



ENVIRONMENTAL MANAGEMENT PLAN

FOR

BETHANIE WATER SUPPLY SCHEME

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LIST OF ABBREVIATIONS

| | |
|-----------------|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| CoC | Code of Conduct |
| DEA | Directorate of Environmental Affairs |
| EMA | Environmental Management Act |
| EMP | Environmental Management Plan |
| HIV | Human Immunodeficiency Virus |
| I&AP | Interested and Affected Parties |
| MEFT | Ministry of Environment, Forestry and Tourism |
| NEM | NamWater Environmental Manager |
| MSDS | Material Safety Data Sheet |
| NWQG | Namibian Water Quality Guidelines |
| NWQS | Namibian Water Quality Standards |
| STI's | Sexually Transmitted Infections |
| WTW | Water Treatment Works |

1. PURPOSE OF THE EMP

This Environmental Management Plan (EMP) has been compiled for the management of potential environmental impacts during the operation, and decommissioning phases of the proposed Bethanie Water Supply Scheme. Best practice is proposed for the generic issues during maintenance of associated scheme infrastructure as well as the on-going management and operation of the pipeline.

In terms of the Environmental Assessment Policy of 1994 and the Environmental Management (Act No 7 of 2007) (EMA), the activities required for the construction of the proposed project requires authorization from the Directorate of Environmental Affairs at the Ministry of Environmental, Forestry and Tourism (MEFT: DEA).

An Environmental Clearance Certificate (ECC) was originally issued in 2019 and this EMP serves as an application for the renewal of the ECC.

2. INTRODUCTION

Bethanie is located approximately 35 km north of Goageb, which is situated approximately 100 km west of Keetmanshoop on the Keetmanshoop-Lüderitz surfaced road. The water scheme is located along the Konkiep River that flows in a southern direction until it reaches the Orange River some 200 km further. The current population of Bethanie is estimated as 2 978 persons.

Bethanie is classified as a village and hence falls under the jurisdiction of the Ministry of Regional and Local Government, Housing and Rural Development. It is administered by a village council who is responsible for managing the services. The location of Bethanie is depicted in **Figure 1**.

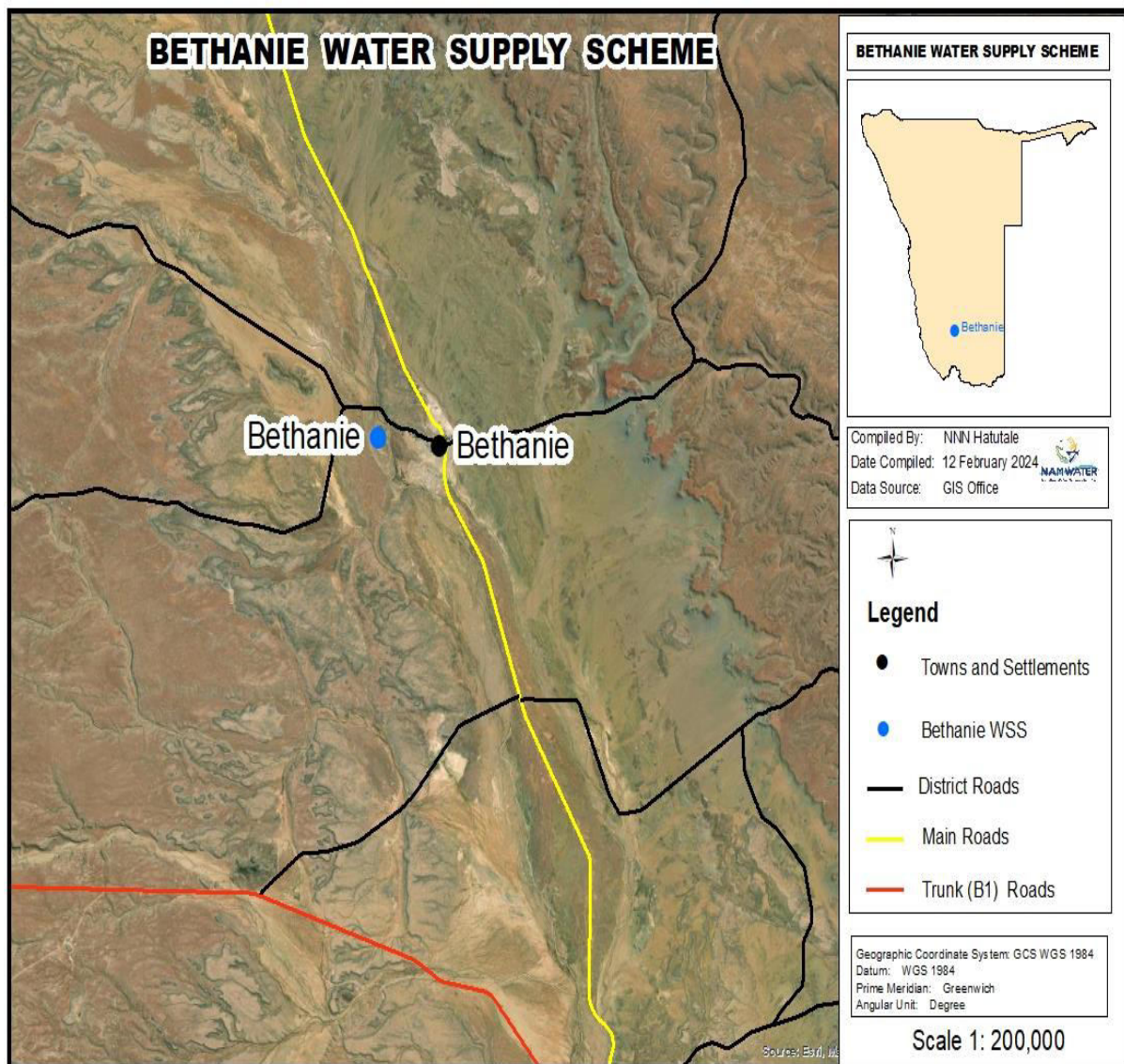


Figure 1: Bethanie Location Map

3. EXISTING BETHANIE WATER SUPPLY INFRASTRUCTURE

3.1 Water Source

Bethanie is supplied from two production boreholes, which are both located within the Konkiep River. The production boreholes can easily supply in the demand that exists at Bethanie.

The aquifer that is associated with these two boreholes is contained in the alluvium within the riverbed. The alluvium of the Konkiep River is saturated with subsurface water, where the sedimentary unit acts as a major source of water that feeds the deeper-lying fractured sedimentary formations. Flood events are however considered important in terms of recharge to the adjacent hard rock aquifers.

3.2 Water Quality and Disinfection

Hydrochloric acid and sodium hydroxide is used to control pH, and other chemicals used for dichlorination and descaling before the membranes. Chemical dosing is automated during the relevant stages of the water treatment process except the cleaning of membranes, which involves cleaning at high pH and low pH.

The quality of water supplied to the pump station was evaluated for compliance with the guidelines presented in the Water Act, 1956 (Act 54 of 1956), Namibian Water Quality Guidelines (NWQG) and the draft Namibian Water Quality Standards (NWQS) as contained in the draft regulations of the Water Resources Management Act of 2013. The Department of Water Affairs, as the custodian of water affairs in Namibia, is applying the new regulations even though it is not yet promulgated. The Guidelines and Standards were formulated to ensure the safety of water supplied for human consumption. Evaluations for compliance to NWQS are not mandatory yet but it indicates compliance with the standards.

According to the NWQG the water can be classified in group A as indicated in the analysis reports. See appendix attached of the water quality reports for Bethanie.

3.3 Reverse Osmosis Plant

The new Reverse Osmosis (RO) Plant is located in the existing footprint of the current NamWater site.

The raw water from the boreholes is pre-treated before it is pumped to the RO plant. This is done to protect the membrane technology in the RO plant at times when turbidity (suspended solid particles) might be high in the water pumped from the boreholes. Although such events are

unlikely in normal pumping operations, the pre-treatment process is important because the membranes are expensive to replace. The pre-treatment process includes:

- Flocculation tanks, from which the small quantities of sludge is removed to evaporation ponds.
- Filtration tanks (sand, anthracite), from which the backwash effluent from the cleaning of filters is removed to evaporation ponds.
- Monitoring of the raw water quality and the pre-treated water that passes into the RO units.

Pre-treatment is done through dosing with ferric chloride. This inorganic compound is commonly used as a coagulant in water treatment. The quantity of ferric chloride depends on the amount of water to be treated.

The non-hazardous properties of ferric chloride at the levels of dilution mean that the sludge from the flocculation tanks and the backwash effluent from the filters is not harmful.

The Reverse Osmosis (RO) unit includes high pressure pumps. The water quality is monitored before and after it passes through the membrane. There are two membranes to avoid shutting down the plant whenever there is a need to clean a membrane. The plant operation is monitored in detail and the control of flow rates through the membranes is an important aspect of the automated system. The pumps are operated under a duty cycle (i.e. the duty pump will change with each start-up of operation).

Brine effluent is generated from the unit. Some of this effluent is recycled into the system so that more potable water can be produced.

The cleaned (permeate) water from the reverse osmosis is passed to the permeate storage tank. This permeate is blended with some raw water as part of the remineralisation process. This is carried out in the remineralisation tank to bring the mineral concentrations within the ranges in normal potable water, remaining within water quality standards. It will also improve the taste of the permeate.

The treated water is then pumped to the existing storage reservoir (volume 750m³), after passing through the chlorination system. If the reservoir is full, the plant is shut down. Membranes automatically rinses when the plant stops.

The treated water is passed to the existing raised water tank in the village.

3.4 Evaporation Ponds

The evaporation ponds are located downhill from the new plant, on a site in the valley of a tributary of the Konkiep River. The four ponds each have an internal area at ground-level of 60m by 60m. **Figure 3** indicates the location for the new RO plant, the PV plant and the evaporation ponds.

The brine effluent from the RO process flows to the evaporation ponds, to allow the precipitated salts to be extracted and properly disposed. The four ponds, each has an area of 60 by 60m and an internal area of at ground-level of 12.5m by 25m. The ponds are lined with a 1.5mm thick high-density polyethylene (HDPE) liner.

Sludge from flocculation tanks, backwash from the sand filters and from backwash of membranes is discharged to the evaporation ponds. These effluents will mainly contain salts.

The ponds is isolated for cleaning and maintenance on an individual basis. The clearing of the salt is manual, by brooms and plastic shovels, so that the risk of damage to the liners is reduced. The cleared salt will be driven by truck to Kupferberg municipal landfill in Windhoek, which is the only lined municipal landfill facility in Namibia. The salt is not hazardous. Storage of salt is unlikely to be needed at the site. Each pond will need clearance a few times per year (4-5 times/year for each pond).

The ponds is designed with a controlled overflow facility in case of unexpected events such as discharge of high quantities of water into the ponds or very high rainfall events.

3.5 Pipe Work

A 150 mm diameter, 2 850 m long Class 12 AC pipeline with a capacity of 1 527 m³/day connects the two boreholes to the ground reservoir.

There is a gravity driven pipeline feeding the backwash water and concentrate from the plant to the evaporation ponds will have a length of approximately 150 m. Sludge from the flocculation tanks and from backwash of membranes is diluted with water before transfer along the pipes. This dilution is important to reduce risks of blockages of pipes and to dilute traces of acid and other chemicals used for cleaning.

3.6 Reservoirs

A circular concrete ground reservoir with a capacity of 750 m³ collects the water from the boreholes from where it is boosted by two pumps to the 18 m high elevated concrete reservoir of 180 m³ capacity from where it gravitates to the town.

An additional new ground water reservoir was constructed for raw water storage with the volume of 700 m³. The ground water reservoir stores about 24 hours of demand.

The existing ground 750 m³ and elevated 180 m³ reservoirs are used as potable water storage for the village.

3.7 Power Supply and Control System

An 11 kV electrical supply line runs to the transformer at the boreholes from where each borehole is supplied with a 400 V supply line.

To supply renewable energy to the RO plant, solar Photovoltaic (PV) panels were installed and cover a land area of about 50m². The panels have a life expectancy of 20 to 25 years. Lithium batteries are used for power storage and housed in a container with air conditioning to keep the batteries cool.

A wind turbine was constructed for monitoring purposes, which is a 12m high structure, with blades of 2.3 m in length. The plant is using the solar system with an option for connection to the national grid in case of an emergency or when the solar system fails.

One borehole runs at a time and is selected at the switchboard located at the boreholes. The float switch in the terminal ground reservoir monitor the reservoir levels and either activate or deactivate the borehole pumps by switching off the main HV line. The booster pumps are controlled electronically based on the ball valves in the tower as well as the ground level reservoir levels. The booster station between the ground reservoir and elevated reservoir keeps the elevated reservoir full based on float switches in both reservoirs.

The RO plant pumps are operated under a duty cycle (i.e. the duty pump will change with each start-up of operation).

3.8 Scheme Processes/Operation

The scheme has operators who checks on a daily basis whether all the systems are functional. The entire plant remotely monitored via a supervisory control and data acquisition (SCADA) system.

A schematic layout of the existing infrastructure is indicated in **Figure 2-5** below.

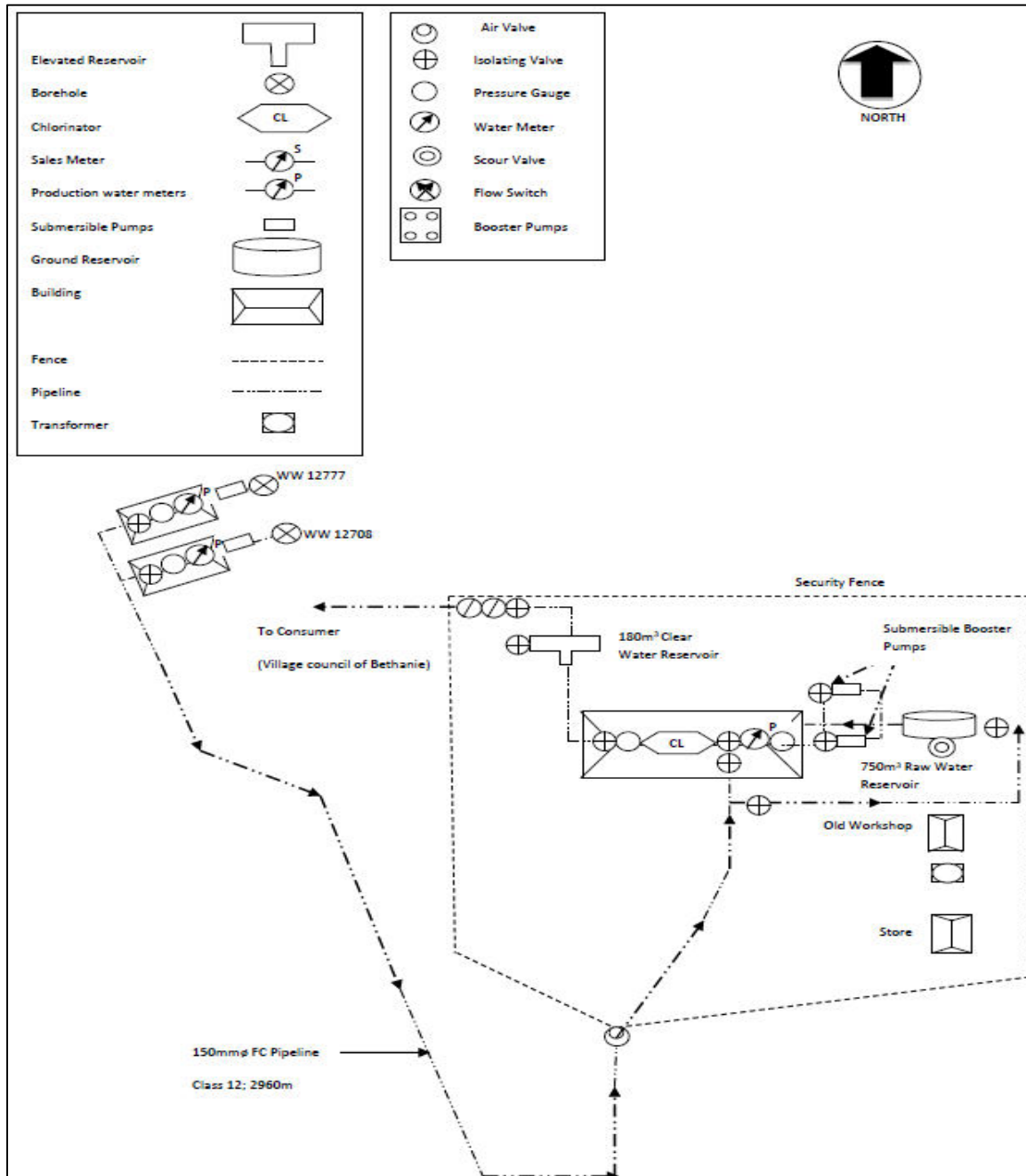


Figure 2: Bethanie Scheme Schematic Layout

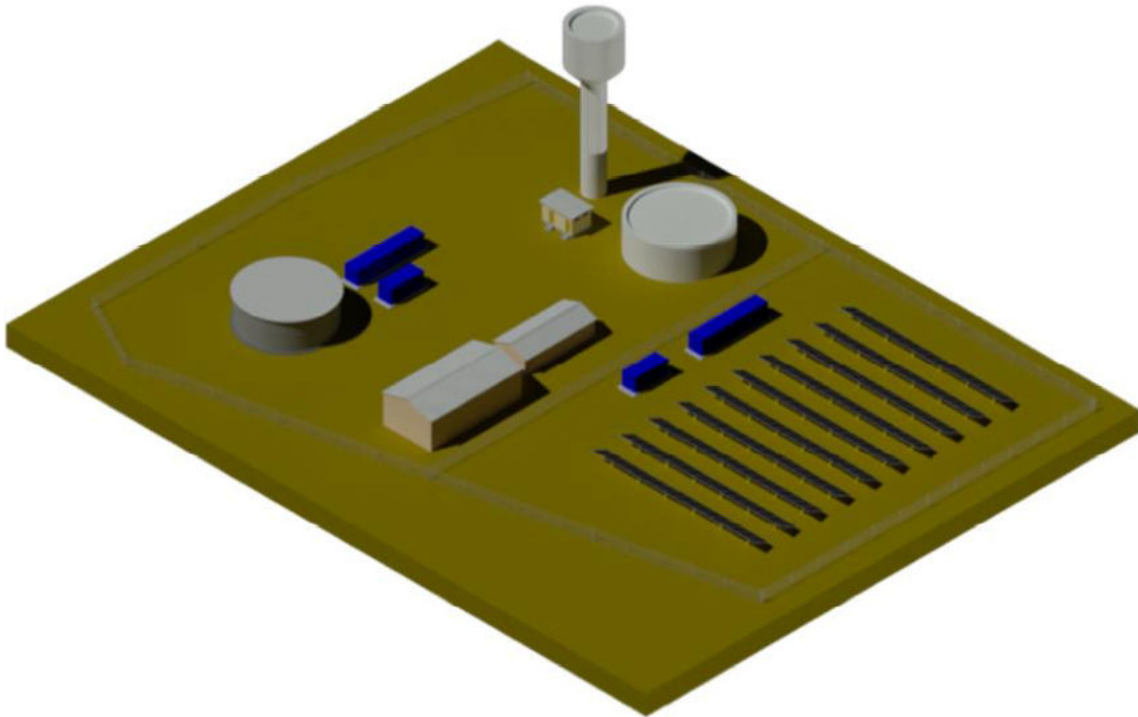


Figure 3: Schematic Layout for Bethanie RO Treatment Plant and Associated Infrastructure



Figure 4: New Infrastructure Added to the Bethanie Plant

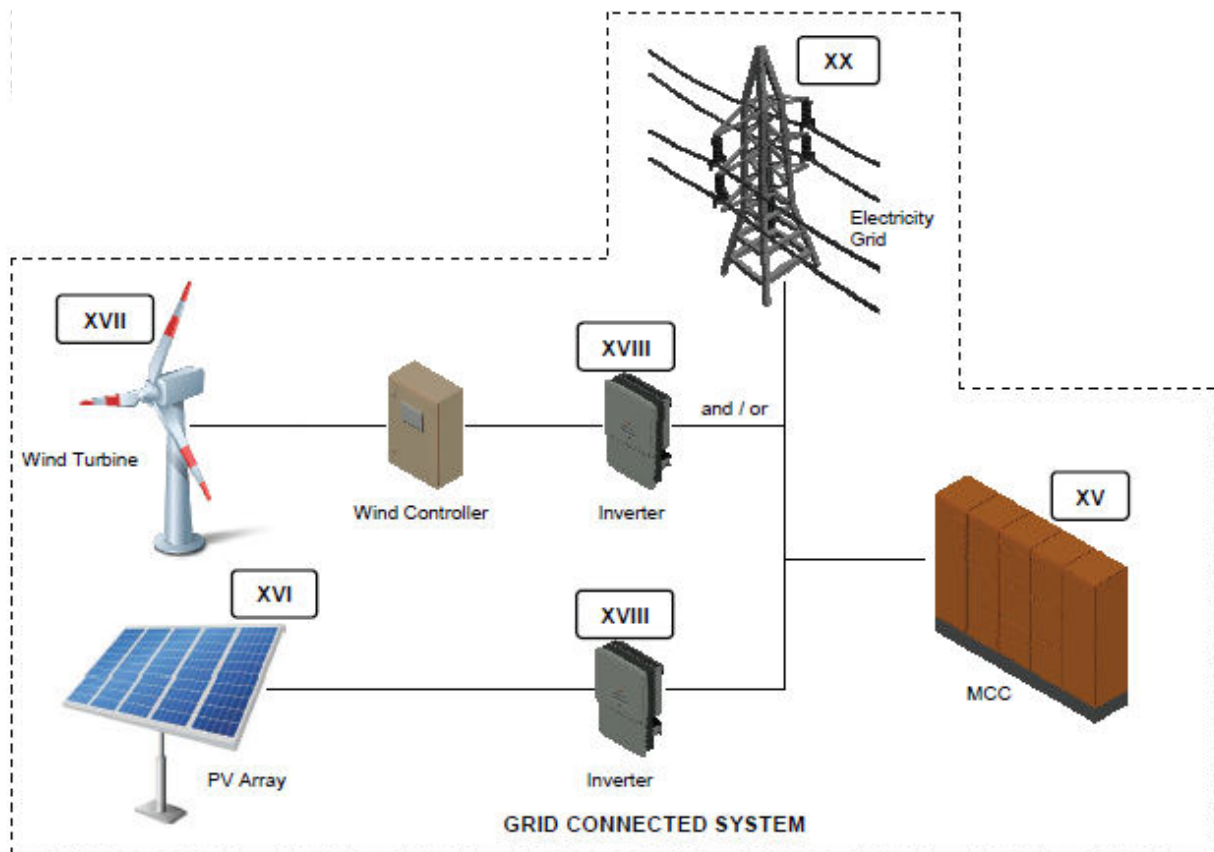


Figure 5: Grid Connected System

3.9 Maintenance

Maintenance is done by a permanent NamWater team.

3.9.1 Pumps

All motors bearings should be lubricated with a high-temperature lithium-based grease after 3000 hours.

If a pump/s were out of operation for six months, lubrication is required before service commence on all motor bearings.

3.9.2 Air Valves

Monthly the valves must be opened to be descaled and cleaned to ensure effective operation. The service intervals will depend on the severity of the conditions.

3.9.3 Pressure Gauges and Transducers

Monthly the gauge cocks must be turned to bleed-off air and ensure accurate readings. Turning prevents scale accumulation which prevents the gauge cock from functioning. The operational or service intervals will depend on the severity of the conditions.

3.9.4 Reservoirs

The reservoirs should be checked for leaks and other damages on a monthly basis. If leaks are detected, it should be fixed immediately.

3.9.5 Pipe Breaks/leaks

Monthly monitor of pipes should be done to avoid wastage of water in an event a major pipe break. The pipeline corridor for maintenance work is 10 m by 5 m.

4. BRIEF DESCRIPTION OF THE RECEIVING ENVIRONMENT

The baseline description provided below focuses on those aspects of the receiving environment:

4.1 Climate

Bethanie has a harsh climate with large seasonal and daily temperature variations.

4.1.1 Precipitation

Rainfall is highly seasonal, peaking between December and March. Annual rainfall ranges between 100-200mm.

4.1.2 Temperature

The lower lying eastern and southern part of Namibia is in fact an extension of the Kalahari (Botswana) and Karoo (South Africa) and the climate is therefore very dry and hot, with an average temperature as high as 40°C.

4.2 Geology

The domestic water supply for Bethanie comes from a fracture in sandstone, limestone and shale of the above subgroups, cutting across the Konkiep River north of the town.

The geology in the Bethanie area is made up of sedimentary formations from the Eocambrium Period that are mainly represented by the Nama Group. Subgroups within this unit are the Schwarzrand and Kuibis Sub-groups.

The Kuibis Sub-group is located below the Schwarzrand Sub-group and in the Bethanie area it consists mainly of shale and quartzite. The Schwarzrand Sub-group, which overlays the Kuibis Sub-group, is mainly made up out of shale, quartzite, limestone and to a lesser degree, some tillite.

4.3 Natural Fauna and Flora

The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soil. The landscape is in the hyper-arid zone. It falls within the transition belt between summer and winter rainfall and consequently has elements of both succulent winter rainfall and woody summer rainfall vegetation.

The area is typically dominated by *Euphorbia*, *Aloe* and *Boscia* species, *Rhigozum trichotomum*, *Parkinsonia africana* and grasslands dominated by *Stipagrostis species*. Larger drainage lines are vegetated with *Acacia erioloba*, *Acacia karroo*, *Tamarix usneoides*, *Euclea pseudebenus* and *Rhus lancea* (Barnard et. al., 1998).

The fauna around Bethanie is relatively species-poor, as a result of the town being found within the Nama Karoo Biome.

Apart from the common ungulate species such as springbok (*Antidorcas marsupialis*), and kudu (*Tragelaphus strepsiceros*), Fauna found in the area includes:

- Reptile species such as tortoise (*Geochelone pardalis*), pythons (*Python natalensis*), geckos (*Chondrodactylus angulifer*), girdled (*Cordylus polyzonus*) and monitor lizards (*Varanus albigularis*);
- Mammals such as the Hedgehog (*Atelerix frontalis*), Pangolin (*Smutsia temminckii*), and Brown Hyena (*Hyaena brunnea*); and
- Bird species such as bustards (*Eupodotis vigorsii*), korhaans (*Afrotis afraoides*) and large raptors (*Sagittarius serpentarius*) (Roads Authority, 2013).

5. THE LEGAL ENVIRONMENT

A legal review was done and the key laws of concern include those which protect the ecological integrity of the Bethanie ecosystem and its water resource, including the Water Act of 1954 and the Water Resources Management Act of 2004, and applicable international treaties such as the Convention on Biological Diversity. These laws and conventions place Namibia under an obligation to conserve the ecological integrity of the Bethanie ecosystem for the sustainable use by Namibians.

5.1 The Constitution of the Republic of Namibia

There are two clauses contained in the Namibian Constitution that are of particular relevance to sound environmental management practice, viz. articles 91(c) and 95(l). In giving effect to articles 91(c) and 95(l) of the Constitution of Namibia, general principles for sound management of the environment and natural resources in an integrated manner have been formulated. The formulation of these general principles resulted in the Namibia's Environmental Assessment Policy of 1994. To give statutory effect to this Policy, the Environmental Management Act was approved in 2007, and gazetted as the Environmental Management Act (Act No. 7 of 2007) (herein referred to as the EMA. As the organ of state responsible for management and protection of its natural resources, MEFT: DEA is committed to pursuing the 13 principles of environmental management that is set out by Part 2 of the Act.

To summarise, Articles 91(c) and 95(l) refer to:

- Guarding against over –utilisation of biological natural resources;
- Limiting over-exploitation of non-renewable resources;
- Ensuring ecosystem functionality
- Protecting Namibia's sense of place and character;
- Maintaining biological diversity and
- Pursuing sustainable natural resource use.

5.2 Environmental Assessment Policy (1995)

Cabinet endorsed Namibia's Environmental Assessment Policy in 1995 as the first formal effort in Namibia to regulate the application of environmental impact assessments and environmental management. Amongst others, the Policy provides a procedure for conducting EIA's which sets out to:

- Better inform decision makers and to promote accountability of decisions taken;
- Strive for a high degree of public participation and involvement of all sectors of the Namibian community during the execution of the EIA;
- Take into account the environmental costs and benefits of projects and programmes;
- Promote sustainable development in Namibia;

- Ensure that anticipated adverse impacts are minimized and that positive impacts are maximized.

5.3 Environmental Management Act (No 7 of 2007) (EMA)

The Environmental Management Act (EMA) was promulgated in 2007 by Parliament and gives effect to the Environmental Assessment Policy. The Act specifies the environmental assessment procedures to be followed as well as the listed activities (activities that require an EIA).

Of relevance to this project are the following listed activities, as provided in Section 27 of this Act, which include:

- Water use and disposal;
- Transportation

5.4 EIA Regulations Government Notice No. 30, promulgated on 6 February 2012

The regulations, promulgated in terms of the EMA, were promulgated on 6 February 2012 and indicated certain activities that require an Environmental Clearance from MEFT: DEA prior to commencing.

5.5 Water Act 54 of 1956 and Water Resources Management Act 11 of 2013

The Water Resources Management Act 11 of 2013 is presently without regulations; therefore the Water Act 54 is still in force. The Act provides for the management and protection of surface and groundwater resources in terms of utilisation and pollution.

6. RESPONSIBLE PARTIES

NamWater's Environmental Manager is primarily responsible for the implementation of the EMP during the operational and maintenance phases.

6.1 NamWater

NamWater, as the implementing agency, is responsible for:

- Ensuring that the objects of the EMP are being obtained;
- Ensuring that all environmental impacts are managed according to the environmental principles of avoiding, minimizing, mitigating and rehabilitation. This will be achieved by successful implementation of the EMP;
- Ensuring that appropriate monitoring and compliance auditing are executed;
- Ensuring that the environment is rehabilitated to its natural state as far as possible.

NamWater shall ensure that all employees attend an Environmental, Awareness Training Course. This course shall be structured to ensure that attendees:

- Become familiar with the environmental controls contained in the EMP;
- Are made aware of the need to conserve water and minimise waste;
- Are made aware of NamWater's Code of Conduct;
- Are aware that a copy of the EMP is readily available at the plant and that all staff are aware of the location and have access to the document;
- Are informed that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) will be placed at prominent locations throughout the site.

6.2 Contractor

The Contractor shall conduct his/her activities so as to cause the least possible disturbance to the existing amenities, whether natural or man-made, in accordance with all the current statutory requirements. Special care shall be taken by the Contractor to prevent irreversible damage to the environment. The Contractor shall take adequate steps to educate all members of his workforce as well as his supervisory staff on the relevant environmental laws and protection requirements. The Contractor shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of environmental obligations.

A suitably qualified independent ECO shall be appointed by NamWater/Contractor to undertake the following tasks:

- Liaison with Contractor, Interested and Affected Parties (I&APs) and Engineer regarding environmental matters.

- Monitoring of all of the Contractor's activities for compliance with the various environmental requirements at regular intervals.
- Routine environmental auditing and reporting of the Contractor's performance against the EMP.
- Reporting of environmental incidents and routine reporting of environmental issues associated with construction activities to NamWater, the Contractor and any relevant environmental authority.
- Identifying environmental non-conformances and initiating measures to remedy such issues, including the institution of fines against the Contractor.

The Contractor shall ensure that all employees attend an Environmental Awareness Training Course. This course shall be structured to ensure that attendees:

- Become familiar with the environmental controls contained in the EMP.
- Are made aware of the need to conserve water and minimise waste.
- Are made aware of NamWater's Code of Conduct.
- Are aware that a copy of the EMP is readily available at the plant and that all staff are aware of the location and have access to the document.
- Are informed that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) will be placed at prominent locations throughout the site.

The Contractor shall construct and/ or implement all the necessary environmental protection measures in each area before any construction work may proceed. The Engineer/ ECO may suspend the Works at any time should the Contractor, in the Engineer/ Eco's opinion, fail to implement, operate or maintain any of the environmental protection measures adequately. The costs of such suspension shall be to the Contractor's account.

7. ENVIRONMENTAL MANAGEMENT PLAN

An EMP is an important tool focusing on the management actions that are required to ensure environmental compliance of a particular project.

EMP implementation is a cyclical process that converts mitigation measures into actions and through cyclical monitoring, auditing, review and corrective action, ensures conformance with stated EMP aims and objectives. Monitoring and auditing, feedback for continual improvement ensures that environmental performance has been provided and corrective action is taken for an effective EMP.

The main aim of this EMP is to ensure that the project complies with the goals of the Namibian Environmental Management Act (No. 7 of 2007); and, more specifically, to provide a framework for implementing the management actions as described in the EMP for the operational and maintenance phases of the scheme. Best practice is proposed for the operation of the scheme.

There are some environmental impacts that cannot be avoided. These environmental impacts require mitigation, and in order to mitigate against these impacts an EMP is required. The EMP aims to ensure best practises are implemented and environmental degradation is avoided through appropriate environmental protection, adherence to legal requirements and maintaining good community relationships.

MEFT indicated that EMP's for existing operations are sufficient.

The project activities are grouped according to the different operational processes and stages. Most of the impacts can be reduced through good housekeeping.

8. MANAGEMENT ACTIONS

8.1 Operation and Maintenance phase of the Bethanie Water Supply Scheme

8.1.1 Introduction

The Operational Phase Section relates to the management and mitigation measures required to ensure that the continuation of the bulk water supply network and the maintenance of the infrastructure is operated in a manner that demonstrates responsible, precautionary environmental management.

The EMP will address specific areas of concern in terms of the long-term environmental management of the affected environment and is intended to serve as a guide to the on-going management of the water supply scheme site as well as the affected environment. The EMP will therefore aim to provide NamWater with the necessary tools to ensure that the potential impacts on the natural environment of the site during the operation of the water supply scheme are minimised. Moreover, it will aim to ensure that the infrastructure is operated and maintained according to Best Practice, in an environmentally sensitive and sustainable manner, and that the operation of the infrastructure does not result in reasonably avoidable environmental impacts.

8.1.2 Maintenance Procedures

The optimal operation and effective maintenance of all the scheme components is important in protecting the environment and ensuring that resources are not wasted and environmental incidents arising out of equipment or infrastructure failures, are avoided. Operation and Maintenance Manuals are available for the Bethanie Scheme. The manuals provide a detailed guidance on the operation of all machinery and associated systems as well as related maintenance procedures, including maintenance schedules. Implementation of this manuals by NamWater will facilitate the proactive management of potential risks and thus result in impacts on the receiving environment being averted.

The maintenance procedures set out in the manuals, provides specific guidance in terms of the monitoring and maintenance of the scheme components. These procedures will specify the equipment item and specific component of each piece of equipment requiring checking, the scope and nature of the check that is to be carried out including detailed instructions related to the specific check, and the programme for conducting each check.

Table 1: Operation and Maintenance Phase Management Table

| Objectives | Potential Impact | Management Action | |
|--|--|---|---|
| a. Minimize the loss of rare/endangered fauna and flora species. | Loss of rare / endangered fauna or flora species. | <ul style="list-style-type: none"> Avoid small mammal / reptile and bird nesting where possible. Do not hurt, kill or unnecessarily disturb birds or animals. | <p>Ensure scheme operations and maintenance is limited to the area next to the pipeline and reservoir corridors.</p> <p>Visual checks to ensure that no disturbance occur outside the pipeline corridor.</p> <p>Frequency: Monthly.</p> <p>Responsible Person: Scheme Supervisor.</p> |
| b. Prevent unnecessary removal of trees/plants of importance. | Unnecessary removal of trees/plants of importance. | <ul style="list-style-type: none"> Do not remove any vegetation unless it is absolutely necessary. Make sure that operation and maintenance team is well informed. Do not disturb, deface, destroy or remove plants or natural features, whether fenced or not. | <p>Visual inspection/checks to prevent, as well as to ensure the unnecessary removal of trees/plants.</p> <p>Frequency: Monthly.</p> <p>Responsible Person: Scheme Supervisor.</p> |

| Objectives | Potential Impact | Management Action | |
|---|---|---|--|
| c. Minimize the loss of rare/ endangered fauna and flora species. | Loss of rare / endangered fauna or flora species. | <ul style="list-style-type: none"> Avoid small mammal / reptile and bird nesting where possible. Do not hurt, kill or unnecessarily disturb birds or animals. | <p>Ensure scheme operations and maintenance is limited to the area next to the pipeline and reservoir corridors.</p> <p>Visual checks to ensure that no unnecessary disturbance occur outside the pipeline and reservoir corridors.</p> <p>Frequency: Monthly.</p> <p>Responsible Person: Scheme Supervisor.</p> |
| d. Prevent the poaching of flora and fauna. | Poaching of fauna and flora. | <ul style="list-style-type: none"> Employees who poach fauna and/or flora will be handed to the authorities for prosecution. Regular checks of the surrounding environment must be undertaken to ensure no traps or snares have been set. Any snares or traps found on or adjacent to the site must be disposed of. | <p>Visual inspection.</p> <p>Frequency: Weekly visual checks.</p> <p>Responsible Person: Scheme Supervisor</p> |
| e. Minimise the creation and use of | Creation of tracks outside existing roads. | <ul style="list-style-type: none"> Use existing roads. Traffic shall be controlled to ensure minimal disruption to other road users. | <p>Visual checks to ensure that no off-road driving exists.</p> <p>Frequency: Weekly.</p> |

| Objectives | Potential Impact | Management Action | |
|--|---|--|---|
| tracks outside existing roads. | | <ul style="list-style-type: none"> • Do not construct new roads when the quality of existing roads deteriorates. Where possible, repair or upgrade existing roads. • Ensure that adequate vehicle turning areas are allowed for. • Enforce speed limits at all times. Unless otherwise specified, the speed limit on access roads is 50km/h. • Runoff from roads must be managed to avoid erosion and pollution problems. • Roads not required for further use shall be rehabilitated immediately. • Use 3-point turns and not U-turns. Confine turning to the road. • Prevent shortcuts between roads. | Responsible Person: Scheme Supervisor. |
| f. Minimise the damage and destruction of important palaeontological and archaeological sites. | Disturbance to sites of palaeontological and archaeological importance. | <ul style="list-style-type: none"> • Do not disrupt any archaeological or palaeontological sites. Inform NEM (J Kamburona at cell no 081 144 1528) who will take the necessary action. • All workers will be educated about the importance of preserving archaeological sites. | Monitoring can and should involve field induction of key scheme personnel so that they will be able to recognize the important palaeontological and |

| Objectives | Potential Impact | Management Action | |
|---|---|---|---|
| | | <ul style="list-style-type: none"> Educate specific workers about tell-tale signs of archaeological sites and the action to be taken if one is identified | archaeological sites themselves. Frequency: Monthly. Person Responsible: Scheme Supervisor. |
| g. Minimise the number of heavy vehicles on the road. | Increased number of heavy vehicles on the road. | <ul style="list-style-type: none"> Heavy vehicles should be limited to numbers necessary. | Checks to ensure that there is minimal heavy vehicle on the road. Frequency: Weekly. Responsible Person: Scheme Supervisor. |
| h. Minimise and if possible prevent the activities that accelerate erosion during operation or maintenance. | Erosion. | <ul style="list-style-type: none"> Runoff on steep inclines should be diverted to prevent the formation of erosion gullies. Vegetative cover is the most efficient and economical means of controlling soil erosion. Berms should be constructed at selected intervals on long sloping areas to prevent erosion. Diversion berms should be reshaped as necessary to divert runoff. | Visual inspection to ensure that activities that accelerate soil erosion are minimised and if possible prevented at all cost. Frequency: Weekly. Responsible Person: Scheme Supervisor. |

| Objectives | Potential Impact | Management Action | |
|--|-------------------------|--|--|
| | | <ul style="list-style-type: none"> • Berms should be constructed with compacted soil, have a minimum top width of 60 cm and a minimum height of 30 cm, and should allow for 10% settlement. It should have side slopes with a gradient of at least 2:1. • Runoff should be guided to a point where it will not cause damage. Scour by the discharge of runoff should be prevented. | |
| i. Minimise and if possible prevent the collection and removal of firewood during operation and maintenance. | Collection of firewood. | <ul style="list-style-type: none"> • No vegetative matter may be removed for firewood. • The collection and removal of firewood is not allowed. | <p>Checks to ensure that there's no removal and collection of firewood by the employees.</p> <p>Frequency: Weekly.</p> <p>Responsible Person: Scheme Supervisor.</p> |
| j. Noise | Generation of noise | <ul style="list-style-type: none"> • Install and maintain silencers on trucks and machinery. • Repair faulty brakes. • Operators should not use hooters for the purposes of general communication. | <p>Visual inspection to ensure that activities that generate noise are minimised and if possible prevented.</p> <p>Frequency: Daily.</p> <p>Responsible Person: Scheme Supervisor.</p> |

| Objectives | Potential Impact | Management Action | |
|---|------------------------------|---|---|
| k. Driving | Increased risk for accidents | <ul style="list-style-type: none"> No operator will operate any equipment when he is under the influence of alcohol. Adhere to safety rules. Always keep your headlights on. Drivers must have the correct licence for the vehicle they are driving. | <p>Visual inspection to ensure that activities that generate noise are minimised and if possible prevented.</p> <p>Frequency: Weekly.</p> <p>Responsible Person: Scheme Supervisor.</p> |
| l. To avoid potential chemical /hazardous substance pollution | Pollution | <ul style="list-style-type: none"> Designated areas for the storage of potentially hazardous material will be lined with concrete and secured. The bunded area will be of adequate capacity to contain 1.5 times the volume of the hazardous material to be stored in the bunded area. | <p>Visual checks to ensure chemical/hazardous substances are stored appropriately.</p> <p>Frequency: Monthly.</p> <p>Responsible Person: Scheme Supervisor.</p> |
| m. To ensure correct procedures are in place to avoid environmental impacts associated with maintenance | Environmental Degradation | <ul style="list-style-type: none"> Establish regular reporting procedures on maintenance Undertake regular inspection and maintenance of all infrastructure to ensure in working order and to assess damaged / deficient equipment, as per the Operations and Maintenance Manual. Review, and if necessary, revise maintenance manual. | <p>A review of the Operations and Maintenance Manual.</p> <p>Frequency: Bi-annual</p> |

| Objectives | Potential Impact | Management Action | |
|--|------------------|---|--|
| <p>activities as well as proactive intervention to avoid, and if required, to respond to emergencies</p> | | <ul style="list-style-type: none"> • Establish emergency procedures guidelines for the blockage/failure, flooding, contaminant removal and disinfection, power failure and fire of the scheme. • Implement the response procedures when emergency incident occurs. • Complete the incident report checklist in the case of emergency and keep with monitoring records for submission. • Undertake annual education course for all operational staff. • Review, and if necessary revise emergency manual. | <p>Responsible Person: NamWater Maintenance Team</p> |

Table 2: Waste Management Table

| Objectives | Potential Impact | Management Action | |
|---|------------------|--|--|
| <p>a. To prevent the improper disposal of waste</p> | <p>Pollution</p> | <ul style="list-style-type: none"> • Enforce a waste management programme. • All waste will be removed to an appropriate waste dump. • No waste should be buried. • General Waste: Includes waste paper, plastic, cardboard, harmless organic (e.g. vegetables) and domestic waste. • Hazardous Substances include: sewerage, fuels, lubrication oils, hydraulic and brake fluid, solvents, paints, anticorrosives, insecticides and pesticides, chemicals, acids etc. It should be disposed of at designated hazardous disposal sites. • Contaminated soil should be stored in drums and taken to the nearest appropriate waste dumpsite. • Do not change oil on uncovered ground. Drip trays will be used to catch oil when vehicles are repaired in the field. • Used oil and hydraulic fluids will not be discarded on the soil or buried. It will be removed from site and taken back to an appropriate dump. • In the event of a hazardous spill: | <p>Visual check to ensure wastes is managed according to the waste management plan</p> <p>Frequency: Weekly.</p> <p>Person Responsible: Scheme Supervisor.</p> |

| Objectives | Potential Impact | Management Action | |
|--|---|--|--|
| | | <ul style="list-style-type: none"> • Immediately implement actions to stop or reduce the spill. • Contain the spill. • Arrange implementation of the necessary clean-up procedures. • Collect contaminated soil, water and other materials and dispose it at an appropriate waste dumpsite. • Used solvents and grease should be stored in drums or other suitable containers. It should be sealed and recycled or disposed at an appropriate disposal site. • Hazardous waste should not be burnt. • Bunding, concrete slabs and/or other protective measures should be installed where hazardous materials are handled. • Ensure that the staff are informed and have information pertaining to the management of spills or ingestion. | |
| <p>b. Prevent diesel and oil spills during operation and maintenance and</p> | <p>Concrete, diesel and oil spills and inadequate clean up.</p> | <ul style="list-style-type: none"> • Clean up concrete, fuel and oil spills immediately. • Clean small oil or fuel spills with an approved/appropriate absorbent material. | <p>Checks to prevent and minimise oil and diesel spills and to ensure adequate clean up should spills occur.</p> |

| Objectives | Potential Impact | Management Action | |
|---------------------------|--|---|---|
| ensure adequate clean up. | | <ul style="list-style-type: none"> • Contain oil or fuel spills in water using an approved oil absorbent fibre. • In cases where oil spills cannot be cleaned up immediately, monitor seepage into deeper soils and groundwater. • Do not bury polluted soil, but rather dispose it at an appropriate dump site. • Provide bunding at fuel storage and transfer sites. The bunding should be big enough to contain 110% of the volume of the tank. Where a bund wall encloses a group of tanks, the bund wall must be able to contain 110% of the volume of the largest tank in the group. Tanks must stand on a concrete slab, or otherwise have a sealed, base in order to prevent the leakage of contaminants into the soil. | <p>Frequency: Daily throughout the operation period.</p> <p>Responsible Person: Scheme Supervisor.</p> |
| c. Waste Management | Littering (Litter such as paper, plastic etc. can be blown away into the surrounding environment). | <ul style="list-style-type: none"> • No littering will be allowed. The operation and maintenance areas will be kept free of waste at all times. All maintenance sites will be cleaned on a daily basis before leaving the site. • Provide sufficient waste bins at worksites. Make sure that all waste is removed from the worksites. • Bins should be placed in pairs to ensure that one is always present while the other is being emptied. | <p>Checks to ensure that litter is disposed of correctly in bins provided.</p> <p>Frequency: Daily, at the end of the work day.</p> <p>Responsible Person: Scheme Supervisor.</p> |

| Objectives | Potential Impact | Management Action | |
|------------|------------------|--|--|
| | | <ul style="list-style-type: none"> • Areas likely to generate higher quantities of waste shall be equipped with additional bins. • Refuse bins must be stable, i.e. cannot be tipped by animals, and have scavenger and baboon proof lids. • Make sure that the bins are covered so that plastic bags, paper etc. are not blown away. • Make sure that the bins are regularly emptied and the waste taken to an appropriate waste dumpsite. • The central waste storage vessel shall be emptied weekly or as necessary. | |

Table 3: Workshops, Vehicle and Equipment Management Table

| Objectives | Potential Impact | Management Action | |
|--|--|---|---|
| a. Appropriate storage of machinery, vehicles, and materials. | Inappropriate storage of machinery, vehicles and materials may result in the possible damage/disturbance of nearby undisturbed environments. | <ul style="list-style-type: none"> • Store machinery, vehicles and materials only in demarcated areas. • Do not leave machinery and equipment standing around if not in use. • Do not store machinery, vehicles, or materials in undisturbed or rehabilitating areas | <p>Regular inspection to ensure that machinery, vehicles, and equipment are stored in designated areas.</p> <p>Frequency: Daily.</p> <p>Responsible Person: Scheme Supervisor.</p> |
| b. Minimize the leakage of fuels and lubricants from vehicles and equipment. | The use of vehicles and equipment that may leak fuel and lubricants. | <ul style="list-style-type: none"> • Only service machinery and vehicles in designated areas. • Regularly check your vehicle for fuel and oil leaks. • Maintain vehicles and equipment in good conditions through regular and thorough servicing. • Inform the Foreman of leaking vehicles and machinery so that he can schedule repairs. • Only refuel on the bund created for that purpose. • Immediately clean any accidental fuel and oil spills – do not hose spills into the natural environment. • Dispose of contaminated soil as hazardous waste in the correct location on site. | <p>Visual inspection to ensure that vehicles and equipment are in excellent condition and also to ensure that there is no leakage of fuels and lubricants.</p> <p>Frequency: Daily.</p> <p>Responsible Person: Scheme Supervisor.</p> |

| Objectives | Potential Impact | Management Action | |
|------------|------------------|--|--|
| | | <ul style="list-style-type: none"> • If a mobile fuel bowser is used, then all refuelling shall occur with appropriate measures in place to prevent spillages (drip trays, funnels, non-dripping dispensing nozzles etc.) • All mobile fuel browsers shall carry a spill kit that is adequately sized to contain at least a 200 litre spill. • Train staff in the correct procedure/technique to transfer fuels. • Make sure all vehicles are roadworthy. Repair faulty brakes, exhausts etc. immediately. • Fire extinguishers shall be present whenever undertaking any form of hot work, i.e. welding, gas cutting, angle grinding, etc. | |

Table 4: Health and Safety Management Table

| Objectives | Potential Impact | Management Action | |
|--|------------------------|--|---|
| a. Minimise the risk of HIV infection and the increase of STI's. | Risk of HIV infection. | <ul style="list-style-type: none"> • Provide an AIDS awareness programme to all the staff. | <p>Verify that an awareness and education programme on the risks of HIV/AIDS and recommended preventative measures has been conducted.</p> <p>Frequency: Monthly</p> <p>Responsible Person: Scheme Supervisor.</p> |
| b. Minimise the occurrence of injuries. | Injuries. | <ul style="list-style-type: none"> • Make sure that all staff are equipped and know how to use safety and protective gear. This includes hard hats, goggles, hearing protectors, dusk masks, steel-toed shoes etc. • Keep a comprehensive first aid kit at the scheme offices and at maintenance sites. • Establish an emergency rescue system for evacuation of serious injured people. • Emergency procedures for accidents should be communicated to all employees. | <p>Checks to ensure that correct procedures are followed and that protective clothing are worn at all times during scheme operations and maintenance.</p> <p>Frequency: Check weekly.</p> <p>Responsible Person: Scheme Supervisor.</p> |

| Objectives | Potential Impact | Management Action | |
|------------|------------------|--|--|
| | | <ul style="list-style-type: none"> • Dangerous areas must be clearly marked and access to these areas controlled or restricted. • Good driving and adherence to safety rules will result in a minimum number of road and workplace accidents. • Fire extinguishers must be available at all refuelling sites. Staff should be trained to handle such equipment. • Nobody is allowed to dispose a burning or smouldering object in an area where it may cause the ignition of a fire. • Hazardous substances must be kept in adequately protected areas to avoid soil, air or water pollution. • Work areas, such as these for the maintenance of equipment, must be on concrete slabs. • Explosives should be stored according to the prescribed regulations. | |

9. SITE CLOSURE AND REHABILITATION

Rehabilitation is the process of returning the land in a given area that has been disturbed by operation and maintenance to its original state, or an otherwise determined state. Many projects, if not all, will result in the land becoming degraded to some extent. However, with proper rehabilitation most impacts associated with the operation and maintenance of the scheme and pipelines, could be mitigated and restored to an acceptable level. Poorly rehabilitated areas provide a difficult legacy issue for governments, communities and companies, and ultimately tarnish the reputation of companies as a whole.

Objectives of proper site closure and rehabilitation include the following:

- Reduction or elimination of the need for a long-term management program to control and minimise the long-term environmental impacts;
- Clean-up, treatment or restoration of contaminated areas (e.g. soils contaminated by oil or fuel spills, concrete spills, etc.). Excavation of contaminated material and disposal thereof in an acceptable manner.

Rehabilitation measures to implement:

- a. A site inspection will be held quarterly by the scheme supervisor after every maintenance work during operation of the scheme. Rehabilitation will be done to the satisfaction of the ENV section and MEFT.
- b. Frequent inspections of the scheme and effective follow-up procedures, to prevent minor defects from becoming major repair jobs.
- c. Make sure all soil polluted during maintenance work is properly stored in drums and removed to an appropriate waste dump.
- d. Make sure all windblown litter is removed once maintenance has seized.
- e. Make sure that all potential hazards (i.e. the sewerage pit) are properly closed and left in a safe and neat position.

Rehabilitation will be completed when the above have been achieved.

10. NAMWATER ENVIRONMENTAL CODE OF CONDUCT

What is an Environmental Code of Conduct?

It is a set of rules that everybody has to follow in order to minimise damage to the environment.

What is the ENVIRONMENT?

The ENVIRONMENT means the surroundings within which people live. The ENVIRONMENT is made up of the **soil, water, plants, and animals** and those characteristics of the soil, water, air, and plant and animal life that influence **human health and well-being**. **People and all human activities** are also part of the environment and have to be considered during the operation of the Scheme.

Do these ENVIRONMENTAL RULES apply to me?

YES, The Environmental Rules apply to EVERYBODY. This includes all permanent, contract, or temporary workers as well as any other person who visits the Scheme. Every person will be required to adhere to the Environmental Code of Conduct.

ALL PERSONNEL must study and keep to the Environmental Code of Conduct

The SCHEME SUPERVISOR will issue warnings and will discipline ANY PERSON who breaks any of the Environmental Rules. Repeated and continued breaking of the Rules will result in a disciplinary enquiry and which may result in that person being asked to leave the Scheme permanently.

What if I do not understand the ENVIRONMENTAL RULES?

ASK FOR ADVICE, if any member of the WORKFORCE does not understand, or does not know how to keep any of the Environmental Rules, that person must seek advice from the SCHEME SUPERVISOR. The PERSON that does not understand must keep asking until he/she is able to keep to all the Environmental Rules.

Safety and Security

1. Only enter and exit roadways and construction areas at demarcated entrances.
2. Wear protective clothing and equipment as per signboards at the Scheme and according to instructions from your SCHEME SUPERVISOR.
3. Report to your SCHEME SUPERVISOR if you see a stranger or unauthorised person in the construction area.

4. Never enter any area that is out of bounds or that is demarcated as dangerous without permission of your SCHEME SUPERVISOR.
5. Never climb over any fence or enter private property without permission of the landowner or your SCHEME SUPERVISOR.
6. Do not remove any vehicle, machinery, equipment, or any other object from the maintenance site without the permission of your SCHEME SUPERVISOR.
7. Keep clear of blasting sites. Follow the instructions of your SCHEME SUPERVISOR.
8. Never enter or work in the Scheme while under the influence of alcohol or other intoxicating substances.
9. All staff should know the emergency procedures in case of accidents.

Waste Disposal

10. Learn the difference between different types of waste, namely:
 - general waste, and
 - hazardous waste.

Containers will be provided for different types of wastes.

General Waste includes waste paper, plastic, cardboard, harmless organic (e.g. Vegetables) and domestic waste

Hazardous Waste includes objects, liquids or gases that are potentially dangerous or harmful to any person or the environment. Sewage, fuel, tyres, diesel, oils, hydraulic and brake fluid, paints, solvents, acids, soaps and detergents, resins, old batteries, etc. are all potentially hazardous.

11. Learn how to identify the containers for the different types of wastes. Only throw general waste into containers, bins or drums provided for general waste.
12. Recycle drums, pallets and other containers.
13. Never bury or burn any waste on site, all waste is to be disposed in allocated refuse disposal containers, bins or bags.
14. Never overfill any waste container. Inform your SCHEME SUPERVISOR if you notice a container that is nearly full.
15. Do not litter.
16. Do not bury litter or rubbish in the backfill trench.

Plants and Animals

17. **Do not ever pick any plants, or catch any animal.** People caught with plants or animals in their possession will be handed to the authorities for prosecution.
18. Never feed, tease, play with, or set devices to trap any animal or livestock. Wild animals are not to be domesticated.
19. Keep off the rock outcrops unless given specific permission by the SCHEME SUPERVISOR to be there.
20. Never cut down any tree or branches for firewood.
21. Never leave rubbish or food scraps or bones where it will attract animals, birds, or insects.
22. Rubbish must be thrown into allocated waste disposal bins/bags.
23. Always close the gates behind you.

Preventing Pollution

24. Only work with hazardous materials in bunded areas.
25. Never discard any hazardous substances such as fuel, oil, paint, solvent, etc. into stream channels or onto the ground. Never allow any hazardous substances to soak into the soil.
26. Clean up spills immediately.
27. Immediately report to your SCHEME SUPERVISOR when you spill, or notice any hazardous substance overflow, leak or drip or spill on site, into the streambeds or along the road.
28. Immediately report to your SCHEME SUPERVISOR when you notice any container, which holds hazardous substances overflow, leak or drip. Spillage must be prevented.
29. Only wash vehicles, equipment and machinery, containers and other surfaces at work site areas designated by your SCHEME SUPERVISOR.
30. Do not change oil on uncovered surfaces.
31. If you are not sure how to transport, store, use, or get rid of any hazardous substances ask your SCHEME SUPERVISOR for advice.

Health

32. Drink lots of clean water every day.
33. Use toilets that have been provided.
34. Take the necessary precautions to avoid contracting HIV / AIDS. Condoms are available at most Clinics.
35. Inform your SCHEME SUPERVISOR when you are sick.
36. Do not work with any machinery when you are sick.
37. If you are working in malaria areas, you must take the necessary precautions.

Dust Control

38. Do not make any new roads or clear any vegetation unless instructed to do so by your SCHEME SUPERVISOR.
39. Keep to established tracks and pathways.
40. Keep within demarcated work areas.

Saving Water

41. Always use as little water as possible. Reduce, re-use and recycle water.
42. Never leave taps or hose pipes running. Close all taps after use.
43. Report any dripping or leaking taps and pipes to your SCHEME SUPERVISOR.

Working Hours

44. You may only work on weekends and after hours with the consent of the SCHEME SUPERVISOR.

Archaeological and Cultural Objects

45. If you find any archaeological, cultural, historical or pre-historical object on the maintenance site you must immediately notify your SCHEME SUPERVISOR.
46. Never remove, destroy, or disturb any cultural, historical, or pre- historical object on site.

Cultural and Historical Objects include old buildings, graves or burial sites, milestones, old coins, beads, pottery and military objects.

Pre-Historical objects include fossils and old bones, old human skeletal remains, pieces of pottery and old tools and implements.

Sensible Driving

47. Tracks and roads should be kept to a minimum. Where possible follow existing roads.
48. No off-road driving is allowed.
49. Never drive any vehicle without a valid licence for that vehicle class and do not drive any vehicle that is not road-worthy.
50. Never drive any vehicle when under the influence of alcohol.
51. **Always** keep your headlights on when driving on dusty roads.
52. Keep to the roads as specified by your SCHEME SUPERVISOR. Vehicles may only be driven on demarcated construction roads. Drivers should always use three point turns, “u-turns” are not allowed. Do not cut corners.
53. Do not drive on rocky outcrops.

Noise

- 54. Keep noise levels as low as possible.
- 55. Do not operate noisy equipment outside normal working hours.

Fire Control

- 56. Do not make open fires, use a drum or tin and do not collect any vegetation to burn.
- 57. Do not smoke or make fires near refuelling depots or any other area where fuel, oil, solvents, or paints are used or stored. Fireplaces should be at a safe distance from fuel and explosive storage sites as well as vehicle parking sites.
- 58. Cigarette butts should always be thrown in allocated refuse bins. Make sure that the cigarette butt is out before throwing it into the bin.
- 59. Immediately notify your SCHEME SUPERVISOR if you see an unsupervised fire at the campsite or maintenance site.

Dealing with Environmental Complaints

- 60. If you have any complaint about dangerous working conditions or potential pollution to the environment, talk to your SCHEME SUPERVISOR.
- 61. If any person complains to you about noise, lights, littering, pollution, or any harmful or dangerous condition, immediately report this to your SCHEME SUPERVISOR.

Jolanda Kamburona

Tell: 061-71 2105

Cell: 081 144 1528

or

Fillemon Aupokolo

Tell: 061-71 2095

Cell: 081 325 3301

11. REFERENCES

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GRIEVANCE PROCEDURE

All grievances should be submitted through the completion of the grievance registration form as presented below and submitted to the Scheme Supervisor during the construction phase and to the Scheme Superintendent during the operation and maintenance phase.

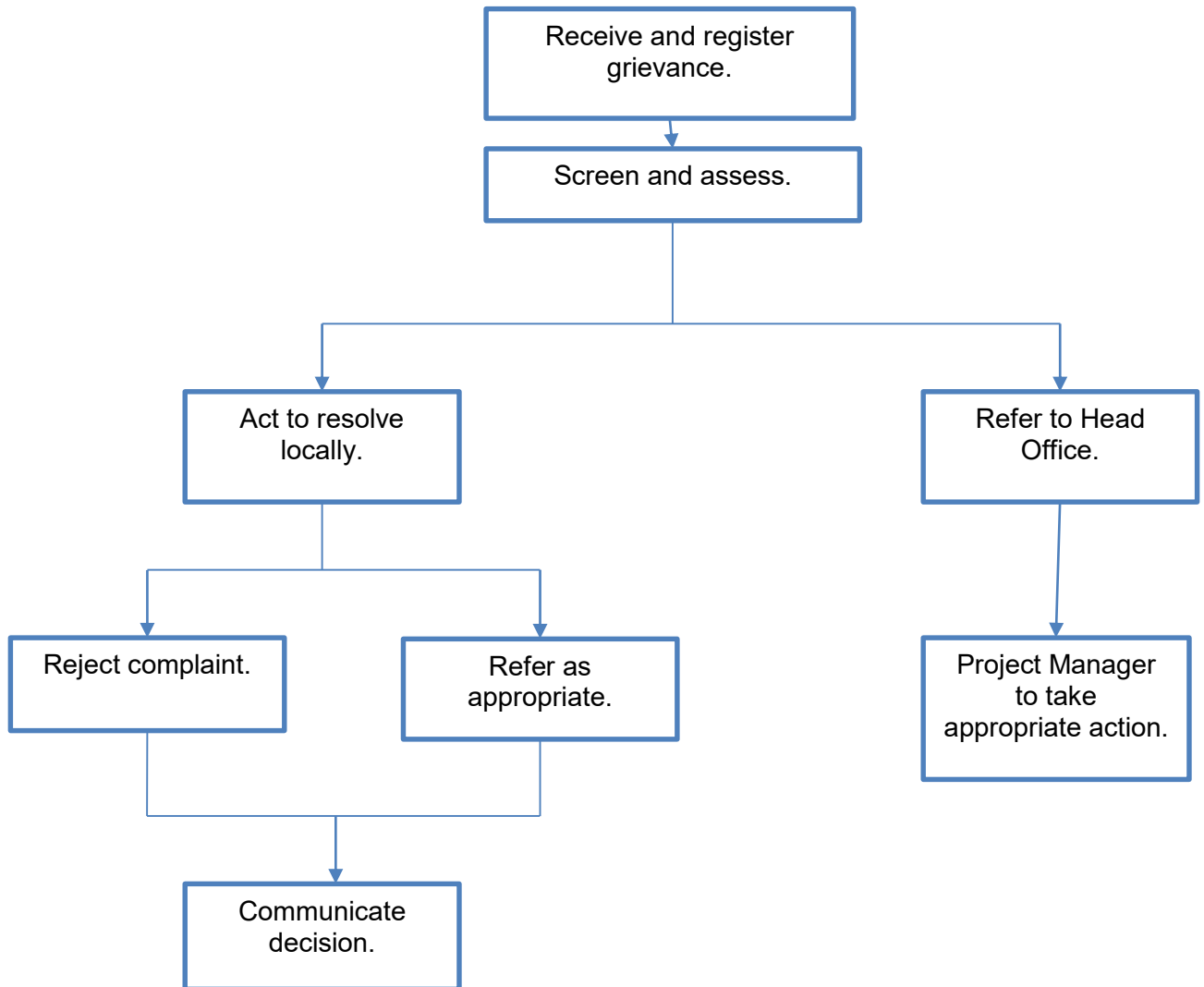


Figure 6: Grievance response procedure

Upon receipt of the registered grievance forms, the Scheme Supervisor shall screen and assess to either act to solve the grievance locally or refer it to head office. If the grievance is referred to the head office, the line manager should decide. If the grievance is to be solved locally, it should either be rejected or handled appropriately of which the decision should be communicated to the aggrieved person.

GRIEVANCE REGISTRATION

| Grievance Registration | |
|--|---------------------------|
| Case No: | Date: |
| Name of complainant: | Cell no: |
| | Email address: |
| Details of grievance: (Date, location, persons involved, frequency of occurrence, effects of ensuing situation, etc) | |
| Name of person recording grievance: | Cell number: |
| Proposed date of response: | |
| Signature of recording person: | Signature of complainant: |
| Date of redress: | |