GAMAKOR HOUSING DEVELOPMENT

Engineering Services Investigation Report

Investigation of the available and required bulk civil and electrical services for the Gamakor development, Keimoes

May 2020

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MACROPLAN

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EXECUTIVE SUMMARY

This report was compiled to investigate the bulk infrastructure in Keimoes and to determine whether the bulk infrastructure is adequate for the formalisation of the Gamakor area, Keimoes, 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 all the bulk infrastructure is not in place to accommodate the Gamakor project. The bulk services for each category that require attention before the project can commence is summarised below:

- **Bulk Water Infrastructure**
  - Repairs to the water treatment works mechanical and electrical components.
  - Replacement of one of the supply pumps at the water treatment works with a larger pump in order to deliver 91 l/s into the distribution system.
  - Construction of a new 4.2km, 450mm diameter supply pipe line;
  - Construction of a new 3ML storage reservoir;
  - Construction of a new 1km, 450mm diameter bulk distribution pipe line.

- **Bulk Sewer Infrastructure**
  - Construction of two new pump stations (37.5 l/s and 53.8 l/s).
  - Construction of two new 250mm rising mains (3.2km and 2km).
  - Construction of a new 2.5ML waste water treatment works;

- **Bulk Electrical Infrastructure**
  - Formal bulk upgrade process to be finalised between Eskom and the municipality;
  - Minor modification to the load centre.

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 Disclaimer

This is a draft report and only outlines the some of the findings of the investigation to date and should not be used as the final or complete report. No recommendations or conclusions have been made and some portions of the report may be incomplete as the investigation is still in process.

1.2 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 Gamakor 1500 project located in the area of Keimoes within the jurisdiction of the Kai !Garib Local Municipality.

II. The planned development consists of 1500 low cost houses on 1 site totalling 92.1 Ha in extent.

III. The purpose of the Bulk Engineering Services Assessment is to determine the availability and capacity of existing bulk services with a view to servicing 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

1.3 Site Location

I. The site is situated approximately 5km to the north-east from the central business area of Keimoes, Northern Cape (Figure 1 – Locality Plan).

II. The development is located at the following co-ordinates: 28°41’40” S; 20°57’54” E

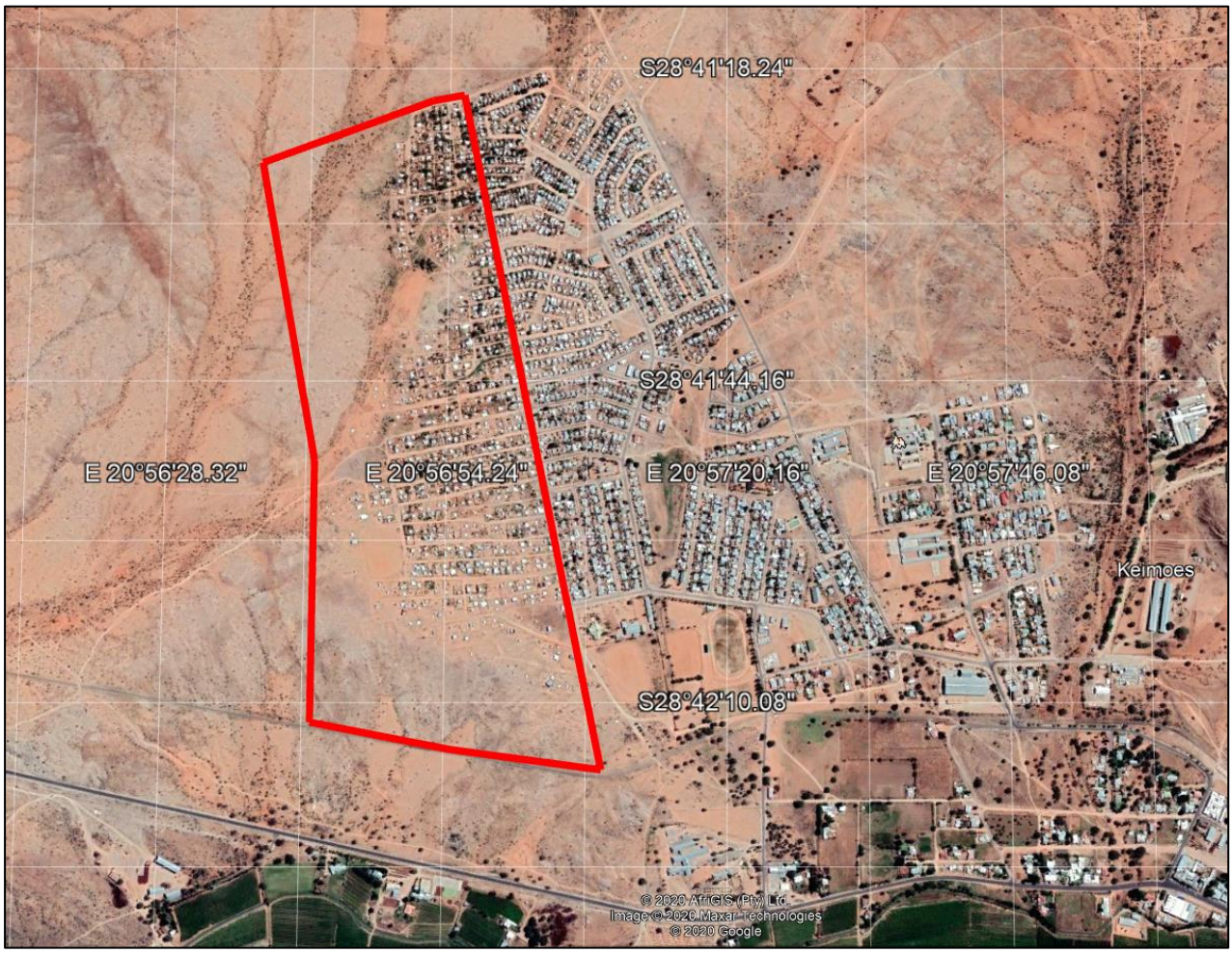


Figure 1: Gamakor Locality Plan

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.

3. WATER SUPPLY

3.1 Existing Water Infrastructure

Overview

The bulk water infrastructure of the Keimoes area can be summarised as follows:

- A raw water river pump station;
- A 450mm diameter raw water supply line;
- A conventional water treatment plant;
- Three bulk distribution supply zones:
    - Residential area and informal settlements north of the railway line, serviced by a 2.5ML reservoir which is supplied by a 250mm diameter uPVC bulk supply line.
    - CBD area services by a 1.7ML reservoir and a dedicated supply line;
    - Malanshoek serviced by a 180kl reservoir supplied by a 74mm diameter supply line.

Figure 2 shows the existing bulk water infrastructure for Keimoes.

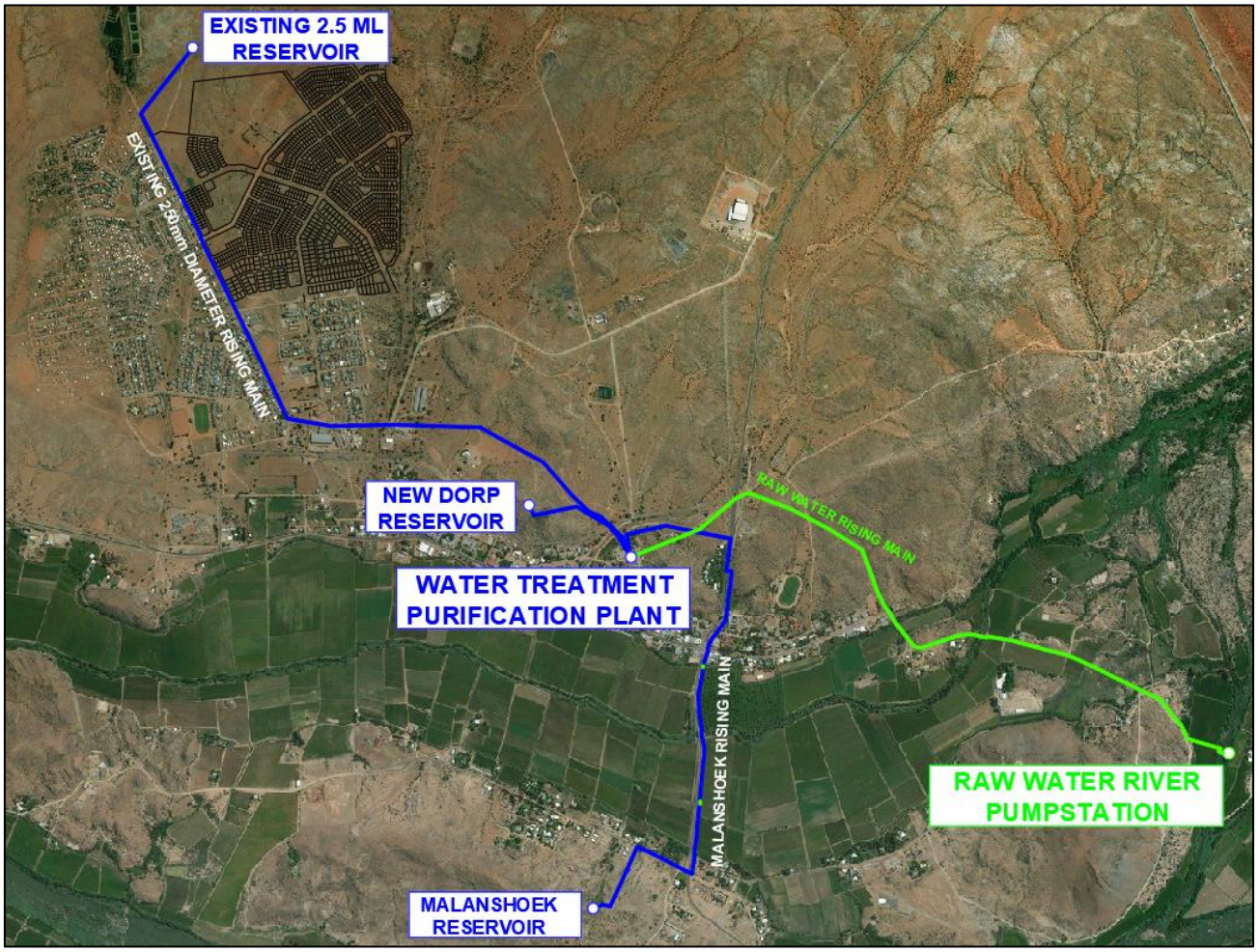


Figure 2: Existing Bulk Water Infrastructure

Raw Water Supply

Water supplied to Keimoes is extracted from Orange River by means of pump station fitted on a raft with the switchgear room located above the 1-in-20 year flood line. The pump station consists of three pumps, each with a capacity of 55l/s. The pumps operate as two duty pumps and one standby pump.

Raw water is pumped from the raft pump station towards the purification plant, delivering a maximum flow rate of 110l/s through a 500m long, 450mm diameter steel pipe.

Currently, only one pump is in working condition. The other pumps will have to be repaired in order to achieve the design flow of 110 l/s. The photo below, on the right, was taken after the pumps were installed. Due to poor maintenance of the site, reeds have obstructed the view to the pump raft.

Water Treatment Plant

The Water Treatment Works (WTW) was upgraded to supply a maximum of 150 l/s.

The WTW consists of a flock canal, dividing water into four horizontal flow, rectangular concrete settlement tanks of 2 x5 m wide, 12m long, 3m deep tanks (see photos below).

Water then flows from the settlement tanks through sand filters and the filtered water is then chlorinated before it flows to a small potable water storage reservoir. Finally, the water is then pumped to the distribution network.

The WTW requires refurbishment for some of the components. This includes the control systems and various mechanical and electrical components.

One of the supply pumps (see photos below) will also have to be replaced with a larger pump to accommodate future demands (see Section 3.3).

Potable Water Supply and Storage

Potable water is pumped from the WTW using three centrifugal pumps with a maximum supply rate of 150 l/s through the distribution system to three concrete storage reservoirs. However, due to the size of the inlet works at the WTW only a maximum of 95 l/s can be supplied.

The first area supplied is Extension 6 and 7, as well as the Gardenia residential area, north of the railway line. The water is pumped through the reticulation network to a 2.5ML concrete reservoir via a 250mm diameter uPVC bulk water supply line. This reservoir will also service the proposed Gamakor development.

The second area is the Keimoes CBD area. This area makes use of a 1.7ML concrete reservoir. The reservoir was supplied through the reticulation network, but this caused periodic pipe bursts. A new dedicated supply line was constructed from the WTW to 1.7ML reservoir which has solved the problem.

The third area is Malanshoek, an economical residential area 3km to the south. Malanshoek has a 180kl concrete storage reservoir supplied by 75mm diameter pipeline.

Reticulation System

The potable water supplied to the northern reservoir from the WTW is pumped through the reticulation network. Pumping through the network causes periodic pipe bursts due to the water hammer action resulting from pump operations, as well as the type of pipe material used (unreinforced fibre cement) within the reticulation. To avoid this, a dedicated supply line to the 2.5ML reservoir is recommended.

The newly proposed Gamakor development will have its own water reticulation system consisting of 75mm to 200mm uPVC pipes.

3.2 Water Demands

Land Use Types

The table below shows the different land use types found in the development along with the respective water demands for each land use type used for this investigation, as set out in Human Settlements Guidelines, 2019.

Land Use Type	Water Demand	Unit
Low-income Housing (Waterborne Sewer)	0.60	kL/unit
School	0.06	kL/student
Business/Commercial	21.0	kL/100m²
Cemetery	12.0	kL/Ha
Park	12.0	kL/Ha

Existing Demands

The existing water demands will be divided into two portions for this investigation, namely: 1) *Supply Zone A*: Total demand supplied by the extraction pump station and the Water Treatment Plant; and 2) *Supply Zone B*: Total demand supplied by the existing 2.5 ML concrete reservoir.

- For Supply Zone A, the Total Average Annual Daily Demand (TAADD) for all areas of Keimoes that are fed by the Keimoes Water Treatment Plant are included.
- For Supply Zone B, the TAADD for all areas of fed by the 2.5 ML Reservoir, which include Extension 6 and 7 and the schools in that area.
- For both supply zones, a loss factor of 10% was applied to the AADD to get to a TAADD amount and a further 10% for the losses at the Water Treatment Plant.

The table below lists the TAADD for both supply zones:

Area	TAADD (kL/day)
Supply Zone A	**2 141**
Keimoes CBD	859
Keimoes Residential (Supply Zone B)	1 178
Malanshoek	104
Supply Zone B	**1 178**
Extension 6 & 7	855
Extension 4	323

Future Demands

For future demands, the same supply zones are used, with the following additions to the demands:

- Gamakor 1500 erven development.
- Possible future developments were identified and are also considered in the table below. This includes 1200 erven to the east of the Gamakor development. It is unlikely that this development will take place in the near future and has been omitted in the demand calculations for Supply Zone A (Supply Zone A demands are used to calculate the WTW and raw water supply capacity). It has however been included in the Supply Zone B demands (used for the supply line and water storage capacity calculations).

The table below lists the future TAADD for both supply zones:

Area	TAADD (kL/day)
Gamakor Development Demands	1 035
Total Future Demand for Supply Zone A	3 176
Total Future Demand for Supply Zone B	3 041

3.3 Bulk Water Infrastructure Requirements

The table below compares the current infrastructure capacities with the required capacity for the various cases. Cells highlighted in red would require upgrading in order to accommodate the expected demands.

Water Infrastructure	Current Capacity	Existing Requirements	Future Requirements
Bulk Raw Water Supply	150 l/s	76.9 l/s	114.1 l/s
Water Treatment Plant	90-95 l/s	55.8 l/s	82.7 l/s
WTP to Reservoir Supply - Pumps	55 l/s	35.3 l/s	90.2 l/s
WTP to Reservoir Supply – Supply Line	250mm Dia.	250mm Dia.	450mm Dia.
Storage Capacity	2.5 ML	2 ML	5.3 ML

The recommended upgrades to the Keimoes bulk water infrastructure in order to implement the Gamakor development are as follows:

- Construction of a new 3ML concrete storage reservoir to the north of Keimoes (see Figure 3).
- Potable water supply to the proposed 3ML concrete reservoir through a new 4.2km rising main (see Figure 3). The rising main will require that the supply from the WTW pump station be increased. It is proposed that one of the pumps will have to be replaced with a larger pump. The pump will be sized for a nominal flow of 327m³/h and 45 m of head.
- Installation of a new 450mm diameter bulk water distribution main to the Gamakor development.
- Repairs at the WTW, including the repair of mechanical and electrical components and the control system.

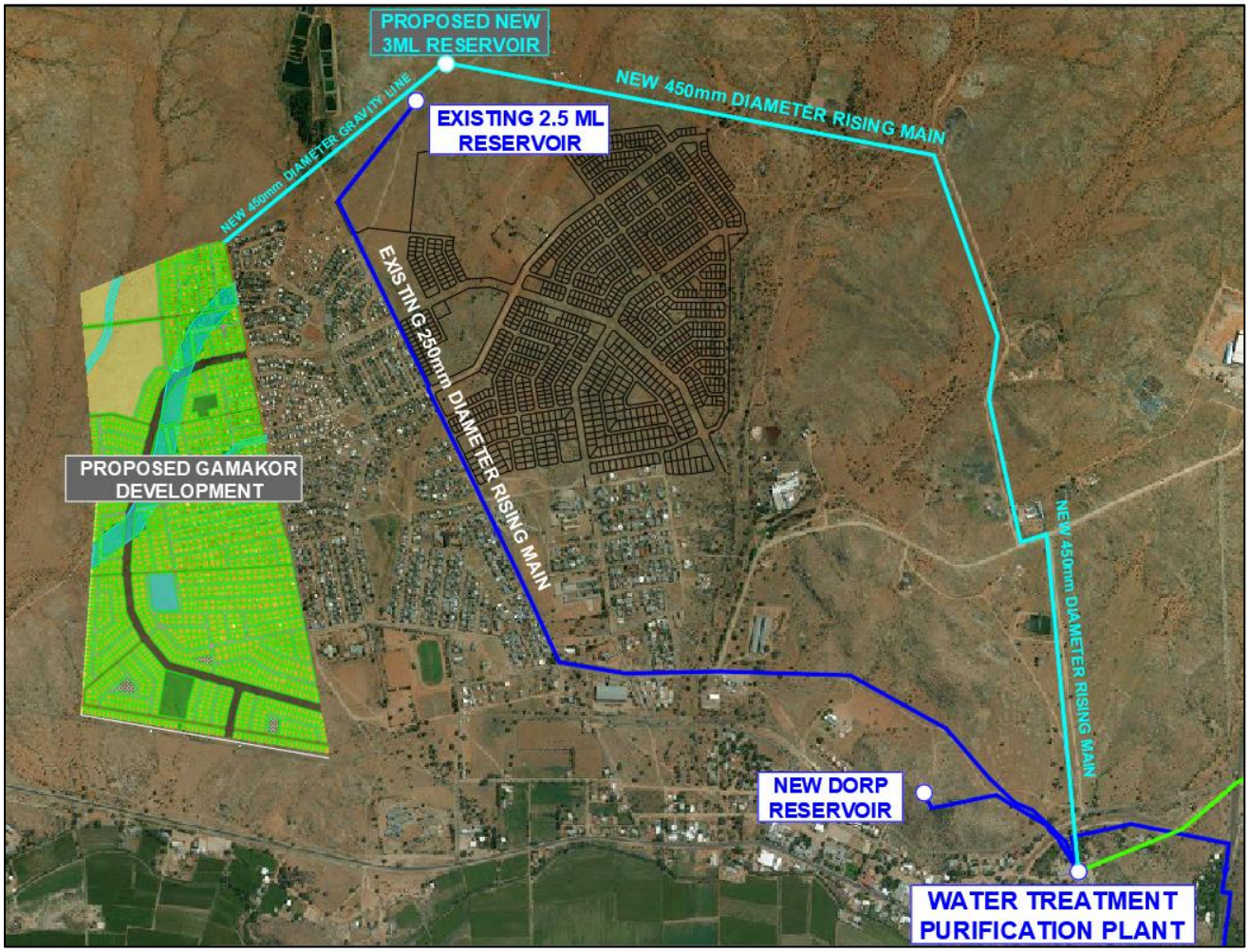


Figure 3: Proposed Water Bulk Infrastructure

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

The only neighborhoods in Keimoes with waterborne sewer are Extension 6 (area indicated in blue) and Extension 7 (area indicated in orange) as well as two schools and a school hostel (see Figure 4 below). The rest of Keimoes is served by septic tanks that are emptied by honey sucker trucks periodically. The effluent from the septic tanks are transport and disposed of at the existing oxidation ponds, where it is treated.

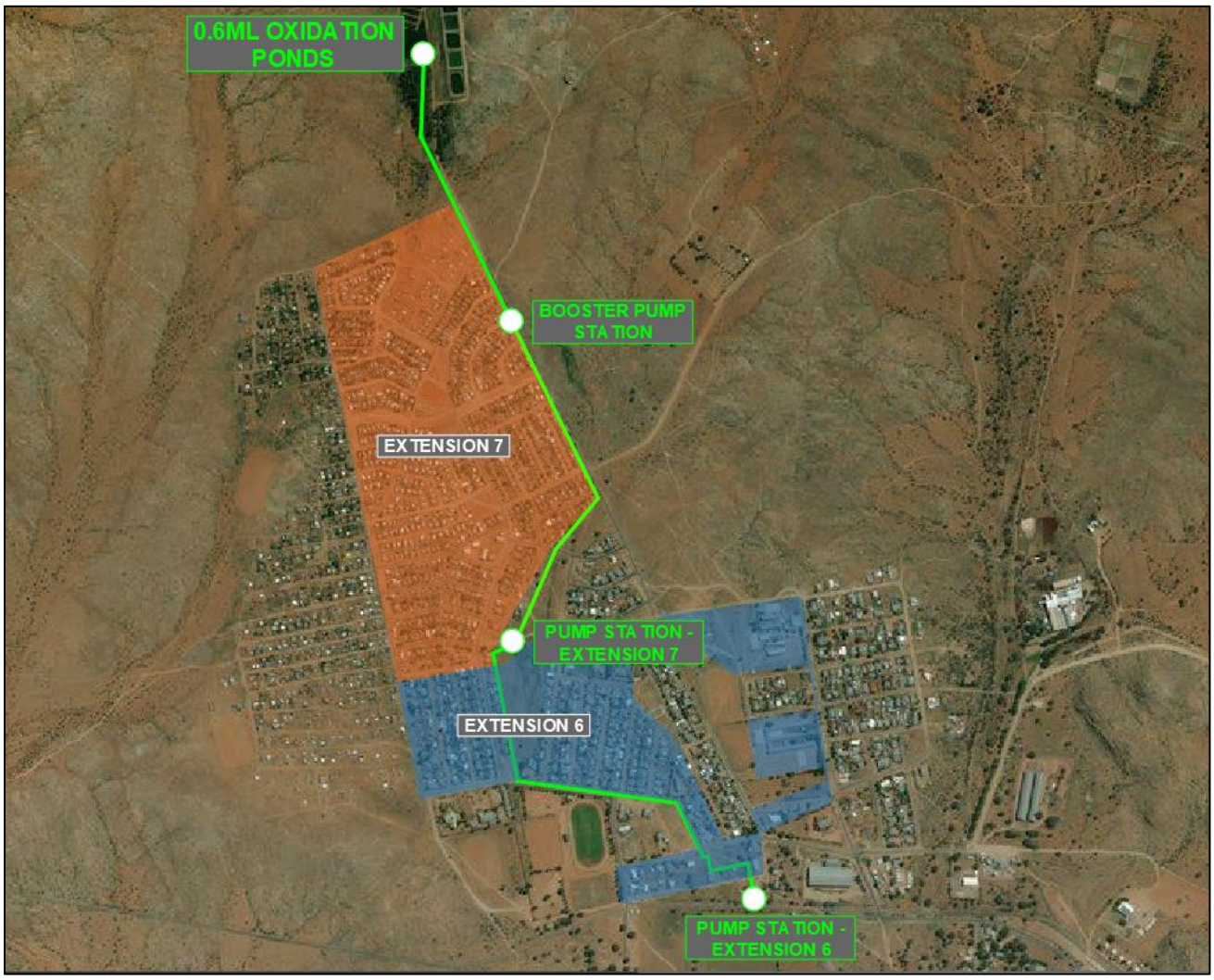


Figure 4: Areas Connected to a Sewer Network

The existing bulk sewer system (see Figure 5 below) currently operates as follows:

- Sewer from the Extension 6 neighbourhood gravitates to the Ext. 6 pump station.
- From there the sewer is pumped through a 160mm diameter PVC pipeline (red line) to the Ext. 7 pump station.

- Sewer from the Extension 7 neighbourhood gravitates to Ext. 7 pump station. Two small pump stations in Extension 7 lifts the sewer over the watershed and gravitates towards the Ext. 7 pump station (orange line).
- Sewer from Extension 7, along with the sewer from the Ext. 6 pump station, is pumped through a 150mm diameter A/S pipeline to a booster pump station.
- The booster pump station lifts the sewer from the Ext.7 pump station through a 150mm diameter A/S pipeline to the oxidation ponds (yellow line).

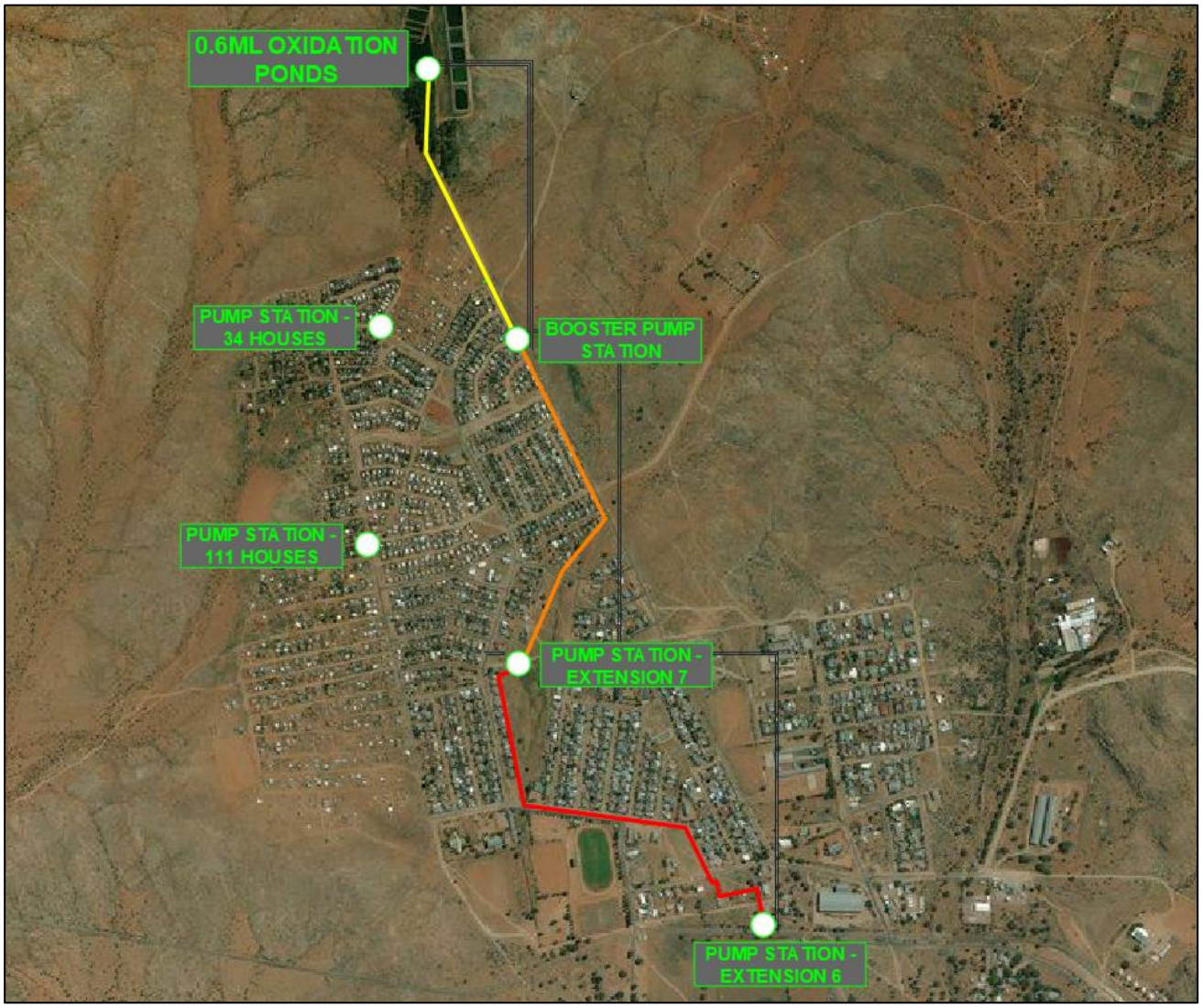


Figure 5: Existing Bulk Sewer Infrastructure

Waste Water Treatment Plant

Currently, the existing Waste Water Treatment Works (WWTW) consists of two sets of oxidation ponds which are being operated in parallel (see Figure 6 below).

The co-ordinates of the Waste Water Treatment Plant is: 28°41'02.40" S; 20°57'07.92" E.

Figure 6: Oxidation Ponds

The capacity of these ponds for effective waste water treatment is 628m^3 per day.

The ponds are 300m away from the nearest residences and less than 600m away from nearest proposed residences within the Gamakor area, posing a public health risk. Guidelines indicated a minimum of 2km away from residencies.

The treatment capacity of the oxidation ponds can effectively handle only 50% of the current sewer volume.

Sewer Pump Stations

The three main pump stations lifting the sewer to the oxidation ponds are not in a good condition. All three pump stations will be upgraded within the year 2020, utilising the Water and Sanitation Infrastructure Grant to the municipality, made available through the Department of Water Affairs.

Internal Sewer Network

Most of the formal housing in the town is connected to a waterborne sewer system consisting of pipes with sizes ranging between 110mm and 250mm. The network gravitates to local low points at various points where the sewer is collected at pump stations. The sewerage is then pumped from the various pump stations through a rising main (150mm AC pipe) to the WWTW to the north.

Lower lying areas (especially the CBD) and the area of Malanshoek are not connected to the sewer network and makes use of septic tanks.

Figure 7: Internal Sewer Network

4.2 Sewage Flows

To estimate the sewage effluent generated by the development the following assumptions were made:

- The sewer flows were calculated assuming 60% of the AADD water consumption. The results were also checked against the unit hydrograph method was used to estimate both existing and future sewer flows relevant to the development, as detailed in the *Neighborhood Planning and Design Guide*. The two methods approximated very similar flows;
- A peak day factor of 1.1 and an additional 30% to allow for extraneous flows (storm water infiltration, etc.) was used during the estimates.
- Allowance has been made for groundwater infiltration (roughly 15%) as well as 30% spare capacity for storm water ingress.

Existing Outflows

The table below indicates the existing Average Daily Wet Weather Flow (ADWWF):

Description	ADWWF (kL/day)
Sub-economic houses (Extension 6 & 7)	446
Economical houses (Extension 4)	128
Economical houses (Town)	231
Economical houses (Malanshoek)	54
Oranjezight School Hostel	18
Oranjezight High and Primary School	23
Keimoes Hoërskool Hostel	18
Keimoes Hoërskool	36
Wine Cellars	92
Hospital	18
Businesses	53
Total ADWWF	**1 117**

The current capacity of sewer infrastructure is as indicated below:

Description	Current Capacity (kL/day)	Current Required Capacity (kL/day)	% of Current Demand
Ext. 6 Pump Station and sewer line	870	275	316%
Ext. 7 & Booster Pump Station and sewer line	1600	717	220%
WWTW (oxidation Ponds)	628	1 117	57%

Future Outflows

For future demands, the same supply zones are used, with the following additions to the demands:

- Gamakor 1500 Erven development.
- Possible future developments were identified and are also considered in the table below. This includes 1200 erven to the east of the Gamakor development.

The table below indicates the additional future Average Daily Wet Weather Flow (ADWWF):

Description	ADWWF (kL/day)
Sub-economic houses (Gamakor)	540
Sub-economic houses (1200 Stands)	432
Economical Houses (490 A Extension)	353
Existing flows	1 117
Total Future ADWWF	**2 413**

4.3 Bulk Sewer Infrastructure Requirements

The proposal for the bulk sewer upgrades is as follows:

- The current waste water treatment plant infrastructure (oxidation ponds) can only treat 50% of the current sewer outflows. In addition to the capacity problems, the oxidation ponds are only 300 meters away from Extension 7. It is therefore recommended that a new waste water treatment works (WWTW) be constructed. A 2.5ML (based on a future ADWWF of 2 413 kL/day) oxidation pond system is proposed.
- Due to concerns about the future expansion of Keimoes, it is proposed that the new WWTW be located 2.5km away from the Gamakor development. The WWTW will also have to be located at a low elevation relative to Keimoes in order to minimize pumping costs. The proposed location of the WWTW is shown in Figure 8 at No. 3. The entire Keimoes will be accommodated at the new location in the future.

Figure 8: Proposed Bulk Sewer Upgrades

- The Gamakor development area drains to the south-west (90%) and to the south-east (10%) (see Figure 9 below). Sewer from the Gamakor area will therefore drain to two pump stations, namely:
    - Gamakor East Pump Station (No. 1 on Figure 8), which will collect sewer from the 10% of the Gamakor Area, portions of the Extension 6 & 7 areas and about half of the newly planned 1200 stands. From there, the sewer is pumped directly through a 250mm diameter dedicated pump line to the new WWTW.
    - Gamakor West Pump Station (No. 2 on Figure 8), which will collect sewer from Gamakor and two small areas in Extension 7 and will be pumped from there via a new 250mm diameter rising main to the WWTW.

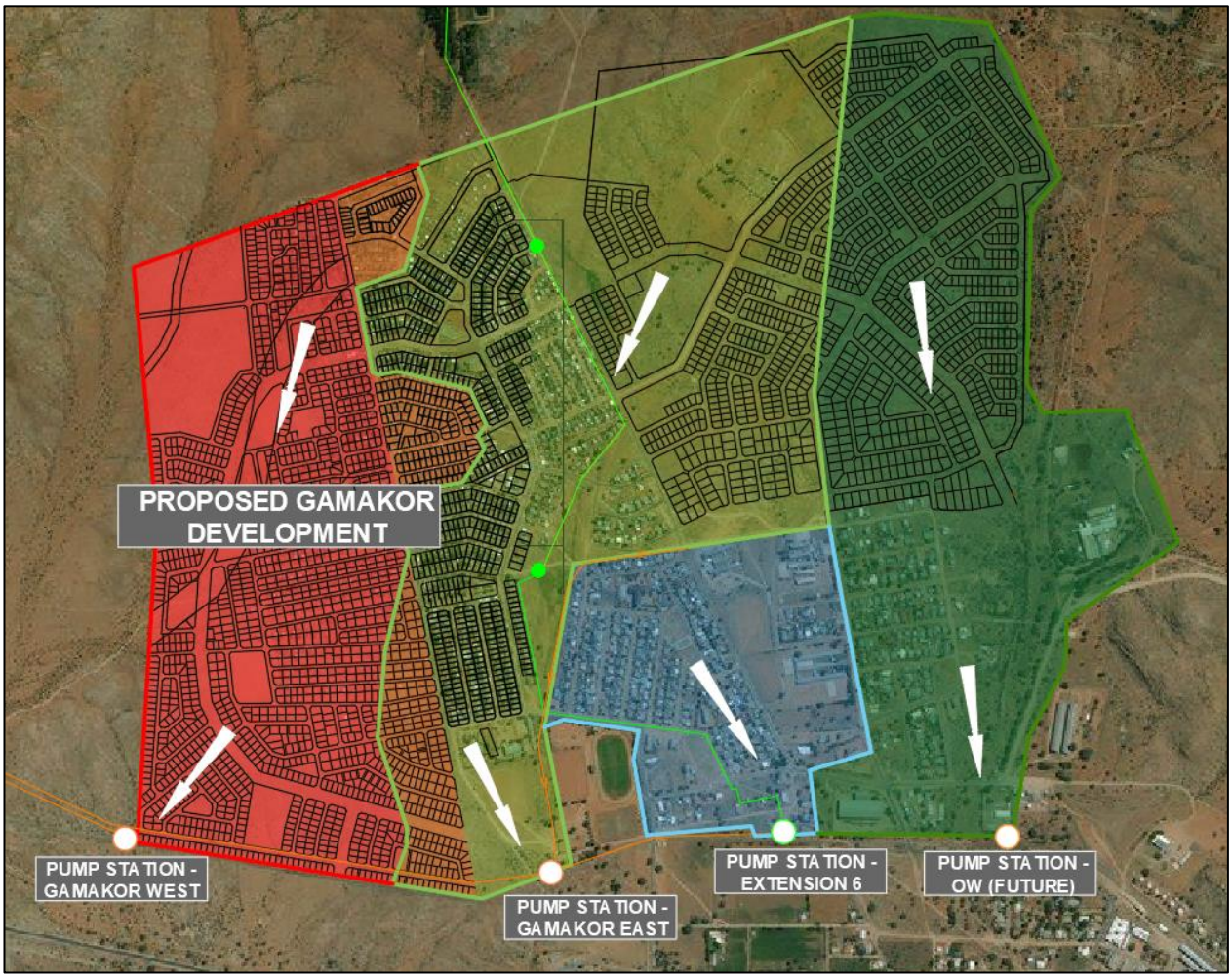


Figure 9: Keimoes Drainage Areas

- A new pump line will also need to be constructed between Extension 6 Pump Station (PS) and Gamakor East Pump Station. Extension 6 PS will then pump sewer collected from part of Extension 6 into Gamakor East PS.

These proposed upgrades to the sewer system will allow most pump stations within Keimoes to be decommissioned resulting in very low pumping costs and will pose less health risks to the community.

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

EXTENSION 6 PUMP STATION AND RISING MAIN		
Sewer flow per day – Sub-economic houses (Extension 6)	196 houses @ 500 l/day	98 000 l/day
Sewer flow per day – Economic houses	10 houses @ 750 l/day	7 500 l/day
Sewer flow per day – Hostels	400 persons @ 140 l/day	56 000 l/day
Sewer flow per day – Schools	1 200 persons @ 20 l/day	24 00 l/day
Sewer flow per day – Total		**185 500 l/day**
Average sewer flow		2.1 l/s
Infiltration	@ 30% infiltration	0.6 l/s
Sewer flow including infiltration		2.8 l/s
Peak network sewer flow	@ 2.21 Peak Factor	6.2 l/s
Flowrate from other pump stations		0 l/s
Total peak flow		**6.17 l/s**
Actual Pumping Ability	@ 2 times peak flow	**12.3 l/s**
Theoretical pump station capacity for normal pump operation	@ 0.5 hour of peak flow	11 m³
Theoretical pump station capacity for emergency storage	@ 1 hour of normal flow	10 m³
Total required theoretical pump station capacity		**21 m³**
Pump System Details		
Rising main diameter	125 mm	
Rising main material	PVC	
Rising main length	700 m	
Static head	6 m	
Friction losses	8 m	
Total head required	14 m	

GAMAKOR EAST PUMP STATION AND RISING MAIN		
Sewer flow per day – Sub-economic houses (Gamakor)	295 houses @ 500 l/day	147 500 l/day
Sewer flow per day – Sub-economic houses (Extension 6)	154 houses @ 500 l/day	77 000 l/day
Sewer flow per day – Sub-economic houses (Extension 7)	685 houses @ 500 l/day	342 500 l/day
Sewer flow per day – Sub-economic houses (Future 1200 houses)	606 houses @ 500 l/day	303 000 l/day
Sewer flow per day – Total		**870 000 l/day**
Average sewer flow		10.1 l/s
Infiltration	@ 30% infiltration	3.0 l/s
Sewer flow including infiltration		13.1 l/s
Peak network sewer flow	@ 2.21 Peak Factor	23.6 l/s
Flowrate from other pump stations		12.3 l/s
Total peak flow		**35.9 l/s**
Actual Pumping Ability	@ 2 times peak flow	**53.8 l/s**

Theoretical pump station capacity for normal pump operation	@ 0.5 hour of peak flow	140 m³
Theoretical pump station capacity for emergency storage	@ 1 hour of normal flow	199 m³
Total required theoretical pump station capacity		**339 m³**
Pump System Details		
Rising main diameter	250 mm	
Rising main material	PVC	
Rising main length	3 200 m	
Static head	12 m	
Friction losses	12 m	
Total head required	24 m	

GAMAKOR WEST PUMP STATION AND RISING MAIN		
Sewer flow per day – Sub-economic houses (Gamakor)	1205 houses @ 500 l/day	602 500 l/day
Sewer flow per day – Sub-economic houses (Extension 6)	101 houses @ 500 l/day	50 500 l/day
Sewer flow per day – Economic houses	40 houses @ 500 l/day	20 000 l/day
Sewer flow per day – Total		**673 000 l/day**
Average sewer flow		7.8 l/s
Infiltration	@ 30% infiltration	2.3 l/s
Sewer flow including infiltration		10.1 l/s
Peak network sewer flow	@ 2.21 Peak Factor	18.7 l/s
Flowrate from other pump stations		0 l/s
Total peak flow		**18.73 l/s**
Actual Pumping Ability	@ 2 times peak flow	**37.5 l/s**
Theoretical pump station capacity for normal pump operation	@ 0.5 hour of peak flow	79 m³
Theoretical pump station capacity for emergency storage	@ 1 hour of normal flow	146 m³
Total required theoretical pump station capacity		**224 m³**
Pump System Details		
Rising main diameter	250 mm	
Rising main material	PVC	
Rising main length	2 000 m	
Static head	12 m	
Friction losses	5 m	
Total head required	17 m	

5. ROADS AND STORMWATER

5.1 Roads and Access

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

- Alwyn Street – Main access to the development
- Estelle Street
- Carnation Street
- Rose Street

No problems are foreseen regarding roads and access.

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.

Areas of erosion should be identified at detail design stage of the storm water system and suitable erosion protection (lined channels, grass blocks, 'Hyson cells' etc.) measures implemented.

6. ELECTRICAL SUPPLY

6.1 Electrical Demands and Availability

This section of the report covers the availability of the Bulk Electrical connection to the future 1500 Gamakor Community stands, an expected load of the proposed development will initially be 1.8MVA as per INEP guidelines and the accommodation of this load will form the basis of this report.

The challenge the project face is the availability of the bulk electrical connection to Keimoes which is currently capped at 5MVA, the information received from the Municipality's Electrical department is that the town maximum demand is currently running at average between 4.8MVA - 4.9MVA ; The Municipality indicated that they are currently engaging with Eskom to upgrade the bulk supply available to 10MVA which is not a problem at this stage.

6.2 Existing Electrical Network

The existing electrical network in the Keimoes Suburbs & Industrial is connected to Load Centre "Keimoes Nommer2" situated in Industrial Weg, and is connected via a dedicated ASCR WOLF feeder to "Eskom Oasis Substation". This Eskom sub-station is also connected to Load Centre "Keimoes Nommer1" via a dedicated ASCR WOLF feeder servicing the CBD area. Load Centre "Keimoes Nommer1" is operating at 2.9MVA and Load Centre "Keimoes Nommer2" at 2MVA according to information received from Kai !Garib Municipality.

These feeders separately can transfer a maximum of 5.17MVA to the individual Load Centres. (See Figure 10 below).

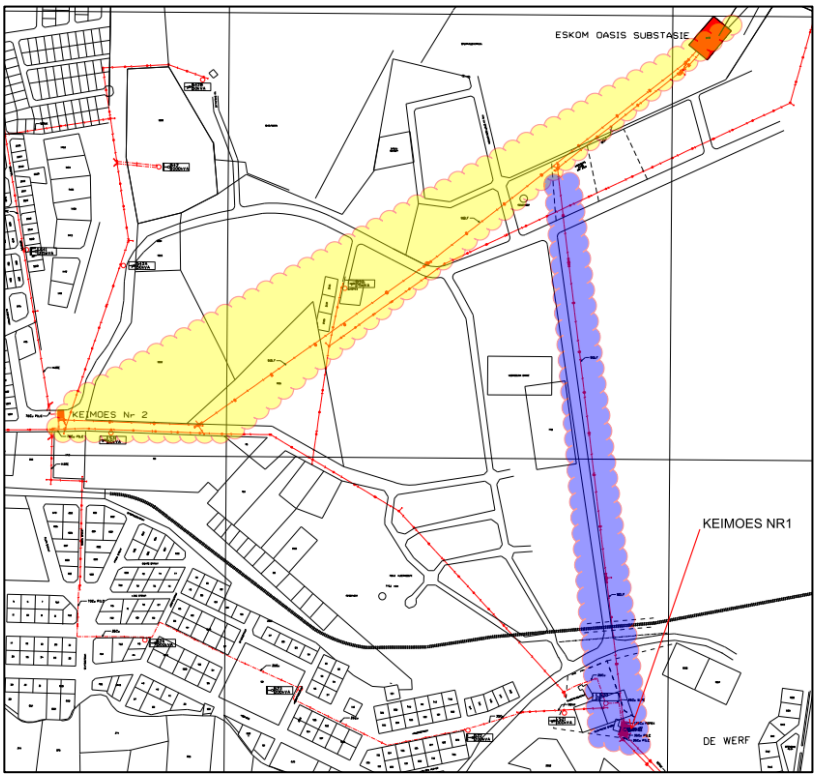


Figure 10: Electrical Infrastructure

It is therefore clear that the expected load (1.8MVA) due to the proposed development can be accommodated by the current load centres without upgrading feeders from the “Eskom Oasis Sub-station”. However, the Eskom bulk availability connection capacity to town must be upgraded to 10MVA by the Municipality.

6.3 Proposed Electrical Network Extension

It is normal and good practise to connect Load Centres through ring feeders to the main substation in order to have a firm supply and to facilitate isolation of faulty cable sections in order to maintain a firm supply to all sections of the network.

As this is not the case with the “Keimoes Nommer 2” Load Centre it is therefore necessary to consider the following upgrading of the network in order to connect the proposed load:

- Provision of a dedicated overhead line feeder of similar size to the existing feeders to create a ring feeder between “Keimoes Nommer 1” and “Keimoes Nommer 2” Load Centres, (See Figure X below)

Figure 11: Bulk Electrical Line to be upgraded

- Install suitable MV circuit breakers at both ends of the overhead line feeder,
- Provision of dedicated overhead line feeder to the proposed development from the “Keimoes Nommer 2” Load Centre, (See Figure 16 below)
- Install suitable MV circuit breaker for the dedicated feeder of the proposed development, and
- Minor modifications to MV switchgear in load centre “Keimoes Nommer 2”

Figure 12: Proposed Bulk Electrical Connection Point

7. 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		Amount
Water Bulk Services		
New 3 ML reservoir	R	9 958 379,45
4,2km 450mm Ø supply line	R	10 578 876,00
1km 450mm Ø distribution line	R	2 518 780,00
Upgrading of supply pump station	R	1 704 034,81
Necessary refurbishment of Water Treatment Works	R	3 001 460,70
Bulk connection	R	1 500 730,35
Sub-Total (Water)	**R**	**29 262 261,32**
Bulk Sewer Services		
New 2.5 ML oxidation pond system	R	26 756 623,55
New sewer pump station (Gamakor West)	R	3 014 830,82
New sewer pump station (Gamakor East)	R	3 447 393,51
2km 250mm Ø uPVC rising main (Gamakor West)	R	2 671 402,27
3,2km 250mm Ø uPVC rising main (Gamakor East)	R	4 274 243,63
Sub-Total (Sewer)	**R**	**35 890 250,15**
Roads and Access		
None	R	-
Stormwater		
None	R	-
Electrical		
O/H ACSR line ring	R	2 300 000,00
Circuit breaker (11kV, LC1&2)	R	1 550 000,00
O/H ACSR line to POC	R	1 850 000,00
Sub-Total (Electrical)	**R**	**5 700 000,00**
Sub-Total (All)	**R**	**70 852 511,47**
15% P&G's	R	10 627 876,72
Sub-Total	**R**	**81 480 388,19**
10% Contingencies	R	8 148 038,82
Sub-Total	**R**	**89 628 427,01**
10% Professional fees	R	8 926 842,70
Sub-Total	**R**	**98 591 269,71**
15% VAT	R	14 788 690,46
Grand Total	**R**	**113 379 960,16**

Notes:

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

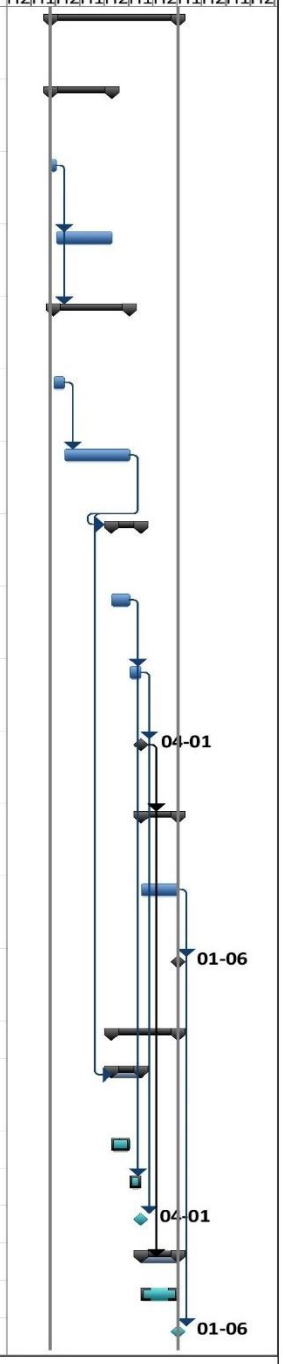
7.1 Funding

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.

8. PROJECT TIMELINE

ID	Task Mode	Task Name	Duration	Start	Finish
1		**BULK INFRASTRUCTURE TIMELINE**	**685 days?**	**Mon 20-05-25**	**Fri 23-01-06**
2		**APPLICATION FOR FUNDS**	**330 days**	**Mon 20-05-25**	**Fri 21-08-27**
3		Application for RBIG & Mig funding	30 days	Mon 20-05-25	Fri 20-07-03
4		Approval of feasibility study & readyness report	300 days	Mon 20-07-06	Fri 21-08-27
5		**EIA PROCESS**	**410 days**	**Mon 20-06-15**	**Fri 22-01-07**
6		Appointment of EIA Specialist	60 days	Mon 20-06-15	Fri 20-09-04
7		EIA study	350 days	Mon 20-09-07	Fri 22-01-07
8		**DESIGN, DOCUMENTATION AND PROCUREMENT**	**160 days**	**Mon 21-08-23**	**Fri 22-04-01**
9		Design and documentation	100 days	Mon 21-08-23	Fri 22-01-07
10		Procurement	60 days	Mon 22-01-10	Fri 22-04-01
11		Contractor appointed	0 days	Fri 22-04-01	Fri 22-04-01
12		**CONSTRUCTION**	**200 days**	**Mon 22-04-04**	**Fri 23-01-06**
13		Construction period	200 days	Mon 22-04-04	Fri 23-01-06
14		Construction completed	0 days	Fri 23-01-06	Fri 23-01-06
15		**INTERNAL SERVICES CONSTRUCTION**	**360 days?**	**Mon 21-08-23**	**Fri 23-01-06**
16		**DESIGN, DOCUMENTATION AND PROCUREMENT**	**160 days**	**Mon 21-08-23**	**Fri 22-04-01**
17		Design and documentation	100 days	Mon 21-08-23	Fri 22-01-07
18		Procurement	60 days	Mon 22-01-10	Fri 22-04-01
19		Contractor appointed	0 days	Fri 22-04-01	Fri 22-04-01
20		**CONSTRUCTION**	**200 days?**	**Mon 22-04-04**	**Fri 23-01-06**
21		Construction period	200 days	Mon 22-04-04	Fri 23-01-06
22		Construction completed	0 days	Fri 23-01-06	Fri 23-01-06



Project: 34702 Gamakor Developm
Date: Sat 20-05-23

Task		Inactive Summary	
Split		Manual Task	
Milestone		Duration-only	
Summary		Manual Summary Rollup	
Project Summary		Manual Summary	
External Tasks		Start-only	
External Milestone		Finish-only	
Inactive Task		Deadline	
Inactive Milestone		Progress	

9. CONCLUSION

Engineering services were assessed to determine spare capacity on the existing bulk infrastructure and compared to the estimated demand of the newly proposed Gamakor 1500 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 Gamakor development as is. It is proposed that the infrastructure should be upgraded, not only to provide adequate capacity for the Gamakor development, but also for future water demand increases. The following upgrades are proposed:
    - Repairs at the Water Treatment Works for mechanical and electrical components and the control system;
    - Replace one of the supply pumps at the Water Treatment works with a larger pump (sized for 91 l/s and 45m head);
    - Install a new 4.2km 450mm Ø uPVC supply line to the storage reservoir from the waste water treatment works;
    - A new storage reservoir will be required to meet the recommended 48-hour storage requirement. The construction of a new 3ML reservoir is proposed to the north of the development.
    - Install a new 1km 450mm Ø uPVC distribution line from the storage reservoir to the Gamakor area.
- Bulk Sewage Infrastructure - The current capacity of the sewer water infrastructure is not enough to accommodate the proposed Gamakor development, nor is it adequate for the current loading. It is proposed that the infrastructure should be upgraded as soon as possible:
    - Waste Water Treatment Works: Construction of a new 2.5 ML Waste Water Treatment Works. The proposed position of the WWTW is to the south-west of the Gamakor development.
    - Gamakor West pump station and rising main: The western portion of the Gamakor will be able to drain to the south-western corner. It is proposed to construct a pump station with a 1km 250mm diameter rising main to the proposed WWTW;
    - Gamakor East pump station and rising main: The south-eastern portion of the Gamakor drains to the south-eastern corner. It is proposed to construct a pump station with a 2km 250mm diameter rising main to the proposed WWTW. This pump and rising main should be sized to accommodate a large portion of the Keimoes area in order to migrate the sewer flows to the new WWTW in the future in phases.
    - In order to migrate future flows from the current pumping system to the new WWTW, a new pump line will also need to be constructed between Extension 6 Pump Station and Gamakor East Pump Station. However, this is not necessary for the Gamakor development and has been omitted from the costing summary.

- 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 – Formal bulk upgrade process to be finalised between Eskom and Kai !Garib Municipality.
- Electrical Load Centre – The existing Load Centre “Keimoes Nommer 2” can accommodate the future additional load, with only minor modification to be done in the Load Centre and as agreed with the Municipality’s Electrical 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 regardless of the implementation of the Gamakor development in order to meet current and expected future needs. The upgrading should be done in such a way as to take in to consideration the Gamakor development.