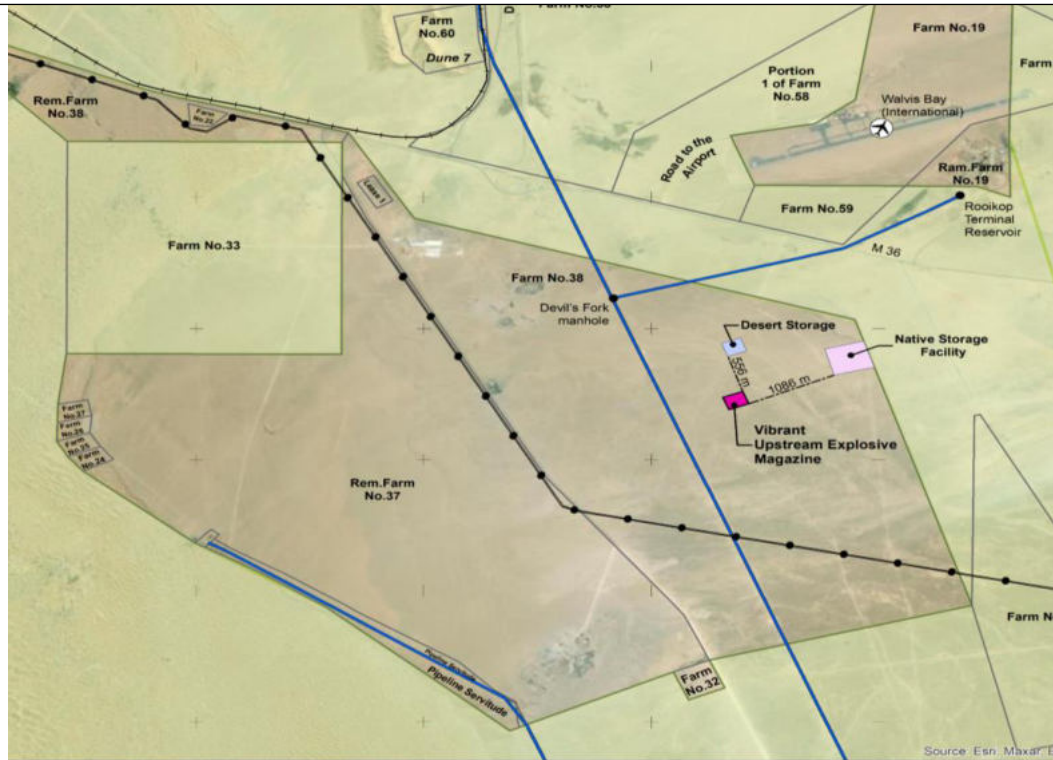


2024

ENVIRONMENTAL MANAGEMENT PLAN

Proposed Construction of a Dangerous Goods Storage Facility on Lease No.22 Over Farm No. 38, Walvis Bay, Erongo Region



Environmental Management Plan

PROJECT DETAILS

PROPONENT

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ABBREVIATIONS

AIDS	Acquired Immuno-Deficiency Syndrome
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
NHC	National Heritage Council
PR	Proponent's Representative
Reg.	Regulation
S	Section
TB	Tuberculosis

1 INTRODUCTION

VUS (Vibrant Upstream Services Pty Ltd) is a wholly owned Namibian company that specializes in oil and gas infrastructure development. It provides support services for the Upstream Oil and Gas industry. The company is also committed to developing the capacity of Namibian businesses and individuals throughout its operations in order to enhance local content.

VUS aims to fill the gaps in the local industry and ensure their clients receive world class services by partnering with international market leaders in dangerous goods storage facilities, oil and gas services, and enhancing Namibian and African competence.

As part of its upstream oil and gas service offering, VUS provides:

- The storage and warehousing of goods;
- Licenses and permits for oilfield service companies and dangerous goods storage companies;
- Maritime services;
- Customs clearance and logistics;
- Providing tubular services, fabrications, and engineering,
- The provision of manpower, training, and development.

Walvis Bay is becoming the centre for Namibian dangerous goods storage, so many resources, especially financial, will be channelled to Walvis Bay in order to bolster the industry. For the swift and efficient service of their clients, VUS has identified the need to set up operations in Walvis Bay. Hence, they have applied to the Municipality of Walvis Bay for access to land for the construction of storage and handling facilities for dangerous goods. Explosives and radioactive materials used in the oil and gas sector make up most of the dangerous goods.

The proponent appointed Environam Consultants Trading cc (ECT) to undertake the Environmental Assessment (EA) in order to obtain an Environmental Clearance Certificate (ECC) for the activity from the Office of the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism (MEFT).

The process will be undertaken in terms of the gazetted Namibian Government Notice No. 30 Environmental Impact Assessment Regulations (herein referred to as EIA Regulations) of the Environmental Management Act (No 7 of 2007) (herein referred to as the EMA). The EIA process will investigate if there are any potential significant bio-physical and socio-economic impacts associated with the proposed development and related infrastructure and services.

The EIA process would also provide an opportunity for the public and key stakeholders to provide comments and participate in the process. It will also serve the purpose of informing

the proponent's decision-making, and that of MEFT.

An EMP is one of the most important outputs of the EIA process as it synthesises all of the proposed mitigation and monitoring actions, set to a timeline and with specific assigned responsibilities. This EMP details the mitigation and monitoring actions to be implemented during the following phases of this development:

- Planning and Design - the period, prior to construction, during which preliminary legislative and administrative arrangements, necessary for the preparation of the land, are made and engineering designs are carried out. The preparation of construction tender documents forms part of this phase;
- Construction - the period during which the proponent, having dealt with the necessary legislative and administrative arrangements, appoints a contractor for the construction of services infrastructure, buildings as well as any other construction process(s) within the development areas;
- Operation and Maintenance - the period during which the development will be fully functional, operational and maintained.
- Decommissioning - the period at which activities on site have reached the end of economic viability and closure is imminent.

2 ROLES AND RESPONSIBILITIES

Vibrant Upstream (Pty) Ltd (the Proponent) is ultimately responsible for the implementation of the EMP, from the planning and design phase to the decommissioning phase of this development, if the development is in future decommissioned. The Proponent will delegate this responsibility as the project progresses 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 (Construction, Operations and Maintenance, and Decommissioning).

2.1 PROPONENT’S REPRESENTATIVE

The Proponent should assign the responsibility of managing all aspects of this development for all development phases (including all contracts for work outsourced) to a designated member of staff, referred to in this EMP as the Proponent’s Representative (PR). The Proponent may decide to assign this role to one person for the full duration of the development, or may assign a different PR to each of the development phases - i.e., one for the planning and design phase, one for the construction phase and one for the operation and maintenance phase. The PR’s responsibilities are depicted in **Table 1** as follows:

Table 1: PR’s responsibilities

Responsibility	Project Phase
Making sure that the necessary approvals and permissions laid out in Table 2 are obtained/adhered to	Throughout the lifecycle of this development
Making sure that the relevant provisions detailed in Table 3 are addressed during planning and design phase.	Planning and design phase
Suspending/evicting individuals and/or equipment not complying with the EMP	<ul style="list-style-type: none"> • Construction • Operation and maintenance • Decommissioning
Issuing fines for contravening EMP provisions	<ul style="list-style-type: none"> • Construction • Operation and maintenance • Decommissioning

2.2 ENVIRONMENTAL CONTROL OFFICER

The PR should assign the responsibility of overseeing the implementation of the whole EMP on the ground during the construction and operation and maintenance phases to a designated member of staff, referred to in this EMP as the Environmental Control Officer (ECO). The PR/Proponent may decide to assign this role to one person for both phases, or may assign a different ECO for each phase. During the operation phase the Proponent may outsource the monitoring and evaluation of the EMP to an independent Environmental Consultant. The ECO will have the following responsibilities during the construction and operation and maintenance phases of these developments:

- Management and facilitation of communication between the Proponent, PR, the contractors, and Interested and Affected Parties (I&APs) with regard to this EMP;

- Conducting site inspections (recommended minimum frequency is monthly) of all construction and/or infrastructure maintenance areas with respect to the implementation of this EMP (monitor and audit the implementation of the EMP);
- Assisting the Contractor 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; and
- Undertaking an annual review of the EMP and recommending additions and/or changes to this document.

2.3 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 4** applies to contractors appointed during the construction phase and **Table 5** to those 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 construction, operation and maintenance work.

The tables in Chapter 5 detail the management measures associated with the roles and responsibilities that have been laid out in this chapter.

3 ASSUMPTIONS AND LIMITATIONS

This EMP has been drafted based on the scoping-level Environmental Impact Assessment (EIA) conducted for the proposed development as represented by the Proponent. ECT will not be held responsible for the potential consequences that may result from any alteration to the initial layout.

It is assumed that construction labourers will be sourced mostly from the Walvis Bay area and that migrant labourers (if applicable) will be housed within the Townlands of Walvis Bay.

4 APPLICABLE LEGISLATION

Legal provisions that have relevance to various aspects of this development are listed in **Table 2** below. The legal instrument and applicable corresponding provisions are provided.

Table 2: Legal provisions relevant to this development

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
The Constitution of the Republic of Namibia as Amended	<p>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.”</p> <p>Article 95(l) deals with the “maintenance of ecosystems, essential ecological processes and biological diversity” and sustainable use of the country’s natural resources.</p>	Sustainable development should be at the forefront of this development.
Environmental Management Act No. 7 of 2007 (EMA)	<p>Section 2 outlines the objective of the Act and the means to achieve that.</p> <p>Section 3 details the principle of Environmental Management</p>	The development should be informed by the EMA.
EA Regulations GN 28, 29, and 30 of EMA (2012)	<p>GN 29 Identifies and lists certain activities that cannot be undertaken without an environmental clearance certificate.</p> <p>GN 30 provides the regulations governing the environmental assessment (EA) process.</p>	<p>Activity 9.1 The manufacturing, storage, handling or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974;</p> <p>Activity 9.2 Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.</p>
Explosives Act 1956 (Act 26 of 1956) and the Explosives Regulations, 1972 (GNR1604 of 8 September 1972)	Regulation 7.2.2 of the Regulations and Sections 22 and 30(1) of the Act stipulates that no explosives magazine may be constructed without approval of the plans by the Chief Inspector of Explosives.	Relevant plans must be submitted and approved before construction.
Atomic Energy & Radiation Act 5 of 2005	Sections 16, 18 and 19 deal with the licencing and registration of persons involved in storage of radiation sources.	The development should adhere to this legislation.
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	Part 1, Stage 8 of the guidelines states that if a proposal is likely to affect people, certain guidelines	The EA process should incorporate the aspects outlined in the guidelines.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
EAs and compiling EMPs (2008)	should be considered by the proponent in the scoping process.	
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 Resources Management Act 11 of 2013.	A permit application in terms of Sections 72(1) of the Water Act is required for the disposal of industrial or domestic waste water and effluent.	The pollution of water resources should be avoided during construction and operation of the development.
The Ministry of Environment, Forestry and Tourism (MEFT) Policy on HIV & AIDS	MEFT has 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/s have to adhere to the guidelines provided to manage the aspects of HIV/AIDS. Experience with construction projects has shown that a significant risk is created when construction workers interact with local communities.
Urban and Regional Planning Act (Act of 2018).	Urban and Regional Planning Act (Act of 2018) regulates subdivisions of portions of land falling within a proclaimed Local Authority area.	Section 16 of Chapter 3 deals with the Ministers' declaration of authorised planning authorities and establishment of joint committees.
Local Authorities Act No. 23 of 1992	The Local Authorities Act prescribes the manner in which a town or municipality should be managed by the Town or Municipal Council. Sections 34-47 make provision for the aspects of water and sewerage.	The development has to comply with the provisions of the Local Authorities Act.
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 Health Act no 36 of 1919	Section 119 prohibits persons from causing nuisance.	The developer and contractors are to comply with these legal requirements.
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	This Ordinance consolidates the laws relating to roads.	The provisions of this legislation have to be taken into consideration in as far as access to the development site is concerned.
Roads Authority Act, 1999	Section 16(5) of this Act places a duty on the Roads Authority to ensure a safe road system.	Some functions of the Roads Ordinance 17 of 1972 have been assigned to the Roads Authority.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
Walvis Bay Town Planning Scheme.	The town planning scheme has as its general purpose the co-ordinated and harmonious development of the local authority area, or the area or areas situate therein.	The site falls in the local authority area of Walvis Bay and has to conform to the Walvis Bay Town Planning Scheme.

5 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 them.

The following tables provide the management actions recommended to manage the potential impacts rated in the scoping-level EIA conducted for this development. These management actions have been organised temporally according to project phase:

- Planning and design phase management actions (**Table 3**);
- Construction phase management actions (**Table 4**);
- Operation and maintenance phase management actions (**Table 5**);
- Chemicals and reagents management actions (**Table 6**);
- Decommissioning management actions (**Table 7**).

The responsible persons at the Proponent's team have assessed these commitments in detail and have committed to the specific management actions were indicated in the tables below.

5.1 Planning and Design Phase

The PR should ensure that the management actions detailed below in **Table 3** are adhered to during the period before the construction of the infrastructure starts.

Table 3: Planning and design management actions

PLANNING AND DESIGN PHASE IMPACTS	
Impact	Mitigation Measures
Fauna and Flora	<ul style="list-style-type: none"> Adapt the proposed development to the local environment - e.g. small adjustments to the site layout to avoid potential features such as existing vegetation. Plant local indigenous species of flora as part of the landscaping as these species would require less maintenance than exotic species. Prevent the introduction of potentially invasive alien ornamental plant species such as; Lantana, Opuntia, Prosopis, Tecoma, etc. as part of the landscaping as these species could infestate the area further over time.
Existing Service Infrastructure	<ul style="list-style-type: none"> Ensure professional design and construction of service infrastructure from qualified and registered engineers. Ensure consultation and compliance with relevant authorities responsible for services, such as the Municipality, Erongo Red and Namwater. The contractor must determine exactly where services amenities and pipelines are situated before construction / maintenance commences (utility clearance e.g. ground penetrating radar surveys). Designs and building materials should be as such to reduce dependency on artificial heating and cooling in order to limit the overall energy demand. Water saving mechanisms should be incorporated within the proposed development's design and plans in order to further reduce water demands. Re-use of treated waste water should be considered wherever possible to reduce the consumption of potable water Train employees on the importance of water and energy savings. Adhere to water quality guidelines in terms of The Water Resource Management Act.
Safety Distances	<ul style="list-style-type: none"> Maintain safety distances between the magazine and other infrastructure, as well as other magazines in line with the table of distances as outlined in the Explosives Act 26 of 1956.
Traffic	<ul style="list-style-type: none"> Ensure that road junctions have good sightlines. Adhere to the speed limit. Implement traffic control measures where necessary. In cooperation with the local authority, erect clear signage regarding restricted areas and roads, access and exit points to the port, speed limits, traffic rules, rail level crossings, etc.

PLANNING AND DESIGN PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> If any extraordinary traffic impacts are expected, traffic management should be performed in conjunction with the local traffic department.
Radiation Management Plan	<ul style="list-style-type: none"> Ensure monitoring of the implementation of the Radiation Management Plan is carried out. This should be carried out by a competent person.

5.2 Construction Phase

The management actions listed in **Table 4** apply during the construction phase. This table may be used as a guide when developing EMPs for other construction activities within this development area.

Table 4: Construction phase management actions

CONSTRUCTION PHASE IMPACTS	
Impact	Mitigation Measures
Fauna and flora	<ul style="list-style-type: none"> Prevent contractors from collecting wood, veld food, etc. during the construction phase. Do not clear cut the entire development site, but rather keep the few individuals shrubs not directly affecting the development as part of the landscaping.
Pressure on Existing Infrastructure	<ul style="list-style-type: none"> Educate workforce on water saving measures. Ensure all potable water points are metered and regularly read. Ensure that the workforce is provided with temporary toilets during the construction phase.
Surface and Ground Water	<ul style="list-style-type: none"> It is recommended that construction takes place outside of the rainy season in order to limit flooding on site and to limit the risk of ground and surface water pollution. No dumping of waste products of any kind in or in close proximity to water bodies. Heavy construction vehicles should be kept out of any surface water bodies and the movement of construction vehicles should be limited where possible to the existing roads and tracks. Ensure that oil/ fuel spillages from construction vehicles and machinery are minimised and that where these occur, they are appropriately dealt with. Drip trays must be placed underneath construction vehicles when not in use to contain all oil and spillages that might be leaking from these vehicles. Contaminated runoff from the construction sites should be prevented from entering the surface and ground water bodies.

CONSTRUCTION PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> • All materials on the construction site should be properly stored. • Disposal of waste from the site should be properly managed and taken to the Walvis Bay landfill site. • Construction workers should be given ablution facilities at the construction site that are located at least 30 m away from any surface water and these should be regularly serviced. • Washing of personnel or any equipment should not be allowed on site. Should it be necessary to wash construction equipment this should be done at an area properly suited and prepared to receive and contain contaminated waters.
Health, Safety and Security	<ul style="list-style-type: none"> • Construction personnel should not overnight at the site, except for security personnel. • Ensure that all construction personnel are properly trained depending on the nature of their work. • Provide for a first aid kit and properly trained personnel to apply first aid when necessary. • A wellness program should be initiated to raise awareness on health issues, especially the impact of sexually transmitted diseases and Covid-19. • Provide free condoms in the workplace throughout the construction phase. • Facilitate access to Antiretroviral medication for construction personnel. • Conform to the stipulated protocols related to 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 contractor/s must comply with all applicable occupational health and safety requirements. The workforce should be provided with all necessary Personal Protective Equipment where appropriate.
Air quality	<ul style="list-style-type: none"> • All loose material should be kept on site for the shortest possible time. • It is recommended that dust suppressants such as Dustex be applied to all the construction clearing activities to minimise dust. • Construction vehicles to only use designated roads. • During high wind conditions the contractor must make the decision to cease works until the wind has calmed down. • Cover any stockpiles with plastic or any suitable material to minimise windblown dust. • Ensure construction vehicles are well maintained to prevent excessive emission of smoke.
Noise	<ul style="list-style-type: none"> • No amplified music should be allowed on site.

CONSTRUCTION PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> • Inform neighbouring communities and companies of construction activities to commence and provide for continuous communication between them and contractor. • Limit construction times to acceptable daylight hours. • Install technology such as silencers on construction machinery. • Do not allow the use of horns/hooters as a general communication tool, but use it only where necessary as a safety measure. • Provide protective equipment such as ear muffs, masks and ear plugs to workers.
Traffic	<ul style="list-style-type: none"> • Limit and control the number of access points to the site. • Ensure that road junctions have good sightlines. • Construction vehicles' need to be in a road worthy condition and maintained throughout the construction phase. • Transport the materials in the least number of trips as possible. • Adhere to the speed limit. • Implement traffic control measures where necessary. • Minimise the movement of heavy vehicles during peak time.
Waste Management	<ul style="list-style-type: none"> • It is recommended that waste from the temporary toilets be disposed of at the Walvis Bay Wastewater Treatment Works, on a regular basis. • 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. • The waste containers should be able to be closed to prevent birds and other animals from scavenging. • Solid waste will be collected and disposed of at an appropriate local landfill in Walvis Bay, in consultation with the local authority.
Hazardous Substances	<ul style="list-style-type: none"> • 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.

CONSTRUCTION PHASE IMPACTS	
Impact	Mitigation Measures
Social	<ul style="list-style-type: none"> • Ensure locals enjoy priority in terms of job opportunities, to the extent possible, for skills that are available locally. • Ensure local procurement where commodities are available locally.

5.3 Operation and Maintenance Phase

The management actions included in **Table 5** below apply during the operation and maintenance phase of this development.

Table 5: Operation and maintenance management actions

OPERATIONAL PHASE IMPACTS	
Impact	Mitigation Measures
Environmental monitoring and Evaluation	<ul style="list-style-type: none"> • An Environmental Practitioner should monitor the implementation of the EMP, and recommend any changes to this document when necessary. • The Environmental Practitioner should inspect the site on a regular basis (preferably monthly or bi-monthly). • Biannual reports are to be submitted to the Environmental Commissioner. • A competent person should monitor the implementation of the Radiation Management Plan. The monitoring report should be submitted to the NRPA.
Explosives Legislation	<ul style="list-style-type: none"> • Ensure compliance with the Explosives Act 1956 (Act 26 of 956) and its Explosives Regulations, 1972 as amended.
Surface and Ground Water	<ul style="list-style-type: none"> • Appoint professional engineers to develop a detailed storm water management design as part of the infrastructure service provision of the development. • The service infrastructure should be designed and constructed by suitably qualified engineering professionals. • Develop and implement a preventative maintenance plan for the service infrastructure. • No dumping of waste products of any kind in or in close proximity to any water bodies. • Ensure that surface water accumulating on-site are channelled and captured through a proper storm water management system to be treated in an appropriate manner before disposal into the environment. • Wastewater should not be discharged directly into the environment. • Ensure wastewater collected in septic tanks are not radioactive.

OPERATIONAL PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> • Ensure septic tank system is installed in accordance with statutory regulation. • Ensure proper containment is provided for septic tanks underground. • The wall and floor must be concrete slabs and ensure no seepage to the ground • Frequent monitoring to establish the level of waste water • Ensure frequent emptying to prevent overflow • Disposal of waste from the development should be properly managed. • Hazardous waste and contaminated water and soil must be disposed of at an appropriately classified facility or by approved contractors. Hazardous waste disposal certificates must be kept on file. • All hazardous substances must be stored in a properly bunded area to prevent any spillages from entering the surrounding environment. • Any fuel spillage of more than 200 litres must be reported to the Ministry of Mines and Energy. • Emergency response plans and spill contingency plans must be in place and include all fuels, chemicals or hazardous substances being handled. • All operational surfaces, chemical and fuel storage tanks must be installed with spill containment areas as per the relevant SANS standards (or better). • Proper monitoring of the product levels must take place to eliminate overfilling. • Ensure that any fuel and chemical products are contained in containment structures (e.g. plastic liners, drip trays etc.). • Avoid discharge of pollutants (such as cement, concrete, lime, chemicals, contaminated waste water or leachate) into stormwater channels and water courses. • Equipment and materials to deal with spill cleanup must be readily available on site and staff must be trained as to how to use the equipment and briefed about reporting procedures. • Develop and implement a groundwater monitoring system and programme, with the aim of monitoring possible contamination to the water resources. • Groundwater monitoring boreholes installed should be sampled and analysed periodically. • Regular tank and pipeline tightness inspections are advised to eliminate the risk of impact on the environment due to leakage. • The condition of the reticulation systems will have to be checked regularly and repaired to prevent leakages. • The presence of an emergency response plan and suitable equipment is advised, so as to react to any spillage or leakages properly and efficiently. • Ensure all stormwater drains or channels are clear of litter or obstructing material. • Remove all excess sedimentation, rubble and any other waste material present in the waterway and dispose of in a suitable manner to ensure proper drainage runoff.

OPERATIONAL PHASE IMPACTS

Impact	Mitigation Measures
Health, Safety and Security	<ul style="list-style-type: none"> • Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises. • Operators must be properly trained on safety and health issues of the project. • Well stocked first aid box which is readily available and accessible should be provided within premises. • Signs such as 'NO SMOKING' must be prominently displayed in parts where inflammable materials are stored on the premises. • Workers should be fully equipped with personal protective equipment gear. • Staff must be properly trained and made aware of all the MSDS (Material Safety Data Sheets) sheets of all chemicals on site. • In the event of a source damage or leaking the following actions shall be taken immediately: <ul style="list-style-type: none"> ○ Isolate area around the source to prevent the potential spread of contamination. ○ Inspect the area and confirm if there is any contamination. ○ Ensure that source is in a suitable container for storage until disposal arrangements can be implemented. ○ Re-inspect the area to ensure there has been no contamination. If contamination exists, the area needs to be clean before it is re-occupied. ○ Complete an incident notification form and report the accident to the NRPA.
Visual and Sense of Place	<ul style="list-style-type: none"> • It is recommended that more 'green' technologies be implemented within the architectural designs and building materials of the development 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.
Noise	<ul style="list-style-type: none"> • Follow Labour Act Regulations - Noise Regulations (Regulation 197), and / or WHO guidelines on maximum noise levels (Guidelines for Community Noise, 1999), to prevent hearing impairment for workers on site and a nuisance for neighbouring properties. • Minimize or prevent noise producing activities and plan to restrict these to daytime as far as practically possible. • All machinery must be regularly serviced to ensure minimal noise production. • The use of low frequency white noise or flashing lights should be considered instead of audible high frequency warning signals for moving forklifts or trucks. • Erect temporary or permanent noise barriers / sound baffles, should the need arise. • Placement of noise producing equipment, e.g. compressors, in such a way that noise is directed away from receptors and / or are attenuated. • Where possible, use infrastructure to act as noise barriers to sensitive environments. • Provide hearing protectors as standard PPE for workers in situations with elevated noise levels. • Delivery of fuel and chemical products by road tankers should be limited to normal working hours (07h00 to 19h00).

OPERATIONAL PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> • Loud music from vehicles / trucks frequenting the development should be restricted. • Maintain the grievance mechanism to capture public perceptions and complaints with regard to noise impacts, track investigation actions and introduce corrective measures for continuous improvement.
Waste management	<ul style="list-style-type: none"> • The area will be kept free of waste, except in designated waste storage areas. Any wastes distributed by winds will be regularly cleaned up. • Ensure that no excavated soil, refuse or building rubble generated on site are placed, dumped or deposited on adjacent/surrounding properties or land. • A sufficient number of weather- proof bins / containers 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 of at an appropriate local land fill. • Categorise waste into various types such as hazardous, general and recyclable. • Hazardous waste to be disposed of at the appropriate facilities of the Walvis Bay Municipality. • Hazardous waste storage is to be clearly marked to indicate the presence of hazardous substances, and the protocols associated with handling of such hazardous wastes shall be known by all relevant staff members. • Ablution facilities should be provided for by the contractor during this phase. No urinating outside these designated facilities. • Place priority on waste reduction, waste reuse and waste recycling, in that order. • Contamination of soil should be prevented through the use of containment areas as provided. • Any contaminated soil generated must be contained and bioremediated accordingly. • Each waste should be kept in a unique container at all times. Unidentified wastes must not, under any circumstances, be mixed with other wastes. • Potential spills of raw materials must be managed in accordance with the requirements of for that specific raw material. Each waste should be disposed of by an approved method. • All areas involving storage or use of oils and fuels must be banded. • Storm water spill (if any) and/or spills captured within the bund walls must be channeled and treated by an oil water separator. • All radioactive sources when no longer in use, will be returned to the manufacturer or supplier for final disposal by the respective client.
Transportation	<ul style="list-style-type: none"> • Radioactive sources will be transported to and from the storage facility by the respective clients.

OPERATIONAL PHASE IMPACTS	
Impact	Mitigation Measures
Social	<ul style="list-style-type: none"> • The proponent must employ local Namibians where possible. • If the skills exist locally, employees must first be sourced from the town, then the region and then nationally. • Deviations from this practice must be justified. • Local businesses and industries should be supported.
Air quality	<ul style="list-style-type: none"> • Manage activities that generate emissions or dust. • Minimise the movement of vehicles in the area. • The development needs to be controlled and managed as required by the Public Health Act (Act No. 36 of 1919) and Atmospheric Pollution Prevention Ordinance (No. 11 of 1976). • It is advised to pave the internal road network. • Provide for area air sampler(s) for monitoring dust for long-lived alpha and beta particles. This should be done weekly as part of the workplace monitoring programme. • All monitoring equipment should be calibrated at an approved metrology laboratory in accordance with a standard schedule and maintain calibration certificates for all equipment. • Vehicle idling time shall be minimised by putting up educative signs. • All venting systems and procedures have to be designed according to SANS standards (SANS 1929:2011) and placed in a sensible manner. • Vent pipes should be placed in such a manner as to prevent impact on potential receptors. Use vapour recovery equipment and techniques to avoid air pollution and minimise fuel loss.
Fire and Explosion	<ul style="list-style-type: none"> • Explosives are stored in dedicated explosive storage magazines separate from detonators, delays and detonating cord. • Magazines have been fitted with lightning protection and locks, and are surrounded by earthen bund walls within a secure compound. • Emergency response procedures should be in place so as to alert the employees on how to react to fire and explosions incidents. • An incident reporting procedure should also be implemented to make the employees aware of how, when and to whom to report fire and explosion incidents. • Regular inspections should be carried out to inspect and test fire fighting equipment and emergency response at the development. • Ensure sufficient water is available all the time for fire fighting purposes. • It is highly recommended that electrical wiring of the facility be installed and approved by a qualified electrician who will issue a Certificate of Compliance. • To handle a major fire for radioactive sources effectively, the following procedure will be followed:

OPERATIONAL PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> ○ Immediately call the Walvis Bay fire department. ○ Do not delay lifesaving actions. ○ The facility representative (RSO/ARSO, Consultant) are to assist Fire Department with facility specifications and radiation protection. Make sure they are aware where radioactive materials are stored as well as any precautions to avoid exposure or risk of creating or spreading radioactive contamination by use of high-pressure water, etc. ○ Consult with the Fire Department and set up a controlled area where the firefighters can be surveyed for contamination of their protective clothing and equipment after the fire is extinguished. ○ Once the fire is extinguished, advise the Fire Department not to enter potentially contaminated areas or areas where radioactive sources may be present until a thorough evaluation and survey are performed to determine the extent of the damage to the licensed material in use and in storage areas. ○ Perform thorough contamination surveys of the First Responders and their equipment before they leave the controlled area and decontaminate, if necessary. ○ Supervise decontamination activities. ○ Document incident. Determine cause and needed corrective actions. ○ Notify the National Radiation Protection Authority of the incident.

5.4 Decommissioning phase

The management actions included in **Table 7** below are applicable during the decommissioning phase.

Table 6: Proposed mitigation measures for the decommissioning phase

DECOMMISSIONING PHASE IMPACTS	
Impact	Mitigation Measures
General Guidelines	<ul style="list-style-type: none"> • Read safety data sheets (SDSs), equipment manuals, instrument instructions, standard operating procedures (SOPs) and any other pertinent documents in preparation for handling equipments. This will allow the user to be aware of the hazards associated with items being handled, packed, and moved. • Wear personal protective equipment (PPE) appropriate for the materials being handled. • Perform basic surface and visible decontamination of all spaces. This includes common areas such as stock rooms, waste collection areas, and equipment rooms. This also includes storage units such as freezers and refrigerators. • Perform basic surface and visible decontamination of all equipment. • A decommissioning Hazard Tag should be affixed to the equipment to be moved when decontamination is complete.
Fauna and flora	<ul style="list-style-type: none"> • Disturbance of areas outside the designated working zone is not allowed. • No vegetation should be removed outside the designated project area. • Prevent contractors from collecting wood, veld food, etc. during the decommissioning phase.
Surface and Ground Water Impacts	<ul style="list-style-type: none"> • Use drip trays, linings or concrete floors when evidence of leaks are observed on vehicles or equipment. • Prevent discharge of any pollutants, such as cements, concrete, lime, chemicals, and hydrocarbons in close proximity to water ways and bodies. • Decommissioning activities should be planned outside of the rainy season in order to limit the risk of ground and surface water pollution. • Contaminated runoff from the project site should be prevented from entering any water ways / bodies; and ground water bodies. • Existing ablution facilities at the project site should be used. No urinating outside these designated facilities will be allowed. • Waste disposal from the site should be properly managed and taken to the local disposal site. • Should it be necessary to wash equipment used during decommissioning activities, this should be done at an area properly suited and prepared to receive and contain contaminated waters.

DECOMMISSIONING PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> • An emergency plan should be in place on how to deal with spillages and leakages during this phase. • Proper environmental awareness and remedial response training of the decommissioning team must be conducted on a regular basis.
Health, Safety and Security	<ul style="list-style-type: none"> • Ensure that all construction personnel are properly trained depending on the nature of their work. • Sensitize operators of earthmoving equipment and tools to switch off engines of vehicles or machinery not being used. • Enforce the use of appropriate Personal Protective Equipment (PPE) for the right task or duties at all times. • All areas where radioactive materials were handled and stored (including equipment and machinery) shall be secured to prevent unauthorized entry and removal. • Provide for first aid kit and properly trained personnel to apply first aid when necessary. • A wellness program should be initiated to raise awareness on health issues, especially the impact of sexually transmitted diseases and Covid-19. • Provide free condoms in the workplace throughout the decommissioning phase. • Facilitate access to antiretroviral medication for construction personnel. • Conform to the stipulated protocols related to Covid-19. • Restrict unauthorized access to the site and implement access control measures. • Clearly demarcate the decommissioning site boundaries along with signage of no unauthorized access. • Clearly demarcate dangerous areas and no go areas on site. • Adequate lighting within and around the decommissioned location should be erected, when visibility becomes an issue. • Staff and visitors to the site must be fully aware of all health and safety measures and emergency procedures. • The contractor/s must comply with all applicable occupational health and safety requirements. The workforce should be provided with all necessary Personal Protective Equipment where appropriate. • Adhere to the Covid-19 protocols as and when they are applicable.
Traffic	<ul style="list-style-type: none"> • Limit and control the number of access points to the site. • Ensure that road junctions have good sightlines. • Construction vehicles and machinery must be tagged with reflective signs or tapes to maximise visibility and avoid accidents. • Construction vehicles need to be in a road worthy condition and maintained throughout the decommissioning phase. • Transport materials in the least number of trips as possible.

DECOMMISSIONING PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> Adhere to the speed limit. Implement traffic control measures where necessary. Construction vehicles should not be allowed to obstruct the C23 road, hence no stopping in the road, wholly or partially, but rather pull off the road or park on the roadside.
Noise	<ul style="list-style-type: none"> No amplified music should be allowed on site. Inform neighbouring communities of decommissioning activities to commence and provide for continuous communication between them and contractor. Limit decommissioning times to acceptable daylight hours. Install technology such as silencers on machinery utilised during decommissioning activities. Do not allow the use of horns/hooters as a general communication tool, but use it only where necessary as a safety measure. Provide protective equipment such as masks, ear muffs and ear plugs to workers.
Air quality	<ul style="list-style-type: none"> All loose material should be kept on site for the shortest possible time. It is recommended that dust suppressants such as Dustex be applied to all the decommissioning clearing activities to minimise dust. Construction vehicles to only use designated roads. During high wind conditions the contractor must make the decision to cease works until the wind has calmed down. Cover any stockpiles with plastic to minimise windblown dust. Ensure construction vehicles are well maintained to prevent excessive emission of smoke.
Waste management	<ul style="list-style-type: none"> 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. The waste containers should be able to be closed to prevent birds and other animals from scavenging. Solid waste will be collected and disposed of at an appropriate local disposal site in Walvis Bay, in consultation with the local authority. Regular inspection and housekeeping procedures should be maintained at all times.
Hazardous Substances	<ul style="list-style-type: none"> 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. Awareness of the hazardous nature of various types of waste should be enforced.

DECOMMISSIONING PHASE IMPACTS	
Impact	Mitigation Measures
	<ul style="list-style-type: none"> • 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.
Radioactive Materials	<ul style="list-style-type: none"> • Consult the Radiation Management Plan for more detailed guidance on handling, storage and disposal of radioactive waste. • Completely wipe down and decontaminate any equipment and other surfaces exposed to radioactive material with decontaminate cleanser. • Perform initial contamination swipe and survey testing in areas exposed to radioactive material as well as surrounding areas. • Final swipe tests should be performed by the NRPA to ensure levels of decontamination are in compliance with relevant regulations and guidelines. • Remove all radioactive labels, stickers, and tape from all facility equipment, refrigerators, sinks, and hoods after final swipe tests results.
Socio-economic	<ul style="list-style-type: none"> • Ensure locals enjoy priority in terms of job opportunities, to the extent possible, for skills that are available locally. • Ensure local procurement where commodities are available locally.

5.5 DECOMMISSIONING PHASE

The impacts associated with this phase will be similar to that of the construction phase. The Environmental Management Plan for this phase will have to be reviewed at the time of decommissioning to cater for changes made to the development.

5.6 CONCLUSION

All known environmental and social risks can be minimised and managed through implementing preventative measures and sound management systems. It is recommended that environmental performance be monitored regularly to ensure compliance and that corrective measures be taken if necessary. It is also recommended that this information be made available to the surrounding communities on a regular basis.

The Environmental Management Plan should be used as an on-site tool during all phases of the project.

Appendix A - Water Quality Guidelines

ANNEXURE

Water Quality Standards for Effluent

Effluent to be discharged or disposed of in areas with potential for drinking water source contamination; international rivers and dams and in water management and other areas				
			Special Standard	General Standard
DETERMINANTS	UNIT	FORMAT	95 percentile requirements	
PHYSICAL REQUIREMENTS				
Temperature	° C		Not more than 10°C higher than the recipient water body	
Turbidity	NTU		< 5	< 12
pH			6,5-9,5	6,5-9,5
Colour	mg/litre Pt		< 10	< 15
Smell			No offensive smell	
Electric conductivity 25 °C	mS/m		< 75 mS/m above the intake potable water quality	
Total Dissolved Solids	mg/litre		< 500 mg/litre above the intake potable water quality	
Total Suspended Solids	mg/litre		< 25	< 100
Dissolved oxygen	% saturation		>75	>75
Radioactivity	units		below ambient water quality of the recipient water body	
ORGANIC REQUIREMENTS				
Biological Oxygen Demand	mg/litre	BOD	< 10	< 30
Chemical Oxygen Demand	mg/litre	COD	< 45	< 100
Detergents (soap)	mg/litre		< 0.2	< 3
Fat, oil & grease, individual	mg/litre	FOG	nil	< 2.5
Phenolic compounds	µg/litre	as phenol	< 0.01	< 0.10
Aldehyde	µg/litre		< 50	< 100
Adsorbable Organic Halogen	µg/litre	AOX	< 50	< 100
INORGANIC MACRO DETERMINANTS				
Ammonia (NH ₄ – N)	mg/litre	N	< 1	< 10
Nitrate (NO ₃ - N)	mg/litre	N	< 15	< 20
Nitrite (NO ₂ - N)	mg/litre	N	< 2	< 3
Total Kjeldahl Nitrogen (TKN)	mg/litre	N	< 18	< 33
Chloride	mg/litre	Cl	< 40 mg/litre above the intake potable water quality	< 70 mg/litre above the intake potable water quality
Sodium	mg/litre	N	< 50 mg/litre above the intake potable water quality	<90 mg/litre above the intake potable water quality
Sulphate	mg/litre	SO ₄	< 20 mg/litre above the intake potable water quality	< 40 mg/litre above the intake potable water quality
Sulphide	µg/litre	S	< 0.05	< 0.5
Fluoride	mg/litre	F	1,0	2,0
Cyanide (Free)	µg/litre	CN	< 30	< 100
Cyanide (recoverable)	µg/litre	CN	< 70	< 200
Soluble Ortho phosphate	mg/litre	P	< 0.2	3,0
Zinc*	mg/litre	Zn	1	5

Effluent to be discharged or disposed of in areas with potential for drinking water source contamination; international rivers and dams and in water management and other areas				
			Special Standard	General Standard
DETERMINANTS	UNIT	FORMAT	95 percentile requirements	
INORGANIC MICRO DETERMINANTS				
Aluminium	µg/litre	Al	< 25	< 200
Antimony	µg/litre	Sb	< 5	< 50
Arsenic	µg/litre	As	< 50	< 150
Barium	µg/litre	Ba	< 50	< 200
Boron	µg/litre	B	< 500	< 1000
Cadmium*	µg/litre	Cd	< 5	< 50
Chromium, (hexavalent)	µg/litre	Cr	< 10	< 50
Chromium, Total*	µg/litre	Cr	< 50	< 1000
Copper*	µg/litre	Cu	< 500	< 2000
Iron	µg/litre	Fe	< 200	< 1000
Lead*	µg/litre	Pb	< 10	< 100
Manganese	µg/litre	Mn	< 100	< 400
Mercury*	µg/litre	Hg	< 1	< 2
Nickel	µg/litre	Ni	< 100	< 300
Selenium	µg/litre	Se	< 10	< 50
Strontium*	µg/litre	Sr	< 100	< 100
Thallium	µg/litre	Tl	< 5	< 10
Tin*	µg/litre	Sn	< 100	< 400
Titanium	µg/litre	Ti	< 100	< 300
Uranium*	µg/litre	U	< 15	< 500
*Total for Heavy Metals (Sum of Cd,Cr,Cu,Hg,Pb)	µg/litre	Cd,Cr,Cu, Hg & Pb	< 200	< 500
UNSPECIFIED COMPOUNDS FROM ANTHROPOGENIC ACTIVITIES				
Agricultural chemical compounds	µg/litre		Any in-/organic compound recognized as an agro-chemical is to be avoided or reduced as far as possible. Maximum acceptable contaminant levels will be site specific, dependent on chemical usage and based the water quality of the recipient water body	
Industrial and mining chemical compounds, including unlisted metals and persistent organic pollutants	µg/litre		Any in-/ organic compound recognized as an industrial chemical including unlisted metals is to be avoided or reduced as far as possible. Maximum acceptable contaminant levels will be site specific dependent on chemical usage and based the water quality of the recipient water body	
Endocrine Disruptive Compounds (EDC)	µg/litre		Any chemical compound that is suspected of having endocrine disruptive effects is to be avoided as far as is possible. Maximum acceptable contaminant levels will be site specific dependent on chemical usage and based the water quality of the recipient water body.	
Hydrocarbons (Benzene, Ethyl Benzene, Toluene and Xylene)	µg/litre		Below detection level	Below detection level
Organo-metallic compounds: methyl mercury, tributyl tin (TBT), etc.	µg/litre		Below detection level	Below detection level
DISINFECTION				
Residual chlorine	mg/litre		< 0.1 Dependent on recipient water body	< 0.3 Dependent on recipient water body

Effluent to be discharged or disposed of in areas with potential for drinking water source contamination; international rivers and dams and in water management and other areas				
			Special Standard	General Standard
DETERMINANTS	UNIT	FORMAT		
BIOLOGICAL REQUIREMENTS (Algae and parasites)				
Further treatment of the effluent dependent on: <ol style="list-style-type: none"> 1. the water quality of the recipient water body if any 2. the distance from any point of potable water abstraction 3. an acceptable maximum contaminant level downstream of the point of discharge 4. the exposure to human and animal consumption downstream of the point of discharge 5. any reuse option that may be implemented. 				
MICROBIOLOGY				
Further treatment of the effluent are dependent on: <ol style="list-style-type: none"> 1. the water quality of the recipient water body if any 2. the distance from any point of potable water abstraction 3. an acceptable maximum contaminant level downstream of the point of discharge 4. the exposure to human and animal consumption downstream of the point of discharge 5. any water reuse option that may be implemented. 				

ANNEXURE

Table 1. Water Quality Guidelines and Standards for Potable Water

Specifications for water quality intended for human consumption from the source and piped water supply					
Status				Ranges and upper limits	
Interpretation				(Ideal guideline)	(Acceptable Standard)
DETERMINANTS	Unit	Format	Concern	95 Percentile Requirement	
PHYSICAL AND ORGANOLEPTIC REQUIREMENTS					
Temperature	° C		E	Ambient temperature	
Colour	PTU	or mg/litre	E	10	<15
Taste			O,E	No objectionable taste	
Odour			O,E	No objectionable odour	
Turbidity (treated surface water)	NTU	or TU	H,I	< 0,3	< 0,5
Turbidity (groundwater)	NTU	or TU	H,I	< 0,5	<2
pH @ 20 °C	pH		I	6.0 to 8,5	6 to 9
Electric Conductivity @ 25 °C	mS/m***	E.C.	H,I	< 80	< 300
Total Dissolved Solids	mg/litre		H,I	< 500	< 2 000
INORGANIC MACRO DETERMINANTS					
Ammonia	mg/litre	N	H	< 0.2	< 0.5
Calcium	mg/litre	Ca	I	< 80	< 150
Chloride	mg/litre	Cl	H,I	< 100	< 300
Fluoride	mg/litre	F	H	< 0.7	< 2,0
Magnesium	mg/litre	Mg	H	< 30	< 70
Nitrate	mg/litre	N	H	< 6	< 11
Nitrite	mg/litre	NO ₂	H	< 0.2	< 0.5
Potassium	mg/litre	K	H	< 25	< 100
Sodium	mg/litre	Na	H,I	< 100	< 300
Sulphate	mg/litre	SO ₄	H,O	100	< 300
Asbestos (fibres longer than 10 µm)	Fibres/litre		H	<500 000	< 1000 000
INORGANIC MICRO DETERMINANTS					
Aluminium	µg/litre	Al	H	< 25	< 100
Antimony	µg/litre	Sb	H	< 5	< 50
Arsenic	µg/litre	As	H	<10	< 50
Barium	µg/litre	Ba	H	0,5	< 2
Beryllium	µg/litre	Be	H	< 2	< 5
Bismuth	µg/litre	Bi	H	< 250	< 500
Boron	µg/litre	B	H	< 300	< 500
Bromide	µg/litre	Br	H	< 500	< 1 000
Cadmium	µg/litre	Cd	H	< 5	< 10
Cerium	µg/litre	Ce	H	<1 000	<2 000
Cesium	µg/litre	Cs	H	< 1 000	< 2 000
Chromium Total	µg/litre	Cr	H	< 50	< 100
Cobalt	µg/litre	Co	H	< 250	< 500
Copper	µg/litre	Cu	H	< 500	< 2 000

Specifications for water quality intended for human consumption from the source and piped water supply					
Status				Ranges and upper limits	
Interpretation				(Ideal guideline)	(Acceptable Standard)
DETERMINANTS	Unit	Format	Concern	95 Percentile Requirement	
INORGANIC MICRO DETERMINANTS					
Cyanide (free)	µg/litre	CN ⁻	H	< 20	< 50
Cyanide (recoverable)	µg/litre	CN ⁻	H	< 70	< 200
Iron	µg/litre	Fe	H,E	< 200	< 300
Lead	µg/litre	Pb	H	<10	< 50
Manganese	µg/litre	Mn	H	< 50	< 100
Mercury	µg/litre	Hg	H	< 1	<2
Nickel	µg/litre	Ni	H	< 50	< 150
Selenium	µg/litre	Se	H	< 10	< 50
Thallium	µg/litre	Tl	H	< 5	< 10
Tin	µg/litre	Sn	H	<100	<200
Titanium	µg/litre	Ti	H	< 100	< 300
Uranium	µg/litre	U	H	< 3	< 15
Vanadium	µg/litre	V	H	< 100	< 500
Zinc	µg/litre	Zn	H	< 1 000	< 5 000
Organo-metallic compounds	µg/litre	-	H	below detection limit	below detection limit
ORGANIC DETERMINANTS					
Dissolved Organic Carbon	mg/litre	DOC-C	H	< 5	<10
Phenol compounds	µg/litre	phenol	H	< 5	< 10
DISINFECTION AND DISINFECTION BY-PRODUCTS					
Bromodichloromethane (Part of THM)	µg/litre		H	< 20	< 50
Bromoform (Part of THM)	µg/litre		H	< 40	< 40
Chloroform (Part of THM)	µg/litre		H	< 20	< 100
Dibromomonochloro-methane (Part of THM)	µg/litre		H	< 20	< 100
Trihalomethanes (Total)	µg/litre	THM	H	< 100	< 150
Bromate	µg/litre		H	< 5	< 10
Chloramines	mg/litre	Cl ₂	H	< 2	< 4
Chlorine dioxide	µg/litre		H	< 400	< 800
Chlorite	µg/litre		H	< 400	< 4000
Chlorate	µg/litre		H	< 200	< 700
Haloacetic acids	µg/litre		H	not detected	< 60
Chlorine, free, after 30 min; GENERAL	mg/litre	Cl ₂	H,I	0,1 – 0,5	0,1 - 3,0
Chlorine, free, after 30 min; SPECIFIC	mg/litre	Cl ₂	Turbidity: < 0,3 NTU	0,1	0,1 - 3,0
Chlorine, free, after 30 min; SPECIFIC	mg/litre	Cl ₂	Turbidity: > 0,3 NTU	0,5	0,1 - 3,0
Chlorine, free, after 60 min; SPECIFIC	mg/litre	Cl ₂	Turbidity: >1,0 NTU	1,0	0,1 - 3,0

Specifications for water quality intended for human consumption from the source and piped water supply					
Status				Ranges and upper limits	
Interpretation				(Ideal guideline)	(Acceptable Standard)
DETERMINANTS	Unit	Format	Concern	95 Percentile Requirement	
BIOLOGICAL REQUIREMENTS					
Algae					
Chlorophyll α	$\mu\text{g/litre}$		E,O	< 1	< 2
Blue-green algae	cells	/ml	H,O	< 200	< 2 000
Mycrocystin	$\mu\text{g/litre}$		H	< 0.1	< 1
Geosmin	$\eta\text{g/litre}$		E, H	< 15	< 30
2-Methyl Iso Borneal (2 MIB)	$\eta\text{g/litre}$		E, H	< 15	< 30
OTHER DETERMINANTS					
Agricultural chemical compounds			H	Any organic compound recognized as an agro-chemical should be in accordance with the WHO and EPA requirements.	
Industrial chemical compounds			H	Any organic compound recognized as an industrial chemical should be in accordance with the WHO and EPA requirements.	
Endocrine disruptive chemicals			H	Any chemical compound that is suspected of having endocrine disruptive effects shall be in accordance with the WHO and EPA requirements.	
RADIOACTIVITY				95 Percentile Requirement	
Gross alpha activity	Bq/litre		H	< 0.2	< 0.5
Gross beta activity	Bq/litre		H	< 0.4	< 1.0
If Gross alpha and beta is above specification calculate Dose based on individual radionuclide concentrations	mSv/a		H	≤ 0.04	≤ 0.1
ANALYSIS QUALITY CHECK***					
Ion balance: Total anions			-	< 3 -Tolerance = 0.2 m equivalent 3-10 – Tolerance 2% on +- balance 10-800 – Tolerance 5% on +- balance	
TDS Balance: determined / calculated	ratio		-	~ 1	~ 1
Ratio TDS / EC (EC as $\mu\text{S/cm}$)	ratio		-	~ 0,66	0,55 – 0,7

"Concern" refers to impact if the limit is transgressed: H = health concern; O = organoleptic effect; I = effect on infrastructure, structural; E = aesthetic effect

* Based on a viral cell culture-dependent method and not on cell culture-independent methods (e.g. PCR)

** Indicative of faecal pollution having occurred, even when the residual disinfectant levels are safe.

*** Comply with SANAS Guidelines

Table 2: Microbiological and Biological Requirements

MICROBIOLOGICAL REQUIREMENTS APPLICABLE TO ALL POTABLE WATER					
Microbiology	cfu			95 percentile	1 of samples maximum
Heterotrophic bacteria HPC or TCC	counts	/ml		100 at 37 ^o C	1 000 at 37 ^o C
Total Coliform	counts	/100 ml	H	0	5
E.Coli	counts	/100 ml	H	0	1
Enterococci	counts	/100 ml	H	0	1
Somatic Coliphage	counts	/100 ml	H	0	1
Clostridium perfringens inclusive spores	counts	/100 ml	H	0	1
Enteric viruses	viral count*	/10 L	H	0	1
Parasites (Protozoa) applicable to all potable water				95 percentile	99 percentile
Giardia lamblia	cysts	/100 litre	H	0	1
Cryptosporidium	oocysts	/100 litre	H	0	1
Giardia lamblia and Giardia lamblia (Grab sample)	cysts or oocysts	/10 L	H	0	0

Table 3: Special Requirements for the Protection of Infrastructure

Specifications for water quality intended for human consumption from the source and piped water supply for the protection of infrastructure against corrosion					
Status				Ranges and upper limits	
Interpretation				(Ideal guideline)	(Acceptable Standard)
DETERMINANTS	Unit	Format	Concern	95 Percentile requirement	
CORROSIVE AND SCALING PROPERTIES					
Calcium Carbonate Precipitation Potential	mg/litre	CCPP	I	4 - 5	3 - 6
Alkalinity/Sulphate/ Chloride Ratio	Equivalents	Corrosivity Ratio	I	With SO ₄ and Cl above 50 mg/litre Ratio=(Alk/50)/(SO ₄ /48+Cl/35.5) > 5.0 Water is Stable Ratio= (SO ₄ /48+Cl/35.5)/(Alk/50) > 0.2 Water is Corrosive	
Total Hardness (Ca & Mg)	mg/litre	CaCO ₃	I	<200	< 400

Table 4: Frequency of Microbiological Monitoring for Bulk Water Supply

Size of population served	Turbidity 95%**	Frequency of sampling
> 250 000	< 0,5 NTU	Thrice weekly ***
100 001 – 250 000	< 1,0 NTU	Twice weekly
50 001 – 100 000	< 1,0 NTU	Once weekly
10 001 – 50 000	< 1,0 NTU	Three times every month
< 10 000 reticulated	< 1,0 NTU	Once every 1 month*
< 10 000 non-reticulated	1 – 2 NTU	Once every 1 month*

* Upon complaints by the consumers or of medical practitioners and after incidents such as pipe breaks, the frequency should be increased until the situation has returned to original counts and been declared safe;

** Average or 95 percentile turbidity of the water supplied

*** The frequency should be stepped up by one extra sampling per week for every 100 000 residents (including the estimated number of visitors residing within the area at any time) in the area served, over and above 250 000.

General Information

1. The area being monitored shall be defined by the Minister in consultation with the Minister responsible for health and, where applicable, relevant officials from the Regional and Local Authorities;
2. At the time of sampling the operator shall also take a "free chlorine" reading of the same water under examination but prior to sampling for microbiological sampling, whilst using a portable device designed for that purpose and accepted by the Minister; this 'reading' is to be recorded and reported together with the results from the microbiological analyses;
3. As for field 'screening' of water supplies for microbiological contamination there exist portable devices designed for that purpose and accepted by the Minister; these 'readings' are to be recorded and reported together with the results from the microbiological analyses;
4. The results of the microbiological monitoring together with the free chlorine readings is to be reported as per mutual agreement to the ultimate supplier (bulk water supplier, Local Authority, or any other supplier) for remedial action where required, and to the Minister for record and monitoring purposes and follow up actions;
5. The costs of routine monitoring shall be borne by the authority commissioning the monitoring;

Methodology for Sampling and Analyses

The methodologies followed for sampling and during transit and storage of samples prior to analysis shall be as prescribed.

1. Preferably samples are to be taken in borosilicate glass bottles with a glass or polypropylene screw-cap lid;
2. Where this is not feasible or practical polyethylene bottles with internal seal and with screw-lid can be used;
3. Samples shall, as far as practical, be analysed within 24 hours of sampling;
4. Where there are special requirements for the period between sampling and analysis to be less than 24 hours, such requirement should be attended to as far as is practical;
5. Samples are to be kept and stored, even during transit, at as low a temperature as is practically manageable, whilst preventing the risk of the sample freezing;
6. The sample shall be kept away from light and shielded from sunlight, to reduce chances of micro-/biological growth to a minimum;
7. The use of preservation chemicals should be considered, planned and executed with extreme care;
8. Where sample preservation is appropriate or required an extra smaller volume sample should be taken so as to not upset any other analyses that are affected by the preservation chemical(s);
9. Certain determinants may be monitored 'in the field' at the time of sampling; such field-data are to be measured in a receptacle or container different from the sample container; data so obtained shall be recorded as "field measurement" and cannot replace laboratory analysis for the parameters concerned;
10. The methodologies followed for physical, chemical and microbiological analysis shall be in agreement with the specifications listed in the latest edition of the SANS 241, Drinking Water Standards, published by the SABS.
11. The cost of routine, regulatory inspections and monitoring, for the purpose of fulfilling the provisions of this regulation shall borne by the service provider.