

**ENVIRONMENTAL MANAGEMENT PLAN**  
FOR  
THE GRUNAU WATER SUPPLY SCHEME



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## LIST OF ABBREVIATIONS

<b>AIDS</b>	Acquired Immune Deficiency Syndrome
<b>CoC</b>	Code of Conduct
<b>DEA</b>	Directorate of Environmental Affairs
<b>EMA</b>	Environmental Management Act
<b>EMP</b>	Environmental Management Plan
<b>HIV</b>	Human Immunodeficiency Virus
<b>I&amp;AP</b>	Interested and Affected Parties
<b>MET</b>	Ministry of Environment and Tourism
<b>NEM</b>	NamWater Environmental Manager
<b>MSDS</b>	Material Safety Data Sheet
<b>NWQG</b>	Namibian Water Quality Guidelines
<b>NWQS</b>	Namibian Water Quality Standards
<b>STI's</b>	Sexually Transmitted Infections
<b>WTW</b>	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 Grünau Water Supply Scheme. Best practice is proposed for the generic issues of construction management and supervision as well as the on-going management and operation of the pipeline.

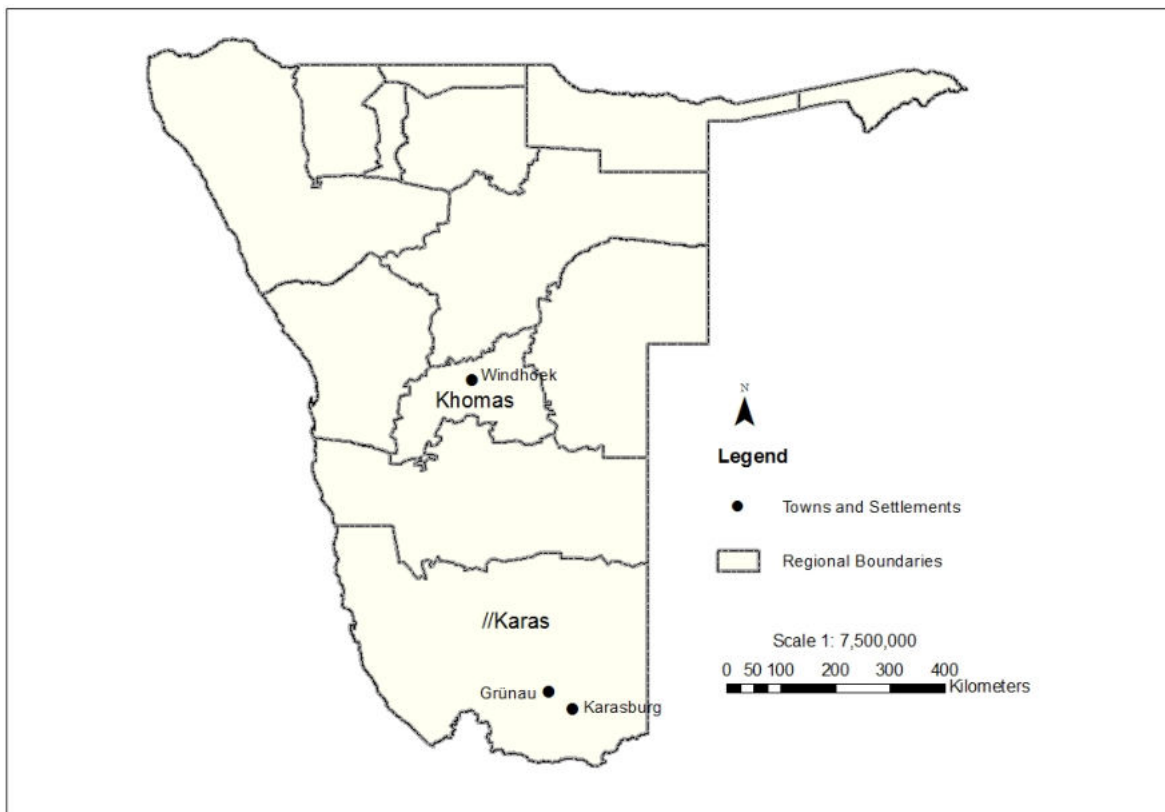
In terms of the Environmental Assessment Policy of 1994 and the Environmental Management Act (Act No 7 of 2007) (EMA), the activities required for the construction of the proposed project requires authorization from the Directorate of Environmental Affairs at the Ministry of Environmental and Tourism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

## 2. INTRODUCTION

NamWater is responsible for bulk water supply to Grünau. Grünau has the following facilities and services available, a hotel, a Shell filling station and garage, a railway station, a pre-primary and primary school, a hostel, a mission, a Village Council office, and a Department of Works office Springs Resort that is situated 50 km from the Orange River in the Karas Area. The village is governed by the Karas Regional Council.

The proclaimed settlement area of Grünau is located approximately 50 km northwest of Karasburg next to the national road and railway line that connects Keetmanshoop to Noordoewer. The current population of Grünau is estimated as 521 persons. The location of Grünau is depicted in **Figure 1**.

The EMP is for an existing scheme and it is therefore only for the operation of the scheme.



**Figure 1: Grünau Location Map**

### 3. EXISTING GRÜNAU WATER SUPPLY INFRASTRUCTURE

#### 3.1 Water Source

Groundwater is sourced from two locations. The first source is from farm Grabwasser, located some 9 kilometres North-West of the town, where water is pumped from two boreholes, WW 23404 and WW 23405, drilled on dolerite dykes. The second source is from the farm Quartzdrift, located some two kilometres of Grünau, where water is pumped from four boreholes, WW 23406, WW 23407, WW 33890 and WW 33891, drilled into a quartz filled fault.

The Grünau Bulk Water Supply Scheme (BWSS) consists of six production boreholes, four equipped with diesel-driven mono pumps (WW 23404, WW 23405, WW 23406 & WW 23407). Boreholes WW 33890 and WW 33891 are equipped submersible Grundfos pumps powered with solar panels.

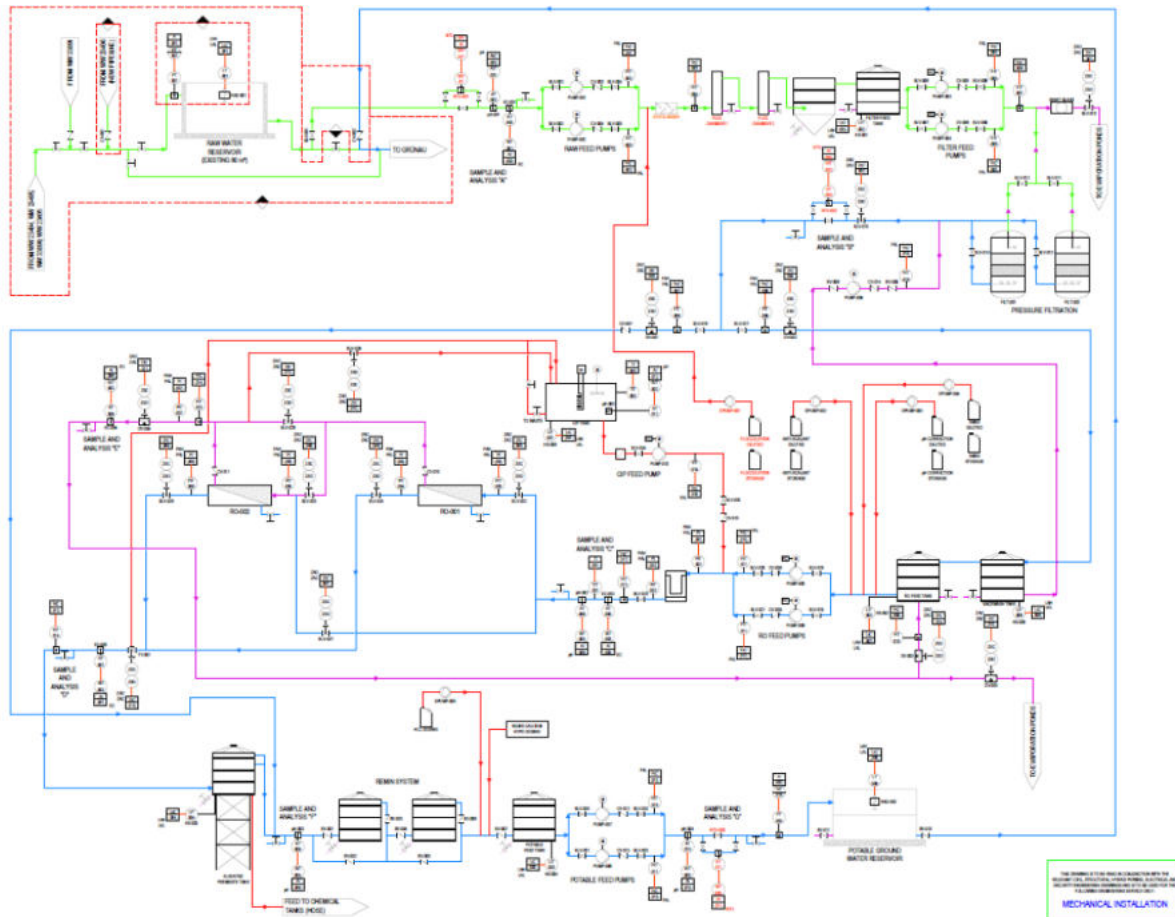
A schematic layout of the existing infrastructure is indicated in **Figure 2** below.

The production boreholes at Grünau provide raw water that contains parameters within Group B and/or Group C of the guidelines.

At present, chlorination takes place by means of a floating dispenser inside the terminal reservoir that has a capacity to chlorinate 200 m<sup>3</sup> of water per day. The floating dispensers have a maximum treatment capacity of 200 m<sup>3</sup>/day.

#### 3.2 Reverse Osmosis (RO) Plant

The Grünau WTP reverse osmosis is comprised of a two stage RO system with cartridge pre-filtration, a recycle return stream and a clean in place (CIP) loop. A portion of the filtrate from the dual media filter process is fed into the RO feed water tank. The RO feed pumps (PUMP-005 & PUMP-006) consist of duty/standby high-pressure multistage pumps. Water is pumped via the instrumentation (listed in Table 1 below) as well as the 5 µm cartridge filter into the first stage vessel. A brine stream (the high dissolved ion concentration water) discharges from the RO vessel on the other end of the vessel and flows to the second stage RO vessel for further treatment. Permeate is generated across the membrane and is collected in the permeate ports on one end of the RO vessel. The permeate is discharged into a permeate collection tank. The flow, conductivity and pH of the permeate is monitored with on-line instrumentation. The brine from the first stage remains under pressure after discharging from the RO vessel and flows into the second stage vessel for secondary RO treatment. A portion of the brine from the second stage RO vessel is recycled back to the RO feed tank. The balance of the RO brine flow is directed to the evaporation ponds. In order to achieve reverse osmosis a feed flow pressure needs to be sustained across the membrane elements. The actuated modulating diaphragm valve (DV-004) is used to automatically control the system pressure and brine flow. Flow meters are used to set the diaphragm valve. The clean in place (CIP) unit consists of a CIP tank, control instrumentation, heater, mixer and pump. The CIP chemical is pumped to the feed flow manifold upstream of the cartridge filter housing. A by-pass is also installed to by-pass the RO plant in the case of an emergency.



**Figure 2: Process and Instrumentation Diagram**

### 3.3 Pipe Work

The pipeline connecting the boreholes WW 23404 and WW 23405 to the first 100 m<sup>3</sup> reservoir is a Ø90 mm, Class 6 uPVC pipe of 250 m length. Reservoir 1 is then connected to another 100 m<sup>3</sup> ground-level clear water reservoir, ± 6.5 km away, by a Ø90 mm uPVC pipe with Class 6 and 9 sections. Boreholes WW 33890 and WW 33891 are connected to this pipeline near to the second reservoir in a manhole. Borehole WW 23407 is connected to the second reservoir site in front of the old chlorination installation (same manhole) by a Ø63 mm uPVC pipe of 1 530 m length.

From Reservoir 2 a Ø160 mm diameter, uPVC Class 4 pipeline of 1 360 m length, leads to the two mechanical bulk water meters. The last borehole, WW 23406, is connected to this pipeline leading to the bulk water meters.

### 3.4 Reservoirs

The first production borehole, WW 23404, at farm Grabwasser is connected to a 100 m<sup>3</sup> concrete reservoir (Reservoir 1) via a Ø90 mm, 250 m long, Class 6 uPVC pipeline, while the next borehole, WW 23405, is situated right next to this Reservoir. The two production boreholes WW 33890 and WW 33891, are directly connected to a manhole just in front of the second 100 m<sup>3</sup> reservoir, where the Ø63 mm uPVC pipeline of 1530 m length from borehole WW 23407 terminates as well. The last borehole, WW 23406, is connected to the Ø160 mm, class 4 uPVC pipeline leading to the bulk water meters at the village boundary by a Ø63 mm uPVC pipeline of unknown class. The water gravitates from the mechanical bulk water meters, into the 100 m<sup>3</sup> Braithwaite bolted galvanised steel panel tank on a 12 m high tower.



### 3.5 Power Supply and Control System

#### 3.5.1 Borehole Power Supply

At present four of the six production boreholes are driven by diesel engines. The other two boreholes are equipped with solar driven pumps.

#### 3.5.2 Hybrid Power Plant

The plant consists of Solar and Wind Power (Figure 3 and 4). The plant consists of 64 x 300Wp Canadian Solar Photovoltaic Modules, producing a maximum of 19.2kWp, which is controlled by 4 x Victron Charge Regulators, charging a 140kWh Lithium Ion Phosphate battery. The Wind Turbine is an 800W unit, elevated 12m to harvest available wind energy and also send the energy to the Lithium Ion battery. The stored energy is then extracted by 3 x 5kVA Victron inverters, providing a maximum of 15kVA 3-phase power to the water treatment plant. The Victron equipment is monitored, data logged and controlled by a Victron Colour Controller device. The Wind Turbine data is logged on a AcuDC240 data logger and communicated to the Scada accordingly.



**Figure 3 Solar PV Plant**



**Figure 4: Wind Turbine**

### 3.6 Evaporation Ponds

The evaporation ponds are provided to collect the brine from the RO membrane system, which is approximately 4.3 m<sup>3</sup>/day. Permeate recovery from the plant is in the order of 85%. There four ponds each with an internal area at ground-level of 12.5m by 25m are lined with a high-density polyethylene HDPE liner, 1.5mm thick.



Figure 5: Evaporation Ponds

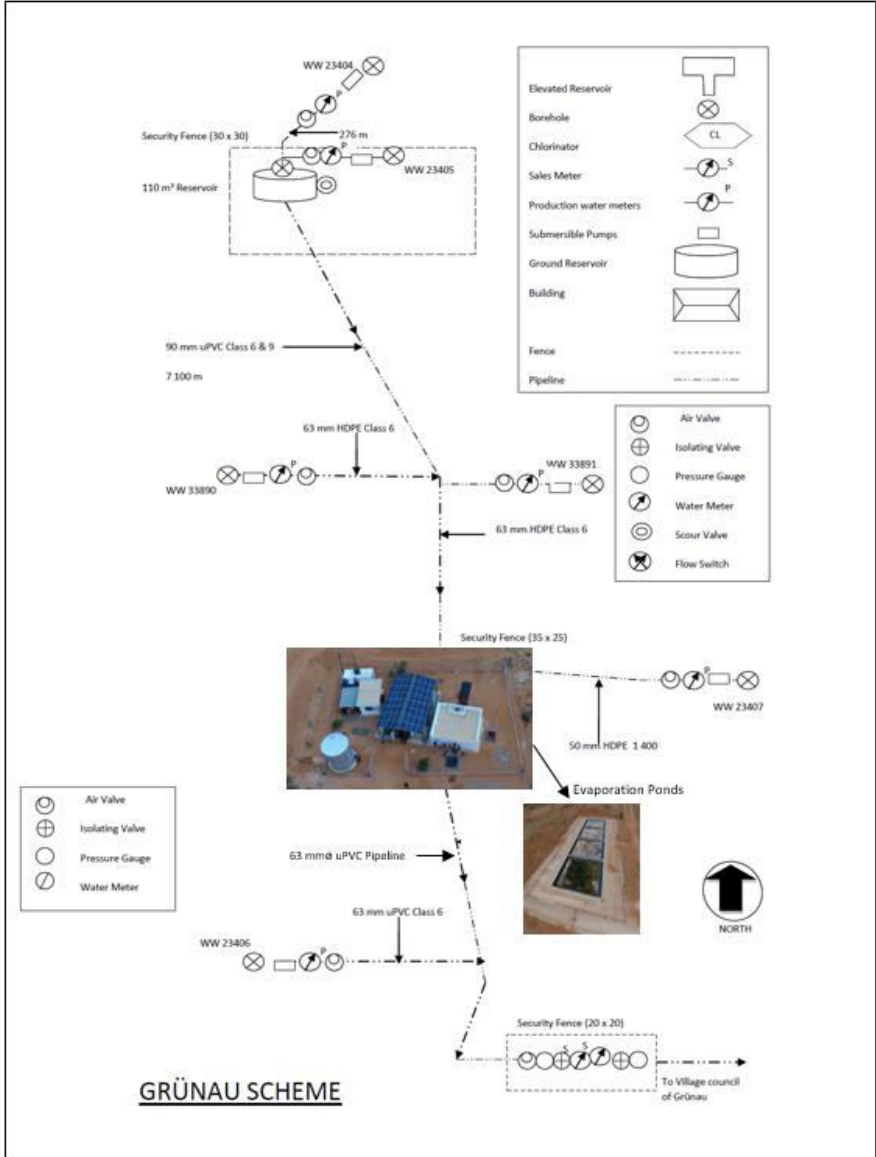


Figure 2: Grünau Scheme Schematic Layout

### **3.7 Scheme Processes/Operation**

#### **3.7.1 Automatic Operation**

The plant is designed and built to be operated in a fully automated manner. The stopping and starting of the pumps are carried out automatically and are controlled by the level units in the RO feed water tank as well as the Potable Feed water tank. The plant is programmed to chase a set recovery rate (set to 63 % at commissioning) through the RO process. This is automatically achieved by the opening and closing of a modulating diaphragm valve located on the brine stream of the RO's second stage. The plant is required to recycle a certain amount of brine to the RO Feed tank – set to 0.5 m<sup>3</sup>/h at commissioning. Instruments monitor the upstream and downstream pressures of the RO vessels. Temperature , pH and electrical conductivity are monitored on the feed water, brine and permeate. The set alarm will automatically be raised as soon as the limits are reached. The CIP process requires the process controller for initiation and is not an automated procedure.

#### **3.7.2 Manual Operation**

Manual operation of the plant is not recommended as the plant was designed to be operated fully automatic. If required the following manual operations are described below. The RO process can run in manual mode, but will not be able to function optimally in a fully manual mode. Optimal operation will require that the operator therefore adjusts the necessary parameters accordingly.

### **3.8 Maintenance**

Remedial maintenance is carried out by the operator and assistants, while the maintenance of the mechanical and electrical equipment, buildings, pipelines and installations is carried out by NamWater from the Keetmanshoop office.

### **3.9 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.

### **3.10 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.

### **3.11 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.

### **3.12 Reservoirs**

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

### **3.13 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 the receiving environment:

### 4.1 Climate

The Grünau area has a typical semi-desert climate, with temperatures soaring during the day. Relief from the heat comes in short spells of occasional thunderstorms.

#### 4.1.1 Precipitation

Grünau experience extremely low rainfall with average annual rainfall ranging between 100 and 200 mm. Rainfall occurs as convective showers and is confined mainly to a rainy season, which extends from October to April. Most of the rain, however occurs during the months of February and March. Rainfall is highly variable and unpredictable, as is the case for most of Namibia.

#### 4.1.2 Temperature

During the hot summer months (October - March) temperatures can rise up to 48°C during the day and cools down to about 30 C at night. During the short winters, temperatures can go down below zero at night, but quickly picks up during the day to a moderate 20 to 28°C.

### 4.2 Geohydrology

Grünau is underlain by the granite-gneiss of the Namaqualand Complex, as typically reflected by the water supply situation in the area. Small rivers and contact zones of younger dolerite dykes surrounding the area, recharges the Groundwater through fractured zones. The groundwater flow direction is north-west to south-east.

### 4.3 Natural Flora

Grünau and surrounds is found within the Succulent Karoo Biomes, which is typically dominated by *Euphorbia*, *Aloe* and *Boscia* species, while on the plains, the dominant species include *Acacia karroo*, *Tamarix usneoides*, *Rhigozum trichotomum*, *Rhus lancea*, *Acacia erioloba*, *Parkinsonia Africana*, and *Euclea pseudebenus*. The grass that is dominantly found in the area is the *Stipagrostis* species.

### 4.4 Fauna

There are several fauna species that can be encountered around the Grünau area, such as the Hartmann zebra (*Equus zebra hartmannae*), Barlow's lark (*Certhilauda barlowi*), kudu (*Tragelaphus strepsiceros*), De Winton's golden mole (*Cryptochloris wintoni*), klipspringer (*Oreotragus oreotragus*), Karoo bustard (*Eupodotis vigorsii*), Ludwig's bustard (*Neotis ludwigii*), Karoo chat (*Cercomela schlegelii*), dune lark (*Certhilauda erythrochlamys*), and dusky sunbird (*Nectarinia fusca*), armadillo girdled lizard (*Cordylus cataphractus*), steenbok (*Raphicerus campestris*), baboon (*Papio ursinus*) and springbok (*Antidorcas marsupialis*) (Conservation International, 2008).

## 5. THE LEGAL ENVIRONMENT

A legal review was done and the key laws of concern include those which protect the ecological integrity of the Grūnau 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 Grūnau 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, MET: 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 MET: 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.

## **7. ENVIRONMENTAL MANAGEMENT PLAN**

An Environmental Management Plans (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.

MET 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 Grünau 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 Grünau Water Treatment Works (WTW). 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"> <li>Avoid small mammal / reptile and bird nesting where possible. Do not hurt, kill or unnecessarily disturb birds or animals.</li> </ul>	<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 pipelines 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"> <li>Do not remove any vegetation unless it is absolutely necessary. Make sure that operation and maintenance team is well informed.</li> <li>Do not disturb, deface, destroy or remove plants or natural features, whether fenced or not.</li> </ul>	<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>
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"> <li>Avoid small mammal / reptile and bird nesting where possible. Do not hurt, kill or unnecessarily disturb birds or animals.</li> </ul>	<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>

Objectives	Potential Impact	Management Action	
			<p>Frequency: Monthly.</p> <p>Responsible Person: Scheme Supervisor.</p>
<p>d. Prevent the poaching of flora and fauna.</p>	<p>Poaching of fauna and flora.</p>	<ul style="list-style-type: none"> <li>• Employees who poach fauna and/or flora will be handed to the authorities for prosecution.</li> <li>• 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.</li> </ul>	<p>Visual inspection.</p> <p>Frequency: Weekly visual checks.</p> <p>Responsible Person: Scheme Supervisor</p>
<p>e. Minimise the creation and use of tracks outside existing roads.</p>	<p>Creation of tracks outside existing roads.</p>	<ul style="list-style-type: none"> <li>• Use existing roads.</li> <li>• Traffic shall be controlled to ensure minimal disruption to other road users.</li> <li>• Do not construct new roads when the quality of existing roads deteriorates. Where possible, repair or upgrade existing roads.</li> <li>• Ensure that adequate vehicle turning areas are allowed for.</li> <li>• Enforce speed limits at all times. Unless otherwise specified, the speed limit on access roads is 50km/h.</li> <li>• Runoff from roads must be managed to avoid erosion and pollution problems.</li> <li>• Roads not required for further use shall be rehabilitated immediately.</li> <li>• Use 3-point turns and not U-turns. Confine turning to the road.</li> </ul>	<p>Visual checks to ensure that no off-road driving exists.</p> <p>Frequency: Weekly.</p> <p>Responsible Person: Scheme Supervisor.</p>

Objectives	Potential Impact	Management Action	
		<ul style="list-style-type: none"> <li>Prevent shortcuts between roads.</li> </ul>	
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"> <li>Do not disrupt any archaeological or palaeontological sites. Inform NEM (N.P. du Plessis at cell no 081 127 9040) who will take the necessary action.</li> <li>All workers will be educated about the importance of preserving archaeological sites.</li> <li>Educate specific workers about tell-tale signs of archaeological sites and the action to be taken if one is identified</li> </ul>	<p>Monitoring can and should involve field induction of key scheme personnel so that they will be able to recognize the important palaeontological and archaeological sites themselves.</p> <p>Frequency: Monthly.</p> <p>Person Responsible: Scheme Supervisor.</p>
g. Minimise the number of heavy vehicles on the road.	Increased number of heavy vehicles on the road.	<ul style="list-style-type: none"> <li>Heavy vehicles should be limited to numbers necessary.</li> </ul>	<p>Checks to ensure that there is minimal heavy vehicle on the road.</p> <p>Frequency: Weekly.</p> <p>Responsible Person: Scheme Supervisor.</p>
h. Minimise and if possible prevent the activities that accelerate erosion during operation or maintenance.	Erosion.	<ul style="list-style-type: none"> <li>Runoff on steep inclines should be diverted to prevent the formation of erosion gullies.</li> <li>Vegetative cover is the most efficient and economical means of controlling soil erosion.</li> <li>Berms should be constructed at selected intervals on long sloping areas to prevent erosion. Diversion berms should be reshaped as necessary to divert runoff.</li> </ul>	<p>Visual inspection to ensure that activities that accelerate soil erosion are minimised and if possible prevented at all cost.</p> <p>Frequency: Weekly.</p>

Objectives	Potential Impact	Management Action	
		<ul style="list-style-type: none"> <li>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.</li> <li>Runoff should be guided to a point where it will not cause damage. Scour by the discharge of runoff should be prevented.</li> </ul>	Responsible Person: Scheme Supervisor.
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"> <li>No vegetative matter may be removed for firewood.</li> <li>The collection and removal of firewood is not allowed.</li> </ul>	<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"> <li>Install and maintain silencers on trucks and machinery.</li> <li>Repair faulty brakes.</li> <li>Operators should not use hooters for the purposes of general communication.</li> </ul>	<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>
k. Driving	Increased risk for accidents	<ul style="list-style-type: none"> <li>No operator will operate any equipment when he is under the influence of alcohol.</li> <li>Adhere to safety rules.</li> <li>Always keep your headlights on.</li> </ul>	<p>Visual inspection to ensure that activities that generate noise are minimised and if possible prevented.</p> <p>Frequency: Weekly.</p>

Objectives	Potential Impact	Management Action	
		<ul style="list-style-type: none"> <li>Drivers must have the correct licence for the vehicle they are driving.</li> </ul>	Responsible Person: Scheme Supervisor.
l. To avoid potential chemical /hazardous substance pollution	Pollution	<ul style="list-style-type: none"> <li>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.</li> </ul>	<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 activities as well as proactive intervention to avoid, and if required, to respond to emergencies	Environmental Degradation	<ul style="list-style-type: none"> <li>Establish regular reporting procedures on maintenance</li> <li>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.</li> <li>Review, and if necessary, revise maintenance manual.</li> <li>Establish emergency procedures guidelines for the blockage/failure, flooding, contaminant removal and disinfection, power failure and fire of the scheme.</li> <li>Implement the response procedures when emergency incident occurs.</li> <li>Complete the incident report checklist in the case of emergency and keep with monitoring records for submission.</li> <li>Undertake annual education course for all operational staff.</li> </ul>	<p>A review of the Operations and Maintenance Manual.</p> <p>Frequency: Bi-annual</p> <p>Responsible Person: NamWater Maintenance Team</p>

Objectives	Potential Impact	Management Action	
		<ul style="list-style-type: none"><li data-bbox="875 252 1599 284">• Review, and if necessary revise emergency manual.</li></ul>	

**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"> <li>• Enforce a waste management programme.</li> <li>• All waste will be removed to an appropriate waste dump.</li> <li>• No waste should be buried.</li> <li>• General Waste: Includes waste paper, plastic, cardboard, harmless organic (e.g. vegetables) and domestic waste.</li> <li>• 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.</li> <li>• Contaminated soil should be stored in drums and taken to the nearest appropriate waste dumpsite.</li> <li>• Do not change oil on uncovered ground. Drip trays will be used to catch oil when vehicles are repaired in the field.</li> <li>• 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.</li> <li>• In the event of an hazardous spill:               <ul style="list-style-type: none"> <li>• Immediately implement actions to stop or reduce the spill.</li> <li>• Contain the spill.</li> <li>• Arrange implementation of the necessary clean-up procedures.</li> </ul> </li> </ul>	<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"> <li>• Collect contaminated soil, water and other materials and dispose it at an appropriate waste dumpsite.</li> <li>• 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.</li> <li>• Hazardous waste should not be burnt.</li> <li>• Bunding, concrete slabs and/or other protective measures should be installed where hazardous materials are handled.</li> <li>• Ensure that the staff are informed and have information pertaining to the management of spills or ingestion.</li> </ul>	
<p>b. Prevent diesel and oil spills during operation and maintenance and ensure adequate clean up.</p>	<p>Concrete, diesel and oil spills and inadequate clean up.</p>	<ul style="list-style-type: none"> <li>• Clean up concrete, fuel and oil spills immediately.</li> <li>• Clean small oil or fuel spills with an approved/appropriate absorbent material.</li> <li>• Contain oil or fuel spills in water using an approved oil absorbent fibre.</li> <li>• In cases where oil spills cannot be cleaned up immediately, monitor seepage into deeper soils and groundwater.</li> <li>• Do not bury polluted soil, but rather dispose it at an appropriate dump site.</li> <li>• 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</li> </ul>	<p>Checks to prevent and minimise oil and diesel spills and to ensure adequate clean up should spills occur.</p> <p>Frequency: Daily throughout the operation period.</p> <p>Responsible Person: Scheme Supervisor.</p>

Objectives	Potential Impact	Management Action	
		<p>on a concrete slab, or otherwise have a sealed, base in order to prevent the leakage of contaminants into the soil.</p>	
<p>c. Waste Management</p>	<p>Littering (Litter such as paper, plastic etc. can be blown away into the surrounding environment).</p>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Provide sufficient waste bins at worksites. Make sure that all waste is removed from the worksites.</li> <li>• Bins should be placed in pairs to ensure that one is always present while the other is being emptied.</li> <li>• Areas likely to generate higher quantities of waste shall be equipped with additional bins.</li> <li>• Refuse bins must be stable, i.e. cannot be tipped by animals, and have scavenger and baboon proof lids.</li> <li>• Make sure that the bins are covered so that plastic bags, paper etc. are not blown away.</li> <li>• Make sure that the bins are regularly emptied and the waste taken to an appropriate waste dumpsite.</li> <li>• The central waste storage vessel shall be emptied weekly or as necessary.</li> </ul>	<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>



**Table 3: Workshops, Vehicle and Equipment Management Table**

Objectives	Potential Impact	Management Action	
<p>a. Appropriate storage of machinery, vehicles and materials.</p>	<p>Inappropriate storage of machinery, vehicles and materials may result in the possible damage/disturbance of nearby undisturbed environments.</p>	<ul style="list-style-type: none"> <li>• Store machinery, vehicles and materials only in demarcated areas;</li> <li>• Do not leave machinery and equipment standing around if not in use;</li> <li>• Do not store machinery, vehicles or materials in undisturbed or rehabilitating areas</li> </ul>	<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>
<p>b. Minimize the leakage of fuels and lubricants from vehicles and equipment.</p>	<p>The use of vehicles and equipment that may leak fuel and lubricants.</p>	<ul style="list-style-type: none"> <li>• Only service machinery and vehicles in designated areas.</li> <li>• Regularly check your vehicle for fuel and oil leaks.</li> <li>• Maintain vehicles and equipment in good conditions through regular and thorough servicing.</li> <li>• Inform the Foreman of leaking vehicles and machinery so that he can schedule repairs.</li> <li>• Only refuel on the bund created for that purpose.</li> <li>• Immediately clean any accidental fuel and oil spills – do not hose spills into the natural environment.</li> <li>• Dispose of contaminated soil as hazardous waste in the correct location on site.</li> <li>• 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.)</li> </ul>	<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"> <li>• All mobile fuel browsers shall carry a spill kit that is adequately sized to contain at least a 200 litre spill.</li> <li>• Train staff in the correct procedure/technique to transfer fuels.</li> <li>• Make sure all vehicles are roadworthy. Repair faulty brakes, exhausts etc. immediately.</li> <li>• Fire extinguishers shall be present whenever undertaking any form of hot work, i.e. welding, gas cutting, angle grinding, etc.</li> </ul>	

**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"> <li>• Provide an AIDS awareness programme to all the staff.</li> </ul>	<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"> <li>• 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.</li> <li>• Keep a comprehensive first aid kit at the scheme offices and at maintenance sites.</li> <li>• Establish an emergency rescue system for evacuation of serious injured people.</li> <li>• Emergency procedures for accidents should be communicated to all employees.</li> <li>• Dangerous areas must be clearly marked and access to these areas controlled or restricted.</li> <li>• Good driving and adherence to safety rules will result in a minimum number of road and workplace accidents.</li> </ul>	<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"> <li>• Fire extinguishers must be available at all refuelling sites. Staff should be trained to handle such equipment.</li> <li>• Nobody is allowed to dispose a burning or smouldering object in an area where it may cause the ignition of a fire.</li> <li>• Hazardous substances must be kept in adequately protected areas to avoid soil, air or water pollution.</li> <li>• Work areas, such as these for the maintenance of equipment, must be on concrete slabs.</li> <li>• Explosives should be stored according to the prescribed regulations.</li> </ul>	

## 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 MET.
- 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 be 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 maintenance 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 maintenance 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 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.

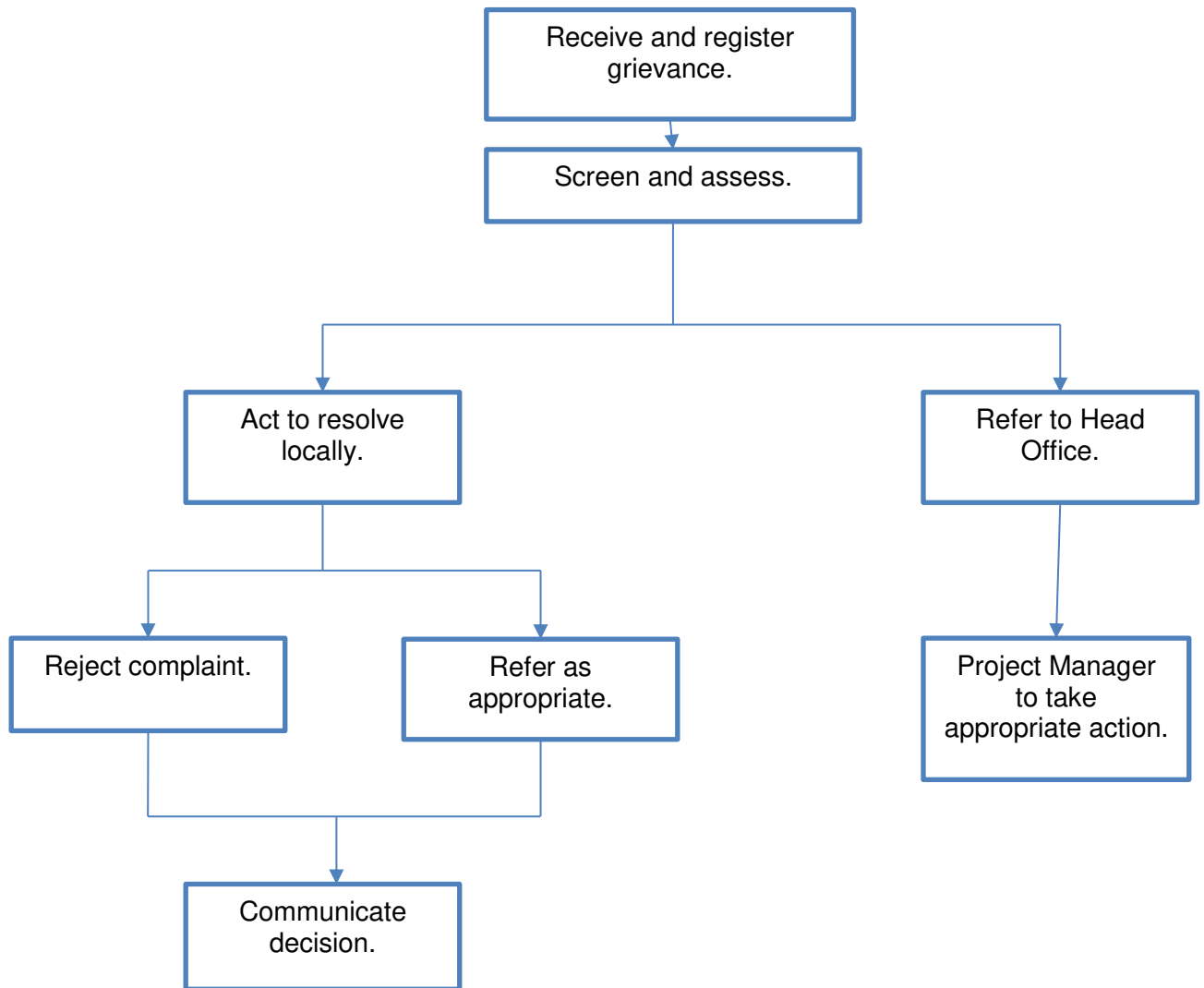


Figure 1: Grievance response procedure

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 FORM

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