Ugu District Municipality

ENSYNC ENGINEERS

GDP DESIGN PROPOSAL REPORT

DOCUMENT CONTROL

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1 INTRODUCTION

UGU District Municipality requested ENsync Engineers to provide professional design proposal for the GDP area, to determine the requirements and cost estimates for the development of a water supply scheme in the community.

This report covers the pipe route, pipe material, valves and other ancillary and a high-level cost estimate of the reticulation system for GDP from the existing Umdoni Reservoir.

2 BACKGROUND

2.1 Background and Overview

ENsync Engineers were requested to plan and propose the GDP Reticulation project. Currently the GDP area does not have proper water supply infrastructure and UGU District Municipality would like to provide such infrastructure to the community in the near future.

2.2 Project Location

The project area is in the uMdoni Local Municipality within the UGU District Municipality in KwaZulu Natal. The project area can be accessed by travelling South along the N2 road from Durban past Scottburgh and Park Rynie. The project area falls on East of the N2 freeway – to be accessed by turning into the R102.

The co-ordinates for the project area are as shown below.

Table 1 Co-ordinates for the project

Project Area	**Latitude**	**Longitude**
GDP Area	30°23'18.49"S	30°39'26.92"E

Figure 1 GDP Project Area

3 WATER SOURCE

The GDP area will be receiving water supply from the existing Umdoni Reservoir currently supplied from Pennington Reservoir and will be receiving a capacity upgrade in the future due to the incoming SCP2 Bulk Water.

4 EXISTING INFRASTRUCTURE

The GDP area currently does not have any water supply infrastructure and even though the surrounding communities have water, they have been without.

4.1 Bulk Pipeline

The existing bulk water infrastructure is split into sections separated by the storage reservoirs, one of which is Umdoni Reservoir. The material of the bulk pipeline is AC and uPVC, and the pipe sizes vary between 110mm diameter to 200mm diameter.

4.2 Reticulation

The GDP area does not have existing reticulation infrastructure.

4.3 Electricity Infrastructure

Existing electricity infrastructure covers the entire footprint of the areas under the scope of the project.

4.4 Road Infrastructure

The project area is accessible by a combination of gravel and paved road network.

5 ESTIMATED CURRENT AND FUTURE WATER DEMANDS

The demand for the project area will be calculated based on the Annual Average Daily Demand (AADD) which will not only incorporate households, but also special institutions located within the project area such as clinics, B&B's and so forth.

The water demand is calculated based on standard guidelines. In summary, demands shall be analysed as follows:

- Present demand – to be obtained from physical site counts based on cadastral layout and recent uMgungundlovu aerial photography.
- Future demand – site demands based on the planed land use zoning as well as population growth estimates based on Census statistics.

5.1 Design Philosophy

This chapter describes the design parameters that are proposed to be used for the design of the replacement pipeline for this project. These criteria have been compiled using the Human Settlement Planning Design Guidelines (Red Book), Department of Water and Sanitation specifications, standards, and specifications from UGU District Municipality and accepted national design practice.

5.1.1 Design Criteria

The design criteria are summarised as follows, see Annexure A for the demand calculation sheet:

Table 2 Design Criteria

Item	Description	Design Parameter	Notes
1.0	Design Horizon	30 years	This design horizon is aligned with the UW Masterplan water supply details.
2.0	Population	• 201 households • 1005 people	Google Earth Aerial Imagery was used to count the number of houses within the supply zone.
3.0	House Occupancy	5 people per household	These are based on the level of service of the area and are verified by the Statistics SA data.
4.0	Non-Domestic Establishments	• B&B	This information was established through an investigation done on site of the project area.
5.0	Growth Rate	2.5% per annum	These are based on land availability and the possibility of growth in the area as per the area analysis of the project supply area.

6.0	Design Water Usage	• Medium 70l/c/d	An informed decision was made when deciding the flows for the area based on the DWS standard and UGU masterplan.
7.0	Conveyance Losses	15%	
8.0	Peak Factor	4	The peak factor used for reticulation system pipeline is 4 as per the Redbook.

5.2 GDP Project Area

Current household counts and typical population statistics based on house counts from aerial imagery are shown in the table below. Population estimates were based on the aerial imagery and compared with the average people per household data from Statistics SA covering the specific areas.

Area	**Household Counts**	**Estimated Population**
GDP Area	201	1005

The previous base data and design criteria was used to estimate the current and future demand for the GDP area:

Therefore, the Gross Annual Average Daily Demand (GAADD) can be calculated as follows:
GAADD= [(201 households x 5ppl/household x 70l/c/d) + 15% losses] = 80902.50 l/day **say 80.90kl/day.**
The future GAADD is: 80.90 + 2.5% growth per year for a period of 30 years = **182.75 kl/day**

5.3 Peak Demand and Peak factors

This refers to the additional capacity required to account for peak water usage periods. It is a safety factor that ensures the water supply system can handle the highest demand levels without experiencing pressure drops or flow issues.

The peak demand which will be used to determine the capacity of the various scheme elements are as follows:

Reticulation: Peak Factor = 4

The peak factor of 4 means that the calculated Annual Average Daily Demand is multiplied by 4 to determine the required pipe size. By using this peak factor, the water supply infrastructure can handle the highest expected water demand without compromising the systems performance. It helps prevent issues such as low water pressure, inadequate flow rates, or pipe failures due to excessive demand.

6 PROPOSED INFRASTRUCTURE

6.1 Pressure Management

The GDP reticulation system will have pipes supplying water through household meters, and the allowable pressure according to the design will be between 2bar and 6 bar at each household point. To maintain these pressures, pressure reducing valves (PRV) will be used to reduce and control the pressure in the system.

6.2 Reticulation System Layout

ENsync Engineers has provided a preliminary design drawing (attached on Annexure B) and high-level cost estimate for the implementation of a reticulation system in the GDP community, and this will be made available to UGU District Municipality to help inform the decision of implementation for this portion of the water supply.

6.3 Metering

The reticulation water system will have household meters at each household entrance point. The metering will enable UGU District Municipality to do relatively accurate water balancing to be carried out in the system, by calculating how much water each household needs and monitoring that consumption.

Table 3 Household demand

Hydraulic Zone	House Count	Demand (l/capita/day)	AADD (kl/day)	Losses @ 15%	GAADD (kl/day)	Household Demand (l/s)
GDP Area	201	70l/c/day	70,35	10,55	182,75	0,010523

7 PROPOSED PIPELINE DETAILS

7.1 Pipeline Diameter

Pipe sizing has been done according to the AADD for the supply zone and considering the peak factor for the reticulation water system of 4.

The pipe diameters and lengths are as follows and they are dependent on the flow that will be supplied to each area.

Table 4 Pipeline diameter and lengths

Pipe Diameter	**Pipe Length**
25mm diameter	2100
50mm diameter	3500
75mm diameter	2800
110mm diameter	2000
Total Length	**10400**

7.2 Material Type Selection

The pipe material for a water system pipeline is selected according to the pressure levels in the design. The options for the reticulation water system for the GPD area are uPVC and HDPE pipe.

For pipes larger that 50mm diameter, uPVC is selected for the following reasons:

- The light weight of the pipe is ideal for handling – suited to labour intensive projects.
- It is easy to install.
- It is durable and tough – resistant to installation damage.
- It has a low frictional resistance and enhanced hydraulic performance.

UPVC is used for reticulation and bulk systems greater than 50mm diameter, with pressure less than 16 bar because it offers uPVC Class 16 and 12.

For pipes less than 50mm diameter, HDPE is selected for the following reasons:

- Durability – the HDPE pipes are durable and resistant to corrosion.
- Flexibility – the pipes can withstand ground movement without cracking.
- Few joints – due to the length of pipe supplied, there are few joints in the system.
- Cost effective – HDPE is cheaper than other pipe materials and have low maintenance costs.

The use of HDPE in reticulation water supply systems for house connections ensures a reliable, efficient and long-lasting water supply system.

8 VALVE AND OTHER CHAMBERS

The valves and chambers in the reticulation water supply system play a crucial role in in controlling for and maintaining the system efficiently. Here are some valves that will be found in the GDP Area:

- Gate Valves: these valves are commonly used in water systems to completely stop or allow the flow of water.
- Air Valves: these valves are used to release air pockets that can accumulate in the system, preventing airlocks and maintaining the systems efficiency. They are installed at all local high points and at a maximum spacing along the flat areas where the pipe runs.
- Scour Valves: these valves are used to remove sediments and debris that may accumulate in the pipe over time and will be installed at all local low points along the pipeline.
- House meters: these valves are used to monitor consumption for individual households in the supply area. They will be constructed at each households entrance point.

The type of valves that will be used will be detailed in the valves and chamber drawings and specified under the tender documents.

9 STREAM CROSSINGS

There is a water course which will need to be crossed along the proposed pipeline route for the GDP area. A geotechnical investigation will be done during the design stage to determine whether a stream crossing below ground would be viable versus a bridge strapping for which is also available for some crossings.

The locations of the watercourse that will be crossed by the pipeline are shown in the table below:

Table 5 Water course location

Water Course Name	Location	
	Latitude	Longitude
Mkumbane River	30°22'54,67"S	30°39'53,59"E

A clear methodology will be finalised between the contractor and the consultant before the installation of these sections.

10 ROAD CROSSINGS

The pipeline route crosses a surfaced and gravel road, and reinstatement will have to be done at these roads. It is the requirement of the Department of Transport DoT that all road crossings be carried out by pipe boring whilst it is proposed that gravel road crossings be carried out by open cut trenching with the necessary provision for traffic deviations and control. This proposal will be confirmed with DoT prior to construction whilst allowance is made for pipe boring for all road crossings.

Table 6 Road crossing location

Road Name	**Latitude**	**Longitude**
R102	30°23'12.01"S	30°39'39.36"E

11 AS-BUILT INFORMATION

ENsync Engineers will provide complete as-built drawings according to the survey of the pipelines constructed. GIS shapefiles will also be provided with the associated attributes together with the close-out report.

12 COST ESTIMATES

The construction cost for the Umdoni South Bulk Augmentation Project is as represented in the terms below.

12.1 GDP Project Area

The construction value includes preliminary and general costs, and the table below represents the high-level cost estimates:

Table 7 Cost Estimates with house connections

DESCRIPTION	Unit	Qty	Rate	Total Estimate (incl VAT)
DIRECT COST				
Umdoni Reservoir Supply Zone				
Reticulation Water System				
GDP	m	10400	R1 170,00	R12 168 000,00
Sub-Total (incl VAT)				**R12 168 000,00**
INDIRECT COST - FEES				
Professional Engineer				
ECSA Fee Guidelines	%	12 168 000	**10,50%**	R1 277 640,00
Additional Services				R0,00
Environmental	%	12 168 000	1,00%	R121 680,00
WULA	%	12 168 000	0,20%	R24 336,00
Geotechnical	%	12 168 000	0,60%	R73 008,00
Topographical Survey	%	12 168 000	1,00%	R121 680,00
Health and Safety	%	12 168 000	0,15%	R18 252,00
Wayleaves, Consents, Va	%	12 168 000	0,25%	R30 420,00
Conveyancer	%	12 168 000	0,30%	R36 504,00
			4%	R425 880,00
Construction Monitoring (Phase	mnths	6	75 000	R450 000,00
Sub-Total (incl VAT)				**R2 153 520,00**
TOTAL (incl VAT)				**R14 321 520,00**

Table 8 Cost Estimates for stand pipes

DESCRIPTION	Unit	Qty	Rate	Total Estimate (incl VAT)
DIRECT COST				
Umdoni Reservoir Supply Zone				
Reticulation Water System				
GDP	m	10400	R800,00	R8 320 000,00
Sub-Total (incl VAT)				**R8 320 000,00**
INDIRECT COST - FEES				
Professional Engineer				
ECSA Fee Guidelines	%	8 320 000	**10,50%**	R873 600,00
Additional Services				R0,00
Environmental	%	8 320 000	1,00%	R83 200,00
WULA	%	8 320 000	0,20%	R16 640,00
Geotechnical	%	8 320 000	0,60%	R49 920,00
Topographical Survey	%	8 320 000	1,00%	R83 200,00
Health and Safety	%	8 320 000	0,15%	R12 480,00
Wayleaves, Consents, Va	%	8 320 000	0,25%	R20 800,00
Conveyancer	%	8 320 000	0,30%	R24 960,00
			4%	R291 200,00
Construction Monitoring (Phase	mnths	6	75 000	R450 000,00
Sub-Total (incl VAT)				**R1 614 800,00**
TOTAL (incl VAT)				**R9 934 800,00**

13 PROPOSAL FOR THE PROJECT AREA

13.1 GDP

The following are the proposals covering the GDP Area which is just East of the N2:

- GDP will be supplied directly from the existing Umdoni Reservoir, which will have the demand for the area already in its capacity.
- The existing Umdoni Reservoir will have a designated outlet to supply GDP, and this will allow for GDP's bulk and reticulation system to be connected independently from the rest of the system supplied by the Umdoni Reservoir.
- ENsync Engineers has provided a preliminary design drawing and high-level cost estimate for this area.
- The GDP reticulation system can be added as a component on the Umdoni South Bulk Water Augmentation Project – where after ENsync Engineers will incorporate it in their design and implementation stages.

14 CONCLUSION

The following conclusions are made from the above investigation:

- The Gross Annual Average Daily Demand for the Umdoni Project Area as determined above is 80,90kL/day. The future demand is 182,75kL/day.
- Implementation of this system upgrade will ensure that the system is able to supply water to the project area for 30 years.
- The total estimated cost for the GDP reticulation system is R14 321 520,00 (incl. VAT).

This report provides a solid foundation for the reticulation system project, but further detailed engineering analysis, environmental impact assessment, and stakeholder engagement are required to refine the design and ensure it's feasibility.

ANNEXURE A – DEMAND CALCULATIONS

GDP

Hydraulic Zone	GPS House Count	Schools' Enrolment	Demand (l) / capita / day		AADD (kl/day)	Losses @ 15%	Bulk GAADD (kl / day)		Storage (24 hrs)	Storage (48 hrs)	Description	Reticulation GAADD (kl / day)			
			Dwelling	Av. HH Size			Current	Future$_{20yrs}$ @ 2.5%				Current	Peak Demand (PF = 4)	GAADD l/s	Ml/day
GDP	201		70	5	70,35	10,55	80,90	182,75			Bulk Meter	182,75	730,99	8,46049453	0,730986727
Total	**201**	**0**	**0**	**0**	**70**	**11**	**81**	**183**		**0**		**183**	**731**		**1**

ANNEXURE B – PROPOSED PIPE ROUTE