2021

Environmental Management Plan

ECT
ENVIRONAM CONSULTANTS TRADING

Southern Africa Railways

Karibib Aggregate Processing Plant

5/11/2021

ENVIRONMENTAL MANAGEMENT PLAN

PROJECT DETAILS

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ABBREVIATIONS

AIDS	Acquired Immuno-Deficiency Syndrome
PR	Proponent's Representative
EA	Environmental Assessment
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment

EMA	Environmental Management Act
EMP	Environmental Management Plan
GG	Government Gazette
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HIV	Human Immuno-deficiency Virus
I&APs	Interested and Affected Parties
SAR	Southern Africa Railways CC
NHC	National Heritage Council
Reg.	Regulation
S	Section

1 INTRODUCTION

Southern Africa Railway (Pty) Ltd (SAR) owns and operates an aggregate processing plant situated on ERF 1501, Extension 6, Karibib, in the Erongo Region. In terms of section 27 of the Environmental Management Act, 2007 (Act 7 of 2007) listed activities may not be undertaken without an Environmental Clearance Certificate (ECC).

While operations on site have commenced SAR has been advised to obtain an ECC in compliance with the legal requirements. It is against this background that SAR have halted the operations and appointed Environam Consultants Trading (ECT) to undertake the process of applying for the ECC on their behalf, before full scale operations resume.

Key to the issuance of an Environmental Clearance Certificate is the submission of an Environmental Management Plan (EMP) which provides for a description of how an activity might impact on the natural environment in which it occurs and clearly sets out commitments from the proponent on how identified impacts will be avoided, minimised and managed so that they are environmentally acceptable.

An EMP is one of the most important outputs of the Environmental Assessment process as it synthesises all of the proposed mitigation and monitoring actions, set to a timeline and with specific assigned responsibilities. As part of the application for an ECC, Environam Consultants Trading has developed an EMP that will outline the appropriate actions. The EMP will normally cover a broader spectrum of actions from the planning and design phase, construction, to the operation and maintenance phase, right up to the decommissioning phase. The operations on this site has been ongoing hence this EMP will only focus on the operation and maintenance, as well as the decommissioning phases of this development.

2 PROJECT OVERVIEW

Southern Africa Railways (SAR) signed a “Railway Ballast Supply Procurement Contract” with China Gezhouba Group Company (Pty) Ltd (CGGC). CGGC is one of the contractors for the project “Upgrading of the Railway line between Walvis bay and Krantzberg”, which was broken down into 2 work packages: C001 was awarded to CGGC while C002 was awarded to Unik Construction Engineering Namibia Pty Ltd (Unik). The Employer of the project is the Ministry of Works and Transport, Republic of Namibia (SAR, 2021).

The contracted quantity of the ballast to be supplied to CGGC is 302 952 metric tons, which translates to approximately 17 000 tons per month over 18 months. SAR also supplies ballast to Unik on the basis of purchase orders rather than supply contracts, unlike CGGC. Unik plans to procure 10 000 tons per month over the next 18 months. The combined demand for these two companies amounts to 27 000 tons per month, however, SAR plans to produce a minimum of 30 000 tons of ballast per month over the next 18 months which includes 3 000 tons excess material per month as a buffer to ensure security of supply (SAR, 2021).

Ballast is the name for the "stones" beneath the railway tracks. This aggregate forms the trackbed and supports the track. In addition it helps with drainage, so that rain water can drain away rather than pooling. Another role played by ballasts is preventing vegetation growth, which could destabilise the track and be a hazard for anyone working on the railway (NetworkRail, 2018).

3 PRODUCTION PROCESS

The production of the railway ballast takes place at the SAR plant located in Karibib. The raw material consists of crushed stone which is obtained from the Navachab gold mine that is located approximately 6 km from the plant. It is then transported with tipper trucks which offload the raw material at the plant. The raw material is fed into a screening machine (screen) with the aid of an excavator, the screen mechanically separates the raw material stones according to the specified sizes. The industry standards (S406 (1998) and SABS 1083) require ballast stone of sizes larger than 19mm but smaller than 63mm. The stone sizes outside this range, mostly smaller than 19mm, are considered as waste products, however they have value in other industries as they can be sold to entities that need such aggregate for use in roads, concrete, bricks, etc. (SAR, 2021).

After screening, the ballast is stacked with the aid of front-end loaders into several stockpiles with an average size of approximately 2500m3 each. Samples are continuously taken from each stockpile to conduct the following major tests: grading analysis, flakiness index, soundness test, relative density, voids content and Mill Abrasion Value. Once the stockpile has been inspected, tested, approved and surveyed, the ballast is loaded onto trucks and transported to the Contractor's storage yards at various locations along the railway line (for CGGC only, Unik collects their ballast from the Karibib plant) (SAR, 2021).

A weighbridge will be installed on site so that the trucks carrying the raw material or the ballast will be weighed at the plant. This will make the practice of surveying the stockpiles redundant (SAR, 2021).

4 AGGREGATE AND THE CONSTRUCTION INDUSTRY

The construction industry in Namibia is a major driving sector for economic growth. The construction of large infrastructure requires plenty of construction materials. Aggregates are among the first construction materials that constitute a major portion of civil engineering construction works. Aggregates are produced from sand and gravel deposits or from bedrock sources. Aggregates are produced with respect to their potential use, so as to match the required grading and thereby ensure marketability (Jullien, A. et al., 2012). Hence, the requirements associated with aggregate mechanical properties will generally undergo investigation, as well, by applying standards in this case (S406 (1998) and SABS 1083). Rock hardness is one of the geological properties that lead to a raw material classification, provided aggregate use properties are determined through laboratory testing (Jullien, A. et al., 2012).

The production of aggregate for the infrastructural development of the country has been increasing for the last three decades due to the high urbanization rates in the main centers and the ever-growing demand for basic infrastructural facilities. However, because of their size and profound societal importance, construction activities and processes are among the largest consumers of materials and energy and by extension also significant polluters on the global scale.

The environmental impact of both fine and coarse aggregate production is hard to ignore especially on the outskirts of the main cities and towns. These impacts are clearly seen on the degradation of landscape and land stability, pollution of water resource, pollution of the atmosphere due to dust, biodiversity and societal impacts (Assefa & Gebregziabher, 2020).

Quarrying and transport of materials have environmental impacts on the local neighborhood and society, for instance with regard to noise, dust, pollution, and effects on biodiversity. Social challenges related to the increase in quarrying activities in general include threats to health and safety, farming obstacle, blockage on free movement of animals, displacement of communities, reduction in agricultural yield, damage of cultural sites, and the formation of mining villages (Assefa & Gebregziabher, 2020).

The operations at Erf 1501, Karibib Extension 6 are however only limited to screening and separating fine and coarse aggregate as the quarrying and crushing takes place at the Navachab mine site. It is however critical to provide the broader context as the carbon footprint is not only limited to the Extension 6 site.

From the potential environmental impacts of aggregate production highlighted above, the ones most relevant to the Extension 6 site include mainly, dust, noise, groundwater pollution, waste management, traffic, and visual.

5 PROJECT LOCALITY

The site is located in Karibib Extension 6. Karibib Extension 6 is located on the south-western side of Karibib. Karibib Extension 6 is adjacent to the C32 road running along its eastern border south of Park Street and south-west of Karibib Extension 2 at the coordinates Lat: -21.946576°; Lon: 15.840694°. Erf 1501 is found on the north-western end of Extension 6. Refer to **Figure 5-1** below for the locality map of Karibib and Figure 5-2 **to** for the locality map of Extension 6 and Erf 1501 (No. 15 on the map).

Figure 5-1: Locality map of Karibib

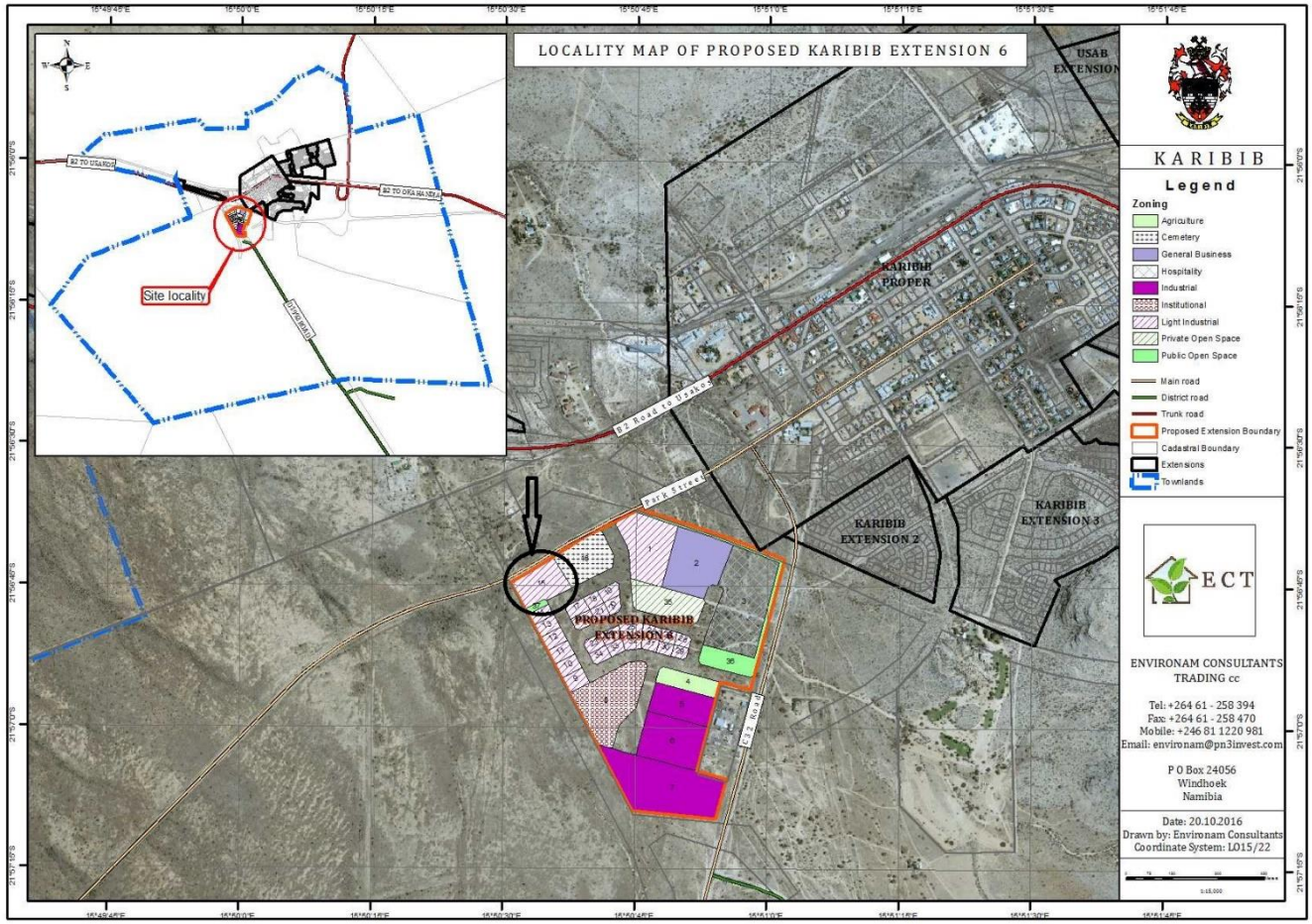

Figure 5-2: Locality map of Extension 6 and Erf 1501

6 APPLICABLE LEGISLATION

Legal provisions that have relevance to various aspects of these developments are listed in **Table 6-1** below. The legal instruments, applicable corresponding provisions and relevance details are provided.

Table 6-1: Legal provisions relevant to this development

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
The Constitution of the Republic of Namibia as Amended	Article 91 (c) provides for duty to guard against "the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia." Article 95(l) deals with the "maintenance of ecosystems, essential ecological processes and biological diversity" and sustainable use of the country's natural resources.	Sustainable development should be at the forefront of this development.
Environmental Management Act No. 7 of 2007 (EMA)	Section 2 outlines the objective of the Act and the means to achieve that. Section 3 details the principle of Environmental Management	The development should be informed by the EMA.
EIA Regulations GN 28, 29, and 30 of EMA (2012)	GN 29 Identifies and lists certain activities that cannot be undertaken without an environmental clearance certificate. GN 30 provides the regulations governing the environmental assessment (EA) process.	**Activity 3.3** Resource extraction, manipulation, conservation and related activities.
Convention on Biological Diversity (1992)	Article 1 lists the conservation of biological diversity amongst the objectives of the convention.	The project should consider the impact it will have on the biodiversity of the area.
Draft Procedures and Guidelines for conducting EIAs and compiling EMPs (2008)	Part 1, Stage 8 of the guidelines states that if a proposal is likely to affect people, certain guidelines should be considered by the proponent in the scoping process.	The EA process should incorporate the aspects outlined in the guidelines.
Namibia Vision 2030	Vision 2030 states that the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought after commodities and must be regarded as valuable natural assets.	Care should be taken that the development does not lead to the degradation of the natural beauty of the area.
Water Act No. 54 of 1956	Section 23(1) deals with the prohibition of pollution of underground and surface water bodies.	The pollution of water resources should be avoided during operation of the development.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
The Ministry of Environment and Tourism (MET) Policy on HIV & AIDS	MET has recently developed a policy on HIV and AIDS. In addition it has also initiated a programme aimed at mainstreaming HIV and gender issues into environmental impact assessments.	The proponent and its contractor have to adhere to the guidelines provided to manage the aspects of HIV/AIDS.
Labour Act no 11 of 2007	Chapter 2 details the fundamental rights and protections. Chapter 3 deals with the basic conditions of employment.	Given the employment opportunities presented by the development, compliance with the labour law is essential.
Public and Environmental Health Act, 2015	Amongst the objectives of the Act in Section 2 are: (a) promote public health and wellbeing; (b) prevent injuries, diseases and disabilities; (c) protect individuals and communities from public health risks.	Public and environmental health is an important component of any development.
Public and Environmental Health Act, 2015	Public Health COVID-19 General Regulations.	The proponent should adhere to Covid 19 legislation and regulations as they are imposed from time to time.
Nature Conservation Ordinance no 4 of 1975	Chapter 6 provides for legislation regarding the protection of indigenous plants.	Indigenous and protected plants have to be managed within the legal confines.
Atmospheric Pollution Prevention Ordinance (No. 11 of 1976).	The Ordinance objective is to provide for the prevention of the pollution of the atmosphere, and for matters incidental thereto.	All activities on the site will have to take due consideration of the provisions of this legislation.
Roads Ordinance 17 of 1972	• Section 3.1 deals with width of proclaimed roads and road reserve boundaries • Section 27.1 is concerned with the control of traffic on urban trunk and main roads • Section 37.1 deals with Infringements and obstructions on and interference with proclaimed roads.	Adhere to all applicable provisions of the Roads Ordinance.

7 IMPACT OBSERVATIONS

The following observations guided by the most relevant identified potential impacts as delineated at the end of chapter 4, were made in respect of the site in question.

7.1 Air Quality and dust

Fugitive dust generated at the site has a potential impact on the air quality of the area and its surroundings. Dust is a major component of air pollution and could negatively affect the health of nearby communities and industries if not mitigated. Due to the proximity of the development site to Park Street, traffic on this road is also at risk of being impacted by dust. Dust at the site is generated mainly from the following activities:

- Transport and loading of aggregate onto and from trucks;
- Stockpiling;
- General use of heavy vehicles, machinery and equipment.

A solar power plant is situated adjacently west of Erf 1501. Concern has been raised by a member of the public that due to the prevailing winds, the solar panels are at risk of settled dust and thus affecting their performance in terms of optimal energy generation.

There exist little empirical data on wind for Namibia, with the closest recorded data available for the prevailing wind direction in the area only available from the Navachab mine situated approximately 10km from Karibib. An environmental scoping study done for the expansion of the Navachab mine indicates that the predominant day-time wind is north-east, while at night-time the prevailing wind is southeast and south-southeast (KUSP, 2016).

During winter time the prevailing winds are from the northeast and east (east winds) while in summer and spring time the prevailing winds are from the northwest north-westerly directions (KUSP, 2016). The above suggests that the general location of Extension 6 and Erf 1501 in particular is favourably located on the south-western side of Karibib. The local authority has not received any complaints or concerns from the owner/operator of the solar power plant in as far as dust settling on the panels is concerned.

7.2 Noise

Noise is perceived as one of the most undesirable consequences of a production facility. Some of the most common impacts are interference in oral communication and hearing loss. The noise impacts from these activities are mainly associated with operations of machinery and vehicles.

7.3 Groundwater pollution

Surface and ground water impacts may be encountered during the operations, especially if there is non-existent or poorly constructed and maintained infrastructure. Ablution facilities are planned to be linked to a septic tank system. Leakage of oil and lubricants as a result of poor storage, maintenance of vehicles and machinery have a potential to pollute ground water sources.

7.4 Waste management

Operational activities are likely to generate a reasonable amount of solid waste. An adequate number of refuse receptacles should be placed at the site for the collection of waste, which should be emptied frequently and taken to the designated landfill site. This could be fitted into the municipal waste collection programme or assigned to a private waste management contractor.

7.5 Traffic

A number of trucks and other heavy machinery are required to deliver, handle and position raw material as well as to transport the finished product. This will have an impact on the vehicular traffic in the area. The safety of road users need to be considered especially in relation to Park Street.

7.6 Visual

The development is visually prominent from many angles. While there are some existing structures in the surrounding area such as the solar plant for example, any additional buildings and infrastructure to be erected on site will cause a higher visual impact to the natural area. The development certainly has an impact on the sense of place of the local community. Therefore the aesthetics quality of any structures has to pleasing and designed to blend in with the natural surrounds.

8 ROLES AND RESPONSIBILITIES

SAR (the proponent) is ultimately responsible for the implementation of the EMP, the proponent may however delegate this responsibility through its life cycle. The delegated responsibility for the effective implementation of this EMP will rest on the following key individuals:

- Proponent’s Representative;
- Environmental Control Officer; and

- Contractor (Operations and Maintenance).

8.1 PROPONENT'S REPRESENTATIVE

The Proponent should assign the responsibility of managing all aspects of the operations (including all contracts for work outsourced) to a designated member of staff, referred to in this EMP as the Proponent's Representative (PR). The PR's responsibilities are shown in Table **8-1** below:

Table 8-1 PR's responsibilities

Making sure that the necessary approvals and permissions laid out in **Table 6-1** are obtained/adhered to;
Suspending/evicting individuals and/or equipment not complying with the EMP;
Issuing fines for contravening EMP provisions.

8.2 ENVIRONMENTAL CONTROL OFFICER

The PR should assign the responsibility of overseeing the implementation of the whole EMP on the ground during the operation and maintenance phases to a designated member of staff, referred to in this EMP as the Environmental Control Officer (ECO). The proponent may also outsource this component to an independent Environmental Consultant. The ECO will have the following responsibilities outlined in **Table 8-2**:

Table 8-2 ECO's responsibilities

• Management and facilitation of communication between the Proponent, PR, the contractors, and Interested and Affected Parties (I&Aps) with regard to this EMP;
• Monitor and audit the implementation of the EMP;
• Submitting bi-annual reports to the Environmental Commissioner.
• Assisting Contractors in finding solutions with respect to matters pertaining to the implementation of this EMP;
• Advising the PR on the removal of person(s) and/or equipment not complying with the provisions of this EMP;
• Making recommendations to the PR with respect to the issuing of fines for contraventions of the EMP.

8.3 CONTRACTOR

Contractors appointed by the Proponent are automatically responsible for implementing all provisions contained within the relevant chapters of this EMP. Contractors will be responsible for the implementation of this EMP applicable to any work outsourced to subcontractors. **Table 9-1** refers to those contractors appointed during the operation and maintenance phase. In order to ensure effective environmental management the aforementioned chapters should be included in the applicable contracts for outsourced operation and maintenance work.

The tables in the following chapter detail the management measures associated with the roles and responsibilities that have been laid out in this chapter.

9 MANAGEMENT ACTIONS

The aim of the management actions in this chapter of the EMP is to avoid potential impacts where possible. Where impacts cannot be avoided, measures are provided to reduce the significance of these impacts.

The following tables provide the management actions recommended to manage the potential impacts:

- Operation and maintenance phase management actions (**Table 9-1**); and
- Decommissioning phase management actions (**Table 9-2**).

The responsible persons at the Proponent's team should assess these commitments in detail and commit to the specific management actions where indicated in the tables below.

9.1 ASSUMPTIONS AND LIMITATIONS

This EMP has been drafted based on the brief for the Karibib Aggregate Processing Plant, as presented by the proponent. ECT will not be held responsible for the potential consequences that may result from any alterations to the information presented.

9.2 OPERATION AND MAINTENANCE PHASE

The management actions included in **Table 9-1** below apply during the operation and maintenance phase of this development.

Table 9-1: Operation and maintenance management actions

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
Surface and Ground Water	• A no-go buffer area of at least 15 m should be allocated to any water bodies in the area. • No dumping of waste products of any kind in or in close proximity to any surface water bodies. • Contaminated runoff from the various operational activities such as greases, fuels, oils etc. should be prevented from entering any surface or ground water bodies, and where these occur, that they are appropriately and immediately dealt with. • Drip trays must be placed underneath heavy vehicles and machinery when not in use to contain all oil that might be leaking from these equipments. • Should it be necessary to wash equipment this should be done at an area properly suited and prepared to receive and contain polluted water. • Ensure that surface water accumulating on-site are channeled and captured through a proper storm water management system to be treated in an appropriate manner before disposal into the environment. • Disposal of waste from the various activities such as workshops should be disposed of properly at the designated landfill. • Prevent fuel spills: look at work practices, staff training, equipment and storage. • Consider the use of environmentally friendly degreasers for washing and cleaning. • In the instance of an accidental fuel spill, the effluent should be contained as far as possible.
Fauna and flora	• Prevent personnel from collecting wood, veld food, hunting etc. during the operational phase.

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
	• Plant local indigenous species (on or off site) of flora in lieu of any loss of vegetation as a result of the operations.
Sewage	• Discharge of wastewater into the environment is prohibited. • The septic tank system shall be kept in a good state of repair at all times. • Seepage of the septic tank into the underground should be avoided at all costs. • Obtain relevant permits for the installation of septic tank system. • In the instance that they become full, effluent should be disposed off at a proper sewage works e.g. Karibib Town Council Wastewater Works. • Official arrangements to that effect should be in place (in writing).
Visual and Sense of Place	• The structures on the site have to be aesthetically pleasing and designed to blend in with the natural surrounds. • It is recommended that more 'green' technologies be implemented within the architectural designs and building materials of the structures where possible in order to minimise the visual prominence of such a development within the more natural surrounding landscape. • Natural colours and building materials such as wood and stone should be incorporated as well as the use of indigenous vegetation in order to beautify the development.
Archaeology and Heritage	• The proponent or PR should promptly report any archaeological or heritage finds to the relevant authorities such as the National Heritage Council.
Health, Safety and Security	• Clearly demarcate and fence off the operational area to prevent unwanted movement of people and animals into the site. • Ensure operations are carried out within the authorised boundaries. • Ensure that all personnel are properly trained depending on the nature of their work. • Provide for a first aid kit and a properly trained person to apply first aid when necessary.

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
	• A wellness program should be initiated to raise awareness on health issues, especially the impact of sexually transmitted diseases. • Provide free condoms in the workplace. • Facilitate access to Antiretroviral medication. • Adhere to the existing protocols in terms of Covid-19. • Restrict unauthorised access to the site and implement access control measures • Clearly demarcate the construction site boundaries along with signage of "no unauthorised access". • Clearly demarcate dangerous areas and no go areas on site. • Staff and visitors to the site must be fully aware of all health and safety measures and emergency procedures. • The proponent must comply with all applicable occupational health and safety requirements. • The workforce should be provided with all necessary Personal Protective Equipment where appropriate, especially dust masks and ear plugs/muffs.
Social	• Ensure locals enjoy priority in terms of job opportunities for skills that are available locally, to the extent possible. • Ensure local procurement where commodities are available locally.
Traffic	• Limit and control the number of access points to the site. • Consider the construction of slip lanes from Park Street onto the site from both directions, to minimise road congestion and accidents. • Ensure that road junctions have good sightlines. • Operational vehicles need to be in a road worthy condition and maintained all the time. • Transport the materials in the least amount of trips as possible.

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
	• Adhere to the speed limit. • Implement traffic control measures where necessary. • Minimise the movement of heavy vehicles during peak time.
Noise	• Limit the types of activities that generate excessive noise within the site. • Noise levels should not exceed 85 dB, where possible. • All areas where noise levels are above 85 dB should be managed and controlled in accordance with the relevant guidelines. • Continuous monitoring of noise levels should be conducted to make sure the noise levels do not exceed acceptable limits. • Maintain equipment used during the operation and keep them in a good state such that they do not emit excessive noise.
Air quality and dust	• Manage activities that generate emissions. • Ensure emissions from any activity within the site are within the World Health Organisation (WHO) Air Quality Guidelines. • Perform regular airborne dust sampling. • Ensure fugitive dust does not exceed applicable limits. • Consider the application of dust suppressants such as Dustex to minimise dust from getting airborne. • Restrict speed of vehicles moving around the site. • Construction vehicles to only use designated roads. • During high wind conditions the PR must make the decision to cease works until the wind has calmed down. • Prevent overloading of vehicles.

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
	• Provide dust masks and relevant PPE to workers and everybody in the operational area. • Carry out pre and regular testing of workers for effects of exposure to dust emissions at recognised health facilities.
Solid Waste	• Adopt the Waste Management Hierarchy i.e. prevention, minimisation, reuse, recycling, energy recovery, and disposal. • Avoid burning waste. • Place separate bins to segregate and collect various types of waste e.g. paper, plastics, cans, metal, hazardous waste. • Arrange with waste contractor such as Rent-A-Drum or the Town Council for the collection of the waste. Hazardous waste to be disposed off at the designated landfill in Walvis Bay or Windhoek. • A sufficient number of waste bins should be placed around the site for the soft refuse. • A sufficient number of skip containers for the heavy waste and rubble should be provided for around the site. • Solid waste will be collected and disposed off at the designated local landfill in Karibib, in consultation with the local authority.
Existing service infrastructure	• Connections to the existing bulk infrastructure should be carried out by properly qualified professionals. • Water saving mechanisms should be incorporated within the operations on the site. • Re-use of treated waste water should be considered wherever possible to reduce the consumption of potable water. • Adhere to water quality guidelines in terms of The Water Act, 1956.

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
Hazardous Substances	• All chemicals and other hazardous substances must be stored and maintained in accordance with the Hazardous Substances Ordinance (No. 14 of 1974), with all relevant licences and permits to be obtained where applicable. • Given the potential harm to human health during handling and use of any of hazardous substances it is essential that all staff be trained with regards to the proper handling of these substances as well as First Aid in the case of spillage or intoxication. • Storage areas for all substances should be bunded and capable to hold 120% of the total volume of a given substance stored on site.
EMP training	• All employees, including all contractors, appointed for maintenance work on the respective infrastructure and their employees must be made aware of necessary health, safety and environmental considerations applicable to their respective work. • Records of environmental training and incidents should be maintained.
Monitoring	• An Environmental Control Officer should monitor the implementation of the EMP. • The Environmental Control Officer should inspect the site on a regular basis (preferably monthly or bi-monthly). • Biannual reports are to be submitted to the Ministry of Environment, Forestry and Tourism. • The above functions may be outsourced to an Independent Environmental Practitioner.

9.3 DECOMMISSIONING PHASE

The objective for closure, decommissioning and rehabilitation is to ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform that is consistent with the surrounding landscape and other environmental values.

While the management hopes for a prolonged lifespan of the development a number of factors may influence the possibility of closing the operations, these could be amongst others:

- exhaustion of the resource;
- economic, such as low commodity prices or high costs;
- geological, such as unanticipated decrease in grade or size of the ore body;
- technical, such as adverse geotechnical conditions or mechanical/equipment failure;
- social or community pressures; and
- closure of downstream industry or markets.

Adequate closure planning is therefore imperative to ensure that SAR and its key stakeholders are fully aware of the requirements of closure and that appropriate provisions are made to ensure that decommissioning and rehabilitation is completed to agreed objectives.

While effective methodologies for site closure are still developing, it is generally accepted that the earlier planning commences for site closure, the greater the chance of success.

If the area in question is not appropriately closed, decommissioned and rehabilitated, the following potential impacts may occur:

- unstable and unsafe post-operational landforms from physical, geochemical and ecological perspectives;
- contamination of surrounding groundwater, surface water or soil;
- poor visual amenity and landscape value;
- loss of socio-economic benefits, for example post-operational land use is adversely affected by any of the above impacts;
- community and stakeholder dissatisfaction; and
- insufficient allocation of funds/resources for closure, particularly in the event of unforeseen or sudden closure.

SAR should develop a Closure Management Plan to include as a minimum the actions delineated in table **Table 9-2** below:

Table 9-2: Decommissioning phase management actions

Environmental Feature	Management Actions
Waste landforms	• Blended with surrounding topography, concave slopes, progressive shaping and revegetation, • Development and satisfaction of agreed completion criteria.
Processing plant and supporting infrastructure	• Removal of equipment, • Removal of buildings, • Cleanup of any contamination, • Landscaping, • Revegetation
Roads and other infrastructure	• Removal of buildings and power lines, • Ripping and revegetation of unwanted roads, • Rehabilitation of waste and sewage facilities.

The Closure Management Plan will be reviewed every two years to incorporate changes to the disturbance footprint, progressive rehabilitation, legislative requirements, technical improvements, cost increases, changes to the needs of stakeholders and changes to environmental practice techniques.

10 REFERENCE

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Appendix A – Water Quality Guidelines

THE WATER ACT, 1956 (ACT 54 OF 1956) AND ITS REQUIREMENTS IN TERMS OF WATER SUPPLIES FOR DRINKING WATER AND FOR WASTE WATER TREATMENT AND DISCHARGE INTO THE ENVIRONMENT

1. INTRODUCTION

The provisions of the Water Act are intended, amongst other things, to promote the maximum beneficial use of the country's water supplies and to safeguard water supplies from avoidable pollution.

The drinking water guidelines are not standards as no publication in the Government Gazette of Namibia exists to that effect. However the Cabinet of the Transitional Government for National Unity adopted the existing South African Guidelines (461/85) and the guidelines took effect from 1April 1988 under the signature of the then Secretary for Water Affairs.

The sections of the Water Act that relate to the discharge of industrial effluents are:
- Section 21(1) which states that
-- The purification of waste water shall form an integral part of water usage and
-- that purified effluents shall comply with the General Standard Quality restrictions as laid out in Government Gazette R553 of 5 April 1962 and
- Section 21(2) which further stipulate that this purified effluent be returned as close as possible to the point of abstraction of the original water.
Where a local authority has undertaken the duty of disposing of all effluents from an industrial process the provisions of Section 21(1) and 21(2) apply to the local authority and not the producer of the effluents. If there is difficulty in complying with these provisions then the applicant may apply for an exemption from the conditions in terms of Section 21(5) and 22(2) of the Water Act. The Permanent Secretary after consultation with the Minister may grant the issuance of a Waste Water Discharge Permit under Sections 21(5) and 22(2) subject to such conditions as he may deem fit to impose.

After independence, the Government of the Republic of Namibia decided that for the interim the existing guidelines will continue to be valid and to remain in use until a proper study has been conducted and new standards have been formulated (Article 140 of Act 1 of 1990).

2. GUIDELINES FOR THE EVALUATION OF DRINKING-WATER QUALITY FOR HUMAN CONSUMPTION WITH REGARD TO CHEMICAL, PHYSICAL AND BACTERIOLOGICAL QUALITY

Water supplied for human consumption must comply with the officially approved guidelines for drinking-water quality. For practical reasons the approved guidelines have been divided into three basic groups of determinants, namely:

- Determinants with aesthetic / physical implications: TABLE 1.
- Inorganic determinants: TABLE 2.
- Bacteriological determinants: TABLE 3.

2.1 CLASSIFICATION OF WATER QUALITY

The concentration of and limits for the aesthetic, physical and inorganic determinants define the group into which water will be classified. See TABLES 1 and 2 for these limits. The water quality has been grouped into 4 quality classes:

- Group A: Water with an excellent quality
- Group B: Water with acceptable quality
- Group C: Water with low health risk
- Group D: Water with a high health risk, or water unsuitable for human consumption.

Water should ideally be of excellent quality (Group A) or acceptable quality (Group B), however in practice many of the determinants may fall outside the limits for these groups.
If water is classified as having a low health risk (Group C), attention should be given to this problem, although the situation is often not critical as yet.
If water is classified as having a higher health risk (Group D), urgent and immediate attention should be given to this matter.

Since the limits are defined on the basis of average lifelong consumption, short-term exposure to determinants exceeding their limits is not necessarily critical, but in the case of toxic substances, such as cyanide, remedial measures should immediately be taken.

The overall quality group, into which water is classified, is determined by the determinant that complies the least with the guidelines for the quality of drinking water.

TABLE 1: DETERMINANTS WITH AESTHETIC / PHYSICAL IMPLICATIONS

DETERMINANTS	UNITS*	LIMITS FOR GROUPS			
		A	B	C	D**
Colour	mg/l Pt***	20			
Conductivity	mS/m !at 25 °C	150	300	400	400
Total hardness	mg/l $CaCO_3$	300	650	1300	1300
Turbidity	N.T.U****	1	5	10	10
Chloride	mg/l Cl	250	600	1200	1200
Chlorine (free)	mg/l Cl	0,1- 5,0	0,1 – 5,0	0,1 – 5,0	5,0
Fluoride	mg/l F	1,5	2,0	3,0	3,0
Sulphate	mg/l SO_4	200	600	1200	1200
Copper	µg/l Cu	500	1000	2000	2000
Nitrate	mg/l N	10	20	40	40
Hydrogen Sulphide	µg/l H_2S	100	300	600	600
Iron	µg/l Fe	100	1000	2000	2000
Manganese	µg/l Mn	50	1000	2000	2000
Zink	mg/l Zn	1	5	10	10
pH****	pH-unit	6,0 – 9,0	5,5 – 9,5	4,0 – 11,0	4,0 – 11,0

* In this and all following tables “l” (lower case L in ARIAL) is used to denote dm^3 or litre
** All values greater than the figure indicated.
*** Pt = Platinum Units
**** Nephelometric Turbidity Units
***** The pH limits of each group exclude the limits of the previous group

TABLE 2: INORGANIC DETERMINANTS

DETERMINANTS	UNITS	LIMITS FOR GROUPS			
		A	B	C	D*
Aluminium	µg/l Al	150	500	1000	1000
Ammonia	mg/l N	1	2	4	4
Antimonia	µg/l Sb	50	100	200	200
Arsenic	µg/l As	100	300	600	600
Barium	µg/l Ba	500	1000	2000	2000
Beryllium	µg/l Be	2	5	10	10
Bismuth	µg/l Bi	250	500	1000	1000
Boron	µg/l B	500	2000	4000	4000
Bromine	µg/l Br	1000	3000	6000	6000
Cadmium	µg/l Cd	10	20	40	40
Calcium	mg/l Ca	150	200	400	400
Calcium	mg/l $CaCO_3$	375	500	1000	1000
Cerium	µg/l Ce	1000	2000	4000	4000
Chromium	µg/l Cr	100	200	400	400
Cobalt	µg/l Co	250	500	1000	1000
Cyanide (free)	µg/l CN	200	300	600	600
Gold	µg/l Au	2	5	10	10
Iodine	µg/l I	500	1000	2000	2000
Lead	µg/l Pb	50	100	200	200
Lithium	µg/l Li	2500	5000	10000	10000
Magnesium	mg/l Mg	70	100	200	200
Magnesium	mg/l $CaCO_3$	290	420	840	840
Mercury	µg/l Hg	5	10	20	20
Molybdenum	µg/l Mo	50	100	200	200
Nickel	µg/l Ni	250	500	1000	1000
Phosphate	mg/l P	1	See note below	See note below	See note below
Potassium	mg/l K	200	400	800	800
Selenium	µg/l Se	20	50	100	100
Silver	µg/l Ag	20	50	100	100
Sodium	mg/l Na	100	400	800	800
Tellurium	µg/l Te	2	5	10	10
Thallium	µg/l Tl	5	10	20	20
Tin	µg/l Sn	100	200	400	400
Titanium	µg/l Ti	100	500	1000	1000
Tungsten	µg/l W	100	500	1000	1000
Uranium	µg/l U	1000	4000	8000	8000
Vanadium	µg/l V	250	500	1000	1000

* All values greater than the figure indicated.

Note FOR Table 2 on phosphate: Phospates are not toxic and essential for all life-forms. Natural water will, however, seldom contain phosphate; it is generally seen as an indicator of pollution and is usually accompanied by other pollutants. Wherever drinking water is combined with or consists wholly of reclaimed or recycled water, it may be expected to contain phosphate. The general guideline for a concentration level to be aimed at is 1 mg/l as P. But in many cases this may be difficult to achieve technically. For this reason the Department will allow a phosphate concentration level of up to 5 mg/l as P in water intended for human consumption. Please refer also to the "Note on Phosphate" under Section 3: General Standards for Waste/Effluent.

2.2 BACTERIOLOGICAL DETERMINANTS

The bacteriological quality of drinking water is also divided into four groups, namely:

- Group A: Water which is bacteriological very safe;
- Group B: Water which is bacteriological still suitable for human consumption;
- Group C: Water which is bacteriological risk for human consumption, which requires immediate action for rectification;
- Group D: Water, which is bacteriological unsuitable for human consumption.

TABLE 3: BACTERIOLOGICAL DETERMINANTS

DETERMINANTS	LIMITS FOR GROUPS			
	A**	B**	C	D*
Standard plate counts per 1 ml	100	1000	10000	10000
Total coliform counts per 100 ml	0	10	100	100
Faecal coliform counts per 100 ml	0	5	50	50
E. coli counts per 100 ml	0	0	10	10

* All values greater than the figure indicated.
** In 95% of the samples.

NB If the guidelines in group A are exceeded, a follow-up sample should be analysed as soon as possible.

2.3 FREQUENCY FOR BACTERIOLOGICAL ANALYSIS OF DRINKING-WATER SUPPLIES

The recommended frequency for bacteriological analysis of drinking water is given in Table 4.

TABLE 4: FREQUENCY FOR BACTERIOLOGICAL ANALYSIS

POPULATION SERVED	MINIMUM FREQUENCY OF SAMPLING
More than 100 000	Twice a week
50 000 – 100 000	Once a week
10 000 – 50 000	Once a month
Minimum analysis	Once every three months

3 GENERAL STANDARDS FOR WASTE / EFFLUENT WATER DISCHARGE INTO THE ENVIRONMENT

All applications in terms of Section 21(5) and 22(2), for compliance with the requirements of Section 21(1) and 21(2) of the Water Act (Act 54 of 1956) that purified water shall comply with the General Standard as laid out in Government Gazette Regulation R553 of 5 April 1962.

TABLE 5 GENERAL STANDARDS FOR ARTICLE 21 PERMITS (EFFLUENTS)

DETERMINANTS	MAXIMUM ALLOWABLE LEVELS
Arsenic	0,5 mg/l as As
Biological Oxygen Demand (BOD)	no value given
Boron	1,0 mg/l as B
Chemical Oxygen Demand (COD)	75 mg / l as O
Chlorine, residual	0,1 mg/l as Cl_2
Chromium, hexavalent	50 µg/l as Cr(VI)
Chromium, total	500 µg/l as Cr
Copper	1,0 mg/l as Cu
Cyanide	500 µg/l as CN
Oxygen, Dissolved (DO)	at least 75% saturation**
Detergents, Surfactants, Tensides	0,5 mg/l as MBAS – See also Note 2
Fats, Oil & Grease (FOG)	2,5 mg/l (!gravimetric method)
Fluoride	1,0 mg/l as F
Free & Saline Ammonia	10 mg/l as N
Lead	1,0 mg/l as Pb
Oxygen, Absorbed (OA)	10 mg / l as O*
pH	5,5 – 9,5
Phenolic Compounds	100 µg/l as phenol
Phosphate	1,0 mg/l as P - See also Note 1
Sodium	not more than 90 mg/l Na more than influent
Sulphide	1,0 mg/l as S
Temperature	35°C
Total Dissolved Solids (TDS)	not more than 500 mg /l more than influent
Total Suspended Solids (TSS)	25 mg/l
Typical faecal Coli.	no typical coli should be counted per 100 ml
Zinc	5,0 mg/l as Zn

* Also known as *Permanganate Value* (or *PV*).
** In Windhoek the saturation level is at approx. 9 mg/l O_2.

Note (1) on phosphate: Phospates are not toxic and essential for all life forms. Natural water will seldom contain phosphate; it is generally seen as an indicator of pollution and is usually accompanied by other pollutants. Wherever drinking water is combined with or consists wholly of reclaimed or recycled water, it may be expected to contain phosphate. There is no general guideline for phosphate contained in the Regulation 553. But generally it is assumed that eutrophication or algal bloom in dams is promoted by nutrient concentrations as low as 0,01 mg/l as P; generally a phosphate concentration limit for dams of 0,1 mg/l is recommended. All water that is consumed and subsequently discharged, will eventually end up in rivers, dams or

groundwater – that is why for potable water, a concentration level of 1 mg/l as P is aimed at.
But, again, in many cases of waste and effluent treatment, this may be difficult to achieve technically, or the required waste and effluent treatment infrastructure is not available; as the required infrastructure is sophisticated and expensive. The current situation calls for a compromise and for this reason, this Department will judge each application individually on its merits and allow, in certain cases, a phosphate concentration level of up to 15 mg/l as P in any effluent or waste stream to be discharged into the environment. This regulation is subject to be reviewed every two years, calculated from the date of approval of this document.

Note (2) on detergents, surfactants and ten sides: The MBAS (or methylene blue active substances) – test does not encompass all surface active compounds currently, commercially available. The limit given is therefore only a guideline. Many of the cleaning agents are toxic to biological life-forms in rivers and dams.
It should be taken into consideration that some commercial products interfere with the effective removal of oil, fat and grease by grease and fat traps, by breaking up such long-chain molecules into shorter ones. These cleaning agents thus effectively allow such components to pass through the traps and land into sections of a treatment plant further down the line and interfere with the process there.
Many cleaning agents contain very powerful disinfectants, and/or biocides. Such substances may interact with biological treatment processes. They may reduce the effectiveness of such treatment or 'kill' it completely, if they land in septic tanks, biofilters or even activate-sludge plants. Their activity may be attenuated by dilution.

4. AUTHORIZATION

Herewith, the Guidelines for the Evaluation of Drinking Water for Human Consumption with regard to Chemical, Physical and Bacteriological Quality, as well as the General Standards for Article 21* Permits, amended for detergents, surfactants, ten sides, as well as phosphates, are confirmed and remain in force until further notice.

Issued under my hand with the authority vested in my office, within the Ministry for Agriculture, Water and Rural Development,

PERMANENT SECRETARY
Dr V Shivute

WINDHOEK, **DATE STAMP**