

WATERBERG-OKAKARARA WATER SUPPLY SCHEME

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
MET	Ministry of Environment 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 Waterberg 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 and Tourism (MET: DEA).

An Environmental Clearance Certificate (ECC) was originally issued in 2016 and this EMP serves as an application for the renewal of the ECC.

2. INTRODUCTION

2.1 Waterberg Water Supply Area

The Waterberg Water Supply Area (WWSA), which was previously known as the Kambazembi Water Supply Area, and before that as the Hereroland West area, covers the area north and east of Okakarara, as far as Otjituuu, which is located to the east of Grootfontein. All of this area falls in the Otjozondjupa Region, whose administrative centre is Otjiwarongo, which is also where NamWater's Area Office responsible for this water supply area is situated. The location of Waterberg is depicted in **Figure 1**.

Waterberg Purification is a surface water purification scheme treating raw-water from the ENWC canal and supplying Okakarara and rural communities in the Waterberg Area. The Waterberg – Okakarara Scheme, as it was previously known, abstracts water from the ENWC, transports it to the Waterberg Purification Plant where it is treated for subsequent supply to Okakarara and further eastwards to Central Reservoir and Elandsplan.

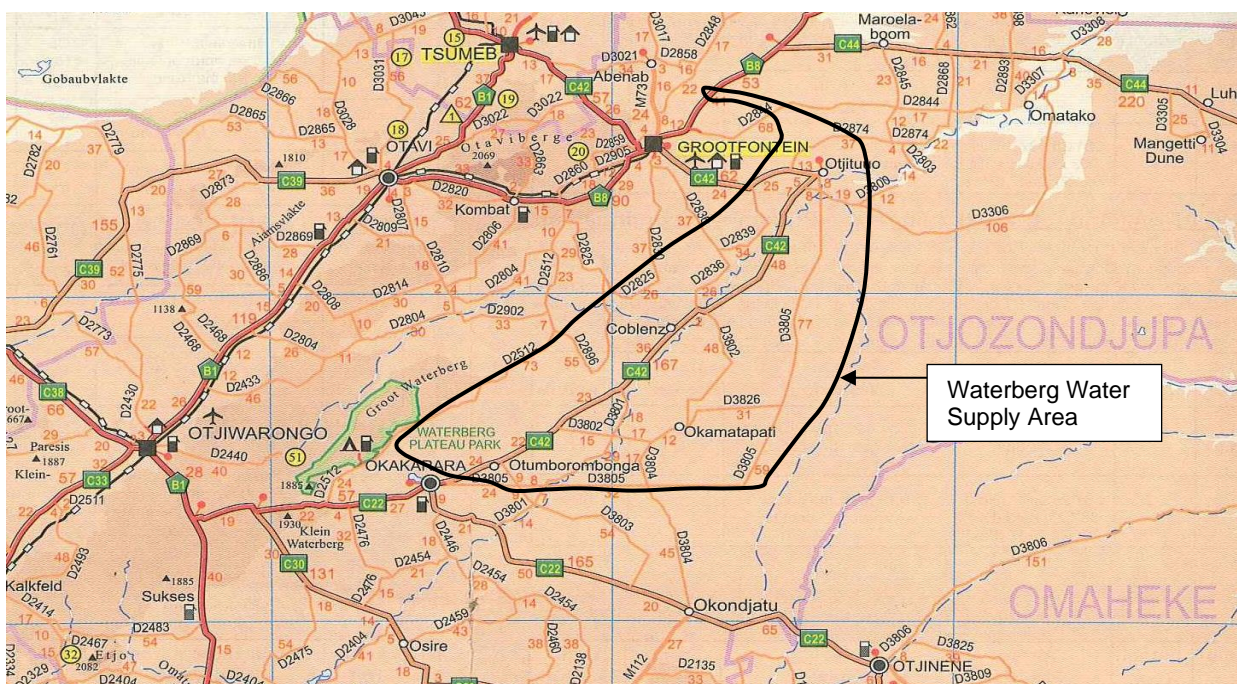


Figure 1: Waterberg-Okakarara Location Map

2.2 Okakarara Water Supply Scheme

Okakarara is a town in Otjozondjupa Region, Namibia, located 50 km southeast of Waterberg National Park. It has an estimated population of 7000. The location of Okakarara is depicted in **Figure 2**.

The Okakarara scheme supplies potable water to Okakarara Town and its vicinity from the Waterberg Purification Plant. Okakarara was initially supplied with water from four boreholes in the vicinity, as well as from the Waterberg Fountains, which were three perennial springs along the slope of the mountain, approximately 25 km to the north west of the town. With the growth of Okakarara these sources became inadequate and the boreholes gradually declined in yield. Following the decline in the yield of the Okakarara boreholes, The Goblenz – Okakarara Regional State Water Scheme was implemented as an interim measure in order to supply water to Okakarara. This scheme entailed the abstraction of water from five boreholes in the vicinity of Goblenz and the pumping of the water to Okakarara, utilising a booster pump

station at Ombinda. This scheme was intended to serve as an interim supply measure until construction of the Waterberg – Okakarara Regional State Water Scheme. The intention was that this latter scheme would supply water to Okakarara, where after the Goblenz boreholes could be used to supply Goblenz, the immediate environs and the farming area adjacent to the Goblenz – Okakarara Pipeline.

Partly due to increasing demand in Okakarara and along the Goblenz – Okakarara Pipeline, and partly with the intention of opening up 56 farming units between Otjituuu and Central Reservoir, to the east of Okakarara, the Berg Aukas – Okakarara Regional State Water Scheme was implemented as the first scheme whereby water from outside the Waterberg area that would be brought into and distributed throughout the area. The intention then was that this scheme would be supplied with water from the Rundu – Grootfontein link of the ENWC, drawing on water abstracted from the Okavango River, and distributing it as far as Okakarara. However, since this portion of the ENWC was not completed at the time, two Berg Aukas boreholes were developed as an interim supply source.

The Okakarara-Ombinda scheme was constructed as part of the Goblenz – Okakarara Scheme in the 1970s and is therefore part of the oldest bulk water supply scheme in the WWSA. The original intention of the Goblenz – Okakarara Scheme was the abstraction of ground water from the five Goblenz boreholes, and the piped transfer of this water south westwards, past Ombinda, towards Okakarara. However, since the supply pressure at Goblenz is insufficient to supply water even as far as Ombinda, the pipeline has been closed off at Ombinda and the communities between Okakarara and Ombinda are supplied from Okakarara.

The EMP is for 3 existing schemes namely Okakarara Town, Okakarara-Ombinda and the Okakarara-Elandsplan and it is therefore only for the operation and maintenance of the schemes.

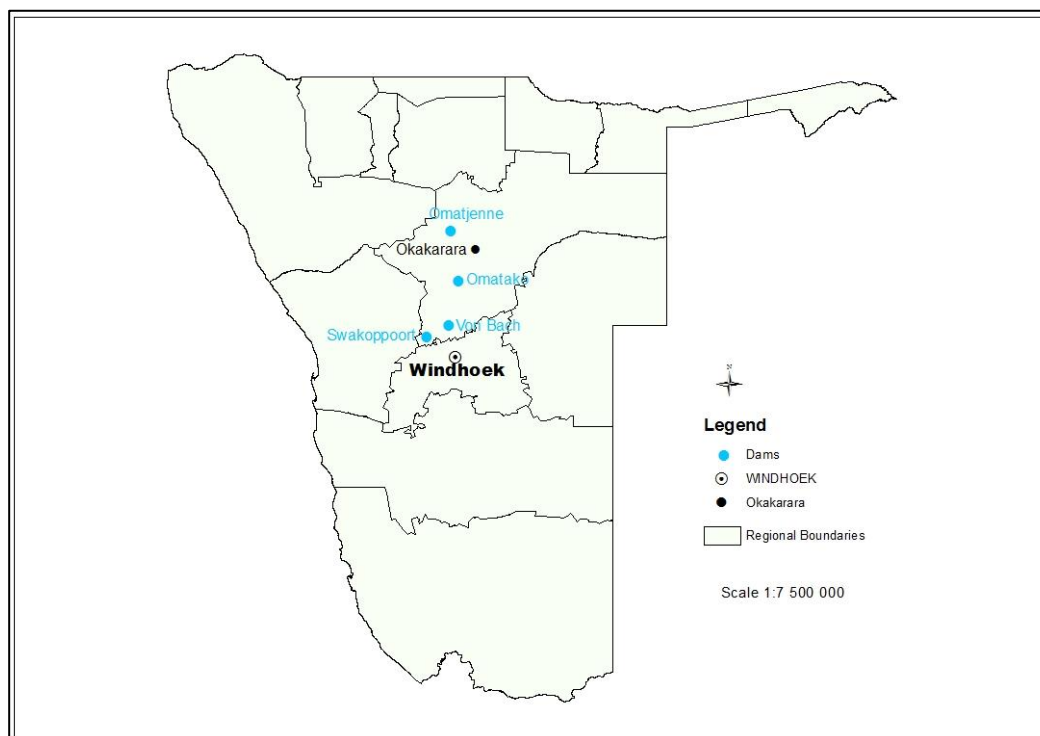


Figure 2: Okakarara Location Map

3. EXISTING WATERBERG-OKAKARARA WATER SUPPLY INFRASTRUCTURE

3.1 Water Source

3.1.1 Okakarara-Elandspan

Raw water from the ENWC is treated at the Waterberg Purification Plant, where the purified water is stored in a 2 000 m³ potable water reservoir. From this reservoir, water gravitates to the Okakarara reservoir which supplies Okakarara Town, through a 600 mm diameter CID Class 12 AC pipeline. A tee-connection on this pipeline, upstream of the inlet to the Okakarara reservoir, is the start of the 102 km long AC Okakarara – Central Reservoir Pipeline, which runs from Okakarara in a easterly direction, alongside District Road D3805. This pipeline features pipe sections of varying diameters and pressure classes and bypasses Central Reservoir to connect to the 61.8 km long, 250 mm diameter AC Central Reservoir – Elandspan Pipeline. From Central Reservoir, the pipeline to Elandspan runs in a more-or-less northerly direction, following the basic alignment of District Road D3805, which turns northwards from its easterly orientation at Central Reservoir. Water gravitates into this pipeline, and all connecting pipelines, as far as Elandspan, from Okakarara.

Between Okakarara and Central Reservoir, the pipeline supplying Okahitwa branches off to the south, and delivers water into an elevated steel reservoir which belongs to NamWater. Several other small pipelines also branch off to the south.

The Okamatjitundu Pipeline branches off to the north, to serve the area between Ombinda and Okamatapati. Some smaller pipelines also branch off to the north of the Okakarara – Central Reservoir Pipeline.

Branchline 3 continues to the east of Central Reservoir. Branchline 2 (east), Branchline 6 (east and west), Branchline 5 (east and west) and Branchline 4 (east and west), listed in sequence, branch off the Central Reservoir – Elandspan Pipeline, north of Central Reservoir. Branchline 4 is located just south of Elandspan. The numbering of these secondary pipelines indicates the sequence in which they were constructed. Tertiary pipelines branch off to the north and south of each of these branchlines. Okamatapati is located at the western extremity of Branchline 6, where water is delivered into a ground level concrete reservoir inside NamWater's fenced off premises.

3.1.2 Okakarara Town

Water abstracted from the ENWC Canal in the vicinity of (Groot) Waterberg gravitates to the Waterberg Purification Plant where it is treated and temporarily stored. From the Waterberg Purification Plant, the treated water gravitates south eastwards through a 600 mm diameter Class 12 AC pipeline towards Okakarara (refer to Section 12.3.1 below). Outside of town, this 600 mm diameter pipeline enters a tee-junction. The left branch of the tee is the 450 mm diameter (initially) FC pipeline to Central Reservoir, whilst the right branch of the tee enters a connection manhole at the start of the Okakarara Scheme.

From this connection manhole, water can be directed to the 2 000 m³ ground level reservoir and / or the 250 m³ ground level reservoir and the Pamwe elevated reservoir. One outlet from the larger ground level reservoir feeds water directly towards Okakarara Town, whilst the other outlet can direct water towards the following:

- The 200 mm diameter FC Class 12 FC pipeline towards Ombinda, via a tee-connection manhole,

- The booster pump station which can direct water either to the 250 m³ ground level reservoir, and thence to the Pamwe elevated reservoir and / or the pipeline from the other outlet of the large ground level reservoir which leads to Okakarara Town.

The schematic layouts of the existing infrastructure are indicated in **Figure 3-6** below.

3.2 Pipe Work

3.2.1 Canal Abstraction Works and Pipeline to the Purification Plant

Water is abstracted from the Grootfontein – Omatako ENWC Canal at chainage km 91.75 through a 1 600 mm long, 200 mm high orifice and fed into a rectangular channel. The width of this channel varies from 3 m at the canal face to 1 m at the gate valve chamber over a length of 10 m. The last 1.8 m of this channel further incorporates a transition from a rectangular slope to a semi-circular slope to match the cross-section of the 600 mm diameter pipe which conveys the water to the raw water reservoir (DWA, undated).

A hinged screen (grating) is provided at the entrance to the pipe upstream of the isolating valve to keep out debris. Immediately after the open channel has transitioned into the 600 mm diameter pipe, an isolating valve is located in a valve chamber, which can be used to throttle inflow into the pipeline and hence to the purification plant. Three aluminium stoplogs were provided to close off flow in the channel upstream of the isolating valve, should repair or maintenance of the isolating valve be required. Provision was made for the storage of these stoplogs in the gate valve chamber.

3.2.2 Raw Water Pipeline

The raw water pipeline between the canal orifice and the raw water reservoir consists of 600 mm diameter Class 12 FC pipe material, approximately 3.98 km long. This pipeline conveys raw water abstracted from the canal to the Waterberg Purification Plant directly, or via the raw water reservoirs. Immediately upstream of the raw water reservoir, a pipeline tees off from the main pipeline to provide a separate inlet to each of the two compartments of the raw water reservoir. Each separate inlet features an isolating valve. An isolating valve is located on the main pipeline immediately downstream of the tee-off to the reservoir inlet, which if closed, will mean that water can be supplied to the purification plant only via the reservoir. The outlet pipeline from each compartment of the reservoir also features an isolating valve. At the purification plant, an electronic water meter is located at the inlet to the sand filters, which for the purposes of this study, marks the end of the raw water pipeline.

3.2.3 Okahitwa

The water at Okahitwa meets the Group B limits for conductivity and total dissolved salts, as well as for all inorganic determinants.

Chlorine dosing at the Okahitwa reservoir is currently done by means of a floating chlorine dispenser, which uses chlorine tablets, placed in the elevated reservoir.

3.2.4 Okamatapati

The water at Okamatapati meets the Group B limits for conductivity and total dissolved salts, as well as for all inorganic determinants.

Chlorination is performed by means of a floating dispenser placed in the concrete ground level reservoir.

3.2.5 Okakarara

The water at Okakarara meets the Group B limits for conductivity and total dissolved salts, as well as for all inorganic determinants (Appendix).

3.3 Reservoirs

3.3.1 Waterberg Reservoir

The raw water reservoir is located approximately 229 m downstream of the canal outlet structure and is of the earth embankment type, partially below and partially above ground, with two compartments, each with a capacity of 46 925 m³ at FSL (DWA, undated), which are open to the atmosphere. The reservoir is rectangular in an almost northerly orientation, such that the one compartment is to the north of the other. The reservoir has an operating water depth of 4.65 m, for which the capacity is 35 057 m³ per reservoir. The side slopes have a gradient of 1:2.5 (v:h).

Each compartment of the reservoir has five underfloor no-fines drains on the southern side, which lead to a 150 mm uPVC collector drain pipe which runs along the southern side of the reservoir. Drainage water from the southern compartment flows north, to which pipe drainage water from the northern compartment is added as the drain pipe flows north, after which it turns to the south east to outfall. Monitoring manholes are provided at the junction of each no-fines drain and the collector pipe, so that any leakage which may develop is monitored.

3.3.2 Ombinda Reservoir and Booster Pump Station

The Ombinda Reservoir and Booster Pump Station are detailed under the Goblenz – Ombinda Scheme configuration in Chapter 8. The Ombinda Reservoir is bypassed such that water pumped from Goblenz through the Goblenz – Ombinda Pipeline or gravitating from Okakarara via the Okakarara – Ombinda Pipeline does not enter the reservoir, which was found empty at the time of the assessment. Water reportedly reaches Ombinda from Okakarara more often than from Goblenz.

3.3.3 Okahitwa Elevated Reservoir

The Okahitwa elevated reservoir is of the section steel panel type, three panels wide, four panels long and two panels high, with a nominal capacity of 41.5 m³, located on a 10 m high steel supporting structure.

3.3.4 Central Reservoir

Central Reservoir is a 7 500 m³ reinforced concrete ground level reservoir with two compartments. No electrical supply is available at this site, and although a chlorine room was constructed, water is also not currently chlorinated at the site.

3.3.5 Okamatapati Reservoir

The reservoir at Okamatapati is a circular concrete ground level reservoir with a diameter of 12 m, height of 5.0 m and a nominal capacity of 500 m³. The reservoir features a top inlet at 4.6 m high, a bottom outlet and a level indicator.

3.3.6 2 000 m³ Ground Level Reservoir

The larger reservoir at Okakarara is a circular concrete ground level reservoir with a diameter of 25.5 m, height of 4.7 m and a nominal capacity of 2 000 m³. The reservoir features a top inlet at height 4.40 m and bottom outlets.

3.3.7 250 m³ Ground Level Reservoir

This reservoir at Okakarara is a circular concrete ground level reservoir with a diameter of 9.40 m, height of 4.50 m and a nominal capacity of 250 m³. The reservoir features a top inlet at a height of 4.15 m.

3.4 The Purification Plant

The Waterberg Purification works are located approximately 3.921 km downstream from the canal off-take and at elevation 1 383.41 m, are some 15.526 m below the invert of the raw water reservoir and 19.90 m below the canal invert at the off-take structure. This location allows water to gravitate from the canal off-take, through or past the raw water reservoir, to and through the purification plant and on towards Okakarara.

Water drawn from the ENWC, either via the raw water reservoir or directly, passes through three identical ASF-42, self-cleaning automatic valve-less gravity sand filters connected in parallel, and a chlorination facility. Chemical dosing with Aluminium Sulphate (if required) can be done immediately upstream of the filters. Treated water then gravitates towards Okakarara, either directly or via a 2 000 m³ ground level reservoir.

Water is drawn off the pipeline to Okakarara to supply the buildings at the plant and the nearby operators' houses, via a booster pump station and a 36 m³, 13 m high elevated reservoir.

3.5 Gravity Sand Filters

The ASF-42 self-cleaning automatic valve-less gravity sand filters each consist of a 3-compartment vertical steel tank divided into a backwash storage compartment, a filter bed compartment and a filtrate collection compartment. These filters are very efficient, operating with a mere 1.2 m to 1.5 m head loss, doing so entirely without any outside energy supply, and even backwash takes place without the need for backwash pumps and valves.

3.6 Scheme Processes/Operation

There is a fulltime NamWater scheme operator, who does checks on a daily basis whether all the systems are functional. The scheme has been electrified and automated with timer switches.

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.

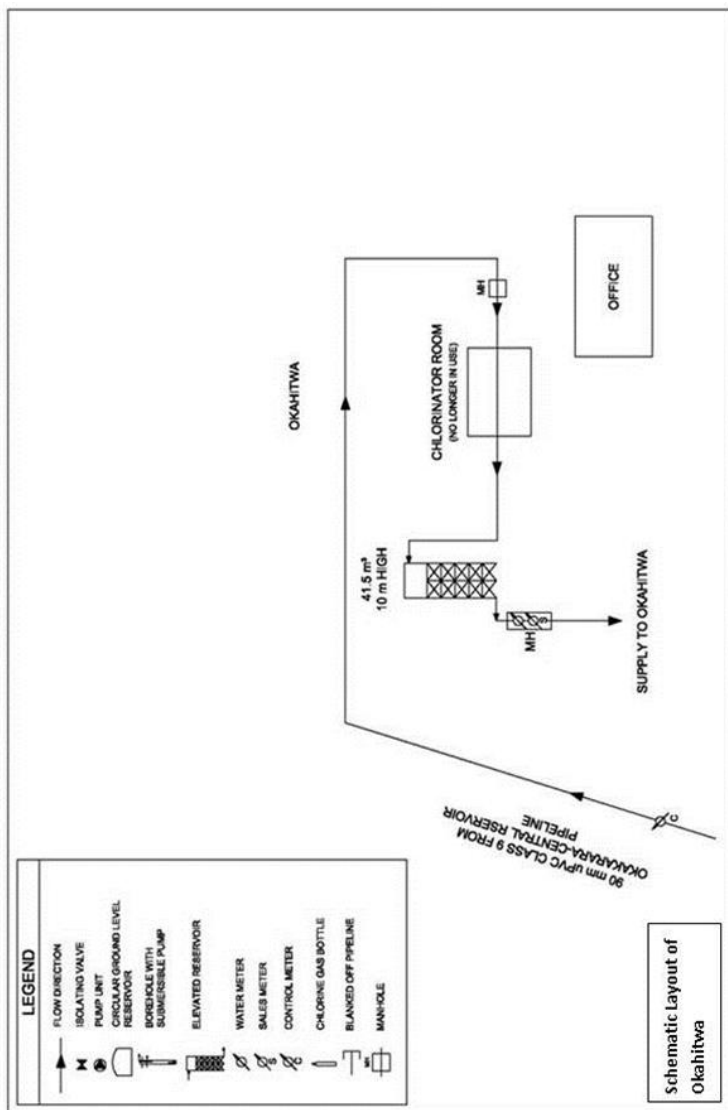


Figure 3: Schematic Layout of Okahitwa

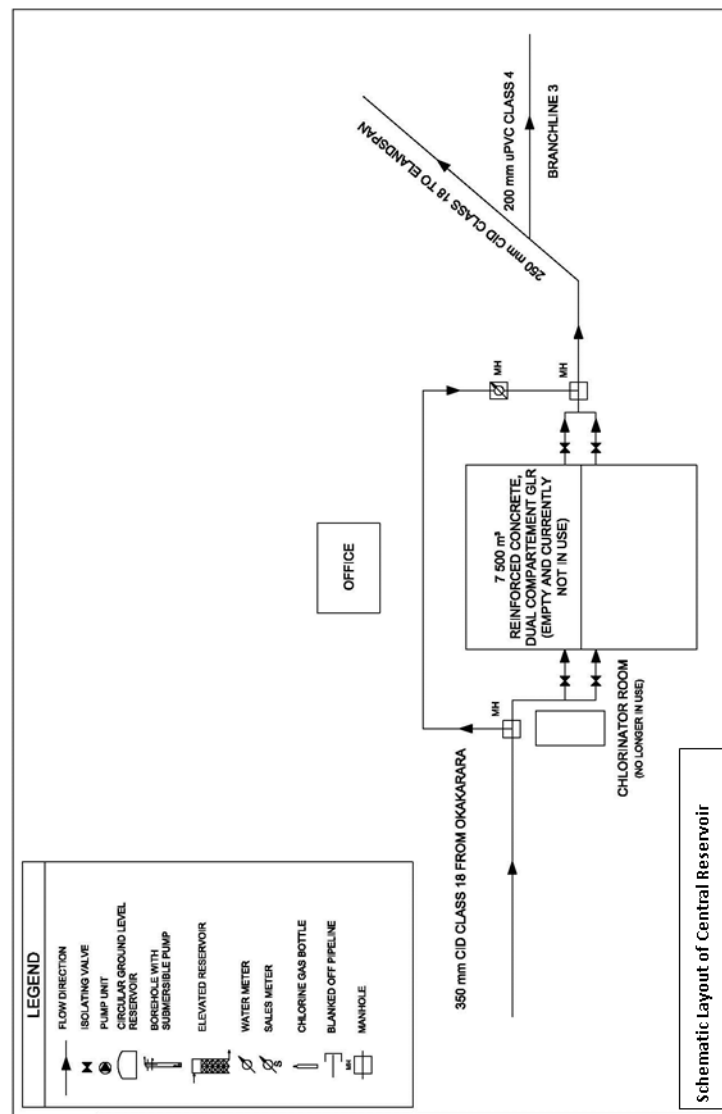
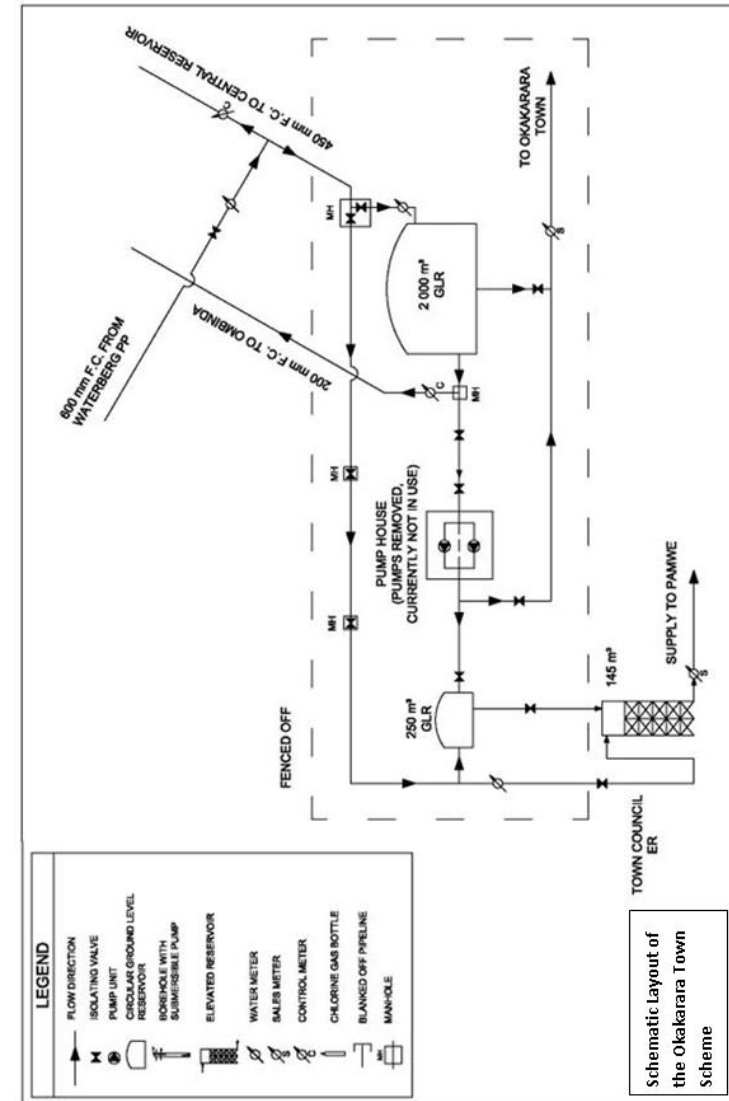
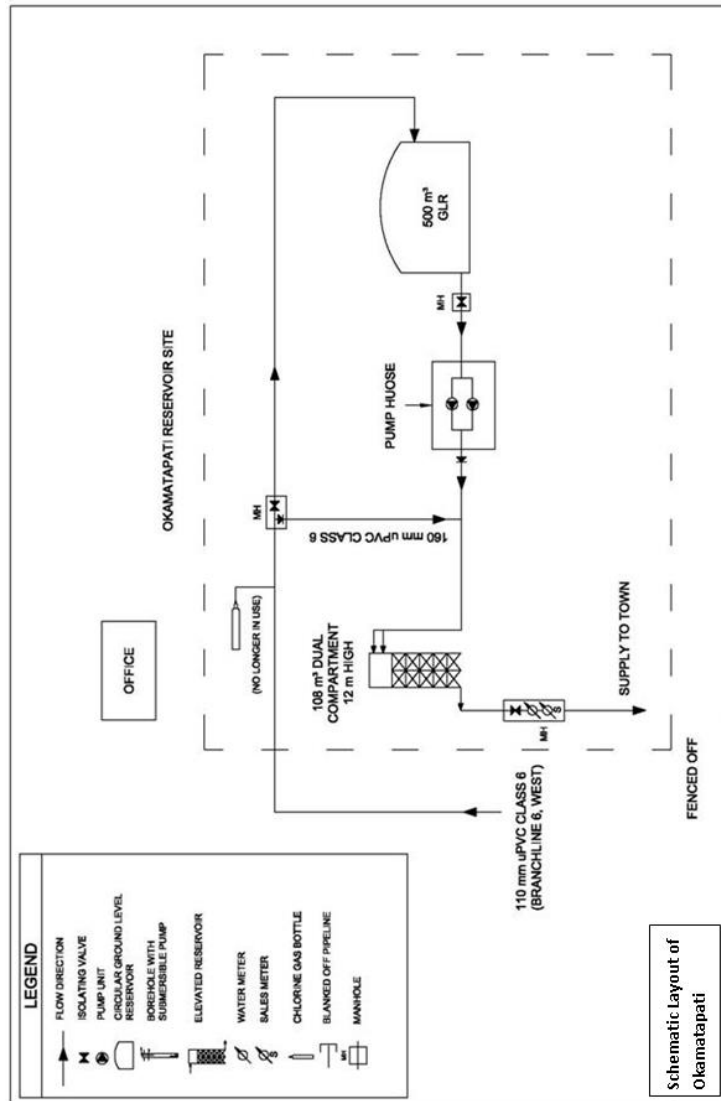


Figure 4: Schematic Layout of Central Reservoir



4. BRIEF DESCRIPTION OF THE RECEIVING ENVIRONMENT

The baseline description provided below focuses on the receiving environment:

4.1 Climate

Waterberg-Okakarara has an extreme climate most times of the year with high temperatures especially during the rainy season and low temperature during the dry winter season.

4.1.1 Precipitation

The study area has according to Mendelsohn *et al.*, (2009) a semi-desert climate, characterised by a large range of temperatures, low rainfall, and high evaporation. Hot summers and mild winters are typical in the area. The prevailing wind direction is south-west and the minimum speeds recorded are 15 km/hour.

4.1.2 Temperature

The area has hot summers and mild winters, maximum summer temperature rising to as high as 32 °C, while minimum temperatures drop as low as 8 °C (Enviro Dynamics, 2015). Extreme daily and seasonal variations are the norm for the central part of the country.

4.2 Geohydrology

The Waterberg-Okakarara area is predominantly flat, Northern Kalahari Sandveld, which generally slopes downwards in an easterly to north-easterly direction from the foot of the Waterberg Plateau (height 1 930 m), which is by far the most prominent feature in the surrounding area. A local high point is found at the Central Reservoir (approximately 1 250 m), which is located at the “kink” where the D3805 District Road turns northwards from its due east-west axis, approximately 96 km to the east of Okakarara.

The hydrology of the area comprises mainly sediments (Aeolian sand) of the Kalahari Sequence, with underlying sediments of the Damara Sequence. The shallow topsoil consists of grey sands, formed by the weathering of the Kalahari layers (Alexander and Becker, 2003). These unconsolidated sediments generally have a low aquifer potential.

Most of the Project Area overlies the Kavango-Epukiro Groundwater Basin, which forms the southwest margin of the greater Kalahari Basin, which extends eastwards into Botswana and northwards into Zambia and Angola. Ground water flow direction and hydro-chemical evidence suggest that recharge takes place from the Otavi Mountains in the Kombat-Grootfontein-Abenab area towards the Omuramba Omatako Basin in the Waterberg Area (SPC, 2005).

4.3 Natural Flora and Fauna

The study area is situated on the edge of the Central-Western Plains. The escarpment divides most of the country into two general landscapes: the low lying coastal plain, and the higher inland plateau (Khomas Hochland to the east of Karibib) (Enviro Dynamics, 2015).

Among the marble ridges, the protected *Sterculia africana* can be found. *Commiphora glaucescens* is the more dominant species on the slopes while *Commiphora saxicola* is observed on top of the marble ridge (Enviro Dynamics, 2015).

The bird species recorded in the area, include the yellow-billed hornbill (*Tockus leucomelas*), the colourful lilac breasted roller (*Coracias caudatus*) and the crimson bou bou (*Laniarius atrocooccineus*). The following type of mammalian species can be found in the Karibib surrounds are: kudu (*Tragelaphus strepsiceros*), blesbok (*Damaliscus pygargus*), springbok (*Antidorcas marsupialis*), steenbok (*Raphicerus campestris*), mountain zebra (*Equus zebra*), and warthog (*Phacochoerus africanus*).

5. THE LEGAL ENVIRONMENT

A legal review was done and the key laws of concern include those which protect the ecological integrity of the Waterberg-Okakarara 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 Waterberg 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 Waterberg-Okakarara 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"> Establish regular reporting procedures on maintenance Undertake regular inspection and maintenance of all infrastructure to ensure in working order and to assess damaged / deficient equipment, as per the O&M Manual. Review, and if necessary, revise maintenance manual. Establish emergency procedures guidelines for the blockage/failure, flooding, contaminant removal and disinfection, power failure and fire of the scheme. Implement the response procedures when emergency incident occurs. Complete the incident report checklist in the case of emergency and keep with monitoring records for submission. Undertake annual education course for all operational staff. Review, and if necessary revise emergency manual. 	<p>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 Waterberg-Okakarara 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 deposal 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, anticorrosives, insecticides and pesticides, chemicals, acids etc. It should be disposed of at designated hazardous disposal sites.
- Contaminated soil should be stored in drums and taken to the nearest appropriate waste dumpsite.
- Do not change oil on uncovered ground. Drip trays will be used to catch oil when vehicles are repaired in the field.
- Used oil and hydraulic fluids will not be discarded on the soil or buried. It will be removed from site and taken back to an appropriate dump.
- In the event of a hazardous spill:
 - ✓ 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-point 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

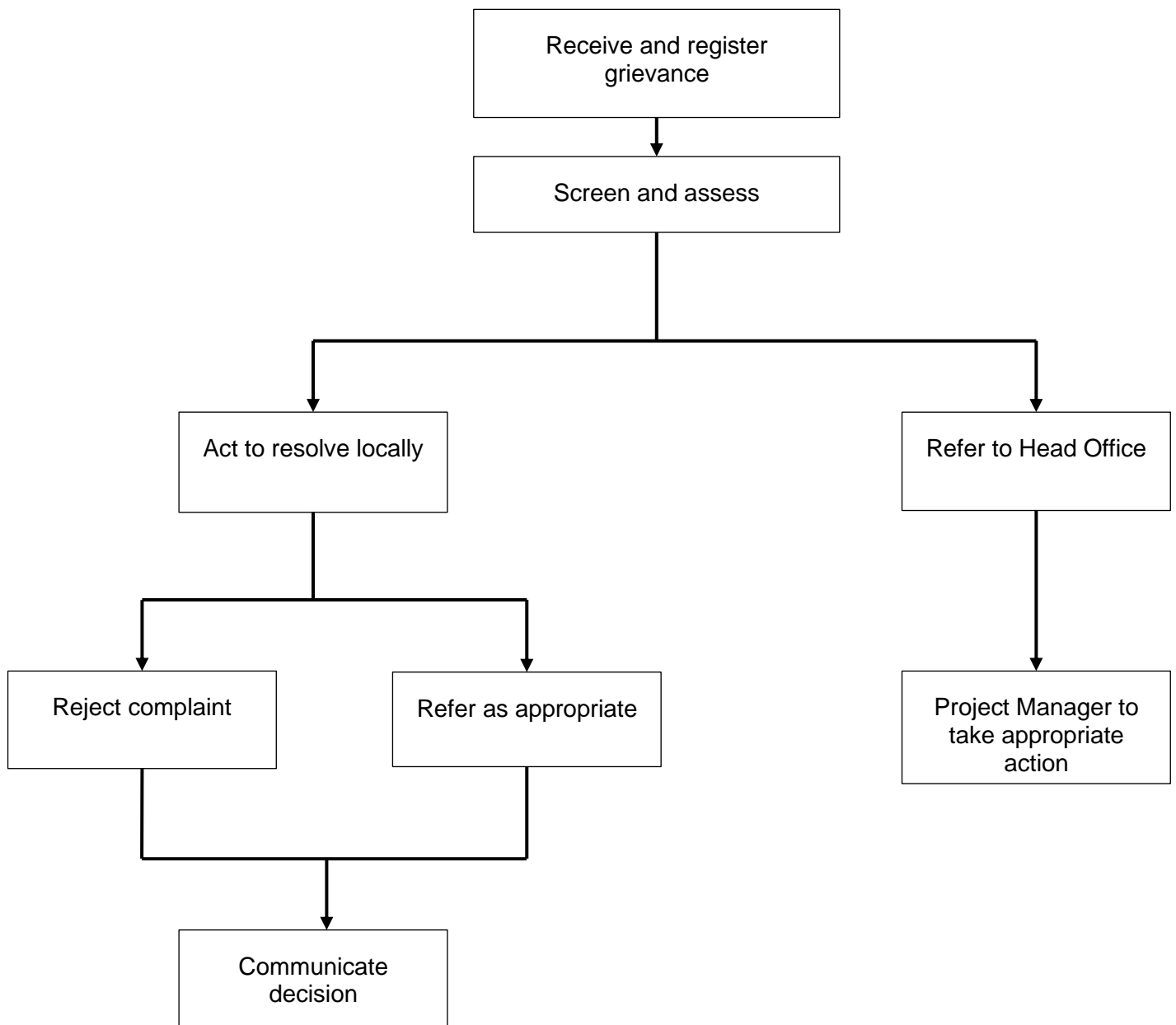
Tell: 061-71 2105

Cell: 081 144 1528

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ANNEXURE 1: GRIEVANCE PROCEDURE AND REGISTRATION FORM



Grievance Registration	
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:	