

ANNEXURE K:

*Concept & Viability Design Report (rehab /
upgrading of sewer network) - Lyners
Consulting Engineers dated June 2025*



GEORGE MUNICIPALITY

CONCEPT AND VIABILITY REPORT

FOR

PROJECT NO.20 (WORK PACKAGE 8): REHABILITATION/ UPGRADING OF SEWER NETWORK AND ASSOCIATED BULK FACILITIES: THEMBALETHU EASTERN BULK GRAVITY SEWER UPGRADE

PORTION 1: CIVIL & STRUCTURAL FOR PIPELINES

JUNE 2025

REVISION 4

COMPILED FOR:

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ANNEXURES:

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Annexure B: George Municipality Schematic Layouts of Sewer Systems (March 2022) – Current and Future System

Annexure C: Master Plan Sewerage System – Correspondence for GLS

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Annexure F: Estimated Cash Flow

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Table of Acronyms:

ADWF	Average Dry Weather Flow
EA	Environmental Authorization
ECO	Environmental Control Officer
EMP	Environmental Management Plan
DEADP	Department of Environmental Affairs and Development Planning
GM	George Municipality
IPWWF	Instantaneous Peak Wet Weather Flow
NEMA	National Environmental Management Act (NEMA).
PDDWF	Peak Daily Dry Weather Flow
PS	Pump Station No
WWTW	Wastewater Treatment Works
UISP	Upgrading of Informal Settlement Programme
WULA	Water Use License Application
SSBRA	Site Specific Baseline Risk Assessment
SSHSS	Site Specific Health and Safety Specification



REPORT DETAILS:

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Report prepared by: M le Roux
Client representative: M Geyer
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M Geyer
Approved
15/07/2025



1. INTRODUCTION

1.1 Appointment

Neil Lyners and Associates (Lyners) was appointed on 25 August 2023 by the George Municipality to investigate and report on the rehabilitation and upgrades of the Thembaletu eastern bulk gravity sewer infrastructure, funded respectively by IUDG and the Municipality. This report includes our understanding of the scope of services of the project, outlines the concept and viability design and provides an estimated project cost.

1.2 Background

1.2.1 Existing System

The wastewater of Thembaletu, George is conveyed via multiple pump stations, rising mains and gravity sewers to the Outeniqua Wastewater Treatment Works (WWTW).

The sewage of the Eastern portion of Thembaletu (East of Nelson Mandela Boulevard) is conveyed via Thembaletu pump station no. 7, 2, A, B and 1. Refer to figure 1 below.

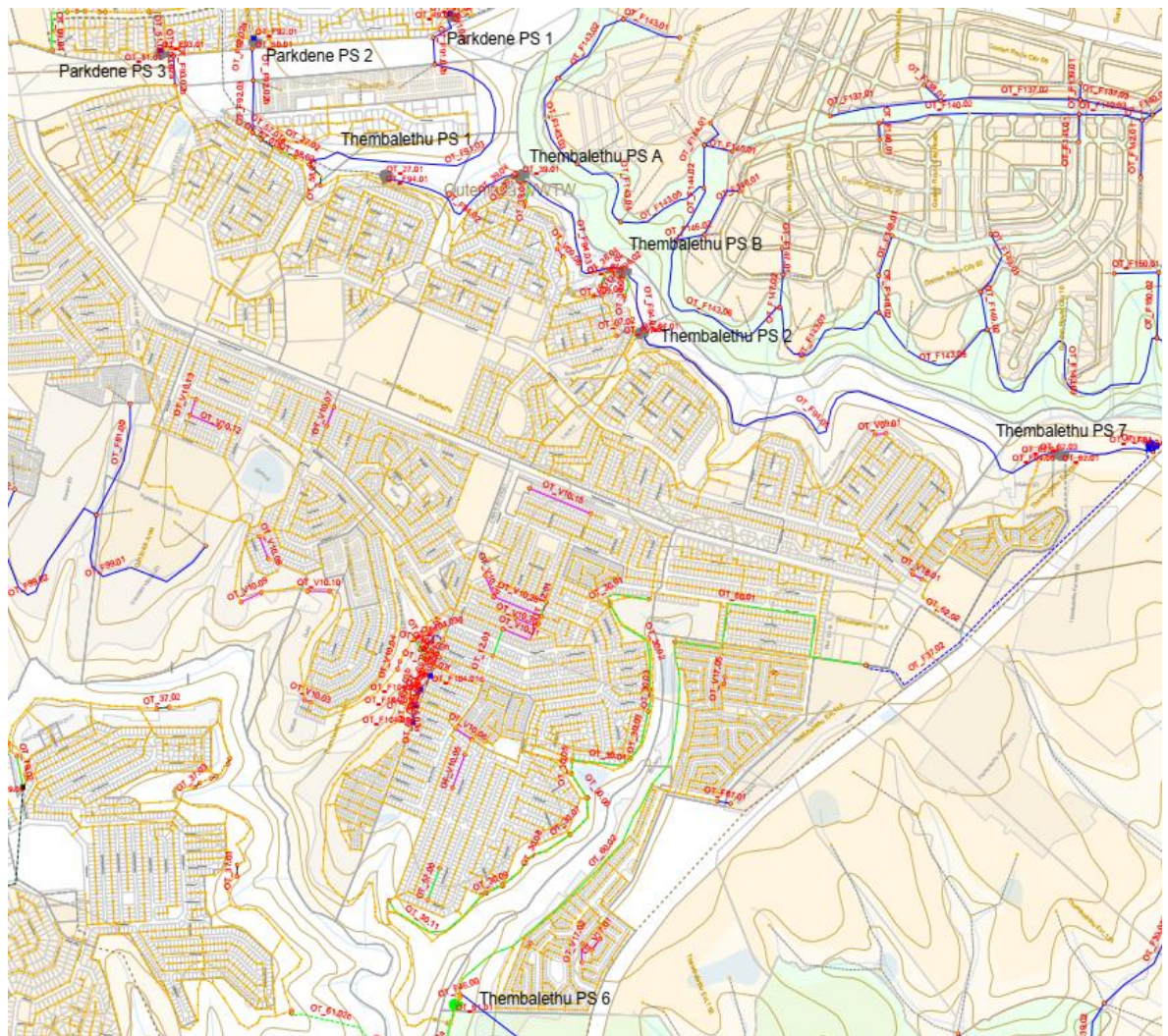


Figure 1: Thembaletu Eastern Bulk Collector Sewer

The collected sewage drains from South to North (towards the N2) from Thembaletu pump station no. 2 to pump station no. 1, with pump station A and B sitting between these pump stations. Pump



station no. 1 transfers all sewage collected South of the N2 to the Meul pump station gravity main (running along Golf Street, Parkdene).

In addition, a portion of Parkdene drains to Parkdene sewer pump station no. 2 and 3 respectively which conveys sewage via two individual 150mm diameter AC pipelines to the Meul pump station gravity main as well. All sewage is conveyed to the Outeniqua WWTW.

Pump station no. 7 however pumps sewage via a 200mm diameter uPVC rising main and where the pipeline joins Tabata Street transitions to a 235mm diameter uPVC gravity sewer where the sewage drains to the Thembaletu pump station no. 6.

The gravity sewer discharges to Pacaltsdorp pump station no. 1, and the sewage is finally conveyed to the Outeniqua WWTW.

The layouts attached as Annexure A provides further detail on the pump stations and pipelines forming the eastern bulk collector sewer of Thembaletu.

The components described above are included in table 1 below for easier understanding.

Table 1: Components of Conveyance System

Component	Pump Station Capacity	Pipeline Details			
		Diameter (mm)	Pipe Type	Class	Length (m)
Thembaletu PS 7	16l/s				
Rising Main		200	uPVC	16	1 170
Gravity Main from transfer structure (Jonga Street) to Thembaletu PS 6	16l/s	250	uPVC		1920
Thembaletu PS 2	15l/s				
Rising Main		150	AC	unknown	84
Gravity Main to PS B transition manhole		200	unknown	unknown	134
Thembaletu PS B	4l/s				
Rising Main		79	unknown	unknown	98
Gravity Main to PS A transition manhole		200	unknown	unknown	515
Thembaletu PS A	4l/s				
Rising Main		79	-	-	90
Gravity Main		200	-	-	515
Thembaletu PS 1	35l/s				
Rising Main		200	-	unknown	867
Parkdene PS 2	22l/s				
Rising Main		150	AC	unknown	150
Parkdene PS 3	25l/s				
Rising Main		150	AC	unknown	226



1.2.2 Proposed System Upgrades

The Municipality's objective is to decommission the existing Thembaletu sewer pump stations no. 1, A, B and 2 as well as the Parkdene sewer pump station no. 2 and 3 by replacing the pump stations and associated rising and gravity mains with a completely new bulk gravity sewer pipeline that will drain to Thembaletu pump station no. 7, and in future to the planned Thembaletu East pump station.

New rising mains from Thembaletu pump station no. 7 (in the interim), and in future Thembaletu East pump station will be required to pump the sewage to the transfer structure in Jonga Street from where it will gravitate to Thembaletu pump station no. 6.

The components described above are described in table 2 and schematically indicated in figure 2 below for easier understanding.

Table 2: Components of Proposed Conveyance System

Component	Pump Station Capacity	New Gravity System Details		
		Diameter (mm)	Pipe Type	Length (m)
Parkdene PS 3 to Parkdene PS 2				
Gravity Main		200	uPVC	370
Parkdene PS 2 to Thembaletu PS 1				
Gravity Main		200	uPVC	950
Thembaletu PS 1 to PS A				
Gravity Main		250	uPVC	520
Thembaletu PS A to PS B				
Gravity Main		355	uPVC	570
Thembaletu PS B to PS 2				
Gravity Main		355	uPVC	200
Thembaletu PS 2 to PS 7				
Gravity Main		355	uPVC	2110
Thembaletu PS 7 to transfer structure	PS 7 – 50 l/s to 80 l/s			
Rising Main		315	HDPE	1170
Transfer Structure (Jonga Street) to Thembaletu PS 6	PS 7 – 50 l/s to 80 l/s			
Gravity Main		350	uPVC	1766
Thembaletu Ps 7 to Thembaletu East				
Gravity Main		355	uPVC	240
Thembaletu East to transfer structure (Jonga Street)	Thembaletu East PS Phased 170 l/s - 323 l/s ¹			
Rising Main		630	HDPE	1170
Transfer Structure (Jonga Street) to Thembaletu PS 6	Thembaletu East PS Phased 170 l/s - 323 l/s ¹			
Gravity Main		630	uPVC	1766

Note: ¹: The Municipality only requires a PS with a flow of 170 l/s. The balance is required by private developments.

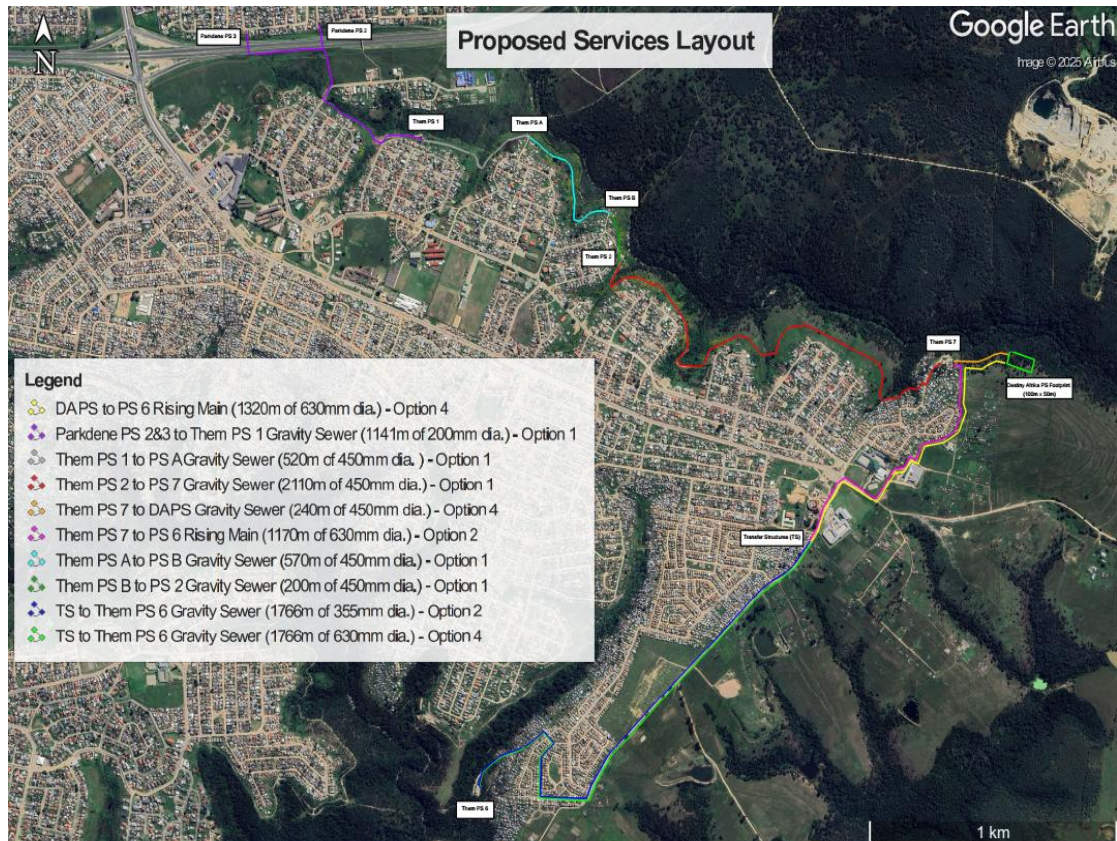


Figure 2: Thembaletu Eastern Bulk Collector Sewer – Proposed Upgrades

1.3 Locality

Thembaletu is a suburb in George and is situated between the suburbs of Ballotsview and Nu Dawn. Access to the residential area/suburb is obtained via Nelson Mandela Boulevard, refer to figure 3 below.



Figure 3: Locality plan of Thembaletu



1.4 Site Description

The site consists of a mix of formal and informal low-income housing with both asphalt and paved streets, as well as gravel and grassed verges. The terrain is undulating, featuring relatively steep slopes, with elevations ranging from 200 meters to 160 meters above mean sea level (MSL).

Key site characteristics include:

- A combination of formal and informal settlements
- Presence of small-scale farming activities
- Mixed land ownership structures

The project is located along the Meul River to the East, residential properties and Nelson Mandela Boulevard in the West. To the North the project will cross the N2 before crossing into the residential area North of the N2.

1.5 Scope of Work

The proposed upgrades included in this report entail a range of infrastructure components comprising the Thembaletu eastern bulk sewer system. Various options for implementation are described below. The proposed pipeline sizes are only preliminary diameters and will be finalized during the detail design phase. Refer to figure 2 for illustrative indication of proposed options.

1.5.1 Option 1:

- Construction of bulk gravity sewer ranging in size from 200mm to 450mm diameter, 3771m in length (with reference to figure 2, line colours purple, grey, light blue, green and red).
- Decommissioning 6 sewer pump stations in terms of the George Municipality's asset disposal plan (Parkdene pump stations no. 2 and 3 and Thembaletu pump stations no. A, B, 1 and 2).
- Decommissioning and disconnection of existing pump stations, rising mains and gravity sewers.
- If option 1 is implemented, one of the options 2, 3, or 4 must also be implemented to accommodate the increased sewer flow generated by the new bulk gravity sewer pipeline as a result of the six decommissioned sewer pump stations.

1.5.2 Option 2 (pump station design does not form part of this report):

- Upgrading Thembaletu pump station no. 7 from 16 l/s to 50 l/s.
- Maintain existing 200mm diameter rising main from Thembaletu pump station no. 7 to the existing transfer structure on an informal road between Jonga and Zusakhe streets.
- Construction of new 355mm diameter gravity main sewer from transfer structure (Jonga Street) to Thembaletu pump station no. 6, 1766m in length (with reference to figure 2, line colour dark blue). (Note: *Will replace existing 250 mm diameter gravity main*).

1.5.3 Option 3 (pump station design does not form part of this report):

- Upgrading Thembaletu pump station no. 7 from 50 l/s to 80 l/s.
- Construction of new 315mm diameter rising main to a new transfer structure in Jonga Street, 1170m in length (with reference to figure 2, line colour pink). (Note: *Will replace existing 200mm diameter rising main*).



1.5.4 Option 4 (pump station design does not form part of this report):

- Construction of phased new Thembaletu East Pumpstation at 170 l/s. Concept and Viability design to consider extension to ultimate capacity of 323 l/s.
- Construction of new 450mm diameter gravity sewer pipeline from Thembaletu pump station no. 7 to Thembaletu East pump station, 240 m in length (with reference to figure 2, line colour orange).
- Construction of new 630mm diameter rising main from Thembaletu East pump station to the new transfer structure in Jonga Street, 1320m in length (with reference to figure 2, line colour yellow).
- Construction of 630mm diameter gravity sewer from transfer structure (Jonga Street) to Thembaletu pump station no. 6, 1766m in length (with reference to figure 2, line colour green). (Note: Parallel to 350 mm diameter gravity main installed under Option 3).

1.6 Objectives

The primary aim of this report is to finalize the concept and viability design for all the civil construction work associated with the pipelines, manholes and chambers on concept level by means of evaluating the various design options and selecting a preferred design option that will be developed during the detailed design phase of the project.

2. CONCEPT AND VIABILITY DESIGN

2.1 OPTION 1: Gravity Main - From Parkdene Pump Stations 2 and 3 To Thembaletu Pump Station No. 7

2.1.1 Objective



Figure 4 – Option 1 proposed upgrades



The objective of Option 1 is to upgrade the existing Thembaletu eastern bulk gravity sewer infrastructure, by decommissioning pump stations Parkdene no. 2 and 3 and Thembaletu no. A, B, 2 and 3, along the infrastructure route up to Thembaletu pump station no. 7.

Due to the extensive number of pump stations that the George Municipality has in operation, the consequences of load shedding on operations and to reduce any pollution to the environment, this option is regarded as the best long term solution to alleviate the current constraints of the existing bulk system.

2.1.2 *Function in the Network*

In terms of the bigger network, the new proposed gravity sewer pipeline from Parkdene pump stations 2 and 3 to Thembaletu pump station no. 7 will become the conveyancing system.

2.1.3 *Status Quo*

Currently the collected sewage drains from South to North (towards the N2) from Thembaletu pump station no. 2 to pump station no.1, with pump station A and B sitting between these pump stations.

Pump Station no. 1 then transfers all sewage collected South of the N2 to the Meul pump station gravity main (running along Golf Street, Parkdene). In addition, a portion of Parkdene drains to Parkdene sewer pump station no. 2 and 3 respectively which conveys sewage via two individual 150mm diameter AC pipelines to the Meul pump station gravity main. *Refer to figure 2 and to George Municipality Schematic Layouts of Sewer Systems (March 2022) included in Annexure B.*

2.1.4 *Proposed New System*

Option 1 entails to decommission Parkdene pump stations no. 2 and 3 and Thembaletu pump stations no. 1, 2, A and B. The new gravity main that will be installed as part of option 1, will then connect all these decommissioned pump stations and drain all sewage collected to Thembaletu pump station no. 7 (length 3771m, 200mm to 450mm diameter). *Refer to GLS Sewer Masterplan of March 2024 (Annexure A)*

2.1.5 *Future System and Future Design Flow*

As the future system allows for the decommissioning of Parkdene pump stations no. 2 and 3 and Thembaletu pump stations no. 1, 2, A and B, these pump stations are not part of the future schematical representation prepared by GLS. A schematical representation of the current and future system from the master plan data is included in Annexure B of this report.

As per the latest sewer master plan, if all pump stations are decommissioned as proposed under sections 2.1.1 and 2.1.4 above a flow of 50 l/s (25.41 l/s IPDWF / 0.5 infiltration = 50.82 l/s IPWWF) from the “current” formally occupied stands will be generated.

The masterplan fully developed future areas will generate a flow of 80 l/s (40.06 l/s IPDWF / 0.7 infiltration = 80.12 l/s IPWWF), refer to Annexure C.

2.1.6 *Proposed Horizontal Alignment*

The proposed alignment was chosen to ensure the pipeline will be able to drain the catchment areas of the existing sewer pump stations to be decommissioned. The alignment also ensures



sufficient slopes of the pipeline to maintain gravity flow. It is considered to be the most suitable alignment in terms of maintenance, operation and construction cost.

Parkdene PS 2 and 3 (figure 4, purple line)

The pipeline will start by connecting Parkdene pump stations no. 2 and 3. The pipeline will cross the N2 National Road by means of a sleeve installed underneath the road, through the process of micro tunnelling or pipe jacking.

Thembaletu PS 1 to Thembaletu PS 7 (figure 5, grey, cyan, green and red lines)

The rest of the pipeline route up from Thembaletu pump station 1 to pump station 7 follows the Meul River below the lowest-lying residential erven leveraging the natural topography slopes. Other feasible alternatives did not present itself in terms of the horizontal alignment due to the terrain and the requirement to drain the existing sewer pump station catchment areas.



Figure 5: Gravity main route along Meul river

A more detailed representation of the proposed route is included in **Annexure D** of the report.

2.1.7 Gravity Main Sizing

In terms of the *Sewer Master planning* (Annexure A) various pipe diameters are proposed for the different sections of the gravity pipeline. At the beginning of the pipeline (Parkdene PS 3 and 2) a 200mm diameter pipe is proposed to accommodate a flow of 1.5 l/s. The pipeline size then gradually increase as additional flow is attributed until a maximum flow of 50.82 l/s (current) and 80.12 l/s (future) were calculated (between PS 7 and Thembaletu East PS), relating to a 450mm diameter pipe. The pipeline up to PS 7 will form part of option 1. The remainder of the pipeline from PS 7 to Thembaletu East PS is part of option 4.

However, due to the topographical layout of the site and the intention to decommission pump stations Parkdene no. 2 and 3 and Thembaletu no. 1, 2, A and B and drain the sewage to Thembaletu pump station no. 7 without altering this pump station 7's civil infrastructure, related to some challenges in the proposed preliminary designs. To overcome the challenges with regards to the Thembaletu pump station no.7 inlet structure levels, a bigger size gravity main was investigated. As the 315mm nominal diameter gravity main proposed by GLS would not be able to meet the minimum design criteria, with reference to The Neighbourhood Planning and Design Guide 2019 standards, minimum gradients and slopes. A 450 mm diameter pipe is therefore proposed.



Considering the topographical layout of the terrain a minimum gradient of 1:500 between pump stations Thembaletu no. A and B and Thembaletu pump station no. 7 could be accommodated. This is the critical section of the pipeline route due to the topographical layout relating to minimum slopes. The remainder of the pump stations upstream of Thembaletu no. B can easily drain towards pump station no. 7.

A capacity of 92.92 l/s and velocity of 0.7 m/s can be expected from a class 34 uPVC 450mm diameter pipe with inside diameter of 424 mm between Thembaletu pump stations no. A and no. 7, which will be sufficient in terms of design standards. Due to the site's topography and the invert levels of the existing pump station scheduled for decommissioning, a larger diameter pipe is proposed, as it allows for installation at a flatter slope. Without this adjustment, connecting all pump stations to the gravity main would not be possible according to the design standards.

The remainder of the gravity pipeline sections upstream of the Thembaletu no. B will be sized smaller to only accommodate the flow of the other decommissioned pump station drainage areas.

Refer to Annexure E for manning flow calculations.

2.1.8 Gravity Main Pipe Material

In line with George Municipality's requirements and standard pipe material, a uPVC Class 34 pipe is proposed.

2.1.9 Backdrop Manholes

Backdrop manholes (external type) will be considered where steep slopes exist and results in excessive velocities of 3.0 m/s or more from the new manhole to tie in with the existing network. Pipes between drop manholes can be laid at flatter slopes to decrease flow velocities.

2.1.10 Tie-In Manhole

The size of the tie in (with existing) manhole must be carefully considered during detail design. The velocity at the manhole can be decreased by installing a drop manhole immediately upstream and by incorporating a longer radius bend in the benching of the tie in manhole.

As per the Sewer Master planning (Annexure C), two scenarios could be considered at Thembaletu pump station no. 7. Refer to e-mail attached (Annexure C) from Johann Rudolph dated 26 September 2024.

- i) Considering all current approved development opportunities, the pump station must be upgraded to 50 l/s (option 2).
- ii) If all future proposed development opportunities are considered, the pump station must be upgraded to 80 l/s (option 3).

Upgrading the pump station to 50 l/s is considered a 5-10 year design/planning horizon and 80 l/s, 20 years.



2.2 OPTION 2: Thembaletu Pump Station 7 – Upgrade From 16 l/s To 50 l/s and Gravity Main - From Transfer Structure In Jonga Street To Thembaletu Pump Station No. 6.

For Option 2 the upgrading of Thembaletu pump station no. 7 from **16 l/s To 50 l/s** will be required. This proposed upgrade to the pump station will be discussed in more detail within the mechanical/electrical concept and viability design report.

2.2.1 Objective



Figure 6 – Option 2 proposed upgrades

The objective of Option 2 is to upgrade pump station 7 from 16 to 50 l/s to allow the decommissioning of six (Parkdene pump stations no. 2 and 3 and Thembaletu pump stations no. A, B, 1 and 2) upstream pump stations.

This option is proposed if funding is limited, or if the Municipality does not want to proceed with Option 3, or as an interim measure to decommission some pump stations.

For Option 2 the upgrading of Thembaletu pump station no. 7 from 16 l/s to 50 l/s will be required. This proposed upgrade will be discussed in more detail within the mechanical/electrical concept and viability design report.

The existing gravity main following the existing rising main in Tabata Street has a pipe size of 250mm diameter. If the pump station is upgraded to 50 l/s the capacity of this pipeline will be insufficient. As per the Sewer Masterplan (Annexure A) and snapshot below (green line, figure 7) indicate the existing pipeline that must be upgraded when the pump station is upgraded. The alignment starts at the existing transfer structure in between Jonga and Zusakhe Street on an informal road and then run along residential streets to the Thembaletu pump station no. 6.

Due to existing services and small road reserves along the existing pipeline route an alternative pipeline route is proposed. A new transfer structure will be constructed at the highest location in Jonga Street (in erf 197/5, owned by Western Cape Government) the



pipeline will then run along Jonga Street and Sea View Street to Thembaletu pump station no. 6. Refer to the blue line on figure nr 6.



Figure 7: Locality of Existing Gravity Main Beyond Transfer Structure leading to Thembaletu pump station no. 6

2.2.2 Function in Network

Gravity Main

A new proposed gravity sewer pipeline from the new proposed transfer structure in Jonga Street to Thembaletu pump station no. 6 is required due to upgrading Thembaletu pump station no. 7 from 16 l/s to 50 l/s. The existing 250mm diameter uPVC Class 34 gravity main cannot accommodate the increased flow from Thembaletu pump station no. 7. Refer to figure 6 above for location of the proposed new gravity sewer (blue line) and transfer structure.

Rising Main

Maintain existing 200mm diameter rising main from Thembaletu pump station no.7 to the existing transfer structure on an informal road between Jonga and Zusakhe streets. The pipeline can accommodate the increased flow of 50 l/s from Thembaletu pump station no.7.

2.2.3 Status Quo

The sewage from the residential area to the West drains under gravity to Thembaletu pump station no. 7, the sewage is then pumped to the transfer structure between Jonga and Zusakhe Street from where it drains under gravity along the tributary of the Skaapkop river along the residential street/roads towards Thembaletu pump station no. 6.

Thembaletu PS 7 and associated rising main can convey a design flow of 50 l/s, but the pump station's mechanical and electrical components have to be upgraded (refer to Portion 2 report). The 200 mm diameter rising main will be able to accommodate slightly higher velocities, but it is not ideal for long term use. The 250 mm diameter gravity main will not be able to accommodate the higher velocities and will need to be upgraded.



2.2.4 *Proposed New System*

Option 2 entails the upgrading of Thembaletu pump station no. 7 as an interim measure, to allow the decommission and installation of gravity sewers as discussed in option 1.

The upgrade to the pump station is mechanical and electrical in nature and is discussed in the Portion 2 report.

The existing rising main can operate for a short to medium term at the higher end velocity range without replacing the pipeline with a larger diameter. The existing gravity main however requires an upgrade from a 250 mm to a 355 mm diameter in a new location or running along Jonga and Seaview Streets to Thembaletu PS 6.

2.2.5 *Interim System and Interim Design Flow*

Pump Station

As the future system allows for Thembaletu pump station no.7 to be taken out of operation (sewer to gravitate to Thembaletu East PS) the upgrading of the pump station from 16 l/s to 50 l/s will only be for the interim. The decommissioning of Parkdene pump stations no. 2 and no. 3 and Thembaletu pump stations no. 1, 2, A and B, will relate to increased flows at Thembaletu PS 7 of up to 50 l/s from the “current” formally occupied stands. Refer to Figure 5 and section 2.1.5.

A schematical representation of the current and future system from the master plan data is included in Annexure B of this report.

2.2.6 *Proposed Horizontal Alignment*

Gravity Main

With reference figures 6 and 7, an alternative pipeline route was chosen for the new proposed 355mm diameter pipeline to the existing 250mm diameter one illustrated in figure 7 above. The main reason being the limited space within the existing road reserves to install a new pipeline and the additional costs associated with existing services, rehabilitation, traffic management etc. The new proposed route is also only 1790m long, whereas the existing route through the residential suburb being 1950m long.

The gravity main will commence at the proposed new transfer structure located on Jonga Street. From there, the alignment will follow Jonga Street up to its intersection with Sea View Street. It will then continue along Sea View Street until it reaches the intersection with Makosi Street. The route will proceed along Makosi Street until it intersects with Luyolo Street.

From this point, the pipeline will run parallel to the existing 250 mm diameter pipeline until it reaches the existing manhole located just before the inlet structure of Thembaletu Pump Station No. 6. The final connection details at Thembaletu Pump Station No. 6 will be determined during the detailed design stage.

2.2.7 *Pipeline Sizing*

Gravity Main

In terms of good practice, it is recommended that the gravity main is sized to correspond with the upstream rising main should capacity be sufficient considering the allowable gradient while also considering minimum velocities. Considering the minimum gradient of 1:150 between the new proposed transfer structure (Jonga Street) and the downstream manhole at Thembaletu



pump station no. 6, a capacity of more or less 94.1 l/s and velocity of 1,2 m/s can be expected from a class 34 uPVC 355mm diameter pipe with inside diameter of 334mm. This is in other words sufficient to accommodate the proposed pump flow of 50 l/s of this option and 80 l/s if option 3 is implemented. Refer to Annexure E for manning flow calculations.

Rising Main

Currently a 200mm diameter uPVC rising main is in place. The internal diameter of this pipe is 175mm. When the velocity is calculated for the design flow of 50 l/s, it relates to a flow of 2.0 m/s which is regarded as too high and could only be implemented in short term conditions.

Therefore, a 315mm class 12 diameter pipe is proposed. As HDPE (PE 100, PN 12.5) is the preferred pipe material, the internal diameter will be 263.60mm. When the velocity is calculated for the design flow of 50 l/s, it relates to a flow of 0.9 m/s which is regarded as acceptable for rising mains in accordance with The Neighbourhood Planning and Design Guide (2019).

2.2.8 Pipe Material

Gravity Main

In line with George Municipality's requirements and standard pipe material, a uPVC Class 34 pipe is proposed.

2.2.9 Gravity Main Backdrop Manhole

Backdrop manholes (external type) will be considered where steep slopes exist and results in excessive velocities of 3.0 m/s or more from the new transfer structure to tie in with the existing network. Pipes between drop manholes can be laid at flatter slopes to decrease flow velocities.

2.2.10 Tie-In Manhole (Thembaletu Pump Station No. 6)

The size of the tie in (with existing) manhole must be carefully considered during detail design. The velocity at the manhole can be decreased by installing a drop manhole immediately upstream and by incorporating a longer radius bend in the benching of the tie in manhole. The final connection details will be finalized during the detail design phase.



2.3 OPTION 3: Thembaletu Pump Station No. 7 - Upgrade Pump Station From 50 l/s To 80 l/s Rising Main - From To Thembaletu Pump Station No. 7 To Transfer Structure In Jonga Street

For Option 3 the upgrading of Thembaletu pump station no. 7 from 50 l/s to 80 l/s will be required. This proposed upgrade to the pump station will be discussed in more detail within the mechanical/electrical concept and viability design report.

2.3.1 Objective



Figure 8 – Option 3 proposed upgrades

The objective of Option 3 is to upgrade Thembaletu pump station 7 from 50 l/s to 80 l/s.

If Thembaletu pump station no. 7 is upgraded to 80 l/s the existing 200mm diameter uPVC rising main from the pump station to the existing transfer structure, approximately 1170m in length will have to be upgraded including a slight alignment change and discharging into the new proposed transfer structure in Jonga Street. The gravity main upgrade as part of Option 2 will be sufficient for this upgrade as well. The maximum flow in the 200mm diameter rising main should not exceed 45 l/s.



Figure 9: Rising main from Thembaletu pump station no. 7 to transfer structure between Jonga and Zusakhe Street (green line)

2.3.2 Function In Network

In terms of the bigger network (current), Thembaletu pump station no.7 and the associated rising main serves only a small residential catchment area.

The complete upgrade of Option 1 will however result in the rising main servicing the entire catchment east of Nelson Mandela Boulevard as well as those catchments previously covered by Parkdene PS 2 and 3.

2.3.3 Status Quo

The sewage from the residential area to the West drains under gravity to Thembaletu pump station no. 7, the sewage is then pumped (at design flow of 16 l/s, in 200 mm diameter uPVC pipe) to the transfer structure between Jonga and Zusakhe Street from where it drains under gravity along the tributary of the Skaapkop river along the residential street/roads towards Thembaletu pump station no. 6.

Thembaletu PS 7 must be upgraded (civil & mechanical/electrical) to accommodate a design flow of 80 l/s, refer to Portion 2 report. This will relate to a larger diameter rising main required as the flow velocity within the existing 175 mm nominal internal diameter (200mm, uPVC Class 16) rising main will be 1.9m/s which is not ideal for the long term due to increased friction losses, erosion and corrosion, pressure surge, flow stability and increased operational costs.

The existing 250 mm diameter gravity main from the transfer structure to Thembaletu PS 6, will be upgraded as part of Option 2 to a 334mm nominal diameter pipeline (355 uPVC class 34).



2.3.4 *Future System and Future Design Flow*

Pump Station & Rising Main

In accordance with GLS correspondence (July 2024) refer to Annexure C, a flow of 50 l/s is anticipated for Thembaletu pump station no. 7 considering current development, and 80 l/s considering future development and growth. A schematical representation of the future system from the master plan data is included in Annexure B of this report.

The mechanical/electrical (pumps etc.) infrastructure of Thembaletu pump station no. 7 is proposed to be upgraded during Option 2 (refer to section 1.5, Scope of Works) to accommodate current development flows of 50 l/s.

With Option 3 it is proposed that the mechanical equipment and associated electrical and electronic items at the Thembaletu pump station no. 7 be upgraded to cater for the increased flow of 80 l/s. A 315mm diameter HDPE class PN 12.5 rising main is proposed with an internal nominal diameter of 263.6 mm which will relate to a flow velocity of 1.5 m/s at 80 l/s.

A schematical representation of the current system forming part of the master plan is included in Annexure B of this report.

Refer to Annexure E for manning flow calculations.

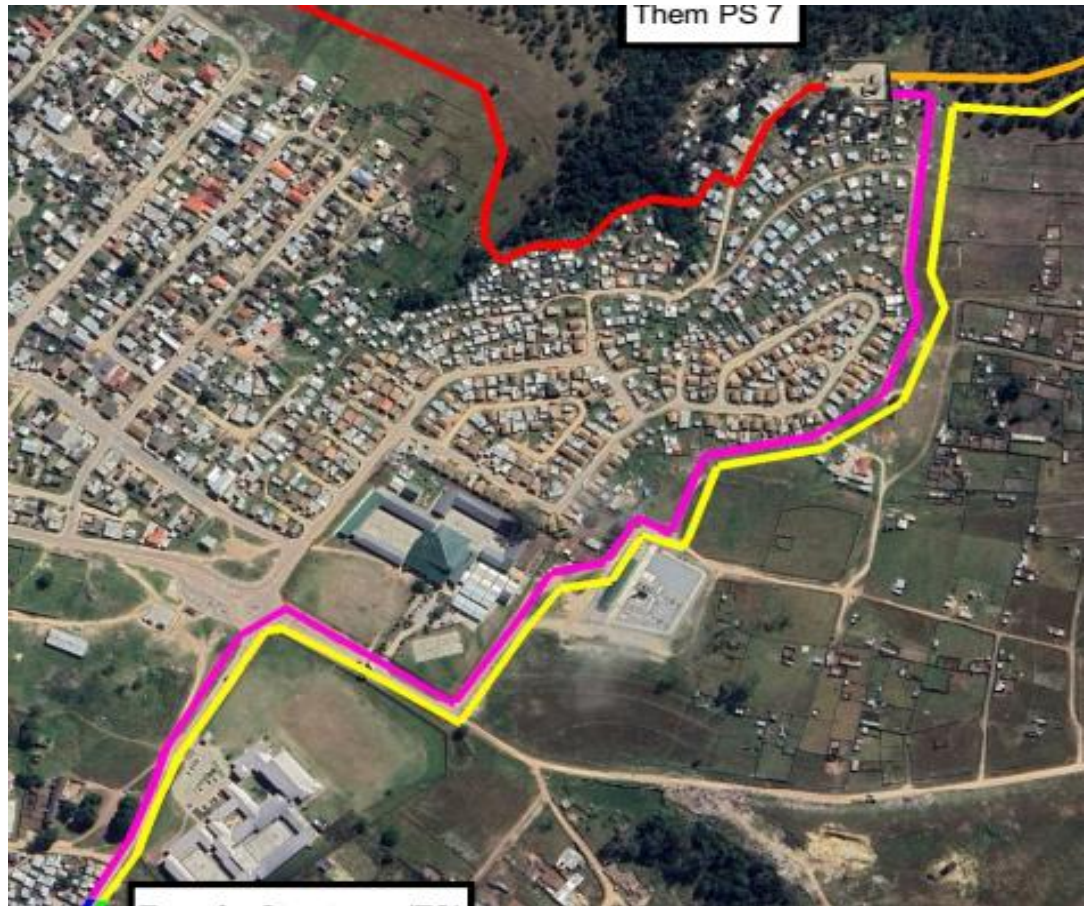
Gravity Main

Option 2 will relate to the existing 250 mm uPVC class 34 gravity main being upgraded to a 355 mm diameter uPVC class 34 pipeline, refer to section 2.2.6.

2.3.5 *Proposed Horizontal Alignment*

Rising Main

The proposed rising main alignment will be as per figure 10 below (pink line). Where possible the new pipeline will have a constant offset (1.5m) next to the existing rising main alignment. This can however only be determined during the construction phase as the exact position of the existing rising main is unknown. Currently the only available data is from the George Municipal IMQS system. According to this alignment the pipeline crosses underneath formal and informal structures at certain locations. At these specific locations the new proposed alignment will follow the existing dirt roads over erf 197/56 (owned by Western Cape Government erf).



**Figure 10: Proposed rising main alignment from Thembaletu pump station no.7
To transfer structure in Tabata Street (pink line)**

The exact horizontal alignment of this existing rising main needs to be confirmed at the start of construction. In accordance with George Municipalities GIS viewer data the alignment is as indicated in figure 9 (green line).

Gravity Main

Option 2 (if implemented) will require the installation of a 355mm diameter uPVC class 34 gravity main being installed from the new transfer structure (See Section 2.3.9) in Jonga Street, to Thembaletu pump station no. 6, refer to section 2.2.6. Therefore when the new proposed 315mm diameter rising main as part of Option 3 is implemented the newly installed 355 mm diameter gravity main installed as part of Option 2 can be utilized, as the existing 200 mm diameter rising main will be abandoned and only be utilized in case of emergency.

2.3.6 Pipeline Sizing

Rising Main

The sizing of the rising main is dependent on the upgraded capacity of Thembaletu pump station no. 7. In terms of the Sewer Master planning (Annexure A) no size for the proposed rising main from Thembaletu pump station no. 7 to the transfer structure between Jonga and Zusakhe Street is indicated, as the Master Plan allow for this pump station to be decommissioned. The Sewer Master plan indicates that in future the sewage from pump station no. 7 will gravitate to the proposed new Thembaletu East pump station, located downstream.



However, due to potential lengthy timelines with regards to the implementation schedule of the future proposed Garden Route City development and portions of the Kraaibosch development footprint (that will be the main sewage contributor to the Thembaletu East pump station), the upgrading of Thembaletu pump station no. 7 is currently proposed by the George Municipality as a potential interim solution.

Considering a design flow of 80 l/s, the proposed 315mm diameter HDPE class 12 rising main will have a velocity of 1.4 m/s which is regarded as acceptable.

The final rising main sizing will be determined/finalized during the detail design stage.

Gravity Main

The proposed new gravity main (option 2 scope of work, 355 mm diameter uPVC class 34) from the new transfer structure (Jonga street) onwards will follow a new route along Jonga, Sea View, Makosi and Luyolo Streets before discharging into the existing manhole located just before the inlet structure of Thembaletu Pump Station No. 6. Refer to section 2.2.6.

The final connection details at Thembaletu pump station no. 6 will be finalized during the detail design stage.

2.3.7 Pipe Material

Rising Main

Market related pricing was retrieved from a local supplier Civil Corp in Oudtshoorn for various pipe materials.

In terms of material, the cost of uPVC and GRP is generally lower compared to HDPE. Even though HDPE and GRP pipes have an increased installation cost compared to the uPVC, the HDPE pipes present a cost saving and that no thrust blocks are required. The very strong bud-joints on the HDPE pipes also reduce the risk of breaks on priority bulk pipes compared to uPVC and GRP pipes. In terms of GRP there is substantial risks relating to improper construction and handling compared to uPVC and HDPE. When the life cycle cost of the different pipes is considered, HDPE is generally the recommended material.

Ultimately HDPE is foreseen as the recommended pipe material for the proposed outflow rising main of Thembaletu pump station no. 7. The outcome in terms of pipe material will be subject to the hydraulic analysis during the detail design stage.

Gravity Main

In line with George Municipality's requirements and standard pipe material, a uPVC Class 34 pipe is proposed.

2.3.8 Rising Main Surge Conditions

A surge analysis was not yet performed on the outflow rising main and will form part of the detail design phase. Class 12 pipes (PN 12.5, PE 100) will conservatively be assumed for now during the preliminary design phase. A water hammer analysis will be conducted during the detail design phase that will confirm the class of pipes required.

2.3.9 Transfer Structure

The existing rising main connects to an existing transfer structure west of the Thembaletu pump station no. 7 on an informal unnamed road between Jonga and Zusakhe Streets. The



existing 250mm diameter gravity main where the existing 200mm diameter rising main connects (transfer structure) is inadequate to accommodate the additional flow of the new proposed 315mm diameter rising main.

2.4 OPTION 4: Gravity Main – From Thembaletu Pump Station No. 7 To Thembaletu East Pump Station. Rising Main – From Thembaletu East Pump Station To Transfer Structure Jonga Street. Gravity Main – From Transfer Structure In Jonga Street To Thembaletu Pump Station No. 6

For Option 4 the construction of Thembaletu East pump station will be required. This proposed pump station will be discussed in more detail within the mechanical/electrical concept and viability design report.

2.4.1 Objective



Figure 11 – Option 4 proposed upgrades

The objective of Option 4 is to construct the new planned Thembaletu East pump station (*green block*) and associated infrastructure. These proposed upgrades are specifically required when the eastern proposed developments within the Municipal urban edge are implemented, this includes the future proposed Garden Route City development southeast of the Garden Route Mall portions of the Kraaibosch development and connection of existing areas such as Victoria Bay and Heights.

The implementation will result in Thembaletu pump station no. 7 being decommissioned and a new gravity main will be installed from Thembaletu pump station no. 7 to the Thembaletu East pump station. The sewage from Thembaletu East pump station will be conveyed via rising and gravity mains to Thembaletu pump station no. 6. Refer to figure 12 below.



**Figure 12: Proposed Thembaletu East pump station upgrades
(Orange line gravity main, yellow line rising main, green line gravity main.**

Although this report discusses the ultimate solution, the Municipality will not implement the ultimate solution as it is not required for Municipal service delivery. A large portion ($\pm 50\%$) of the Thembaletu East pump station capacity is required for private development. The pump station will therefore be designed and constructed in this manner while allowing for extension as and when required.

2.4.2 Function In Network

Gravity Mains

The upstream flow will drain via the new gravity sewer to the Thembaletu East pump station (long-term and master plan proposed route) for further conveyancing through the system.

The new proposed gravity sewer pipeline from Thembaletu pump station no. 7 to Thembaletu East pump station is required due to Thembaletu pump station no. 7 being decommissioned, once the new pump station is constructed.

The 630mm diameter uPVC gravity main from the new proposed transfer structure in Jonga Street to Thembaletu pump station no. 6. is required because of the increased sewage flow generated by the new Thembaletu East pump station (this pipeline will be installed parallel to the proposed 355mm diameter gravity pipeline as part of option 2).

Rising Main

In terms of the bigger network, the rising main will service the Thembaletu East pump station catchment by means of pumping the sewage in an easterly direction to Thembaletu pump station no.6.

2.4.3 Status Quo

Gravity Mains

No gravity mains are currently in place.

Rising Main

No rising main and transfer structure is currently in place.



2.4.4 Proposed Horizontal Alignment

Gravity Main: Thembaletu PS 7 to Thembaletu East PS

With reference figure 12 above. The gravity main (orange line) replacing Thembaletu pump station no. 7 to convey sewage to the new Thembaletu East pump station will run parallel to the Meul river and cross over the open erf 197/56 (owned by Western Cape Government).

The sewage will drain directly via gravity (PS no. 7 decommissioned) to the Thembaletu East pump station. Refer to figure 12 above.

Gravity Main: Transfer Structure in Jonga Street to Thembaletu PS 6

The gravity main (green line) from the rising main end point will start at the new transfer structure in Jonga Street. The alignment will follow Jonga Street in a westerly direction until the intersection with Sea View Street. It will then continue along Sea View Street until it reaches the intersection with Makosi Street. The route will proceed along Makosi Street until it intersects with Luyolo Street.

The pipeline will then run parallel to the existing 250 mm diameter pipeline until it reaches the existing manhole located just before the inlet structure of Thembaletu Pump Station No. 6. The final connection details at Thembaletu pump station no. 6 will be finalized during the detail design.

Rising Main

The proposed rising main alignment (*yellow line*) will be as per figure 13 below. From the Thembaletu East pump station (green block) it will cross over an open erf 197/56 (*Western Cape Government property*), towards Thembaletu pump station no. 7, before turning in a westerly direction towards Nelson Mandela Boulevard. From there it will be installed adjacent to the existing rising main proposed under Option 2 (*pink line*), up to the transfer structure in Jonga Street on erf 197/5 (Western Cape Government property).

Where possible the new proposed rising main will have a constant offset next to the existing (or new proposed under Option 2) rising main alignment ($\pm 1.5\text{m}$ away). This can however only be determined during the construction phase as the exact position of the existing rising main is unknown. Currently the only available data is from the George Municipal IMQS system. According to this alignment the pipeline crosses underneath formal and informal structures at certain locations over property 197/56 owned by the Western Cape Government. At these specific locations the new proposed alignment will follow the existing dirt roads over erf 197/56.

Option 4 includes the construction of the Thembaletu East pump station and the associated conveyancing pipelines in a phased approach to accommodate current and 20-year future flows. However, large private developments also require this pump station to connect to the municipal sewer network. In terms of the Sewer Master planning (Annexure A) a 323 l/s pump station is anticipated in future. The Municipality intends to implement this pump station for municipal needs only. The infrastructure must therefore be designed in such a manner to allow for future capacity extensions in phases as required by private developments.

According to Sewer Master plan a 550mm nominal diameter rising main is required from the Thembaletu East pump station to the newly proposed transfer structure on Jonga Street. To accommodate the reduced flows of approximately 170 l/s due to the phased implementation of the Thembaletu East pump station, the mechanical operations (pumps, cycles, and durations) will be adjusted accordingly. This approach will ensure that the larger diameter pipeline, designed for the full development flow, can effectively handle the reduced flows.

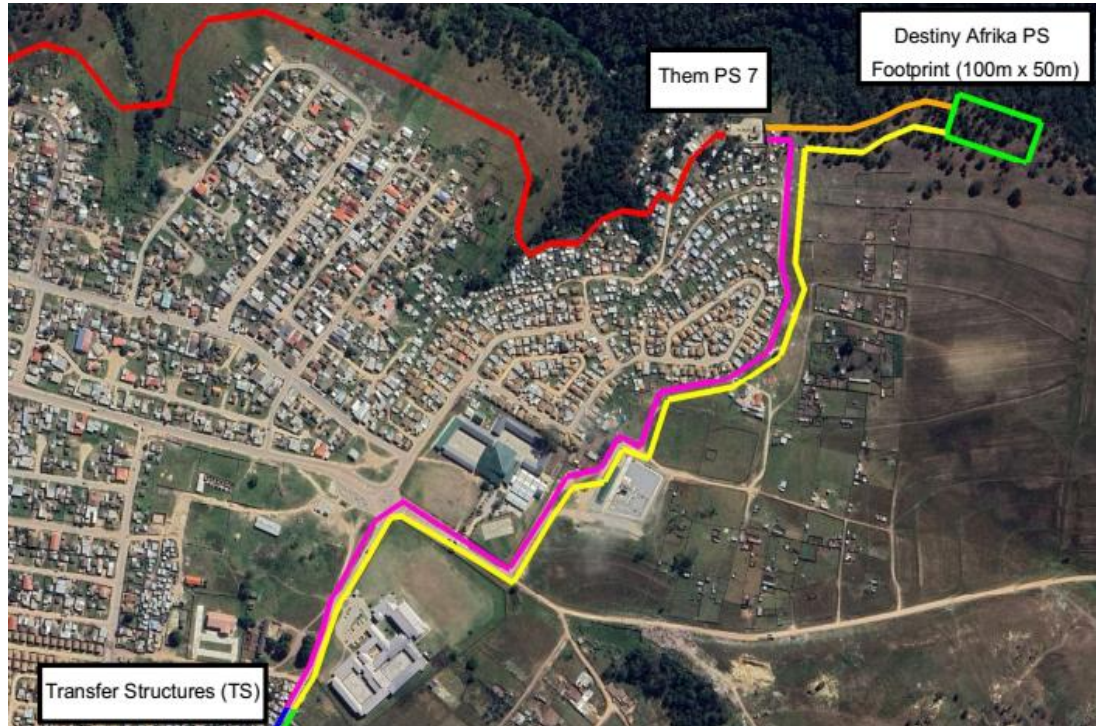


Figure 13: Proposed rising main from Thembaletu East to transfer structure in Jonga Street (yellow line rising main).

2.4.5 Pipeline Sizing

Gravity Main: New gravity sewer to Thembaletu East Pump Station (replacing Thembaletu Pump Station no. 7).

In terms of the Sewer Master planning (Annexure A) a 450mm diameter pipe (with a nominal diameter of 424mm) is proposed to accommodate the “master plan” (fully developed future areas, IPWWF) of 80.12 l/s between Thembaletu pump station no. 7 and Thembaletu East pump station.

With reference to Section 2.1.7 above. In summary a larger diameter pipeline possibly 450mm diameter class 34 uPVC is proposed from Thembaletu pump station A to Thembaletu pump station no. 7, due to the existing topographical ground conditions of the proposed pipeline route over this section. Therefore, the same diameter (450mm diameter) is proposed to continue to the proposed Thembaletu East pump station.

A capacity of more or less 97 l/s and velocity of 0.8 m/s can be expected from a class 34 uPVC 450mm diameter pipe with inside diameter of 424 mm for the new portion of gravity sewer to the new Thembaletu East pump station at a slope of 1:500, which will be more than sufficient in terms of design standards. Due to the site’s topography and the invert levels of the existing pump stations scheduled for decommissioning, the 450 mm diameter pipe is proposed, as it allows for installation at a flatter slope. Without this adjustment, connecting all pump stations to the gravity main would not be possible according to the The Neighbourhood Planning and Design Guide 2019 design standards.

Gravity Main: Transfer structure in Jonga street to Thembaletu PS no 6.

From the transfer structure in Jonga Street, a new 630 mm diameter pipe is proposed to accommodate a flow of 323 l/s (complete replacement of 355 mm ø installed as part of Option 1).



A capacity of more or less 412 l/s and velocity of 1.6 m/s can be expected from a class 34 uPVC 630mm diameter pipe with inside diameter of 593mm between the transfer structure in Jonga Street and Thembaletu pump station no. 6 at a slope of 1:150, which will be more than sufficient in terms of design standards. A smaller diameter class 34 uPVC 560mm pipe, with an inside diameter of 527mm at a slope of 1:150 will only have a capacity of 301 l/s, which is not sufficient.

In Option 2 (gravity sewer of Thembaletu PS 7), which includes a 355mm diameter uPVC gravity main from the new transfer structure in Jonga Street is implemented before Option 4 (630mm diameter uPVC). The detail design should consider utilizing the 355mm diameter pipe as part of Option 4, which will relate to a smaller additional gravity main to be installed under Option 4. These pipelines will therefore operate in parallel. Alternatively if the Municipality requires a back-up gravity sewer the larger diameter can be installed. This requirement will be discussed during the design workshop.

Rising Main

The sizing of the rising main is dependent on the phased capacity implementation of Thembaletu East pump station. In terms of the sewer master planning (Annexure A) the pump station should be upgraded to an ultimate capacity of 323 l/s. In terms of the Sewer Master planning a 550mm nominal diameter pipe is anticipated. If HDPE is the preferred pipe material, the internal diameter of PN 12.5 (PE 100) 630mm diameter pipe will be 515.6mm. To accommodate the reduced flows of approximately 170 l/s due to the phased implementation of the Thembaletu East pump station, the mechanical operations (pumps, cycles, and durations) will be adjusted accordingly. This approach will ensure that the larger diameter pipeline, designed for the full development flow, can effectively handle the reduced flows.

When velocities are calculated for the above-mentioned 630mm diameter HDPE pipe, taking into account the design flow of 323 l/s relates to a flow velocity of 1.6 m/s which is generally regarded acceptable (<1.8m/s) for risings mains in accordance with The Neighbourhood Planning and Design Guide (2019). A 710mm diameter (PN 12.5, PE 100) HDPE pipe will have a nominal diameter of 594.8mm, and can accommodate a design flow of 323 l/s at 1.2 m/s.

If Option 3, which relates to a 315mm diameter rising main is implemented before Option 4 (630mm diameter rising main). The detail design should consider using the 315mm diameter rising main (installed under Option 3), which will relate to a smaller 500mm diameter (instead of 630 mm) additional rising main to be installed under Option 4, resulting in the two pipelines (500mm & 315 mm diameter) operating in parallel.

As HDPE (PE 100, PN 12.5) is the preferred pipe material, the internal nominal diameter of a 500mm diameter pipe will be 406.00mm. A design flow of 226 l/s will relate to a flow velocity of 1.746 m/s, which is generally regarded acceptable (<1.8m/s) for rising mains in accordance with The Neighbourhood Planning and Design Guide (2019). To accommodate for the sewer master planning design flow of 323 l/s the additional 315 mm diameter (Option 3) HDPE rising main pipe will be able to accommodate a design flow of 97 l/s at a flow velocity of 1.777 m/s. The two pipelines in parallel will thus be able to handle the design flow of 323 l/s.

The final rising main sizes will be determined/finalized during the detail design phase.



2.4.6 *Pipe Material*

Gravity Mains

In line with George Municipality's requirements and standard pipe material, a uPVC Class 34 pipe is proposed.

Rising Main

With reference to Section 2.2.7, HDPE is currently the recommended pipe material. The outcome in terms of pipe material will be subject to the final outcome of the hydraulic analysis during the detail design stage.

2.4.7 *Backdrop Manholes*

Backdrop manholes (external type) will be considered where steep slopes exist and results in excessive velocities of 3.0 m/s or more from the new transfer structure to tie in with the existing network. Pipes between drop manholes can be laid at flatter slopes to decrease flow velocities.

2.4.8 *Tie-in Manholes*

The size of the tie in manholes at both Thembaletu East and Thembaletu pump station no. 6 will be finalized during the detail design stages of the various "Options" to be implemented.

2.4.9 *Rising Main – Surge Conditions*

A surge analysis was not yet performed on the outflow rising main and will form part of the detail design phase. Class 12 pipes (PN 12.5, PE 100) will conservatively be assumed for now during the concept design phase. A water hammer analysis will be conducted during the detail design phase that will confirm the class of pipes required.

2.4.10 *Rising Main – Outlet (Transfer Structure)*

A new transfer structure will be constructed in Jonga Street between the transition point of the rising and gravity main.

The existing transfer structure between Jonga and Zusakhe Streets will not be considered to be upgraded as a new pipe route has been proposed, requiring replacement of the existing structure.

3. **LAND MATTERS**

3.1 **Properties affected by proposed infrastructure development**

The planned infrastructure comprising pipelines, manholes, chambers, and pump stations will extend across multiple properties under varied ownership, including Government Institutions, George Municipality, and private entities. The table below provides a summary of the properties affected.

To facilitate the necessary development permissions, a professional town planner will be appointed to manage the subdivision or transfer of erven as needed. Additionally, a land surveyor will oversee the registration of service servitudes to ensure access and maintenance rights are secured.



Table 3: Properties Affected (Not Owned by George Municipality)

Erf number	Owner	Proposed New Service	Registrations/Actions Required
1284	Western Cape Government	Pipelines	Transfer to George Mun/ Register Servitude
197/56	Western Cape Government	Thembalethu East Pump station, pipelines	Transfer to George Mun/ Register Servitude
197/5	Western Cape Government	Pipelines	Transfer to George Mun/ Register Servitude
197/62	Western Cape Government	Pipelines	Transfer to George Mun/ Register Servitude
8142	National Housing Finance Corporation	Pipelines	Transfer to George Mun/ Register Servitude

Notes: Erf 197/56 – The George Municipality has formally requested that portions of erf 197/56 be made available for sewerage infrastructure. There are constraints and agreements required between the relevant internal provincial departments with regards to the rights/processes to follow to transfer or a portion of the property to the George Municipality.

4. GENERIC PROJECT DETAIL

4.1 Project Specific Challenges

The following project specific challenges exist in terms of the project in general:

4.1.1 Construction in Roads

The only available space in the road reserves is in the road itself. Backfilling of the trenches will need to be in accordance with the specification at 300mm depths.

The upgrade will entail a challenge in terms of traffic accommodation and maintaining access to the various erven.

Sufficient allowances for traffic accommodation will be made in the BOQ and alignment with the specifications.

Construction work shall be limited within the residential area for safety, manageable excavations and closure (specified trench lengths) and always maintaining access to properties.

In addition, the Contractor will be required to provide a traffic management plan for approval and implementation throughout the construction period.

Due to the location of some pump stations to be decommissioned the N2 national road will need to be crossed by means of horizontal drilling, micro tunnelling or pipe jacking. Relevant approvals will need to be obtained.

4.1.2 Operational Sewer

It is required that all pump stations to be decommissioned to remain operational at all times until the required new infrastructure upgrades have been completed. Workflow will need to be carefully planned in order to ensure no unintended interruptions on spillages occur.

Interruption to the sewer will however occur during commissioning of the system. The sewer shall be commissioned during off-peak times and notification via a formal advert in the local newspaper and George Municipality social media platforms shall be placed about 1 week in



advance. Allowances will be made in the tender bill of quantity to address relevant health and safety matters dealing with live sewage.

4.1.3 Property Ownership

The location of all proposed infrastructure is located on Western Cape Government Property.

The agreement, negotiation and transfer of properties to the George Municipality must be finalised in order for the Municipality to implement the infrastructure and apply for and obtain the required environmental approvals.

4.2 Existing Services and Wayleaves

Various services are located on the proposed infrastructure upgrade routes. Wayleaves will be required from Eskom, Telkom, Sanral, fiber service providers and all other municipal services. Planning wayleaves will be requested as soon as the preliminary route of the proposed pipes have been accepted.

During construction all services will need to be carefully opened prior to any excavation activities to confirm locations.

Crossing of various services is anticipated in all the municipal road reserves as indicated on the topographic surveys completed by May 2024.

Crossing of the N2 national road is required to connect the Parkdene pump stations, wayleave approval will be required from Sanral.

At this stage of the design, it is not anticipated that services will need to be relocated in order to accommodate the proposed works.

The appointed Contractor will be required to apply for construction wayleaves prior to any construction activities.

4.3 Health and Safety

XAKS Consulting Health and Safety Agent was appointed by George Municipality in September 2023 to perform all functions pre, during and post construction in terms of the OHS Act and 2014 Construction Regulations is underway.

The services by the agent will include:

- Prepare Site Specific Baseline Risk Assessment (SSBRA) and Site Specific Health and Safety Specification (SSHSS);
- Liaise with designer to advise on design and documentation;
- Assist during tender evaluation for adequate H&S provision (pre- and post tender);
- Confirm that Contractor is in good standing with the Compensation Commission;
- Compile, manage and ensure mandatory agreement between Client and Contractor;
- Apply for construction work permit (if applicable);
- Attend monthly site meetings and report;
- Monthly audits;
- Compile close-out audit.



4.4 Procurement Strategy

The construction contract will be prepared in accordance with the relevant legislation, the George Municipality's latest approved SCM and Procurement Policy and standard tender document.

Each option will attract its own strategy. Option 1 will potentially be implemented in a phased approach, depending on available budget and will be potentially be a combined civil, mechanical and electrical contract.

Option 2 & 3 can be implemented in 1 or 2 separate contracts by separating the disciplines. However, the Municipality at the time of writing this report does not intend to implement Option 3.

Option 4 will be implemented through 2 separate contracts potentially divided into a pipelines and pumpstation contract respectively, however if the entire budget is available the full scope could be implemented through 1 contract.

Once the detail design is finalized and the environmental authorisation is obtained the strategy in line with available municipal budgets and priorities will be discussed and finalised in order to prepare tender documentation.

5. SOIL CONDITIONS / GEOTECHNICAL STUDIES

A geotechnical investigation was performed by Outeniqua Laboratory in July 2024. The investigation consists of twenty (20) TLB-excavated test pits along the proposed pipeline routes. In-situ penetration tests (DCP) were also carried out at each test position. Samples of soil types were collected for laboratory tests and a brief analysis of the results has been summarized in a geotechnical report attached under Annexure G.

The site topography ranges from gently sloped plains to very steep slopes, with valleys and numerous stream crossings. While most areas along the pipeline route are accessible with a TLB, certain sections will require the use of a tracked excavator due to the challenging terrain.

The underlying geology of the area consists of Maalgaten and related Granites of the Kaaaimans series sand soil derived from the weathering of these rocks. This formation is typically deeply weathered in the area, forming fine gravels to silt/silty clays soil profiles, as well as rock outcrops on surface.

The test pits conducted indicate that the soil profiles are dominated by silty sands, Ferricrete, silt/silty clays and fine gravels, this correlates with the local geology of the area.

The tests conducted on the soils confirmed the visual assessment of the clayey nature of the soils above the fine gravels with isolated Ferricrete lenses.

The fine gravels and clean silty sands could not be classified according to TRH14, indicating that the material is less than a G10 quality, with only the silty sand that has some well developed Ferricrete in, providing a TRH14 classification of G7 quality.

The silt/silty clay samples range between SC (clayey sand) and MH (elastic silt) classification with low potential expansiveness.

None of the silty sands could meet the requirements of SABS 1200LB for bedding sands.



Fine gravel test pit no. 20



Silty sand and silty clay test pit no. 5

The slope stability of the site appears suitable, with the material on the steep slopes being cohesive. However if moisture is allowed into any open trenches the stability of the slopes could be affected.

The trench side walls are also stable under dry conditions, however the Ferricrete layer could form a perched water table which could lead to the sided wall failure of the trench.

The insitu materials are not considered useful as a potential source of bedding, blanket or engineering filling material, due to the high fines content and classification, but if required can be used as general low quality filling material where compaction is not crucial.

Sufficient allowances will be made in the bill of quantity for battering/shoring of trenches, dewatering of trenches, importing bedding and possibly backfill material to a maximum depth of 2.5m or refusal along the proposed pipeline route.

Trial pit excavations to a depth of 2.3m are classified as “soft” and can be excavated with light plant such as a TLB, except for the proposed Thembaletu East pump station site where the material would be classified as “medium to hard” with some areas having exposed rock on the surface. There are also areas along the pipe route with exposed rock outcrops.

The investigation indicated that the site is suitable for the pipeline upgrade with the material being easily excavatable with a TLB in most areas with isolated hard rock and rock out crops along the line. The site is stable under dry conditions and care must be taken to shore the walls of the trenches where any possible perched water table could be encountered.

Consideration must be taken when selecting the backfill material from the site and bedding material should be imported from commercial sources.

6. ENVIRONMENTAL

Greenfire Enviro was appointed as the Environmental Assessment Practitioner in April 2024 to compile, manage, submit and obtain the required environmental approvals associated with the project.

6.1.1 National Environmental Management Act

An Environmental Impact Assessment will be required for the project. The Notice of Intent process is currently underway.



6.1.2 National Water Act

The proposed work is carried out within 100 (hundred) meters from a river which requires a Water Use License Application (WULA). The WULA process will run parallel to the environmental process.

6.1.3 National Heritage Act

Considering the pipes are longer than 300 (three hundred) meters a notice was submitted to the Western Cape Department for consideration will be required.

6.1.4 Monitoring and Control

Quotations for an Environmental Control Officer (ECO) will be sourced after receipt of the Environmental Authorization (EA) and WUL, an ECO will be appointed prior to construction commencing.

7. COST ESTIMATE

Estimates are provided below for the different scope of work options 1, 2, 3 and 4 discussed under Section 1.5. The cost estimates below are based on recent unit prices of similar projects:

7.1 Cost Estimate Breakdown

OPTION 1:

ESTIMATED CONSTRUCTION COST		Oct-24
ITEM		COST
Gravity Main from Parkdene PS 2 and 3 to Thembaletu PS 7:		R 19,115,300
200mm Ø – 450 Ø, class 34 uPVC pipes, 4540 m in total		
Associated works: Road reinstatement, manholes, N2 crossing, gravity main		
Erosion Rehabilitation:		R 2,250,000.00
75mx15m=2,250 m ² @ R 2000/m ²		
Associated works: gabion mattresses and -baskets, geofabric blankets and vegetation		
SUBTOTAL		R 21,365,300.00
Preliminary and General (20%)		R 4,273,060.00
SUBTOTAL CONSTRUCTION COST		R 25,638,360.00
Contingencies (10%)		R 2,563,836.00
SUBTOTAL		R28,202,196
Consumer Price Index (CPI) of 7.5%/year for 2 years		R4,230,329
TOTAL CONSTRUCTION COST		R 32,432,525



ESTIMATED PROFESSIONAL FEES	
ITEM	COST
Engineering Fees (Civil)	R 2,814,138
Site Supervision (18-months)	R 1,125,000
Health and Safety (18-months)	R 180,000.00
Environmental Approvals (EIA etc.)	R 462,500
Environmental Control Officer (ECO, 18-months)	R 180,000.00
Surveys	R 342,787
Geotechnical Investigations	R 84,410
TOTAL PROFESSIONAL FEES	R 5 188 835
SUBTOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)	R 37 621 360
VAT 15%	R 5 643 204
<u>TOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)</u>	<u>R 43 264 564</u>

OPTION 2:

ESTIMATED CONSTRUCTION COST		Oct-24
ITEM		COST
Gravity Main from transfer structure in (Jonga Street) to Thembaletu PS 6:		R 6,223,000
355mm Ø class 34 uPVC pipe, 1790 m in total		
Associated works: Manholes, hard rock		
SUBTOTAL		R 6,223,000
Preliminary and General (20%)		R 1,244,600
SUBTOTAL CONSTRUCTION COST		R 7,467,600
Contingencies (10%)		R 746,760
SUBTOTAL		R 8,214,360
Consumer Price Index (CPI) of 7.5%/year for 2 years		R 1,232,154
TOTAL CONSTRUCTION COST		R 9,446,514
ESTIMATED PROFESSIONAL FEES		
ITEM		COST
Engineering Fees (Civil)		R 892,668
Site Supervision (8-months)		R 500,000
Health and Safety (8-months)		R 80,000
Environmental Control Officer (ECO, 8-months)		R 80,000
TOTAL PROFESSIONAL FEES		R 1,552,668
SUBTOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)		R 10,999,182
VAT 15%		R 1,649,877
<u>TOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)</u>		<u>R 12,649,059</u>


OPTION 3:

ESTIMATED CONSTRUCTION COST		Oct-24
ITEM		COST
Rising Main from Thembaletu PS 7 to transfer structure (Jonga Street):		R 5,414,000
315mm Ø, class 12 HDPE pipe, 1190 m in total		
Associated works: Road reinstatement, transfer structure		
SUBTOTAL		R 5,414,000
Preliminary and General (20%)		R 1,082,800
SUBTOTAL CONSTRUCTION COST		R 6,496,800
Contingencies (10%)		R 649,680
SUBTOTAL		R 7,146,480
Consumer Price Index (CPI) of 7.5%/year for 2 years		R 1,071,972
TOTAL CONSTRUCTION COST		R 8,218,452
ESTIMATED PROFESSIONAL FEES		
ITEM		COST
Engineering Fees (Civil)		R 753,973
Site Supervision (12-months)		R 500,000
Health and Safety (12-months)		R 80,000
Environmental Control Officer (ECO, 12-months)		R 80,000
TOTAL PROFESSIONAL FEES		R 1,413,973
SUBTOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)		R 9,632,425
VAT 15%		R 1,444,864
<u>TOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)</u>		<u>R 11,077,289</u>


OPTION 4:

ESTIMATED CONSTRUCTION COST		Oct-24
ITEM		COST
Gravity Main from Thembaletu PS 7 to Thembaletu East PS:		
450mm Ø, class 34 uPVC pipe, 240 m in total		R 840,000
Associated works: Road reinstatement, transfer structure		
Rising Main from Thembaletu East PS to transfer structure (Jonga Street):		
630mm Ø, class 12 HDPE pipe, 1190 m in total		R 9,240,000
Associated works: Road reinstatement, transfer structure		
Gravity Main from transfer structure in (Jonga Street) to Thembaletu PS 6:		
630mm Ø, class 34 uPVC pipe, 1790 m in total		R 11,235,000
Associated works: Road reinstatement, transfer structure		
SUBTOTAL		R 21,315,000
Preliminary and General (20%)		R 4,263,000
SUBTOTAL CONSTRUCTION COST		R 25,578,000
Contingencies (10%)		R 2,557,800
SUBTOTAL		R 28,135,800
Consumer Price Index (CPI) of 7.5%/year for 2 years		R 4,220,370
TOTAL CONSTRUCTION COST		R 32 356 170
ESTIMATED PROFESSIONAL FEES		
ITEM		COST
Engineering Fees (Civil)		R 2,840,056.00
Site Supervision (18-months)		R1,125,000.00
Health and Safety (18-months)		R180,000.00
Environmental Control Officer (ECO, 18-months)		R180,000.00
TOTAL PROFESSIONAL FEES		R 4,325,056,00
SUBTOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)		R 36,681,226,00
VAT 15%		R 5,502,183,90
<u>TOTAL (CONSTRUCTION COST + PROFESSIONAL FEES)</u>		<u>R 42,183 409,90</u>

NOTE: Cost can reduce if Option 1 gravity main is used in conjunction with a smaller gravity main.



8. ESTIMATED CASH FLOW

The estimated cash flow of the project will be based on the options chosen to be implemented. The cash flow below is based on the cost estimates for Options 1, 2, 3 and 4 and includes direct and indirect costs:

Table 3: Cashflow for various options

FINANCIAL YEAR	BUDGET	OPTION 1 (direct costs)	OPTION 1 (indirect costs)	OPTION 2 (direct costs)	OPTION 2 (indirect costs)	OPTION 3 (direct costs)	OPTION 3 (indirect costs)	OPTION 4 (direct costs)	OPTION 4 (indirect costs)	TOTAL
FY 23/24	R2 083 393	R 0	R 2 083 393	R 0	R 0	R 0	R 0	R 0	R 0	R 2 083 393
FY 24/25	R3 450 000	R 0	R 250 000	R 0	R 300 000	R 0	R 300 000	R 0	R 1 000 000	R 1 850 000
FY 25/26	R223 371	R 4 425 000	R 575 000	R 2 400 000	R 595 000	R 0	R 0	R 0	R 0	R 7 995 000
FY 26/27	R 7 526 403	R 16 800 000	R 1 200 000	R 7 046 514	R 657 668	R 0	R 0	R 0	R 0	R 25 704 182
FY 27/28 and beyond	R4 535 246	R 11 207 525	R 1 080 442	R 0	R 0	R 8 218 452	R 1 113 973	R 32 356 170	R 3 325 056	R 57 301 618
Total (Excl. Vat)	R17 818 413	R 32 432 525	R 5 188 835	R 9 446 514	R 1 552 668	R 8 218 452	R 1 413 973	R 32 356 170	R 4 325 056	R 94 934 193

Please refer to **Annexure F** for detailed monthly cash flow projections. The detailed cashflow only allow for the short terms options to be implemented (Options 1, 2 & 4).



9. WAY FORWARD

This Concept and Viability Report documents the potential options considered for implementation to achieve the project objectives. Due to various options discussed the recommendations are separated into short term and long term, the following recommendations are made.

Short Term:

9.1 Option 1

- Construction of bulk gravity sewer main ranging in size from 200mm to 450mm diameter.
- Decommissioning 6 sewer pump stations (Parkdene pump stations no. 2 and 3 and Thembaletu pump stations no. A, B, 1 and 2).
- Decommissioning and disconnection of existing gravity sewers where required.
- uPVC Class 34 pipe material for all gravity pipelines.
- HDPE pipe material for all rising mains, pending detailed hydraulic analysis.
- Pipeline alignments acceptable as proposed on preliminary layouts.

9.2 Option 2

- Upgrading Thembaletu pump station no. 7 from 16 l/s to 50 l/s. (pump station design discussed in concept and viability report, portion 2 report).
- Construction of new 355mm diameter (1766 m) gravity main from transfer structure in Jonga Street to Thembaletu pump station no. 6.
- New transfer structure in Jonga street.
- uPVC Class 34 pipe material for all gravity pipelines.
- HDPE pipe material for all rising mains, pending detailed hydraulic analysis.
- Pipeline alignments acceptable as proposed on preliminary layouts.

Medium Term:

9.3 Option 3

- Upgrading Thembaletu pump station no. 7 from 50 l/s to 80 l/s. (pump station design discussed in concept and viability report, portion 2 report)
- Construction of new 315 mm diameter (1170 m) rising main from Thembaletu pump station no. 7 to new transfer structure in Jonga Street.
- Maintain existing 200mm diameter rising main as an emergency back-up rising main from pump station no. 7 to transfer structure (located between Jonga and Zusakhe Streets).
- HDPE pipe material for all rising mains, pending detailed hydraulic analysis.
- Pipeline alignments acceptable as proposed on preliminary layouts.



Long Term:

9.4 Option 4:

- Construction of the new Thembaletu East pump station in a phased approach with Phase 1 estimated at 100-170 l/s.
- Construction of new gravity sewer pipeline to continue (replacement of Thembaletu pump station no. 7) to Thembaletu East pump station.
- Construction of new rising main from Thembaletu East pump station to new transfer structure in Jonga Street.
- Construction of new or parallel gravity sewer from transfer structure (Jonga Street) to Thembaletu pump station no. 6.
- uPVC Class 34 pipe material for all gravity pipelines.
- HDPE pipe material for all rising mains, pending detailed hydraulic analysis.
- Pipeline alignments acceptable as proposed on preliminary layouts.

10. CONCLUSION

In conclusion, it is recommended that the Municipality confirm the way forward and approve this report in order to commence with the detail design stage.



ANNEXURE A

Master Plan Sewerage System for George, Outeniqua drainage area (June 2024) by GLS Consulting



ANNEXURE B

George Municipality Sewer Master Plan Data (March 2022) – Current System and Future System



ANNEXURE C

Master Plan Sewerage System – Correspondence for GLS



ANNEXURE D

Proposed Layout Drawings



ANNEXURE E

Gravity and Rising Main Flow Calculations



ANNEXURE F

Estimated Cash Flow



ANNEXURE G

Geotechnical Report by Outeniqua Laboratory

ANNEXURE L:

*George Municipality confirmation of Electrical
services availability dated 09 June 2025*

Danie Greeff Pr.Eng
Deputy Director (Planning & Design)
Electro-Technical Services
E-mail: dgreeff@george.gov.za
Tel: +27 (0) 44 801 9221 Fax: +27 (0) 44 873 3776

Reference number:

Date: 9 June 2025

Enquiries: Danie Greeff

Attention: Mr. A Steenkamp

By E-Mail: andries@mne-oak.co.za

PROPOSED DEVELOPMENT: THEMBALETHU EAST PUMP STATION

With reference to your email request (4 June 2025) for confirmation of capacity. The proposed development was discussed and the preliminary proposal relating to the connection to the Municipal infrastructure was submitted to the Electrotechnical department for approval on 20 May 2025. This included the estimated electrical loading required.

The preliminary design and estimated loading were approved by the electrotechnical department in principle and the technical details of the installation will be determined once an approved Site Development Plan is finalised and an official application for electrical supply is submitted.

We can confirm that there is adequate spare capacity available on the George Municipal network to accommodate the proposed development in line with the preliminary planning submitted.

The Development will, however, be responsible for all required upgrading as needed in order to establish this capacity on site. The capacity required is calculated at: **650kVA**.

We trust that the above information is sufficient for the statutory approval process to be concluded.

Yours faithfully

Kind regards,



Danie Greeff Pr.Eng
Deputy Director (Planning & Design)
Electro-Technical Services

ANNEXURE M:

*DEADP - Acceptance Updated Environmental
Management Programme (EMPr) dated 17
November 2021*



REFERENCE: 16/3/1/1/D2/50/0060/12
ENQUIRIES: Shireen Pullen
DATE OF ISSUE: 17 November 2021

The Municipal Manager
George Municipality
Private Bag 19
GEORGE
6530

Attention: Ms. L. Mooiman

Tel: (044) 801 9111
Email: lc mooiman@george.gov.za

Dear Madam

**ACCEPTANCE OF THE UPDATED ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr) FOR
THEMBALETHU BULK SERVICES, GEORGE**

1. The above-mentioned document received by the Directorate: Development Management (Region 3) hereinafter referred to as "this Directorate" on 18 October 2021 refers.
2. Based on the review of the content of the updated EMPr and by virtue of the powers conferred on it by the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the Environmental Impact Assessment Regulations, 2014 (as amended), the competent authority herewith approves the amended EMPr.
3. In addition to the above, please be reminded that the EMPr is a working document and can be amended at times to address certain changes (if any) that may be required, provided that the outcomes of the EMPr are still the same and remains relevant.
4. Currently, the EMPr contains an updated Site Development Plan (SDP) and not the SDP referred to in the Environmental Authorisation (EA). In the new updated plan, the pipeline follows the contours slightly up the stream valley, instead of straight across, as indicated on the approved SDP. This section of pipeline was re-aligned to the top of the valley slope to avoid traversing the remaining Afrotropical Forest patches located within this section of the Schaapkop River Valley. It is hereby confirmed that no application for amendment is required as this slight change in the routing is considered to still be approximate to the site development plan approved as part of the development.
5. A compliance monitoring inspection will be undertaken after commencement of construction activities, in order to determine compliance with the Environmental Authorisation issued on 6 April 2021.

6. Your attention is further drawn to the audit requirements of the aforementioned Environmental Authorisation. Please note that in light of the recent official feedback received from the Chief Director: Development Planning regarding environmental audits, neither the Environmental Assessment Practitioner (EAP) or the Environmental Control Officer (ECO) can undertake an audit nor a person from the same company as the EAP or ECO, as it would represent a circumstance that may compromise the objectivity of the audit. Therefore, all audits to be conducted must be done by an independent auditor (not the EAP/ECO).
7. Please note that it is an offence in terms of Section 49A of the NEMA to fail to comply with the provisions of an Environmental authorisation. Failure to comply with the requirements of Section 24F of the NEMA shall result in the matter being referred to the Environmental Compliance and Enforcement Directorate of this Department. A person convicted of an offence in terms of the above is liable to a fine not exceeding R10 million or to imprisonment for a period not exceeding 10 years, or to both such fine and imprisonment.
8. Kindly quote the abovementioned reference number in any future correspondence in respect of the abovementioned development.
9. This Department reserves the right to revise initial comments and request further information from you based on any new or revised information received.

Yours faithfully

pp _____

**HEAD OF COMPONENT: ENVIRONMENTAL: IMPACT MANAGEMENT SERVICES
DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND DEVELOPMENT PLANNING**

Copies to:

Ms Siân Holder

Mr. A. Molendorf

Cape EAPrac

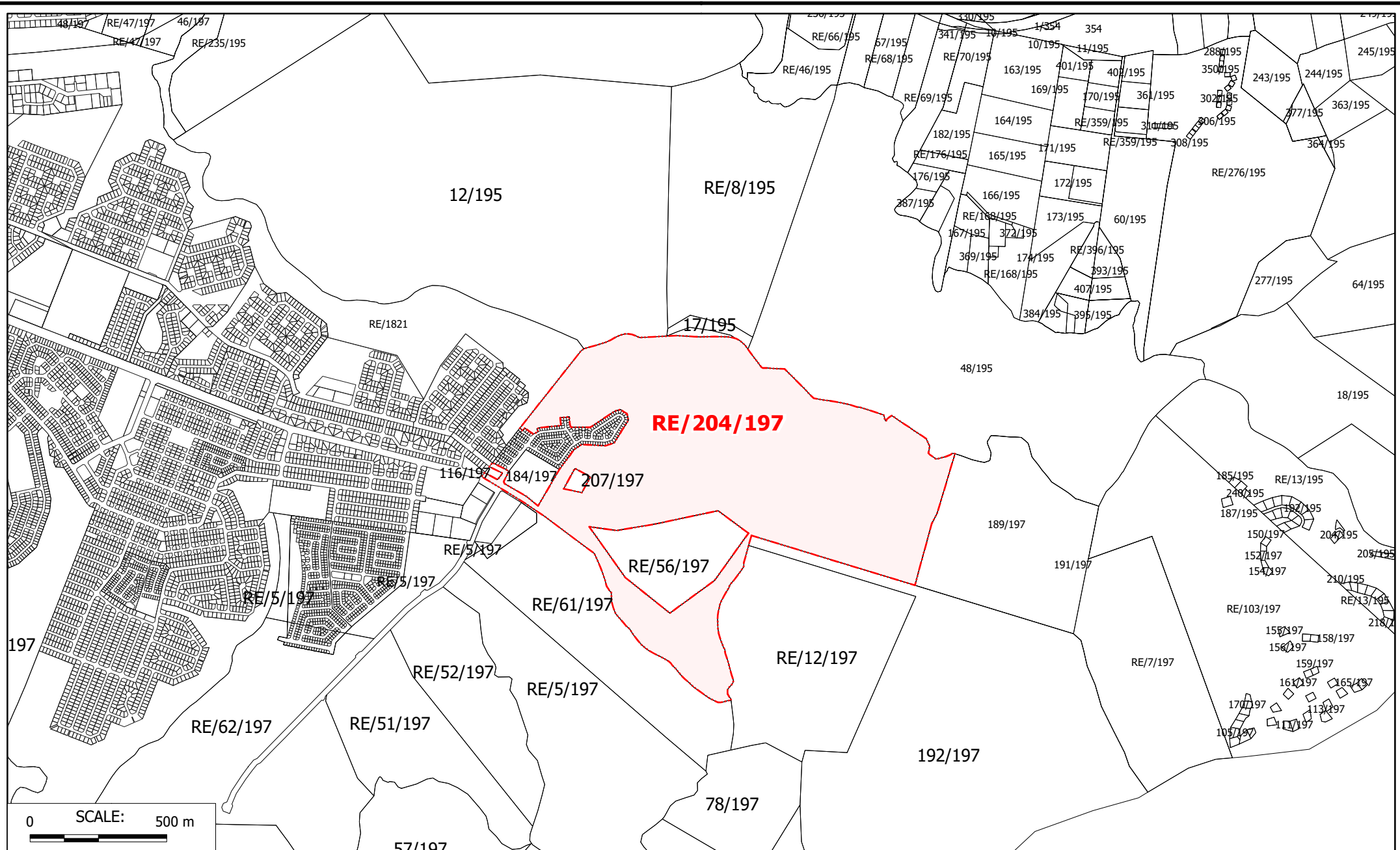
George Municipality

Email: sian@cape-eaprac.co.za

Email: avmolendorff@george.gov.za

PLAN 1:

Locality Plan



**THE REMAINDER OF PORTION 204
OF THE FARM SAND KRAAL NO 197**

LOCALITY PLAN



Projection: Transverse Mercator
Centre Lon: 22°30'51" E
Centre Lat: 34°00'30" S
Created: 8/14/2026
Scale: 1:18000



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PLAN 2:

Subdivision Plan – Pr26/27SUB-01

12/195

LEGEND

 THE REMAINDER OF PORTION 204 OF THE FARM SAND KRAAL NO 197

 PORTION A (±1.6440 Ha) - Utility zone (UZ)
of Portion 204 of the Farm Sand Kraal No 197

 Remainder - Portion 204 of the Farm Sand Kraal No 197

PROPOSED SERVITUDES

 PIPELINE SERVITUDES

 RIGHT-OF-WAY SERVITUDE

NOTES:

1. Sizes and dimensions are approximate and subject to final survey
2. For property info, refer to SG 218/2014

**PTN A OF 204/197
(±1.644 Ha)**

RE OF 16/197

SCALE:

100 m

**THE REMAINDER OF PORTION 204
OF THE FARM SAND KRAAL NO 197**

SUBDIVISION PLAN (SHEET 1 OF 3)



Projection: Transverse Mercator
Centre Lon: 22°30'45" E
Centre Lat: 34°00'20" S
Pr26/27-SUB01
Created: 2026/06/18
Scale: 1:1900



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12/195

LEGEND

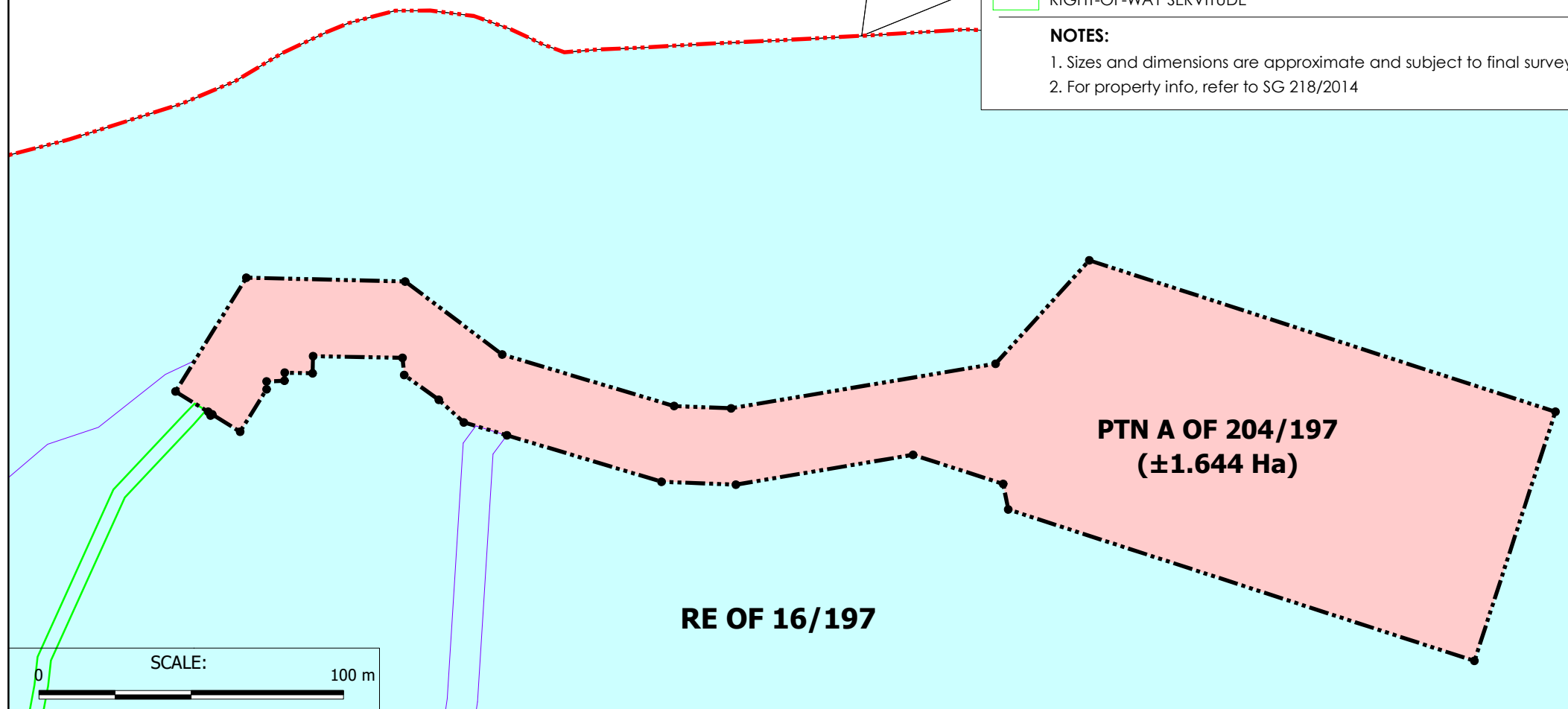
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-  PORTION A (±1.6440 Ha) - Utility zone (UZ) of Portion 204 of the Farm Sand Kraal No 197
-  Remainder - Portion 204 of the Farm Sand Kraal No 197

PROPOSED SERVITUDES

-  PIPELINE SERVITUDES
-  RIGHT-OF-WAY SERVITUDE

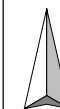
NOTES:

- Sizes and dimensions are approximate and subject to final survey
- For property info, refer to SG 218/2014



THE REMAINDER OF PORTION 204
OF THE FARM SAND KRAAL NO 197

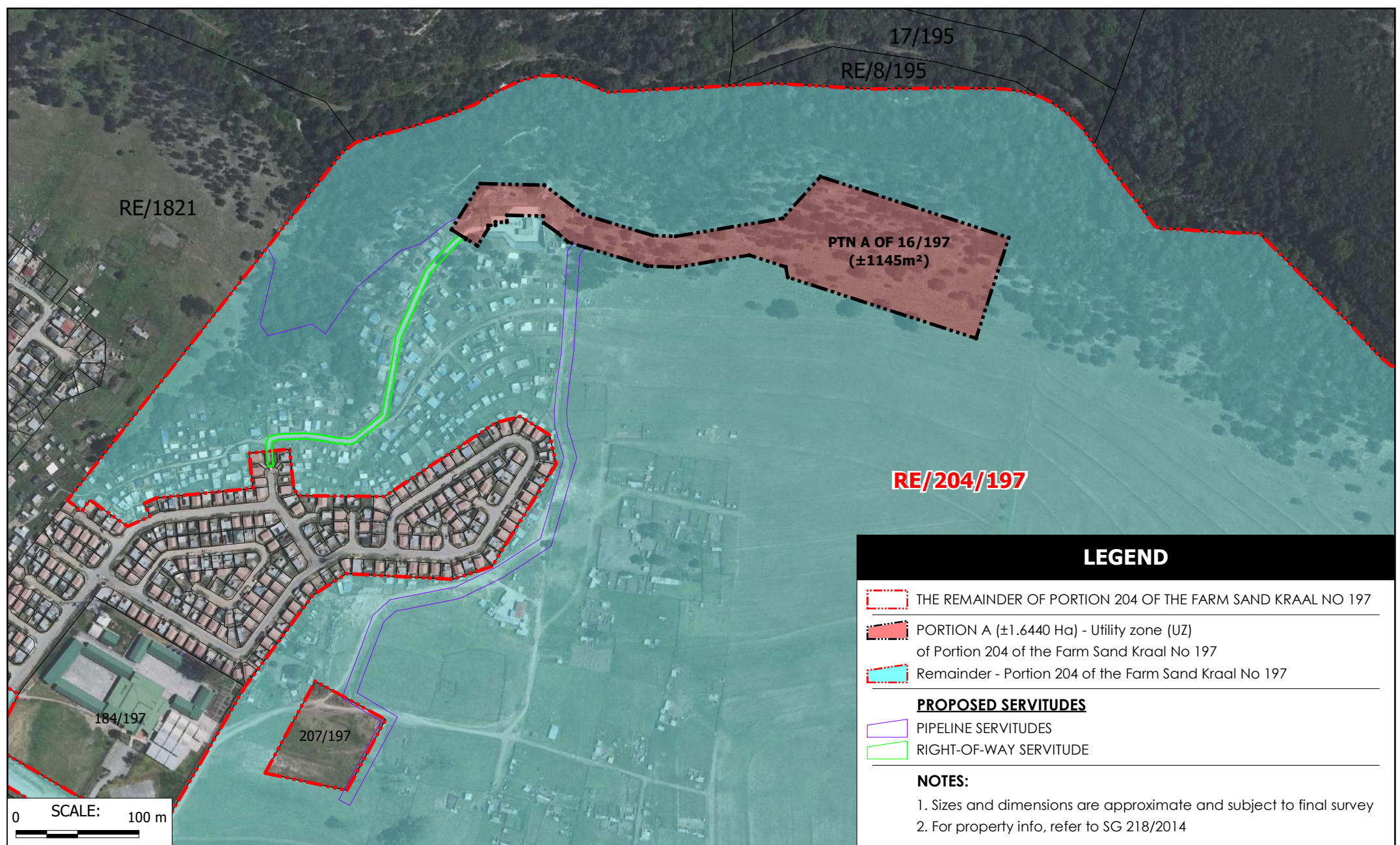
SUBDIVISION PLAN (SHEET 1 OF 3)



Projection: Transverse Mercator
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Centre Lat: 34°00'20" S
Pr26/27-SUB01
Created: 2026/06/18
Scale: 1:1900



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LEGEND

- THE REMAINDER OF PORTION 204 OF THE FARM SAND KRAAL NO 197
- PORTION A (±1.6440 Ha) - Utility zone (UZ) of Portion 204 of the Farm Sand Kraal No 197
- Remainder - Portion 204 of the Farm Sand Kraal No 197

PROPOSED SERVITUDES

- PIPELINE SERVITUDES
- RIGHT-OF-WAY SERVITUDE

NOTES:

1. Sizes and dimensions are approximate and subject to final survey
2. For property info, refer to SG 218/2014

THE REMAINDER OF PORTION 204
OF THE FARM SAND KRAAL NO 197

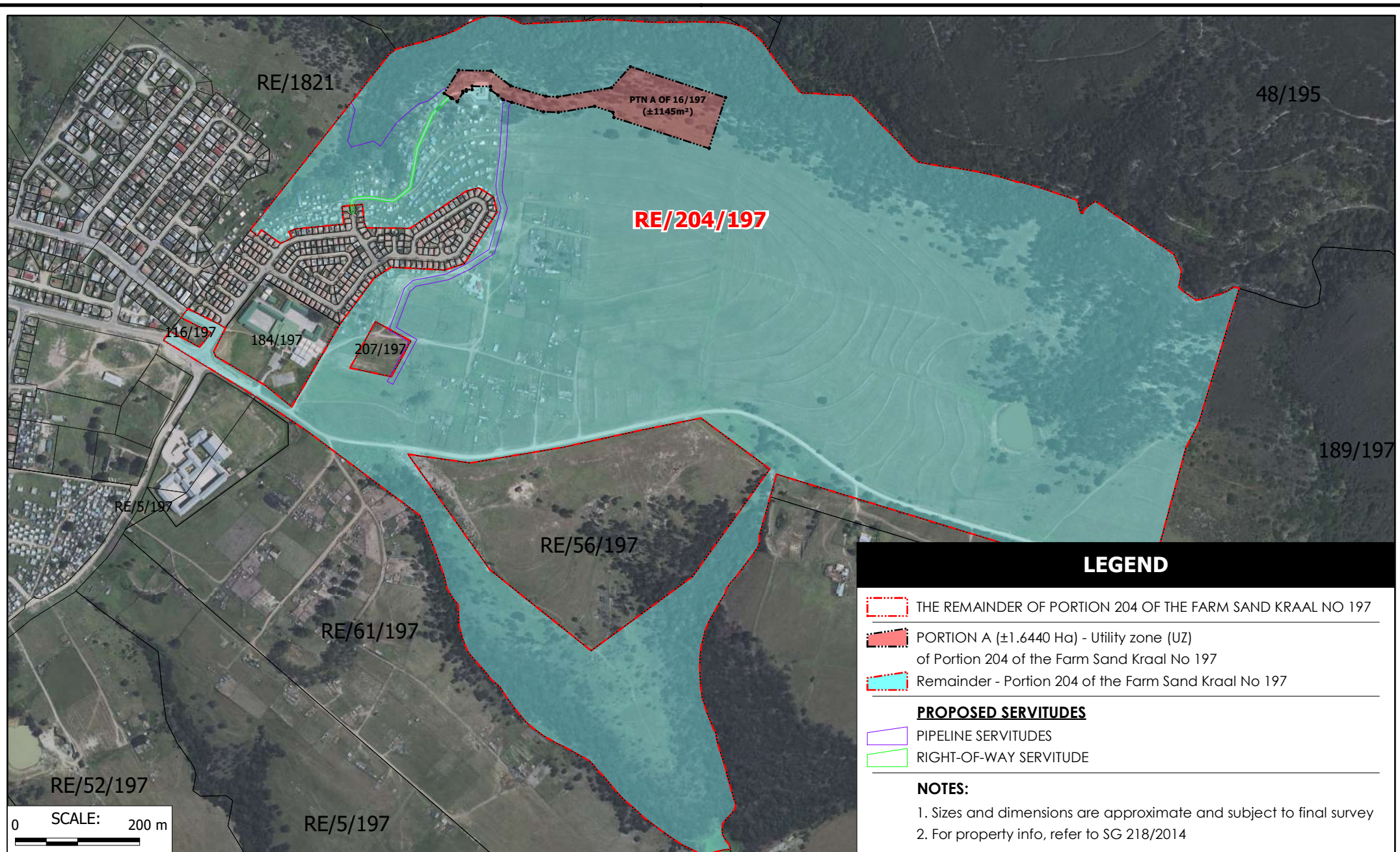
SUBDIVISION PLAN (SHEET 2 OF 3)



Projection: Transverse Mercator
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Centre Lat: 34°00'27" S
Pr26/27-SUB01
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Scale: 1:4000



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THE REMAINDER OF PORTION 204
OF THE FARM SAND KRAAL NO 197

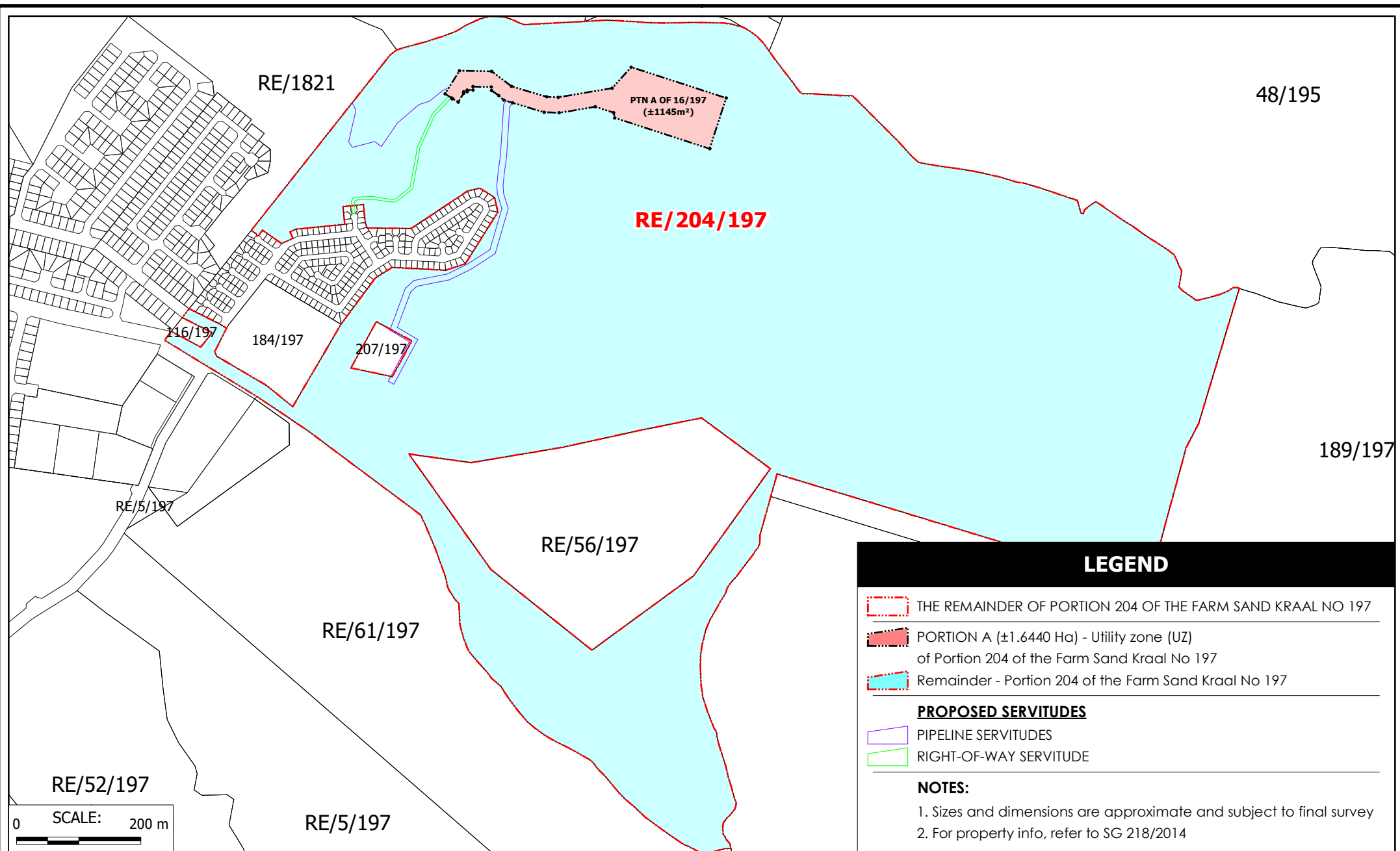
SUBDIVISION PLAN (SHEET 3 OF 3)



Projection: Transverse Mercator
Centre Lon: 22°30'53" E
Centre Lat: 34°00'40" S
Pr26/27-SUB01
Created: 2026/06/18
Scale: 1:7900



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LEGEND

- THE REMAINDER OF PORTION 204 OF THE FARM SAND KRAAL NO 197
- PORTION A (±1.6440 Ha) - Utility zone (UZ) of Portion 204 of the Farm Sand Kraal No 197
- Remainder - Portion 204 of the Farm Sand Kraal No 197

PROPOSED SERVITUDES

- PIPELINE SERVITUDES
- RIGHT-OF-WAY SERVITUDE

NOTES:

1. Sizes and dimensions are approximate and subject to final survey
2. For property info, refer to SG 218/2014

THE REMAINDER OF PORTION 204
OF THE FARM SAND KRAAL NO 197

SUBDIVISION PLAN (SHEET 3 OF 3)



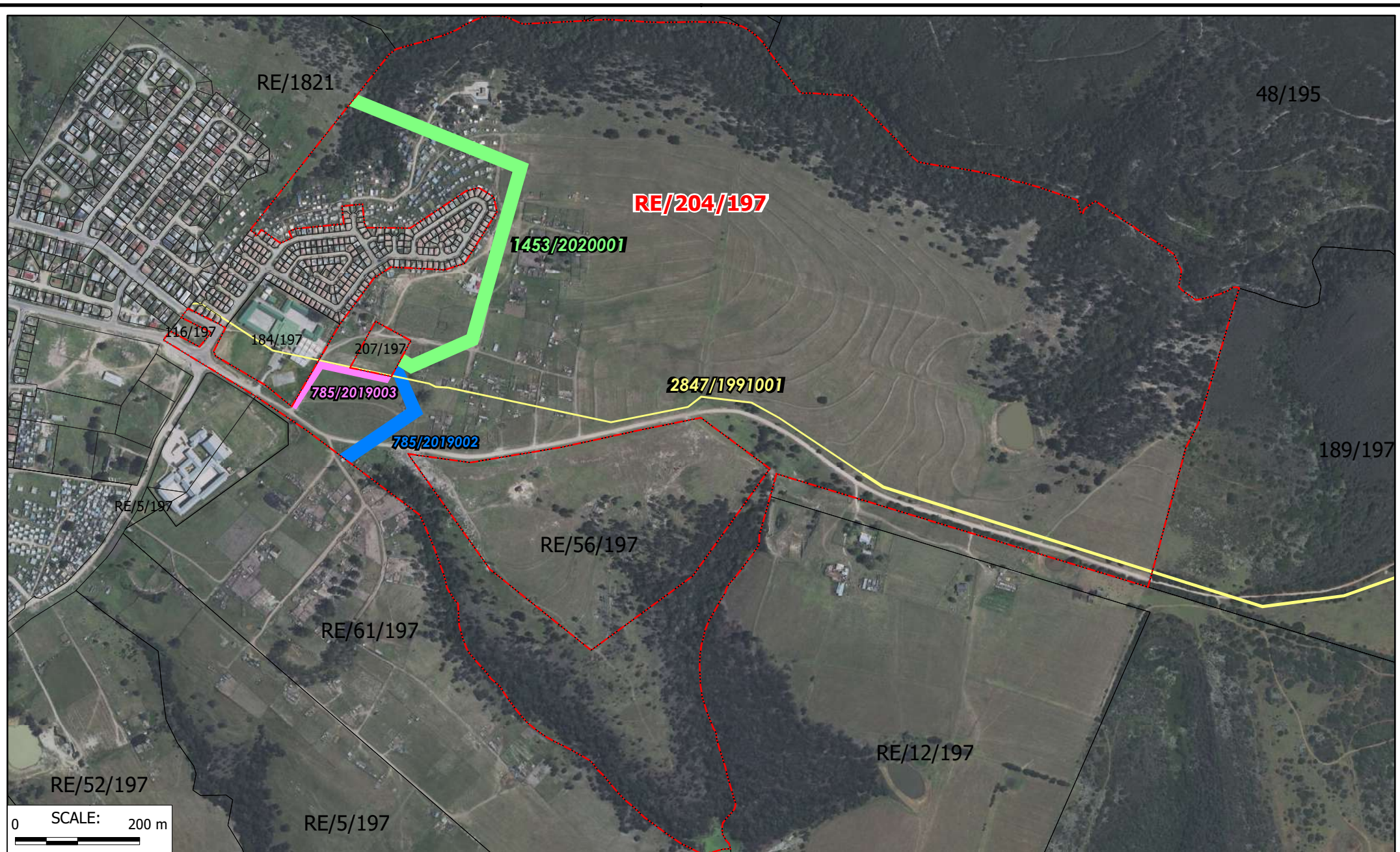
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Scale: 1:7900



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PLAN 3:

Servitude Plan – Pr26/27-SERV01



THE REMAINDER OF PORTION 204
OF THE FARM SAND KRAAL NO 197

EXISTING SERVITUDES



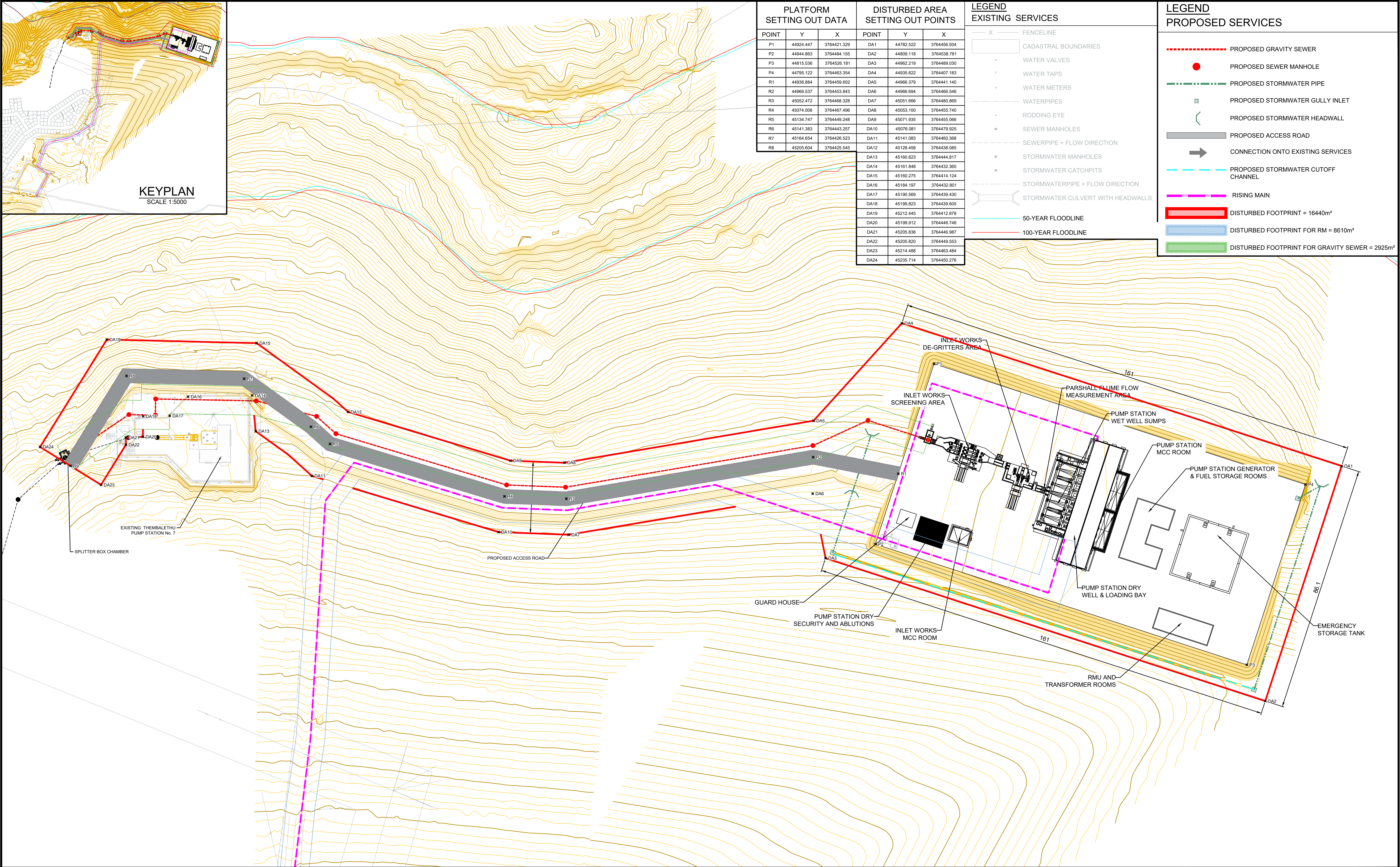
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Pr26/27-SERV-01
Created: 2026/06/18
Scale: 1:7900



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PLAN 4:

*Engineering Drawings - Lyners Consulting
Engineers dated 23 October 2026*



PLATFORM SETTING OUT DATA			DISTURBED AREA SETTING OUT POINTS		
POINT	Y	X	POINT	Y	X
P1	44924.447	3764421.329	DA1	44782.522	3764456.934
P2	44944.863	3764484.155	DA2	44809.118	3764538.781
P3	44815.536	3764526.181	DA3	44962.219	3764489.030
P4	44795.122	3764463.354	DA4	44935.622	3764407.183
R1	44936.884	3764459.602	DA5	44966.379	3764441.140
R2	44966.537	3764453.843	DA6	44966.094	3764466.546
R3	45052.472	3764468.328	DA7	45051.666	3764480.869
R4	45074.008	3764467.496	DA8	45053.100	3764455.740
R5	45134.747	3764449.248	DA9	45071.935	3764455.066
R6	45141.383	3764443.257	DA10	45076.081	3764479.925
R7	45164.654	3764426.523	DA11	45141.083	3764460.368
R8	45205.604	3764425.545	DA12	45128.458	3764438.085
			DA13	45160.623	3764444.817
			DA14	45161.848	3764432.365
			DA15	45160.275	3764414.124
			DA16	45184.197	3764432.801
			DA17	45190.569	3764439.430
			DA18	45199.823	3764439.605
			DA19	45212.445	3764412.878
			DA20	45199.912	3764446.748
			DA21	45205.836	3764446.987
			DA22	45205.820	3764449.553
			DA23	45214.488	3764463.484
			DA24	45235.714	3764450.276

LEGEND EXISTING SERVICES	
— X —	FENCELINE
[Symbol]	CADASTRAL BOUNDARIES
•	WATER VALVES
•	WATER TAPS
•	WATER METERS
---	WATERPIPES
•	RODDING EYE
•	SEWER MANHOLES
---	SEWERPIPE + FLOW DIRECTION
•	STORMWATER MANHOLES
•	STORMWATER CATCHPITS
---	STORMWATERPIPE + FLOW DIRECTION
[Symbol]	STORMWATER CULVERT WITH HEADWALLS
---	50-YEAR FLOODLINE
---	100-YEAR FLOODLINE

LEGEND PROPOSED SERVICES	
---	PROPOSED GRAVITY SEWER
•	PROPOSED SEWER MANHOLE
---	PROPOSED STORMWATER PIPE
[Symbol]	PROPOSED STORMWATER GULLY INLET
[Symbol]	PROPOSED STORMWATER HEADWALL
---	PROPOSED ACCESS ROAD
→	CONNECTION ONTO EXISTING SERVICES
---	PROPOSED STORMWATER CUTOFF CHANNEL
---	RISING MAIN
[Symbol]	DISTURBED FOOTPRINT = 16440m²
[Symbol]	DISTURBED FOOTPRINT FOR RM = 8610m²
[Symbol]	DISTURBED FOOTPRINT FOR GRAVITY SEWER = 2925m²

SCALEBAR

0 30 60

Meters 1:1000

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All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

B	MINOR AMENDMENTS	25-10-23	AL	CD
A	FOR INFORMATION	25-10-20	AL	CD
REV	DESCRIPTION	DATE	REV BY	CHKD
REVISIONS				

DESIGNED AL/JJP

DRAWN AL

CHECKED CD

CONSULTING ENGINEERS

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email: bellville@lyniers.co.za

APPROVED

ENGINEERS: _____

DATE: 2025-10-23

APPROVED

CLIENT: _____

DATE: _____

CLIENT

GEORGE

THE CITY FOR ALL REASONS

PROJECT

UPGRADING OF THEMBALETHU PUMP STATION 7 AND CONSTRUCTION OF THE NEW THEMBALETHU REGIONAL PUMP STATION: PORTION 2: CIVIL, STRUCTURAL, MECHANICAL & ELECTRICAL WORKS

TITLE

GENERAL ARRANGEMENT WITH PROPOSED SERVICES

SCALE on A1 AS SHOWN

CONTRACT No. CE

DRAWING No. 23176-CG-000-01

COORDINATE SYSTEM: WGS84 / L203

SHEET 1 OF 1

PROJECT No. 23176CG

REV B

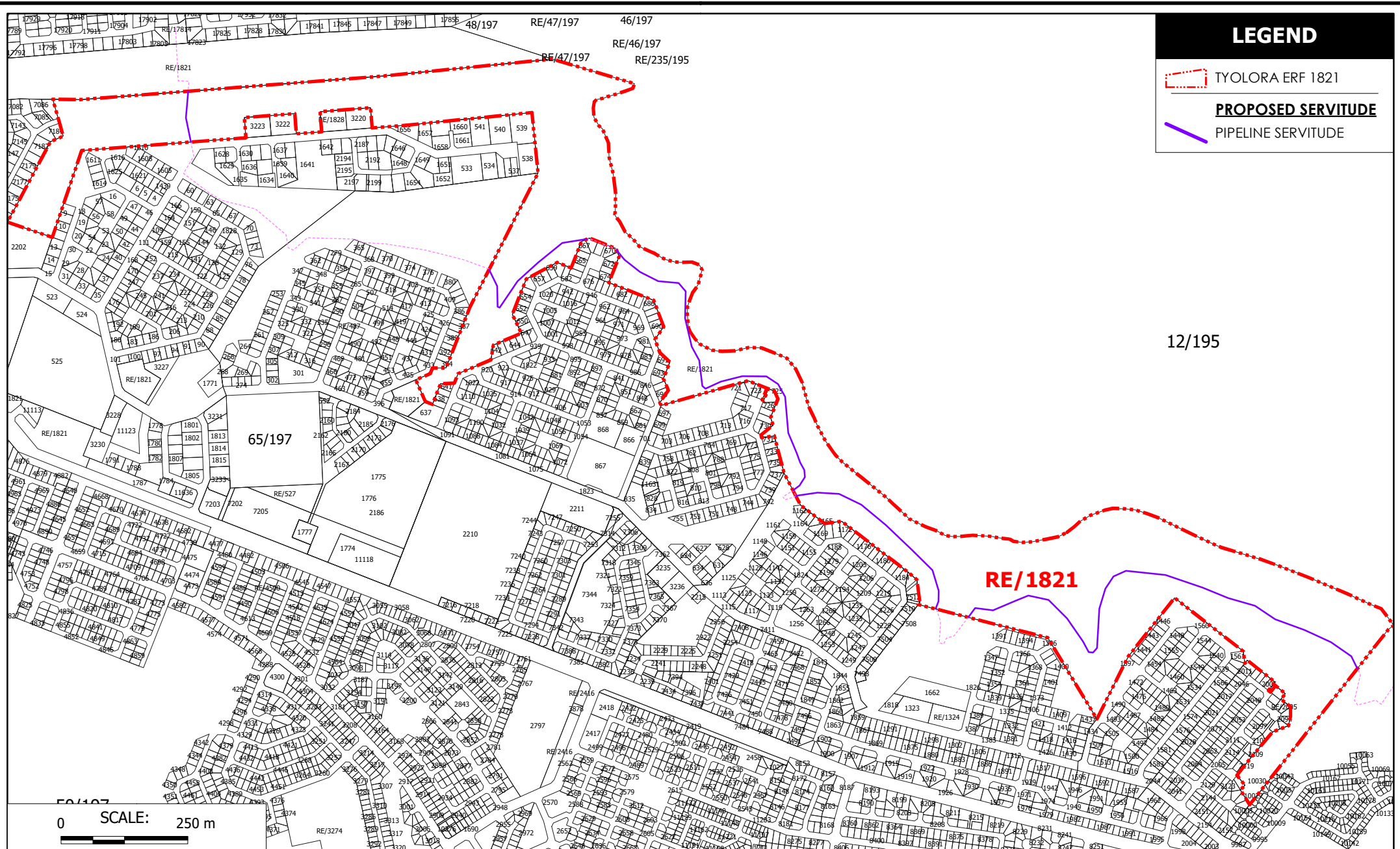
2025-10-22

2025-10-22

Arnold Low

PLAN 5:

Subdivision Plan – Pr26/27-EXEMPT-01



LEGEND

TYOLORA ERF 1821

PROPOSED SERVITUDE

PIPELINE SERVITUDE

12/195

RE/1821

THE REMAINDER OF
TYOLORA ERF 1821

SUBDIVISION PLAN (SERVITUDE)



Projection: Transverse Mercator
Centre Lon: 22°29'41" E
Centre Lat: 34°00'07" S
Plan No: Pr26/27-EXEMPT-01
Created: 2026/06/19
Scale: 1:9700



Stads & Omgevingsplanneers

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