BOEGOEBERG 550 – TOWNSHIP EXPANSION

Engineering Services Investigation Report

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

OCTOBER 2020

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EXECUTIVE SUMMARY

This report was compiled to investigate the bulk infrastructure serving Boegoeberg village and to determine whether the bulk infrastructure is adequate for the development of an additional 550 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 Boegoeberg 550 Houses project. The bulk services for each category that require attention before the project can commence is summarised below:

- **Bulk Water Infrastructure**

  Installation of a new canal pump station and pressure pipeline connecting the abstraction point with the raw water storage reservoir.

  Upgrading of the water treatment works.

  New 300m² sectional steel tower including a pump station and pressure line connecting the reservoir with the tower.

- **Bulk Sewer Infrastructure**

  Construction of two (2) new sewer pump stations.

  Construction of two (2) new 250mm and 200mm rising mains of 1.6km and 0.5km, respectively.

  Construction of a new Oxidation Pond.

- **Bulk Electrical Infrastructure**

  Upgrading and extension of the existing bulk electrical supply system is required by Eskom. The extension of the electrical system will not be a problem as the main sub-station in Groblershoop 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	500 000.00	R	17 845 335.35	R	18 345 335.35
Bulk Sewer Services	R	-	R	17 912 875.21	R	17 912 875.21
Roads and Access	R	-	R	-	R	-
Electrical	R	-	R	-	R	-
TOTAL CONSTRUCTION	**R**	**500 000.00**	**R**	**35 758 210.56**	**R**	**36 258 210.56**
10% Contingencies	R	50 000.00	R	3 575 821.06	R	3 625 821.06
SUB TOTAL	**R**	**550 000.00**	**R**	**39 334 031.61**	**R**	**39 884 031.61**
10% Professional fees	R	55 000.00	R	3 933 403.16	R	3 988 403.16
SUB-TOTAL	**R**	**605 000.00**	**R**	**43 267 434.77**	**R**	**43 872 434.77**
15% VAT	R	90 750.00	R	6 490 115.22	R	6 580 865.22
GRAND TOTAL	**R**	**750 750.00**	**R**	**53 690 953.15**	**R**	**54 441 703.15**

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

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Terms of Reference

BVI Consulting Engineers was appointed by Macroplan to undertake this Bulk Engineering Services Study (Water, Sewer, Electricity and Roads & Storm Water) for the proposed Boegoeberg 550 housing project. Boegoeberg 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 17 km to the south-east of Groblershoop in the Northern Cape (Figure 1 – Locality Plan).

II. The development is located at the following coordinates: 28°55'48.10"S; 22° 7'12.78"E.

Figure 1: Boegoeberg (Brandboom) 550 Housing Development Locality Plan

III. The planned development consists of 550 low-cost houses next to the existing village.

(Figure 2: 550 Stands Development Area).

Figure 2: Boegoeberg 550 Housing Development Locality Plan

IV. 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.

V. 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 selective highs towards natural streams within the village. Kindly refer to contours as shown in Figure 3 below.
- Calcrete is close to the surface of the natural ground level, which makes excavations very hard.

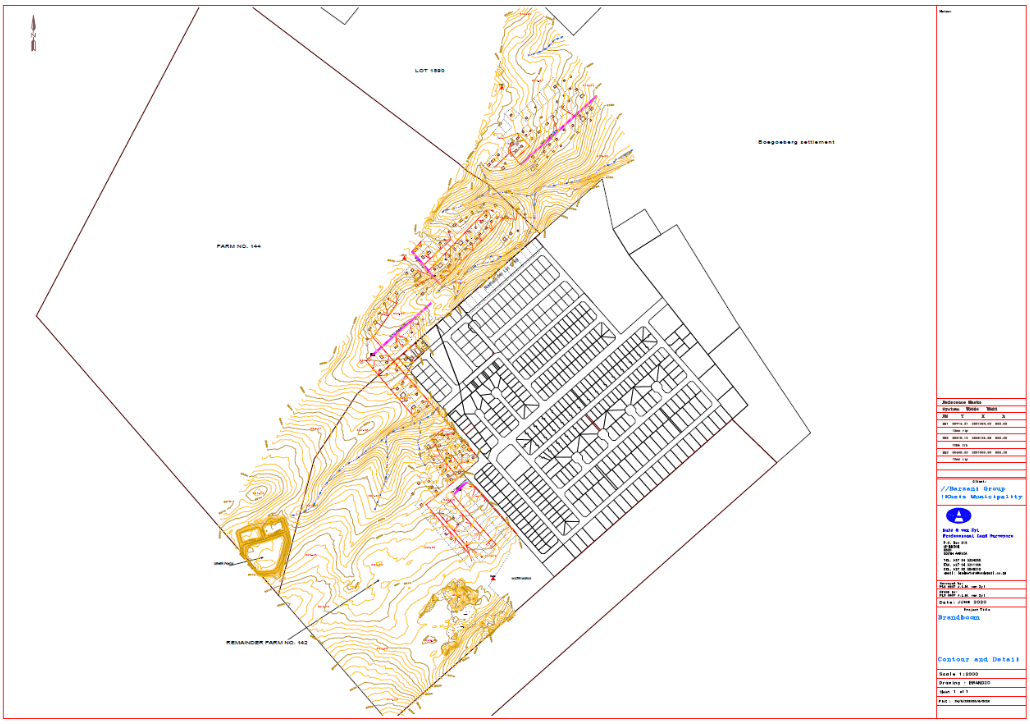


Figure 3: Boegoeberg 550 Contour Plan of Site

3. WATER SUPPLY

3.1 Existing Water Infrastructure

Overview

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

- A raw water canal pump station delivering 14l/s, when the canal is at least 50% full.
- The long weir does not have a sluice gate to control (increase) the downstream volume.
- A 1610m long, 90mm diameter PVC raw water supply line between the canal and the water purification works.
- The water treatment works consisting of:
  - An open raw water storage dam
  - A package type water treatment plant,
  - A sectional steel storage tank
  - A high lift pump
  - A High level 90kL sectional steel storage tank on a 10m high stand.
  - A new high level 26kL sectional steel storage tank on a 15m high stand.
  - A 711kL sectional steel storage tank on dwarf walls.
- Distribution into the village, consists of a 110mm PVC pipe ring feed.

Figure 4: Existing Bulk Water Infrastructure

Raw Water Supply

Water supplied to Boegoeberg is extracted from a concrete canal by means of a pump located within a secured building.. The pump station consists of one (1) pump that delivers 14 l/s. The suction point will be submersed when the canal is in operation. There is a long weir to ensure the suction pipe remains submersed during peak hours. The long weir is currently not operating sufficiently as there is no sluice gate in place to control the volume available when the canal is in operation. Kindly refer to photos below, illustrating the long weir with no sluice gate.

Raw water is pumped from the canal pump station to the purification plant, delivering a maximum flow rate of 14 l/s through a 1610m long, 90mm diameter PVC pipeline to a 4644 m^3 raw water storage dam next to the Water Treatment Works in the village.

Figure 5: Canal Pump

Water treatment and storage site

The diagram below shows a schematic layout of the treatment works, raw and potable water storage reservoirs, as well as the elevated tower.

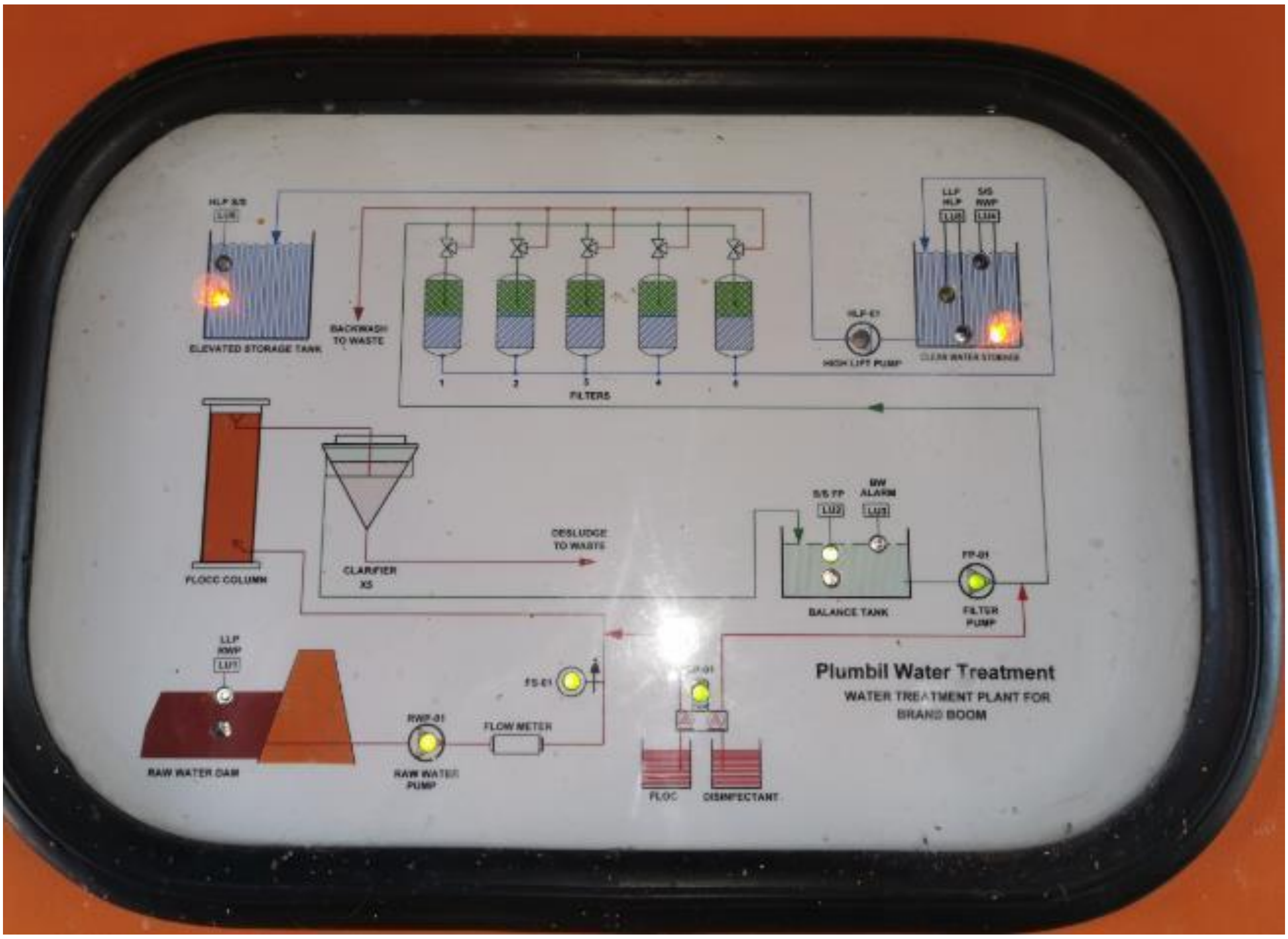


Figure 6: Schematic Layout

Water is pumped from the raw water storage dam through the Water Treatment Plant to a 711 m^3 sectional steel potable water storage reservoir. The potable water is also pumped via a high lift pump stored within the container from treatment plant into a 90 m^3 elevated storage tank. Both section storage tanks provides water to the village via a 110mm ring feed.

The photo’s below shows the storage reservoirs and treatment plant.

Figure 7: Photos of WTW and Storage Facilities

Water Treatment Plant

The Package Plant Water Treatment Works (WTW) was constructed in 2010 to supply water at a rate of 4.2 l/s.

Photo's below shows five (5) settlement tanks, five (5) filters, one (1) Flocculent tank, one(1) Chlorination tank including a dosing apparatus.

Figure 8: Photos of Treatment Plant

Reticulation System

The potable water is stored into two(2) storage tanks. The 711 m^3 storage tank provides water to the area North (Block 1) of the treatment site and the 90 m^3 elevated storage tank provides water to the area north east of the treatment site (Block 2). The storage tanks gravitates into the reticulation network via a 110mm diameter PVC pipeline. The reticulation network is shown in the drawing below.

There is a newly installed 261.48 m^3 elevated storage tank located next to the existing elevated storage tank, which is currently not connected to the system.

Figure 9: Google Image of Existing reticulation

Condition of the water supply system

The overall condition of the water treatment site is fairly good. However, most of the elements of the water supply system are currently manually operated. These include the canal pump, the water treatment works, and the reservoir levels. The newly installed elevated storage tank is currently not in use. Most of the water meters and pressure gauges are out of service.

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 below shows the factors obtained from the Red Book and estimated operating hours which will be used in the calculations:

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)		4,5
OPERATING HOURS	1	Source Pump Station (SPSH)	(Maximum operating hours per day that required volume of wate	16 hours
	2	Water purification plant (WTPH)	(Maximum operating hours per day that required volume of wate	16 Hours
	3	Lifting Pump Station **(LPS%)**	(% of Instantanious peak flow)	150%
STORAGE	1	Storage in elevated tanks	(Hours of Instantanous Peak Demand)	3 hours
	2	Potable Water Storage Reservoirs	(Hours of Annual Average Daily Demand*SPF)	24 hours
	3	Raw Water Storage Reservoirs	(Hours of Summer Average Daily Demand)	10 days

Table 1 Design Factors and Operating hours.

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)	420	Houses	600 l/ household per day	252 m^3/d
	2	Sub-Economical Houses (550 houses development)	0	Houses	600 l/ household per day	0 m^3/d
	4	Economical Houses (Existing)	45	Houses	1200 l/ household per day	54 m^3/d
	5	Economical Houses (550 houses development)	0	Houses	1200 l/ household per day	0 m^3/d
	7	Primary School Hostel	0	Learne	150 l/ Learner per day	0 m^3/d
	8	Schools	500	Learne	25 l/ Learner per day	12,5 m^3/d
	9	High School Hostel	0	Learne	150 l/ Learner per day	0 m^3/d
	10	High School	250	Learne	25 l/ Learner per day	6,25 m^3/d
	11	Clinics	600	m^2 x	500 l/100m^2 per day	3 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	1,00	ha	5 mm water per day	50 m^3/d
		ANNUAL AVERAGE DAILY DEMAND (AADD)				**379,8 m^3/d**

THEORETICAL DEMANDS	1	Annual Average Daily Demand (AADD)	AADD	379,8 m^3/day	15,8 m^3/hour	4,4 l/s	CURRENT CAPACITY	
	2	Gross Annual Average Daily demand (GAADD)	(1+Lfr)*AADD	436,7 m^3/day	18,2 m^3/hour	5,1 l/s		
	3	Summer Gross Daily Demand (SGDD)	SPF*GAADD	655,1 m^3/day	27,3 m^3/hour	7,6 l/s		
	4	Instantanious Peak Demand (IPD) (Main supply pipeline to reticulation)	AADD*PFR		71,2 m^3/hour	19,8 l/s		
	5	Storage Capacity Elevated Storage	hours*IPD			213,6 m^3	90,8 m^3	43%
	6	Lifting Pump Station Capacity and Pipeline Flow between Main Storage and Elevated tank	IPD***LPS%**	194 mm dia	106,8 m^3/hour	29,7 l/s	16,6 l/s	56%
	7	Potable Water Storage Capacity (Main Storage)	hours*AADD			379,8 m^3	711,8 m3	187%
	8	**Water Treatment Plant Capacity (WTPC)**	**SGDD*24/WTPH**	**982,6 m3/da**	**40,9 m3/hou**	**11,4 l/s**	**4,2 l/s**	**37%**
	9	**Source Pump Station Capacity and Pipeline Flow**	**WTPC*(1+LFW)*24/SPS**	**158 mm di**	**70,6 m3/hou**	**19,6 l/s**	**14,4 l/s**	**73%**
	10	Raw Water Storage Capacity	Days*SGDD			6551,0 m^3	4644,0 m3	71%

Table 2: Existing Capacity Calculations

It is clear from the table that the parts of the existing infrastructure is under pressure to handle the existing demand. The biggest problems are with treatment capacity, pump capacity and elevated storage.

3.3 Bulk Water Infrastructure Requirements

The table below compares the current infrastructure capacities with the capacity that is required for the additional 550 stands development.

	BULK AND CONNECTOR SERVICES CAPACITY CALCULATION : FUTURE					
	NO.	**DESCRIPTION**	**UNITS**		**DEMAND PER UNIT**	**Criteria**
GENERAL	1	Sub-Economical Houses (Existing)	420	Houses	600 l/ household per day	252 m^3/d
	2	Sub-Economical Houses (550 houses development)	550	Houses	600 l/ household per day	330 m^3/d
	4	Economical Houses (Existing)	45	Houses	1200 l/ household per day	54 m^3/d
	5	Economical Houses (550 houses development)	0	Houses	1200 l/ household per day	0 m^3/d
	7	Primary School Hostel	0	Learne	150 l/ Learner per day	0 m^3/d
	8	Schools	500	Learne	25 l/ Learner per day	12,5 m^3/d
	9	High School Hostel	0	Learne	150 l/ Learner per day	0 m^3/d
	10	High School	250	Learne	25 l/ Learner per day	6,25 m^3/d
	11	Clinics	600	m^2 x	500 l/100m^2 per day	3 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	1,00	ha	5 mm water per day	50 m^3/d
		ANNUAL AVERAGE DAILY DEMAND (AADD)				**709,8 m^3/d**

THEORETICAL DEMANDS	1	Annual Average Daily Demand (AADD)	AADD	709,8 m^3/day	29,6 m^3/hour	8,2 l/s	**CURRENT CAPACITY**	
	2	Gross Annual Average Daily demand (GAADD)	(1+Lfr)*AADD	816,2 m^3/day	34,0 m^3/hour	9,4 l/s		
	3	Summer Gross Daily Demand (SGDD)	SPF*GAADD	1224,3 m^3/day	51,0 m^3/hour	14,2 l/s		
	4	Instantanious Peak Demand (IPD) (Main supply pipeline to reticulation)	AADD*PFR		133,1 m^3/hour	37,0 l/s		
	5	Storage Capacity Elevated Storage	hours*IPD			399,2 m^3	351,0 m^3	**88%**
	6	Lifting Pump Station Capacity and Pipeline Flow between Main Storage and Elevated tank	IPD***LPS%**	266 mm dia	199,6 m^3/hour	55,4 l/s	16,6 l/s	**30%**
	7	Potable Water Storage Capacity (Main Storage)	hours*AADD			709,8 m^3	711,8 m3	**100%**
	8	**Water Treatment Plant Capacity (WTPC)**	**SGDD*24/WTPH**	**1836,5 m3/day**	**76,5 m3/hou**	**21,3 l/s**	**4,2 l/s**	**20%**
	9	**Source Pump Station Capacity and Pipeline Flow**	**WTPC*(1+LFW)*24/SPSI**	**216 mm di**	**132,0 m3/hou**	**36,7 l/s**	**14,4 l/s**	**39%**
	10	Raw Water Storage Capacity	Days*SGDD			12243,0 m^3	4644,0 m3	**38%**

Table 3: Future Capacity Calculations

The Recommended upgrades to the Boegoeberg bulk water infrastructure are as follows (as shown on the following page):

- The supply and installation of two (2) new Etanorm 100-080-250 duty and standby pump for the canal pump station. Installation of sluice gate and refurbishment to the existing abstraction point.
- A new 200 mm diameter Class 9 PVC pipeline between the canal pump station and the existing raw water storage reservoir (1610m long)
- Upgrade the existing Water Treatment Works to deliver a maximum of 76m^3/h potable water during summer peak months to the storage facilities. Replace the existing raw water pump and filter pump with a new Etanorm 080-65-150.
- Connect the newly installed 261 m^3 and the existing 90 m^3 sectional steel pressure towers to the new high lift pump located in the Package Plant.
- Upgrade the existing high lift pump by replacing the existing pump with a Etanorm 125-100-250 to increase pump capacity to 55.4l/s.
- The construction of a new 250mm Class 9 pipeline between the lifting pump station and the pressure towers.
- The existing raw water storage supply is currently 50% in use, the V-shaped overflow should be closed and replaced with a pipe overflow. This will increase storage capacity to at least double.

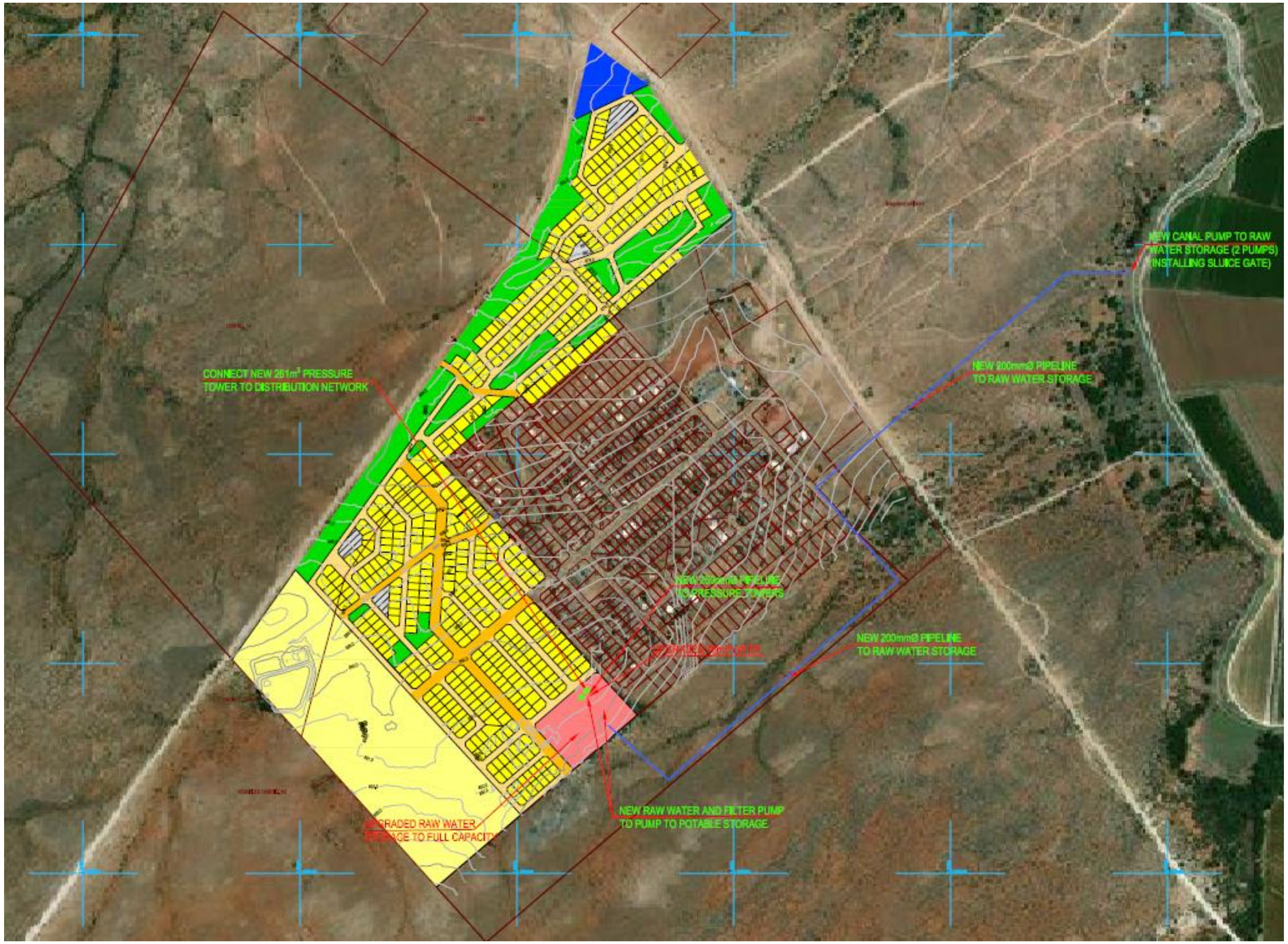


Figure 10: Proposed Water Bulk Infrastructure

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

Overview

The bulk sewer infrastructure can be summarised as follows:

- The houses are connected to a bulk sewer, which gravitates to a submersible pump and pumps to an earth dam.
- The sewer pump station consists of a hand rake screen at entry.
- Unfortunately, no information could be obtained regarding the existing pump station, as it was completely submersed in sewer.

Kindly refer to the figure below, illustrating the bulk sewer and internal sewer infrastructure.

Figure 11: Existing Sewer Infrastructure

Condition of the water supply system

Kindly refer to the photos below on the current condition of the sewer pump station and Earth Dam currently used for outfall sewer.

Figure 12: Photos of Sewer Pump Station and Earth Dam.

4.2 Bulk Sewer Infrastructure Requirements

We propose a new full borne sewerage system to accommodate the existing 465 houses and the additional 550 houses, the associated bulk infrastructure will most possibly consist of a pump station, rising main, oxidation ponds as shown on the Google image below.

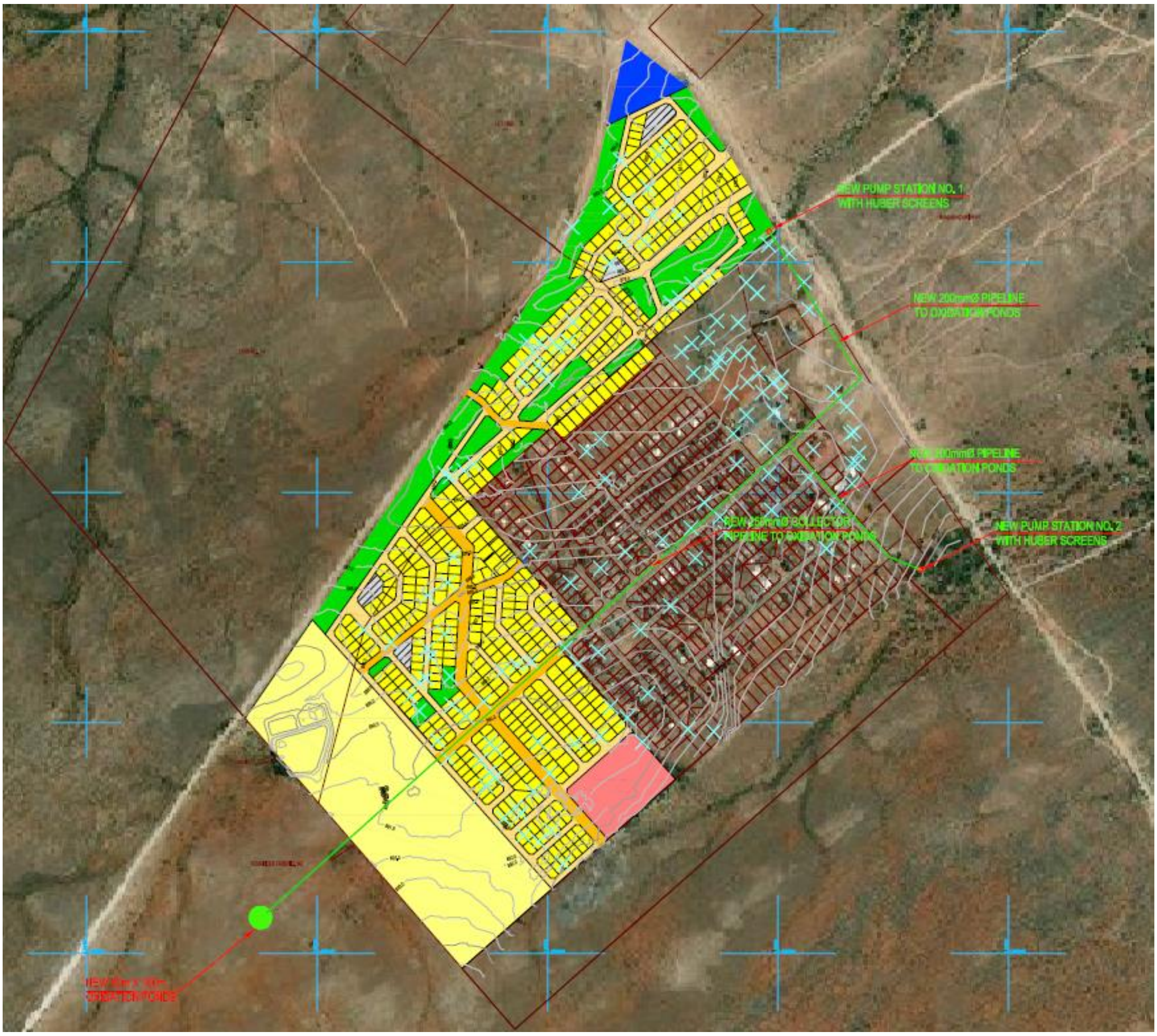


Figure 13: Proposed Bulk Sewer Requirements

The total sewer flow is calculated as follows:

BOEGOEBERG TOTAL SEWER FLOW					
Sewer flow per day - Sub economical houses	970	sub economical houses @	500 l/day	**485 000**	**l/day**
Sewer flow per day - Economical houses	45	economical houses @	750 l/day	**33 750**	**l/day**
Sewer flow per day - Hostels	0	persons @	140 l/day	**-**	**l/day**
Sewer flow per day - Schools	600	persons @	20 l/day	**12 000**	**l/day**
Businesses and State Institutions	3	buildings	100 l/day	**300**	**l/day**
SEWER FLOW PER DAY - TOTAL				**531 050**	**l/day**

Table 4: Total Sewer Run off

The sizes and capacities of the proposed pump stations and rising mains were calculated as follows:

PUMP STATION No 1 AND RISING MAIN				
Sewer flow per day - Sub economical houses	603	sub economical houses @	500 l/day	**301500 l/day**
Sewer flow per day - Economical houses	45	economical houses @	750 l/day	**33750 l/day**
Sewer flow per day - Hostels	0	persons @	140 l/day	**0 l/day**
Sewer flow per day - Schools	600	persons @	20 l/day	**12000 l/day**
Businesses and State Institutions	3	buildings	100 l/day	**300 l/day**
SEWER FLOW PER DAY - TOTAL				**347550 l/day**
Average sewer flow				**4,0 l/s**
Factor for inflow from other sources	15%			**0,6 l/s**
Sewer flow with inflow from other sources				**4,6 l/s**
PEAK NETWORK SEWER FLOW	4,6		3,5	**16,2 l/s**
FLOWRATE FROM OTHER PUMP STATIONS				**0 l/s**
TOTAL PEAK FLOW				**16,19 l/s**
ACTUAL PUMP ABILITY	**1,63**	times peak flow		**26,4 l/s**
Theoretical pump station capacity for normal pump operation	1	hours of peak flow		**58 m^3**
Theoretical pump station capacity for emergency storage	2	hours of normal flow		**33 m^3**
TOTAL REQUIRED THEORETICAL PUMP STATION CAPACITY				**92 m^3**
Pump details		Gorman Rupp V4A60-B		**22 kW**
Rising main diameter				**219 mm**
Rising main material				**PVC**
Rising main length				**1619 m**
Static pump height				**20 m**
Friction losses				**12 m**
Total pump height				**42 m**

Table 5: Pump station no. 1

PUMP STATION No 2 AND RISING MAIN				
Sewer flow per day - Sub economical houses	367	sub economical houses @	500 l/day	183500 l/day
Sewer flow per day - Economical houses	0	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	0	persons @	20 l/day	0 l/day
Businesses and State Institutions	0	buildings	100 l/day	0 l/day
SEWER FLOW PER DAY - TOTAL				**183500 l/day**
Average sewer flow				**2,1 l/s**
Factor for inflow from other sources	15%			**0,3 l/s**
Sewer flow with inflow from other sources				**2,4 l/s**
PEAK NETWORK SEWER FLOW	2,4		3,5	**8,5 l/s**
FLOWRATE FROM OTHER PUMP STATIONS				**0 l/s**
TOTAL PEAK FLOW				**8,55 l/s**
ACTUAL PUMP ABILITY	**1,84**	times peak flow		**15,7 l/s**
Theoretical pump station capacity for normal pump operation	1	hours of peak flow		**31 m^3**
Theoretical pump station capacity for emergency storage	2	hours of normal flow		**18 m^3**
TOTAL REQUIRED THEORETICAL PUMP STATION CAPACITY				**48 m^3**
Pump details		Gorman Rupp V4A60-B		**15 kW**
Rising main diameter				**169 mm**
Rising main material				**PVC**
Rising main length				**450 m**
Static pump height				**10 m**
Friction losses				**12 m**
Total pump height				**32 m**

Table 6: Pump Station no. 2

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

- Construction of two (2) new sewer pump stations capable of delivering 26.4 l/s and 15.7 l/s, respectively direct to the Waste Water Treatment plant. Self priming centrifugal pumps to be used.
- Construction of two (2) new Huber screens at both Sewer Pump stations.
- New 250mm diameter pipelines (1610m) between the pump station no. 1 and the Waste Water Treatment Plant.
- New 200mm diameter pipelines (450m) between the pump station no. 2 and the new rising main from pump station no. 1.
- Construction of a 80m x 160m Oxidation Pond. Kindly refer to ***Figure 14*** for typical Oxidation Pond to be used.

Typical Oxidation Dam to be constructed.

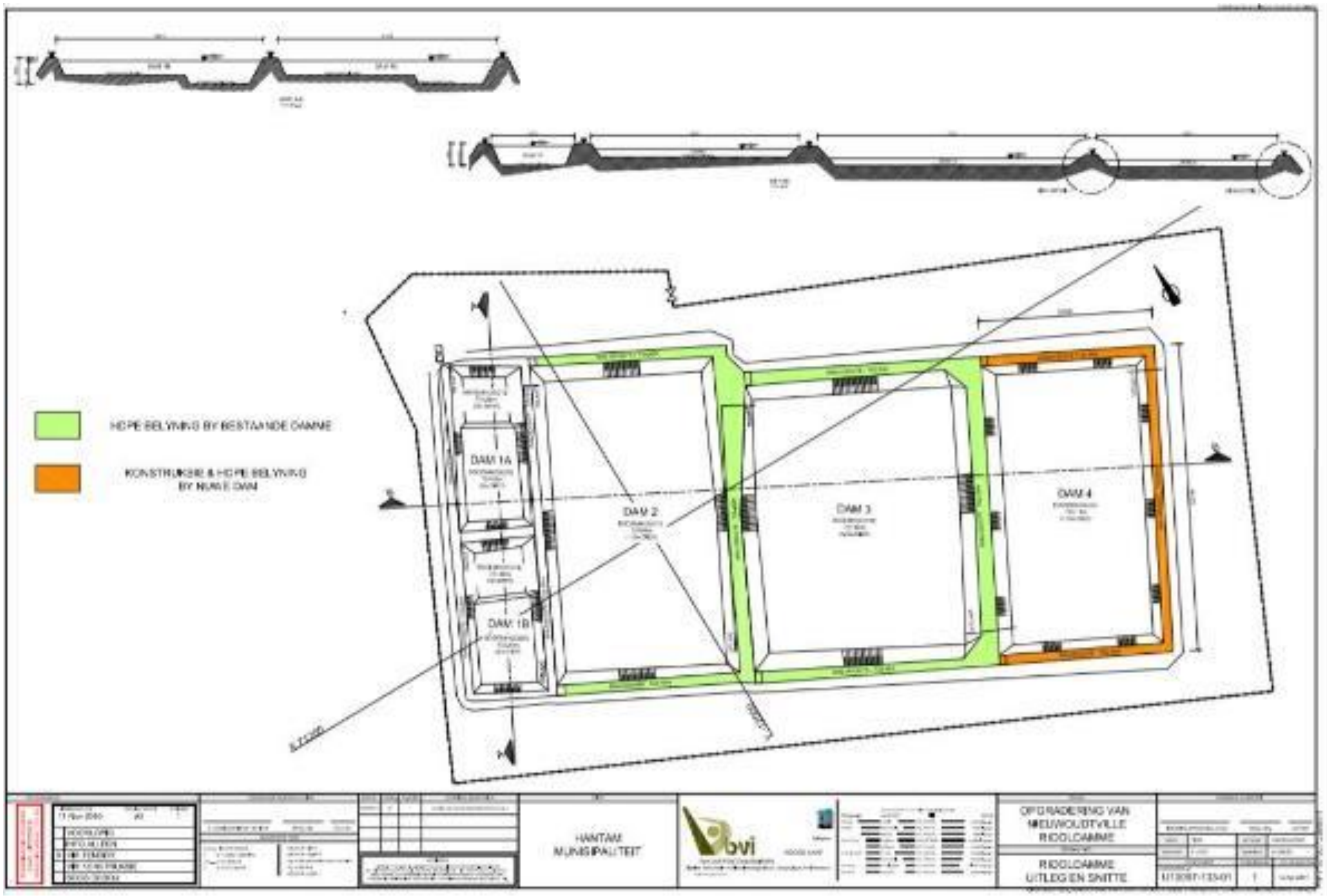


Figure14 Typical Oxidation Pond.

5. ROADS AND STORMWATER

5.1 Roads and Access

Existing access along National Route 10 (between Groblershoop and Marydale) will be used. The access road to Boegoeberg is DR03293 and MR00779.

Internal roads are mostly gravel roads. These roads can be upgraded to interlocking paved streets, which in turn will result in local unskilled job creation for the community.

5.2 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.

Boegoeberg is a small village that generally drains from the center. Gravel surfaced roads should be upgraded to interlocking paved roads. Interlocking paved roads with kerbs will be adequate for surface drainage.

6. SOLID WASTE DISPOSAL

6.1 CURRENT SPOIL SITE

The designated spoil site, is as shown in ***Figure 15*** below.

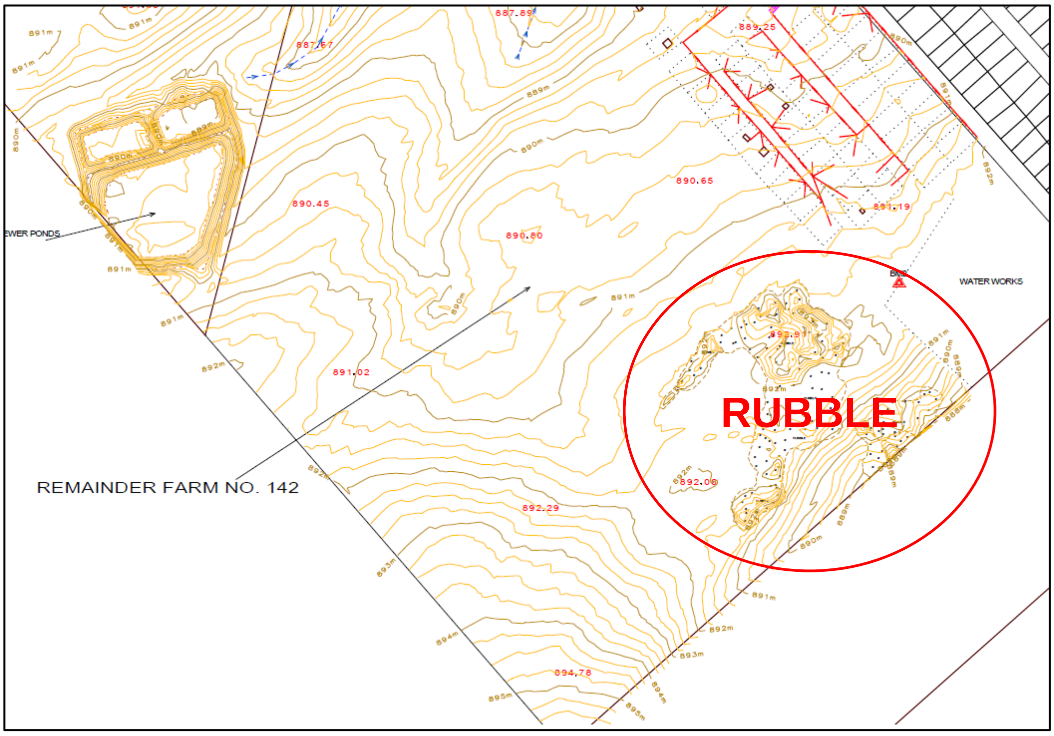


Figure 15 Designated Spoil Site.

Figure 16 Alternative sites where spoiling occurs (@ existing pumpstation).

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 135 Community stands, an expected additional load of the proposed development will initially be 660 KVA as per INEP guidelines and the accommodation of this load will form the basis of this report. The community of Boegoeberg 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.

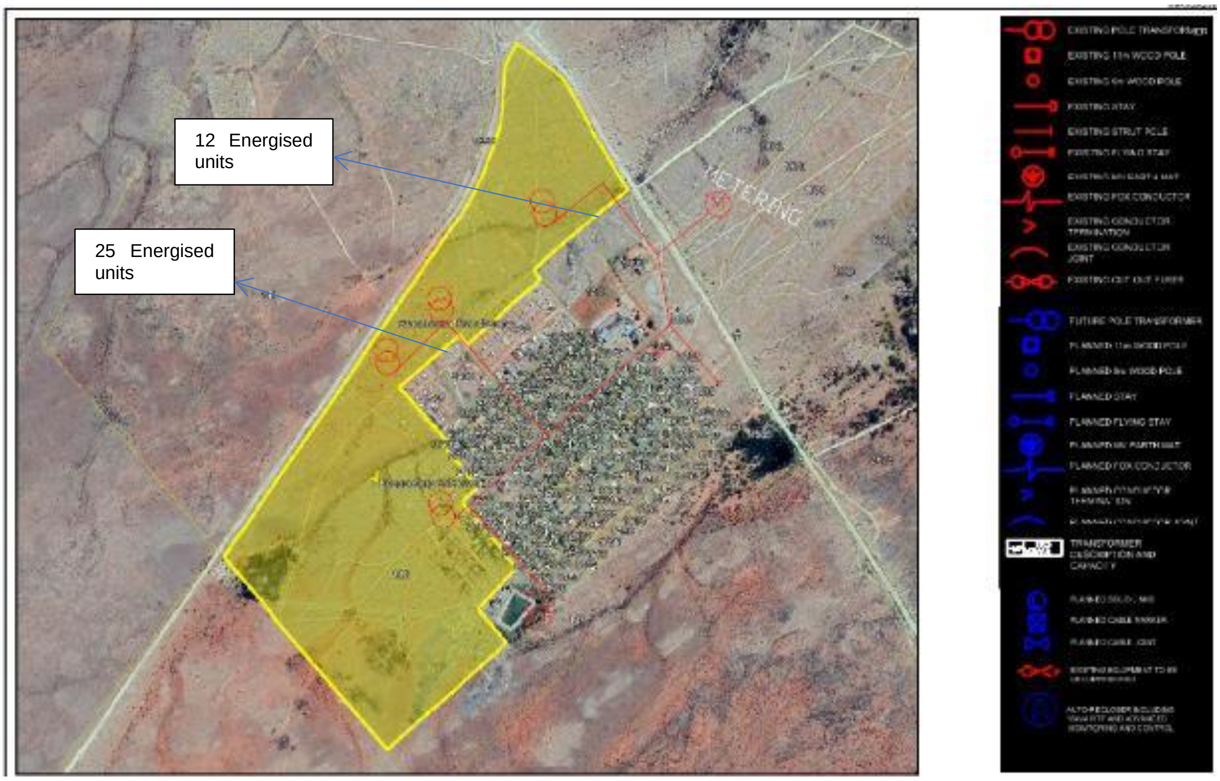
The bulk connection to the community / town is via a 22kV overhead line fed from the 10MVA Groblershoop sub-station

7.2 Existing Electrical Network

The bulk connection to the community / town is via a 22kV overhead line fed from the Eskom 10MVA Groblershoop 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 Boegoeberg area runs through the town via 22 KV overhead line feeder connecting to various pole mounted transformers (see figure 1 below). The existing overhead line feed is running through a section of the proposed development and 12 & 25 separately informal houses / shacks are already been energised.

The existing feeder can easily handle the future additional 660kVA load only after the upgraded Eskom Grobelershoop 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 Boegoeberg 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 INFRASTRUCTURE	AMOUNT NEW INFRASTRUCTURE	TOTAL
Water Bulk Services							
Source pump station - Canal			37.0	l/s		999 000	999 000
Pump line from source to raw water storage reservoir	200	mm dia	1 610.0	m		2 126 818	2 126 818
Water Treatment Works			1.5	Ml/day	500 000	10 488 000	10 988 000
Potable water pump station - Mechanical			56.0	l/s		1 512 000	1 512 000
Pump line from storage reservoir to Pressure Tower	250	mm dia	1 000.0	m		1 519 517	1 519 517
Elevated Starage Tower - Sectional Steel			300.0	m3		1 200 000	1 200 000
						-	-
Sub-Total (Water)					**500 000**	**17 845 335**	**18 345 335**
Bulk Sewer Services							
Sewer Pump Station No 1 - Civil/Structural			92.0	m3		736 000	736 000
Sewer Pump Station No 1 - Mechanical/Electrical/Control			92.0	m3		165 600	165 600
Pump Line from Sewer Pump Station No 1 to Treatment Works	250	mm dia	1 610.0	m		2 446 423	2 446 423
Sewer Pump Station No 2 - Civil/Structural			48.0	m3		384 000	384 000
Sewer Pump Station No 2 - Mechanical/Electrical/Control			48.0	m3		86 400	86 400
Pump Line from Sewer Pump Station No 2 to Treatment Works	200	mm dia	450.0	m		594 452	594 452
Treatment Works Oxidation Ponds			540.0	kl/day		13 500 000	13 500 000
Sub-Total (Sewer)					-	**17 912 875**	**17 912 875**
Roads and Access							
None						-	
Electrical							
None							
TOTAL CONSTRUCTION					**500 000**	**35 758 211**	**36 258 211**
10% Contingencies					50 000	3 575 821	3 625 821
SUB TOTAL					**550 000**	**39 334 032**	**39 884 032**
10% Professional fees					55 000	3 933 403	3 988 403
SUB-TOTAL					**605 000**	**43 267 435**	**43 872 435**
15% VAT					90 750	6 490 115	6 580 865
GRAND TOTAL					**750 750**	**53 690 953**	**54 441 703**

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.

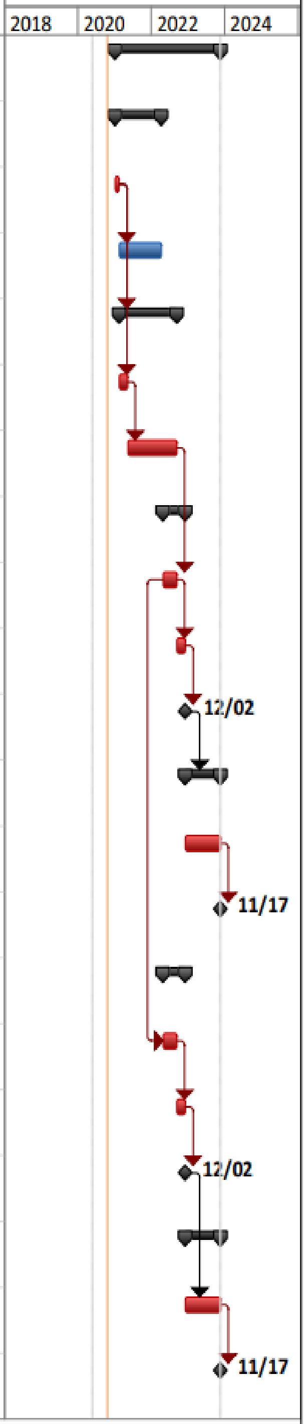
7.1 Funding

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 21/05/10	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 Boegoeberg 550 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 550 houses development as is. It is proposed that the infrastructure should be upgraded, not only to provide adequate capacity for the Boegoeberg development, but also for future water demand increases.
- Bulk Sewage Infrastructure – The bulk sewer infrastructure will need to be upgraded which will include two pump stations, a pump line and new oxidation ponds.
- 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 660kVA load only after the upgraded Eskom Grobelershoop 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 Boegoeberg 550 houses in order to meet expected future needs.