



**FORMALIZATION OF THE SETTLEMENT SITUATED ON ERF 6,
ERF 1912, ERF 1926 AND ERF 2037 EZAKHENI E TOWNSHIP**

ENGINEERING SERVICES REPORT

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EZAKHENI E TOWNSHIP: ENGINEERING SERVICES**

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1. INTRODUCTION

Nkanivo Developments on behalf Alfred Duma Local Municipality appointed Ukhozikazi Projects (Pty) Ltd to carry out an assessment for bulk engineering services for the formalization of the settlement situated on Erf 6, Erf 1912, Erf 1926 And Erf 2037 Ezakheni E Township, KwaZulu Natal Province.

2. PURPOSE OF THE REPORT

The purpose of this report is to outline the current status quo and report on the existing capacities for engineering bulk services that are currently being utilised at the mentioned Erfs. This report presents findings of a preliminary site investigation relating to bulk services.

The civil engineering services addressed in this report are as follows:

- Potable Water
- Sanitation
- Roads and Stormwater

3. PROJECT LOCATION

The site is located on Erf 6, Erf 1912, Erf 1926 And Erf 2037 Ezakheni E Township which is approximately 17km South East of Ladysmith CDB, within the Alfred Duma Local Municipality in KwaZulu Natal Province. The proposed formalisation Erfs are bordered by Steadville, Roosboom and Ezakheni Industrial Area within 15km radius of the proposed site.

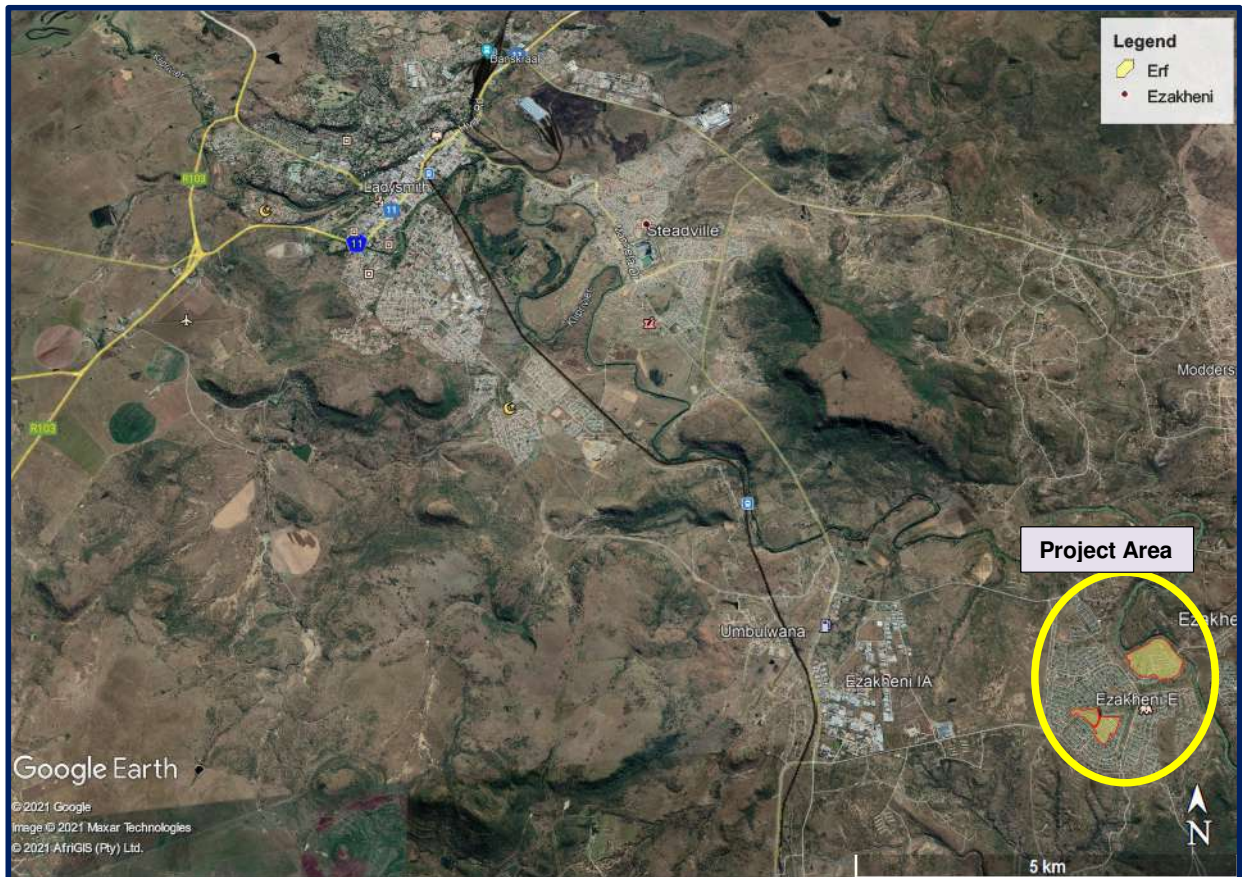


Figure 1: Project Location: Source: Google Earth



Figure 2: Project Study Area: Source: Google Earth

4. SITE VISIT

A site investigation was conducted on the 14th of August 2021, during which the site conditions and services were noted and recorded. The sites will be formalized as per the Township Layouts issued by Nkanivo Development Consultants provided on **Annexure A** of this report.

5. FLOODLINE

The sites are bordered by Kliprivier which meanders approximately 20m North of Erf 6 and approximately 1.6km East of Erf 1912 and Erf 1926 and 2037.

6. LAND USE

The formalised erf's will be zoned as per the Township Layout received from Nkanivo Development attached on this report.

7. WATER

7.1 Findings and Status Quo

The Water Treatment Works of Ezakheni (28°39'59.34"S; 29°52'31.02"E) is currently operating at a capacity of 34 ML/day, it has an abstraction point at the Tugela River and serves the area of Ezakheni. After purification the potable water is stored at the Aasvoelkop Internal Reservoir (5ML) which is located within the Water Treatment Works premises. The water is then pumped to various reservoirs including the two Aasvoelkop External Reservoirs (which mainly serve Ezakheni E), the 8ML Weltevreden Reservoir (which serves Ezakheni C) and the 6ML Rose Hill Reservoir, see **Annexure B**. Aasvoelkop Reservoir One is 2ML in capacity and Aasvoelkop Reservoir Two is 3ML in capacity. Both reservoirs cater for the area of Ezakheni E by means of a Ø 600mm gravity pipeline and a Ø 400mm gravity pipeline which run parallel to each other. Figure 3 and 4 show the two Aasvoelkop Reservoirs servicing the area of Ezakheni.

There are three different sites within the Ezakheni E township that were visited and investigated on site, namely: Erf 6 Ezakheni E, Erf 1926 and Erf 2037 Ezakheni E, and Erf 1912 and Erf 1408 Ezakheni E. These areas appear to be formally developed with built low-cost houses and functioning water systems.



Figure 3: Aasvoelkop Reservoir One



Figure 4: Aasvoelkop Reservoir Two

7.1.1 Erf 6 Ezakheni E

The area of Ezakheni E Erf 6 has a well-functioning water reticulation system. During the site visit it was noted that all the stands within this area were serviced, maintained and metered by the municipality. During the site visit it was also documented that the area receives adequate pressure on the reticulation. Figure 5 and 6 show metered stands within this area. **Annexure C** shows the water and sewer reticulation within the area of Erf 6 Ezakheni E.



Figure 5: Water Meters in Erf 6 Ezakheni



Figure 6: Erf 6 Ezakheni Street View

7.1.1.1 General Design Criteria

The water demand calculations were done according to the design standards and specifications from Section J of "The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version".

Design Element		Criteria
1.	Average Annual Daily Demand (AADD) Residential	0.6 – 0.80 Kl/unit/d
2.	Average Annual Daily Demand (AADD) Business/ Commercial	0.65 Kl/unit/d
3.	Average Annual Daily Demand (AADD) Educational	0.60 Kl/unit/d
4.	Average Annual Daily Demand (AADD) Creche	0.60 Kl/unit/d
5.	Average Annual Daily Demand (AADD) Places of Worship	0.60 Kl/unit/d
6.	Gross Average Annual Daily demand	10% Losses
7.	Peak Factor	1.5
8.	Capacity of Reservoir Storage	48 of AADD
9.	Minimum Head Under Instantaneous Peak Demand	10m
10.	Maximum Head under zero flow conditions	90m
11.	Total Fire Flow (l/s): Moderate Risk 2	15 l/s

Table 1: Summary of Water design criteria

7.1.1.2 Current Water Demand and Supply

Current Daily Water Demand for Erf 6 Ezakheni E

According to Section J of "The Neighbourhood Planning and Design Guide, the potable daily water demands for the existing buildings are as follows:

Land Use	No. of Erven	No. of Units	Area (Ha)	F.A.R	Unit Flow	Unit of Measure	Water Demand (Kl/d)	
Residential	446	446	12,35		0,6	Kl/ unit	267,6	
Business/ Commercial	1		0,23	0,4	0,65	Kl/100m ²	5,98	
TVET College (Educational)	1		3,43	0,4	0,6	Kl/100m ²	82,32	
Creche (Educational)	2		0,14	0,4	0,6	Kl/100m ²	3,36	
Places of Worship (Institutional)	1		0,07	0,4	0,6	Kl/100m ²	1,68	
Public Open Spaces	1		11,46	0,4				
Total AADD							360,94 Kl/d	4,18 l/s
Total GAADD							397,03 Kl/d	4,60 l/s
PAADD							595,55 Kl/d	6,89 l/s

Table 2: Summary of Current Daily Water Demand

7.1.1.3 Fire Water Status Quo

During the site visit a number of fire hydrants were noted. The hydrants noted on site are positioned in areas that allow for a 200m radius to be archived. Therefore, making the fire hydrant positioning and fire planning compliant with the Red Book. Furthermore, the minimum pipe size required for reticulations that have fire hydrants is Ø75mm. According to the layout shown in **Annexure B**, the water reticulation in this area has a minimum of Ø90mm, which complies with the requirement for fire hydrants. This is shown in figure 7 and 8.



Figure 7: Erf 6 Ezakheni Fire Hydrant



Figure 8: Erf 6 Ezakheni Fire Hydrant Valve

7.1.1.4 Summarized Findings of the Current Water and Fire Water System

Erf 6 of Ezakheni E is currently serviced and its receiving adequate water. The observations on site also showed a presence of several fire hydrants indicating a compliant fire water system (it is assumed that the fire hydrants are connected).

7.1.2 Erf 1926 and Erf 2037 Ezakheni E

A well-functioning water reticulation system exists in the Ezakheni E Erf 1926 and Erf 2037 area. During the site visit, it was found that the municipality serviced, maintained, and metered all of the stands in this area. During the site visit, it was also verified that the reticulation in the area receives enough pressure. Metered stands are depicted in Figures 9 and 10. **Annexure D** shows the water and sewer reticulation within the area of Erf 1926 and 2037 Ezakheni E.



Figure 9: Water Meters in Erf 1926 and Erf 2037



Figure 10: Water Meter in relation to Sewer Manhole

7.1.2.1 General Design Criteria

The water demand calculations were done according to the design standards and specifications from Section J of "The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version".

Design Element		Criteria
1.	Average Annual Daily Demand (AADD) Residential	0.6 – 0.80 Kl/unit/d
2.	Average Annual Daily Demand (AADD) Business/ Commercial	0.65 Kl/unit/d
3.	Average Annual Daily Demand (AADD) Educational	0.60 Kl/unit/d
4.	Average Annual Daily Demand (AADD) Creche	0.60 Kl/unit/d
5.	Average Annual Daily Demand (AADD) Places of Worship	0.60 Kl/unit/d
6.	Gross Average Annual Daily demand	10% Losses
7.	Peak Factor	1.5
8.	Capacity of Reservoir Storage	48 of AADD
9.	Minimum Head Under Instantaneous Peak Demand	10m
10.	Maximum Head under zero flow conditions	90m
11.	Total Fire Flow (l/s): Moderate Risk 2	15 l/s

Table 3: Summary of Water design criteria

7.1.2.2 Current Water Demand and Supply

Current Daily Water Demand for Each Building

According to Section J of "The Neighbourhood Planning and Design Guide, the potable daily water demands for the existing buildings are as follows:

Land Use	No. of Erven	No. of Units	Area (Ha)	F.A.R	Unit Flow	Unit of Measure	Water Demand (Kl/d)	
Residential	152	152	48,22		0,6	Kl/ unit	91,2	
School (Educational)	1		2,18	0,4	0,6	Kl/100m ²	52,32	
Public Open Spaces	5		0,80	0,4				
Total AADD							143,52 Kl/d	1,66 l/s
Total GAADD							157,87 Kl/d	1,83 l/s
PAADD							236,81 Kl/d	2,74 l/s

Table 4: Summary of Current Daily Water Demand

7.1.2.3 Fire Water Status Quo

Several fire hydrants were discovered during the site visit. The hydrants noted on site are positioned in areas that allow for a 200m radius to be archived. As a result, the fire hydrant's position and fire planning are in compliance with the Red Book. Furthermore, for reticulations with fire hydrants, a minimum pipe size of 75mm is necessary. Figures 11 and 12 depict this.



Figure 11: Erf 1926 and Erf 2037 Fire Hydrant



Figure 12: Fire Hydrant and valve.

7.1.2.4 Summarized Findings of the Current Water and Fire Water System

Ezakheni E's Erf 1926 and Erf 2037 are currently served and receiving adequate water. On-site observations revealed the presence of multiple fire hydrants, indicating a well-functioning fire water system (it is assumed that the fire hydrants are connected).

9.1.1 Erf 1912 and Erf 1408 Ezakheni E

A reliable water reticulation system exists in the Ezakheni E Erf 1916 and Erf 1408 area. During the site visit it was noted that all the stands within this area were serviced, maintained and metered by the municipality. During the site visit it was also documented that the area receives adequate pressure on the reticulation. Figure 13 and 14 show metered stands. **Annexure E** shows the water and sewer reticulation within the area of Erf 1912 and 1408 Ezakheni E.



Figure 13: Water Valve and Marker Erf 1916 and 1408



Figure 14: Water Meters in 1912 and 1408

7.1.3.1 General Design Criteria

The water demand calculations were done according to the design standards and specifications from Section J of "The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version".

Design Element		Criteria
1.	Average Annual Daily Demand (AADD) Residential	0.6 – 0.80 Kl/unit/d
2.	Average Annual Daily Demand (AADD) Business/ Commercial	0.65 Kl/unit/d
3.	Average Annual Daily Demand (AADD) Educational	0.60 Kl/unit/d
4.	Average Annual Daily Demand (AADD) Creche	0.60 Kl/unit/d
5.	Average Annual Daily Demand (AADD) Places of Worship	0.60 Kl/unit/d
6.	Gross Average Annual Daily demand	10% Losses
7.	Peak Factor	1.5
8.	Capacity of Reservoir Storage	48 of AADD
9.	Minimum Head Under Instantaneous Peak Demand	10m
10.	Maximum Head under zero flow conditions	90m
11.	Total Fire Flow (l/s): Moderate Risk 2	15 l/s

Table 5: Summary of Water design criteria

7.1.3.2 Current Water Demand and Supply

Current Daily Water Demand for Each Building

According to Section J of "The Neighbourhood Planning and Design Guide, the potable daily water demands for the existing buildings are as follows:

Land Use	No. of Erven	No. of Units	Area (Ha)	F.A.R	Unit Flow	Unit of Measure	Water Demand (Kl/d)	
Residential	75	75	2,14		0,6	Kl/ unit	45	
Public Open Spaces	1		3,88	0,4				
Total AADD							45,00 Kl/d	0,52 l/s
Total GAADD							49,50 Kl/d	0,57 l/s
PAADD							74,25 Kl/d	0,86 l/s

Table 7: Summary of Current Daily Water Demand

7.1.3.3 Fire Water Status Quo

During the site visit there were no fire hydrants noted on this specific area. However, one of the several fire hydrants identified in Erf 1916 and Erf 1408 Ezakheni E is positioned to cover a 200m radius that includes this area, see Figure 15 below.



Figure 15: 200m Radius of the Fire Hydrant that is in Erf 1926 and Erf 2037

7.1.3.4 Summarized Findings of the Current Water and Fire Water System

Erf 1912 and Erf 1408 of Ezakheni E is currently serviced and its receiving adequate water. The observations on site also showed a presence of several fire hydrants indicating a compliant fire water system (it is assumed that the fire hydrants are connected).

8 SANITATION

8.1 Findings and Status Quo

Sanitation facilities, like most of the other infrastructure elements in the Ezakheni region, have vastly improved. The area of Ezakheni predominantly has flushing toilets connected to a sewer reticulation system. Currently, the area of Ezakheni is serviced by the Ezakheni Waste Water Treatment Works (WWTW) co-ordinates 28°38'9.03"S; 29°55'28.97"E, however this WWTW is currently not functioning. The design capacity of the wastewater plant is currently 12 Mℓ /day. Through a reticulation network and outfall sewer lines, the waste water facility receives sewer generated from the Ezakheni, nearby and domestic sewer.

There are three different sites within the Ezakheni E township that were visited and investigated on site, namely: Erf 6 Ezakheni E, Erf 1926 and Erf 2037 Ezakheni E, and Erf 1912 and Erf 1408 Ezakheni E. These areas appear to be formally developed with built low-cost houses and a sewer reticulation system.

8.1.1 Erf 6 Ezakheni E

The stands within the area of Erf 6 Ezakheni E are fully reticulated with a water borne sewer system. The flushing toilets are mainly located within the wards of the stands and not inside the houses. Effluent within the sewer reticulation system gravitates to two different pump stations located within Ezakheni E. Previously, the pump stations pumped to the Ezakheni Waste Water Treatment Works but due to the WWTW not functioning the effluent is retained in the retention pond and pumped into the nearby Klip River. The minimum pipe size within the reticulation system is 110mm diameter (See figure 16 and 17). **Annexure C** shows the water and sewer reticulation within the area of Erf 6 Ezakheni E.



Figure 16: Erf 6 Ezakheni Toilets



Figure 17: One of Erf 6 Pump Stations



Figure 18: Retention Pond at the Erf 6 pumpstation

8.1.1.1 General Design Criteria

The sewer flow calculations were done according to the design standards and specifications from Section K of “The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version

Design Element		Criteria
1.	Average Annual Daily Demand (AADD) Residential	0.48 – 0.56 Kl/unit/d
2.	Average Annual Daily Demand (AADD) Business/ Commercial	0.52 Kl/unit/d
3.	Average Annual Daily Demand (AADD) Educational	0.48 Kl/unit/d
4.	Average Annual Daily Demand (AADD) Creche	0.48 Kl/unit/d
5.	Average Annual Daily Demand (AADD) Places of Worship	0.48 Kl/unit/d
6.	Allowance for Infiltration	15%
7.	Peak Factor	2.5

Table 6: Summary of Sewer design criteria

8.1.1.2 Sewer Analysis

The sewer flow calculations were done according to the design standards and specifications from Section K of “The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version”.

8.1.1.3 Current Sewer Flow

Land Use	No. of Erven	No. of Units	Area (Ha)	Unit Flow	Water Demand (Kl/d)	
Residential	446	446	12,35	0,48	214,08	
Business/ Commercial	1		0,23	0,52	4,784	
TVET College (Educational)	1		3,43	0,48	65,856	
Creche (Educational)	2		0,14	0,48	2,688	
Places of Worship (Institutional)	1		0,07	0,48	1,344	
Public Open Spaces	1		11,46			
PDDWF					288,75 Kl/d	3,34 l/s
15% Infiltration					43,31 Kl/d	0,50 l/s
Total IPWDF					332,06 Kl/d	3,84 l/s
Total IPWWF					830,16 Kl/d	9,61 l/s

Table 7: Summary of Current Sewer flows

8.1.1.4 Summarized Findings of the Current Sewer Analysis

During the site visit, no blocked or overflowing manholes were noted. The current sewer reticulation system appears to be adequate. The pump stations however have some retained water in the inlet of the pump sump.

8.1.2 Erf 1926 and Erf 2037 Ezakheni E

The stands within the area of Erf 1926 and Erf 2037 Ezakheni E are fully reticulated with a water borne sewer system. The minimum pipe size within the reticulation system is 110mm diameter. During the site visit several manholes were blocked (See figure 19 and 20). **Annexure D** shows the water and sewer reticulation within the area of Erf 1926 and Erf 2037 Ezakheni E.



Figure 19: Sewer manholes in Erf 1926 and Erf 2037



Figure 20: Blocked Sewer Manhole

8.1.2.1 General Design Criteria

The sewer flow calculations were done according to the design standards and specifications from Section K of “The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version

Design Element		Criteria
1.	Average Annual Daily Demand (AADD) Residential	0.48 – 0.56 Kl/unit/d
2.	Average Annual Daily Demand (AADD) Business/ Commercial	0.52 Kl/unit/d
3.	Average Annual Daily Demand (AADD) Educational	0.48 Kl/unit/d
4.	Average Annual Daily Demand (AADD) Creche	0.48 Kl/unit/d
5.	Average Annual Daily Demand (AADD) Places of Worship	0.48 Kl/unit/d
6.	Allowance for Infiltration	15%
7.	Peak Factor	2.5

Table 8: Summary of Sewer design criteria

8.1.2.2 Sewer Analysis

The sewer flow calculations were done according to the design standards and specifications from Section K of “The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version”.

8.1.2.3 Current Sewer Flow

Land Use	No. of Erven	No. of Units	Area (Ha)	Unit Flow	Water Demand (Kl/d)	
Residential	152	152	48,22	0,48	72,96	
School (Educational)	1		2,18	0,48	41,856	
Public Open Spaces	5		0,80			
PDDWF					114,82 Kl/d	1,33 l/s
15% Infiltration					17,22 Kl/d	0,20 l/s
Total IPWDF					132,04 Kl/d	1,53 l/s
Total IPWWF					330,10 Kl/d	3,82 l/s

Table 9: Summary of Current Sewer flows

8.1.2.4 Summarized Findings of the Current Sewer Analysis

During the site visit, several blocked and overflowing manholes were noted. This could be as a result of sewer foreign objects in the system, inadequate pipe size, inadequate gradient, etc. A more detailed investigation must be conducted to determine the cause of the blockages in this system.

8.1.3 Erf 1912 and Erf 1408 of Ezakheni E

The stands in Ezakheni E's Erf 1912 and Erf 1408 are fully reticulated with a water-borne sewer system. The reticulation system's minimum pipe size is 110mm in diameter. During the site visit, there were no blocked or overflowing sewer manholes (See figure 20 and 21). **AnnexureE** shows the water and sewer reticulation in the Ezakheni E area of Erf 1912 and Erf 1408.



Figure 21: Erf 1912 and Erf 1408 Toilets and Stands



Figure 22: Toilets in the area of Erf 1912 and 1408

8.1.3.1 General Design Criteria

The sewer flow calculations were done according to the design standards and specifications from Section K of "The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version

Design Element		Criteria
1.	Average Annual Daily Demand (AADD) Residential	0.48 – 0.56 Kl/unit/d
2.	Average Annual Daily Demand (AADD) Business/ Commercial	0.52 Kl/unit/d
3.	Average Annual Daily Demand (AADD) Educational	0.48 Kl/unit/d
4.	Average Annual Daily Demand (AADD) Creche	0.48 Kl/unit/d
5.	Average Annual Daily Demand (AADD) Places of Worship	0.48 Kl/unit/d
6.	Allowance for Infiltration	15%
7.	Peak Factor	2.5

Table 10: Summary of Sewer design criteria

8.1.3.2 Sewer Analysis

The sewer flow calculations were done according to the design standards and specifications from Section K of "The Neighbourhood Planning and Design Guide (Also known as the Redbook) 2019 version".

8.1.3.3 Current Sewer Flow

Land Use	No. of Erven	No. of Units	Area (Ha)	Unit Flow	Water Demand (Kl/d)	
Residential	75	75	2,14	0,48	36	
Public Open Spaces	1		3,88			
PDDWF					36,00 Kl/d	0,42 l/s
15% Infiltration					5,40 Kl/d	0,06 l/s
Total IPWDF					41,40 Kl/d	0,48 l/s
Total IPWWF					103,50 Kl/d	1,20 l/s

Table 11: Summary of Current Sewer flows

8.1.3.4 Summarized Findings of the Current Sewer Analysis

During the site visit, no blocked or overflowing manholes were noted. The current sewer reticulation system appears to be adequate.

9 ROADS

9.1 Existing Roads Infrastructure

The existing roads for Erf 6, Erf 1912 and Erf 1926 & 2037 are similar. They are mostly gravel roads with darkish material which helps with skid resistance during rainy seasons.

There are some surfaced roads on Erf 1912 which are currently in a fair condition.

The following information was recorded on the existing roads:

- The mentioned Erfs are connected by the Main Collector which is Road P333 (Rolihlahla Drive)
- The sites are located South of Rolihlahla Drive
- They are bordered by the R103 which connects Ladysmith to Colenso
- The roads within these Erfs can be classified under Class 5- UC Category according to the Guidelines for Human Settlement Planning and Design
- Annexures C to E are existing layouts which were obtained from the Municipality, according to these no formal roads and stormwater has been recorded.

9.1.1 Photographic Information Erf 6



Figure 23: Internal access street



Figure 24: Umabilwane Road



Figure 25: Existing Bridge over Kliprivier River



Figure 26: Bridge over Kliprivier



Figure 27: Gravel material on existing roads



Figure 28: End of surfacing after bridge to Umabilwana Road

9.1.2 Photographic Information Erf 1926 and 2037



Figure 29: Internal access street



Figure 30: Umabilwane Road



Figure 31: Gravel road Sambane Road



Figure 32: Concrete pipe used as bridge crossing

9.1.3 Photographic Information Erf 1912



Figure 33: Internal access street



Figure 34: Umabilwane Road



Figure 35: Existing Bridge over Kliprivier River

9.2 Proposed Roads Infrastructure

In order to formalize the roads infrastructure within these Erfs, all roads should be designed in accordance with the Guidelines for Human Settlement and Design (Red Book). Typical Geometry and Pavement design standards are highlighted below.

9.2.1 Typical Roads Geometry

The typical roads geometry should be as per the table below:

Geometric Design Standard		
Design Element	Design Parameter	Design Value
Min turning radius: Collector Roads Local Streets	Multi-link trucks, heavy vehicle, articulated bus, single unit bus / semi-trailer Passenger car	15m
Speed Design: Collector roads Local streets		
Stopping Sight Distance: Collector roads Local streets	Not to be considered	80m 50m
Super elevation Local streets		2-4 % None
Min k-values (Sags & Crests): Collector streets Local streets		3%
Camber		

Table 12: Geometric Design Standards

9.2.2 Typical Roads Pavement Design

Typical pavement design for internal roads within the Erf: The layerworks must be confirmed once a Geotechnical Investigation has been conducted. The information below is solely based on visual inspection and the design requirement as per Red Book.





	80 mm interlocking block paving 20 mm river sand.
	150mm C4 stabilised sub-base compacted to 97% Mod. AASHTO density,
	150mm G7 Imported gravel selected material to 95% Mod. AASHTO density
	Rip and recompact in-situ roadbed G7 material at 93% Mod. AASHTO or 500 mm dump rock Pioneer Layer, (where underground water is encountered)

Table 13: Typical Road Layerworks for Internal Access Roads

10 STORMWATER DRAINAGE

10.1 Existing Stormwater Infrastructure

The following information was recorded:

- No formal stormwater was noted on the internal access roads
- The stormwater system was only noted on the main access which is Dr Rolihlahla Drive on Erf 6
- A watercourse was noted on the South of Erf 6; one was also noted on the North of Erf 1926 and 2037; and another within Erf 1912
- On Erf 1912 some concrete pipes are used to discharge water from the residents properties into the wetland.
- Stormwater ponding on Dr Rolihlahla drive
- Blocked stormwater pipes on Dr Rolihlahla Drive
- On Erf 1926 a natural watercourse on Sigwala Road was noted, this watercourse has been used as a waste dump, which has caused the stormwater inlet and outlet to be completely blocked. This is one cause of pollution and becomes a hazard during flooding.
- There are kerb inlets in good condition on Erf 1912 within Sigwala Road vicinity

10.1.1 Photographic Information Erf 6



Figure 36: No stormwater was noted on the internal roads



Figure 37: Stormwater ponding on Dr Rolihlahla Drive



Figure 38: Blocked Kerb inlet on Dr Rolihlahla Drive

10.1.2 Photographic Information Erf 1926 and 2037



Figure 39: Stormwater pipe from a property into the wetland



Figure 40: Earth drain blocked



Figure 41: Natural watercourse used for dumping waste



Figure 42: Blocked stormwater outlet on Sigwala Road

10.1.3 Photographic Information Erf 1912



Figure 43: Kerb inlet to channel stormwater



Figure 44: kerb inlet



Figure 45: Kerb Inlet in good condition



Figure 46: Wetland

10.2 Proposed Infrastructure

The stormwater management system within the sites shall be designed in accordance with the Red Book.

The stormwater can be discharged into the main system on Dr Rolihlahla, however that can be done once the capacity of the catchment has been confirmed.

10.2.1 Standards and Specifications

Minimum Pipe size	: 450 mm
Pipe Material	: Ogee pipes
Minimum Gradient	: 1:150
Catch pit, junction boxes etc	: In accordance with the Red Book

10.2.2 Design Criteria

Return Period:	1:5 years for the combined pipe and road systems
Design Method:	Rational method
Average yearly rainfall to be used	585mm.

11 RECOMMENDATIONS

11.1 Water Use

The water supply at all the three sites (Erf 6 Ezakheni E, Erf 1926 and Erf 2037 Ezakheni E, and Erf 1912 and Erf 1408 Ezakheni E) is currently adequate for the current domestic use. No problems were reported, investigated or observed.

11.2 Sanitation

During the site visit in Erf 1926 and Erf 2037 Ezakheni E, several blocked and overflowing manholes were noted. A more detailed investigation must be conducted to determine the cause of the blockages in this system.

11.3 Roads

The internal access roads to be designed according to the manual, currently some other roads alignment does not appear to conform to standards.

11.4 Stormwater

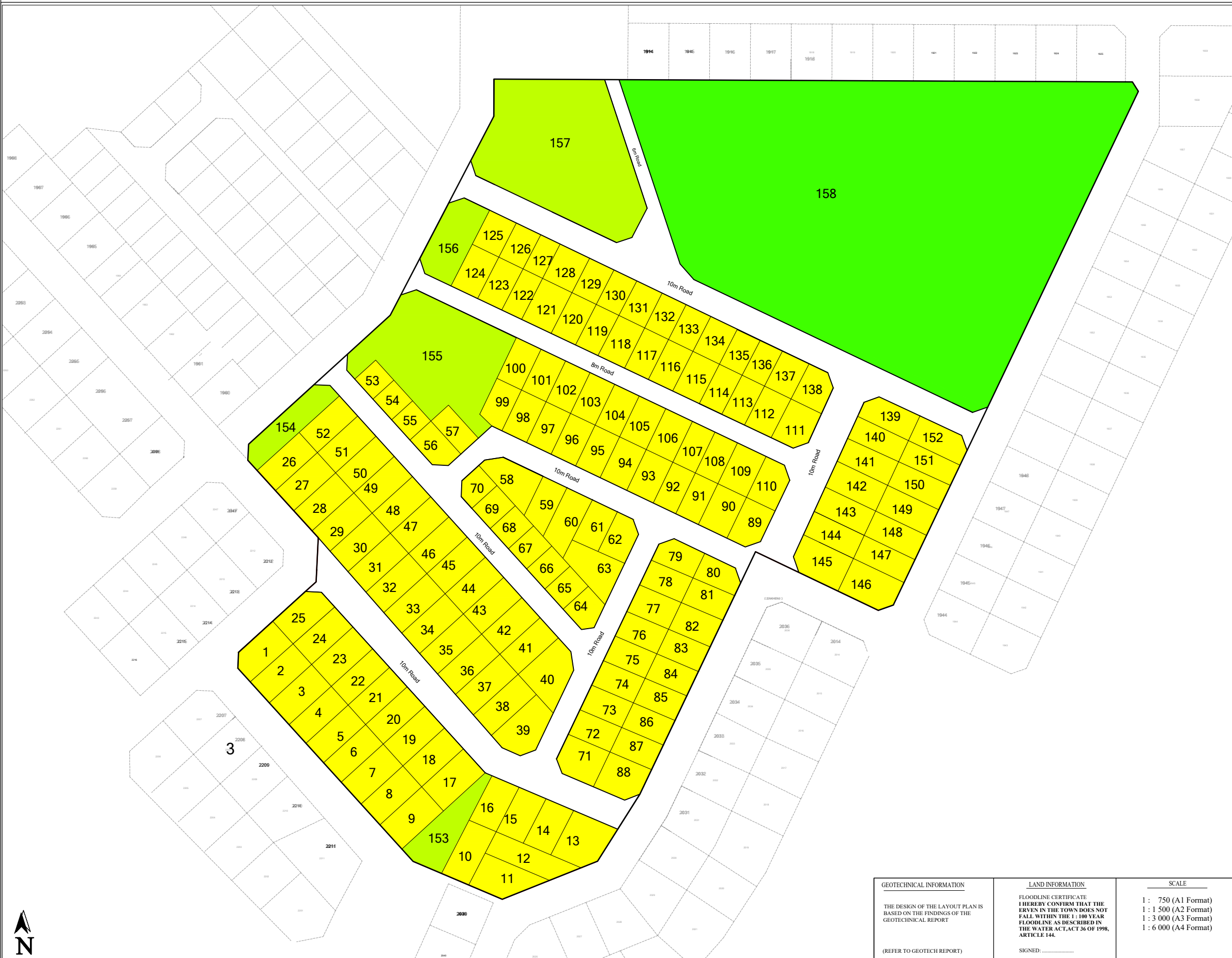
The stormwater system that is blocked, it is recommended that the system be cleaned in order to ensure that the pipes are functioning to the full capacity that were designed for.

ANNEXURES

ANNEXURE A- NKANIVO TOWNSHIP LAYOUTS

TOWNSHIP LAYOUT PLAN

Erf 1926 and Erf 2037 Ezakheni E Township



LOCALITY MAP



ZONING	LAND USES	ERVEN	TOTAL ERVEN	AREA (HA)	AREA (%)	NOTATION
RESIDENTIAL	DWELLING UNIT	1-152	152	4.06	48.22	
SCHOOL	SCHOOL	158	1	2.18	25.89	
ACTIVE PUBLIC OPEN SPACE	PUBLIC OPEN SPACE	153-157	5	0.80	9.74	
STREET				1.36	16.15	
TOTAL DEVELOPABLE AREA			158	8.42	100	

NOTES:

- Represents Proposed Township Boundary (Erf 6)
- Represents Contours
- Average residential stand size is 250m²
- Street/Road width 8m - 10m
- Servitudes range from 4m - 5m
- All areas and distances are approximate and subject to final survey

SURVEY NOTES:

CONTOUR INTERVALS 1 M IN ACCORDANCE TO REG. ORDINANCE

SURVEYOR GENERAL SYSTEM WGS 84

CLIENT: ALFRED DUMA LOCAL MUNICIPALITY

AlfredDuma

Local Municipality

Service Delivery beyond expectation

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LAND SURVEYOR (WINDUS M & ASSOCIATES SURVEYS)		
CONSULTING ENGINEER (-)		
DESIGNED:	REFILWE PHEEHA	
CHECKED:	NYIKO BALOYI & SAMUEL CHAUKE Tech.Pln (-)	
DRAWING No:	2021-001	
DATE:	05/08/2021	

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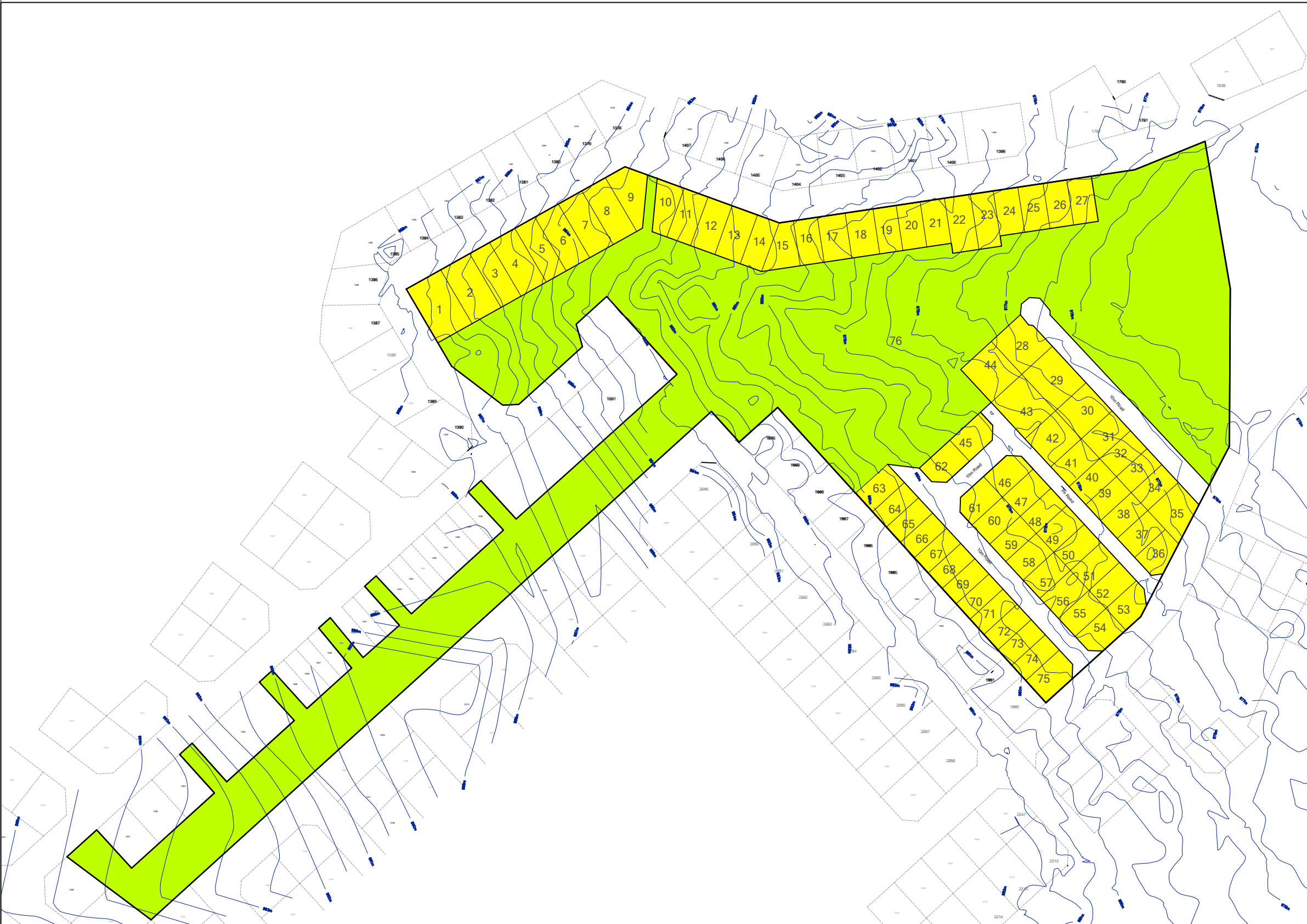
GEOTECHNICAL INFORMATION	LAND INFORMATION	SCALE
THE DESIGN OF THE LAYOUT PLAN IS BASED ON THE FINDINGS OF THE GEOTECHNICAL REPORT (REFER TO GEOTECH REPORT)	FLOODLINE CERTIFICATE I HEREBY CONFIRM THAT THE ERVEN IN THE TOWN DOES NOT FALL WITHIN THE 1 : 100 YEAR FLOODLINE AS DESCRIBED IN THE WATER ACT, ACT 36 OF 1998, ARTICLE 144. SIGNED:	1 : 750 (A1 Format) 1 : 1 500 (A2 Format) 1 : 3 000 (A3 Format) 1 : 6 000 (A4 Format)



TOWNSHIP LAYOUT PLAN

Erf 1912 and Erf 1408 Ezakheni E Township

LOCALITY MAP



ZONING	LAND USES	ERVEN	TOTAL ERVEN	AREA (HA)	AREA (%)	NOTATION
RESIDENTIAL	DWELLING UNIT	1-75	75	2.14	33.33	
ACTIVE PUBLIC OPEN SPACE	PUBLIC OPEN SPACE	76	1	3.88	60.43	
STREET				0.40	6.24	
TOTAL DEVELOPABLE AREA			76	6.42	100	

NOTES:

1. ——— Represents Proposed Township Boundary (Erf 6)
2. ——— Represents Contours
3. Average residential stand size is 250m²
4. Street/Road width 7m - 15m
5. Servitudes range from 4m - 5m
6. All areas and distances are approximate and subject to final survey

SURVEY NOTES:

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Alfred Duma

Local Municipality

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CONSULTING ENGINEER (-)		
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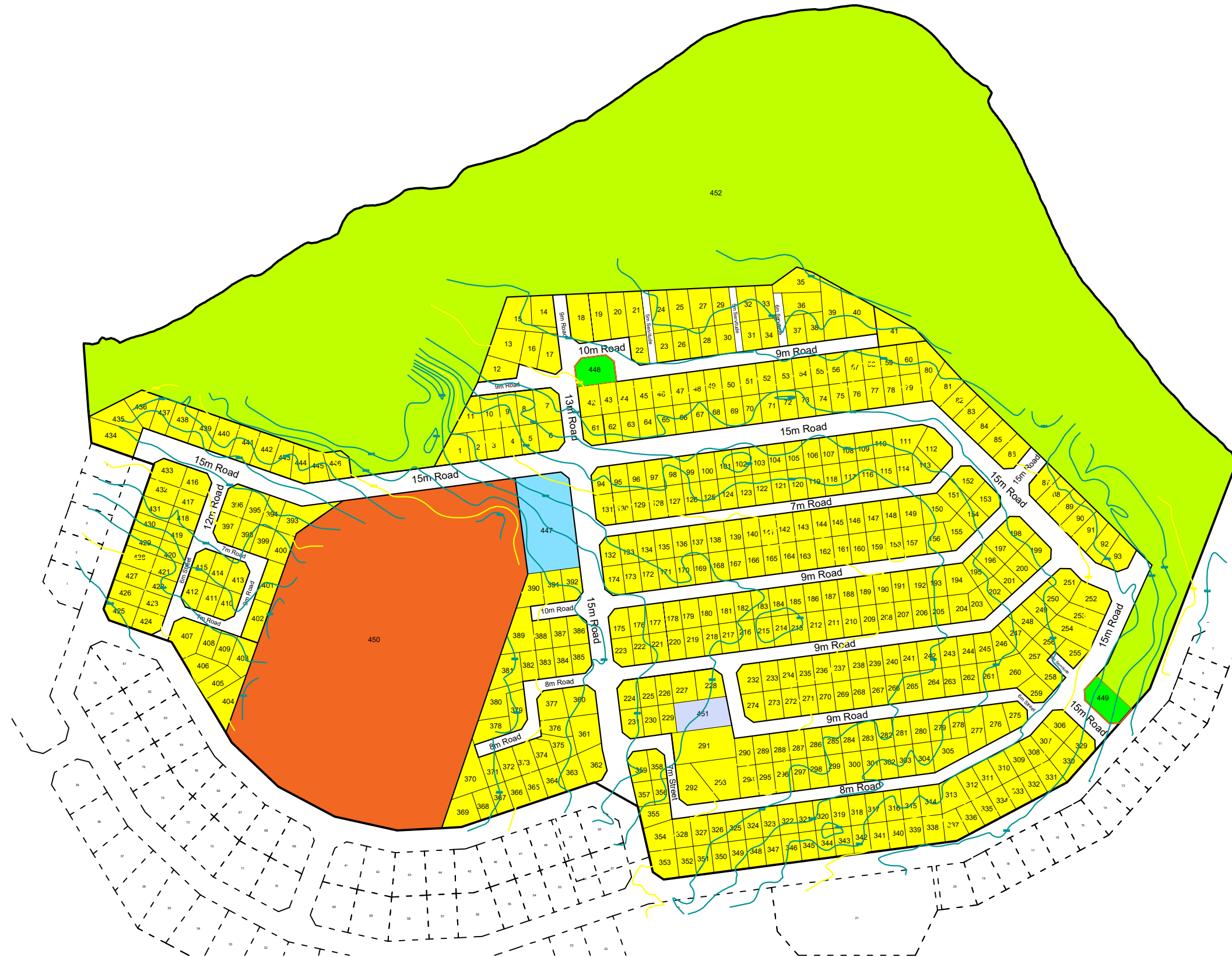
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- 1 : 2 000 (A3 Format)
- 1 : 4 000 (A4 Format)



TOWNSHIP LAYOUT PLAN

Erf 6 Ezakheni E Township

LOCALITY MAP



ZONING	LAND USES	ERVEN	TOTAL ERVEN	AREA (HA)	AREA (%)	NOTATION
RESIDENTIAL	DWELLING UNIT	1-446	446	12.35	39.20	
LOW IMPACT MIXED USE	SHOP	467	1	0.23	0.73	
CRECHE	CRECHE	448-449	2	0.14	0.44	
INSTITUTION	TVET COLLEGE	450	1	3.43	10.60	
WORSHIP	PLACE OF WORSHIP	451	1	0.07	0.22	
ACTIVE PUBLIC OPEN SPACE	PUBLIC OPEN SPACE	452	1	11.46	36.38	
STREET				3.82	12.12	
TOTAL DEVELOPABLE AREA			452	31.50	100%	

NOTES:
 1. ——— Represents Proposed Township Boundary (Erf 6)
 2. ——— Represents Contours
 3. Average residential stand size is 250m²
 4. Street width 6m - 15m
 5. Servitudes 4m - 5m
 6. All areas and distances are approximate and subject to final survey

SURVEY NOTES:
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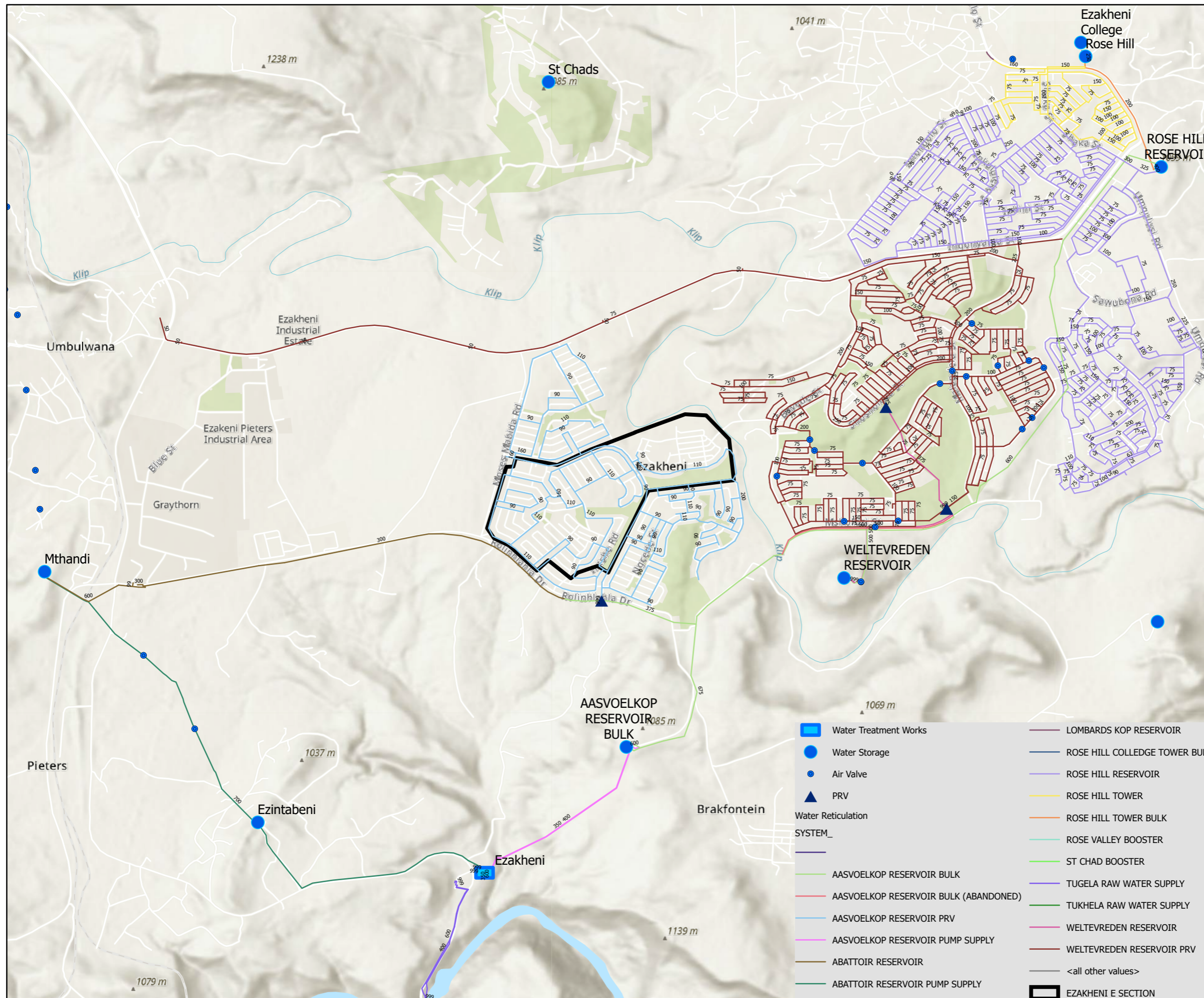
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ANNEXURE B- EZAKHENI WATER RETICULATION

EZAKHENI WATER RETICULATION



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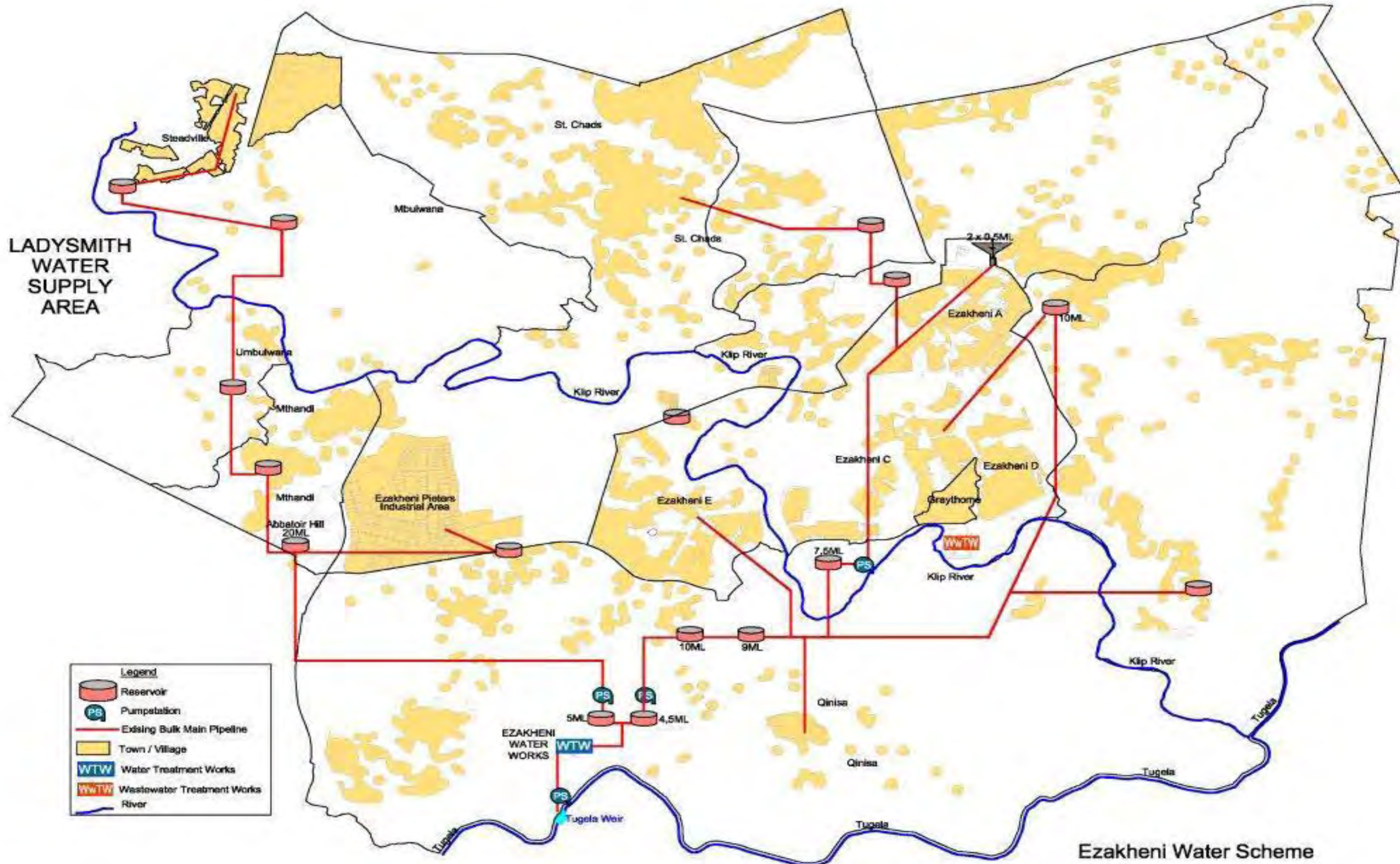


Figure 12 - Schematic layout of Ezakheni Water Supply Scheme area

(Source: First Stage Reconciliation Strategy for Ezakheni Water Supply Scheme Area Emnambithi Municipality, 2011)

ANNEXURE C- EXISTING ERF 6 LAYOUT

ANNEXURE C- EXISTING ERF 6 LAYOUT



Alfred Duma
Local Municipality

lot 6

Legend

- ADLM Water Pipes
- ADLM PROPERTY UPDATED REGISTRY
- elec. lines, wq20
- SEWER, Gravity
- combus. wq20
- LSM, Streets



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Alfred Duma Municipality
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Valuation Roll

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ANNEXURE D- EXISTING ERF 1926 &2037 LAYOUT



LOT 1926

- Legend
- ADLM Water Pipes
 - ADLM PROPERTY UPDATED REGISTRY
 - Elec. line, w/g2S
 - SEWER, Gravelly
 - Cable & w/g2S
 - Local Streets

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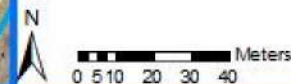
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LOT 2037

- Legend
- ADLM Water Pipes
 - ADLM PROPERTY UPDATED REGISTRY
 - elec. line 220V
 - SEWER, Gravity
 - concrete water
 - LSM6 Streets

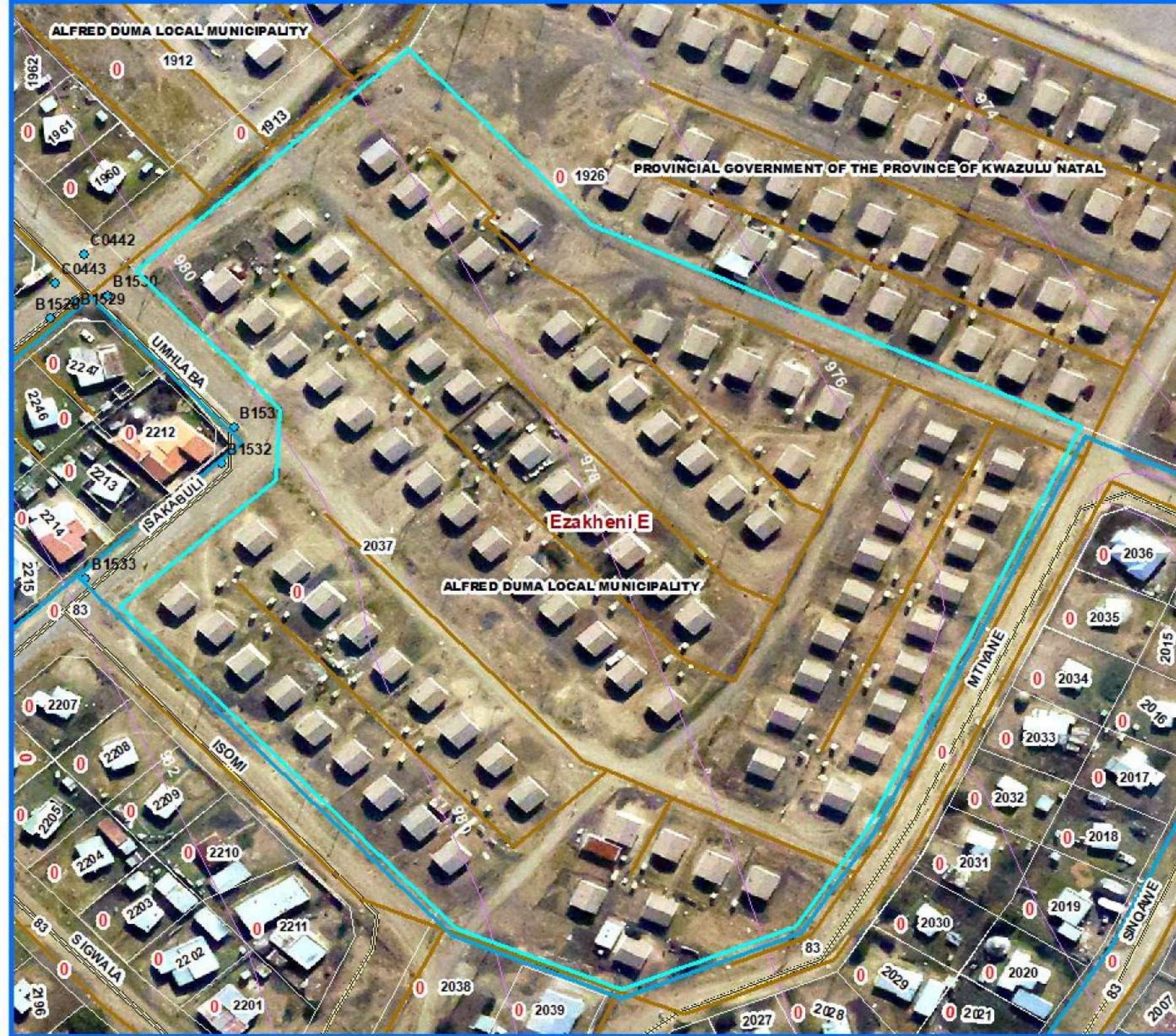
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ANNEXURE E- EXISTING ERF 1912 LAYOUT



LOT 1912

- Legend
- ADLM Water Pipes
 - ADLM PROPERTY UPDATED REGISTRY
 - elec. lines w/22
 - SEWER, Gravity
 - contour, w/10
 - LSM, Streets

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