

**PROPOSED SIKHWAHLANE TOWNSHIP, SITUATED ON THE  
REMAINDER OF THE FARM MATABULA 701 JU, NKOMAZI LOCAL  
MUNICIPALITY, MPUMALANGA PROVINCE**

**BULK ENGINEERING SERVICES REPORT**

**JANUARY 2021, REV 0**

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## Abbreviations

AADD	-	Average Annual Daily Demand
ADWF	-	Average Dry Weather Flow
DWS	-	Department of Water and Sanitation
IDP	-	Infrastructure Development Plan
kℓ	-	Kilo Litres
kℓ/day	-	Kilo Litres per day
ℓ/s	-	Litres per second
m <sup>3</sup>	-	cubic metre
MAP	-	Mean Annual Precipitation
Mℓ /day	-	Mega litres per day
PSC	-	Project Steering Committee
RWS	-	Regional Water Scheme
StatsSA	-	Statistics South Africa
VIP toilet	-	Ventilated Improved Pit toilet
WC	-	Water Committee

## 1 INTRODUCTION

There is a proposal to develop a township on the remainder of the farm Matabula 701 JU, Nkomazi Local Municipality, Mpumalanga Province.

This township will be of mixed land use but will be mainly of residential use.

This report outlines the engineering services needed for the proposed township, i.e. roads, water, sewer, and electricity.

## 2 SITE DESCRIPTION

The proposed township is situated in Sikhwahlane, 50km south of Malelane town. Malelane town is in turn 70km east, along N4 highway, from Nelspruit the capital of Mpumalanga Province. The area is administered by Nkomazi Local Municipality, under the Ehlanzeni District Municipality. GPS coordinates of site are 25°47'11.77"S 31°46'18.59"E.

The locality map is shown on the figures below.

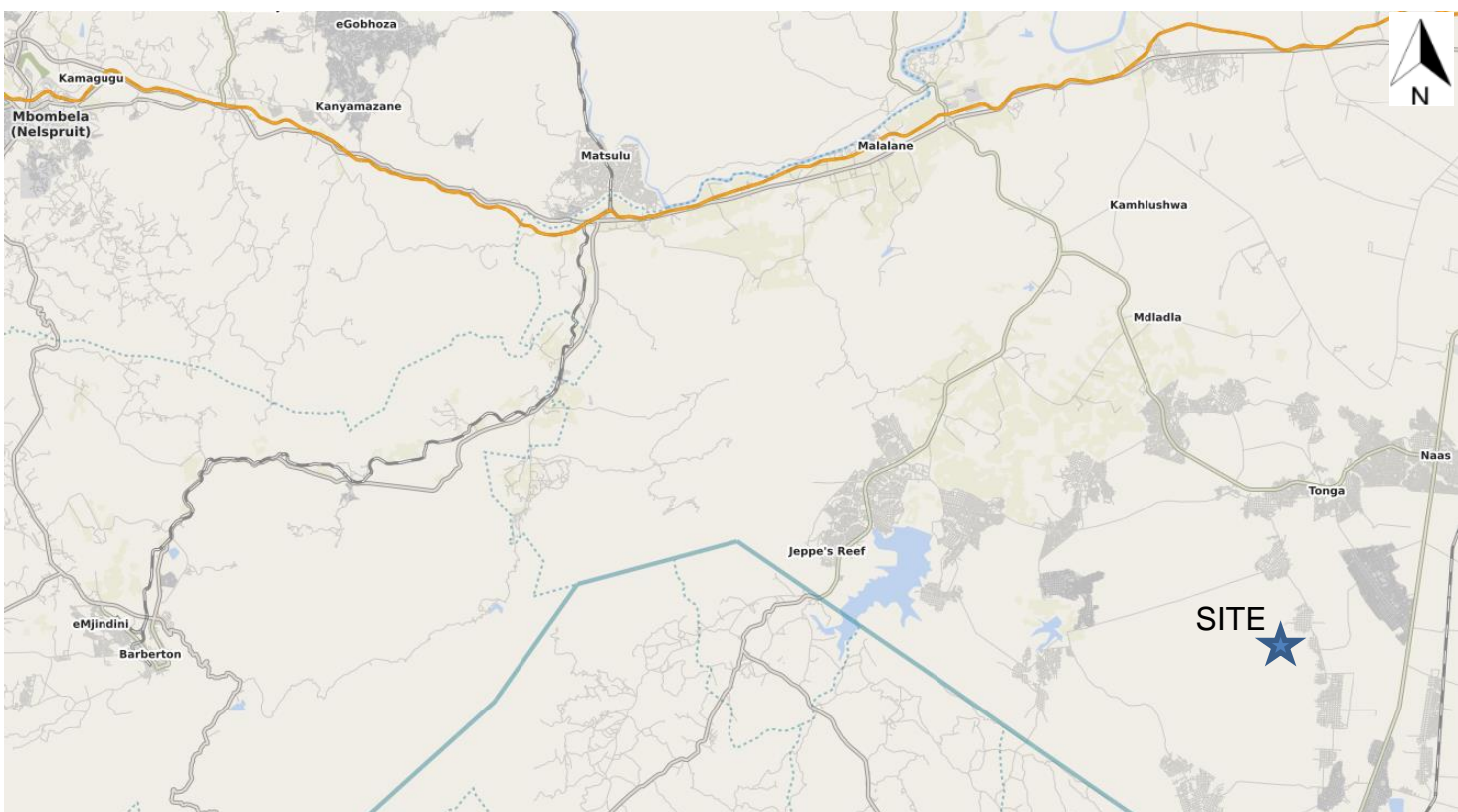


Figure 1: Locality map

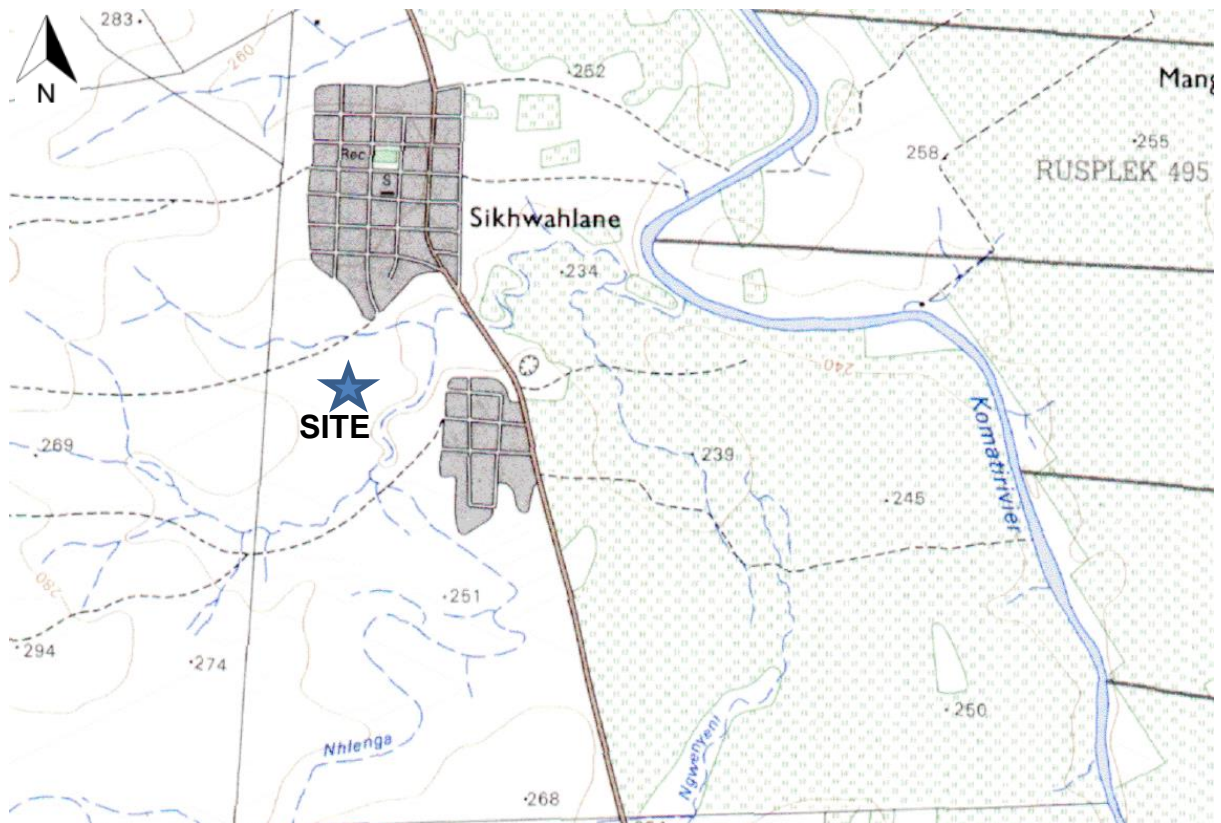


Figure 2 Site locality

### 3 TOWN PLANNING

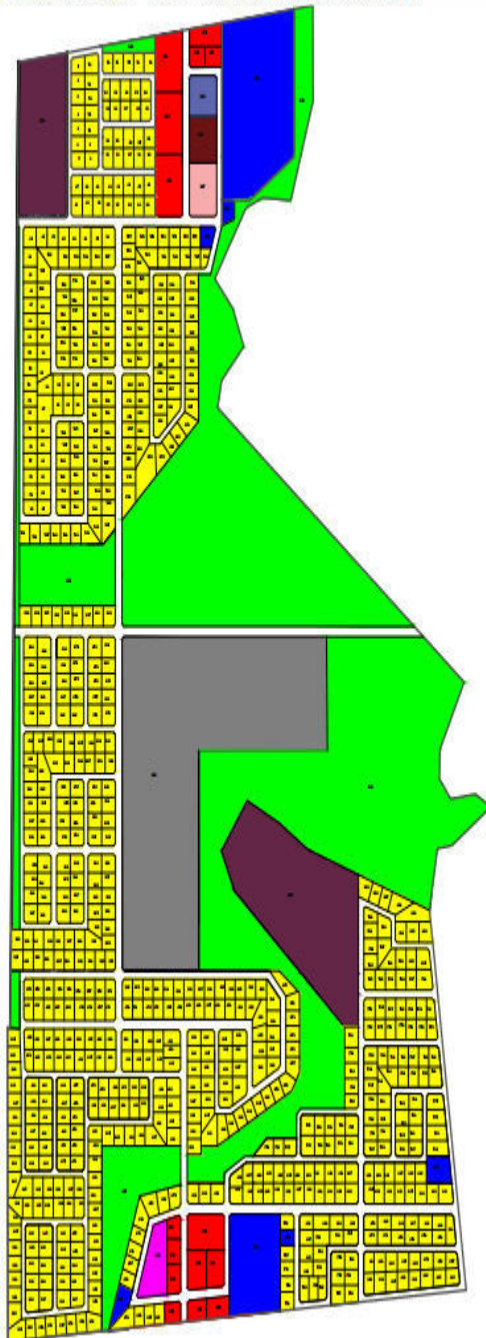
The site is currently a bush and is yet to be developed.

The proposed township land use is shown in the table below.

Table 1 Land use

ZONING	LAND USES	NO. OF ERF	AREA (HA)	AREA (%)	NOTATION
RESIDENTIAL	DWELLING UNIT	809	102.21	39.31	
BUSINESS	RETAIL	15	6.38	2.45	
INSTITUTIONAL	CHURCH/SCHOOL/ CRECHE	7	10.83	4.2	
COMMUNITY	CLINIC	1	0.91	0.35	
GOVERNMENT	THUSONG CENTRE	1	0.64	0.25	
COMMUNITY	LIBRARY	1	0.83	0.32	
GOVERNMENT	MUNICIPAL	1	0.72	0.28	
COMMUNITY	SPORTS & RECREATION GROUND	2	13.61	5.23	
PUBLIC 2	PARK	5	67.90	26.12	
GOVERNMENT	CEMETERY	1	22.68	8.72	
STREETS			33.29	12.80	
TOTAL DEVELOPABLE AREA		843	260	100%	

# SKHWAHLANE SETTLEMENT PLAN REMAINDER OF THE FARM MATABULA 701 JU



## LOCALITY MAP



ZONING	LAND USES	NOL OF ERF	AREA (HA)	AREA (%)	MOTATION
RESIDENTIAL	DWELLING UNIT	809	102.21	39.31	
BUSINESS	RETAIL	15	6.38	2.45	
INSTITUTIONAL	CHURCH/SCHOOL/CLINIC	7	10.83	4.2	
COMMUNITY	CLINIC	1	0.91	0.35	
GOVERNMENT	TRAINING CENTRE	1	0.84	0.32	
COMMUNITY	LIBRARY	1	0.63	0.25	
GOVERNMENT	MUNICIPAL	1	0.72	0.28	
COMMUNITY	SPORTS & RECREATION GROUND	2	11.61	5.23	
PUBLIC 2	PARK	3	67.90	26.12	
GOVERNMENT	CEMETERY	1	22.68	8.72	
STREETS			35.29	13.80	
TOTAL DEVELOPABLE AREA		843	268	100%	

**NOTES**  
1. Represents Proposed Township Boundary.  
2. All areas and distances are approximate and subject to final survey.

### SURVEY NOTES

CLIENT:  
NKOMAZI LOCAL MUNICIPALITY



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Figure 3 Proposed stands layout

#### 4 TOPOGRAPHY AND ACCESS

The proposed township site slope is generally flat.

The site can be accessed through the existing internal gravel road streets in Sikhwahlane village. There is an existing tarred main road D2945 that links Sikhwahlane to other villages.

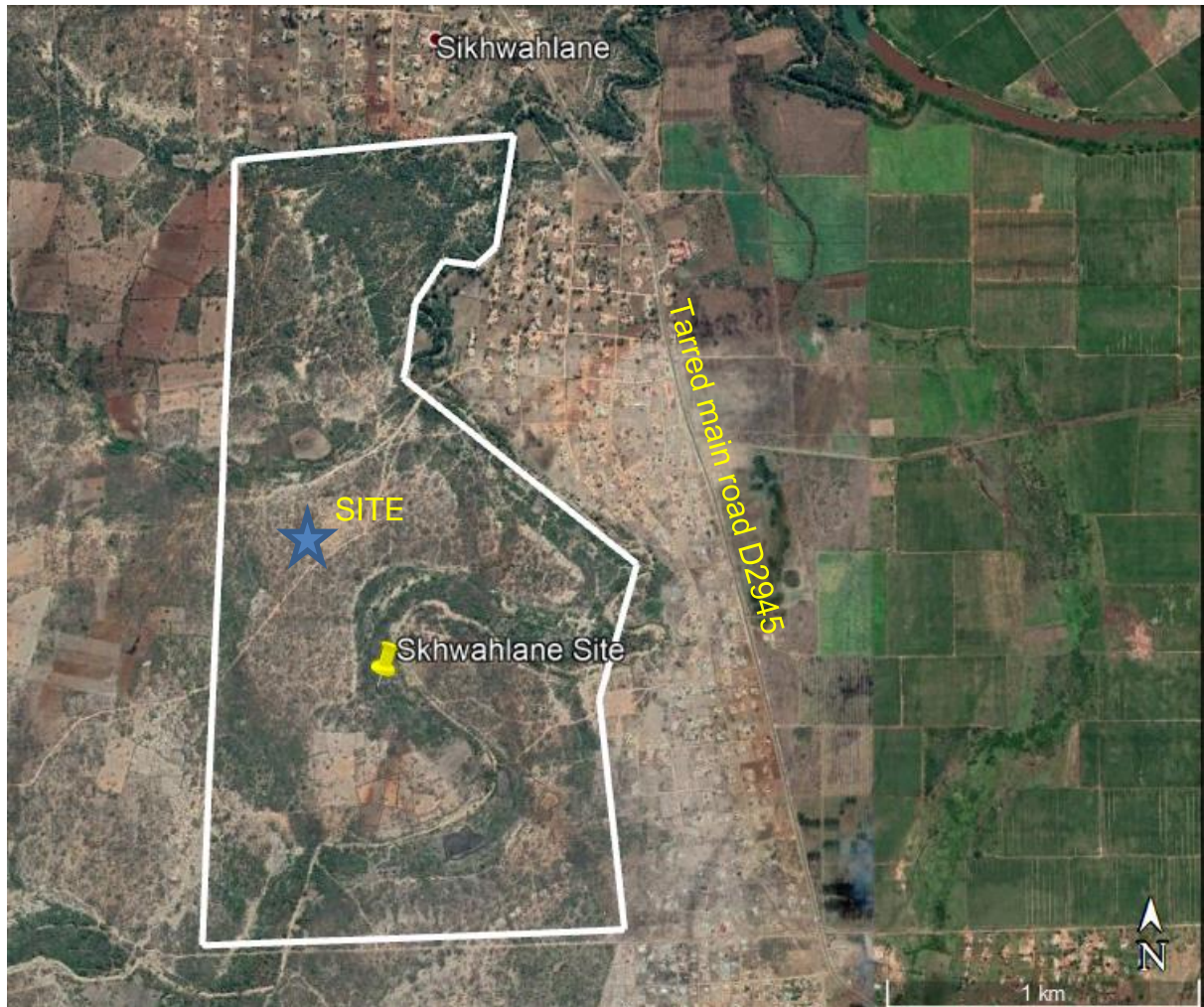


Figure 4 Road for access

## 5 WATER SERVICE

### 5.1 Water source

The proposed township is within the Sibange Regional Bulk Water Scheme. Raw water is sourced / abstracted from the Komati river. The raw water is then treated at the following Water Treatment Works (WTW).

- Masibekela WTW, located at GPS coordinates 25°49'19.45"S 31°49'42.15"E.

The Masibekela WTW is currently being upgraded from the existing 14Mℓ/d to 21Mℓ/d. The upgrading project is expected to be completed in the current year 2021.



Figure 5 Masibekela WTW

## 5.2 Storage

There is a current project for the construction of the following in Sikhwahlane village:

- 1000kℓ command reservoir,
- 160kℓ elevated tank,
- Sikhwahlane pump station.



Figure 6 Water storage site 25°45'52.45"S 31°45'52.21"E

### 5.3 Water Bulklines

There is a current project for the construction of the following for Sikhwahlane village:

- 250mm diameter pumping main from Masibekela WTW to Sikhwahlane command reservoir.

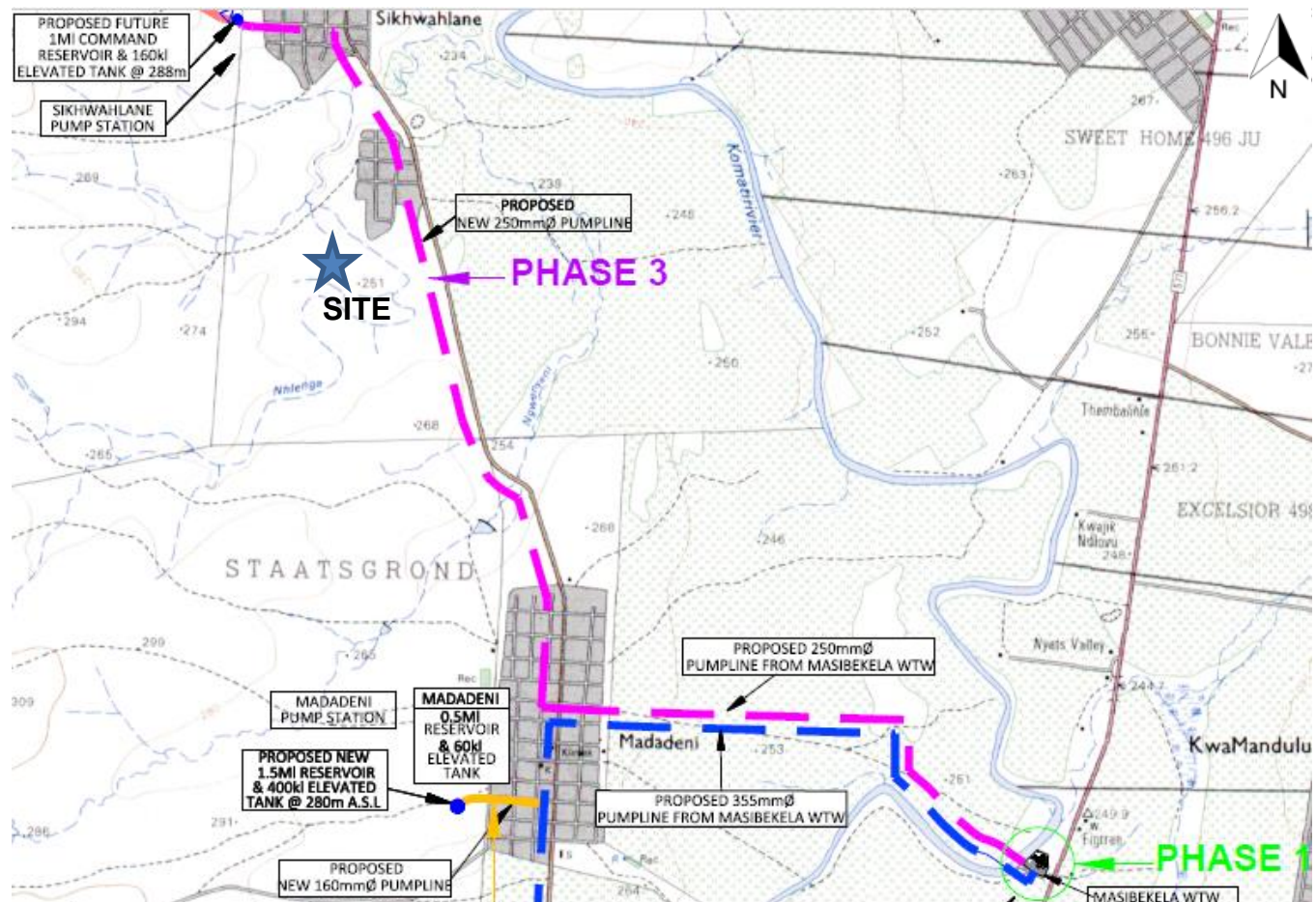


Figure 7 Bulklines project current

The project is expected to be complete this 2021 year.

## 5.4 Water design criteria

The water design criterion to be used is listed in the table below. The water demands and fire flow were adopted from 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, The Red Book.*

Table 2 The water design criteria

Item	Design element	Criteria
i.	Average Annual Daily Demand (AADD), for residential 1	0.6kl/c/day
ii.	Average Annual Daily Demand (AADD), for residential 2	0.6kl/c/day
iii.	Average Annual Daily Demand (AADD), for business	400l/100m <sup>2</sup>
iv.	Average Annual Daily Demand (AADD), for park	12.5-15kl/hectare
v.	Average Annual Daily Demand (AADD), for Municipal	400l/100m <sup>2</sup>
vi.	Average Annual Daily Demand (AADD), for Institutional	400l/100m <sup>2</sup>
vii.	Gross Average Annual Daily Demand (GAADD)	Allow 10% losses
viii.	Daily Instantaneous Peak Factor (DIPF)	1.5
ix.	Design Peak Flow Rate (DPFR) for domestic flows.	25l/s
x.	Maximum static head	90m
xi.	Minimum residual head under conditions of domestic peak flow	10m
xii.	Maximum linear flow velocity under conditions of domestic peak flow	3m/s
xiii.	Pipe type	uPVC
xiv.	Minimum pipe class	9
xv.	Fire flow at any one hydrant under the conditions of domestic peak flows (one hydrant at a time)	15 l/s
xvi.	Minimum residual head (fire plus domestic peak flow)	25m
xvii.	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	
xix.	Group / cluster housing, Medium density	0.5kl/unit/day

## 5.5 Water demands

The estimated water demand for the development is shown in table below.

As per the table below, the water demand calculations indicate that the development will require 1061.1kl/d AADD and 1167.2kl/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 measure of	Water Demand	
Residential (Dwelling Unit)	809	102.21	809		0.6	kℓ/erf/day	649.8	kℓ/d
Business (Retail)	15	6.38		0.4	0.400	kℓ/100m <sup>2</sup>	86.6	kℓ/d
Institutional (Church / School / Creche)	7	10.83			0.060	kℓ/student	30.0	kℓ/d
Community Facility (Clinic)	1	0.91		0.4	0.600	kℓ/100m <sup>2</sup>	21.8	kℓ/d
Government (Thusong Centre)	1	0.64		0.4	0.600	kℓ/100m <sup>2</sup>	15.1	kℓ/d
Community Facility (Library)	1	0.83		0.4	0.600	kℓ/100m <sup>2</sup>	17.3	kℓ/d
Municipal (Municipal)	1	0.72		0.4	0.600	kℓ/100m <sup>2</sup>	19.7	kℓ/d
Community Facility (Sports Centre)	2	13.61		0.4	0.600	kℓ/100m <sup>2</sup>	220.8	kℓ/d
Public Open Space	5	67.90						
Streets								
<b>Totals</b>	<b>843</b>	<b>260.00</b>						
Sub-total Average Annual Daily Demand (AADD)							1 061.1	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							1 167.2	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							13.5	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	1 750.8	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	20.3	ℓ/s

The Fire flows are presented on the table below.

Table 4 Fire flow demands

<b>RISK CLASSIFICATION</b>	<b>Total Fire Flow (l/s)</b>	<b>Duration of Fire flow (h)</b>	<b>Minimum Flow at one hydrant (l/s)</b>
Low risk: Single residential housing	15	1	15

## 5.6 Water bulk proposed

The far southern area of the proposed township has elevation just over 10m below that of the Sikhwahlane command reservoir. This implies that a gravity feed alone from the command reservoir would have stands that may not receive water. It is then proposed to build a booster pump and a 20m elevated tank for the proposed township.

The figure below shows the proposed 3km long bulk line (in blue colour), booster pump and elevated tank, to cater for the township.

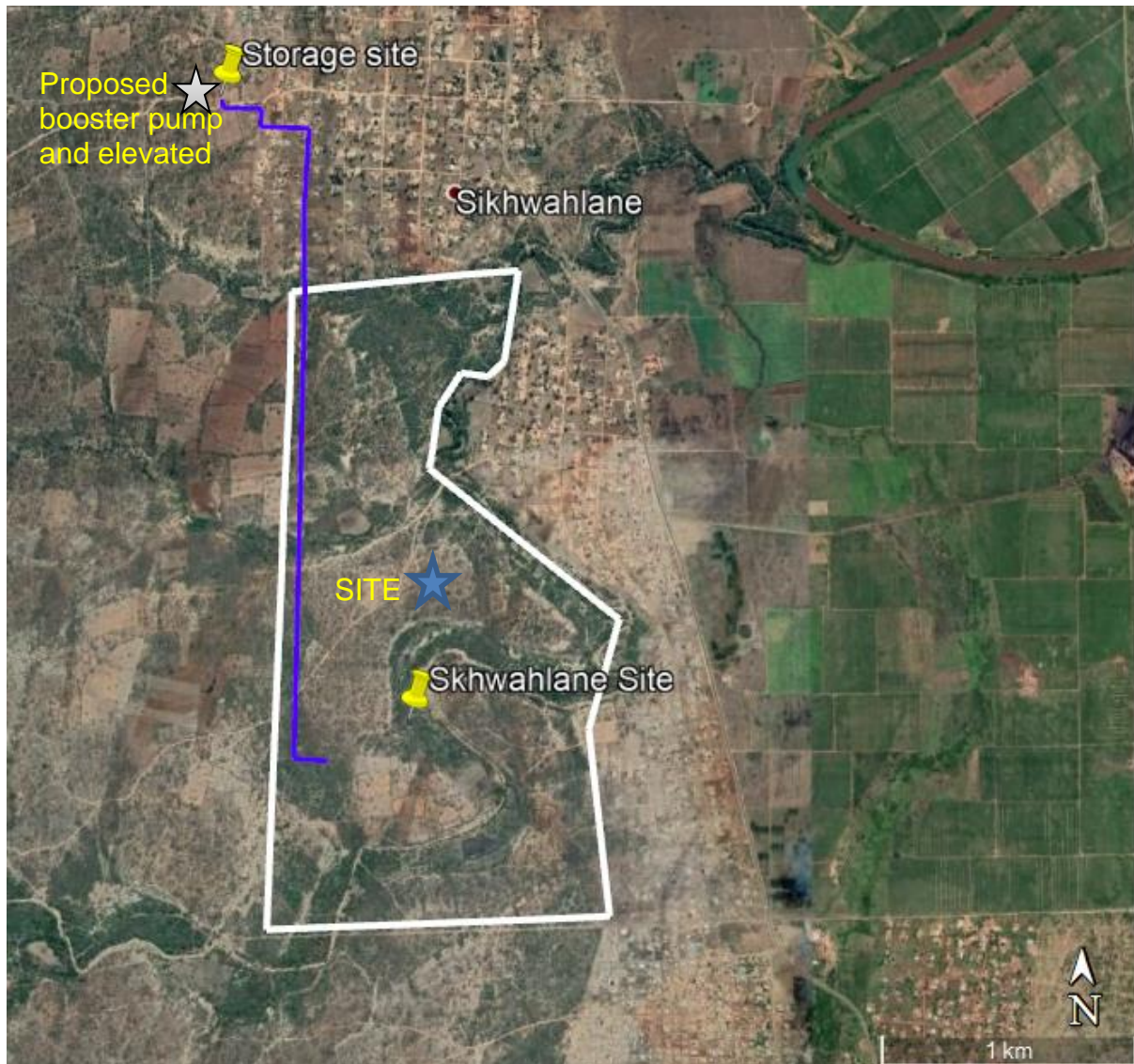


Figure 8 Water bulk line proposed

The capacity of the elevated tank proposed

$$\begin{aligned} &= 2 \times \text{AADD} = 2 \times 1061.1 \text{ k}\ell \\ &= 2122.2 \text{ k}\ell \\ &= \underline{\text{say } 2200 \text{ k}\ell} \end{aligned}$$

It is proposed that additional water sources would be needed to augment the existing water source through boreholes field with a yield of at least 13.5ℓ/s. Water reticulation must then be constructed to service the township.

## 6 SEWER SERVICE

### 6.1 Existing Wastewater Treatment Works

Sikhwahlane currently has no existing wastewater treatment works. Sewer is currently handled onsite through septic tanks and pit toilets.

### 6.2 Sewer flows

The design guidelines were adopted from the Red Book. The proposed development sewer flow calculations are shown in the table below.

Table 5 Sewer design flow

Land Use	No. of Erven	Area (Ha)	Water Demand		Sewer Return	Sewer Flow	
Residential (Dwelling Unit)	809	102.21	649.8	kl/d	85%	552.3	kl/d
Business (Retail)	15	6.38	86.6	kl/d	85%	73.6	kl/d
Institutional (Church / School / Creche)	7	10.83	30.0	kl/d	85%	25.5	kl/d
Community Facility (Clinic)	1	0.91	21.8	kl/d	85%	18.6	kl/d
Government (Thusong Centre)	1	0.64	15.1	kl/d	85%	12.9	kl/d
Community Facility (Library)	1	0.83	17.3	kl/d	85%	14.7	kl/d
Municipal (Municipal)	1	0.72	19.7	kl/d	85%	16.7	kl/d
Community Facility (Sports Centre)	2	13.61	220.8	kl/d	85%	187.7	kl/d
Public Open Space	4	67.90	0.0	kl/d	85%		kl/d
Streets	0		0.0	kl/d	85%		kl/d
<b>Totals</b>	<b>843</b>	<b>260.00</b>	<b>1061.1</b>				
<b>Sub-total Sewer ADWF</b>						<b>901.9</b>	<b>kl/d</b>
15% Extraneous flow						135.3	kl/d
Gross Sewer						1 037.2	kl/d
Gross Sewer Flow						12.0	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						30.0	ℓ/s

The new development will have a sewer ADWF of 901.9kl/d and a gross sewer flow of 1037.2kl/d.

### **6.3 Sewer reticulation**

Sewer reticulation must be constructed to service the township on the premise that the following must be in-place:

- A WasteWater Treatment Works (WWTW) to handle the sewer for the whole area. Or;
- A WWTW package plant to handle the proposed township sewer flows.

A new WWTW will require a water use licence from the Department of Water and Sanitation (DWS).

If the above conditions are not met, then sewer flow may have to be handled onsite, as currently is the situation in the area.

## **7 Electricity**

There is existing electricity supply infrastructure in the area and adjacent to the site. This can be utilised to supply the development, subject to approval from the power authority.

A separate electrical report for the development is prepared elsewhere.

## **8 TOWNSHIP ROADS**

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

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

Main access to the township is to be gained through existing bounding road.

## 8.1 Classification of roads

Table 6 Classification of roads

Description	Class no.	Function	Reserve width	Roadway width
Access Road	5d	Access from existing bounding road	16m	7.4m
Internal Service Road	5f	Internal Road	13	6m
Internal Service Road	5f	Internal Road	10	6m

## 8.2 Geometric Design Standards

Table 7 Class 5d – Access road

Design speed	60km/h
Minimum centre line radii	50m
Minimum gradient	0.5%
Favoured maximum gradient	10%
Maximum grade/grade length	12.5% over 70m
Maximum K-value : Crest	16
: Sag	16

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

### 8.3 Pavement Design

The proposed pavement designs are based on anticipated traffic volumes and ground conditions, a detailed pavement design will require a geotechnical centreline investigation report.

The table below shows the proposed pavement design for the development.

Table 9 Proposed pavement design

Design	Description
Pavement	50mm Premix Asphalt / 80mm Paving blocks / Concrete
Base	150mm Thick commercially graded gravel G1 material compacted to Minimum of 88% of apparent relative density.
Subbase	300mm Thick natural gravel stabilised with Cement to create C3 material compacted to 97% of Mod AASHTO
Upper Selected Layer	150mm Thick Natural gravel G7 material compacted to 97% of Mod AASHTO Density.
Lower Selected Layer	150mm Thick Natural gravel G7 material compacted to 97% of Mod AASHTO Density.
Roadbed & Fill (where required)	150mm Thick layers compacted to 90% of Mod AASHTO Density. Minimum CBR= 3 at 90% of Mod AASHTO Density- G9

## 9 Stormwater Drainage

Stormwater generated onsite can be channelled to follow 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.

The stormwater will drain on according to the slope of the natural ground.

The topography of the site promotes the stormwater run-off effectively towards the veld.

Further development of the site will result in an increase of an impermeable surface area, resulting in an increase of the stormwater runoff.

## 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.

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 10 Hydrological data

<b>Hydrological Data</b>	
a) Flood return period	1: 2 years for storm water pipe system. 1: 5 years for the combined storm water Pipe and road systems
b) Average yearly rainfall	800mm
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 11 Stormwater design standard

<b>Design Element</b>	<b>Specification</b>
a) Minimum pipe size	600 concrete
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 0.41 kg per capita per day in the poor areas, to 1.29 kg per capita per day.

The lower rate of 0.41kg/c/d was adopted for the township. Solid waste will be generated by the development.

Population estimate = 809 residential x 4people per unit = 3236 people

- Solid waste = 0.41kg/per person/day or (0.41kgx365 days)
- Waste generated per day = 0.41x 3236 = 1326kg = 1.33 tonne

Waste generated per annum = 1.33x365 = 485 tonne

## 11 Conclusion

A new WWTW will need to be built to serve a proposed sewer network for the development. Sewer generated onsite may have to be handled onsite prior to the sewer infrastructure build.

The township will improve the housing stock of the Skhwahlane area.

Signature:

Signed by:

PR No.:

For Dalimede Projects (PTY) Ltd

# ANNEXURES

## ANNEXURE 1 Layout Plan