

CENTRAL NORTH WATER SUPPLY AREA: ZONE 6

ENVIRONMENTAL MANAGEMENT PLAN

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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 and updated for the management of potential environmental impacts during the operation, and decommissioning phases of the existing Central North Water Supply Area (CNWSA): Zone 6 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 water supply scheme.

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 2018 and this EMP serves as an application for the renewal of the ECC.

2. INTRODUCTION

The Central North Water Supply Area (CNWSA) is located in the Central North area of Namibia, and covers areas of the Oshikoto, Omusati, Oshana and Ohangwena Regions. CNWSA infrastructure components have been divided into 8 separate zones.

The infrastructure of Zone 6, includes the Oshakati Purification Plant, four pump stations at this Plant and one at Ongwediva, the Oshakati – Ongwediva – Ondangwa (old) bulk pipeline, as well as the Oshakati – Omapale Rural Water Supply Scheme. Reservoirs are located at the Oshakati Purification Plant and at Ongwediva Pump Station. The urban centres of Eheke, Ongwediva and Oshakati are located in Zone 6.

The NamWater premises in Oshakati contain the purification plant, several reservoirs and pump stations. The Oshakati Purification Plant is the source of water for Zones 6, 7 and 8. At Oshakati, raw water from the Ogongo – Oshakati Canal is treated, stored and pumped towards Omakango, Ondangwa, lindangungu, Omapale and into the Oshakati Town's distribution network. Under Zone 6, treated water is pumped eastwards to Ongwediva and Ondangwa and southwards to Omapale. The supply of water northwards, eastwards and north-westwards from Oshakati is covered by Zone 7.

Treated water was previously transferred to Oshakati from the Ogongo Pump Station, but this was prior to the construction of the Oshakati Purification Plant and this facility is now used for emergency purposes only.

2.1 Oshakati Purification Plant

The Oshakati Purification Plant is a conventional design, the construction of which was completed at the end of 1996. The plant was sized to treat water not only for Oshakati, but also for a substantial area north, south and east of Oshakati.

The location of CNWSA: Zone 6 is depicted in **Figure 1**.

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

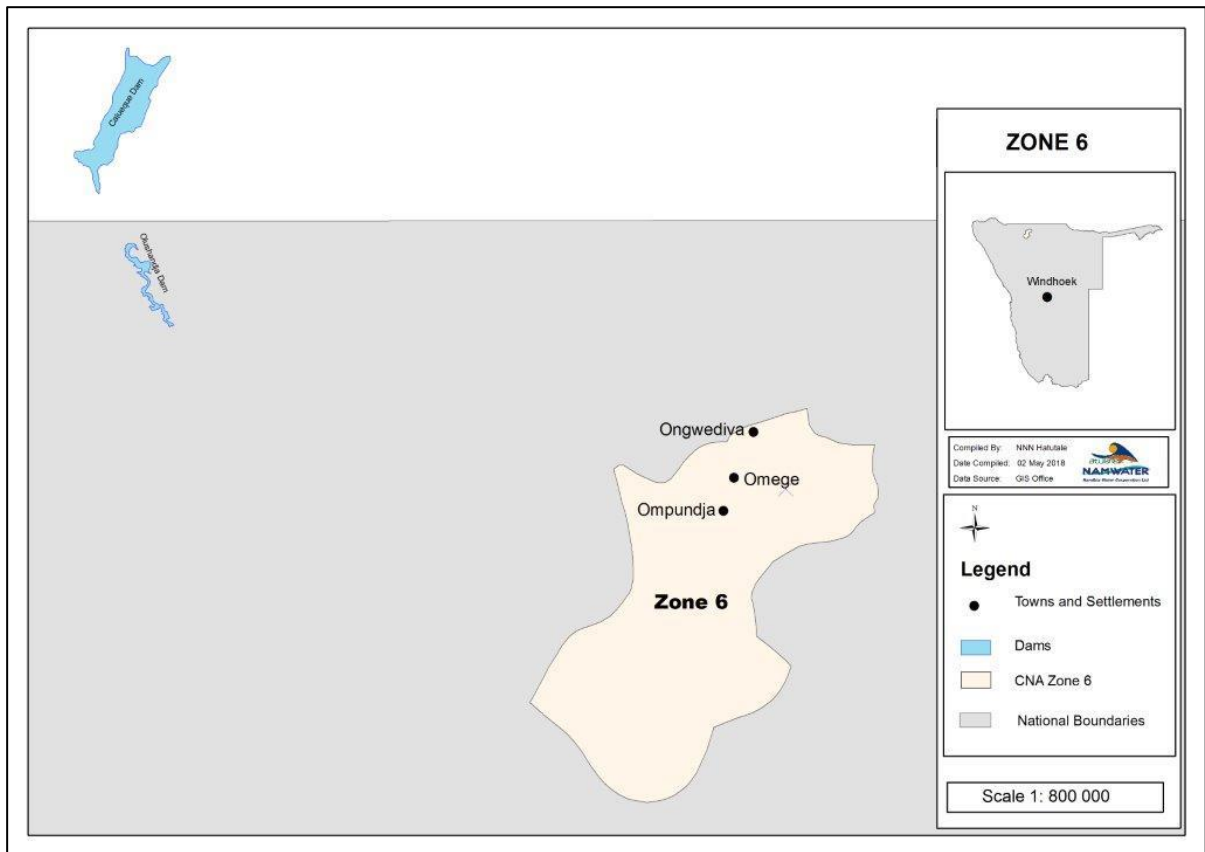


Figure 1: CNWSA: Zone 6 Location Map

3. EXISTING CNWSA: ZONE 6 WATER SUPPLY INFRASTRUCTURE

3.1. Water Source

3.1.1 Oshakati Purification Plant

The plant receives its water from the Calueque Dam in the Kunene River by means of the Calueque - Oshakati Canal. The canal discharges into a forebay at the site of the purification plant. From there the water is pumped to a flash mixer. At the flash mixer, lime and a coagulant, presently a polymer, are dosed. Facilities for the dosing of aluminium sulphate and ferric chloride have also been provided. From the flash mixer, the water flows through flocculation channels to the sedimentation tanks, also called clarifiers. These clarifiers are equipped with lamella packs. Settled water flows from the clarifiers to six Aquazur V-type filters. The clear water from the filters is chlorinated and pumped to the clear water reservoir. Sludge from the clarifiers and the filters is discharged to four sludge lagoons. The sludge lagoons are utilised as a sludge drying facility, and for decanting of the sludge supernatant water back to the forebay.

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

3.2. Water Quality and Disinfection

The quality of water supplied to the CNWSA: Zone 6 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. It is expected that the Act and Regulations will come in force before the end of the year (2017) or by early next year (2018). 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 as Group **A** (see appendix attached).

The chlorination point of the filtered water is only done upstream of the Linyanti Pump Station at the Katima Mulilo Treatment Plant.

3.2.1 Oshakati Purification Plant

The design of the water purification process includes the unit processes of pre-chlorination, coagulation, flocculation, sedimentation, intermediate chlorination, filtration, stabilisation (pre- and post-lime dosing) and post chlorination. Other activities include chemical storage, chemical preparation and dosing, lime saturation, sludge recycling, filter backwash recovery and waterworks sludge disposal in lagoons, with the recirculation of supernatant. These processes and components are discussed in the following paragraphs.

The plant was designed for an average clean water flow of 40 000 m³ per day with a peak flow capacity of 50 000 m³/day.

3.2.1.1 Raw Water Pumping Station

Raw water is pumped from the forebay to the flash mixer. Raw water is metered at the pump station and at the flash mixer with in-line flow meters.

Three raw water pumps with variable speed drives have been installed to achieve the flexibility required for the average and peak flow conditions. The pumps have been designed for a peak flow of 2 625 m³/h.

3.2.1.2 Coagulation and Flocculation

The bulk of the water to be treated at Oshakati is raw Kunene River water, which is a natural surface water.

The plant has a hydraulic flash mixer. Provision has been made to recycle sludge from the clarifier into the flash mixer in order to aid floc formation.

In the original design, the coagulants provided for were aluminium sulphate (alum), as well as an organic polymer and ferric chloride. The dosing of lime at the coagulation stage was also provided for to restore the alkalinity of the raw water and to achieve optimum pH conditions for the formation of floc. For this purpose, a lime saturator was provided for the dosing of lime as a solution. Pre-lime dosing can be done on the raw water line before the flash mixer and in the flash mixer itself.

For the flocculation of the colloidal particles, the plant has baffled horizontal channels. The flocculator is also subdivided into three individual compartments to allow a tapered mixing intensity and the facility for short circuiting any of the compartments to alter retention time.

3.2.1.3 Sedimentation

The plant has a rectangular settling tank with sludge hoppers covering 100% of the floor area, and installed with lamella packs.

3.2.1.4 Sand Filtration

The removal of suspended solids and micro-organisms from the coagulated and settled water is achieved by single medium sand filtration. Six rapid gravity filters have been provided for the plant, operating at a filtration rate of 5.3 m/h. The filters are installed with Aquazur's V-filter with a siphon flow control system. The company was responsible for the design, supply and installation of the filters, as well as the lamella packs and the chemical dosing plant.

3.2.1.5 Chlorination

The plant incorporates three chlorine dosing points, namely, pre-chlorination, intermediate chlorination and post-chlorination.

Pre-chlorination is done at the flashmixer, intermediate chlorination is done between sedimentation and sand filtration, and post-chlorination is done downstream of the filters.

Four chlorinators and four injectors have been installed, one for each of the chlorination points, while a standby chlorinator/injector is provided with the capability of feeding any of the three points of application. Bottle-mounted chlorinators on one-ton cylinders are used. Duty cylinders are mounted on cradles and weighing scales. The original design allowed for the manual setting of the chlorine dosing by means of gas rotameters.

3.2.1.6 Sludge Handling

Waterworks sludge is generated at two locations in the plant, i.e. at the settling tanks, from desludging, and at the filters, from backwash water.

Sludge flows from the filters and from the settling tanks, under gravity, to the sludge lagoons. A system of adjustable weirs enables the decanting of supernatant down to the sludge level in order to accelerate the drying of the sludge. The supernatant is discharged into the forebay.

3.2.1.7 Chemical Storage and Handling

Chemical stockpile space is provided for the storage of the equivalent of two months' consumption of chemicals.

Two dry feeders have been supplied and installed for alum, and two dry feeders for lime. This effectively creates a 100% standby capacity. The lime feeders are designed to provide the required lime slurry to the lime saturator. From the lime saturator, the solution is either pumped to the pre-lime dosing point or fed under gravity to the clear water well for post lime dosing. However, the lime saturator is presently not utilised.

A polymer make-up system is available for the batch preparation of the polymer solution. The polymer solution is fed to the flash mixer by means of a dosing pump.

Ferric chloride is delivered by bulk tanker to the works. The bulk storage tanks consist of four 10 m³ capacity HDPE tanks. The solution is pumped to the ferric chloride day tank by means of bulk transfer pumps, from where the solution is pumped to the flash mixer by means of dosing pumps.

3.3. Pipe Work

3.3.1 Oshakati – Ondangwa (Old) Pipeline

This pipeline starts at the Oshakati – Ondangwa Pump Station on NamWater's premises in Oshakati and follows a route south of the Oshakati – Ondangwa Road, to eventually terminate at the NamWater pump station in Ondangwa. This line primarily serves private users, although some accounts are billed to the town councils of Oshakati, Ongwediva and Ondangwa. There are also a few DRWS water points along the route.

This pipeline is 31.5 km long, with 306 water meter installations.

3.3.2 Oshakati–Omapale Rural Water Supply Scheme

This scheme, which was also called the Oshakati–Oponono scheme, starts at the Oshakati–Omapale Pump Station on NamWater's premises in Oshakati and runs almost due south in the direction of the Etosha Pan for a distance of approximately 65 km. This scheme was designed and constructed in a very short period, to provide water to the inhabitants of the area, and also to provide water for emergency grazing. The main pipeline consists of 250 mm Class 9 uPVC pipes at the start, reducing to 110 mm Class 6 at the end.

3.4. Reservoirs

The location and material of construction of the three reservoirs located in CNWSA: Zone 6 are provided in **Table 1** below.

Table 1: Reservoirs of Zone 6

Reservoir Name or Location	Reservoir Type and Configuration	Nominal Capacity (m ³)
Oshakati Purification Plant	Earth embankment with a floating roof	75 000
Oshakati Purification Plant	Reinforced concrete GLR	9 000
Oshakati Purification Plant	Reinforced concrete GLR	2 500
Ongwediva	Reinforced concrete GLR	7 500

3.5. Power Supply and Control System

3.5.1 Oshakati Purification Plant Pump Station

Water is drawn from “the square dam” by three pumps of the transfer pump station, and delivered into a pipeline which joins the Ogongo–Oshakati Pipeline. Water from Ogongo and Oshakati is then transferred into either the 9 000 m³ or 2 500 m³ ground level reservoirs. (It should be noted that 9 000 m³ is the nominal or design capacity of this reservoir, whilst the actual useable volume is 8 500 m³.)

Water is drawn off the Ogongo–Oshakati Pipeline, upstream of the connection of the pipeline from “the square dam”, via one pipeline, which splits to allow the transfer of water to either Omakango or Ondangwa/lindangungu via one of two pump stations.

With the exception of the Transfer Pump Station, the pump stations in Oshakati which fall in Zone 6 are those located downstream of the clear water ground level reservoirs. These four pump stations will be dealt with as separate pump stations, although they are located on one premises, as they can be operated relatively independently from each other.

3.5.2 Transfer Pump Station

Three pumps in the Transfer Pump Station draw water from “the square dam” and deliver this into the Ogongo – Oshakati Pipeline, via which water enters either the 9 000 m³ or 2 500 m³ ground level reservoirs.

Three pumps are installed in parallel and are manually controlled. All pumps are constant speed pumps.

All three pumps, which are KSB ETA 300-35 units, driven by 30 kW, 380 V, WEG TEFC model motors running at 980 rpm, are in a reasonable condition and require only minor maintenance, such as the repair of gland leakages. It is recommended that new controls for the pumps are installed so that both the 9 000 m³ and 2 500 m³ reservoirs can be filled to their maximum capacity. Reservoir inlet and level control via telemetry needs to be considered.

The main power supply to the pump station is from a 11 000/400 V, 630 kVA transformer via the Raw Water Pump Station MCC. A 200 A TP main isolator is installed in the pump station control panel. The electricity bill is included in the account for the Oshakati Purification Plant.

3.5.3 Town Pump Station

Three pumps of the Town Pump Station draw water from the 9 000 m³ ground level reservoir, and deliver into a pipeline which later branches off as follows:

- To Oshakati east,
- To Oshakati west and the meat factory, which pipeline has since been closed,
- To the Oshakati Hospital,
- To Oneshila,
- A second pipeline to Oshakati west and the meat factory, which pipeline has since been closed,
- To the Army Base, which pipeline has since been closed.

The three pump sets are installed in parallel and are controlled via a pressure switch which is installed on the outlet manifold. All three pumps are constant speed pumps. The pumps duty cycle automatically. One of the three pumps is for standby purposes. The three pumps are KSB ETA 125-40 units, driven by 55 kW, 380 V, GEC TEFC motors running at 1 480 rpm.

The main power supply to the pump station is from a 11 000/400 V, 500 kVA transformer which requires servicing and cable terminations need to be re-terminated as a matter of urgency. The supply to the pump station is from a main distribution board that is in a poor condition and poses a great danger to the personnel. A 300 A TP main isolator is installed in the control panel of the pump station. The electricity bill is included in the account for the Oshakati Purification Plant.

Instrumentation of the pump station is connected to the telemetry system for all measurements to be recorded on the SCADA system.

3.5.4 Oshakati–Ondangwa Pump Station

Five of the six pumps of the Oshakati–Ondangwa Pump Station draw water from the 9 000 m³ ground level reservoir and deliver into the (old) pipeline which transfers water to Ongwediva and Ondangwa. One pump in this pump station delivers water into a 225 m³ elevated reservoir, from where water can gravitate into this pipeline. Downstream of the pump station, a pipeline to the Oshakati Hospital branches off.

The outlet pipe from the elevated reservoir is equipped with a non-return valve, to prevent water being pumped into the outlet of the reservoir.

This pump station has six pump sets of which pump sets three and four have two electric motors with different speeds installed in tandem. The purpose of this configuration is to facilitate different pump deliveries, which can nowadays be achieved with VSD pumps. The pumps are controlled via pressure and level sensors in the 7 500 m³ Ondangwa Ground Reservoir.

Pump sets three and four consist of a KSB ETA 150-315 pump. At the time of the assessment, both motors of this pump set had been removed for repairs.

Details of the other pumps are as follows:

1. Pump Set 1: KSB ETA 80-16AK pump, driven by a 15 kW, 380 V, Siemens TEFC electrical motor running at 2 940 rpm,
2. Pump Set 2: KSB ETA 150-315 pump, driven by a 15 kW, 380 V, Siemens TEFC electrical motor running at 970 rpm,

3. Pump Set 5: KSB ETA 150-315 pump, driven by a 45 kW, 380 V, Siemens TEFC electrical motor running at 1 470 rpm in series with a 15 kW, 380 V, Siemens TEFC model 180 L electrical motor running at 970 rpm,
4. Pump Set 6: KSB ETA 150-315 pump, driven by a 45 kW, 380 V, Siemens TEFC electrical motor running at 1 470 rpm in series with a 55 kW, 380 V, Siemens TEFC model 280 S electrical motor running at 980 rpm.

The main power supply to the pump station is from a 11 000/400 V, 500 kVA transformer which requires servicing and cable terminations need to be re-terminated as a matter of urgency. The supply to the pump station is from a main distribution board that is in a poor condition and poses a great danger to the personnel. The electricity bill is included in the account for the Oshakati Purification Plant.

A telemetry system is installed at the pump station for all measurements to be recorded on the SCADA system.

3.5.5 Oshakati–Omapale Pump Station

Five pumps of the Oshakati–Omapale Pump Station draw water from the 2 500 m³ ground level reservoir and deliver into a pipeline which transfers water southwards to Omapale. The pumps are pressure controlled and two of the five pumps are so-called jockey pumps used during low flow periods and the other three pumps are used for high flow periods. One jockey pump and one of the large pumps are standby pumps. All pumps are constant speed pumps.

Pumps 1 and 2 are KSB ETA 50-315 units, driven by 7.5 kW, 380 V, Leroy Summer TEFC, electrical motors running at 1 450 rpm.

Pumps 3 and 4 are KSB ETA 80-315 units. The motors of pumps 3 to 5 are 18.5 kW, 380 V, Leroy Summer TEFC electrical motors running at 1 450 rpm.

The main power supply to the pump station is from a 11 000/400 V, 500 kVA transformer which requires servicing and cable terminations need to be re-terminated as a matter of urgency. The supply to the pump station is from a main distribution board that is in a poor condition and poses a great danger to the personnel. A 125 A TP main isolator is installed in the control panel of the pump station. The electricity bill is included in the account for the Oshakati Purification Plant.

A telemetry system is installed at the pump station for all measurements to be recorded on the SCADA system.

3.5.6 Ongwediva Pump Station

The Ongwediva Pump Station draws water directly from the Oshakati–Ondangwa (old) Pipeline, bypassing the Ongwediva 7 000 m³ ground level reservoir, and delivers into the water towers which supply Ongwediva Town.

The two pumps operate in parallel in a duty/standby configuration and are level controlled via telemetry signal from the Ongwediva Elevated Reservoir. Both pumps are constant speed pumps. The direct in-line boosting configuration experiences problems when the Oshakati – Ondangwa

pumps switch off. No signal is provided to the Ongwediva Pump Station to switch off when the Oshakati – Ondangwa pump station switches off.

The pumps are KSB ETA 125-40 units. One is driven by a 45 kW, 380 V, Siemens TEFC electrical motor running at 1 475 rpm, whilst the other motor is a 380 V VEM unit, whose other details could not be established.

The main power supply to the pump station is via a 200 A TP circuit breaker situated in a distribution board underneath a 11 000/400 V, 200 kVA pole mounted transformer. The transformer is the property of Northern Regional Electricity Distributor (NORED) and maintenance costs for the transformer are the responsibility of NORED

The monthly electricity bill from NORED consists of the units of kWh used, ECB levy, basic rate and the maximum demand which will be maximum 70% of the declared maximum demand. The account is acceptable.

A telemetry system is installed at the pump station and allows all measurements to be recorded on the SCADA system for future use. An old radio communication system is in operation in the pump station.

3.6. Scheme Processes/Operation

There is one fulltime NamWater operator based in CNWSA: Zone 6.

3.7. Maintenance

Maintenance is done by a permanent NamWater team.

3.7.1 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.

3.7.2 Air Valves

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

3.7.3 Pressure Gauges and Transducers

The gauge cocks must be turned monthly 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.

3.7.4 Reservoirs

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

3.7.5 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.

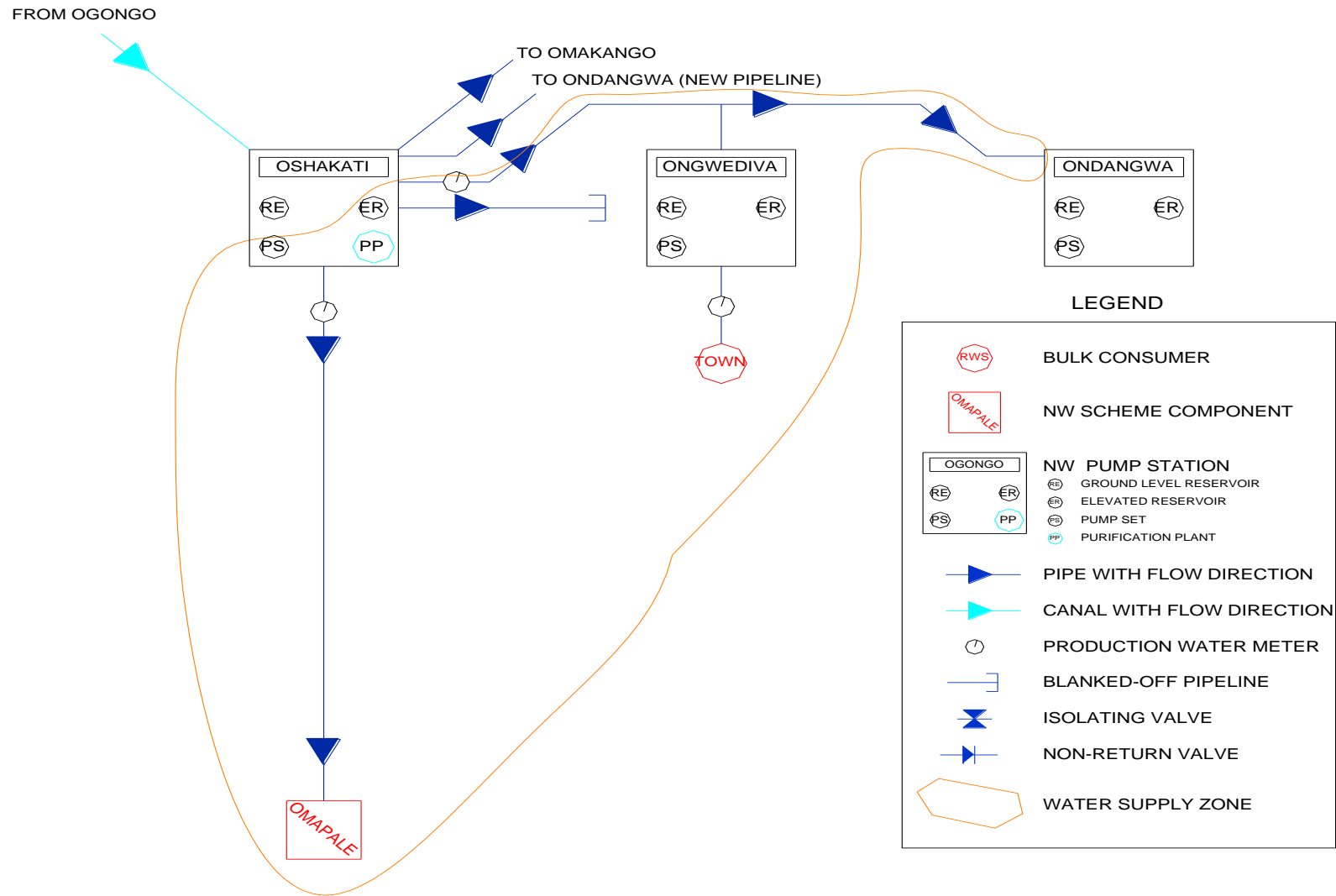
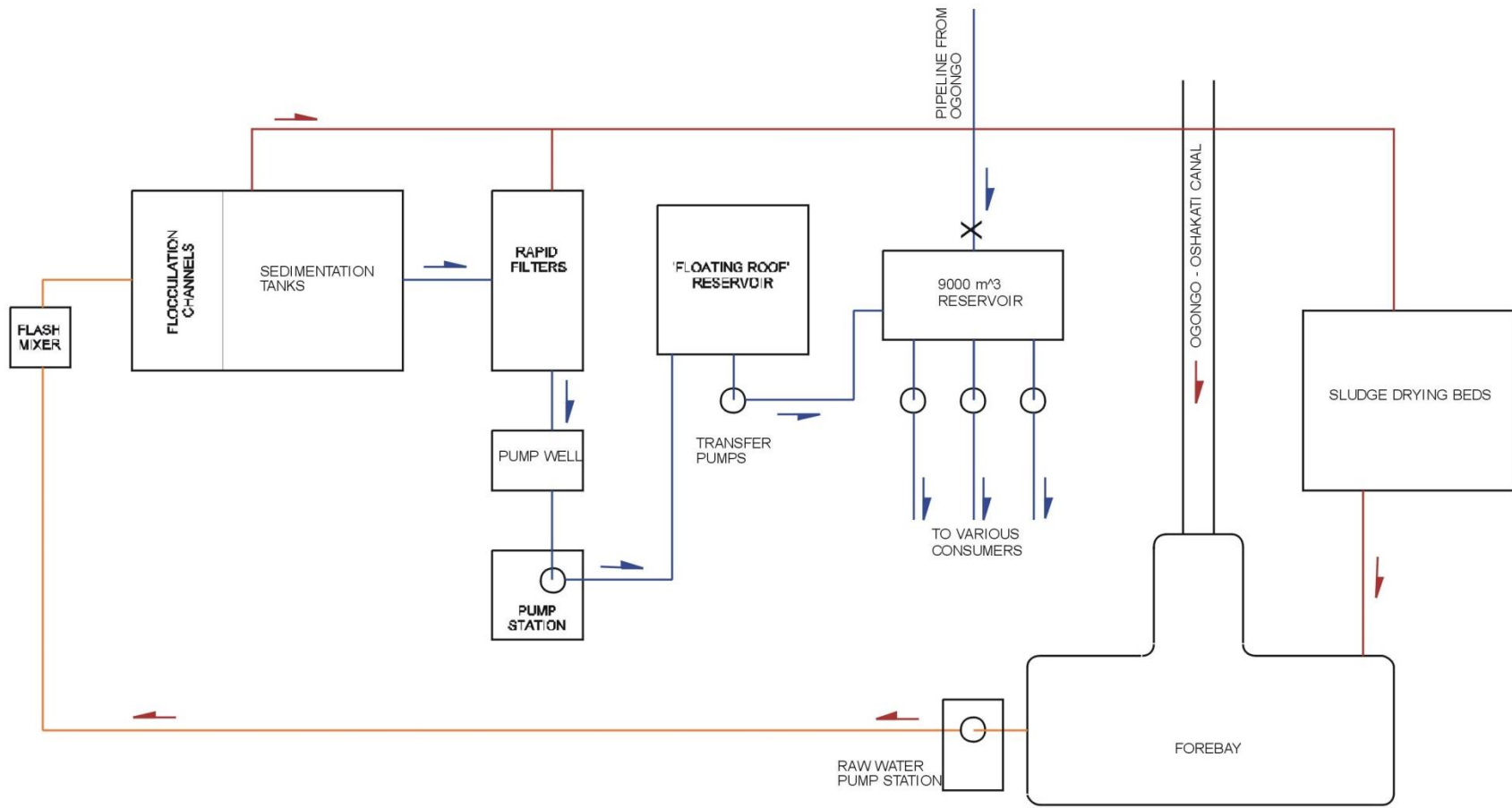


Figure 2: CNWSA: Zone 6 Scheme Layout



- LEGEND
- RAW WATER
 - POTABLE WATER
 - WASTE WATER

NOTE
 FOR CLARITY NOT ALL COMPONENTS SUCH AS PUMPS AND PIPES HAVE BEEN SHOWN WHERE THERE ARE MULTIPLE COMPONENTS

Figure 3: Configuration of the Oshakati Purification Plant

4. BRIEF DESCRIPTION OF THE RECEIVING ENVIRONMENT

The baseline description provided below focuses on the receiving environment:

4.1 Climate

The climate in the North Central part of Namibia is semi-arid, categorized by various rainfalls that differ significantly in out pour quantity and timing. The rainfall is experienced during the summer months between November and April when temperatures are highest. The eastern area receives higher rainfalls with annual average of about 550 – 600 mm while the western area receives average rainfall of about 350 – 400mm (Mendelsohn et. al., 2000).

4.1.1 Precipitation

Precipitation at CNWSA: Zone 6 is between 350 mm to 400 mm annually. And the highest precipitation falls in January and the driest month is June (Mendelsohn, et al., 2002).

4.1.2 Temperature

The average maximum temperature experienced in this zone is recorded to be between 34 °C to 36 °C, whereas, the average minimum temperature during the coldest month of July is between 6 °C to 8 °C (Mendelsohn, et al., 2002).

4.2 Geology

The structure of this area is of infill deposits of the Kalahari Basin, which covers the entire Kalahari Sandveld, the Owambo Basin and the Kavango and Caprivi regions. This flat landscape is dominated by a network of shallow channels, called oshanas. Thousands of these drainage channels and pans form part of the Cuvelai Delta which drains southwards towards the Etosha Pan. They periodically carry water after heavy local rains in highland areas some 300 km to the north in Angola. The traditionally hand-dug shallow wells or omithima are found throughout CNWSA: Zone 6, and have been used to draw water from the shallow Discontinuous Perched Aquifer after the oshanas have dried up (after Mendelsohn et. al., 2000).

4.3 Natural Fauna and Flora

Large vertebrates survive in arid areas due to their nomadic lifestyle in search of food and water: herds of antelope, ostriches (*Struthio camelus australis*), gazelle (*Oryx gazella*) and Hartmann zebra (*Equus zebra hartmannae*) graze in the grass where rainfall occurs (Mendelsohn et. al., 2009).

The vegetation structure in this area is woodland. The eastern areas of the CNWSA generally feature better vegetation cover. Mopane scrub (*Colophospermum mopane*) and various trees (*Eragrostis trichophora*, *Hyphaene petersiana*, and *Acacia arenaria*) are found in the area. The area also supports much of the crop production and grazing areas with various saline grasses dominating the vegetation (Kangombe, 2010).

5. THE LEGAL ENVIRONMENT

A legal review was done and the key laws of concern include those which protect the ecological integrity of the CNWSA: Zone 6 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 CNWSA: Zone 6 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 management actions are being adhered to;
- 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 CNWSA: Zone 6 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.

Table 2: Operation and Maintenance Phase Management Table

Issue	Objective	Strategy	Actions	Time frame
Maintenance and emergency procedures	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	<ul style="list-style-type: none"> • Establish environmentally sensitive and technically sound maintenance procedures as well as reporting structures. • Compile a staff competency assessment and training programme. • Establish emergency procedures to ensure appropriate response and minimise potential risk to the biophysical and social environment. 	<ol style="list-style-type: none"> 1. Establish regular reporting procedures on maintenance 2. Undertake regular inspection and maintenance of all infrastructure to ensure in working order and to assess damaged / deficient equipment, as per the O&M Manual. 3. Review, and if necessary, revise maintenance manual. 4. Establish emergency procedures guidelines for the blockage/failure, flooding, contaminant removal and disinfection, power failure and fire of the scheme. 5. Implement the response procedures when emergency incident occurs. 6. Complete the incident report checklist in the case of emergency and keep with monitoring records for submission. 7. Undertake annual education course for all operational staff. 8. Review, and if necessary revise emergency manual. 	<p>Bi-monthly for the lifespan of infrastructure as per the maintenance manual.</p> <p>Bi-annually for lifespan of works.</p> <p>When emergency incident occurs.</p> <p>Emergency incident</p> <p>Annually for lifespan of operation.</p> <p>Annually for lifespan of operation</p> <p>Annually for lifespan of operation</p>

8.2 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 CNWSA: Zone 6 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.

8.3 Facility Management and Operations

NamWater shall ensure that sufficient budget allocations and provisions are made available to ensure that the infrastructure can be adequately operated and maintained. NamWater must also attend to damage to the scheme components resulting in water loss as a matter of high priority.

8.4 Routine Maintenance and Repairs

The condition of the infrastructure shall be inspected routinely and a maintenance list compiled. Identified, preventative maintenance issues shall be undertaken as soon as possible. Any wastes arising from the repair and maintenance work must be removed and disposed-off at a designated waste disposal site as part of the operation.

8.5 Environmental Awareness

Instilling a sense of environmental awareness and consideration in all employees, but especially those involved with the scheme operations is vital to the overall success of any environmental management plan. It is therefore recommended that a general environmental awareness course for the Scheme Staff Members, who may be required to carry out duties on the scheme, be undertaken.

8.6 Waste and Pollution Management

8.6.1 Waste and Pollution Prevention

To prevent the improper disposal of waste and to prevent pollution, the following management actions shall be enforced:

- 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.
- No littering will be allowed. The plant area will be kept free of waste at all times.
- Provide sufficient waste bins at worksites. Make sure that all waste is removed from the worksites.

- Hazardous Substances include: sewerage, fuels, lubrication oils, hydraulic and brake fluid, solvents, paints, anti-corrosives, 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:
 - ✓ 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.

8.6.2 Hazardous Materials

Where hazardous materials are required for repair and maintenance work (including fuels and oils), care will be taken to ensure that a competent individual is appointed to enforce the responsible use of such materials. The operational staff or maintenance teams shall carry a copy of the relevant Material Safety Data Sheet (MSDS) whenever using such materials. The Scheme Supervisor shall ensure that persons working with hazardous materials have been trained in the handling of such substances, as well as in emergency procedures to be followed in the event of an accidental spillage or medical emergency. Maintenance teams shall also carry a spill kit containing the appropriate neutralizing chemicals, absorbent materials and other relevant equipment required to undertake a clean-up of any spill that may occur.

8.6.3 Noise Management

During maintenance operations, all silencing mechanisms on all equipment must be in a good state of repair. Except for in emergency situations, no amplified sound may be broadcast. All routine maintenance shall be restricted to daylight hours.

8.7 Health and Safety

To minimise the risk of HIV infection and the increase of STI's and the occurrence injuries the following management actions shall be enforced:

- Provide an AIDS awareness programme to all the staff.

- 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 Scheme.
- Establish an emergency rescue system for evacuation of serious injured people.
- Emergency procedures for accidents should be communicated to all employees.
- 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 construction and earthworks to some degree of its former 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 reservoir construction project, could be mitigated and restored to an acceptable level. Poorly rehabilitated construction areas provide a difficult legacy issue for governments, communities and companies, and ultimately tarnish the reputation of operators 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 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 construction 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

21. **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.
22. Never feed, tease, play with, or set devices to trap any animal or livestock. Wild animals are not to be domesticated.
23. Keep off the rock outcrops unless given specific permission by the SCHEME SUPERVISOR to be there.
24. Never cut down any tree or branches for firewood.
25. Never leave rubbish or food scraps or bones where it will attract animals, birds, or insects.
26. Rubbish must be thrown into allocated waste disposal bins/bags.
27. Always close the gates behind you.

Preventing Pollution

28. Only work with hazardous materials in bunded areas.
29. 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.
30. Clean up spills immediately.
31. 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.

32. Immediately report to your SCHEME SUPERVISOR when you notice any container, which holds hazardous substances overflow, leak or drip. Spillage must be prevented.
33. Only wash vehicles, equipment and machinery, containers and other surfaces at work site areas designated by your SCHEME SUPERVISOR.
34. Do not change oil on uncovered surfaces.
35. If you are not sure how to transport, store, use, or get rid of any hazardous substances ask your SCHEME SUPERVISOR for advice.

Health

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

Dust Control

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

Saving Water

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

Working Hours

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

Archaeological and Cultural Objects

52. If you find any archaeological, cultural, historical or pre-historical object on the construction site you must immediately notify your SCHEME SUPERVISOR.
53. 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

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

Noise

61. Keep noise levels as low as possible.
62. Do not operate noisy equipment outside normal working hours.

Fire Control

63. Do not make open fires, use a drum or tin and do not collect any vegetation to burn.
64. 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.
65. Cigarette butts should always be thrown in allocated refuse bins. Make sure that the cigarette butt is out before throwing it into the bin.
66. Immediately notify your SCHEME SUPERVISOR if you see an unsupervised fire at the campsite or construction site.

Dealing with Environmental Complaints

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

NP du Plessis

Tell: 061-71 2093

Cell: 081 127 9040

OR

Jolanda Kamburona

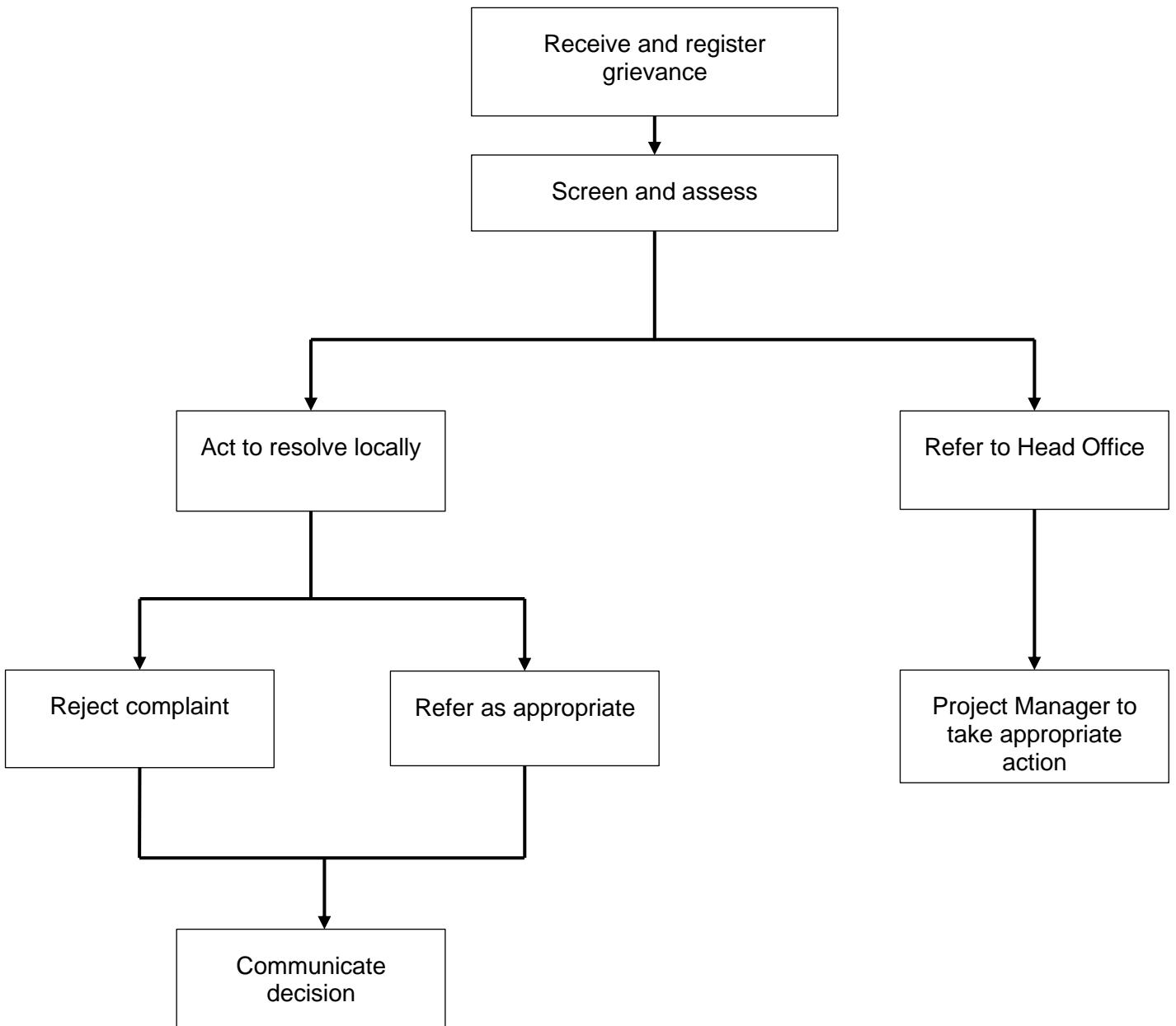
Tell: 061-71 2105

Cell: 081 144 1528

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ANNEXURE 1: GRIEVANCE PROCEDURE AND REGISTRATION FORM



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:	
Decision and action:	