VON BACH WATER SUPPLY SCHEME

ENVIRONMENTAL MANAGEMENT PLAN

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CoC	Code of Conduct
DEA	Directorate of Environmental Affairs
EMA	Environmental Management Act
EMP	Environmental Management Plan
HIV	Human Immunodeficiency Virus
I&AP	Interested and Affected Parties
MET	Ministry of Environment and Tourism
NEM	NamWater Environmental Manager
MSDS	Material Safety Data Sheet
NWQG	Namibian Water Quality Guidelines
NWQS	Namibian Water Quality Standards
STI's	Sexually Transmitted Infections
WTW	Water Treatment Works

1. PURPOSE OF THE EMP

This Environmental Management Plan (EMP) has been compiled and updated for the management of potential environmental impacts during the operation, and decommissioning phases of the existing Von Bach Water Supply Scheme. Best practice is proposed for the generic issues of construction management and supervision as well as the on-going management and operation of the water supply scheme.

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

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

2. INTRODUCTION

2.1 Von Bach- Windhoek Scheme

The Von Bach - Windhoek Scheme is located in the Khomas region. This scheme forms the main supply to Windhoek and various consumers on the different pipeline routes.

The Von Bach Dam is one of the three Central Area dams and located some 70 km north of Windhoek and 10km southeast of Okahandja. The Von Bach dam is the main storage dam for water supply to Windhoek. It further acts as the water source for the town of Okahandja, the group of consumers along the water supply route to the Hosea Kutako International Airport and the tourist facilities at Gross Barmen.

Although the dam's rock-fill embankments and concrete elements are in very good condition, the refurbishment of the asphalt-concrete sealing needs to be investigated by specialists.
Water can be abstracted from various levels in the dam and this is controlled by means of valves located in the dam wall.

Raw water from the dam is supplied to the Von Bach water treatment works approximately 2.3 km downstream of the dam wall. The raw water pipeline comprises various sections made up of different pipe material and sizes and concerns have been raised regarding the hydraulic capacity of the pipeline.

The DN 900 steel outlets from the S. Von Bach Dam could not be assessed due to being underground and the same applies to the downstream ± 135 m reduced DN 600 steel pipeline. Hydraulic calculations revealed that the required flow of 5 940 m^3/h would not be achieved when the dam has reached ⅓ of its level. The ± 135 m of DN 600 steel pipeline (steel section of the DN 1 050 concrete pipeline) needs to be upgraded to at least to DN 1 000. A further increase in flow capacity can be achieved if the DN 1 050 concrete raw water pipeline can be put back into operation in parallel with the DN 1 000 GRP raw water pipeline.
Water is pumped from the Von Bach purification plant via three pump stations to Windhoek Terminal Reservoir. City of Windhoek/NamWater handover takes place at the bulk sales meter at the outlet end of the reservoir.

2.2 Windhoek Airport Scheme

Windhoek Airport is a combination scheme supplying water to Hosea Kutako and a large number of other consumers.

The Windhoek Airport Scheme is located in the Khomas region. The scheme consists primarily of 3 components; Windhoek Airport, Otjihase and Seeis.

Potable water is pumped from Von Bach Water Treatment Plant via the Von Francois Ost pump station at Booster 2 to Otjihase mine, from Otjihase the water is pumped to Windhoek Airport and Finkenstein a number of consumers have off-takes along the pipelines.

The Seeis scheme supplies water to the Hosea Kutako Airport and acts as supplementary supply to the main supply from Booster Pump Station 2 on the main pipeline from Von Bach to Windhoek.

2.3 Von Bach – Okahandja

The Von Bach - Okahandja Scheme is located in the Otjozondjupa region. This scheme also supplies water to the Von Bach Resort

2.3.1 Von Bach - Okahandja Scheme

This scheme is supplied from the Von Bach Purification Plant. The scheme consists of a base pump station at the Von Bach treatment works, a 3.7 km long pipeline from the treatment works and the Okahandja East ground level storage reservoir, located on the hill overlooking the town. From there, water gravitates to the town reticulation via the bulk sales meter.

2.3.2 Von Bach Resort Scheme

Purified water is supplied to the tourism facilities at the Von Bach Resort scheme from a tee-off on the pipeline from the Okahandja East pump line. From the tee-off the water is transported via a 2.6 km long pipeline to a ground level storage reservoir on the hill overlooking the Von Bach Dam. From there, water gravitates to the resort reticulation via the bulk sales meter.

The Von Bach Resort scheme supplies the Von Bach Namibia Wildlife Resort (NWR), which comprises a total of 20 Chalets and 200 Camp sites. The scheme also supplies the Von Bach Ski Club and the NamWater Dam Wall plant.

The location of all the schemes is depicted in **Figure 1** below.

2.4 Von Bach – Gross Barmen

The Von Bach – Gross Barmen scheme is located in the Otjozondjupa region, 23 km south west from Okahandja.

The scheme consists of 2 components:

2.4.1 Von Bach – Gross Barmen scheme

The Gross Barmen scheme supplies the Namibia Wildlife Resort (NWR) at Gross Barmen, as well as a number of commercial farmers along the pipeline route. The NWR at Gross Barmen comprises a total of 37 Chalets and 370 Camp sites. There are 20 other consumer meters along the pipeline route, which are read monthly.

The scheme consists of two pump sets located in the same pump station as the Okahandja base pumps at the Von Bach purification works and a clear water balancing reservoir, also located on the Von Bach premises. The balancing reservoir feeds into a 14.6 km long gravity pipeline to a pressure break reservoir and a further 10.2 km long pipeline to the elevated storage reservoir at the Gross Barmen resort. From there, water gravitates to the resort reticulation.

2.4.2 Gross Barmen – Rüdenau Nord scheme

This is a Rural Water Supply Scheme providing water to the local community on the communal farm Rüdenau Nord. Although the Directorate of Rural Water Supply and Sanitation Co-ordination (DWSSC) in the Ministry of Agriculture, Water and Forestry preside over the scheme, NamWater is currently maintaining the scheme.

The very poor groundwater situation in the area originally led the DWSSC to construct the small diameter pipeline to the Rüdenau Nord farm. The bulk water pipeline now supplies most of the water for the Rüdenau communities. The original water points supplied from boreholes have largely been abandoned in favour of the pipeline water points.

The scheme is supplied from the Gross Barmen scheme and consists of a pump set located in a pump house at Gross Barmen and a booster pump set in a container 8.9 km from Gross Barmen. There is one elevated water tank at each of the posts, two at the booster pump station and four at a distance of 7.1 km from the booster pump station. The total length of the pipe work on this

scheme is 25.6 km. The bulk sales meter is located downstream of the pump set at the Gross Barmen pump station.

The EMP is for 4 existing schemes namely Von Bach-Windhoek, Von Bach-Okahandja, Von Bach-Gross Barmen, and Windhoek Airport and it is therefore only for the operation and maintenance of the schemes.

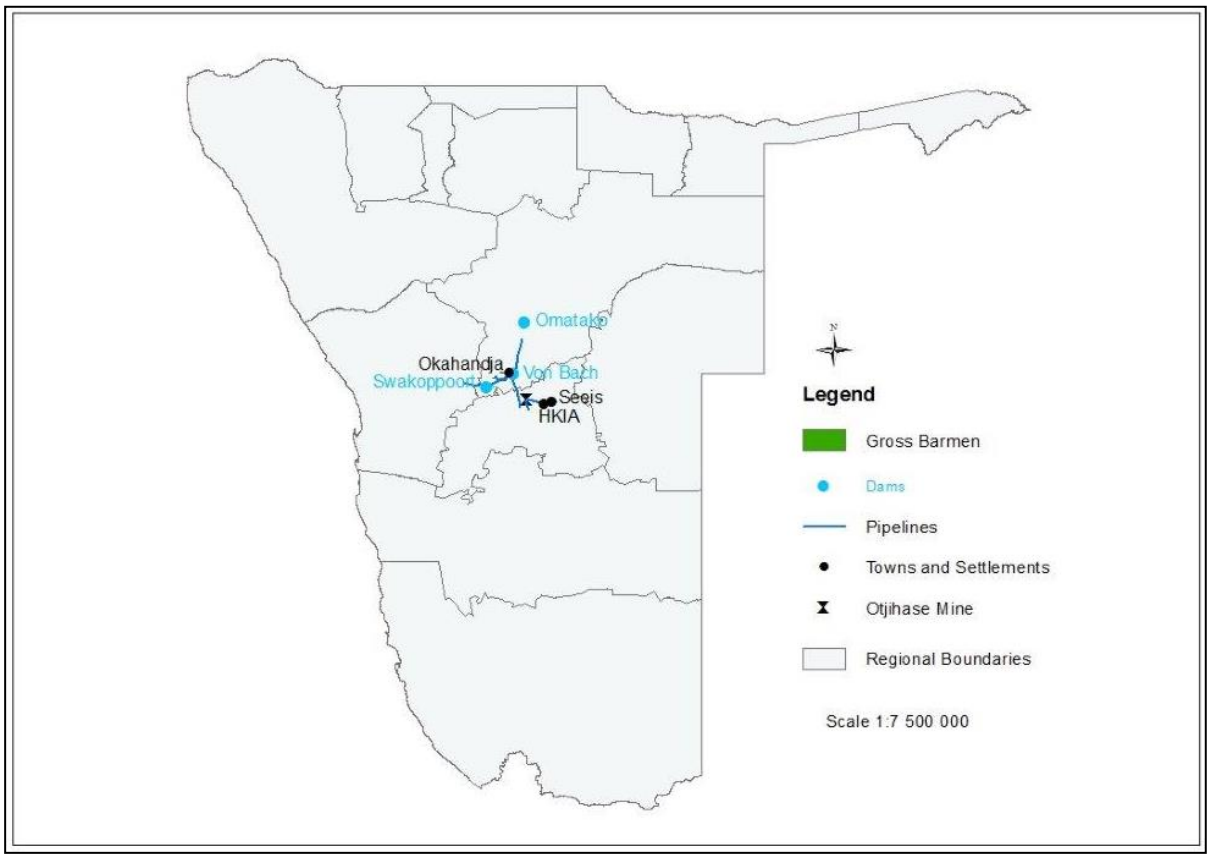

Figure 1: Von Bach Location Map

3. EXISTING VON BACH WATER SUPPLY INFRASTRUCTURE

3.1 Water Source

3.1.1 Von Bach-Windhoek Scheme

The Von Bach Dam is located in the upper reaches of the Swakop River, with a catchment area of roughly 2 920 km^2.

The Von Bach Dam's capacity of 48.6 Mm³ is comparable to that of the Omatako Dam, but the dam's water surface area is much smaller.

Therefore, the Von Bach Dam, serving as a collecting reservoir for water supplied from the ENWC and the Omatako and Swakoppoort Dams, is the main supplier of water to Windhoek, Okahandja and other supply points in the surrounding area.

3.1.2 Windhoek Airport Scheme

The Von Bach dam is the main water source supplying the Windhoek airport, Otjihase mine and various other consumers. The Von Bach Dam is discussed in detail in Chapter 19.

The Seeis boreholes acts as supplementary supply to the main supply from Booster station 2. The Seeis scheme consists of seven production boreholes (WW 21808, WW 22014, WW 21222, WW 21869, WW 33556, WW 33558 and WW 811260). Boreholes WW 22014 and WW 21222 are currently out of operation.

The boreholes are between 9 m and 50 m deep. The boreholes yield between 1.5 m³/h and 4 m³/h.

3.1.3 Von Bach- Okahandja

The Von Bach dam is the main water source for both of these schemes. The domestic water supply to both schemes is treated at the Von Bach Purification Plant.

3.1.4 Von Bach – Gross Barmen

3.1.4.1 Von Bach – Gross Barmen Scheme

This scheme is supplied with treated water from the Von Bach Purification Plant.

3.1.4.2 Gross Barmen – Rüdenau Nord scheme

The scheme is supplied from the Gross Barmen scheme.

The schematic layouts of the existing infrastructure are indicated in **Figure 2-7** below.

3.2 Water Quality and Disinfection

3.2.1 Von Bach

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

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

3.2.2 Windhoek Airport Scheme

Chlorination is done with Cl2 gas installations at Booster 2, Otjihase reservoirs and Windhoek airport ground level reservoir. The chlorination systems are reported to be in good working condition and should be maintained properly at recommended intervals.

3.2.3 Von Bach – Gross Barmen

Additional chlorination of the Rüdenau Nord supply is done at the Gross Barmen pump house. The chlorination is undertaken by means of injecting a concentrated Sodium Hypochlorite solution into the pump line at a position downstream of the base pumps.

A single Grundfos/Alldos diaphragm type dosing pump, BMI 1.0-10 B, is installed with a maximum capacity of 1.0 L/h at 10 Bar pressure. The dosing pump is equipped with an adjustable dial to vary the dosing rate. The Sodium Hypochlorite solution is fed to the dosing pump from a 500L GRP make-up tank, which is also housed inside the pump house.

3.3 Pipe Work

3.3.1 Von Bach – Windhoek Scheme

The 40 km long Von Bach – Ombinda Pipeline is located alongside the C42 road, runs in a north easterly direction from Von Bach to Ombinda and consists of 200 mm diameter CID AC pipes. This pipeline commences at a connection manhole located on the outlet of the 2 000 m3 concrete ground level reservoir at NamWater's premises in Von Bach (refer to Figure 10.6), where the pipeline tees off the reservoir outlet which leads to the booster pump station at Von Bach. The pipeline is therefore fed by water from the Von Bach Reservoir under gravity.

The first 17 km of the pipeline (from chainage 0.0 km at Von Bach) consist of Class 12 (60 m) pipes, the next 9.0 km of Class 18 (90 m) pipes, and the last 14.0 km to Ombinda (at chainage 40 km from Von Bach) of Class 24 (120 m) pipes. The increasing pressure rating of the pipes used, in the direction of Ombinda, makes sense if it is remembered that the pipeline was designed for supply in the opposite direction, from Goblenz to Von Bach, with a reservoir and booster pump station at Ombinda, in which case, with the off-takes along the length of the pipeline, the pressure in the pipeline was expected to reduce from Ombinda (at the booster pump station) in the direction of Von Bach.

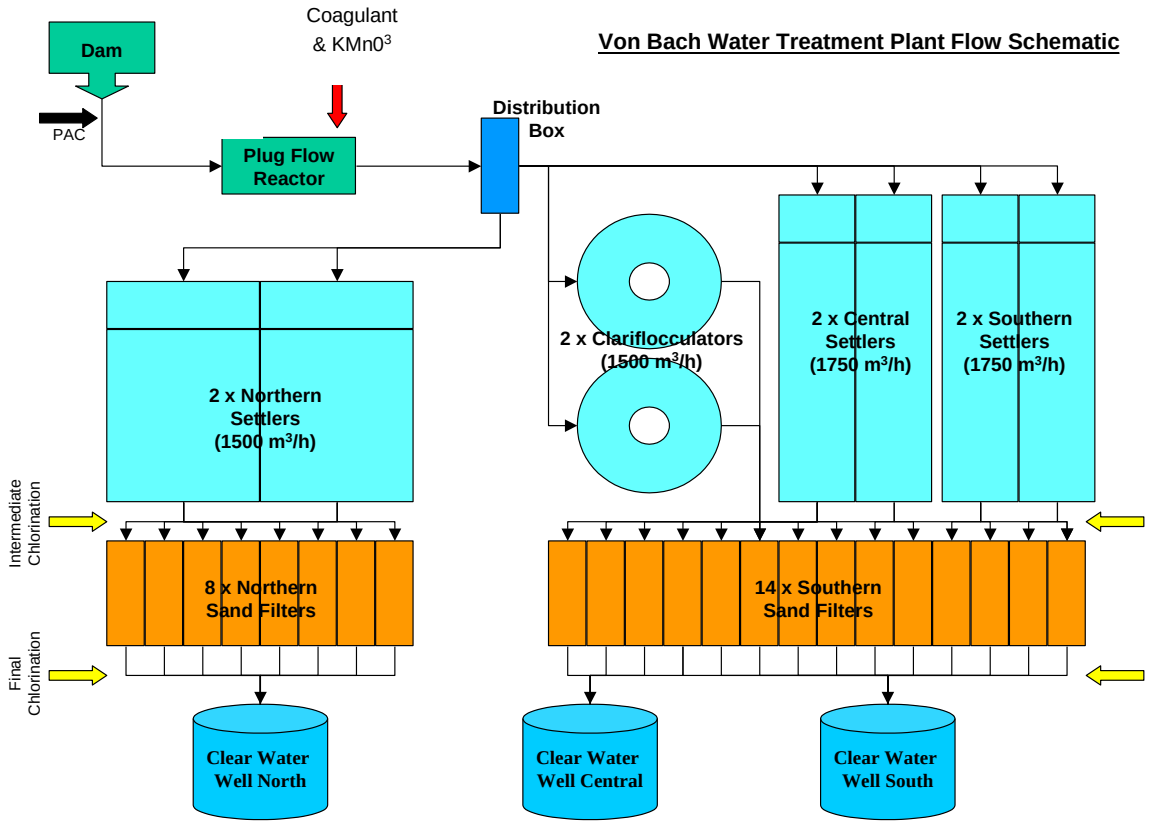

Figure 2: Schematic of the Von Bach Water Treatment Plant Process

The current process at the Von Bach Water Treatment Plant is summarised below:

- Powder Activated Carbon dosage as and when required in the raw water pipeline at the abstraction tower
- Coagulant and potassium permanganate dosing at hydraulic jump near outlet of the plug flow reactor
- Distribution box to three parallel treatment streams
- Flocculation canals before clarification (northern settlers and southern settlers)
- Intermediate chlorination before the sand filters which may change to intermittent chlorination
- Rapid sand filtration
- Clear water wells
- Stabilisation with NaOH
- Chlorination

The flow capacity of the pipeline between the Von Bach dam and the VBWTP was determined. The maximum flow was only 3 750 m³/hour. The pressure drop between the water meter and the inlet works is approximately 7 metres more than the calculated drop. The cause of the restricted flow was not determined. During testing in 2008 with a relatively low raw water intake of 2 557 m³/hour, the outlet mixing weir of the plug flow reactor was almost submerged which contributes to inadequate flash mixing. A temporary weir at the outlet of the plug flow reactor was installed in 2008 to improve flash mixing of coagulant. Testing at full flow may reveal hydraulic restrictions.

The blower at the inlet works is not in operation. The blower can perhaps be downsized depending on the final aeration system selected. It was not possible to inspect the diffusers, but as result of the lime dosing upstream of the diffusers, it is expected that all the diffusers will be covered and blocked with a calcium carbonate precipitate as indicated in the report by Shand (2003). In view of the operational problems encountered with the clogging of the small orifices in the diffuser domes, it may be a more sustainable solution to rather install a splash aerator near the start of the plug flow reactor, if there is sufficient head available.

The flow control to each settler is cumbersome and the flow rates are almost impossible to control. With the unreliable flow meters (5 of the 7 flow meters were not in operation) it was almost impossible to control the flow to each settler. It is doubtful whether correct flow distribution can be achieved, even if the water meters are repaired or replaced, because the lime deposits in the feed lines to the settler made it almost impossible to adjust the butterfly flow control valves accurately.

3.3.2 Von Bach PP to Windhoek Pipeline (Clear Water Pipeline)

The clear water transfer system from the Von Bach PP to Windhoek comprises of a dual pipeline: a DN 1 100 pre-stressed concrete line, built in the late 1970's, and a DN 600 spiral welded, bitumen coated steel pipeline, constructed in the late 1960's, with a total length of 60 097 m. Both pipelines are generally operated in parallel.

3.3.3 Von Bach - Okahandja Scheme

The pipeline from the Okahandja Base Pump Station at the Von Bach treatment works to the 7 000 m³ Okahandja East reservoir is approximately 3 700 m long. The first 3 km of the Okahandja east pipeline is a 300 mm diam. AC class 24 CID pipe and the last 700 m is a 300 mm diam. AC class 18 CID pipe, all with triplex joints. A mixture of double and small orifice air release valves are installed on the line. The scour valves are 100 mm diameter and there are 6 isolating valves at 4 locations on the pipeline. This pipeline is known as the Okahandja east pipeline.

There is a separate 150 mm diam. AC pipe, known as the Okahandja West pipeline, which is running parallel to the Okahandja East pipeline for a distance of 2.2 km from the Okahandja Base Pump Station. At this point the Okahandja west pipeline was blocked off and a connection was made to the Okahandja East pipeline. The remainder of the Okahandja west pipeline has been abandoned due the amount of pipe breaks and depth of the pipeline in the river bed.

The design capacity of the 300 mm dia. pipeline is 340 m³/h at 1.34 m/s.

3.3.4 Von Bach Resort Scheme

The pipeline to the Von Bach Resort tees off from the Okahandja East pipeline at a position 400 m from the pump station. The branch pipeline to the 500 m³ reservoir at the Von Bach resort is approximately 2 600 m long and is constructed from 150 mm diam. steel. For the last 400 m, there are two lines running next to each other. The one is the NamWater supply line and the other one is the supply to the Resort from the reservoir.

The design capacity of the 150 mm dia pipeline is 55 m³/h at 1 m/s.

3.3.5 Von Bach – Gross Barmen

3.3.5.1 Von Bach – Gross Barmen Scheme

From the available data the 14.6 km long pipeline from the base pump station at the Von Bach purification works to the pressure break reservoir is constructed from 250 mm diam. AC pipes of unknown pressure rating for the first 1.4 km, 110 mm diam. uPVC class 6 pipes for the next 11.2 km and 110 mm diam. uPVC class 9 for the last 2 km. Air release valves are mostly 50 mm diam. small orifice air release valves at regular intervals and the scour valves are 100 mm diam. The estimated capacity of the 250 mm diam. AC /110 mm diam. uPVC pipelines is 11.7m³/h at velocities of 0.07 m/s and 0.4 m/s respectively.

No as-built data could be obtained to confirm the type and size of the short pipeline from the base pump station to the clear water balancing reservoir at the Von Bach purification.

From the pressure break reservoir the pipeline is a 110 mm diam. uPVC class 9 for 3.7 km, with the remaining 6.5 km being a 110 mm diam. class 12 uPVC pipeline. The estimated capacity of the 110 mm diam. uPVC pipeline is 21.4 m³/h at 0.76 m/s. The outlet is connected to the elevated storage tank at Gross Barmen.

3.3.5.2 Gross Barmen – Rüdenau Nord scheme

The pipeline from the Gross Barmen pump house to the booster pump station is a 63 mm diam. HDPE Class 16 pipeline. The 8.9 km long pipeline starts at Gross Barmen and is routed in a north westerly direction through the Resort premises towards the two elevated water tanks at the booster pump station on the farm Rüdenau Nord. A non-return valve is located at the tee junction to Erikapos and is used to prevent water flowing back into the pump line.

From the booster pump station water is pumped over a distance of 7.1 km to four elevated water tanks via a 50 mm diam. HDPE Class 12 pipeline. From these water tanks water is gravity fed to Flikkepos, Paradyspos and Okamumbonde.
The rural water distribution network at Rüdenau Nord consists of the following branch lines:

- To Erikapos: 70 m long, 32 mm diam. HDPE pipeline, tee-ing off from the pump line at a position 5.6 km from Gross Barmen. Water is stored at the water point in an elevated water tank and the water meter is located at the tee junction.
- To Flikkepos: 1.2 km long, 40 mm diam. HDPE pipeline supplying water to an elevated water tank. The water meter is located at the four elevated water tanks.
- To Paradyspos and Okamumbonde: a 40 mm diam. HDPE pipeline is used to convey water to the tee junction 3.3 km from the four elevated water tanks. The pipeline is constructed in the same trench as the pipeline between the booster pump station and the four elevated water tanks.
- To Paradyspos: 1.2 km long, 32 mm diam. HDPE pipeline takes water to the elevated water tank. The water meter is located at the 3.3 km tee junction noted above.
- To Okamumbonde: 3.6 km long, 32 mm diam. HDPE pipeline to the elevated water tank. The water meter is also located at the 3.3 km tee junction noted above.

3.4 Reservoirs

3.4.1 Terminal Reservoir in Windhoek

The outlet of the Terminal Reservoir (30 000 m³) in Windhoek represents the hand-over point for the bulk water to the City of Windhoek. The highest consumption recorded in Windhoek, without any AR, was in October 2008. The record notes a peak of 83 000 m³/day, and a daily average of 77 000 m³/day over the period of one week. Theoretically, the available storage duration for this demand scenario is between 7 and 8 hours.

3.4.2 Windhoek Airport Scheme

In addition to the main pumps at Booster 2 that deliver to the terminal reservoir in Windhoek, there is an additional booster station that supplies the Otjihase scheme, and further from there also the Airport scheme. At Booster 2 the Otjihase scheme comprises a 1 000 m3 reinforced concrete reservoir and a pump station. Two multi-stage Sulzer pumps deliver water to two 4 000 m3 concrete reservoirs at the Otjihase Mine.

The storage facilities consist of a round concrete ground reservoir and an elevated concrete water tower. The water from Otjihase booster station and the Seeis boreholes is pumped into the ground reservoir from where it is pumped via two electric submersible pumps to the elevated water tower.

The concrete ground reservoir is 15.2 m in diameter and 4.8 m high with an actual capacity of approximately 870 m³. The reservoir was observed to be in a general good working condition.

3.4.3 Von Bach-Okahandja

The storage facilities consist of the following two reservoirs:

- The Okahandja East reservoir, situated at a position approximately 1 km east of the Okahandja River and approximately 3.7 km north of the Von Bach purification works. It consists of a 7 000 m³ rectangular concrete reservoir with a roof. The reservoir is divided in two compartments, each with a capacity of approximately 3 500 m³. Inlet and outlet pipes to the reservoir are constructed above ground.
- A 500 m³ concrete ground level reservoir at the Von Bach Resort. The reservoir has a cylindrical shape and is covered with a concrete roof.

3.4.4 Von Bach – Gross Barmen

3.4.4.1 Von Bach – Gross Barmen scheme

The storage facilities consist of the following two reservoirs:

- The 2 500 m³ concrete Clear Water Balancing Reservoir, located on a hill at the eastern side of the Von Bach Purification works premises. The concrete reservoir has a cylindrical shape and is covered with a concrete roof. Inlet and outlet pipes to the reservoir are constructed underground and appear to be in reasonable condition where visible in the manholes. The concrete appears to be in good condition and no leaks were visible on the joints in the walls.
- A 194 m³ pressure break reservoir at km 14.6 on the pipeline route. The concrete reservoir has a cylindrical shape and is covered with a concrete roof. Inlet and outlet pipes to the reservoir are constructed underground and also appear to be in reasonable condition where visible in the manholes.

3.4.4.2 Gross Barmen – Rüdenau Nord scheme

With the exception of one post, all the Rüdenau pipelines terminate in plastic water tanks. The storage facilities consist of the following tanks:

- 2 x 10 000 L HDPE storage tanks mounted on a 1 m high tank stand at the booster pump station.
- 4 x 10 000 L HDPE storage tanks mounted on a 1 m high tank stand at the end of the main pump line.
- 4 x 10 000 L HDPE storage tanks mounted on a 1 m high tank stand at each of the following 4 posts: Erikapos, Flikkepos, Paradyspos and Okamumbonde

3.4.5 2 000 m^3 Ground Level Reservoir

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

3.4.6 250 m^3 Ground Level Reservoir

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

3.5 Power Supply and Control System

3.5.1 Von Bach-Windhoek Scheme

3.5.1.1 Treatment Works

It is understood from NamPower that currently Base and Booster 01 are fed from Osona sub-station and Booster 02 is fed from van Eck sub-station.

The power supply for the Von Bach treatment works is the 66/11kV NamPower Von Bach Base Substation from which power at 11kV is supplied to the treatment works, including the township. The Base substation is equipped with two 2.5MVA 66/11kV transformers for two separate feeds to the NamWater main substation at the treatment works. The authorised maximum demand of the NamWater substation is 2125 kVA (1700 kW).

The Von Bach Treatment Works main substation is equipped with Hawker Siddeley 11 kV switchgear which is old but still in a good condition. Switchgear consists of the main incomer, Treatment plant feeder and Magnifix feeder from which power is supplied to the township.

The Magnifix feeder feeds three 11kV circuitbreakers in the substation. These are feeds to minisub Green, to Minisub Yellow, and to Pumpstation Aux.

3.5.1.2 Dam Wall Plant

The power supply for the Von Bach dam is a foot mounted 100kVA 11kV/400V transformer located in a substation building near the east end of the dam wall. The supply to the transformer is an 11kV overhead power line which comes from the Von Bach purification works over a distance of about 3km. The line is part of the 11kV reticulation of the NamWater property at Von Bach. The line is in poor condition and is the cause of many power failures at the dam. The end pole of the 11 kV line is located at the western end of the dam wall, and from the end pole an HT cable runs along the top of the wall to the substation building, and is terminated on a foot mounted HT switch. The switch make is Hawker Siddeley. It is very old and spares are no longer available. HT cable protection is by a set of pole mounted drop-out fuses on the end pole of the overhead line.

The maximum demand for the dam plant is calculated as 100kVA or 144A Three Phase at 400V. The power supply was constructed for the scheme, is old, but in good condition.
Standby power is provided by a Diesel generator set located in the generator room which forms part of the substation building. The engine is a 6 cylinder air cooled Deutz driving a Siemens alternator with a nominal output of 82kVA at 400V.

3.5.2 Windhoek Airport Scheme

The scheme is controlled with level sensors and timers. The scheme can be controlled remotely for Von Bach via telemetry.

The power supply for the Von Francois Ost Power station is fed from the Von Eck substation. The Booster pump stations at Otjihase and Windhoek airport are fed from pole mounted transformers.

3.5.3 Von Bach- Okahandja

The pumps in the Okahandja Base Station are telemetry controlled by a Citect System installation, with central control from the Von Bach Works control room. The pump station MCC has a 630 A TP main circuit breaker.

The MCC is new and in good condition. It was locked and in operation during the inspection. NamWater staff mentioned that all pump control panels installed after 2004 have electronic versions of the Operating Manuals available on the NamWater website.

The telemetry installation at the Okahandja East reservoir is powered by a small solar PV installation. All telemetry installations are new and in a good condition. All panels were locked at the time of the inspections.

3.5.4 Von Bach – Gross Barmen

3.5.4.1 Von Bach – Gross Barmen scheme

The Gross Barmen pumps are telemetry controlled by a Citect System installation, with central control from the Von Bach Works control room. The telemetry installation at the break pressure reservoir on the pipeline to Gross Barmen is powered by a small solar PV installation. All telemetry installations are new and in a good condition. All panels were locked at the time of the inspections.

Power supply to the Gross Barmen pump sets at the Von Bach purification works comes via a 630 A TP main circuit breaker. The MCC is new and in good condition. It was locked and in operation during the inspection. The circuit breaker size for each of the pumps is 40A TP with a Moeller Electric ZEV motor protection unit.

3.5.4.2 Gross Barmen – Rüdenau Nord scheme

All of the pumps in the two pump houses are telemetry controlled by a Citect System installation, with central control from the Von Bach Treatment Works control room. The telemetry panels are new and in good condition, and contain batteries and a battery charger for uninterruptible operation.

The telemetry UPS at the Gross Barmen pump house is fed from the MCC, and is a MGE unit with a rated output of 4.8A at 230V, or 660W nominal.

Power for the Gross Barmen pump house comes from the nearby kiosk. The pump control panel was locked at the time of the inspection, but is new and in a good condition. The main switch is a 25A SP isolator, and the MCC contains two contactors for 2.2kW motors, for Pumps 1 and 2 respectively.

The power supply for the Rüdenau booster pump station is a pole mounted 25 kVA 11kV/400V transformer located near the booster pump station container. The supply to the transformer is an 11kV overhead power line connected to the local rural reticulation.

Power from the transformer is supplied to a wall mounted MCC located inside the container. The incomer circuit breaker is rated at 40A TP.

3.6 Scheme Processes/Operation

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

3.7 Maintenance

Maintenance is done by a permanent NamWater team.

3.8 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.

3.9 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.

3.10 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.

3.11 Reservoirs

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

3.12 Pipe Breaks/leaks

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

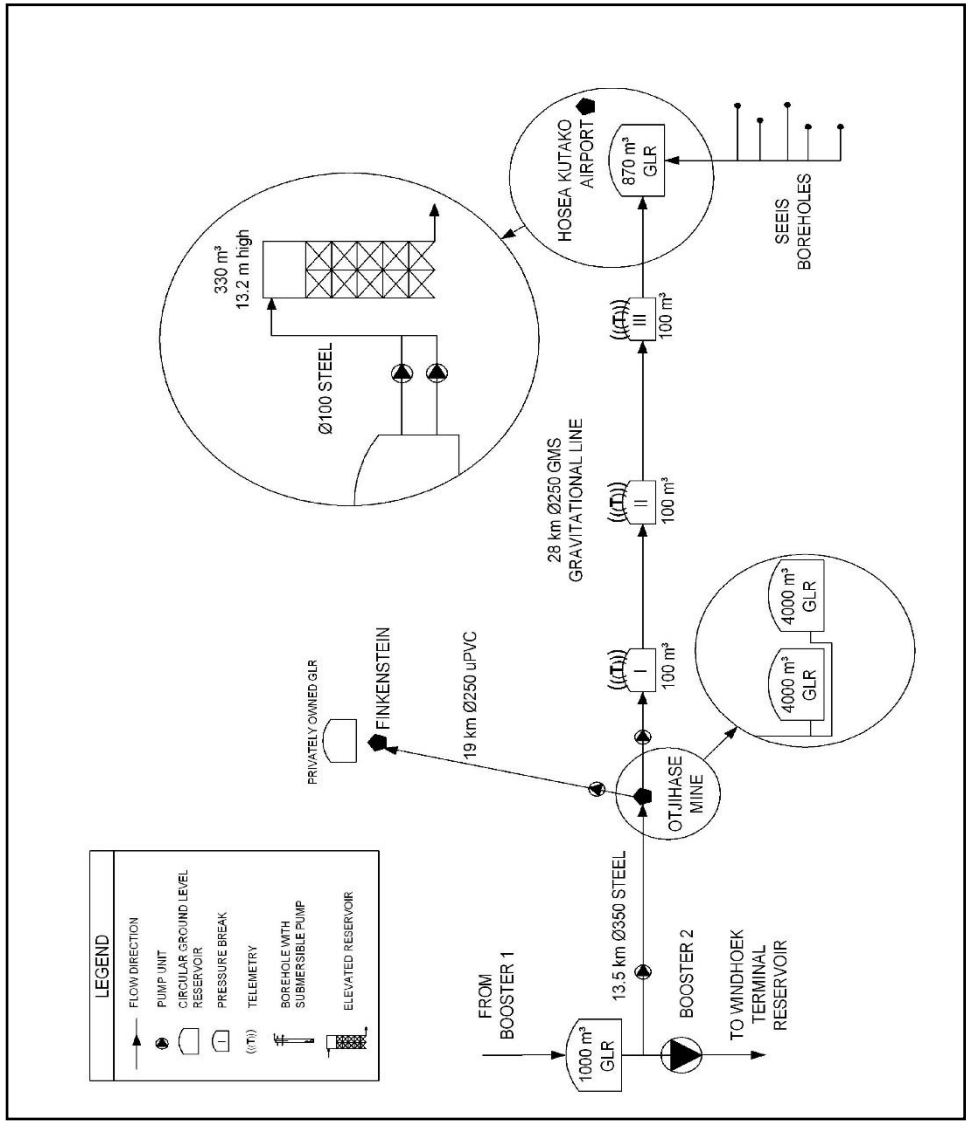

Figure 3: Schematic Layout of the Windhoek Airport Supply points Scheme

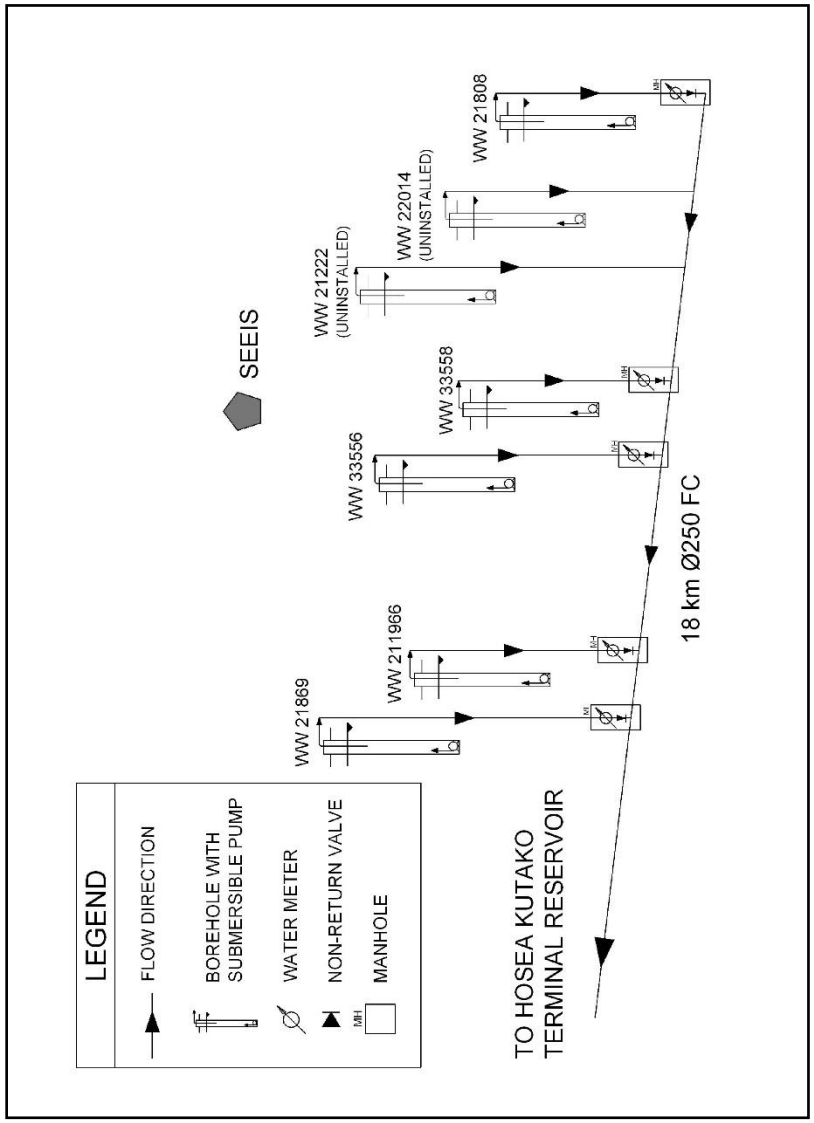

Figure 4: Schematic Layout of Seeis Boreholes Scheme

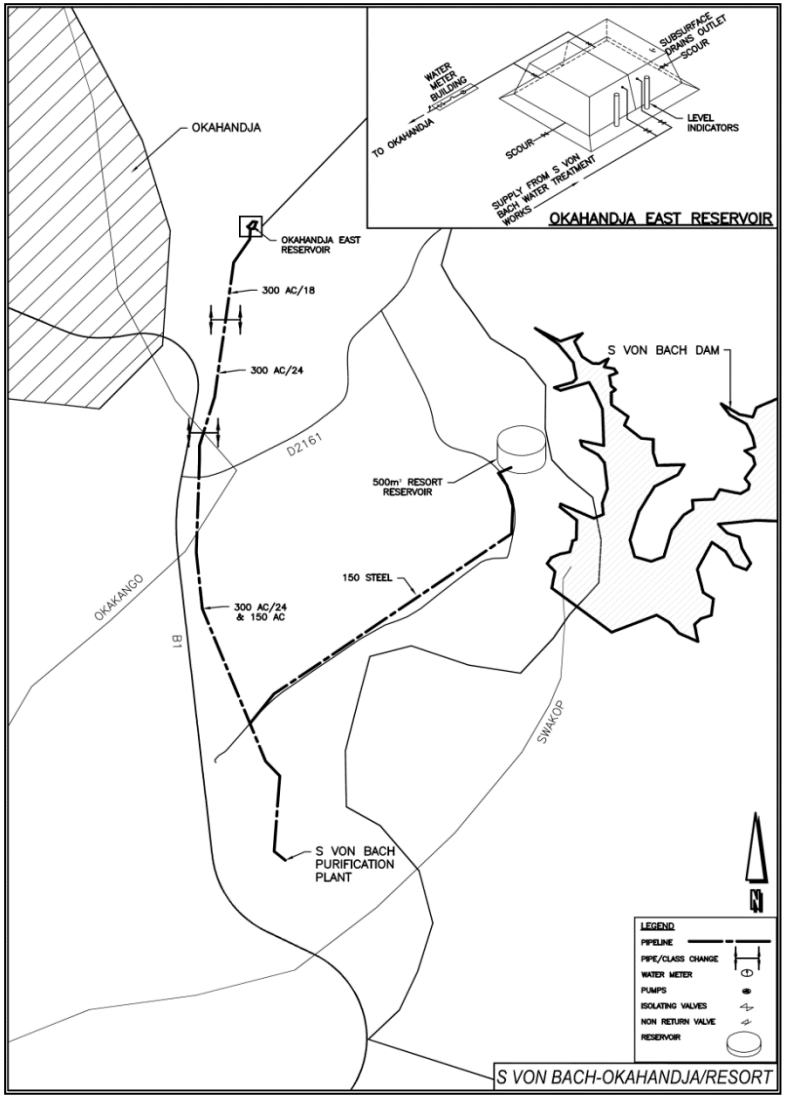

Figure 5: Schematic Layout of Von Bach-Okahandja/Resort

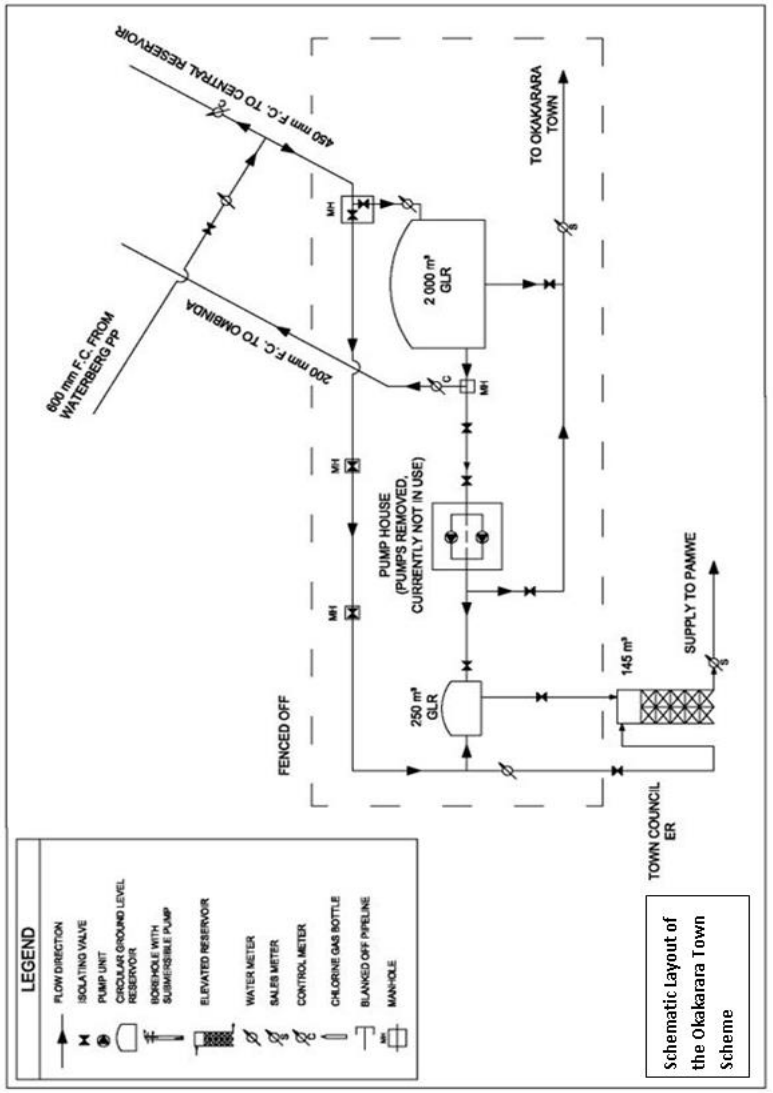

Figure 6: Schematic Layout of Von Bach Town Scheme

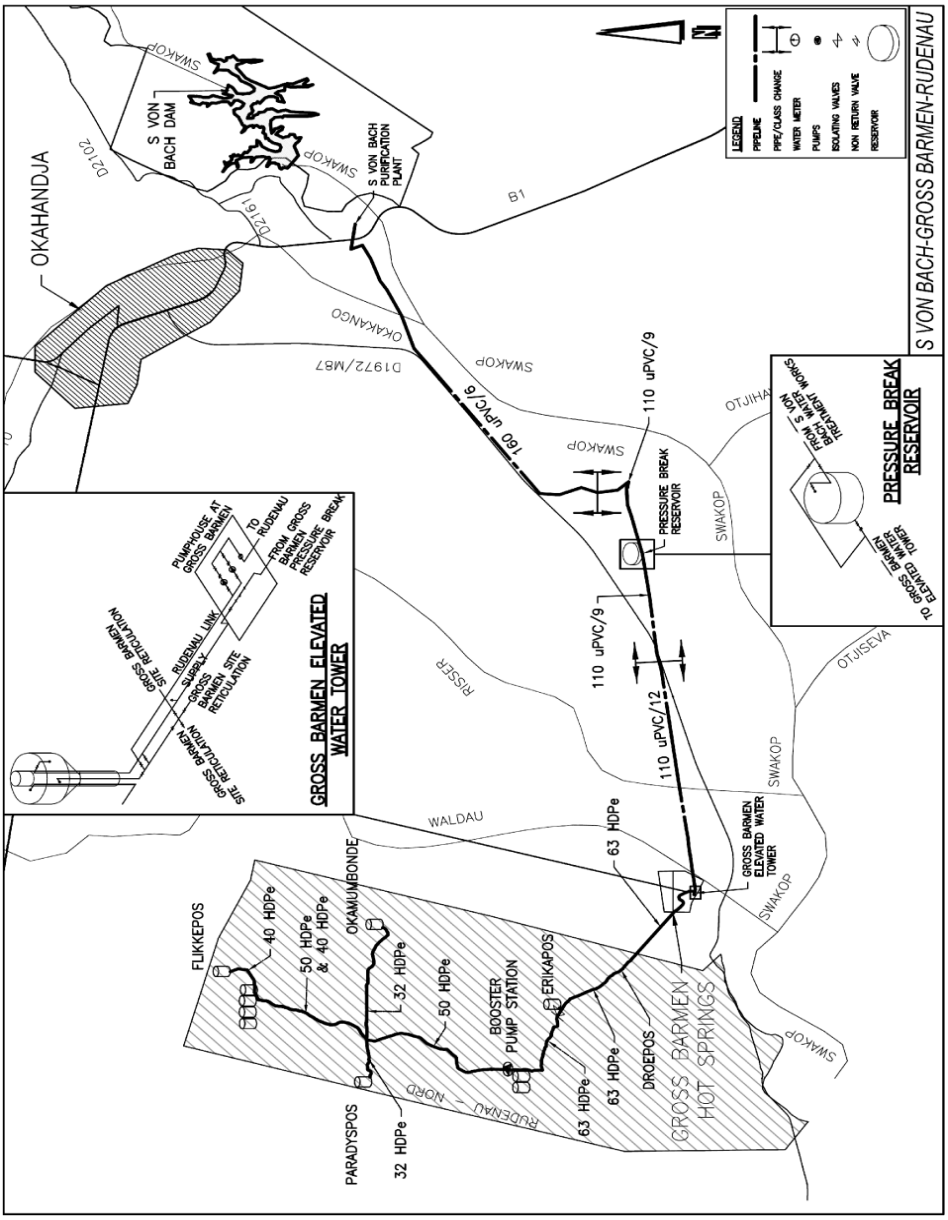

Figure 7: Schematic Layout of Von Bach-Gross Barmen-Rüdenau

4. BRIEF DESCRIPTION OF THE RECEIVING ENVIRONMENT

The baseline description provided below focuses on the receiving environment:

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

4.1 Climate

4.1.1 Precipitation

The highest rainfall per month received usually occurs in February and there is about 40 days of rain per year. The annual rainfall for Okahandja is approximately 350 mm. The rainfall frequency is irregular and can vary by 40% per annum (Enviro Dynamic, 2010).

The humidity of the area ranges from 10-20% during September and 70-80% during March. The variance in humidity during the day is high with an up to 40% difference in one day.

4.1.2 Temperature

The average annual temperature in the Omatako-Von Bach area is 19.47 °C. The coldest month is July with average minimum temperatures of 4°C, with December being the hottest month with average maximum temperatures of up to 34°C. The area receives between 10 to 20 days of frost annually. Extreme daily and seasonal variations are the norm for the central part of the country.

4.2 Topography and Geology

The landscape is classified as being in the Khomas Hochland Plateau region, which is rolling hills in the west with many summit heights equivalent reflecting older land surfaces. The topography falls off to the east as the Kalahari is approached.

The geology in the area consists of alluvial soil surface cover and the subsurface geology consisting of fractured mica schist, minor quartzite, graphitic schist and marble of the Kuiseb Formation in the Swakop Group. Groundwater flows in a westerly direction, along fractures and faults.

4.3 Natural Flora and Fauna

The habitat at the Von Bach and surrounds is uniform with no unique features such as significant drainage lines and broken terrain (rocky ridges or outcrops). A large part of this area has been cleared of woody vegetation.

The Savannah Biome, of which the Von Bach area and surrounds forms part, is underrepresented in the protected area network in Namibia, covering 37 % of the land area, but only 7.5 % of the biome. The most important tree or shrub species occurring in the general area are Cyphostemma bainesii (endemic), Cyphostemma currorii, Cyphostemma juttae (endemic), Erythrina decora (endemic), Heteromorpha papillosa (endemic) and Manuleopsis dinteri (endemic).

Endemic reptile species known or expected to occur in the general Von Bach area and surrounds make up 35.9 % of the reptiles from the general area. Reptiles of greatest concern are the Leopard tortoise (Stigmochelys pardalis) and Kalahari tent tortoise (Psammobates oculiferus) which are often consumed by humans. Anchietae's dwarf python (Python anchietae) and Southern African python (P. natalensis) are also of concern as they are indiscriminately killed throughout their range. Therock monitor (Varanus albigularis) as well as the various thick-toed gecko's (Pachydactylus sp.) of which 80 % are considered to be endemic to the Von Bach area and surrounds and are also considered species of concern. Other important species are the blind

snakes (Rhinotyphlops species of which two species in Namibia are endemic) and thread snakes (Leptotyphlops species of which one species is endemic). These could be associated with the sandier soils in the area. Of the nine species of amphibians expected to occur in the general Von Bach area and surrounds, three species are of conservation value, with two species being endemic namely Hoesch's pygmy toad (Poyntonophrynus hoeschi) and marbled rubber frog (Phrynomantis annectens) as well as the giant bullfrog (Pyxicephalus adspersus), which is considered to be near threatened.

According to Cunningham (2014), central Namibia has between 161 and 200 endemic vertebrates (all vertebrates included). The overall diversity and abundance of large herbivorous mammals (big game) is viewed as "high" with seven to eight species while the overall diversity of large carnivorous mammals (large predators) is determined at three species. Of the 85 species of mammals expected to occur in the general Von Bach area and surrounds, 5.9 % are endemic and 36.5 % are classified under international conservation legislation. The most important groups are rodents (12 % endemic), bats (4.5 % endemic) and carnivores (5.9 % endemic). The most important species from the general area, other than the endemic species, are probably all those classified as near threatened (straw-coloured fruit bat Eidolon helvum, striped leaf-nosed bat (Hipposideros vittatus), Blasius's horseshoe bat (Rhinolophus blasii), brown hyena (Hyaena brunnea) and leopard (Panthera pardus) and vulnerable cheetah (Acinonyx jubatus), small spotted cat (Felis nigripes) and Hartmann's mountain zebra (Equus zebra hartmannae) by the IUCN (2013).

Ten of the 14 endemics birds to Namibia (i.e. 71 % of all endemics) are expected to occur in the general Von Bach area and surrounds which underscore the importance of this area. Furthermore, 21 % are classified as southern African endemics (or 6 % of all the birds expected) and 79 % are classified as southern African near-endemics (or 23 % of all the birds expected). The most important species known or expected although not exclusively associated with the general Von Bach area and surrounds are viewed as various larger raptors and vultures, Monteiro's hornbill (Tockus monteiri) and Damara hornbill (Tockus damarensis), Rüppells parrot (Poicephalus rueppellii), Rosy-faced lovebird (Agapornis roseicollis) and rockrunner (Achaetops pycnopygius), all of which breed in the general area, but not exclusively associated with the area (Cunningham, 2014).

5. THE LEGAL ENVIRONMENT

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

5.1 The Constitution of the Republic of Namibia

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

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

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

5.2 Environmental Assessment Policy (1995)

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

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

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

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

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

- Water use and disposal;
- Transportation

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

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

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

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

6. RESPONSIBLE PARTIES

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

6.1 NamWater

NamWater, as the implementing agency, is responsible for:

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

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

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

7. ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plans (EMP) is an important tool focusing on the management actions that are required to ensure environmental compliance of a particular project.

EMP implementation is a cyclical process that converts mitigation measures into actions and through cyclical monitoring, auditing, review and corrective action, ensures conformance with stated EMP aims and objectives. Monitoring and auditing, feedback for continual improvement ensures that environmental performance has been provided and corrective action is taken for an effective EMP.

The main aim of this EMP is to ensure that the project complies with the goals of the Namibian Environmental Management Act (No. 7 of 2007); and, more specifically, to provide a framework for implementing the management actions as described in the EMP for the operational and maintenance phases of the scheme. Best practice is proposed for the operation of the scheme.

There are some environmental impacts that cannot be avoided. These environmental impacts require mitigation, and in order to mitigate against these impacts an EMP is required. The EMP aims to ensure best practises are implemented and environmental degradation is avoided through appropriate environmental protection, adherence to legal requirements and maintaining good community relationships.

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

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

8. MANAGEMENT ACTIONS

8.1 Operation and Maintenance phase of the Von Bach Water Supply Scheme

8.1.1 Introduction

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

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

Table 2: Operation and Maintenance Phase Management Table

Issue	Objective	Strategy	Actions	Time frame
Maintenance and emergency procedures	To ensure correct procedures are in place to avoid environmental impacts associated with maintenance activities as well as proactive intervention to avoid, and if required, to respond to emergencies	• 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.	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.	Bi-monthly for the lifespan of infrastructure as per the maintenance manual. Bi-annually for lifespan of works. When emergency incident occurs. Emergency incident Annually for lifespan of operation. Annually for lifespan of operation Annually for lifespan of operation

8.2 Maintenance Procedures

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

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

8.3 Facility Management and Operations

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

8.4 Routine Maintenance and Repairs

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

8.5 Environmental Awareness

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

8.6 Waste and Pollution Management

8.6.1 Waste and Pollution Prevention

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

- All waste will be removed to an appropriate waste dump.
- No waste should be buried.
- General Waste: Includes waste paper, plastic, cardboard, harmless organic (e.g. vegetables) and domestic waste.
- No littering will be allowed. The plant area will be kept free of waste at all times.
- Provide sufficient waste bins at worksites. Make sure that all waste is removed from the worksites.

- Hazardous Substances include: sewerage, fuels, lubrication oils, hydraulic and brake fluid, solvents, paints, anticorrosives, insecticides and pesticides, chemicals, acids etc. It should be disposed of at designated hazardous disposal sites.
- Contaminated soil should be stored in drums and taken to the nearest appropriate waste dumpsite.
- Do not change oil on uncovered ground. Drip trays will be used to catch oil when vehicles are repaired in the field.
- Used oil and hydraulic fluids will not be discarded on the soil or buried. It will be removed from site and taken back to an appropriate dump.
- In the event of a hazardous spill:
  - ✓ Immediately implement actions to stop or reduce the spill.
  - ✓ Contain the spill.
  - ✓ Arrange implementation of the necessary clean-up procedures.
  - ✓ Collect contaminated soil, water and other materials and dispose it at an appropriate waste dumpsite.
- Used solvents and grease should be stored in drums or other suitable containers. It should be sealed and recycled or disposed at an appropriate disposal site.
- Hazardous waste should not be burnt.
- Bunding, concrete slabs and/or other protective measures should be installed where hazardous materials are handled.
- Ensure that the staff are informed and have information pertaining to the management of spills or ingestion.

8.6.2 Hazardous Materials

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

8.6.3 Noise Management

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

8.7 Health and Safety

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

- Provide an AIDS awareness programme to all the staff.

- Make sure that all staff are equipped and know how to use safety and protective gear. This includes hard hats, goggles, hearing protectors, dusk masks, steel-toed shoes etc.
- Keep a comprehensive first aid kit at Scheme.
- Establish an emergency rescue system for evacuation of serious injured people.
- Emergency procedures for accidents should be communicated to all employees.
- Dangerous areas must be clearly marked and access to these areas controlled or restricted.
- Good driving and adherence to safety rules will result in a minimum number of road and workplace accidents.
- Fire extinguishers must be available at all refuelling sites. Staff should be trained to handle such equipment.
- Nobody is allowed to dispose a burning or smouldering object in an area where it may cause the ignition of a fire.
- Hazardous substances must be kept in adequately protected areas to avoid soil, air or water pollution.
- Work areas, such as these for the maintenance of equipment, must be on concrete slabs.
- Explosives should be stored according to the prescribed regulations.

9. SITE CLOSURE AND REHABILITATION

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

Objectives of proper site closure and rehabilitation include the following:

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

Rehabilitation measures to implement:

a. A site inspection will be held quarterly by the scheme supervisor after every maintenance work during operation of the scheme. Rehabilitation will be done to the satisfaction of the ENV section and MET.

b. Frequent inspections of the scheme and effective follow-up procedures, to prevent minor defects from becoming major repair jobs.

c. Make sure all soil polluted during maintenance work is properly stored in drums and removed to an appropriate waste dump.

d. Make sure all windblown litter is removed once maintenance has seized.

e. Make sure that all potential hazards (i.e. the sewerage pit) are properly closed and left in a safe and neat position.

Rehabilitation will be completed when the above have be achieved.

10. NAMWATER ENVIRONMENTAL CODE OF CONDUCT

What is an Environmental Code of Conduct?

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

What is the ENVIRONMENT?

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

Do these ENVIRONMENTAL RULES apply to me?

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

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

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

What if I do not understand the ENVIRONMENTAL RULES?

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

Safety and Security

1. Only enter and exit roadways and construction areas at demarcated entrances.
2. Wear protective clothing and equipment as per signboards at the Scheme and according to instructions from your SCHEME SUPERVISOR.
3. Report to your SCHEME SUPERVISOR if you see a stranger or unauthorised person in the construction area.
4. Never enter any area that is out of bounds or that is demarcated as dangerous without permission of your SCHEME SUPERVISOR.
5. Never climb over any fence or enter private property without permission of the landowner or your SCHEME SUPERVISOR.
6. Do not remove any vehicle, machinery, equipment, or any other object from the construction site without the permission of your SCHEME SUPERVISOR.
7. Keep clear of blasting sites. Follow the instructions of your SCHEME SUPERVISOR.
8. Never enter or work in the Scheme while under the influence of alcohol or other intoxicating substances.

9. All staff should know the emergency procedures in case of accidents.

Waste Disposal

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

Containers will be provided for different types of wastes.

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

<u>Hazardous Waste</u> 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.

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

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

Sensible Driving

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

Noise

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

Fire Control

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

Dealing with Environmental Complaints

67. If you have any complaint about dangerous working conditions or potential pollution to the environment, talk to your SCHEME SUPERVISOR.

68. If any person complains to you about noise, lights, littering, pollution, or any harmful or dangerous condition, immediately report this to your SCHEME SUPERVISOR.

NP du Plessis
Tell: 061-71 2093
Cell: 081 127 9040

OR

Jolanda Kamburona
Tell: 061-71 2105
Cell: 081 144 1528

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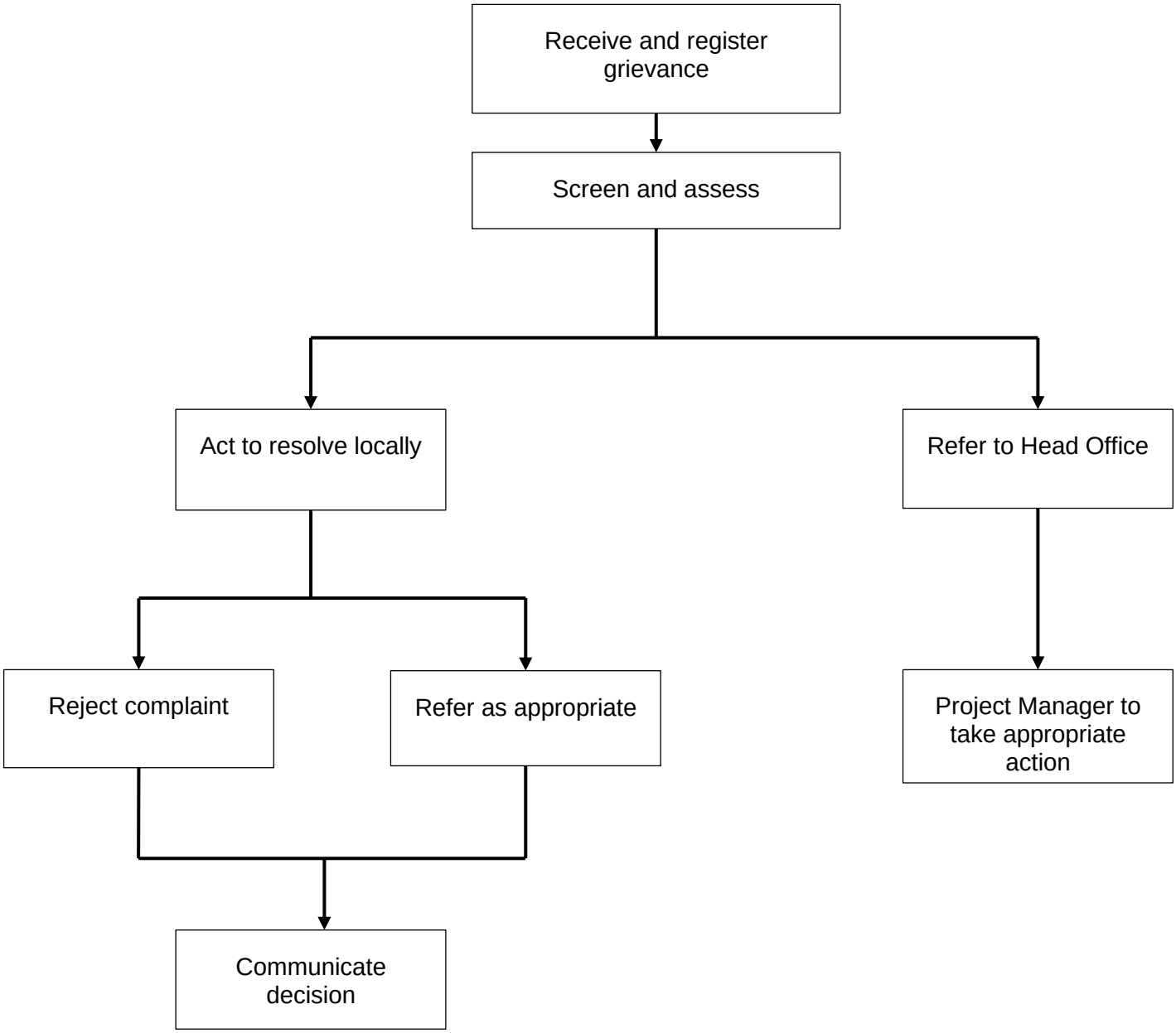
ANNEXURE 1: GRIEVANCE PROCEDURE AND REGISTRATION FORM



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