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DRAFT ENVIRONMENTAL MANAGEMENT PLAN

AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS REQUIRED UNDER NEMA FOR:

PROPOSED PERING MINING PROJECT

DEDECT REF: NWP/EIA/50/2010

DRAFT, OCTOBER 2012

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Introduction

1.1 Background

Pering Mine (Pty) Ltd proposes to re-open an opencast zinc and lead mining operation at Pering Mine located on the farm Pering Mine 1023 HN in the magisterial district of Vryburg in the North West Province, where mining activities ceased in 2003. The extent of the mining area is 883.1 ha.

Pering Mine was historically mined by Shell and subsequently by BHP Billiton until 2002. BHP Billiton instituted closure and decommissioning activities in 2003 as ore grades were not considered to be economically viable. Pering Mine intends to re-open the mine by processing the existing waste rock dumps and extending the mine pit using Dense Media Separation (DMS) mining techniques.

1.2 Mining activities

1.2.1 Historic mining

The key remaining residual features/impacts at Pering Mine which resulted from historic mining activity include the following:

- Tailings dam which has been lined with a cladding of waste rock to limit water seepage into the tails dam and minimize wind and water erosion and dust fallout.
- A sulphurous groundwater contamination plume from the tailings dam which has migrated beyond the mine boundary, in an easterly direction.
- Main Pit and Pit 24 – These pits have been infiltrated with groundwater and rainwater since closure and currently there is approximately 8 million m^3 of water in the Main Pit.

1.2.2 Proposed mining

There will be two phases to the mining operation. While the pits are being dewatered, the existing waste rock dumps will be mined and processed. Once the pits are dewatered, opencast mining will take place in the pits (year three). In total, 4Mt will be mined from the pit annually, of which 1.8Mt will be waste and 2.2Mt ore. This translates to on average 330Kt mined each month. Conventional drill, blast, load and haul, open pit mining operations is envisaged for the future mining of the ore deposit. Mining will consist of drilling and blasting, where the rock will be broken down to less than 400 mm. . It is envisaged that standard face shovels and tipper truck configurations will be employed to mine the pit. Face shovels will load blasted material to off-highway dump trucks for hauling to the crushing plant (where it will be reduced to less than 18mm), stockpiles or waste dumps. In summary, future proposed mining will involve:

- Mining of the existing stockpiles;
- Dewatering of two existing open pits to permit their re-mining (construction phase);
- Deepening and expansion of the open pits through a series of cut backs;

- Ore and waste will be drilled and blasted in mining blocks on 10m bench heights;
- Blasted ore will be loaded by an excavator and hauled with dump trucks. Material will either be tipped directly into the crusher or stockpiled for later use;
- Waste will be loaded by an excavator and hauled.

1.3 Legislative background

1.3.1 Environmental authorisation

An EIA process was undertaken in terms of GNR 385 of the EIA regulations 2006, to obtain environmental authorisation for the activities listed in the tables below, such that new proposed mining activities may commence.

Table 1: Listed activities as per the GN. R386 (April 2006)

#	Describe each listed activity:
386 (1)(b)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the above ground storage of 1 000 tons or more but less than 100 000 tons of ore;
386 (1)(k)(i)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the bulk transportation of sewage and water, including storm water, in pipelines with an internal diameter of 0,36 metres or more
386 (1)(k)(ii)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the bulk transportation of sewage and water, including storm water, in pipelines with a peak throughput of 120 litres per second or more
386 (1)(l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of electricity above ground with a capacity of more than 33 kilovolts and less than 120 kilovolts
386 (7)	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site
386 (13)	The abstraction of groundwater at a volume where any general authorization issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded
386 (15)	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long

Table 2: Listed activities as per the GN. R387 (April 2006)

	Describe each listed activity:
387 (1)(c)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of 1 000 cubic metres or more at any one location or site including the storage of one or more dangerous goods, in a tank farm
387 (1)(e)	The construction of facilities or infrastructure, including associated structures or infrastructure, for any process or activity which requires a permit or license in terms of legislation governing the generation or release of emissions, pollution, effluent or waste and which is not identified in Government Notice No. R. 386 of 2006

387 (1)(h)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the manufacturing, storage or testing of explosives, including ammunition, but excluding licensed retail outlets and the legal end use of such explosives
387 (2)	Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more

This EMP must be updated to include any conditions stipulated in the Environmental Authorisation issued by the DEDECT.

1.3.2 Mining license

Pering Mine must be in possession of an approved Mining Right for the mining of zinc and lead within the study area before mining operations may commence. Pering submitted a mining right application to the DME, North West Province which was submitted on 05 December 2008 [NW/30/5/1/2/2/417/MR]. A Scoping Report, as per Regulation 49(1) of the Mineral and Petroleum Resources Development Act [MPRDA] (Act No. 28 of 2002), was submitted to the DMR on 15 June 2009. An Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) Report in terms of Regulations 50 and 51 were submitted on 11 June 2010 to the DMR for approval. The DMR subsequently requested additional information and in March 2012, the revised EMPR was submitted to the DMR for review.

This draft EMP contains mitigation measures and controls which were not included in the management measures of the Environmental Management Programme submitted in fulfilment of the requirements of the MPRDA for a mining license, as a result of new specialist information becoming available during the EIA process.

1.3.3 Water use license

An application for the authorisation of the following water uses to the Department of Water Affairs for the proposed mining operation is in process:

1. 21(a): Taking of water from a water resource.
   - For the dewatering of the pits

2. 21(f): discharging waste or water containing waste into a water resource through a pipe, canal or other conduit
   - Relevant to the dewatering of the pits into a watercourse

3. 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource.
   - Establishing waste rock and slimes dams

4. 21(i): Altering the bed, banks, course or characteristics of a watercourse.
   - Relevant to the dewatering of the pits into a watercourse

5. 21(j): Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

- Continuation of open cast mining activities

1.4 Project responsibilities

1.4.1 EMP compilation

Marsh Environmental Services (MES) was appointed to conduct the Environmental Assessment Process and Water Use License authorisation for the project. This EMP was prepared by MES however the mitigation measures contained in this EMP are a consolidation of the consulting teams' inputs and knowledge of the project. Where relevant, mitigation measures as put forward by the sub-consulting specialists have been included.

1.4.2 Department of Economic Development, Environment, Conservation and Tourism

Environmental Authorisation is required from DEDECT before commencement with mining activities. This EMP will reflect conditions and specific requirements contained in the EIA Report and the Record of Decision (RoD) as appropriate upon receipt of the RoD. The duties of DEDECT may extend to site visits during construction and operational phases as deemed appropriate by the Environmental Management Inspectorate (EMI), and may oversee compliance with the RoD and EMP.

1.4.3 Department of Water Affairs

A Water Use License is required for the water uses referred to in Section 1.3.3. A final WULA Report will be submitted to DWA Northern Cape Regional Office for approval of the mine water uses and consideration of the dewatering alternatives. The EIA report recommended that on-site solutions to pit dewatering are favoured as off-site solutions will be less sustainable as a result of prohibitive costs and predicted off-site pollution. A combination of on-site and off-site dewatering options may however be preferred by DWA. Refer to 1.5.2.1 for further information.

1.4.4 Applicant

Pering Mine (Pty) Ltd as applicant is responsible for mitigating the environmental impacts associated with the mine. The applicant must ensure that the EMP is included in the tender documentation so that all appointed contractors are bound to the conditions of the EMP.

1.4.5 Mine manager

The mine manager or appointed environmental manager is responsible for:

- Appointing an environmental manager and/or SHEQ coordinator for Pering Mine
- Appointing an independent Environmental Control Officer (ECO) to independently audit the provisions of the EMP and conditions of the Environmental Authorisation.
- Environmental awareness training
- Implementing mitigation measures

- Visual inspections
- Auditing and enforcement
- Overseeing preparation of rehabilitation plans and executing rehabilitation
- Stakeholder and neighbour relations
- Managing and communicating monitoring information including independent monitoring

1.4.6 Environmental Control Officer

An independent Environmental Control Officer (ECO) to independently audit the provisions of the EMP and conditions of the Environmental Authorisation shall be appointed.

1.5 Pertinent information and knowledge gaps

1.5.1 Pertinent information

The following documents should be read in conjunction with this draft EMP and provide the source of many of the potential impacts and the mitigation measures described herein:

1. Environmental Impact Assessment Report for the Pering Mining Project (final) dated November 2012
2. Environmental Authorisation issued by DEDECT and all conditions.
3. Mining license issued by the DMR and all conditions
4. Hydrocensus compiled by Rison Groundwater Services
5. Geohydrological Assessment undertaken by SRK
6. Surface water baseline investigation undertaken by GCS
7. Air quality impact assessment undertaken by Airshed
8. Biodiversity Assessment undertaken by Bathusi Environmental Consulting
9. Heritage Impact Assessment undertaken by PGS
10. Environmental Management Programme in application for a Mining License (Marsh Environmental Services)
11. Pering Mine Closure Report (Metago Environmental Engineers)

1.5.2 Gaps in knowledge

Certain gaps in information were identified in the EIA and should be addressed before mining commences.

1.5.2.1 17km pipeline stream discharge dewatering alternative

This pit dewatering alternative involves treating the pit water and conveying it through a 17-18 km long 300mm Nominal Bore (NB) pipeline that discharges into a well defined non-perennial tributary of the Harts River located to the south east of Pering Mine on Kgore 898 HN (belonging to Mr David Nel) and Sebetse Tsapitse 899 HN (belonging to Mr Isaac Jocum). The EIA report suggested that on-site solutions to pit dewatering are favoured as off-site solutions will be less sustainable as a result of prohibitive costs and predicted off-site pollution.

Should Pering Mine and the stakeholders involved pursue this option, the following is required before implementation:

- An indication of the total quantity of water to be evaporated on-site and the total quantity of water to be discharged into the watercourse.
- Based on the impact of sulphates on groundwater quality and within the watercourse it is recommended that the discharge water be treated so as not to exceed 300mg/l for sulphates.
- Landowner consent (requirement for processing of Water Use License by DWA).
- Chemical modelling of the downstream water quality.
- Study to confirm the affect on soils, flora and fauna (after water treatment).
- A water use license issued by DWA.

1.5.2.2 Enhanced evaporation dewatering alternative

The potential for metals to evaporate as a result of enhanced evaporation over the pits over was modelled in the air quality impact study undertaken by Airshed. Predicted ground level concentrations of manganese and zinc were predicted to exceed thresholds off-site. Airshed has stipulated that further investigation is required to ensure minimal off-site impacts. This represents a gap in knowledge to be queried with the manufacturer of the waste water evaporation system.

1.5.2.3 Surface water

Water treatment standard

The standard to which water will be treated at the mines water treatment plant is undetermined. It is however assumed that the pit water and all groundwater ingress into the pit will be treated to a standard appropriate to the mines requirements and the dewatering alternative selected to eliminate off-site impacts.

Surface water assessment

A surface water assessment should be undertaken with the following objectives:

- Collect hydrology data to describe baseline hydrology.
- Develop an integrated site wide water management plan covering all areas of the proposed mine. The water management plan includes stormwater and pit water management for all project phases.
- Achieve compliance with Regulation 704 of the National Water Act of 1998 and make best practice recommendations.
- Guidelines for the integrated site wide water management plan.
- Determine the sizes of the water management infrastructure including diversion berms and pump capacities.
- Develop a water quality monitoring program for surface.
- Conceptual level design of sewage and potable water treatment plants.

1.5.2.4 Groundwater information

Due to landowner access issues at the time of the hydrocensus survey, neighbouring farms were not included in the study undertaken by Rison Groundwater Services. A future, more regional hydrocensus of the mine must include neighbouring farms to determine liability and potential actions to be taken by the mine. A response plan is required in the event that the monitoring data suggests that migration of the sulphate plume will impact on other water users.

1.5.2.5 Palaeontology

The physical survey of the proposed development area yielded one tangible heritage resource of low significance. Due to the discovery of early hominid fossils within the Taung district, the potential discovery of other fossils in the region cannot be discounted. . A palaeontological desktop study and (if required) a palaeontological impact assessment will have to be undertaken in terms of the project and its associated activities and the finding presented to SAHRA.

2

Environmental management and mitigation

2.1 Purpose of the draft EMP

The purpose of this EMPR is to ensure environmental compliance during the construction and operational phases of the pipeline during construction and operation. It seeks to manage and minimize the negative impacts of a project while enhancing positive and beneficial impacts. This EMPr is a standalone document, which must be used as an on-site environmental management document during each phase of the development (i.e. construction, operational and closure).

This document should be flexible so as to allow Pering Mine to conform to the management commitments without being prescriptive. If implemented consistently, the management commitments will ensure that the anticipated environmental risks are minimized. It is the responsibility of the Mine and associated Contractors and Sub-contractors to comply with the requirements of this EMP. Any parties responsible for transgression of the underlying management measures outlined in this document will be held liable for non-compliances. It is intended that the EMP be included with the tender documentation, such that the developer and contractor are aware of any additional costs that may be imposed as a result of the EMP from the outset of the project.

The mine / contractor is deemed not to have complied with the EMP if there is evidence of contravention of the provisions of the EMP, if environmental damage occurs due to negligence, or if complaints from affected parties and landowners are not attended to adequately.

2.2 Environmental receivers

The various environmental receivers on which the project can potentially have an impact include:

1. Geology
2. Topography
3. Soil
4. Land capability
5. Land use
6. Flora and fauna (plants and animals)
7. Surface water
8. Groundwater
9. Air quality
10. Noise
11. Archaeological and paleontological sites
12. Sensitive landscapes
13. Visual aspects
14. Socio-economic structure
15. Interested and affected parties
16. Traffic

2.3 Management plans

2.3.1 Geology

Impact	Destruction of geology
Cause	No mitigation for impact on geology is proposed. The impact upon the geology is to be limited to the pits. In total 70.6Mt of material will be moved from the open pit and existing surface stockpiles All waste material will be hauled to the designated waste dumps.
Mitigation	▪ None possible – geology will be permanently destroyed. ▪ Ensure that mine plan is adhered to at all times ▪ Limit impacts of geology to the mining right area only.
Management action required	Ensure adherence to the mining plan at all times
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Keep all records of quarry planning ▪ Audit annually to ensure adherence to the mine development plan
Closure objective	The disturbed geological structure cannot be replaced or rehabilitated.
Post closure impact	Rehabilitation, soil replacement and re-vegetation

2.3.2 Soil

Impact	Soil disturbance, compaction and erosion
Cause	▪ Clearing of vegetation for infrastructure development. ▪ Removal of topsoil for infrastructure development. ▪ Infrastructure construction footprint. ▪ Establishment of plant foundations. ▪ ROM Stockpile pad construction. ▪ Stockpiling of soils. ▪ Spillages. ▪ Erosion by wind and water. ▪ Spillage from conveyors and / or roads. ▪ Construction of surface water management system.
Mitigation	Construction phase ▪ Strip and stockpile topsoil and subsoils appropriately. ▪ Commence rehabilitation of affected areas timeously. ▪ Application of soil handling and removal practices (including vegetative cover). ▪ Application of soil placement and storage practices. ▪ Fertilisation as needed. ▪ Re-use topsoil and subsoils during ongoing rehabilitation

	▪ Erosion control and prevention. ▪ Implementation of good house-keeping practices. ▪ Rapid spillage clean-up (i.e. hydrocarbon, oil, water, etc.). Operational phase ▪ Commence rehabilitation of affected areas timeously. ▪ Erosion control and prevention. ▪ Implementation of good house-keeping practices. ▪ Rapid spillage clean-up (i.e. hydrocarbon, oil, water, etc.). ▪ Implement live placement of soil where possible ▪ Improve organic status of soils ▪ Maintain fertility levels ▪ Curb topsoil loss ▪ Stockpiles can be used as a barrier to screen operational activities (to mitigate visual impacts). ▪ The stockpiles should not exceed a maximum height of 6 m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion. ▪ If used to screen construction operations, the surface of the stockpile should not be used as a roadway as this will result in excessive soil compaction. Closure ▪ When stockpiled soils have been replaced during rehabilitation, the soil fertility should be assessed to determine the level of fertilisation required to sustain normal plant growth. The fertility remediation requirements need to be verified at time of rehabilitation. The topsoil should be uniformly spread onto the rehabilitated areas and care should be taken to minimise compaction that would result in soil loss and poor root penetration. ▪ When returning the soil to the rehabilitation site care should be taken to place soil in a manner that will allow for levelling of soil to take place in a single pass. The soil profile should not be built up using a repeated tipping and levelling action to increase the soil depth. Proper water control measures should be implemented to ensure a free draining rehabilitated landscape.
Management action required	▪ Ensure removal and proper storage of topsoils ▪ Overburden material should be stockpiled separately ▪ Topsoil must only be used for rehabilitation purposes
Responsible person	Quarry supervisor and mine manager
Measurement method to ensure implementation of action	▪ Weekly inspections ▪ Audit annually
Closure objective	All topsoil removed during operation should be replaced and will be stable,

	vegetated with no signs of erosion.
Post closure impact	Topsoil to be stable and vegetation sustainable

2.3.3 Land capability and land use

Impact	**Change in land capability and land use**
Cause	▪ Land capability will be reduced to "mining land" status. ▪ Loss of natural habitat (i.e. a change of land use from wilderness to mining). ▪ Temporary loss of grazing potential
Mitigation	Construction phase ▪ Effective soil handling and removal practices. ▪ Effective soil placement and storage practices. ▪ Fertilisation as needed. ▪ Soil amelioration. ▪ Limiting the footprint of the mining operation to the mining right area. ▪ Prevention of dust and spillage of rock material. ▪ Appropriate maintenance of the road ways. Operational phase ▪ Ongoing rehabilitation. ▪ Top dressing of permanent features. ▪ Limiting the footprint of the mining operation to the mining right area. ▪ Prevention of dust and spillage of ore. ▪ Appropriate maintenance of the road ways.
Management action required	▪ Ensure that development is kept within the boundaries of the mining plan ▪ Ensure that the rehabilitation plan is implemented
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Weekly inspections ▪ Audit annually
Closure objective	Rehabilitate to the state suitable for predetermined and agreed land capability. During rehabilitation indigenous vegetation cover comprising of local plant species and palatable grass species should be established in order to ensure a well adapted sustainable plant cover approaching suitable grazing conditions.
Post closure impact	None

2.3.4 Vegetation

Impact	**Vegetation clearance and disturbance**
Cause	▪ Land transformation through mine related activities. ▪ Destruction of plant communities
Mitigation	▪ Appoint an Environmental Control Officer (ECO) prior to commencement of construction. Responsibilities should include, but

	not necessarily be limited to, ensuring adherence to EMP guidelines, guidance of activities, planning, reporting. ▪ Demarcate construction/ development areas by semi-permanent means/ material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; ▪ No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required. ▪ Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible; ▪ Woody vegetation should be chipped and stored separately to use as rehabilitation material; ▪ Remove and store topsoil separately in areas where excavation/ degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate regrowth of species that occur naturally in the area; ▪ Disturbance of vegetation must be limited to areas of construction; ▪ The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO; ▪ Cut vegetation (grass and shrubs) only if required within areas where surface disturbances are not planned. No clearing of vegetation or soil by grading machinery shall be undertaken; ▪ The establishment and regrowth of alien vegetation and weeds must be controlled after the removal of vegetation cover; ▪ All declared aliens must be managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); ▪ Ensure proper surface restoration and resloping in order to prevent erosion, taking cognisance of local contours and landscaping; ▪ The grass mix should consist of indigenous grasses adapted to the local environmental conditions ▪ The revegetated areas should be temporarily fenced to prevent damage by grazing animals; ▪ Revegetated areas showing inadequate surface coverage (less than 30% within eight months after re-vegetation) should be prepared and revegetated from scratch ▪ Damage to re-vegetated areas should be repaired promptly; ▪ Exotic weeds and invaders that might establish on the revegetated areas should be controlled to allow the grasses to properly establish ▪ Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and protecting the agricultural resources and soil conservation works are regulated by the Conservation of Agricultural Resources Act, No. 43 of 1983 and should be addressed on a continuous basis

	▪ Compile and implement environmental monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Biodiversity monitoring should be conducted at least twice per year (Summer, Winter) in order to assess the status of conservation areas ▪ Allow for a suitable buffer in order to provide protection of surrounding areas against peripheral impacts. No effluent of any nature should be released into natural habitat.
Management action required	▪ Ensure that development is kept within the boundaries of the mining plan ▪ Establish Environmental Monitoring Programme and buffer area around infrastructure
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Weekly inspections ▪ Audit annually
Closure objective	During rehabilitation indigenous vegetation cover comprising of local plant species and palatable grass species should be established in order to ensure a well adapted sustainable plant cover approaching suitable grazing conditions.
Post closure impact	Vegetation cover should be sustainable and palatable

2.3.5 Fauna

Impact	**Injury and death to fauna**
Cause	▪ Potential loss / degradation of local pristine faunal habitat and / or communities. ▪ Road deaths of animals on access roads. ▪ Alteration of natural ecosystem functioning.
Mitigation	Construction and operation ▪ Appoint an Environmental Control Officer (ECO) prior to commencement of construction. Responsibilities should include, but not necessarily be limited to, ensuring adherence to EMP guidelines, guidance of activities, planning, reporting ▪ Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity. ▪ Limit impacts to the mining right area. ▪ Vehicles to maintain speed limits to avoid collision with animals. ▪ Vehicles are to yield to animals. ▪ No animal may be hunted, trapped, snared or killed for any purpose whatsoever ▪ Fences and boundaries should be patrolled weekly in order to ensure the removal of snares ▪ Vehicular traffic should not be allowed after dark in order to limit

	accidental killing of nocturnal animals ▪ Dangerous animals should be handled by a competent person ▪ Compile a graphic list of potentially dangerous animals and present this to all workers as part of site induction ▪ Fences should allow free movement of small/ medium size animals ▪ Ensure that a snake handler and/ or anti venom serum is available at all times, together with a competent person to administer this serum. Closure ▪ Maintain fencing around mining area until closure is granted. ▪ Implement an alien / invasive species eradication programme.
Management action required	▪ Ensure that development is kept within the boundaries of the mining plan ▪ Ensure that the rehabilitation plan is implemented
Responsible person	Mine manager and SHEQ coordinator
Measurement method to ensure implementation of action	▪ Audit incidents register ▪ Environmental training material to be provided
Closure objective	▪ During rehabilitation indigenous vegetation cover comprising of local plant species and palatable grass species should be established in order to ensure a well adapted sustainable plant cover approaching suitable grazing conditions. ▪ Ensure that access to the pit is secure such that access by fauna potentially resulting in injury or death is avoided.
Post closure impact	▪ Vegetation cover should be sustainable and palatable ▪ Pits shall be safe and secure

2.3.6 Surface water management

Before specific impacts and management actions are discussed, the following general principles are to be noted:

A surface water management plan should be developed to ensure all aspects are addressed.

Management strategies to address the following aspects need to be developed and monitored:

- Storm water management and disposal
- Water quality and quantity monitoring points and frequency of measurements
- Quality variables to be monitored. Reference is made to existing monitoring reports concerning quality variables.
- Protection against hydrological events
- Malfunctions
- Reporting

Impact	**Impacts on surface water quality**
Cause	▪ Increased TDS and erosion ▪ Surface water contamination

	▪ Sludge from washing plant. o Sludge and water effluent from sewage works. o Impact from workshop area, including areas of storage of diesel, fuel, lubricants and cleaning materials. o Surface water runoff from roads and mining areas affected by oil spills or other contaminated material. o Accidental fuel and other hazardous, toxic, chemical spills. o Ongoing chemical contamination (e.g. fertiliser application during rehabilitation). o Leachate from mining infrastructure (i.e. slimes dam, waste rock overburden dump and Return Water Dams (RWDs)). o Water pumped from open pit for dewatering purposes.
Mitigation	▪ Stormwater structures will need to be installed to prevent clean water catchments from being contaminated and keep dirty water within the mine boundaries. ▪ Institute a surface water monitoring network at the mine within clean and dirty water catchments. ▪ Limit areas to be stripped for construction and development purposes. ▪ Minimise wind and water erosion. ▪ Implement slope stabilisation and surface water management structures. ▪ Develop a detailed DTM of the area. ▪ Sludge will be managed in terms of legal requirements for its hazard classification. ▪ Sewage sludge will be classified and managed accordingly. ▪ Hydrocarbons will be contained within engineered areas at point sources and managed accordingly. ▪ Remediation kits to be made available on site for diesel and other hydrocarbon related spills. ▪ Slimes dam design has been undertaken to mitigate seepage impacts.
Management action required	▪ Provision of spill kits ▪ Ensure water control structures are intact ▪ Visual inspection to identify any risk
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Prepare and implement surface water management plan ▪ Incident register ▪ Audit annually ▪ Maintenance reports
Closure objective	The post closure water run-off may under no circumstances impact negatively on the water quality.
Post closure impact	Soil amelioration should be done as not to cause surface water impacts

2.3.7 Surface water – pit dewatering

Impact	**Dewatering: Impacts on land and surface water resources located off site**
Cause	▪ Treatment, conveyance and discharge of treated mine pit water into the Droe Harts River ▪ Accumulation of sulphates in the soil due to low dilution potential
Mitigation	▪ Treatment of water to DWA standards but no more than 300mg/l for sulphates. ▪ Align pipeline with existing infrastructure including roads and farm fences. ▪ Construct subterranean pipeline by way of trench and backfill method. ▪ Implement erosion control measures at the discharge point.
Management action required	▪ Ensure that gaps in knowledge are addressed ▪ Obtain landowner consent ▪ Outlet design and construction to be done by suitably qualified professionals
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Continuous water monitoring over period ▪ Continuous provision of quality monitoring data to landowners
Closure objective	▪ No significant change to the environmental baseline should have occurred as a result of the dewatering into a surface water resource. ▪ No groundwater contamination should have occurred due to the concentration of sulphates in the water
Post closure impact	▪ Decommissioning of the pipeline and outlet structure
Closure cost	Undetermined

2.3.8 Groundwater

Impact	**Cumulative groundwater quality impacts**
Cause	▪ Pollution of the neighbouring aquifers from the opencast areas post closure (pollution plume movement).
Mitigation	▪ The Groundwater Monitoring Programme undertaken for Pering Mine by SRK should be implemented during all mining phases. ▪ It is recommended to do regular (every 5 years) Hydrocensus and sampling of selected neighbouring farms to ensure that groundwater qualities are acceptable for domestic use and/or livestock watering. ▪ The mine water balance should be accurately maintained, so that a reliable estimate of losses from the SSF can be made. ▪ The monitoring data, water balance information and other relevant data should be reviewed periodically so that any plume emanating from the

	TSF and SSF can be effectively managed and liabilities defined. ▪ Liner to be installed at the TSF and SSF. ▪ The post closure conditions of the mine includes a detailed monitoring network incorporating the farm boreholes downgradient and closest to the mine that could be impacted by the past mining activities. ▪ Bentonite lining of temporary evaporation dams for pit dewatering.
Management action required	▪ Regular water sampling and monitoring ▪ Extend monitoring network to adjacent farms ▪ Vehicle maintenance and inspections to ensure that no oil and hydraulic leaks occur
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Continuous water monitoring over period ▪ Continuous provision of quality monitoring data to landowners
Closure objective	▪ Acceptable cumulative groundwater quality impacts (SO4) in addition to existing contamination plume ▪ No increase in the extent and concentration of the pollution plume ▪ Continuous monitoring
Post closure impact	None – monitoring of existing pollution plume only

2.3.9 Air quality

Impact	▪ Impact of exceedences of ground level concentrations of PM10 and NO2 off site due to mining impacts ▪ Impact of exceedences of ground level concentrations of manganese and zinc off-site for dewatering of the pits through enhanced evaporation.
Cause	▪ Enhanced evaporation ▪ Stockpile reclamation activities at the existing tailings dams including hauling of waste to designated waste dumps leading to the liberation of dust. ▪ Undertaking activities in high dust areas. ▪ Vehicle exhaust emissions.
Mitigation	Dewatering of pits through enhanced/forced evaporation ▪ The potential for metals to evaporate as a result of enhanced evaporation over the pits over an 18 month period has been modelled in the air quality impact study undertaken by Airshed. Airshed has stipulated that further investigation is required to ensure minimal off-site impacts. The manufacturer of the waste water evaporation system should be approached concerning potential for metals to evaporate. Mitigation of crushing operations ▪ Crushing operations can be mitigated in a number of ways; these

	include the continuous use of water sprays (50% control efficiency), hooding with cyclones (65 % control efficiency), hooding with scrubbers (75 % control efficiency), hooding with fabric filters (83 % control efficiency) and enclosing crushing operations (100 % control efficiency) (NPI, 2012). Mitigation of Materials handling ▪ Dust generation from materials handling will reduce by 62% by merely doubling the moisture content of the material handled. Control efficiencies from the application of liquid spray systems at conveyor transfer points have in practice been reported to be in the range of 42% to 75%. General engineering guidelines which have been shown to be effective in improving the control efficiency of liquid spray systems are as follows: ▪ Of the various nozzle types, the use of hollow cone nozzles tend to afford the greatest control for bulk materials handling applications whilst minimizing clogging; ▪ Optimal droplet size for surface impaction and fine particle agglomeration is about 500µm; finer droplets are affected by drift and surface tension and appear to be less effective; and, ▪ Application of water sprays to the underside of conveyor belts has been noted by various studies to improve the efficiency of water suppression systems and belt-to-belt transfer points. Mitigation of Vehicle Entrained Dust on Unpaved Roads ▪ The unpaved roads were modelled with a 75% efficient control efficiency during the mitigated TSP and PM10 model runs. However, exceedances of the NAAQ limit values still existed at the mine boundary and a control efficiency of 75% is thus not expected to be sufficient. Pering mine stated that watering and periodical chemical dust suppression will take place at the mine. As the level of watering and chemical dust suppression was unknown, the mitigation control measure was taken to be a conservative 75% (taking in account level 2 watering of unpaved haul roads only). ▪ Application of dust palliatives (**such as lignosulphonates**) have almost no negative environmental effects, and will therefore not harm the sensitive semi-arid environment in which the Pering mine is situated
Management action required	▪ Regular water sampling and monitoring ▪ Extend monitoring network to adjacent farms ▪ Vehicle maintenance and inspections to ensure that no oil and hydraulic leaks occur
Responsible person	Plant manager / Mine manager
Measurement method to ensure implementation of	▪ Establish a PM10 monitor and a passive sampler (for measuring NO2 levels) at recommended point indicated by red star in following map.

action	 ▪ It is recommended that two passive sampling campaigns are launched during the first operational year at Pering mine. The aim of the campaign is to establish whether measured data correlate with modelled results from this study, as only an upper and lower boundary could be predicted in this study. As predicted NO_2 emissions at the Pering mine are high, it is strongly advised that vehicles be properly maintained in order to keep emissions as low as possible ▪ Daily inspection of plant and material ▪ Continuous provision of quality monitoring data to landowners
Closure objective	▪ Dust count to pre-mining levels must be achieved (residential limits as per dust monitoring report)
Post closure impact	Nil

2.3.9 Noise and vibration

Impact	**Excessive noise impacts:** The mine is located in a rural setting with the baseline being a very silent environment. Any change will be substantial. The impact is of importance regarding the working environment that should adhere to the requirements of the Mine Health and Safety Act.
Cause	▪ Increased ambient noise levels from operations. ▪ Nuisance disruption to sensitive fauna, employees and communities. ▪ Construction activities (mine and other infrastructure). ▪ Use of diesel generators. ▪ Increase traffic flow (on-site). ▪ Periodic blasting as part of topsoil and overburden stripping activities. ▪ Blasting of waste material and ore.
Mitigation	▪ All machinery used during construction will be maintained in sound mechanical condition ▪ PPE will be worn in areas where noise levels are expected to be increased. ▪ All vehicles will be fitted with appropriate sound suppression devices or silencers. ▪ Vehicles will be regularly monitored and maintained.

	▪ Keep within the applicable speed limits. ▪ Placement of waste structures (tailings dam) has been designed such as to create a noise barrier. ▪ PPE will be worn at all times during operational activities. ▪ Complaints by I&APs will be recorded in an Issues and Complaints Register and addressed throughout the duration of the existence of the Pering Mine. ▪ Blasts will be designed and executed by a suitably qualified engineer. ▪ Foundations of buildings closer to the open-pit area are to be able to withstand the effects of the ground vibrations.
Management action required	▪ Inspection of machinery and vehicles to ensure silencers are fitted ▪ Ensure blasting schedule is communicated to adjacent landowners ▪ Ensure the creation, management and maintenance of a complaints register ▪ Undertake environmental noise monitoring
Responsible person	SHEQ manager / Mine manager / Plant manager
Measurement method to ensure implementation of action	▪ Annual audits ▪ Monthly monitoring
Closure objective	▪ No noise attributed to mining
Post closure impact	Nil

2.3.9 Archaeology and palaeontology

The physical survey of the proposed mine area yielded one tangible heritage resource of low significance. Due to the discovery of early hominid fossils within the Taung district, the potential discovery of other fossils in the region cannot be discounted. The following is recommended:

- A palaeontological desktop study and (if required) a palaeontological impact assessment will have to be undertaken in terms of the project and its associated activities and the finding presented to the South African Heritage Resources Agency (SAHRA).
- While the study area was covered in detail during the physical survey, the subterranean nature of some heritage sites such as archaeological deposits, graves and burials means that one can never exclude the potential existence of any such resources within the study area.
- Should any heritage sites be discovered during the construction phase of the project, construction should stop immediately in that area and a suitably qualified archaeologist or heritage practitioner called to site to investigate the finds and make recommendations on the way forward.

2.3.10 Visual aspects

Impact	**Change in land-use and available view**
Cause	▪ Mining vehicle movement (sequential impact). ▪ Buildings and other structures (including residential structures, process plant and offices).

	▪ Entrances, signs and boundary treatment. ▪ Material storage (topsoil stockpiles and material stockpiles). ▪ Lighting of mining operations during night time.
Mitigation	▪ All buildings and structures shall be finished in a colour (or a surface which weathers to a colour) in shades of green, brown or grey with a maximum reflectance value of 37% (excluding fittings). ▪ Limit signage (number and size). ▪ Restriction of the height of mineralogical waste structures. ▪ Ongoing rehabilitation and re-vegetation of mineralogical waste structures. ▪ Appropriate light fitting installation. ▪ Installation of shielding. ▪ Limit light intensity.
Management action required	▪ Inspection of machinery and vehicles to ensure silencers are fitted ▪ Ensure blasting schedule is communicated to adjacent landowners ▪ Ensure the creation, management and maintenance of a complaints register ▪ Undertake environmental noise monitoring
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Visual inspection of rehabilitation actions ▪ Annual audit
Closure objective	▪ The terrain should blend in with the surrounding landscape as far as possible
Post closure impact	Closure will result in stabilisation of visual impact over time with effective rehabilitation.

2.3.11 Waste management

Impact	Contamination of soil, surface water and groundwater; health risks as a result of exposure to hazardous substances.
Cause	▪ Leaching of hazardous substances from construction equipment and storage areas ▪ Generation and disposal of general waste to landfill. ▪ Temporary storage of hazardous waste on unlined and / or unbunded areas, hazardous waste spills. ▪ Disposal of hazardous wastes on general landfills. ▪ Waste not placed in designated waste bins / containers. ▪ Waste not disposed of timeously or kept in closed containers. ▪ Unsuitable handling and disposal of medical waste (i.e. sharps and bandages) and other wastes. ▪ Handling of hazardous waste without suitable PPE by staff or public.
Mitigation	Construction and operation ▪ Equipment must be regularly inspected for leaks.

	▪ Storage areas must be lined and / or secured by an adequate bund wall. ▪ Re-use of waste, where possible. ▪ Recycling of waste material on and off site. ▪ Waste removal to licensed site. ▪ Storage of hazardous wastes in purpose built stores (impermeable floors, bunding etc.). ▪ Labelling of containers. ▪ Waste removal to a licensed waste site. ▪ Contactor control to ensure correct disposal procedures is followed. ▪ Traceability (documentation) and reconciliation of waste disposed. ▪ Provision of waste bins (colour coded for different waste types). ▪ Management and education of people. ▪ Frequent removal of waste bins. ▪ Operate according to the generated Waste Code of Practise (COP). ▪ Provision of suitable medical waste disposal / storage containers. ▪ Contractor control to ensure correct disposal procedures is followed. ▪ Disposal to authorised sites only. ▪ Provision of suitable waste containers and PPE for waste handling activities (medical and other). ▪ Contractor controls to ensure correct disposal procedures are followed. ▪ Disposal to authorised sites only.
Management action required	▪ Preparation of a waste management plan and policy ▪ Records to be kept for movement and disposal of waste
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Annual audit
Closure objective	Waste material and overburden should not impact on the environment
Post closure impact	Nil

2.3.12 Socio-economic environment

Impact	**Change in socio-economic setting**
Cause	▪ Creation of mine specific employment opportunities. ▪ Creation of employment opportunities not directly related to the mine itself. ▪ Increased infection rates.
Mitigation	▪ Site-specific construction employing unskilled, semi-skilled, skilled labour within the project area. ▪ Focus on short-term employment opportunities near communities, preceded by extensive community liaison to support employment

	across community members. ▪ Implement an HIV/AIDS plan of action. ▪ Implement condom programming, information and attitudinal change, gender relations and power over sexual decision-making, life skills education, testing, Anti-Retroviral (ARV) education, and recreational activities for on-site employees. ▪ Conduct education within the context of a broader wellness programme. ▪ Construction firms required to engage in enhanced HIV/AIDS response. ▪ Contracting local partner NGOs skilled in HIV/AIDS prevention and response.
Management action required	▪ Appointment of staff members in fulfilment of the requirements of the approved Social and Labour Plan ▪ To avoid or minimise job losses resulting from major restructuring or retrenchment exercises as far as possible; ▪ To mitigate negative social and economic impacts on local and regional economies and labour-sending areas should retrenchment or closure be required; ▪ To ensure the relevant processes for effective retrenchment and mine closure are in place during the life of the mine; ▪ To adequately communicate with employees in respect of training and re-skilling programs, applicable to mining and non-mining industries; and ▪ To ensure the workforce is informed as to the current and future business prospects (i.e. business plan) for the mine in order to equip them with sufficient information to make informed decisions in respect of careers and general livelihoods should retrenchment programs be required in the near future.
Responsible person	Mine manager
Measurement method to ensure implementation of action	▪ Mining plan, SLP
Closure objective	▪ Sustainable employment and economic opportunities long after closure
Post closure impact	Limit unemployment

2.3.13 Traffic

The traffic safety issues have been identified as the main challenges already present in the study area. The additional movement of heavy vehicles would certainly increase the traffic safety risk to vulnerable members of the local community and relevant mitigation and improvement measures would have to be considered and implemented gradually based on the regular monitoring of the traffic safety parameters and consultation with the members of the local community. The following are the specific recommendations in this regard:

- Continuous road safety awareness program should be prepared by the management of the Pering Mine in conjunction with the Local Municipality and other community representatives;
- Implementation of pedestrian sidewalks and/or road grading of shoulders should be further considered for sections downstream and upstream of the intersections of R372 road and access roads to Qhoo and Mogkareng villages. This measure would minimise the vehicle and pedestrian conflict situations in the vicinity to the residential places;
- Speed restriction measures and road lighting should further be considered along the same road sections as proposed in the previous recommendation as further measures based on the outcome of the traffic safety monitoring programmes and input provided by the local community;
- The road maintenance authorities should take into consideration additional EVUs and determine impact on the road maintenance requirements in the study area; and
- The traffic conditions at the R372 / N18 intersection and at the rail siding access point should be monitored on an annual basis to address potential impact of the traffic movements of large trucks on the traffic conditions.
- The proposed shortest route between the Pering Mine and the rail siding in Taung comprises a gravel road section of approximately nine kilometres between the access point to the mine premises and the junction of the mine access road and R371 road. This gravel road section has been identified as a project risk element as it gets flooded during rainy seasons and could get further damaged if used frequently by heavy vehicles. It is proposed to pave this road section to prevent frequent gravel road maintenance interventions and uncomfortable and unsafe situations to all road users in the area.

2.3.14 Environmental awareness programme

Pering Mine is required to develop an environmental awareness and induction programme, taking into account site conditions and impacts, while addressing, amongst others, the following:

- What is the environment?
- Why must we look after the environment?
- How do we look after the environment?
- The importance of working areas and no-go areas
- Surface water aspects
- Plants and animals
- The hazards associated with smoking and fire
- The use of petrol, oil and diesel
- The importance of dust control and dust management
- Noise
- Use of toilets
- Rubbish
- Trucks and driving
- Emergency procedures
- Fines and penalties

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