GEOTECHNICAL REPORT

FOR THE PROPOSED RESIDENTIAL DEVELOPMENT ON THE SUBDIVISION OF ERF 19374 GEORGE

1 July 2022

Revision 0

Prepared by:

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Report review history:

Revision No	Date	Prepared by:	Reviewed by:	Approved by:
0	1.7.2022	I.Paton Pr Sci Nat Pr Tech Eng	D Snyders Pr Sci Nat	I.Paton Pr Sci Nat Pr Tech Eng
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Authors qualifications and affiliations:

Iain Paton has a Bachelor's degree with Honours in Geology and a Master's degree in Geotechnical Engineering and has over 25 years' experience in the mining, energy and construction industries. Iain Paton is a registered Professional with the Engineering Council of South Africa (Pr Tech Eng #2019300500), the South African Council for Natural and Scientific Professions (Pr Sci Nat # 400236/07), and is a member of the South African Institute of Engineering and Environmental Geologists (SAIEG), the Geotechnical Division of the South African Institute of Civil Engineering (SAICE) and the Institute of Municipal Engineering of South Africa (IMESA).

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 or 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 eclipsed 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.

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1. Introduction

1.1 Background information

Outeniqua Geotechnical Services was appointed by Urban Front Developers to conduct a geotechnical site investigation for proposed new residential development on the subdivision of Erf 19374, George, situated ~3km northwest of the CBD of the city of George (see **Figure 1**). The geotechnical nature of the site was investigated to facilitate the engineering design of structural foundations and civil services.

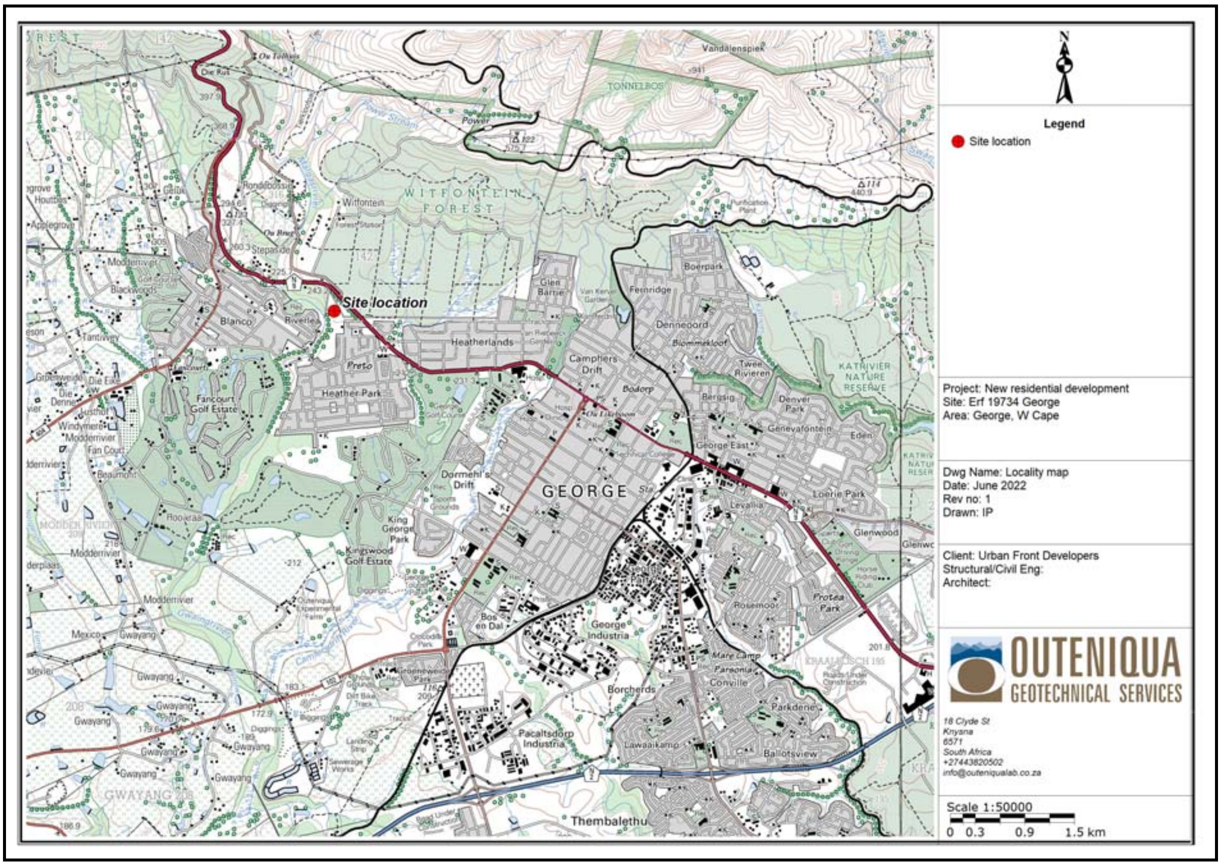


Figure 1: Locality map

1.2 Scope of work

The scope of work for the investigation was as follows:

Desk Study:

- Review all available information of the location, topography and geology of the site.

Site Work:

- Conduct a site walk over survey to assess the general terrain and any obvious geotechnical risks associated with development of the site;
- Excavate and profile 8 test pits to ~2.5m deep or refusal with a TLB;
- Collect soil samples for laboratory testing;
- Conduct DCP tests from natural ground level at each test position.

Laboratory Tests:

- 6 x Foundation Indicator tests;
- 4 x Mod AASHTO/CBR/Indicator tests;

Assessment report:

Preparation of a concise factual and interpretive report with an assessment of the geotechnical conditions and constraints, and recommendations on:

- Foundation design for structures (including founding depths, estimated allowable safe bearing pressures).
- Design of access roads, parking areas and civil services.
- Any other precautions to be taken with regards to the geotechnical conditions for the proposed development.

1.3 Available information

The following maps & plans were available for consultation:

- 1:250 000 Geological map of the area, obtained from the Council for Geoscience.
- Topo-cadastral data for the area, obtained from the National Geospatial Institute (NGI).
- Aerial photos of the area, obtained from the NGI and Google Earth.
- Site layout plans obtained from Urban Front Developers.

2. Site description

The site was situated just north of the residential area of Heather Park in George. At the time of the investigation the site was vacant and was easily accessible via the existing municipal roads leading to the southern and eastern boundaries of the site (see **Figure 2**). The vegetation consisted of long grass and medium sized bushes and some large trees along the western and eastern boundaries (**Figure 3**). The topography was described as very gentle but becoming steep along the western boundary, which falls downward towards the Malgas River which runs along this boundary, flowing in a southerly direction.

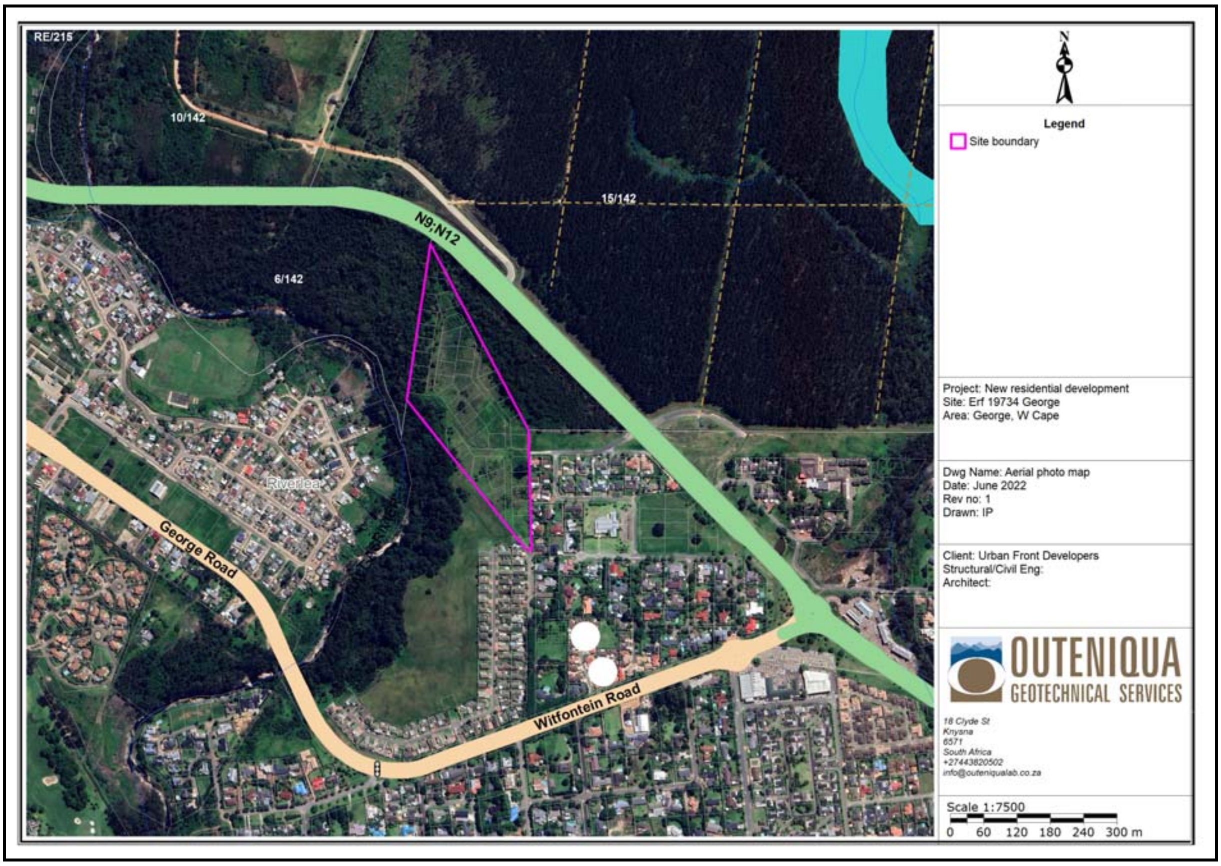


Figure 2: Aerial photo map of site

Figure 3: View of the typical terrain and vegetation on the central part of site

3. Methods of investigation

An initial site walk-over of the site was conducted to assess the site terrain, any remarkable topographic features and any obvious geotechnical issues. This was followed by a subsurface investigation consisting of eight test pits, excavated at randomly-spaced positions around the site with a TLB/backactor, in order to observe and record the general soil profile of the site. The soil profiles and photographs of the test pits were included in **Appendix 2** of this report.

Representative samples of different soil types were collected from test pits for Foundation Indicator tests and Mod/CBR/Indicator tests. The tests were performed at a SANAS-Accredited laboratory (Outeniqua Lab), in accordance with the SANS 3001 and ASTM methods. Details of the tests were included in **Appendix 3** of this report.

In situ dynamic cone penetrometer (DCP) tests were conducted at each test pit position to investigate soil consistency and bearing capacity. Details of the tests were included in **Appendix 4** of this report.

4. Results of the site investigation

4.1 Regional geology

The 1:250 000 geological map indicated that the site was underlain by schist and hornfels of the Saasveld Formation of the Kaaimans Group, which had been intruded by granite of the George pluton to the south of the site (**Figure 4**). The risk of seismic activity in the areas was low.

The geology of the site was generally considered suitable for urban development purposes with due consideration to local geotechnical constraints.

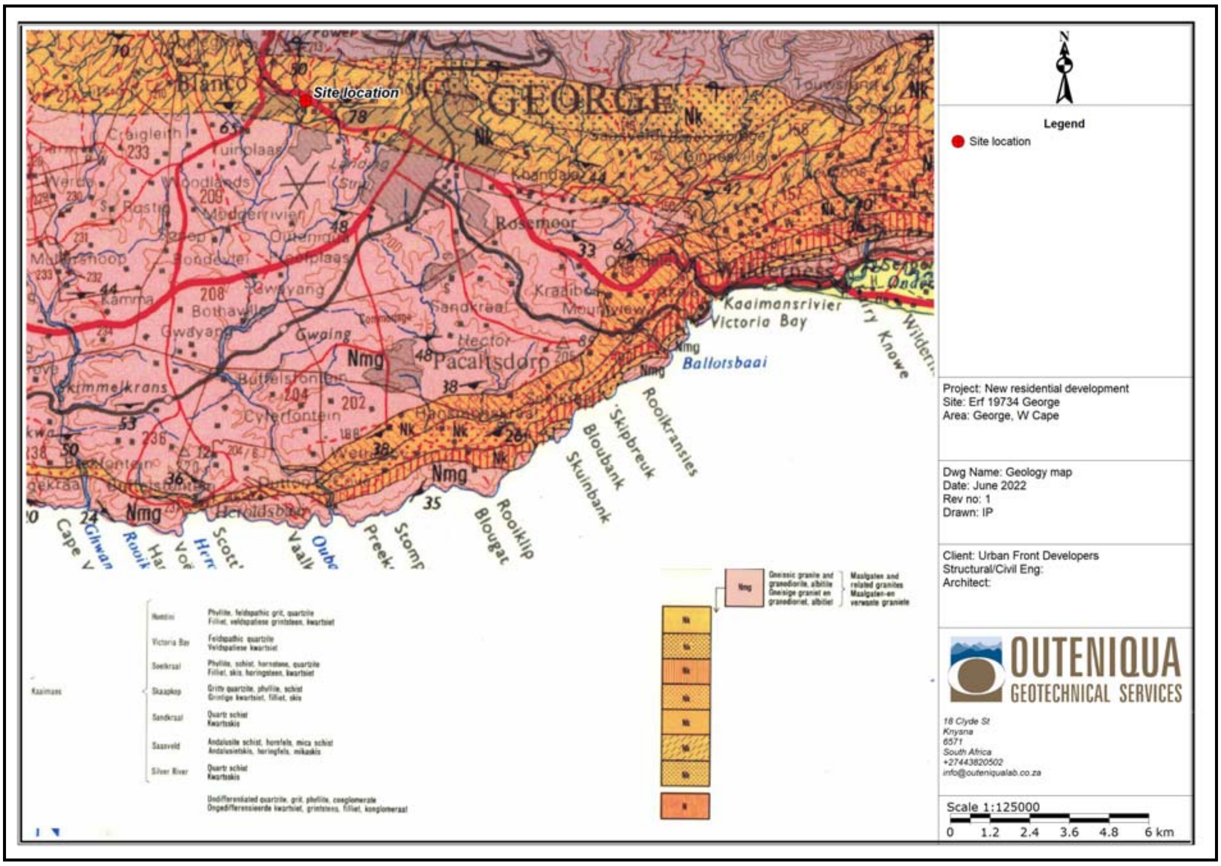


Figure 4: Geological map of site

4.2 Local soil & rock types

The test pits revealed a variable soil profile but was generally described as an assemblage of fine-grained colluvial soils, including clayey silt and fine sand with sporadic gravel, overlying a sporadic pedogenic horizon (ferricrete nodules in clayey sandy matrix), which was then underlain by clayey sandy gravelly residual soil derived from the complete weathering of the underlying feldspathic sandstone or hornfels. The underlying rock was only encountered in a few of the pits. The general soil profile was recorded as follows:

- 0-500mm: Moist to very moist, dark brown, soft to firm, intact, clayey silt with abundant roots (topsoil).
- 500-900mm: Moist, light brown, medium dense, intact, silty fine sand, colluvium.
- 900-1100mm: dark red orange, medium dense, pinholed & voided, clay & sandy gravel (ferricrete), pedogenic.
- 1100-2000mm: Moist, mottled light brown & dark red orange, stiff, micro-shattered & slickensided, silty clay with scattered gravel & cobbles, residual (completely weathered feldspathic sandstone – see **Figure 5**).
- >2000mm: Blotched grey & red orange, highly to completely weathered, highly fractured, soft rock, feldspathic sandstone/hornfels.

Figure 5: Active residual clay extracted from test pits

A summary of the soil types and thicknesses is given in **Table 1**.

Table 1: Summary of test pits with soil types and horizon depth intervals (in mm)

TP No.	Imported (fill)	Transported	Pedogenic	Residual	Rock	Total depth of test pit	Refusal
TP1	-	0-700	700-1200	1200-2800	-	2800	Slow
TP2	-	0-600	600-1000	1000-2000	2000-2200	2200	Rock
TP3	-	0-1000	-	-	1000-1100	1100	Rock
TP4	-	0-700	-	700-2500	2500-2600	2600	Rock
TP5	-	0-900	900-1100	1100-2100	-	2100	Slow
TP6	-	0-800	800-1000	1000-2700	-	2700	-
TP7	-	0-700	700-1100	1100-2500	-	2500	Slow
TP8	-	0-1000	-	1000-2600	-	2600	-

4.3 Groundwater

No significant groundwater tables were encountered in any test pits. Slight seepage was noted in TP5.

4.4 Laboratory tests

Representative samples of the different soil types were collected for Foundation Indicator tests to determine the particle size distribution (grading) and Atterberg limits. The results of the Foundation Indicator tests are shown in **Table 2**.

Table 2: Summary of Foundation Indicator test results

Test Pit No	Sample Depth (mm)	Atterberg Limits			Particle Analysis (%)				MC*	PE**	USC
		PI	LL	LS	Clay	Silt	Sand	Gravel			***
TP1	700-1200	16	44	8	7	3	10	80	12.1	LOW	GW-GM
TP3	500-1000	4	24	2	15	12	33	40	8.2	LOW	GM-GC
TP4	700-2000	26	70	13	40	11	30	19	33.8	MED	MH
TP6	0-800	5	21	3	15	25	52	8	17.2	LOW	SM-SC
TP7	1100-2500	4	23	2	22	15	34	29	10.5	LOW	SM-SC
TP8	1000-1700	25	50	13	42	19	38	1	23.0	HIGH	CL-CH

* Insitu Moisture Content ** Potential Expansiveness *** Unified Soil Classification

The lab results indicated that the insitu soils were highly variable in terms of texture and plasticity but generally containing appreciable fines (silt and clay) with a medium to high plasticity. Most of the samples displayed an overall low potential expansivity but a few of the samples taken from pits on the eastern side of the site (TP4 & TP8) displayed a medium to high potential for expansion.

The soils were classified into the following groups under the Unified Soil Classification (USC) system:

- MH – Inorganic elastic silts.
- CH – Inorganic clays of high plasticity.
- CL – Inorganic clays of low to medium plasticity.

- GW – Well graded gravels.
- GC – Clayey gravels.
- GM – Silty gravels.
- SM – Silty sands.
- SC – Clayey sands.

Representative samples of insitu soil were also collected for Modified AASHTO density, CBR, and Road Indicator tests to determine the potential for use as a natural roadbed or fill material in road pavements or under surface bed floors. The results of the tests were summarised in **Table 3**.

Table 3: Summary of CBR test results

Test Pit No	Sample Depth (mm)	CBR at					Swell (%)	PI (%)	GM	MDD / OMC	COLTO
		100%	98%	95%	93%	90%					
TP1	700-1200	53	36	20	13	7	0.1	16	2.55	2410/14.1	-
TP3	500-1000	56	37	21	14	8	0.1	4	1.54	2032/10.3	-
TP6	0-800	17	13	9	7	5	0.6	5	0.68	2084/8.2	-
TP7	1100-2500	50	33	18	12	6	0.1	4	1.17	2120/9.7	G7

The test results indicated that the insitu soil were typically low quality and unsuitable for construction purposes (not classified in terms of COLTO), although sporadic horizons of slightly better (marginal) quality material was identified. Further recommendations were given in **Chapter 6**.

4.5 Insitu tests

The DCP tests indicated a generally loose/soft soils in the upper 0.8m, which broadly correlated to the transported horizons, but the tests consistently improved below this depth to medium dense or dense consistency. The tests indicated allowable bearing capacities in the range of 125-150kPa below a nominal founding depth of 0.8m.

5. Geotechnical assessment

5.1 Terrain mapping units

The site was broadly mapped into separate “Terrains” according to the dominant geotechnical constraints and each terrain was classified according to the residential site class designations provided under SANS10400-H (**Table 4**), which were discussed in the following chapters. The mapping was presented in **Figure 6**. The majority of the site was mapped as “Terrain 1” which was dominated by potentially active clays, compressible soils and low slope gradients. The western portion of the site, mapped as “Terrain 2”, was classified separately due to the presence of moderate to steep slopes and relatively shallow rock, which had a mitigating effect on total soil movements.

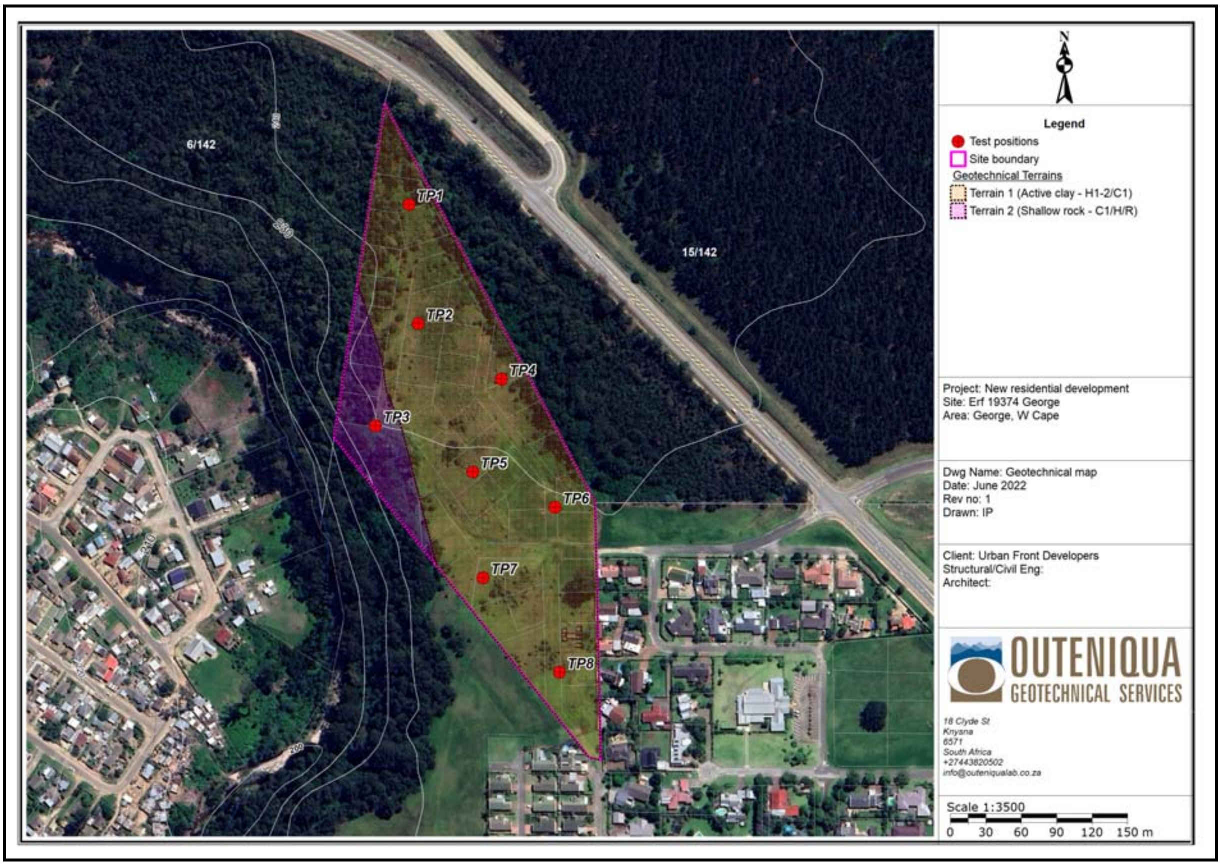


Figure 6: Geotechnical map of site

Table 4: Residential site class designations of single and double storey Type 1 masonry buildings

Typical founding material	Nature of founding material	Expected range of total soil movements mm	Assumed differential movement % of total	Site class designation
Rock (excluding mud rocks which might exhibit swelling to some depth)	Stable	Negligible	–	R
Fine-grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	Expansive soils	< 7,5 7,5 to 15 15 to 30 > 30	50 50 50 50	H H1 H2 H3
Silty sands, clayey sands, sands, sandy and gravelly soils	Compressible and potentially collapsible soils	< 5 5 to 10 > 10	75 75 75	C C1 C2
Fine-grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	Compressible soils	< 10 10 to 20 > 20	50 50 50	S S1 S2
Contaminated soils[a], controlled fill, dolomite land, landslip, landfill, marshy areas, mine waste fill, mining subsidence reclaimed areas, uncontrolled fill, very soft silts/silty clays	Variable	Variable	–	P[b]

NOTE 1 A composite description is more appropriate to describe a site more fully, for example, C1/H2 or S1 or H2 (or both). Composite site classes might lead to higher differential movements and result in design solutions appropriate to a higher range of differential movement, for example, a class R/S1 may be described as a class S2 site. Alternatively, a further site investigation might be necessary as the final design solution might depend on the location of the housing unit on a particular site.

NOTE 2 Where it is not possible to provide a single site designation and a composite description is inappropriate, sites may be given multiple descriptions to indicate the range of possible conditions, for example, H1-H2 or C1-C2.

NOTE 3 Soft silts and clays usually exhibit high consolidation and low bearing characteristics. Structures founded on these horizons might experience high settlements and such sites should be designated as class S1 or S2, as relevant and appropriate.

5.2 Bearing capacity and settlement

The uppermost soil horizons across the entire site (0-0.8m depth range) were typically loose with low bearing capacity. The underlying dense pedogenic or residual horizons were generally considered as a suitable founding horizon for single or double storey residential structures. A reasonably conservative calculation of safe bearing capacity of a standard strip foundation under the assumed conditions was 145kPa (see **Appendix 5**) with less than 10mm anticipated settlement (immediate or collapse-induced). The entire site was classified according to SANS 10400-H as C1 – See **Table 4**.

5.3 Heave

The heave potential of the insitu soils was found to be highly variable, and although calculations generally indicated higher potential on the eastern side of the site, this may vary significantly between test positions. Preliminary calculations of heave according to the Van der Merwe method (See **Appendix 5**) indicated a maximum heave of 23mm in Terrain 1, and although this was likely to be conservatively applied to the entire terrain, any variation within this area would be difficult to predict on a higher resolution, given the variability of the soil. Terrain 1 was thus classified according to SANS 10400-H as as H1-H2. Terrain 2, due to the presence of shallow rock, was classified with a significantly lower potential, not likely to exceed 7.5mm total heave (Class H).

5.4 Groundwater and site drainage

No significant groundwater tables were observed in any of the test pits, so foundation buoyancy was not considered to affect the design. Minor transient seepage was noted in one pit, and thus expected to occur seasonally throughout the profile at random levels.

The natural slope of the site was gently sloping, draining in a southwesterly direction into the Malgas River.

5.5 Slope stability

The majority of the site was very gently sloping with no global stability problems anticipated. Steep terrain forming the river banks along the western boundary was expected to be less stable under certain conditions, but due to the presence of shallow rock in this area, this generally had a positive effect on the stability.

5.6 Excavations

Excavations were classified according to SABS1200D as per **Table 5**.

Table 5: Classification of excavations

Terrain	*Soft excavations*	*Hard excavations*
1	0-2m	>2m
2	0-1m	>1m

Sidewalls of test pits were generally marginally stable for short periods, but the top 0.5m (topsoil) was unstable, requiring battering to 45°.

5.7 Site classifications

The site was mapped and classified according to the residential site designations provided under SANS10400-H (refer to **Table 6**).

Table 6: Residential site designations

Terrain unit	***Geotechnical Constraint***	***Soil Class***	***Total expected heave (mm)***	***Total expected settlement (mm)***
Terrain 1	Compressible and/or collapsible soils	C1	-	5-10
	Active soil	H1-2	7.5-30	-
Terrain 2	Compressible and/or collapsible soils	C1		5-10
	Active soil	H	<7.5mm	
	Shallow rock	R		

A summary of geotechnical constraints that potentially may affect the development of the site was tabulated in **Table 7**.

Table 7: Assessment of potential geotechnical constraints

Geotechnical Constraint	Effect on the proposed development	Severity	Comment
Collapsible and/or compressible soil	Soil horizons with a potentially collapsible and/or compressible fabric which may affect stability of foundations	Medium	Underlying fine grained insitu soils may be compressible and/or display some minor collapse potential.
Differential settlement	Foundations placed in different soil types or rock may settle differentially.	Medium	In situ soil profile was highly variable
Bearing capacity	Foundations placed on soils with low bearing capacity will display unsuitable settlement.	Medium	Bearing capacity unlikely to be a problem for normal single-double storey structures founded on insitu soils, but heavier structures may require special consideration
Groundwater	Seepage, permanent or perched water tables affecting excavations.	Low	No significant groundwater tables were encountered at the time of the investigation
Active soil	Heaving clays affecting foundation stability	Medium - High	Insitu soils exhibited medium to high potential expansivity
Excavations	Boulders or rock affecting excavations	Low	Soft excavations expected to a depth of 2m over most of the site
	Unstable excavations requiring shoring	Low	
Slope stability	Geological instability causing damage to structures founded on slopes	Low	Slope gradient of the site is very gentle, becoming steeper along the western boundary
	Soil creep or erosion by storm water	Low	Erosion unlikely to pose a significant threat but contractors should monitor erosion from site.
Flood potential	Low lying areas affected by poor drainage.	Medium	Site had low gradient and low soil permeability. Storm water management solutions would be required
Uncontrolled fill	Uncontrolled fill material affecting earthworks and foundations	Low	Very minor fill horizon detected
Sources of construction material	Suitability of insitu soils for use as natural construction material affecting cost of importation of material	Medium-high	The insitu soils are generally unsuitable for use as natural construction purposes. All selected fill material will need to be imported
	Distance to sources of construction material affecting costs	Low	Commercial sources of better material are readily available in the area.

6. Recommendations

The design of foundations and engineering services is the structural and civil engineer's responsibility. The following recommendations are based on limited information gained from the site investigation and although the confidence in the information is high, some variations can occur between information points. All geotechnical information must be confirmed during the construction process and any significant variations are to be brought to the attention of the authors for comment or further recommendations. It is recommended that the structural engineer discuss his/her conceptual design with the geotechnical specialist to ensure that any calculations and recommendations are in line with current thinking.

6.1 Earthworks

It was recommended that the site be cleared of vegetation and the top 150mm grubbed of topsoil and roots and carted to spoil or stockpiled on site for landscaping purposes. Any existing superficial fill material, such as rubbish/rubble that may exist on the site should be cut to spoil.

Soil obtained from bulk earthworks and excavations is unlikely to be suitable for re-use as load-bearing fill material, but any potentially suitable material should be stockpiled and approved by the engineer before being used.

For deep excavations up to 2m, e.g. for gravity sewers, the upper 1m should be battered to a safer angle of 45°.

6.2 Stormwater drainage

Infiltration into the soil will generally be low and restricted by fine grained soils of low permeability and a significant portion of rainfall will end up as run-off or standing water. A well-planned road layout can assist with storm water management. Raised barrier kerbs, mountable or semi-mountable kerbs along roads are recommended in order to channel storm water along roads and prevent over-topping into erven. The ponding of storm water around the exterior of houses can be avoided by shaping the ground levels around the exterior to create a fall away from the house and constructing a 1m wide a concrete apron with a 10% fall away from the house. This will also assist in maintaining ground moistures stable. The finished floor level of all houses should be a minimum of 150mm above final ground level to prevent flooding.

6.3 Roads

For access roads and parking areas, it is recommended that allowance is made for importation of selected subgrade material of at least G7 quality to improve the road subgrade, below the conventional road layerworks (subbase/base layers). The recommended layerworks are given in **Table 6**.

Table 6: Pavement design recommendations

Layer	*Material*	*Thickness*	*Required Compaction*
Pavers*	Cement interlock paving on 25mm sand bedding	80 mm	
Subbase	Imported G4/5 crushed rock	150mm	95% MDD
SSG	Imported G7 gravel	150-300mm	93% MDD
OR			
Seal	13.2mm Cape Seal or 40mm HMA		
Base course	Imported G1/3 crushed rock	150mm	98% MDD
Subbase	Imported G4/5 crushed rock	150mm	95% MDD
SSG	Imported G7 gravel	150-300mm	93% MDD

6.4 Foundations and floors

A preliminary recommendation for foundations for single to triple storey masonry structures is well reinforced concrete strip or pad foundations, founded at a minimum recommended depth of 0.8m on stiff/dense insitu soils with a maximum recommended bearing pressure of 145kPa. Additional engineering of the founding conditions below footings can be considered to mitigate heave and settlement, such as placing a layer of compacted G5 crushed rock below footings (recommend minimum 0.15m, compacted to 95%MDD). This will also facilitate better foundation trench preparation during wet weather periods. Alternative systems, such as raft foundations can also be considered as highly suitable. Ground conditions and foundation designs should be verified on site during earthworks.

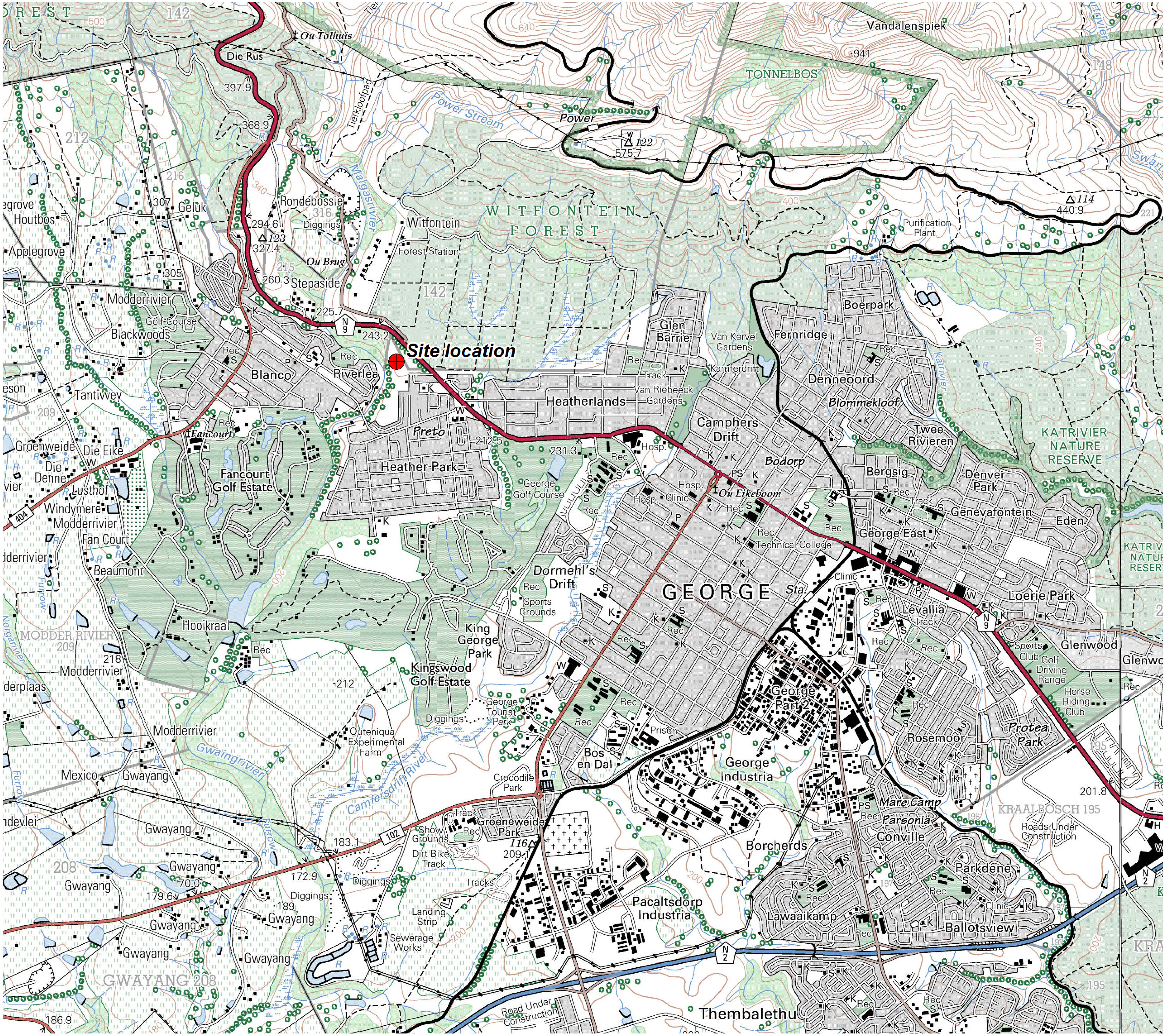
RC surface bed floors should be supported on at least 0.3m of well compacted imported crushed rock or inert natural gravel, compacted to 95%MDD.

7. Conclusions

The site is generally suitable for the proposed development in terms of the geology but there are some geotechnical constraints which may have an effect the engineering design. Some preliminary precautionary measures have been recommended for consideration by the design engineers to cater for the expected conditions, but all information should be verified on site during construction.

Appendix 1

Maps



Project: New residential development
Site: Erf 19734 George
Area: George, W Cape

Dwg Name: Locality map
Date: June 2022
Rev no: 1
Drawn: IP

Client: Urban Front Developers
Structural/Civil Eng:
Architect:

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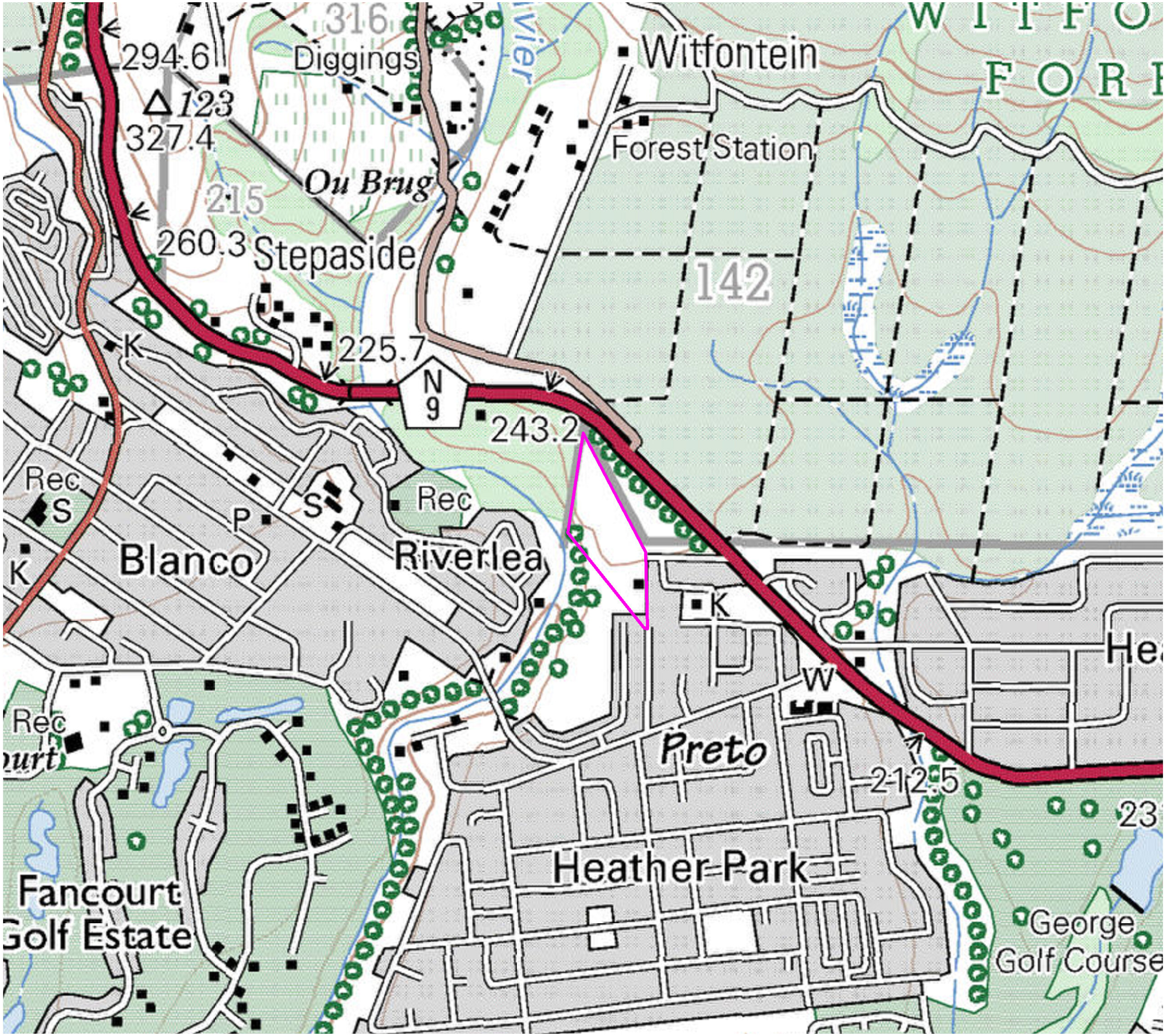
Scale 1:50000
0 0.3 0.9 1.5 km



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Legend

Site boundary

Project: New residential development
Site: Erf 19734 George
Area: George, W Cape

Dwg Name: Topographical map
Date: June 2022
Rev no: 1
Drawn: IP

Client: Urban Front Developers
Structural/Civil Eng:
Architect:

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Scale 1:15000

0 120 240 360 480 600 m

Nmg	Gneissic granite and granodiorite, albitite Gneisige graniet en granodioriet, albitiet	Maalgaten and related granites Maalgaten-en verwante graniete		

Kaaimans	Homtini	Phyllite, feldspathic grit, quartzite Filliet, veldspatiese grintsteen, kwartsiet	Nk
	Victoria Bay	Feldspathic quartzite Veldspatiese kwartsiet	Nk
	Soetkraal	Phyllite, schist, hornstone, quartzite Filliet, skis, horingsteen, kwartsiet	Nk
	Skaapkop	Gritty quartzite, phyllite, schist Grintige kwartsiet, filliet, skis	Nk
	Sandkraal	Quartz schist Kwartsskis	Nk
	Saasveld	Andalusite schist, hornfels, mica schist Andalusietskis, horingfels, mikaskis	Nk
	Silver River	Quartz schist Kwartsskis	Nk
		Undifferentiated quartzite, grit, phyllite, conglomerate Ongedifferensieerde kwartsiet, grintsteen, filliet, konglomeraat	N

N

Legend

Site location

Project: New residential development
Site: Erf 19734 George
Area: George, W Cape

Dwg Name: Geology map
Date: June 2022
Rev no: 1
Drawn: IP

Client: Urban Front Developers
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Architect:

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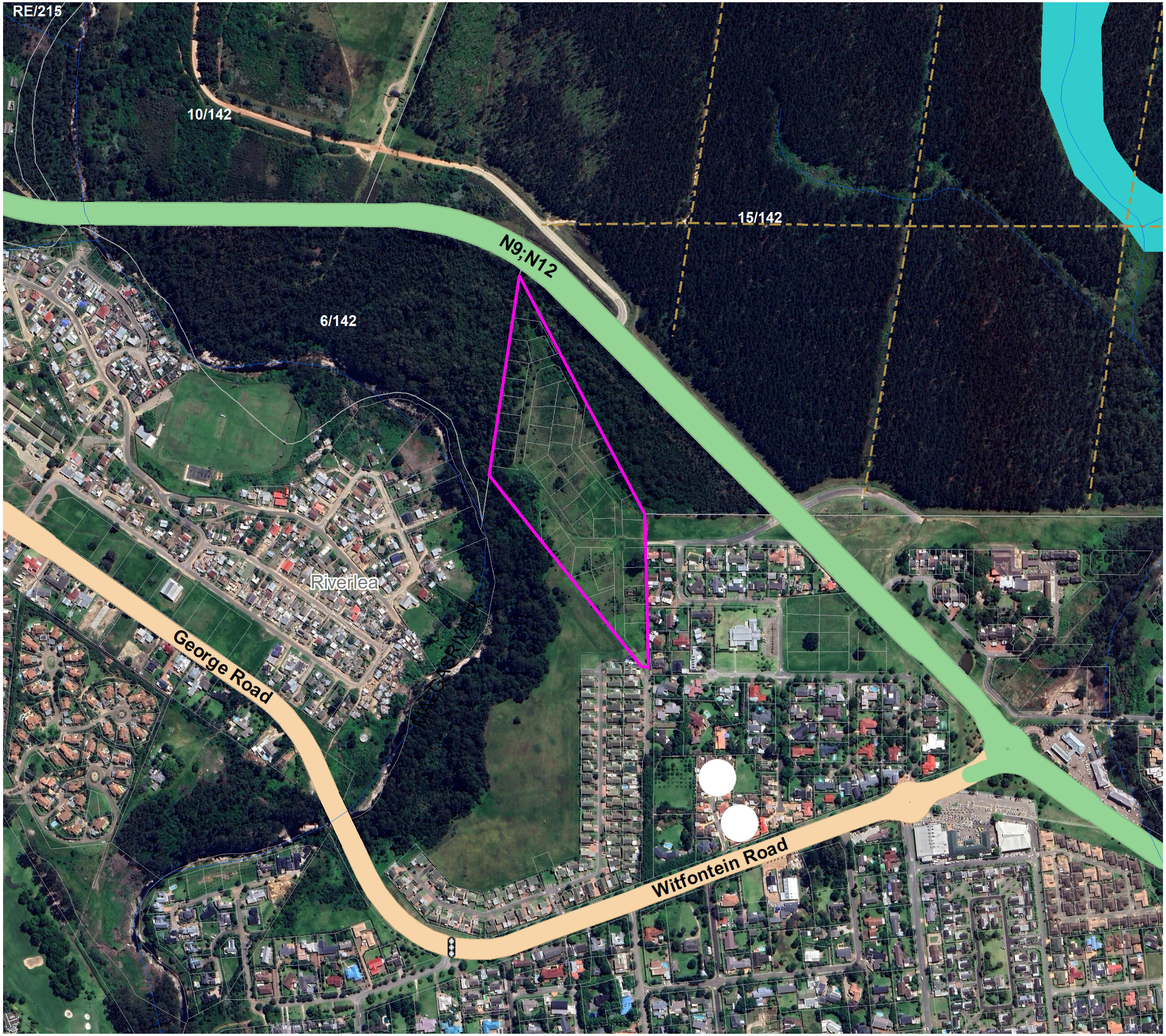

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Legend

Site boundary

Project: New residential development
Site: Erf 19734 George
Area: George, W Cape

Dwg Name: Aerial photo map
Date: June 2022
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Scale 1:7500

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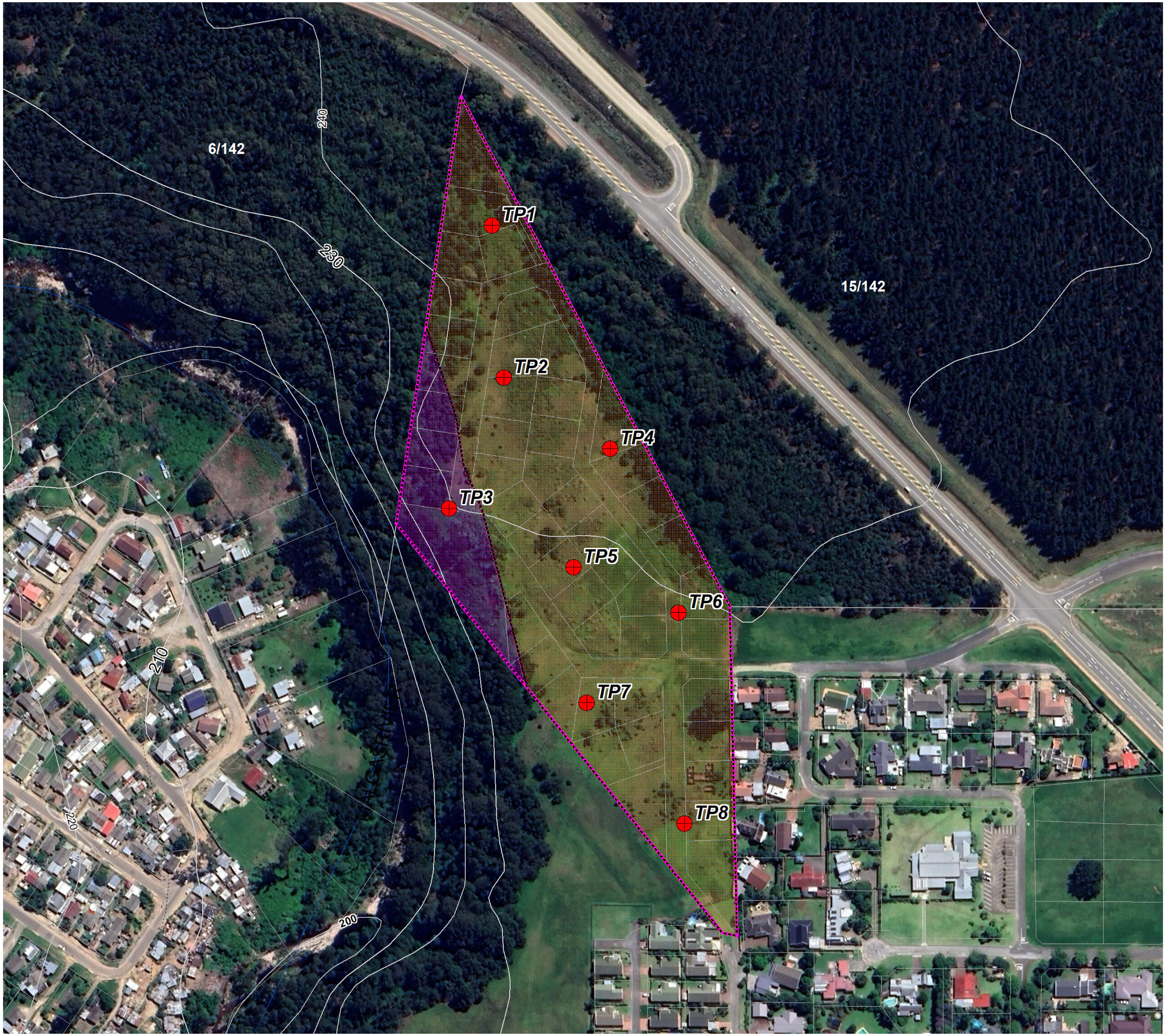

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Legend

- Test positions
- Site boundary

Geotechnical Terrains

- Terrain 1 (Active clay - H1-2/C1)
- Terrain 2 (Shallow rock - C1/H/R)

Project: New residential development
Site: Erf 19374 George
Area: George, W Cape

Dwg Name: Geotechnical map
Date: June 2022
Rev no: 1
Drawn: IP

Client: Urban Front Developers
Structural/Civil Eng:
Architect:

OUTENIQUA GEOTECHNICAL SERVICES

18 Clyde St
Knysna
6571
South Africa
+27443820502
info@outeniqualab.co.za

Scale 1:3500

0 30 60 90 120 150 m

Appendix 2

Test pit profiles

Geotechnical Soil Profile

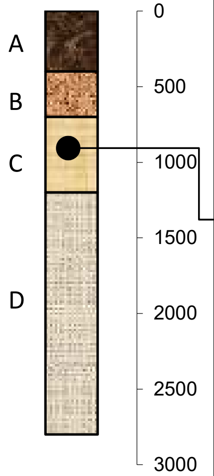
OUTENIQUA GEOTECHNICAL SERVICES

Client:	Urban Front Developers
Project:	Erf 19374 Heather Park
Area:	George
Date:	02.06.2022
Excavator:	TLB

TP 1

Datum: NGL | Co-ords: 23 Y0053042 X3757648

Key to symbols: ● Sample taken | Groundwater



Depth (mm)	Description
(0 to 400)	Slightly moist, dark grey brown, medium dense, intact, **CLAYEY SILT & FINE SAND** with abundant roots. Topsoil.
(400 to 700)	Slightly moist, light grey brown, medium dense to dense, intact, **SILTY FINE SAND.** Colluvial.
(700 to 1200)	Slightly moist, dark red orange, medium dense, pinholed, **CLAY & SILTY GRAVEL.** Gravel is subangular to subrounded, fine to coarse, ferricrete nodules. Colluvial/pedogenic.
	Foundation Indicator & MOD/CBR/ Indicator
(1200 to 2800)	Moist, blotched & mottled light grey & dark red orange & yellow orange, stiff to very stiff, shattered, **SILTY CLAY.** Residual feldspathic sandstone

Near refusal in very stiff residual
No Water

Dynamic Cone Penetrometer (DCP)

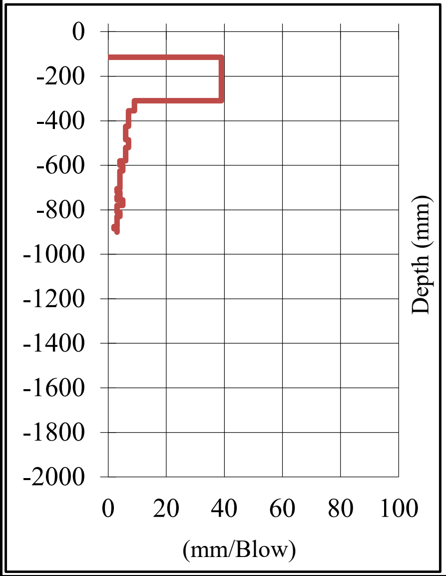
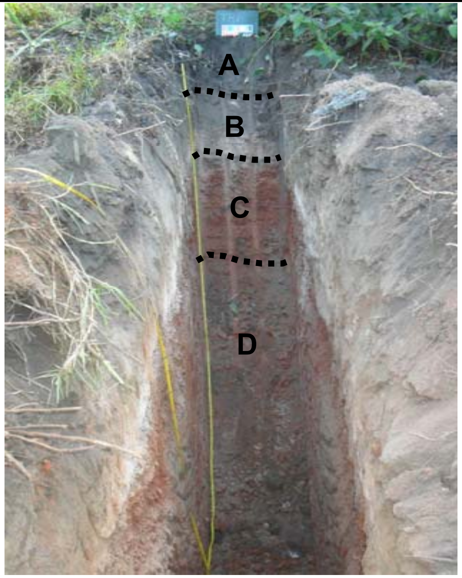


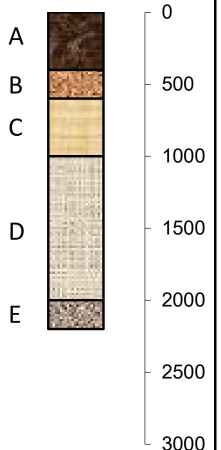
Photo of Test Pit



TP 2

Datum: NGL | Co-ords: 23 Y0053033 X3757748

Key to symbols: ● Sample taken | Groundwater



Depth (mm)	Description
(0 to 400)	Moist, dark brown, soft to firm, intact, **CLAYEY SILT** with roots. Topsoil.
(400 to 600)	Slightly moist, light grey brown, medium dense, intact, **SILTY FINE SAND**. Colluvial.
(600 to 1000)	Moist, mottled light brown & red orange, stiff, pinholed, **GRAVELLY SILTY CLAY** to **CLAYEY SILTY GRAVEL**. Gravel is subangular to subrounded, fine to coarse, ferricrete nodules. Pedogenic.
(1000 to 2000)	Moist, blotched light brown & red orange, dense, intact, **CLAYEY SILTY FINE SAND** to **SANDY SILT & CLAY**. Residual feldspathic sandstone
(2000 to 2200)	Light yellow orange & red orange, highly to completely weathered, highly fractured, very soft rock to soft rock, **feldspathic SANDSTONE**.

Refusal on soft rock SANDSTONE
No Water

Dynamic Cone Penetrometer (DCP)

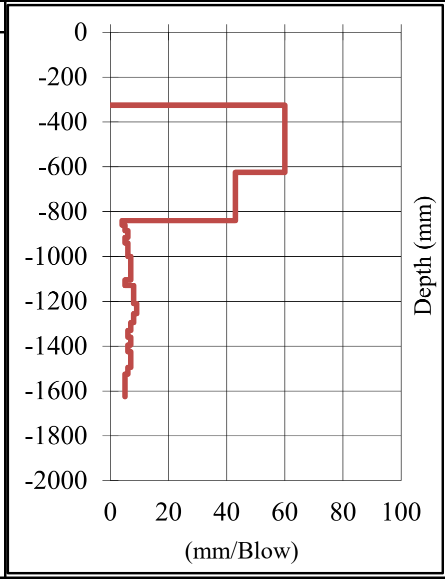
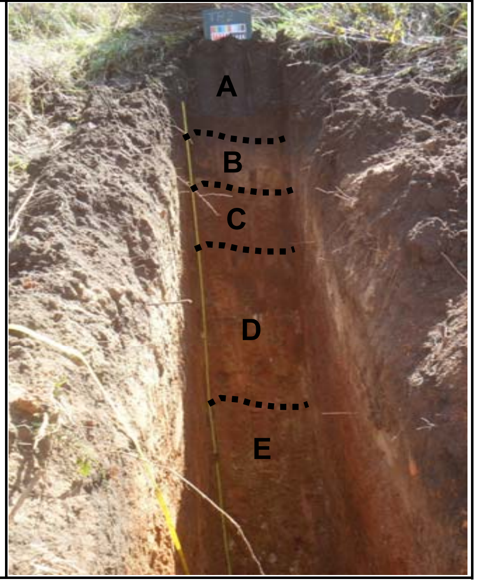


Photo of Test Pit



OUTENIQUA GEOTECHNICAL SERVICES

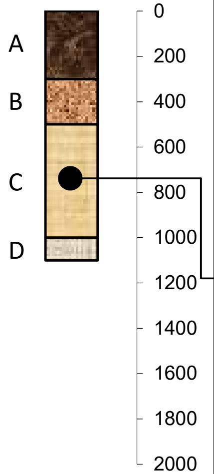
Geotechnical Soil Profile

Client:	Urban Front Developers
Project:	Erf 19374 Heather Park
Area:	George
Date:	02.06.2022
Excavator:	TLB

TP 3

Datum: NGL | Co-ords: 23 Y0053069 X3757834

Key to symbols: ● Sample taken | Groundwater



(0 to 300)	Slightly moist, dark brown, loose, intact, **CLAYEY SILTY FINE SAND** with roots & scattered rubble. Topsoil
(300 to 500)	Slightly moist to moist, dark brown, medium dense to dense, intact, **SILTY SANDY GRAVEL**. Gravel is subangular to subrounded, fine to coarse ferricrete nodules. Colluvial.
(500 to 1000)	Slightly moist, light brown & light yellow & red orange, dense to very dense, intact, **GRAVEL & COBBLES SILTY FINE SAND**. Cobbles are highly to completely weathered, very soft to soft rock quartzitic sandstone. Gravel is quartz. Colluvial.
	Foundation Indicator & MOD/CBR/Indicator
(1000 to 1100)	Light brown & light yellow orange & light red, highly weathered to completely weathered, highly fractured, very soft rock to soft rock **feldspathic SANDSTONE**.

Refusal on soft rock sandstone
No Water

Dynamic Cone Penetrometer (DCP)

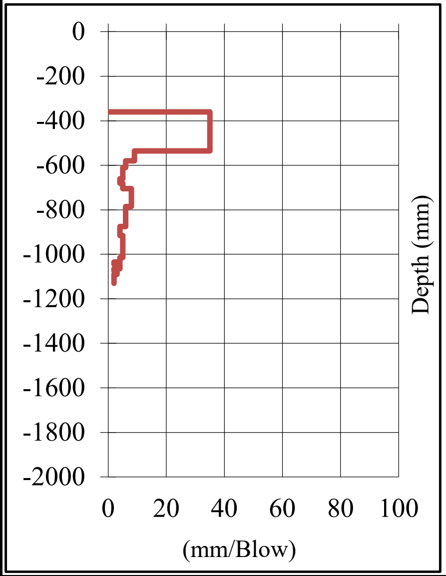
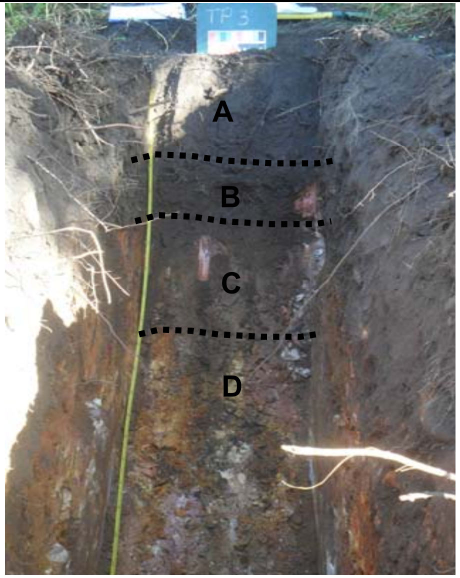


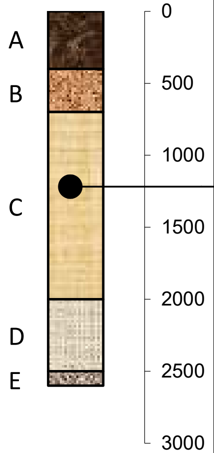
Photo of Test Pit



TP 4

Datum: NGL | Co-ords: 23 Y0052963 X3757794

Key to symbols: ● Sample taken | Groundwater



(0 to 400)	Moist, dark brown, soft to firm, intact, **CLAYEY SILT** with abundant roots. Topsoil.
(400 to 700)	Moist, light grey brown, medium dense, intact, **CLAYEY SILT** with some fine ferricrete nodules at base. Colluvial.
(700 to 2000)	Moist, mottled light brown & red orange, stiff, micro-shattered, **SILTY CLAY**. Residual feldspathic sandstone.
	Foundation Indicator
(2000 to 2500)	Moist, mottled grey & red orange & yellow orange, stiff to very stiff/medium dense to dense, shattered, **CLAYEY SILT** to **SILTY CLAY.** Residual feldspathic sandstone.
(2500 to 2600)	Blotched grey & red orange & yellow orange, highly to completely weathered, highly fractured, soft rock, **feldspathic SANDSTONE.**

Refusal on soft rock SANDSTONE
Sidewalls stable
No Water

Dynamic Cone Penetrometer (DCP)

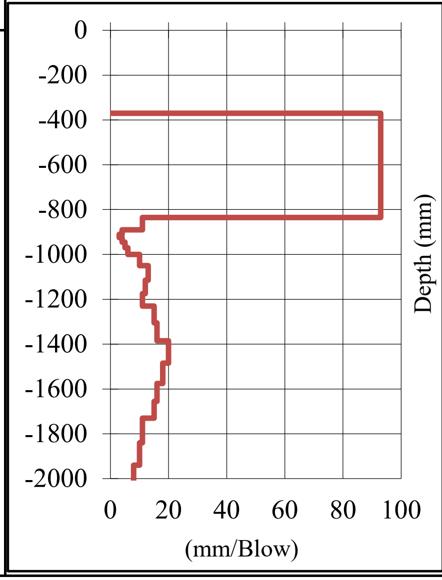
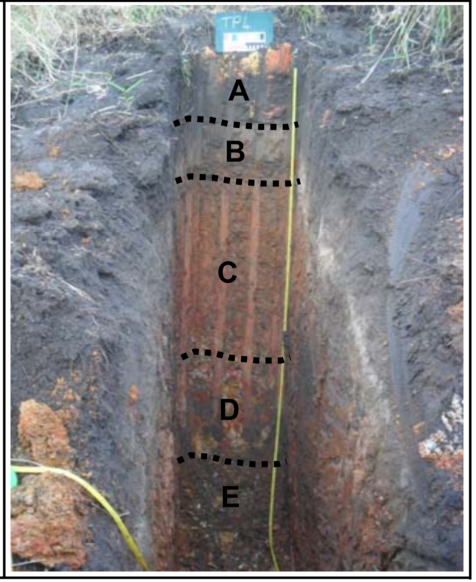


Photo of Test Pit



OUTENIQUA GEOTECHNICAL SERVICES

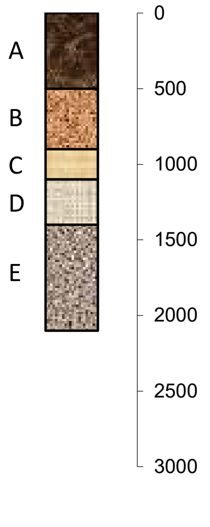
Geotechnical Soil Profile

Client:	Urban Front Developers
Project:	Erf 19374 Heather Park
Area:	George
Date:	02.06.2022
Excavator:	TLB

TP 5

Datum: NGL | Co-ords: 23 Y0052987 X3757872

Key to symbols: ● Sample taken | Groundwater



Depth (mm)	Description
(0 to 500)	Very moist, dark brown, soft to firm, intact, **CLAYEY SILT** with abundant roots. Topsoil.
(500 to 900)	Moist, light brown, medium dense, intact, **SILTY FINE SAND**. Colluvial.
(900 to 1100)	Moist, dark red orange, medium dense, pinholed & voided, **CLAY & SANDY GRAVEL.** Gravel is subangular to subrounded, fine to medium, ferricrete nodules. Pedogenic.
(1100 to 1400)	Moist, mottled grey & red orange & yellow orange, stiff, shattered, **SILTY CLAY**. Residual feldspathic sandstone.
(1400 to 2100)	Moist, blotched yellow orange & red orange, dense to very dense, intact, **CLAYEY SILTY FINE SAND** with occasional rounded quartz pebbles. Residual feldspathic sandstone.

Near refusal in very dense residual
TP partial backfilled to 1.8m. Possibly old excavation
Slight water seeping from bottom of backfilled section.

Dynamic Cone Penetrometer (DCP)

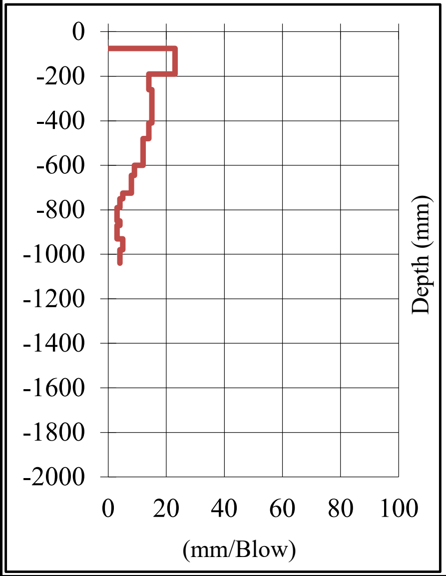
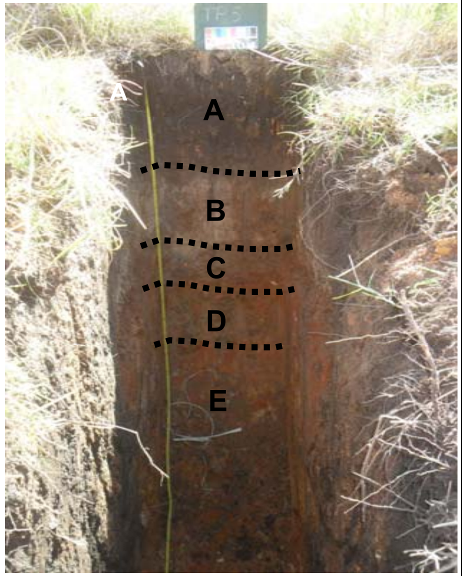


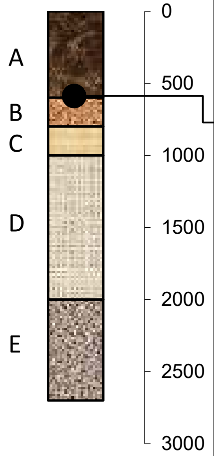
Photo of Test Pit



TP 6

Datum: NGL | Co-ords: 23 Y0052918 X3757901

Key to symbols: ● Sample taken | Groundwater



Depth (mm)	Description
(0 to 600)	Moist, dark brown, soft to firm, intact, **CLAYEY SILT** with abundant roots. Topsoil.
(600 to 800)	Moist, light grey brown, firm to stiff, intact, **SILTY CLAY**. Colluvial.
	Foundation Indicator & MOD/CBR/Indicator
(800 to 1000)	Moist, dark red orange, medium dense to dense, pinholed/voided, **SILT & CLAYEY GRAVEL**. Gravel is subangular to sub rounded fine to medium ferricrete nodules. Pedogenic.
(1000 to 2000)	Moist, mottled & light brown & dark red orange, stiff, shattered, **SILTY CLAY**. Residual feldspathic sandstone.
(2000 to 2700)	Moist, blotched yellow orange & red orange & white, stiff / very dense, intact, **CLAY & SILTY SAND** to **CLAYEY SILT** with occasional weathered pebbles & cobbles of sandstone/quartzite. Residual feldspathic sandstone.

Near refusal in very dense residual
No Water

Dynamic Cone Penetrometer (DCP)

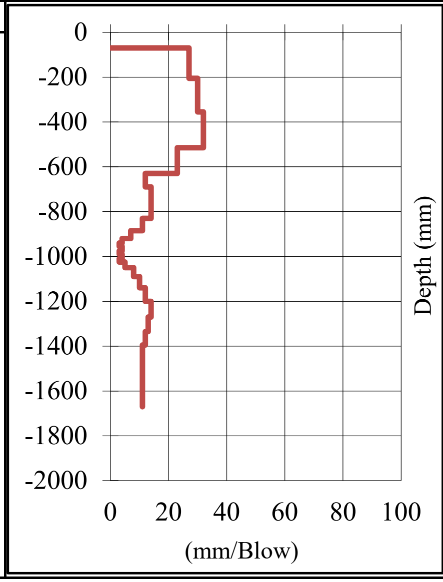


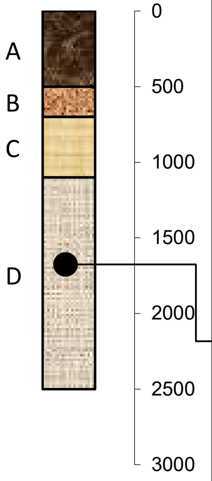
Photo of Test Pit

Geotechnical Soil Profile

Client:	Urban Front Developers
Project:	Erf 19374 Heather Park
Area:	George
Date:	02.06.2022
Excavator:	TLB

TP 7

Datum:	NGL	Co-ords:	23 Y0052978 X3757960
Key to symbols:	● Sample taken		Groundwater



(0 to 500) Moist to very moist, dark brown, soft, intact, **CLAYEY SILT** with abundant roots. Topsoil

(500 to 700) Very moist, light brown, soft to very soft, intact, **CLAYEY SILTY FINE SAND**. Colluvial.

(700 to 1100) Moist, dark red orange, medium dense, pinholed/voided, **CLAY & SILTY GRAVEL**. Gravel is subangular to subrounded, fine to medium ferricrete nodules. Pedogenic.

(1100 to 2500) Moist, yellow orange & light red orange blotched, dense, intact, **CLAY & SILTY SAND WITH GRAVEL & COBBLES**. Gravel and cobbles are rounded weathered quartzite. Residual feldspathic sandstone / conglomerate.

Foundation Indicator & MOD/CBR/Indicator

Near refusal in very dense residual
No Water

Dynamic Cone Penetrometer (DCP)

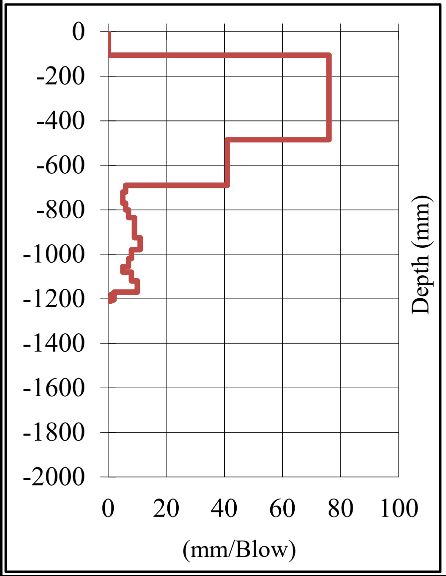
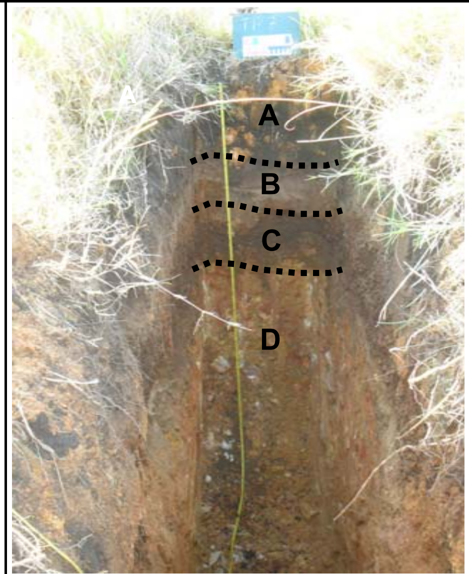
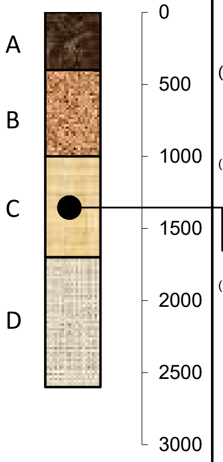


Photo of Test Pit



TP 8

Datum:	NGL	Co-ords:	23 Y0052913 X3758039
Key to symbols:	● Sample taken		Groundwater



(0 to 400) Very moist, dark brown, soft, intact, **CLAYEY SILT** with abundant roots. Topsoil.

(400 to 1000) Very moist, light grey brown, soft to firm, intact, **CLAYEY SANDY SILT**. Colluvial.

(1000 to 1700) Moist, mottled light brown & red orange, firm to stiff, micro-shattered & slickensided, **SANDY SILTY CLAY**. Residual feldspathic sandstone.

Foundation Indicator

(1700 to 2600) Moist, mottled & blotched light grey brown & red orange, stiff, intact, **SANDY CLAYEY SILT** to **SILTY CLAY**. Residual feldspathic sandstone.

No Refusal
No Water

Dynamic Cone Penetrometer (DCP)

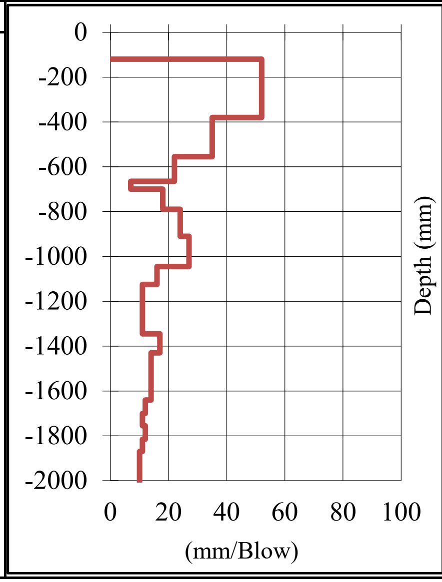
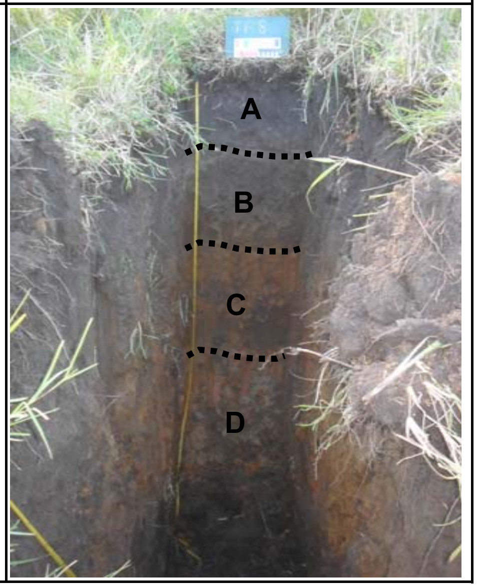


Photo of Test Pit



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@outeniqualab.co.za

R-FIND-1-6 Jan-22

T0347

Customer :	Outeniqua Geotechnical Services	Project :	Erf 19374 - George
	P O Box 964	Date Received :	03/06/22
	Knysna	Date Reported :	20/06/22
	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	1/6

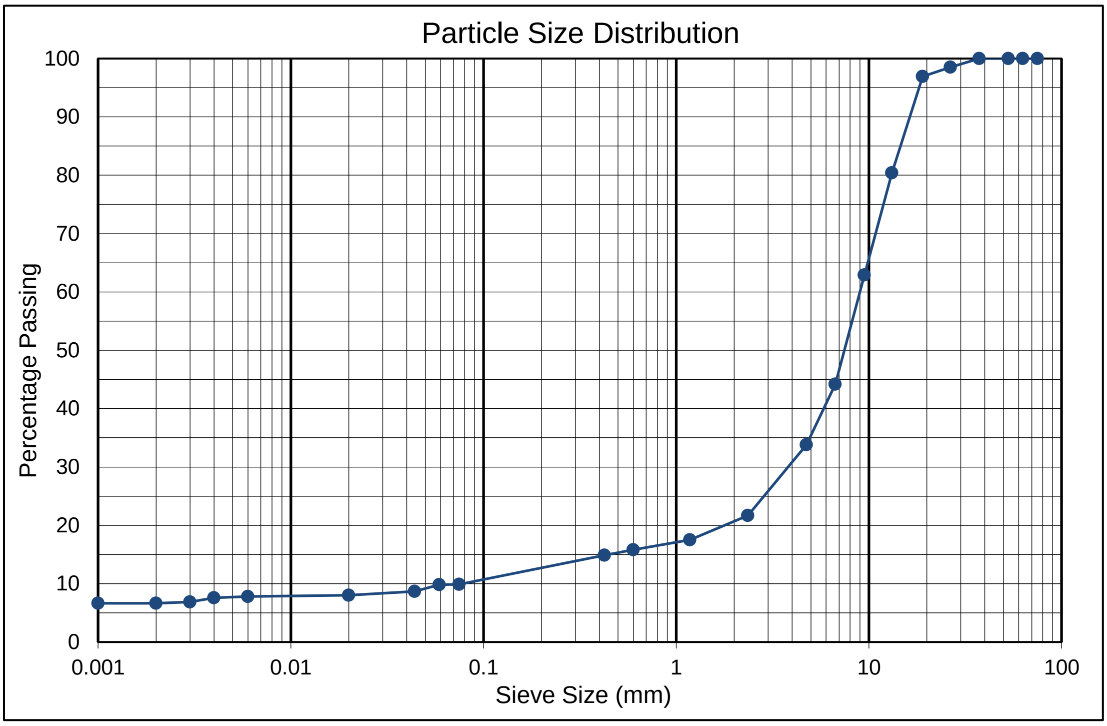
TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)	TP 1 - Layer 3
Depth (mm):	700 - 1200
Sample No.:	83973
Materials Description – Source	In-Situ
Colour	Dark Red Orange
Soil Type	Well Graded Gravel with Silt and Sand
Classification	Existing

Percentage Passing

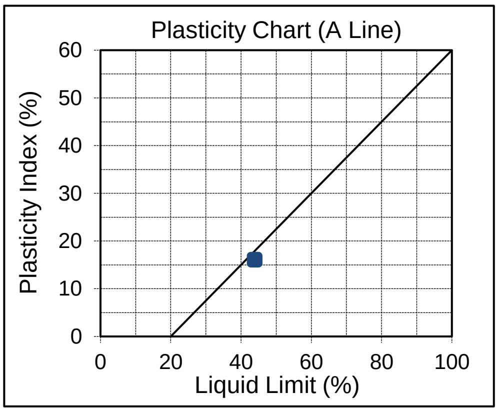
	Percentage Passing
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	99
19mm	97
13.2mm	80
9.5mm	63
6.7mm	44
4.75mm	34
2.36mm	22
1.18mm	18
0.6mm	16
0.425mm	15
0.075mm	10
0.059mm	10
0.044mm	9
0.02mm	8
0.006mm	8
0.004mm	8
0.003mm	7
0.002mm	7
0.001mm	7

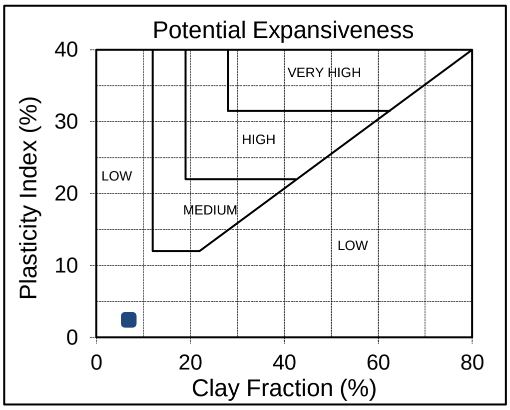


Liquid Limit (%)	44
Plasticity Index (%)	16
Linear Shrinkage (%)	8
Moisture Content (%)	12.1

% Clay	7
% Silt	3
% Sand	10
% Gravel	80

Unified Soil Classification	GW-GM
AASHTO Soil Classification	A-2-7





- **Specimen delivered to Outeniqua Lab in good order.**

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

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@outeniqualab.co.za T0347

Customer :	Outeniqua Geotechnical Services	Project :	Erf 19374 - George
	P O Box 964	Date Received :	03/06/22
	Knysna	Date Reported :	20/06/22
	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	2/6

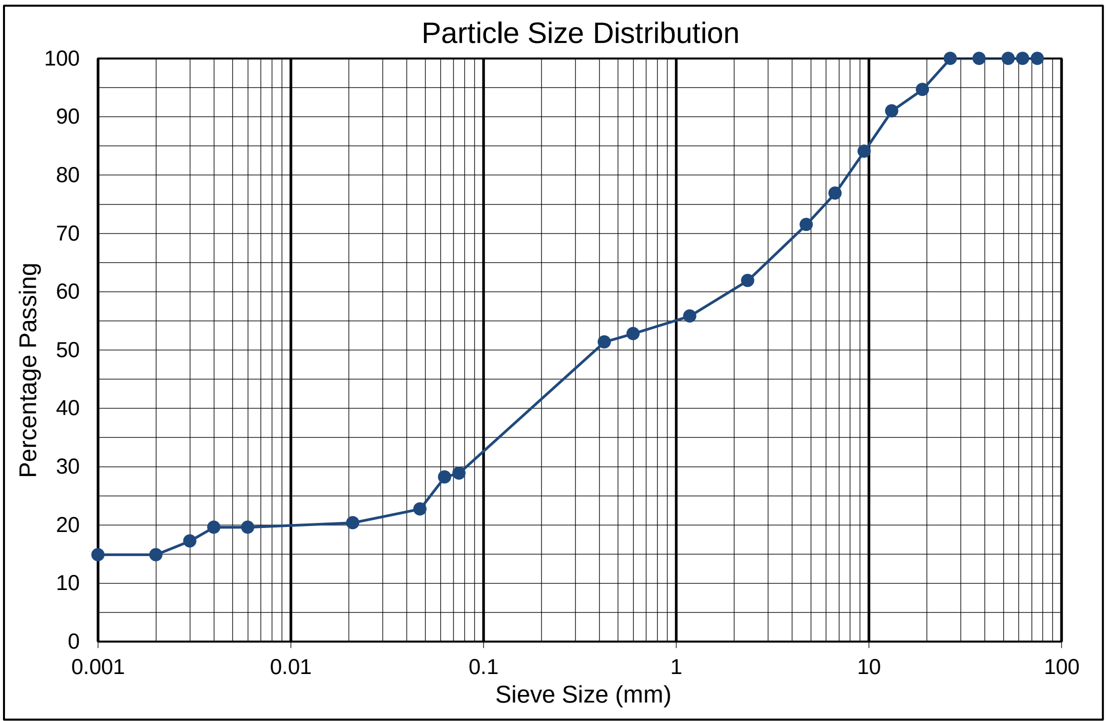
TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)	TP 3 - Layer 3
Depth (mm):	500 - 1000
Sample No.:	83974
Materials Description: Source	In-Situ
Colour	Light Brown - Light Yellow Orange
Soil Type	Silty/Clayey Gravel with Sand
Classification	Existing

Percentage Passing

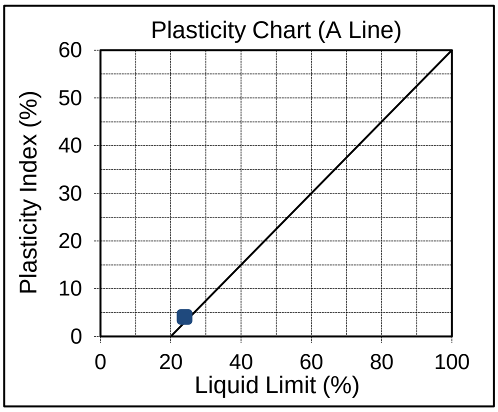
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	95
13.2mm	91
9.5mm	84
6.7mm	77
4.75mm	72
2.36mm	62
1.18mm	56
0.6mm	53
0.425mm	51
0.075mm	29
0.063mm	28
0.047mm	23
0.021mm	20
0.006mm	20
0.004mm	20
0.003mm	17
0.002mm	15
0.001mm	15

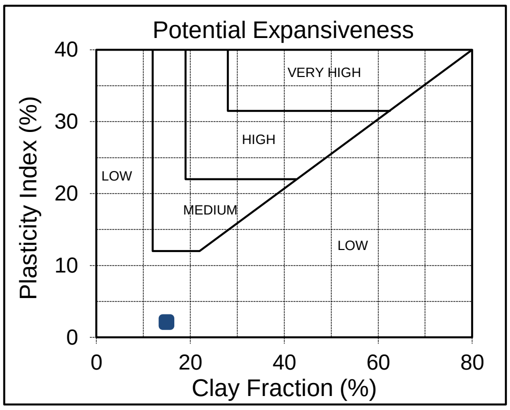


Liquid Limit (%)	24
Plasticity Index (%)	4
Linear Shrinkage (%)	2
Moisture Content (%)	8.2

% Clay	15
% Silt	12
% Sand	33
% Gravel	40

Unified Soil Classification	GM-GC
AASHTO Soil Classification	A-2-4





- **Specimen delivered to Outeniqua Lab in good order.**

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

OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

Materials Testing Laboratory

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T0347

Customer :	Outeniqua Geotechnical Services	Project :	Erf 19374 - George
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	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	3/6

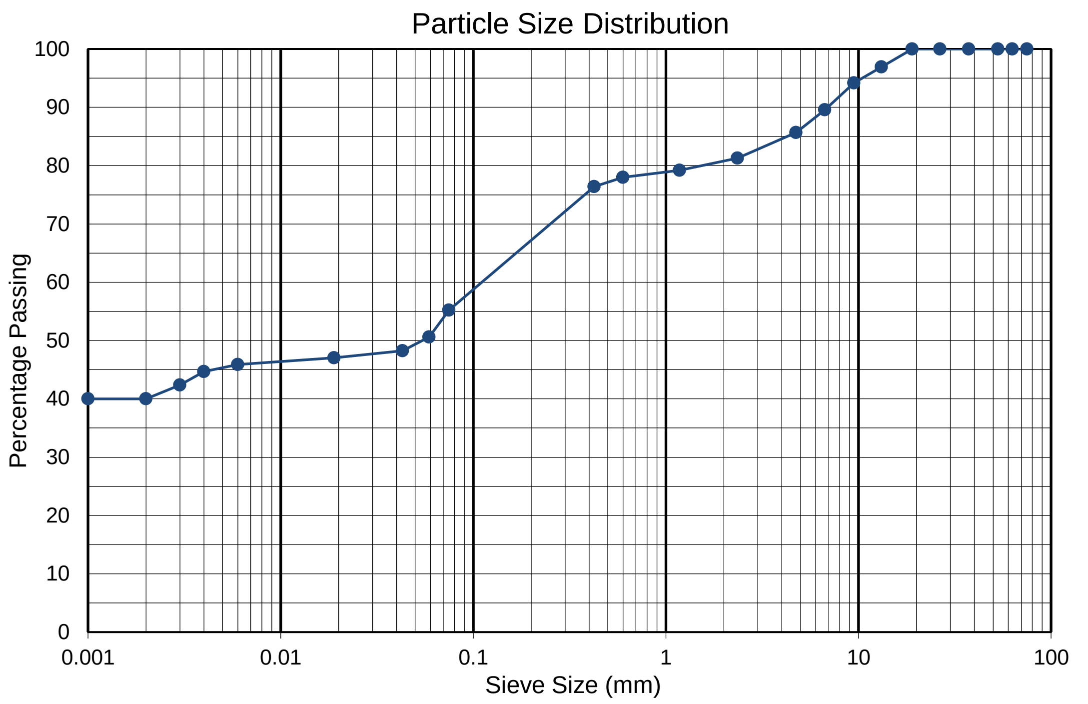
TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)	TP 4 - Layer 3
Depth (mm):	700 - 2000
Sample No.:	83975
Materials Description: Source	In-Situ
Colour	Light Brown - Dark Red Orange
Soil Type	Sandy Elastic Silt
Classification	Existing

Percentage Passing

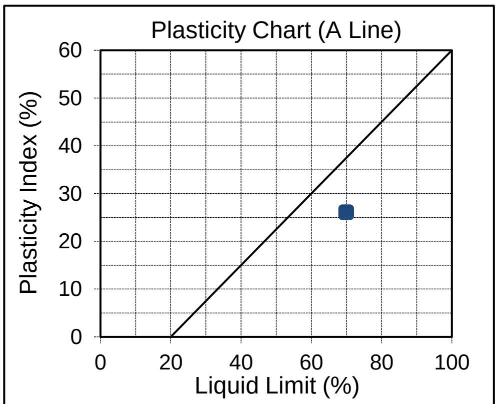
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	97
9.5mm	94
6.7mm	90
4.75mm	86
2.36mm	81
1.18mm	79
0.6mm	78
0.425mm	76
0.075mm	55
0.059mm	51
0.043mm	48
0.019mm	47
0.006mm	46
0.004mm	45
0.003mm	42
0.002mm	40
0.001mm	40

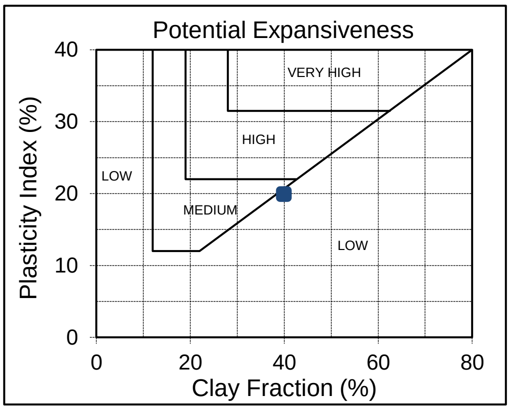


Liquid Limit (%)	70
Plasticity Index (%)	26
Linear Shrinkage (%)	13
Moisture Content (%)	33.8

% Clay	40
% Silt	11
% Sand	30
% Gravel	19

Unified Soil Classification	MH
AASHTO Soil Classification	A-7-5





- **Specimen delivered to Outeniqua Lab in good order.**

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

OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

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

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	P O Box 964	Date Received :	03/06/22
	Knysna	Date Reported :	20/06/22
	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	4/6

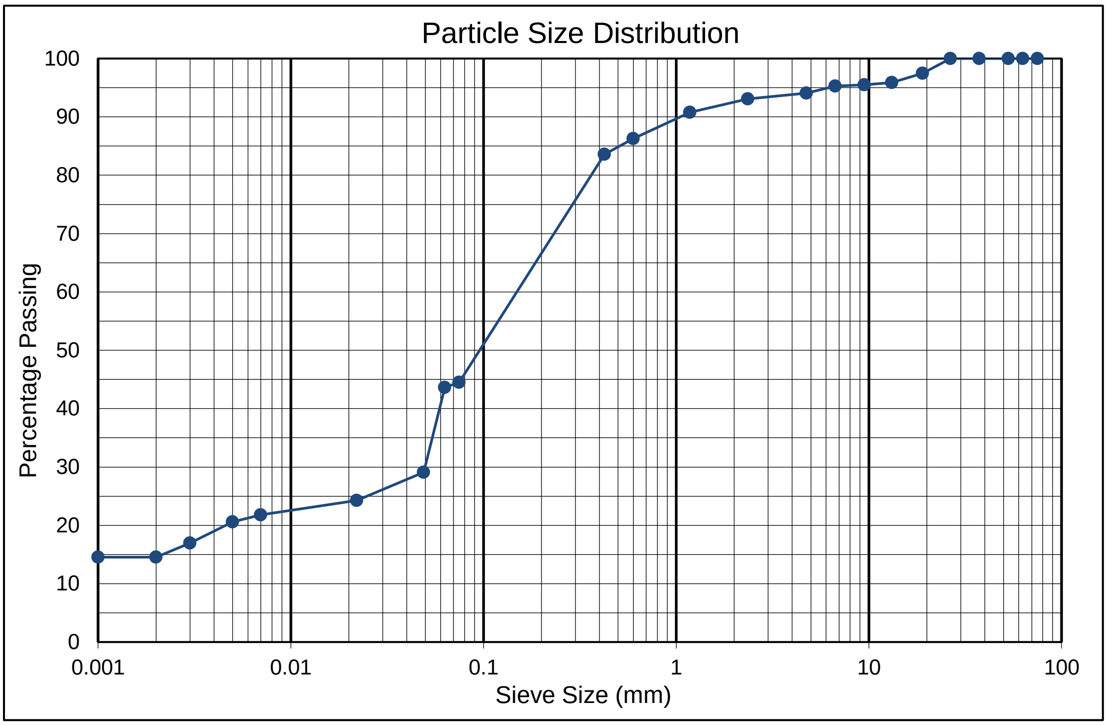
TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)	TP 6 - Layer 1&2
Depth (mm):	0 - 800
Sample No.:	83976
Materials Description: Source	In-Situ
Colour	Dark Brown - Light Grey Brown
Soil Type	Silty/Clayey Sand
Classification	Existing

Percentage Passing

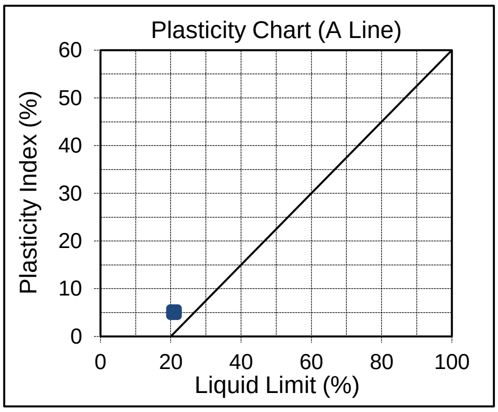
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	98
13.2mm	96
9.5mm	96
6.7mm	95
4.75mm	94
2.36mm	93
1.18mm	91
0.6mm	86
0.425mm	84
0.075mm	45
0.063mm	44
0.049mm	29
0.022mm	24
0.007mm	22
0.005mm	21
0.003mm	17
0.002mm	15
0.001mm	15

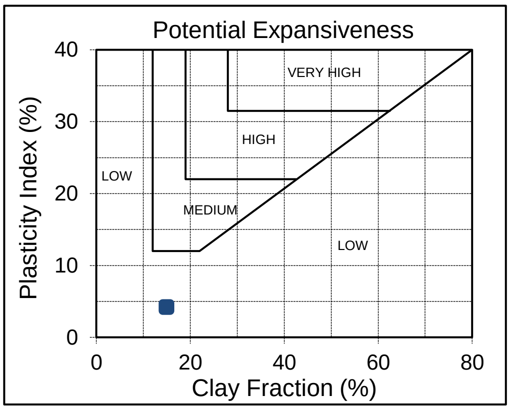


Liquid Limit (%)	21
Plasticity Index (%)	5
Linear Shrinkage (%)	3
Moisture Content (%)	17.2

% Clay	15
% Silt	25
% Sand	52
% Gravel	8

Unified Soil Classification	SM-SC
AASHTO Soil Classification	A-4





- **Specimen delivered to Outeniqua Lab in good order.**

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

OUTENIQUA LAB (Pty) Ltd.

R-FIND-1-6 Jan-22

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@outeniqualab.co.za T0347

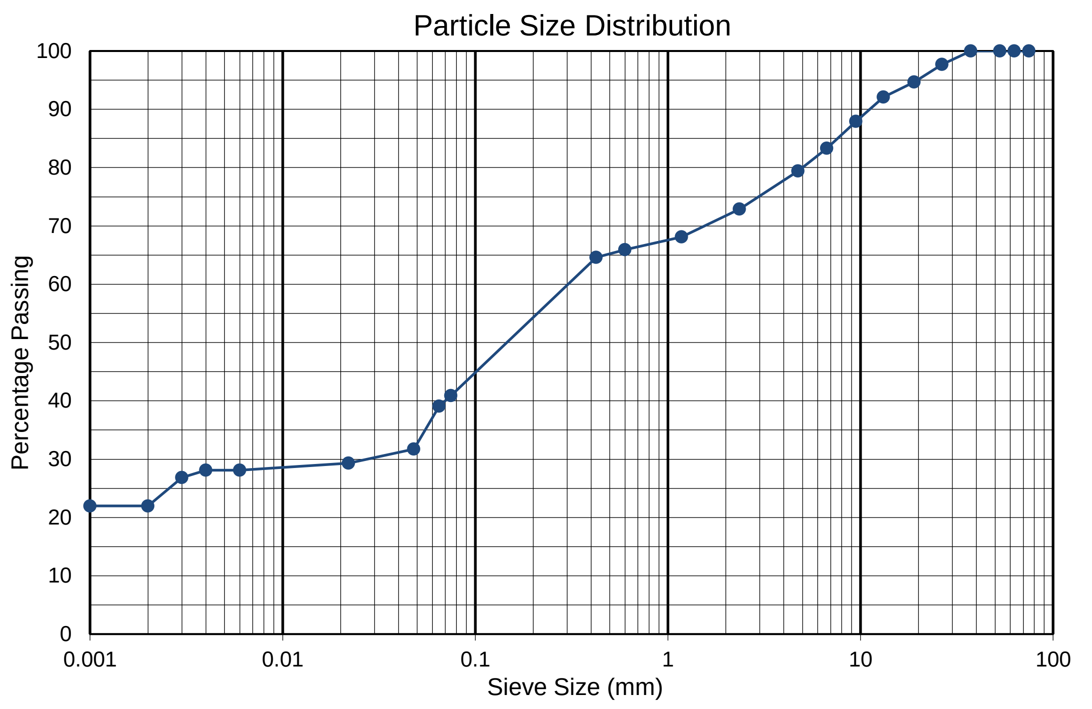
Customer :	Outeniqua Geotechnical Services	Project :	Erf 19374 - George
	P O Box 964	Date Received :	03/06/22
	Knysna	Date Reported :	20/06/22
	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	5/6

TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)		TP 7 - Layer 4
Depth (mm):		1100 - 2500
Sample No.:		83977
Materials Description	Source	In-Situ
	Colour	Yellow Orange - Light Red
	Soil Type	Silty/Clayey Sand with Gravel
	Classification	Existing

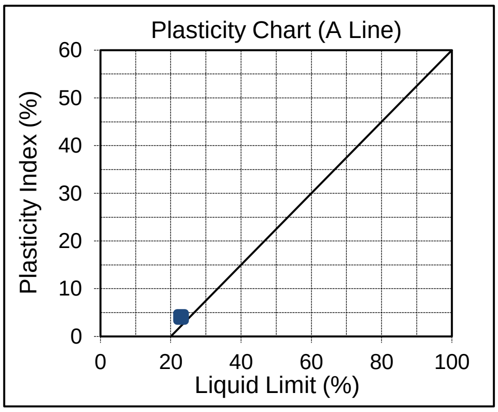
Percentage Passing	
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	98
19mm	95
13.2mm	92
9.5mm	88
6.7mm	83
4.75mm	79
2.36mm	73
1.18mm	68
0.6mm	66
0.425mm	65
0.075mm	41
0.065mm	39
0.048mm	32
0.022mm	29
0.006mm	28
0.004mm	28
0.003mm	27
0.002mm	22
0.001mm	22

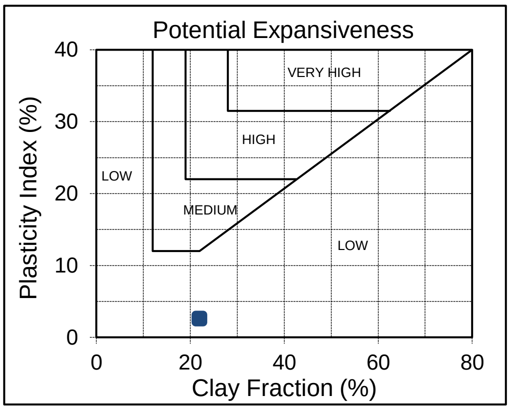


Liquid Limit (%)	23
Plasticity Index (%)	4
Linear Shrinkage (%)	2
Moisture Content (%)	10.5

% Clay	22
% Silt	15
% Sand	34
% Gravel	29

Unified Soil Classification	SM-SC
AASHTO Soil Classification	A-4





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

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@outeniqualab.co.za

sanas Testing Laboratory T0347

Customer :	Outeniqua Geotechnical Services	Project :	Erf 19374 - George
	P O Box 964	Date Received :	03/06/22
	Knysna	Date Reported :	20/06/22
	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	6/6

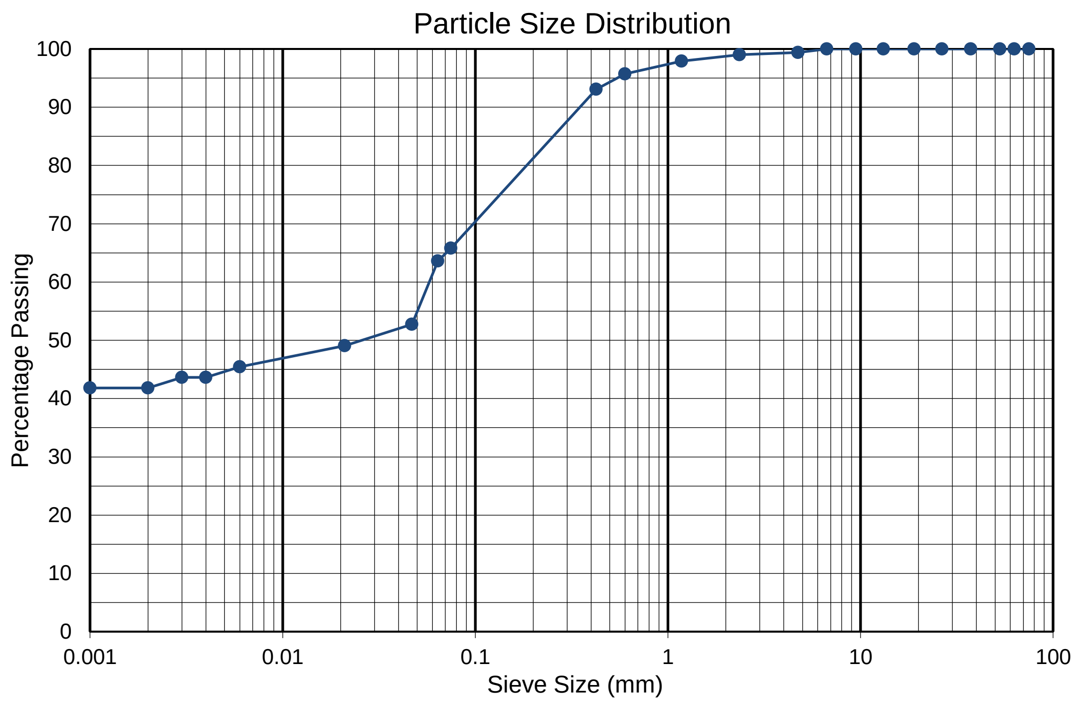
TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)	TP 8 - Layer 4
Depth (mm):	1000 - 1700
Sample No.:	83978
Materials Description: Source	In-Situ
Colour	Light Brown Red - Reddish Orange
Soil Type	Sandy Lean Clay
Classification	Existing

Percentage Passing

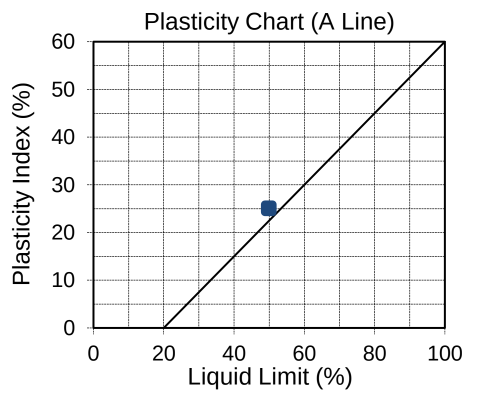
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	99
2.36mm	99
1.18mm	98
0.6mm	96
0.425mm	93
0.075mm	66
0.064mm	64
0.047mm	53
0.021mm	49
0.006mm	45
0.004mm	44
0.003mm	44
0.002mm	42
0.001mm	42

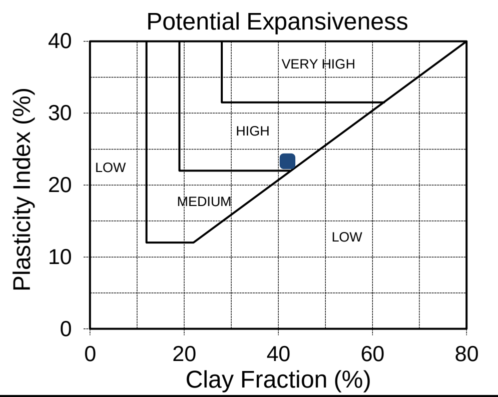


Liquid Limit (%)	50
Plasticity Index (%)	25
Linear Shrinkage (%)	13
Moisture Content (%)	23.0

% Clay	42
% Silt	19
% Sand	38
% Gravel	1

Unified Soil Classification	CL
AASHTO Soil Classification	A-7-6





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Technical Signatory
For Outeniqua Lab (Pty) Ltd.

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@outeniqualab.co.za

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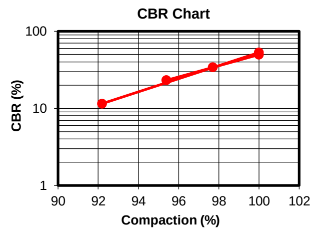
T0347

Customer :	Outeniqua Geotechnical Services	Project :	Erf 19374George
	P O Box 964	Date Received :	06/06/22
	Knysna	Date Reported :	20/06/22
	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	1/2

TEST REPORT
CALIFORNIA BEARING RATIO

	Sample Position (SV)	TP 1 - Layer 3	COLTO:		TP 3 - Layer 3	COLTO:	
	Depth (mm)	700 - 1200	Not		500 - 1000	G7 SSG	
	Sample No	**83973**	Classified		**83974**		
Materials Description	Source	In-Situ			In-Situ		
	Colour	Dark Red Orange			Light Brown - Light Yellow Orange		
	Soil Type	Well Graded Gravel with Silty Sand			Silty Clayey Gravel with Sand		
	Classification	Existing			Existing		
Material Indicators - (SANS 3001 Method GR1)							
Percentage Passing	75 mm	100		Opinion	100		Opinion
	63 mm	100			100		
	50 mm	100			100		
	37.5 mm	100			100		
	28 mm	98			100		
	20 mm	97			95		
	14 mm	80			91		
	5 mm	34			71		
	2 mm	20			60		
	0.425 mm	15			51		
	0.075 mm	10.3			34.8		
Material Indicators - (SANS 3001 Method PR5)							
	Grading Modulus	2.55			1.54	0.75 - 2.70	✓
	Coarse Sand Soil-Mortar (%)	27			14		
Atterberg Limits - (SANS 3001 Method GR10)							
	Liquid Limit (%)	44			24		
	Plasticity Index (%)	16			4	≤ 12	✓
	Linear Shrinkage (%)	8.0			2.0		
Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)							
MDD	Max Dry Density (kg/m^3)	2410			2032		
	Optimum Moisture Content (%)	14.1			10.3		
	Mould Moisture Content (%)	14.1			10.1		
A	Relative Compaction (%)	100.0			100.0		
	Swell (%)	0.1			0.1	≤ 1.5	✓
B	Relative Compaction (%)	95.4			94.3		
	Swell (%)	0.2			0.2		
C	Relative Compaction (%)	92.2			91.6		
	Swell (%)	0.4			0.3		
CBR	@100% Max Dry Density	53			56		
	@98% Max Dry Density	36			37		
	@95% Max Dry Density	20			21		
	@93% Max Dry Density	13			14	≥ 15	∗
	@90% Max Dry Density	7			8		
Material Condition							
	Insitu Moisture Content (%)						
Soil Classification Achieved By The Material							
	COLTO:	Not Classified			G7 SSG		
	AASHTO System	A-2-7			A-4		
	Unified System	GP-GM			GM-GC		

83973



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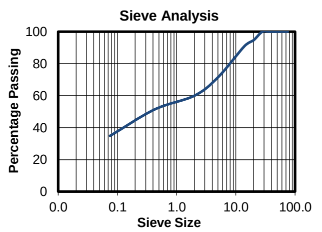
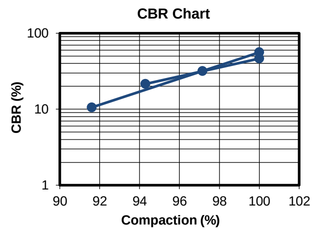
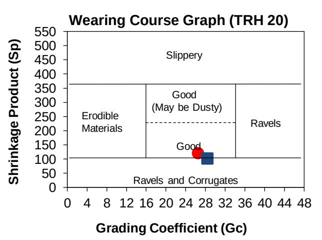




● 83973 ■ 83974



- **Specimens delivered to Outeniqua Lab in good order.**

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

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R-CBR-1-8 May-19

OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

Materials Testing Laboratory

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sanas Testing Laboratory

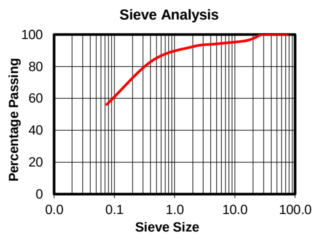
T0347

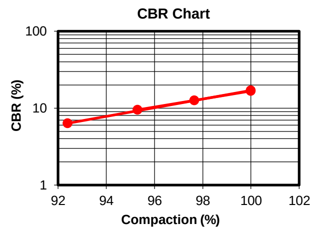
Customer :	Outeniqua Geotechnical Services	Project :	Erf 19374 - George
	P O Box 964	Date Received :	06/06/22
	Knysna	Date Reported :	20/06/22
	6570	Req. Number :	1857/22
Attention :	Iain Paton	No. of Pages :	2/2

TEST REPORT
CALIFORNIA BEARING RATIO

Sample Position (SV)		TP 6 - Layer 1&2	COLTO: Not Classified		TP 7 - Layer 4	COLTO: G7 SSG	
Depth (mm)		0 - 800			1100 - 2500		
Sample No		**83976**			**83977**		
Materials Description	Source	In-Situ			In-Situ		
	Colour	Dark Brown - Light Grey Brown			Yellow Orange - Light Red		
	Soil Type	Silty Clayey Sand			Silty Clayey Sand with Gravel		
	Classification	Existing			Existing		
Material Indicators - (SANS 3001 Method GR1)							
Percentage Passing	75 mm	100		Opinion	100		Opinion
	63 mm	100			100		
	50 mm	100			100		
	37.5 mm	100			100		
	28 mm	100			98		
	20 mm	97			95		
	14 mm	96			92		
	5 mm	94			79		
	2 mm	92			71		
	0.425 mm	84			65		
	0.075 mm	56.2			46.6		
Material Indicators - (SANS 3001 Method PR5)							
Grading Modulus		0.68			1.17	0.75 - 2.70	✓
Coarse Sand Soil-Mortar (%)		10			10		
Atterberg Limits - (SANS 3001 Method GR10)							
Liquid Limit (%)		21			23		
Plasticity Index (%)		5			4	≤ 12	✓
Linear Shrinkage (%)		2.5			2.0		
Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)							
MDD	Max Dry Density (kg/m^3)	2084			2120		
	Optimum Moisture Content (%)	8.2			9.7		
	Mould Moisture Content (%)	8.5			10.0		
A	Relative Compaction (%)	100.0			100.0		
	Swell (%)	0.6			0.1	≤ 1.5	✓
B	Relative Compaction (%)	95.3			95.8		
	Swell (%)	0.8			0.1		
C	Relative Compaction (%)	92.4			92.2		
	Swell (%)	1.0			0.2		
CBR	@100% Max Dry Density	17			50		
	@98% Max Dry Density	13			33		
	@95% Max Dry Density	9			18		
	@93% Max Dry Density	7			12	≥ 15	∗
	@90% Max Dry Density	5			6		
Material Condition							
Insitu Moisture Content (%)							
Soil Classification Achieved By The Material							
COLTO:		Not Classified			G7 SSG		
AASHTO System		A-4			A-4		
Unified System		CL-ML			GM-GC		

83976





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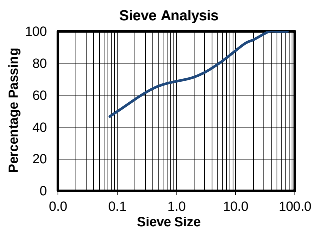
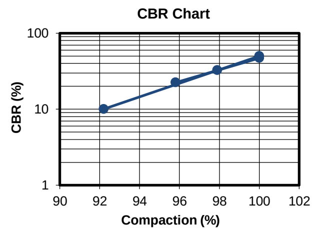
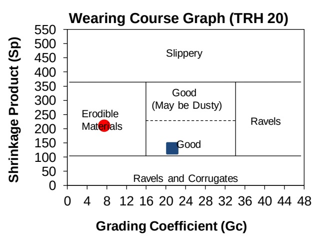




● 83976 ■ 83977



- **Specimens delivered to Outeniqua Lab in good order.**

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

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Appendix 4

DCP test data

Outeniqua Geotechnical Services cc.

Geotechnical Engineering Consultants

Registration No. 1999/062743/23

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

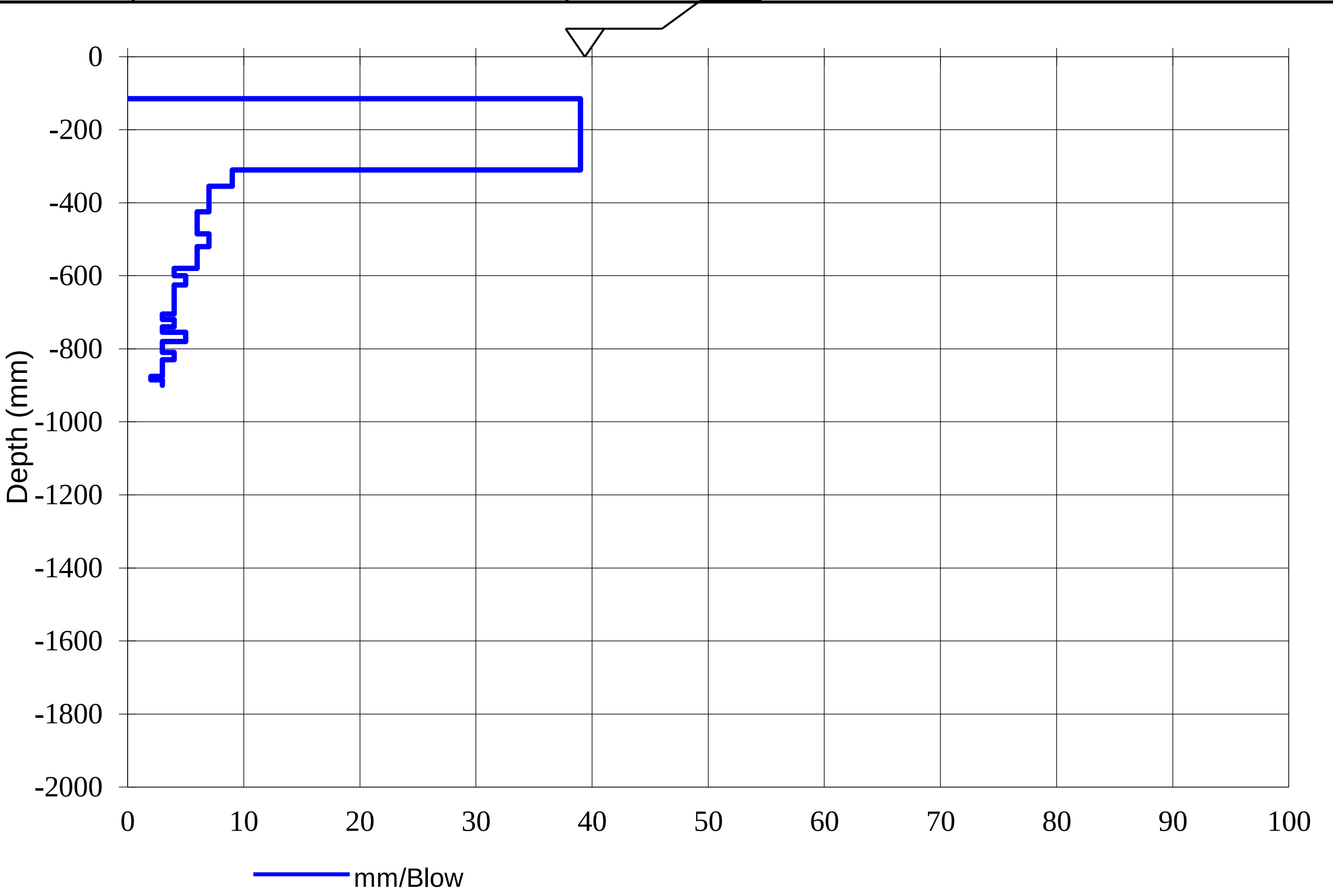
Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za

Customer :	Urban Front Developers	Project :	Erf 19734 Heather Park George
	Homewood St, Heather Park	Date Received :	30.05.2022
	George	Date Reported :	02.06.2022
	6529	Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	1 of 8

TEST REPORT

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

Position:	TP1	Datum Level:	NGL



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

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

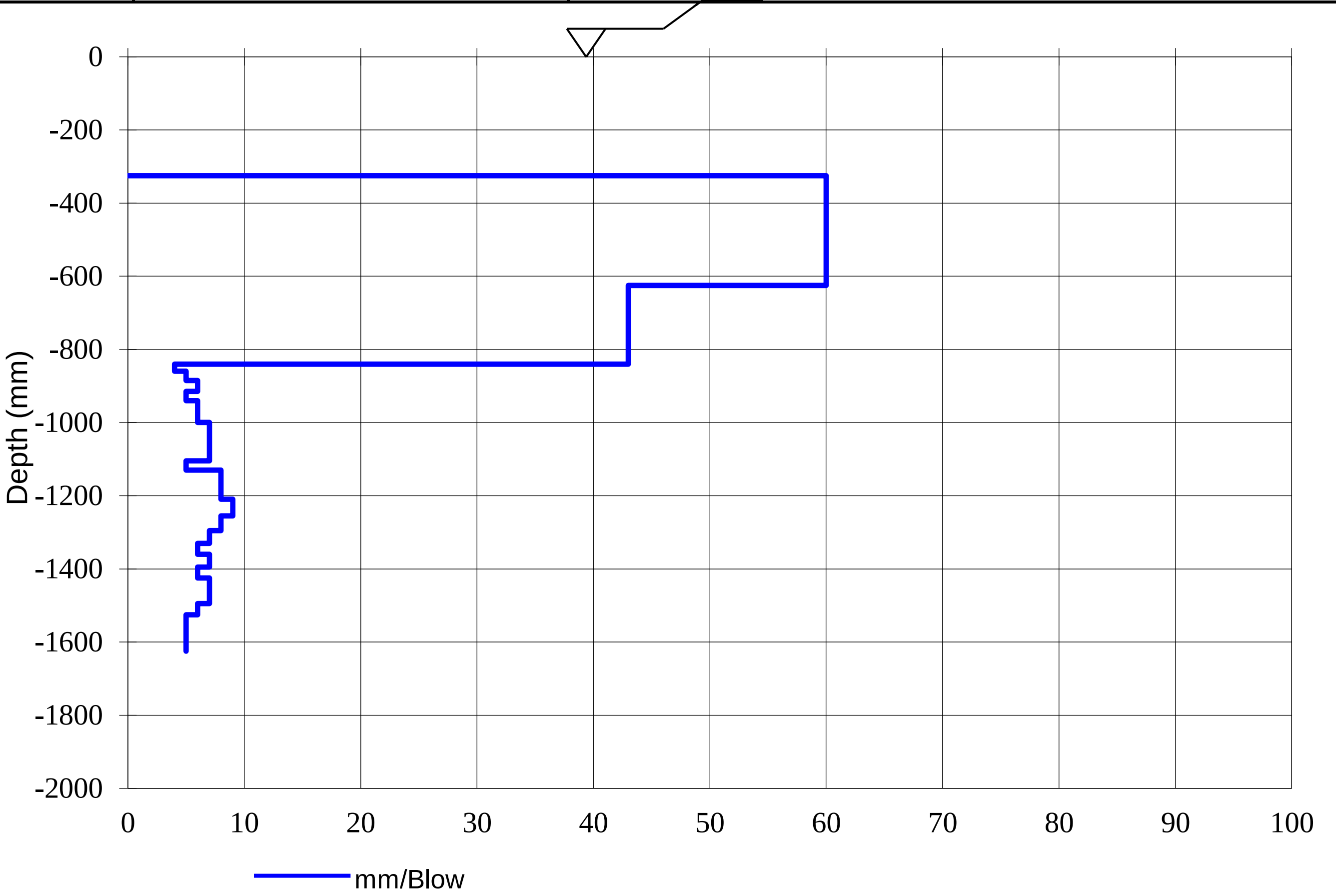
Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za

Customer :	Urban Front Developers Homewood St, Heather Park George 6529	Project :	Erf 19734 Heather Park George
		Date Received :	30.05.2022
		Date Reported :	02.06.2022
		Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	2 of 8

TEST REPORT

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

Position:	TP2	Datum Level:	NGL



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

Outeniqua Geotechnical Services cc.

Geotechnical Engineering Consultants

Registration No. 1999/062743/23

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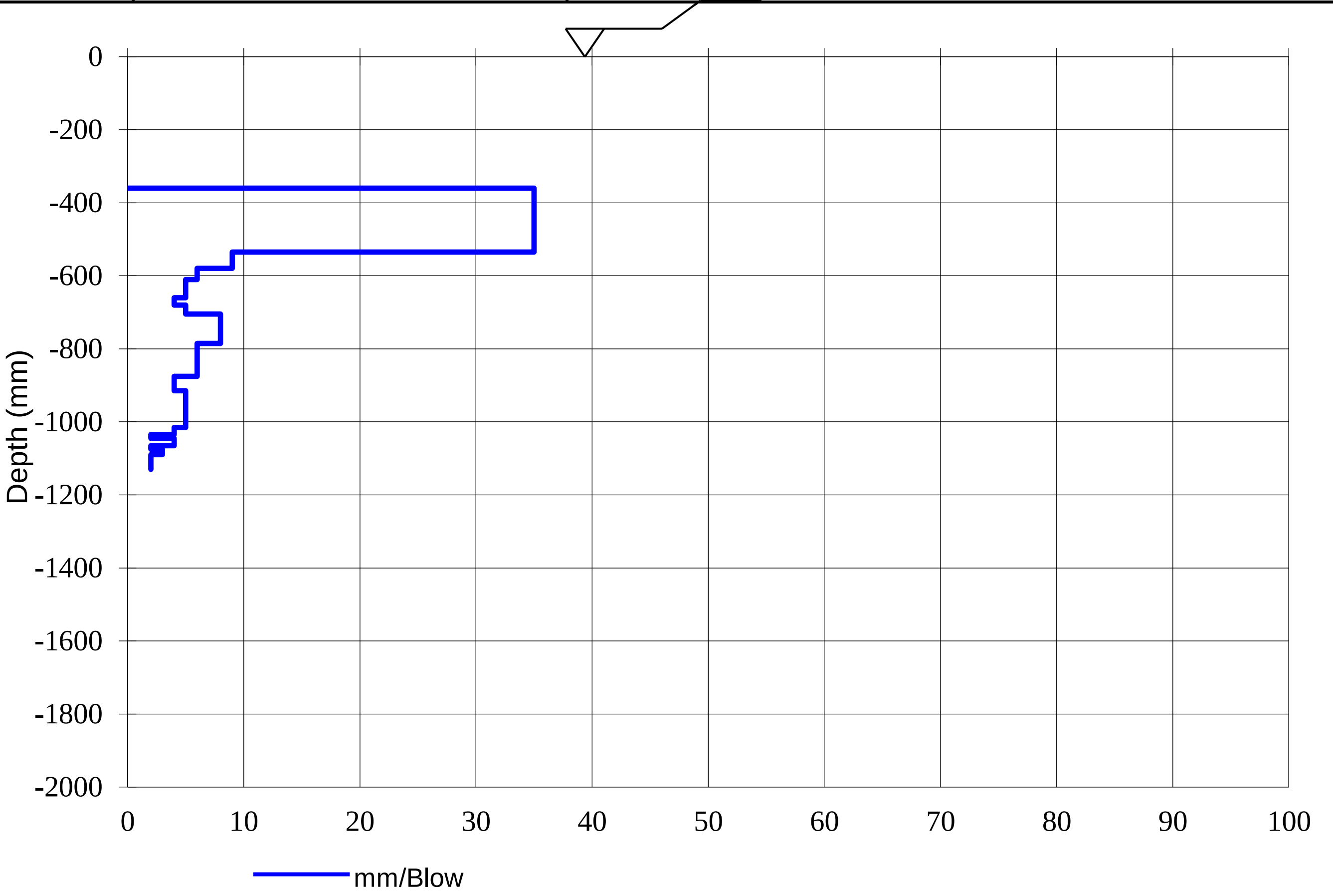
Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za

Customer :	Urban Front Developers Homewood St, Heather Park George 6529	Project :	Erf 19734 Heather Park George
		Date Received :	30.05.2022
		Date Reported :	02.06.2022
		Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	3 of 8

TEST REPORT

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

Position:	TP3	Datum Level:	NGL



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

Outeniqua Geotechnical Services cc.

Geotechnical Engineering Consultants

Registration No. 1999/062743/23

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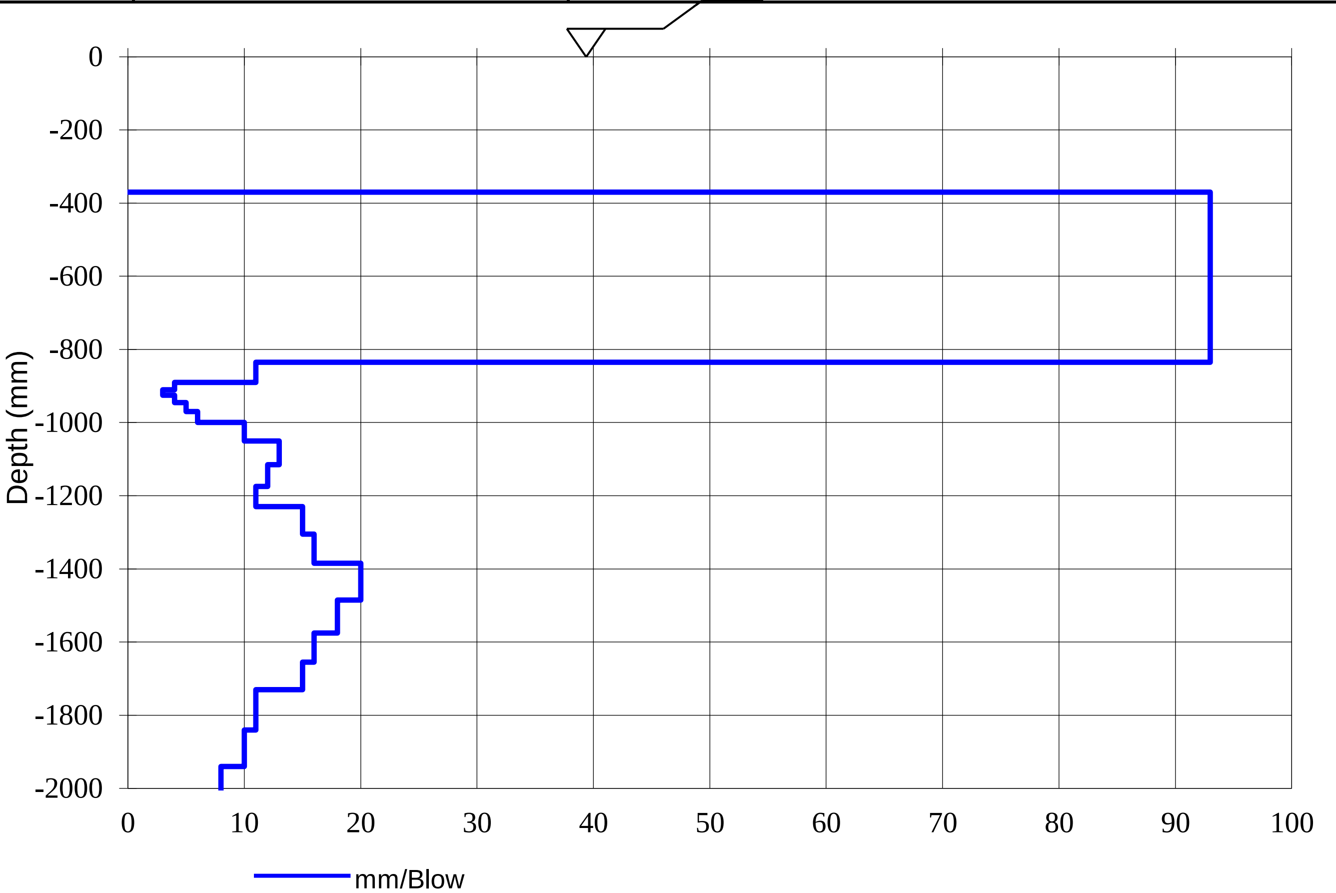
Customer :	Urban Front Developers Homewood St, Heather Park George 6529	Project :	Erf 19734 Heather Park George
		Date Received :	30.05.2022
		Date Reported :	02.06.2022
		Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	4 of 8

TEST REPORT

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

Position:	TP4	Datum Level:	NGL



I Paton (Member)
For Outeniqua Geotech. Services cc.
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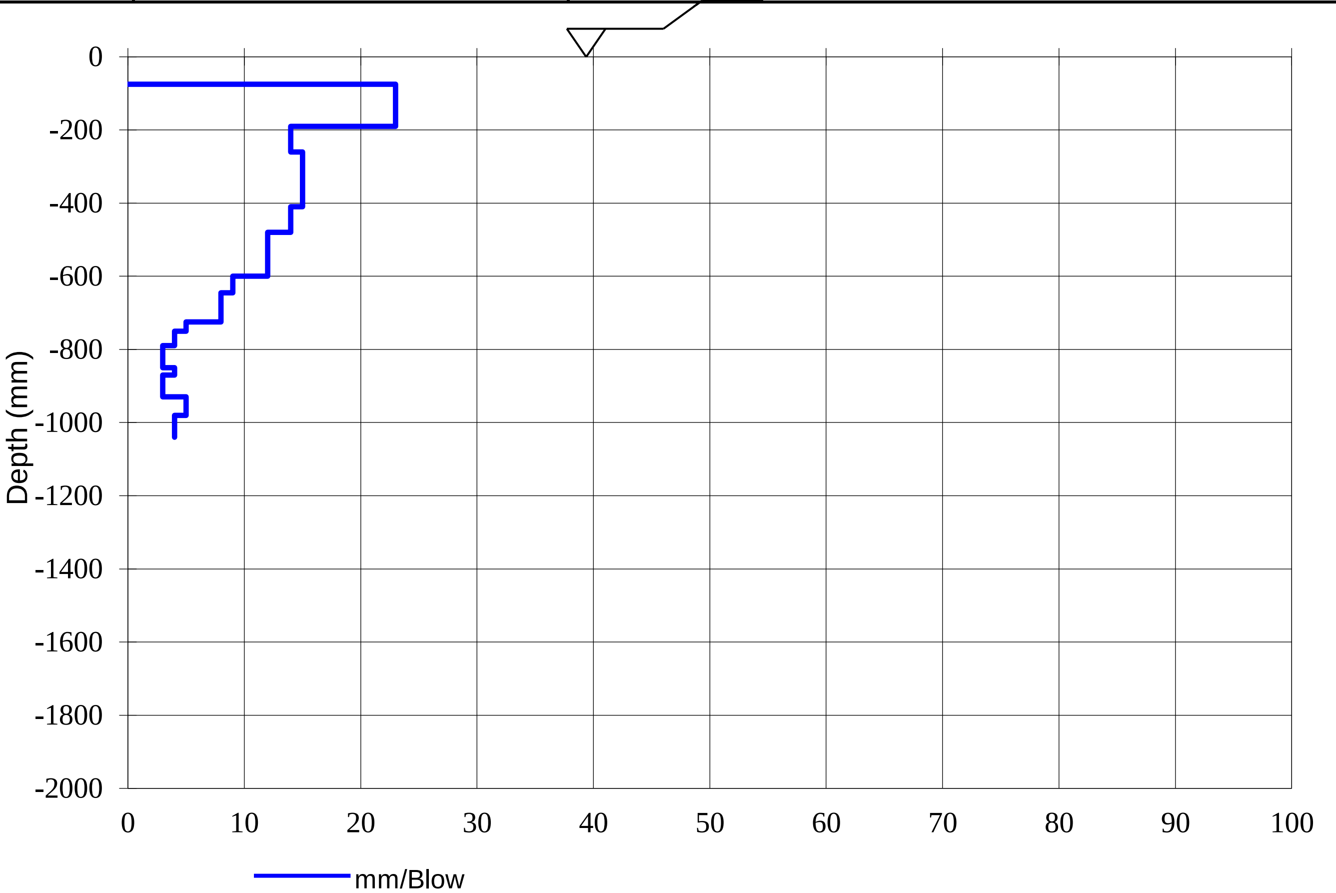
Customer :	Urban Front Developers Homewood St, Heather Park George 6529	Project :	Erf 19734 Heather Park George
		Date Received :	30.05.2022
		Date Reported :	02.06.2022
		Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	5 of 8

TEST REPORT

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

Position:	TP5	Datum Level:	NGL



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

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Geotechnical Engineering Consultants

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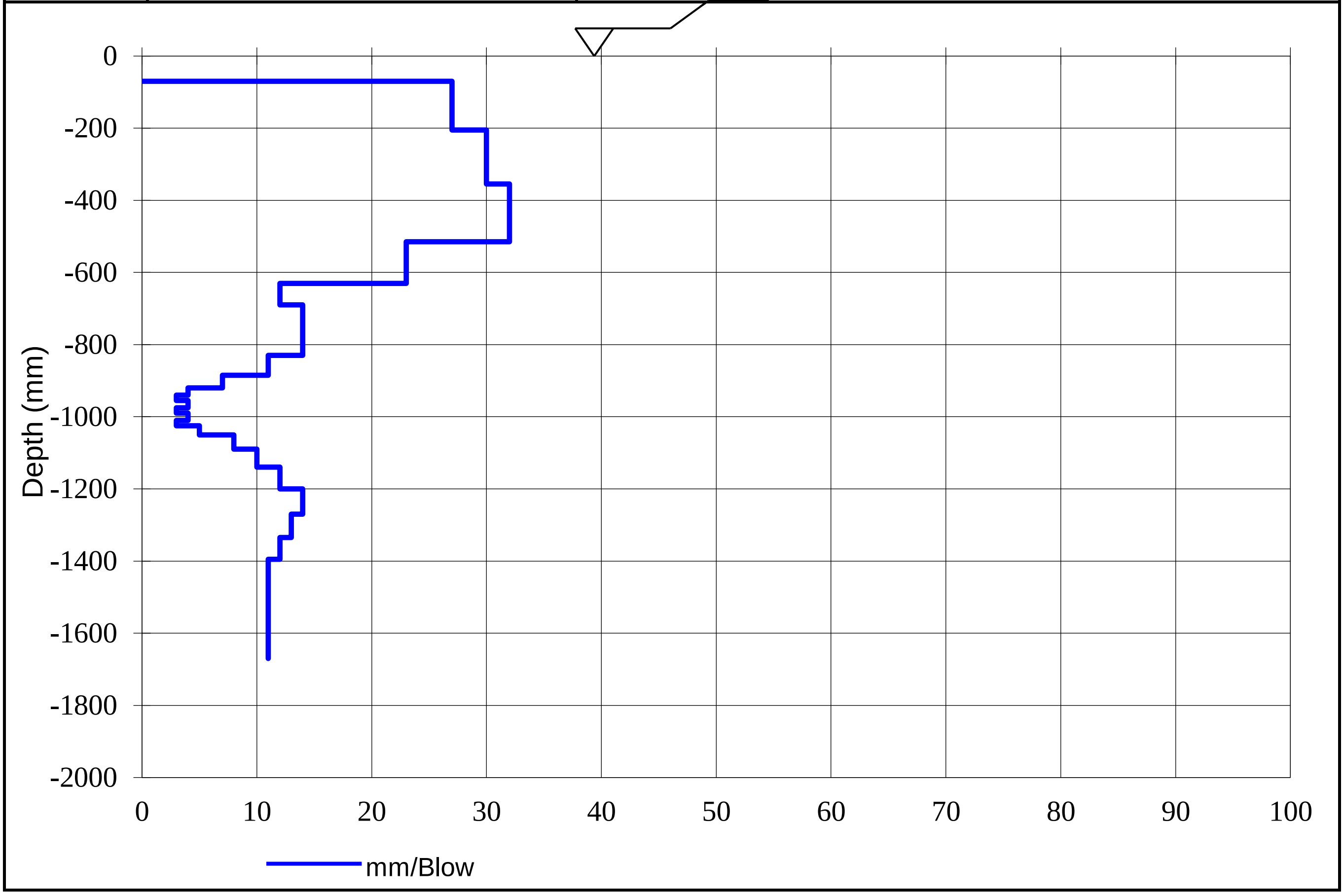
	Homewood St, Heather Park	Date Received :	30.05.2022
	George	Date Reported :	02.06.2022
	6529	Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	6 of 8

TEST REPORT

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

Position:	TP6	Datum Level:	NGL



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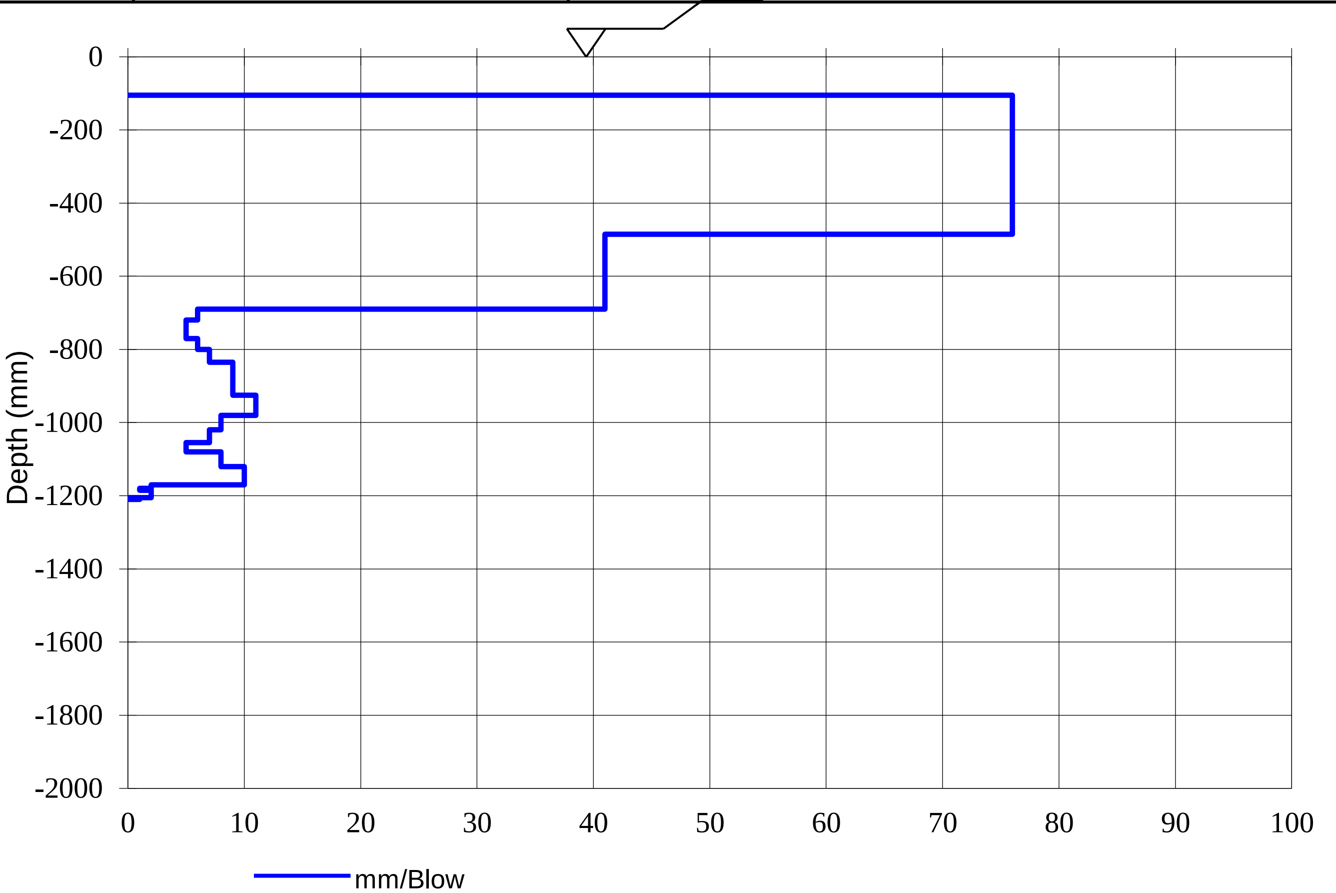
		Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	7 of 8

TEST REPORT

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

Position:	TP7	Datum Level:	NGL



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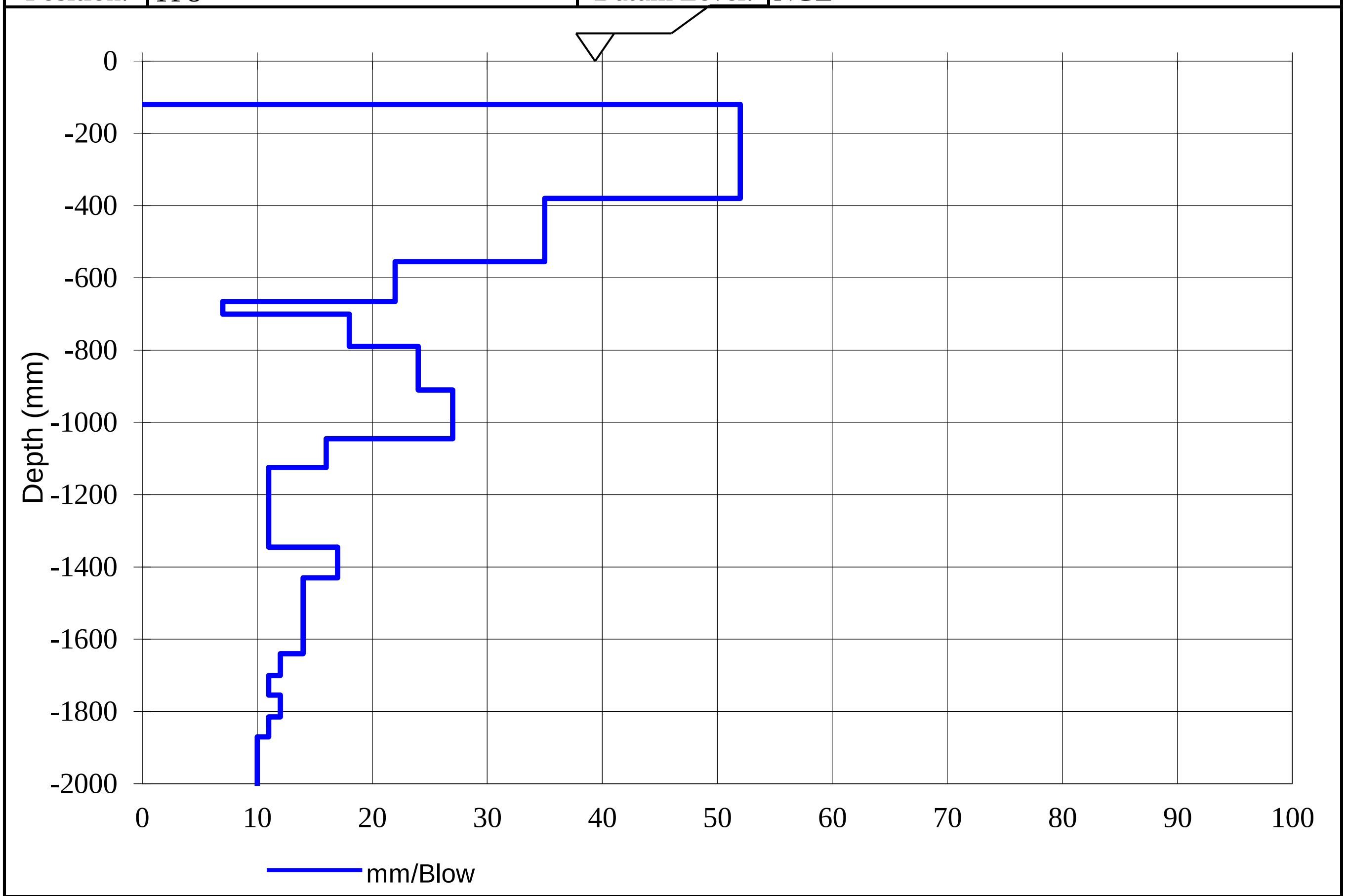
		Date Received :	30.05.2022
		Date Reported :	02.06.2022
		Req. Number :	
Attention :	Shaun Gomez	No. of Pages :	8 of 8

TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP8	Datum Level:	NGL



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Appendix 5

Calculations

Potential Heave Calculations - Van der Merwe Method*

Site: Erf 19374 George TP no: 4

From (Depth in mm)	To (Depth in mm)	Depth from (ft)	Depth to (ft)	Depth factor	Potential Expansiveness	Total Heave (in)	Heave (mm)	NHBRC Cat
0	400	0	1	0.943	0	0.0	0.00	
400	700	1	2	0.824	0	0.0	0.00	
700	2000	2	7	3.018	0.25	0.8	19.16	
2000	2500	7	8	0.422	0	0.0	0.00	
2500	2600	8	9	0.376	0	0.0	0.00	
						0.8	19.16	H2

Potential Expansiveness		Inches
Very High		1
High-Very High		0.75
High		0.5
Medium		0.25
Low		0

* Van der Merwe, D M 1964. The prediction of heave from the plasticity index and percentage clay fraction of soils. The Civil Engineer in South Africa, 6(6): 103–107.

Potential Heave Calculations - Van der Merwe Method*

Site: Erf 19374 George TP no: 8

From (Depth in mm)	To (Depth in mm)	Depth from (ft)	Depth to (ft)	Depth factor	Potential Expansiveness	Total Heave (in)	Heave (mm)	NHBRC Cat
0	400	0	1	0.943	0	0.0	0.00	
400	1000	1	3	1.574	0	0.0	0.00	
1000	1700	3	6	1.795	0.5	0.9	22.80	
1700	2600	6	9	1.271	0	0.0	0.00	
						0.9	22.80	H2

Potential Expansiveness		Inches
Very High		1
High-Very High		0.75
High		0.5
Medium		0.25
Low		0

* Van der Merwe, D M 1964. The prediction of heave from the plasticity index and percentage clay fraction of soils. The Civil Engineer in South Africa, 6(6): 103–107.