



GEOTECHNICAL INVESTIGATION FOR PORTION 20 OF FARM 23, PATERNOSTER, WESTERN CAPE.

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GEOSS
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Executive Summary

A geotechnical investigation was conducted at Portion 20 of Farm 23, Paternoster, Western Cape, to assess subsurface conditions for a proposed development on the currently vacant site. The area is topographically flat, vegetated by Saldanha Flats Strandveld, and characterised by surface deposits of loose SAND.

The subsurface profile generally consists of three different soil horizons (1) an upper layer of transported material or uncontrolled fill (0.0 - 0.70 mbgl) containing organic matter and rubble, (2) a medium dense transported **SAND** layer exhibiting varying degrees of pedogenic cementation and (3) an underlying strongly cemented **HARDPAN CALCRETE**. Calcrete was encountered at variable depths ranging from 1.40 mbgl to 3.50 mbgl and refused light earthmoving equipment. Consequently, the upper **SANDS** are classified as 'soft excavation' conditions, while the **HARDPAN CALCRETE** is classified as 'hard excavation' conditions in accordance with COTO (2019) standards.

The site is considered feasible for light structures using conventional strip and pad footings founded on improved SANDY horizons. These solutions offer anticipated safe bearing capacities of 150 kPa and 175 kPa, respectively, with estimated total settlements of 5 - 10 mm. To mitigate risks associated with potentially collapsible fabrics or the tendency of partially cemented **SANDS** to deteriorate with depth, it is required that foundation trenches be excavated and recompacted to at least 95% Mod AASHTO to a depth of 1.5 x times the foundation width (i.e., depth of influence). Additionally, excavations must be inspected for localised karst features or sinkholes inherent to weathered **CALCRETE**.

While the loose to medium dense, porous, **SANDY** subsurface offers favourable natural drainage, a perched water table may develop atop the **HARDPAN CALCRETE** during intense rainfall events. Furthermore, highly compacted soils exhibit reduced permeability. Therefore, adequate drainage measures should be considered to prevent moisture entrapment around foundations. Laboratory results indicate the subsurface soils at Portion 20 of Farm 23 are non-expansive but must be considered 'corrosive' to 'highly corrosive' and 'moderately alkaline' from a soil chemistry point of view. This necessitates specialised concrete mixes and corrosion-resistant materials for newly installed underground services.

In terms of material reuse, the upper 0.70 m is suitable only for landscaping, while the underlying transported **SANDS** and/or cemented **SANDS** may be utilised for building material, service backfill, or pavement layers, subject to qualified professionals' approval.

Based on these findings, the following NHBRC Site Class Designations are attributed:

- | | |
|---|--|
| • <u>Uppermost</u> transported soils and/or uncontrolled fill | P due to its variability. |
| • <u>Underlying</u> transported poorly graded SAND . | C1 due to its compressibility and potential collapsibility |
| • HARDPAN CALCRETE | R due to its anticipated stable nature under light structures |

GEOSS has endeavoured to highlight and characterise all potential geotechnical risks posed by the site proposed for additional infrastructure development at the property. However, due to the anisotropic (variable) nature of earth materials, each point on the site will present results that differ. For this reason, it is considered of utmost importance that additional geotechnical work be undertaken before the implementation of site work

Table of Contents

1.	Introduction.....	1
2.	Scope of Work.....	1
3.	Information Available	2
4.	Methodology.....	2
4.1.	Desktop Study	2
4.2.	Intrusive Investigation	2
5.	Regional Study Area and Geological Setting	2
5.1.	Site Location and Description	2
5.2.	Climate	2
5.3.	Regional Geology	3
5.4.	Anticipated Engineering Geology.....	4
6.	Geotechnical Site Investigation	7
6.1.	Field Investigation Overview	7
6.2.	Generalised Soil Profile	8
6.3.	Dynamic Cone Penetrometer Results	9
6.4.	Laboratory Results	11
7.	Geotechnical Evaluation.....	14
7.1.	Excavation Conditions.....	14
7.2.	Safe Bearing Capacities and Anticipated Settlements	14
7.3.	Problem Soils	16
7.4.	Groundwater and Drainage	16
7.5.	Reuse of In-situ Soils.....	17
7.6.	NHBRC Site Class Designation	17
8.	Conclusions	18
9.	Assumptions and Limitations.....	20
10.	References	20
	Appendix A: Site Development Plans	22
	Appendix B: Site Photographs & Soil Logs.....	24
	Appendix C: DCP Results and Logs	33
	Appendix D: Laboratory Results.....	39

List of Tables

Table 1: Summary of the regional geology of the study area.	4
Table 2: Summary of TP and DCP positions and details.	7
Table 3: Generalised soil profile for the northern and western extents of the study area.	8
Table 4: Summary of grading analysis and foundation indicators.	11
Table 5: Summary of moisture density analysis.	11
Table 6: Summary of EC and pH tests.	11
Table 7: Summary of falling head permeability results.	12
Table 8: Summary of oedometer test results.	12
Table 9: Potential foundation solutions for the proposed development at Portion 20 of Farm 23.	15
Table 10: Summary of NHBRC site classification designation for Portion 20 of Farm 23, Paternoster; Western Cape.	18

List of Figures

Figure 1: Monthly average minimum and maximum air temperatures for the study area (Schulze, 2009)...	2
Figure 2: Monthly mean rainfall and evaporation distribution for the study area (Schulze, 2009).	3
Figure 3: DCP data plotted on a graph showing soil consistencies. The 3 rd Quartile (Q3) of depth penetration by blow is shown in blue.	10
Figure 4: Site Development Plan for Portion 20 of Farm 23.	23
Figure 5: General soil conditions recorded during trial pitting at TP01 displaying full profile depth and fill comprising the topmost horizon; TP02 displaying full profile depth and HARDPAN CALCRETE at 2.30 mbgl excavatable with TLB just prior to refusal; TP03 displaying full profile depth and medium dense fine-grained SAND between 0.70 – 1.90 mbgl.	25
Figure 6: General soil conditions recorded during trial pitting at TP04 displaying full profile depth and transported loose SAND comprising the topmost horizon; TP05 displaying full profile depth and refusal on HARDPAN CALCRETE at a depth of 1.40 mbgl.	26
Figure 7: Soil log for TP01.	27
Figure 8: Soil log for TP02.	28
Figure 9: Soil log for TP03.	29
Figure 10: Soil log for TP04.	30
Figure 11: Soil log for TP05.	31
Figure 12: Legend to be used to interpret the soil logs.	32
Figure 13: Log and results for DCP_01.	34
Figure 14: Log and results for DCP_02.	35
Figure 15: Log and results for DCP_03.	36
Figure 16: Log and results for DCP_04.	37
Figure 17: Log and results for DCP_05.	38

List of Maps

Map 1: General location of study area.	1
Map 2: Regional geology of the site and surrounding region (CGS, 2019)	6
Map 3: Map showing in-situ test positions across the developable area.	13

Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
CBR	California bearing ratio
CGS	Council for Geoscience
kg/m ³	kilogram per metres cube
LL	Liquid Limit
LS	Linear Shrinkage
m	metres
mamsl	metres above mean sea level
mbgl	metres below ground level
MDD	Maximum Dry Density
mm	millimetre
MOD	Modified AASHTO
NHBRC	National Home Builders Registration Council
OMC	Optimum Moisture Content
PI	Plasticity Index
TLB	Tractor Loader Backhoe
TP	Trial Pit
USCS	Unified Soil Classification System

Glossary of Terms

Angle of internal friction	For a given soil, the angle on the graph of the shear stress and normal effective stresses at which shear failure occurs.
Bulk density	Soil density. The total mass of water and soil particles contained in a unit volume of soil.
Density	The ratio of the total mass to the total volume of a unit of soil. Usually expressed as a unit weight where weight is interchanged with mass.
Dry density	The ratio of the mass of the solids (soil grains) to the total unit volume of soil.
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface, i.e., the water table marks the upper surface of groundwater systems
Saturated	A soil condition in which the void spaces are assumed to be fully filled with water, resulting in the loss of matric suction and the development of positive pore water pressures. For the purposes of this assessment, saturated conditions are represented by assuming zero effective cohesion for the residual soil, reflecting a conservative reduction in shear strength under prolonged or intense rainfall.
Unsaturated	A soil condition in which the void spaces are partially filled with water and air, giving rise to matric suction within the soil mass. This suction contributes an apparent cohesion component to shear strength, in addition to frictional resistance, and is represented in this assessment by adopting non-zero effective cohesion values for the residual soil under typical antecedent moisture conditions.

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1. Introduction

Mr NJ de Kock approached GEOSS to complete an intrusive geotechnical investigation for geotechnical characterisation of the subsoils at Portion 20 of Farm 23 in Paternoster, Western Cape (refer to **Map 1**). The main objective of this geotechnical investigation is to characterise the subsurface soil conditions from a geotechnical and engineering-geological perspective and to inform the general NHBRC site class designation for the study area.

This study includes a desktop assessment of regional geological and geotechnical datasets, a field visit to document existing site conditions, collect samples for laboratory analysis, and conduct field testing to determine the geotechnical properties of the in-situ material. Further to this, the results obtained from the desktop study, field investigation and laboratory analyses were used to determine the NHBRC Site Class Designation for the earmarked Portion 20 of Farm 23.

2. Scope of Work

The main objective of this assessment was to identify potential geotechnical risks, including the presence of problematic soils such as potentially compressible or collapsible materials, etc. The investigation also aimed to classify the subsurface conditions in accordance with the relevant NHBRC Site Class Designations, based on the results of both the desktop study and fieldwork. This report addresses the following key aspects:

- Determine and describe the general geology of the site and surrounding areas concerning regional and local geology, including the topography and surface drainage systems, through a desktop-level study, followed by physical observations of on-site conditions and surroundings.
- Site and excavate trial pits to a suitable depth (preferably bedrock or refusal). Describe the soil profiles exposed in terms of standard descriptors: moisture content, colour, consistency, structure, texture and origin (MCCSTO) in accordance with Dippenaar, Van Rooy, Davis & A'Bear (2025) modified after Jennings et al (1973). Supply a representative photograph of each trial pit.
- Identify and comment upon the presence (or absence) of water or seepage within each trial pit.
- Dynamic Cone Penetrometer (DCP) tests across the property.
- Take a representative bulk and undisturbed samples of the soil horizon targeted for founding, mark and seal the sample and transport it to a SANAS-accredited geotechnical laboratory to undertake the following laboratory tests:
 - Grading Analysis
 - Atterberg Limits
 - Maximum Dry Density (MDD)
 - California Bearing Ratio (CBR)
 - Permeability Testing
 - Oedometer tests

- Determination of:
 - geotechnical soil parameters,
 - soil consistencies,
 - expected settlements,
 - expected safe bearing capacities,
 - NHBRC Site Class Designation.
- A report summarising the above investigation tests and geotechnical characterisation of the site.

3. Information Available

During the planning, desk study and compilation of the report, the following information compiled by 'Van Biljon Barnardo Architects' was made available and consulted (refer to **Appendix A**):

- Paternoster Vaalplaas Development: Proposed Site Layout Erf 23/17 (Dated: 05/11/2025).
- Paternoster Vaalplaas Development: Proposed Site Layout Erf 23/20 (Dated: 03/11/2025).

4. Methodology

4.1. Desktop Study

The procedure adopted for this study involved a desktop study followed by site work. The initial desktop study involved obtaining and reviewing all relevant data for the project. This involved analysing data from geological sources, including the following:

- The 1:50 000 geological series map – Sheet 3217DB & DD, Vredenburg, (Council for Geoscience, 2009).
- Engineering Geology of Southern Africa – Volume 4, (Brink, 1985).
- The Geology of South Africa – Chapter 30 Coastal Cenozoic deposit (Roberts, Botha, Maud, & Pether, 2006).

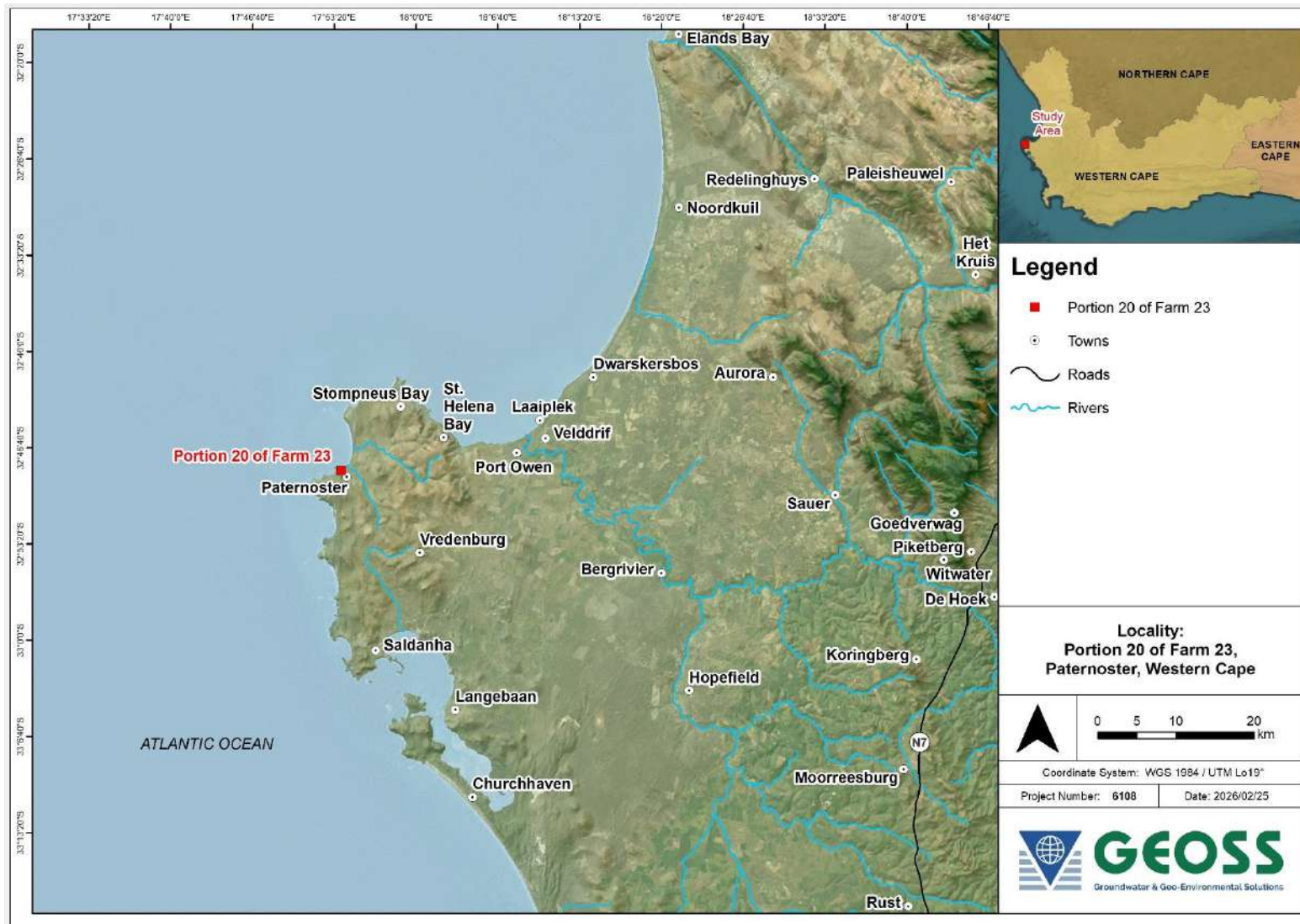
4.2. Intrusive Investigation

A preliminary reconnaissance site visit was conducted on 16 January 2026 to meet with the client to set our trial pit positions to avoid the shell middens present on the site. A site visit was conducted on 29 January 2026 to verify as much of this data as possible, make on-site observations, log trial pits, and collect relevant disturbed and undisturbed soil samples from exposures in the trial pits for laboratory analysis.

The following tasks were undertaken during the field investigation:

- During trial pitting, the exposed subsurface soil horizons were logged and documented according to standard terminology as originally recommended by Jennings et al. (1973), and later updated by Dippenaar, et al. (2025). Soil profiles observed have been presented visually by means of photographs and using the commercially available hatching software dotPLOT (**Appendix B**). This information was used to develop a ground model for the site.

- DCP testing across the study area to define the consistencies of the subsurface soil horizons (**Appendix C**). This includes DCP tests undertaken adjacent to trial pits as well as within the trial pits.
- Three disturbed bulk soil samples were collected and submitted to a SANAS-accredited commercial laboratory. The samples were analysed for Grading Analysis, Atterberg Limits, Maximum Dry Density (MDD), California Bearing Ratio (CBR) and material permeability compacted at 100% Mod AASHTO. Additional permeability test results are, however, available in the appendix from similar and other units encountered in areas nearby (< 1 km) to the present study site. (**Appendix D**).
- One undisturbed soil sample was collected and submitted to a SANAS-accredited commercial laboratory. The sample was submitted for oedometer testing (**Appendix D**).
- The trial pit (TP) and DCP positions were set and documented using a handheld GPS.



Map 1: General location of study area.

5. Regional Study Area and Geological Setting

5.1. Site Location and Description

The site proposed for development is located on Portion 20 of Farm 23, Paternoster, Western Cape. The property is situated on the eastern side of Paternoster, adjacent to Visvanger Street and directly north of the neighbouring property.

The site is currently vacant. The surface material is characterised by deposits of **SAND** and the area is vegetated by Saldanha Flats Strandveld flora. From a topographical perspective, the site is generally flat with no notable depressions or elevated areas.

5.2. Climate

The regional area experiences a semi-desert type with cool winters and warm, dry summers. **Figure 1** illustrates the monthly average minimum and maximum air temperatures and **Figure 2** illustrates the monthly mean rainfall and evaporation distribution for the study area (Schulze, 2009). The long-term (1950 – 2000) mean annual evaporation value of 962 mm per annum (mm/a) for the study area exceeds the long-term (1950 – 2000) mean annual precipitation value of 187 mm/a for the same area. The average evaporation typically exceeds the average expected rainfall year-round except for the month of June.

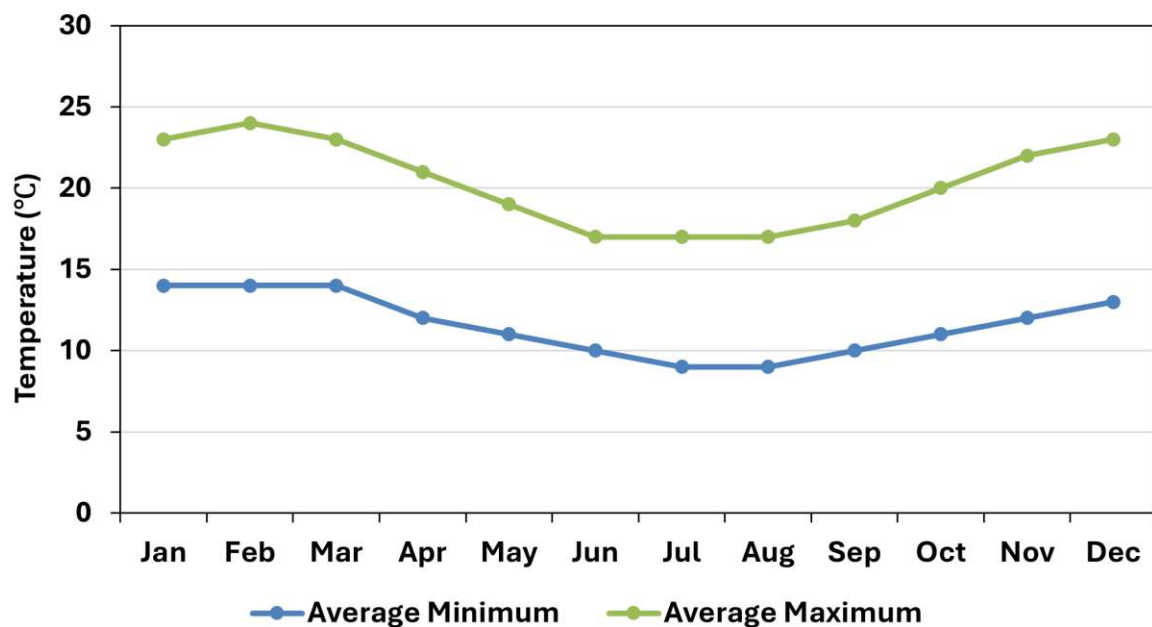


Figure 1: Monthly average minimum and maximum air temperatures for the study area (Schulze, 2009).

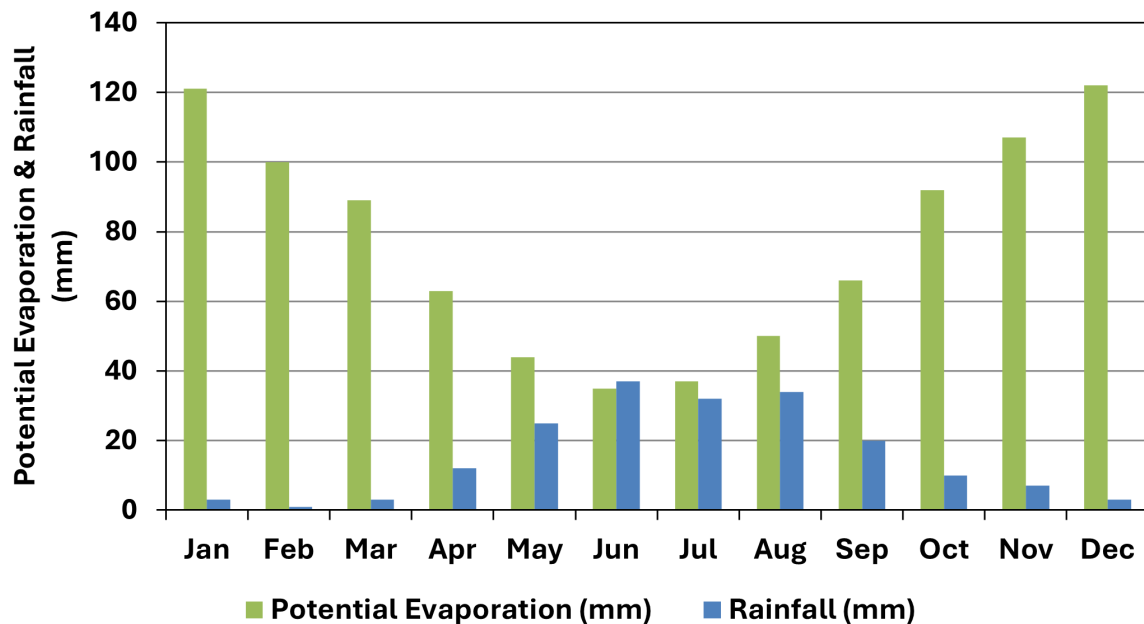


Figure 2: Monthly mean rainfall and evaporation distribution for the study area (Schulze, 2009).

5.3. Regional Geology

The Council for Geoscience (CGS, 2009) mapped the area at a scale of 1:50 000 (Sheet 3217DB & DD, Vredenburg). The regional geological setting is illustrated in **Map 2**, and the main geological units are summarised in **Table 1**. The general profile consists of quaternary and tertiary-aged calcareous and sandy sediments overlying bedrock. The quaternary sediments directly underlying the site belong to two formations, i.e., the Witzand- and Prospect Hill Formations. The Witzand Formation is composed of mobile, partly vegetated, whitish-grey to red **SAND** containing 20-85% carbonate in the form of angular (comminuted) sea shells as well as the dune snail *Trigonepherus globulus* (Roberts et al., 2006). The Prospect Hill Formations is primarily composed of reddish-orange, cross-bedded aeolianite, with terrestrial fossil fauna and massive brown calcrete. Regionally, other sandy deposits include the Springfontyn- and Langebaan Formations, with features of interest being the presence of reddish to grey mostly unconsolidated quartzose aeolian **SAND**; and buff-coloured bioclastic-siliciclastic aeolianites that are mantled by hardpan calcrete, of each respectively (Roberts et al., 2006). The regional bedrock is composed of two units comprising the metasedimentary rocks of the Moorreesburg Formation, which form part of the Malmesbury Group which outcrop to the east of the site locally along the beach and various felsic units (mainly granitic in composition) locally to the west and southwest of the site.

Table 1: Summary of the regional geology of the study area.

Code	Formation / Batholith	Member	Group	Lithology
Qwi	Witzand	-	Sandveld	Unconsolidated, windblown, white to light-grey calcareous sand with comminuted shells (vegetated).
Qsp	Springfontyn	-		Light grey to pale red quartzose sand and dune sand.
Qkr	Langebaan	Kraalbaai		Cross-bedded, light-grey bio-calcareous-siliclastic aeolianite, calcrete (Middle to Upper Pleistocene).
Np	Prospect Hill	-		Reddish-orange, cross-bedded aeolianite, with terrestrial fossil fauna, massive brown calcrete.
EAve	Vredenburg	-	Vredenburg	Granite, coarse-grained, porphyritic with characteristic pink feldspar phenocrysts.
EDmo	Moorreesburg	-	Malmesbury	Phyllitic shale, thick to medium-bedded, fine- to medium-grained wacke.

5.4. Anticipated Engineering Geology

Extensive research has been conducted by the Council for Geoscience (CGS), Theron et al. (1992), and Fouché & Day (2022) regarding the Quaternary sediments of the Cape Flats. These deposits primarily comprise the Witzand, Springfontyn, and Langebaan Formations of the Sandveld Group. Although the proposed development at Paternoster is geographically removed from the Cape Flats, the extensive research conducted on these Cenozoic deposits serves as a reliable proxy for predicting the subsurface conditions and engineering geological behaviour of the Sandveld Group material in the study area.

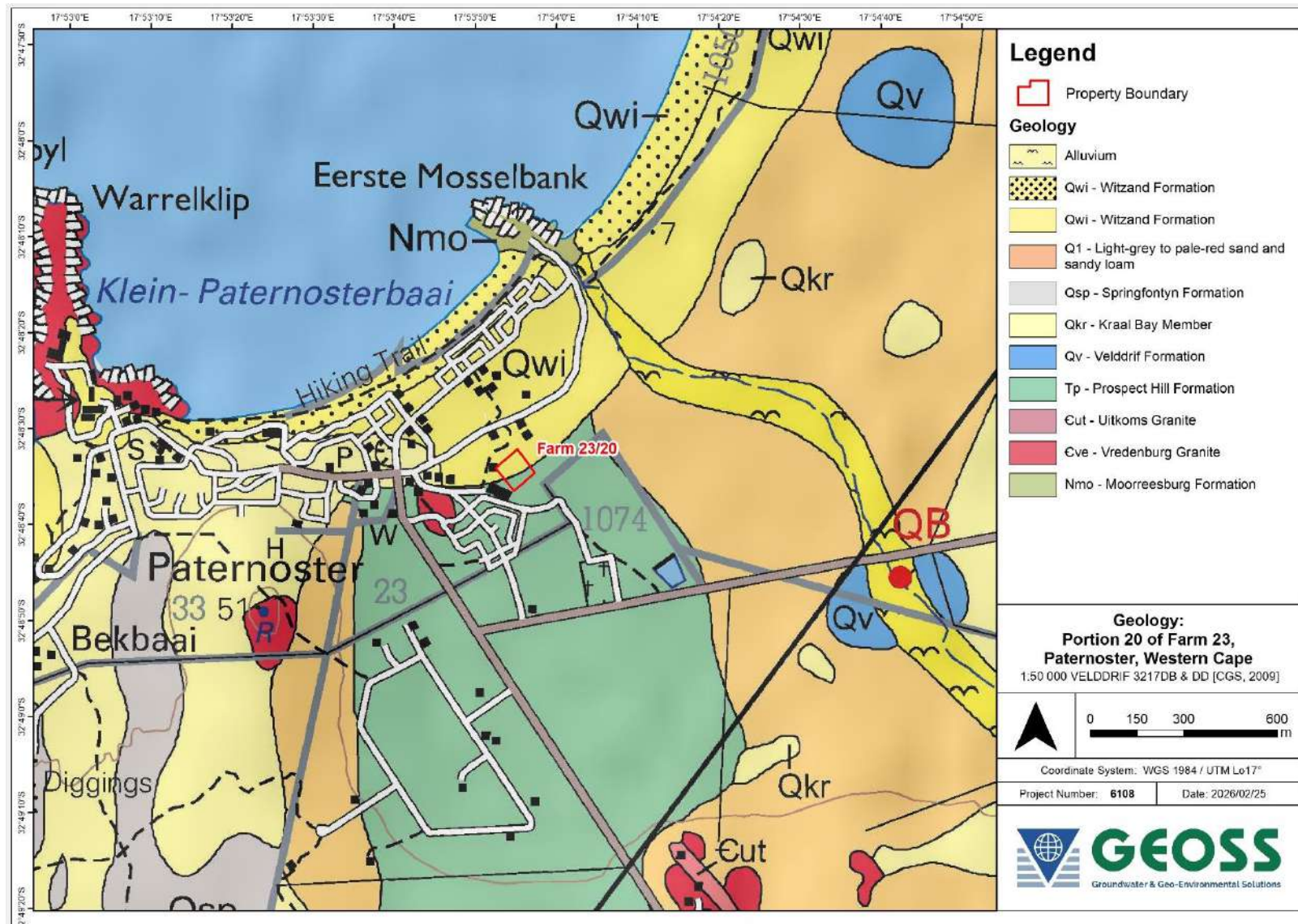
From the research conducted by Stapelberg (2008) on the geotechnical properties of the Cape Flats Quaternary sediments that may potentially influence development and construction, the following may be expected for the proposed developments at Portion 20 of Farm 23 in Paternoster:

- Material susceptible to excessive consolidation when used as a foundation horizon. (Immediate settlement of loose SAND).
- Loose surface soil susceptible to wind erosion.
- Medium to high soil permeabilities (0.30×10^{-5} cm/s).

Fouché & Day (2022) noted that the Witzand Formation sands have a low collapse potential when saturated but are compressible at natural moisture content. The formation is also described as having a potentially high alkalinity ($\text{pH} > 7.9$) and may pose a corrosion risk to steel.

The regional sediments in the study area show signs of pedogenesis, resulting in irregular calcic layers of variable thickness (Fey, 2010). Pedogenesis is evident in the widespread development of both surface and subsurface calcrete horizons (pedocretes). Although pedocretes can enhance slope stability and reduce erosion risks (Gidagasu, 1976), they can pose challenges as foundation layers. Unlike standard soil profiles, pedocrete strength decreases with depth (Brink, 1985). Foundations on pedocretes, such as calcretes, are suitable only if the horizon is sufficiently thick and the underlying soil is neither strongly collapsible nor expansive (Brink, 1985). Additionally, weathered calcretes may exhibit small karst-like features, which can lead to minor sinkholes in coastal regions (Netterberg, 1980).

From a material usage point of view, pedocretes, particularly calcretes, are also widely used in road construction as wearing courses for unpaved roads and across all layers of the road prism (Brink, 1985). However, pedocrete properties can vary significantly, impacting their suitability as construction materials from poor to good. Therefore, thorough soil profiling and laboratory testing are essential to determine the material properties and geotechnical characteristics of the subsurface at each site.



Map 2: Regional geology of the site and surrounding region (CGS, 2019)

6. Geotechnical Site Investigation

6.1. Field Investigation Overview

The geotechnical site investigation involved a site walkover and logging of five trial pits (TPs) excavated by a CAT 126F2 TLB. The fieldwork component sought to identify and confirm geological and geotechnical features of interest. Additional to the TPs, five Dynamic Cone Penetrometer (DCP) tests were conducted next to (and within) each trial pit to confirm the consistency of the materials encountered during profiling. A summary of the details of each data point collected from the investigation is represented in **Table 2** and displayed spatially on **Map 3**. The photographs and soil logs of the TP's are displayed in **Figure 5 - Figure 12** in **Appendix B**, while DCP results and logs are displayed in **Figure 13 - Figure 17** in **Appendix C**. Following the completion of the trial pit profiling and DCP testing, bulk disturbed and undisturbed soil samples were collected from multiple TPs across the study area. The samples were transported to an SANAS-accredited laboratory following the fieldwork component of the study. A summary of the results is displayed in

Table 4 - Table 8 and the actual full laboratory reports can be viewed in **Appendix D**.

Table 2: Summary of TP and DCP positions and details.

Label	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Elevation (mamsl)	Investigation depth (mbgl)
TP_01	-32.809465	17.898039	5.00	1.70
TP_02	-32.809993	17.898701	6.00	2.30
TP_03	-32.809776	17.899541	6.00	3.50
TP_04	-32.808920	17.898791	4.00	2.40
TP_05	-32.809454	17.898777	5.00	1.40
DCP_01	-32.809465	17.898039	5.00	~1.55
DCP_02	-32.809993	17.898701	6.00	~2.69
DCP_03	-32.809776	17.899541	6.00	~2.35
DCP_04	-32.808920	17.898791	4.00	~2.00
DCP_05	-32.809454	17.898777	5.00	~1.09

***NOTES**

DD – decimal degrees

mamsl – meters above mean sea level

mbgl – meters below ground level

TP – Trial Pit

DCP – Dynamic Cone Penetrometer

6.2. Generalised Soil Profile

Following completion of the fieldwork component of the study, a generalised soil profile was compiled to summarise the data collected from the trial pitting investigation. Overall, generally similar material types (sand-dominant) were logged with numerous pedogenic horizons encountered, i.e., calcrete and cemented horizons. The generalised soil profile is presented in **Table 3**.

Throughout the fieldwork component of the study, groundwater was not encountered in any of the TPs. Pedogenic horizons were encountered in all of the pits with varying degrees of hardness and cemented conditions. Pedogenic horizons are defined by calcretised **SAND**, nodular **CALCRETE**, **CALCRETE** boulders and strongly cemented **HARDPAN CALCRETE**.

Table 3: Generalised soil profile for the northern and western extents of the study area.

Depth (mbgl)	Generalised Soil Characteristics
0.00 – 0.70	Slightly moist, brown to grey, <u>loose to medium dense</u>, non-cemented, intact, fine-grained SAND. Fill / Transported soils. NOTES: i) Contains plant roots. ii) May contain some builder's rubble such as tile pieces and plastic. iii) Snail shells are often noted. iv) In some cases, minor sidewall collapse was noted.
0.70 – 1.70	Slightly moist to moist, brown to grey-brown, <u>medium dense</u>, non-cemented to partially cemented, intact and sometimes stratified, fine-grained SAND. Transported material. NOTES: i) Shell fragments are frequently noted. ii) Occasional calcrete nodules present
+ 1.70 (Refusal)	Cream to off-white, <u>HARD</u>, strongly cemented, widely jointed to massive, medium-grained HARDPAN CALCRETE. NOTES: i) Refusal encountered at varying depths across the study area, i.e., encountered anything between 1.40 – 3.50 mbgl.
OR	

1.70 – 2.30 / 3.50	Slightly moist, off-white to yellowish-brown, <u>medium dense</u> to <u>dense</u>, partially cemented, fine-grained SAND. Transported material. NOTES: i) Calcrete boulders and nodules present. ii) This depth interval may generally be seen as the transition zone between <u>soft</u>-and <u>hard excavation conditions</u>.
2.30 / 3.50 (Refusal)	Cream to off-white, <u>HARD</u>, strongly cemented, widely jointed to massive, medium-grained HARDPAN CALCRETE. NOTES: i) Refusal encountered at varying depths across the study area, i.e., encountered anything between 2.30 – 3.50 mbgl. ii) Sidewall caving noted at depth, specifically at TP_03.

6.3. Dynamic Cone Penetrometer Results

Dynamic Cone Penetration (DCP) tests were conducted at five positions across the study area. Each test was conducted adjacent to, or within, a TP. To evaluate the overall consistency of the subsurface materials, the third quartile (Q3) of the DCP data was plotted, at 0.20 m increments, as shown in **Figure 3**. This analysis indicates that 75% (Q3) of the data points for each depth interval exhibit a range of consistencies. The DCP-logs for each test conducted can be viewed in **Appendix D**. Based on the data available, the material consistencies can be summarised as follows:

- 0.00 to 1.00 mbgl: Very loose, through loose to medium dense with depth.
- 1.00 to 1.50 mbgl: Marks a region of limited information, however, considered reasonable to assume consistencies ranging between loose and medium dense.
- 1.50 to 2.50 mbgl: Loose to medium dense. It should be noted that some degree of disturbance would have taken place ahead of undertaking of these tests as they were conducted from a step excavated within the trial pits at the indicated depths.

It should be noted that the DCP tests were conducted in 1.00 m lengths, i.e., 1.00 m penetration at natural ground level and another 1.00 m penetration anywhere between 1.00 – 1.50 mbgl. According to **Figure 3 A** considerable decrease in consistencies was experienced at this depth range, likely resulting from the disturbance of the subsurface caused by the excavation activities. It is considered reasonable to assume that the soil consistencies between 1.00 – 1.50 mbgl may be regarded as loose to medium dense, considering the consistencies just above and just below this depth increment.

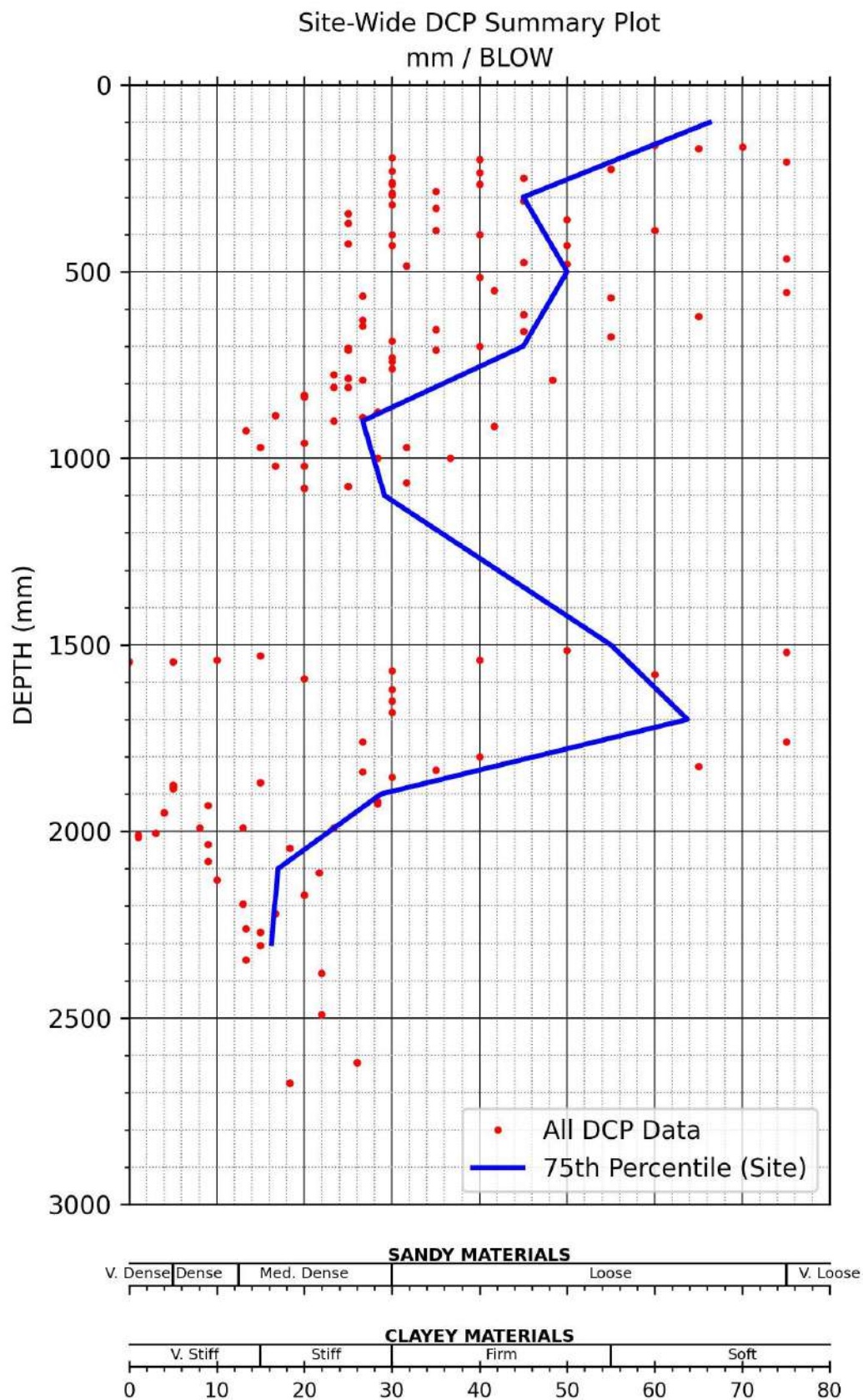


Figure 3: DCP data plotted on a graph showing soil consistencies. The 3rd Quartile (Q3) of depth penetration by blow is shown in blue.

6.4. Laboratory Results

A total of four soil samples were collected during the fieldwork component, i.e., three bulk disturbed samples and one undisturbed sample. Classification tests were undertaken on the bulk samples, including Foundation Indicators (FI), Maximum Dry Density (MDD) and California bearing ratio (CBR). The laboratory classification and characterisation tests served to determine the general engineering properties of the soils encountered on site. An oedometer test was undertaken on a sample collected from TP05, and a falling head permeability test was undertaken on a sample collected from TP02. A summary of the results is displayed in

Table 4 - Table 8 with the full laboratory reports available in **Appendix D**.

Table 4: Summary of grading analysis and foundation indicators.

Sample No. (TP##)	Sample depth (mbgl)	Soil Type (USCS)	Grading Analysis (mm)				PI (%)	Pot. Exp.
			(% Clay)	(% Silt)	(% Sand)	(% Gravel)		
TP01	1.00	SP	1	6	93	0	NP	NP
TP02	0.20	SP	1	4	95	0	NP	NP
TP05	0.80	SP	1	6	92	1	NP	NP

*** NOTES** PI – Plasticity index NP – Non-plastic MDD – Maximum Dry Density
mbgl – metres below ground level SP – Poorly graded **SAND**

Table 5: Summary of moisture density analysis.

Sample No. (TP##)	Sample depth (mbgl)	Soil Type (USCS)	CBR @ (##%)						MDD (kg/m ³)	OMC (%)
			100	98	97	95	93	90		
TP01	1.00	SP	19	16	14	11	9	7	1755	14.40
TP02	0.20	SP	19	17	16	14	12	10	1490	16.50
TP05	0.80	SP	16	14	13	11	10	8	1791	12.30

*** NOTES** NP – Non-plastic MDD – Maximum Dry Density
kg/m³ – kilograms per cubic metre mbgl – metres below ground level
SP – Poorly graded **SAND**

Table 6: Summary of EC and pH tests.

Sample No. (TP##)	Depth (mbgl)	Soil Type (USCS)	EC (mS/m)	pH
TP01	1.00	SP	88.70	8.33
TP02	0.20	SP	55.20	8.30
TP05	0.80	SP	330.00	8.24

*** NOTES** mbgl – metres below ground level mS/m – milli-Siemens per metre

Table 7: Summary of falling head permeability results.

Sample No. (TP##)	Depth (mbgl)	Soil Type (USCS)	Compaction	Permeability (m/s)	Drainage Potential
TP02	0.20	SP	100%	6.15e ⁻⁶	GOOD - POOR

*** NOTES**

mbgl – metres below ground level

cm/s – centimetres per second

m/s – metres per second

SP – Poorly graded **SAND**

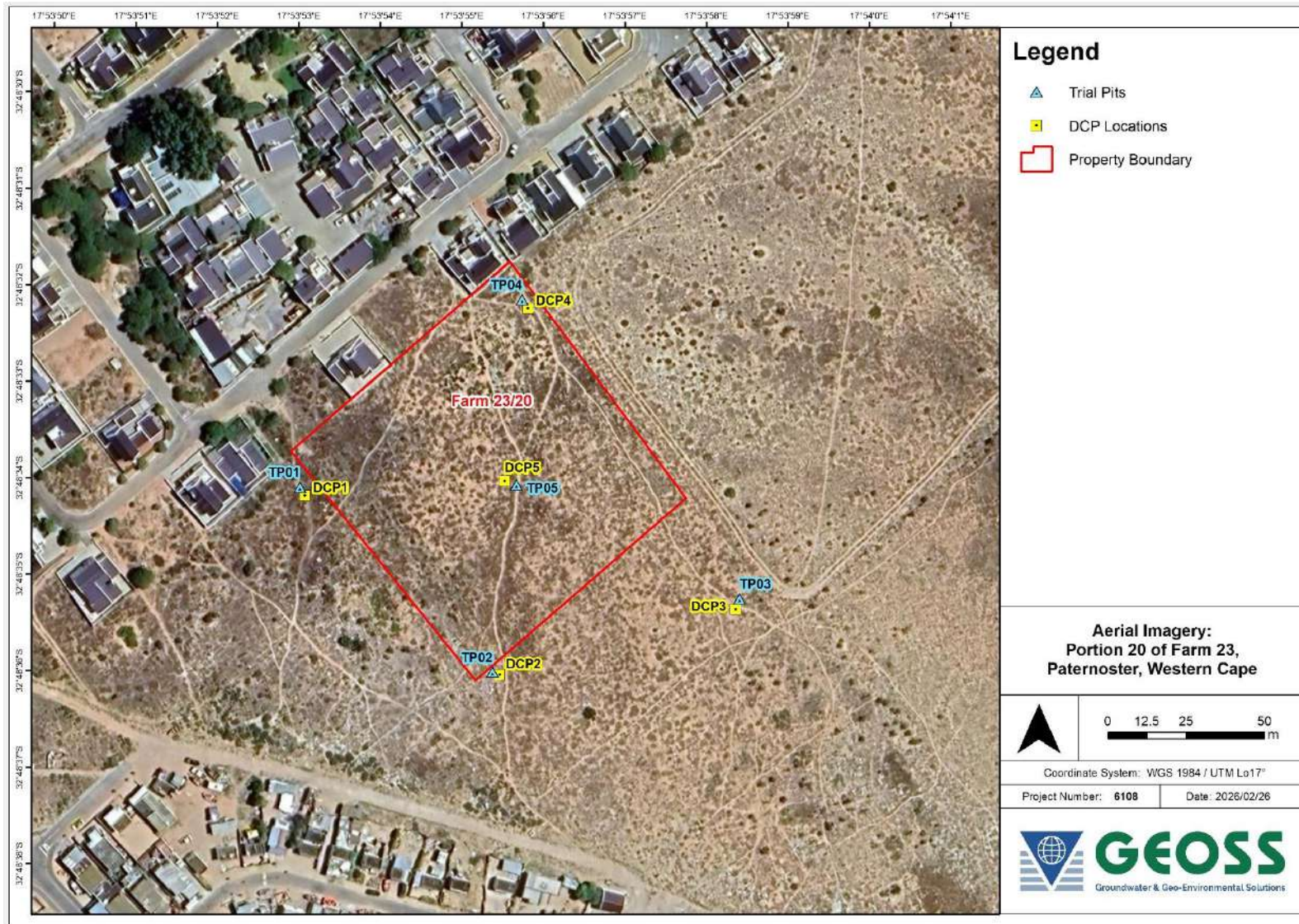
Table 8: Summary of oedometer test results.

Sample No. (TP##)	Soil Type (USCS)	Maximum Load (kPa)	Initial height (mm)	Final height (mm)	Initial Void Ratio (-)	Final Void Ratio (-)
TP_05_0.80m	SP	800	18.80	16.90	0.76	0.59

*** NOTES**

kPa – kilo Pascal

SP – Poorly graded **SAND**



Map 3: Map showing in-situ test positions across the developable area.

7. Geotechnical Evaluation

7.1. Excavation Conditions

During the fieldwork component of the study, five TPs were excavated across Portion 20 of Farm 23. The soil profiles are primarily characterised by loose to medium dense **SAND**, with pedogenic horizons encountered at various depths. Refusal occurred in all TPs due to strongly cemented **HARDPAN CALCRETE**. The depth of refusal varied notably across the study area, ranging from as shallow as 1.40 - 1.70 mbgl to depths of 2.30 - 3.50 mbgl.

All materials overlying the **HARDPAN CALCRETES** were successfully excavated using light earth-moving equipment, i.e., TLB. Consequently, these subsurface soils are classified as 'soft excavation' in accordance with COTO (2019) standards. However, the discontinuous **HARDPAN CALCRETES** horizons that caused TLB refusal will likely require heavier machinery, such as a 30t excavator or rock-breaking equipment, for example, excavator-mounted peckers. As a result, **HARDPAN CALCRETES** may be classed as 'hard excavation' conditions according to COTO (2019) standards.

Although the majority of the encountered soil horizons consist of loose to medium dense **SAND**, the sidewalls of the TPs remained generally stable, with the exception of TP03, where minor instability was noted at approximately 3.50 mbgl. This apparent stability is likely attributed to pedogenesis, which has resulted in localised cementation of the subsurface soils. However, because pedogenic processes are inherently variable, this cementation may be discontinuous. Cognisance of this variability must be taken during the excavation of foundation trenches. It is recommended that any foundation trenches exceeding 1.50 m (or 1.00 m in non-cemented sands) be evaluated for shuttering or battered slopes to ensure worker safety.

7.2. Safe Bearing Capacities and Anticipated Settlements

Regarding the placement of foundations for the proposed structures, several critical factors must be considered during both the design phase and the preparation for foundation casting. While foundations may be cast on strongly cemented pedogenic horizons, the nature, consistency, and lateral continuity of these horizons must be verified following the excavation of foundation trenches. This is particularly important because, as highlighted by Brink (1985), typical rock weathering profiles improve with depth whereas pedocretes generally tend to deteriorate. This creates a risk when placing heavier robust structures on semi-competent pedocrete layers without first verifying their thickness; these layers may resist penetration by tools like picks, light truck-mounted augers, and tube piles, yet still sit atop loose, incompetent soil.

Lighter structures, however, can often benefit from the rafting effect provided by these cemented layers, which helps to distribute weight and minimize uneven settling across the building footprint. Furthermore, the presence of small-scale karst features is common in weathered calcretes, as noted by Netterberg (1980). These potential subsurface conditions should be identified and carefully considered before construction commences to avoid localized structural failure.

In addition to the variability of pedocretes, potentially collapsible and compressible materials may be encountered. Brink's 1985 work confirms that a collapsible fabric may be present in certain nodular calcretes and cemented soils, necessitating modified foundation designs in accordance with GFSH (2002) standards. A potential solution involves the excavation and recompaction of materials within the foundation trenches. This process generally requires excavation to a depth of 1.50 times the breadth (B) of the maximum foundation width, followed by replacement in 300 mm thick compacted layers. During re-compaction, it is anticipated that achieving 95% Mod AASHTO density will be sufficient to stabilize the horizon. Alternatively, a soil raft could be constructed using appropriate imported engineered fill to provide a uniform founding medium.

It is understood that the proposed dwellings to be constructed on Portion 20 of Farm 23 will be light structures, presumably single storey structures. Therefore, it is anticipated that conventional strip- and pad footings will suffice as potential foundation solutions targeting improved predominantly **SANDY** horizons that may or not be cemented and that may or may not contain pedogenic characteristics. Additionally, it should be ensured that the shell content in founding horizons is not excessive as it may potentially alter the performance of the improved soils. **Table 9** displays the aforementioned potential foundation solutions with their respective safe bearing capacities and expected settlements. Safe bearing capacities were determined using Meyerhof's method (Das, 2017), while anticipated total settlements were estimated based on elastic theory (Craig & Knappett, 2012).

Table 9: Potential foundation solutions for the proposed development at Portion 20 of Farm 23.

Foundation Type	Dimensions (m)	Founding Depth (mbgl)	Safe Bearing Capacity (kPa)	Anticipated Settlement (mm)
Targeting improved SANDY horizons				
Strip Footing	0.85 x ∞	0.85	150	5 – 10
Pad Footing	0.85 x 0.85	0.85	175	5 - 10

*** NOTES**

m – metres

mbgl – metres below ground level

kPa – kilo Pascal

mm – milli metres

7.3. Problem Soils

During the investigation of Portion 20 of Farm 23 the subsurface was assessed to determine the presence of potential problematic soils. In terms of heave the soils were analysed by the laboratory to determine their clay percentages and plasticity indices in order to estimate potential expansiveness. Additionally, the chemical characteristics of the soils were also reviewed and evaluated based on the electrical conductivity and pH of the soils encountered on site.

Potential Expansiveness

Following the laboratory analyses of the bulk disturbed samples across the study area it was found that the subsurface soils contained of very little to no fines and mainly **SAND**. The soils may be regarded as non-plastic and as a result have no potential expansiveness.

Soil EC and Soil pH

From a soil chemistry perspective, by means of laboratory analyses of the soils, it was determined that the subsurface may have EC values ranging between 55.20 mS/m – 330.00 mS/m while soil pH values were found to range between 8.24 – 8.33. According to MacVicar (1991) the subsurface ,may be classified as ‘corrosive’ to ‘highly corrosive’ and ‘moderately alkaline’. Cognisance should be taken of this when selecting materials used in foundation (e.g. concrete mix design and steel reinforcement cover depths), buried services and drainage construction.

7.4. Groundwater and Drainage

During the fieldwork component of this study, groundwater seepage was not encountered in any of the TPs. It should be noted that fieldwork was conducted in mid-summer (January 2026), which is typically the dry season for this region. According to Schulze (2009), the study area receives the bulk of its rainfall during the winter months, though overall totals remain relatively low.

Due to the nature of the subsurface, a perched water table may develop atop the discontinuous **HARDPAN CALCRETE** horizons during intense rainfall events. This should be taken into account depending on the construction season, as foundation trenches may experience increased moisture or localised ponding. Typically, a shallow or perched water table can decrease the anticipated safe bearing capacity of the founding horizons. However, this is not expected to significantly impact the soils encountered at this specific site. Nevertheless, implementing sufficient drainage measures, especially at or below the founding level, to keep the subsurface soils unsaturated will yield favourable results for maintaining bearing capacities.

Overall, the subsurface is characterised by loose to medium dense, weakly cemented, and poorly graded **SANDY** horizons exhibiting favourable natural drainage conditions. Consequently, general site drainage is not considered problematic.

A disturbed soil sample was collected from TP02 (0.20 mbgl) and submitted for a falling head permeability test, compacted to 100% Mod AASHTO density. The test results indicated that, in a highly compacted state,

the soil exhibits ‘**GOOD**’ to ‘**POOR**’ drainage characteristics (refer to **Table 7**). This suggests that moisture will dissipate at a slower rate in areas where soils are optimally compacted, such as beneath engineered fills or road layers. Cognisance of this reduced permeability should be taken during the casting of foundations and the installation of underground services to prevent moisture entrapment.

7.5. Reuse of In-situ Soils

According to the generalised soil profile, the first approximately 0.70 m of soil in the soil profile is defined by either transported material and/or fill containing organic matter such as plant roots and rubble in the form of plastics and pieces of brick and/or tiles. Therefore, the uppermost soil horizon across the study area is considered variable and is not recommended for construction purposes. It may, however, be utilised for landscaping; although some sieving/separating may be required to separate out undesirable pieces of rubble and/or plastic.

Subject to additional laboratory analysis results and approval by the site engineer, the following selected soil types located below the uppermost soil horizon may be considered for use:

- Fine- to medium-grained **SAND** might potentially be utilised as building **SAND** for the proposed new structures.
- Fine- to medium-grained **SAND** can potentially be used for backfilling of newly installed underground services, given that they are free of organic material and calcrete nodules. It may also be regarded as sufficient as a main backfill material for underground services.
- Fine- to medium-grained **SAND** might potentially fall within G10 to G9 pavement material classes and is, therefore, suitable for the lower selected pavement layers as well as the roadbed.
- **HARDPAN CALCRETE** and calcretised **SAND** might be used for multiple layers in road prisms. Should the materials from the site potentially grade between G10 and G7, then they may be suitable for roadbed, lower- and upper-selected pavement layers. According to Brink (1985) shear failures in calcrete pavement layers are also rare, given that proper drainage systems are in place and water ponding is avoided.

It is strongly recommended that these potential material uses be approved by a professional engineer.

7.6. NHBRC Site Class Designation

Following the field investigation and the analyses of the data obtained during this study, the following site class designations have been given to Portion 20 of Farm 23 based on the generalised soil profile displayed in **Table 10**. The site class designations have been done according to the GFSH-2 (2002).

Table 10: Summary of NHBRC site classification designation for Portion 20 of Farm 23, Paternoster, Western Cape.

Depth (mbgl)	Site class designation	Founding material	Character of the founding material	Expected range of total soil movements (mm)
0.0 to ± 0.70	P	Transported soils and or Uncontrolled Fill	Variable	Variable
± 0.70 to 3.50	C1 / R	Transported material (poorly graded SAND) OR HARDPAN CALCRETE	Compressible and potentially collapsible OR Stable	5 – 10 OR Negligible

8. Conclusions

A geotechnical investigation was conducted at Portion 20 of Farm 23, Paternoster, Western Cape, to assess subsurface conditions and determine the NHBRC Site Class Designation for a newly proposed development. At the time of the investigation, the site was vacant; however, it appeared that some informal dumping had taken place across the site. The surface material is characterised by deposits of **SAND** and the area is vegetated by Saldanha Flats Strandveld flora. From a topographical perspective, the site is generally flat with no notable depressions or elevated areas.

The site is characterised by three primary horizons up to a maximum depth of 3.50 mbgl.

1. Transported material and/or Uncontrolled Fill: Mainly defined by slightly moist, loose to medium dense fine-grained **SAND** containing organic material such as plant roots, snail shells and often rubble in the form of plastic and pieces of brick and tile.
2. Transported material: Slightly moist, medium dense, non-cemented to partially cemented, fine-grained **SAND**. May in some cases contain shell fragments, nodular calcrete and calcrete boulder-sized clasts. Pedogenesis encountered at varying depths.
3. Strongly cemented, widely jointed to massive **HARDPAN CALCRETE**. This horizon refuses light earthmoving equipment and is encountered at variable depths, i.e., as shallow as 1.40 mbgl and as deep as 3.50 mbgl.

DCP results indicate that generally speaking, the topmost soil horizon exhibits a loose consistency, while the transported material at depths greater than 0.70 mbgl predominantly has a consistency of medium dense.

All horizons, up to the **HARDPAN CALCRETE** horizon/s were successfully excavated using a TLB (light earth-moving equipment); therefore, in accordance with COTO (2019), the subsurface is classified as 'soft excavation'. **HARDPAN CALCRETE** horizon/s are considered as 'hard excavation' conditions as the likely

require heavier earthmoving equipment such as a 30t excavator and/or pneumatic/hydraulic rock-breaking machinery.

From a potential expansiveness perspective, the subsurface material may be regarded as 'non-expansive' as it is primarily composed of fine- to medium-grained **SAND** with little or no fines. Soil chemistry results indicate that the subsurface should be considered as 'corrosive' to 'highly corrosive' 'moderately alkaline', which must be factored into the selection of concrete mixes, foundation designs and underground service materials.

The proposed development on Portion 20 of Farm 23 is considered feasible for light structures using conventional strip footings and pad footings targeting improved **SANDY** horizons. These solutions provide an anticipated safe bearing capacity of 150 kPa and 175 kPa, respectively, with total settlements estimated between 5–10 mm. Because pedogenic horizons such as **HARDPAN CALCRETES** can deteriorate with depth and may overlie loose soil (Brink, 1985), the continuity of these horizons must be verified during excavation. To mitigate risks from collapsible fabrics, materials within foundation trenches should be excavated and recompacted to at least 95% Mod AASHTO density to a depth of 1.5 x times B (width of foundation). Furthermore, excavations should be inspected for small-scale karst features or sinkholes, common in weathered calcretes, to prevent localised failures or the risk of structures straddling a sand/hardpan calcrete boundary.

While no groundwater was encountered during the fieldwork component of the assessment, a perched water table may develop atop discontinuous hardpan calcrete during intense rainfall, potentially reducing bearing capacities. Although the subsurface generally exhibits favourable natural drainage, laboratory results show that soils compacted to 100% Mod AASHTO exhibit '**GOOD**' to '**POOR**' drainage characteristics. As moisture will dissipate more slowly in these highly compacted zones, such as beneath engineered fills, consideration should be given to implement sufficient drainage measures at or below the founding level to keep subsurface soils unsaturated and prevent moisture entrapment around foundations and services.

Regarding material reuse, the uppermost 0.70 m of the profile contains organic matter and rubble and is unsuitable for structural use, though it may be sieved for landscaping. Below this depth, the fine- to medium-grained **SAND** is potentially suitable as building SAND, service backfill, or G10 to G9 pavement material. Additionally, **HARDPAN CALCRETE** and calcretised sands may be utilised in road prisms, provided proper drainage is maintained to prevent shear failure. All potential material reuse remains subject to confirmatory laboratory analysis and professional engineering approval.

From an NHBRC Site Class Designation perspective, the topmost transported and/or fill horizon is classified as **P** due to its variability. The underlying transported **SANDS** and **HARDPAN CALCRETE** are classified as **C1** due to potential compressibility and/or collapsibility, and **R** due to their potentially stable nature under light structures.

9. Assumptions and Limitations

GEOSS has endeavoured to highlight and characterise all potential geotechnical risks that are presented by the site that has been proposed for development. However, due to the anisotropic (variable) nature of earth materials, each point on the site will present results that differ. For this reason, it is considered of the utmost importance that the foundation trenches be inspected prior to casting to ensure that soil with an adequate bearing capacity is obtained beneath each footing.

This site investigation was undertaken on a single day (29 January 2026) during which time five trial pits were dug and profiled to depths of between 2.0 and 2.9 mbgl.

10. References

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Appendix A:

Site Development Plans



Appendix B:

Site Photographs & Soil Logs



Figure 5: General soil conditions recorded during trial pitting at TP01 displaying full profile depth and fill comprising the topmost horizon; TP02 displaying full profile depth and **HARDPAN CALCRETE** at 2.30 mbgl excavatable with TLB just prior to refusal; TP03 displaying full profile depth and medium dense fine-grained **SAND** between 0.70 – 1.90 mbgl.



*Figure 6: General soil conditions recorded during trial pitting at TP04 displaying full profile depth and transported **loose SAND** comprising the topmost horizon; TP05 displaying full profile depth and refusal on **HARDPAN CALCRETE** at a depth of 1.40 mbgl.*

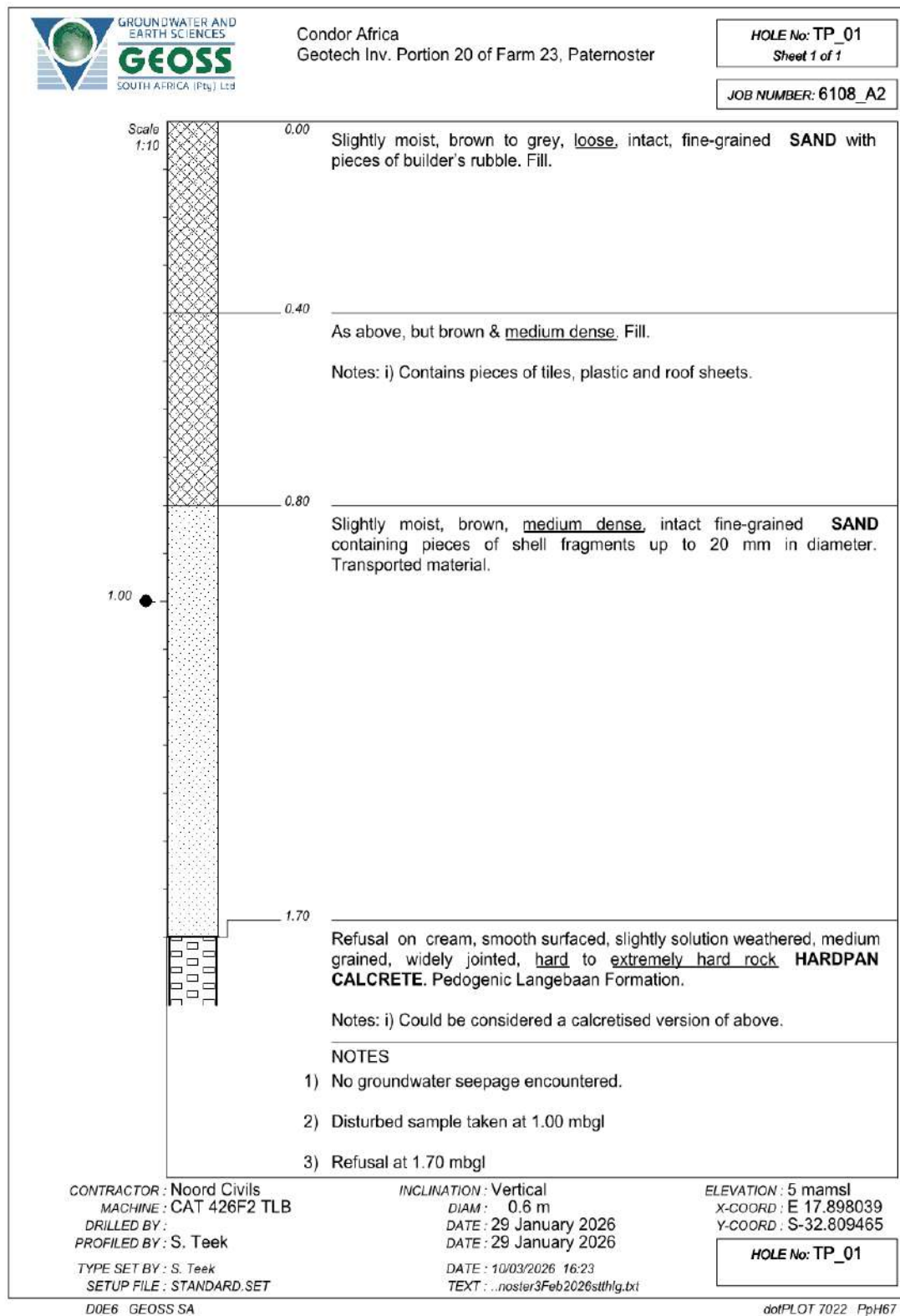


Figure 7: Soil log for TP01.

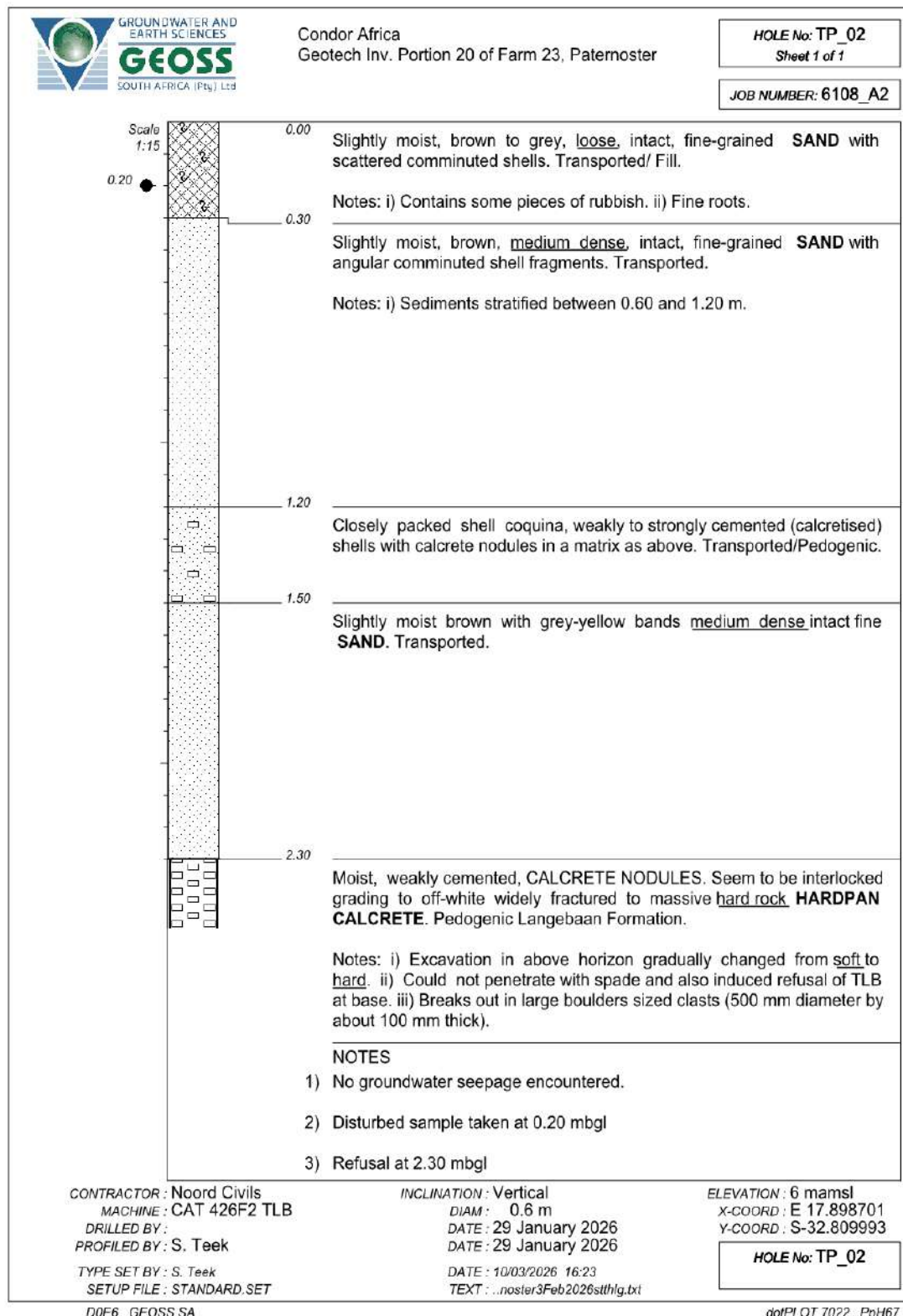


Figure 8: Soil log for TP02.

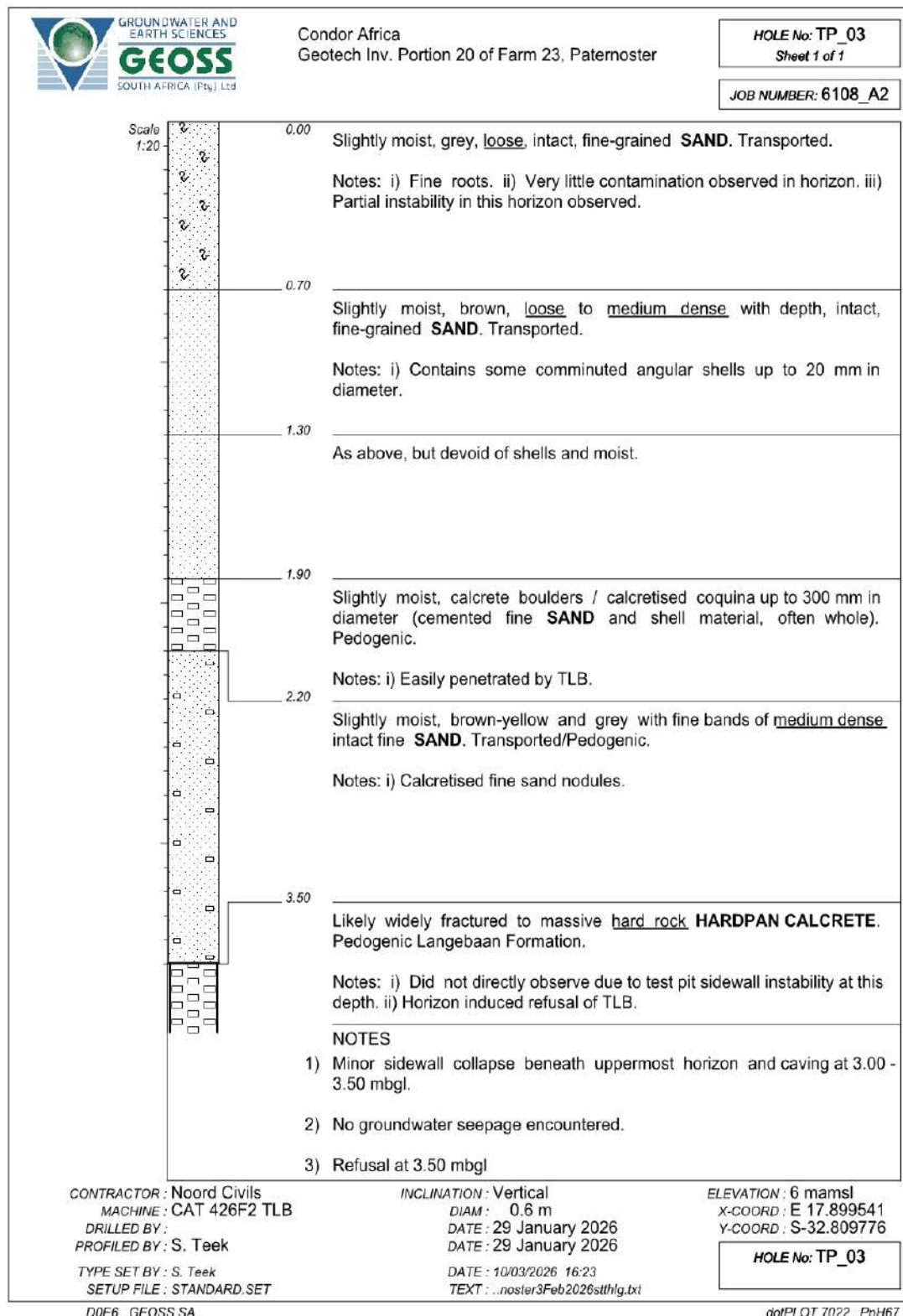


Figure 9: Soil log for TP03.

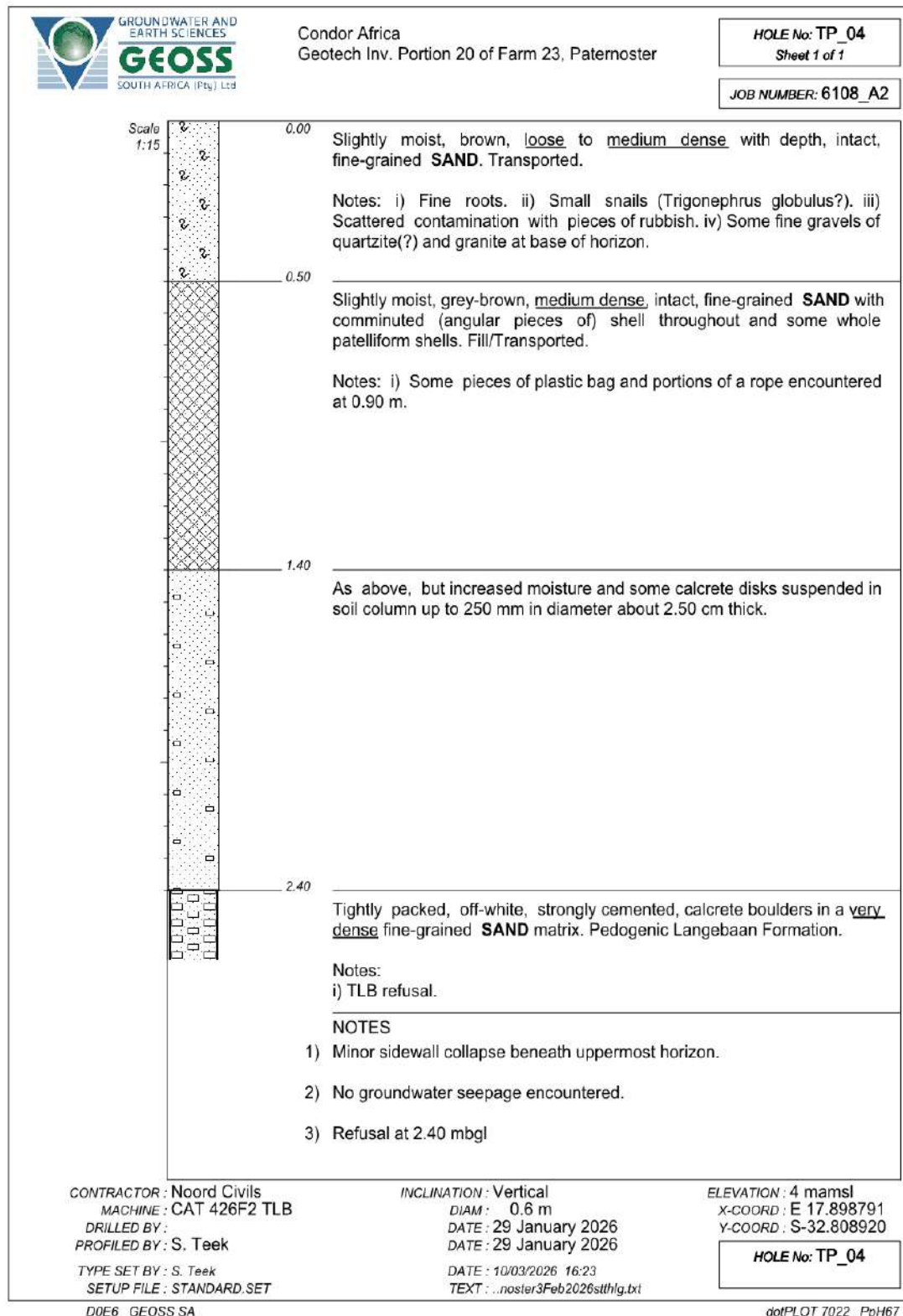


Figure 10: Soil log for TP04.

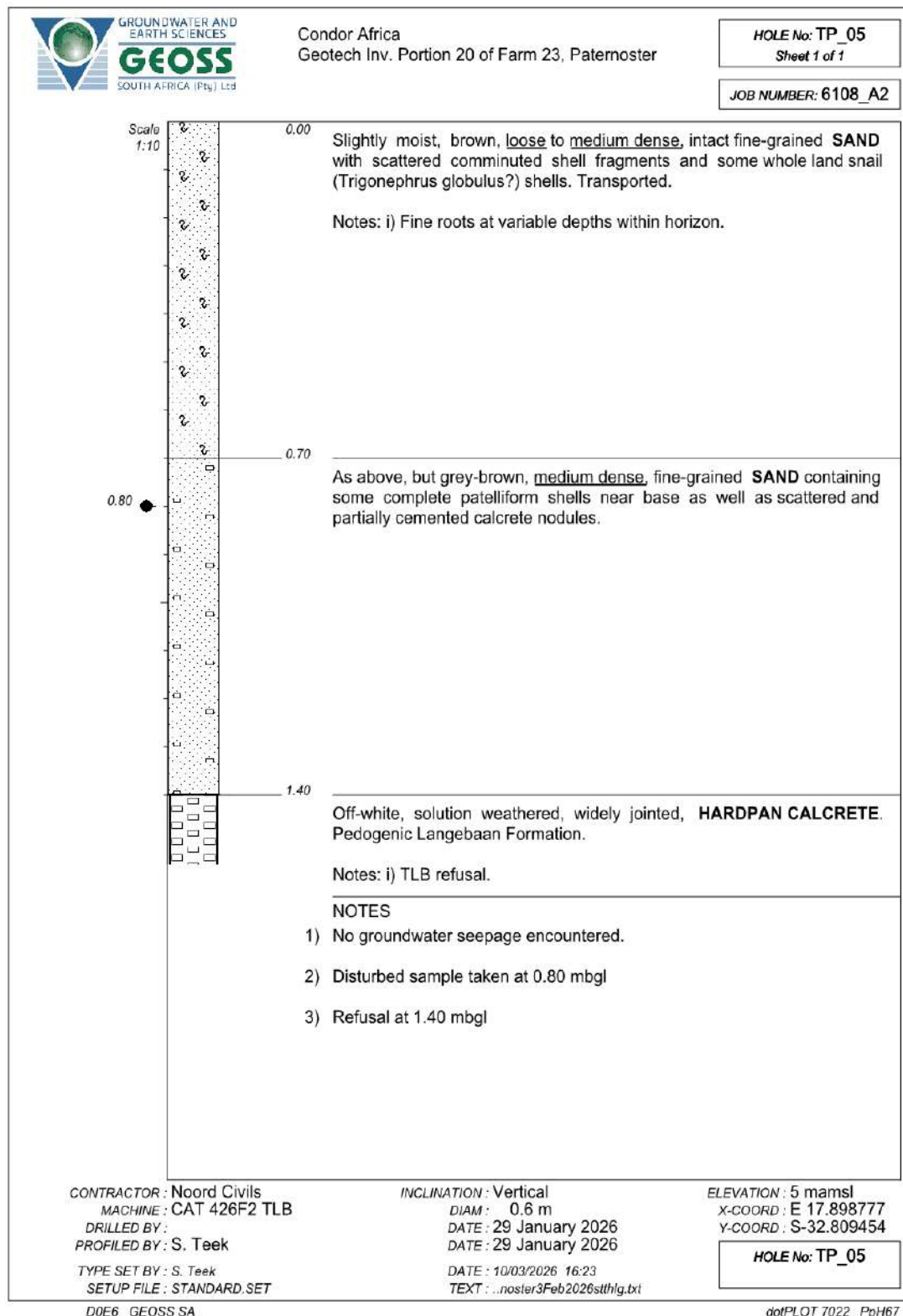


Figure 11: Soil log for TP05.

	GROUNDWATER AND EARTH SCIENCES GEOSS SOUTH AFRICA (Pty) Ltd		Condor Africa Geotech Inv. Portion 20 of Farm 23, Paternoster
			LEGEND Sheet 1 of 1
			JOB NUMBER: 6108_A2

	SAND	{SA04}
	HARDPAN CALCRETE	{SA26}{SA29}
	CALCRETE	{SA26}
	CALCRETE NODULES	{SA27}
	SPARSE CALCRETE NODULES/occasional calcrete nodules....	{SA28}
	WELL CEMENTED/well stabilised/well ferruginised	{SA29}
	PARTIALLY CEMENTED/partially stabilised/partially ferruginised	{SA30}
	FILL	{SA32}
	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}

CONTRACTOR :
 MACHINE :
 DRILLED BY :
 PROFILED BY :

INCLINATION :
 DIAM :
 DATE :
 DATE :

ELEVATION :
 X-COORD :
 Y-COORD :

TYPE SET BY : S. Teek
 SETUP FILE : STANDARD.SET

DATE : 10/03/2026 16:23
 TEXT : ..noster3Feb2026sttthlg.txt

LEGEND
 SUMMARY OF SYMBOLS

D0E6 GEOSS SA dotPLOT 7022 PpH67

Figure 12: Legend to be used to interpret the soil logs.

Appendix C:

DCP Results and Logs

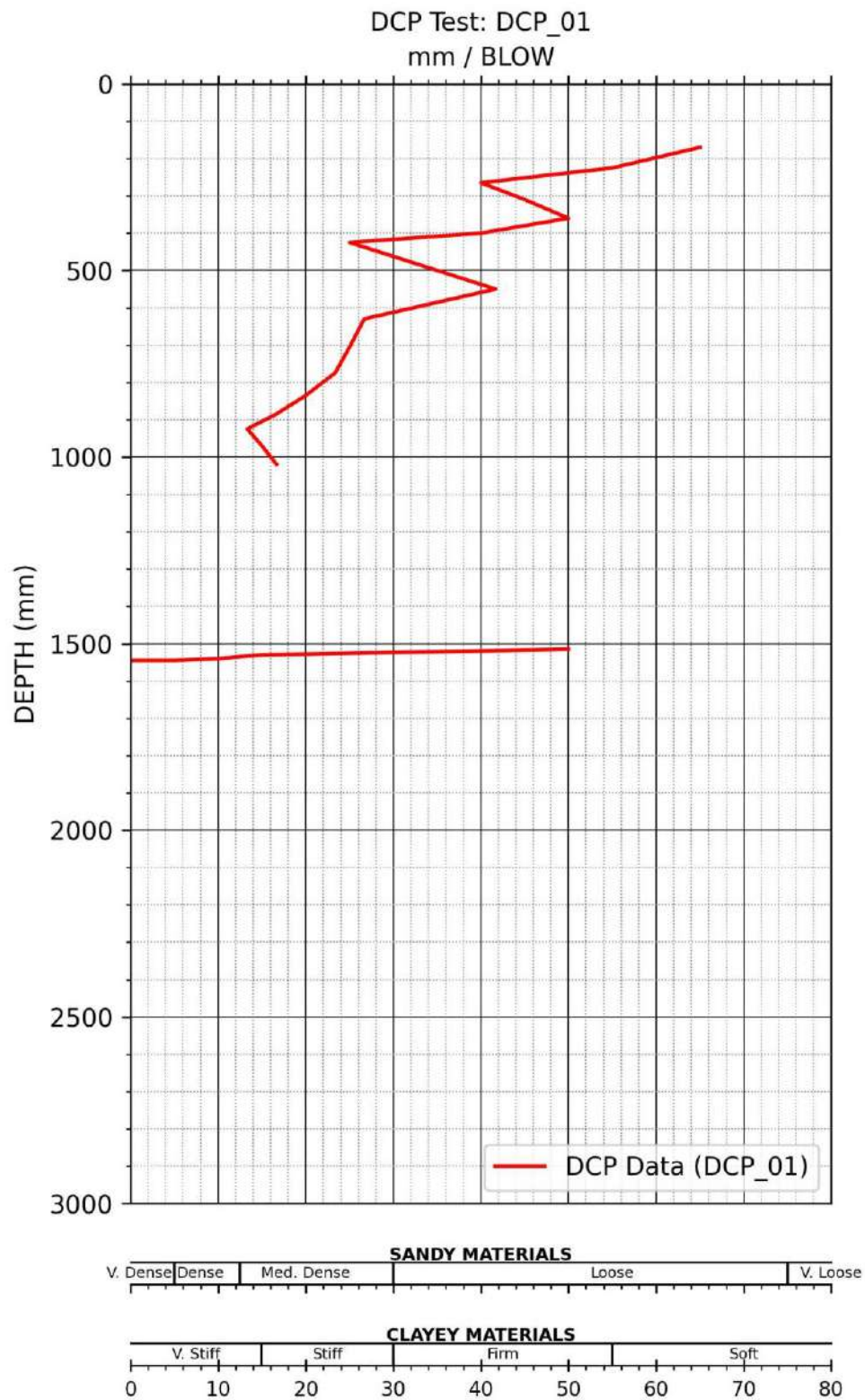


Figure 13: Log and results for DCP_01.

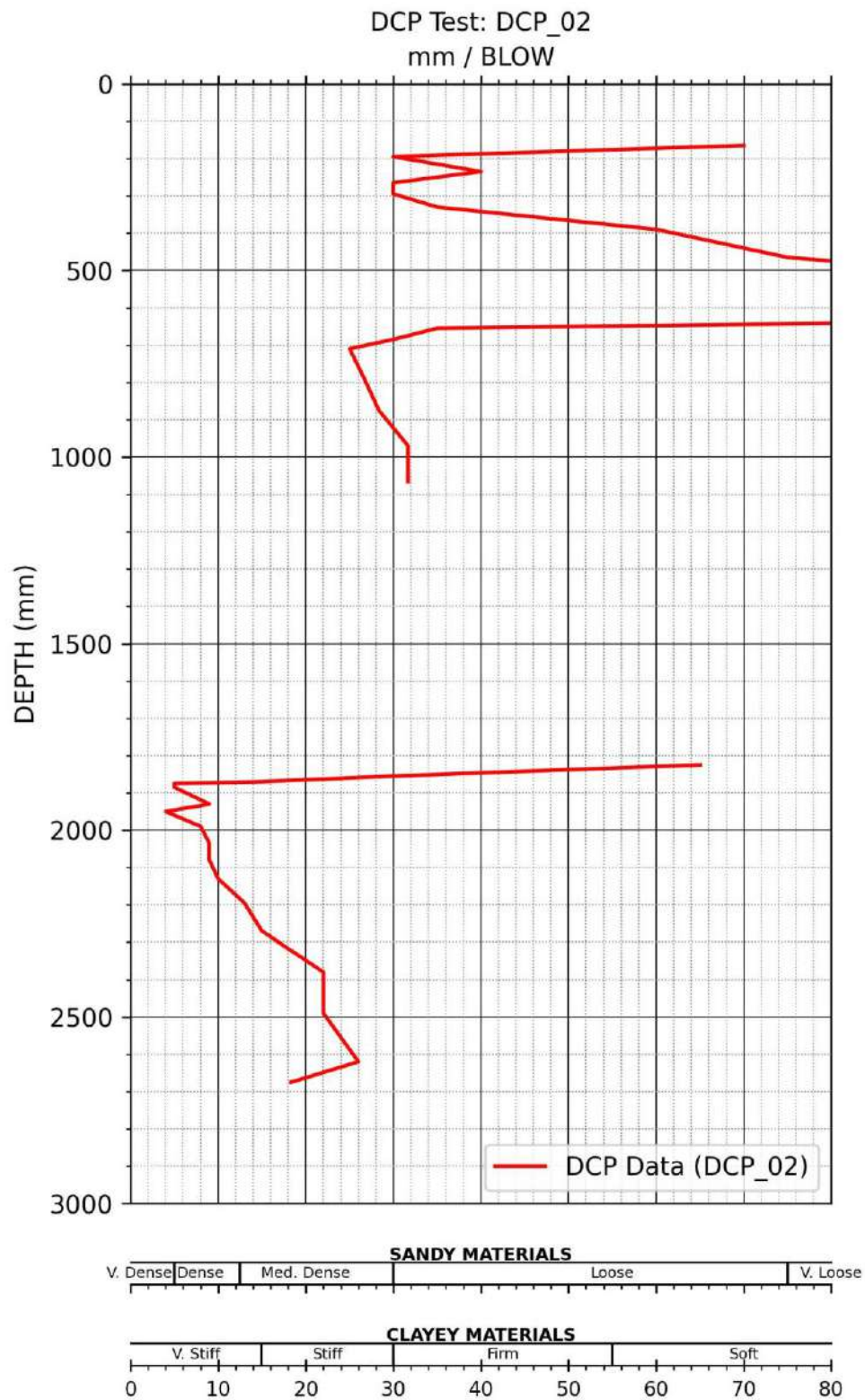


Figure 14: Log and results for DCP_02.

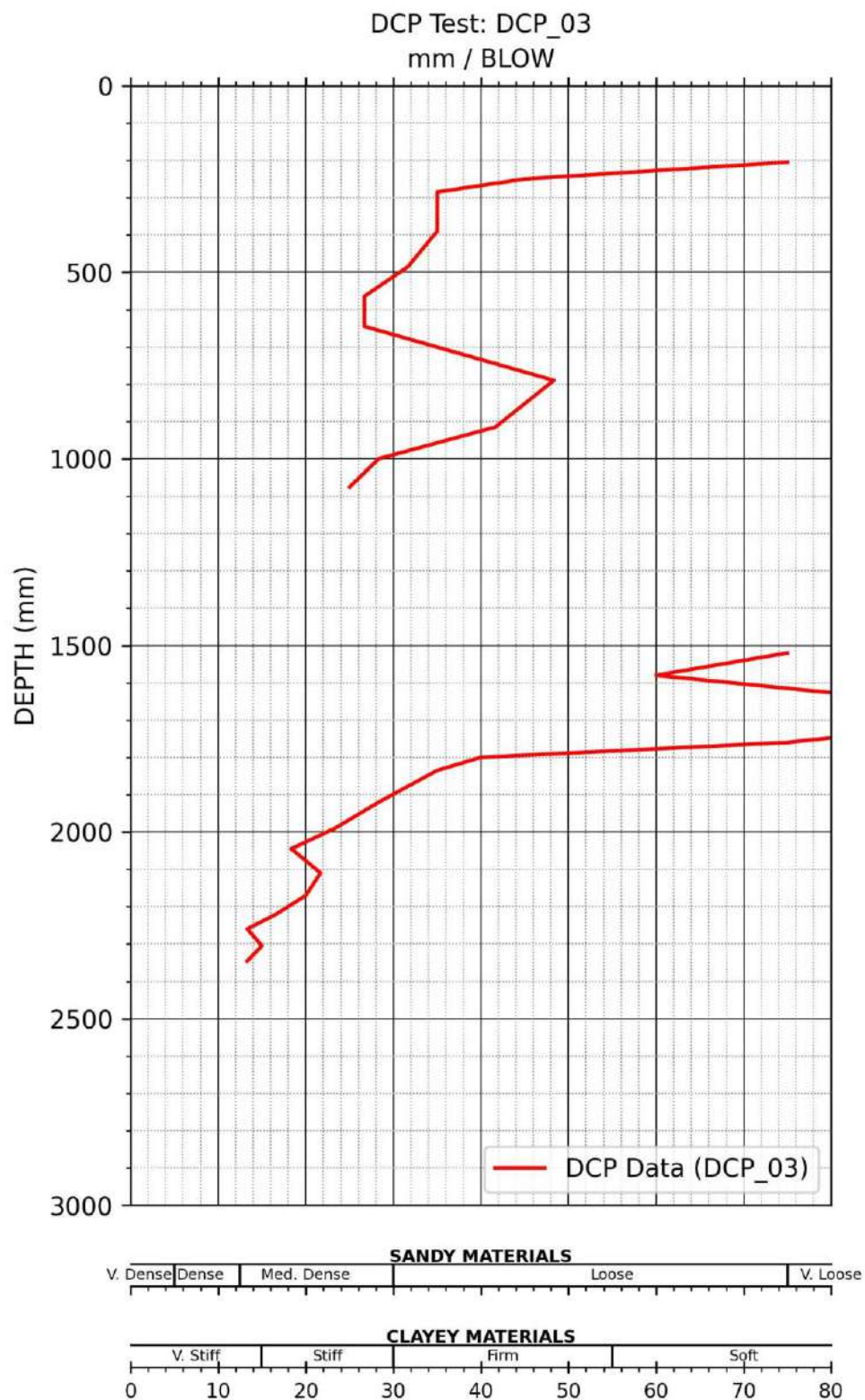


Figure 15: Log and results for DCP_03.

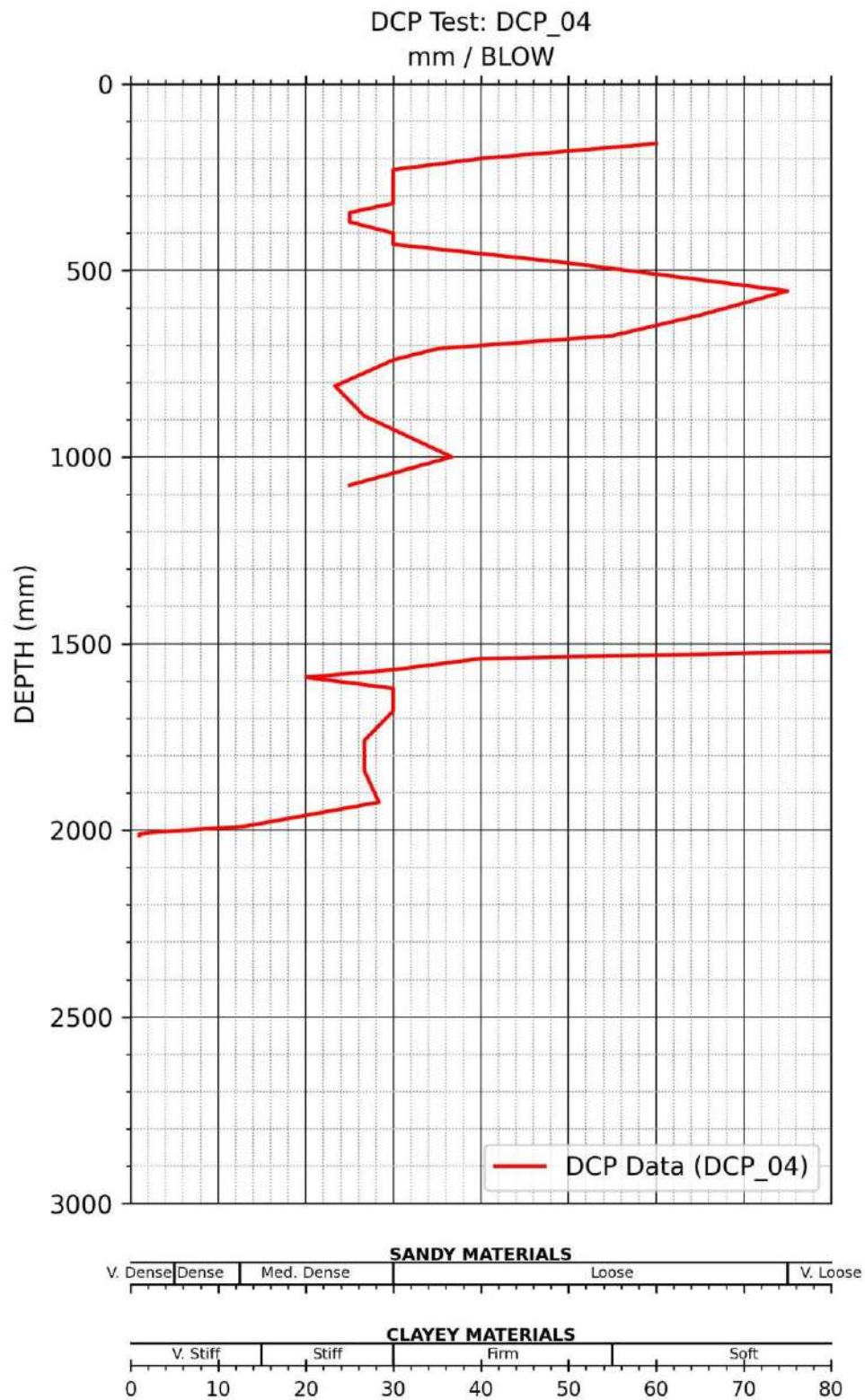


Figure 16: Log and results for DCP_04.

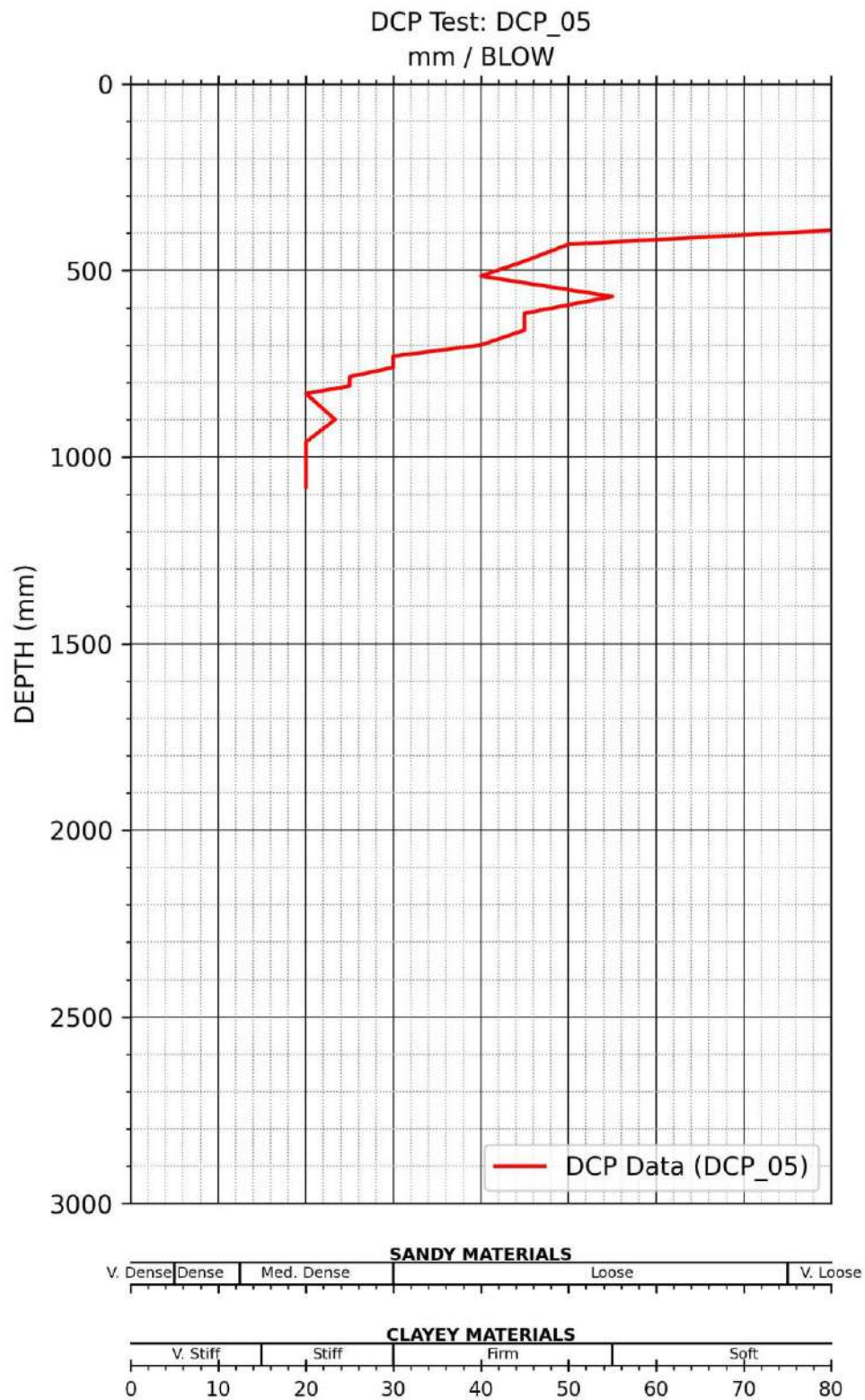


Figure 17: Log and results for DCP_05.

Appendix D:

Laboratory Results

29 March 2025

Rev05

TR - SWK039



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Client: **GEOSS South Africa**
Project: **6108 A1 - A3**
Attention: **Shane Teek**
Your Ref. No: **-**
Date Reported **Wednesday, 11 February 2026**

TEST REPORT REFERENCE NUMBER / JOB NUMBER :**SWL50434**

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested4 x **MOD / CBR / FOUNDATION INDICATOR**3 x **PH & CONDUCTIVITY****Site Sampling and Materials Information**

Sampling Method

Specimens delivered to Steyn Wilson Laboratory.

Environmental Condition

Sunny

Deviation from the prescribed test method

No deviation from standard test method.

Responsibility of information disclaimer

The sample information was received from the customer. Results apply to the sample as received from the Customer.

FINAL REPORT

We would like to take this opportunity to thank you for your valued support.
Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully

STEYN-WILSON LABORATORIES (PTY) LTD

Remarks:

- Information contained herein is confidential to STEYN-WILSON PTY LTD and the addressee
- Opinions & Interpretations are not included in our schedule of Accreditation.
- The samples were subjected and analysed according to ASTM.
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Mr. R. Wilson
Technical Signatory

DIRECTORS: **Mr. J. Steyn ND-Civil (Managing) | Mr. R. Wilson B-Tech Civil (Operations)**

Compiled by: M. Skye

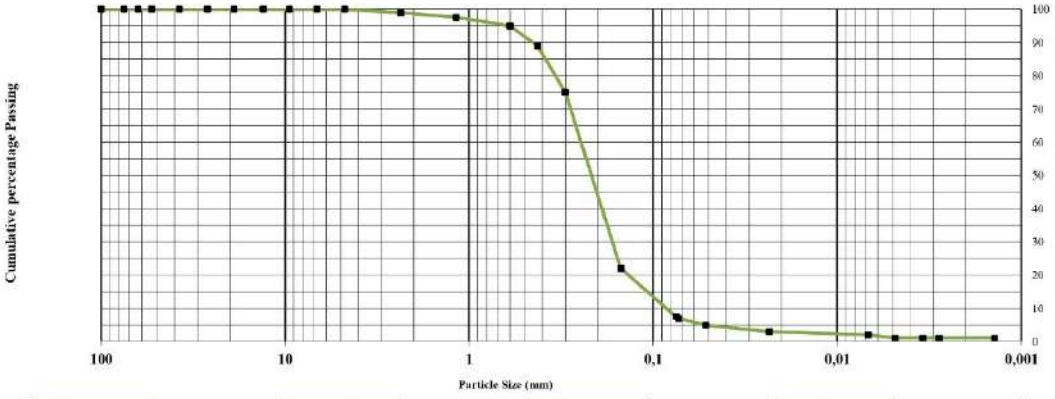
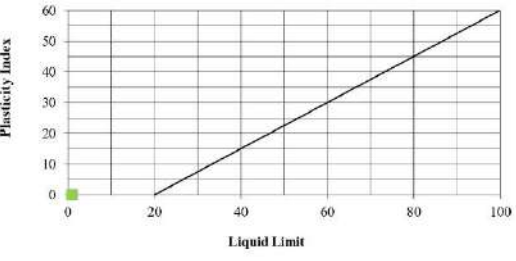
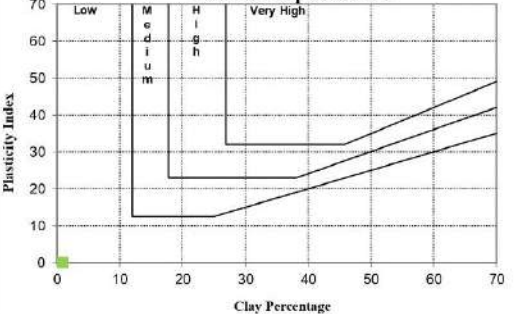
Approved By: J. Steyn / R. Wilson

Page 1 of 5

26 March 2025

Rev05

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 STEYN-WILSON LABORATORIES CIVIL ENGINEERING TESTING LABORATORIES				11 Gooderson Road Blackheath PO Box 58 Blackheath 7581 Tel: 021 905 0435 Fax: 086 499 9482 Email: info@steynwilson.co.za Web: www.steynwilson.co.za																																																																														
Customer : GEOSS South Africa 9 Quantum Street, Techno Park, Unit 12 Technostell Building Stellenbosch 7600 Attention : Shane Teek		Project : 6108 A1 - A3 Date Received : 30 January 2026 Date Reported : 11 February 2026 Req. Number : -																																																																																
MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*																																																																																		
Material Description: Light Brown SAND		Sample Number: 50434 / 2																																																																																
Position: TP1B		Liquid Limit: NP		Linear Shrinkage: 0,0																																																																														
Depth: 1.0m		Plasticity Index: NP		Insitu M/C%: 1,6																																																																														
pH (TMH1 A20): 8,33		Conductivity (s/m) (TMH1 A21T): 0,0887		SG (TMH1 A12T)*: 2,570																																																																														
<table border="1"> <thead> <tr> <th colspan="15">SIEVE ANALYSIS (TMH 1 A1a)*</th> <th colspan="10">HYDROMETER ASTM D422</th> </tr> </thead> <tbody> <tr> <td>100</td><td>75</td><td>63</td><td>53</td><td>37,5</td><td>26,5</td><td>19,0</td><td>13,2</td><td>9,5</td><td>6,7</td><td>4,75</td><td>2,36</td><td>1,18</td><td>0,60</td><td>0,425</td><td>0,300</td><td>0,150</td><td>0,075</td><td>0,073</td><td>0,052</td><td>0,024</td><td>0,007</td><td>0,005</td><td>0,003</td><td>0,003</td><td>0,001</td> </tr> <tr> <td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>99</td><td>97,6</td><td>95</td><td>89</td><td>75</td><td>22</td><td>7,4</td><td>6,8</td><td>4,9</td><td>2,9</td><td>2,0</td><td>1,0</td><td>1,0</td><td>1,0</td><td>1,0</td> </tr> </tbody> </table>						SIEVE ANALYSIS (TMH 1 A1a)*															HYDROMETER ASTM D422										100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,073	0,052	0,024	0,007	0,005	0,003	0,003	0,001	100	100	100	100	100	100	100	100	100	100	100	99	97,6	95	89	75	22	7,4	6,8	4,9	2,9	2,0	1,0	1,0	1,0	1,0
SIEVE ANALYSIS (TMH 1 A1a)*															HYDROMETER ASTM D422																																																																			
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100	100	100	100	100	100	100	100	100	100	100	99	97,6	95	89	75	22	7,4	6,8	4,9	2,9	2,0	1,0	1,0	1,0	1,0																																																									
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Plasticity Chart A Line 			Potential Expansiveness 																																																																															

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

Compiled by: M.Steyn

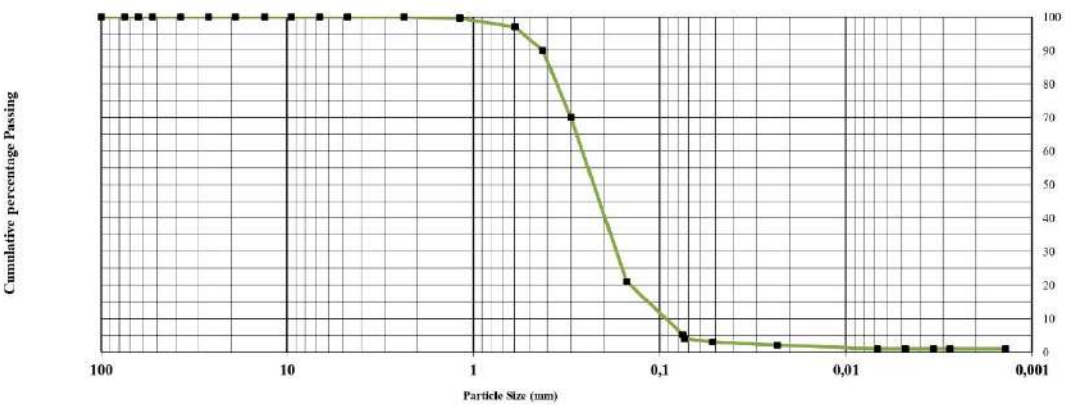
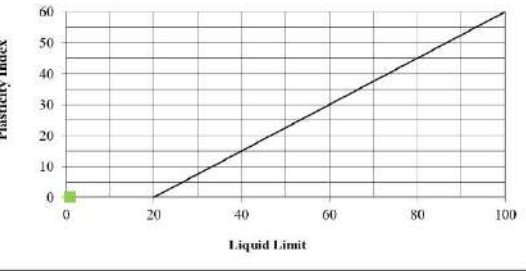
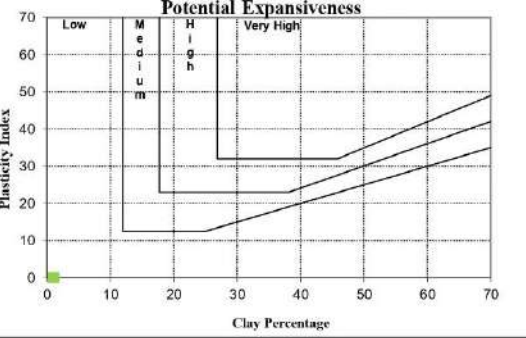
Approved By: J.Steyn / R. Wilson

Page 3 of 5

26 March 2025

Rev05

TR - SW0039

				11 Gooderson Road Blackheath PO Box 58 Blackheath 7581 Tel: 021 905 0435 Fax: 086 499 9482 Email: info@steynwilson.co.za Web: www.steynwilson.co.za																							
CIVIL ENGINEERING TESTING LABORATORIES																											
Customer : GEOSS South Africa 9 Quantum Street, Techno Park, Unit 12 Technostell Building Stellenbosch 7600 Attention : Shane Teek			Project : 6108 A1 - A3 Date Received : 30 January 2026 Date Reported : 11 February 2026 Req. Number : -																								
MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*																											
Material Description:		Light Brown SAND		Sample Number: 50434 / 5																							
Position:		TP2B		Liquid Limit: NP Linear Shrinkage: 0,0																							
Depth:		0,2m		Plasticity Index: NP Insitu M/C%: 0,5																							
pH (TMH1 A20)		8,3		Conductivity (s/m) (TMH1 A21T)																							
				0,0552																							
				SG (TMH1 A12T)*																							
				2,595																							
SIEVE ANALYSIS (TMH 1 A1a)*												HYDROMETER ASTM D422															
100	75	63	53	37,5	25,0	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,073	0,052	0,023	0,007	0,005	0,003	0,001			
100	100	100	100	100	100	100	100	100	100	100	100	99,6	97	90	70	21	5,2	4,0	3,0	2,0	1,0	1,0	1,0	1,0			
% Passing																											
MOD AASHTO SANS 3001 GR30												CBR SANS 3001 GR40															
OMC%		16,5										COMP MC		% SWELL		100%		98%		97%		95%		93%		90%	
MDD(KG/M³)		1490										16,4		0,0		19		17		16		14		12		10	
Particle Size Distribution 																											
% Gravel												% Sand		95		% Silt		4		% Clay		1					
Plasticity Chart A Line 													Potential Expansiveness 														

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

Compiled by: M.Steyn

Approved By: J.Steyn / R. Wilson

Page 2 of 5

26 March 2025

Rev05

TR - SW0039



CIVIL ENGINEERING TESTING LABORATORIES



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Web: www.steynwilson.co.za

Customer : **GEOSS South Africa**
9 Quantum Street, Techno Park, Unit 12 Technostell Building
Stellenbosch
7600
Attention : **Shane Teek**

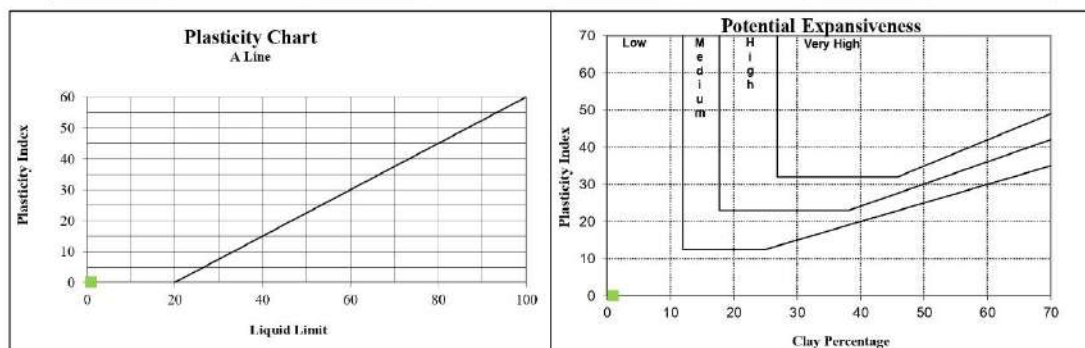
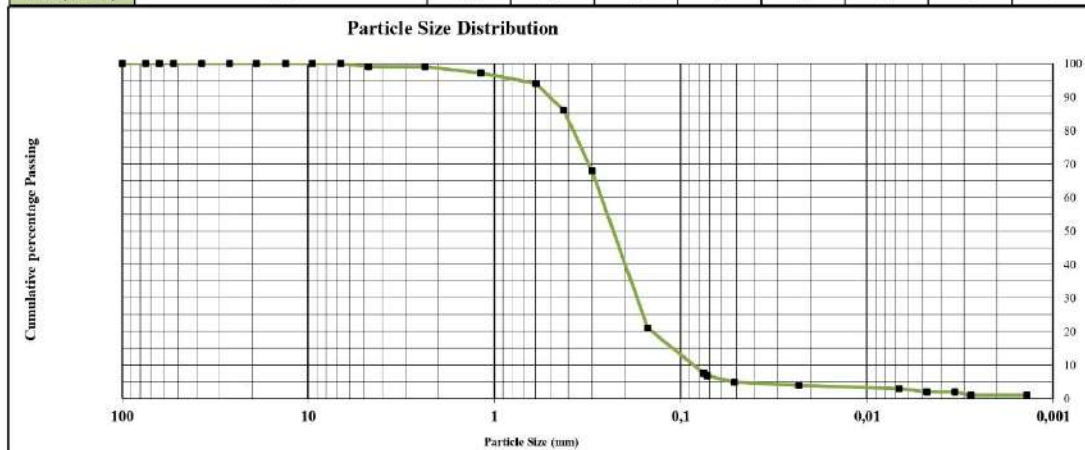
Project : **6108 A1 - A3**
Date Received : **30 January 2026**
Date Reported : **11 February 2026**
Req. Number : **-**

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	Light Brown SAND	Sample Number:	50434 / 9		
Position:	TP5B	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	0,8m	Plasticity Index	NP	Insitu M/C%	3,1

pH (TMH1 A20)	6,24	Conductivity (s/m) (TMH1 A21T)	0,330	SG (TMH1 A12T)*	2,596
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SIEVE ANALYSIS (TMH 1 A1a)*															HYDROMETER ASTM D422												
100	75	63	53	37,5	25,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,072	0,052	0,023	0,007	0,005	0,003	0,001			
100	100	100	100	100	100	100	100	100	100	99	99	97,1	94	86	68	21	7,5	6,8	4,9	3,9	2,9	1,9	1,9	1,0	1,0		
% Passing																											
MOD AASHTO SANS 3001 GR30												CBR SANS 3001 GR40															
OMC%		12,3										COMP MC		% SWELL		100%		98%		97%		95%		93%		90%	
MDD(KG/M³)		1791										12,4		0,0		16		14		13		11		10		8	



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

Compiled by: M.Steyn

Approved By: J.Steyn / R. Wilson

Page 2 of 5

02/08/2018

Rev.01



11 Gooderson Road Blackheath
PO Box 58 Blackheath 7581
Tel: 021 905 0435
Fax: 086 499 9482
Email: geotech@steynwillson.co.za
Web: www.steynwillson.co.za

Client: Geoss SA
Project: 6108
Attention: Hardy Luttig
Address: 9 Quantum St, Techno Park, Stellenbosch, 7600
Contact No.: -
Your Ref. No: -
Date Reported: 19/02/2026

TEST REPORT REFERENCE NUMBER / JOB NUMBER :

SWL50434

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

- 4 Cedometer tests
- 3 Falling Head Permeability tests

Site Sampling and Materials Information

Sampling Method
Environmental Conditions
Deviations from prescribed method
Responsibility of information disclaimer

Specimens delivered to Steyn Wilson Laboratories
Sunny
No deviation from standard test method
The sample information was received from the customer. Results apply to the sample as received from the customer

FINAL REPORT

We would like to take this opportunity to thank you for your valued support.
Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully
Steyn Wilson Geotechnical



Frank Goetsee
Technical Signatory

Remarks:

1. Information contained herein is confidential to Steyn Wilson Geotechnical and the addressee.
2. Opinions & Interpretations are not included in our schedule of Accreditation.
3. The results reported relate only to the sample tested. Further use of the attached information is not the responsibility or liability of Steyn Wilson Geotechnical.
4. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of Steyn Wilson Geotechnical.
5. Measuring equipment is traceable to SI Units (Where applicable).
6. Should there be any deviation from the prescribed test method comments will be made thereof, pertaining to the test on the relevant materials report.
7. Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
8. The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of Steyn Wilson Geotechnical.
9. All tests marked with (*) means that those test methods are not accredited.

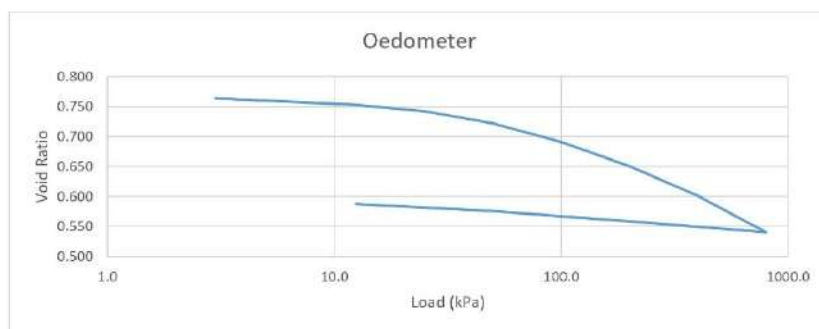
Compiled: M. Singh

Approved: M. Singh

Oedometer Test

Sample Detail		Initial	Final
Height	(mm)	18.8	16.9
Diameter	(mm)	69.6	69.6
Mass	(g)	108.6	127.9
Moisture	(%)	3.2	24.5
Dry Density	(Mg/m ³)	1.472	1.595
Bulk Density	(Mg/m ³)	1.518	1.986
Void Ratio		0.763	0.588
SG		2.595	
Disturbed/Undisturbed		Undisturbed	
Remoulded Density	(Mg/m ³)	-	
Material Description		Light brown Sand	
Screened Through	(mm)	-	

Load (kPa)	Height (mm)	Void Ratio
3	18.800	0.763
12.5	18.687	0.753
25	18.574	0.742
50	18.358	0.722
100	18.027	0.691
200	17.597	0.651
400	17.068	0.601
800	16.420	0.540
200	16.614	0.558
50	16.797	0.576
12.5	16.924	0.588



Project	6108 A1-A3		
Sample	TP5B_0.8m		
Client	Geoss SA	Test Method	BS1377
Jobfile	SWL-50434	Test Date	07/02/2026

16/08/2025 Rev3 TR/GEO-SW0006 Compiled: M. Steyn Approved: R. Wilson

FALLING HEAD PERMEABILITY TEST REPORT - TEST METHOD: ASTM D2434 & KH HEAD

Sample Details				Remould Details (Proctor)						Test	
Sample:	Depth(m):	Material description:	Screened through (mm):	Specified			Actual			(Average of 3 readings)	
				Dry Density (kg/m ³):	Compaction (%):	OMC (%):	Dry Density (kg/m ³):	Compaction (%):	Moisture Content (%):	Permeability (cm/s):	Permeability (m/s):
TP1A	1.4	Lt Brown Sand	5.0	1606	100	16.5	1606	100	16.5	2.1800E-03	2.1800E-05
TP2B	0.2	Lt Brown Sand	5.0	1490	100	16.5	1490	100	16.5	6.1526E-04	6.1526E-06
TP5C	1.10-1.95	Lt greyish brown Clay	5.0	1758	100	14.3	1758	100	14.3	4.2785E-08	4.2785E-10



15/09/2025 Rev4 TR/GEO-SW0001 Compiled: M.Steyn Approved: R.Wilson

Project	6108 A1-A3
Client	Geoss SA
Jobfile	SWLS0434
Test Date	17/02/2026

(last page)