

# MOSSEL BAY

## PROPOSED NEW SOCIAL HOUSING DEVELOPMENT ON ERVEN 2667, 2686 & 2687, GROOT BRAKRIVIER, MOSSEL BAY.



### TECHNICAL REPORT ON THE PROVISION OF CIVIL INFRASTRUCTURE SERVICES

### REPORT NO. 01 (REVISION 01)

16 JULY 2026

#### Compiled for:

Mossel Bay Municipality  
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|                            |                                                                                                  |
|----------------------------|--------------------------------------------------------------------------------------------------|
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**Date** 16 JULYn 2026

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LOCALITY PLAN – MOSSEL BAY



# PROPOSED NEW SOCIAL HOUSING DEVELOPMENT ON ERVEN 2667, 2686 & 2687, GROOT BRAKRIVIER, MOSSEL BAY.

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## 1. INTRODUCTION

Marike Vreken Town Planners CC, on behalf of Mossel Bay Municipality, appointed V3 Consulting Engineers (Pty) Ltd to prepare a services report for the provision of Civil Infrastructure Services for the proposed new Social Housing Development on Erven 2667, 2686 & 2687, Groot Brakrivier, Mossel Bay.

The proposed development, as depicted by Marike Vreken Town Planners and attached as ANNEXURE A, comprises the following:

- 25 x freehold residential erven,
- 1 x clinic site,
- 1 x private open space for a multi-purpose sports centre, and
- 1 x public open space.

## 2. DESIGN AND CONSTRUCTION STANDARDS

The minimum standards proposed for the civil services and pertaining infrastructure will comply with the “Guidelines for Human Settlements, Planning and Design” as compiled under patronage of the Department of Housing by CSIR Building & Construction Technology (also known as the “Red Book”) as well as any specific requirements prescribed by the Local Authority, Mossel Bay Municipality.

The relevant code of standards (i.e. SANS 1200, etc.) should be made applicable to material and construction standards.

## 3. TOPOGRAPHY

Erven 2667, 2686 & 2687 (*The Site*) is approximately 1.47 hectares in size and is currently not developed.

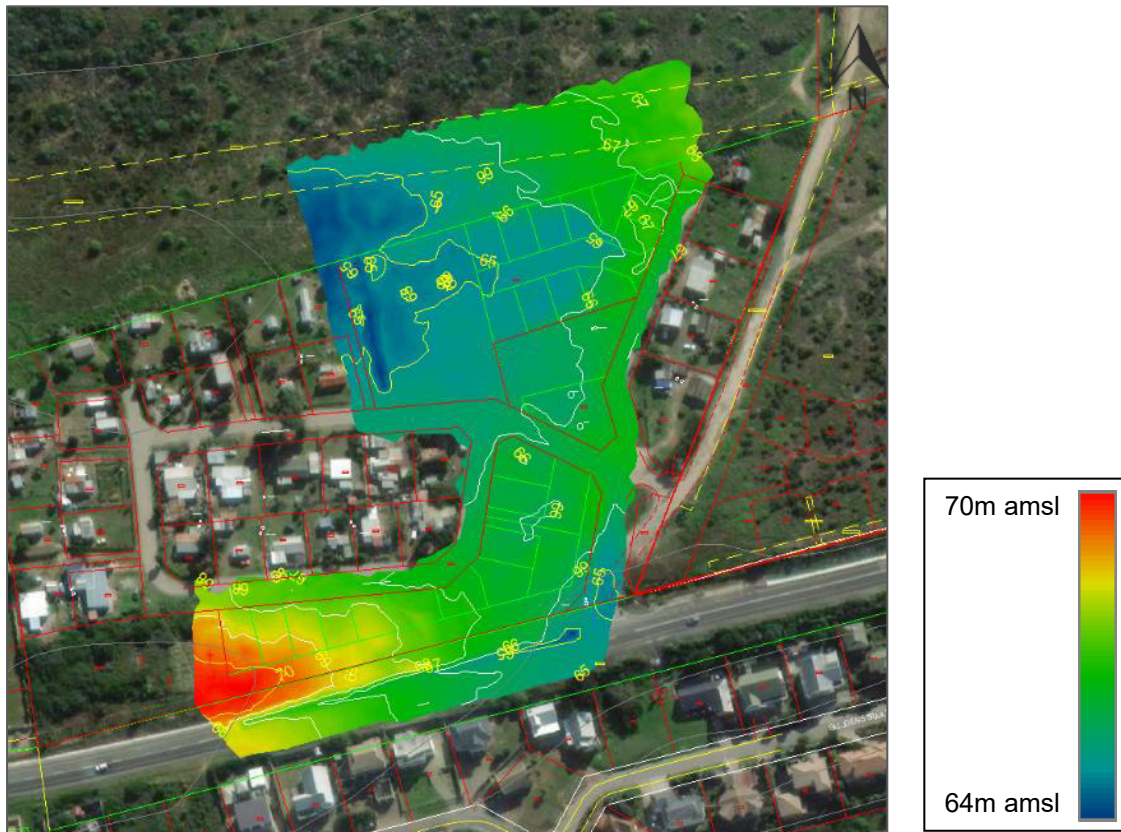


Figure 1: Site Topography

The topography of the area is fairly flat and level. The drainage ranges from the north-east to the north-west direction with an approximate slope of 4% or 1:24, with an isolated low point located to the north-west of the proposed site.

## **4. GEOTECHNICAL CONDITIONS**

A Phase 1 Geotechnical Report was prepared by Outeniqua Geotechnical Services and dated 25 May 2026. Refer to ANNEXURE B

## **5. PROPOSED SERVICES**

### **5.1 Sanitation**

Refer to ANNEXURE C, for the Capacity Analysis Report of the Bulk Sewer Services done by GLS Consulting (Pty)Ltd on the current Municipal sewer network.

This is a detailed report, and the main points are summarised as follows:

#### **5.1.1 Sewage Removal**

Sewage will be removed by means of a waterborne gravity sewer network. The gravity sewer network will consist of 110mm & 160mm diameter uPVC sewer pipes and 1,0m diameter concrete sewer manholes. The estimated length of the network is approximately 348m and approximately 11 manholes will need to be constructed.

The proposed sewer network will drain to a low point on Public Open Space (currently erf 2686), from where it will need to be pumped by means of a small underground sewerage pump station to the nearest gravity main sewer located approximately 235 m east of the proposed development near Helderkruijn Lane.

The proposed connection point to the existing sewer system is to the existing 200 mm dia. uPVC pipeline situated in a pipeline servitude in the Seesig Development as shown in Figure 2 in ANNEXURE C from where the sewage will gravitate to the existing Toekoms Pumping Station (PS). From this PS the sewage is pumped directly to the existing Great Brak Wastewater Treatment Plant (WWTP).

The peak day dry weather flow (PDDWF) for the proposed development on Erven 2667, 2686 & 2687 was calculated at 15,0 kL/d.

The existing sewer reticulation system has sufficient capacity to accommodate the proposed development on Erven 2667, 2686, and 2687.

Refer to ANNEXURE D, drawing 11599000-002 for the preliminary sewer network design.

### **5.2 Water**

Refer to ANNEXURE C for the Capacity Analysis Report of the Bulk Water Services conducted by GLS Consulting (Pty) Ltd on the current Municipal water network.

This is a detailed report and the main points are summarised as follows:

### 5.2.1 Water Supply

The total annual average daily demand (AADD) and required fire flow for the proposed development on Erven 2667, 2686 & 2687 was calculated as follows:

- 25 Residential erven (High density, small sized) @ 0,6 kL/d/unit = 15,0 kL/d
- 0,19 ha Business/Commercial @ 20,8 kL/d/ha = 4,0 kL/d
- Total = 19,0 kL/d

As per Table J.2 from Section J - Water Supply of "The Neighbourhood Planning and Design Guide" (so-called "Red book").

- Fire flow criteria (Moderate risk) = 25 L/s @ 15 m

The development will be serviced by means of a water network consisting of uPVC water pipes of 90mm to 110mm diameter (total estimated length 390m) installed in road reserves. The proposed connection point is to the existing 200 mm Ø supply pipeline situated in Helderkruijn Lane, as shown in Figure 1 in ANNEXURE C.

The existing system has sufficient capacity to supply the domestic water demand during peak demand conditions to the proposed development.

There is also sufficient capacity in the existing water reticulation network of the Sandhoogte Water Treatment Plant (WTP) Great Brak River (GBR) reservoir water distribution zone to provide fire flow of more than 25,0 L/s to the proposed development.

Storage capacity in the Sandhoogte WTP GBR reservoir to accommodate the proposed development.

Refer to ANNEXURE D, drawing 11599000-002, for the preliminary water network design.

## 5.3 Roads and Storm Water

### 5.3.1 Internal Roads

The proposed development will be accessed from Main Road MR344 via the existing public roads within the surrounding established township, namely Dagbreek – and Helderkruijn Lane. All new roads and parking for the proposed development will be provided with a permanent surface finish (80mm Interlocking cement pavement blocks). Edging and kerbs will be provided on all sides of the roads and parking in accordance with SANS standards. Due to the size of the proposed development, the use of pedestrian sidewalks is not foreseen.

The total estimated area to be surfaced is 382m<sup>2</sup> with associated kerbs and edging.

### 5.3.2 External Roads

A TIA is prepared by Others and the proposed Development will comply with any approved recommendations.



### **5.3.3 Storm water Drainage and Management**

Refer to ANNEXURE D, drawing 11599000-002 for the existing Municipal storm water network.

Stormwater from the existing and proposed Development is directed to the north and discharged into the Public Open Space erf, where it will soak into the natural permeable soil.

From the Phase 1 Geotechnical investigation, soils are classified as “Soft – Fine Sand” to depths in excess of 3m with “moderate permeability” and are suitable for stormwater infiltration.

Provision is made for a stormwater soakaway pond on the Public Open Space erf.

Refer to ANNEXURE D, drawing 11599000-002 for the preliminary storm water network design.

A stormwater master plan must be provided to the Municipality for approval before construction may start.

### **5.4 Refuse Removal**

Refuse removal will be done by the Mossel Bay Municipality as part of their normal services provided.

No hazardous waste is expected to be generated waste will generally be household waste.

## **6. CONCLUSION**

In conclusion, the provision of civil infrastructure services for the proposed new Social Housing Development on Erven 2667, 2686 & 2687, Groot Brakrivier, Mossel Bay, as outlined in this report, aims to ensure compliance with established design and construction standards.

The Site is deemed to be viable for development and will contribute positively to the greater development of Mossel Bay.

Refer to ANNEXURE E for confirmation of Municipal Sewer and Water infrastructure to service erven 2667, 2686 & 2687.

--END--

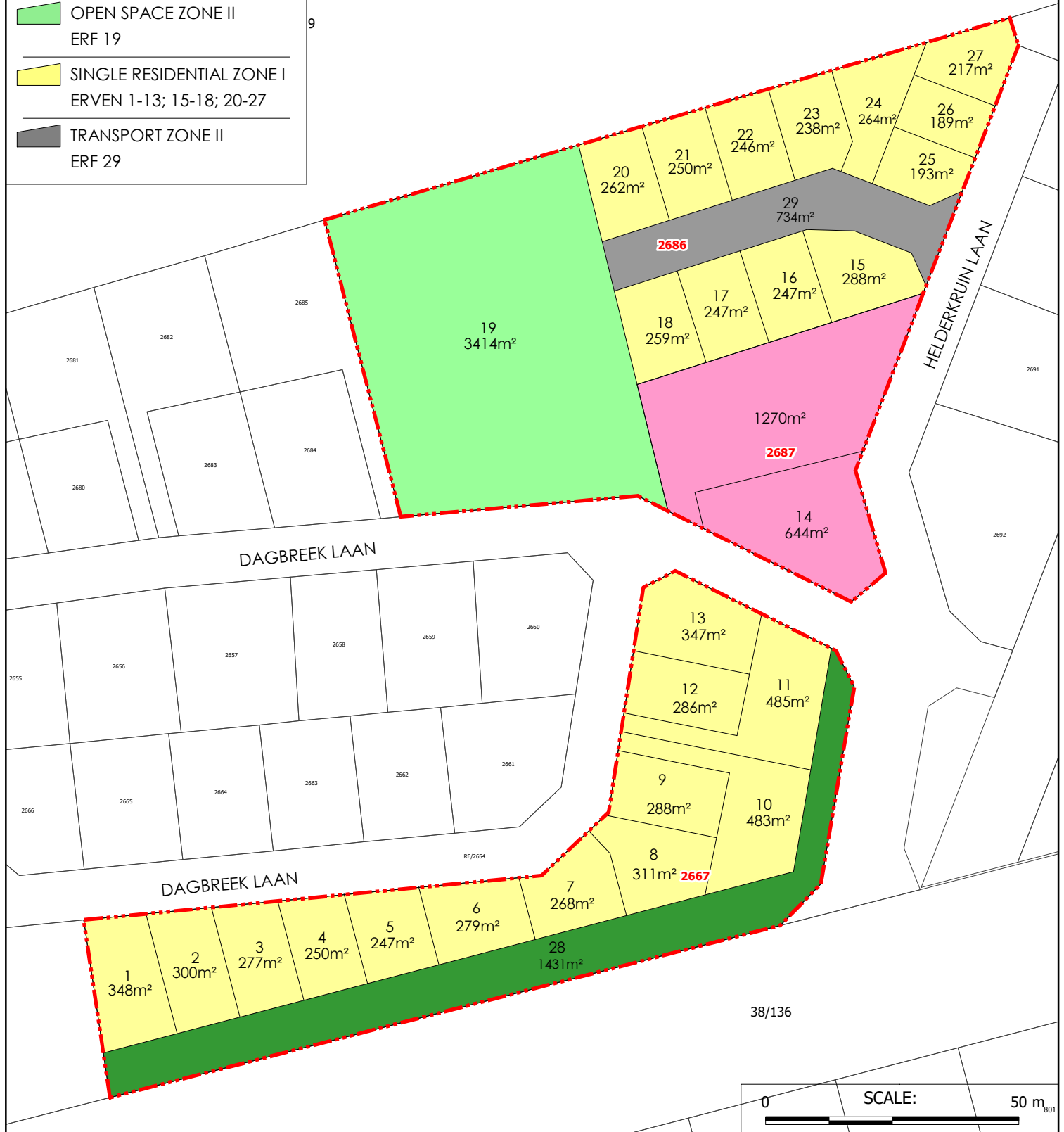
# ANNEXURE A

## PROPOSED SITE DEVELOPMENT PLAN

## LEGEND

### LAND USE / ERF NUMBER

- APPLICATION AREA
- COMMUNITY ZONE III  
ERF 14
- OPEN SPACE ZONE I  
ERF 28
- OPEN SPACE ZONE II  
ERF 19
- SINGLE RESIDENTIAL ZONE I  
ERVEN 1-13; 15-18; 20-27
- TRANSPORT ZONE II  
ERF 29



**GROOT BRAKRIVIER  
ERVEN 2667, 2686 & 2687**

## LAYOUT PLAN



Projection: Transverse Mercator  
Centre Lon: 22°11'43" E  
Centre Lat: 34°03'47" S  
Plan No: Pr2404GB-2667&2686L05  
Created: 2024/10/30  
Scale: 1:1100

Sheet: 1 of 2 (Aggregated Project) (P2404) - Groot Brakrivier 2667, 2686 & 2687 (P2404) - 02 Erven 2667, 2686 & 2



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# ANNEXURE B

## PHASE 1 GEOTECHNICAL INVESTIGATION REPORT



# PHASE 1 GEOTECHNICAL REPORT

## PROPOSED MIDDLE INCOME HOUSING PROJECT ON ERVEN 2667, 2686 & 2687, GREAT BRAK, PROVINCE OF THE WESTERN CAPE

25 May 2026

Revision 0



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Geotechnical Report 25.05.2026 Rev 0

Report review history:

| Revision No | Date       | Prepared by:       | Reviewed by:                    | Approved by:                                                                        |
|-------------|------------|--------------------|---------------------------------|-------------------------------------------------------------------------------------|
| 0           | 25.05.2026 | G Mmako Pr Sci Nat | I. Paton Pr Sci Nat Pr Tech Eng | I. Paton Pr Sci Nat Pr Tech Eng (Pr # 2019300500)                                   |
|             |            |                    |                                 |  |

Authors qualifications and affiliations:

Iain Paton has post graduate degrees in Geology and Geotechnical Engineering and 30 years' experience in the mining, energy and construction industries. Iain Paton is a registered geotechnical professional with the Engineering Council of South Africa (ECSA) and the South African Council for Natural and Scientific Professions (SACNSP). Iain Paton is a member of the Geotechnical Division of the South African Institute of Civil Engineering (SAICE), South African Institute of Engineering and Environmental Geologists (SAIEG), the and the Institute of Municipal Engineering of South Africa (IMESA).

Gift Mmako has an Honours degree in geology and is a registered Professional Natural Scientist with the South African Council for Natural and Scientific Professions (SACNSP).

Declaration of independence:

The author of this report is independent professional consultant with no vested interest in the project, other than remuneration for work associated with the compilation of this report.

General limitations:

1. The investigation has been conducted in accordance with generally accepted engineering practice, and the opinions and conclusions expressed in the report are made in good faith based on the information at hand at the time of the investigation.
2. The contents of this report are valid as of the date of preparation. However, changes in the condition of the site can occur over time as a result of either natural processes or human activity. In addition, advancements in the practice of geotechnical engineering and changes in applicable practice codes may affect the validity of this report. Consequently, this report should not be relied upon after an elapsed period of one year without a review by this firm for verification of validity. This warranty is in lieu of all other warranties, either expressed or implied.
3. Unless otherwise stated, the investigation did not include any specialist studies, including but not limited to the evaluation or assessment of any potential environmental hazards or groundwater contamination that may be present.
4. The investigation is conducted within the constraints of the budget and time and therefore limited information was available. Although the confidence in the information is reasonably high, some variation in the geotechnical conditions should be expected during and after construction. The nature and extent of variations across the site may not become evident until construction. If variations then become apparent this could affect the proposed project, and it may be necessary to re-evaluate recommendations in this report. Therefore, it is recommended that Outeniqua Geotechnical Services is retained to provide specialist geotechnical engineering services during construction in order to observe compliance with the design concepts, specifications and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction. Any significant deviation from the expected geotechnical conditions should be brought to the author's attention for further investigation.
5. The assessment and interpretation of the geotechnical information and the design of structures and services and the management of risk is the responsibility of the appointed engineer.

## EXECUTIVE SUMMARY

Outeniqua Geotechnical Services was appointed by Marike Vreken Town Planners on behalf of their client, Mossel Bay Municipality, to undertake a Phase 1 geotechnical site investigation of a proposed middle income housing project in the town of Great Brak, located between Mossel Bay and George in the Province of the Western Cape.

The proposed housing project consisted of several single storey detached dwellings catering for middle-income bracket families. The development area consisted of three individual land parcels: Erf 2667 (0.57ha), Erf 2687 (0.19ha) and Erf 2686 (0.71ha), with a combined total area of 1.47ha.

The site investigation involved a desk study, site walkover and subsurface investigation consisting of test pits, insitu tests and laboratory tests to determine the geotechnical nature of the site.

The topography of the area was gentle (nearly flat) but slightly uneven/hummocky in places. The site was largely vacant but there were two small single storey buildings on Erf 2687, a playground on Erf 2686 and there was a cemetery just beyond the western boundary of Erf 2667. The vegetation cover consisted of long grass and scattered fynbos bushes. There was a storm water culvert on the southwestern corner and on the eastern boundary of Erf 2686. Access to the site was easily gained from the surrounding paved roads.

The geology of the area consisted of aeolian Quaternary sand deposits underlain by Cretaceous-aged mudstone, siltstone and sandstone of the Kirkwood Formation of the Uitenhage Group at unknown depth.

Subsurface investigations revealed fairly consistent soil profile across the site dominated by fine sand of aeolian and/or pedogenic origin. At some test positions the insitu soil was overlain by a layer of uncontrolled fill consisting of silty fine sand with bits of rubbish. The subsurface investigations facilitated the broad-scale mapping of the site into two geotechnical terrains consisting of compressible soils (S1) and compressible soils with uncontrolled fill (S1/P).

Due to the presence of compressible soils, the proposed method for single storey structures is modified normal reinforced RC strips or a light RC raft founded on compacted insitu soil with a maximum bearing pressure not exceeding 100kPa. Improved site drainage measures were also recommended to mitigate stormwater ingress into foundations which may cause soil movement (settlement). The recommended minimum specification for structural fill material is G8 granular material or better, compacted to a minimum of 95% of the maximum dry density, or as directed by the engineer.

The majority of the site generally appeared to be suitable for the proposed development but there were some moderate geotechnical constraints that require careful attention and consideration in the town planning and engineering design.

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## 1. Introduction and terms of reference

Outeniqua Geotechnical Services was appointed by Marike Vreken Town Planners on behalf of their client, Mossel Bay Municipality, to undertake a Phase 1 geotechnical site investigation of a proposed middle income housing project in the town of Great Brak in the Province of the Western Cape (see Figure 1).

The proposed housing project consisted of middle-income, government-subsidised residential dwellings with access roads and services. The site was located in the coastal village of Great Brak approximately 15km northeast of the central business district of the city of Mossel Bay. The development area consisted of three individual land parcels: Erf 2667 (0.57ha), Erf 2687 (0.19ha) and Erf 2686 (0.71ha), with a combined total area of 1.47ha (See Figure 2).

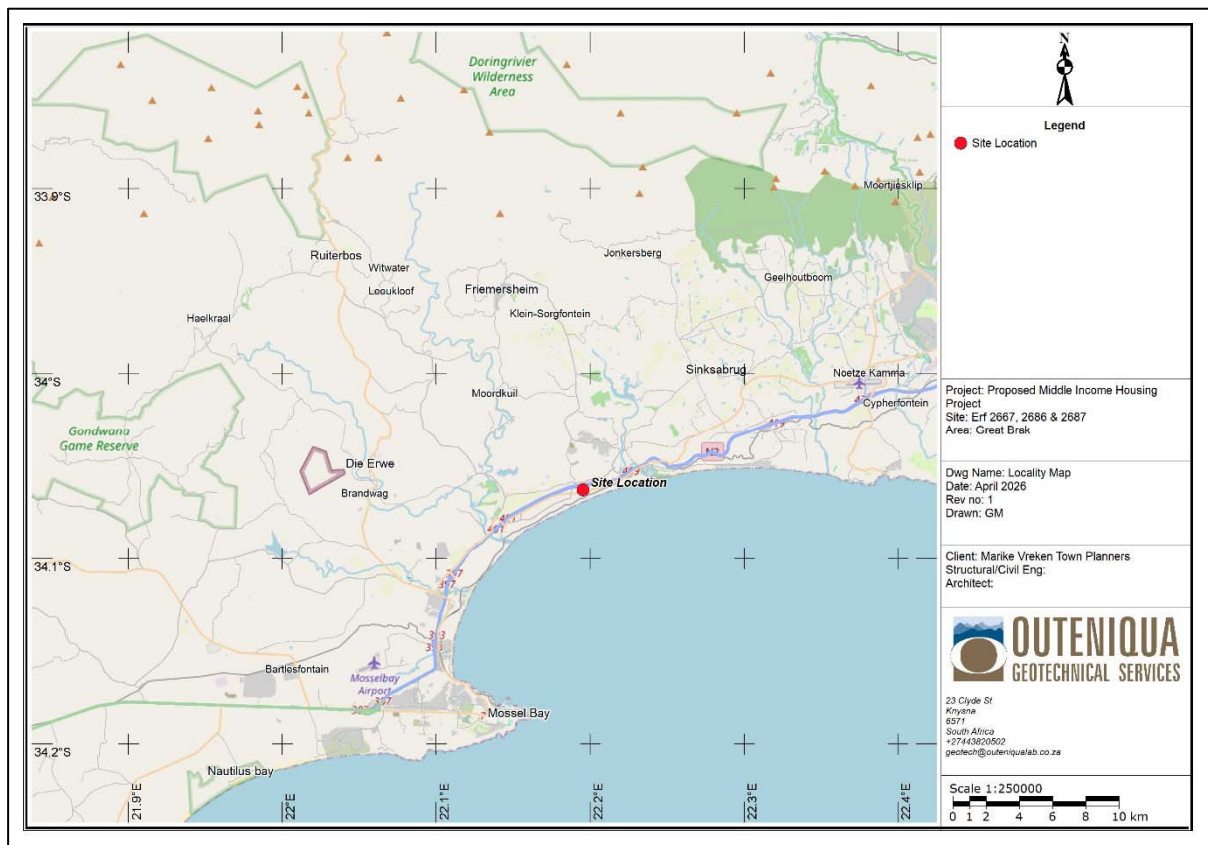


Figure 1: Locality map





Figure 2: Aerial photo of site area

The geotechnical nature of the site was investigated in order to facilitate the town planning and civil and structural engineering design. The investigation involved a desk study, site walkover and subsurface investigation consisting of test pits, insitu tests and laboratory tests. The investigation was conducted in broad accordance with the draft standard for geotechnical site investigations for township developments (SANS 634).

The scope of work was broadly defined as follows:

- Describe the topography, geology, soil types and expected founding conditions;
- Highlight any problem soils, slope stability or drainage issues;
- Estimate the bearing capacity, settlement and/or swell potential of the soil;
- Classify the excavations in terms of SABS 1200;
- Prepare a factual and interpretive report with recommendations for the design of earthworks, foundations and services.

## 2. Information available

The following maps and plans were available for reference purposes and were reproduced in this report:

- Topocadastral information and aerial photographs obtained from the NGI and Google Earth;
- 1:50 000 Geological map of the area published by the Council for Geoscience;
- Plan showing the approximate site development area, provided by Marike Vreken Town Planners.

## 3. Nature of the investigation

An initial desktop study was conducted to assess the topographical and geological nature of the site using available maps, aerial photos and site plans. This was then followed by a site reconnaissance walk-over to conduct visual observations of the site and assess



any obvious geotechnical risks. The preliminary assessment was then followed by a detailed subsurface investigation involving seven test pits that were excavated across the site using a TLB/back-actor, to a maximum depth of 2.5m or refusal (See Figure 3). The distribution and quality of information obtained using this rationale was deemed acceptable and adequate to broadly classify the site and inform the design process.

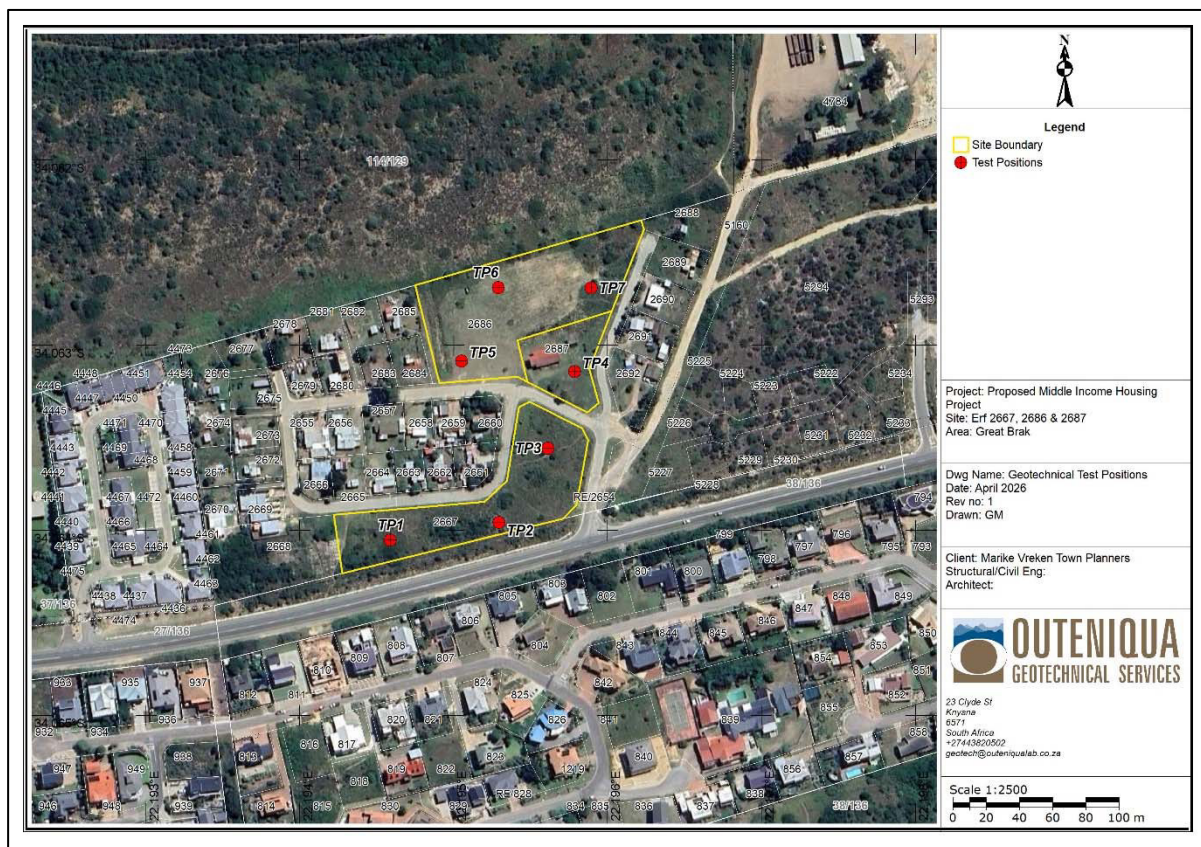


Figure 3: Location of test positions on the site

Selected representative soil horizons were sampled from the test pits for:

- Foundation Indicator tests (ASTM D422) to determine gradings, Atterberg limits and potential expansiveness (tested at Outeniqua Lab in George).
- MDD, CBR & Indicator tests (SANS3001) to determine the compaction density relationship of the insitu soils (tested at Outeniqua Lab in George).
- pH and Conductivity tests to determine soil corrosivity (tested at Steyn Wilson Labs in Cape Town).

Handheld Dynamic Cone Penetrometer (DCP) tests were conducted from ground level adjacent to the test pits to test soil consistency and estimate shear parameters.

#### 4. Site description

The natural topography of the site was gentle (nearly flat) but slightly uneven/hummoc in places. The site was largely vacant but there were two small single storey prefab and/or masonry buildings on Erf 2687, a playground on Erf 2686, and a cemetery just beyond the western boundary of Erf 2667. The vegetation cover consisted of long grass and scattered fynbos bushes. There was a storm water culvert on the southwestern corner and on the eastern boundary of Erf 2686. Access to the site was easily gained from the surrounding paved roads. Access across the site was fairly easy with a 4x2 vehicle, but the surface conditions were generally loose and sandy. Existing services noted in the area included overhead electrical & telephone lines, stormwater kerb inlets and pipe culverts crossing existing roads. Refer to Figure 4 to Figure 11.



Great Brak lies on the boundary between a warm temperate climatic area (Köppen-Geiger classification Cfb) and an arid steppe climatic area near Mossel Bay (BSk). The average annual precipitation is 400mm. The average winter minimum temperature is 10°C and average summer maximum temperature is 23°C (www.weatherandclimate.com).

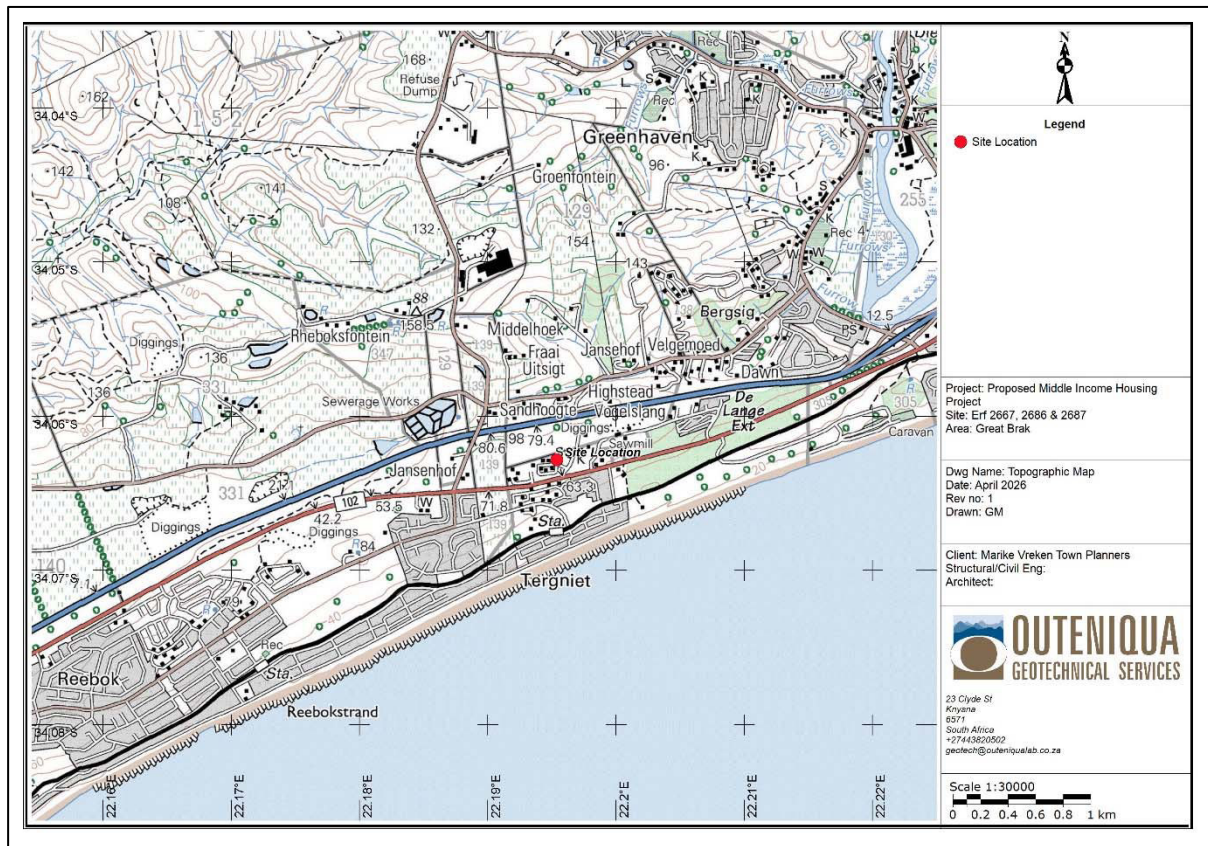


Figure 4: Topographic map of the site



Figure 5: View of Erf 2667 looking south from the road along the northern boundary





Figure 6: View of Erf 2667 looking west from the road along the eastern boundary



Figure 7: View of Erf 2687 looking northeast from the road on the southern boundary (note existing building)



Figure 8: View of Erf 2686 looking northwest from the road on the southern boundary





Figure 9: View of Erf 2687 & 2686 looking south from the northern boundary



Figure 10: Existing roads and services in the area





Figure 11: Stormwater pipe culvert under road on eastern boundary of Erf 2686

## 5. Geology and seismology

The regional geological map of the area on 1:50000 scale indicates that the site is underlain by aeolian Quaternary sand deposits (Qg- light yellow on the map) underlain by Cretaceous-aged mudstone, siltstone and sandstone of the Kirkwood Formation (J-Kk-dark yellow on the map) of the Uitenhage Group at unknown depth (see Figure 12 & Figure 13).

The geological maps of the site did not indicate any underground mining or cavities caused by soluble rock formations such as dolomite. There were also no known mining operations on or in the immediate vicinity of the site.

The seismic hazard maps for South Africa indicate a low risk of seismic activity in the area with a peak horizontal ground acceleration of 0.075g with a 10% chance of being exceeded in a 50-year period. The general geology and seismology were therefore considered suitable for urban development with precautions taken for local geotechnical constraints.



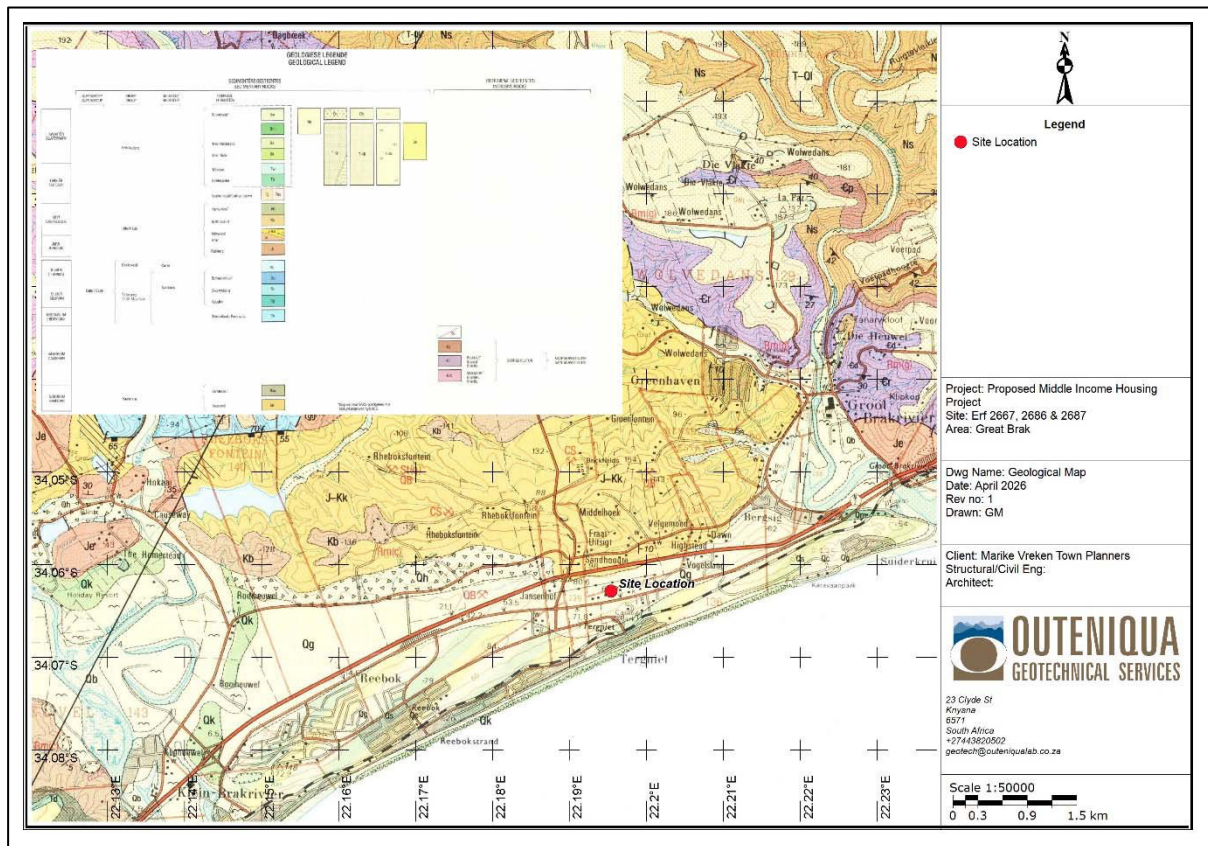


Figure 12: Geological map

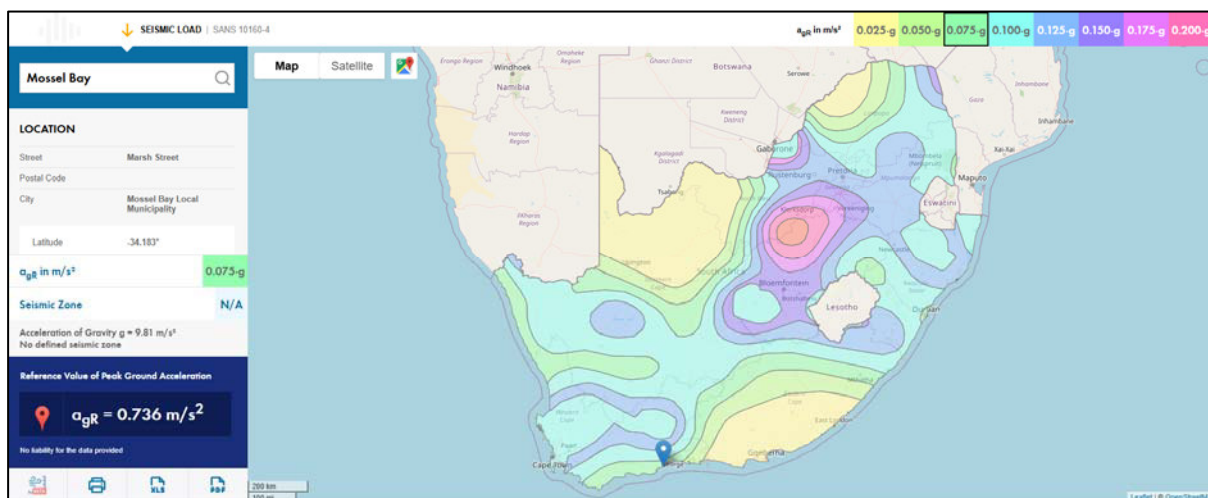


Figure 13: Seismic hazard map of South Africa (SANS10160-4)

## 6. Geotechnical Evaluation

### 6.1 Engineering and material characteristics

#### 6.1.1 Topography, slopes and vegetation cover

#### Results of the investigation

The natural topography of the site was gentle (nearly flat) but slightly irregular and uneven. The site was largely vacant but there were two small single storey structures on Erf 2687, a playground on Erf 2686, and a cemetery just beyond the western boundary of Erf 2667. The vegetation cover consisted of long grass and scattered fynbos bushes. Storm water pipe culverts were noted on the southwestern corner and on the northeastern boundary of Erf 2686. There was some uncontrolled fill (artificially raised ground) on the northeastern portion of Erf 2686. Access to the site was easily gained

from the surrounding paved roads. Access across the site was fairly easy with a 4x4 vehicle, but the surface conditions were loose and sandy.

#### Effect on the proposed development

The civil works will involve some minor bush clearing, removal of scattered heaps of fill, levelling to create platforms for houses, and trenching for services. Additional roads may require box cut excavations. The gentle slopes will favour easy accessibility, earthworks, and the lack of retaining walls. Gentle gradients may affect the depth of gravity sewers.

#### 6.1.2 Soil types and rock

##### Results of the investigation

The natural (insitu) soil profile was fairly consistent across the site and was characterised by a topsoil horizon, consisting of moist, dark brown, medium dense, structureless, silty fine sand; which was underlain by slightly moist to moist, light yellow, medium dense, structureless, fine sand of aeolian origin. Some localised scattered cobble & boulder sized calcrete of pedogenic origin was encountered at TP1 & TP3. At some test positions the insitu topsoil or aeolian soil was overlain by uncontrolled fill consisting of slightly moist, dark brown/light yellow, loose, structureless, silty fine sand with bits of rubbish (See Figure 14 to Figure 16).

The thickness of the different soil horizons that were encountered in test pits was summarised in Table 1 and Figure 17.



Figure 14: Typical soil profile exposed in test pits





Figure 15: Typical spoil heap excavated from test pits



Figure 16: Uncontrolled fill underlain by insitu sand



Table 1: Summary of soil profile data (mm)

| Test pos. No. | Imported soil (fill) | Transported/pedogenic soil | Residual soil | Rock | Total depth of test pit | Termination | Water level |
|---------------|----------------------|----------------------------|---------------|------|-------------------------|-------------|-------------|
| TP1           | -                    | 0-2600                     | -             | -    | 2600                    | TP stopped  | -           |
| TP2           | -                    | 0-2600                     | -             | -    | 2600                    | TP stopped  | -           |
| TP3           | -                    | 0-2700                     | -             | -    | 2700                    | TP stopped  | -           |
| TP4           | -                    | 0-2800                     | -             | -    | 2800                    | TP stopped  | -           |
| TP5           | 0-300                | 300-2500                   | -             | -    | 2500                    | TP stopped  | -           |
| TP6           | -                    | 0-2600                     | -             | -    | 2600                    | TP stopped  | -           |
| TP7           | 0-1400               | 1400-2700                  | -             | -    | 2700                    | TP stopped  | -           |

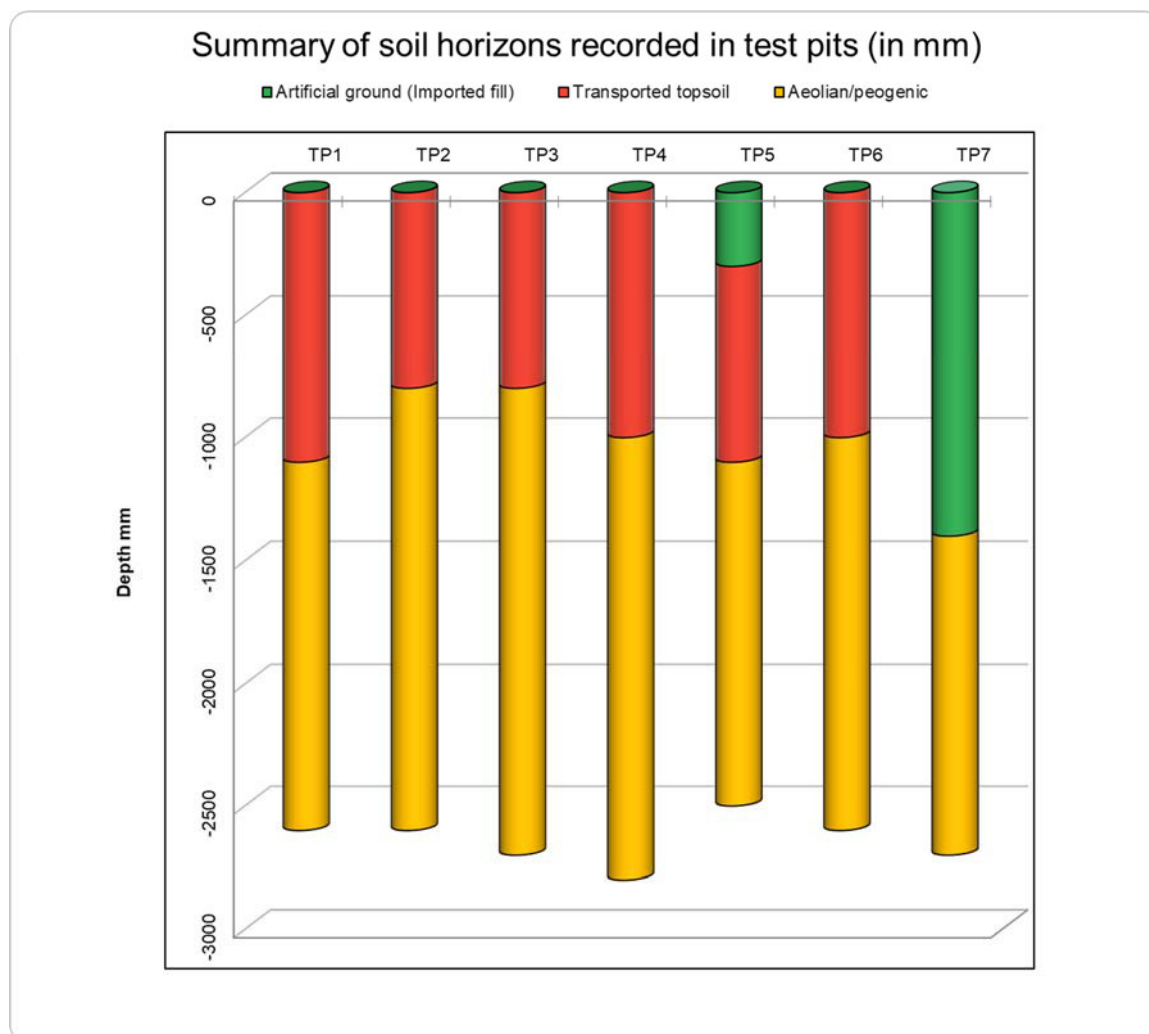


Figure 17: Summary of soil horizons recorded in the test pits

#### Effect on the proposed development

The insitu soil profile across the site and uncontrolled fill encountered at Erf 2686 was generally considered slightly to moderately problematic due to the presence of potentially compressible sandy soils which may cause settlement of foundations on uncompacted soil. Modified/improved foundation systems including steel reinforcement of concrete and foundation earthworks (removal and replacement of unsuitable soil e.g. uncontrolled fill and/or compaction improvement) would therefore be required to mitigate these effects on structures. Refer to recommendations in Chapter 8.

The fine granular nature of the soil promoted easy excavations and also served as a potentially useful source of backfill material.

### 6.1.3 Grading, Atterberg limits and potential expansiveness

#### Results of the investigation

Samples of soil were collected from the test pits and subjected to a sieve analysis and Atterberg limit tests (Foundation Indicator tests) in order to characterise the soils and estimate potential expansivity. The results of these tests were provided in Table 2.

Table 2: Grading and Atterberg limits test results summary

| Test Pit No | Sample Depth (mm) | Atterberg Limits |    |    | Particle Analysis (%) |      |      |        | MC <sup>1</sup> | PE <sup>2</sup> | USC <sup>3</sup> |
|-------------|-------------------|------------------|----|----|-----------------------|------|------|--------|-----------------|-----------------|------------------|
|             |                   | PI               | LL | LS | Clay                  | Silt | Sand | Gravel |                 |                 |                  |
| TP1         | 1100-2600         | NP               | NP | NP | 1                     | 7    | 90   | 2      | 2.4             | Low             | SM               |
| TP2         | 800-2600          | NP               | NP | NP | 1                     | 17   | 82   | 0      | 3.5             | Low             | SM               |
| TP3         | 1700-2700         | NP               | NP | NP | 3                     | 8    | 88   | 1      | 10.5            | Low             | SM               |
| TP4         | 1000-2800         | NP               | NP | NP | 1                     | 8    | 91   | 0      | 4.7             | Low             | SM               |
| TP5         | 1100-2500         | NP               | NP | NP | 2                     | 5    | 93   | 0      | 1.9             | Low             | SM               |
| TP6         | 1000-2600         | NP               | NP | NP | 1                     | 9    | 90   | 0      | 3.5             | Low             | SM               |
| TP7         | 1400-2700         | NP               | NP | NP | 2                     | 6    | 92   | 0      | 1.7             | Low             | SW-SM            |

Notes: 1 *In situ* moisture 2 Potential expansiveness 3 Unified Soil Classification System

The soil types of the samples tested fell into the following categories under the Universal Soil Classification:

- SM: Silty sands.
- SP: Poorly graded sands.

The sand content varied from 82% to 92% and the soils were non plastic indicating zero potential for heave/expansiveness.

#### Effect on the proposed development

The soils did not indicate any major problems related to clay heave and were deemed suitable as natural granular construction/fill materials.

### 6.1.4 Moisture/ density relationship and CBR

#### Results of the investigation

Samples of near surface soils were collected for CBR, Mod. AASHTO density and Indicator tests in order to determine the road subgrade quality and the suitability of the material as a potential natural construction material. The test results were provided in Table 3.

Table 3: Table 3: CBR test results summary

| Test Pit No | Sample Depth (mm) | CBR at |     |     |     |     | Swell (%) | PI (%) | GM   | MDD /OMC   | COTO |
|-------------|-------------------|--------|-----|-----|-----|-----|-----------|--------|------|------------|------|
|             |                   | 100%   | 98% | 95% | 93% | 90% |           |        |      |            |      |
| TP1         | 1100-2600         | 17     | 13  | 10  | 8   | 6   | 0         | NP     | 1.11 | 1624 /14.2 | G8   |
| TP2         | 800-2600          | 10     | 9   | 8   | 7   | 6   | 0         | NP     | 1.03 | 1608 /13.9 | G8   |
| TP5         | 1100-2500         | 18     | 14  | 9   | 7   | 5   | 0         | NP     | 0.96 | 1597 /13.8 | G8   |
| TP7         | 1400-2700         | 17     | 11  | 6   | 4   | 2   | 0         | NP     | 0.99 | 1565 /15.8 | G9   |

The tests indicated that the insitu sandy soils were potentially useful as a low/marginal quality (G8/G9) subgrade fill material which was also deemed generally suitable for filling on platforms, roadbeds, and under foundations and surface bed concrete floors.

#### Effect on the proposed development

The insitu sandy soils may be used as natural construction materials resulting in a saving on imported materials. Detailed recommendations are provided in Chapter 8.

#### 6.1.5 pH and Conductivity

##### Results of the investigation

Corrosion of metallic pipe fittings, concrete foundations and other construction materials can be negatively influenced by low or high pH, and high conductivity (indicating high concentration of dissolved salts in the soils). The influence of pH and conductivity on the corrosiveness of soil was indicated in Table 4.

Table 4: Influence of pH and conductivity on the corrosiveness of soil

| pH          | Conductivity (S/m) | Corrosiveness    |
|-------------|--------------------|------------------|
| 6-8         | <0.01              | Non corrosive    |
| 5-6 or 8-9  | 0.01-0.02          | Mildly corrosive |
| 4-5 or 9-10 | 0.02-0.05          | Corrosive        |
| <4 or >10   | >0.05              | Highly corrosive |

Samples of insitu soils were collected for pH & Conductivity tests in order to determine the aggressiveness of the soil. The test results were provided in Table 5.



Table 5: pH and conductivity test results summary

| Test Position | Depth<br>m | pH  | Conductivity (S/m) |
|---------------|------------|-----|--------------------|
| TP1           | 0-1.1      | 7.6 | 0.0278             |
| TP1           | 1.1-2.6    | 8.9 | 0.0353             |
| TP2           | 0.8-2.6    | 8.7 | 0.0211             |
| TP3           | 0.8-1.7    | 7.9 | 0.0277             |
| TP4           | 0-1.0      | 8.0 | 0.0136             |
| TP6           | 1.0-2.6    | 7.9 | 0.0211             |
| TP7           | 1.4-2.7    | 7.6 | 0.0178             |

The tests indicated that the pH of the insitu sandy soil was slightly alkaline with pH ranging from 7.6 to 8.9. Conductivity results indicated that the soil had a moderate concentration of dissolved salts and was mildly corrosive to buried metallic structures (i.e. rust).

#### Effect on the proposed development

HDPE or PVC pipe products will be suitable and buried metallic valves and fittings should be epoxy powder coated to protect against rust corrosion. Normal rebar cover was recommended in concrete foundations.

#### 6.1.6 Compressibility, collapse potential and bearing capacity

##### Results of the investigation

No undisturbed samples were obtainable for oedometer tests due to the cohesionless nature of these soils, an assessment of the compressibility and bearing capacity was assessed through other methods including visual assessments and penetration tests.

In situ dynamic cone penetration tests (DCP) indicated the following broad categories of soil consistency, with correlated stiffness and shear strength parameters from empirical data shown in Table 6 to Table 8Error! Reference source not found.:

- 0-1m: Very loose-loose,  $\phi' = 26-28^\circ$ ,  $c' = 0\text{kPa}$ ,  $E = 2-5\text{MPa}$
- 1-1.6m: Loose-medium dense,  $\phi' = 28-30^\circ$ ,  $c' = 0\text{kPa}$ ,  $E = 5-10\text{MPa}$
- >1.6m: Medium dense,  $\phi' = 30-33^\circ$ ,  $c' = 0\text{kPa}$ ,  $E = 10-25\text{MPa}$

Table 6: Empirical correlation of soil consistency with penetration rates for sandy soils (Brink et. Al, 1982 cited in Byrne & Berry, 2008)

| Sandy Materials |                              |                                            |
|-----------------|------------------------------|--------------------------------------------|
| Description     | SPT 'N'<br>(blows per 300mm) | Dynamic Probe Light<br>(DPL) (mm per blow) |
| Very Loose      | < 5                          | > 75                                       |
| Loose           | 5 - 10                       | 30 - 75                                    |
| Medium Dense    | 10 - 30                      | 12.5 - 30                                  |
| Dense           | 30 - 50                      | 5 - 12.5                                   |
| Very Dense      | > 50                         | 2 - 5                                      |

Table 7: Empirical correlations of soil consistency with shear parameters (Bowles, 2004)

| Soil type   | SPT ( $N_{70}$ value) | Consistency | Friction angle ( $\phi'$ ) | Relative density ( $D_r$ ) |
|-------------|-----------------------|-------------|----------------------------|----------------------------|
| Fine sand   | 1-2                   | Very loose  | 26-28                      | 0-0.15                     |
|             | 3-6                   | Loose       | 28-30                      | 0.15-0.35                  |
|             | 7-15                  | Medium      | 30-33                      | 0.35-0.65                  |
| Medium sand | 16-30                 | Dense       | 33-38                      | 0.65-0.85                  |
|             | <30                   | Very dense  | <38                        | <0.85                      |
|             | 2-3                   | Very loose  | 27-30                      | 0-0.15                     |
|             | 4-7                   | Loose       | 30-32                      | 0.15-0.35                  |
|             | 8-20                  | Medium      | 32-36                      | 0.35-0.65                  |
| Coarse sand | 21-40                 | Dense       | 36-42                      | 0.65-0.85                  |
|             | <40                   | Very dense  | <42                        | <0.85                      |
|             | 3-6                   | Very loose  | 28-30                      | 0-0.15                     |
|             | 5-9                   | Loose       | 30-33                      | 0.15-0.35                  |
|             | 10-25                 | Medium      | 33-40                      | 0.35-0.65                  |
|             | 26-45                 | Dense       | 40-50                      | 0.65-0.85                  |
|             | <45                   | Very dense  | <50                        | <0.85                      |

Table 8: Empirical correlations of soil consistency and elastic modulus (Look, 2014)

| Table 11.7 Elastic parameters of various soils. |                  |                          |           |
|-------------------------------------------------|------------------|--------------------------|-----------|
| Type                                            | Strength of soil | Elastic modulus, E (MPa) |           |
|                                                 |                  | Short term               | Long term |
| Gravel                                          | Loose            | 25-50                    |           |
|                                                 | Medium           | 50-100                   |           |
|                                                 | Dense            | 100-200                  |           |
| Medium to coarse sand                           | Very loose       | <5                       |           |
|                                                 | Loose            | 3-10                     |           |
|                                                 | Medium dense     | 8-30                     |           |
|                                                 | Dense            | 25-50                    |           |
|                                                 | Very dense       | 40-100                   |           |
| Fine sand                                       | Loose            | 5-10                     |           |
|                                                 | Medium           | 10-25                    |           |
|                                                 | Dense            | 25-50                    |           |
| Silt                                            | Soft             | <10                      | <8        |
|                                                 | Stiff            | 10-20                    | 8-15      |
|                                                 | Hard             | >20                      | >15       |

A conservative estimation of the potential settlement was calculated at gross bearing pressure of 50kPa indicated settlement potential of 8.4mm and at 150kPa indicated 29.1mm (see Appendix 5), which broadly concurred with previous experience of similar soils in the area. A site classification of S1 was therefore deemed appropriate for the entire site.

#### Effect on the proposed development

Precautions such as soil improvement (densification/compaction) will be required to mitigate soil movement. Modified normal foundation systems such as RC strips and/or RC rafts, will be required to improve structural stiffness and mitigate movement induced by compressible soil. Other precautions include drainage improvement to prevent inundation of the foundations. Recommendations are provided in Chapter 8.

#### 6.1.7 Swell/ heave

##### Results of the investigation

The soils indicated zero potential for swell/heave.

#### Effect on the proposed development

No additional measures to mitigate soil movement under foundations due to swell/heave.

#### 6.1.8 Soil moisture, permeability and groundwater

##### Results of the investigation

All soil types were generally characterised by low-moderate permeability silty fine sands, estimated at  $10^{-8}$  –  $10^{-6}$  m/s, and the soil moisture contents were generally normal in the range of 1.7-10.5%. The subsurface investigation did not reveal any groundwater, but seasonal seepage was expected in the upper part of the soil profile (~1m) during wet weather periods due to gradual infiltration from surface water.

#### Effect on the proposed development

Groundwater problems were not expected to have a major effect on earthworks and structural design. Recommendations on site drainage are provided in Chapter 9.

#### 6.1.9 Existing structures

##### Results of the investigation

There were no informal existing structures on the site but there were existing structures on Erf 2687 and a recreational playground on Erf 2686.

#### Effect on the proposed development

Allowances should be made for the demolition (& possible relocation) of the existing structures and the relocation of the recreational facilities.

#### 6.2 Slope stability and erosion

There were no unstable natural slopes on the site.



### 6.3 Excavation classification with respect to foundations and services

All excavations to a depth of 3m were provisionally classified as "Soft" in terms of SABS1200D, requiring only normal excavation plant, such as TLBs. Shallow excavations <1m such as foundation trenches can be carried out by hand.

### 6.4 Impact of the geotechnical character of the site on subsidy variations

The site was classified in accordance with the Variation Manual contained in the DOHS National Housing Code, Vol 2 Part 3 to cater for extraordinary development conditions for subsidy housing projects (DOHS, 2009). This classification was provided in Table 9.

Table 9: Site specific subsidy variations

| Geotechnical Conditions            | Category or type | Criteria                                                                             | Precautionary measures                                                                                              | Affected areas | Comment |
|------------------------------------|------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------|---------|
| Seepage / groundwater              | Category 1       | Permanent or perched water tables less than 1.0m below ground surface                | Subsurface drainage/improved damp-proofing measures to houses, service trenches to be dewatered during construction | None           |         |
|                                    | Category 2       | Permanent or perched water tables more than 1m but less than 1.5m below ground level | Service trenches to be dewatered during construction                                                                | None           |         |
| Erodability of soil                | Category 1       | High risk (Erodability index 1-8)                                                    | Retaining walls & earthworks to reduce slopes & surface drainage                                                    | None           |         |
|                                    | Category 2       | Medium risk (Erodability index 9-15)                                                 | Retaining walls & earthworks to reduce slopes                                                                       | None           |         |
| Hard excavation                    | Category 1       | Hard rock excavation to a depth of 1.5m                                              | Additional cost of trench and foundation excavation                                                                 | None           |         |
|                                    | Category 2       | Boulder excavation to a depth of 1.5m                                                | Additional cost of trench, foundation and road excavation                                                           | None           |         |
| Dolomite                           | Category 1       | Risk class 1&2 (Dolomite area class D2)                                              | Additional cost of foundations                                                                                      | None           |         |
|                                    | Category 2       | Risk class 3&4 (Dolomite area class D3)                                              | Additional cost of foundations                                                                                      | None           |         |
| Expansive Clays                    | Category 1       | H1                                                                                   | Foundation design, building procedures and precautionary measures: Modified normal                                  | None           |         |
|                                    | Category 2       | H2                                                                                   | Foundation design, building procedures and precautionary measures: Light/medium raft                                | None           |         |
|                                    | Category 3       | H3                                                                                   | Foundation design, building procedures and precautionary measures: Heavy raft                                       | None           |         |
| Compressible and Collapsible soils | Category 1       | C1                                                                                   | Foundation design, building procedures and precautionary measures: Modified normal                                  | None           |         |
|                                    | Category 2       | C2                                                                                   | Foundation design, building procedures and precautionary measures: Light or heavy raft                              | None           |         |
| Compressible soils                 | Category 1       | S1                                                                                   | Foundation design, building procedures and precautionary measures: Modified normal                                  | All areas      |         |
|                                    | Category 2       | S2                                                                                   | Foundation design, building procedures and precautionary measures: Light or heavy raft                              | None           |         |

| Geotechnical Conditions | Category or type                        | Criteria                                                                                           | Precautionary measures                                                                                           | Affected areas | Comment         |
|-------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|----------------|-----------------|
| Mining subsidence       | Category 1                              | Old undermining to a depth of between 90-240m below surface where stope closure has ceased         | Additional cost of foundations: Compaction below footings or raft                                                | None           |                 |
|                         | Category 2                              | Old undermining to a depth of between 90-240m below surface where total extraction has taken place | Additional cost of foundations: additional earthworks or soil reinforcement                                      | None           |                 |
| Seismic activity        | Category 1                              | Mining induced seismic activity > 100cm/s <sup>2</sup>                                             | Additional cost of foundations: Stiffened strip footings or raft                                                 | None           |                 |
|                         | Category 2                              | Natural seismic activity > 100cm/s <sup>2</sup>                                                    | Additional cost of foundations: Stiffened strip footings or raft                                                 | None           |                 |
| Topography              | Category 1                              | Average ground slope flatter than 1:100                                                            | Increased depth of sewer lines on site                                                                           |                |                 |
|                         | Category 2                              | Average ground slope of between 1:10 and 1:20                                                      | Terracing for houses & additional earthworks to roads & storm water control measures                             |                |                 |
|                         | Category 3                              | Average ground slope of between 1:7.5 and 1:10                                                     | Terracing for houses & additional earthworks to roads & storm water control measures                             |                |                 |
|                         | Category 4                              | Average ground slope of between 1:5 and 1:7.5                                                      | Terracing for houses & additional earthworks to roads & storm water control measures                             |                |                 |
|                         | Category 5                              | Average ground slope steeper than 1:5                                                              | Terracing for houses & additional earthworks to roads & storm water control measures                             |                |                 |
| SCCCA                   | Southern Cape Coastal Condensation Area | Area subjected to severe condensation conditions                                                   | Plaster and paint on all external walls & 6.4mm gypsum plasterboard ceilings & 80mm thick glass fibre insulation | All areas      |                 |
| Location of site        |                                         | Site more than 20km from major centres                                                             | Additional cost of transportation                                                                                | All areas      | Mossel Bay 40km |

## 7. Site classification

In accordance with SANS10400-H, the site classifications were provided in Table 10 (refer also to Figure 18).

Table 10: SANS 10400-H Residential site classification

| Terrain Unit* | Geotechnical Constraint       | Expected movement (mm) | Site Classification |
|---------------|-------------------------------|------------------------|---------------------|
| 1             | Potentially compressible soil | 10-20                  | S1                  |
| 2             | Potentially compressible soil | 10-20                  | S1                  |
|               | Uncontrolled fill             |                        | P                   |

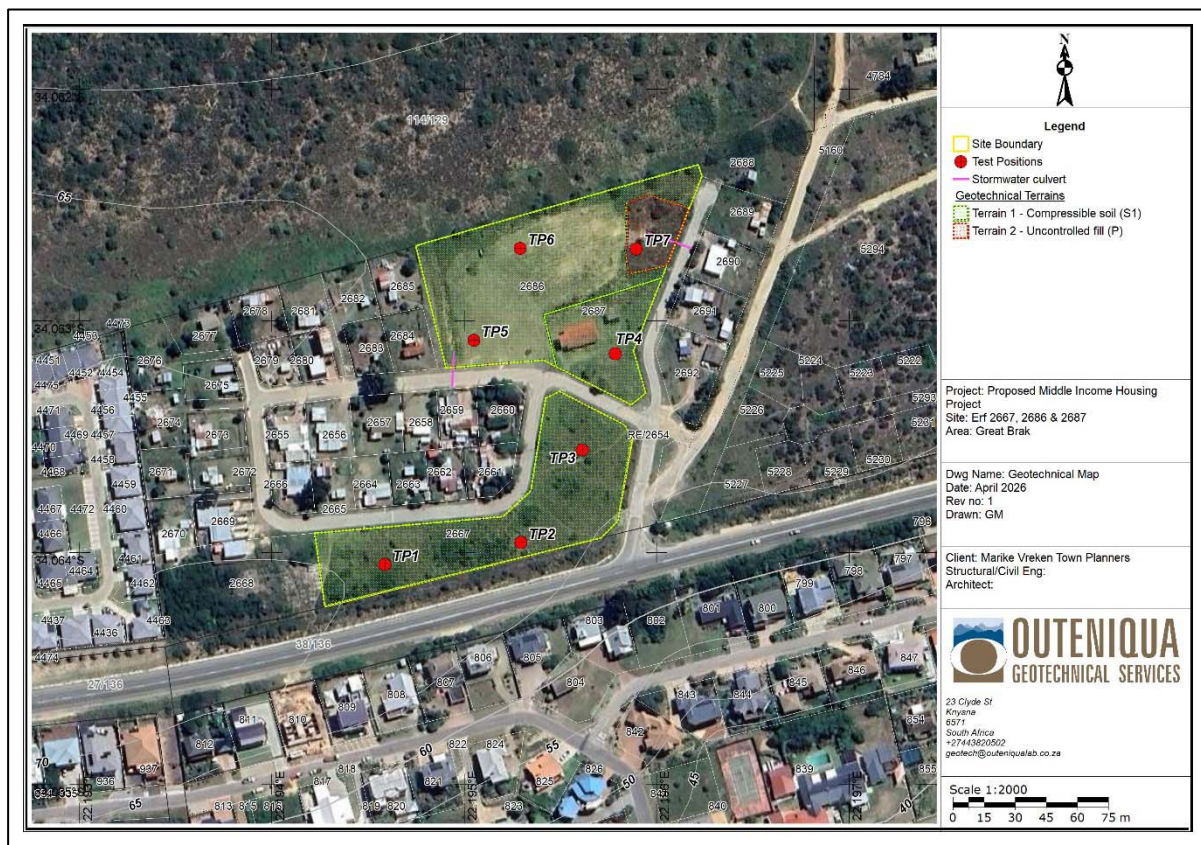


Figure 18: Geotechnical map of the site

## 8. Foundation recommendations and solutions

The following recommendations were provided as a guideline based on the information available at the time of the investigation. The design of structures and services remains the responsibility of the appointed engineer.

### 8.1 Earthworks and structural foundations

Earthworks should be conducted as per SANS, COTO or any site-specific specifications provided by the engineer. The design and construction of foundations and superstructures should be carried out as per SANS 10400-H or any site-specific specifications provided by the engineer.

The recommended foundation methods for the proposed single storey structures include modified normal reinforced RC strips or a light RC raft founded on well compacted insitu soil at a minimum founding depth of GL-0.7m, width (B) of 0.7m and a maximum bearing pressure not exceeding 100kPa (See Figure 19). The recommended minimum specification for compacted fill material below foundations is at least Bx1.5 (estimated 1m) of G9 granular material, compacted to a minimum of 93% of the maximum dry density (<30mm/blow of DCP), or as directed by the engineer. The insitu aeolian/pedogenic sands appear to be suitable for such applications, but quality control tests are recommended. Ground floor slabs should be nominally reinforced and supported on well compacted selected fill material.



Type 2 – Foundations on moderately compressible/collapsible and/or active soil (Site Class S1/C1/H1)

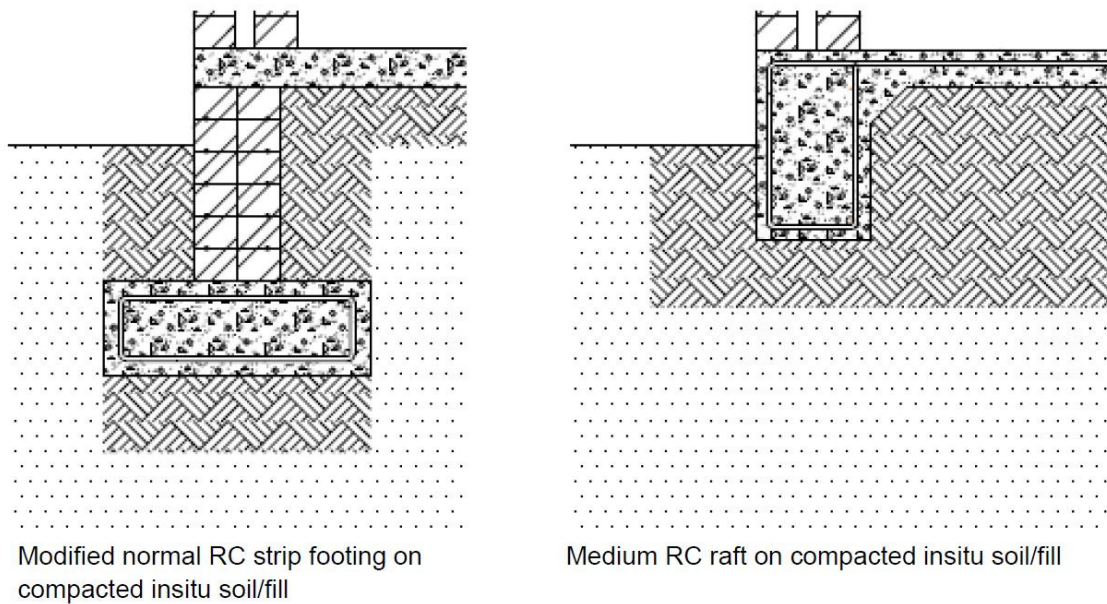


Figure 19: Recommended foundation systems

The following additional recommendations were provided:

- Strip all organic and foreign matter (rubbish) over the footprint area.
- No structures should be placed on saturated soil or uncontrolled fill containing any deleterious material such as rubbish or organic matter.
- Localised depressions requiring filling should be filled with G9 material and compacted to 93% MDD.
- The finished floor level of all houses should be a minimum of 250mm above surrounding ground level to prevent flooding. Special attention should be paid to the stormwater management of the site.
- Earthworks for structural foundations should be inspected by the engineer to approve founding conditions, such as soil types, consistency in density and moisture levels.

A phase 2 investigation should be commissioned during the construction of bulk earthworks to obtain more accurate site soil class designations.

## 8.2 Roads

Road construction should be carried out according to SANS, COTO or any site-specific specifications provided by the engineer. The following recommendations are provided for the preparation of the roadbed and the design of lightly trafficked road pavement layerworks (refer to Figure 20):

- Clear & grub vegetation & roots and cut road prism to line and roadbed level.
- Stockpile suitable granular soil obtained from roadbed excavations.
- Rip 300mm of insitu roadbed and compact to 93%MDD.
- Remove soft/wet spots and replace with similar suitable compacted fill.
- Source locally or import and place approved G7/8 material for selected subgrade layer. Compact to 93%MDD.
- Import and place 150mm of approved G5/6 subbase. Compacted to 95%MDD.
- Construct paving with 60mm Class 25 Interlocking concrete pavers or similar other approved method on 20mm bedding sand. Asphalt surfaces will require an imported G2-4 base course.

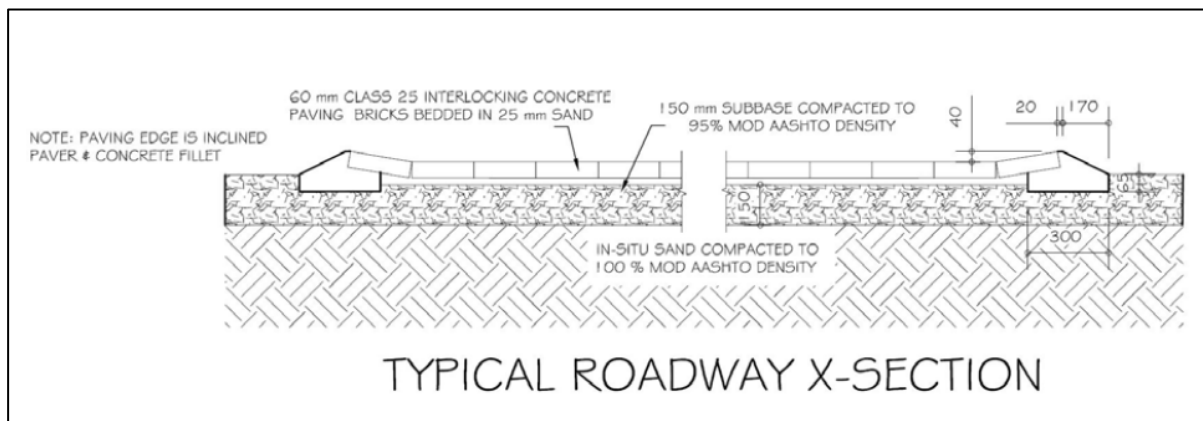


Figure 20: Typical road layerworks design

## 9. Site drainage

Design and construction of stormwater drainage should be carried out according to the Red Book, SANS, SAPEM, COTO or any site-specific specifications provided by the engineer.

The soil types have allow to moderate permeability, and the site has a very gentle gradient and therefore high rainfall may temporarily accumulate on surface during peak rainfall episodes, thus requiring adequate stormwater drainage to prevent flooding. An effective storm water system consisting of both open channels and/or underground pipes are recommended along roads to collect run-off and direct towards suitable discharge points. Careful attention should be paid to the stormwater design on the site. The existing stormwater culverts discharging into Erf 2686 should be temporarily redirected such that stormwater flows away from the site during construction and then integrated it into the new stormwater system.

Ponding of storm water around the exterior of houses should be avoided by constructing a 1m-wide concrete apron with a 10% fall away from the house. This will assist with roof water run-off where no gutters are installed, or if they become damaged over the long term. A concrete apron will also prevent undermining of the foundations.

## 10. Special precautionary measures

There were no special measures.

## 11. Conclusions

The site appeared to be generally suitable for the proposed development but there were some geotechnical constraints that require attention in the engineering design. Recommendations were provided for consideration by the civil and structural engineers but all information should be verified during construction.

## References

Brink, A.B.A. & Bruin, R.M.H. Eds. 1990. Guidelines for Soil and Rock Logging in South Africa. 2nd Impression 2008 ed.: Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG.

Byrne, G. & Berry, A.D., 2008. A Guide to Practical Geotechnical Engineering in South Africa. 4th ed. Johannesburg: Franki South Africa (Pty) Ltd, Chapter 3: Soil and Rock Classification and Design Parameters, p.56.

Chief Director of the Geological Survey. 1992. Seismic Hazard Map of Southern Africa. 1:6000000. Pretoria: Government Printer.

Committee of State Road Authorities, National Institute for Transport and Road Research (CSIR). 1986. Technical Methods for Highways (TMH1). Pretoria: Department of Transport.

Council for Geoscience. 1997. Geological Series sheet 3420 (1:250 000), Council for Geoscience, Pretoria.

Department of Human Settlements (DOHS), 2009. National Housing Code - Technical and General Guidelines. Pretoria.

Look, B.G., 2007. *Handbook of Geotechnical Investigation and Design Tables*. London: Taylor & Francis Group, Chapter 11: Deformation parameters, p.127.

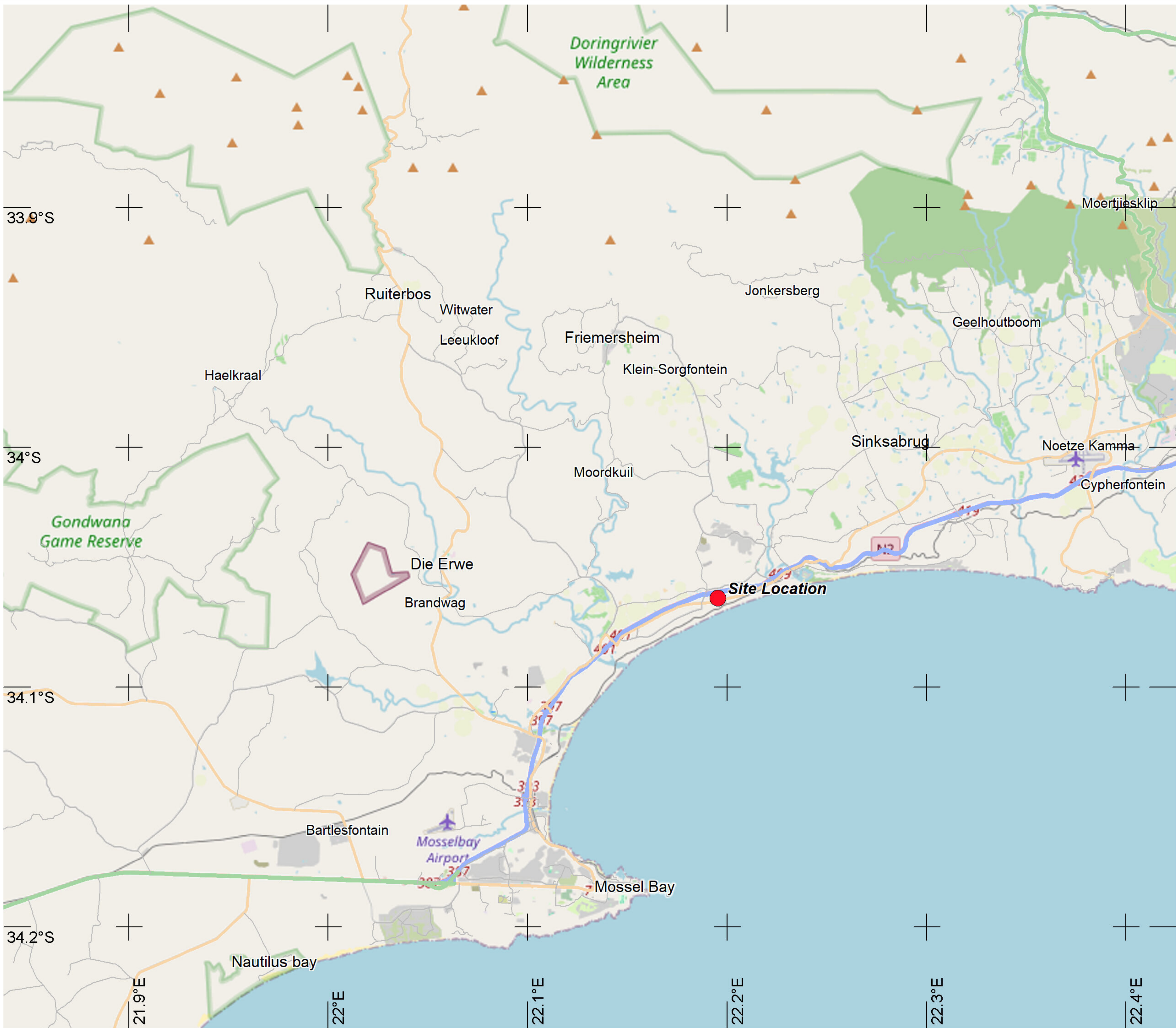
South African Bureau of Standards (SABS). 1982. SABS 1200. Standardised Specifications for Civil Engineering Construction. Government Printer. Pretoria.



## **Appendix 1**

### **Maps**





Legend

● Site Location

Project: Proposed Middle Income Housing Project  
Site: Erf 2667, 2686 & 2687  
Area: Great Brak

Dwg Name: Locality Map  
Date: April 2026  
Rev no: 1  
Drawn: GM

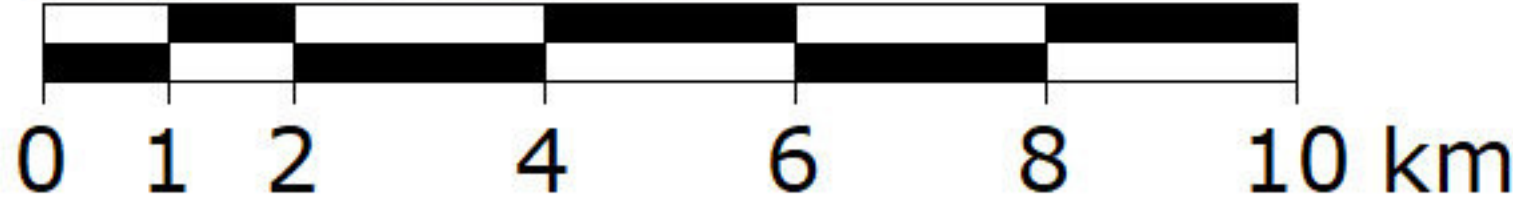
Client: Marike Vreken Town Planners  
Structural/Civil Eng:  
Architect:



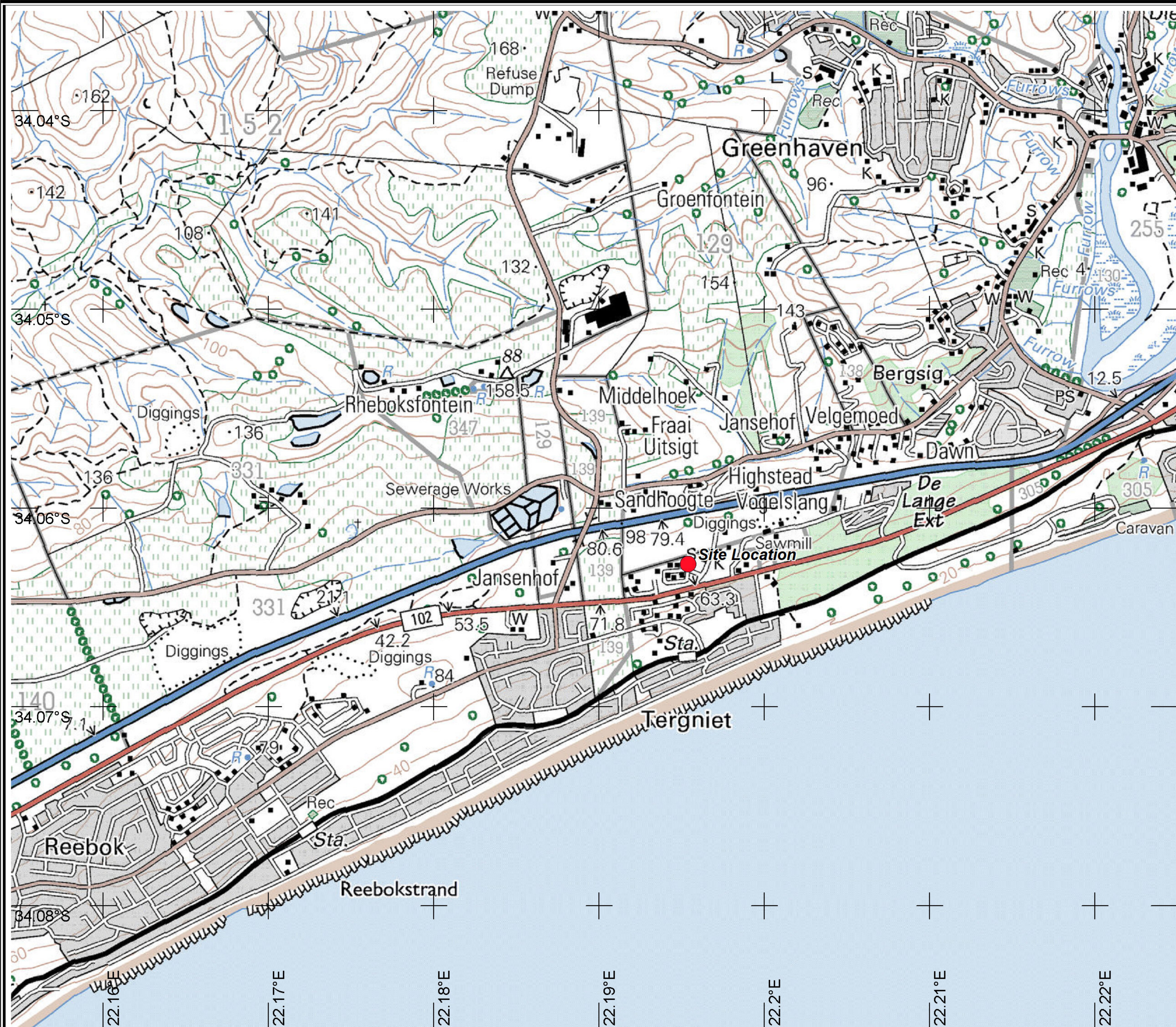
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Scale 1:250000







#### Legend

● Site Location

Project: Proposed Middle Income Housing Project  
Site: Erf 2667, 2686 & 2687  
Area: Great Brak

Dwg Name: Topographic Map  
Date: April 2026  
Rev no: 1  
Drawn: GM

Client: Marike Vreken Town Planners  
Structural/Civil Eng:  
Architect:



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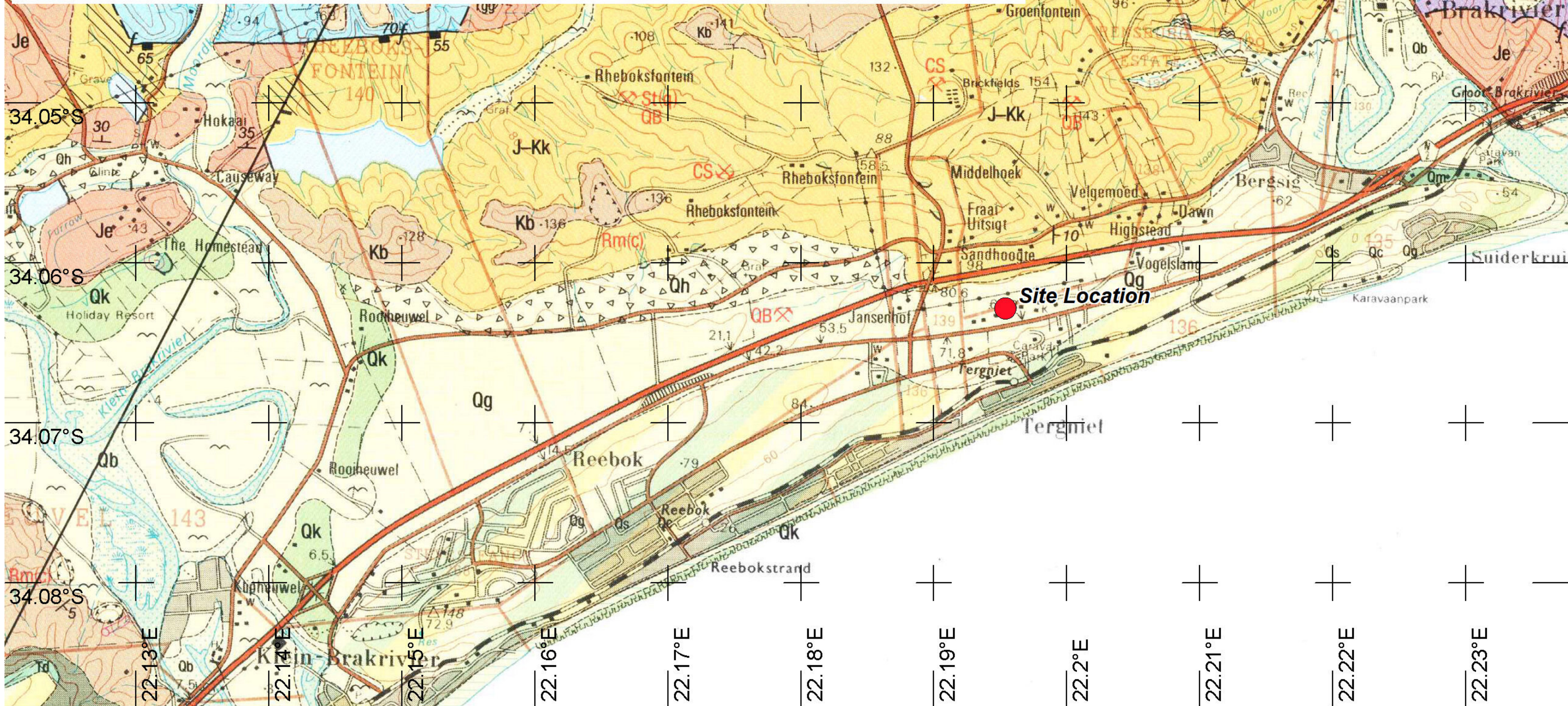
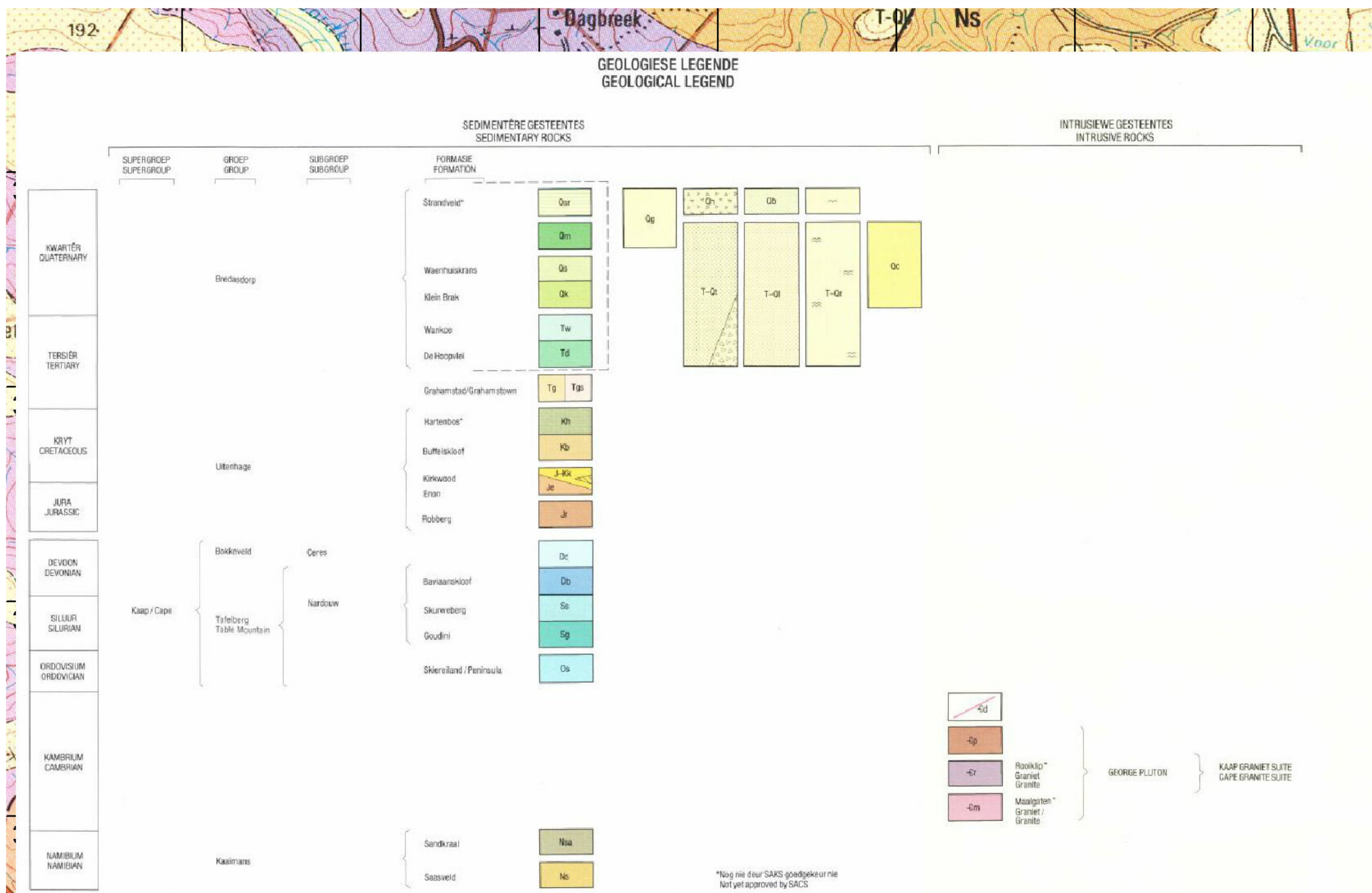
Scale 1:30000

0 0.2 0.4 0.6 0.8 1 km













**Legend**

- Site Boundary
- Test Positions
- Stormwater culvert
- Geotechnical Terrains
  - Terrain 1 - Compressible soil (S1)
  - Terrain 2 - Uncontrolled fill (P)

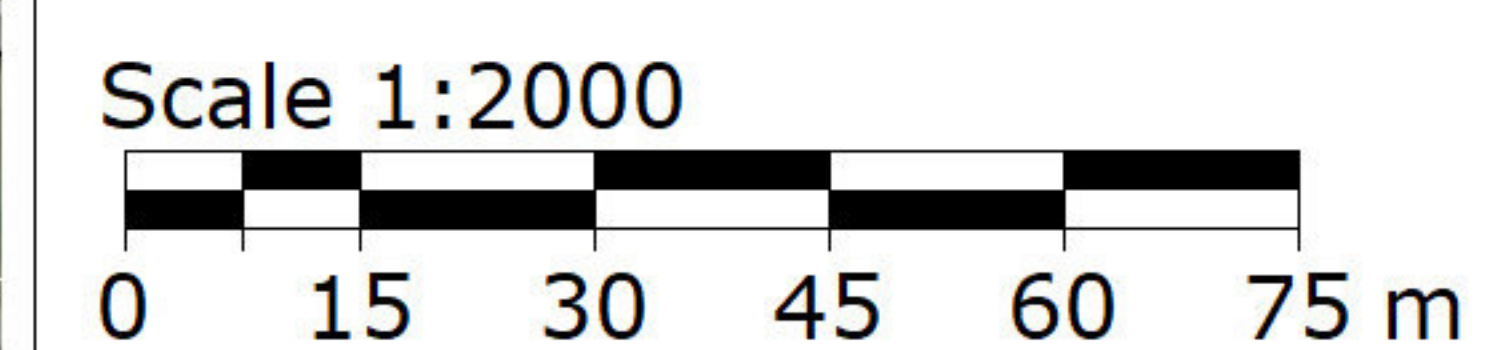
Project: Proposed Middle Income Housing Project  
Site: Erf 2667, 2686 & 2687  
Area: Great Brak

Dwg Name: Geotechnical Map  
Date: April 2026  
Rev no: 1  
Drawn: GM

Client: Marike Vreken Town Planners  
Structural/Civil Eng:  
Architect:



23 Clyde St  
Knysna  
6571  
South Africa  
+27443820502  
geotech@outeniqua.co.za





## **Appendix 2**

### **Test pit profiles**



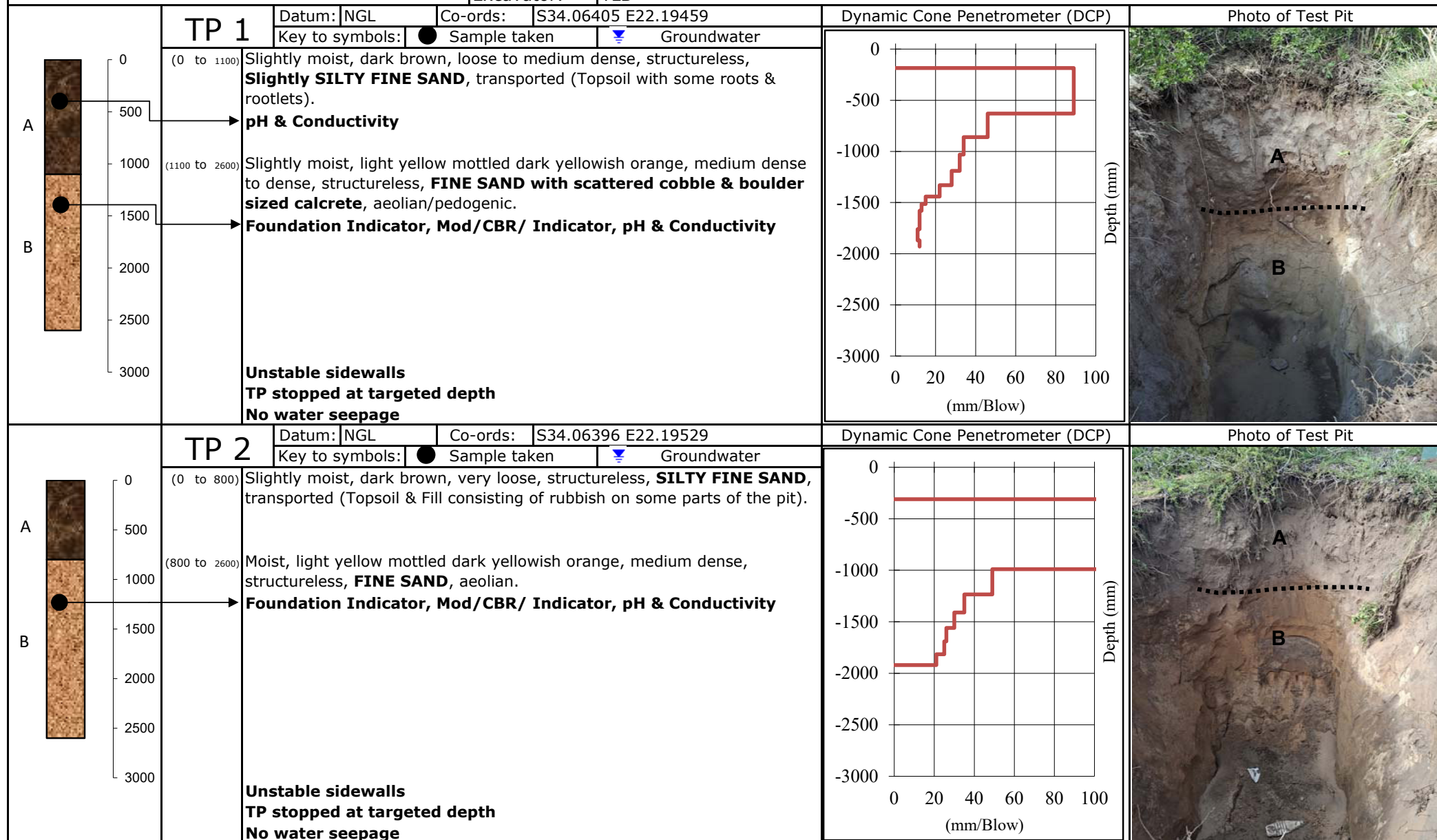


# OUTENIQUA

## GEOTECHNICAL SERVICES

### Geotechnical Soil Profile

|            |                                                       |
|------------|-------------------------------------------------------|
| Client:    | Marike Vreken Town Planners                           |
| Project:   | Erf 2667, 2686 & 2687 (Middle Income Housing Project) |
| Area:      | Great Brak                                            |
| Date:      | 09.04.2026                                            |
| Excavator: | TLB                                                   |





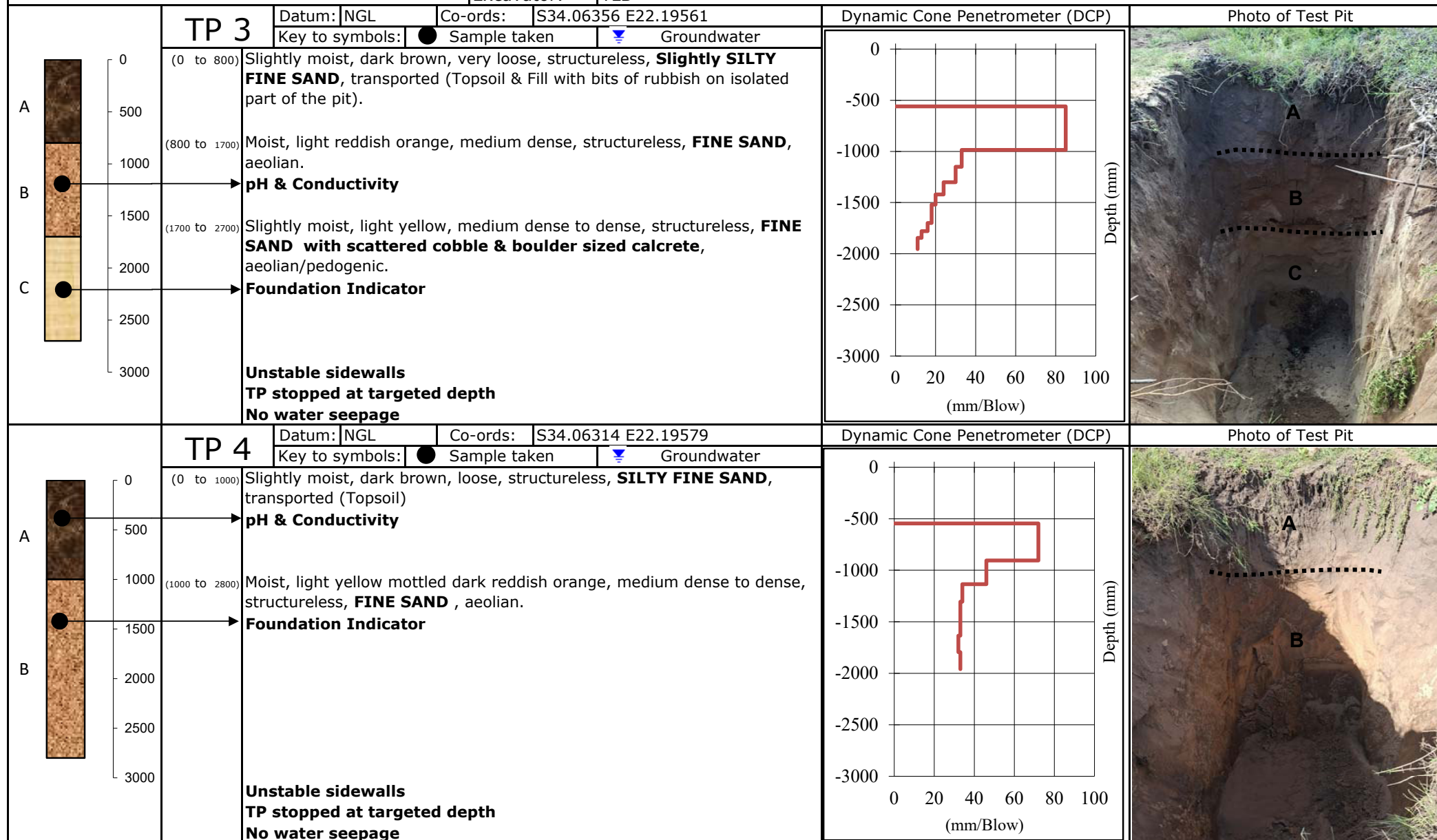


# OUTENIQUA

## GEOTECHNICAL SERVICES

### Geotechnical Soil Profile

|            |                                                       |
|------------|-------------------------------------------------------|
| Client:    | Marike Vreken Town Planners                           |
| Project:   | Erf 2667, 2686 & 2687 (Middle Income Housing Project) |
| Area:      | Great Brak                                            |
| Date:      | 09.04.2026                                            |
| Excavator: | TLB                                                   |





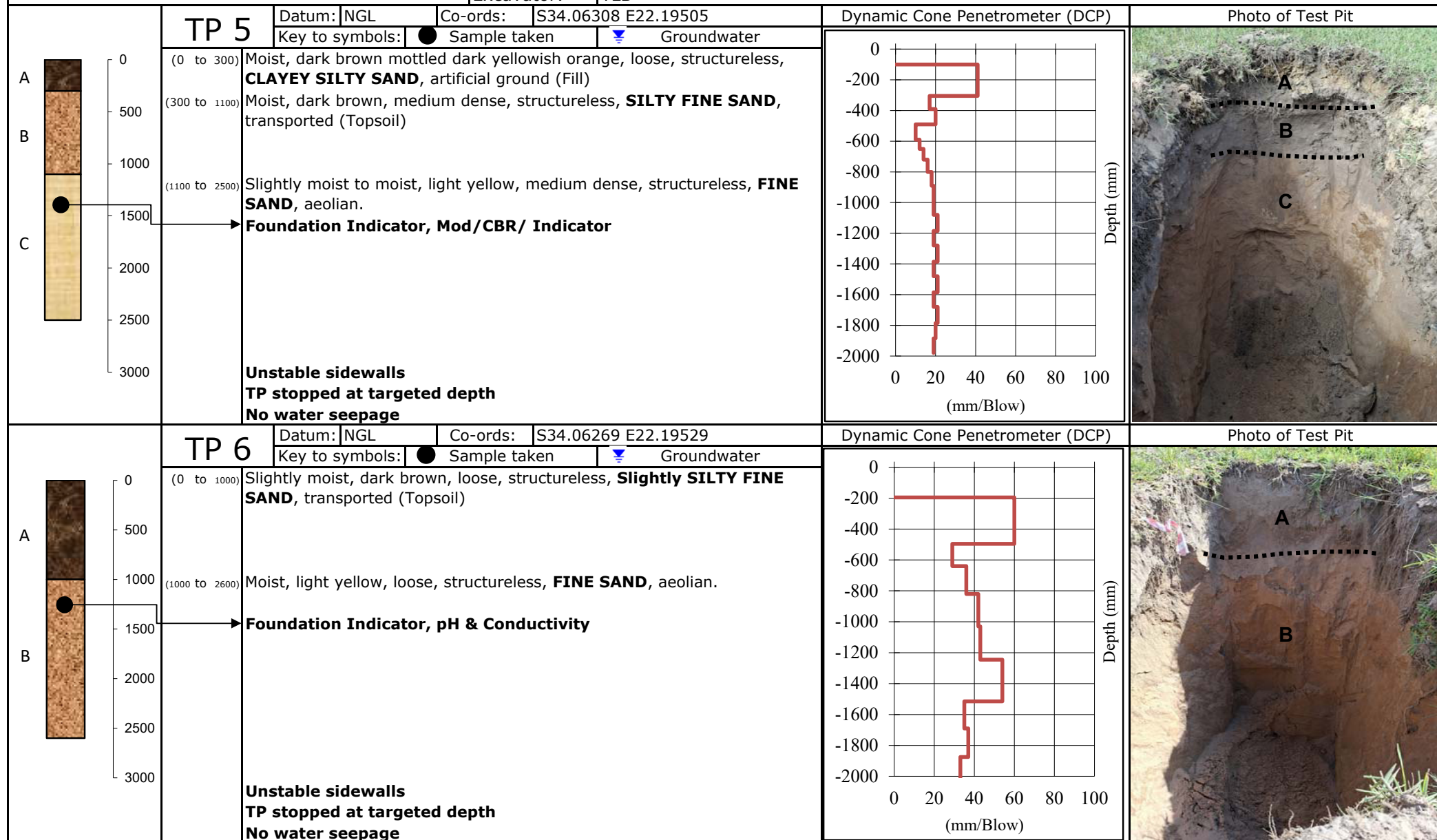


# OUTENIQUA

## GEOTECHNICAL SERVICES

### Geotechnical Soil Profile

|            |                                                       |
|------------|-------------------------------------------------------|
| Client:    | Marike Vreken Town Planners                           |
| Project:   | Erf 2667, 2686 & 2687 (Middle Income Housing Project) |
| Area:      | Great Brak                                            |
| Date:      | 09.04.2026                                            |
| Excavator: | TLB                                                   |





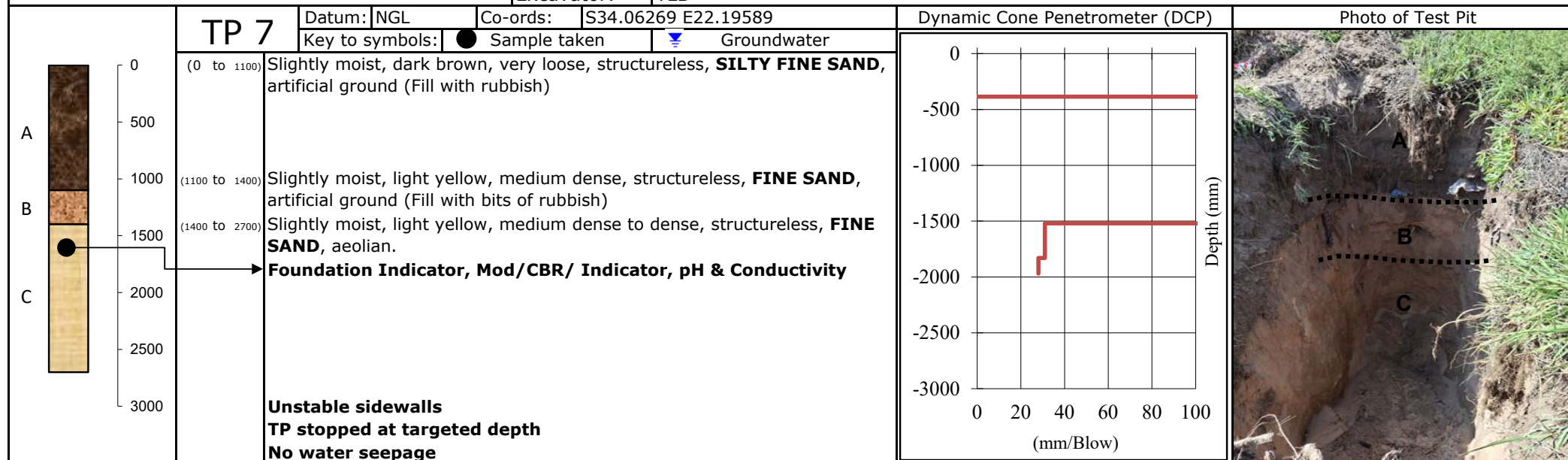


# OUTENIQUA

## GEOTECHNICAL SERVICES

### Geotechnical Soil Profile

|            |                                                       |
|------------|-------------------------------------------------------|
| Client:    | Marike Vreken Town Planners                           |
| Project:   | Erf 2667, 2686 & 2687 (Middle Income Housing Project) |
| Area:      | Great Brak                                            |
| Date:      | 09.04.2026                                            |
| Excavator: | TLB                                                   |





## **Appendix 3**

### **Lab test data**





# OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

## Materials Testing Laboratory

6 Mirrorball Street, George : PO Box 3186, George Industria, 6536

Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqua.co.za

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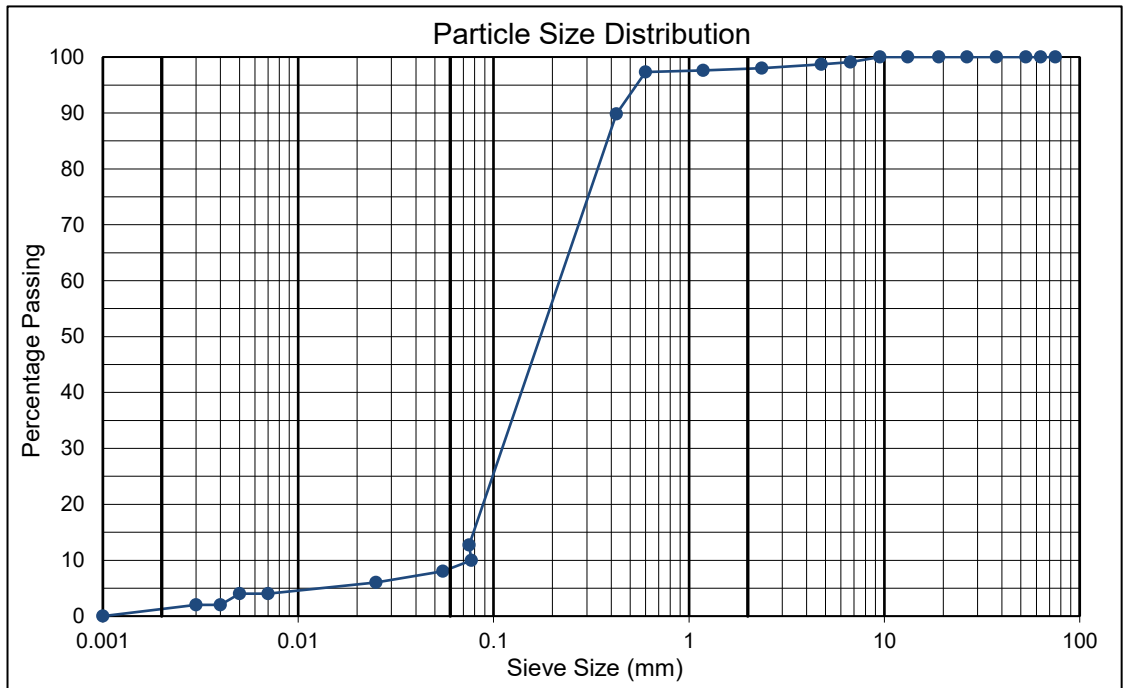
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|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
| Attention : | Iain Paton                                                       | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
|             |                                                                  | No. of Pages :  | 2 of 7                                                |

### TEST REPORT

#### FOUNDATION INDICATOR - (ASTM Method D422)

|                       |                                                                                 |
|-----------------------|---------------------------------------------------------------------------------|
| Sample Position (SV)  | TP1                                                                             |
| Depth (mm):           | 1100-2600                                                                       |
| Sample No.:           | 94416                                                                           |
| Materials Description | Source<br>Colour<br>Soil Type<br>Classification                                 |
|                       | Test Pit<br>Light Yellow Mottled Dark Yellowish Orange<br>Silty Sand<br>In-situ |

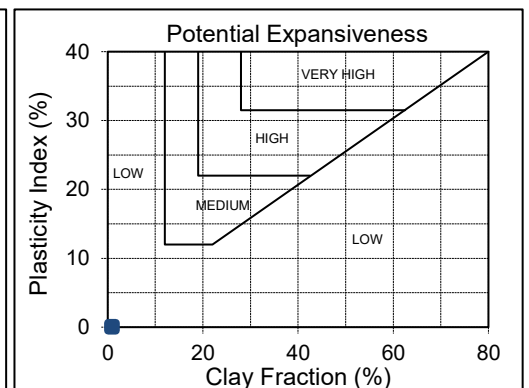
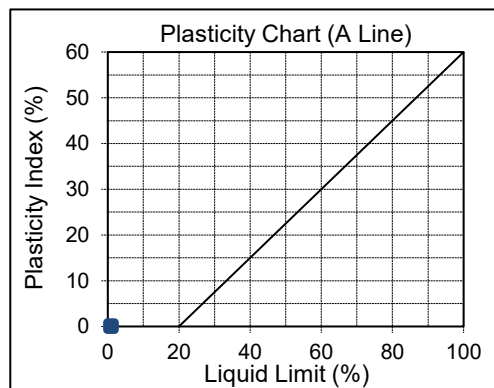
|         |     |
|---------|-----|
| 75.0mm  | 100 |
| 63.0mm  | 100 |
| 53.0mm  | 100 |
| 37.5mm  | 100 |
| 26.5mm  | 100 |
| 19mm    | 100 |
| 13.2mm  | 100 |
| 9.5mm   | 100 |
| 6.7mm   | 99  |
| 4.75mm  | 99  |
| 2.36mm  | 98  |
| 1.18mm  | 98  |
| 0.6mm   | 97  |
| 0.425mm | 90  |
| 0.075mm | 13  |
| 0.077mm | 10  |
| 0.055mm | 8   |
| 0.025mm | 6   |
| 0.007mm | 4   |
| 0.005mm | 4   |
| 0.004mm | 2   |
| 0.003mm | 2   |
| 0.001mm | 0   |



|                      |     |
|----------------------|-----|
| Liquid Limit (%)     | NP  |
| Plasticity Index (%) | NP  |
| Linear Shrinkage (%) | NP  |
| Moisture Content (%) | 2.4 |

|          |    |
|----------|----|
| % Clay   | 1  |
| % Silt   | 7  |
| % Sand   | 90 |
| % Gravel | 2  |

|                             |       |
|-----------------------------|-------|
| Unified Soil Classification | SM    |
| AASHTO Soil Classification  | A-2-4 |



- Specimen delivered to Outeniqua Lab in good order.

Ruaan Lesch  
Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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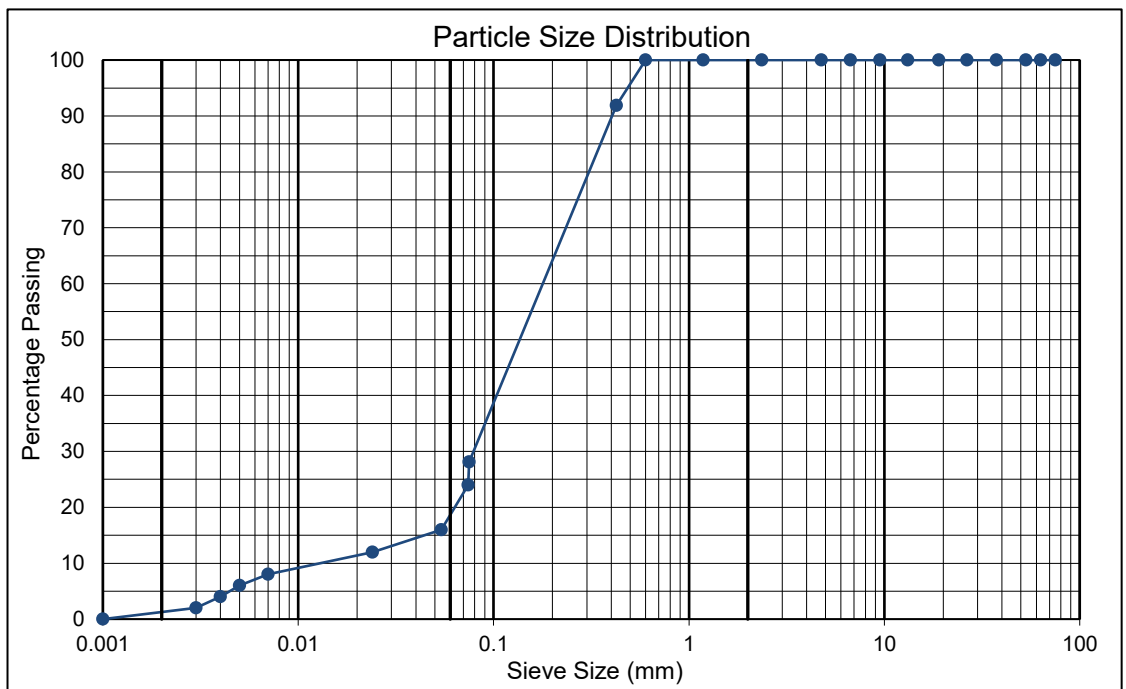
T0347

|             |                                                                  |                 |                                                       |
|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
| Attention : | Iain Paton                                                       | Date Received : | 09/04/2026                                            |
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|             |                                                                  | No. of Pages :  | 1 of 7                                                |

## TEST REPORT FOUNDATION INDICATOR - (ASTM Method D422)

|                       |                                                                                 |
|-----------------------|---------------------------------------------------------------------------------|
| Sample Position (SV)  | TP2                                                                             |
| Depth (mm):           | 800-2600                                                                        |
| Sample No.:           | 94414                                                                           |
| Materials Description | Test Pit<br>Light Yellow Mottled Dark Yellowish Orange<br>Silty Sand<br>In-situ |
| Source                |                                                                                 |
| Colour                |                                                                                 |
| Soil Type             |                                                                                 |
| Classification        |                                                                                 |

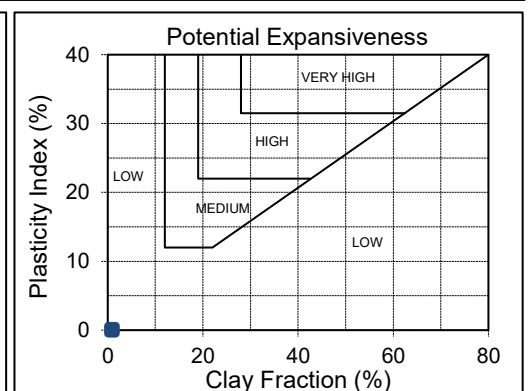
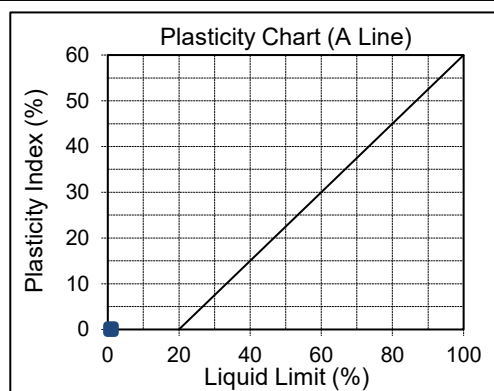
|         |     |
|---------|-----|
| 75.0mm  | 100 |
| 63.0mm  | 100 |
| 53.0mm  | 100 |
| 37.5mm  | 100 |
| 26.5mm  | 100 |
| 19mm    | 100 |
| 13.2mm  | 100 |
| 9.5mm   | 100 |
| 6.7mm   | 100 |
| 4.75mm  | 100 |
| 2.36mm  | 100 |
| 1.18mm  | 100 |
| 0.6mm   | 100 |
| 0.425mm | 92  |
| 0.075mm | 28  |
| 0.074mm | 24  |
| 0.054mm | 16  |
| 0.024mm | 12  |
| 0.007mm | 8   |
| 0.005mm | 6   |
| 0.004mm | 4   |
| 0.003mm | 2   |
| 0.001mm | 0   |



|                      |     |
|----------------------|-----|
| Liquid Limit (%)     | NP  |
| Plasticity Index (%) | NP  |
| Linear Shrinkage (%) | NP  |
| Moisture Content (%) | 3.5 |

|          |    |
|----------|----|
| % Clay   | 1  |
| % Silt   | 17 |
| % Sand   | 82 |
| % Gravel | 0  |

|                             |       |
|-----------------------------|-------|
| Unified Soil Classification | SM    |
| AASHTO Soil Classification  | A-2-4 |



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Ruaan Lesch  
Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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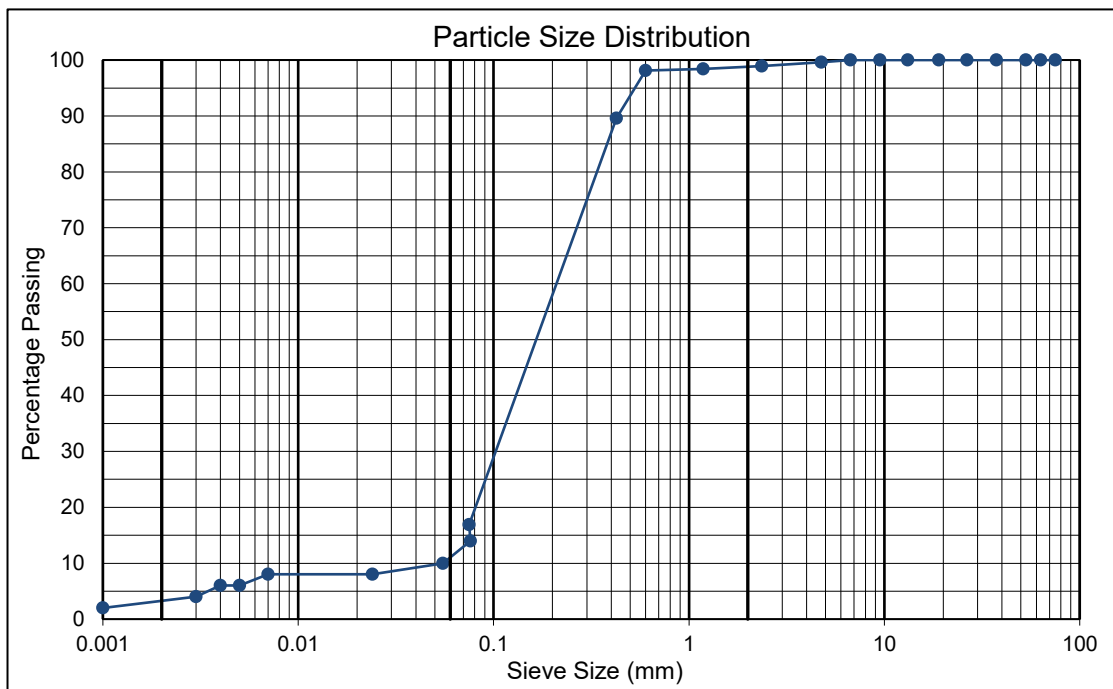
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|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
| Attention : | Iain Paton                                                       | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
|             |                                                                  | No. of Pages :  | 3 of 7                                                |

## TEST REPORT

### FOUNDATION INDICATOR - (ASTM Method D422)

|                       |                                                   |
|-----------------------|---------------------------------------------------|
| Sample Position (SV)  | TP3                                               |
| Depth (mm):           | 1700-2700                                         |
| Sample No.:           | 94418                                             |
| Materials Description | Source<br>Colour<br>Soil Type<br>Classification   |
|                       | Test Pit<br>Light Yellow<br>Silty Sand<br>In-situ |

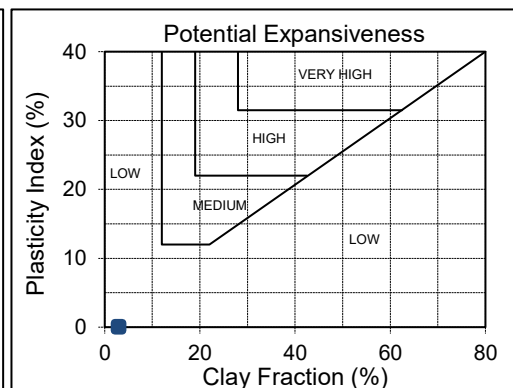
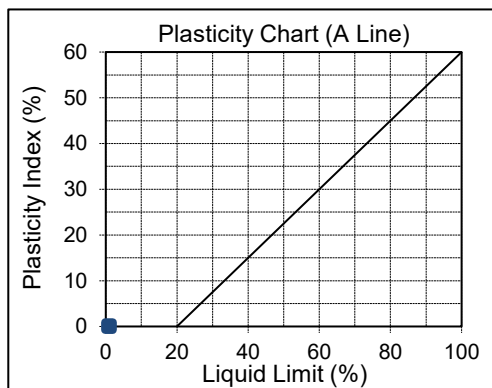
|                    |         |     |
|--------------------|---------|-----|
| Percentage Passing | 75.0mm  | 100 |
|                    | 63.0mm  | 100 |
|                    | 53.0mm  | 100 |
|                    | 37.5mm  | 100 |
|                    | 26.5mm  | 100 |
|                    | 19mm    | 100 |
|                    | 13.2mm  | 100 |
|                    | 9.5mm   | 100 |
|                    | 6.7mm   | 100 |
|                    | 4.75mm  | 100 |
|                    | 2.36mm  | 99  |
|                    | 1.18mm  | 98  |
|                    | 0.6mm   | 98  |
|                    | 0.425mm | 90  |
|                    | 0.075mm | 17  |
|                    | 0.076mm | 14  |
|                    | 0.055mm | 10  |
|                    | 0.024mm | 8   |
|                    | 0.007mm | 8   |
|                    | 0.005mm | 6   |
|                    | 0.004mm | 6   |
|                    | 0.003mm | 4   |
|                    | 0.001mm | 2   |



|                      |      |
|----------------------|------|
| Liquid Limit (%)     | NP   |
| Plasticity Index (%) | NP   |
| Linear Shrinkage (%) | NP   |
| Moisture Content (%) | 10.5 |

|          |    |
|----------|----|
| % Clay   | 3  |
| % Silt   | 8  |
| % Sand   | 88 |
| % Gravel | 1  |

|                             |       |
|-----------------------------|-------|
| Unified Soil Classification | SM    |
| AASHTO Soil Classification  | A-2-4 |



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Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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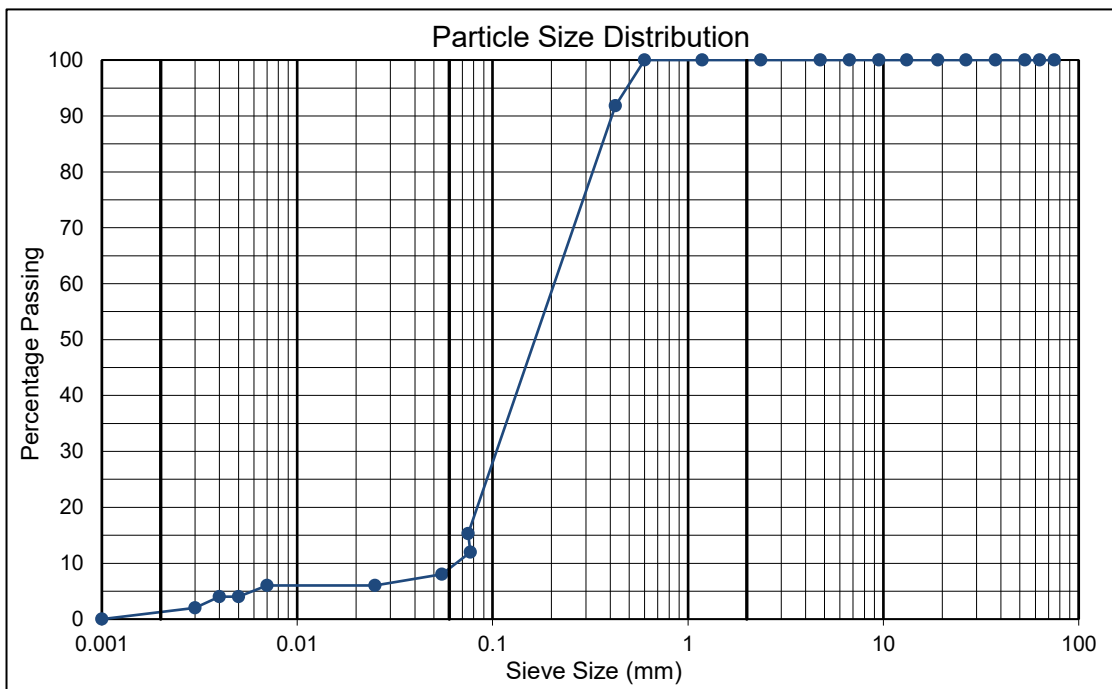
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|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
| Attention : | Iain Paton                                                       | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
|             |                                                                  | No. of Pages :  | 4 of 7                                                |

## TEST REPORT

### FOUNDATION INDICATOR - (ASTM Method D422)

|                       |                                                                                 |
|-----------------------|---------------------------------------------------------------------------------|
| Sample Position (SV)  | TP4                                                                             |
| Depth (mm):           | 1000-2800                                                                       |
| Sample No.:           | 94419                                                                           |
| Materials Description | Test Pit<br>Light Yellow Mottled Dark Yellowish Orange<br>Silty Sand<br>In-situ |
| Source                |                                                                                 |
| Colour                |                                                                                 |
| Soil Type             |                                                                                 |
| Classification        |                                                                                 |

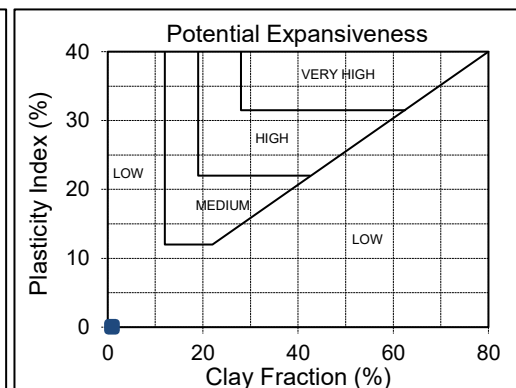
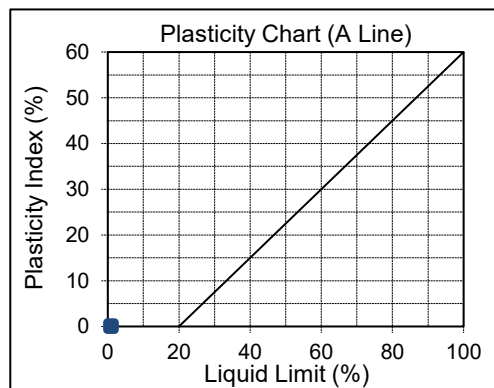
|         |     |
|---------|-----|
| 75.0mm  | 100 |
| 63.0mm  | 100 |
| 53.0mm  | 100 |
| 37.5mm  | 100 |
| 26.5mm  | 100 |
| 19mm    | 100 |
| 13.2mm  | 100 |
| 9.5mm   | 100 |
| 6.7mm   | 100 |
| 4.75mm  | 100 |
| 2.36mm  | 100 |
| 1.18mm  | 100 |
| 0.6mm   | 100 |
| 0.425mm | 92  |
| 0.075mm | 15  |
| 0.077mm | 12  |
| 0.055mm | 8   |
| 0.025mm | 6   |
| 0.007mm | 6   |
| 0.005mm | 4   |
| 0.004mm | 4   |
| 0.003mm | 2   |
| 0.001mm | 0   |



|                      |     |
|----------------------|-----|
| Liquid Limit (%)     | NP  |
| Plasticity Index (%) | NP  |
| Linear Shrinkage (%) | NP  |
| Moisture Content (%) | 4.7 |

|          |    |
|----------|----|
| % Clay   | 1  |
| % Silt   | 8  |
| % Sand   | 91 |
| % Gravel | 0  |

|                             |       |
|-----------------------------|-------|
| Unified Soil Classification | SM    |
| AASHTO Soil Classification  | A-2-4 |



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Ruaan Lesch  
Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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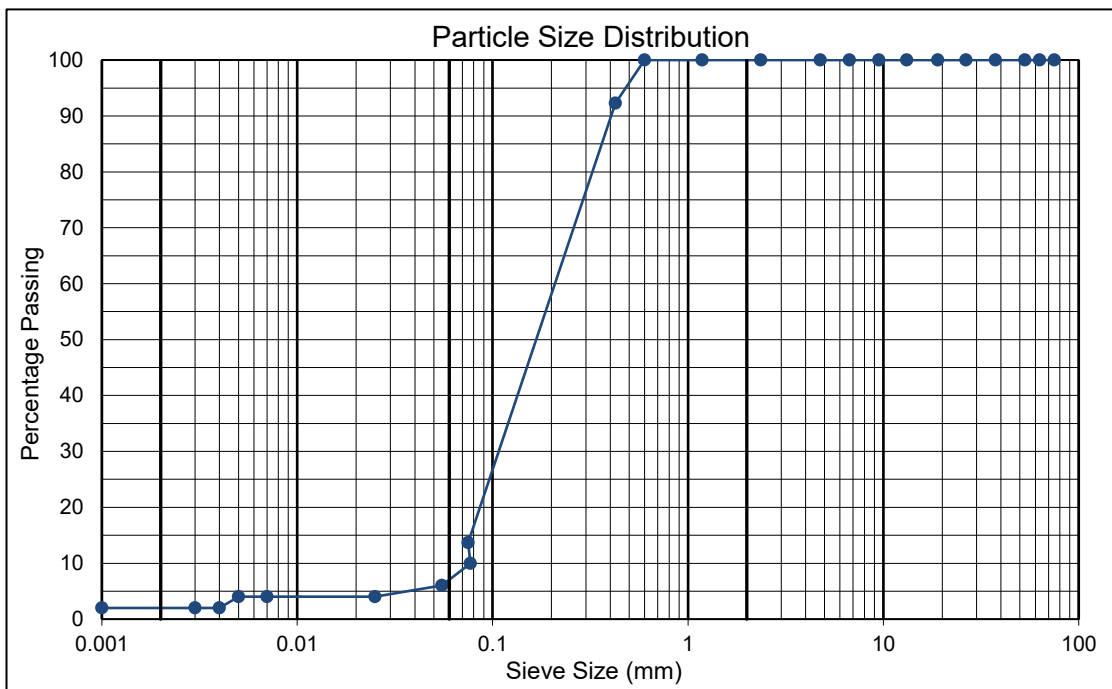
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|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
| Attention : | Iain Paton                                                       | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
|             |                                                                  | No. of Pages :  | 5 of 7                                                |

## TEST REPORT

### FOUNDATION INDICATOR - (ASTM Method D422)

|                       |                                                   |
|-----------------------|---------------------------------------------------|
| Sample Position (SV)  | TP5                                               |
| Depth (mm):           | 1100-2500                                         |
| Sample No.:           | 94420                                             |
| Materials Description | Source<br>Colour<br>Soil Type<br>Classification   |
|                       | Test Pit<br>Light Yellow<br>Silty Sand<br>In-situ |

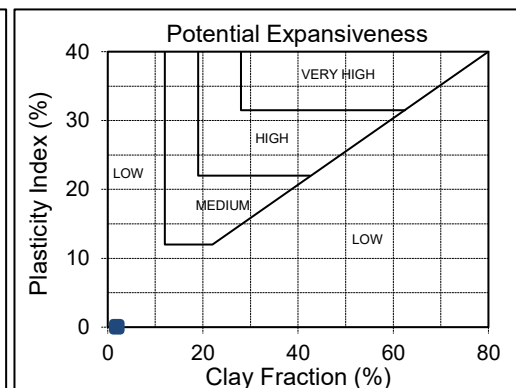
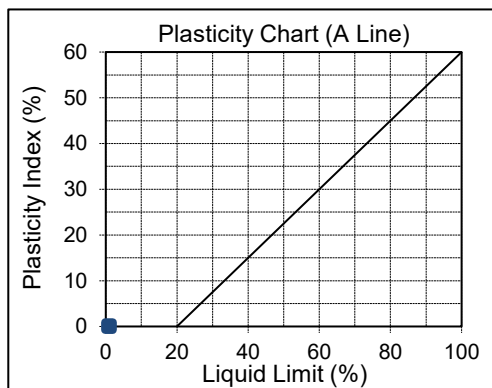
|         |     |
|---------|-----|
| 75.0mm  | 100 |
| 63.0mm  | 100 |
| 53.0mm  | 100 |
| 37.5mm  | 100 |
| 26.5mm  | 100 |
| 19mm    | 100 |
| 13.2mm  | 100 |
| 9.5mm   | 100 |
| 6.7mm   | 100 |
| 4.75mm  | 100 |
| 2.36mm  | 100 |
| 1.18mm  | 100 |
| 0.6mm   | 100 |
| 0.425mm | 92  |
| 0.075mm | 14  |
| 0.077mm | 10  |
| 0.055mm | 6   |
| 0.025mm | 4   |
| 0.007mm | 4   |
| 0.005mm | 4   |
| 0.004mm | 2   |
| 0.003mm | 2   |
| 0.001mm | 2   |



|                      |     |
|----------------------|-----|
| Liquid Limit (%)     | NP  |
| Plasticity Index (%) | NP  |
| Linear Shrinkage (%) | NP  |
| Moisture Content (%) | 1.9 |

|          |    |
|----------|----|
| % Clay   | 2  |
| % Silt   | 5  |
| % Sand   | 93 |
| % Gravel | 0  |

|                             |       |
|-----------------------------|-------|
| Unified Soil Classification | SM    |
| AASHTO Soil Classification  | A-2-4 |



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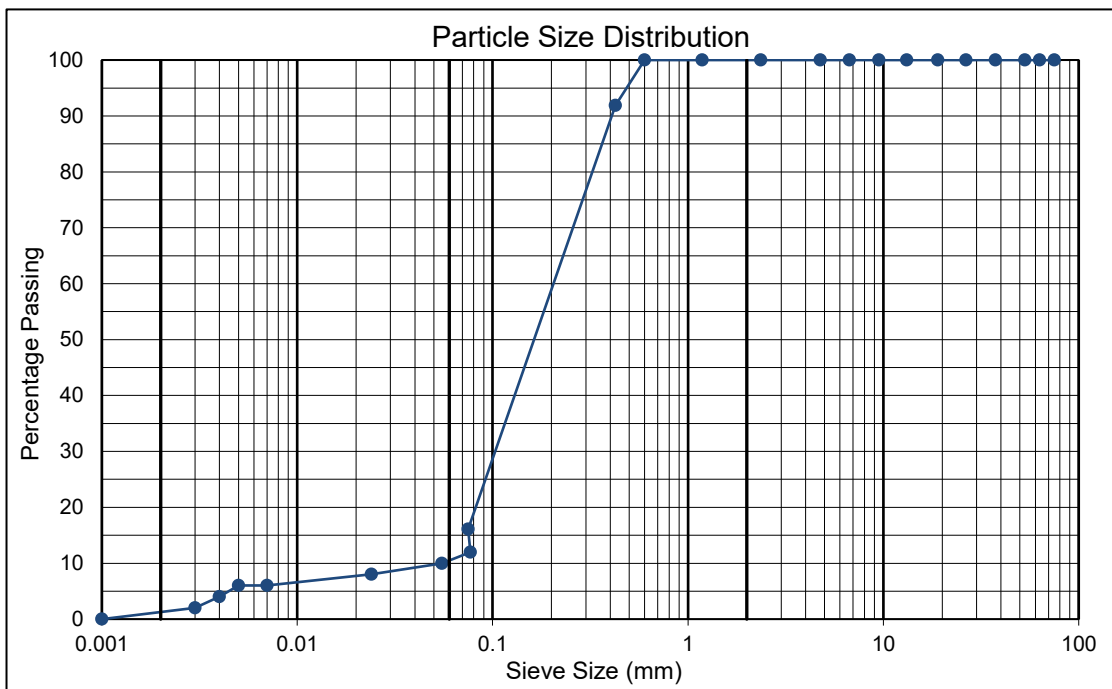
|             |                                                                  |                 |                                                       |
|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
| Attention : | Iain Paton                                                       | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
|             |                                                                  | No. of Pages :  | 6 of 7                                                |

## TEST REPORT

### FOUNDATION INDICATOR - (ASTM Method D422)

|                       |                                                   |
|-----------------------|---------------------------------------------------|
| Sample Position (SV)  | TP6                                               |
| Depth (mm):           | 1000-2600                                         |
| Sample No.:           | 94422                                             |
| Materials Description | Test Pit<br>Light Yellow<br>Silty Sand<br>In-situ |
| Source                |                                                   |
| Colour                |                                                   |
| Soil Type             |                                                   |
| Classification        |                                                   |

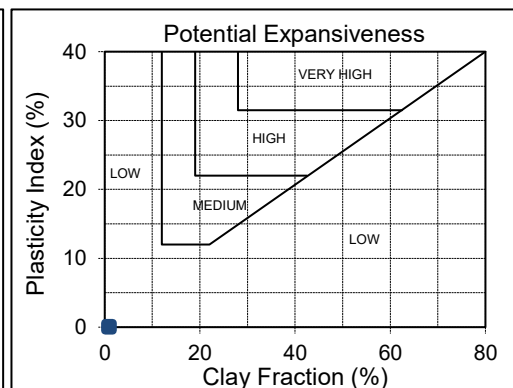
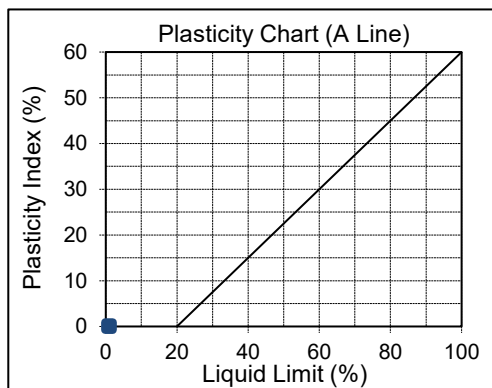
|         |     |
|---------|-----|
| 75.0mm  | 100 |
| 63.0mm  | 100 |
| 53.0mm  | 100 |
| 37.5mm  | 100 |
| 26.5mm  | 100 |
| 19mm    | 100 |
| 13.2mm  | 100 |
| 9.5mm   | 100 |
| 6.7mm   | 100 |
| 4.75mm  | 100 |
| 2.36mm  | 100 |
| 1.18mm  | 100 |
| 0.6mm   | 100 |
| 0.425mm | 92  |
| 0.075mm | 16  |
| 0.077mm | 12  |
| 0.055mm | 10  |
| 0.024mm | 8   |
| 0.007mm | 6   |
| 0.005mm | 6   |
| 0.004mm | 4   |
| 0.003mm | 2   |
| 0.001mm | 0   |



|                      |     |
|----------------------|-----|
| Liquid Limit (%)     | NP  |
| Plasticity Index (%) | NP  |
| Linear Shrinkage (%) | NP  |
| Moisture Content (%) | 3.5 |

|          |    |
|----------|----|
| % Clay   | 1  |
| % Silt   | 9  |
| % Sand   | 90 |
| % Gravel | 0  |

|                             |       |
|-----------------------------|-------|
| Unified Soil Classification | SM    |
| AASHTO Soil Classification  | A-2-4 |



• Specimen delivered to Outeniqua Lab in good order.

Ruaan Lesch  
Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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Director: L Heathcote B-Tech. (Civil Eng.) & BSc Hons (Transport)





# OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

## Materials Testing Laboratory

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Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqua.co.za

R-FIND-1-6

Jan-22



T0347

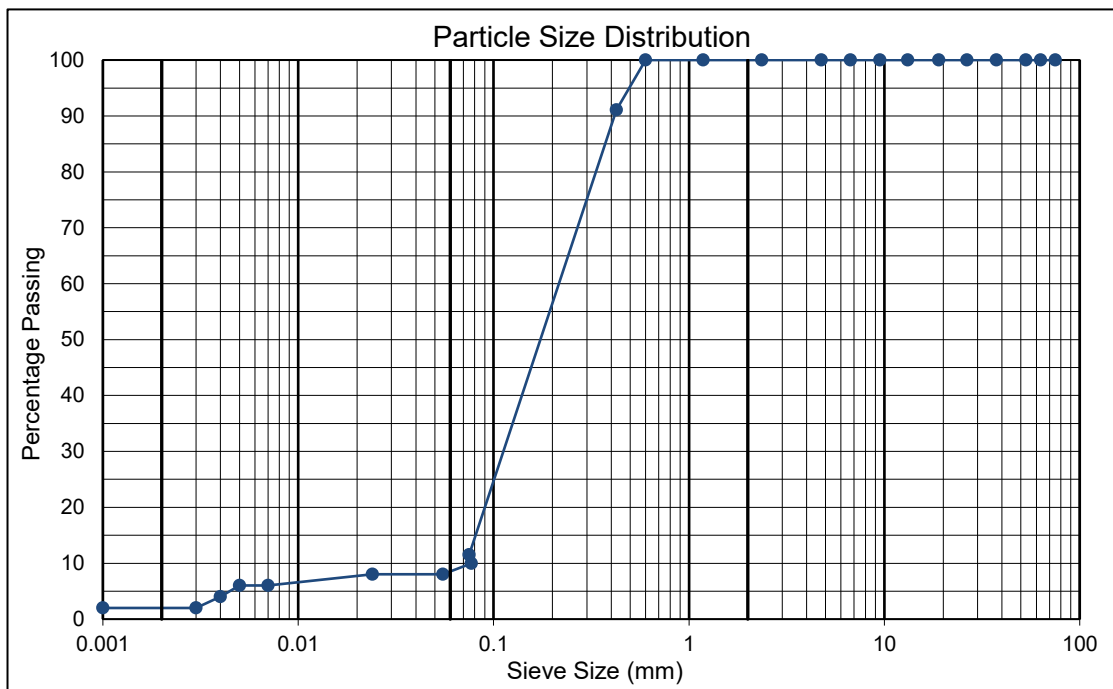
|             |                                                                  |                 |                                                       |
|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
| Attention : | Iain Paton                                                       | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
|             |                                                                  | No. of Pages :  | 7 of 7                                                |

### TEST REPORT

#### FOUNDATION INDICATOR - (ASTM Method D422)

|                       |                                                                   |
|-----------------------|-------------------------------------------------------------------|
| Sample Position (SV)  | TP7                                                               |
| Depth (mm):           | 1400-2700                                                         |
| Sample No.:           | 94423                                                             |
| Materials Description | Source<br>Colour<br>Soil Type<br>Classification                   |
|                       | Test Pit<br>Light Yellow<br>Well Graded Sand with Silt<br>In-situ |

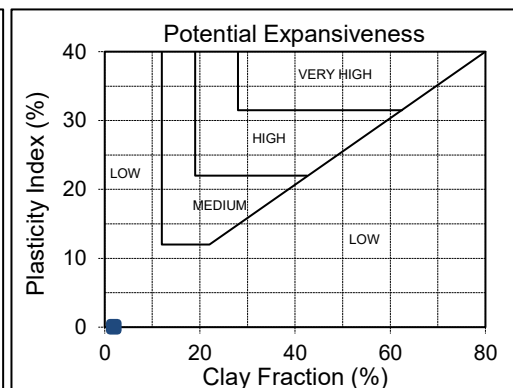
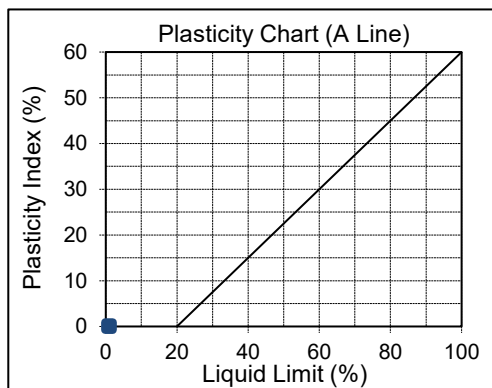
|         |     |
|---------|-----|
| 75.0mm  | 100 |
| 63.0mm  | 100 |
| 53.0mm  | 100 |
| 37.5mm  | 100 |
| 26.5mm  | 100 |
| 19mm    | 100 |
| 13.2mm  | 100 |
| 9.5mm   | 100 |
| 6.7mm   | 100 |
| 4.75mm  | 100 |
| 2.36mm  | 100 |
| 1.18mm  | 100 |
| 0.6mm   | 100 |
| 0.425mm | 91  |
| 0.075mm | 12  |
| 0.077mm | 10  |
| 0.055mm | 8   |
| 0.024mm | 8   |
| 0.007mm | 6   |
| 0.005mm | 6   |
| 0.004mm | 4   |
| 0.003mm | 2   |
| 0.001mm | 2   |



|                      |     |
|----------------------|-----|
| Liquid Limit (%)     | NP  |
| Plasticity Index (%) | NP  |
| Linear Shrinkage (%) | NP  |
| Moisture Content (%) | 1.7 |

|          |    |
|----------|----|
| % Clay   | 2  |
| % Silt   | 6  |
| % Sand   | 92 |
| % Gravel | 0  |

|                             |       |
|-----------------------------|-------|
| Unified Soil Classification | SW-SM |
| AASHTO Soil Classification  | A-2-4 |



• Specimen delivered to Outeniqua Lab in good order.

Ruaan Lesch  
Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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Director: L Heathcote B-Tech. (Civil Eng.) & BSc Hons (Transport)





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R-CBR-1-9

Jun-23



T0347

|             |                                                                  |                 |                                                       |
|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
|             |                                                                  | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
| Attention : | Iain Paton                                                       | No. of Pages :  | 2 of 4                                                |

### TEST REPORT CALIFORNIA BEARING RATIO

|                                                                           |                              |                                            |             |         |  |  |
|---------------------------------------------------------------------------|------------------------------|--------------------------------------------|-------------|---------|--|--|
| Sample Position (SV)                                                      |                              | TP1                                        | COTO DS:    |         |  |  |
| Depth (mm)                                                                |                              | 1100-2600                                  | G8 SSG      |         |  |  |
| Sample No                                                                 |                              | 94417                                      |             |         |  |  |
| Materials Description                                                     | Source                       | Test Pit                                   |             |         |  |  |
|                                                                           | Colour                       | Light Yellow Mottled Dark Yellowish Orange |             |         |  |  |
|                                                                           | Soil Type                    | Fine Sand                                  |             |         |  |  |
|                                                                           | Classification               | In-situ                                    |             |         |  |  |
| Material Indicators - (SANS 3001 Method GR1)                              |                              |                                            |             |         |  |  |
| Percentage Passing                                                        | 75 mm                        | 100                                        |             | Opinion |  |  |
|                                                                           | 63 mm                        | 100                                        |             |         |  |  |
|                                                                           | 50 mm                        | 100                                        |             |         |  |  |
|                                                                           | 37.5 mm                      | 100                                        |             |         |  |  |
|                                                                           | 28 mm                        | 100                                        |             |         |  |  |
|                                                                           | 20 mm                        | 100                                        |             |         |  |  |
|                                                                           | 14 mm                        | 100                                        |             |         |  |  |
|                                                                           | 5 mm                         | 96                                         |             |         |  |  |
|                                                                           | 2 mm                         | 94                                         |             |         |  |  |
|                                                                           | 0.425 mm                     | 92                                         |             |         |  |  |
| 0.075 mm                                                                  | 3.7                          |                                            |             |         |  |  |
| Material Indicators - (SANS 3001 Method PR5)                              |                              |                                            |             |         |  |  |
| Grading Modulus *                                                         |                              | 1.11                                       | 0.75 - 2.70 | ✓       |  |  |
| Coarse Sand Soil-Mortar (%)                                               |                              | 2                                          |             |         |  |  |
| Atterberg Limits - (SANS 3001 Method GR10)                                |                              |                                            |             |         |  |  |
| Liquid Limit (%)                                                          |                              | Undetermined                               |             |         |  |  |
| Plasticity Index (%)                                                      |                              | NP                                         | ≤ 13        | ✓       |  |  |
| Linear Shrinkage (%)                                                      |                              | NP                                         |             |         |  |  |
| Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)                |                              |                                            |             |         |  |  |
| MDD                                                                       | Max Dry Density (kg/m³)      | 1624                                       |             |         |  |  |
|                                                                           | Optimum Moisture Content (%) | 14.2                                       |             |         |  |  |
|                                                                           | Mould Moisture Content (%)   | 14.2                                       |             |         |  |  |
| A                                                                         | Relative Compaction (%)      | 100.0                                      |             |         |  |  |
|                                                                           | Swell (%)                    | 0.0                                        | ≤ 1.5       | ✓       |  |  |
| B                                                                         | Relative Compaction (%)      | 95.9                                       |             |         |  |  |
|                                                                           | Swell (%)                    | 0.0                                        |             |         |  |  |
| C                                                                         | Relative Compaction (%)      | 92.0                                       |             |         |  |  |
|                                                                           | Swell (%)                    | 0.0                                        |             |         |  |  |
| CBR                                                                       | @100% Max Dry Density        | 17                                         |             |         |  |  |
|                                                                           | @98% Max Dry Density         | 13                                         |             |         |  |  |
|                                                                           | @95% Max Dry Density         | 10                                         |             |         |  |  |
|                                                                           | @93% Max Dry Density         | 8                                          | ≥ 10        | *       |  |  |
|                                                                           | @90% Max Dry Density         | 6                                          |             |         |  |  |
| Material Condition                                                        |                              |                                            |             |         |  |  |
| Insitu Moisture Content (%)                                               |                              |                                            |             |         |  |  |
| Soil Classification Of The Material Based Only On The Tests Results Above |                              |                                            |             |         |  |  |
| COTO DS Specification:                                                    |                              | G8 SSG                                     |             |         |  |  |
| AASHTO System                                                             |                              | A-3 / A-2-4                                |             |         |  |  |
| Unified System                                                            |                              | SP                                         |             |         |  |  |

**Sieve Analysis**

| Sieve Size (mm) | Percentage Passing (%) |
|-----------------|------------------------|
| 0.075           | 0                      |
| 0.15            | 0                      |
| 0.3             | 0                      |
| 0.425           | 92                     |
| 0.6             | 94                     |
| 0.85            | 96                     |
| 1.18            | 96                     |
| 1.75            | 96                     |
| 2.5             | 96                     |
| 3.35            | 96                     |
| 4.75            | 96                     |
| 6.35            | 96                     |
| 7.5             | 96                     |
| 10.0            | 96                     |
| 15.0            | 96                     |
| 20.0            | 96                     |
| 25.0            | 96                     |
| 30.0            | 96                     |
| 35.0            | 96                     |
| 40.0            | 96                     |
| 45.0            | 96                     |
| 50.0            | 96                     |
| 60.0            | 96                     |
| 75.0            | 100                    |

**CBR Chart**

| Compaction (%) | CBR (%) |
|----------------|---------|
| 92             | 8       |
| 96             | 10      |
| 98             | 12      |
| 100            | 17      |

**Sieve Analysis**

| Sieve Size (mm) | Percentage Passing (%) |
|-----------------|------------------------|
| 0.075           | 0                      |
| 0.15            | 0                      |
| 0.3             | 0                      |
| 0.425           | 0                      |
| 0.6             | 0                      |
| 0.85            | 0                      |
| 1.18            | 0                      |
| 1.75            | 0                      |
| 2.5             | 0                      |
| 3.35            | 0                      |
| 4.75            | 0                      |
| 6.35            | 0                      |
| 7.5             | 0                      |
| 10.0            | 0                      |
| 15.0            | 0                      |
| 20.0            | 0                      |
| 25.0            | 0                      |
| 30.0            | 0                      |
| 35.0            | 0                      |
| 40.0            | 0                      |
| 45.0            | 0                      |
| 50.0            | 0                      |
| 60.0            | 0                      |
| 75.0            | 0                      |
| 100.0           | 0                      |

**CBR Chart**

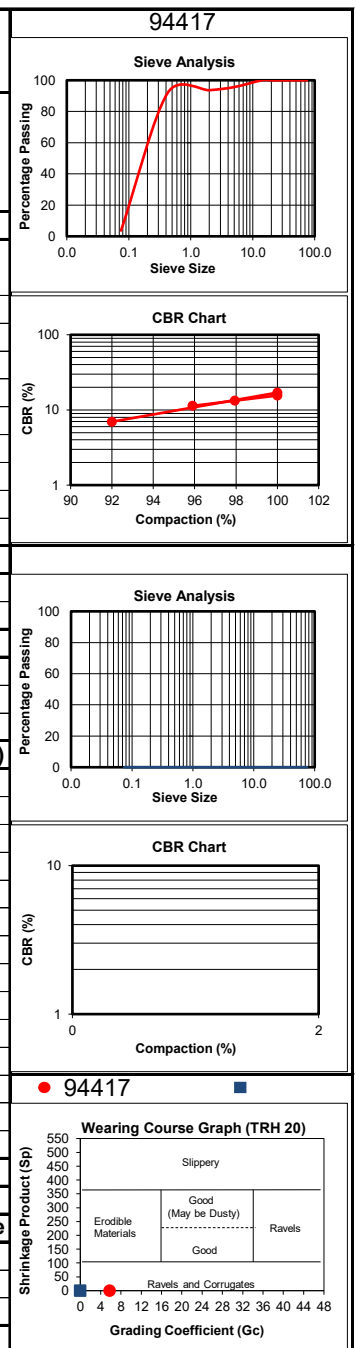
| Compaction (%) | CBR (%) |
|----------------|---------|
| 90             | 0       |
| 92             | 0       |
| 94             | 0       |
| 96             | 0       |
| 98             | 0       |
| 100            | 0       |
| 102            | 0       |

● 94417 ■

**Wearing Course Graph (TRH 20)**

| Grading Coefficient (Gc) | Shrinkage Product (Sp) |
|--------------------------|------------------------|
| 0                        | 0                      |
| 4                        | 0                      |
| 8                        | 0                      |
| 12                       | 0                      |
| 16                       | 0                      |
| 20                       | 0                      |
| 24                       | 0                      |
| 28                       | 0                      |
| 32                       | 0                      |
| 36                       | 0                      |
| 40                       | 0                      |
| 44                       | 0                      |
| 48                       | 0                      |

Tests marked with a ( \* ) are NOT SANAS Accredited results.



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- The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (✓), non compliant (×) and uncertain (\*) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
- The uncertain (\*) indicates that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (✓) or non compliant (×) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
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R-CBR-1-9

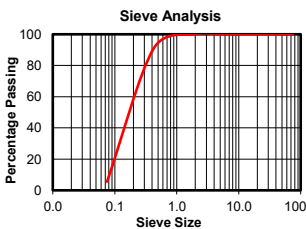
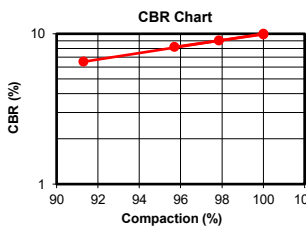
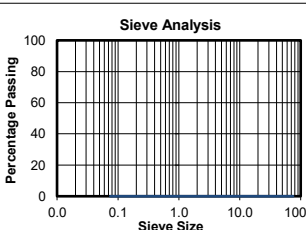
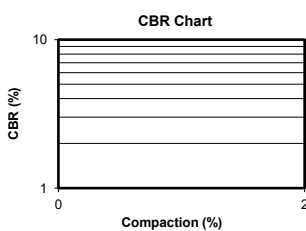
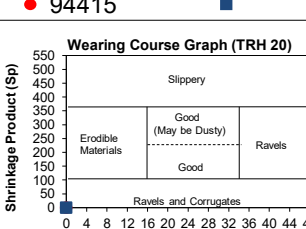
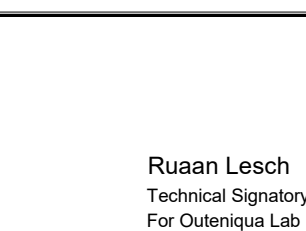
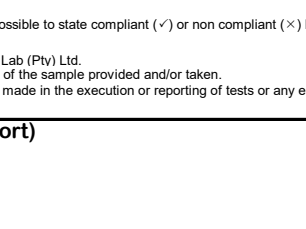
Jun-23



T0347

|             |                                                                  |                 |                                                       |
|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
|             |                                                                  | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
| Attention : | Iain Paton                                                       | No. of Pages :  | 1 of 4                                                |

### TEST REPORT CALIFORNIA BEARING RATIO

|                                                                           |                              |                                            |             |         |  |  |                                                                                       |  |
|---------------------------------------------------------------------------|------------------------------|--------------------------------------------|-------------|---------|--|--|---------------------------------------------------------------------------------------|--|
| Sample Position (SV)                                                      |                              | TP2                                        | COTO DS:    |         |  |  | 94415                                                                                 |  |
| Depth (mm)                                                                |                              | 800-2600                                   | G8 SSG      |         |  |  |                                                                                       |  |
| Sample No                                                                 |                              | 94415                                      |             |         |  |  |                                                                                       |  |
| Materials<br>Descriptio<br>n                                              | Source                       | Test Pit                                   |             |         |  |  |    |  |
|                                                                           | Colour                       | Light Yellow Mottled Dark Yellowish Orange |             |         |  |  |                                                                                       |  |
|                                                                           | Soil Type                    | Fine Sand                                  |             |         |  |  |                                                                                       |  |
|                                                                           | Classification               | In-situ                                    |             |         |  |  |                                                                                       |  |
| Material Indicators - (SANS 3001 Method GR1)                              |                              |                                            |             |         |  |  |                                                                                       |  |
| Percentage Passing                                                        | 75 mm                        | 100                                        |             | Opinion |  |  |    |  |
|                                                                           | 63 mm                        | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 50 mm                        | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 37.5 mm                      | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 28 mm                        | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 20 mm                        | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 14 mm                        | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 5 mm                         | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 2 mm                         | 100                                        |             |         |  |  |                                                                                       |  |
|                                                                           | 0.425 mm                     | 91                                         |             |         |  |  |                                                                                       |  |
| 0.075 mm                                                                  | 5.6                          |                                            |             |         |  |  |                                                                                       |  |
| Material Indicators - (SANS 3001 Method PR5)                              |                              |                                            |             |         |  |  |                                                                                       |  |
| Grading Modulus *                                                         |                              | 1.03                                       | 0.75 - 2.70 | ✓       |  |  |   |  |
| Coarse Sand Soil-Mortar (%)                                               |                              | 9                                          |             |         |  |  |                                                                                       |  |
| Atterberg Limits - (SANS 3001 Method GR10)                                |                              |                                            |             |         |  |  |                                                                                       |  |
| Liquid Limit (%)                                                          |                              | Undetermined                               |             |         |  |  |  |  |
| Plasticity Index (%)                                                      |                              | NP                                         | ≤ 13        | ✓       |  |  |                                                                                       |  |
| Linear Shrinkage (%)                                                      |                              | NP                                         |             |         |  |  |                                                                                       |  |
| Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)                |                              |                                            |             |         |  |  |                                                                                       |  |
| MDD                                                                       | Max Dry Density (kg/m³)      | 1608                                       |             |         |  |  |  |  |
|                                                                           | Optimum Moisture Content (%) | 13.9                                       |             |         |  |  |                                                                                       |  |
|                                                                           | Mould Moisture Content (%)   | 13.9                                       |             |         |  |  |                                                                                       |  |
| A                                                                         | Relative Compaction (%)      | 100.0                                      |             |         |  |  |  |  |
|                                                                           | Swell (%)                    | 0.0                                        | ≤ 1.5       | ✓       |  |  |                                                                                       |  |
| B                                                                         | Relative Compaction (%)      | 95.7                                       |             |         |  |  |  |  |
|                                                                           | Swell (%)                    | 0.0                                        |             |         |  |  |                                                                                       |  |
| C                                                                         | Relative Compaction (%)      | 91.3                                       |             |         |  |  |  |  |
|                                                                           | Swell (%)                    | 0.0                                        |             |         |  |  |                                                                                       |  |
| CBR                                                                       | @100% Max Dry Density        | 10                                         |             |         |  |  |  |  |
|                                                                           | @98% Max Dry Density         | 9                                          |             |         |  |  |                                                                                       |  |
|                                                                           | @95% Max Dry Density         | 8                                          |             |         |  |  |                                                                                       |  |
|                                                                           | @93% Max Dry Density         | 7                                          | ≥ 10        | *       |  |  |                                                                                       |  |
|                                                                           | @90% Max Dry Density         | 6                                          |             |         |  |  |                                                                                       |  |
| Material Condition                                                        |                              |                                            |             |         |  |  |                                                                                       |  |
| Insitu Moisture Content (%)                                               |                              |                                            |             |         |  |  | ● 94415 ■                                                                             |  |
| Soil Classification Of The Material Based Only On The Tests Results Above |                              |                                            |             |         |  |  |                                                                                       |  |
| COTO DS Specification:                                                    |                              | G8 SSG                                     |             |         |  |  |                                                                                       |  |
| AASHTO System                                                             |                              | A-3 / A-2-4                                |             |         |  |  |  |  |
| Unified System                                                            |                              | SP-SM                                      |             |         |  |  |                                                                                       |  |
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Ruaan Lesch  
Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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Director: L Heathcote B-Tech. (Civil Eng.) & BSc Hons (Transport)





# OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

## Materials Testing Laboratory

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R-CBR-1-9

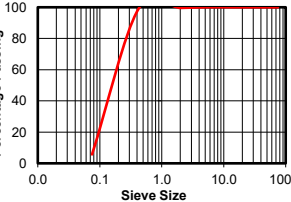
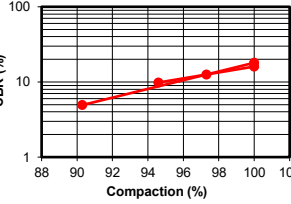
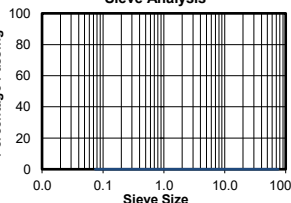
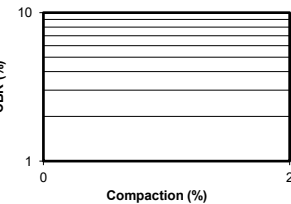
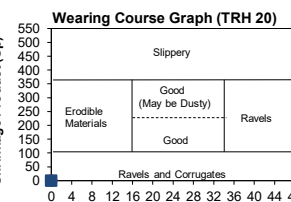
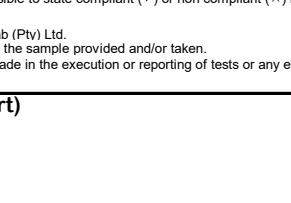
Jun-23



T0347

|             |                                                                  |                 |                                                       |
|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
|             |                                                                  | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
| Attention : | Iain Paton                                                       | No. of Pages :  | 3 of 4                                                |

### TEST REPORT CALIFORNIA BEARING RATIO

|                                                                           |                              |              |             |         |  |  |                                                                                       |                                                                                       |
|---------------------------------------------------------------------------|------------------------------|--------------|-------------|---------|--|--|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Sample Position (SV)                                                      |                              | TP5          | COTO DS:    |         |  |  | 94421                                                                                 |                                                                                       |
| Depth (mm)                                                                |                              | 1100-2500    | G8 SSG      |         |  |  |    |                                                                                       |
| Sample No                                                                 |                              | 94421        |             |         |  |  |                                                                                       |                                                                                       |
| Materials Description                                                     | Source                       | Test Pit     |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | Colour                       | Light Yellow |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | Soil Type                    | Fine Sand    |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | Classification               | In-situ      |             |         |  |  |                                                                                       |                                                                                       |
| Material Indicators - (SANS 3001 Method GR1)                              |                              |              |             |         |  |  |                                                                                       |                                                                                       |
| Percentage Passing                                                        | 75 mm                        | 100          |             | Opinion |  |  |    |                                                                                       |
|                                                                           | 63 mm                        | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 50 mm                        | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 37.5 mm                      | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 28 mm                        | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 20 mm                        | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 14 mm                        | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 5 mm                         | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 2 mm                         | 100          |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | 0.425 mm                     | 99           |             |         |  |  |                                                                                       |                                                                                       |
| 0.075 mm                                                                  | 5.7                          |              |             |         |  |  |                                                                                       |                                                                                       |
| Material Indicators - (SANS 3001 Method PR5)                              |                              |              |             |         |  |  |                                                                                       |                                                                                       |
| Grading Modulus *                                                         |                              | 0.96         | 0.75 - 2.70 | ✓       |  |  |  |                                                                                       |
| Coarse Sand Soil-Mortar (%)                                               |                              | 0            |             |         |  |  |                                                                                       |                                                                                       |
| Atterberg Limits - (SANS 3001 Method GR10)                                |                              |              |             |         |  |  |                                                                                       |                                                                                       |
| Liquid Limit (%)                                                          |                              | Undetermined |             |         |  |  |                                                                                       |                                                                                       |
| Plasticity Index (%)                                                      |                              | NP           | ≤ 13        | ✓       |  |  |  |                                                                                       |
| Linear Shrinkage (%)                                                      |                              | NP           |             |         |  |  |                                                                                       |                                                                                       |
| Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)                |                              |              |             |         |  |  |                                                                                       |                                                                                       |
| MDD                                                                       | Max Dry Density (kg/m³)      | 1597         |             |         |  |  |                                                                                       |  |
|                                                                           | Optimum Moisture Content (%) | 13.8         |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | Mould Moisture Content (%)   | 13.9         |             |         |  |  |                                                                                       |                                                                                       |
| A                                                                         | Relative Compaction (%)      | 100.0        |             |         |  |  |  |                                                                                       |
|                                                                           | Swell (%)                    | 0.0          | ≤ 1.5       | ✓       |  |  |                                                                                       |                                                                                       |
| B                                                                         | Relative Compaction (%)      | 94.6         |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | Swell (%)                    | 0.0          |             |         |  |  |                                                                                       |                                                                                       |
| C                                                                         | Relative Compaction (%)      | 90.3         |             |         |  |  |  |                                                                                       |
|                                                                           | Swell (%)                    | 0.0          |             |         |  |  |                                                                                       |                                                                                       |
| CBR                                                                       | @100% Max Dry Density        | 18           |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | @98% Max Dry Density         | 14           |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | @95% Max Dry Density         | 9            |             |         |  |  |                                                                                       |                                                                                       |
|                                                                           | @93% Max Dry Density         | 7            | ≥ 10        | *       |  |  |                                                                                       |                                                                                       |
|                                                                           | @90% Max Dry Density         | 5            |             |         |  |  |                                                                                       |                                                                                       |
| Material Condition                                                        |                              |              |             |         |  |  |                                                                                       |                                                                                       |
| Insitu Moisture Content (%)                                               |                              |              |             |         |  |  |  |                                                                                       |
| Soil Classification Of The Material Based Only On The Tests Results Above |                              |              |             |         |  |  |                                                                                       |                                                                                       |
| COTO DS Specification:                                                    |                              | G8 SSG       |             |         |  |  |                                                                                       |                                                                                       |
| AASHTO System                                                             |                              | A-3 / A-2-4  |             |         |  |  |                                                                                       |                                                                                       |
| Unified System                                                            |                              | SP-SM        |             |         |  |  |                                                                                       |                                                                                       |
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Director: L Heathcote B-Tech. (Civil Eng.) & BSc Hons (Transport)

Ruaan Lesch  
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Registration No. 95/07742/07

## Materials Testing Laboratory

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R-CBR-1-9

Jun-23



T0347

|             |                                                                  |                 |                                                       |
|-------------|------------------------------------------------------------------|-----------------|-------------------------------------------------------|
| Customer :  | Outeniqua Geotechnical Services<br>P O Box 964<br>Knysna<br>6570 | Project :       | Middle Income Housing Great Brak Erf 2667,2686 & 2687 |
|             |                                                                  | Date Received : | 09/04/2026                                            |
|             |                                                                  | Date Reported : | 16/04/2026                                            |
|             |                                                                  | Req. Number :   | 1214/26                                               |
| Attention : | Iain Paton                                                       | No. of Pages :  | 4 of 4                                                |

### TEST REPORT CALIFORNIA BEARING RATIO

|                                                                           |                              |              |             |         |  |  |       |  |
|---------------------------------------------------------------------------|------------------------------|--------------|-------------|---------|--|--|-------|--|
| Sample Position (SV)                                                      |                              | TP7          | COTO DS: G9 |         |  |  | 94424 |  |
| Depth (mm)                                                                |                              | 1400-2700    |             |         |  |  |       |  |
| Sample No                                                                 |                              | 94424        | Subgrade    |         |  |  |       |  |
| Materials Description                                                     | Source                       | Test Pit     |             |         |  |  |       |  |
|                                                                           | Colour                       | Light Yellow |             |         |  |  |       |  |
|                                                                           | Soil Type                    | Fine Sand    |             |         |  |  |       |  |
|                                                                           | Classification               | In-situ      |             |         |  |  |       |  |
| Material Indicators - (SANS 3001 Method GR1)                              |                              |              |             |         |  |  |       |  |
| Percentage Passing                                                        | 75 mm                        | 100          |             | Opinion |  |  |       |  |
|                                                                           | 63 mm                        | 100          |             |         |  |  |       |  |
|                                                                           | 50 mm                        | 100          |             |         |  |  |       |  |
|                                                                           | 37.5 mm                      | 100          |             |         |  |  |       |  |
|                                                                           | 28 mm                        | 100          |             |         |  |  |       |  |
|                                                                           | 20 mm                        | 100          |             |         |  |  |       |  |
|                                                                           | 14 mm                        | 100          |             |         |  |  |       |  |
|                                                                           | 5 mm                         | 100          |             |         |  |  |       |  |
|                                                                           | 2 mm                         | 100          |             |         |  |  |       |  |
|                                                                           | 0.425 mm                     | 96           |             |         |  |  |       |  |
| 0.075 mm                                                                  | 5.6                          |              |             |         |  |  |       |  |
| Material Indicators - (SANS 3001 Method PR5)                              |                              |              |             |         |  |  |       |  |
| Grading Modulus *                                                         |                              | 0.99         | 0.75 - 2.70 | ✓       |  |  |       |  |
| Coarse Sand Soil-Mortar (%)                                               |                              | 4            |             |         |  |  |       |  |
| Atterberg Limits - (SANS 3001 Method GR10)                                |                              |              |             |         |  |  |       |  |
| Liquid Limit (%)                                                          |                              | Undetermined |             |         |  |  |       |  |
| Plasticity Index (%)                                                      |                              | NP           | ≤ 13        | ✓       |  |  |       |  |
| Linear Shrinkage (%)                                                      |                              | NP           |             |         |  |  |       |  |
| Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)                |                              |              |             |         |  |  |       |  |
| MDD                                                                       | Max Dry Density (kg/m³)      | 1565         |             |         |  |  |       |  |
|                                                                           | Optimum Moisture Content (%) | 15.8         |             |         |  |  |       |  |
|                                                                           | Mould Moisture Content (%)   | 16.1         |             |         |  |  |       |  |
| A                                                                         | Relative Compaction (%)      | 100.0        |             |         |  |  |       |  |
|                                                                           | Swell (%)                    | 0.0          | ≤ 1.5       | ✓       |  |  |       |  |
| B                                                                         | Relative Compaction (%)      | 95.5         |             |         |  |  |       |  |
|                                                                           | Swell (%)                    | 0.0          |             |         |  |  |       |  |
| C                                                                         | Relative Compaction (%)      | 92.3         |             |         |  |  |       |  |
|                                                                           | Swell (%)                    | 0.0          |             |         |  |  |       |  |
| CBR                                                                       | @100% Max Dry Density        | 17           |             |         |  |  |       |  |
|                                                                           | @98% Max Dry Density         | 11           |             |         |  |  |       |  |
|                                                                           | @95% Max Dry Density         | 6            |             |         |  |  |       |  |
|                                                                           | @93% Max Dry Density         | 4            | ≥ 7         | *       |  |  |       |  |
|                                                                           | @90% Max Dry Density         | 2            |             |         |  |  |       |  |
| Material Condition                                                        |                              |              |             |         |  |  |       |  |
| Insitu Moisture Content (%)                                               |                              |              |             |         |  |  |       |  |
| Soil Classification Of The Material Based Only On The Tests Results Above |                              |              |             |         |  |  |       |  |
| COTO DS Specification:                                                    |                              | G9 Subgrade  |             |         |  |  |       |  |
| AASHTO System                                                             |                              | A-3 / A-2-4  |             |         |  |  |       |  |
| Unified System                                                            |                              | SP-SM        |             |         |  |  |       |  |

**Sieve Analysis**

| Sieve Size (mm) | Percentage Passing (%) |
|-----------------|------------------------|
| 0.075           | 5.6                    |
| 0.15            | 10                     |
| 0.3             | 20                     |
| 0.6             | 40                     |
| 1.18            | 60                     |
| 2.5             | 80                     |
| 5.0             | 90                     |
| 75              | 100                    |

**CBR Chart**

| Compaction (%) | CBR (%) |
|----------------|---------|
| 92             | 4       |
| 95             | 8       |
| 98             | 10      |
| 100            | 17      |

**Sieve Analysis**

| Sieve Size (mm) | Percentage Passing (%) |
|-----------------|------------------------|
| 0.075           | 0                      |
| 0.15            | 0                      |
| 0.3             | 0                      |
| 0.6             | 0                      |
| 1.18            | 0                      |
| 2.5             | 0                      |
| 5.0             | 0                      |
| 75              | 0                      |

**CBR Chart**

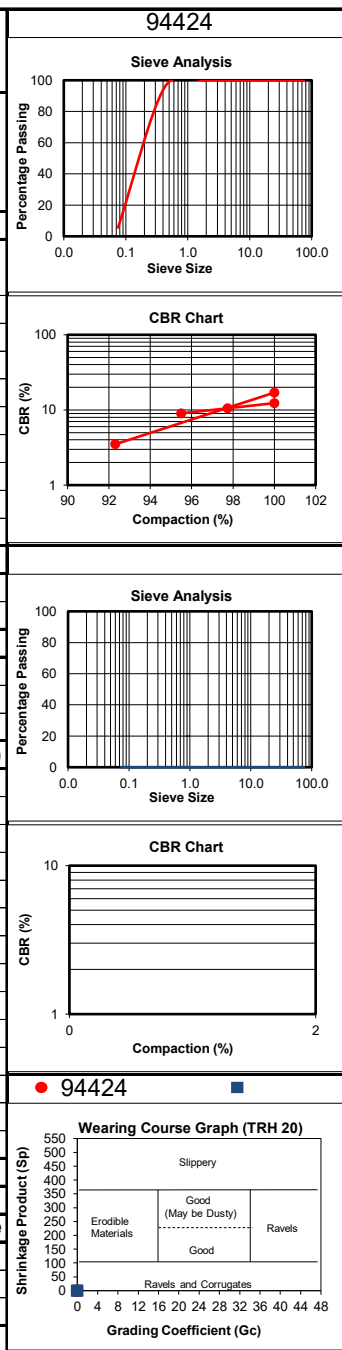
| Compaction (%) | CBR (%) |
|----------------|---------|
| 92             | 0       |
| 95             | 0       |
| 98             | 0       |
| 100            | 0       |

● 94424 ■

**Wearing Course Graph (TRH 20)**

| Grading Coefficient (Gc) | Shrinkage Product (Sp) | Region |
|--------------------------|------------------------|--------|
| 0                        | 0                      | Good   |
| 4                        | 0                      | Good   |
| 8                        | 0                      | Good   |
| 12                       | 0                      | Good   |
| 16                       | 0                      | Good   |
| 20                       | 0                      | Good   |
| 24                       | 0                      | Good   |
| 28                       | 0                      | Good   |
| 32                       | 0                      | Good   |
| 36                       | 0                      | Good   |
| 40                       | 0                      | Good   |
| 44                       | 0                      | Good   |
| 48                       | 0                      | Good   |

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Director: L Heathcote B-Tech. (Civil Eng.) & BSc Hons (Transport)

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JOB NO:SWL53041

REF.: -

Date:20 April 2026

Outeriqua Geotechnical Services

Customer : 18 Clyde Street  
Knysna

Attention : Iain Paton

Project : Greak Brak Middle Income Housing Project

Date Sampled / Received : 16 April 2026

Aggregate Analysis SANS 3001 : AG1, AG2, AG3, AG4, AG5, AG10, AG15, AG20, AG21, AG22, AG23, TMH1 A20, A21T, TMH1 B9 & TMH 1 B6\*

| SIEVE ANALYSIS - SANS 3001 AG1  |                                          |      |                                          |      |                                          |      |  |
|---------------------------------|------------------------------------------|------|------------------------------------------|------|------------------------------------------|------|--|
| Sample Position                 | TP4                                      |      | TP6                                      |      | TP7                                      |      |  |
| Depth                           | 0 - 1,0m                                 |      | 1,0 - 2,6m                               |      | 1,4 - 2,7m                               |      |  |
| Source                          | Greak Brak Middle Income Housing Project |      | Greak Brak Middle Income Housing Project |      | Greak Brak Middle Income Housing Project |      |  |
| Sample Number                   | 53041/5                                  |      | 53041/6                                  |      | 53041/7                                  |      |  |
| Description of Materials        | Silty Fine Sand                          | Spec | Fine Sand                                | Spec | Fine Sand                                | Spec |  |
|                                 |                                          |      |                                          |      |                                          |      |  |
| Sieve Size (SANS AG1) % Passing |                                          |      |                                          |      |                                          |      |  |
| 100,0                           |                                          |      |                                          |      |                                          |      |  |
| 75,0                            |                                          |      |                                          |      |                                          |      |  |
| 63,0                            |                                          |      |                                          |      |                                          |      |  |
| 50,0                            |                                          |      |                                          |      |                                          |      |  |
| 37,5                            |                                          |      |                                          |      |                                          |      |  |
| 28,0                            |                                          |      |                                          |      |                                          |      |  |
| 20,0                            |                                          |      |                                          |      |                                          |      |  |
| 14,0                            |                                          |      |                                          |      |                                          |      |  |
| 10,0                            |                                          |      |                                          |      |                                          |      |  |
| 7,1                             |                                          |      |                                          |      |                                          |      |  |
| 5,0                             |                                          |      |                                          |      |                                          |      |  |
| 2,0                             |                                          |      |                                          |      |                                          |      |  |
| 1,0                             |                                          |      |                                          |      |                                          |      |  |
| 0,600                           |                                          |      |                                          |      |                                          |      |  |
| 0,425                           |                                          |      |                                          |      |                                          |      |  |
| 0,300                           |                                          |      |                                          |      |                                          |      |  |
| 0,150                           |                                          |      |                                          |      |                                          |      |  |
| 0,075                           |                                          |      |                                          |      |                                          |      |  |
| Fineness Modulus                |                                          |      |                                          |      |                                          |      |  |

| MATERIAL PROPERTIES                  |                   |        |        |        |  |  |  |
|--------------------------------------|-------------------|--------|--------|--------|--|--|--|
| ACV (dry) (SANS AG10)                | %                 |        |        |        |  |  |  |
| ACV (wet) (SANS AG10)                | %                 |        |        |        |  |  |  |
| ACV (gly) (SANS AG15)                | %                 |        |        |        |  |  |  |
| 10% Fact (dry) (SANS AG10)           | kN                |        |        |        |  |  |  |
| 10% Fact (wet) (SANS AG10)           | kN                |        |        |        |  |  |  |
| 10% Fact (gly) (SANS AG15)           | kN                |        |        |        |  |  |  |
| Ethylene Glycol Index (SANS AG14)    | Index             |        |        |        |  |  |  |
| LA Abrasion (SANS 5846)*             | %                 |        |        |        |  |  |  |
| PSV (SANS AG11)*                     | Value (N)         |        |        |        |  |  |  |
| AD (SANS AG20, AG21)                 | kg/m <sup>3</sup> |        |        |        |  |  |  |
| BD (SANS AG20, AG21)                 | kg/m <sup>3</sup> |        |        |        |  |  |  |
| Water Absorption (AG20, AG21)        | %                 |        |        |        |  |  |  |
| Loose Bulk Density (TMH1 B9)         | kg/m <sup>3</sup> |        |        |        |  |  |  |
| Compacted Bulk Density(TMH1 B9)      | kg/m <sup>3</sup> |        |        |        |  |  |  |
| ALD measured (SANS AG2)              | mm                |        |        |        |  |  |  |
| ALD computed (SANS AG3)              | mm                |        |        |        |  |  |  |
| Flakiness (SANS AG4)                 | %                 |        |        |        |  |  |  |
| Drying Shrinkage (SANS 5836)*        | %                 |        |        |        |  |  |  |
| Linear Expansion (SANS 5836)*        | %                 |        |        |        |  |  |  |
| ASR (10 cycle) (SANS 6245)*          | %                 |        |        |        |  |  |  |
| ASR (12 cycle) (SANS 6245)*          | %                 |        |        |        |  |  |  |
| PH (TMH1 A20)                        | pH                | 8,0    | 7,9    | 7,6    |  |  |  |
| Conductivity (TMH1 A21T)             | S/m               | 0,0136 | 0,0211 | 0,0178 |  |  |  |
| Sand Equivelant (SANS AG5)           | %                 |        |        |        |  |  |  |
| Organic Impurities (SANS 5832)       | Drk / Lig         |        |        |        |  |  |  |
| Soluble Deleterious (SANS 5834)      | %                 |        |        |        |  |  |  |
| Organic Impurities (SANS 5832)       | Drk / Lig         |        |        |        |  |  |  |
| Chloride content (SANS 202)          | %m/m              |        |        |        |  |  |  |
| Water-soluble Sulfates (SANS 5850-1) | %(m/m)            |        |        |        |  |  |  |
| Sugar (SANS 5833)                    | P+ / N-           |        |        |        |  |  |  |
| Water-soluble Salts (SANS 5849)      | %(m/m)            |        |        |        |  |  |  |

NOTE: All tests marked with (\*) means that those test methods are not accredited.





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Tel: 021 905 0435  
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Web: [www.steynwilson.co.za](http://www.steynwilson.co.za)

JOB NO:SWL53041

REF.: -

Date:20 April 2026

Outeniqua Geotechnical Services

Customer : 18 Clyde Street  
Knysna

Attention : Iain Paton

Project : Greak Brak Middle Income Housing Project

Date Sampled / Received : 16 April 2026

Aggregate Analysis SANS 3001 : AG1, AG2, AG3, AG4, AG5, AG10, AG15, AG20, AG21, AG22, AG23, TMH1 A20, A21T, TMH1 B9 & TMH 1 B6\*

| SIEVE ANALYSIS - SANS 3001 AG1       |                                          |        |                                          |        |                                          |      |                                          |
|--------------------------------------|------------------------------------------|--------|------------------------------------------|--------|------------------------------------------|------|------------------------------------------|
| Sample Position                      | TP1                                      |        | TP1                                      |        | TP3                                      |      | TP2                                      |
| Depth                                | 0 -1,1m                                  |        | 1,1 - 2,6m                               |        | 0,8 - 1,7m                               |      | 0,8 - 2,6m                               |
| Source                               | Greak Brak Middle Income Housing Project |        | Greak Brak Middle Income Housing Project |        | Greak Brak Middle Income Housing Project |      | Greak Brak Middle Income Housing Project |
| Sample Number                        | 53041/1                                  |        | 53041/2                                  |        | 53041/3                                  |      | 53041/4                                  |
| Description of Materials             | Slightly Silty Fine Sand                 | Spec   | Fine Sand                                | Spec   | Fine Sand                                | Spec | Fine Sand                                |
|                                      |                                          |        |                                          |        |                                          |      |                                          |
| Sieve Size (SANS AG1) % Passing      |                                          |        |                                          |        |                                          |      |                                          |
| 100,0                                |                                          |        |                                          |        |                                          |      |                                          |
| 75,0                                 |                                          |        |                                          |        |                                          |      |                                          |
| 63,0                                 |                                          |        |                                          |        |                                          |      |                                          |
| 50,0                                 |                                          |        |                                          |        |                                          |      |                                          |
| 37,5                                 |                                          |        |                                          |        |                                          |      |                                          |
| 28,0                                 |                                          |        |                                          |        |                                          |      |                                          |
| 20,0                                 |                                          |        |                                          |        |                                          |      |                                          |
| 14,0                                 |                                          |        |                                          |        |                                          |      |                                          |
| 10,0                                 |                                          |        |                                          |        |                                          |      |                                          |
| 7,1                                  |                                          |        |                                          |        |                                          |      |                                          |
| 5,0                                  |                                          |        |                                          |        |                                          |      |                                          |
| 2,0                                  |                                          |        |                                          |        |                                          |      |                                          |
| 1,0                                  |                                          |        |                                          |        |                                          |      |                                          |
| 0,600                                |                                          |        |                                          |        |                                          |      |                                          |
| 0,425                                |                                          |        |                                          |        |                                          |      |                                          |
| 0,300                                |                                          |        |                                          |        |                                          |      |                                          |
| 0,150                                |                                          |        |                                          |        |                                          |      |                                          |
| 0,075                                |                                          |        |                                          |        |                                          |      |                                          |
| Fineness Modulus                     |                                          |        |                                          |        |                                          |      |                                          |
| MATERIAL PROPERTIES                  |                                          |        |                                          |        |                                          |      |                                          |
| ACV (dry) (SANS AG10)                | %                                        |        |                                          |        |                                          |      |                                          |
| ACV (wet) (SANS AG10)                | %                                        |        |                                          |        |                                          |      |                                          |
| ACV (gly) (SANS AG15)                | %                                        |        |                                          |        |                                          |      |                                          |
| 10% Fact (dry) (SANS AG10)           | kN                                       |        |                                          |        |                                          |      |                                          |
| 10% Fact (wet) (SANS AG10)           | kN                                       |        |                                          |        |                                          |      |                                          |
| 10% Fact (gly) (SANS AG15)           | kN                                       |        |                                          |        |                                          |      |                                          |
| Ethylene Glycol Index (SANS AG14)    | Index                                    |        |                                          |        |                                          |      |                                          |
| LA Abrasion (SANS 5846)*             | %                                        |        |                                          |        |                                          |      |                                          |
| PSV (SANS AG11)*                     | Value (N)                                |        |                                          |        |                                          |      |                                          |
| AD (SANS AG20, AG21)                 | kg/m <sup>3</sup>                        |        |                                          |        |                                          |      |                                          |
| BD (SANS AG20, AG21)                 | kg/m <sup>3</sup>                        |        |                                          |        |                                          |      |                                          |
| Water Absorption (AG20, AG21)        | %                                        |        |                                          |        |                                          |      |                                          |
| Loose Bulk Density (TMH1 B9)         | kg/m <sup>3</sup>                        |        |                                          |        |                                          |      |                                          |
| Compacted Bulk Density(TMH1 B9)      | kg/m <sup>3</sup>                        |        |                                          |        |                                          |      |                                          |
| ALD measured (SANS AG2)              | mm                                       |        |                                          |        |                                          |      |                                          |
| ALD computed (SANS AG3)              | mm                                       |        |                                          |        |                                          |      |                                          |
| Flakiness (SANS AG4)                 | %                                        |        |                                          |        |                                          |      |                                          |
| Drying Shrinkage (SANS 5836)*        | %                                        |        |                                          |        |                                          |      |                                          |
| Linear Expansion (SANS 5836)*        | %                                        |        |                                          |        |                                          |      |                                          |
| ASR (10 cycle) (SANS 6245)*          | %                                        |        |                                          |        |                                          |      |                                          |
| ASR (12 cycle) (SANS 6245)*          | %                                        |        |                                          |        |                                          |      |                                          |
| PH (TMH1 A20)                        | pH                                       | 7,6    | 8,9                                      | 7,9    | 8,7                                      |      |                                          |
| Conductivity (TMH1 A21T)             | S/m                                      | 0,0278 | 0,0353                                   | 0,0277 | 0,0211                                   |      |                                          |
| Sand Equivelant (SANS AG5)           | %                                        |        |                                          |        |                                          |      |                                          |
| Organic Impurities (SANS 5832)       | Drk / Lig                                |        |                                          |        |                                          |      |                                          |
| Soluble Deleterious (SANS 5834)      | %                                        |        |                                          |        |                                          |      |                                          |
| Organic Impurities (SANS 5832)       | Drk / Lig                                |        |                                          |        |                                          |      |                                          |
| Chloride content (SANS 202)          | %m/m                                     |        |                                          |        |                                          |      |                                          |
| Water-soluble Sulfates (SANS 5850-1) | %(m/m)                                   |        |                                          |        |                                          |      |                                          |
| Sugar (SANS 5833)                    | P+ / N-                                  |        |                                          |        |                                          |      |                                          |
| Water-soluble Salts (SANS 5849)      | %(m/m)                                   |        |                                          |        |                                          |      |                                          |



## **Appendix 4**

### **DCP test data**





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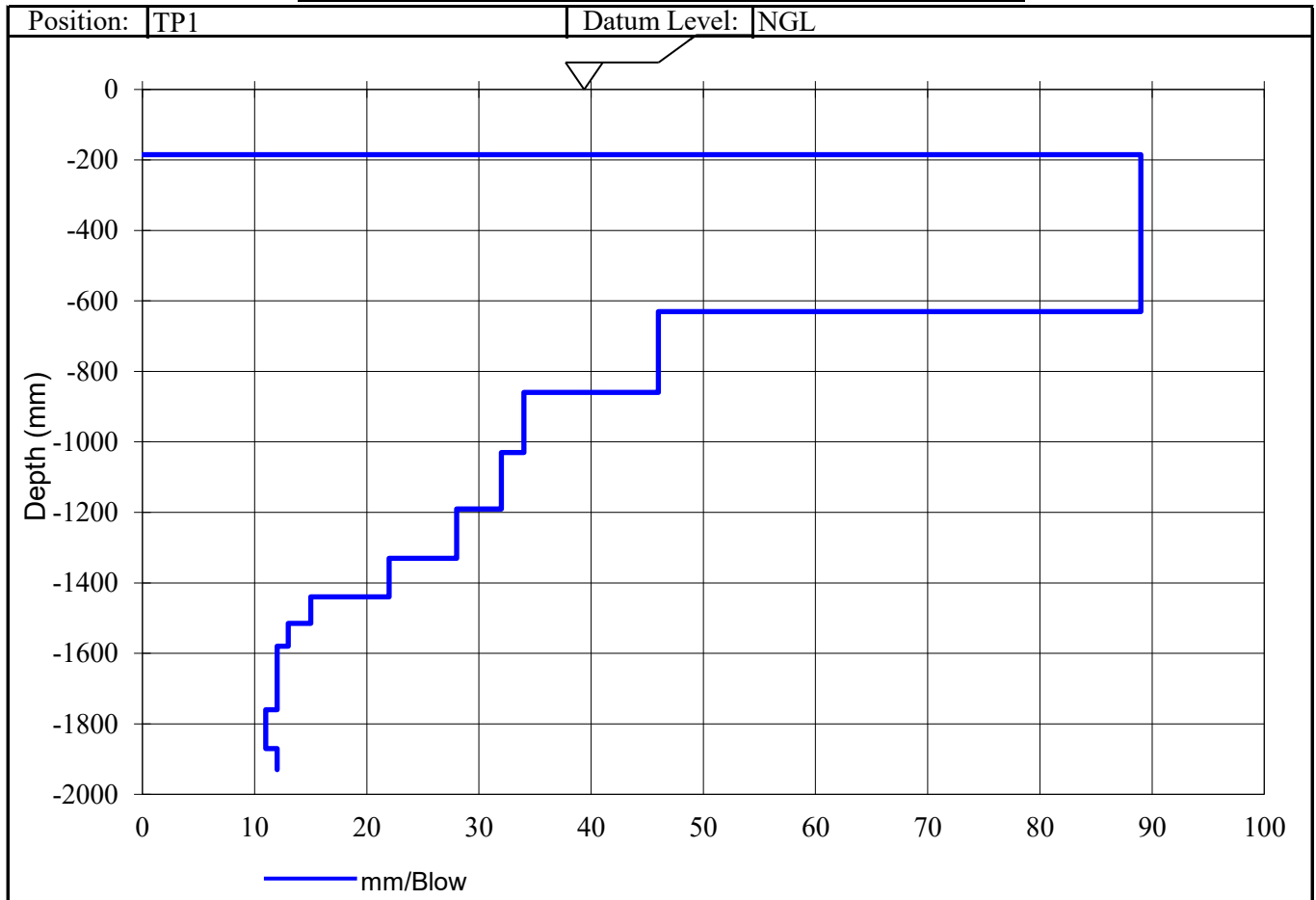
23 Clyde Street, Knysna : PO Box 964, Knysna, 6570

Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za

|             |                                                                |                 |                                                                  |
|-------------|----------------------------------------------------------------|-----------------|------------------------------------------------------------------|
| Customer :  | Marike Vreken Town Planners<br>P.O. Box 2180<br>Knysna<br>6570 | Project :       | Erf 2667, 2686 & 2687 (Middle Income Housing Project) Great Brak |
|             |                                                                | Date Received : | 09.03.2026                                                       |
|             |                                                                | Date Reported : | 09.04.2026                                                       |
|             |                                                                | Req. Number :   |                                                                  |
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## TEST REPORT

### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



I Paton (Member)  
For Outeniqua Geotech. Services cc.  
Technical Signatory

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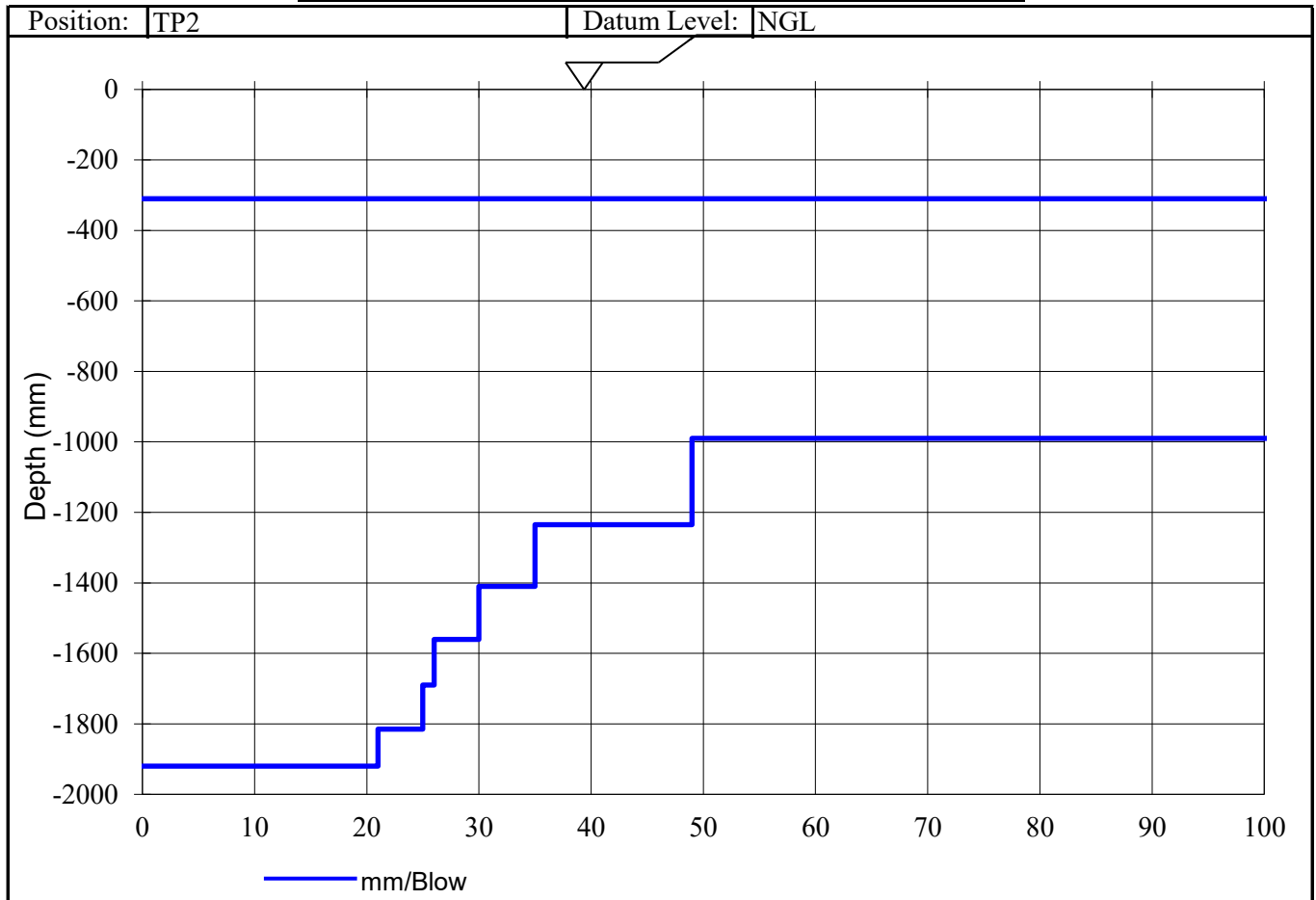
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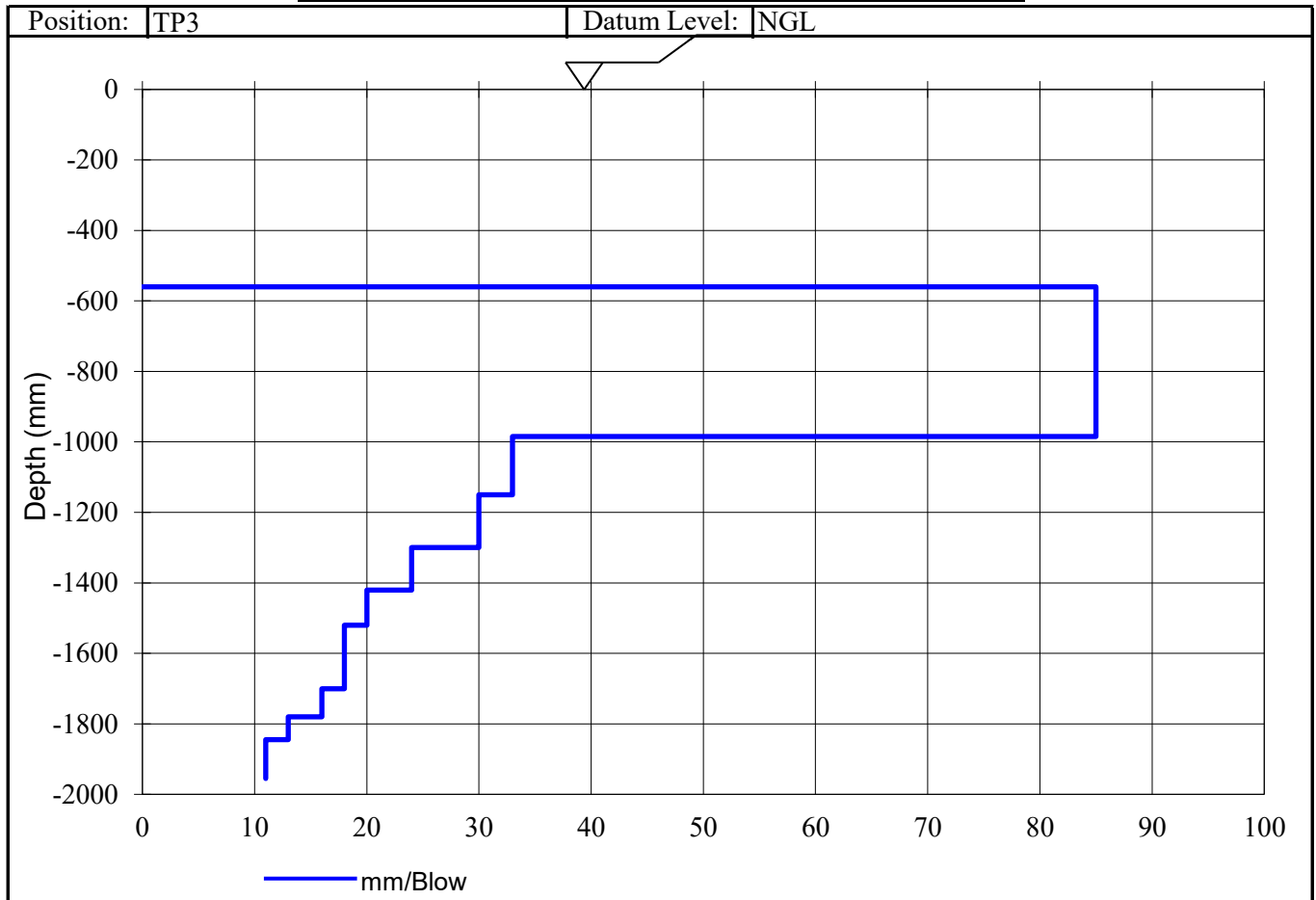
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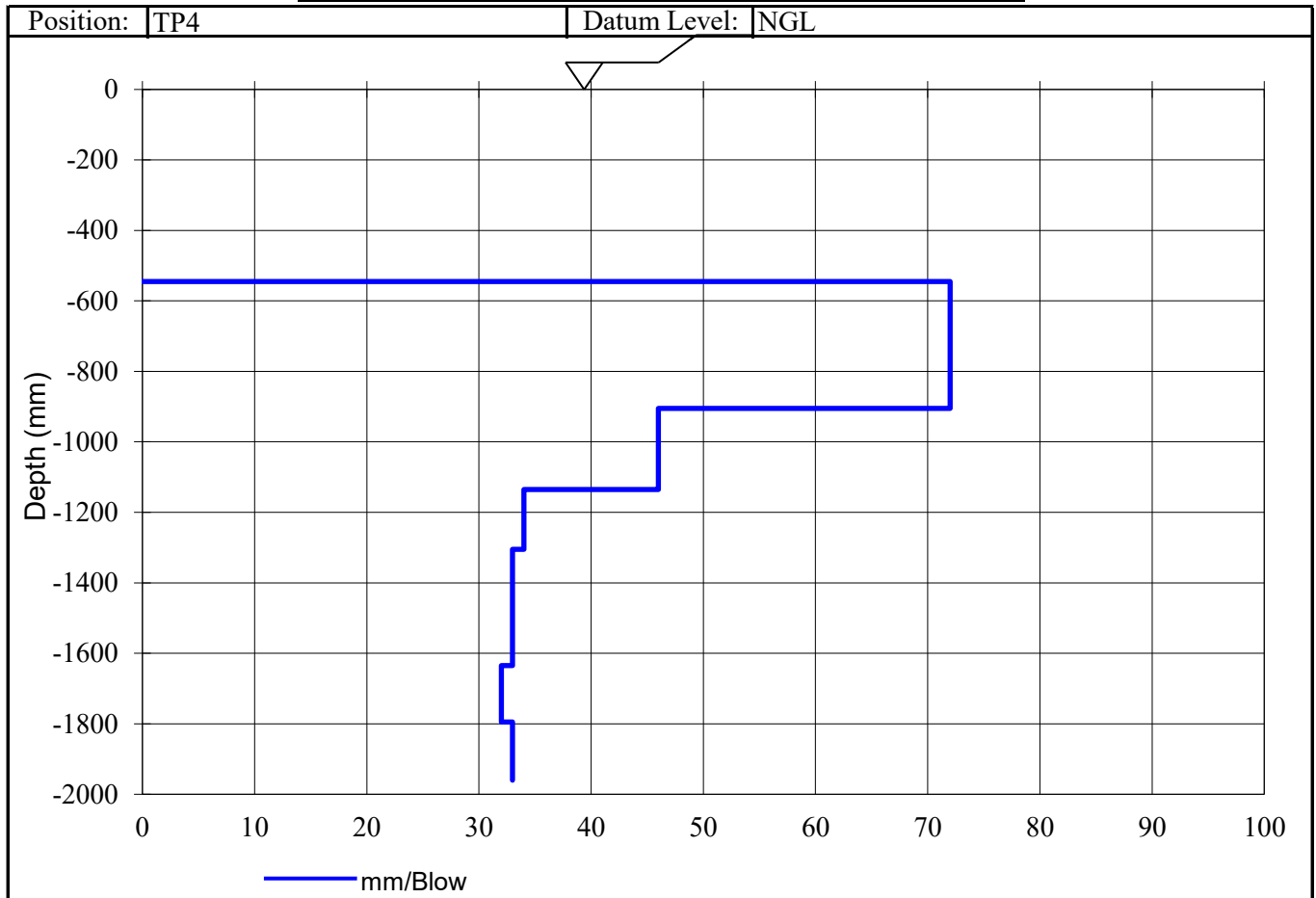
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### TEST REPORT

#### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqua.co.za

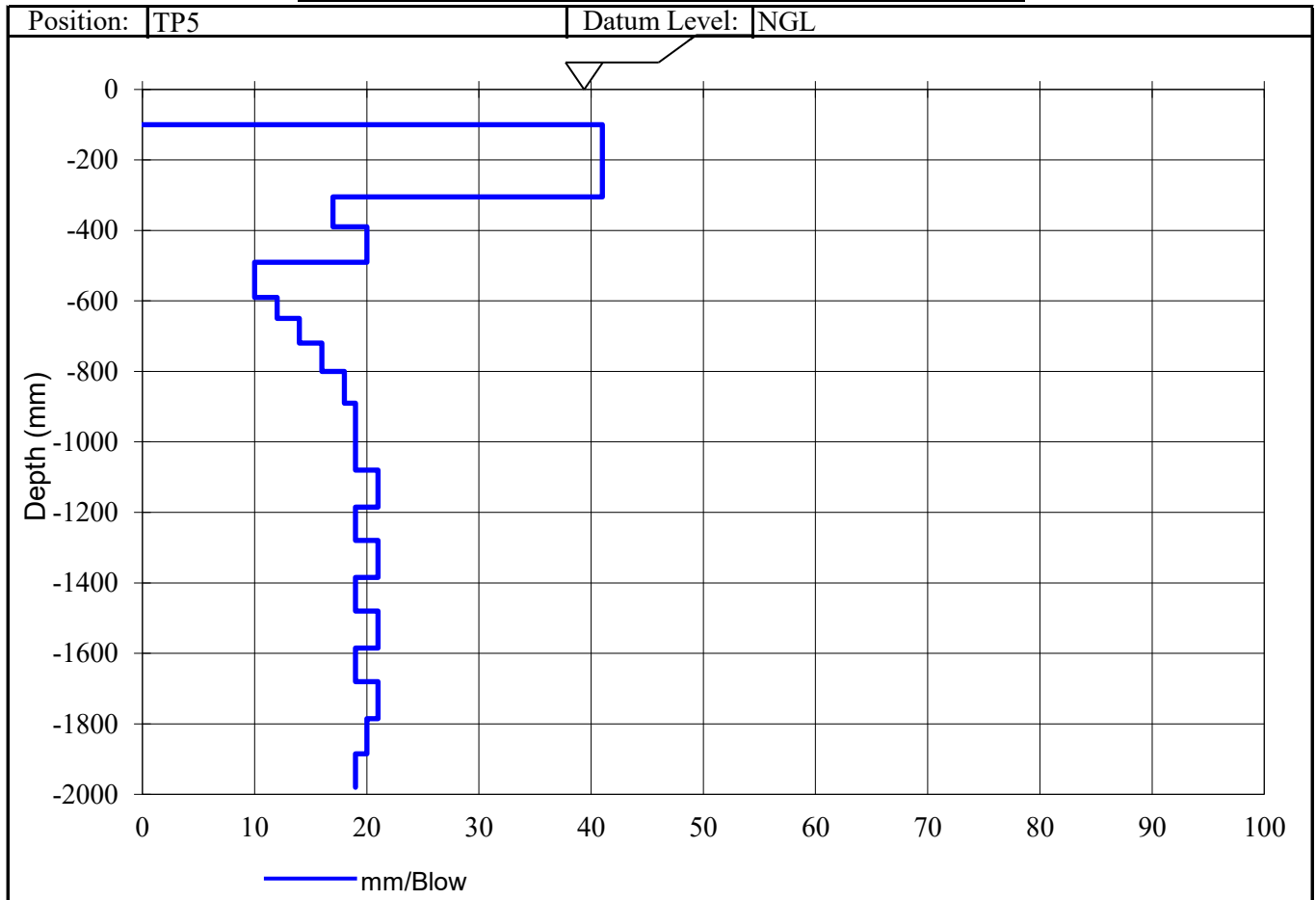
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| Customer :  | Marike Vreken Town Planners<br>P.O. Box 2180<br>Knysna<br>6570 | Project :       | Erf 2667, 2686 & 2687 (Middle Income Housing Project) Great Brak |
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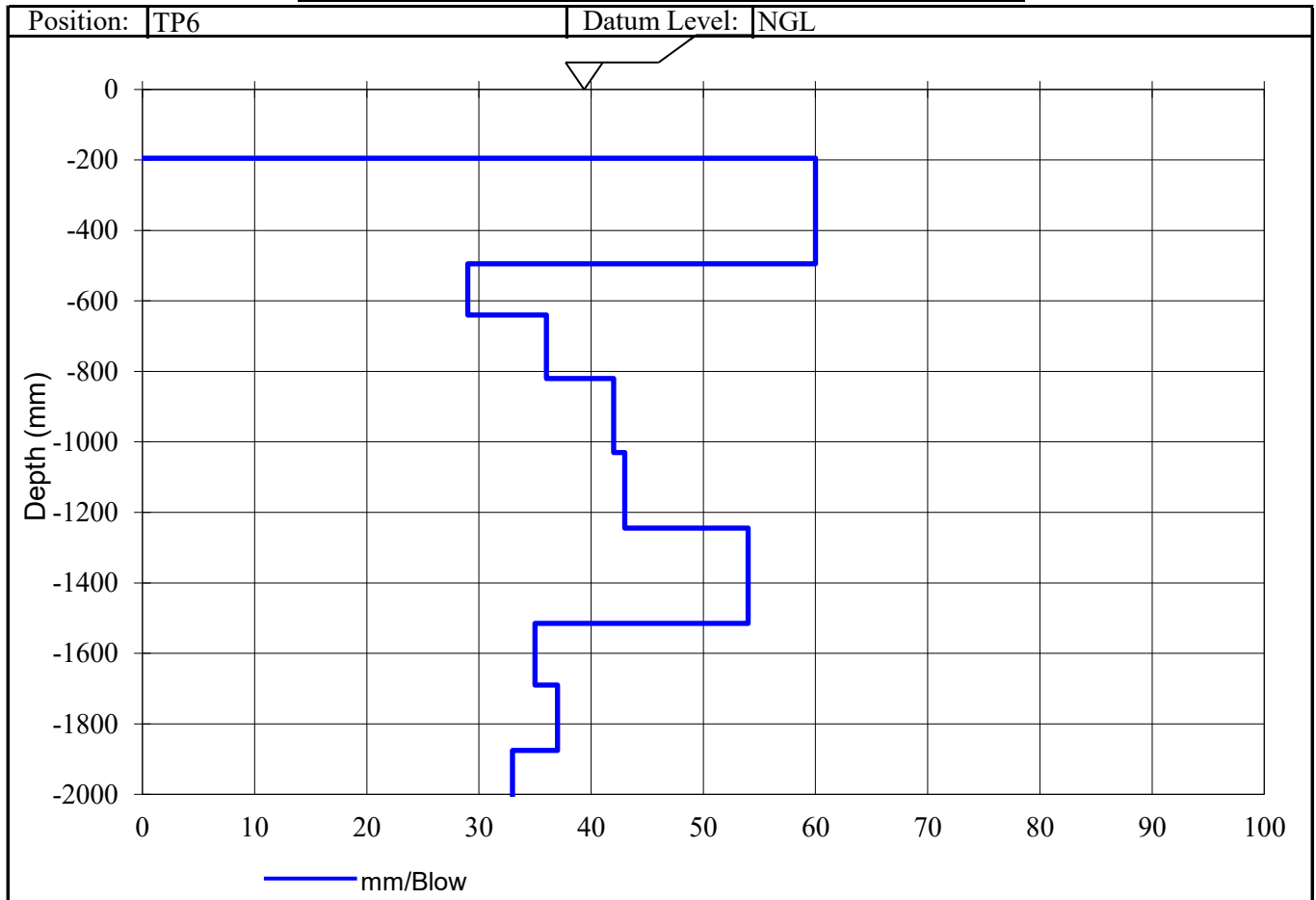
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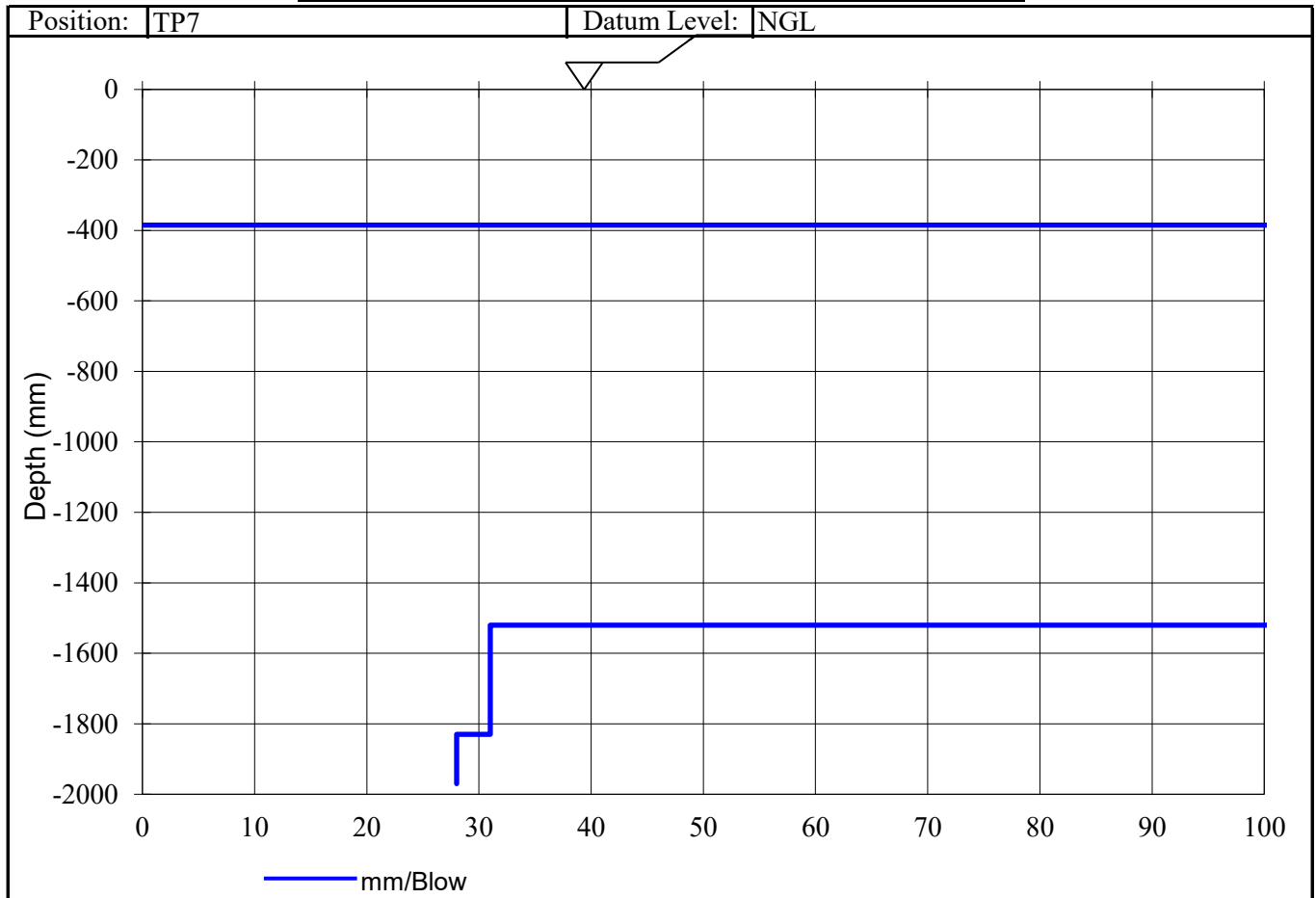
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R-DCP-1-5

Dec-14

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Registration No. 1999/062743/23

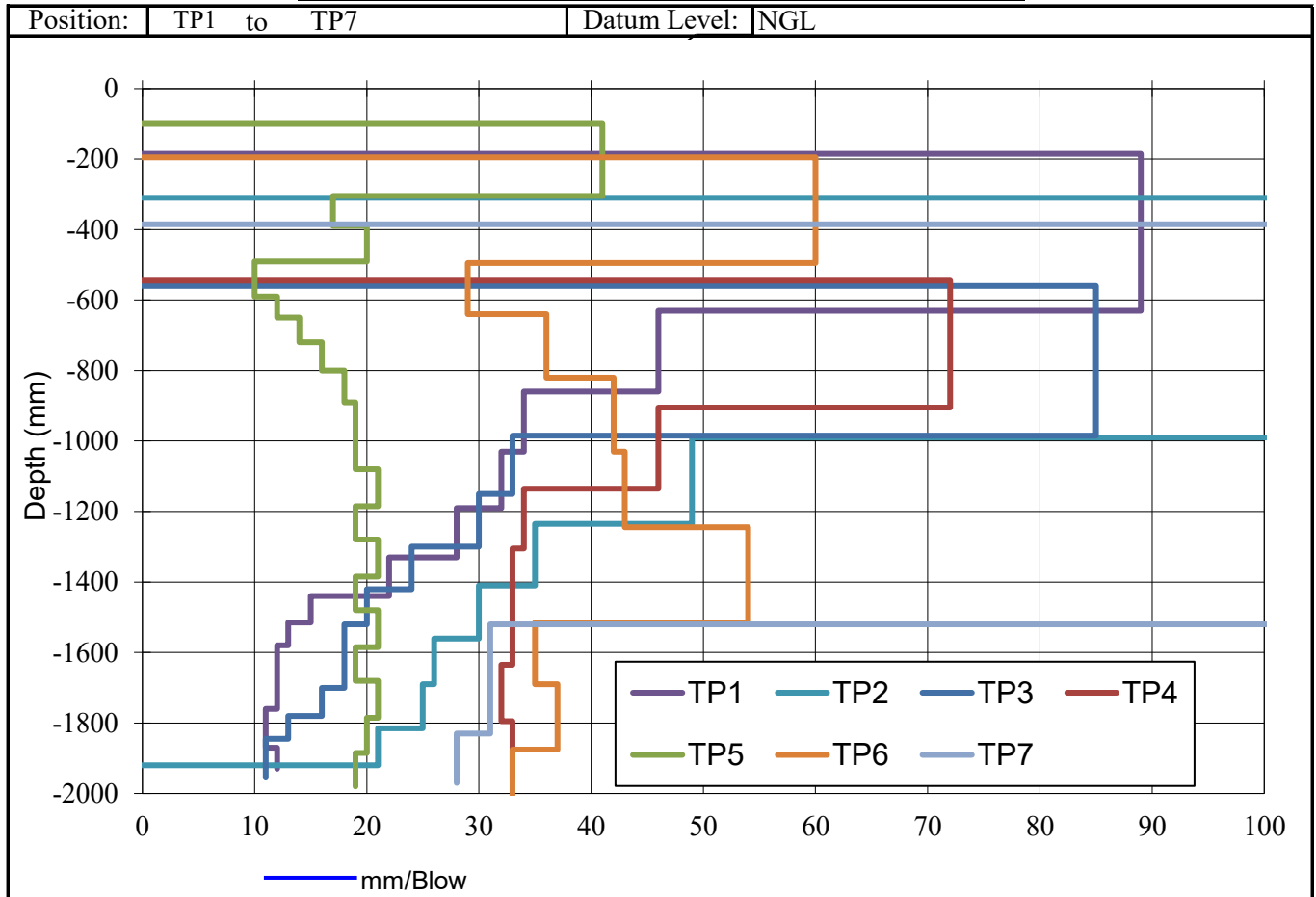
23 Clyde Street, Knysna : PO Box 964, Knysna, 6570

Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqua.co.za

|             |                                                                |                 |                                                                  |
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|             |                                                                | Date Received : | 09.03.2026                                                       |
|             |                                                                | Date Reported : | 09.04.2026                                                       |
|             |                                                                | Req. Number :   |                                                                  |
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## **Appendix 5**

### **Calculations**



## ELASTIC SETTLEMENT CALCULATION

### Foundation Data

|                        |             |
|------------------------|-------------|
| Width                  | 0.6 m       |
| Length                 | 10 m        |
| Depth                  | 0.6 m       |
| Gross Bearing Pressure | 50 kPa      |
| m (L/B)                | 16.66666667 |

### Soil Data

|                      |            |
|----------------------|------------|
| Bulk Density         | 16 kN/cu.m |
| Bouyancy Density     | 10 kN/cu.m |
| Depth of WT          | 10 m       |
| Po @ founding depth  | 9.6 kPa    |
| dZ (depth increment) | 0.2 m      |

### Corrections

|             |       |
|-------------|-------|
| Rigidity    | 0.8   |
| Depth (Fox) | 0.939 |

### Settlement

8.4 mm

| Depth (mid-layer)<br>(m) | n (2z/B) | k     | dP<br>(kPa) | E<br>(MPa) | dS<br>(mm) | S<br>(mm) |
|--------------------------|----------|-------|-------------|------------|------------|-----------|
| 0.7                      | 0.333    | 0.247 | 39.8        | 2          | 2.99       | 8.4       |
| 0.9                      | 1.000    | 0.205 | 33.1        | 2          | 2.48       | 5.4       |
| 1.1                      | 1.667    | 0.156 | 25.2        | 4          | 0.95       | 2.9       |
| 1.3                      | 2.333    | 0.122 | 19.7        | 4          | 0.74       | 2.0       |
| 1.5                      | 3.000    | 0.099 | 16.0        | 10         | 0.24       | 1.2       |
| 1.7                      | 3.667    | 0.083 | 13.4        | 12         | 0.17       | 1.0       |
| 1.9                      | 4.333    | 0.071 | 11.5        | 15         | 0.11       | 0.8       |
| 2.1                      | 5.000    | 0.062 | 10.0        | 15         | 0.10       | 0.7       |
| 2.3                      | 5.667    | 0.055 | 8.9         | 25         | 0.05       | 0.6       |
| 2.5                      | 6.333    | 0.049 | 7.9         | 25         | 0.05       | 0.5       |
| 2.7                      | 7.000    | 0.044 | 7.2         | 25         | 0.04       | 0.5       |
| 2.9                      | 7.667    | 0.041 | 6.6         | 25         | 0.04       | 0.4       |
| 3.1                      | 8.333    | 0.037 | 6.0         | 25         | 0.04       | 0.4       |
| 3.3                      | 9.000    | 0.034 | 5.6         | 25         | 0.03       | 0.4       |
| 3.5                      | 9.667    | 0.032 | 5.1         | 25         | 0.03       | 0.3       |
| 3.7                      | 10.333   | 0.030 | 4.8         | 25         | 0.03       | 0.3       |
| 3.9                      | 11.000   | 0.028 | 4.5         | 25         | 0.03       | 0.3       |
| 4.1                      | 11.667   | 0.026 | 4.2         | 30         | 0.02       | 0.2       |
| 4.3                      | 12.333   | 0.024 | 3.9         | 30         | 0.02       | 0.2       |
| 4.5                      | 13.000   | 0.023 | 3.7         | 30         | 0.02       | 0.2       |
| 4.7                      | 13.667   | 0.022 | 3.5         | 30         | 0.02       | 0.2       |
| 4.9                      | 14.333   | 0.020 | 3.3         | 30         | 0.02       | 0.2       |
| 5.1                      | 15.000   | 0.019 | 3.1         | 30         | 0.02       | 0.2       |
| 5.3                      | 15.667   | 0.018 | 2.9         | 30         | 0.01       | 0.1       |
| 5.5                      | 16.333   | 0.017 | 2.8         | 30         | 0.01       | 0.1       |
| 5.7                      | 17.000   | 0.016 | 2.7         | 30         | 0.01       | 0.1       |
| 5.9                      | 17.667   | 0.016 | 2.5         | 30         | 0.01       | 0.1       |
| 6.1                      | 18.333   | 0.015 | 2.4         | 30         | 0.01       | 0.1       |
| 6.3                      | 19.000   | 0.014 | 2.3         | 30         | 0.01       | 0.1       |
| 6.5                      | 19.667   | 0.013 | 2.2         | 40         | 0.01       | 0.1       |
| 6.7                      | 20.333   | 0.013 | 2.1         | 40         | 0.01       | 0.1       |
| 6.9                      | 21.000   | 0.012 | 2.0         | 40         | 0.01       | 0.0       |
| 7.1                      | 21.667   | 0.012 | 1.9         | 40         | 0.01       | 0.0       |
| 7.3                      | 22.333   | 0.011 | 1.8         | 40         | 0.01       | 0.0       |
| 7.5                      | 23.000   | 0.011 | 1.7         | 40         | 0.01       | 0.0       |
| 7.7                      | 23.667   | 0.010 | 1.7         | 40         | 0.01       | 0.0       |
| 7.9                      | 24.333   | 0.010 | 1.6         | 40         | 0.01       | 0.0       |
| 8.1                      | 25.000   | 0.009 | 1.5         | 40         | 0.01       | 0.0       |

8.37



## ELASTIC SETTLEMENT CALCULATION

### Foundation Data

|                        |             |
|------------------------|-------------|
| Width                  | 0.6 m       |
| Length                 | 10 m        |
| Depth                  | 0.6 m       |
| Gross Bearing Pressure | 150 kPa     |
| m (L/B)                | 16.66666667 |

### Soil Data

|                      |            |
|----------------------|------------|
| Bulk Density         | 16 kN/cu.m |
| Bouyancy Density     | 10 kN/cu.m |
| Depth of WT          | 10 m       |
| Po @ founding depth  | 9.6 kPa    |
| dZ (depth increment) | 0.2 m      |

### Corrections

|             |       |
|-------------|-------|
| Rigidity    | 0.8   |
| Depth (Fox) | 0.939 |

### Settlement

29.1 mm

| Depth (mid-layer)<br>(m) | n (2z/B) | k     | dP<br>(kPa) | E<br>(MPa) | dS<br>(mm) | S<br>(mm) |
|--------------------------|----------|-------|-------------|------------|------------|-----------|
| 0.7                      | 0.333    | 0.247 | 138.5       | 2          | 10.40      | 29.1      |
| 0.9                      | 1.000    | 0.205 | 114.9       | 2          | 8.63       | 18.7      |
| 1.1                      | 1.667    | 0.156 | 87.7        | 4          | 3.29       | 10.1      |
| 1.3                      | 2.333    | 0.122 | 68.5        | 4          | 2.57       | 6.8       |
| 1.5                      | 3.000    | 0.099 | 55.6        | 10         | 0.83       | 4.2       |
| 1.7                      | 3.667    | 0.083 | 46.4        | 12         | 0.58       | 3.4       |
| 1.9                      | 4.333    | 0.071 | 39.8        | 15         | 0.40       | 2.8       |
| 2.1                      | 5.000    | 0.062 | 34.7        | 15         | 0.35       | 2.4       |
| 2.3                      | 5.667    | 0.055 | 30.8        | 25         | 0.18       | 2.0       |
| 2.5                      | 6.333    | 0.049 | 27.6        | 25         | 0.17       | 1.9       |
| 2.7                      | 7.000    | 0.044 | 25.0        | 25         | 0.15       | 1.7       |
| 2.9                      | 7.667    | 0.041 | 22.8        | 25         | 0.14       | 1.5       |
| 3.1                      | 8.333    | 0.037 | 20.9        | 25         | 0.13       | 1.4       |
| 3.3                      | 9.000    | 0.034 | 19.3        | 25         | 0.12       | 1.3       |
| 3.5                      | 9.667    | 0.032 | 17.9        | 25         | 0.11       | 1.2       |
| 3.7                      | 10.333   | 0.030 | 16.6        | 25         | 0.10       | 1.1       |
| 3.9                      | 11.000   | 0.028 | 15.5        | 25         | 0.09       | 1.0       |
| 4.1                      | 11.667   | 0.026 | 14.5        | 30         | 0.07       | 0.9       |
| 4.3                      | 12.333   | 0.024 | 13.7        | 30         | 0.07       | 0.8       |
| 4.5                      | 13.000   | 0.023 | 12.8        | 30         | 0.06       | 0.7       |
| 4.7                      | 13.667   | 0.022 | 12.1        | 30         | 0.06       | 0.7       |
| 4.9                      | 14.333   | 0.020 | 11.4        | 30         | 0.06       | 0.6       |
| 5.1                      | 15.000   | 0.019 | 10.8        | 30         | 0.05       | 0.5       |
| 5.3                      | 15.667   | 0.018 | 10.2        | 30         | 0.05       | 0.5       |
| 5.5                      | 16.333   | 0.017 | 9.7         | 30         | 0.05       | 0.4       |
| 5.7                      | 17.000   | 0.016 | 9.2         | 30         | 0.05       | 0.4       |
| 5.9                      | 17.667   | 0.016 | 8.8         | 30         | 0.04       | 0.3       |
| 6.1                      | 18.333   | 0.015 | 8.3         | 30         | 0.04       | 0.3       |
| 6.3                      | 19.000   | 0.014 | 7.9         | 30         | 0.04       | 0.3       |
| 6.5                      | 19.667   | 0.013 | 7.6         | 40         | 0.03       | 0.2       |
| 6.7                      | 20.333   | 0.013 | 7.2         | 40         | 0.03       | 0.2       |
| 6.9                      | 21.000   | 0.012 | 6.9         | 40         | 0.03       | 0.2       |
| 7.1                      | 21.667   | 0.012 | 6.6         | 40         | 0.02       | 0.1       |
| 7.3                      | 22.333   | 0.011 | 6.3         | 40         | 0.02       | 0.1       |
| 7.5                      | 23.000   | 0.011 | 6.0         | 40         | 0.02       | 0.1       |
| 7.7                      | 23.667   | 0.010 | 5.8         | 40         | 0.02       | 0.1       |
| 7.9                      | 24.333   | 0.010 | 5.6         | 40         | 0.02       | 0.0       |
| 8.1                      | 25.000   | 0.009 | 5.3         | 40         | 0.02       | 0.0       |

29.10



# ANNEXURE C

## CAPACITY ANALYSIS OF THE BULK WATER & SEWER SERVICES



5 February 2025

V3 Consulting Engineers  
PO Box 730  
Mossel Bay  
6500

**Attention: Mr Dean Jacobs**

Dear Sir

**PROPOSED DEVELOPMENT OF ERVEN 2667, 2686 & 2687, MOSSEL BAY: CAPACITY ANALYSIS OF THE BULK WATER & SEWER SERVICES**

Your request for GLS Consulting to investigate and comment on the bulk water supply and sewer discharge of the proposed development (Residential development on Erven 2667, 2686 & 2687, Mossel Bay), refers.

This document should inter alia be read in conjunction with the following reports:

- “Mossel Bay Municipality Water Master Plan”, dated April 2017.
- “Mossel Bay Municipality Sewer Master Plan”, dated April 2017.
- “Mossel Bay Municipality Existing Water System Assessment”, dated June 2024.
- “Mossel Bay Municipality Existing Sewer System Assessment”, dated June 2024.

The proposed development of Erven 2667, 2686 & 2687, was not taken into consideration for the April 2017 master plans for the water and sewer networks.

GLS is currently in the process to update the April 2017 water and sewer master plans for Mossel Bay Municipality (existing water and sewer hydraulic models were updated during the 2023/24 financial year) and the result of this bulk water and sewer capacity investigation report for development on Erven 2667, 2686 & 2687 will be included in the updated master plans.

## **1. WATER DISTRIBUTION SYSTEM**

### **1.1. Distribution zone**

The proposed development is situated in Reebok in the Sandhoogte Water Treatment Plant (WTP) Great Brak (GBR) water distribution zone. It is proposed that the development is supplied with bulk water from the Sandhoogte WTP GBR reservoir. The reservoir capacity is 8,0 ML and has a Top Water Level (TWL) of 145,3 m above mean sea level (m a.s.l.).

The development is situated inside the water priority area.

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Stellenbosch, 7599  
South Africa



## 1.2. Water demand

The total annual average daily demand (AADD) and required fire flow for the proposed development on Erven 2667, 2686 & 2687 was calculated as follows:

|                                                                                    |   |                 |
|------------------------------------------------------------------------------------|---|-----------------|
| • 25 Residential stands (High density, small sized) @ 0,6 kL/d/unit <sup>(1)</sup> | = | 15,0 kL/d       |
| • 0,19 ha Business/Commercial @ 20,8 kL/d/ha <sup>(1)</sup>                        | = | <u>4,0 kL/d</u> |
| Total                                                                              | = | 19,0 kL/d       |

<sup>(1)</sup> As per Table J.2 from Section J - Water Supply of "The Neighbourhood Planning and Design Guide" (so called "Red book").

- Fire flow criteria (Moderate risk) = 25 L/s @ 10 m

The total potential AADD for the existing stands (fully occupied) as well as the proposed development in the Sandhogte WTP GBR reservoir water distribution zone was calculated as follows:

|                                                |   |                  |
|------------------------------------------------|---|------------------|
| • Sandhogte WTP GBR supply zone fully occupied | = | 2 584,0 kL/d     |
| • Proposed development                         | = | <u>19,0 kL/d</u> |
| Total                                          | = | 2 603,0 kL/d     |

## 1.3. Present situation

### 1.3.1. Reticulation network

It is proposed that the development is accommodated in the existing Sandhogte WTP GBR reservoir water distribution zone. The proposed connection point to the existing water system is to the existing 200 mm Ø pipeline situated in Lynbos Avenue, as shown in Figure 1.

The existing system has sufficient capacity to supply the domestic water demand during peak demand conditions to the proposed development. There is sufficient capacity in the existing water reticulation network of the Sandhogte WTP GBR reservoir water distribution zone to provide fire flow of more than 25 L/s @ 10 m to the proposed development.

### 1.3.2. Reservoirs

The criteria for total reservoir volume used in the Mossel Bay Water Master Plan is 48 hours of the AADD (of the reservoir supply zone) for gravity and pumped supply to the reservoir.

According to the re-analysis of the fully occupied AADD scenario for the Sandhogte WTP GBR reservoir water distribution zone, the AADD for the distribution zone can potentially increase to approximately 2 603,0 kL/d when the development has been fully developed. The storage capacity of the existing Sandhogte WTP GBR reservoir is 8 000 kL, which results in a storage capacity of 74 hours of the AADD.

There is sufficient capacity available at the Sandhogte WTP GBR reservoir to accommodate the proposed development.



## **2. SEWER NETWORK**

### **2.1. *Drainage area***

In the sewer master plan for Mossel Bay it is proposed that development on Erven 2667, 2686 & 2687 should be accommodated in the existing Toekoms Pumping Station (PS) drainage area. It is proposed that sewage from Erven 2667, 2686 & 2687 gravitates eastwards from the proposed connection point to the Toekoms PS, from where sewage is pumped directly to the existing Great Brak Wastewater Treatment Plant (WWTP). The proposed connection point to the existing sewer system is to the existing 200 mm Ø uPVC pipeline situated in Lynbos Avenue, as shown in Figure 2.

The proposed development is inside the sewer priority area.

### **2.2. *Sewer flow***

The peak day dry weather flow (PDDWF) for this analysis of the proposed development on Erven 2667, 2686 & 2687 in Mossel Bay was calculated at 15,0 kL/d.

### **2.3. *Present situation***

#### **2.3.1. Gravity sewers**

There is sufficient spare capacity available in the existing gravity sewer system downstream of the proposed interim connection point to accommodate the proposed development.

#### **2.3.2. Pumping stations and rising mains**

##### **Toekoms PS**

Sewage from the proposed connection to the existing system gravitates towards the Toekoms PS, which pumps sewage to the Great Brak WWTP via a 450 mm Ø GRP rising main. The capacity of the Toekoms PS is assumed to be more than 95,4 L/s (minimum capacity to reach scouring velocity through the downstream 450 mm Ø rising main), which is sufficient to accommodate the proposed development in the existing sewer system.

It is however proposed that flow measurements are taken at the Toekoms PS to verify the capacity of the PS.





**3. CONCLUSION**

The developer of Erven 2667, 2686 & 2687 in Mossel Bay may be liable for the payment of a Development Contribution (as calculated by Mossel Bay Municipality) for bulk water and sewer infrastructure as per Council Policy.

There is sufficient capacity in the water and sewer reticulation systems to accommodate the proposed development on of Erven 2667, 2686 & 2687.

We trust that you find this of value.

Yours sincerely

GLS CONSULTING (PTY) LTD  
REG. NO.: 2007/003039/07

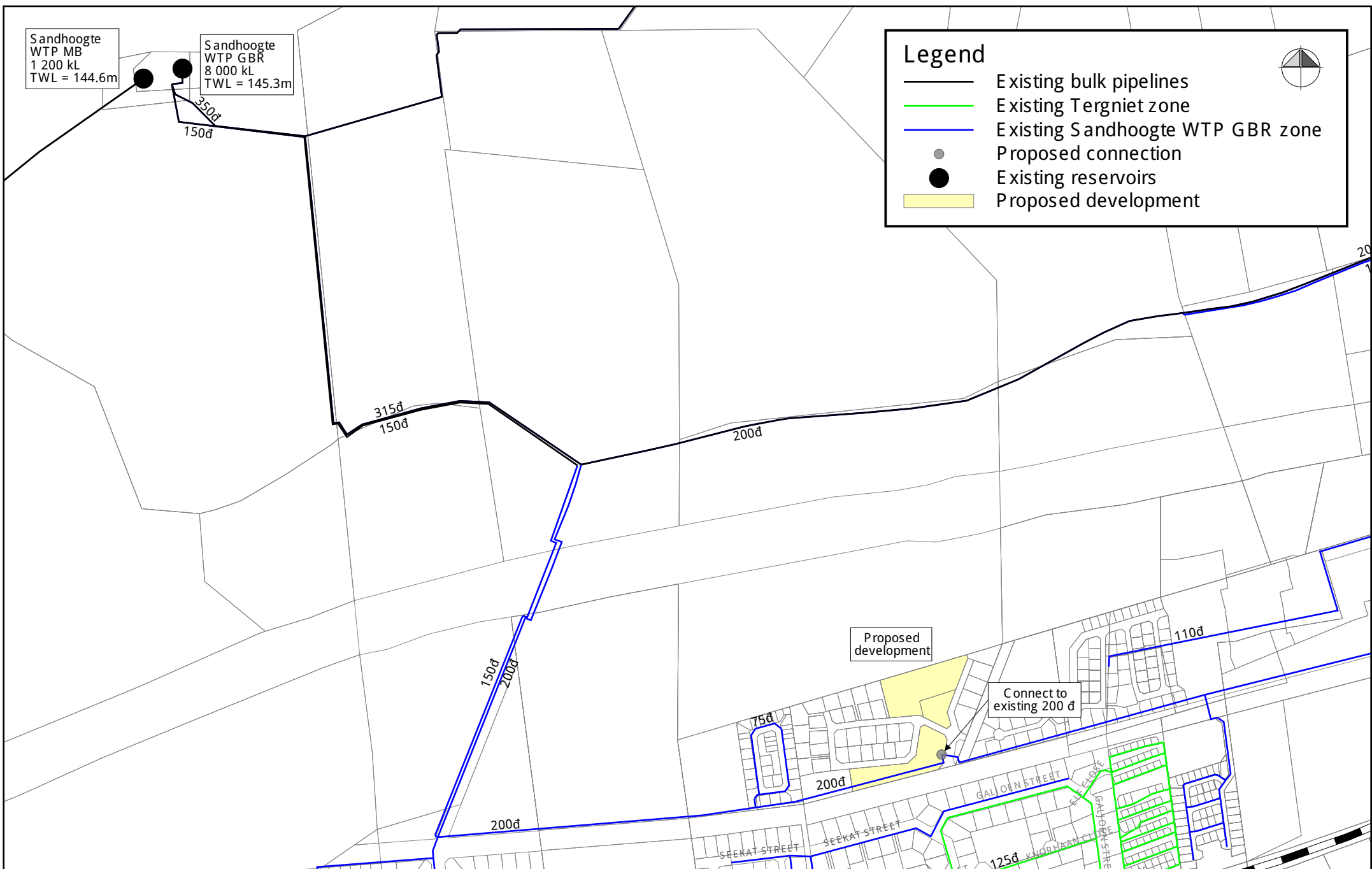
A handwritten signature in dark ink, appearing to read 'P. Du Plessis', written over a horizontal line.

Per: PC DU PLESSIS

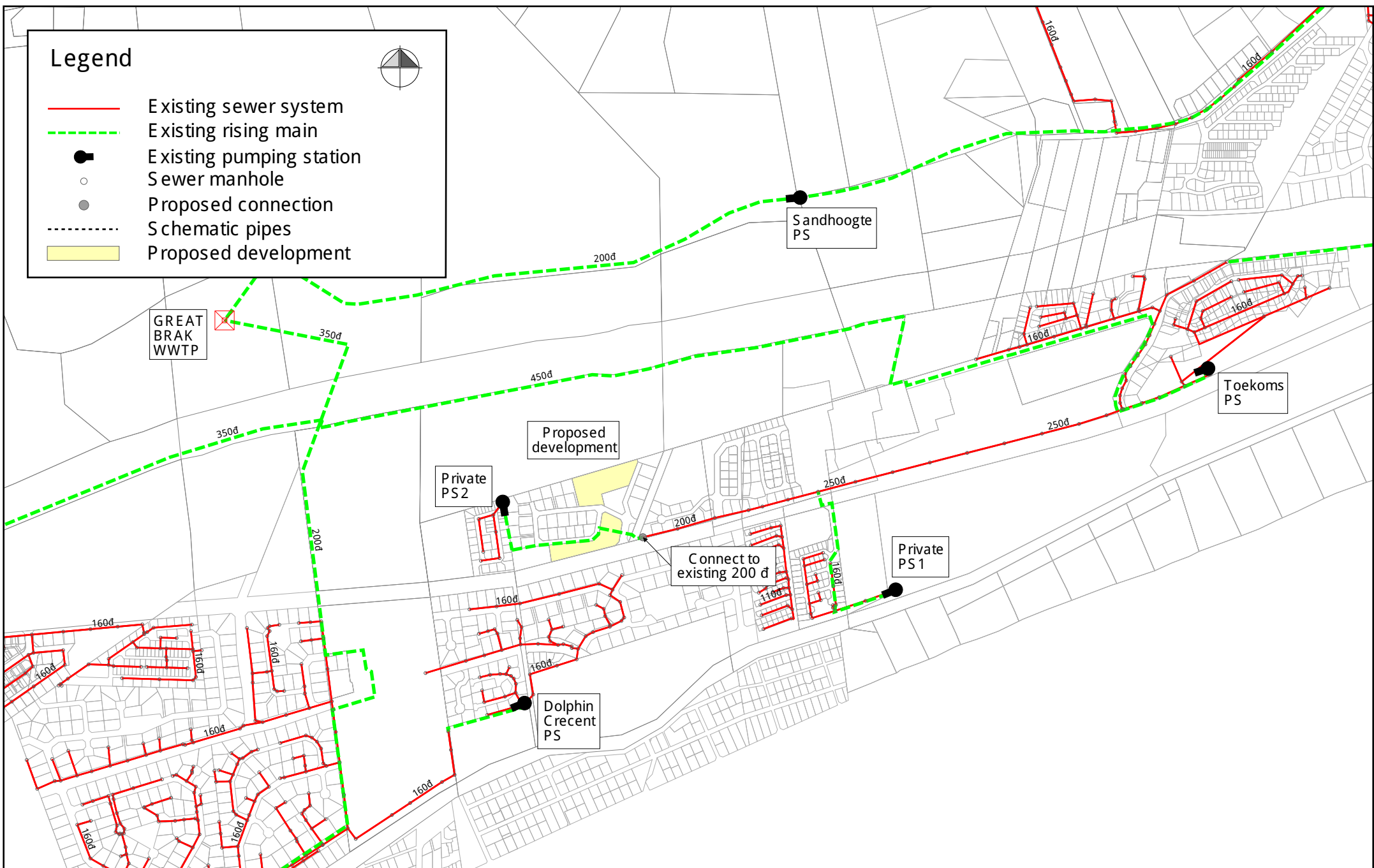
cc. The Manager: Civil Engineering Services  
Mossel Bay Municipality  
Private Bag X29  
**MOSSEL BAY**  
6500

Attention: Mr Eric Louw







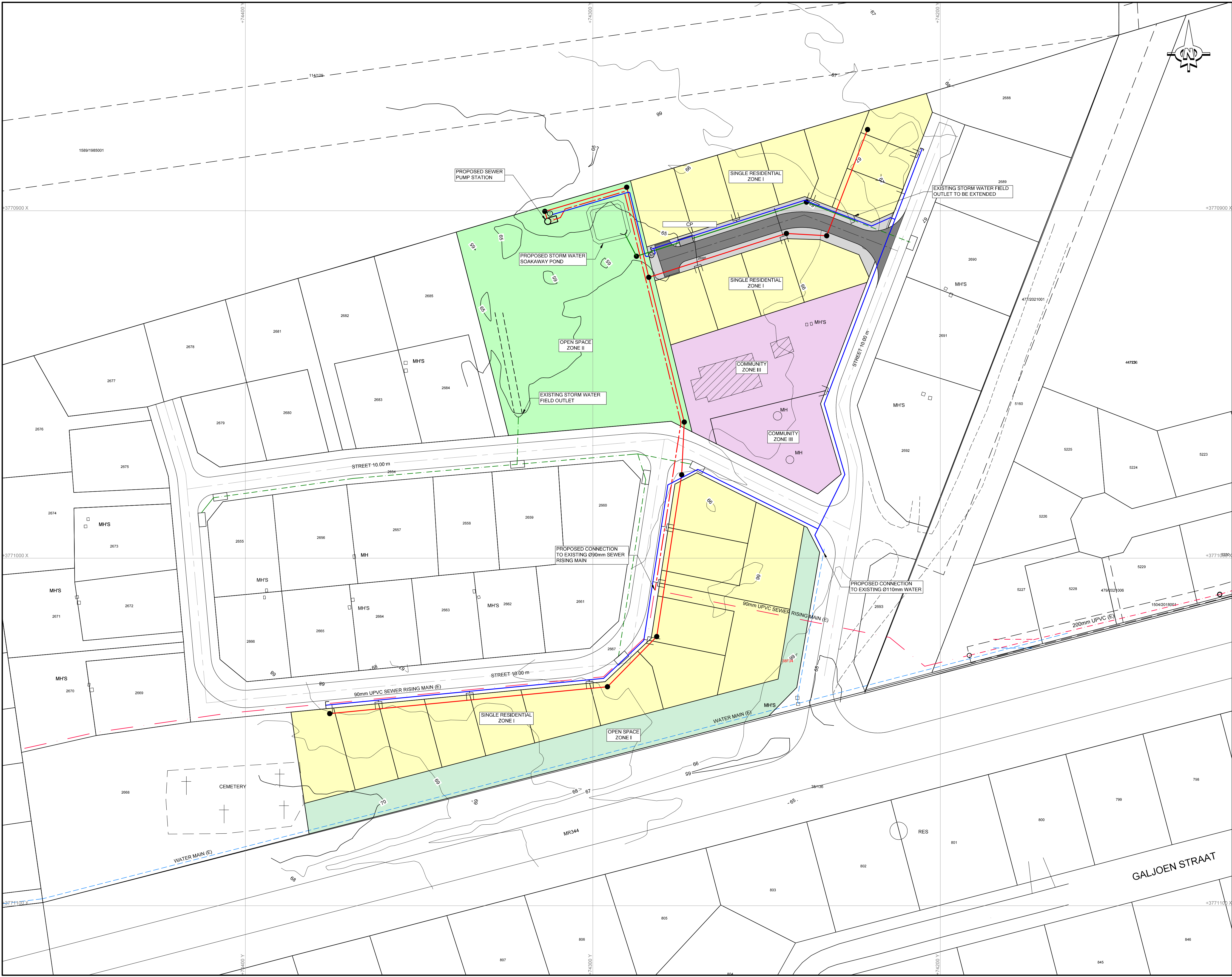




# ANNEXURE D

## PROPOSED CIVIL INFRASTRUCTURE LAYOUT





**LEGEND**

- PROPOSED STORMWATER PIPE & SIDE INLET
- PROPOSED SEWER RISING MAIN
- PROPOSED SEWER PUMP STATION
- PROPOSED SEWER PIPE WITH MANHOLE
- PROPOSED WATER PIPE
- PROPOSED WATER CHAMBER WITH NOTATION  
A - AIR VALVE  
M - WATER METER  
S - SCOUR VALVE  
T - WATER TAP
- PROPOSED NEW ROADWAY
- EXISTING STORMWATER PIPE & SIDE INLET
- EXISTING SEWER PIPE WITH MANHOLE
- EXISTING WATER PIPE
- 1m CONTOUR INTERVALS
- EXISTING STRUCTURE

**NOTES**

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
- C.O.S. - CONFIRM ON SITE  
E - EXISTING  
F - FUTURE  
GI - GULLY INLET  
HW - HEAD WALL  
JB - JUNCTION BOX  
LOC - LIMIT OF CONSTRUCTION  
M - METER (WATER)  
MH - MANHOLE  
V - VALVE
- ALL CO-ORDINATES OF PPS, BC'S, EC'S, ETC. NEED TO BE SURVEYED AND CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF WORKS.
- NO DIMENSIONS MAY BE SCALED FROM DRAWINGS.
- ANY ERRORS OR DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER FOR CLARIFICATION PRIOR TO ANY WORK BEING UNDERTAKEN.
- UNLESS OTHERWISE SPECIFIED ALL CONCRETE WORKS TO BE 30MPa.

**FOR INFORMATION**  
(for discussion purposes only)

100 MILLIMETRES ON ORIGINAL DRAWING

**DRAWING REVISIONS:**

| No. | DATE                         | AMENDMENTS                     |
|-----|------------------------------|--------------------------------|
| A   | BEFORE CONTRACT COMMENCES    |                                |
| A   | AFTER CONTRACT HAS COMMENCED |                                |
| A   | 2026-07-13                   | SOAKAWAY POND LOCATION AMENDED |

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PO Box 730, Mossel Bay, 6500, South Africa

PROJECT  
**GROOT BRAKRIVIER  
ERVEN 2667, 2686 & 2687**

DRAWING DESCRIPTION  
**PROPOSED SERVICES LAYOUT**

|                                                                                                                            |                  |          |
|----------------------------------------------------------------------------------------------------------------------------|------------------|----------|
| DRAWING NO.<br><b>11599000-002</b>                                                                                         |                  | <b>A</b> |
| DESIGNED: DKJ                                                                                                              | CHECKED: DKJ     |          |
| DRAWN: LA                                                                                                                  | SCALE: 1:500     | A1       |
| APPROVED:                                                                                                                  | DATE: 2026-07-13 |          |
| FILE PATH: Mossel Bay - 11599000 - Various Housing Developments/02 Concept/04 Draw/P2404 - Toekoms! 11044000-002 (LAY).dws |                  |          |



# ANNEXURE E

CONFIRMATION OF MUNICIPAL SEWER  
AND WATER INFRASTRUCTURE TO SERVICE  
ERVEN 2667, 2686 & 2687





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# Mossel Bay

M U N I C I P A L I T Y

MOSSSEL BAY | HARTENBOS | GREAT BRAK RIVER | HERBERTSDALE

In antwoord verwys na nommer

In reply quote number 15/1/1/3ELouw

Xa Uphendula chaza Le Nombolo

8 April 2025

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To Mr Dean Jacobs

## CONFIRMATION OF MUNICIPAL SEWER AND WATER INFRASTRUCTURE TO SERVICE ERVEN 2667, 2686 & 2687

The developer of Erven 2667, 2686 & 2687 in Mossel Bay may be liable for the payment of a Development Contribution (as calculated by Mossel Bay Municipality) for bulk water and sewer infrastructure as per Council Policy.

There is sufficient capacity in the water and sewer reticulation systems to accommodate the proposed development on of Erven 2667, 2686 & 2687.

We trust that you find this of value.

Senior Manager : Water and Sanitation

E. Louw

MOSSSEL BAY | HARTENBOS | GREAT BRAK RIVER | HERBERTSDALE

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