North River Resources (Pty) Ltd incorporating
Namib Lead & Zinc Mining (Pty) Ltd

PROPOSED RECOMMISSIONING OF LEAD & ZINC MINE ON EPL 2902

ENVIRONMENTAL MANAGEMENT PLAN
INCLUDING CLOSURE AND REHABILITATION

C049

December 2013
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11 INTRODUCTION TO EMP

An Environmental Impact Assessment was conducted for North River Resources (Pty) Ltd (NRR) for the proposed recommissioning of the old Namib Lead and Zinc Mine on EPL 2902. The EIA was conducted by Colin Christian & Associates CC (CCA, 2013).

The EIA Report made many recommendations for the mitigation of environmental impacts, including broad recommendations for closure and rehabilitation.

This Environmental Management Plan (EMP) further develops the recommendations of the EIA into particular management measures for each environmental aspect of concern that was identified in the EIA. This EMP is “preliminary” because further work will be needed in terms of quantification and engineering design (for example, the required capacity of stormwater retention dams, and the volume of waste marble required to cover the tailings).

Each section in the EMP below deals with a different environmental aspect (e.g. soil, vegetation, water, etc) and the management measures required to protect that environmental aspect. Also identified are recommendations for monitoring (e.g. dust and metals fallout), as well as additional work needed during the project design stage.

The details contained in this EMP need to be integrated and implemented throughout the project life cycle – from planning and design stages, construction, operations, closure and rehabilitation, and post closure stages.

12 ENVIRONMENTAL MANAGEMENT PLAN

12.1 Geology

Impacts

- Mining out the ore shoots, as well as waste rock (marble);
- Creation of tailings;
- Some waste rock can be disposed of in worked out voids underground, but some should be used for rehabilitation of tailings.

Management Measures

- Removal of rock is inevitable and cannot be mitigated;
- After trimming tailings, a layer of waste marble should be used to cover the tailings.

Monitoring / Planning / Further Investigation

- Engineers to calculate / model the amount of waste rock required;
- Plan for the removal of sufficient waste rock to the surface and plan stockpiling for later closure.
12.2 Soils

Impacts

- Soils are already contaminated due to previous mining operations. There is a risk of aggravating the contamination of soils by metals in dust and rainfall runoff;
- Disturbance of soils to create platforms or new shafts resulting in soil loss by erosion and/or release of metals into the environment;
- Driving off road causes considerable damage to the substrate that can be visible for decades – especially on gravel plains.

Management Measures

- Control of dust emissions at source;
- Restrict removal of soil to sites where absolutely necessary. Where any soil must be removed, stockpile and protect stockpile against erosion by wind and water for later replacement during rehabilitation;
- Staff must be restricted to the mine site and not be allowed to do any recreational driving in the EPL. If any activity requiring movement away from the mine is required, it should be limited to existing tracks and subject to strict controls by management;
- To control recreational driving in the EPL by people not connected to the mine, signs should be put up – for which the approval of Parks would be requested.

Monitoring / Planning / Further Investigation

- Design of mine and processing site;
- Plan the removal of soil – as restricted as possible;
- Plan the location and protection of soil stockpiles;
- Annual soil sampling to determine whether there is any increase in metal concentrations in soils that would indicate the need for improved mitigation measures.

12.3 Air quality (and consequent soil contamination)

Impacts

- PM$_{10}$ concentrations of dust in the air pose a health risk to site staff and must be addressed as a matter of occupational health and safety;
- The dispersion of dust by wind results in soil contamination as the dust contains metals;
- Metals in soils may have impacts on living organisms, and will affect the quality of surface runoff.

Management Measures

- Refer also to detailed recommendations by Airshed (2013)

Crushing and screening:

- Regular clean up of loose material around the crusher area – at least once per week, more often if necessary;
- Wetting loose material;
• Addition of chemical surfactants to water sprays to lower water surface tension and increase binding properties;
• Target control of at least 50%.

Materials handling:
• Water sprays on dry material at off-loading points;
• Wetting of material on ROM pad;
• Minimise drop height from truck onto stockpiles (control efficiency of 25%);
• Keep material to be handled by dozers and wheeled loaders moist (achieve 50% control efficiency);
• Clean up spillage regularly;
• Reduce tipping speeds.

Unpaved haul road & access road:
• Target control of 90%;
• Water sprays on all roads especially between the mine entrance and ROM pad;
• Add chemical suppressants to water sprays if necessary;
• Speed limits of 20km/hr for haul trucks;
• Regular inspections to ensure effectiveness of chemical stabilisation.

Wind erosion from the tailings:
• Airshed (2013) recommended that rock cladding is the most effective way to prevent wind erosion from tailings in the short and long term. Marble waste rock should be used for this (also to minimise visual impacts, and reduce mobilisation of metals by surface water). A layer of marble waste rock at least 300mm thick covering the entire tailings (after trimming) is recommended. This would be subject to sufficient waste marble being available – NRR would not be required to mine marble just for the purpose of rehabilitation. However, it is recommended that, instead of disposing of the waste marble in the mine, it should be brought to the surface and stockpiled around the tailings for later application. It is further recommended that the mine engineers, during the design stage, should calculate the volumes of waste marble that will become available from the mine, and calculate the volumes required to cover the tailings – to confirm the feasibility of this recommendation.
• Wind breaks can be considered as an alternative short term solution during operations.
• Water sprays on the flanks of the tailings and stockpiles, especially before and during easterly winds would also help a great deal during operations. Sprays have to be placed on the windward side.

All the above:
• Ensure that an internal environmental officer is tasked with daily monitoring, reporting and implementation of controls.
• Ensure that operators are effectively trained and given periodic reminders and refresher courses as needed to maintain objectives;
• Achieve dust deposition rates less than 1200 mg/m²/day at dust bucket immediately downwind of the works.

Monitoring / Planning / Further Investigation
• Daily visual inspections for dust levels must be conducted by the person who is designated to be responsible on site;
o In addition a specialist consultant should be appointed to conduct regular measurement and monitoring of dust – in order to: -
  - Determine actual dust deposition rates to assess the need for improved controls at all sources;
  - Monitor dust levels, including PM$_{10}$ concentrations at work stations on site for reasons of occupational health and safety;
  - Quantify the nuisance risk to the surrounding environment;
  - Set up dust monitoring network of at least: -
    - One dust bucket in each of the four main wind directions, and
    - One dust bucket south-east of the plant (for the prevailing wind), and
    - One each to the west-northwest, and west-southwest of the plant to determine the deposition rates during the easterly winds.

o The dust deposited in these buckets should be analysed for metals to determine the impacts of the tailings on downwind receptors.

12.4 Natural Vegetation / Flora

Impacts

- Vegetation cover is very sparse on the mine site and all natural vegetation should be regarded as important for conservation. However, the only greatest biodiversity concern at risk are the Lithops ruschiorum populations near the mine site that may be affected by extended exploration and any resultant mining beyond that which is currently proposed.
- Alien invasive plants may be introduced and the existing Prosopis trees may spread.

Management Measures

- Design layout to minimize the footprint of all activities within previously disturbed areas;
- Create staff awareness of the need to avoid the Lithops populations;
- If any Lithops become affected in future, timeous consideration should be given to transplanting these to a safe location;
- Alien invasive plants need to be eradicated before mine development. A mixture of Garlon and diesel painted on the stems is effective.

Monitoring / Planning / Further Investigation

- If any new exploration or mining targets are identified, then further botanical mapping will be needed;
- Lithops communities should be monitored periodically for damage;
- Monitoring and eradication of any new infestations of alien plants is necessary.
12.5 Fauna (Invertebrates, Reptiles, Birds and Mammals)

Impacts

- Exposure to soil contaminated by metals may be harmful to fauna, especially invertebrates. Metals may bio-accumulate up the food chain so that predatory reptiles, birds and mammals may be adversely affected;
- Road kills of slow moving animals such as chameleons and nocturnal birds and animals;
- Poaching of wildlife or killing of animals such as snakes;
- Honey bees are attracted to water in the desert and may be dangerous to people;
- Avoid leaving food out or allowing animals any access to human’s food. For example hyaenas that get access to human food can become “problem” animals that become dangerous and may have to be shot;
- Large birds, especially Bustards, are frequently killed by collisions with power lines (Pallett, pers comm., and Shaw, 2013).

Management Measures

- Implement mitigations as for soils and air quality;
- Create awareness amongst employees and drivers;
- Speed limits (20 km/hr) and drivers to avoid slow moving animals, and birds at night;
- Prohibit poaching or killing of wildlife, including reptiles (snakes included) as part of the contracts of employees;
- Avoid leaving containers with water or cool drinks open;
- Never feed animals. Discourage scavengers, including the use of animal-proof rubbish bins;
- Game fencing around retention ponds that contain contaminated water to prevent animals from drinking this water;
- Attach bird defectors to the power line during refurbishment of the line (Shaw, 2013).

Monitoring / Planning / Further Investigation

- Monitoring as for soils and air quality regarding metals contamination;
- Monitoring road kills and any other issues arising in regard to fauna, and keep a record of problems so that solutions can be sought.

12.6 Groundwater Levels

Impacts

- Groundwater is of poor quality and low yield, so it does not comprise a significant resource except for drilling water. Impacts on groundwater levels are of little concern.

Management Measures

- In regard to groundwater levels no mitigation is considered to be necessary.

Monitoring / Planning / Further Investigation

- Monitoring of groundwater levels in monitoring boreholes is recommended to confirm the expected low level of impact;
SLR has suggested drilling of additional monitoring boreholes (see groundwater quality, below).
- Refer to SLR (Aug 2013) and SLR (Oct 2013) for further details of groundwater conditions and recommendations.

12.7 Groundwater Quality, Impacts from installations: offices, workshops, ablutions, chemical & fuel stores, waste collection/ treatment and refuelling

Impacts

- Groundwater quality can be affected from a number of sources:
  - Fuel installations,
  - Storage, movement and handling of hazardous chemical reagents,
  - Leakage or overflow from sewage / domestic wastewater system.

Management Measures

- Engineering design and adequate sizing of all installations to ensure containment; e.g. bunding, lining of refuelling tanks and sites;
- Operation according to strict management and controls to prevent spillage;
- Keep cleanup kits available and ready for use in case of any spillage;
- Establish emergency response procedures;
- Ensure compliance with MAWF permitting requirements.

Monitoring / Planning / Further Investigation

- Monitor groundwater quality
- SLR has suggested drilling of additional monitoring boreholes (see groundwater quality, below) and possible numerical modelling.
- Refer to SLR (Aug 2013) and SLR (Oct 2013) for further details of groundwater conditions and recommendations.

12.8 Groundwater Quality (Seepage from Tailings)

Impacts

- The tailings will contain some of the chemical reagents, metals and water – even after as much water has been recovered as possible. Seepage through the tailings and underlying marbles, of water containing chemicals and metals, presents a risk to groundwater quality. The marbles may have a buffering effect to reduce the risk to groundwater. The main pathway for groundwater contamination is expected to be fractures in the marbles as the marbles, which are otherwise of low permeability.
  - Claridge (pers. comm.) explained that Epoch has been commissioned by NRR to undertake geochemical work to determine the risk of acid generation and resulting mobilisation of metals in the tailings, and to determine the degree of buffering that will occur due to the underlying marbles. Following this study, decisions can be made on the management measures necessary to prevent groundwater contamination.

Management Measures

- Place tailings only on the marble outcrop (as proposed);
Avoid fractured bedrock;
- If fractured bedrock cannot be entirely avoided, two options are available: -
  - Possible grouting of fractures if necessary; and
  - Possible lining of tailings if necessary;
- Design and operation of the tailings to prevent overflowing;
- Collection and recycling of supernatant / tailings liquor;
- Trimming off tailings after closure to prevent ponding and reduce infiltration;
- Cover the entire tailings with a layer of crushed marble waste rock.

Monitoring / Planning / Further Investigation

- Geophysics study to identify any fractures in bedrock;
- Groundwater monitoring during operations to detect any changes in groundwater quality;
- SLR has suggested drilling of additional monitoring boreholes (see groundwater quality, below) and possible numerical modelling.
- Refer to SLR (Aug 2013) and SLR (Oct 2013) for further details of groundwater conditions and recommendations.

12.9 Groundwater Quality (Acid Rock Drainage)

Impacts

- Sulphide minerals in the ore may result in acid rock drainage locally, although this may be buffered to a degree by the host marbles.

Management Measures

- Refer to measures under Section 2.8 above; and
- Further investigation to determine the need for and nature of any additional mitigations.

Monitoring / Planning / Further Investigation

- As mentioned above, an Acid Rock Drainage study will be conducted by Epoch to ascertain local conditions with regard to mining processes and investigate buffering effects of host marbles. Epoch’s report is expected to be completed by the end of December 2013 (Claridge, pers comm)
- Groundwater monitoring to identify any problems, with mitigation designed in response to the monitoring results.
- Refer to SLR (Aug 2013) and SLR (Oct 2013) for further details of groundwater conditions and recommendations.

12.10 Surface Water: Volume of Runoff

Impacts

- Retention dams are needed to intercept contaminated water from the mine site. The intercepted water should be pumped out for use in the plant. This will have only a
minor impact on downstream runoff. The retention dams need to remain in place after mine closure.

Management Measures

- No mitigation is considered necessary for runoff volumes.

Monitoring / Planning / Further Investigation

- Refer to the hydrological report SLR (Nov 2013) and SLR (Oct 2013) for details of surface water conditions and recommendations.

12.11 Surface Water Quality

Impacts

- Contamination of rainfall runoff is possible from the following sources:
  - Lubricants and fuels from machinery and vehicles, and refuelling installations,
  - Possible chemical spills,
  - Metals in dust,
  - Overflows or spillages from sewage systems,
  - Poor management and containment of solid or liquid waste systems.

Management Measures

- Control all risks at source through design for containment, management;
- Regular clean up of crushed ore and dust accumulations;
- Design and construction of stormwater retention dams sufficient for at least the 1:50 year rainfall event;
- Pump out water and use it in the process, if possible;
- If any water needs to be released it must first be treated according to MAWF permit requirements;
- Retain dams after mine closure.

Monitoring / Planning / Further Investigation

- Accurate survey in order to design stormwater management system;
- Further detailed design of stormwater management system;
- Engineering design of collection channels and retention ponds, including sizing for the 1:50 year rainfall event with sufficient freeboard;
- Design of system for pumping and re-use of water in the process;
- Refer to the hydrological report SLR (Nov 2013) and SLR (Oct 2013) for details of surface water conditions and recommendations.

12.12 Solid & Liquid Waste (including sewage)

Impacts

- The context of the National Park makes all disposal of waste in the Park unacceptable;
• Waste may attract scavengers resulting in conflicts with humans, or injury or fatalities to animals;
• Litter is unsightly and poses risks to animals (e.g. plastics) if eaten; Bottles, wire and other scrap may trap animals and cause injury or death;
• Fire can result in loss of grazing in years when grass is abundant.

Management Measures

o Waste shall not be buried or burned within the Park at all. The only exception may be a high temperature incinerator with appropriate safety specifications;
• A priority should be given to recycling via companies that collect recyclables (e.g. glass, metals, paper and plastic);
• All temporary storage bins must be secure against animals, birds and wind;
• The design and management of facilities for treatment and disposal of sewage should make use of technologies that are tried and proven in Namibian conditions. Maintenance of such systems must be to a very high standard. Treated water should be recycled via the processing plant. No water shall be disposed of to the environment;
• General waste that cannot be recycled should be sent to the Municipal waste disposal site at Swakopmund. The Swakopmund Municipality requires that NRR must apply to dispose there as they are outside the Municipal area

Monitoring / Planning / Further Investigation

o Engineering design of the infrastructure and management systems;
• Regular internal monitoring by NRR to ensure compliance with procedures and maintenance.

12.13 Chemical Reagents and Hazardous Waste

Impacts

• Hazardous chemicals will be used in the processing plant. Some will be returned to the process in water that is recovered from the tailings, while some will remain in the tailings - that cannot be mitigated;
• Any hazardous chemicals that may get into the environment pose a threat to living organisms and possibly humans.

Management Measures

o Hazardous substances are strictly regulated in regard to their import, transport, storage, use and disposal. NRR must ensure that they comply with all relevant legislation.
• All hazardous waste must be sent to a licensed Hazardous Waste Disposal facility such as that at Walvis Bay. A manifest must accompany each load and all relevant legislation must be complied with.
• Any lubrication oils and used hydraulic fluids, if they are not recyclable, should also be sent to a licensed hazardous waste facility.

Monitoring / Planning / Further Investigation

o It is recommended that a specialist company be employed to advise on, manage, transport and dispose of hazardous waste.
• Refer to Envirolex (2012)
12.14 Explosives

Impacts

- The risks posed by potential accidents involving the use of explosives are obvious enough – risks to people and to infrastructure, road users etc.;
- In the unlikely event of accidental explosions occurring, there could be secondary impacts if any facilities involving hazardous substances were affected.

Management Measures

- Comply with all legislation relating to explosives, for example in the transport, storage, use of and disposal of explosives;
- In designing the layout, transport routes and storage facilities of the mine, take into account the secondary risks and impacts of accidental explosion at stores or along transport routes at the mine – particularly the risks to installations involving hazardous chemicals;
- Ensure rigorous compliance with all legislated procedures involving explosives.

Monitoring / Planning / Further Investigation

- Regular internal inspections regarding procedures and compliance with regulations.

12.15 Electricity demand

Impacts

- The electricity demand of the mine will, in a small way, aggravate the shortage of power in Namibia and southern Africa. Therefore every effort should be made to conserve power where possible.

Management Measures

- Use of solar water heating;
- Energy efficient machines, lights and appliances;
- Design of energy efficient buildings to reduce the need for air conditioning;

Monitoring / Planning / Further Investigation

- Design stage considerations;
- Monitoring and improvement of consumption during operations.

12.16 Electricity supply infrastructure

Impacts

- Potential proliferation of unnecessary tracks;
- Risks to large birds;
- Unnecessary visual impacts post closure of the mine.
Management Measures

- Use a single access track for construction and maintenance;
- Consider combining the power line and pipeline corridors and use one track for both;
- Attach bird deflectors on the conductors (Shaw, 2013);
- Remove all infrastructure following mine closure.

Monitoring / Planning / Further Investigation

- Take the above into account during the design stage.

12.17 Water demand

Impacts

- Water resources are always an issue in the Erongo Region. Therefore every effort must be made to conserve water where possible.

Management Measures

- Thickening of tailings before disposal to tailings dam;
- Design to optimize the recovery of water from the tailings;
- Design sewage treatment system for efficiency.

Monitoring / Planning / Further Investigation

- Design stage considerations.

12.18 Water supply infrastructure

Impacts

- Disturbance of the substrate;
- Visual impacts;
- Tracks.

Management Measures

- Consider combining pipeline with power line corridor and using a single access track for both;
- Remove all infrastructure following mine closure.

Monitoring / Planning / Further Investigation

- Monitor compliance by construction contractor.
12.19 Visual Aspects

Impacts

- The most important long term impact is the tailings dump. The existing one is a dark colour that contrasts strongly with its light surroundings.

Management Measures

- After mine closure, trim off tailings to make a more natural looking landform; and
- Cover the entire tailings with a 300mm layer of waste rock (marble). This thickness is subject to sufficient waste marble being available. If not, a reduced thickness could be considered for visual impacts in combination with prior use of stabiliser products to control dust emissions;
- Other infrastructure will be removed.

Monitoring / Planning / Further Investigation

- Planning for mine closure, and stockpiling of the waste rock etc.

12.20 Road Traffic

Impacts

- Approximately 2 trucks per day will transport product to the port of Walvis Bay, and a buses will transport staff from Swakopmund and possibly Walvis Bay for each shift, three shifts per day. This will result in a very minor increase in traffic, but the roads are dangerous especially in fog.

Management Measures

- Restrict heavy vehicles to off-peak traffic times; and
- All vehicles should drive with lights on when visibility is poor;
- Driver education and awareness;
- Maintenance of vehicles.

12.21 Socio-economic Aspects

Impacts & Benefits

- The mine will employ approximately 106 people over a short period (expected 7 years);
- Benefits to outsourced suppliers;
- Benefits of training in technical skills;
- Movement of workers around the country may disrupt families and often has consequences for the spread of HIV/AIDS. This can also be detrimental to the mining company when trained staff are lost to the disease;
- Workers face risks of accident at the mine and plant, as well as road accidents;
- Workers also face health risks from inhaling dust, from the metals in that dust, from noise, etc. Occupational health and safety is not covered in this EIA and EMP.
Management & Enhancement

- Provide training to staff to optimize their performance and their employability after mine closure;
- Consider housing allowances as part of salary packages to encourage staff to secure home ownership;
- The mine has a short expected lifespan. Prepare staff from the time of first interviews for final retrenchment, include providing advice on financial planning and the value of home ownership;
- Consider training of young students at NIMT, Arandis – as an investment in human resources to benefit Namibia after mine closure;
- Provide education on HIV/AIDS from induction onwards;
- Develop emergency response procedures.
- Employ occupational health and safety (OHS) specialists to ensure compliance with relevant legislation including the Labour Act, and to ensure that the health issues of staff are managed and monitored.

Monitoring / Planning / Further Investigation

- Plan training and educational programmes;
- Plan social benefit projects;
- Identify risks and plan for potential emergency scenarios;
- Monitoring of OHS issues by independent specialists.

12.22 Relationship with the Directorate of Parks & Tourism

Impacts & Benefits

- The Directorate of Parks and the Wardens of the Erongo Region are the key Interested & Affected Parties. Parks can be significantly disadvantaged by poor planning or poor environmental management by the mine. On the other hand there may be opportunities for NRR to assist Parks in some ways, in addition to fulfilling their environmental responsibilities.

Management & Enhancement

- Maintain open and regular communication with Parks officials and wardens;
- Consider and discuss opportunities to assist Parks in a spirit of good neighbourliness.

12.23 Environmental Monitoring Plan

The EIA (Sections 8 & 9) and EMP have identified many issues that need to be included in a comprehensive monitoring programme.

Annual environmental performance assessments by an independent, qualified environmental practitioner, are necessary to assess compliance with this EMP.
12.24 Environmental Awareness Plan

An environmental awareness plan needs to be developed for NRR to achieve the following objectives:

- To create awareness of the environmental issues amongst employees, contractors and transport drivers;
- To ensure that employees have the necessary understanding to comply with the environmental management measures in this EIA and EMP;
- To provide skills training to employees and contractors;
- To evaluate the skills of employees based on environmental performance, interviews and other means;
- To provide for re-training / refresher training where performance or knowledge is clearly inadequate;
- To provide a system of recording of training provided to individuals;
- Periodic re-assessment of training needs, particularly with regard to new developments, newly identified issues and impacts and associated mitigation measures.

12.25 Procedures for Environmental Emergencies

Objectives

The objective of the Environmental Emergency Preparedness and Response Procedure is to identify and prepare for potential accidents and emergency situations that can have an impact on the environment. Preparedness facilitates rapid and effective response to environmental emergencies.

Responsibilities

North River Resources will be responsible for all aspects of environmental management and compliance with this EMP. NRR should appoint a Mine Manager who will be responsible for the day-to-day monitoring and enforcement of environmental management. Alternatively NRR may appoint an Environmental Manager to fulfil this responsibility.

In any event a designated individual who is capable and committed must carry the responsibility for environmental management. His responsibilities should include:

- Responding to any environmental emergency;
- Ensuring that sufficient financial and human resources are available at short notice to implement emergency procedures;
- Identification of potential environmental emergencies;
- Pro-active response to avert potential environmental emergencies;
- Testing, where practical, the proposed response plans;
- Investigating any environmental impacts following any emergency and recording all relevant data and procedures undertaken;
- Ensuring periodical review, and if necessary revision of procedures to prevent recurrence of the emergency situation;
- Distribution of all standard procedure to all relevant mine managers;
- Ensure compliance with the recommended environmental management measures (in the EIA and EMP) for mitigation of impacts on a routine basis;
o Ensure that the Environmental Monitoring Plan, including independent monitors, is implemented according to schedule.

Dealing with Environmental Emergencies

Potential environmental emergencies are identified by the Environmental Manager based on legal requirements, knowledge of the mining environment and understanding of the Environmental Impact Assessment and EMP, and experience of previous emergency situations.

In the event of an emergency, the following procedure shall be followed:

- Notify the following people:
  - the relevant Warden of the Dorob National Park / Erongo Parks;
  - the office of the Environmental Commissioner in Windhoek;
  - in the event of pollution, notify the Directorate of Water Affairs (MAWF);
  - any neighbours if the pollution occurs on a public road;
  - any other authorities that may be affected (e.g. Swakopmund or Walvis Bay if affected); and

- Take steps immediately to limit the spread of pollution;
- Take samples of the pollutants, affected water and affected soil (as applicable) for chemical analysis;
- Implement clean up actions. These may be directed by external parties such as a fire brigade, private contractors, or government departments.
- Inform the relevant authorities when the necessary response has been fully effected and the situation remediated.

12.26 Compliance Monitoring – Internal and Independent

NRR must be committed to continuous monitoring and assessment of their own operations to ensure compliance with the EIA, Environmental Management Plan and all environmental legislation. Documentation of any instances of non-compliance should be made with a record of what measures have been implemented to prevent recurrence of the issue at hand.

In addition, it is recommended that compliance monitoring should be carried out twice per year by an independent, qualified environmental practitioner.

The Compliance Monitoring Report should specifically deal with:

- The adequacy of NRR's own monitoring and recording on a continuous, daily basis during the operation of the mine;
- The methodology used for compliance monitoring;
- The results - degree of compliance with the recommendations of the EIA and EMP;
- Recommendations on how to improve environmental performance in cases of non-compliance;
- Identification of any inadequacies in the EMP itself and recommended amendments to the EMP (involving discussion with the Client).
13 MINE CLOSURE & REHABILITATION

13.1 Mine Closure Process

Given the sensitive nature of the project and location in the Dorob National Park, the following formal process is recommended.

Step 1: Inform relevant authorities of proposed mine closure

- Hold meetings with the relevant Authorities to discuss the proposed mine closure process and to ensure alignment with their requirements before the work commences;
- At least the following authorities should be involved – MET (Environmental Commissioner’s office), Directorate of Parks (Windhoek) and Chief Warden, Erongo Region (Swakopmund); Ministry of Mines & Energy;
- Included in the discussions, amongst other environmental issues, should be the question of post closure land use and whether any existing facilities can be used by Parks.

Step 2: Risk assessments

- Conduct workshops to identify all potential environmental risks associated with the mine closure process;
- These workshops must involve the client (NRR) and their managers and mine engineers, Environmental Scientist and specialist consultants as needed;
- Risks should be classified in some way according to the significance of the issue concerned.

Step 3: Draft Mine Closure Plan

- A draft Closure Plan should be compiled that explains what steps will be taken to protect the environment;
- The Plan must include a summary of the requirements of the authorities;
- It should include any monitoring requirements post closure if necessary;
- The draft Plan must be circulated to the authorities and any other key I&APs for input and comment.

Step 4: Approval of Mine Closure Plan

- Once the relevant Authorities and I&APs have approved the Mine Closure Plan, it will be submitted to the authorities for approval.

Step 5: Implementing the Mine Closure Plan

- Once approved by the Authorities, the Mine closure Plan will be implemented.
13.2 Closure Plan Objectives

The Closure Plan must address the environmental issues identified: -

- in this EIA and EMP;
- any issues arising from the specialist monitoring during operations;
- any other environmental issues emerging during the operations stage; and
- any issues arising from the Steps 1-3 outlined above.

The overall rehabilitation goals of the Closure Plan should include but not necessarily be limited to the following: --

- Ensure a safe, stable and non-polluting situation;
- Trim slopes to reduce erosion and replace stockpiled topsoil;
- Address any issues of drainage so that clean water flows to natural watercourses, while mine contact water is lead to retention ponds from where it can evaporate;
- Remove all surface infrastructure that has no beneficial post closure use;
- Establish bio-diverse floral communities where practically possible;
- Remove threats to wildlife, birds etc and ensure that the area is habitable to fauna as befits a National Park;
- Remove all hazardous waste to a licensed disposal facility;
- Remove fences and re-integrate the mining area into the surroundings. Excepted that it will probably be desirable to retain the stormwater retention ponds and the fences around them;
- Address any health and safety issues as may be remaining on the site;
- Restore the site to be aesthetically acceptable, with particular attention to reducing the visual impacts of the tailings;
- Prepare employees well in advance for retrenchment.

The Closure & Rehabilitation Plan will include at least the following activities: -

**Underground & Shafts**

- Ensuring that backfilling of waste is secure will be ongoing during operations and upon closure of mine;
- Cast reinforced concrete slabs over the shafts at the surface before covering with waste rock (marble) and soil. This is safer than fencing, which will corrode in due course and is less able to keep animals and people out.
- Secure the entrance of the mine against unauthorised entry.

**Infrastructure**

- Remove all buildings, plant, equipment, concrete slabs, fixings and machinery from site for safe and legal disposal, giving due consideration to recycling whatever can be recycled;
- Remove the pipeline and power line unless they have some beneficial use after mine closure, and in consultation with Namwater and ErongoRED respectively;
- Remove all rubble and waste to an approved landfill site;
- Rip up haul roads and access roads that are no longer required and ensure that scars on hillsides are removed;
- Rip up any areas that were compacted (e.g. beneath concrete slabs).
Hazardous substances

- Hazardous waste shall not be left on site or disposed on in the mine.
- Hazardous waste should have been removed to a licensed disposal site on a regular basis during operations, so there should be no build up of hazardous waste. At mine closure any remaining chemicals shall be removed and disposed of to an approved waste facility;
- Clean up possible sources of contamination of water;
- Any areas of soil that are contaminated by hazardous chemicals should be cleaned up. This should also be carried out immediately any spills occur during operations and not left till the end of the project.

Tailings

- Trimming of the dry tailings storage facility to prevent ponding of water and remove hard lines for reasons of visual impacts;
- Cover the entire tailings with a layer of broken waste rock (marble), ideally 300mm thick, to reduce erosion and reduce visual impacts. The purpose it to prevent dust containing metals from being removed by wind and water from the tailings, and to achieve visual blending with the surroundings;
- To the extent that is practically possible, ensure that the final form and appearance resembles the natural landforms and blends with them visually.

Water issues and Retention ponds

- Maintain any diversion channels leading to retention ponds so that they continue to operate effectively for many years after closure. Even if they overflow in events greater than the 1: 50 year magnitude, the retention dams will still trap silt that contains metals;
- Retention ponds should remain in place so that they can intercept rainfall runoff from the site for many years after mine closure. Game fencing around retention ponds should probably be retained to prevent animals from drinking contaminated water, until water tests show that water quality has reached acceptable standards for wildlife;
- Sample and test surface water to determine water quality, levels of salts, metals, and other possible contaminants, and compare with water standards for livestock / wildlife consumption;
- Review groundwater monitoring data and determine the need for any remedial measures.

Trimming of cut slopes, replacing of Soil stockpiles and erosion prevention

- Where it was necessary to remove soil before construction, e.g. for buildings and foundations, the soil must be replaced and graded to give a natural appearance;
- Where ground has been made uneven, e.g. by cut-and-fill for the purpose of levelling, the slopes must be reinstated to their natural slope angle and made to look as natural as possible;
- Reinstate disturbed ground to emulate the surrounding surface topography;
- Eliminate any unsafe steep slopes;
- All areas must be free draining – i.e. eliminate any ponding of rainwater;
- After trimming and shaping, the available topsoil must be replaced, spread over the reinstated areas. Be mindful of the risks of soil erosion – for example, naturally
exposed bedrock will probably not retain soil during rainfalls and should probably be left exposed;
  o Ensure that drainage lines created on the rehabilitated surface will not scour or result in gulley erosion.

**Sweeping of tracks in the EPL**

  o It is standard practice within EPLs in Namibian Parks to sweep tracks that are no longer required, leaving only those main tracks that are approved by the Parks authorities.

**Biodiversity**

  o Eradicate any alien invasive plants that have established or spread. For example there are alien *Prosopis* trees on the site at present;
  o It may be possible to plant some of the local indigenous species where there is sufficient depth of soil.

**Consultation with Directorate of Parks**

  o Maintain regular communications with the Parks authorities.
During the public participation programme, a concern was expressed to ensure that funds would be available for rehabilitation in the event of project failure, bankruptcy, or default by the mining company.

North River Resources has indicated a willingness to establish a trust fund, in a separate account that will be protected from claims in the event of bankruptcy, and that will be available for rehabilitation in any event.

An amount will be lodged in the trust fund annually, based on a dollar per tonne of ore mined. In order to arrive at the appropriate $/t figure, the amount required for rehabilitation needs to be calculated. This should be done during the engineers during the design stage. During design, the affected ground areas, and surface area of the final tailings facility can be determined – for example.

As an approach to determining the amount that is needed in the trust fund, and the annual contributions to it, it is recommended that the requirements of the South African Minerals and Petroleum Resources Development Act (Act 28 of 2002) - (MPRDA) Guidelines for the Calculation of Quantum for Rehabilitation be used.
REFERENCES


SLR (September 2012) Quarterly Review September 2012 Sampling of Monitoring Boreholes at EPL-2902

SLR (December 2012) Quarterly Review December 2012 Sampling of Monitoring Boreholes at EPL-2902

SLR (March 2013) Quarterly Review March 2013 Sampling of Monitoring Boreholes at EPL-2902

SLR (June 2013) Quarterly Review June 2013 Sampling of Monitoring Boreholes at EPL-2902


ACKNOWLEDGEMENTS

We would like to express our appreciation to all those Interested and Affected Parties who participated in the Public Meetings and made their concerns known to us.