



ENVIRONMENTAL MANAGEMENT PLAN FOR CENTRAL NORTH WATER SUPPLY AREA: ZONE 7

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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 Forest and Tourism
NEM	NamWater Environmental Manager
MSDS	Material Safety Data Sheet
NWQG	Namibian Water Quality Guidelines
NWQS	Namibian Water Quality Standards
STI's	Sexually Transmitted Infections
WTW	Water Treatment Works

1. PURPOSE OF THE EMP

This Environmental Management Plan (EMP) has been compiled for the management of potential environmental impacts during the operation, and decommissioning phases of the proposed Central North Water Supply Area (CNWSA): Zone 7 Water Supply Scheme. Best practice is proposed for the generic issues of construction management and supervision as well as the on-going management and operation of the pipeline.

In terms of the Environmental Assessment Policy of 1994 and the Environmental Management (Act 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 2021 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 7 includes the following pump stations:

- Oshakati (two),
- Iindangungu,
- Omakango,
- Omafo,
- Oshikango,
- Ongha,
- Ohangwena,
- Eenhana,
- Oshaango.

The following bulk pipelines fall into Zone 7:

- Oshakati – Ondangwa / Iindangungu (new),
- Oshakati – Omakango,
- Iindangungu – Omakango / Ongha,
- Omakango – Omafo / Ohangwena,
- Omafo – Oshikango,
- Omafo – Omungwelume,
- Omafo – Eenhana / Mandume Lodge / Ondobe,
- Omakango – Onambutu,
- Omakango – Endola,
- Endola North East,
- Oshikango – Odibo,
- Mandume Lodge,
- Iindangungu – Etope / Oshaango,
- Oshaango – Epembe / Onangolo West.

The Endola East Rural Water Supply Scheme also forms part of the infrastructure of Zone 7. Reservoirs are located at all of the abovementioned pump stations. The urban centres of Eenhana, Oshikango, Engela, Ohangwena and Ongenga are located in Zone 7.

The location of CNWSA: Zone 7 is depicted in **Figure 1**.

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

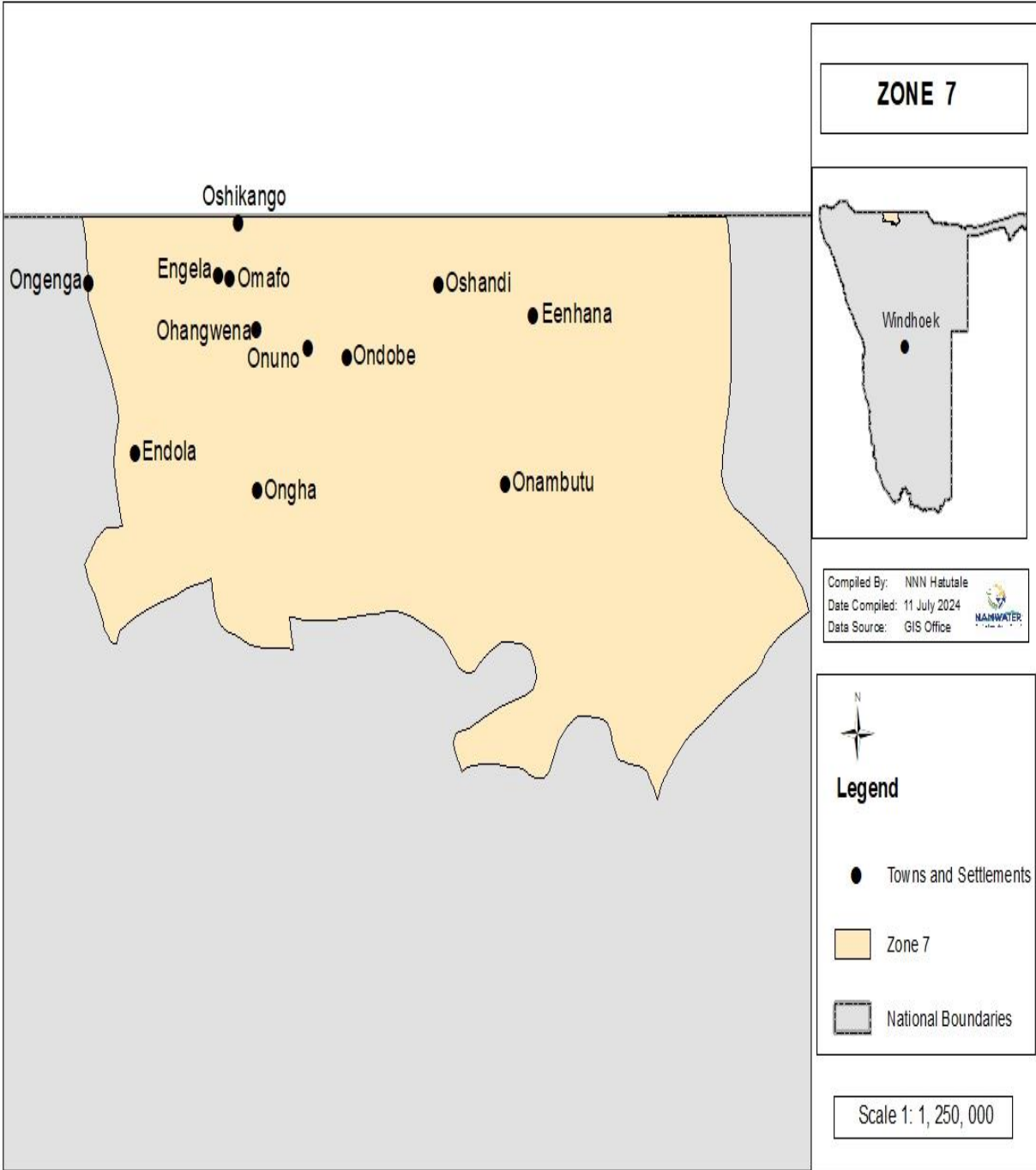


Figure 1: CNWSA: Zone 7 Location Map

3. EXISTING CNWSA: ZONE 7 WATER SUPPLY INFRASTRUCTURE

3.1. Water Source

The Oshakati Purification Plant is the source of water for both Zones 6, 7 and 8, but is located in Zone 6. Under Zone 7, treated water is pumped northwards as far as Oshikango, eastwards as far as Eenhana and Oshaango, as well as eastwards to Ondangwa, and north-westwards as far as Omungwelume, including the areas in between.

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 Linyanti reservoir was evaluated for compliance with the Namibian Water Quality Guidelines (NWQG) and the Namibian Water Quality Standards (NWQS). According to the NWQG the water can be classified as Group A and B.

3.2.1 Omakango Pump Station

The chlorination consists of a 68 kg gas chlorination system fitted with an Alldos 545 1011 Ejector unit and two Grundfos CR 3 booster pumps, which were recently installed, but which are not yet in operation.

3.2.2 Omafo Pump Station

The chlorination consists of a 68 kg gas chlorination system fitted with an Alldos 545 1011 Ejector unit and two Grundfos CH2-50 booster pumps, which were recently installed.

3.2.3 Oshikango Pump Station

The chlorination consists of a 68 kg gas chlorination system fitted with a Jesco Ejector. The model and dosing rate of the system could not be obtained during the field assessment.

3.2.4 Eenhana Pump Station

The chlorination consists of a 68 kg gas chlorination system fitted with a Jesco Ejector.

3.3. Rural Water Supply Schemes

3.3.1 Endola East Rural Water Supply Scheme

This DRWS Rural Water Supply Project is fed from the Endola North East Bulk Pipeline. The scheme consists of eight branch lines running in a general north – south direction from the Endola North Bulk Pipeline, with associated domestic and institutional water points and appurtenances.

3.4. Pipe Work

3.4.1 Oshakati – Ondangwa / lindangungu (New) Pipeline

This pipeline starts at the Oshakati – Ondangwa Pump Station on NamWater’s premises in Oshakati, from where it follows a southerly direction, running to the north of the town of Ongwediva. From there, it follows a south-westerly direction, to a manhole from where a branch pipeline to lindangungu is connected. From this branch point, the pipeline continues in a southerly and south-westerly direction, to eventually terminate at the NamWater premises in Ondangwa. This pipeline has no private or DRWS water meter installations and is only used to transfer water from Oshakati to Ondangwa and lindangungu. This line is 35.9 km long.

3.4.2 Oshakati – Omakango Pipeline

This pipeline starts at the Oshakati – Omakango Pump Station on NamWater’s premises in Oshakati, and follows a northerly route up to the village of Okatana, before it turns northwest to cross the Cuvelai River and terminate at the NamWater pump station in Omakango. Several DRWS water points draw water from this line, as well as some DRWS branch pipelines. This pipeline also serves numerous private water meter installations.

This pipeline is 30.8 km long, with 165 water meter installations.

3.4.3 lindangungu – Omakango / Ongha Pipeline

This pipeline is the second portion of the Ondangwa–Oshikango route (the first being the Ondangwa–lindangungu Pipeline which falls in Zone 8) and connects lindangungu and Omakango, with a short branch line to the reservoir at Ongha. Water meters on this pipeline are primarily made up of private water meters, but a few Department of Rural Water Supply (DRWS) water points also draw water from the line.

The pipeline is approximately 21 km long, with 252 water meter installations.

3.4.4 Omakango–Omafo/Ohangwena Pipeline

The next leg of the Ondangwa–Oshikango pipeline route runs from Omakango to Omafo. This pipeline has mainly private water meters, with several red cages where NamWater reads only the main meter, whilst the other meters are read by the town council of Helao Nafidi.

This portion of the pipeline is about 18.7 km long. A total of 88 water meters were identified along the pipeline route.

3.4.5 Omafo–Oshikango Pipeline

Between the Omafo and Oshikango Pump Stations, two pipelines run in parallel, an old line and a newer pipeline. Although both pipelines are in operation, the exact routes of both are unclear. All water meter readings taken by NamWater on these two pipelines are being billed to the Helao Nafidi Town Council.

Both pipelines are approximately 5.9 km long. A total of 32 water meters were found along the route.

3.4.6 Omafo–Omungwelume Pipeline

Starting at NamWater’s pump station in Omafo, this pipeline runs in a westerly direction up to Ongenga, from where it turns in a south-westerly direction to terminate at NamWater’s Omungwelume Pump Station. This pipeline primarily has private consumers connected to it.

This pipeline is approximately 30.4 km in length, and a total of 205 water meters were found along the route.

3.4.7 Omafo–Eenhana Pipeline

This pipeline runs from NamWater’s pump station in Omafo in an easterly direction to end at the pump station in Eenhana. The pipeline runs parallel to a service road for the majority of the route. This pipeline has several DRWS branch lines and water points, and numerous private water meter installations connected to it.

The pipeline is approximately 48 km long. A total of 145 water meters were found along the pipeline route.

3.4.8 Ondobe Pipeline

This pipeline branches off the Omafo–Eenhana Pipeline and runs in a southerly direction to end at the village of Ondobe.

The pipeline is about 6.1 km long, with 55 water meters along the pipeline route.

3.4.9 Omakango–Onambutu Pipeline

This pipeline runs from NamWater’s pump station in Omakango in an easterly direction, crossing the Oshigambo – Ondobe and Oshigambo – Eenhana roads, before terminating at the village of Onambutu. This pipeline has several DRWS branch lines and water points, and numerous private water meter installations connected to it.

This pipeline is 40.8 km long, with 43 water meter installations along the route.

3.4.10 Omakango – Endola Pipeline

This pipeline runs from the NamWater pump station at Omakango in a westerly direction, to terminate in the vicinity of the village of Endola. This pipeline primarily serves to supply private consumers. The pipeline is approximately 17.6 km long. A total of 37 water meters were found along the pipeline route.

3.4.11 Endola North East Pipeline

This pipeline branches off from the Omakango–Omafo Pipeline at the village of Onhuno, from where it runs in a westerly direction, terminating in the vicinity of the village of Endola. Originally designed to supply bulk water to a number of branch lines forming part of the DRWS Endola East Water Supply Project, a number of private water meter installations also draw water from this pipeline.

The pipeline is 16.4 km long. A total of 61 water meters were found along the pipeline route.

3.4.12 Oshikango – Odibo Pipeline

This pipeline branches off the old Omafo – Oshikango Pipeline in the vicinity of Oshikango, from where it runs in an easterly direction to terminate at Odibo. The pipeline serves DRWS water points as well as private consumers.

The pipeline is about 4.5 km long, has 19 water meters and 9 GPS waypoints were taken along the route.

3.4.13 Mandume Lodge (Oihole) Pipeline

This pipeline branches off the Omafo – Eenhana Pipeline in the vicinity of Ohamwaala village, from where it follows a northerly route. It crosses the Namibia – Angola border in the vicinity of Ohanghwe village. It is reported that the pipeline runs into Angola to terminate at the Mandume Lodge, but it is closed off at a manhole just south of the border.

The section of the pipeline south of the border is approximately 4.3 km long. A total of 11 water meters were found in this section of the pipeline route. The section of the pipeline north of the border was not assessed.

3.5. Reservoirs

The location, material of construction and condition of the three reservoirs located in CNWSA: Zone 7 are provided in Table 1 below.

Table 1: Reservoirs of Zone 7

Reservoir Name or Location	Reservoir Type and Configuration	Nominal Capacity (m³)
Eenhana	Reinforced concrete GLR	670
Eenhana	Pressed steel ER	125
lindangungu	Reinforced concrete, round, GLR	4 500
lindangungu	Circular steel ER	200
Ohangwena	Pressed steel GLR	330
Ohangwena	Pressed steel ER	104
Omafo	Reinforced concrete GLR	1 500
Omafo	Circular steel ER	200
Omakango	Reinforced concrete GLR	3 500
Omakango	Circular steel ER	200
Onambutu	Reinforced concrete GLR	800
Onambutu	4 x 5 m ³ plastic tanks, ER	20
Ongenga	Reinforced concrete GLR	3 000
Ongenga	Plastic tanks, ER	20
Ongha	Pressed steel GLR	330
Ongha	Pressed steel ER	104
Oshikango	Reinforced concrete GLR	350
Oshikango	Circular steel ER	200

3.6. Power Supply and Control System

3.6.1 Oshakati – Ondangwa Pump Station

This pump station is also located on NamWater’s premises in Oshakati. Three pumps draw water from the 9 000 m³ Oshakati Ground Level Reservoir, via the Ogongo – Oshakati Pipeline, and deliver this into the (new) Oshakati – Ondangwa Pipeline, which features a branch which supplies water to lindangungu.

The three pump sets are variable speed driven and are controlled via pressure sensors, an electro-magnetic flow meter and by measuring the reservoir levels at Ondangwa and lindangungu. The speed of the pumps increases with the increasing flow rate and loss of pressure in the pipeline. The three pumps are KSB ETA 200-40 units, driven by 132 kW, 380 V, Alstrom TEFC, electrical motors running at 1 485 rpm.

The main power supply to the pump station is from a 11 000 / 400 V, 500 kVA transformer which requires servicing as soon as possible. It is recommended that the area around the transformer

be cleared of all plants, the fence be rectified and trenches be installed to prevent water from entering the area of the transformer. A 630 A TP main isolator set to 0.7 is installed in the control panel of the pump station. The electricity bill is included in the account for the Oshakati Purification Plant.

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

3.6.2 Oshakati – Omakango Pump Station

This pump station is located on NamWater's premises in Oshakati. Five pumps draw water from the floating roof reservoir, via the Ogongo – Oshakati Pipeline, and deliver this into the Oshakati – Omakango Pipeline.

The pumps are pressure controlled and one of the five pumps is a so-called jockey pump used during low flow periods and the other four pumps are used for high flow periods. One of the high demand pumps is a standby pump. All pumps are constant speed pumps.

The jockey pump is a KSB ETA 80-400 unit, driven by a 30 kW, 380 V, Leroy Summer, TEFC, electrical motor running at 1 450 rpm. The other four pumps are KSB ETA 100-50/C2 units, driven by 55 kW, 380 V, Leroy Summer, TEFC electrical motors running at 1 475 rpm.

The main power supply to the pump station is from a 11 000 / 400 V, 630 kVA transformer which requires a servicing as soon as possible. It is recommended that the area around the transformer be cleared of all plants, the fence be rectified and trenches be installed to prevent water from entering the area of the transformer. A 800 A TP main isolator is installed in the control panel of the pump station. The electricity bill is included in the account for the Oshakati Purification Plant.

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

3.6.3 lindangungu Pump Station

The lindangungu Pump Station is supplied with water from both Oshakati, via the Oshakati–Ondangwa/lindangungu Pipeline (Zone 7) and from Ondangwa via the Ondangwa–lindangungu/Oshitayi Pipeline (Zone 8) and in turn pumps water in several directions.

Supply to Etope/Oshaango

The water supplied from Oshakati either enters a 5 000 m³ concrete ground level reservoir or bypasses the reservoir directly to the pump station. Water is normally pumped into the reservoir, as the bypass is only used for emergencies. Five pumps draw water from the reservoir and deliver into the pipeline to Etope/Oshaango.

Supply to Omakango/Ongha

At present, water is not supplied to Ongha from the Omakango Pump Station.

Water entering the lindangungu Pump Station from Ondangwa enters the 5 000 m³ concrete ground level reservoir or passes directly past the pump station where the pipeline ends in a tee. The left branch of this tee supplies water to Omakango, which is not boosted at lindangungu. Between lindangungu and Omakango, a pipeline branches off to supply Ongha.

At lindangungu, water is pumped from the 5 000 m³ ground level reservoir into the elevated 200 m³ elevated reservoir from where it can gravitate into the same pipeline towards Omakango and Ongha mentioned above, once the outlet of the 200 m³ elevated reservoir has been completed.

Supply to Oshigambo

The right branch of the tee of the pipeline from Ondangwa supplies Oshigambo with water, which pipeline and pump station fall under Zone 8.

The outlet of the 200 m³ elevated reservoir is not yet connected, but the intention is that it will be connected to the pipeline which supplies Omakango to the one side and Oshigambo to the other.

All five pump sets are variable speed driven and are controlled via a pressure sensor and electromagnetic flow meter. The speed of the pumps increases with increasing flow and loss in pressure in the pipeline. One pump is a standby pump.

The five pumps are Grundfos CR90-3 units driven by 30 kW, 400 V, Siemens TEFC motors running up to 2 950 rpm.

The main power supply to the pump station is via an 80 A TP circuit breaker situated in a kiosk underneath a 11 000/400 V, 200 kVA pole mounted transformer located adjacent to the pump station. A 400 A TP main isolator is installed in the control panel of the pump station. The transformer is the property of NORED Electricity and maintenance costs for the transformer are the responsibility of NORED.

A telemetry system is installed at the pump station and all flow meters, level detectors and pressure transmitters are connected to the telemetry system to allow all measurements to be recorded on the SCADA system.

3.6.4 Omakango Pump Station

The Omakango Pump Station receives water either from Oshakati, via the Oshakati–Omakango Pipeline, or from the lindungungu Pump Station. The pipeline from Oshakati tees to either supply water into the 4 000 m³ concrete ground level reservoir or to the pipeline to Omafo.

The pipeline from lindungungu tees into the outlet pipe from the 200 m³ elevated reservoir, which pipeline supplies both Endola and Onambutu. The pipeline from lindungungu connects on the Endola side of the branch from the reservoir outlet, and could therefore supply water to either Endola or Onambutu, depending on the relative flow rates and pressures, but most likely supplies water to Endola. The pipeline from lindungungu is equipped with a non-return valve, so that the elevated reservoir cannot supply water back towards lindungungu.

The Omakango Pump Station has only two pumps which draw water from the 4 000 m³ concrete ground level reservoir and boost in three directions – towards Omafo (directly) and towards Endola and Onambutu via a 200 m³ elevated reservoir.

Supply to Omafo

Water from either Oshakati or lindungungu is supplied to Omafo. This water is supplied under pressure from the Omakango pumps, via a branch pipeline upstream of the inlet to the 200 m³ elevated reservoir. Between Omakango and Omafo, a pipeline branches west to supply a Rural Water Supply Scheme and east to supply Ohangwena.

Supply to Endola

Water is supplied to Endola via the 200 m³ elevated reservoir, which water is either from Oshakati (via the 4 000 m³ reservoir and pumps) or from lindungungu, via a connecting pipeline.

Supply to Onambutu

Water is supplied to Onambutu via the outlet of the 200 m³ elevated reservoir, which outlet also supplies Endola.

Two pumps are installed in parallel and operate in a duty / standby configuration and are controlled either via level float switches installed in the Omakango Elevated Reservoir and the Omafo Ground Level Reservoir or by the pressure in the pipeline. The pumps duty cycle automatically. Both pumps are constant speed pumps. The two pumps are KSB ETA 150-8 units, driven by 90 kW, 380 V, Alstom TEFC motors, running at 1 480 rpm.

The main power supply to the pump station is via a 200 A TP circuit breaker situated in a distribution board underneath a 11 000 / 400 V, 200 kVA pole mounted transformer. The

transformer is the property of NORED Electricity and maintenance costs for the transformer are the responsibility of NORED.

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

3.6.5 Omafo Pump Station

The Omafo Pump Station receives water only from Omakango, but supplies water in several directions, to Ongenga, Oshikango and to Eenhana. The pipeline from Omakango branches to supply water either to a 2 000 m³ concrete ground level reservoir or past the reservoir to the Eenhana pump sets. This bypass pipeline is equipped with isolating valves.

Supply to Eenhana

Four pumps and two jockey pumps of the Omafo – Eenhana Pump Sets draw water from either the 2 000 m³ concrete ground level reservoir or the Omakango Pipeline (via the reservoir bypass) and boost water into the new pipeline which supplies Eenhana, as well as the Ondobe RWS and the Border Post, amongst other consumers. Downstream of the pumps, a pipeline from the 200 m³ elevated reservoir connects to the new Eenhana Pipeline, such that water from this reservoir can also gravitate to Eenhana. Water cannot be pumped back into the 200 m³ elevated reservoir due to a non-return valve on this pipeline.

The old pipeline to Eenhana is no longer in use.

Supply to Ongenga

Two pumps of the so-called Omungwelum Pump Sets draw water from the 2 000 m³ concrete ground level reservoir and boost into two pipelines, a new and an old one, which run in the direction of Ongenga.

The pipelines to Ongenga (both new and old) can also be supplied from the 200 m³ elevated reservoir, via a pipeline featuring non-return and isolating valves by which these supply options can be facilitated. Water pumped from the Omungwelum pump sets cannot be pumped back into the 200 m³ elevated reservoir due to the non-return valve.

Supply to Oshikango (and Eenhana)

Two pumps of the so-called Tower Pump Sets draw water from the 2 000 m³ concrete ground level reservoir and boost it into the 200 m³ elevated reservoir, from where it gravitates to supply Ongenga (via either the old line only or both the new and old pipelines) and Oshikango. Water

can also gravitate through the old pipeline towards Eenhana, although this pipeline has been decommissioned.

A pipeline supplying the Odibo Rural Water Supply Scheme branches off the Omakango – Oshikango Pipeline.

Omafo–Eenhana Pumps

These (four pumps and two jockey pumps) operate in series / parallel. The pump controls have been designed to be controlled via a pressure sensor and an electro-magnetic flow meter. However, the pump station is currently controlled manually. The jockey pumps are used for low flow periods and the other four pumps are used for high flow periods. All pump sets are constant speed pumps. The pumps duty cycle automatically. One jockey and one high demand pump are standby pumps.

Omafo Tower Pumps

These two pumps operate in parallel in a duty / standby configuration and are controlled via a level float switch installed in the elevated reservoir. The pumps duty cycle automatically. Both pumps are constant speed pumps.

Omungwelume Pumps

These two pumps operate in parallel in a duty / standby configuration. At the time of the assessment, the pumps were not in operation and NamWater was busy installing a new pump control board. The pump control could not be established at that time. It is assumed that both pumps are constant speed pumps.

Omafo–Eenhana Pumps

The two jockey pumps are KSB ETA 50-200 units, driven by 15 kW, 380 V, WEG TEFC electrical motors running at 2 920 rpm. The four main pumps are KSB ETA 65-200 units, driven by 22 kW, 380 V, WEG TEFC electrical motors running at 2 960 rpm.

Omafo Tower Pumps

These two pumps are KSB ETA 80-315 units, driven by 18.5 kW, 380 V, VEM TEFC-type electrical motors running at 1 460 rpm.

Omungwelume Pumps

These two pumps are KSB ETA 50-33/2 (AK) units, driven by 5.5 kW, 380 V, Eberle ,TEFC electrical motors running at 1 465 rpm.

The main power supply to the pump station is via a 250 A TP circuit breaker from a 11000 / 400 V, 200 kVA pole mounted transformer. The main isolator for the old control panel is a 80 A TP isolator set to 63 A TP and the main isolator for the new control panel is a 200 A TP. The monthly electricity bill from NORED consists of the units of kWh used, ECB levy, basic rate and the maximum demand which will be maximum 70% of the declared maximum demand. The account is acceptable.

A telemetry system is installed at the pump station for all measurements to be recorded on the SCADA system. An old radio communication system is still operational in the pump station.

3.6.6 Oshikango Pump Station

The pipeline from Omafo supplies water into a 350 m³ ground level reservoir. A bypass pipeline branches off the pipeline from Omafo upstream of the reservoir inlet and the inlet water meter, and connects to the outlet of the 200 m³ elevated reservoir upstream of the distribution manifold. A cross connection between this bypass pipeline and the pipeline between the outlet of the 350 m³ ground level reservoir and the pumps is also provided, and is equipped with an isolating valve.

Two pumps draw water from either the 350 m³ ground level reservoir or the bypass pipeline and deliver into the 200 m³ elevated reservoir. The outlet of this elevated reservoir leads to a distribution manifold which supplies water to Santa Clara in Angola under gravity. The pumps operate in parallel in a duty / standby configuration and are controlled via a level float switch installed in the elevated reservoir. The pumps duty cycle automatically. Both pumps are constant speed pumps.

These two pumps are KSB ETA 80-35 units, driven by 15 kW, 380 V, Siemens, TEFC electrical motors running at 1 460 rpm.

The main power supply to the pump station is via a 70 A TP circuit breaker located against the wall of the pump station from a 11 000/400 V, 315 kVA mini substation. The mini substation is the property of NORED Electricity and maintenance costs for the mini substation are the responsibility of NORED.

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

3.6.7 Ongha Pump Station

The Ongha Pump Station is supplied with water from a branch pipeline from the lindangungu–Omakango Pipeline. This inlet pipeline to the pump station supplies either the 340 m³ reservoir or bypasses the reservoir, pump station and 100 m³ elevated reservoir, to connect to the outlet

pipe from this elevated reservoir. An interconnecting pipeline connects this bypass pipeline to the pipeline between the reservoir and pump station, and is fitted with an isolating valve.

Two pumps draw water from either the reservoir or the bypass pipeline and deliver into the 100 m³ elevated reservoir, from where water gravitates to Ongha town.

The pumps operate in parallel in a duty/standby configuration and are controlled via a level float switch installed in the elevated reservoir. Both pumps are constant speed pumps. The two pumps are Salweir units, model VEG 50-4898 and VEG 50-5138 respectively, both driven by 5.5 kW, 380 V, Eberle, TEFC-type electrical motors, running at 1 465 rpm. Both pumps are quite old but seem to be in a good condition.

The main power supply to the pump station is via a 50 A TP circuit breaker located against the wall of the pump station supplied via an overhead line from Ongha Village. The monthly electricity bill from NORED consists of the units of kWh used, ECB levy, basic rate and the capacity charged on the size of the supply circuit breaker.

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

3.6.8 Ohangwena Pump Station

The Ohangwena Pump Station is supplied with water from Omakango, via a branch pipeline from the Omakango – Omafo Pipeline. Upstream of the inlet to the 350 m³ reservoir, a bypass pipeline branches off and bypasses the reservoir, pump station and 90 m³ elevated reservoir, to connect to the outlet of this elevated reservoir. An interconnecting pipeline connects this bypass pipeline to the pipeline between the reservoir and pump station, but is not fitted with an isolating valve.

Two pumps draw water either from the 350 m³ reservoir or bypass pipeline and deliver into the 90 m³ elevated reservoir, from where water gravitates to Ohangwena Town and the Regional Council buildings. The pumps operate in parallel in a duty / standby configuration and are controlled via a level float switch installed in the elevated reservoir. Both pumps are constant speed pumps.

The two pumps are Salweir units, model VEG 65-7534, both driven by 5.5 kW, 380 V, Eberle, TEFC-type electrical motors, running at 1 465 rpm. The main power supply to the pump station is via an 80 A TP circuit breaker located in a distribution board underneath a 11 000 / 400 V, 315 kVA pole mounted transformer. The transformer is the property of NORED Electricity and maintenance costs for the transformer are the responsibility of NORED.

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

3.6.9 Eenhana Pump Station

The Eenhana Pump Station is supplied with water via either the new or old pipelines from Omafo, which join upstream of the inlet to the ground level reservoir. Upstream of the 600 m³ ground level reservoir, a bypass pipeline, equipped with an isolating valve, branches off to bypass only the reservoir.

Two pumps draw water from the 600 m³ reservoir and deliver into a pipeline which branches to supply Eenhana Town and the 85 m³ elevated reservoir respectively. Water from this elevated reservoir also gravitates to consumers in Eenhana Town. The pumps operate in parallel in a duty / standby configuration and are controlled via a level float switch installed in the elevated reservoir. Both pumps are constant speed pumps.

The two pumps are M+B units, model NE 80-315, both driven by 15 kW, 380 V, WEG, TEFC-type electrical motors, running at 1 460 rpm. Both pumps are quite old but seem to be in a good condition.

The main power supply to the pump station is via a 50 A TP circuit breaker located in a distribution board underneath a 11 000/400 V, 100 kVA pole mounted transformer. The transformer is the property of NORED Electricity and maintenance costs for the transformer are the responsibility of NORED.

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

3.6.10 Oshaango Pump Station

The pipeline from lindangungu delivers water into the 600 m³ ground level reservoir, or bypasses the reservoir only. Five pumps draw water either from this 600 m³ reservoir or the bypass pipeline and deliver into a pipeline which branches to supply the Onangolo West RWSS and Epembe.

All five pump sets are variable speed driven and are controlled via a pressure sensor and an electro-magnetic flow meter. The speed of the pumps increases with increasing flow rate and loss in pressure in the pipeline. One pump is a standby pump. The five pumps are Grundfos CR45-3 units, driven by 15 kW, 380 V, Siemens, TEFC-type electrical motors running up to 2 945 rpm.

The main power supply to the pump station is via a 125 A TP circuit breaker located in a distribution board underneath a 11 00 /400 V, 100 kVA pole mounted transformer. The transformer is the property of NORED Electricity and maintenance costs for the transformer are the responsibility of NORED.

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

3.7. Scheme Processes/Operation

There is one fulltime NamWater operator based in CNWSA: Zone 7.

3.8. Maintenance

Maintenance is done by a permanent NamWater team.

3.8.1 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.

3.8.2 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.

3.8.3 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.

3.8.4 Reservoirs

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

3.8.5 Pipe Breaks/leaks

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

4. BRIEF DESCRIPTION OF THE RECEIVING ENVIRONMENT

The baseline description provided below focuses on the receiving environment:

4.1 Climate

The North Central portion of Namibia has a semi-arid climate, which is characterised by rainfall, with the rains falling mostly in the summer months of January, February and March when the temperatures are highest. The CNWSA: Zone 7 receives little rainfall throughout the year (Mendelsohn, *et al.*, 2009).

4.1.1 Precipitation

According to Mendelsohn, *et al.*, (2002), the rainfall is erratic, and it normally starts from the end of October and ends early in April. The annual rainfall for CNWSA: Zone 7 is between 400 mm to 450 mm.

4.1.2 Temperature

The CNWSA: Zone 7 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. The area has an average annual temperature of 22°C, with average winter temperatures ranges between 6°C to 8°C and summer temperatures ranges between 34°C to 38°C (Mendelsohn *et al.*, 2000).

4.2 Geology

The CNWSA: Zone 7 lies in the Main Deep Aquifer. The aquifer recharge area is located in southern Angola and it flows southward, towards the Etosha Pan. The Main Deep Aquifer is a continuous porous aquifer (Lucas, 2015).

The topography of CNWSA: Zone 7 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 Z CNWSA: Zone 7 area and these metamorphic inliers represent some of the oldest rocks of Palaeoproterozoic age in Namibia (Lucas, 2015).

4.3 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 (Spriggs, n.d).

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. The area has four endemic reptiles: *Afrogecko ansorgii*, *Coluber zebrinus*, Ruben's sand lizard (*Pedioplanis rubens*), and the skaapsteker snake (*Psammophylax rhombeatus ocellatus*). There is also one strictly endemic amphibian known from the ecoregion, *Ptychadena mapacha* (Vetter, n.d.).

CNWSA: Zone 7 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 (Vetter, n.d.).

Purple-pod terminalia (*Terminalia prunioides*) *Acacia erioloba*, leadwood (*Combretum imberbe*) red bushwillow (*Combretum apiculatum* subsp. *apiculatum*), Lonchocarpus nelsii and tamboti (*Spirostachys Africana*) (White, 1983; Berry, 1991).

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.*, 2000).

5. THE LEGAL ENVIRONMENT

A legal review was done and the key laws of concern include those which protect the ecological integrity of the CNWSA: Zone 7 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 7 ecosystem for the sustainable use by Namibians.

5.1 The Constitution of the Republic of Namibia

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

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

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

5.2 Environmental Assessment Policy (1995)

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

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

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

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

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

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

- Water use and disposal;
- Transportation

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

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

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

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

6. RESPONSIBLE PARTIES

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

6.1 NamWater

NamWater, as the implementing agency, is responsible for:

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

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

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

6.2 Contractor

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

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

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

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

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

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

7. ENVIRONMENTAL MANAGEMENT PLAN

An 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.

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

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

8. MANAGEMENT ACTIONS

8.1 Operation and Maintenance phase of the CNWSA: Zone 7 Water Supply Scheme

8.1.1 Introduction

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

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

8.1.2 Maintenance Procedures

The optimal operation and effective maintenance of all the scheme components is important in protecting the environment and ensuring that resources are not wasted and environmental incidents arising out of equipment or infrastructure failures, are avoided. Operation and Maintenance Manuals are available for the CNWSA: Zone 7 Scheme. The manuals provide a detailed guidance on the operation of all machinery and associated systems as well as related maintenance procedures, including maintenance schedules. Implementation of this manuals by NamWater will facilitate the proactive management of potential risks and thus result in impacts on the receiving environment being averted.

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

Table 1: Operation and Maintenance Phase Management Table

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

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

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

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

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

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

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

Table 2: Waste Management Table

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

Objectives	Potential Impact	Management Action	
		<ul style="list-style-type: none"> • 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. 	

Objectives	Potential Impact	Management Action	
<p>b. Prevent diesel and oil spills during operation and maintenance and ensure adequate clean up.</p>	<p>Concrete, diesel and oil spills and inadequate clean up.</p>	<ul style="list-style-type: none"> • Clean up concrete, fuel and oil spills immediately. • Clean small oil or fuel spills with an approved/appropriate absorbent material. • Contain oil or fuel spills in water using an approved oil absorbent fibre. • In cases where oil spills cannot be cleaned up immediately, monitor seepage into deeper soils and groundwater. • Do not bury polluted soil, but rather dispose it at an appropriate dump site. • Provide bunding at fuel storage and transfer sites. The bunding should be big enough to contain 110% of the volume of the tank. Where a bund wall encloses a group of tanks, the bund wall must be able to contain 110% of the volume of the largest tank in the group. Tanks must stand on a concrete slab, or otherwise have a sealed, base in order to prevent the leakage of contaminants into the soil. 	<p>Checks to prevent and minimise oil and diesel spills and to ensure adequate clean up should spills occur.</p> <p>Frequency: Daily throughout the operation period.</p> <p>Responsible Person: Scheme Supervisor.</p>

Objectives	Potential Impact	Management Action	
c. Waste Management	Littering (Litter such as paper, plastic etc. can be blown away into the surrounding environment).	<ul style="list-style-type: none"> • No littering will be allowed. The operation and maintenance areas will be kept free of waste at all times. All maintenance sites will be cleaned on a daily basis before leaving the site. • Provide sufficient waste bins at worksites. Make sure that all waste is removed from the worksites. • Bins should be placed in pairs to ensure that one is always present while the other is being emptied. • Areas likely to generate higher quantities of waste shall be equipped with additional bins. • Refuse bins must be stable, i.e. cannot be tipped by animals, and have scavenger and baboon proof lids. • Make sure that the bins are covered so that plastic bags, paper etc. are not blown away. • Make sure that the bins are regularly emptied and the waste taken to an appropriate waste dumpsite. • The central waste storage vessel shall be emptied weekly or as necessary. 	<p>Checks to ensure that litter is disposed of correctly in bins provided.</p> <p>Frequency: Daily, at the end of the work day.</p> <p>Responsible Person: Scheme Supervisor.</p>

Table 3: Workshops, Vehicle and Equipment Management Table

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

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

Table 4: Health and Safety Management Table

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

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

9. SITE CLOSURE AND REHABILITATION

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

Objectives of proper site closure and rehabilitation include the following:

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

Rehabilitation measures to implement:

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

Rehabilitation will be completed when the above have been achieved.

10. NAMWATER ENVIRONMENTAL CODE OF CONDUCT

What is an Environmental Code of Conduct?

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

What is the ENVIRONMENT?

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

Do these ENVIRONMENTAL RULES apply to me?

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

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

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

What if I do not understand the ENVIRONMENTAL RULES?

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

Safety and Security

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

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

Waste Disposal

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

Containers will be provided for different types of wastes.

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

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

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

Plants and Animals

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

Preventing Pollution

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

Health

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

Dust Control

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

Saving Water

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

Working Hours

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

Archaeological and Cultural Objects

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

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

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

Sensible Driving

47. Tracks and roads should be kept to a minimum. Where possible follow existing roads.
48. No off-road driving is allowed.
49. Never drive any vehicle without a valid licence for that vehicle class and do not drive any vehicle that is not road-worthy.
50. Never drive any vehicle when under the influence of alcohol.
51. **Always** keep your headlights on when driving on dusty roads.

52. Keep to the roads as specified by your SCHEME SUPERVISOR. Vehicles may only be driven on demarcated construction roads. Drivers should always use three points turns, “u-turns” are not allowed. Do not cut corners.
53. Do not drive on rocky outcrops.

Noise

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

Fire Control

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

Dealing with Environmental Complaints

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

Jolanda Kamburona

Tell: 061-71 2105

Cell: 081 144 1528

or

Fillemon Aupokolo

Tell: 061-71 2095

Cell: 081 325 3301

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GRIEVANCE PROCEDURE

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

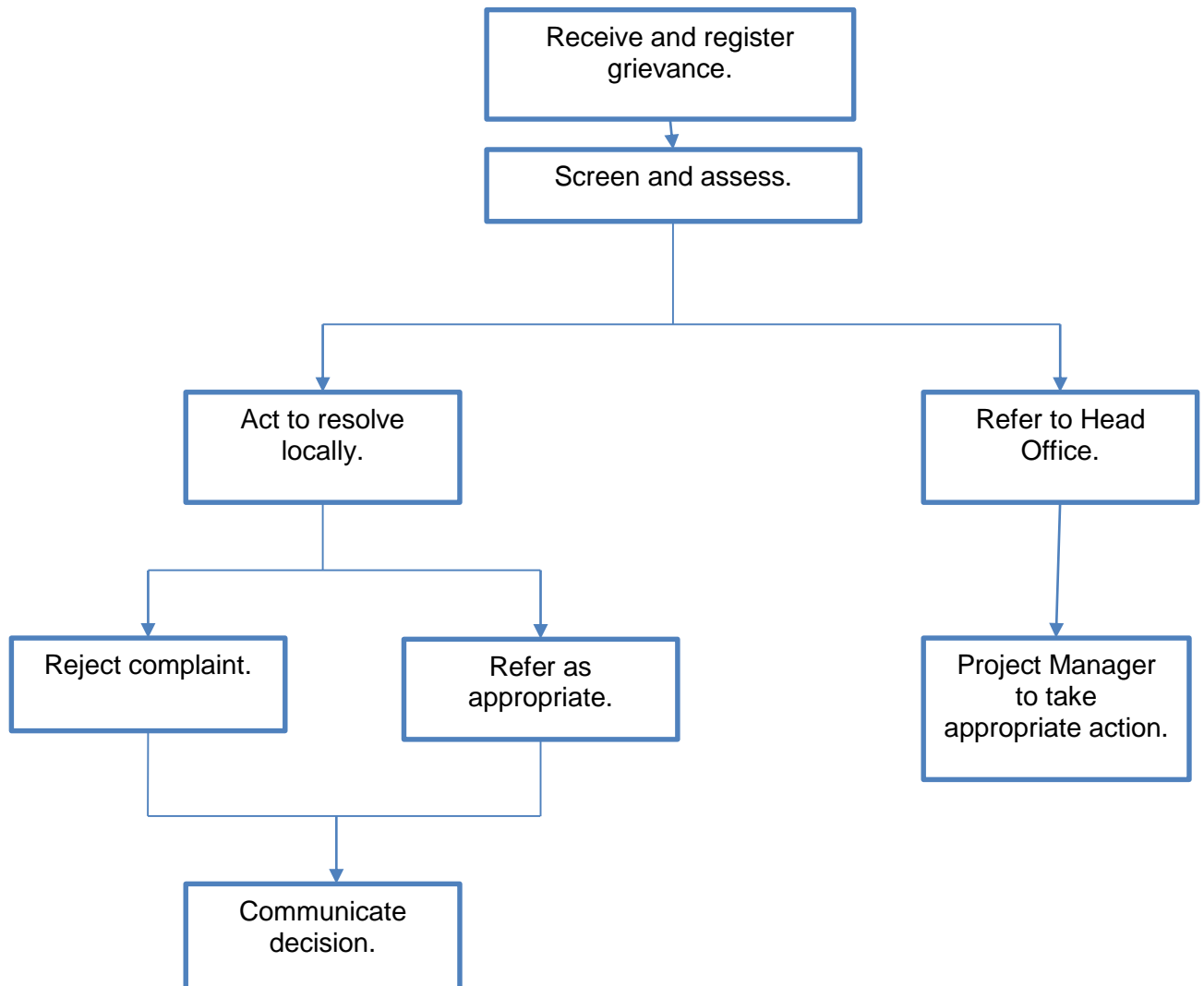


Figure 3: Grievance response procedure

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

GRIEVANCE REGISTRATION

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