PROPOSED DEVELOPMENT OF PORTION 24 AND 28 OF 567 MOHLABA, TZANEEN, LIMPOPO

BULK ENGINEERING SERVICES REPORT

October 2022, Rev3

PREPARED BY:

Dalimede Projects (PTY) LTD
No. 11 Pierre Street,
IT Park RentCo Building,
Office 6,
Bendor, Polokwane,
South Africa,
0699

Tel: 015 291 0775,
Cell: 079 368 8414,
E-mail: admin@dalimede.com

PREPARED FOR:

Vaxumi Consulting Town Planners
11 Henry Morey Street
White River
P.O Box 322
White River
Mpumalanga
1240

Tel: 012 770 4022
Cell: +27 71 876 0042
Email: maluleke@vaxumi.co.za

EXECUTIVE SUMMARY

There is a proposal to develop a township on portions 24 and 28 of 567 Mohlaba, Tzaneen, Limpopo. The following summarises the report:

LOCALITY

The proposed township on portion 24 and 28 of 567 Mohlaba, is located in Dan, Limpopo, east of Tzaneen town CBD. The area is administered by Tzaneen Local Municipality, under the Mopani District Municipality. GPS coordinates of site are 23°52'42.38"S 30°15'34.16"E.

TOPOGRAPHY AND ACCESS

The site can be accessed via road R36, internal streets, and road D673 to Letaba Hospital.

The R36 is surfaced and in good condition but the internal street is earth road.

An application to connect the township to the existing R36 road has to be approved by road authority, SANRAL, prior to construction.

WATER SERVICE

1. Nkowankowa WTW abstracts raw water from Groot Letaba River. The water treatment works then purifies the water and supplies water to Dan Reservoirs. The WTW design capacity is 24Mℓ/day. GPS: 23°52'26.47"S 30°16'23.12"E.
2. Purified water is pumped from Nkowankowa WTW to the Dan village reservoirs. There are two pumping pipelines conveying the water.
3. The Dan reservoirs inlet pipe sizes are 300mm and the reservoirs outlet has a 450mm diameter.
4. Purified water from the Nkowankowa WTW is also pumped directly to the water reticulation.
5. In the vicinity of the proposed development, there is an existing 200mm diameter bulkline conveying water to the industrial area.
6. There are two reservoirs in Dan, viz;
7. Two concrete reservoirs. GPS coordinates 23°53'51.10"S 30°15'54.04"E and 23°53'52.71"S 30°15'52.98"E.
8. The reservoirs have a combined capacity of 20Mℓ. The reservoirs supply Nkowankowa, Mokgolotho, Dan, Juliesburg and Mulati.
9. Reservoirs inlet pipe valves are opened at 8pm daily, while the outlet pipe valves are closed also at 8pm daily.
10. Reservoirs inlet pipe valves are the closed at 4am daily, while the outlet pipe valves are the opened also at 4am daily.
11. The site does not have water reticulation.
12. The water demand calculations indicate that the proposed development will require 1 673.1kℓ/d AADD and 1 840.7kℓ/d Gross Average Annual Daily Demand.
13. The output from the Nkowankowa WTW is not reaching capacity because of the following:
    - 13.1. Eskom electricity supply load shedding at the WTW.
    - 13.2. There are two back-up electricity generators at the WTW. One is operational and one is not working. The one functional generator is only capable of powering one of the three pumps at the WTW.

13.3. The generators require a steadily available supply of diesel.

14. It has been reported that the Dan water networks experience severe water leaks.
15. Water infrastructure proposed:
    15.1. The proposed development will require a water storage of 3.4Mℓ., alternatively a water bulkline can be connected to the existing Dan concrete ground reservoirs and feed the proposed development.
    15.2. Application for an increased water license use from the Department of Water and Sanitation.
    15.3. Upgrading of the Nkowankowa WTW.
    15.4. For the proposed development to have water reticulation to yard connection standard.
    15.5. Upgrading of the electricity generators at the Nkowankowa WTW.
    15.6. Upgrading of the existing water line to accommodate the proposed development.

SEWER SERVICE

1. The Dan, area is serviced by the following wastewater treatment works (WWTW):
    1.1. Nkowankowa WWTW, GPS 23°53'37.87"S 30°19'7.55"E. The design capacity of the WWTW is 2Mℓ/d. The town has bulk sewer infrastructure in place.
2. There is an existing bulk sewer pipeline that is currently servicing Dan.
3. The sewer bulk line flows to the existing wastewater treatment works.
4. There is an existing 300mm diameter sewer outfall located near the industrial area.
5. There is NO existing sewer reticulation onsite.
6. The development will have an estimated sewer ADWF of 1 422.2kℓ/d and a gross sewer flow of 1 635.5kℓ/d.
7. This peak wastewater flow from the development is LESS than the pipe capacity of the existing sewer outfall.
8. The proposed wastewater infrastructure is as follows:
    8.1. That the proposed township has sewer reticulation.
    8.2. That a sewer pump station be built at the lowest elevation of the proposed development. The proposed pump station will convey sewer through a pumping line to the gravity manhole on the 300mm diameter sewer outfall.
    8.3. That the proposed township be connected to the existing sewer outfall.
    8.4. That the Nkowankowa WWTW be upgraded.

ELECTRICITY

There is existing electricity supply infrastructure in the vicinity of Mohlaba. This could be utilised to supply the development, subject to approval from the power authority.

TOWNSHIP ROADS

There is an existing functioning road network that can be used to access Mohlaba.

STORMWATER DRAINAGE

A stormwater management plan will need to be submitted to the municipality before construction starts. Extraneous stormwater from above the site will be accommodated over the site.

SOLID WASTE

Calculated solid waste Mohlaba is expected to generated per annum is 1752 tons.

Table of Contents

Tables

Annexures

Figures

Abbreviations

AADD	-	Average Annual Daily Demand
ADWF	-	Average Dry Weather Flow
DWS	-	Department of Water and Sanitation
FAR	-	Floor Area Ratio
IDP	-	Infrastructure Development Plan
kℓ	-	Kilo Litres
kℓ/day	-	Kilo Litres per day
ℓ/s	-	Litres per second
m^3	-	Cubic metre
MAP	-	Mean Annual Precipitation
Mℓ /day	-	Mega litres per day
PSC	-	Project Steering Committee
RWS	-	Regional Water Scheme
SANRAL	-	South African National Roads Authority Limited
StatsSA	-	Statistics South Africa
VIP toilet	-	Ventilated Improved Pit toilet
WC	-	Water Committee

1 INTRODUCTION

There is a proposal to develop a township on portion 24 and 28 of 567 Mohlaba, Tzaneen, Limpopo.

This report outlines the engineering services needed for the proposed development.

2 LOCALITY

The proposed portion 24 and 28 of 567 Mohlaba, Tzaneen, Limpopo, is located 30km east of Tzaneen town CBD along the R36 road. The area is administered by Tzaneen Local Municipality, under the Mopani District Municipality. GPS coordinates of site are 23°52'42.38"S 30°15'34.16"E

The locality map is shown on the figures below

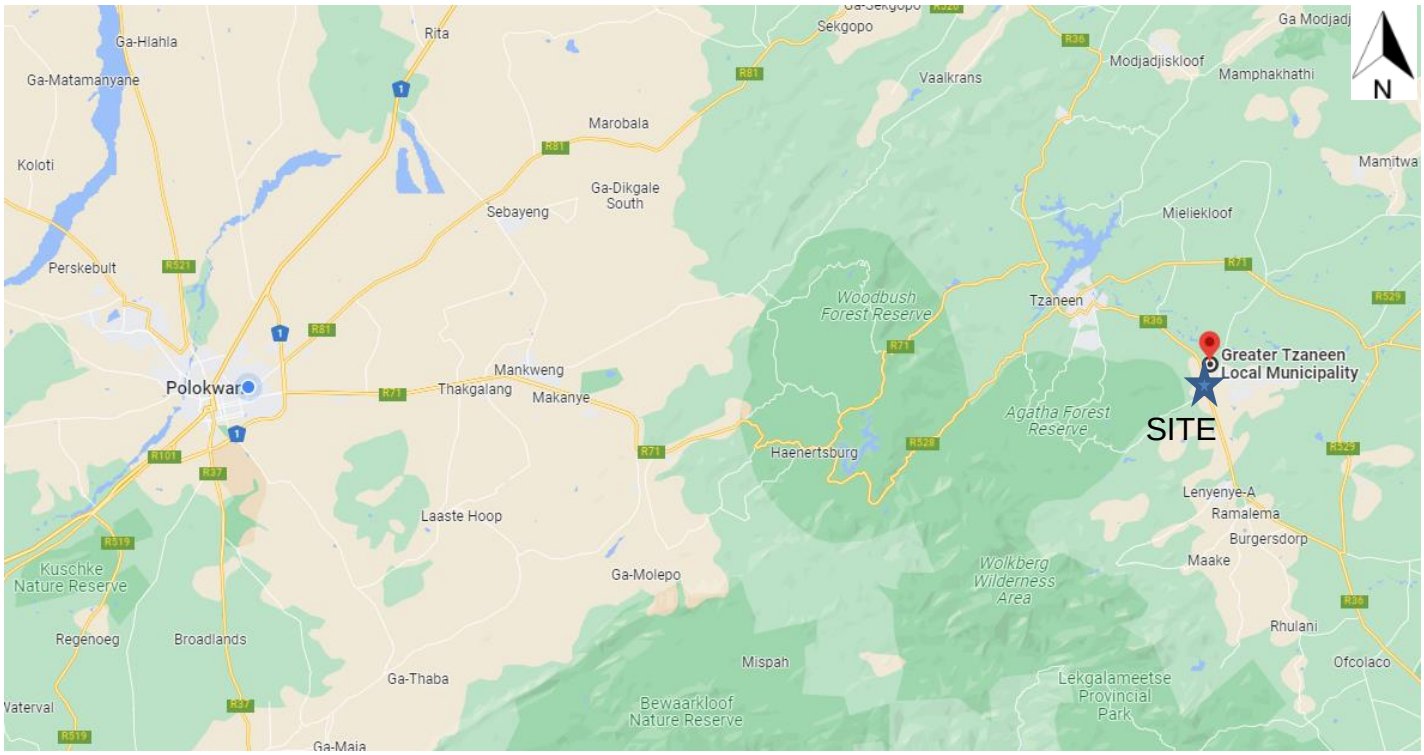

Figure 1 Locality map

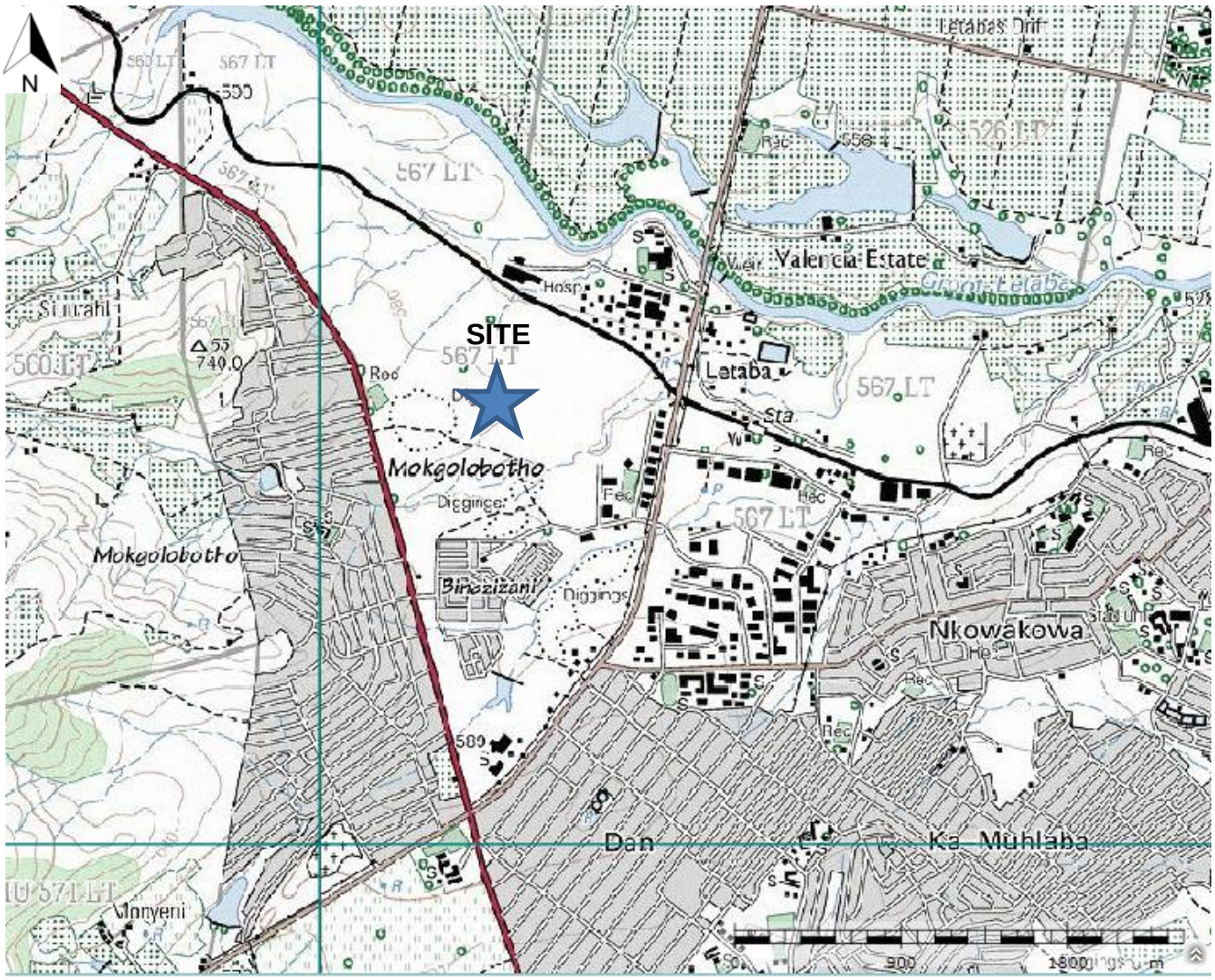

Figure 2 Locality

3 TOWN PLANNING

The site is currently a greenfield development and is yet to be developed.

The proposed township land use is for residential.

Table 1 Land use

LAND USE TABLE			
LAND USE ZONE	NO. OF SITES	AREA (Ha)	% OF AREA
RESIDENTIAL 1	1345	37.16	25.20
RESIDENTIAL 2	416	10.25	9.56
RESIDENTIAL 3	99	4.47	3.03
BUSINESS 1	45	4.28	2.90
BUSINESS 2	62	5.03	3.41
INSTITUTIONAL	30	9.70	6.58
INDUSTRIAL	1	0.19	0.13
MUNICIPAL	4	0.30	0.20
OPEN SPACE	6	42.63	28.91
ROAD		28.16	19.10
TOTAL	2008	147.47	100.00

Figure 3 Spatial Development Plan

Figure 4 Site layout

4 TOPOGRAPHY AND ACCESS

The proposed township site slope is generally flat. The flat slopes allow for buildings and access road to be constructed with minimal site earthworks.

Figure 5 Topography

The site can be accessed via road R36, internal streets, and road D673 to Letaba Hospital. See the figures below.

R36

Internal Street

Figure 6 Access pictures

The R36 is surfaced and in good condition but the internal street is earth road. The road D673 is surfaced but has potholes especially around Binzulani centre.
An application to connect the township to the existing R36 road has to be approved by road authority, SANRAL, prior to construction.

Figure 7 Roads for access

5 WATER SERVICE

5.1 Water source

Nkowankowa WTW abstracts raw water from Groot Letaba River. The water treatment works then purifies the water and supplies water to Dan Reservoirs. The WTW design capacity is 24Mℓ/day. GPS: 23°52'26.47"S 30°16'23.12"E**.**

5.2 Water Bulkline

Purified water is pumped from Nkowankowa WTW to the Dan village reservoirs. There are two pumping pipelines conveying the water.

The Dan reservoirs inlet pipe sizes are 300mm and the reservoirs outlet has a 450mm diameter.

Purified water from the Nkowankowa WTW is also pumped directly to the water reticulation.

In the vicinity of the proposed development, there is an existing 200mm diameter bulkline conveying water to the industrial area.

Figure 8 Existing 200mm diameter bulkline (In blue line)

5.3 Storage Reservoirs

There are two reservoirs in Dan, viz;

- Two concrete reservoirs. GPS coordinates 23°53'51.10"S 30°15'54.04"E and 23°53'52.71"S 30°15'52.98"E.

The reservoirs have a combined capacity of 20Mℓ. The reservoirs supply Nkowankowa, Mokgolotho, Dan, Juliesburg and Mulati.

The reservoirs are operated as follows:

- Reservoirs inlet pipe valves are opened at 8pm daily, while the outlet pipe valves are closed also at 8pm daily.
- Reservoirs inlet pipe valves are the closed at 4am daily, while the outlet pipe valves are the opened also at 4am daily.

The reservoirs are shown in the figure below.

Reservoir in relation to site proximity.	Arial view of reservoirs

Figure 9 Water storage

Figure 10 Water storage

5.4 Water Reticulation

The site does not have water reticulation.
There are existing bulk water lines currently servicing areas next to the proposed site.
The areas within the vicinity are fully serviced for water.

5.5 Water design criteria

The water design criterion to be used is listed in the table below. The design guidelines were adopted from the CSIR document titled:

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

Table 2 The water design criteria

Item	Design element	Criteria
i.	Average Annual Daily Demand (AADD), for Residential 1	0.6kℓ/c/day
ii.	Group / cluster housing, medium density	0.5kℓ/unit/day
iii.	Business / commercial, FAR = 0.4	0.65kℓ/100m^2
iv.	Park	12kℓ/hectare
v.	Municipal, FAR = 0.4	0.6kℓ/100m^2
vi.	Institutional, FAR = 0.4	0.6kℓ/100m^2
vii.	Educational, FAR = 0.4	0.6kℓ/100m^2
viii.	Industrial, FAR = 0.4	0.4kℓ/100m^2
ix.	Taxi Rank	0.3kℓ/100m^2
x.	School, crèche, educational buildings	60 ℓ/student
xi.	Hospital, building according to Floor Area Ratio (FAR)	1.2 kℓ/100m^2
xii.	Church buildings	0.3 kℓ/100m^2
xiii.	Church grounds	1.2 kℓ/Ha
xiv.	Schools, Live-in student	0.3 kℓ/student
xv.	School, crèche, educational buildings	60 ℓ/student
xvi.	School, crèche, educational grounds	12 kℓ/Ha
xvii.	Institutional, FAR = 0.4	0.6 kℓ/100m^2
xviii.	Sport grounds / Recreational	40 kℓ/Ha
xix.	Residential stands; High density, small sized, with 20 to 12 units/Ha	11 kℓ/Ha/day
xx.	Flats, High density	0.35 kℓ/unit/day
xxi.	Stadium: Buildings only	1.5 kℓ/1000seats
xxii.	Stadium: Grounds only	12 kℓ/Ha/day
xxiii.	Hotels	0.2 kℓ/person
xxiv.	Golf estate - excluding golf course water requirements. Stand size less than 2670m^2.	3kℓ/stand/day
xxv.	Garage or filling station	0.8kℓ/100m^2
xxvi.	Frail care centres and hospitals, Building according to FAR	1.2kℓ/100m^2
xxvii.	Gross Average Annual Daily Demand (GAADD)	Allow 10% losses
xviii.	Daily Instantaneous Peak Factor (DIPF)	1.5
xxix.	Design Peak Flow Rate (DPFR) for domestic flows.	25ℓ/s
xxx.	Maximum static head	90m
xxxi.	Minimum residual head under conditions of domestic peak flow	10m
xxxii.	Maximum linear flow velocity under conditions of domestic peak flow	3m/s
xxiii.	Pipe type	uPVC
xxiv.	Minimum pipe class	9
xxv.	Fire flow at any one hydrant under the conditions of domestic peak flows (one hydrant at a time)	15 ℓ/s
xxvi.	Minimum residual head (fire plus domestic peak flow)	25m
xxvii.	Maximum linear flow velocity under conditions of fire-fighting	3m/s
xviii.	DWS storage reservoirs sizing criteria: 48 Hrs x AADD Pumped from One Source 36 Hrs x AADD Pumped from Multiple Sources 24 Hrs x AADD Gravity Source	

The following adoptions were also made:

- Residential 2 land use type has 44 Dwelling Units / Hectare
- Residential 3 land use type has 65 Dwelling Units / Hectare
- Residential 4 land use type has 120 Dwelling Units / Hectare

5.6 Water demands

The estimated water demand for the proposed development is shown in table below. As per the table below, the water demand calculations indicate that the proposed development will require 1 673.1kℓ/d AADD and 1 840.7kℓ/d Gross Average Annual Daily Demand.

Table 3 Water demand

Land Use	No. of Erven	Area (Ha)	No. of Units	Floor Area Ratio, FAR	Unit flow	Unit of measure	Water Demand	
Residential 1	1345	37.16	1345		0.6	kℓ/erf/day	807.0	kℓ/d
Residential 2	416	10.25	472		0.5	kℓ/unit/day	235.8	kℓ/d
Residential 3	99	4.47	291		0.5	kℓ/unit/day	145.3	kℓ/d
Business 1	45	4.28		0.4	0.65	kℓ/100m^2	111.3	kℓ/d
Business 2	62	5.03		0.4	0.65	kℓ/100m^3	130.8	kℓ/d
Institutional	30	9.70		0.4	0.600	kℓ/100m2	232.8	kℓ/d
Industrial	1	0.19		0.4	0.400	kℓ/100m3	3.0	kℓ/d
Municipal	4	0.30		0.4	0.600	kℓ/100m2	7.2	kℓ/d
Open Space	6	42.63						
Road		28.10						
Totals	2008	142.11						
Sub-total Average Annual Daily Demand (AADD)							1673.1	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							1840.4	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							21.3	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	2760.7	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	32.0	ℓ/s

The Fire flows are shown in the table below.

Table 4 Fire flow demands

Fire category: **Moderate risk 1: Industrial, business, high rise flats ≥ four storeys**	**Quantity**	**Unit**
Total fire flow	50	ℓ/s
Duration of design fire flow	4	Hours
Minimum Flow at one hydrant (ℓ/s)	25	ℓ/s
Moderate risk 2: Cluster & low-income housing, high rise flats ≤ three storeys		
Total fire flow	25	ℓ/s
Duration of design fire flow	2	Hours
Minimum Flow at one hydrant (ℓ/s)	25	ℓ/s
Fire category: **Low risk: Single residential housing**		
Total fire flow	15	ℓ/s
Duration of design fire flow	1	Hours
Minimum Flow at one hydrant (ℓ/s)	15	ℓ/s

5.7 Bulk water capacity

The observed output from the Nkowankowa WTW ranges as follows:

- 20Mℓ
- 17Mℓ
- 22Mℓ
- 14Mℓ

The output from the Nkowankowa WTW is not reaching capacity because of the following:

- Eskom electricity supply load shedding at the WTW.
- There are two back-up electricity generators at the WTW. One is operational and one is not working. The one functional generator is only capable of powering one of the three pumps at the WTW.
- The generators require a steadily available supply of diesel.

It has been reported that the Dan water networks experience severe water leaks.

The operations of the water reservoirs being closed and opened at 8pm and 4am in trying to satisfy water demand is evidence that the capacity of the Nkowankowa WTW is not enough.

The proposed development water demand AADD is 1 673.1kℓ/d = 1.7Mℓ/d.

Therefore, proposed development's required storage = AADD x 2 = 1.7Mℓ x 2 = 3.4Mℓ.

The capacity of the existing 200mm bulkline pumping water to the industrial area is shown in the table below.

Table 5 Pipeline existing capacity

BULKLINE	**INTERNAL DIAMETER**	**MAX CAPACITY (at V=1.2m/s)**		**WATER SUPPLY**	
DIAMETER	**(mm)**	**Flow Q (ℓ/s)**	**Flow Q (m^3/s)**	**Supply (m^3/d)**	**Supply (Mℓ/d)**
200mm	175.8	29.13	0.029	2516.6	2.517

The proposed development peak water demand of 32.0ℓ/s is MORE than the capacity of the existing 200mm diameter pipeline with a capacity of 29.13ℓ/s.

5.8 Water infrastructure proposed

The proposed infrastructure is as follows:

- Connection to the existing water bulkline. See the figure below.

Figure 11 Proposed connection to the 200mm diameter bulkline (blue line)

- Application for an increased water license use from the Department of Water and Sanitation.
- Upgrading of the Nkowankowa WTW.
- For the proposed development to have water reticulation to yard connection standard.
- Upgrading of the electricity generators at the Nkowankowa WTW.
- Upgrading of the existing water line to accommodate the proposed development.

6 SEWER SERVICE

6.1 Existing Waste Water Treatment Plant

The Dan, area is serviced by the following wastewater treatment works (WWTW):

- Nkowankowa WWTW, GPS 23°53'37.87"S 30°19'7.55"E. The design capacity of the WWTW is 2Mℓ/d.

The WWTW is located as shown in the figure below.

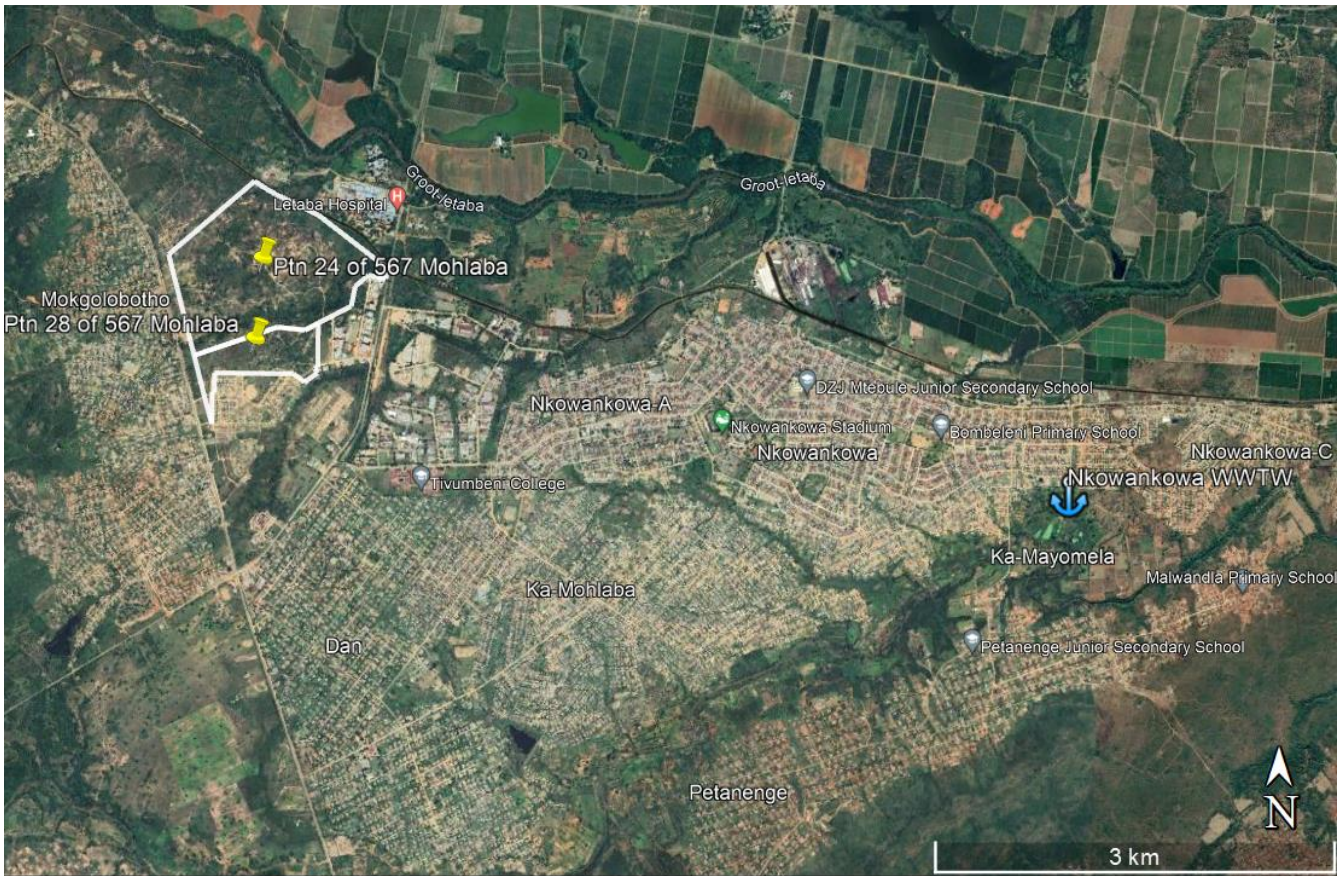

Figure 12 Wastewater Treatment Works Nkowankowa

6.2 Bulk sewer infrastructure

There is an existing bulk sewer pipeline that is currently servicing Dan.

The sewer bulk line flows to the existing wastewater treatment works.

There is an existing 300mm diameter sewer outfall located near the industrial area.

Figure 13 Existing gravity sewer outfall, 300mm diameter (yellow line)

The existing gravity manhole shown in the figure above is 4.6m deep and shown in the figure below:

Figure 14 Existing gravity manhole with 300mm diameter sewer outfall

6.3 Sewer Reticulation

There is NO existing sewer reticulation onsite. The vicinity near the proposed site has existing sewer reticulation.

Figure 15 Existing manhole on existing settlement near site

The sewer outfall from the existing settlement has a pipe diameter of 200mm.

See figures below.

Figure 16 Open sewer manhole on 200mm line

Figure 17 Existing sewer infrastructure

6.4 Sewer flows

The design guidelines were adopted from the CSIR document titled:

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

Table 6 Sewer design flow of proposed development

Land Use	**No. of Erven**	**Area (Ha)**	**Water Demand**		**Sewer Return**	**Sewer Flow**	
Residential 1	1345	37.16	807.0	kℓ/d	85%	686.0	kℓ/d
Residential 2	416	10.25	235.8	kℓ/d	85%	200.4	kℓ/d
Residential 3	99	4.47	145.3	kℓ/d	85%	123.5	kℓ/d
Business 1	45	4.28	111.3	kℓ/d	85%	94.6	kℓ/d
Business 2	62	5.03	130.8	kℓ/d	85%	111.2	kℓ/d
Institutional	30	9.70	232.8	kℓ/d	85%	197.9	kℓ/d
Industrial	1	0.19	3.0	kℓ/d	85%	2.6	kℓ/d
Municipal	4	0.30	7.2	kℓ/d	85%	6.1	kℓ/d
Open Space	6	42.63					
Road		28.10					
Totals	2008	142.11	1673.1				
Sub-total Sewer ADWF						**1422.2**	**kℓ/d**
15% Extraneous flow						213.3	kℓ/d
Gross Sewer						1635.5	kℓ/d
Gross Sewer Flow						18.9	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						47.3	ℓ/s

The development will have an estimated sewer ADWF of 1 422.2kℓ/d and a gross sewer flow of 1 635.5kℓ/d.

6.5 Wastewater bulk capacity

The proposed development gross sewer flow is estimated at 1 422.2kℓ/d kℓ/d = 1.4Mℓ/d.

The capacity of the existing Nkowankowa WWTW 2Mℓ/d.

At percent of ratio to full depth (diameter) 70% and at 1.25% slope, Manning's roughness coefficient n = 0.011. This existing 300mm diameter sewer outfall has a capacity of 107 ℓ/s.

The estimated peak sewer flow from the proposed site is 47.3 ℓ/s.

This peak wastewater flow from the development is LESS than the pipe capacity of the existing sewer outfall.

6.6 Wastewater Infrastructure Proposed

The proposed wastewater infrastructure is as follows:

- That the proposed township has sewer reticulation.
- That a sewer pump station be built at the lowest elevation of the proposed development. The proposed pump station will convey sewer through a pumping line to the gravity manhole on the 300mm diameter sewer outfall.
- That the proposed township be connected to the existing sewer outfall.
- That the Nkowankowa WWTW be upgraded.

Figure 18 proposed connection

7 ELECTRICITY

There is existing electricity supply infrastructure currently available and servicing Dan. The electrical connection to the proposed site will need to be applied for at the electricity supply authority.

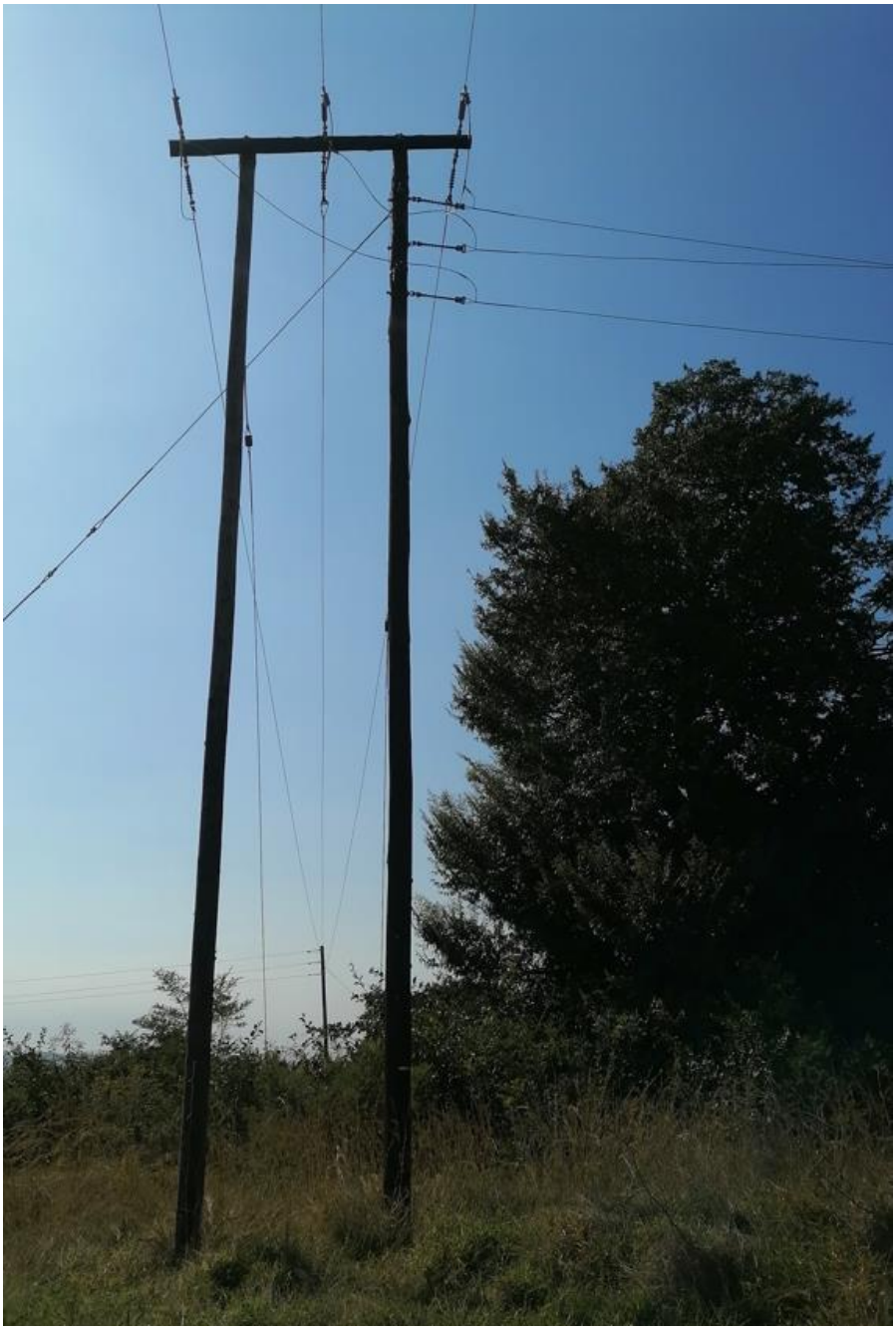

Figure 19 Electrical Infrastructure in the vicinity

8 TOWNSHIP ROADS

There is an existing functioning road network that can be used to access the proposed development.

The road infrastructure to internally service the development will be the standards of the Red Book, TMH, TRH books and the local municipality.

8.1 Classification of roads

Table 7 Classification of roads

Description	Class no.	Function	Reserve width	Roadway width
Access Road	5d	Access from existing bounding road	15m	7.4m
Internal Service Road	5f	Internal Road	13	6m
Internal Service Road	5f	Internal Road	10	6m

8.2 Geometric Design Standards

Table 8 Class 5f – Internal roads

Design speed	30km/h
Minimum centre line radii	30m
Minimum gradient	0.5%
Favoured maximum gradient	12%
Maximum grade/grade length	16% over 50m
Maximum K-value : Crest	6
: Sag	8

9 STORMWATER DRAINAGE

Stormwater generated onsite can be channelled to follows the natural slope of the ground, to the lowest point. It is envisioned to use Sustainable Urban Drainage Systems (SuDS) to manage stormwater runoff from the site. A stormwater management plan will need to be submitted to the municipality before construction starts. Extraneous stormwater from above the site will be accommodated over the site.

9.1 Stormwater systems

Stormwater runoff onsite will be handled through an internal stormwater system that will be provided to drain the site in a safe and efficient way. It is proposed to make use of SuDS to manage the stormwater runoff before being discharged into the natural water courses. The stormwater can be discharged into the internal street stormwater channel.

Stormwater discharge control will be applied in order to reduce the damaging effect of the increase in runoff due to densification.

9.2 Hydrology

The hydrological data used in the design of the stormwater drainage system is shown in the table below.

Table 9 Hydrological data

Hydrological Data	
a) Flood return period	1: 2 years for storm water pipe system. 1: 5 years for the combined stormwater pipe and road systems
b) Average yearly rainfall	1000mm
c) Minimum time of concentration and run	As per Local Municipality Guidelines
d) Design Method	Rational method

9.3 Design Standards

The table below lists the standards to be used in the design of the stormwater drainage system:

Table 10 Stormwater design standard

Design Element	Specification
a) Minimum pipe size	600 concretes
b) Minimum pipe gradient	0.67%
c) Storm water details	Local Municipal Standard Details

10 SOLID WASTE

A regional landfill situated nearest the site is to be used to dispose solid waste. The local municipality is responsible for connecting and disposing the solid waste. If the municipality is not able to provide this service, then a private company will need to be appointed by the development owners for the service.

A refuse area with bins will be done onsite and solid waste will be disposed of at the municipal dump site as per the municipal health bylaws.

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

The solid waste generation range from 0.6 kg per capita per day in the poor areas, to 1.29 kg per capita per day.

The rate of 0.6kg/c/d was adopted for the township. Solid waste will be generated by the development.

Population estimate = 2107 residential units x 4 people per unit = 8428 people

- Solid waste = 0.6kg/per person/day or (0.6kgx365 days)
- Waste generated per day = 0.6x 8428= 5057kg = 5.0 tons
- Waste generated per annum = 5.0 x365 = 1846 tons

11 CONCLUSION

The proposed development will contribute towards improving the service delivery of the area and general livelihood of the residents.

PROPOSED DEVELOPMENT OF PORTION 24 AND 28 OF 567 MOHLABA, TZANEEN, LIMPOPO

BULK ENGINEERING SERVICES REPORT:

CIVIL SERVICES REPORT

Compiled by	W. KASILEMBO B. Tech Civil	Kasilembo Signature	21/10/2022 Date
Reviewed by	L. MTHUNZI BSc Hons Eng, Pr Tech Eng ECSA	 Signature	21/10/2022 Date

ANNEXURES

ANNEXURE 1 Layout Plan