WEGDRAAI 360 HOUSING DEVELOPMENT

Engineering Services Investigation Report

Investigation of the available and required bulk civil and electrical services for the Wegdraai village development in the !Kheis municipal area

OCTOBER 2020

Prepared for:
MACROPLAN

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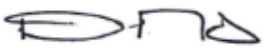
Author signature		Approver signature	

EXECUTIVE SUMMARY

This report was compiled to investigate the bulk infrastructure serving the Wegdraai village and to determine whether the bulk infrastructure is adequate for the development of an additional 360 stands, through a low-cost housing development.

The bulk engineering services report includes the following categories:

- Bulk Water Infrastructure
- Bulk Sewer Infrastructure
- Bulk Road and Storm Water Infrastructure
- Bulk Electrical Infrastructure

After investigating the infrastructure, it was found that the existing bulk infrastructure is not sufficient to accommodate the Wegdraai 360 Houses project. The bulk services for each category that require attention before the project can commence is summarised below:

- **Bulk Water Infrastructure**

  Construction of 28l/s raft river pump station including pressure pipeline to raw water storage
  Water treatment plant to be able to deliver 24m³/h per day
  Construction of a 700m³ sectional steel tank.
  Construction of 650m³ sectional steel elevated tower, including lifting station and pressure line connecting the reservoir and elevated tower

- **Bulk Sewer Infrastructure**

  Construction of a new pump stations (40 l/s).
  Construction of a new 250mm rising mains (940m).
  Construction of a new 0.5ML waste water treatment works;

- **Bulk Electrical Infrastructure**

  Upgrading and exstension of the exsiting bulk electrical supply system is required by Eskom,the exstension of the electrical system will not be a problem as the main sub-station in Grobelaarshoop is currently being upgraded and will be commissioned in December 2020.

DESCRIPTION	AMOUNT TO REPAIR OF EXISTING INFRASTRUCTURE	AMOUNT NEW/UPGRADED INFRASTRUCTURE	TOTAL BULK INFRASTRUCTURE
Water Bulk Services	R 1 000 000.00	R 15 384 995.42	R 16 384 995.42
Bulk Sewer Services	R 2 000 000.00	R 9 510 946.34	R 11 510 946.34
Roads and Access	R -	R -	R -
Electrical	R -	R -	R -
TOTAL CONSTRUCTION	**R 3 000 000.00**	**R 24 895 941.76**	**R 27 895 941.76**
10% Contingencies	R 300 000.00	R 2 489 594.18	R 2 789 594.18
SUB TOTAL	**R 3 300 000.00**	**R 27 385 535.93**	**R 30 685 535.93**
10% Professional fees	R 330 000.00	R 2 738 553.59	R 3 068 553.59
SUB-TOTAL	**R 3 630 000.00**	**R 30 124 089.52**	**R 33 754 089.52**
15% VAT	R 544 500.00	R 4 518 613.43	R 5 063 113.43
GRAND TOTAL	**R 4 504 500.00**	**R 37 381 256.55**	**R 41 885 756.55**

This report can be used both for business plans and funding applications from the various funding schemes available.

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1. INTRODUCTION

1.1 Terms of Reference

I. BVI Consulting Engineers was appointed by Macroplan to undertake this Bulk Engineering Services Study (Water, Sewer, Electricity and Roads & Storm Water) for the proposed Wegdraai 360 housing project. Wegdraai is one of six villages located close to the Orange river within the jurisdiction of !Kheis Local Municipality.

1.2 Site Location

I. The site is situated approximately 40 km to the north-west of Groblershoop in the Northern Cape (Figure 1 – Locality Plan).

II. The development is located at the following coordinates: 28°50'21.79" S; 21°51'51.86" E

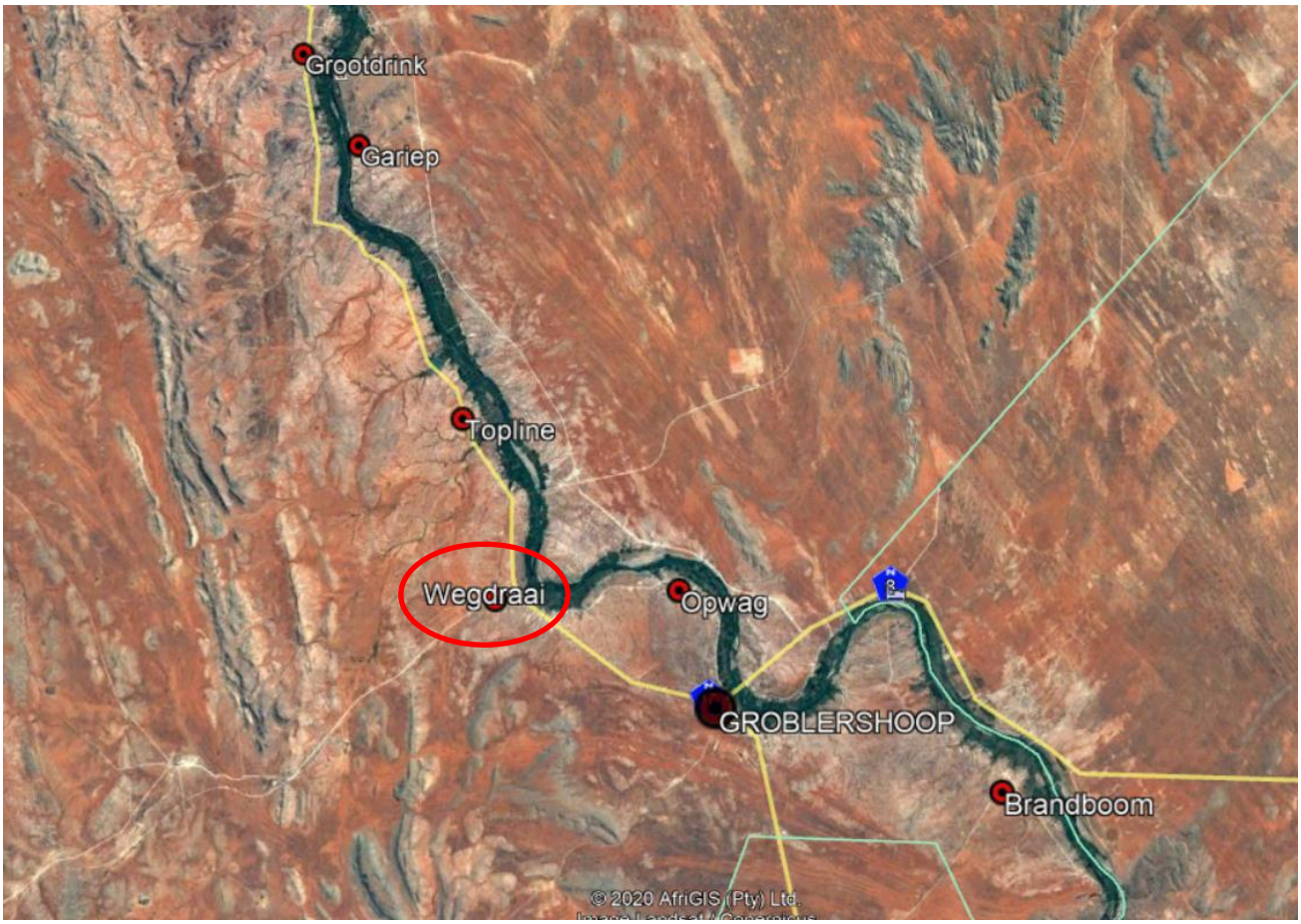


Figure 1: Wegdraai 360 Housing Development Locality Plan

II. The planned development consists of 360 low-cost houses next to the existing village (Figure 2: 360 Stands Development Area)

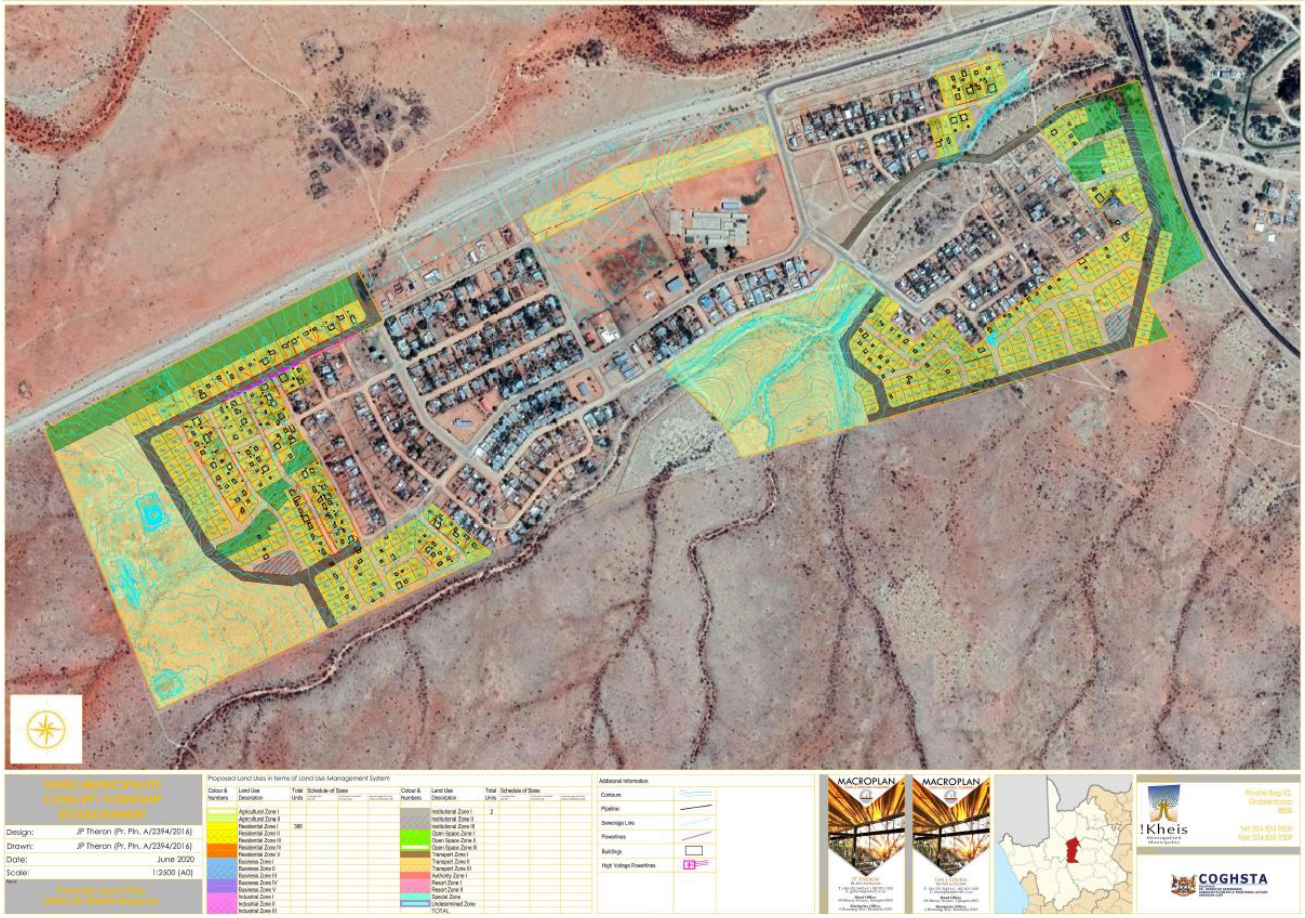


Figure 2: Wegdraai 360 Housing Development Development Area

III. The purpose of the Bulk Engineering Services Assessment is to determine the availability and capacity of existing bulk services to service the proposed development. This report presents the findings of a preliminary visual inspection and desktop investigation relating to bulk services and further sets out the criteria and standards for the internal services for the new development.

IV. The Bulk Engineering Services addressed in this report are the following:

- Water Supply
- Sewerage
- Roads and Access
- Storm Water Management
- Electricity Supply

2. TOPOGRAPHY

The physical characteristics of the site can be summarized as follows:

- Ground cover comprises mostly of natural veld with short grass;
- Topographically, the site has a relatively gentle sloping terrain from the the village towards the gravel roads.
- Calcrete is close to the surface of the natural ground level, which makes excavations very hard.

3. WATER SUPPLY

3.1 Existing Water Infrastructure

Overview

The bulk water infrastructure supplying Wegdraai village with water can be summarised as follows:

- A raw water river pump station delivering 6.5l/s;
- A 1 200m long, 110mm diameter PVC Class 6 raw water supply line between the river and the water purification works on the side of the village
- The water treatment works consisting of:
    - An open raw water storage dam
    - A UFMC water treatment system
    - A Sectional steel storage tank
    - A high lift pump station
    - A Elevated Sectional steel storage tank (pressure towers)
- Distribution into the village

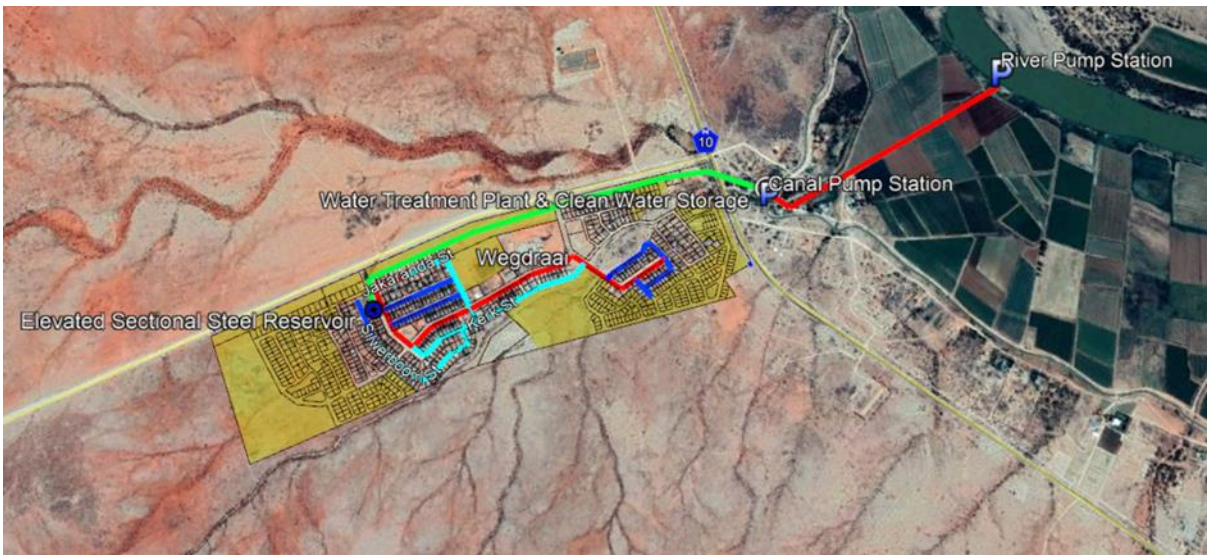
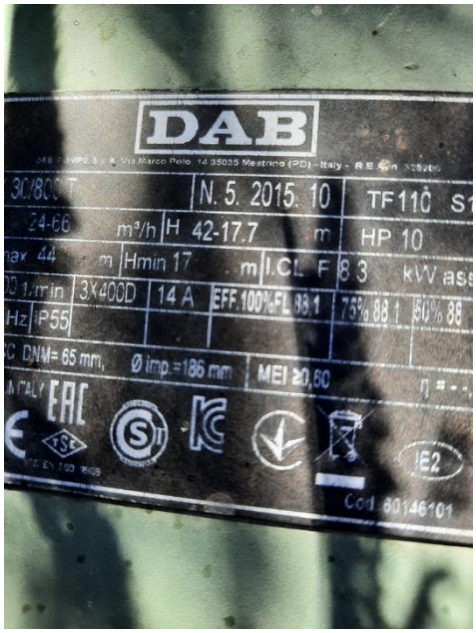


Figure 2: Existing Bulk Water Infrastructure

Raw Water Supply

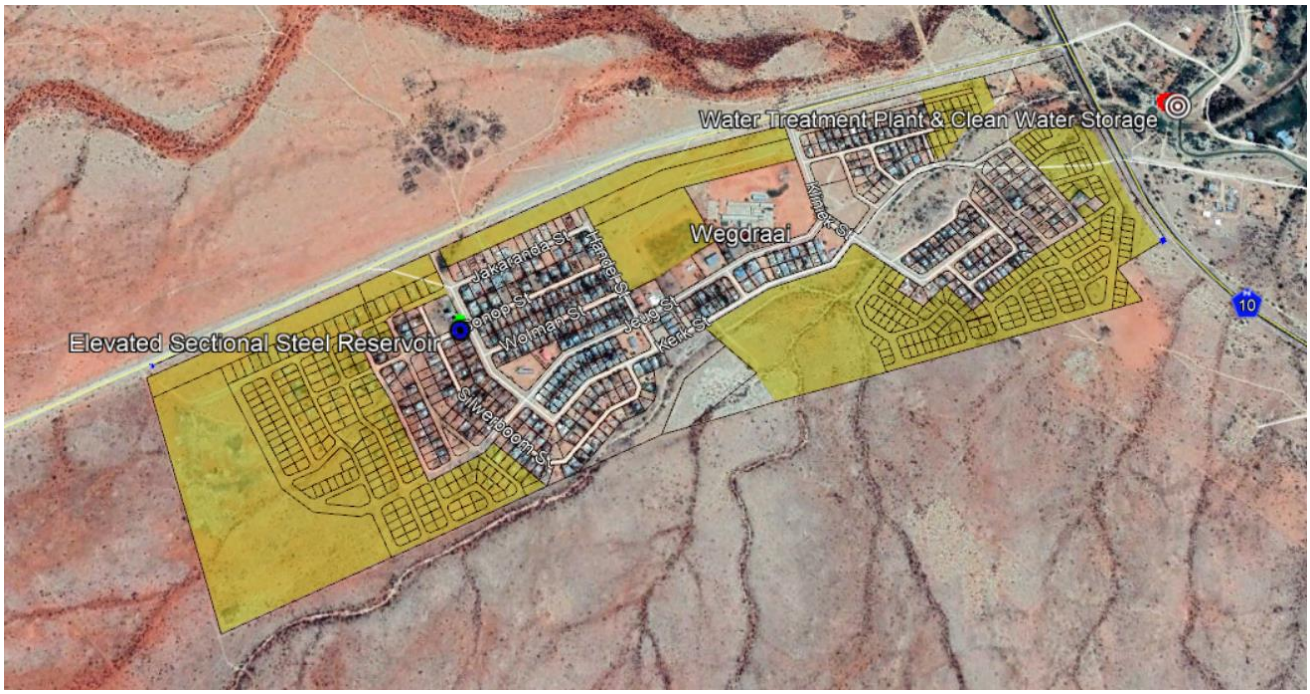
Water supplied to Wegdraai is extracted from Orange River by means of a pump station fitted on a stand with a pole mounted switchgear. The pump station consists of one pump that delivers 12l/s to the raw water treatment works.

Raw water is pumped from the rivier pump station to the purification plant, delivering a maximum flow rate of 12 l/s through a 1 000m long, 110mm diameter Class 6 PVC pipeline to a 100 m^3 raw water storage dam next to the Water Treatment Works in the village



Water treatment and storage site

The figure below shows the site layout where the treatment works and potable water storage reservoirs, is located.



Water is pumped from the raw water storage dam through the Water Treatment Plant with a capcity of 14l/s to a 380m^3 sectional steel potable water storage reservoir. From there, it is pumped into the 134m^3 elevated storage tank before is gravitates into the village network.

The photo's below shows the reservoirs and treatment plant.

Water Treatment Plant

The Water Treatment Works (WTW) consist of a dosing system as well as 50 000l/h UFMC water treatment system as shown on the photos belw.

Photo's below shows the water treatment system and also the pumps and MCC panels of the Water Treatment Plant:

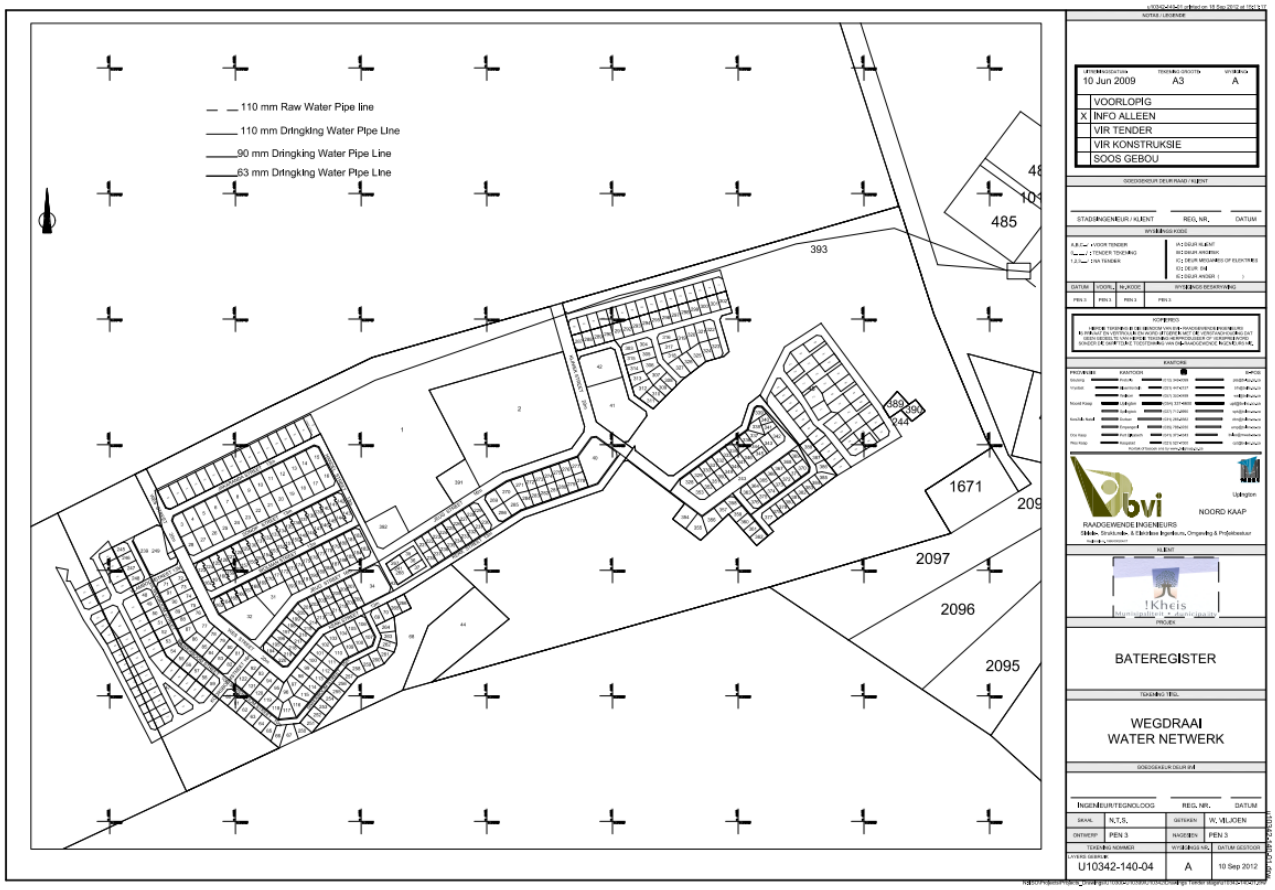
Pressure Towers

The potable water is delivered from the elevated storage tank into the reticulation network via a 110mm diameter PVC pipeline.

Reticulation System

The potable water is delivered from the elevated storage tank into the existing reticulation network.

The reticulation network is shown in the drawing below.



Condition of the water supply system

Most of the elements of the water supply system are currently manually operated. These include the river pump, the water treatment works, and the reservoir levels. Water is distributed to the village from the sectional steel reservoir that stores pottable water. Most of the water meters and pressure gauges are out of service. Please refer to the photo's below for more information.

3.2 Current water demands and capacity of the existing bulk water supply system

The Red Book was used as basis for calculations of the theoretical capacity for the current bulk water supply system as well as required infrastructure.

The table blow shows factors capacities and operating hours used in the calculations:

OPERATING HOURS	1	Source Pump Station (SPSH)	(Maximum operating hours per day that required volume of water	16	hours
	2	Water purification plant (WTPH)	(Maximum operating hours per day that required volume of water	16	Hours
	3	Lifting Pump Station **(LPS%)**	(% of Instantanious peak flow)	150%	
STORAGE	1	Storage in elevated tanks	(Hours of Instantanous Peak Demand)	4	hours
	2	Potable Water Storage Reservoirs	(Hours of Annual Average Daily Demand*SPF)	48	hours
	3	Raw Water Storage Reservoirs	(Hours of Summer Average Daily Demand)	1	days

The table on the next page shows the current theoretical demands and capacity of the existing bulk water infrastructure:

		BULK AND CONNECTOR SERVICES CAPACITY CALCULATION : CURRENT								
	NO.	DESCRIPTION	UNITS		DEMAND PER UNIT			Criteria		
GENERAL	1	Sub-Economical Houses (Existing)	466	Houses x	600 l/ household per day			279.6 m^3/d		
	2	Sub-Economical Houses (360 houses development)	0	Houses x	600 l/ household per day			0 m^3/d		
	4	Economical Houses (Existing)	0	Houses x	1200 l/ household per day			0 m^3/d		
	5	Economical Houses (360 houses development)	0	Houses x	1200 l/ household per day			0 m^3/d		
	7	Primary School Hostel	0	Learners	150 l/ Learner per day			0 m^3/d		
	8	Schools	200	Learners	25 l/ Learner per day			5 m^3/d		
	9	High School Hostel	0	Learners	150 l/ Learner per day			0 m^3/d		
	10	High School	250	Learners	25 l/ Learner per day			6.25 m^3/d		
	11	Clinics	250	m^2 x	500 l/100m^2 per day			1.25 m^3/d		
	12	Businesses, Government and Municipal	500	m^2 x	400 l/100m^2 per day			2 m^3/d		
	13	Developed Parks, Sportsgrounds and Day Cares	0.50	ha	5 mm water per day			25 m^3/d		
		ANNUAL AVERAGE DAILY DEMAND (AADD)						**319.1 m^3/d**		
FACTORS	1	Design Loss Factor Water treatment works (LFw)						10.0%		
	2	Design Loss Factor Total conveyance losses (LFr)						15.0%		
	3	Summer peak factor (SPF)						1.5		
	4	Peak factor reticulation (PFR) From Red Book (Instantenous Peak)						6		
THEORETICAL DEMANDS	1	Annual Average Daily Demand (AADD)	AADD	319.1 m^3/day	13.3 m^3/hour	3.7 l/s	CURRENT CAPACITY			
	2	Gross Annual Average Daily demand (GAADD)	(1+Lfr)*AADD	367.0 m^3/day	15.3 m^3/hour	4.2 l/s				
	3	Summer Gross Daily Demand (SGDD)	SPF*GAADD	550.4 m^3/day	22.9 m^3/hour	6.4 l/s				
	4	Instantanious Peak Demand (IPD) (Main supply pipeline to reticulation)	AADD*PFR		79.8 m^3/hour	22.2 l/s				
	5	Storage Capacity Elevated Storage	hours*IPD			319.1 m^3	135.0 m^3	**42%**		
	6	Lifting Pump Station Capacity and Pipeline Flow between Main Storage and Elevated tank	IPD***LPS%**	206 mm dia	119.7 m^3/hour	33.2 l/s	12.0 l/s	**36%**		
	7	Potable Water Storage Capacity (Main Storage)	hours*AADD			380.0 m^3	256.0 m3	**67%**		
	8	**Water Treatment Plant Capacity (WTPC)**	**SGDD*24/WTPH**	**825.7 m3/day**	**34.4 m3/hour**	**9.6 l/s**	**14.0 l/s**	**146%**		
	9	**Source Pump Station Capacity and Pipeline Flow**	**WTPC*(1+LFW)*24/SPS**	**145 mm dia**	**59.3 m3/hour**	**16.5 l/s**	**12.0 l/s**	**73%**		
	10	Raw Water Storage Capacity	Days*SGDD			550.0 m^3	100.0 m3	**18%**		

It is clear from the table that the existing infrastructure is already under pressure to handle the demand.

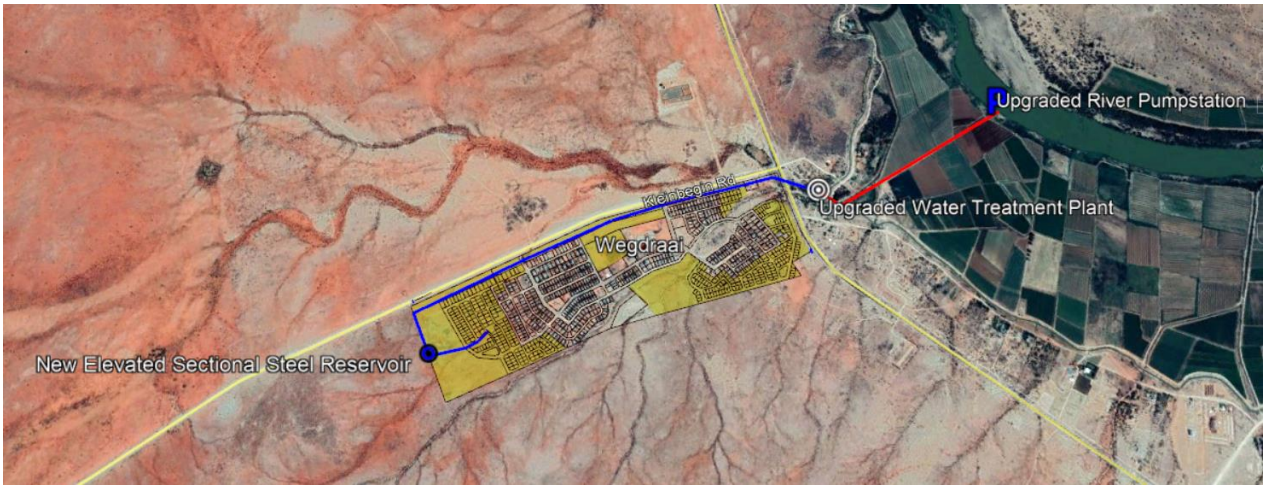
3.3 Bulk Water Infrastructure Requirements

The table below compares the current infrastructure capacities with the capacity that is required for the 360 stands development.

	BULK AND CONNECTOR SERVICES CAPACITY CALCULATION : FUTURE								
	NO.	DESCRIPTION		UNITS		DEMAND PER UNIT		Criteria	
GENERAL	1	Sub-Economical Houses (Existing)		466	Houses x	600 l/ household per day		279.6 m^3/d	
	2	Sub-Economical Houses (360 houses development)		360	Houses x	600 l/ household per day		216 m^3/d	
	4	Economical Houses (Existing)		0	Houses x	1200 l/ household per day		0 m^3/d	
	5	Economical Houses (360 houses development)		0	Houses x	1200 l/ household per day		0 m^3/d	
	7	Primary School Hostel		0	Learners	150 l/ Learner per day		0 m^3/d	
	8	Schools		200	Learners	25 l/ Learner per day		5 m^3/d	
	9	High School Hostel		0	Learners	150 l/ Learner per day		0 m^3/d	
	10	High School		250	Learners	25 l/ Learner per day		6.25 m^3/d	
	11	Clinics		250	m^2 x	500 l/100m^2 per day		1.25 m^3/d	
	12	Businesses, Government and Municipal		500	m^2 x	400 l/100m^2 per day		2 m^3/d	
	13	Developed Parks, Sportsgrounds and Day Cares		0.50	ha	5 mm water per day		25 m^3/d	
		ANNUAL AVERAGE DAILY DEMAND (AADD)						**535.1 m^3/d**	
THEORETICAL DEMANDS	1	Annual Average Daily Demand (AADD)	AADD	535.1 m^3/day		22.3 m^3/hour	6.2 l/s	CURRENT CAPACITY	
	2	Gross Annual Average Daily demand (GAADD)	(1+Lfr)*AADD	615.4 m^3/day		25.6 m^3/hour	7.1 l/s		
	3	Summer Gross Daily Demand (SGDD)	SPF*GAADD	923.0 m^3/day		38.5 m^3/hour	10.7 l/s		
	4	Instantanious Peak Demand (IPD) (Main supply pipeline to reticulation)	AADD*PFR			111.5 m^3/hour	31.0 l/s		
	5	Storage Capacity Elevated Storage	hours*IPD				445.9 m^3	135.0 m^3	30%
	6	Lifting Pump Station Capacity and Pipeline Flow between Main Storage and Elevated tank	IPD***LPS%**	243 mm dia		167.2 m^3/hour	46.4 l/s	12.0 l/s	26%
	7	Potable Water Storage Capacity (Main Storage)	hours*AADD				1070.2 m^3	256.0 m3	24%
	8	**Water Treatment Plant Capacity (WTPC)**	SGDD*24/WTPH	1384.6 m3/day		57.7 m3/hour	16.0 l/s	14.0 l/s	87%
	9	**Source Pump Station Capacity and Pipeline Flow**	WTPC*(1+LFW)*24/SPS	188 mm dia		99.5 m3/hour	27.6 l/s	12.0 l/s	43%
	10	Raw Water Storage Capacity	Days*SGDD				923.0 m^3	100.0 m3	11%

Recommended upgrades to the Wegdraai bulk water infrastructure are as follows :

- Construction of a new 28l/s river pump station with a duty and standby pump.
- New 1000m long 200mm diameter uPVC pipeline between the river pump station and the existing potable water storage reservoir.
- Upgraded Water Treatment Works capable of delivering 24m^3/h on the existing treatment works site
- An additional 700m^3 sectional steel reservoir next to the upgraded water treatment works
- A new 650m^3 sectional steel pressure tower on the highest point to the south.
- A new 46l/s uplifting pump station at the treatment works.
- A new 2200m long 250mm pipeline between the lifting pump station and the new pressure tower.



Fire Fighting Requirements

Areas to be protected by a fire service should be classified according to a fire-risk category. The new development can be classified as a “Low risk – Group 4” according to the “Guidelines for Human Settlement Planning and Design”.

No specific provision for fire fighting water is required in water storage, or reticulation mains in these areas. Hydrants should, however, be located at convenient points in the area on all mains of 75 mm nominal internal diameter and larger, and in the vicinity of all schools, commercial areas and public buildings.

Fire fighting in areas zoned “Low-risk – Group 4” should generally be carried out using trailer-mounted water tanks or fire appliances that carry water, which can be replenished from the hydrants provided in the reticulation, if necessary.

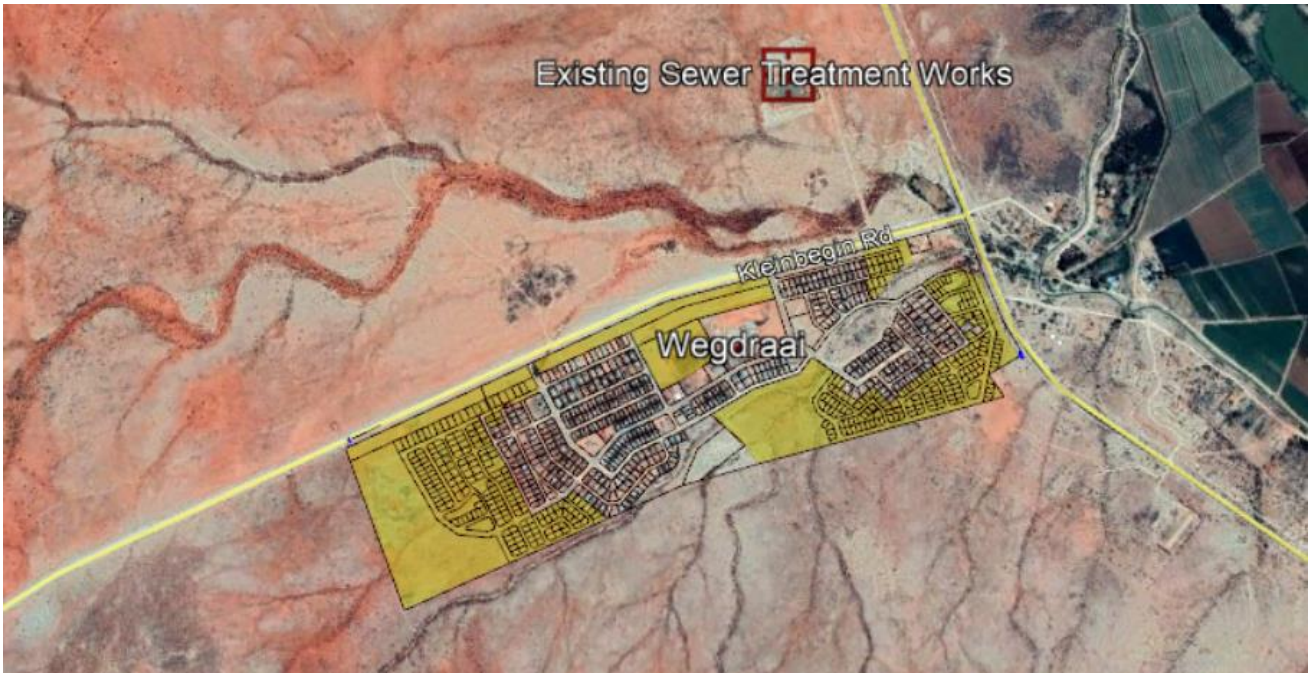
4. SEWERAGE

4.1 Existing Sewage Infrastructure overview

Houses in the Wegdraai village is currently serviced by conservancy tanks and VIP toilets. There are currently no waterborne sewer system in place. The conservancy tanks are currently emptied by the honey suckers at the existing oxidation pond system. The photos below refers to the existing oxidation pond system.

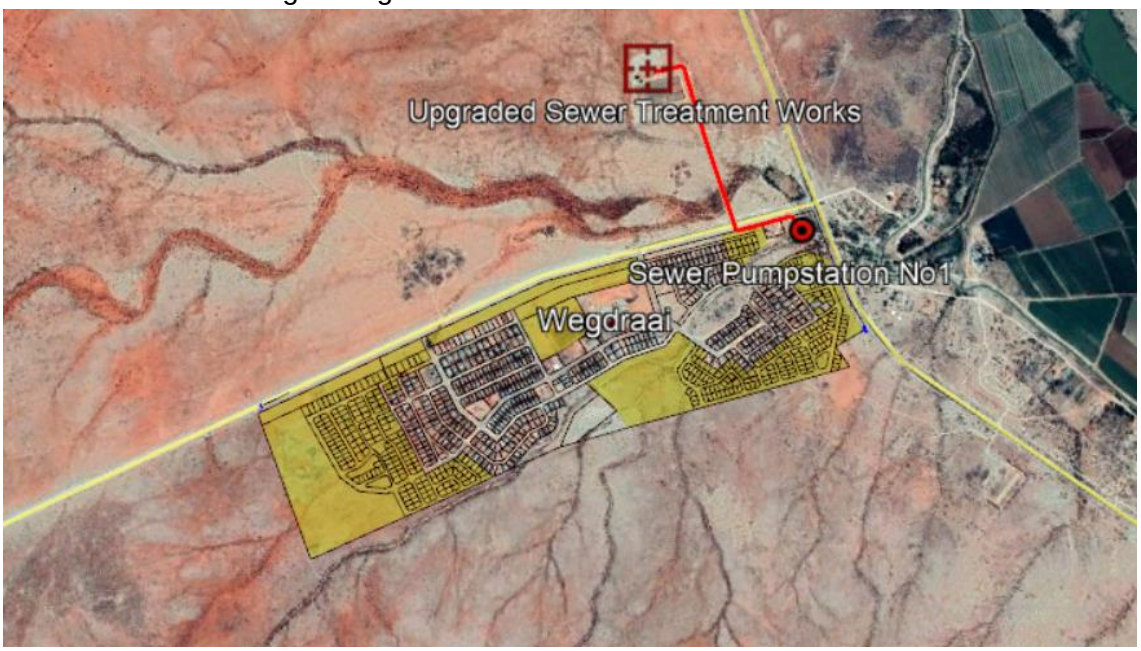
Condition of the Oxidation Ponds System

The condition of the existing oxidation ponds is not fuctional. The concrete inlet and works and primary dams needs attention. Portions of the HDPE lining of the secondary ponds were removed and needed to be replaced or repaired.



4.2 Bulk Sewer Infrastructure Requirements

If a full borne sewer sewerage system is required for the new 360 houses development, the associated bulk infrastructure will consist of a pumpstation, rising main pipeline and upgraded oxidation ponds as shown on the Google image below.



The total sewer flow is calculated as follows:

WEGDRAAI TOTAL SEWER FLOW						
Sewer flow per day - Sub economical houses	907	sub economical houses @	500	l/day	**453 500**	**l/day**
Sewer flow per day - Economical houses	0	economical houses @	750	l/day	**-**	**l/day**
Sewer flow per day - Hostels	0	persons @	140	l/day	**-**	**l/day**
Sewer flow per day - Schools	400	persons @	20	l/day	**8 000**	**l/day**
Businesses and State Institutions	0	buildings	100	l/day	**-**	**l/day**
SEWER FLOW PER DAY - TOTAL					**461 500**	**l/day**

The sizes and capacities of the proposed pump station and rising main were calculated as follows:

PUMP STATION No 1 AND RISING MAIN						
Sewer flow per day - Sub economical houses	907	sub economical houses @	500	l/day	**453500**	**l/day**
Sewer flow per day - Economical houses		economical houses @	750	l/day	**0**	**l/day**
Sewer flow per day - Hostels	0	persons @	140	l/day	**0**	**l/day**
Sewer flow per day - Schools	400	persons @	20	l/day	**8000**	**l/day**
Businesses and State Institutions	0	buildings	100	l/day	**0**	**l/day**
SEWER FLOW PER DAY - TOTAL					**461500**	**l/day**
Average sewer flow					**5.3**	**l/s**
Factor for inflow from other sources	30%				**1.6**	**l/s**
Sewer flow with inflow from other sources					**6.9**	**l/s**
PEAK NETWORK SEWER FLOW	2.0		3.5		**24.3**	**l/s**
FLOWRATE FROM OTHER PUMP STATIONS					**0**	**l/s**
TOTAL PEAK FLOW					**24.30**	**l/s**
ACTUAL PUMP ABILITY	**1.63**	times peak flow			**39.6**	**l/s**
Theoretical pump station capacity for normal pump operation	1	hours of peak flow			**87**	**m^3**
Theoretical pump station capacity for emergency storage	4	hours of normal flow			**100**	**m^3**
TOTAL REQUIRED THEORETICAL PUMP STATION CAPACITY					**187**	**m^3**
Pump details						**kW**
Rising main diameter					**268**	**mm**
Rising main material					**PVC**	
Rising main length					**940**	**m**
Static pump height					**10**	**m**
Friction losses					**4**	**m**
Total pump height					**14**	**m**

Recommended Wegdraai bulk sewer infrastructure construction (excluding internal sewer lines) are as follows (shown on the drawing above):

- Construction of a new sewer pump stations capable of delivering 40 l/s direct to the Waste Water Treatment plant.
- New 940m long, 250mm diameter Class 6 PVC pipelines between the pump station and a new Waste Water Treatment Plant (oxidation ponds).
- Upgrading of theexisting Waste Water Treatment Plant (oxidation ponds) with a capacity of 0.5Ml per day.

5. SOLID WASTE

The solid waste disposal will be upgraded to accommodate the future 360 stands.

6. ROADS AND STORMWATER

6.1 Roads and Access

Access to the development will be from the existing Residential Collector Streets (Class 4b), as shown on the drawing below:

No problems are foreseen regarding roads and access.

6.2 Stormwater Management

The guiding principle underlying the storm water management strategy is that, where possible, the peak run-off from the post-developed site should not exceed that of the pre-developed site for the full range of storm return periods (1:2 to 1:50). Where possible, measures should be incorporated into the site development plan to attenuate the post-development flows to pre-development rates.

The storm water network must be designed to accommodate (flood frequencies as prescribed by "The Red Book") the minor storm event (1:5 year) in open channels or side drains of streets. The major storm (1:50 year) should be managed through controlled overland flows, above-ground attenuation storage (if required) and berms at the higher end of the site (if required). As no formal storm water system exists in the area, concentration of storm water must be avoided as far as possible. Earthworks on plots should therefore encourage free drainage of the area.

Wegdraai is a small village that generally drains from the centre. Existing roads will be adequate for this purpose.

7. ELECTRICAL SUPPLY

7.1 Electrical Demands and Availability

This section of the report covers the availability of the Bulk Electrical connection to the future 360 Community stands, an expected additional load of the proposed development will initially be 432 KVA as per INEP guidelines and the accommodation of this load will form the basis of this report. The community of Wegdraai falls directly under “Eskom Distribution” and the existing electrified homes in the community purchase electricity directly from Eskom and not through the Kheis local Municipality.

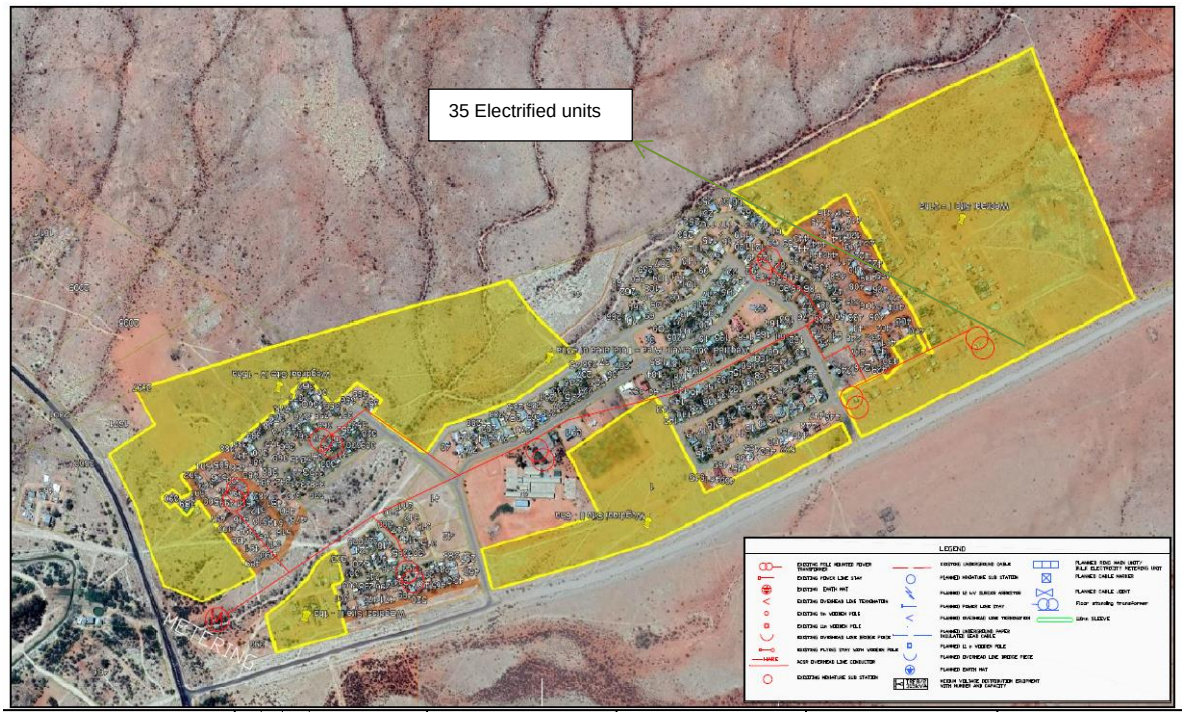
The bulk connection to the community / town is via a 22kV overhead line fed from the 10MVA Grobelershoop sub-station

7.2 Existing Electrical Network

The bulk connection to the community / town is via a 22kV overhead line fed from the Eskom 10MVA Grobelershoop sub-station , this sub-station is currently in the process of being upgraded to 20MVA and will be commissioned in December 2020.

The existing MV electrical network in the Wegdraai area runs through the town via 22 KV overhead line feeder connecting to various pole mounted transformers (see below). The existing overhead line feed is running through a section of the proposed development and 35 informal homes have been electrified by Eskom.

The existing feeder can easily handle the future additional 432 kVA load only after the upgraded Eskom Groblershoop sub-station is brought online as indicated by Eskom’s network planning department.



7.3 Electrical Network Extension

The internal electrical network extension in the Wegdraai community will only be done by Eskom after the formulation processes are completed as this area falls under the Eskom Distribution

8. COST ESTIMATE

The cost estimate for the proposed activities are as provided below. The level of accuracy is commensurate with a concept level design.

DESCRIPTION			QUANTITY	QUANTITY UNIT	AMOUNT TO REPAIR OF EXISTING INFRASTRUCTUR	AMOUNT NEW INFRASTRUCTURE	TOTAL
Water Bulk Services							
Source pump station - Raft						300 000	300 000
Source pump station - Civil Works			28.0	l/s		700 000	700 000
Source pump station - Mechanical			28.0	l/s		756 000	756 000
Pump line from source to raw water storage reservoir	200	mm dia	1 100.0	m		1 453 105	1 453 105
Water Treatment Works			0.5	Ml/day	1 000 000	3 312 000	4 312 000
Potable Water Storage - Ground Reservoir with floating roof			800.0	m3		2 000 000	2 000 000
Potable water pump station - Building			20.0	sq.m		100 000	100 000
Potable water pump station - Mechanical			47.0	l/s		1 269 000	1 269 000
Pump line from storage reservoir to Pressure Tower	250	mm dia	2 300.0	m		3 494 890	3 494 890
Elevated Starage Tower - Sectional Steel			500.0	m3		2 000 000	2 000 000
Sub-Total (Water)					**1 000 000**	**15 384 995**	**16 384 995**
Bulk Sewer Services							
Sewer Pump Station No 1 - Civil/Structural			187.0	m3		1 496 000	1 496 000
Sewer Pump Station No 1 - Mechanical/Electrical/Control			187.0	m3		336 600	336 600
Pump Line from Sewer Pump Station No 1 to Treatment Wo	250	mm dia	940.0	m		1 428 346	1 428 346
Treatment Works Oxidation Ponds			250.0	kl/day	2 000 000	6 250 000	8 250 000
Sub-Total (Sewer)					**2 000 000**	**9 510 946**	**11 510 946**
Roads and Access							
None						-	
Electrical							
None							
TOTAL CONSTRUCTION					**3 000 000**	**24 895 942**	**27 895 942**
10% Contingencies					300 000	2 489 594	2 789 594
SUB TOTAL					**3 300 000**	**27 385 536**	**30 685 536**
10% Professional fees					330 000	2 738 554	3 068 554
SUB-TOTAL					**3 630 000**	**30 124 090**	**33 754 090**
15% VAT					544 500	4 518 613	5 063 113
GRAND TOTAL					**4 504 500**	**37 381 257**	**41 885 757**

Notes:

1) Base date of the calculations is October 2020;
2) No provision was made for EIA, registration and/or land acquisition;
3) No allowance was made for institutional and/or social development.

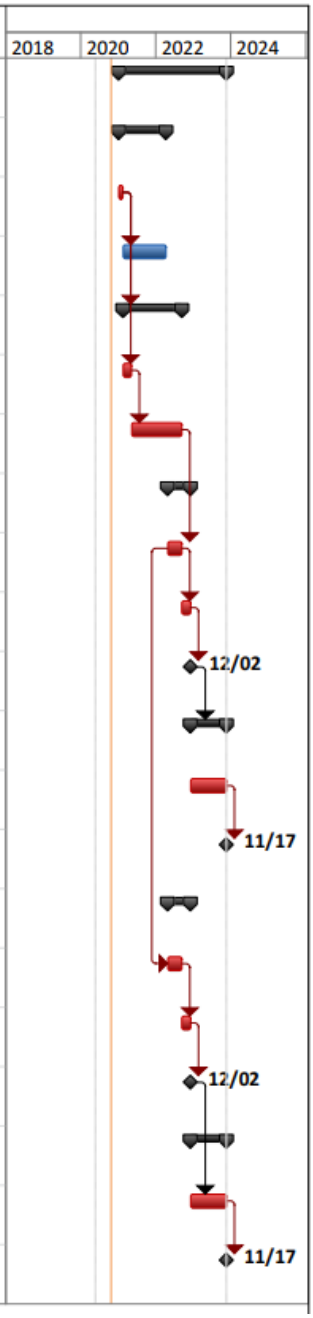
7.1 Funding

Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.

This report can be used for funding application from the various schemes available.

9. PROJECT TIMELINE

ID	Task Mode	Task Name	Duration	Start	Finish
1		**BULK INFRASTRUCTURE TIMELINE**	**750 days**	**Mon 21/01/0**	**Fri 23/11/17**
2		**APPLICATION FOR FUNDS**	**330 days**	**Mon 21/01/0**	**Fri 22/04/08**
3		Application for RBIG & Mig funding	30 days	Mon 21/01/04	Fri 21/02/12
4		Approval of feasibility study & readyness re	300 days	Mon 21/02/15	Fri 22/04/08
5		**EIA PROCESS**	**410 days**	**Mon 21/02/1**	**Fri 22/09/09**
6		Appointment of EIA Specialist	60 days	Mon 21/02/15	Fri 21/05/07
7		EIA study	350 days	Mon 21/05/1(	Fri 22/09/09
8		**DESIGN, DOCUMENTATION AND PROCUREMENT BULK SERVICES**	**160 days**	**Mon 22/04/25**	**Fri 22/12/02**
9		Design and documentation	100 days	Mon 22/04/25	Fri 22/09/09
10		Procurement	60 days	Mon 22/09/12	Fri 22/12/02
11		Contractor appointed	0 days	Fri 22/12/02	Fri 22/12/02
12		**CONSTRUCTION**	**250 days**	**Mon 22/12/0**	**Fri 23/11/17**
13		Construction period	250 days	Mon 22/12/05	Fri 23/11/17
14		Construction completed	0 days	Fri 23/11/17	Fri 23/11/17
15		**DESIGN, DOCUMENTATION AND PROCUREMENT INTERNAL SERVICES**	**160 days**	**Mon 22/04/25**	**Fri 22/12/02**
16		Design and documentation	100 days	Mon 22/04/25	Fri 22/09/09
17		Procurement	60 days	Mon 22/09/12	Fri 22/12/02
18		Contractor appointed	0 days	Fri 22/12/02	Fri 22/12/02
19		**CONSTRUCTION**	**250 days**	**Mon 22/12/05**	**Fri 23/11/17**
20		Construction period	250 days	Mon 22/12/05	Fri 23/11/17
21		Construction completed	0 days	Fri 23/11/17	Fri 23/11/17



10. CONCLUSION

Engineering services were assessed to determine spare capacity on the existing bulk infrastructure and compared to the estimated demand of the newly proposed Wegdraai 360 houses development.

The findings and conclusions in this report are based on a preliminary desktop study, as well as site visits.

- Bulk Water Infrastructure – The current capacity of the bulk water infrastructure is not enough to accommodate the proposed 360 houses development as is.
- Bulk Sewage Infrastructure – The current bulk sewer infrastructure is not able to accommodate the future demands.
- Roads and Access: No bulk infrastructure upgrading required on the roads.
- Storm Water Management: No bulk infrastructure upgrading required on the storm water.
- Electricity Supply – The existing feeder can easily handle the future additional 432 kVA load only after the upgraded Eskom Groblershoop sub-station is brought online as indicated by Eskom's network planning department.

In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. The infrastructure will have to be upgraded for the implementation of the Wegdraai 360 houses development in order to meet current and expected future needs.