focus of the closure strategy is to ensure that the post-mining land-use of wilderness is attained by the time of mine closure. The environmental risk assessment is covered in Section 8 for ongoing, residual and latent risks. Effective mitigation measures will have to be implemented to reduce the significance of the risks to manageable and safe levels so that they don't threaten rehabilitation and closure.

The closure strategy has the following important components:

- Minimising risks and negative environmental impacts associated with the mining activities.
- Conducting mining activities and rehabilitation so that they contribute progressively towards a wilderness ecosystem, the closure target land-use.
- Backfilling as much waste rock as possible into pit 1 and 2.
- Shaping and contouring of pit 1 and 2 and the waste rock hill in the waste rock dump (WRD) so that gradients enable effective rehabilitation.
- Removing all temporary infrastructure and waste from the mining footprint, including the WRD, stockpile area and site camp.
- Applying topsoil and subsoils to the mining footprint and preparing them for revegetation with indigenous vegetation grown in the nursery from the pre-mining footprint. The focus areas are pit 1 and 2, waste rock hill and WRD, stockpile area, site camp and haulage roads.
- Revegetating the mining footprint with indigenous vegetation grown in the nursery from the pre-mining footprint.
- Eradicating alien and invasive plants from the revegetated mining footprint.
- Ensuring that permanent changes in topography due to mining are sustainable and do not cause erosion or the damming of surface water, except for pit 1 and 2 which will gradually fill with water.
- Ensuring that all parts of the mining footprint are stable and safe.
- Assessing the developing wilderness ecosystem quantitatively to determine when the indigenous flora, fauna, habitats and terrestrial and aquatic ecosystems have attained levels of diversity, richness and quality that are similar to the pre-mining wilderness ecosystem.

7.2 Closure Design Principles

It must be emphasised that parts of the mining footprint will already have been rehabilitated during annual and progressive rehabilitation where closure design principles will have been applied long before the closure phase, for example pit 1 once mining is completed.

7.2.1 Pit 1 & 2 & Waste Rock Hill

Before pit 1 and 2 and the waste rock hill in the waste rock dump are ready to be rehabilitated, Assmang (Pty) Ltd will request the expertise of a rock engineer to determine the final design of the pits and waste rock hill. The pits and waste rock hill will be developed into stable sustainable landscape features with acceptable gradients that minimise erosion and maximise revegetation and rehabilitation. These landscape features will be rehabilitated according to Section 6.2.19 (Replacement of

Topsoil & Subsoils), 6.2.20 (Soil Amelioration) and 6.2.21 (Revegetation). The mine manager, rehabilitation specialist and nursery manager will contribute their expertise to this vital rehabilitation.

7.2.2 Waste Rock Dump, Stockpile Area, Site Camp & Haulage Roads

When all introduced structures and materials have been removed from the waste rock dump, stockpile area, site camp and haulage roads which will then be ready for rehabilitation, the areas will be landscaped to their pre-mining form and rehabilitation will take place according to Section 6.2.19 (Replacement of Topsoil & Subsoils), 6.2.20 (Soil Amelioration) and 6.2.21 (Revegetation). The rehabilitation specialist and nursery manager will be responsible for this vital rehabilitation.

7.3 Post-Mining Land-Use

The post-mining land-use is a wilderness ecosystem that is similar in diversity, richness and quality to the pre-mining wilderness ecosystem.

7.4 Closure Actions

All closure actions will contribute to the attainment of a post-mining land-use wilderness ecosystem that is similar in diversity, richness and quality to the pre-mining wilderness ecosystem. These actions will cover the following main aspects:

- The pits and waste rock hill will be developed into stable sustainable landscape features with acceptable gradients that minimise erosion and maximise revegetation and rehabilitation. These landscape features will be rehabilitated according to Section 6.2.19 (Replacement of Topsoil & Subsoils), 6.2.20 (Soil Amelioration) and 6.2.21 (Revegetation).
- All introduced structures and materials will be removed from the waste rock dump, stockpile area, site camp and haulage roads which will then be landscaped to their pre-mining form and rehabilitation will take place according to Section 6.2.19 (Replacement of Topsoil & Subsoils), 6.2.20 (Soil Amelioration) and 6.2.21 (Revegetation).

7.5 Final Rehabilitation, Decommissioning & Closure Action Schedule

The proposed rehabilitation area is extensive and covers 264 ha which include mining footprint areas such as pit 1 and 2, waste rock hill, waste rock dump, stockpile area, site camp and haulage roads that will require intensive sustained rehabilitation. The semi-arid climate that prevails in the proposed mining area will pose significant challenges to successful revegetation and attainment of the post-mining wilderness ecosystem. In addition, other potential risks which are covered in Section 8, will pose further significant challenges to successful revegetation and attainment of the post-mining wilderness ecosystem. The attainment of the wilderness ecosystem with acceptable levels of diversity, richness and quality, is likely to take years. In this challenging context, it is far too early and unrealistic to stipulate a final rehabilitation, decommissioning and closure action schedule which will have to be developed during annual progressive rehabilitation.

According to the Mineral and Petroleum Resources Development Act's requirements for a closure certificate, Section 43 (4) has relevance:

"Section 43(4) Issuing of a closure certificate -

(4) An application for a closure certificate must be made to the Regional Manager in whose region the land in question is situated within 180 days of the occurrence of the lapsing, abandonment, cancellation, cessation, relinquishment or completion contemplated in subsection (3) and must be accompanied by the prescribed environmental risk report."

7.6 Organisational Capacity for Final Rehabilitation, Decommissioning & Closure Plan's Implementation

The final rehabilitation, decommissioning and closure plan's implementation will be the responsibility of the mine manager and rehabilitation specialist. The rehabilitation specialist will delegate relevant activities to the environmental control officer, nursery manager and other relevant individuals.

7.7 Final Rehabilitation, Decommissioning & Closure Plan's Gaps

At present, no gaps have been identified in the final rehabilitation, decommissioning and closure plan. However, a more comprehensive plan will be developed as annual and progressive rehabilitation progress from year to year and gaps become more apparent.

7.8 Final Rehabilitation, Decommissioning & Closure Plan's Relinquishment Criteria

The relinquishment criteria against which successful rehabilitation of the Makganyane iron-ore mining and rehabilitation area should be measured are as follows:

- Removal of all equipment, infrastructure and materials that were introduced during the mining operation.
- Reshaped mining footprint topography that is similar to the pre-mining footprint with gradients and other topographical features which are within the natural range and constitute a stable sustainable landscape suitable for a wilderness ecosystem. This excludes pit 1 and 2 and the waste rock hill which will be new topographical features.
- Shaped and developed pit 1 and 2 and the waste rock hill that form stable sustainable landscape features with acceptable gradients that minimise erosion and maximise development of the wilderness ecosystem.
- Absence of unsafe edges in pit 1 and 2 and on the waste rock hill.
- Adequate ameliorated (non-toxic and unpolluted) non-compacted topsoil and subsoils that enable the growth and prosperity of indigenous plants from the nursery found in the pre-mining footprint. Recommended soil physical and chemical testing and possible amelioration during final rehabilitation will ensure that this component is satisfied.
- Absence of visible erosion in the mining area or downslope of the area as a result of mining, and absence of significant erosion risk after successful implementation of the recommended erosion risk assessment and management plan.
- Absence of water pollution or toxicity in pit 1 and 2.
- Absence of water pollution or toxicity in monitoring boreholes in the mining right area and in boreholes on neighbouring farms.
- Eradication of all alien and invasive plants in the 264 ha rehabilitation area (Figure 2).
- Effective implementation of all mitigation and management measures recommended in this rehabilitation plan, including those recommended by specialists: Soils (Appendix 1), waste rock (Section 3.6), geohydrology (Appendix 2), surface hydrology (Appendix 3), storm water management plan (Section 3.8), freshwater ecosystem (Appendix 4), terrestrial floristic biodiversity (Appendix 5), and terrestrial faunal biodiversity (Appendix 6).
- Addressed potential residual and latent rehabilitation risks through the effective implementation of mitigation and management measures to minimise or preferably prevent their occurrence after mine closure.
- Attainment of the rehabilitated 264 ha rehabilitation area in terms of a stable sustainable wilderness ecosystem with its terrestrial and freshwater ecosystems, habitats, and indigenous plant and animal species that are representative of and similar to those in the pre-mining footprint with respect to diversity, richness and quality. The recommended vegetation, faunal and ecosystem assessment before closure will determine when this ecological state has been attained.

7.9 Closure Cost Estimate

The background to the estimate of rehabilitation costs has been prepared using the following references: EOH (2017a), EOH (2017b), EOH (2018) and Readman (2017).

The Mineral and Petroleum Resources Development Act, No. 28 of 2002 (MPRDA) determines the financial provision for mine rehabilitation and closure requirements. In terms of Section 41 and Regulations 53 and 54 of the Act, the miner is required to make financial provision for any rehabilitation activities that will take place during and after cessation of mining, as well as submit an undertaking and commitment to rehabilitation. This financial provision must be assessed annually and amended accordingly for potential additional rehabilitation activities and inflation.

The Department of Minerals and Petroleum Resources (DMPR) must assess, review and approve a quantum of financial provision showing that there are sufficient available funds to cover rehabilitation costs at the specific time (i.e., year on year) and for the rehabilitation costs associated with final mine rehabilitation, decommissioning and closure.

The regulations contained in the MPRDA (as amended) that deal with financial provision have been extracted from the Act and are as follows:

"Methods for financial provision

(1) Financial provision required in terms of Section 41 of the Act to achieve the total quantum for the rehabilitation, management and remediation of negative environmental impacts must be provided for by one or more of the following methods:

(a) An approved contribution to a trust fund as required in terms of section 10(1) (cH) of the Income Tax Act, 1962 (Act No. 58 of 1962) and must be in the format as approved by the Director General from time to time;

(b) a financial guarantee from a South African registered bank or any other bank or financial institution approved by the Director-General guaranteeing the financial provision relating to the environmental management programme or plan in the format as approved by the Director General from time to time;

(c) a deposit into the account specified by the Director-General in the format as approved by the Director-General from time to time; or

(d) any other method as the Director-General may determine.

(2) In the case of sub-regulation (1)(c), proof of payment must be submitted to the office of the relevant Regional Manager.

Quantum of financial provision

(1) The quantum of the financial provision as determined in a guideline document published by the Department from time to time, includes a detailed itemization of all actual costs required for-

(a) premature closure regarding-

(i) the rehabilitation of the surface of the area;

(ii) the prevention and management of pollution of the atmosphere; and

(iii) the prevention and management of pollution of water and the soil; and

(iv) the prevention of leakage of water and minerals between subsurface formations and the surface.

(b) decommissioning and final closure of the operation; and

(c) post closure management of residual and latent environmental impacts.

(2) The holder of a prospecting right, mining right or mining permit must annually update and review the quantum of the

financial provision -

(a) in consultation with a competent person;

(b) as required in terms of the approved environmental management programme or environmental management plan; or

(c) as requested by the Minister.

(3) Any inadequacies with regard to the financial provision must be rectified by the holder of a prospecting right, mining right or mining permit –

(a) in an amendment of the environmental management programme or environmental management plan, as the case may be;

(b) within the timeframe provided for; or

(c) as determined by the Minister."

The costs associated with the rehabilitation of the Makganyane iron-ore mine rehabilitation area (Figure 2) have been determined using the Guideline Document for the Evaluation for the Quantum of Closure Related to Financial Provision Provided by a Mine, produced by the DMRE. The following components have been costed in the quantum calculation table below:

- No. 3: Rehabilitation of access roads.
- No. 5: Demolition of housing and/or administration facilities.
- No. 6: Opencast rehabilitation including final voids and ramps
- No. 8 (A): Rehabilitation of overburden and spoils.
- No. 8 (B): Rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential).
- No. 9: Rehabilitation of subsided areas.
- No. 10: General surface rehabilitation.
- 12: Fencing.
- No. 13: Water management.
- No. 14: 2 to 3 years of maintenance and aftercare.
- No. 15 (A): Plant and animal search and rescue.
- 15 (B): Nursery establishment.
- 15 (C): Nursery manager and staff salaries and training (10 years).
- 15 (D): Provincial and national plant and animal permits.
- 15 (E): Soil physical and chemical testing before mining and during rehabilitation (10 tests).
- 15 (F): Erosion risk assessment and management plan.
- 15 (G): Vegetation, faunal and ecosystem assessment before closure.

The total rehabilitation quantum for the Makganyane Iron Ore Mine is estimated to be **R99,903,239.82**, as detailed below (Table 1).

Table 1: The anticipated estimated rehabilitation costs of the Makganyane iron ore mine.

No.	Description	Unit	A Quantity	B Master Rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)
1	Dismantling of processing plant and related structures (including overland conveyors and pow erlines)	m3	0	R 17.40	1	1	R 0.00
2 (A)	Demolition of steel buildings and structures	m2	0	R 238.71	1	1	R 0.00
2(B)	Demolition of reinforced concrete buildings and structures	m2	0	R 351.79	1	1	R 0.00
3	Rehabilitation of access roads	m2	50000	R 42.72	1	1	R 2 136 000.00
4 (A)	Demolition and rehabilitation of electrified railw ay lines	m	0	R 414.61	1	1	R 0.00
4 (A)	Demolition and rehabilitation of non-electrified railw ay lines	m	0	R 226.15	1	1	R 0.00
5	Demolition of housing and/or administration facilities	m2	2500	R 477.42	1	1	R 1 193 550.00
6	Opencast rehabilitation including final voids and ramps	ha	40	R 242 984.15	1	1	R 9 719 366.00
7	Sealing of shafts adits and inclines	m3	0	R 128.15	1	1	R 0.00
8 (A)	Rehabilitation of overburden and spoils	ha	90	R 166 847.44	1	1	R 15 016 269.60
8 (B)	Rehabilitation of processing w aste deposits and evaporation ponds (non-polluting potential)	ha	2	R 207 805.47	1	1	R 415 610.94
8 (C)	Rehabilitation of processing w aste deposits and evaporation ponds (polluting potential)	ha	0	R 603 565.59	1	1	R 0.00
9	Rehabilitation of subsided areas	ha	6	R 139 709.60	1	1	R 838 257.60
10	General surface rehabilitation	ha	264	R 132 171.31	0.5	0.5	R 8 723 306.46
11	River diversions	ha	0	R 132 171.31	1	1	R 0.00
12	Fencing	m	6100	R 150.77	1	1	R 919 697.00
13	Water management	ha	264	R 50 255.25	1	1	R 13 267 386.00
14	2 to 3 years of maintenance and aftercare	ha	264	R 17 589.34	1	1	R 4 643 585.76
15 (A)	Plant and animal search and rescue	Sum	1				R 342 872.50
15 (B)	Nursery establishment	Sum	1				R 1 462 480.30
15 (C)	Nursery manager and staff salaries and training (10 years)	Sum	1				R 12 259 101.20
15 (D)	Provincial and national plant and animal permits	Sum	1				R 58 650.00
15 (E)	Soil physical and chemical testing before mining and during rehabilitation (10 tests)	Sum	1				R 87 400.00
15 (F)	Erosion risk assessment and management plan	Sum	1				R 31 050.00
15 (G)	Vegetation, faunal and ecosystem assessment before closure	Sum	1				R 92 287.50
					Sub Total 1		R 71 206 870.86
1	Preliminary and General		8544824.503		weighting factor 2 1		R 8 544 824.50
2	Contingencies			7120687.086			R 7 120 687.09
					Subtotal 2		R 86 872 382.45
					VAT (15%)		R 13 030 857.37
					Grand Total		R 99 903 239.82

7.10 Monitoring, Auditing & Reporting

The critical importance of monitoring, auditing and reporting has been emphasised in Section 5 on Annual and Progressive Rehabilitation where monitoring is covered extensively.

For the rehabilitation process to succeed, it is essential that comprehensive electronic records are kept and the necessary regular reports are written and audits are conducted. Electronic records, reports and audits must be easily accessible by means of an excellent filing system with weekly safe and secure backups.

Prevention is far better than cure (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Thus, it is essential that problem areas are prevented by good planning, monitoring and management during the life of the mine. One of the biggest problems, when facing mine closure, is to determine exactly what has been done historically to correct a problem situation. It is essential that all corrective actions are documented and records are stored for future reference. A document control system should be in place to ensure that detailed records are kept that are filed properly and are readily accessible.

In compliance with applicable legislation, Assmang (Pty) Ltd will conduct rehabilitation monitoring, auditing and reporting for the duration of the final rehabilitation, decommissioning and closure phase which represents a vital terminal part of the whole rehabilitation process. Rehabilitation compliance reports will be sent to relevant authorities. Monitoring, auditing and reporting must be conducted until mine closure has been approved by the DMRE and the closure certificate is issued.

The rehabilitation specialist will manage monitoring, auditing, reporting and record-keeping during the final rehabilitation, decommissioning and closure phase.

7.11 Motivations for Amendments to the Final Rehabilitation, Decommissioning & Closure Plan

Since the Final Rehabilitation, Decommissioning and Closure Plan is still being prepared, no motivations for amendments have been received.

8 RISK ASSESSMENT, MANAGEMENT & MITIGATION

Appendix 5 of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations provides the minimum content of an environmental risk assessment on which Section 8 is based (DEA, 2015). According to Appendix 5, the objectives of the environmental risk assessment are as follows:

a) Ensure timeous risk reduction through appropriate interventions.
b) Identify and quantify the potential latent environmental risks related to post closure.
c) Detail the approach to managing the risks.
d) Quantify the potential liabilities associated with the management of the risks.
e) Outline monitoring, auditing and reporting requirements.

Although this risk assessment identifies and quantifies the potential **latent** environmental risks related to post-closure of the proposed Makganyane iron ore mine, the main **ongoing** and **residual** risks are also identified and quantified before mitigation (Table 9) and after mitigation (Table 10).

The following definitions of risk are pertinent (LRSSA, CoalTech & MCSA, 2018):

- Ongoing risk refers to uncertain future events that could affect or hinder achievement of the rehabilitation objectives, as determined from the likelihood of their occurrence and resultant impacts during the construction, operational and closure phases.
- Residual risk refers to the remaining risk after rehabilitation is complete and after all reasonable efforts have been made to identify, eliminate, or mitigate potential hazards.
- Latent risk refers to a risk that may or may not result or manifest after actions for final rehabilitation, decommissioning and closure have been implemented, and that affects achievement of stipulated rehabilitation objectives.

Ongoing, residual and latent risks discussed below must be monitored regularly and their risk status updated by the mine manager and rehabilitation specialist. Necessary remedial action should be carried out to avert the risks becoming more severe and occurring. Risk status should be reduced over the life of the mine.

8.1 Methodology

The following quantitative methodology for the assessment of potential ongoing, residual and latent risks associated with the proposed Makganyane iron ore mine uses interval scale data in terms of measurement theory (Siegel & Castellan, 1988). The interval scale measures numerical values along a scale with equal, measurable differences between points. Unlike qualitative data, interval scales allow for arithmetic operations like addition and subtraction, enabling researchers to infer precise differences between values, which is a hallmark of quantitative analysis. There is an element of subjectivity in the assessment criteria described below to which the interval scale is applied that form part of the risk assessment process. However, the influence of this subjectivity is minimised by the expertise and experience of the specialist.

The various aspects of environmental risk are determined in the following way:

- Overall Consequence = (Severity or Intensity + Duration + Extent)/3
- Overall Likelihood = (Frequency + Probability)/2
- Environmental Significance of Risk = Overall Consequence x Overall Likelihood

The following definitions apply:

- Severity or intensity relates to the nature of the event, aspect or impact to the environment and describes the relative degree of severity or intensity on the biophysical and/or socio-economic environment (Table 2).
- Duration refers to the amount of time that the environment will be affected by the event, risk or impact if no intervention, e.g., remedial action, takes place (Table 3).
- Extent or spatial scale is the area affected by the event, aspect or impact (Table 4).
- Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken (Table 5).
- Probability refers to how often the activity or aspect has an impact on the environment (Table 6).
- Environmental significance of risks (Table 7).
- Environmental significance of risks and related required action (Table 8).

8.2 Risk Assessment

8.2.1 Veld Fires

Veld fires constitute an **ongoing, residual and latent risk** and may either be started inadvertently by the mining operation during the construction, operational, closure and post-closure phases or they may emanate from outside the mining footprint and be caused by external agents. Whatever the cause, they have an uncertain risk (Table 7 & 9). The negative impact may be of low order and unlikely to have significant effect or it may be of higher order and have significant consequences (Table 8). Particular sensitive areas include the nursery during the construction, operational and closure phases and revegetated areas during the operational, closure and post-closure phases. The maintenance of sufficient fire-fighting capability to control and extinguish any fires rapidly, together with regular monitoring and evaluation to determine the possible increase in potential risk must be undertaken by the mine manager (Table 8). Should the risk increase, additional mitigation will be necessary by the mine manager to reduce the risk, which will include retaining a reserve of nursery plants in the nursery for revegetation and the creation of effective fire-breaks. An uncertain risk remains after mitigation, although of lower significance than before mitigation (Table 7 & 10). The risk may be of low order and unlikely to have significant effect or it may be of higher order with significant effect, and therefore ongoing monitoring and evaluation will be necessary (Table 8).

8.2.2 Land Subsidence

Land subsidence, including melon holes, constitutes a **residual and latent risk** that is very difficult to assess due to the extreme complexity and unpredictability of physical processes that are likely to occur after as much waste rock as possible is back-filled into pit 1 and 2 and the waste rock hill is developed in the waste rock dump. For example, one of the key uncertainties in final landform prediction is the bulking factor. Soft materials frequently compact by as much as 15%, while hard materials may expand by as much as 25-30% (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Land subsidence has an uncertain risk that may affect back-filled pit 1 and 2 and the waste rock hill (Table 7 & 9). The negative impact may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 8).

Table 2: Rating of severity or intensity in the assessment of potential risks.

Criteria	Rating				
	1	**2**	**3**	**4**	**5**
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous / Extremely harmful
Biophysical: Air quality, water quantity and quality, waste production, fauna & flora	Insignificant change / Deterioration or Disturbance	Moderate change / Deterioration or Disturbance	Significant change / Deterioration or Disturbance	Very significant change / Deterioration or Disturbance	Disastrous change / Deterioration or Disturbance
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable / Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Cost	Very low cost to mitigate	Low cost to mitigate	Substantial cost to mitigate	High cost to mitigate	Prohibitive cost to mitigate
Irreversibility	High potential to mitigate impact to level of insignificance / Easily reversible	Moderate potential to mitigate impact to level of insignificance / Moderately reversibility	Potential to mitigate impact / Potential to reverse impact	Difficulty in mitigating impact	Little or no mechanism to mitigate impact / Irreversible

Table 3: Rating of duration in the assessment of potential risks.

Rating	Description
1	Up to 1 month
2	1 month to 3 months
3	3 months to 1 year
4	1 to 10 years
5	More than 10 years

Table 4: Rating of extent or spatial scale in the assessment of potential risks.

Rating	Description
1	Immediate, fully contained area
2	Surrounding area
3	Within the business unit area of responsibility
4	Within the farm / neighboring farm area
5	Regional, National, International

Table 5: Rating of frequency in the assessment of potential risks.

Rating	Description
1	Once a year or once / more during operation
2	Once / more in 6 months
3	Once / more a month
4	Once / more a week
5	Daily

Table 6: Rating of probability in the assessment of potential risks.

Rating	Description
1	Almost never / almost impossible
2	Very seldom / highly unlikely

3	Infrequent / unlikely / seldom
4	Often / regularly / likely / possible
5	Daily / highly likely / definitely

Table 7: Determination of the overall significance in the assessment of potential risks.

Significance or Risk	Insignificant risk	Uncertain risk	Potential significant risk
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 – 19.9

Table 8: Description of environmental significance of risks and related required action in the assessment of potential risks.

Significance	An insignificant risk	An uncertain risk	A potential significant risk
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect or impact is of higher order and may have real effect. Acceptable / Unacceptable	Impact is real and substantial in relation to other impacts; poses a risk to the company. Unacceptable.
Action Required	Maintain current management measures. Where possible improve.	Maintain or improve current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve.	Improve management measures to reduce risk.

Required action by the geotechnical/rock engineer and rehabilitation specialist after back-filling of pit 1 and 2 and development of the waste rock hill are regular monitoring and evaluation to assess the risk and determine when final shaping of the waste rock subsequent replacement of subsoils and topsoil should take place. Should land subsidence, including melon holes occur, reserve overburden, subsoils, topsoil, mulch and nursery vegetation should be retained to remedy the situation so as to maintain free-draining rehabilitated areas and conserve land capability (CoalTech & MCSA, 2018). An uncertain risk remains after mitigation, although of lower significance than before mitigation (Table 7 & 10). The risk may be of low order and unlikely to have significant effect or it may be of higher order with significant effect, and therefore ongoing monitoring and evaluation will be necessary (Table 8).

8.2.3 Development of Cracks

Crack development, like land subsidence, constitutes a **residual and latent risk** that is very difficult to assess due to the extreme complexity and unpredictability of physical processes that are likely to occur after pit 1 and 2 are back-filled with waste rock and the waste rock hill is developed in the waste rock dump (CMSA & CoalTech, 2007). Crack development has an uncertain risk that may affect back-filled pit 1 and 2 and the waste rock hill (Table 7 & 9). The negative impact may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 8). Required action by the geotechnical/rock engineer and rehabilitation specialist after back-filling of pit 1 and 2 and development of the waste rock hill are regular monitoring and evaluation to assess the risk and determine when final shaping of the overburden and subsequent replacement of subsoils and topsoils should take place. Should crack development occur, overburden, subsoils, topsoil, mulch and nursery vegetation should be retained in reserve to remedy the situation so as to maintain free-draining rehabilitated areas and conserve land capability (CoalTech & MCSA, 2018). An uncertain risk remains after mitigation, although of lower significance than before mitigation (Table 7 & 10). The risk may be of low order and unlikely to have significant effect or it may be of higher order with significant effect, and therefore ongoing monitoring and evaluation will be necessary (Table 8).

8.2.4 Insufficient Topsoil & Subsoils

Insufficient topsoil, subsoils and mulch, especially topsoils, constitute a critically important **ongoing risk** of potential high significance that can affect large parts of the mining footprint (Table 7 & 9). Should this risk transpire, the rehabilitation process will be seriously threatened and the potential negative impact on the environment and Assmang (Pty) Ltd will be highly significant (Table 8). According to the specialist soil report for the mining footprint, topsoil and subsoils will be extremely limited in terms of the Mispah/Glenrosa and Mispah soil forms which dominate the mining footprint (ZRC, 2025). It is not possible to calculate the actual volume of topsoil and subsoils in the mining footprint, and hence the risk is difficult to assess accurately. However, topsoil and subsoils are likely to be in very limited supply, both of which will be vital for the growth of the indigenous vegetation during the revegetation phase of rehabilitation, especially the topsoil. The rehabilitation specialist must ensure that excellent monitoring and management of soil stripping, stockpiling and replacement take place so that the extremely limited quantity of topsoil and subsoils is available for restoring the whole mining footprint. Topsoil could be imported, but this resource is normally in very short supply and difficult to procure. Imported material will introduce a foreign growth medium for the indigenous plants that may have significant negative ecological impacts, including the seeds of indigenous plants not found naturally in the mining footprint, the seeds of invasive alien plants from outside the mining footprint, and nutrient deficiencies or imbalances for the indigenous plants from the mining footprint. A potential significant risk remains after mitigation, although of lower significance than before mitigation (Table 7 & 10). Improved mitigation and management measures will be necessary to reduce this risk (Table 8).

8.2.5 Depauperate Topsoil

After probable dilution with subsoils and underlying material during the topsoil stripping phase and after a long period of stockpiling, the topsoil may be deficient chemically in terms of nutrients, physically in terms of structure due to compaction and biologically in terms of soil bacteria and other important organisms. The replacement of depauperate topsoil in the rehabilitation area is a potential significant **ongoing risk** of great importance that can affect large parts of the mining footprint (Table 7 & 9). Should this risk transpire, the rehabilitation process will be threatened and the potential negative impact on the environment and Assmang (Pty) Ltd will be highly significant (Table 8). However, although mitigation is difficult, it is possible in terms of chemical and physical amelioration. Determination of topsoil bulk density, ripping of the topsoil, assessment in terms of target bulk density, analysis of topsoil nutrient status, assessment in terms of target nutrient content and application of fertilisers will help ameliorate the topsoil physically and chemically. Biological amelioration is more difficult. An uncertain risk remains after mitigation that may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 10). Ongoing monitoring and evaluation will be necessary by the rehabilitation specialist (Table 8).

8.2.6 Polluted Soils

Soils may become polluted due to the spillage of harmful substances during the construction, operational and closure phases that constitutes an **ongoing risk** of potential significance that is unacceptable (Table 7, 8 & 9). Mitigation is relatively straight forward and involves creating awareness of the spillage procedure to be strictly followed, immediate reporting of the spillage to the rehabilitation specialist and thereafter immediate remediation by removing the polluted soil and placing it in a dedicated area for disposal at a registered landfill site. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation will be necessary (Table 8).

8.2.7 Toxic Soils

Topsoil and subsoils may develop toxicity during stockpiling due to changes in chemical properties such as pH that constitutes an **ongoing risk** of potential significance which may negatively affect the revegetation in parts of the rehabilitation area (Table 7, 8 & 9). Required action by the rehabilitation specialist involves mitigatory chemical testing of the topsoil and subsoils before revegetation of the rehabilitation area takes place to ensure that they are suitable for plant growth. Appropriate remediation will be necessary for affected areas. An insignificant risk remains after mitigation that is likely to have very little real effect (Table 7, 8 & 10).

8.2.8 Dust Pollution

Dust pollution will be a daily occurrence due to the semi-arid climate and the substantial disturbance of the substrate during the construction, operational and closure phases that constitutes an **ongoing risk** of potential significance to the mining operation, rehabilitation and the surrounding ecology (Table 7, 8 & 9). Required action by the rehabilitation specialist involves daily dust suppression mitigation using water tanker vehicles and the spraying of the exposed substrate. An uncertain risk remains after mitigation that is likely to have low order impact and little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation will be necessary to determine the potential increase in risk and necessary further mitigation (Table 8).

8.2.9 Evaporation Dam Spillage

Spillage from the two proposed evaporation dams may occur during the construction and operational phases due to overtopping or breach of the dam walls that constitutes an **ongoing risk** of uncertain significance which may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 9). Required action by the mine manager and rehabilitation specialist involves regular monitoring of the dams to check effluent levels and integrity of the retaining walls. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation will be necessary (Table 8).

8.2.10 Wind & Water Erosion

The whole mining footprint will comprise largely of exposed soils or substrate during the construction and operational phases and initial part of the closure phase that will be highly vulnerable to wind and water erosion, despite the low rainfall regime in the semi-arid area (TBC, 2025). The unconsolidated topsoil and subsoils in the stockpile area and the unconsolidated waste rock in the waste rock dump during the construction and operational phases will be especially vulnerable before any protective vegetation cover is established. The replaced topsoil and subsoils will also be highly vulnerable before revegetation and during the early stages of revegetation when the soil is not bound and covered well. Thus, wind and water erosion pose an **ongoing risk** of potential significance to rehabilitation and the surrounding ecology (Table 7, 8 & 9). Required action by the rehabilitation specialist involves the implementation of suitable mitigation measures to minimise wind and water erosion (Section 3.8 & Appendix 3), including the following (LRSSA, CoalTech & MCSA. 2018): Concave slopes rather than linear slopes; mimicking natural slopes using the geomorphic approach; determining the best slope angle for soils in the rehabilitation area; minimising slope length; minimising runoff velocities; planting of stabilising grasses from the nursery without delay; protecting and conserving the minimal topsoil and subsoils in the stockpile area by planting grasses from the nursery without delay; ensuring that topsoil and subsoil stockpiles and the overburden stockpile are located outside of drainage lines and are placed in free-draining areas so as to minimise waterlogging and soil erosion losses; prevention of livestock in the rehabilitation area until revegetation is well established; ongoing monitoring of the erosion status of the mining footprint and rehabilitated land with areas of excessive erosion being identified for remedial action. An uncertain risk remains after mitigation that may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 10). Ongoing monitoring and evaluation will be necessary (Table 8).

8.2.11 Sedimentation

The whole mining footprint will comprise largely of exposed soils or substrate during the construction and operational phases and initial part of the closure phase that will be highly vulnerable to wind and water erosion and ensuing sedimentation in the mining footprint and surrounding natural area, including the episodic drainage lines and preferential flow paths. Sedimentation poses an **ongoing risk** of potential significance to rehabilitation and the surrounding ecology (Table 7, 8 & 9). Required action by the rehabilitation specialist involves the implementation of suitable mitigation measures to minimise wind and water erosion as described in Section 8.2.10 above that will minimise ensuing sedimentation. An uncertain risk remains after mitigation that may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table Y, 18G & 19G). Ongoing monitoring and evaluation will be necessary (Table 8).

8.2.12 Surface Water Pollution

Surface water flowing in and from the mining footprint and rehabilitation area may become polluted during rainfall events due to unremedied spillages of polluting substances and presence of soils and waste rock that become toxic because of chemical changes like pH. However, the waste rock is likely to pose negligible risk in this regard (IQS, 2025). Surface water pollution poses an **ongoing risk** of uncertain significance that may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 9). Required action by the rehabilitation specialist involves mitigation measures described in Section 8.2.6 (Polluted Soils) and Section 8.2.7 (Toxic Soils) above. Further mitigation measures are described in Section 3.6, Section 3.8 and Appendix 3. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation will be necessary (Table 8).

8.2.13 Groundwater Impacts

The groundwater may become polluted or deficient in quantity due to the mining operation that may affect the mining right area and surrounding areas. Contamination of groundwater is not expected according to the waste rock (IQS, 2025) and geohydrological assessments (Groundwater Complete, 2025). However, depletion of groundwater levels is possible and contamination is not impossible. Groundwater impacts pose potential significant **ongoing, residual and latent risks** to the groundwater integrity and health of the mining right area and surrounding areas, and to Assmang (Pty) Ltd (Table 7, 8 & 9). Required action by the rehabilitation specialist involves mitigatory chemical and volume testing of the groundwater in the mining right area boreholes and neighbouring farm boreholes. Further mitigation measures are shown in Section 3.6 and Appendix 2. A potential significant risk remains after mitigation, although of lower significance than before mitigation (Table 7 & 10). Improved mitigation and management measures are likely to be difficult to reduce this risk (Table 8).

8.2.14 Alien & Invasive Plants (AIPs)

AIPs pose an **ongoing, residual and latent risk** of potential significance that may threaten the rehabilitation process (Table 7, 8 & 9). Sixteen AIPs were recorded in the pre-mining footprint (Section 6.2.21; STS, 2025b). With the likely use of imported topsoil, more AIPs will probably be introduced to the rehabilitation area. AIPS have proved to be a major problem in many mining areas, and one of the key objectives in the revegetation and maintenance programmes for mined land is the control and eradication of AIPS (CMSA & CoalTech, 2007; LRSSA, CoalTech & MCSA, 2018). Required action by the rehabilitation specialist and nursery manager involves regular frequent monitoring of the revegetated areas for all 16 recorded AIPs and any others which will ensure that AIPS are at the seedling stage and can be easily hand-pulled using protective gloves. Chemical control methods should not be necessary. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation will be necessary (Table 8).

8.2.15 Nursery Failure

Nursery failure poses an **ongoing risk** of potential significance that may threaten the rehabilitation process (Table 7, 8 & 9). Required action by the mine manager and rehabilitation specialist is the contracting of an experienced nursery manager with extensive expertise who will be responsible for the training of nursery staff, establishment and management of the nursery, and propagation of plant species found in the pre-mining footprint. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation of the nursery manager by the mine manager and rehabilitation specialist will be necessary (Table 8).

8.2.16 Livestock Grazing & Browsing

The grazing and browsing of livestock in the revegetated areas poses an **ongoing and residual risk** of uncertain significance which may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 9). Cattle are known to graze in the area near the proposed mine. It is not known whether goats also are present in the area. Required action by the mine manager is liaising with the farmer who owns the land to ensure that a shepherd is present with the livestock to prevent grazing and browsing in revegetated areas. These areas can also be fenced temporarily to protect the developing plants. Shrubs and tree seedlings can be protected with metal protectors. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation by the rehabilitation specialist and nursery manager will be necessary (Table 8).

8.2.17 Revegetation Failure

Revegetation failure poses an **ongoing, residual and latent risk** of potential significance that may threaten the rehabilitation process (Table 7, 8 & 9). Required action by the rehabilitation specialist and nursery manager involves ensuring the following intensive measures: Successful nursery propagation of plants found in the pre-mining footprint; promotion of healthy plant growth by physical and chemical properties of the soil; successful planting of the nursery plants in the rehabilitation area; daily watering of revegetated areas; removal of alien and invasive plant species regularly and frequently; and prevention of livestock from damaging the plants. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation by the rehabilitation specialist and nursery manager will be necessary (Table 8).

8.2.18 Hunting, Trapping, Trafficking & Plant Harvesting

Hunting, trapping, trafficking and plant harvesting pose an **ongoing and residual risk** of uncertain significance which may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 9). These illegal activities form part of wildlife crime which constitutes a major threat to indigenous plant and animal populations and is a huge problem in South Africa and globally. Required action by the mine manager and rehabilitation specialist involves providing stern warnings to all mining staff and contractors about these illegal activities and their dire consequences. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation by the rehabilitation specialist and nursery manager will be necessary (Table 8).

8.2.19 Surrounding Area Degradation

Surrounding area degradation poses an **ongoing and residual risk** of uncertain significance which may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 9). Required action by the mine manager and rehabilitation specialist involves ensuring that the mining footprint is clearly demarcated and that mining staff and contractors operate within the demarcated areas. In addition, minimising exposed soil and substrate and daily dust suppression of exposed soil and substrate will limit the dust fallout on and stomatal clogging of indigenous vegetation in the surrounding area. Progressive intensive rehabilitation of areas where mining has been completed will also reduce dust pollution. An uncertain risk remains after mitigation, although of lower significance than before mitigation, which may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 10). Ongoing monitoring and evaluation by the rehabilitation specialist will be necessary (Table 8).

8.2.20 Rehabilitation Failure

Rehabilitation failure poses an **ongoing risk** of uncertain significance which may be of low order and unlikely to have significant effect or it may be of higher order with significant effect (Table 7, 8 & 9). Required action by the rehabilitation specialist involves excellent management, organising and problem-solving abilities and the absolute unrelenting determination to ensure sustained intensive rehabilitation in an extremely difficult semi-arid environment where revegetation and the attainment of the target wilderness ecosystem will be very challenging and time-consuming. An insignificant risk remains after mitigation where the impact is of very low magnitude and therefore likely to have very little real effect (Table 7, 8 & 10). Ongoing monitoring and evaluation by the rehabilitation specialist will be necessary (Table 8).

8.3 Management Activities

No additional management activities have been identified at this stage, other than the ones mentioned in Section 8.2 above.

8.4 Cost Estimate

The cost estimate for covering latent risks identified in Section 8.2 will have to be calculated.

8.5 Monitoring, Auditing & Reporting Requirements

These have been dealt with briefly in Section 8.2.

Table 9: The overall consequence and likelihood and significance of potential ongoing, residual and latent risks during the mining operation before mitigation.

Risk	Severity/ Intensity	Duration	Extent	Overall Consequence	Frequency	Probability	Overall Likelihood	Significance
Veld Fires	5	3	4	**4**	1	3	**2**	**8**
Land Subsidence	3	5	1	**3**	2	4	**3**	**9**
Crack Development	3	4	1	**2.67**	2	4	**3**	**8**
Insufficient Topsoil & Subsoils	4	5	1	**3.33**	5	5	**5**	**16.65**
Depauperate Topsoils	4	4	1	**3**	5	5	**5**	**15**
Polluted Soils	2	4	1	**2.33**	5	4	**4.5**	**10.49**
Toxic Soils	3	4	1	**2.67**	5	4	**4.5**	**12.02**
Dust Pollution	2	4	2	**2.67**	5	5	**5**	**13.35**
Evaporation Pond Spillage	2	4	2	**2.67**	3	4	**3.5**	**9.35**
Wind & Water Erosion	3	4	1	**2.67**	4	4	**4**	**10.67**
Sediment-ation	3	4	2	**3**	4	4	**4**	**12.0**
Surface Water Pollution	2	4	2	**2.67**	3	3	**3**	**8.01**
Groundwater Impacts	3	4	4	**3.67**	5	4	**4.5**	**16.52**
Alien & Invasive Plants	4	5	2	**3.67**	5	4	**4.5**	**16.52**
Nursery Failure	4	5	1	**3.33**	5	4	**4.5**	**14.99**

Risk	Severity/ Intensity	Duration	Extent	Overall Consequence	Frequency	Probability	Overall Likelihood	Significance
Livestock Grazing & Browsing	3	4	1	**2.67**	3	4	**3.5**	**9.35**
Revegetation Failure	5	5	1	**3.67**	5	4	**4.5**	**16.52**
Hunting, Trapping, Trafficking & Plant Harvesting	2	4	2	**2.67**	3	4	**3.5**	**9.35**
Surrounding Area Degradation	3	4	2	**3**	3	4	**3.5**	**10.5**
Rehabilitation Failure	5	5	1	**3.67**	1	4	**2.5**	**9.18**

Table 10: The overall consequence and likelihood and significance of potential ongoing, residual and latent risks during the mining operation after mitigation.

Risk	Severity/ Intensity	Duration	Extent	Overall Consequence	Frequency	Probability	Overall Likelihood	Significance
Veld Fires	3	3	2	**2.67**	1	3	**2**	**5.33**
Land Subsidence	2	3	1	**2**	2	3	**2.5**	**5**
Crack Development	2	3	1	**2**	2	3	**2.5**	**5**
Insufficient Topsoil & Subsoils	3	4	1	**2.67**	5	4	**4.5**	**12.02**
Depauperate Topsoils	3	3	1	**2.33**	4	4	**4**	**9.33**
Polluted Soils	1	1	1	**1**	3	3	**3**	**3**
Toxic Soils	1	1	1	**1**	1	3	**2**	**2**
Dust Pollution	1	4	2	**2.33**	3	4	**3.5**	**8.16**

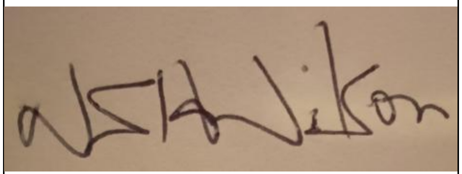
Risk	Severity/ Intensity	Duration	Extent	Overall Consequence	Frequency	Probability	Overall Likelihood	Significance
Evaporation Pond Spillage	1	2	1	**1.33**	2	3	**2.5**	**3.33**
Wind & Water Erosion	2	4	1	**2.33**	3	4	**3.5**	**8.16**
Sediment-ation	2	4	1	**2.33**	3	4	**3.5**	**8.16**
Surface Water Pollution	1	1	1	**1**	2	3	**2.5**	**2.5**
Groundwater Impacts	2	4	4	**3.33**	5	3	**4**	**13.32**
Alien & Invasive Plants	1	1	1	**1**	1	3	**2**	**2**
Nursery Failure	1	1	1	**1**	1	3	**2**	**2**
Livestock Grazing & Browsing	1	1	1	**1**	2	3	**2.5**	**2.5**
Revegetation Failure	1	1	1	**1**	1	3	**2**	**2**
Hunting, Trapping, Trafficking & Plant Harvesting	1	1	2	**1.33**	2	3	**2.5**	**3.33**
Surrounding Area Degradation	2	4	2	**2.67**	2	4	**3**	**8.01**
Rehabilitation Failure	1	4	1	**2**	1	3	**2**	**4**

9 CONCLUSION

The Makganyane Iron Ore Mine Rehabilitation, Decommissioning and Closure Plan must be implemented together with the Environmental Management Programme and their amendments if Assmang (Pty) Ltd obtains the mining right and environmental authorisation. This plan provides detailed procedures, costs and relevant information for the mine's successful rehabilitation. Failure is no option.

Assmang (Pty) Ltd commits to providing all the necessary resources to ensure that all legislative requirements are satisfied and that the mine's rehabilitation is successful and acceptable to all parties involved.

10 SIGNATURE OF AUTHOR

NAME	SIGNATURE	DATE
Neil Samuel Hugh Wilson		3 September 2025

11 UNDERTAKING BY PERMIT HOLDER

I, ……………………………………………………………………………., the undersigned and duly authorised thereto by .... ……………………………………. that Assmang (Pty) Ltd will comply with the provisions of the MPRDA and its Regulations as set out in Government Gazette No. 26275 (23 April 2004), as well as the NEMA.

I have studied and understand the contents of this document and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to in writing.

Signed at ………………………………….. on this ………… day of .... 20……

____

Name:

Designation:

12 LITERATURE CITED

Assmang. Undated. *Mining Work Programme submitted for a Mining Right Application for the Makganyane Iron Ore Mine - Mining License*. Assmang (Pty) Ltd, P.O. Box 782058, Sandton, Gauteng, 2146, South Africa.

CMSA & CoalTech. 2007. *Guidelines for the Rehabilitation of Mined Land.* Chamber of Mines of South Africa and CoalTech, Johannesburg, South Africa.

DEA. 2015. Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations under section 44(aE), (aF), (aG), (aH) read with sections 24(5)(b)(ix), 24(5)(d), 24N, 24P and 24R of the National Environmental Management Act, 1998 (Act No.107 of 1998). Department of Environmental Affairs, No. R. 1147, 20 November 2015. *Government Gazette*, No. 39425, 20 November 2015, Government Printer, Pretoria, South Africa.

EOH. 2017a. *Draft Environmental Impact Assessment Report - Mining Application for borrow pit Sites Located Between Ncgobo and Mthatha, Eastern Cape Province, South Africa*. Report compiled by EOH Coastal and Environmental Services on behalf of JG Africa (Pty)Ltd for SANRAL SOC Ltd. February 2017.

EOH. 2017b. *Draft Scoping Report - Application for A Mining Permit and Related Environmental Approvals for Borrow Pit 3 Adjacent to The R61 Section 6 Km 52.6, Eastern Cape Province*. Report compiled by EOH Coastal and Environmental Services on behalf of Mott Macdonald for SANRAL SOC Ltd. February 2017.

EOH. 2018. *Environmental Management Programme - Rehabilitation of National Route R61 Section 6: borrow pit*. Report compiled by EOH Coastal and Environmental Services for SANRAL SOC Ltd. January 2018.

Groundwater Complete. 2025. *Makganyane Proposed Iron Ore Mine Report on Geohydrological Investigation as Specialist Risk Assessment*. P.O. Box 448, Riversdal, 6670, Western Cape, South Africa.

IQS. 2025. *Makganyane Iron Ore Mine, Northern Cape Province, Waste Classification and Assessment of Expected Waste Rock*. IQS Holdings, 64 Halepensis St, Lynnwood Ridge, Pretoria, 0081, South Africa.

Lee A.T.K., Rose S., Banda S., Bezeng S.B., Maphalala M.I., Maphisa D.H., Smit-Robinson H.A. (eds). 2025. *The 2025 Red Data Book of Birds of South Africa, Lesotho and Eswatini*. BirdLife South Africa, Johannesburg, South Africa. https://www.birdlife.org.za/red-list.

LRSSA, CoalTech & MCSA. 2018. *Land Rehabilitation Guidelines for Surface Coal Mines*. Land Rehabilitation Society of Southern Africa, CoalTech, Minerals Council of South Africa, Johannesburg, South Africa.

Readman, J. 2017. *Draft Environmental Management Programme – Application for the Establishment of a borrow pit on Pogela Farm near Heatonville, KwaZulu-Natal*. Report compiled by John Readman for ACER (Africa) Environmental Consultants. April 2017.

SAS. 2025. *Freshwater Ecosystem Assessment as Part of the Environmental and Water Use Authorisation Processes for the Proposed Makganyane Iron Ore Mine, Near Beeshoek, Northern Cape Province*. Scientific Aquatic Services, 29 Arterial Road West Oriel, Johannesburg, South Africa.

Siegel, S. & Castellan, N.J. 1988. *Nonparametric Statistics for the Behavioral Sciences*. 2nd Edition. McGraw-Hill Book Company, New York, USA.

STS. 2025a. *Biodiversity Assessment as Part of the Environmental Authorisation Process for the Proposed Mining*

Rights Application for the Makganyane Iron Ore Mine, Located in the Northern Cape. Executive Summary and Background Information. Scientific Terrestrial Services, 29 Arterial Road West Oriel, Johannesburg, South Africa.

STS. 2025b. *Terrestrial Biodiversity Assessment as Part of the Environmental Authorisation Process for the Proposed Mining Rights Application for the Makganyane Iron Ore Mine, Located in the Northern Cape. Part B: Terrestrial Assessment and Floral Compliance Statement*. Scientific Terrestrial Services, 29 Arterial Road West Oriel, Johannesburg, South Africa.

STS. 2025c. *Terrestrial Biodiversity Assessment as Part of the Environmental Authorisation Process for the Proposed Makganyane Iron Ore Mine near Postmasburg, Northern Cape Province. Part C: Faunal Assessment*. Scientific Terrestrial Services, 29 Arterial Road West Oriel, Johannesburg, South Africa.

TBC. 2025a. *Hydrological Assessment: Proposed Makganyane Iron Ore Mine, Tsantsabane Municipality, Northern Cape, South Africa.* The Biodiversity Company, Johannesburg, South Africa.

TBC. 2025b. *Stormwater Management Plan: Proposed Makganyane Iron Ore Mine. Tsantsabane Municipality, Northern Cape, South Africa.* The Biodiversity Company, Johannesburg, South Africa.

Wilman, V. 2019. *A practical guide for community-run nurseries: Growing indigenous plants for restoration*. WWF South Africa, Cape Town.

ZRC. 2025. *Soil, Land use and Land Capability Assessment Report for the Proposed Makganyane Iron Ore Mine Near Postmasburg, Northern Cape Province*. Zimpande Research Collaborative, 29 Arterial Road West Oriel, Johannesburg, South Africa.

13 APPENDIX 1: Soil, Land use and Land Capability Mitigation Measures (ZRC, 2025).

Integrated Mitigation Measures	
Management of Loss of Land Capability	• Direct surface disturbance of the identified arable soils must be avoided where possible to minimise loss of arable soils; • The proposed development and associated surface infrastructure should be limited to within the demarcated footprint area; • Soils of different characteristics should be stockpiled separately and clearly demarcated; • The dumping of waste materials next to or on the stockpiles should be prohibited; • Construction of surface infrastructure should preferably be limited to areas of the footprint or on already significantly disturbed soils.
Stockpile and Stripping Management	• Excavation and long-term stockpiling of soil should be limited within the demarcated areas; • Ensure all stockpiles (especially topsoil) are clearly and permanently demarcated and located in defined “no-go areas”; • Restrict the amount of mechanical handling, as each handling event increases the compaction level and the changes to the soil structure. Wherever possible, the ‘cut and cover’ technique (where the stripped soils is immediately placed in an area already prepared for rehabilitation, thus avoiding stockpiling) should be used; • Separate stockpiles of different soils to achieve the highest post-development land capability and thus reduce the residual loss of agricultural potential; • Stockpile height should be restricted to that which can deposited without additional traversing by machinery. A Maximum height of 4-5 m is therefore proposed, and the stockpile should be treated with temporary soil stabilisation methods, such as the application of organic matter to promote soil aggregate formation, leading to increased infiltration rate, thereby reducing soil erosion. Also, the use of agricultural lime to stabilise soil pH levels; • The topsoil stockpile should be vegetated and while vegetating, measures will be needed to contain erosion of the stockpile during rain events; and • Temporary berms can be installed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion.
Soil Compaction Management	• Soil compaction is usually greatest when soils are moist, so soils should ideally be stripped when moisture content is as low as possible. If they have to be moved when wet, truck and shovel should be used as bowl scrapers create excessive compaction when moving on wet soils; • Minimise compaction during the stockpiling phase by keeping stockpile soil loose and limit stockpile height to 4-5 meters height, to limit internal soil compaction (Coaltech: chamber of mines, 2007); • Compaction should be minimised by use of appropriate equipment and replacing soil to the greatest possible thickness in single lifts; • Heavy equipment movement over replaced soils should be minimized; and • Following placement, compacted soils should be ripped to full rooting depth (at least 60 cm or 30cm as the bare minimum seedbed) to allow penetration of plant roots.
Soil Contamination Management	• Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be always implemented and made available and accessible to the contractors and construction crew conducting the works on site for reference; • A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works; • An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent contamination; and • Burying of any waste including rubble, domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site.
Soil Erosion and Dust Emission Management	• The footprint of the proposed development and construction activities should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible;

	• Bare soils within the access roads can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast; • All disturbed areas adjacent to the proposed development areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission; • Temporary erosion control measures should be used to protect the disturbed soils during the construction phase until adequate vegetation has established.
Potential Impacts on the Soil Regime	
Mitigation Measures	• Direct surface disturbance of the identified arable soils must be avoided where possible to minimise loss of arable soils; • The proposed development, associated infrastructure and the access roads should be limited to within the demarcated footprint areas; • Stockpiles that will remain in location for more than one growing season and that have not revegetated naturally, should be revegetated to avoid erosion losses; • Ensure all stockpiles (especially topsoil) are clearly and permanently demarcated and located in defined "no-go areas"; • Restrict the amount of mechanical handling, as each handling event increases the compaction level and the changes to the soil structure. Wherever possible, the 'cut and cover' technique (where the stripped soils is immediately placed in an area already prepared for rehabilitation, thus avoiding stockpiling) should be used; • Separate stockpiles of different soils to achieve the highest post-development land capability and thus reduce the residual loss of agricultural potential; • The footprint areas should be lightly ripped to alleviate compaction • The footprint of the proposed development and construction activities should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible; • Bare soils within the access roads must be regularly dampened with water to suppress dust during the construction and operational phase, especially when strong wind conditions are predicted according to the local weather forecast; • Temporary erosion control measures should be used to protect the disturbed soils during the construction phase until adequate vegetation has established; • Contamination prevention measures should be addressed in the Environmental Management Programme (EMP) for the proposed development, and this should be always implemented and made available and accessible to the contractors and construction crew conducting the works on site for reference; • A spill prevention and emergency spill response plan considering the nature of the proposed development, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works; • An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent contamination; and • Burying of any waste including domestic waste, empty containers on the site should be strictly prohibited.

14 APPENDIX 2: Geohydrological Investigation Mitigation Measures (Groundwater Complete, 2025).

Deposition of Potential Leachate Forming Material	
Mitigation	• A sealing layer can be constructed beneath the dumps in order to seal it off from groundwater, however, due to the expected inertness of the materials, this is not deemed necessary.
Creation of a Void for Groundwater to Flow Into	
Mitigation	• Due to the nature of the activity and impacts, not much can be done to prevent or mitigate the impact.
Production of Waste in the Form of Sewage	
Mitigation	• Routine maintenance of the sewage system may decrease the risk of failure and spillage.

Summary of Important Information

- The lowest surface elevation of approximately 1,250 meters above mean sea level (mamsl) occurs near a tributary to the south/south-west, while the highest elevations are found in the hills in the centre of the farm at approximately 1 360 mamsl.
- The Soutloop River and its numerous tributaries that cut through the project area are strictly non-perennial and only experience flow during and directly after a significant rainfall event.
- The project area is located within the D73A quaternary catchment, which covers an area of just over 3 200 km^2.
- The mean annual precipitation for the project area is in the region of 320 mm.
- Evapotranspiration is very high and in excess of 2,200 mm/year.
- The project area has a net environmental moisture deficit for the entire year.
- Numerous faults and/or igneous intrusions (dykes) occur throughout the project area and are of significant importance to the geohydrology. Few of the structures seemed to act as either prominent barriers for horizontal groundwater flow, or as preferred flow paths for extended distances.
- Exploration boreholes drilled in the Makganyane area intersected highly brecciated areas (mainly banded iron formation, shale and quartzite) at depths of between ±30 and 300 meters below surface. From a geohydrological perspective, these areas are of significant importance as they have the potential to yield significant volumes of groundwater.
- A total of 98 boreholes were located during the hydrocensus.
- Agriculture and livestock watering are the main water uses in the area.
- The Makganyane area is underlain by two distinct and very different aquifers.
- The first of the aquifers exists in the eastern and western flatter areas of the Makganyane property. The host rock of the aquifer is the andesitic lavas of the Ongeluk Formation.
- The second aquifer present in the Makganyane area is the aquifer that exists mainly in the planned mining area. This aquifer exists mainly in a specific layer, namely the chertbreccia layer.
- Topographical highs and lows were used to approximate no-flow boundaries for the model.
- Not all groundwater levels have a linear relationship with regards to the surface topography.
- Groundwater levels in the flatter areas to the west of the hills varied between 7 and 22 meters below surface (mbs), while the water levels to the east of the hills varied between 18 and 28 mbs.
- The groundwater levels in the hilled area were markedly deeper, ranging between 30 and 100mbs.
- The lowest measured static groundwater elevation of approximately 1,237 meters above mean sea level (mamsl) occurs in the down gradient groundwater flow direction towards the south/south-west, while the highest elevation of ± 1,289 mamsl is found in the hills in the centre of the mining rights area.
- By substituting the hydraulic head difference over lateral distance, the average hydraulic gradient was calculated to be in the order of 0.0042 or 0.42% and was then used to calculate the rate of groundwater movement (the so-called 'Darcy flux') in the project area.
- By making use of these values, the average rate of flux in the project area was calculated to be in the order of 4.8 meters per year.
- Due the highly varying nature of aquifers that are present in the Makganyane area, the groundwater flow calculated for this report only represents a regional average flow velocity and direction. Flow velocity and direction both vary significantly if tested more specifically on a smaller scale.
- The project area achieved a score of 6 and the underlying aquifer can therefore be regarded as having a medium vulnerability.
- The GQM rating for Makganyane is 8, which indicates a high level of protection.

- After consideration of all the data collected by conducting the slug tests and constant rate tests, the following summary of conclusions was drawn:
  o Two different aquifers exist in the Makganyane area.
  o The aquifer where mining activities will be concentrated is a highly heterogeneous aquifer with hydraulic parameters varying significantly over short distances.
  o The aquifer to the east and west of the hills have shallower water levels and is expected to have a higher groundwater yield, however, very few of them were pump tested.
  o The two aquifers are poorly connected to each other.
  o The matrix transmissivities of the aquifer in the hills range from 0.08 to 57 m2/d.
  o The aquifer provides little to middling volumes of water.
- An average recharge of 2% was calculated with the Chloride Method, which is in line with the 1.8 - 2.4% range of Vegter.
- Based on all the gathered information and experience from previous studies in similar areas, the mean annual recharge to the aquifer regime in the Makganyane was estimated to be in the order of 2% or 6.5 mm/a.
- Groundwater is considered to be of good quality and also suitable for human consumption according to the South African National Standards for drinking water (SANS 241:2015).
- Groundwater samples were collected from a total of 20 boreholes located on and around the Makganyane property.
- Groundwater samples were taken from 10 of the pump testing boreholes.
- Among the hydrocensus boreholes, samples were taken from 10 user boreholes in use for specifically domestic or livestock watering purposes and located closer to mining operations.
- Two samples were taken from the old Kimberlite shaft at different depths.
- Groundwater TDS concentrations measured in the site-specific groundwater user boreholes vary between 330 mg/l and 590 mg/l and is considered a normal range for this arid region.
- The highest nitrate concentrations measured during this study are around 7 mg/l.
- Groundwater magnesium concentrations are relatively low and vary between ±27 mg/l and 64 mg/l.
- Boreholes display groundwater chloride concentrations of between approximately 8 mg/l and 68 mg/l.
- Since no mining occurs within the immediate vicinity of any of the hydrocensus boreholes, the elevated nitrate concentrations are believed to originate from areas where animals congregate in significant numbers (feedlot, kraal, etc.).
- Groundwater within the Makganyane area is dominated by calcium and magnesium cations, while bicarbonate alkalinity dominates the anion content.
- The concentrations of groundwater parameters measured in the old Kimberlite pit were largely similar to the qualities measured in the other Makganyane boreholes.
- None of the parameters' concentrations exceeded the SANS 241:2015 guidelines for drinking water purposes.
- The only differences between the concentrations measured in the Kimberlite pit versus the surrounding area are slightly higher concentrations of sodium, magnesium and potassium – likely due to higher evaporation.
- For a negative groundwater quality impact to be registered the following three components should be present:
  o A source to generate and release the contamination,
  o A pathway along which the contamination may migrate, and
  o A receptor to receive the contamination.

15 APPENDIX 3: Hydrological Impact Assessment Mitigation Measures (TBC, 2025a).

Construction Phase Impacts **Vegetation Clearing**	
Mitigation and Management Measures	• Areas where works are envisaged should be (where practical) limited to the extent of the footprint, and activities outside of the footprint should be kept to a minimum. • Vegetation should only be removed where absolutely necessary and the areas which can be rehabilitated should be rehabilitated in a timely manner. • Vehicle movement should be kept to a minimum to reduce soil compaction and limited to existing or proposed roadways where practical. • Any soil excavated during the works should be appropriately stored in stockpiles which are protected from erosion. • For the duration of the project, stormwater runoff should be directed away from active earthworks. • Signs of erosion must be addressed immediately to prevent further erosion; Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching. • The use of sediment traps and/or silt fences is encouraged. • Concentrated surface run-off from the project area flowing down the embankments can scour the surface. This should be catered for by means of the stormwater management plan through the aid channels with energy dissipaters that channel these flows in a controlled manner.
Water Quality - Sedimentation	
Mitigation and Management Measures	• Areas where works are envisaged should be (where practical) limited to the extent of the footprint, and activities outside of the footprint should be kept to a minimum. • Any soil excavated during the excavation, should be appropriately stored in stockpiles which are protected from erosion and bermed. • For the duration of the project, stormwater runoff should be directed away from active earthworks. • Signs of erosion must be addressed immediately to prevent further erosion; Temporary and permanent. • Erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching. • Dust suppression at the site is encouraged. • The use of sediment traps and/or silt fences is encouraged. • Concentrated surface run-off from the project area flowing down the embankments can scour the surface. This should be catered for by means of the stormwater management plan through the aid channels with energy dissipaters that channel these flows in a controlled manner.
Water Quality – Domestic Waste and Sewage	
Mitigation and Management Measures	• All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping". • No dumping of any waste or material on-site may take place. • All domestic waste must be placed in predefined storage areas and removed from the workings area. These areas should lie outside the 100-year flood line. • Staff should use ablution facilities, which should be located away from the flood plain. • Staff should actively inspect the area for any domestic waste.
Water Quality – Hydrocarbons and Hazardous Materials	
Mitigation and	• All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".

Management Measures	• All dangerous goods must be stored in bunded areas located outside the 100-year flood line. • Material Safety Data Sheets should be easily accessible on site. • All hazardous materials should be clearly marked, and appropriate PPE utilized. • Vehicles and equipment should be stored in designated area outside the 100yr flood line. • Develop spill prevention and response plans to address potential leaks or spills of fuels, oils, or other hazardous substances. • The stormwater management plan must factor in the stockpile and waste dump areas, and any associated runoff must be captured and re-used. • Trucks utilized for the transport of product should be covered to prevent fines from entering the surrounding environment.
Destruction of Riverine Habitats	
Mitigation and Management Measures	• The delineated water resources should be marked as no-go areas. In the event that this is unavoidable, all means necessary should be taken to limit impacts to these and restrict the impacts to the smallest footprint. • Future mining activities should be located away from the water resources and associated flood lines. • Instream activities should be considered as least favorable options. • Should any instream activities be required such as the diversion of streams or channel modifications should occur in the dry period to prevent any unforeseen risks of erosion or inundation of the site. • Measures to prevent erosion of the area immediately downstream of the activity should be implemented. These could be the installation of gabions to prevent scour of the immediate downstream regions.
Alterations to the Natural Flow Regime	
Mitigation and Management Measures	• It is recommended that construction activities be undertaken in a phased approach. • Temporary stormwater management interventions should be included as part of the construction phase. The aim of this should be to control runoff volumes from the newly developed hard standing areas. • Vegetation should be re-established as soon as possible post any construction related activities.

Operational Phase Impacts **Water Quality- Sedimentation**	
Mitigation and Management Measures	• Areas where works are envisaged should be (where practical) limited to the extent of the footprint, and activities outside of the footprint should be kept to a minimum. • Any soil excavated during the excavation, should be appropriately stored in stockpiles which are protected from erosion. • For the duration of the project, stormwater runoff should be directed away from active earthworks. • Signs of erosion must be addressed immediately to prevent further erosion; Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching. • Dust suppression at the site is encouraged. • The use of sediment traps and/or silt fences is encouraged. • Concentrated surface run-off from the project area flowing down the embankments can scour the surface. This should be catered for by means of the stormwater management plan through the aid channels with energy dissipaters that channel these flows in a controlled manner.
Water Quality – Discharge from Operations	
Mitigation and Management	• A stormwater management plan must be implemented. • Mining methods should aim to minimize discharge and promote the re-use of water within the operations. • Dirty water catchment areas should be bunded.

Measures	• Dirty water should be contained in storage facilities, such as PCDs. • This water should either be treated and discharged or re-used within the operations. • Surface water quality sampling should be undertaken on a regular basis to ascertain whether impacts are detected and to what extent.
Water Quality - Domestic Waste and Sewage	
Mitigation and Management Measures	• All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping". • No dumping of any waste or material on-site may take place. • All domestic waste must be placed in predefined storage areas and removed from the workings area. These areas should lie outside the 100-year flood line. • Staff should use ablution facilities, which should be located away from the flood plain. • Staff should actively inspect the area for any domestic waste.
Water Quality - Hydrocarbons and Hazardous Materials	
Mitigation and Management Measures	• All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping". • All dangerous goods must be stored in bunded areas located outside the 100-year flood line. • Material Safety Data Sheets should be easily accessible on site. • All hazardous materials should be clearly marked, and appropriate PPE utilized. • Vehicles and equipment should be stored in designated area outside the 100yr flood line. • Develop spill prevention and response plans to address potential leaks or spills of fuels, oils, or other hazardous substances. • The stormwater management plan must factor in the stockpile and waste dump areas and any associated runoff must be captured and re-used. • Trucks utilized for the transport of product should be covered to prevent fines from entering the surrounding environment.
Increased Surface Water Runoff	
Mitigation and Management Measures	• A stormwater management plan must be implemented for the proposed site. The aim of this should be to control runoff volumes from the newly developed hard standing areas. • Vegetation should be re-established as soon as possible post any related activities.

16 APPENDIX 4: Freshwater Ecosystem Assessment Mitigation Measures (SAS, 2025).

Pre-Construction Phase: Potentially Poor Planning of Stormwater Management and Pollution Control for the Project	
Mitigation Measures	• Stormwater generated from mining areas must not adversely affect downgradient freshwater ecosystems. Accordingly, a stormwater management plan must be developed for the proposed mine that ensures the separation of clean and dirty water in line with GN704. Stormwater management must be implemented continuously in terms of both mining and rehabilitation activities; • It is highly recommended that the clean and dirty water separation systems (including the evaporation pond/s) be located as far as practically and feasibly possible outside of the GN 4167 100m ZoR of the EDLs to minimise the potential risk of a spill and contamination; • All dirty water channels that could carry contaminated water must be suitably lined; and • The evaporation pond/s must be appropriately lined to ensure no leakage of dirty / polluted water occurs and must be designed to have sufficient capacity to hold the full design capacity inflow. The evaporation pond/s must be designed according to the Department: Water Affairs and Forestry Best Practice Guideline A4: Pollution control dams (2007).
Construction Phase: Clearing of Vegetation and Earthworks Associated with the Dirty Water Channel and Sump Within the 48m Ecological Buffer and 100m ZoR of the Southern EDL	
Mitigation Measures	• In line with the mitigation hierarchy, the stockpile area has been reshaped and redesigned to avoid the 48m non-development buffer area as well as the 100m GN 4167 ZoR, therefore limiting the potential indirect impacts as a result of catchment wide activities. This in itself is deemed a mitigation measure; • It was however not deemed feasible or practically possible to reshape or redesign the Phase 2 OC pit area. However, the recommended mitigation measures have been suitably designed to best limit potential indirect impacts; • Prior to the onset of any clearing, the approved works area must be demarcated (preferably as part of the proposed fencing of the mining footprint). It is critical that the reaches of the EDLs and the associated 48 m ecological buffer not located in the open cast or other mining infrastructure footprint be clearly demarcated as a no-access areas; • All vegetation removed as part of the site clearing activities (specifically where large areas need to be cleared) must be transported from the construction site (if not being used for rehabilitation purposes (may not be stockpiled) and disposed of at a registered waste disposal facility; • Stripping of topsoil and vegetation must by planned so that smaller areas (blocks) of vegetation are cleared systematically and only when excavation is immediately planned in that part of the footprint to avoid and minimise the area of exposed subsoils and time during which this is exposed; • Stormwater controls must be put in place on the downgradient side of the area being excavated and along the boundaries of any development exclusion area located downgradient of the works area so that as construction takes place, dirty water runoff is appropriately managed; and • it is recommended that an AIP control plan is developed, and that AIP control is implemented for the duration of the construction and mining periods.
Creation of the Stockpile Within the Immediate Catchment of the Northern EDL (Outside of the GN 4167 100m ZoR)	
Mitigation Measures	• Stockpiling must be carefully monitored by the Environmental Control Officer (ECO) to ensure that all Environmental Management Programme (EMPr)-related control measures are implemented; • Any topsoil stockpile/s may not be left to become naturally revegetated (material stockpiles will be transported from site) as this is associated with a significant risk of alien invasive plant proliferation as well as erosion development; rather the topsoil stockpile/s must either be covered with tarpaulins or similar durable covering that will last for the duration of the works period, or be revegetated by means of hydroseeding with a suitable indigenous plant mix to prevent these from becoming eroded by rainfall and associated runoff or to prevent the stockpile from generating significant volumes of dust into surrounding areas; and • Silt and stormwater controls that are durable must be installed on the downgradient side of all stockpile area. It is recommended that a dirty water management system be installed around the stockpile boundaries to ensure that silt-laden water is properly managed.
Upgrading of Existing Informal Roads (If Required) which Bisect the EDLs and are Located Within the GN 4167 100m ZoR	
Mitigation Measures	• The construction footprint must be limited to a construction Right of Way (RoW) that comprises a 5 m construction buffer (upstream and downstream of the freshwater ecosystem crossing) only to prevent indiscriminate movement of mining equipment in the system;

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Upgrading of the informal roads must take cognisance of the delineated extent of the freshwater ecosystem traversed by the existing informal access road. Should the road be increased in width, the road must be expanded on the side opposite of a freshwater feature (where applicable), to ensure that the remaining natural buffer between the access road and the freshwater feature remains intact;
Material to be used (gravel – if applicable) as part of the upgrading of the existing roads must be stockpiled outside the delineated extent of the freshwater ecosystems (preferably outside of the 48 m ecological buffer from the freshwater feature) to prevent sedimentation thereof and to avoid any other vegetation being impacted by the construction activities. These stockpiles may not exceed a height of 2 m and must be protected from wind using tarpaulins;
The disturbed area surrounding the road must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring;
The alien vegetation management plan as compiled by the terrestrial/botanical ecologist is highly recommended and supported by the freshwater specialist and must be implemented concurrently with the commencement of construction; and
All existing alien and invasive vegetation must be removed. All material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.

With regards to excavation and soil compaction activities within the freshwater ecosystems:

Although the proposed freshwater ecosystems crossings upgrades are associated with generally existing informal roads, and as such the most significant impacts have already occurred, the existing gravel roads are relatively small and are lacking formal through-flow structures (pipe culverts are considered suitable in this context). The following are applicable with regards to excavation works and any concrete related activities:
During the excavation activities, any soil/sediment or silt removed from the freshwater ecosystem may be temporarily stockpiled in the construction ROW but outside the delineated extent of the freshwater ecosystem. These stockpiles may not exceed 2 m in height, and their footprint must be kept to a minimum;
Stockpiling of removed materials may only be temporary (may only be stockpiled during the period of construction at a particular site) and must be suitably disposed of;
Excavated materials must not be contaminated, and it must be ensured that the minimum surface area is taken up. Mixture of the lower and upper layers of the excavated soil must be kept to a minimum, for later usage as backfill material or as part of rehabilitation activities;
Care must be taken to ensure that no scouring or erosion occurs as a result of the proposed crossing;
All construction material (with specific mention of prefabricated culvert structures) must be stockpiled in the laydown area and must only be imported to the construction site when required; and
Construction equipment/vehicles used to install culvert structures must be parked on the existing road surface and may not enter the freshwater ecosystems.

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<tr><td colspan="2">Operational Phase: Undertaking of Open Cast Mining (Including Blasting) Adjacent To and Within the GN 4167 100m ZoR of the Southern EDL (Phase 2 OC Pit)</td></tr>
<tr><td>Mitigation Measures</td><td>

The portions of the 48 m non development (ecological) buffer around the EDL, not impacted by the OC pit, must be maintained to provide some form of residual protection to the system from spill-over and edge effects of the mining operations;
Stormwater controls in the form of temporary berms and silt traps must be installed and maintained for the duration of the mining operations to prevent polluted sediment and other fines materials from being transported by stormwater into the downgradient reach of the system;
A monitoring programme must be implemented to detect and prevent the pollution of soil, surface water and groundwater;
Reduce airborne dust during blasting activities through damping dust generation areas with freshwater (although not in sufficient quantities to generate runoff); and
No dewatering operations from the pit must allow any discharge of such water into the natural environment, and all such water must be handled as part of the dirty water management system of the Phase 2 OC pit.

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<tr><td colspan="2">Operational Reshaping of the Phase 2 Open Cast Pit and Associated Rehabilitation (Topsoil Restoration and Revegetation) Adjacent To and Within the GN 4167 100m ZoR of the Southern EDL</td></tr>
<tr><td>Mitigation Measures</td><td>

The reshaping of the western side of the Phase 2 OC pit within the 48 m ecological buffer ensure a natural gradient as possible, which fits into the overall landscape;
Reinstatement of substrate must allow interflow that mimics the direction of the slope to be reinstated;
Subsoil and topsoil restoration and revegetation, along with post-reshaping AIP control is recommended to be undertaken in the reshaped areas as soon as possible once reshaping is complete;

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	• Rehabilitated areas in the open cast pit footprint must be revegetated with a range of species that is similar to the current species assemblage in line with the recommendations from a suitably qualified specialist; • Monitoring of erosion in the reshaped area must be undertaken and any developing rills / gullies must be immediately rehabilitated; • Follow up revegetation must be undertaken if bare areas develop or if seeding is unsuccessful to ensure that soils remain protected and not vulnerable to sheet and rill erosion; and • Sediment control measures must be installed for the reshaped area within 100m of the boundary of the southern EDL.
Operation of the Portion of the OC Pit 2 Dirty Water Channel and Sump Within the GN 4167 100m ZoR of the Southern EDL	
Mitigation Measures	• All recommendations and mitigation measures as provided in the SWMP (TBC, 20251) must be strictly adhered to; • Regular inspection of the dirty water channel must be undertaken; • The EDL may not be inundated as a result of leaks of the dirty water channel (tearing in the lining), an emergency plan must be compiled to ensure a quick response and attendance to the matter in case of tearing in the dirty water channel lining; and • Only existing roadways must be utilised during maintenance and monitoring activities to avoid indiscriminate movement of vehicles.
Transport of Product from the Open Cast Pit (Phase 2) to the Primary Beneficiation Plant (Offsite) Via the Upgraded Road which Bisects the Southern EDL and is Located Within the Associated GN 4167 100m ZoR	
Mitigation Measures	• Only the approved haul route between blasting / extraction areas and screening / crushing plants must be used and must be strictly controlled through the compliance monitoring as associated with the EMPr; • Vehicles transporting product must not be overloaded to avoid spillage of product; • Vehicles transporting product must be maintained in a good working condition and no leaking vehicles and machinery must be allowed to travel on the haul road; and • Speed limits for vehicles transporting product must be strictly enforced.
Operation and Maintenance of the Upgraded Road Crossings Within the EDLs	
Mitigation Measures	• No indiscriminate movement of maintenance equipment or vehicles through the freshwater ecosystems may be permitted during standard operational activities or maintenance activities. Use must be made of the existing road crossings only; • Unnecessary disturbances surrounding the perimeter of the surface infrastructure must be avoided; • Vehicles used in the development site must be regularly washed (on a non-permeable surface or off-site) to avoid the dispersal of seeds on any alien or invasive species into the freshwater ecosystems; • Ensure that routine inspections and monitoring of any instream infrastructure are undertaken to monitor any build-up of debris that will impact on structure integrity or lead to erosion and sedimentation. Furthermore, monitoring to determine the establishment of indigenous vegetation and the presence of any alien or invasive plant species; • Routine maintenance of the roads must be undertaken to ensure that no concentration of flow and subsequent erosion occurs due to the road crossings/instream infrastructure. Such maintenance activities must specifically be undertaken after high rainfall events; • During periodic maintenance activities of the roads, monitoring for erosion must be undertaken; and • Should erosion be observed, caused by the road crossings, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation. Use can also be made of rocks collected from the surrounding area to infill any area prone to erosion (however, these must be sustainably sourced not taken from the surrounding freshwater ecosystems including rivers in the local area).
Decommissioning Phase: Ongoing (Long Term) Rehabilitation of the Mining Footprint Areas Within the GN 4167 100m ZoR of the EDLs	
Mitigation Measures	• The topsoil along the roads and their immediate vicinity are likely to be contaminated by spilled material; all such material must be removed and disposed of in the waste material dumps of the mine or at a hazardous landfill site in the case of spilled material such as oils or other hydrocarbons. This material must not be utilised for restoration; • Should erosion gullies be noted, these areas must be rehabilitated by infilling them with suitable soil and ensuring the area is vegetated. The increased surface roughness will discourage concentrated flow paths to develop and ensure diffuse flow patterns; • All bare areas must be ripped and be revegetated within suitable indigenous vegetation species; • Follow up revegetation must take place where initial revegetation is not successful; and

	• Post-closure monitoring of the freshwater ecosystems (for a period of 3 years), with specific mention of the invasion of alien vegetation species) is recommended to be undertaken.
Post-Closure Management Activities	
Mitigation Measures	• Potential points of decant and risks of water contamination as a result must be determined. The management and mitigation measures as recommended in the geohydrological study should be implemented to mitigate the potential impacts arising from decant of contaminated water from the mine into the receiving environment.

General "Good Housekeeping" Mitigation Measures.

General Construction Management and Good Housekeeping Practices.

Development Footprint	
Mitigation Measures	• All development footprint areas must remain as small as possible and must not encroach into the freshwater areas unless absolutely essential and part of the proposed development. It must be ensured that the freshwater habitat is off-limits to construction vehicles and non-essential personnel; • The boundaries of footprint areas, including contractor laydown areas, must be clearly defined and all activities must remain within defined footprint areas. Edge effects will need to be extremely carefully controlled; • Planning of temporary roads and access routes must avoid freshwater ecosystems and be restricted to existing roads where possible; • Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility; • All hazardous chemicals as well as stockpiles must be stored on bunded surfaces and have facilities constructed to control runoff from these areas; • All hazardous storage containers and storage areas must comply with the relevant SABS standards to prevent leakage; • No fires must be permitted in or near the construction area; and • Ensuring that an adequate number of waste and "spill" bins are provided will also prevent litter and ensure the proper disposal of waste and spills.
Vehicle Access	
Mitigation Measures	• All vehicles must be regularly inspected for leaks. Re-fuelling must take place offsite on a sealed surface area to prevent ingress of hydrocarbons into the topsoil; • In the event of a vehicle breakdown, maintenance of vehicles must take place with care and spillage must be prevented near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and • All spills should they occur, should be immediately cleaned up and treated accordingly. Contaminated soil must be bagged and disposed of in hazardous waste receptacles.
Vegetation	
Mitigation Measures	• Removal of the alien and weed species encountered within the wetlands must take place to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational, and maintenance phases; and • Species specific and area specific eradication recommendations: •Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used; •Footprint areas must be kept as small as possible when removing alien plant species; and No vehicles must be allowed to drive through designated sensitive watercourse areas during the eradication of alien and weed species.
Soil	
Mitigation Measures	• Sheet runoff from access roads and the walk ways must be slowed down by the strategic placement of berms; • As far as possible, all construction activities must occur in the low flow season, during the drier winter months; • As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soil;

	• No stockpiling of topsoil must take place within close proximity to the watercourse, and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the watercourse; • All soil compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas must be ripped and profiled; and • A monitoring plan for the development and the immediate zone of influence must be implemented to prevent erosion and incision.
Rehabilitation	
Mitigation Measures	• Construction rubble must be collected and disposed of at a suitable landfill site; • All alien vegetation in the footprint area as well as immediate vicinity of the proposed development must be removed. Alien vegetation control must take place for a minimum period of two growing seasons after rehabilitation is completed; and • Side slope and embankment vegetation cover must be monitored to ensure that sufficient vegetation is present to bind these soils and prevent further erosion.

17 APPENDIX 5: Terrestrial Assessment and Floral Compliance Statement Mitigation Measures (STS, 2025b).

Floral Ecology for the Proposed Development, Prior to Mitigation and Post Mitigation for the Pre-Construction and Planning Phase	
Mitigation Measures	• At all times, ensure that sound environmental management is in place during the planning phase; • Stockpile height and slope angle / steepness must follow sound geotechnical design. Ensure that the slope ratio is not designed or planned to be excessively steep which may induce slope failure. Ensure mechanisms to improve slope stability are planned for. Stormwater management planning and erosion control must be stricter for all newly proposed stockpiles as the existing stockpiles have contributed to sedimentation of the adjacent natural habitat due to sub-par stormwater management; • Prior to the commencement of vegetation clearing activities, 1) a rehabilitation plan and/or strategy must be developed (by suitably qualified individuals) for implementation throughout the project phases, 2) a rescue and relocation plan must be developed (by suitably qualified individuals), specifically targeting protected species, under the guidance of the relevant authorities (after walkdown was implemented), and 3) an AIP control plan must be developed and the AIP control must subsequently be implemented throughout all phases of the proposed project. The AIP control and management plan should be regularly updated by a suitably trained specialist. It is highly recommended that the AIP Management/ Control Plan should be monitored on a yearly basis (or as specified by an AIP professional); • A thorough walkdown of all footprint areas (including a 15 m buffer around the footprint areas) must take place within the optimal flowering season of all (or most of) the anticipated provincially protected species prior to the project initiation. The appropriate permitting and authorisation processes must be followed as per the Northern Cape Environmental Department (for provincially protected species) and DFFE (for non-threatened TOPS and/or NFA species) requirements. A rescue and relocation plan, under the guidance of the DFFE and/or Northern Cape Environmental Department, must be developed based on the outcome of the site walkdowns; • Based on the outcome of the walkdowns, the following permit application and/or authorisation will be necessary before project activities can commence. Where NCNCA - protected species will be impacted, permits from the Northern Cape Environmental Department will be required. Provincially protected species can be targeted for rescue and relocation attempts or destruction permits prior to the mining phase; • Minimise loss of indigenous vegetation and natural habitat by considering the sensitivity of the biodiversity report as well as other specialist studies, i.e., optimise layouts within medium to very low SEI habitats, and avoid loss of high and very high SEI habitats as best possible, and avoid very high SEI habitats. At all times, ensure placement of infrastructure does not lead to increased habitat fragmentation (i.e., ensure temporary laydown areas and infrastructure placement occur within already disturbed areas or as close to existing disturbances as possible) or avoidable disruption to ecological processes; and • It is recommended that prior to the commencement of construction activities, the construction servitude be clearly demarcated to prevent footprint creep into areas beyond the authorised footprints.
Floral Ecology for the Proposed Development, Prior to Mitigation and Post-Mitigation for the Mining Phase	
Mitigation Measures	**Floral Habitat and Diversity** • No NCNCA-protected floral species may be removed during any mining phase activities without 1) permits from the DFFE and Northern Cape Environmental Department, and 2) all conditions of the permits being adhered to. It is recommended that propagules and/or seed of the NCNCA-protected species be harvested (depending on the permit conditions) and grown under nursery conditions to be used for 1) rehabilitation activities later down the line, and/or 2) to supplement unsuccessful relocation attempts; • Removal of vegetation must be restricted to what is absolutely necessary and must remain within the approved project footprint. Footprints to be clearly demarcated to avoid footprint creep into adjacent habitat. It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, be placed outside of sensitive habitat units;

	• As far as possible, vehicles must utilise the existing and planned roads and avoid the creation of unplanned / unauthorised roads; • No vegetation cuttings from clearing activities may be left to accumulate in the Freshwater Habitat. Discard all construction related waste and material (including cleared vegetation) at a registered waste facility or in a secluded area designated by the mine. No waste or construction rubble may be dumped in the surrounding natural habitats, or any unauthorised areas; • Current proposed infrastructure and future expansions during the mining phase (as material is deposited), must be kept within authorised footprints only. No additional habitat outside of the demarcated and approved footprints (being applied for) may to be disturbed during the operational phase of the project. Monthly (minimum requirement) monitoring and recording of the footprint areas must be done by the Mine Surveyor to ensure consistency of footprint areas and no footprint creep takes place; • Initiating, and maintaining, an annual vegetation monitoring programme, therefore the biodiversity within the Focus Areas (remaining natural areas) can be protected and managed in terms of ecological function, which comprises the floral species composition associated with the reference vegetation types. Furthermore, continued monitoring of relocation of SCC until evident that the individuals have successfully established. • All crossings must be constructed as per the recommendations of a freshwater specialist (SAS 25-0028, 2025) and engineer. Where crossings will be constructed, these must be adequately designed to prevent impacts on habitat, instream flow, pattern and timing of water and water quality. Ensure AIP vegetation cuttings and propagules do not enter the freshwater systems where crossings will be constructed; • It must be ensured that stockpiled topsoil is not contaminated by AIP material, and is considered a high priority for AIP control (stockpiled topsoil should be included in monitoring activities). Handling of topsoil must follow best-practice standards. Topsoil must be stockpiled in such a way as to limit soil compaction and erosion. No personnel and heavy vehicles to move over topsoil stockpiles. It is recommended that topsoil stockpiles be vegetated and while vegetating, measures will be needed to contain erosion of the stockpile during rain events; • No collection of floral SCC or indigenous vegetation beyond the planned footprints must be allowed by construction or operational personnel; • Open fires must be restricted to fire safe zone facilities and suitable fire control measures must be in place. However, harvesting of surrounding trees, shrubs or any indigenous vegetation for fire-making purposes must be strictly prohibited. A Fire Management Plan (FMP) must be in place to ensure that any fires that do originate can be managed and / or stopped before significant damage to the environment occurs; • Care must be taken during the construction and operation of the proposed activities to limit edge effects to the surrounding natural habitat. This can be achieved by: • Demarcating all footprint areas during construction activities; • All soils compacted outside of the footprint areas because of construction activities must be ripped and profiled and reseeded; • Suppress dust to mitigate the impact of dust on flora within a close proximity of construction activities, as well as to prevent sedimentation of the Wetland Habitats surrounding the activities; • Minimise the risk of erosion by limiting the extent of disturbed vegetation and exposed soil; and • Manage the spread of AIP species, which may affect natural habitat outside of planned footprints; • Appropriate sanitary facilities must be provided during the construction of the development and must be removed to an appropriate waste disposal site. No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed because of the construction activities must be disposed of at an appropriate registered dump site or a safe area designated by the mine. No temporary dump sites should be allowed in areas with natural vegetation. It is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste; • If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line;

	• Appropriate fuel storage and distribution facilities need to be established; and • Rehabilitate areas that are no longer used for construction and operational activities. Any natural areas beyond the direct footprint, which have been affected by construction activities, must be rehabilitated using indigenous species. As part of rehabilitation activities, ensure that a vegetation layer is reinstated and maintained where natural areas beyond the direct footprint have been affected by construction and operational activities – i.e., to promote soil health and vegetation establishment, to reduced habitat fragmentation, and to provide resources for fauna. In this regard, the use of indigenous plants from either the reference vegetation type or the general area is recommended for best biodiversity outcomes. **Significant Biodiversity Features** • Options to mitigate the loss of habitat associated with ESAs are limited. Edge effects should be managed to reduce cumulative loss of ESAs through 1) minimisation of habitat loss through reconsideration of layouts, especially with regards to habitats that support protected floral species and watercourses, 2) limiting of habitat fragmentation through utilisation of existing roads and keeping new construction activities within or close to existing disturbances, 3) ensure a rehabilitation plan is developed and approved by authorities prior to mining activities commencing, which must aim to incorporate concurrent rehabilitation through all phases of the project (preferred), and 4) Ensuring habitat degradation especially surrounding the authorised footprints are kept to a minimum (limit edge effects). **Alien Vegetation** • AIP proliferation, which may affect adjacent natural areas, must be strictly managed. Specific mention in this regard is made of Category 1b and 2 AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020). Management of AIPs during the mining phase activities must be focused on limiting their introduction and preventing their spread; • Ongoing AIP monitoring and clearing/control should take place throughout the mining (e.g., construction and operational) phase of the proposed activities; a 30 m buffer surrounding the proposed activities during the operational phase should regularly be monitored for AIP proliferation and instances thereof controlled appropriately. Disturbed areas and linear infrastructure must be regularly checked for AIP proliferation to prevent spread into surrounding natural areas (until successfully rehabilitated); • All cleared alien vegetation must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards, or at a garden refuse site • The AIP Management/Control Plan should be implemented by a qualified professional (i.e., the person must have a good record of experience in AIP management and control). No chemical control of AIPs to occur within 32 m of a watercourse, unless registered as safe for use in watercourses by the Working for Water group; • Yearly monitoring of alien vegetation control plan (as implemented by a qualified specialist), stormwater management, and general good housekeeping must be done by the mine Environmental Control Officer (ECO) and photographic records kept; and • Quarterly reporting on alien vegetation control to effectively monitor and manage the control and spread of AIPs.
Floral Ecology for the Proposed Development, Prior to Mitigation and Post-Mitigation for the Decommissioning and Rehabilitation Phase	
Mitigation Measures	**Habitat and Diversity** • All infrastructure and footprint areas must be rehabilitated in accordance with the rehabilitation plan. Rehabilitation efforts must be implemented and continuously monitored for a period of at least 5 years after decommissioning and closure, or until an acceptable level of habitat and biodiversity re-instatement has occurred, in such a way as to ensure that natural processes and veld succession will lead to the re-establishment of the natural wilderness conditions that are analogous with the desired post-closure land use; • The post-closure rehabilitation land use must be used as guidance for the rehabilitation plan to be implemented. It is recommended that the post-closure land use be to natural vegetation that represents, as far as possible, the pre-mined vegetation communities, with

	ecological function and habitat connectivity enhanced as much as feasible. The rehabilitated areas must be able to sustain floral SCC, especially if such species were rescued and propagated for relocation into rehabilitated sites; • Species selected for rehabilitation should meet the biodiversity and land end-use objectives. Only use species that are well adapted to local climatic conditions and post-establishment method of use (as provided by a suitably qualified individual); • All temporary structures, waste, rubble, AIPs etc., must be removed from the site before re-vegetating can commence. Site levelling and preparation for rehabilitation activities must ensure no harm or disturbance come to the surrounding natural areas; • Appropriate shaping of disturbed areas is essential. To promote successful establishment of vegetation, the slopes must resemble the natural surroundings. Where slopes are left steeper than what is recommended for whatever reason, additional measures must be implemented to prevent soil erosion and stormwater must be adequately managed; • Shaping and backfilling recommendations include: - Areas that will be backfilled must be monitored for subsidence (as the backfill settles) and depressions filled using available material; - Replacement of topsoil that was removed and stored during site clearance activities must be to the original depth. Where topsoil is not enough for rehabilitation activities (or where topsoil has been severely contaminated by AIPs and regarded unsuitable for rehabilitation), provision must be made to import enough soils that will be suitable for slope shaping and for the re-establishment of vegetation; and - The site must be monitored for signs of erosion and remedial action taken where there are problems. • Edge effects such as erosion and AIP proliferation, which may affect adjacent or sensitive habitat, need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase continuing for at least 3 years post mine closure. Followed by ongoing AIP monitoring and control throughout the rehabilitation phase of the project; • Monitoring of rescued and relocated floral SCC must continue during the decommissioning and rehabilitation phase until it is evident that the species have successfully established; and • Collection of floral SCC and protected flora by rehabilitation and decommissioning teams must be prohibited.

18 APPENDIX 6: Terrestrial Faunal Assessment Mitigation Measures (STS, 2025c).

Planning Phase Impacts on the Faunal Habitat, Diversity, and SCC From the Proposed Activities	
Mitigation Measures	• At all times, ensure that sound environmental management is in place during the planning phase; • Site boundaries should be clearly demarcated so as to ensure that vegetation beyond the authorised footprint is not cleared; • Where possible, and feasible, all access roads should be kept to existing roads and areas that have already been disturbed so as to reduce fragmentation of existing natural habitat; • Ensure that a suitable relocation plan is in place to guide the effective and efficient relocation of species where necessary; • Ensure that a suitable snake handler is on call, or a suitable staff member has been trained to carry out removal activities of snakes encountered; • Prior to the commencement of construction activities, an authorised AIP Management/Control Plan should be compiled/implement; and • Prior • to the commencement of construction activities on site, a rehabilitation plan should be developed and regularly updated as needed
Mining Phase Impacts on the Faunal Habitat, Diversity, and SCC From the Proposed Activities	
Mitigation Measures	**Faunal Habitat and Diversity** • Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved project footprint. Footprints to be clearly demarcated to avoid footprint creep into adjacent habitat; • If snakes / scorpions / baboon spiders (or any other faunal species) are located within any buildings on site and pose a risk to operations staff and /or infrastructure, the species is to be carefully captured and moved to a safe space outside of the footprint. Where necessary, a trained snake catcher / competent staff member / ECO must effect the relocation; • No collection or hunting of any fauna species is to be allowed by personnel; • Night lighting must be kept to a minimum, as it attracts insects and disturbs their natural nocturnal activities and navigation senses. In this regard, lighting should be inward and downward facing to the footprint area. Lights should avoid the use of LEDs and other bright white globes. Soft yellow light emitting globes (sodium vapour) and red lights should be installed at all points as and where needed; • No unauthorised fires are to be allowed on the site; • No dumping of litter or human refuse/waste on site should be allowed; • Edge effects must be monitored and managed, notably AIP proliferation; • Existing roads are to be used for access purposes. No off-roading or driving through the surrounding veld is to be permitted; • Any disturbed areas should be concurrently rehabilitated; • Clearing activities within the various footprints should be undertaken in a phased approach. This will allow for faunal species to move out ahead of clearance activities. Where necessary, small/slow-moving species must be assisted / relocated out of harm's way; • Suppress dust to mitigate the impact of dust on surrounding vegetation which will reduce its palatability for herbivores; • Manage the spread of AIP species, which may affect natural habitat outside of planned footprints; and • Disturbed / bare areas no longer in use are to be rehabilitated using indigenous plant species. **Faunal SCC** • Edge effect control needs to be implemented to prevent further degradation and potential loss of faunal SCC habitat outside of the proposed development footprint; • No collection or hunting of SCC allowed by mining staff or associated contract workers, unless for the purpose of relocation; • Before any vegetation clearing activities start the footprint and immediate surrounding areas should be inspected for the presence of Smutsia temminckii (Temminck's Ground Pangolin, VU). Should individuals be found they should be safely captured and relocated to similar habitat outside of the footprint areas; • It is recommended that prior to and during vegetation clearing activities in the natural vegetation units, the site should be inspected for the presence of protected burrowing scorpions and baboon spiders. If located, these species should be carefully excavated ensuring no harm to the specimens and relocated to similar surrounding habitat outside of the footprint area. A night-time survey utilising UV

	lights is recommended to aid in the collection of potentially protected scorpions. The survey should be undertaken in summer when these arachnids are more active; • Should any SCC need to be removed from any footprint areas, it is to be done carefully by a trained professional/competent staff member. Where applicable permits must be obtained for such relocation. A biodiversity specialist should be contacted to advise in this regard, or alternatively the project ECO; and • If avian SCC nests are located, a qualified avifaunal specialist should be consulted to determine the best management options. If nests are known to have nestlings or eggs within, these should be allowed to fledge prior to the nest removal. It is important that no mining related activities take place adjacent to any active nest, ideally not within 200m, in order to limit the risk of nest abandonment.
Decommissioning and Rehabilitation Phase Impacts on the Faunal Habitat, Diversity, and SCC From the Proposed Activities	
Mitigation Measures	**Habitat, Diversity and SCC** • All infrastructure and footprint areas should be rehabilitated in accordance with the rehabilitation plan. Rehabilitation efforts must be implemented and continuously monitored for a period of at least 5 years after decommissioning and closure, or until an acceptable level of habitat and biodiversity re-instatement has occurred, in such a way as to ensure that natural processes and veld succession will lead to the re-establishment of the natural wilderness conditions which are analogous with the desired post-closure land use; • The post-closure rehabilitation land use must be determined and agreed upon for the rehabilitation plan to be drafted. It is recommended that the post-closure land use be to natural vegetation that represents, as far as possible, the pre-mined vegetation communities, with ecological function prioritised; • All temporary structures, waste, rubble, AIPs etc. must be removed from the site before re-vegetating can commence. Site levelling and preparation for rehabilitation activities must ensure no harm or disturbance comes to the surrounding natural areas; • Appropriate shaping of disturbed areas is essential. Ideally, the pit is to be backfilled with the excavated waste rock material and the remaining areas sloped in accordance with the surrounding landscape. Topsoil is to be used to cover the disturbed areas to ensure suitable growth media is present in order to best facilitate rehabilitation measures; • Edge effects such as erosion and AIP proliferation, which may affect adjacent or sensitive habitat, need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase; • Ongoing AIP monitoring and control should take place throughout the rehabilitation phase of the project; • Any natural areas beyond the direct authorised footprint, which have been affected by the decommissioning activities, must be rehabilitated using indigenous species; and • All soils compacted because of construction activities falling outside of the Focus Areas should be ripped and profiled. Special attention should be paid to AIP control within these areas.

19 APPENDIX 7: Professional Resume of Specialist

NEIL WILSON

Gender: Male
Date of Birth: 18 May 1957
Languages: English
Driver's licence: Code B
Mobile number: (+27) 82 349 7992
Email address: neil@afzelia.co.za

BIOGRAPHICAL PROFILE

Neil is a professional results-oriented specialist ecologist, behavioural ecologist, ethologist, conservation biologist and environmental scientist, who is passionate about biodiversity conservation for vital and critically important local, regional, continental, and global reasons. His mission and principal objectives are focused on making positive, meaningful, substantial, and effective contributions in preferably preventing or minimising significant negative ecological and environmental anthropogenic impacts, together with rehabilitating and rewilding affected areas to their natural state, and contributing to the excellent service delivery of Team Afzelia.

With more than 20 years of diverse empirical field experience, he has successfully completed more than 700 specialist ecological and biodiversity conservation studies in the following scientific disciplines: Biodiversity; terrestrial, wetland, peatland, riverine, riparian, aquatic (freshwater: rivers, streams, lakes & vleis), estuarine, sandy beach and rocky shore (freshwater & coastal marine), and marine ecology. Neil manages and conducts extensive complex scientific studies, complex studies of moderate size and smaller studies of moderate complexity.

Neil's specialist studies have covered biodiversity, ecosystems, habitats, biodiversity hotspots, centres of endemism; ecological, biodiversity conservation and ancient ancestral corridors; rehabilitation and rewilding of damaged and degraded landscapes, ecosystems, and habitats; plant and animal species of conservation concern, including their identification, rescue and conservation; and focal plant and animal studies. Work is conducted and completed to high scientific standards in a timely way to the satisfaction of diverse national and international clients. He marries the needs of clients with those of the natural environment, and thereby promotes truly sustainable development, including the conservation and wise use of natural resources.

He has a solid academic and research background with a Bachelor of Science (BSc), majoring in Botany and Zoology; BSc Honours in Zoology, focusing on Ecology, Animal Behaviour, Animal Sound Communication, Evolutionary Biology and Palaeontology; and MSc in Zoology comprised of Animal Sound Communication research and thesis. Neil's first MSc thesis in Zoology at the University of Cape Town and PhD thesis in Ecology, Behavioural Ecology and Zoology at Royal Holloway, University of London were not submitted due to supervisor misconduct, corruption and conflict and ensuing financial difficulties, but he benefitted considerably from the two years MSc and six years PhD research, extensive univariate and multivariate analyses, interpretation of results and preparation of theses. Neil has a solid grounding in and extensive experience with univariate and multivariate analyses. He has conducted research, lectured, and tutored at the Universities of Cape Town, the Witwatersrand, Pretoria and London. He strongly supports a wide range of national and international biodiversity conservation organisations.

ACADEMIC QUALIFICATIONS

Master of Science in Zoology (Research and Thesis), University of Pretoria, 2001.

Bachelor of Science Honours in Zoology, University of the Witwatersrand, 1985.

Bachelor of Science in Botany and Zoology, University of Cape Town, 1981.

OTHER QUALIFICATIONS

Identified professional expert by the Water Research Commission in the water research field.

Competent Communication Course (CC1-10), Toastmasters International, June 2013.

PROFESSIONAL MEMBERSHIP

Southern African Institute of Ecologists and Environmental Scientists.

SKILLS

- Extensive diverse range of skills including the following:
- Quantitative and qualitative methodologies
- Extensive field work
- Data analyses and interpretation
- GPS data capture and Basic GIS
- Terrestrial, wetland and aquatic ecology and ecological assessments
- Wildlife assessments
- Biodiversity assessments
- Biodiversity conservation assessments
- Scientific report writing
- Scientific paper writing
- External reviews

EMPLOYMENT HISTORY

Principal ecologist, conservation biologist and environmental scientist at The Ecological Partnership (Pty) Ltd from 2000 to 2024.

REFERENCES

Dr Sivile Mngese, Director of Ufefe Development Consultants, +27 83 393 6494, Sivilem@ufefe.co.za

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