

CENTRAL NORTH WATER SUPPLY AREA: ZONE 1

ENVIRONMENTAL MANAGEMENT PLAN

Date:
June 2021

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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 1 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 CNWSA: Zone 1 includes mostly canals, being the Calueque – Oshakati and Etaka Canals, as well as the Olushandja Dam and the Calueque Pump Station. The Calueque – Oshakati Canal is split into separate sections as follows:

- Calueque – Border Canal,
- Border – Olushandja Canal,
- Olushandja – Ombalantu Canal,
- Ombalantu – Ogongo Canal,
- Ogongo – Oshakati Canal.

Construction of the Calueque – Oshakati Canal took place in stages, starting at Calueque in 1970, and ending at Oshakati in 1996.

2.1 Calueque – Border Canal

The Calueque – Border Canal is a 12 km long trapezoidal canal, with a design capacity of 10 m³/s. This canal was originally designed to supply water:

- For irrigation in the area between Olushandja and Ombalantu,
- To treatment plants further east,
- To the start of the so-called Western National Water Carrier.

The canal is fed by a pipeline from the Calueque Barrage.

2.2 Border – Bifurcation Canal

This section of canal runs from the Angolan border for a distance of 2 400 m to where the canal splits and a bifurcation in the canal has been constructed. The bifurcation was intended to be the start of the Western National Water Carrier. Most of the canal is either in slight cut, or in slight fill.

This section of canal has the same profile as the section upstream, in Angola, but in contrast to the section upstream (which is lined with nominally reinforced concrete panels), the canal is lined with concrete panels, 750 x 750 mm in size. The capacity of the canal is given as 10 m³/s.

2.3 Bifurcation – Olushandja Canal

This section of canal, 7 000 m in length, has the same profile as the section upstream of the bifurcation, but with a flatter slope, and therefore yields a lower flow capacity than the section upstream. From the bifurcation, the canal runs southwards to the tar road, from where it runs in an easterly direction parallel to the road to Olushandja Dam. At Olushandja Dam the canal feeds into a siphon which runs the full length of the dam wall. At the end of the canal, a valve installation allows water to be discharged into the dam itself.

The canal was originally constructed in the 1970s. A 3 600 m long section that had deteriorated badly was replaced in the mid-1990s, and the canal therefore presently consists of a 3 600 m long “new” section and a 3 400 m long “old” section.

The original canal was lined with concrete panels, approximately 750 x 750 mm in size, and 50 mm thick. These panels have only nominal tongue-and-grooves and therefore only have a

slight interlocking effect. The new section of canal is lined with 100 mm thick, nominally reinforced concrete panels, with transverse joints at 3 m intervals.

The capacity of this section of canal is given as 6 m³/s. As stated above, the “old” section of the canal is lined with concrete panels approximately 750 x 750 mm in size, whereas the “new” section is lined with nominally reinforced (steel) concrete panels.

2.4 Olushandja – Ombalantu Canal

The 47 km long section of canal was originally intended to supply, not only water for domestic consumption, but also to supply water for irrigation use between Olushandja and Ombalantu. The canal is trapezoidal in shape, with rounded corners. The bottom width varies between 2.93 m (upstream) and 2.78 m (downstream). The lining depth varies between 1.62 m (upstream) and 1.44 m (downstream). The canal lining is constructed from so-called Deckwerk interlocking bricks.

The upstream section has a stated design capacity of 4.5 m³/s, and the downstream section a stated design capacity of 3.2 m³/s.

2.5 Ombalantu – Ogongo Canal

This 34 km long canal runs from Ombalantu to the treatment plant at Ogongo. The first part of the route follows the Ombalantu – Ogongo tar road. Most of the canal runs in slight fill. Most of the canal is parabolic in shape. In the vicinity of Ombalantu, however, the first section in cut was of a different construction and was replaced by a siphon and interlocking brick construction in 2004.

This canal has a stated capacity of 1.5 m³/s.

2.6 Ogongo – Oshakati Canal

This canal was constructed in the mid-1990s. The canal is 54 km long including siphons, is trapezoidal in shape, on average 1.62 m in depth, with 20 siphons of various lengths constructed at oshanas and pans. It has a bottom width of 1.0 m and an average lining depth of 1.62 m. With invert slopes in the order of 1:31 000 (i.e., 0.0032%), this canal has the flattest slope of all of lined canals in the Project Area. The slope was dictated by the level of the incoming canal at Ogongo, and by the level of the forebay at Oshakati.

The canal was originally designed and constructed with mitre drains running along the sections in cut, but due to their ineffectiveness, they were filled in before commissioning of the canal.

Apart from the trapezoidally shaped section which makes up most of the canal, there is also a 1 000 m section that consists of standard inverted culvert sections.

The canal was designed for a nominal capacity of 1.3 m³/s with a freeboard of 200 mm. In recent years there have been reports that the capacity of the canal was significantly less than the design capacity of 1.3 m³/s, and in fact as low as 0.8 m³/s.

2.7 Etaka Canal

The Etaka Canal is a 130 km long earth canal, which starts at the South Wall of the Olushandja Dam and then runs in a south-easterly direction to Okahao and beyond. Figure 7.33 below shows the start of the canal. This canal was previously used to provide water, mainly for livestock watering, to the communities between Olushandja and Okahao. However, in the past, due to very high seepage and evaporation losses, a very low portion of the water pumped into the canal reached the end. As a result, the Etaka Canal has not been in use for several years, and its possible future use will mostly likely only be as a drought relief measure.

The capacity of the Etaka Canal has not been determined, as the canal is not in use, and is unlikely to be in the foreseeable future.

2.8 Olushandja Dam

The Olushandja Dam is located in the Etaka Oshana and consists of a North Wall and a South Wall, approximately 22 km apart. At the present operating levels, the reservoir is 1.8 km at its widest, and 1.0 km wide on average. It does not have a catchment area, and is only fed by the Calueque – Olushandja Canal. A siphon runs along the length of the North Wall and links the end of the canal from Calueque with the start of the canal to Ombalantu. A pump station and inlet works is situated on the dam wall. Water can be pumped from the dam into the siphon (and therefore into the Ombalantu Canal) by means of the electrically driven pumps.

The purpose of the Olushandja Dam was to act as a storage facility closer to the demand centres and to accommodate peak demands. The maximum water level in the Dam is 6.5 m, which corresponds to a storage capacity of 26.8 Mm³ and a surface area of 22.5 km².

Irrigation is currently taking place on the western bank of the dam, between the northern bank of the dam and District Road DR3616.

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

The EMP is for an existing CNWSA: Zone 1 infrastructure and it is therefore only for the operation and maintenance of CNWSA: Zone 1.

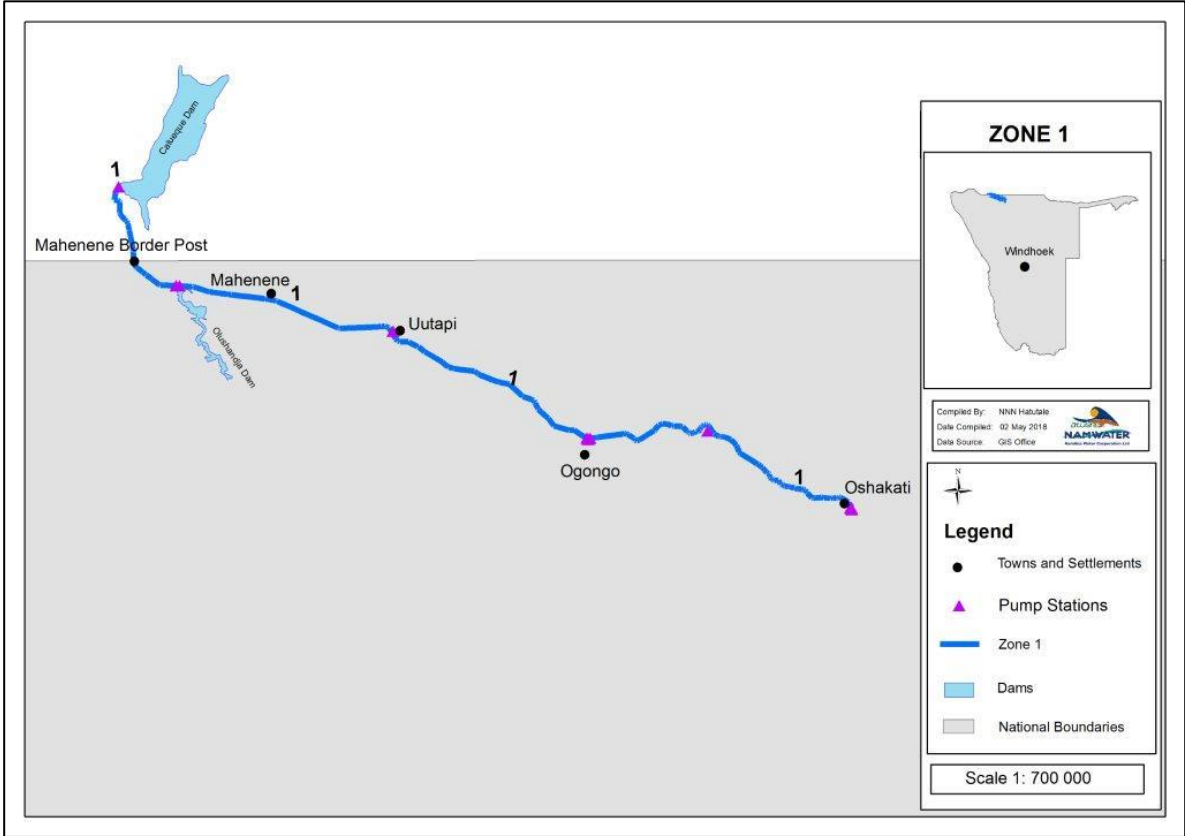


Figure 1: CNWSA: Zone 1 Location Map

3. EXISTING CNWSA: ZONE 1 WATER SUPPLY INFRASTRUCTURE

3.1 Water Source

The Calueque Pump Station draws water from the Calueque Dam on the Kunene River in Angola and pumps this water into the Calueque – Oshakati Canal, which transfers this water to Olushandja Dam, from where it is eventually transferred to Oshakati as well as to the Etunda Irrigation Scheme via a separate canal. The Outapi / Ombalantu and the Ogongo Purification Plants draw water from the Calueque – Oshakati Canal downstream of Olushandja Dam.

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 1 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).

3.3 Calueque – Border Canal

3.3.1 Pipe Work

The pipeline from the Calueque Barrage is a 2.4 km long, above-ground, 1 600 mm diameter steel rising main, laid on concrete pedestals to which the pipes are strapped. The pipeline dips underground at the start of the canal. The pipes are joined by steel Viking Johnson-type flexible couplings. A surge tower has been constructed along the pipeline.

3.3.2 Canal

This canal is 12 km in length. It runs from the end of the rising main, up to the Angola / Namibia Border (at the Calueque border post).

The canal cross-sections are trapezoidal and parabolic in shape and consist of reinforced concrete slabs. Most of the canal is raised above ground in slight fill.

The canal is documented as having a capacity 10 m³/s.

3.4 Power Supply and Control System

3.4.1 Calueque Pump Station

This pump station consists of two pumps which draw water from the Calueque Dam and deliver into the Calueque Pipeline which flows into the Calueque – Border Canal.

The two pumps are Mather & Platt 36"/36" BLEY vertical split, single stage, double suction pumps, which are driven by two BBC ZSM0229 electrical motors of 650 kW, 3.3 kV, 50 Hz each, which run at a fixed speed of 494 rpm.

These pumps and motors each have a nominal capacity of 7 128 m³/h or 1.98 m³/s. However, at a dam level of 1 092 m, the installed pumping capacity per pump at a head of about 22 m is

1.9 m³/s. At the same dam level, with two pumps running simultaneously, the delivery amounts to 3.3 m³/s at a head of about 24 m.

Two pumps are installed in parallel and are controlled manually by a start and stop button. The pumps are used on a permanent basis. Both pumps are constant speed pumps.

3.4.2 Olushandja North Wall Pump Station

Two pumps are used to pump raw water from the dam, via a suction sump, to the Calueque–Ombalantu Canal, if the canal level is too low. These are APE pumps driven by 55 kW, 380 V WEG motors running at 740 rpm. The pumps and motors can deliver 600 m³/h at 37 m head.

3.4.3 Ogongo Raw Water Pump Station

Two submersible pumps are used to pump raw water from the canal to the 1 Mm³ ground storage dam at Ogongo. These are Flygt type 3300.180 pumps driven by 49 kW, 380 V type TEFC Flygt motors running at 970 rpm. These pumps have a nominal capacity of 630 m³/h at 7 m head.

3.5 Maintenance

Maintenance is done by a permanent NamWater team.

3.5.1 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.

3.5.2 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.

3.5.3 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.

3.5.4 Reservoirs

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

3.5.5 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.

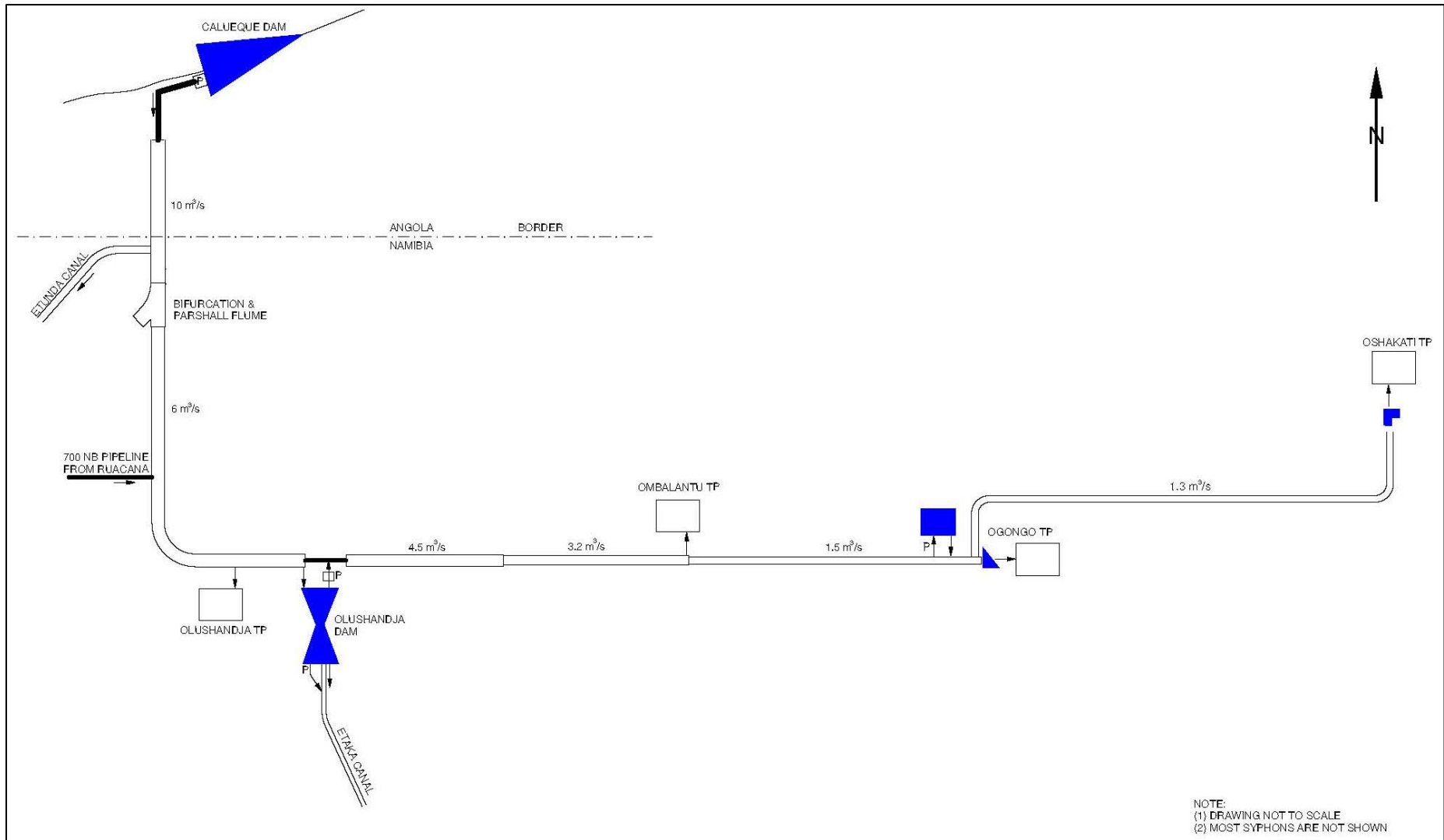


Figure 2: CNWSA: Zone 1 Scheme Layout

4. CANAL REHABILITATION

4.1 Background

The section of canal between Mahenene border and Olushandja Dam has deteriorated in some places over the years and about 10% of it needs to be repaired. The sections of greatest concern are at Olushandja Treatment Plant and at Mahenene Border Post. These sections of the canal are trapezoidal in shape and lined with 750 x 750 x 50 mm unreinforced concrete panels. Some of the problems being experienced with this lining are:

1. Some of the panels lining the sides of the canal have tilted up, forming hollows behind them.
2. Soil behind the panels is washed into the canal through the joints between the panels
3. Some panels are moved from their positions by people.

This section of the canal will be rehabilitated in order to restore its functionality by replacing the panels with reinforced concrete slabs. The rehabilitation will be done in two parts: Mahenene border to Bifurcation (2.5 km) and Main Road Bridge to Olushandja (3.5 km).

4.2 Scope

The scope of works entails the following:

1. Conduct suitable geotechnical investigation, analyse results and design the canal and bypass.
2. Construct a temporary bypass pumped or gravity pipeline of which the equipment shall become NamWater property after construction.
3. Remove the existing concrete blocks/panels and stockpile the blocks at Olushandja treatment works.
4. Remove, reshape or replace existing top sand layer, on the sides of the canal that is no longer suitable for a stable canal foundation.
5. Construct a new reinforced canal lining.
6. Construction of a fence on both sides alongside the canal for the first 130 m from the Mahenene border canal crossing bridge
7. Construction of a long weir
8. Remove, reshape or replace earthworks for sections in fill for the reconstructed canal embankment with a top width of 2 m on both sides in sections under fill.
9. Reconstruct culverts, animal and human crossing and any super-passages disturbed during the removal of the panels or that are non-functional.
10. Install flow measuring equipment
11. Consult and communicate with affected communities during the construction of bypass pipelines.
12. Prepare and finish off the site for commissioning.

5. BRIEF DESCRIPTION OF THE RECEIVING ENVIRONMENT

The baseline description provided below focuses on the receiving environment:

5.1 Climate

The North Central portion of Namibia has a semi-arid climate, which is characterised by rainfall which varies greatly in amount and timing.

5.1.1 Precipitation

The rainfall is erratic, and it normally starts from the end of October and ends early in April. Annual rainfall in the area ranges from 480 to 600 mm (IECN, 2011).

5.1.2 Temperature

CNWSA: Zone 1 area has temperatures similar to most places in found in the central-north region. All temperatures in north-central Namibia are only recorded in Ondangwa on a longer-term basis. Average winter temperatures are just below 20°C and summer temperatures around 28°C. The maximum temperatures reach around 35°C in summer, with a minimum of 8°C in winter.

5.2 Geology

The topography of CNWSA: Zone 1 is generally flat, with moderate changes in elevation. The ground generally slopes from the north to the south, towards the Etosha Pan. Metamorphic inliers consisting of highly deformed gneisses, amphibolites, meta-sediments and associated intrusive rocks occur in the central and northern parts of the country which includes the Zone 2 area, and these metamorphic inliers represent some of the oldest rocks of Palaeoproterozoic age in Namibia (Christelis, et. al., 2011).

The CNWSA: Zone 1 lies in the Main Deep Aquifer located in the eastern Ohangwena and northern Oshikoto regions. The aquifer recharge area is located in southern Angola and it flows southward, towards the Etosha Pan (Christelis, et. al., 2011). The Main Deep Aquifer is a continuous porous aquifer, representing the main freshwater source in the Ohangwena Region. West of Eenhana-Okankolo line, this aquifer is brackish to saline and cannot be developed for drinking water purposes (Christelis, et. al., 2011).

5.3 Natural Fauna and Flora

The Angolan Mopane Woodlands ecoregion has four mammals which are almost endemic to the ecoregion: blackish white-toothed shrew (*Crocidura nigricans*), Thomas's rock rat (*Aethomys thomasi*), heather shrew (*Crocidura erica*) and the black-faced impala. The mopane trees are the habitat of the mopane emperor moth (*gonimbrasia belina*), who's caterpillars feed on the leaves and are collected for food by people in the area (Mendelsohn *et. al.*, 2009).

Four mammals are near-endemic to the Angolan Mopane Woodlands. These are the bush rat (*Aethomys thomasi*), two white-toothed shrews (*Crocidura erica*, and *C. nigricans*), and the black-faced impala (*Aepyceros melampus petersi*). *Crocidura erica* and the black-faced impala are classified as vulnerable in the IUCN red list of threatened animals (Mendelsohn *et. al.*, 2002). The area has four endemic reptiles: Afrogecko ansorgii, Coluber zebrinus, Ruben's sand lizard (*Pedioplanis rubens*), and the skaapesteker snake (*Psammophylax rhombeatus ocellatus*). There is also one strictly endemic amphibian known from the ecoregion, *Ptychadena mapacha* (Mendelsohn *et. al.*, 2009).

According to Mendelsohn *et al.*, (2009) CNWSA: Zone 1, is found within the Angolan Mopane Woodlands ecoregion, located in both Namibia and Angola. In the west of the ecoregion, the

ephemeral wetlands of the Oshanas support an open landscape with palm (*Hyphaene petersiana*) and marula trees (*Sclerocarya birrea*), while the eastern parts comprise woodlands. Mopane (*Colophospermum mopane*) dominates the vegetation of this ecoregion.

Purple-pod terminalia (*Terminalia prunioides*) *Acacia erioloba*, leadwood (*Combretum imberbe*) red bushwillow (*Combretum apiculatum* subsp. *apiculatum*), Lonchocarpus nelsii and tamboti (*Spirostachys Africana*) (Mendelsohn *et. al.*, 2002).

During the dry season, most of the oshanas are covered by grass, while on the higher ground in between, saline Kalahari sands support Mopane scrub and various larger trees. These raised areas also support much of the crop production and grazing areas – various saline grasses dominate the vegetation (Mendelsohn *et. al.*, 2002).

6. 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 1 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 1 ecosystem for the sustainable use by Namibians.

6.1 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.

6.2 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.

6.3 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

6.4 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.

6.5 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.

7. RESPONSIBLE PARTIES

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

7.1 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.

8. 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.

9. MANAGEMENT ACTIONS

9.1 Operation and Maintenance phase of the CNWSA: Zone 1 Water Supply Scheme

9.1.1 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>

9.2 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 1 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.

9.3 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.

9.4 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.

9.5 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.

9.6 Waste and Pollution Management

9.6.1 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.

9.6.2 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.

9.6.3 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.

9.7 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.

10. 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.

11. 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

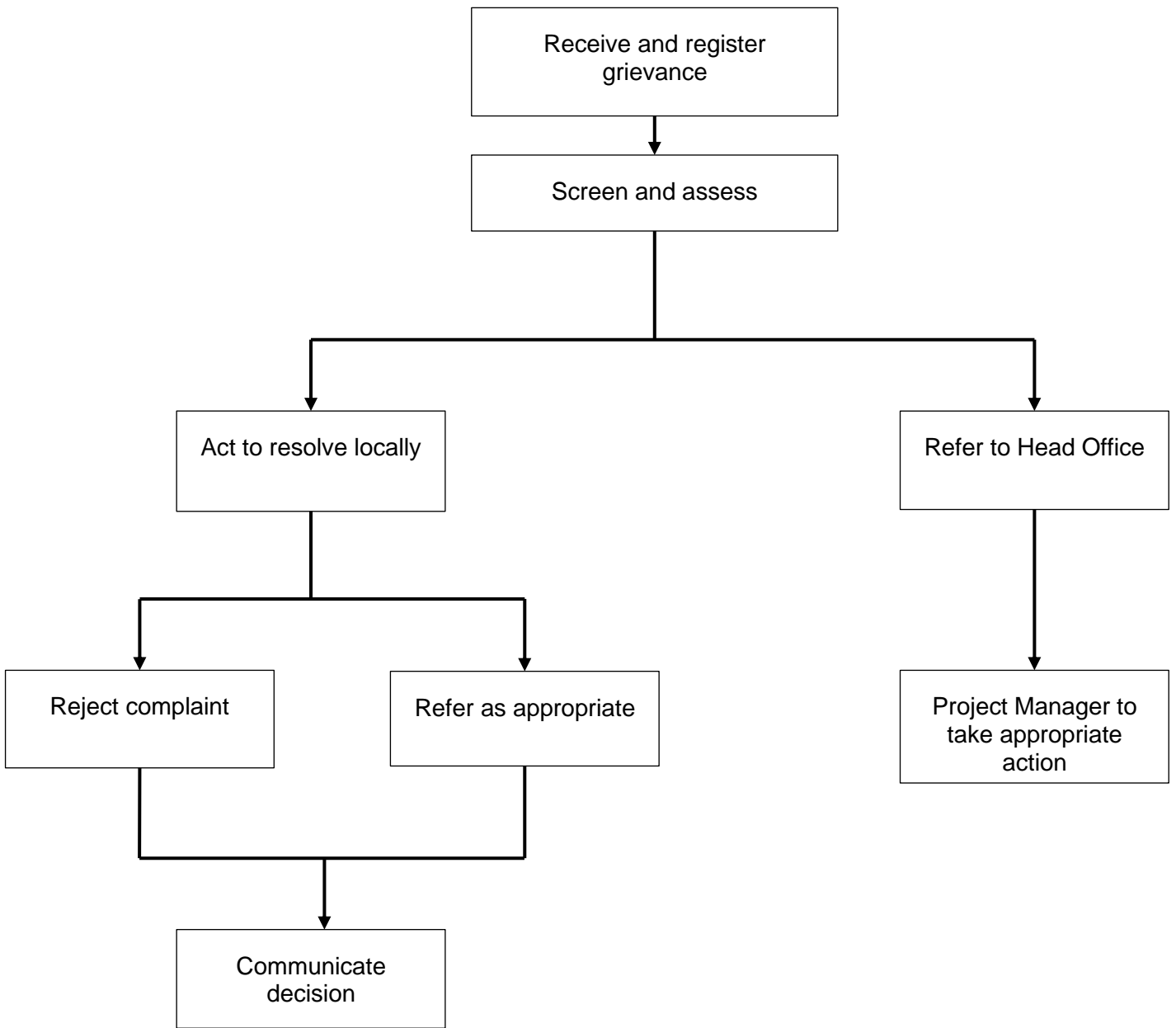
Tell: 061-71 2105

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:	