PROPOSED TOWNSHIP SITUATED ON A PORTION OF THE REMAINING EXTENT OF PORTION 3 OF THE FARM NABOOMSPRUIT 348 KT, LIMPOPO

BULK ENGINEERING SERVICES REPORT

March 2022, Rev1

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:

Real Development Planning Company
9 Leadwood Street, Nelspruit
P.O. Box 19557, Nelspruit,
Mpumalanga, 1200

Tel: 013 741 4844
Email: Harrington.Dhlamini@gmail.com

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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

Real Development Planning Company appointed Dalimede Projects to prepare the bulk engineering services report for the proposed township establishment in Naboomspruit Township, located in Limpopo Province.

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

2 LOCALITY

The proposed township is situated, 150km from Polokwane in the heart of Mookgophong town, in Limpopo Province. The area is administered by Modimolle-Mookgophong Local Municipality, under the Waterberg District Municipality. GPS coordinates of site are 24°31'25.13"S 28°42'59.66"E. The locality map is shown on the figures below.

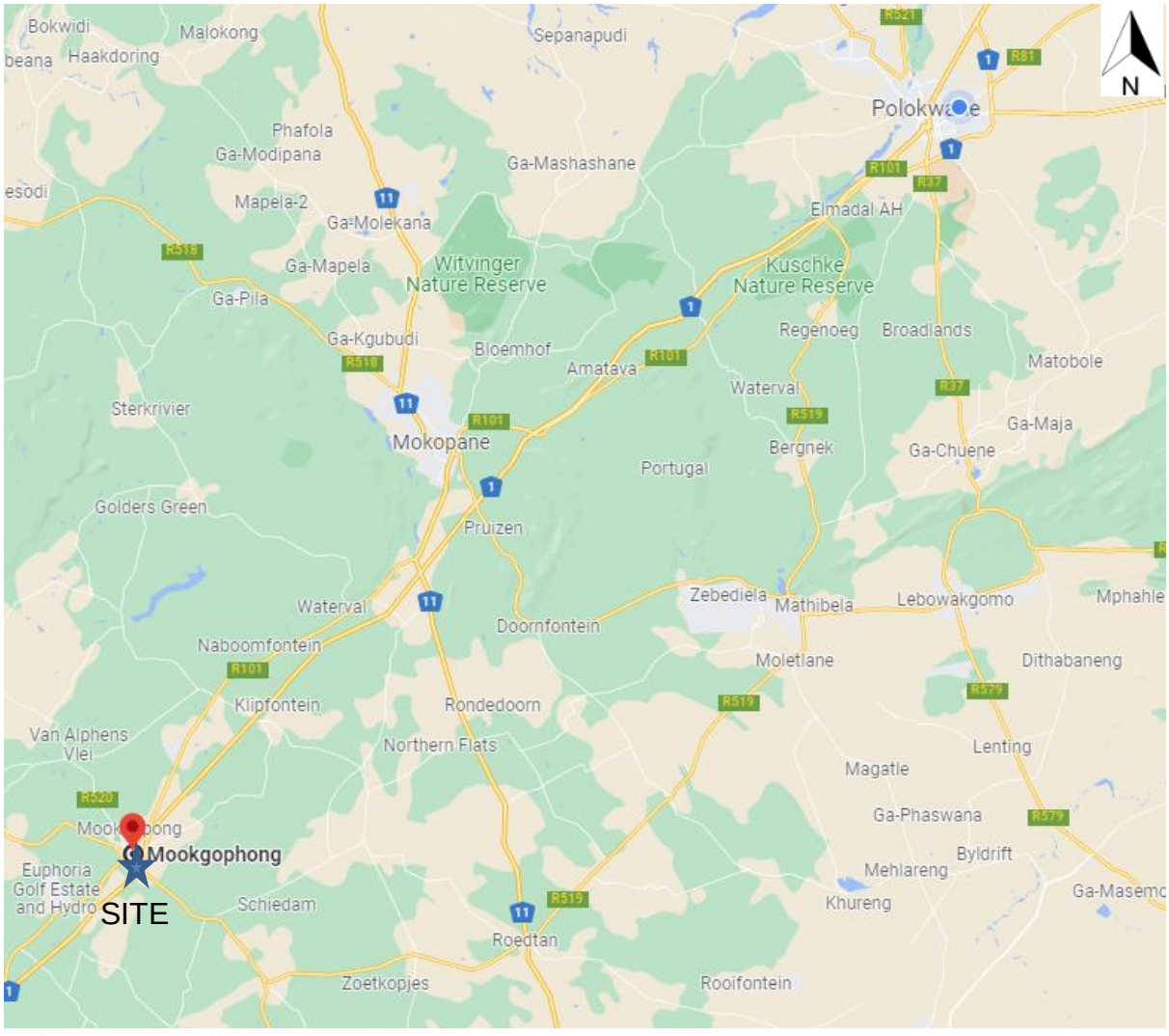


Figure 1 Locality map

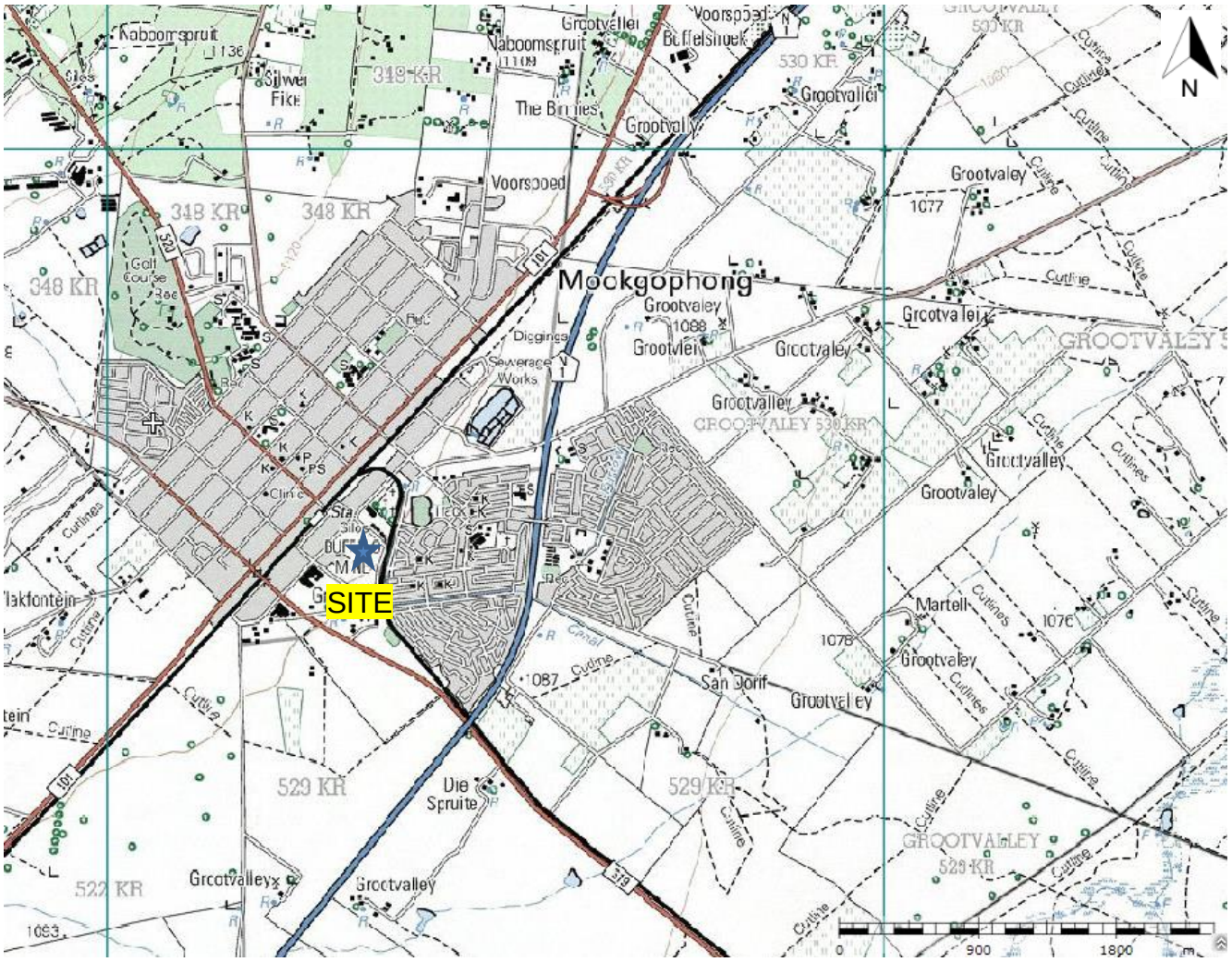


Figure 2 Locality

Figure 3 Locality plan

3 TOWN PLANNING

Township is to be of mixed land use but will be mainly for residential purposes.

The site is to be developed to land uses shown in the table below.

Table 1 Land use

ZONING	LAND USE	LEGEND	NUMBER OF ERVEN	AREA (HA)	% OF AREA
Residential 1	Dwelling House		85	2,72	28,63%
Institutional	Orphanage		1	0,12	1,31%
	Early Childhood Development Centre		1	1,51	15,92%
Business 1	Shops and other business related uses		1	0,13	1,41%
Place of Public Worship	Church		1	0,28	2,94%
Municipal	Municipal Commonage		1	2,20	23,18%
Government	Social Services Offices		1	0,59	6,16%
ROADS			*	1,94	20,45%
TOTAL	*	*	**91**	**9,50**	**100,00%**

The proposed land use layout is shown in the figure on the next page.

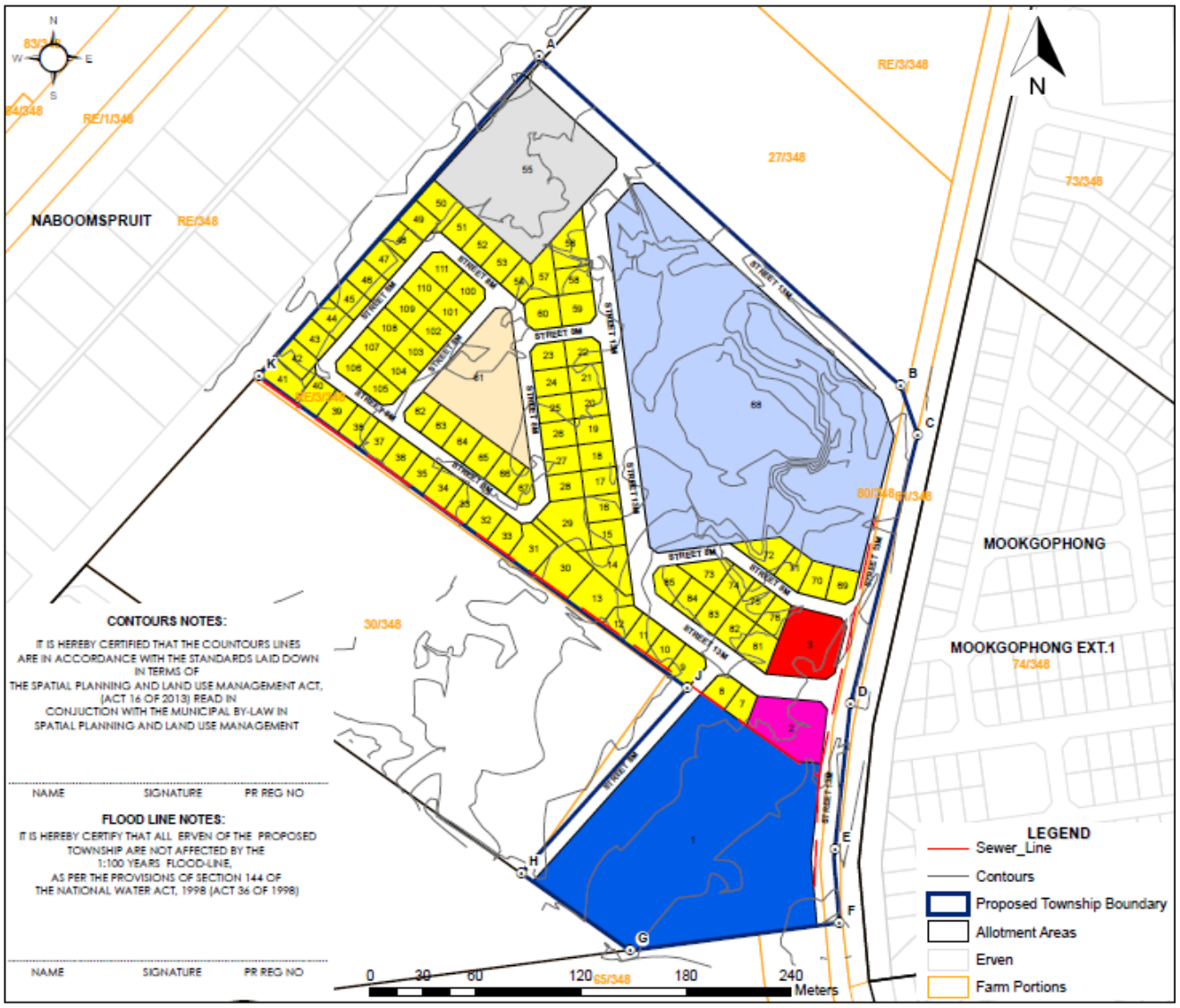


Figure 4 Site Development Plan

Mookgophong has an existing settlement shown in the figure below.

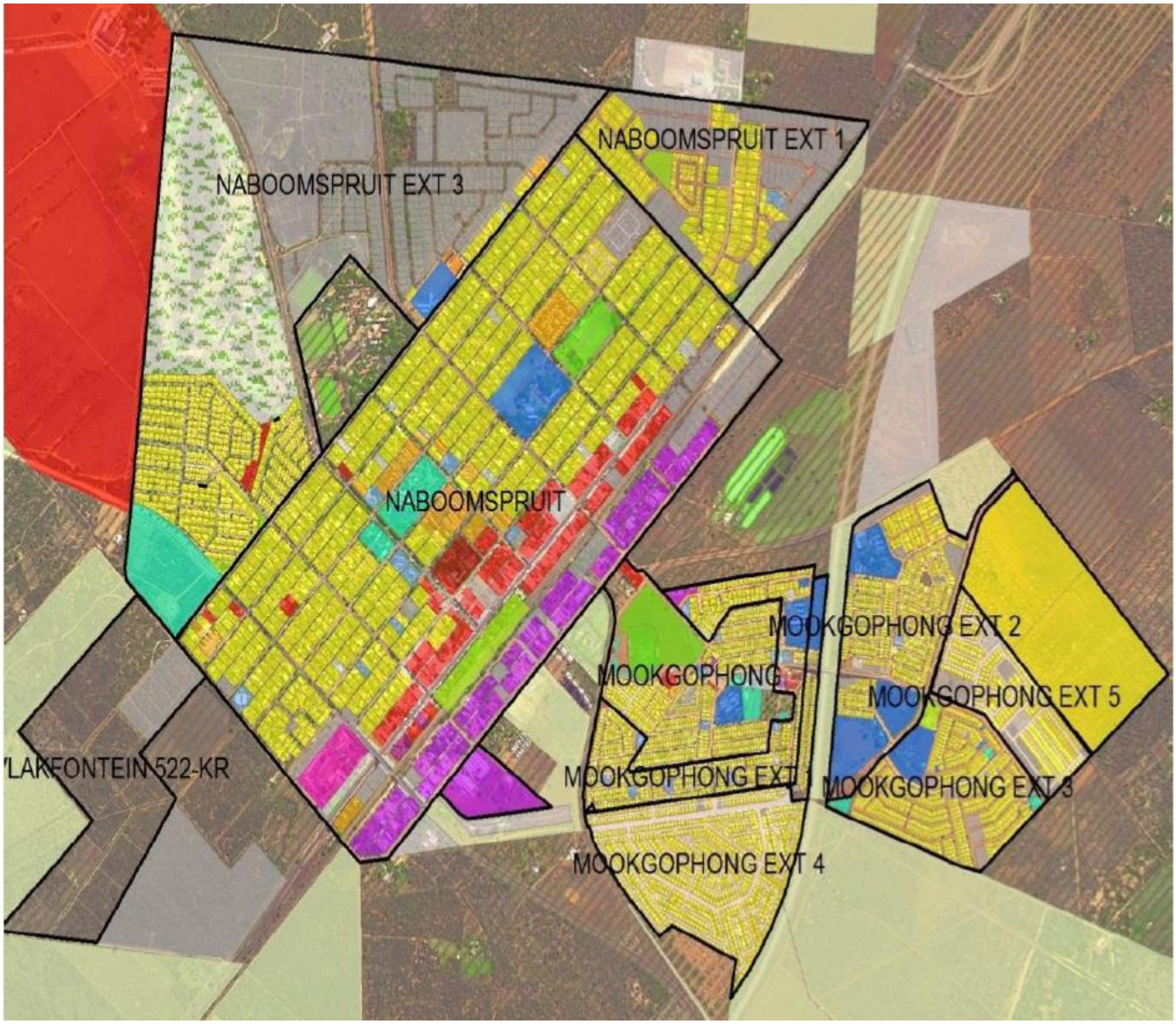


Figure 5 Existing Mookgophong settlement

Table 2: Glossary of Mookgophong existing layout:

Township Boundaries	Filling Station	Municipal	Small Holding
Agricultural	Game Farm	Park	Sport Grounds
Business	Golf Course	Post Office	Vacant
Cemetary	Government	Protected Area	Other
Church	Holiday Resort	Railway	Unkown
Clinic	Industrial	Road	
Creche	Mine	School	
Farm	Multiple Residential	Single Residential	

Table 3 Mookgophong existing settlement

Land Use	No. of Erven	Area (Ha)
Existing Settlement		
Business 1	121	22.1999
Church	9	2.0
Clinic	1	4.2917
Creche	11	1.8
Educational	16	41.9304
Golf Course Green	1	48.4791
Industrial 1	109	28.7161
Informal Settlement	499	30.0250
Municipal	13	18.0953
Private Open Space	5	11.6950
Public Open Space	2	5.6421
Residential 1	4635	290.5879
Residential 2 (Dwelling Unit) [44 DU/ha]	42	11.0410
Undetermined	1255	159.9040
Totals	**6 719**	**676.43**

4 TOPOGRAPHY AND ACCESS

The site topography is generally flat.

Figure 6 Site view

The proposed site of Naboomspruit / Mookgophong town is accessible from 1st street, which is an internal street in Mookgophong.

1st street is bituminous top surfaced whereas the access road is earth road. There are existing random pot-holes on 1st street.

See the figures below.

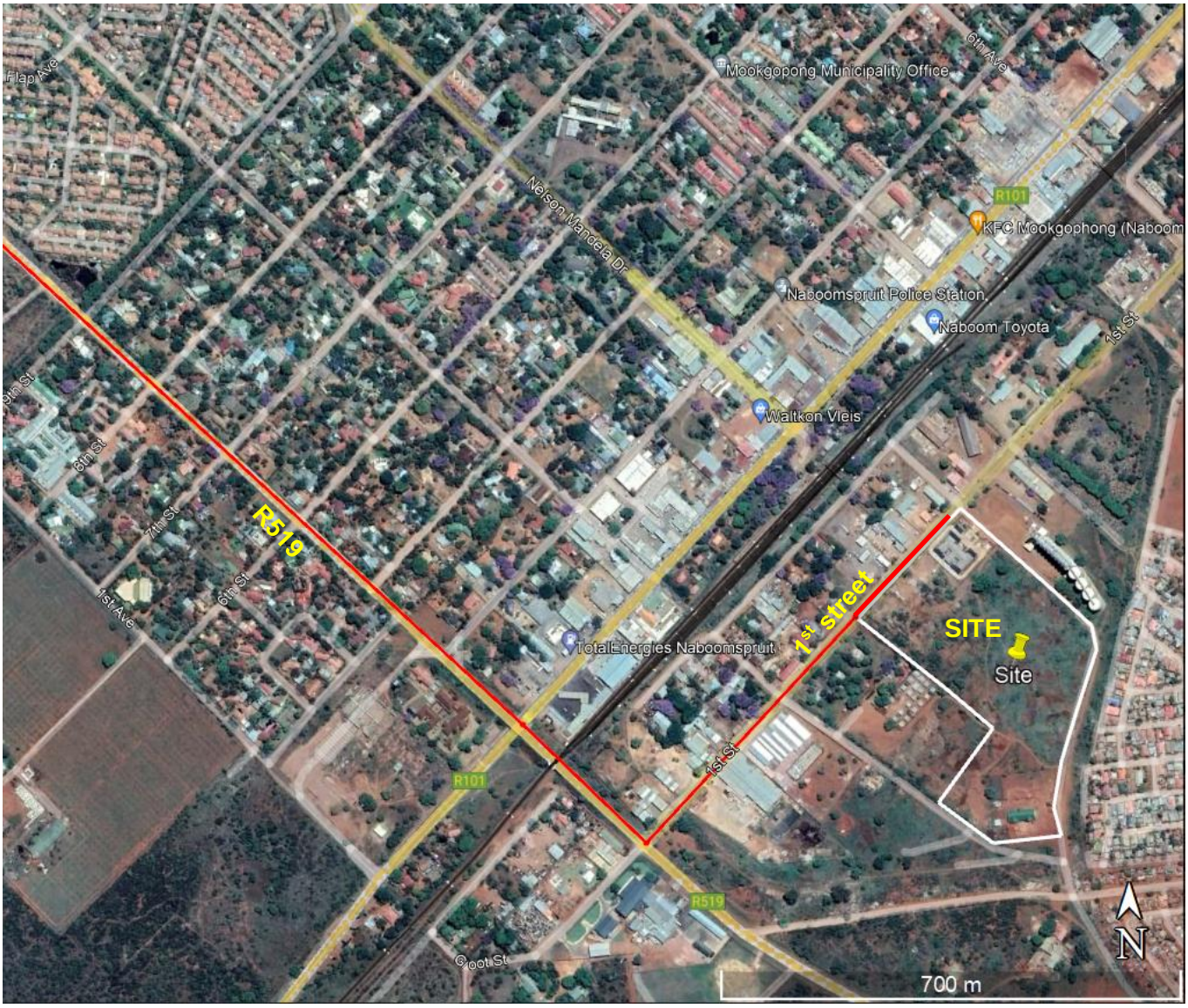


Figure 7 Site access

Figure 8 Access road – 1st street

5 WATER SERVICE

The project site has existing municipal infrastructure for water, sewer, electricity, access roads and stormwater. The existing bulk water infrastructure is shown on the figure below.

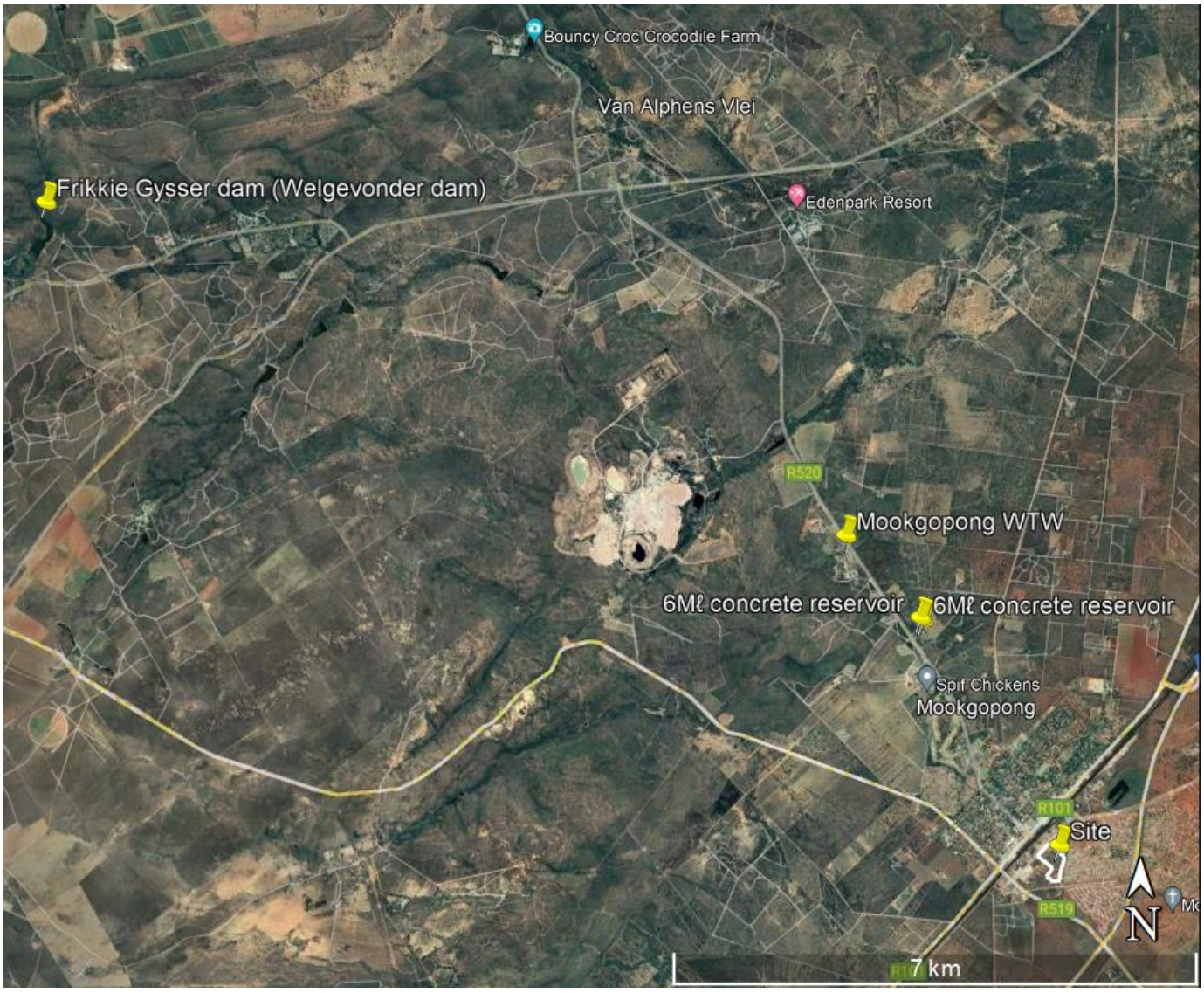


Figure 9 Existing water bulk infrastructure

5.1 Water source

Mookgophong town receives water from the Mookgophong Regional Water Scheme (RWS).

The settlements within the Mookgophong RWS includes Mookgophong town, Phomolong, Phomolong Squatter Settlement and Rietbokvalley.

Water for this scheme is sourced from the Frikkie Geyser Dam (also known as the Welgevonden Dam). GPS: 24°26'48.40"S 28°35'0.86"E, and from a wellfield in the Nyl Valley groundwater aquifer.

Welgevonden / Frikkie Geyser Dam supplies a portion of the town's water, while there are **6 active boreholes** from the Nyl Valley groundwater aquifer augments water supply.

Water allocation from the Frikkie Geyser Dam is 0.504 million m^3/annum.

Water supplied from the Nyl groundwater aquifer is unknown due to non-functioning water meters.

Depending on the irrigation development upstream of the dam the yield of Frikkie Geyser Dam can vary between 0.850 million m^3 /a to as much as 2.230 million m^3 /a (the higher value is given should there be no upstream irrigation or other developments utilising water from the catchment).

Table 4 Abstraction Point

Description	**Locality:**
	Mookgophong
Water Source	Welgevonden / Frikkie Geyser Dam
Abstraction allocation (DWS), water use licence	504 000 m^3/annum i.e. 1381 m^3/day = 1381kℓ/day = 1.38Mℓ/day
Raw Water Pumps	Working
Raw Water Bulk line	200mm diameter

Raw water is then conveyed to the following water treatment works (WTW):

- Mookgophong WTW, GPS 24°29'46.59"S 28°41'53.31"E.

Table 5 Mookgophong WTW details

Description	**Locality:**
	Mookgophong
Water Treatment Works Capacity	1.5 Mℓ/day

See figure below:

Raw water induced with coagulants and lime is then shocked by letting water run through inlet works prior being conveyed to settlement tank.

WTW inlet after treatment with coagulant and lime.

Lime machine to treat raw water is out of order and has to be induced by hand

Coagulation dosage

Figure 10 Mookgophong WTW

Raw water is pumped from the Frikkie Geyser dam to a 2.5Mℓ raw water concrete reservoir through a 200mm diameter pipeline. From the raw water reservoir, the raw water pipeline bottle necks from a 315mm diameter AC pipeline to a 250mm diameter AC pipeline to a 160mm diameter AC pipeline to a 200mm diameter AC pipeline that serves as an inlet to the Mookgophong WTW.

Mookgophong has 21 existing boreholes, if all 21 boreholes were operational then the supply to Mookgophong town could be 2.7Mℓ/day, but only 6 are functional currently, and the amount supplied from the 6 boreholes could not be provided as water meters are not working.

Table 6 Existing Boreholes

Description	**Locality:**
	Mookgophong
Number of existing boreholes	21
Number of Functional Boreholes	6
Total borehole water discharge	Unknown

Bulk meter water supply records could not be obtained.

5.2 Bulk Water Pipeline

At the Mookgophong WTW, water is pumped through a 160mm diameter AC pipeline, and the Nyl aquifer boreholes is pumped through a 200mm diameter AC pipeline. The pumping main conveys potable water from the Mookgophong WTW to one of the two reservoirs in Mookgophong and the second of the two reservoirs is supplied by the Nyl aquifer boreholes, although both reservoirs transpose water to one another to assure that they are both filled to the same level at all times.

The valves at the reservoirs are opened at around 4:00-5:00am each day to supply the town with water and it usually runs out by 12:00pm (midday) any potable water conveyed to the reservoir runs directly into the bulk water pipeline and thus leads to the reservoir valves being closed around 15:00pm to recharge. This practice is conducted on a daily basis.

The potable water from the reservoirs is conveyed by gravity to the town of Mookgophong, where the lowest point of the town is constantly supplied with water until the valves are closed at 15:00pm and any part of the town higher than 4m above the elevation of the lowest part of the town runs out of water daily as soon as the reservoirs are empty.

5.3 Storage Reservoirs / Tanks

There are two concrete reservoirs in Mookgophong, viz;

- Two x 6Mℓ concrete reservoirs. GPS coordinates 24°29'47.59"S 28°41'54.25"E.

Water level recorded at empty at 12:00pm (midday)

Tank supplied by Nyl river borehole augmented by Reservoir 1 (Supplied by Mookgophong WTW)

Figure 11 Water storage

5.4 Water Reticulation

The area adjacent to site has an existing water reticulation to yard connection standard. The reticulation closest to site is a 90mm diameter AC pipeline. The water operators indicated that this 90mm water pipeline is experiencing capacity challenges.

Figure 12 Water reticulation onsite

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 7 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
xxxii.	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

Item	Design element	Criteria
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 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

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 township will require 164.1kℓ/d AADD and 180.5kℓ/d Gross Average Annual Daily Demand.

Table 8 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 House)	85	2.72	107		0.6	kℓ/erf/day	50.1	kℓ/d
Institutional (Orphanage)	1	0.12	500		0.060	kℓ/student	30.0	kℓ/d
Institutional (Early Childhood Development Centre)	1	1.51	100		0.060	kℓ/student	6.0	kℓ/d
Business 1 (Shops and other business-related uses)	1	0.13		0.4	0.65	kℓ/100m^2	3.4	kℓ/d
Place of Worship (Church)	1	0.28		0.4	0.600	kℓ/100m^2	6.7	kℓ/d
Municipal (Municipal Commonage)	1	2.20		0.4	0.600	kℓ/100m^2	52.8	kℓ/d
Government (Social Services Offices)	1	0.59		0.4	0.600	kℓ/100m^2	14.2	kℓ/d
		1.95						
Totals	113	9.50						
Sub-total Average Annual Daily Demand (AADD)							164.1	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							180.5	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							2.1	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	270.7	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	3.1	ℓ/s

The Fire flows are shown in the table below.

Table 9 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

The proposed development will add into the existing Mookgophong households.

Table 10 Water demand (Existing Mookgophong settlement)

Land Use	No. of Erven	Area (Ha)	No. of Units	Floor Area Ratio, FAR	Unit flow	Unit of measure	Water Demand	
Business 1	121	22.1999		0.4	0.65	kℓ/100m^2	577.2	kℓ/d
Church	9	2.0		0.4	0.600	kℓ/100m^2	48.0	kℓ/d
Clinic	1	4.2917		0.4	0.600	kℓ/100m^2	103.0	kℓ/d
Creche	11	1.8	1100		0.060	kℓ/student	66.0	kℓ/d
Educational	16	41.9304		0.8	0.600	kℓ/100m^2	2012.7	kℓ/d
Golf Course Green	1	48.4791			12.0	kℓ/Ha	581.7	kℓ/d
Industrial 1	109	28.7161		0.4	0.400	kℓ/100m^2	459.5	kℓ/d
Informal Settlement	499	30.0250			11.0	kℓ/Ha	330.3	kℓ/d
Municipal	13	18.0953		0.4	0.600	kℓ/100m^2	434.3	kℓ/d
Private Open Space	5	11.6950			12.0	kℓ/Ha	140.3	kℓ/d
Public Open Space	2	5.6421						
Residential 1	4635	290.5879	4635		0.6	kℓ/erf/day	2781.0	kℓ/d
Residential 2 (Dwelling Unit) [44 DU/ha]	42	11.0410	486		0.5	kℓ/erf/day	242.9	kℓ/d
Unknown	1255	159.9040		0.4	0.65	kℓ/100m^2	4157.5	kℓ/d
Totals	6719	676.43						
Sub-total Average Annual Daily Demand (AADD)							11934.4	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							13127.8	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							151.9	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	19691.8	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	227.9	ℓ/s

The combined water demand for the Mookgophong existing and proposed is shown in the table below.

Table 11 Combined (Existing and proposed) Mookgophong water demand

Land Use	No. of Erven	Area (Ha)	No. of Units	Floor Area Ratio, FAR	Unit flow	Unit of measure	Water Demand	
Existing Development								
Business 1	121	22.1999		0.4	0.65	kℓ/100m^2	577.2	kℓ/d
Church	9	2.0		0.4	0.600	kℓ/100m^2	48.0	kℓ/d
Clinic	1	4.2917		0.4	0.600	kℓ/100m^2	103.0	kℓ/d
Creche	11	1.8	1100		0.060	kℓ/student	66.0	kℓ/d
Educational	16	41.9304		0.8	0.600	kℓ/100m^2	2012.7	kℓ/d
Golf Course Green	1	48.4791			12.0	kℓ/Ha	581.7	kℓ/d
Industrial 1	109	28.7161		0.4	0.400	kℓ/100m^2	459.5	kℓ/d
Informal Settlement	499	30.0250			11.0	kℓ/Ha	330.3	kℓ/d
Municipal	13	18.0953		0.4	0.600	kℓ/100m^2	434.3	kℓ/d
Private Open Space	5	11.6950			12.0	kℓ/Ha	140.3	kℓ/d
Public Open Space	2	5.6421						
Residential 1	4635	290.5879	4635		0.6	kℓ/erf/day	2781.0	kℓ/d
Residential 2 (Dwelling Unit) [44 DU/ha]	42	11.0410	486		0.5	kℓ/erf/day	242.9	kℓ/d
Undetermined	1255	159.9040		0.4	0.65	kℓ/100m^2	4157.5	kℓ/d
Proposed Development								
Residential (Dwelling House)	85	2.72	85		0.6	kℓ/erf/day	51.0	kℓ/d
Institutional (Orphanage)	1	0.12	500		0.060	kℓ/student	30.0	kℓ/d
Institutional (Early Childhood Development Centre)	1	1.51	100		0.060	kℓ/student	6.0	kℓ/d

Land Use	No. of Erven	Area (Ha)	No. of Units	Floor Area Ratio, FAR	Unit flow	Unit of measure	Water Demand	
Business 1 (Shops and other business-related uses)	1	0.13		0.4	0.65	kℓ/100m^2	3.4	kℓ/d
Place of Worship (Church)	1	0.28		0.4	0.600	kℓ/100m^2	6.7	kℓ/d
Municipal (Municipal Commonage)	1	2.2000		0.4	0.600	kℓ/100m^2	52.8	kℓ/d
Government (Social Services Offices)	1	0.59		0.4	0.600	kℓ/100m^2	14.2	kℓ/d
Roads		1.95						
Totals	6810	685.93						
Sub-total Average Annual Daily Demand (AADD)							12098.5	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							13308.3	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							154.0	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	Peak factor	19962.5	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	Peak factor	231.0	ℓ/s

5.7 Bulk water capacity

The combined Mookgophong water demand AADD is 12 098.5kℓ/d.

The Mookgophong reservoirs capacity is 12Mℓ.

Therefore, Mookgophong required storage = AADD x 1 = 12 098.5kℓ x 1 = 12 098.5kℓ = 12.1Mℓ

Mookgophong required storage (12.1Mℓ) **is greater than** Existing reservoirs capacity of 12Mℓ.

Hence the required water storage for Mookgophong is slightly more than the available Mookgophong reservoirs capacity.

The capacity of the existing 90mm pipeline near the proposed site is shown in the table below.

Table 12 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)**
90mm	76.6	5.53	0.006	477.8	0.478

The capacity of the existing 90mm diameter pipeline has a capacity of 5.53ℓ/s. The proposed development has a peak water demand of 2.2ℓ/s.

The existing 90mm diameter pipeline was reported to have capacity challenges.

Mookgophong Bulk water supply experience the following challenges:

1. There are water meters on the inlet and outlets of the Mookgophong reservoirs. They are both currently not working, there is no way of determining the amount of water that is actually being utilised.

2. Due to the aging infrastructure of the current asbestos cement (AC) bulk water lines, Mookgophong also experiences severe water loss through leakages and periodic bursting water pipelines. The quantity of water losses could not be determined due to the water meters not working.

3. In addition to the above challenges, the existing Nyl aquifer boreholes in Mookgophong amount to 21 in total. Only 6 of which are currently operating.

4. The pumping pipe lines for the WTW and the boreholes both are experiencing electrical power issues, where for 5 to 6 hours a day there is no electricity being supplied to run the pumps. This has a huge impact on water services capability to deliver potable water to the people of Mookgophong.

5. Operators of the WWTW lack tools, equipment, machinery and vehicle for operation and maintenance.

6. There is a lack of a water master plan.

5.8 Water infrastructure proposed

The following is proposed:

- Existing asbestos cement (AC) water reticulation will need to the upgraded.
- An application for a water license is to be submitted to the Department of Water Affairs to increase the extraction capacity from Frikkie Geyser dam.
- Pipeline condition survey will need to be done on the existing 160mm diameter pipeline will be needed in the short term. This would include water leak detection and water metering.
- A water connection to the existing reticulation for the proposed development.
- Boreholes pumps currently not working to be repaired.
- Upgrading of water treatment works will be required

5.9 Ground water source

In order to augment the water supply to site, another groundwater source will need to be divined, drilled and tested. The borehole should be aimed at matching the water demand of the development as shown in Table for Water demand.

Figure 13 Water connection proposed

6 SEWER SERVICE

6.1 Existing wastewater treatment works

Mookgophong town is serviced by the following wastewater treatment works (WWTW):

- Mookgophong WWTW, GPS 24°30'60.00"S 28°43'23.19"E. The design capacity of the WWTW is 3Mℓ/day.

The actual sewer flows at the WWTW's is unknown.

The WWTW is located as shown in the figure below.

Figure 14 Wastewater Treatment Works, sewer outfall (black line)

6.2 Bulk sewer

There are existing bulk sewer pipelines that are currently servicing Mookgophong in general.

Sewer bulk lines flow to the existing wastewater treatment works. The wastewater is conveyed to the treatment works through gravity outfalls. The sewer outfall pipe size is not known, as there was boulder placed on top of the manhole to replace a missing manhole lid and there are no sewer reticulation layout plans.

The sewer bulkline inflow is unknown.

Figure 15 Sewer outfall manhole (Missing manhole cover)

6.3 Sewer Reticulation

The existing residential area sewer basin that currently contributes sewer to the existing 160mm diameter sewer pipeline, at the point of the proposed developments is shown in the figure below. The area adjacent to site has an existing sewer reticulation. A sewer manhole without a lid had a 160mm diameter pipeline.

There are some areas in Mookgophong that do not have sewer reticulation.

Figure 16 Sewer reticulation manhole

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 13 Sewer design flow of proposed development

Land Use	**No. of Erven**	**Area (Ha)**	**Water Demand**		**Sewer Return**	**Sewer Flow**	
Residential (Dwelling House)	85	2.72	51.0	kℓ/d	85%	43.4	kℓ/d
Institutional (Orphanage)	1	0.12	30.0	kℓ/d	85%	25.5	kℓ/d
Institutional (Early Childhood Development Centre)	1	1.51	6.0	kℓ/d	85%	5.1	kℓ/d
Business 1 (Shops and other business-related uses)	1	0.13	3.4	kℓ/d	85%	2.9	kℓ/d
Place of Worship (Church)	1	0.28	6.7	kℓ/d	85%	5.7	kℓ/d
Municipal (Municipal Commonage)	1	2.20	52.8	kℓ/d	85%	44.9	kℓ/d
Government (Social Services Offices)	1	0.59	14.2	kℓ/d	85%	12.0	kℓ/d
Roads	0	1.95					kℓ/d
Totals	91	9.50	164.1				
Sub-total Sewer ADWF						**139.5**	**kℓ/d**
15% Extraneous flow						20.9	kℓ/d
Gross Sewer						160.4	kℓ/d
Gross Sewer Flow						1.9	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						4.6	ℓ/s

The proposed development will have an estimated sewer ADWF of 139.5kℓ/d and a gross sewer flow of 160.4kℓ/d.

The combined sewer generated from the existing residential area and proposed development is shown in the table below.

Table 14 Combined Mookgophong wastewater flow

Land Use	No. of Erven	Area (Ha)	Water Demand		Sewer Return	Sewer Flow	
Existing Development							
Business 1	121	22.20	577.2	kℓ/d	85%	490.6	kℓ/d
Church	9	2.00	48.0	kℓ/d	85%	40.8	kℓ/d
Clinic	1	4.29	103.0	kℓ/d	85%	87.6	kℓ/d
Creche	11	1.82	66.0	kℓ/d	85%	56.1	kℓ/d
Educational	16	41.93	2012.7	kℓ/d	85%	1710.8	kℓ/d
Golf Course Green	1	48.48	581.7	kℓ/d	85%	494.5	kℓ/d
Industrial 1	109	28.72	459.5	kℓ/d	85%	390.5	kℓ/d
Informal Settlement	499	30.02	330.3	kℓ/d	85%	280.7	kℓ/d
Municipal	13	18.10	434.3	kℓ/d	85%	369.1	kℓ/d
Private Open Space	5	11.69	140.3	kℓ/d	85%	119.3	kℓ/d
Public Open Space	2	5.64	0.0	kℓ/d	85%	-	kℓ/d
Residential 1	4635	290.59	2781.0	kℓ/d	85%	2363.9	kℓ/d
Residential 2 (Dwelling Unit) [44 DU/ha]	42	11.04	242.9	kℓ/d	85%	206.5	kℓ/d
Undetermined	1255	159.90	4157.5	kℓ/d	85%	3533.9	kℓ/d
Proposed Development							
Residential (Dwelling House)	85	2.72	51.0	kℓ/d	85%	43.4	kℓ/d
Institutional (Orphanage)	1	0.12	30.0	kℓ/d	85%	25.5	kℓ/d
Institutional (Early Childhood Development Centre)	1	1.51	6.0	kℓ/d	85%	5.1	kℓ/d
Business 1 (Shops and other business-related uses)	1	0.13	3.4	kℓ/d	85%	2.9	kℓ/d
Place of Worship (Church)	1	0.28	6.7	kℓ/d	85%	5.7	kℓ/d
Municipal (Municipal Commonage)	1	2.20	52.8	kℓ/d	85%	44.9	kℓ/d
Government (Social Services Offices)	1	0.59	14.2	kℓ/d	85%	12.0	kℓ/d
Roads		1.95					
Totals	6810	685.93	12098.5				
Sub-total Sewer ADWF						**10283.7**	**kℓ/d**
15% Extraneous flow						1542.6	kℓ/d
Gross Sewer						11826.2	kℓ/d
Gross Sewer Flow						136.9	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						342.2	ℓ/s

The combined existing and proposed development will have an estimated sewer ADWF of 10 283.7kℓ/d and a gross sewer flow of 11 826.2kℓ/d.

6.5 Wastewater bulk capacity

The combined existing and proposed development gross sewer flow of 11.8Mℓ/d is greater than the capacity of the existing Mookgophong WWTW of 3Mℓ/d.

Hence the capacity of existing Mookgophong WWTW is Not sufficient to handle gross sewer flow for the whole town.

6.6 Wastewater infrastructure proposed

The proposed wastewater input is as follows:

- The wastewater treatment works is to be upgraded.
- That the proposed development be connected to the upgraded sewer outfall and WWTW.

7 ELECTRICITY

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

Figure 17 Electrical lines onsite

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 15 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 16 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 17 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. This will be finalised at design stage.

Table 18 Proposed pavement design

Design	Description
Pavement	30mm Premix Asphalt / 80mm paving
Base	150mm Thick natural gravel stabilised with Cement to create C4 material compacted to 97% of Mod AASHTO
Subbase	150mm Thick natural gravel G7 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.

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 existing internal streets.

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 19 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	600mm
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 20 Stormwater design standard

Design Element	Specification
a) Minimum pipe size	600mm diameter concrete pipe
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 rate of 0.6kg/c/d was adopted for the township. Solid waste will be generated by the development.

Population estimate = 85 residential units x 4 people per unit = 340 people

- Solid waste = 0.6kg/per person/day or (0.6kgx365 days)
- Waste generated per day = 0.6x 340 = 204kg = 0.20 tonne
- Waste generated per annum = 0.20x365 = 74 tonne

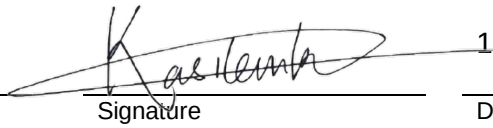
11 CONCLUSION

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

PROPOSED TOWNSHIP SITUATED ON A PORTION OF THE REMAINING EXTENT OF PORTION 3 OF THE FARM NABOOMSPRUIT 348 KT, LIMPOPO

BULK ENGINEERING SERVICES REPORT:

CIVIL SERVICES REPORT

Compiled by	W. KASILEMBO		16/03/2022
	B. Tech Civil	Signature	Date
Reviewed by	L. MTHUNZI		16/03/2022
	BSc Hons Eng, Pr Tech Eng	Signature	Date
	ECSA		

ANNEXURES

ANNEXURE 1 Layout Plan