PROPOSED TOWNSHIP, SITUATED IN REMAINDER OF THE FARM DWARSLOOP 248 KU, MPUMALANGA PROVINCE

BULK ENGINEERING SERVICES REPORT

JULY 2021, REV 1

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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^3	-	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 in remainder of the farm Dwarsloop 248 KU, Mpumalanga Province.
This township will be of mixed land use but will be mainly 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 Dwarsloop, 11km north of Bushbuckridge town along the R40 highway. Bushbuckridge is in turn 100km north from Nelspruit the capital of Mpumalanga Province. The area is administered by Bushbuckridge Local Municipality, under the Ehlanzeni District Municipality. GPS coordinates of site are 24°46'35.20"S 31° 5'20.21"E.
The locality map is shown on the figures below.

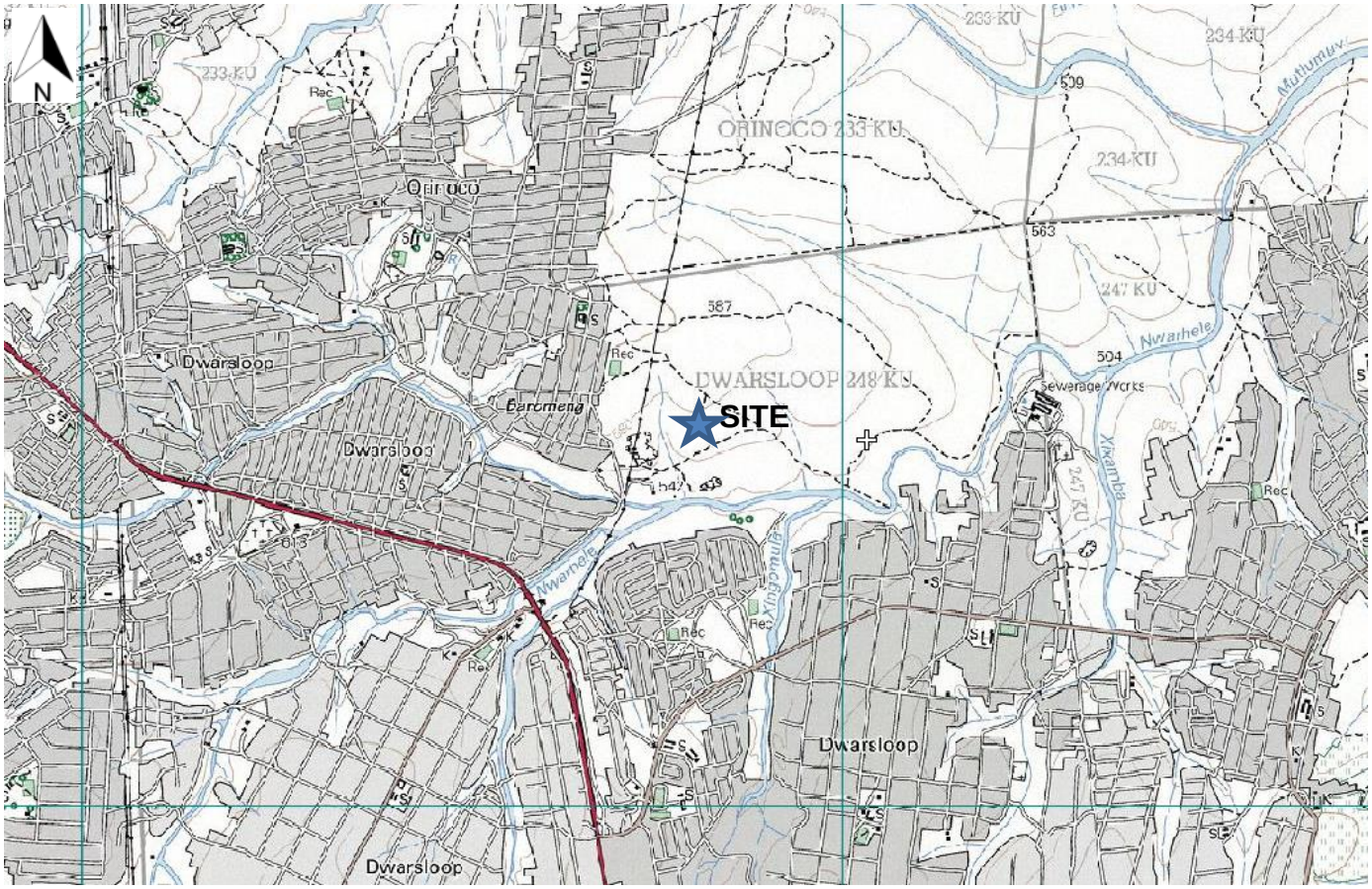

Figure 1 Site locality

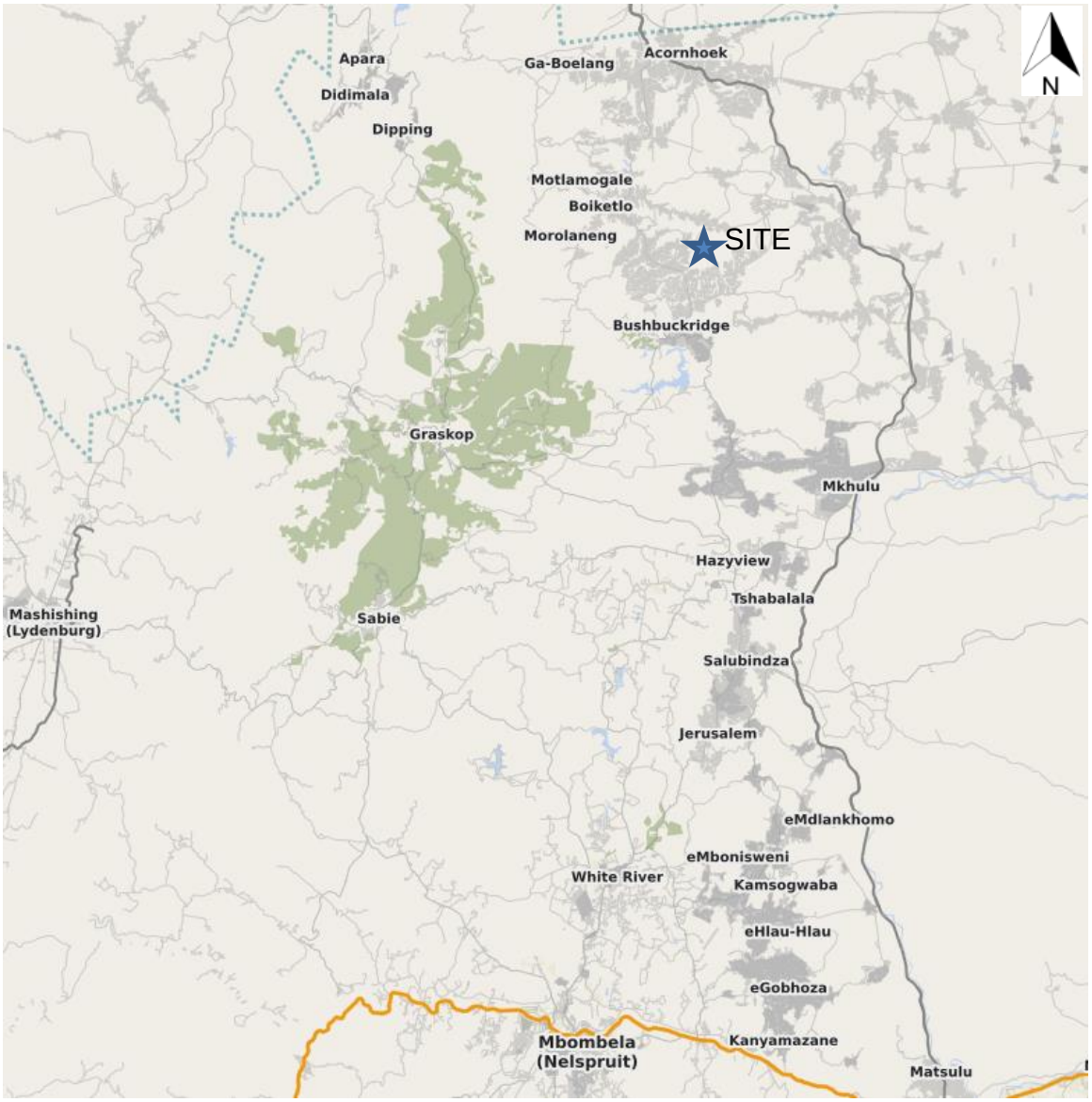

Figure 2: Locality plan

3 TOWN PLANNING

The site is currently a bush and a vacant land.

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 1	DWELLING UNIT	517	32.07	59.16	
BUSINESS 1	RETAIL	5	0.65	1.20	
INSTITUTIONAL	CRECHE	3	0.27	0.50	
INSTITUTIONAL	CHURCH	3	0.30	0.55	
EDUCATIONAL	PRIMARY SCHOOL	1	3.24	5.98	
PUBLIC OPEN SPACE	PUBLIC OPEN SPACE	4	3.78	6.97	
ROADS PURPOSES			13.93	25.64	
TOTAL DEVELOPABLE AREA		533	54.24	100%	

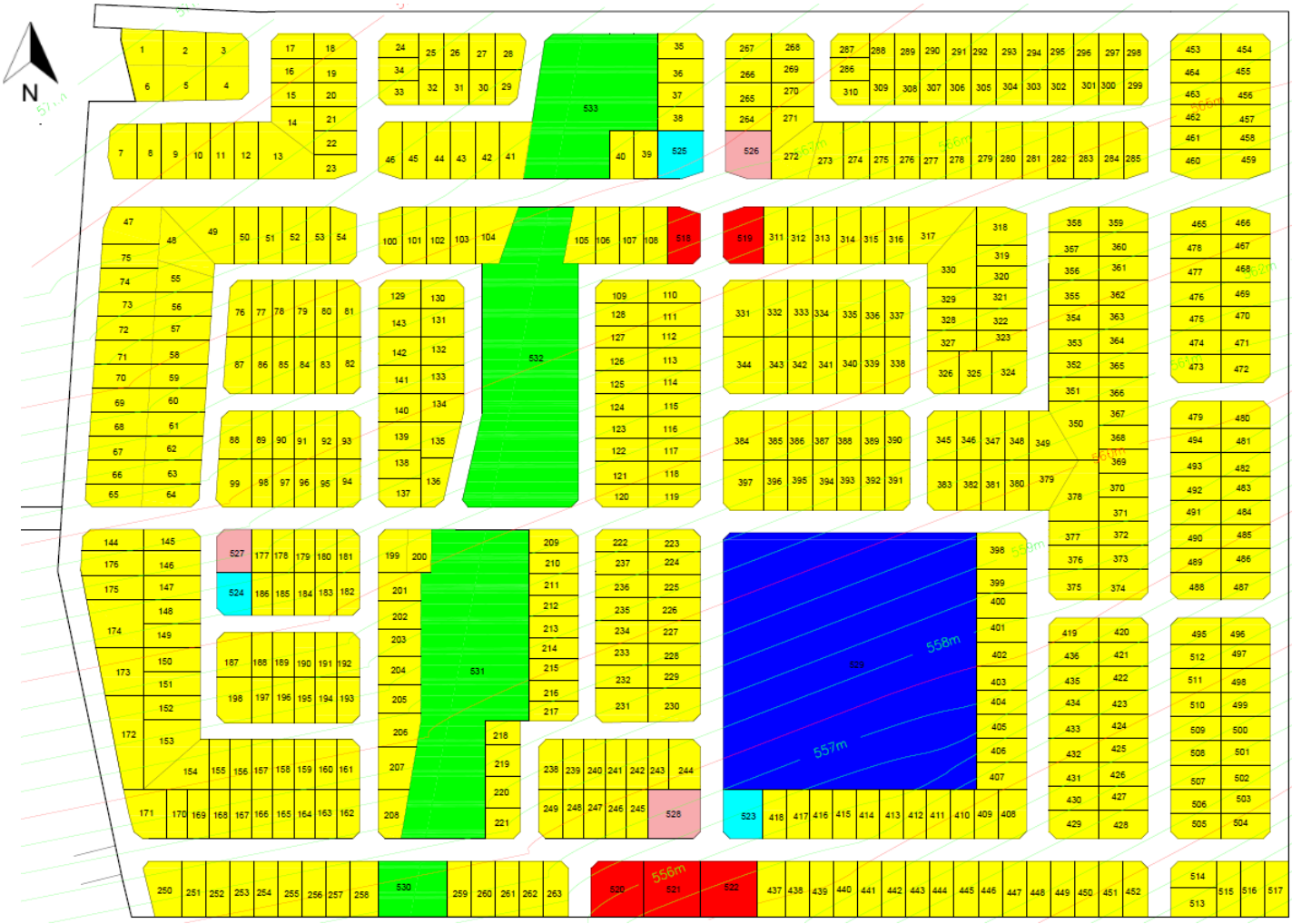

Figure 3 Proposed stands layout

4 TOPOGRAPHY AND ACCESS

The proposed township site slope is generally flat. The community is utilising a portion of the site for sand mining.

Figure 4 Topography

The site is can be accessed through existing gravel internal streets within Dwarsloop C / Baromeng villages.

An application to connect the township to the internal streets, has to be approved by road authorities prior to construction.

Figure 5 Road for access

5 WATER SERVICE

5.1 Water source

The Dwarsloop area water source is the Inyaka Dam Bulk Water Treatment Works (WTW), whose custodian is Bushbuckridge Water. The Inyaka Dam is located at GPS coordinates 24°53'9.31"S 31° 5'4.37"E, some 20km north to the Dwarsloop site along the R40 highway.
Water is conveyed from the Inyaka Bulk WTW to the existing Dwarsloop command reservoir.

The water meter records could not be obtained for further analysis.

5.2 Storage

The Dwarsloop reservoirs receive water from the Inyaka WTW bulk line that passes through the village. Dwarsloop area is then supplied water from the reservoirs. The exact capacities of the reservoirs could not be determined but are estimated to have a capacity of 5Mℓ.

Figure 6 Water storage

5.3 Water Bulklines

There is an existing 600mm diameter water bulk line passing through the village, along the R40 highway, and linked to the reservoirs in Dwarsloop.

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.	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.	School, crèche, educational buildings	60 ℓ/student
xv.	School, crèche, educational grounds	12 kℓ/Ha
xvi.	Institutional, FAR = 0.4	0.6 kℓ/100m^2
xvii.	Sport grounds / Recreational	40 kℓ/Ha
xviii.	Residential stands; High density, small sized, with 20 to 12 units/Ha	11 kℓ/Ha/day
xix.	Flats, High density	0.35 kℓ/unit/day
xx.	Stadium: Buildings only	1.5 kℓ/1000seats
xxi.	Stadium: Grounds only	12 kℓ/Ha/day
xxii.	Hotels	0.2 kℓ/person
xxiii.	Golf estate - excluding golf course water requirements. Stand size less than 2670m^2.	3kℓ/stand/day
xxiv.	Garage or filling station	0.8kℓ/100m^2
xxv.	Frail care centres and hospitals, Building according to FAR	1.2kℓ/100m^2
xxvi.	Gross Average Annual Daily Demand (GAADD)	Allow 10% losses
xxvii.	Daily Instantaneous Peak Factor (DIPF)	1.5
xviii.	Design Peak Flow Rate (DPFR) for domestic flows.	25ℓ/s
xxix.	Maximum static head	90m
xxx.	Minimum residual head under conditions of domestic peak flow	10m
xxxi.	Maximum linear flow velocity under conditions of domestic peak flow	3m/s

Item	Design element	Criteria
xxii.	Pipe type	uPVC
xxiii.	Minimum pipe class	9
xxiv.	Fire flow at any one hydrant under the conditions of domestic peak flows (one hydrant at a time)	15 ℓ/s
xxv.	Minimum residual head (fire plus domestic peak flow)	25m
xxvi.	Maximum linear flow velocity under conditions of fire-fighting	3m/s
xxvii.	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 Department of Basic Education (DBE) classifies school according to the sizes of small, medium and large, as listed below:

Secondary Schools:

- Enrolment less than 200: Small school
- Enrolment between 200 – 600: Medium school
- Enrolment greater than 600: Large school

Primary Schools:

- Enrolment less than 311: Small school
- Enrolment between 311 – 620: Medium school
- Enrolment greater than 620: Large school

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 400kℓ/d AADD and 440kℓ/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 (Dwelling Unit)	517	32.07	517		0.6	kℓ/erf/day	310.2	kℓ/d
Business 1 (Retail)	5	0.65		0.4	0.650	kℓ/100m^2	11.7	kℓ/d
Institutional (Creche)	3	0.27	300		0.060	kℓ/student	18.0	kℓ/d
Institutional (Church)	3	0.30		0.4	0.600	kℓ/100m^2	7.0	kℓ/d
Institutional (Primary School)	1	3.24	620		0.060	kℓ/student	37.2	kℓ/d
Public Open Space	4	3.78			12	kℓ/hectare	16.0	kℓ/d
Roads Purposes		13.93						
Totals	533	54.24						
Sub-total Average Annual Daily Demand (AADD)							400.0	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							440.0	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							5.1	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	660.0	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	7.6	ℓ/s
Peak Water Flow							7.6	ℓ/s

NB: The primary school was taken as a medium sized school.

The Fire flows are presented on the table below.

Table 4 Fire flow demands

Fire category: **Moderate risk 1: Industrial, business, highrise 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
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

5.6 Water bulk proposed

The figure below shows the proposed 4km long bulk line (in blue colour), to cater for the proposed township.

Figure 7 Water bulk line proposed

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 4.5ℓ/s.
Water reticulation must then be constructed to service the township.

6 SEWER SERVICE

6.1 Existing Wastewater Treatment Works

A portion of Dwarsloop area is serviced by the Dwarsloop WasteWater Treatment Works (WWTW). The design capacity of the wastewater plant is 1.65 Mℓ /day. The actual sewer flows at the works is yet to be established.

The plant treats the wastewater generates from the area, covering business, industrial and domestic. The plant is located as shown in the figure below. GPS coordinates: 24°46'35.00"S 31° 6'43.87"E.

Figure 8 Dwarsloop WWTW

The areas not serviced by the WWTW currently depend on 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)	517	32.07	310.2	kℓ/d	85%	263.7	kℓ/d
Business 1 (Retail)	5	0.65	11.7	kℓ/d	85%	9.9	kℓ/d
Institutional (Creche)	3	0.27	18.0	kℓ/d	85%	15.3	kℓ/d
Institutional (Church)	3	0.30	7.0	kℓ/d	85%	5.9	kℓ/d
Institutional (Primary School)	1	3.24	37.2	kℓ/d	85%	31.6	kℓ/d
Public Open Space	4	3.78	16.0	kℓ/d	85%	13.6	kℓ/d
Roads Purposes		13.93	0.0	kℓ/d	85%	-	kℓ/d
Totals	533	54.24	400.0				
Sub-total Sewer ADWF						**340.0**	**kℓ/d**
15% Extraneous flow						51.0	kℓ/d
Gross Sewer						391.0	kℓ/d
Gross Sewer Flow						4.5	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						11.3	ℓ/s

The new development will have a sewer ADWF of 340kℓ/d and a gross sewer flow of 391kℓ/d.

6.3 Sewer reticulation

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

- The municipality is amenable to connecting the proposed township to the Dwarsloop WWTW to handle the sewer for the township. 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, through Enviro Loo toilets. These toilets that can be bought from commercial suppliers.

Figure 9 Enviro-loo domestic toilets

6.4 Sewer infrastructure proposed

The proposed 2.5km sewer outfall to service the new development is shown in the figure below.

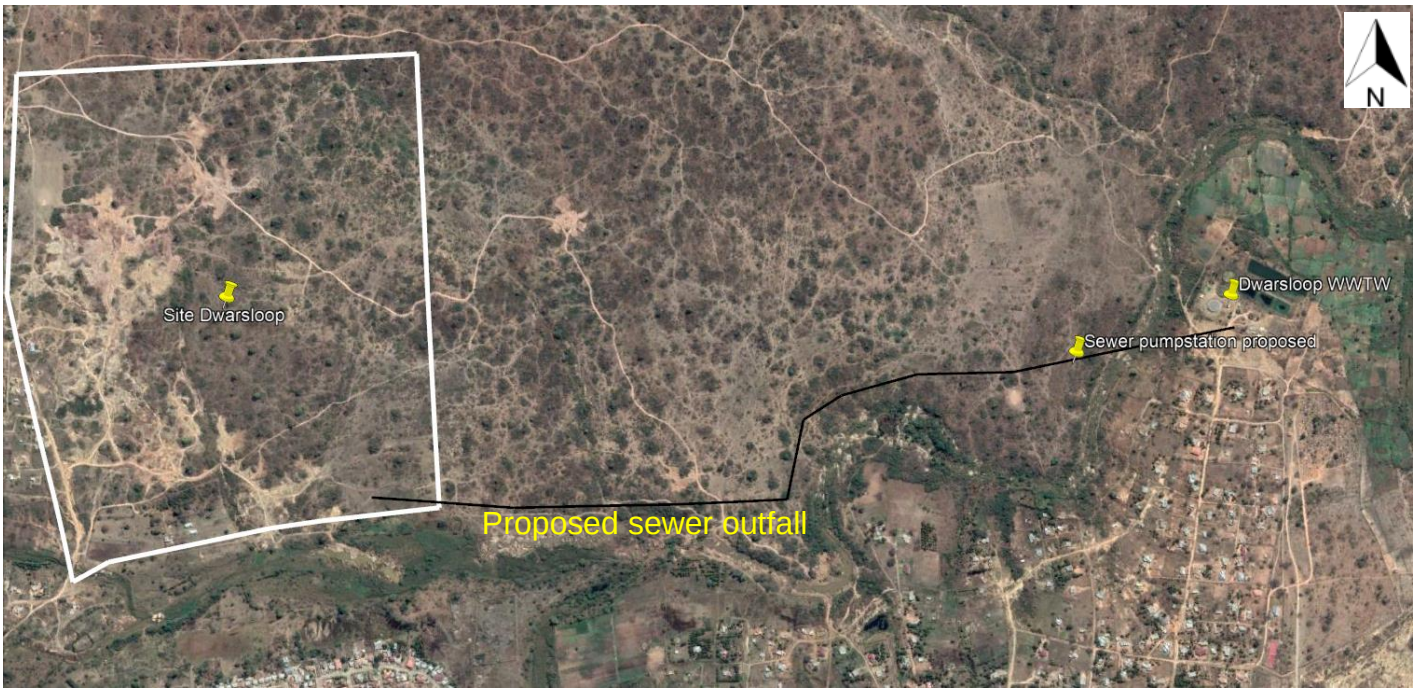

Figure 10 Proposed sewer outfall

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.

Figure 11 Electrical infrastructure onsite

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

Hydrological Data	
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	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 11 Stormwater design standard

Design Element	**Specification**
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 = 517 residential x 4people per unit = 2068 people

- Solid waste = 0.41kg/per person/day or (0.41kgx365 days)
- Waste generated per day = 0.41x 2068 = 848kg = 0.85 tonne

Waste generated per annum = 0.85x365 = 309 tonne

11 Conclusion

The proposed township is viable and will improve the housing stock of Dwarsloop.

Signature:

Signed by:
PR No.:
For Dalimede Projects (PTY) Ltd

ANNEXURES

ANNEXURE 1 Layout Plan