MOGALAKWENA MUNICIPALITY

Lidwala
Specialist Solutions

MOGALAKWENA LOCAL MUNICIPALITY

DETAIL DESIGN REPORT

13010

Dipichi Cluster water mini scheme project

July 2017

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ABBREVIATIONS

AADD	Average Annual Daily Demand
CLO	Community Liaison Officer
DWS	Department of Water and Sanitation
GAADD	Gross Average Annual Daily Demand
HDPE	High Density Polyethylene
MIG	Municipal Infrastructure Grant
MLM	Mogalakwena Local Municipality
ORWRDP	Oliphants River Water Resources Development Programme
BFCR	Beyond Functional Scheme Area Command Reservoir
PSC	Project Steering Committee
R-	Rand
RDP	Reconstruction and Development Programme
EPWP	Extended Public Works Programme
SSA	Shikwambana Sithole & Associates Consulting Engineers
SDD	Summer Daily Demand
SPF	Summer Peak Factor
Upvc	Unplasticised Polyvinyl Chloride
WTW	Water Treatment Works
b/h	borehole
ca	capita
d	day
hr	hour
K-	Kilo
l	litre
l/s	litres per second
m	metre
m3	cubic metre
M-	Mega
no	number
p.a.	per annum
s	second
LOS	Level Of Service
Lcd	Litres per Capita per Day

DOCUMENT CONTROL

Date	Revision	Name	Role	Signature
2017/04/18	Rev 00	Nkosinathi Dube	Author- Design Engineer	
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By signing this document the signatory confirms the authenticity of the electronic signatures on the approval page of this document

DOCUMENT CHANGE HISTORY

Date	From Version	To Version	Paragraph Reference	Change Description
2017/07/06	00	01	5.1.2	Reinstated the 350kl/day package treatment as per the Municipality and DWS's request.
2017/07/06	00	01	5.1.3	Reduced the size of the ground steel tank at the booster pump station from 450kl to 200kl as per the Municipality and DWS's request.
2017/07/06	00	01	5.2	Updated the cost estimate summary due to the changes requested as stated above.

1. PROJECT BACKGROUND

1.1 Introduction

Lidwala Consulting Engineers were appointed by Mogalakwena Local Municipality as a professional service provider to assist with the design, tender documentation and supervision of the upgrading and improvements to the Dipichi Cluster Water Mini Scheme.

The major problem with the existing water supply system is that it is un-reliable; hence some of the communities are unable to get access to water all year round. This problem is mainly caused by inadequate bulk water infrastructure and low pressure in the system. The existing boreholes are not reliable to cater for all the communities.

The new scheme will comprise of re-aligning the infrastructure from the existing isolated schemes to one, remodelled around the utilisation of the more reliable Sand Abstraction well H03W2359 by Mogalakwena River as the main source of water for all villages.

1.2 Location

The project is located in the rural resettlement areas of Mogalakwena in the villages of Diretsaneng, Ramoseseane, Kgopeng, Dipichi and Buffelshoek, 72km northwest of Mokopane Town in Ward 2 of Mogalakwena Local Municipality. The villages fall within the northern settlements of Waterberg District municipality.

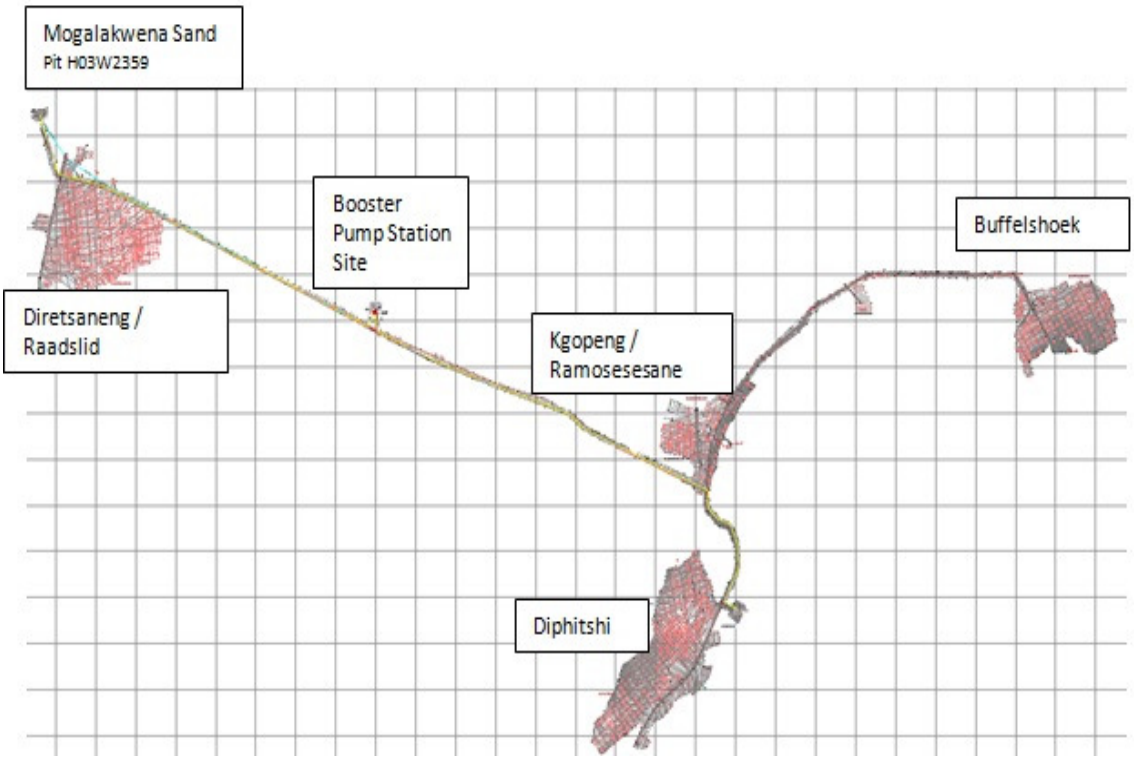

Figure 1: Locality Map

2. INVESTIGATIONS

2.1 Stakeholder liaison

This detail design report is a cumulation of extensive stakeholder's liaison, site investigations, reviews, feedbacks, tests, studies and approvals that were conducted during the concept and preliminary design stages.

Lidwala was instructed by the Municipality to engage the Department of Water and Sanitation for approval of their preliminary design report. After a series of reviews and final approval by DWS, the report was then submitted and approved by MIG for funding on the 18th of July 2016 (see appendix 8) for implementation in the 2017/2018 financial year.

Recently at a meeting held on the 24th of January 2017, the municipality informed Lidwala of a recently approved water masterplan championed by SSA Consulting Engineers. It was then agreed at the meeting that Lidwala re-align their previous approved preliminary report and designs to the new masterplan. The revised preliminary design report was approved by SSA Consulting Engineers and the municipality representatives on the 13 of March and hence a go-ahead was granted to Lidwala to proceed with the detail design stage.

Some of the crucial information compiled in this report was obtained from the following sources:

- MLM Master Plan document (version 4.2) produced by SSA Consultants.
- Geohydrological report from VSA Leboa Consulting.
- Statistics South Africa
- SSA Consulting Engineers.
- Department of Water and Sanitation

3. EXISTING STATUS QUO

3.1 Water Sources

The villages of Dipichi, Ramoseseane, Buffelshoek and Kgopeng are currently supplied by a cluster of independent systems which draws their water from boreholes using pumps that are mechanically powered by electric or diesel combustion engines. Only the village of Direstaneng draws water from the Sand Abstraction well H03W2359.

Table below is a list of all the boreholes in the area together with their respective yields capacity as per the geohydrological tests done on them.

Table 1: Summary of existing boreholes

Item	Village name	Water Supply	Pumps	Yield (m^3/day)	Class	Functionality
1	Kgopeng	Borehole (H03-3489)	Electric	Not available	Not available	Decommissioned
2	Dipichi	Borehole (H03-3541)	Electric-mono	Not available	Not available	Decommissioned
3	Kgopeng	Borehole (H03-1366)	Electric-mono	34.56	Class 2	In –use
4	Dipichi	Borehole (H03-1158)	Electric	12.96	Class 3	In -use
5	Kgopeng	Borehole (H03-3617)	Electric	21.60	Class 3	No equipment
6	Buffleshoek	Borehole (H03-3148)	Diesel	Not available	Not available	Decommissioned
7	Direstaneng	Borehole(H03-3777)	None	5.18	Not available	Decommissioned
8	Buffelshoek	Borehole(H03-2088)	Electric	172.8	Class 1	In -use

3.2 Sand abstraction well H03W2359

According to findings of the geo-hydrologist (refer to appendix 4), VSA Leboa Consulting, "sand point H03W2359", is 4.17m deep and dug in the river sand. The filtration system is still efficient, as evidenced by pumping rates as high as 30.6l/s which were reached during testing. However, for most of the testing period, the turbidity of water was not satisfactory, as it had a brownish colour for the most part of the testing period. This indicates that the filtration properties of the sand blanket are not effective enough to prevent micro sediments from entering the well during pumping / extraction. The yield of H03W2359 sand well abstraction points was tested to be 432 m^3/day. The chemical analysis of the water at this point classified the quality of the water to be Class 1.

The recommended abstraction volumes are based on the results of the pumping tests. The tests however would represent an insignificant period of the expected production life of the sand point/ borehole. The calculation of the extent of the aquifer is based on assumptions as well as data from the pumping test.

There are three aquifers identified during this study as follows:

- The **alluvial aquifer** represents the main storage reservoir of the aquifer in dry periods.

- During surface flow periods of the river, abstraction can be assumed to be directly from the river. Additional available storage will be the level of flow in the river.
- The groundwater sources not located within the river are fractured aquifers. These were not tested.

In the event of a prolonged drought, the alluvial aquifer will be negatively affected. For this period the fractured aquifers can be used. The recommended abstraction rates present a scenario that is influenced by seasonal changes.

- During surface flow in the river H03W2359 can be pumped at 60% of the maximum yield, thus 18.0 l/s.
- During wet periods or 5 months/year, H03W2359 can be pumped at 7.5l/s for a 24hr period per day.
- During dry periods or 7 months/year the ground water level will decrease thus resulting in the gradual dewatering of the shallow aquifer. The abstraction volume during this period will be significantly less than during the wet period. . H03W2359 can be pumped at 5.0 l/s for a 24 hr period per day.

3.3 Storage

There are 9 existing storage concrete reservoirs/steel tanks within the villages in the area. Figure 2 below shows the location of the reservoirs in the area.

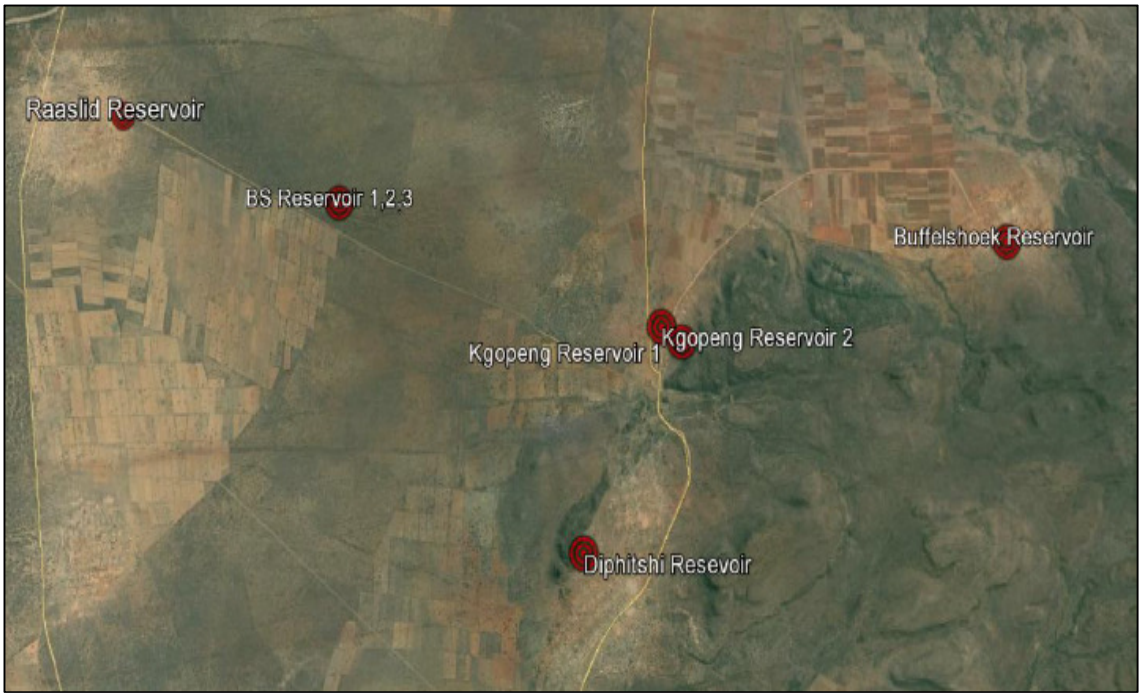

Figure 2: Location Plan of Reservoirs

The capacities of the reservoirs/tanks are detailed in the table below;

Table 2: Summary of storage facilities

Village	Capacity (kl)	Construction Material	Functionality and condition
Buffelshoek	60	Concrete	Reservoir functional but with minor leaks.
Buffelshoek	180	Concrete	Reservoir not in use (decommissioned)
Kgopeng	105	Steel panel	Reservoir has never been used since being built in 2013.
Dipichi	180	Concrete	Reservoir functional but with minor leaks.
Kgopeng	200	Concrete	Reservoir functional but with minor leaks.
Booster Pump Station Area	180	Concrete	Reservoir functional but with minor leaks.
Booster Pump Station Area	50	Concrete	Reservoir not in use (decommissioned).
Booster Pump Station Area	105	Steel panel	Not in use. Reservoir had significant leaks and has since been abandoned.
Direstaneng	80	Concrete	Reservoir not in use (decommissioned).

For most of the villages, water from the boreholes is pumped into the concrete reservoirs located in those villages. Most of these concrete reservoirs are old, the ones still functional have minor leaks whilst a few has been decommissioned.

For the village of Direstaneng, water is pumped from the sand abstraction well H03W2349 to the 180kl concrete reservoir at the Booster Pump station through a 160mm uPVC pumping main, Thereafter, water gravitates back to communal stand pipes through the same 160mm pipeline. This pipeline therefore acts as both a pumping and gravity mains.

3.4 Pump Station at Sand Abstraction Well

The existing pump station at the abstraction point is equipped with a single diesel pump via a 160mm uPVC pipeline. The pump is old and experiences frequent breakdowns. Also when the diesel tank runs dry, long outages are experienced before the diesel supply is provided. The pump station pumps water from the sand abstraction point to the booster pump station where the water is stored in a 180 kl concrete reservoir.

An application has been made for an electrical connection from Eskom by the local authority but this is still outstanding. The following are pictures of the existing abstraction pump station.

Figure 3: Existing Pump inside sump

Figure 4: Diesel tank at Pump station

3.5 Water Treatment

Currently no treatment of water from the boreholes or the sand abstraction well is being undertaken. For the water extracted from the sand abstraction well, additional water quality testing must be done to determine the concentrations of biological constituents such as blue algae, faecal coliform, pesticides, etc.

3.6 Mains and Distribution

For the Inlet and outlet pipelines systems supplying reservoirs and also gravitating to the communal distribution pipes the following problems were noted:

- Leakages at junctions and connections.
- Lack of bulk meters to monitor water usages and conduct water balance estimates.

Information obtained during our investigations, lead to the conclusion that the system grew by extending supply pipes to new village growth nodes.

3.7 Reticulation

For the villages of Dipichi, Kgopeng, Buffelshoek and Ramoseseane, water is pumped from boreholes to fill up the concrete reservoirs before it gravitates to some strategic stand pipes located within the residential areas. For Diretsaneng village, from the booster pump reservoir, water gravitates directly to the communal stand pipes within the village.

Many of the communal stand taps were not functional as they had either been decommissioned or vandalised by the local communities. The majority of the villagers have since illegally connected from the distribution pipelines running along the streets into their homes therefore compromising the efficiency of the network and also disrupting the equitable share of water for all. Very few of the communal standpipes remain functional and utilised.

4. DESIGN ASPECTS

4.1 Design philosophy, criteria, and standards

4.1.1 ORWRDP Masterplan Summary

At a recent meeting held with Mogalakwena Local Municipality and SSA Consulting Engineers on the 24th of January, it was stated that Lidwala's previous designs must be realigned to the latest masterplan. The masterplan is termed the Olifants River Water Resources Development Programme (ORWRDP Water Master Plan).

The bulk water supply from Flag Boshielo dam has been delayed and it is uncertain when supply to the beyond functional area from this source will be realised. However, the ground water sources comprising of scheme clusters as explained below are immediately available and the municipality has thus decided to proceed with the development before bulk water from the Flag Boshielo Dam is made available.

There will be 8 scheme clusters (supply areas) made up of 14 well fields in total complementing the bulk water from the Flag Boshielo Dam. Each cluster will have a command reservoir that has been determined to ensure close proximity to the area to be supplied and with sufficient elevation to supply the village reservoirs by gravity. Also, when bulk water becomes available from the Flag Boshielo dam, the respective cluster command reservoirs are still positioned well to be supplied with potable water through gravity from the Sekuruwe WTW. **Table 3** below summarises all the clusters and well fields under the masterplan.

Table 3: Scheme clusters and Well Fields

CLUSTER	WELL FIELD
BFCR1 Cluster	WF1; WF2; WF8
BFCR2 Cluster	WF3; WF4; WF7
BFCR3 Cluster	WF9
BFCR4 Cluster	WF5; WF11
BFCR5 Cluster	WF6; WF12; WF13
BFCR6 Cluster	WF15
BFCR7 Cluster	WF10
BFCR8 Cluster	WF14

The Dipichi cluster villages covered in this report are part of the BFCR1 Cluster. The sand pit well H03W2359 which is the main supply of water for the scope of this report will also form part of the Well Field 1 (WF1) under the BFCR1 scheme cluster. Both the proposed BFCR1 Cluster's WTW and 3500 kl Command RC reservoir will be located at Kromkloof village. Kromkloof village is south of the project scope area as shown by the cluster1 layout drawing attached in the appendices 5 & 6.

4.1.2 Alignment of design to ORWRDP Masterplan

In realigning our scope to suit the masterplan, the sandpit well H03W2359 will still supply the villages of Direstaneng, Buffelshoek, Dipichi and Kgopeng under our scope as previously proposed (see appendix 7 for the schematic layout plan). Below is the summary of the design philosophy:

- Instead of the water from the sandpit being pumped directly to Kromkloof WTW, it will now be pumped to the Booster station and then pumped further to the new 450kl command elevated steel tank in Dipichi village.
- However, the new command storage in Dipichi will now serve 2 purposes.
  1. To supply water to directly to the reticulation networks of the villages of Buffelshoek, Dipichi, Ramoseseane and Kgopeng.
  2. The remainder of the water will be supplied directly to the Kromkloof WTW further south of these villages through gravity pipeline as per the masterplan.
- The new Dipichi command steel tank will still be strategically located to be used as storage tank for the potable water for all the 5 villages when water from Kromkloof becomes readily available.
- There will be no need for the construction of a new 150kl RC reservoir at Buffelshoek as had been planned to be constructed in year 2020.
- Pipeline P168 (see appendix 6) will be utilised initially as a pumping main from Kgopeng to Booster station. After the masterplan is commissioned, it will then be utilised as a gravity main from Dipichi command tank to Direstaneng village through the booster station reservoir.
- Gravity pipelines P171 (Dipichi tank to Buffelshoek village) and P84 (Dipichi tank to Dipichi village) will be utilised now and also after the commissioning of the masterplan.
- Current old concrete reservoirs will still be refurbished and their borehole isolated schemes retained and used as back up water for the villages, hence complementing the potable water from the WTW.

4.2 Technical Design Criteria and Parameters

The following design guidelines were consulted in the design:

- Guidelines for Human Settlement Planning and Design (by CSIR & Construction Technology)
- The South African Design Guidelines for rural water-supply systems published by the South African Department of Water Affairs and Forestry in 2004 (DWAF 2004)- see Appendix 1.
- Flow velocity – 0.6 – 2.0 m/s.

4.2.1 Water Hammer

Surge Analysis according to the Joukowsky Equation:

$$\Delta P = c \cdot \Delta v / g$$

Where:

- ΔP (m) is the change in pressure.
- C (m/s) is celerity (i.e. speed of the pressure wave)

- Δv (m/s) is the change in flow velocity.
- g. is gravitational acceleration = 9.81 m/s^2

Design was checked for surge pressure and also it can be concluded that UPVC pipes at low velocities given their elasticity nature experience less surge pressures.

4.2.2 Water Balance Projections

The 2011 population figures on table below were obtained from the Census 2011 statistics. Thereafter the water demand was projected using a population growth of +1.0% as agreed upon with the MLM representatives instead of the actual low rate of +0.3% provided by Stats SA. The other factors used for GAADD and other peak factors were obtained from the DWS standards attached on the appendix 1. The Level of Service used applied in this project is for yard taps with the design water usage of 60 lcd for all infrastructure components as per DWS standards.

Table 4: Population and Projected demands

Village		Year 2037 Demand projections (20-design life)				
	Population 2011	Population 2037	AADD (kl)	GAADD (kl)	SDD_{PL} (kl)	Storage required /kl (48hrs)
Ramoseseane	318	413	24.8	27.3	40.9	49.6
Direstaneng	718	933	56.0	61.6	92.4	112.0
Kgopeng	488	634	38.1	41.9	62.8	76.1
Buffelshoek	444	577	34.6	38.1	57.1	69.3
Dipichi	697	906	54.4	59.8	89.7	108.7
Total	**2665**	**3465**	**207.9**	**228.7**	**343.0**	**415.7**

4.2.3 Income level

There are no sources of employment save for the civil servants (teachers, nurses etc) who provide services to the communities. Most people fall in the lower income bracket. A high rate of unemployment is a major concern within the community.

5. PROPOSED WORKS SUMMARY

5.1 Proposed solutions

5.1.1 Sand Pit Abstraction well

The following works will be conducted at the sand abstraction well site:

- A new electrical pump station will be constructed next to the existing diesel one with the following characteristics:
  1) Sump foot valve level = 875.00

2) Recommended Pumping rate for each pump = 11 l/s
3) Pump head = 90m

- One pump on duty and the other on standby, both electrically driven. The ideal solution was to completely replace the existing old diesel pump with the electrical driven pumps but on earlier discussions with Mogalakwena Municipality representatives it was agreed that we retain and repair it as a backup option.
- Repairing and refurbishment of existing diesel pump station will also be done by the municipality.
- If the connection of electricity to the new pump station is delayed after the project has been completed, the existing diesel pump will be in operation then until electrical pumps are commissioned.
- Refurbishment of the sand blanket system to prevent micro sediments from entering the well during pumping / extraction of the water. Turbidity was observed during testing of the abstraction well. The municipality indicated during the preliminary design stage that they will carry out this refurbishment.
- The pumps will be switched on and off manually but will have pressure sensors to trip when suction pressure falls below a given value.
- Water use license will need to be applied for, with a total abstraction of 0.168 million m^3/annum.

5.1.2 Booster Pump station

Construction of a new pump house and supply new pumps at the Booster pump station to pump water from the new 450kl ground steel tank at the site to the command tank at Dipichi village. The new pump will have to pump water through a pumping main 160mm diameter, uPVC classes ranging from 12 to 25, 6000m long against a total head of 170m with estimated maximum flow of 11.4 l/s.

5.1.3 Storage

As earlier stated a new command steel tank is recommended as per the masterplan and also to supply the 5 villages with water. A size of 450kl is recommended factoring in the storage demand for these villages and also raw water passing through to the new Kromkloof WTW under the masterplan.

The existing 105kl steel tank at the booster station site has since been abandoned as previously stated. Resuscitating it might be difficult considering the weak foundation it is founded on and the extensive joint sealing that has occurred already. Therefore, it will be replaced by a new 200kl ground tank. Its purposes will be to supply the Dipichi command steel tank through pump station and also some of the water will bypass to the existing concrete reservoir at the site.

Geotechnical investigations (see Appendices) were recently done and foundation designs done for the 2 new steel tanks to avoid the foundation failing like the previous tank. It is suspected that the region has collapsible soils, hence the water leaks could have compromised the integrity of the foundation of these existing 105kl steel tank. The concrete reservoir at the booster station site

currently supplying Direstaneng village will be retained and will get water from the new 200kl ground steel tank.

5.1.4 Package Treatment Plant

As stated in the previous chapters, the sand abstraction water quality is of class 1. A package water treatment plant is therefore proposed to clean the water. The raw water treatment works demand (SDDPL for 20-year design period) on Table 4 is 343 kl/day, therefore the proposed plant will have a capacity of 350kl/day. The treatment plant costs are included in the cost estimates. This package plant will be decommissioned at a later stage once the ORWRDP masterplan project is in full operation.

5.1.5 Pumping and Distribution mains

- Construction of 110 mm diameter, uPVC class 12 distribution mains connecting from the new Dipichi command steel tank to the reticulation network pipes at the villages over a distance of approximately 9000m.
- Construction of valves and meter chambers on the piping system.
- Gate valves and water flow meters are sized to a ratio of 0.7 of pipe diameter. The gate valves, water meters on the 160mm diameter pipe will be 110 mm in diameter while on the 110mm pipes will have 75 mm diameter fittings. Eminence mechanical water meters or equivalent are specified. We have specified 75mm scour valves, air valves are 50mm diameter.

5.2 Cost estimate

The following table is a summary of the project's priced Bill of Quantities. A detailed Bill of quantities is attached in appendix 3.

Table 5: Bill of Quantities Summary

Schedule No.	Description	Amount (R)
1	Preliminary and General	3,170,800.00
2	Dayworks, Provisional Sums and Prime Cost Items	570,500.00
3	Site Clearance	204,600.00
4	Earthworks (pipe trenches)	2,673,524.00
5	Bedding (pipes)	2,139,000.00
6	Water Supply	4,358,000.00
7	Pump Stations, Storage tanks and Package treatment plant	9,855,000.00
Sub - Total		22,971,424.00
Contigencies (5%)		1,148,571.20
Sub - Total		24,119,995.20

Total Professional fees for design and supervision (ECSA fees scale).	3,859,199.23
Prject Total	27,979,194.43
Value Added Tax at 14%	3,917,087.22
Project Sum Total	31,896,281.65

6. DEVELOPMENT REQUIREMENTS

6.1 Environmental requirements

A Basic Assessment (Environmental Authorisation) and a Water Use License application (WULA) are required before the commencement of the project works (construction). An Enviromental Control Officer is required for the costruction period. The most notable activities for the Basic Assessment are as follows

Listing 1 GN 983

- **Activity 12**: The development of-(vi) bulk storm water outlet structures exceeding 100 square metres in size; where such development occurs-
- **Activity 19** - the infilling or depositing of any material of more than 5 cubic meters into, or the dregging, excavation, removal or moving of soil, sand, shells grit, pebbles or rock of than 5 cubic meters from- a watercourse.
- WULA license will have to be registered for the sand abstraction well in the Mogalakwena River under section 21 (a).

6.2 Occupational health and safety aspects

The Contractor who will execute the project shall enter into and execute an Agreement as provided for under Section 37 (2) of the Occupational Health and Safety Act 1993 (Act No. 85 of 1993).

6.3 Expanded public works programme aspects

Labour intensive construction will be the most preferred method of implementing this project to enhance the social-economic development of the project area. Guidance will be sort from the latest EPWP guidelines while compiling the tender document for this project. Plant and equipment will only be allowed on site where the use of labour intensive construction is not feasible.

6.4 Operation and maintenance requirements

The Mogalakwena Local Municipality is the authority responsible for the villages. The municipality has assumed the responsibilities for the implementation of the Water Services Act, Water Service provision and bulk water provision to the villages. The operation and maintenance responsibility is within the hands of the local municipality, with some assistance from the Waterberg District Municipality.

7. CONCLUSION

- This study area is located in the rural resettlement areas of Mogalakwena in the villages of Diretsaneng, Ramoseseane, Kgopeng, Dipichi and Buffelshoek.
- Currently the area's water is from several boreholes in the area which are mostly unreliable and seasonal. Only the village of Direstaneng get its water from a sand abstraction pit extracting water from the Mogalakwena River.
- From the meeting that occurred on the 24th of January 2017, the Municipality asked Lidwala to realign their initial design to the ORWRDP masterplan design being done by SSA Consulting Engineers.
- The masterplan scope involves bulk water supply from Flag Boshielo Dam, the project has been delayed and there is no agreed date yet when it's going to start.
- To complement the bulk water from Flag Boshielo dam, there will be 8 scheme clusters (supply areas) made up of 14 well fields in total. Sandpit well (H03W2359 included) is one of the wellfields.
- For the water extracted from the sand abstraction well, additional water quality testing must be done to determine the concentrations of biological constituents such as blue algae, faecal coliform, pesticides, etc.
- A new 450kl command steel tank at Dipichi village has been earmarked to serve the 5 villages directly and also to convey the remainder of raw water to the proposed Kromkloof WTW south of the study area.
- The booster pump station will be resuscitated with a new pump house with 2 pumps pumping water to the 450kl command steel tank in Dipichi.
- A 350 kl/day package treatment plant has been proposed to treat water from the sand abstraction pit and will be positioned at the Booster pump station site.
- The existing 105kl steel tank at the booster station site will likely be replaced by a 200kl new one that will store water to be pumped to the Dipichi Command tank.
- The project will also involve refurbishment and repair of all existing reservoirs, pumps and also installation of pumping and distribution mains.
- The total estimated cost of the project is **R 31,896,281.65.**

8. APPENDICES

8.1 Appendix 1: Design Norms and standards

The design norms and standards to be adopted are those proposed by DWA together with standards as per following specifications and guidelines:

- SANS 1200.
- SABS 241 – Water Quality.
- Guidelines for Human Settlement Planning and Design – Department Of Housing, CSIR
- The South African Design Guidelines for rural water-supply systems published by the South African Department of Water Affairs and Forestry in 2004 (DWAF 2004).

Table 6: Basic planning and design criteria

1	Design Horizon:	20 Years from commissioning for pipelines and reticulation. 5 - 10 years for all above ground civil works and mechanical and electrical equipment.
2	Population:	For Design Horizon as above. Over 10 years. Growth rate as prescribed by Mogalakwena Municipality is +1.00%
3	House occupancy:	Mogalakwena municipality recommended that the household's figures from the IDP be adopted as the best reflection In this project.
4	Growth Rate: (up to Design Horizon)	1.00%
5	Design Water Usage:	60 lcd for all infrastructure components In cases of restricted groundwater sources, a minimum water usage of 25 lcd is acceptable for pumps, pumping mains and elevated tanks only. Even in cases of restricted groundwater sources reticulation is to be designed for 60 lcd.
6	Design Loss Factors (LF):	i) Water treatment works, LF_w = 10% ii) Total conveyance losses, LF_r = 10%
7	Gross Average Annual Daily Demand (GAADD):	GAADD = (1 + LF_r) * AADD
8	Summer Peak Factor:	SPF = 1,2 minimum to 1,5 maximum
9	Summer Daily Demand, WATER TREATMENT WORKS AND RAW WATER AND CLEAN WATER PUMPS, (SDD_{ww}):	SDD_{ww} = SPF * GAADD * (1 + LF_w) Design Pumping Period = 20 hrs./day
10	Summer Daily Demand, BULK SUPPLY PIPELINES, (SDD_{pl}):	SDD_{pl} = SPF * GAADD
11	Summer Daily Demand, BOREHOLE PUMPS, (SDD_{pu})	SDD_{pu} = SPF * GAADD Design Pumping Period – See below
12	Storage Reservoirs:	48 Hrs. * AADD Pumped from One Source 36 Hrs. * AADD Pumped from Multiple Sources

	(Total Storage, i.e. Regional and Village Reservoirs combined, but excluding elevated tank volume)	24 Hrs. * AADD Gravity Source Recommended to split volumes roughly equal between Regional and Village storage's for new reservoirs. A maximum of 24 hours and a minimum of 16 hours are required at Village storage. Reinforced concrete structures only acceptable. Exceptions apply for a groundwater source supply where ground level storage is inappropriate. In this case an elevated tank with 16hrs (for 2 or more powered borehole pumps) to 24hrs * AADD (one powered pump only) for 25 lcd is acceptable**.**
13	Elevated Tank/Tower: (Only required to provide reticulation pressures)	4 Hrs. * AADD (only for area to be served by tank) Max. 6 x 10 kl for polyethylene tanks on stands. From 75 kl and greater size use pressed sectional steel tanks on stand.
14	Design for pipeline flow between Main Storage and Elevated Tank:	2 * GAADD (Gravity) 2 * GAADD (Pumped: 20hrs/day)
15	Design Peak Factor (for Reticulations):	DPF = 2 to 3
16	Design Peak Flow Rate (DPFR for Reticulation):	DPFR = DPF * GAADD Primary reticulation designed to supply 60 lcd for all erven, but only standpipes and existing erf connections to be provided against project costs. New erf connection piping to be paid for by the new consumer.
17	Standpipe design: Flow Rate	DPFR divided by No. of standpipes, subject to a minimum of 10 1/min (0,17l/s) per tap Note: Standpipe with two taps – flow rate 20 l/min
18	Standpipe design: Spacing	Each household must be within a 200m radius of a Standpipe Note: Additional standpipes should be provided if a physical barrier, such as a river, main highway, railway or long housing block unduly lengthens the walking distance to standpipes.
19	Residual Pressures (above GL):	10 m minimum at point of delivery, where possible. *Flow limiters must be installed on stand pipes when Residual Pressure are greater than 25 m above GL.*

8.2 Appendix 2: Letter Mogalakwena LM

8.3 Appendix 3: Bill of Quantities

8.4 Appendix 4: Geohydrological Report

8.5 Appendix 5: Beyond Functional scheme area Report (ORWRDP Masterplan Report)

8.6 Appendix 6: BFCR1 Scheme cluster Layout

8.7 Appendix 7: Schematic Layout Plan (Mini Scheme 13: Dipichi Cluster)

8.8 Appendix 8: MIG approved preliminary design report