

REPORT DVH-20-78A

FINAL GEOTECHNICAL INVESTIGATION REPORT

NEW ACADEMIC HOSPITAL, POLOKWANE

April 2021

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EXECUTIVE SUMMARY

The following key points are considered pertinent to the current report.

- The area of investigation is underlain by gneiss of the Hout River Gneiss. This was confirmed during the current investigation. Residual soils have developed from the weathering of the gneiss bedrock and include localised occurrences of residual schist within the gneiss country rock.
- The site classifies as soft excavation material to depths varying between 0,95m and 2,4m (average depth 1,45m). Below these depths the site classifies as hard rock excavation upon soft rock or better gneiss bedrock. The gneiss bedrock would essentially require excavation by blasting.
- The in-situ soils across the site (localised fill, transported hillwash / pebble marker and reworked / residual gneiss) are considered suitable for use as general fill and selected layer material. Should they be required for use as subbase then they would need to be stabilised. Further laboratory testing would however be required to determine suitable stabilising agents and to optimise mix ratios.
- An allowable bearing pressure of 600kPa could be utilised for the soft rock gneiss. This founding horizon occurs at depths varying between 0,95m and 2,4m (average depth 1,45m). Dependant on final earthworks levels conventional and / or deeper than normal strip / spread foundations could be employed as suitable foundation types. Under these load conditions total and differential settlements would be negligible.
- It is noted that the abovementioned founding horizon exhibits a rugged bedrock topography with pockets of reworked / residual soils being commonly intercalated within the uppermost portions of the bedrock horizon. As such it should be ensured that any reworked / residual soils or zones of intercalated schist are bypassed and removed to spoil during excavation for the foundations.


CLIENT: SAKHIWO HEALTH SOLUTIONS (PTY) LTD

NEW ACADEMIC HOSPITAL, POLOKWANE

FINAL GEOTECHNICAL REPORT

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DVH CONSULTING QUALITY VERIFICATION		
	PREPARED BY	REVIEWED BY
ORIGINAL	Mr J van Huyssteen	Mr J Davel
DATE	April 2021	April 2021
SIGNATURE		

1 INTRODUCTION

1.1 General

DVH Consulting (Pty) Ltd was appointed by SAKHIWO Health Solutions (Pty) Ltd, acting on behalf of the Department of Health, in November 2020 to undertake a geotechnical investigation for the proposed New Academic Hospital development in Polokwane. Our cost proposal (Q196-2020) dated 22 September 2020 was provided to Mr A. Ekermans of Ekcon Engineers & Project Managers. Confirmation to proceed with the investigation was received via a Letter of Appointment from SAKHIWO Health Solutions dated 11 November 2020.

The proposed development will comprise a new Academic Hospital structure with associated access roads and parking areas. Column loads of the order of 4200kN will be associated with the development. Exact earthworks levels are unknown at this stage. However, owing to the current site topography, minor cut to fill terrace operations are anticipated.

1.2 Terms of Reference

The terms of reference for the geotechnical investigation are as follows:

- To establish the nature and relevant engineering properties of the upper in situ soil layers across the site.
- To present foundation recommendations for the proposed structures.
- To comment on excavation procedures as per SANS 1200D, DA and DB for cut excavations and for the installation of services.
- To present materials usage recommendations for the in-situ soils encountered across the site.
- To give foundation recommendations for the proposed structures.
- To comment on any other geotechnical aspects which may affect the development.

2 SITE LOCALITY AND DESCRIPTION

The area of investigation comprises a vacant portion of land situated approximately 550m south east of the intersection of Suid Street and Webster Street in the Flora Park area of Polokwane. Site topography shows a slight dip towards the south. Vegetation on site comprises abundant small to large acacia trees interspersed with veld grass, scrub vegetation and open gravel areas. A site locality plan is presented in Figure 1 below.

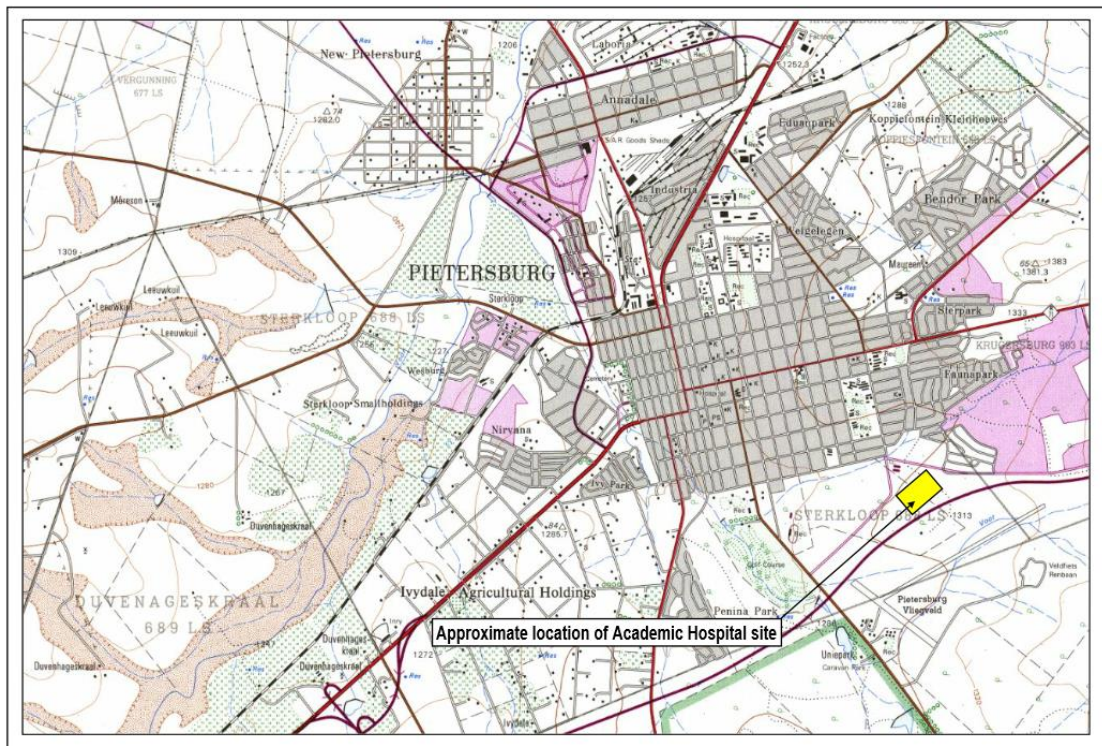


Figure 1: Site Locality Plan, New Academic Hospital, Polokwane

3 METHOD OF INVESTIGATION

3.1 Fieldwork

DVH Consulting established on site and carried out the geotechnical investigation on 23 November 2020. Test pits were excavated across the site using a Doosan 225 LCV tracked excavator. The test pits were excavated to refusal of the machine. All test pits (TP1 to TP18) were profiled in situ by an engineering geologist. Disturbed soil samples were retrieved from the test pit excavations and submitted to Civilab (SANAS Accredited) for laboratory testing. The locations of the test pits TP1 to TP18 are shown on the Site Plan enclosed in Appendix A. The recorded test pit soil profiles are presented in Appendix B.

3.2 Laboratory Testing

The following laboratory tests have been carried out on samples of the in-situ soils recovered from the test pit excavations across the site. The laboratory test procedures are as follows:

Test Description	Test Methods
Atterberg limits and particle size distribution	SANS 3001 GR1, SANS 3001 GR3, SANS 3001 GR10
Moisture/Density and California Bearing Ratio (CBR) tests to evaluate compaction and strength characteristics	SANS 3001 GR30, SANS 3001 GR40

The full set of laboratory test results are presented in Appendix C. For ease of reference the laboratory test results are summarized in Table 1 on page 10, Section 7.

4 REGIONAL & SITE-SPECIFIC GEOLOGY

The regional geological map 1:250 000 “2328 Pietersburg” has been consulted to determine the prevailing geological conditions in the vicinity of the study site. Figure 2 below indicates the approximate location of the study site in relation to the regional geology of the general area.

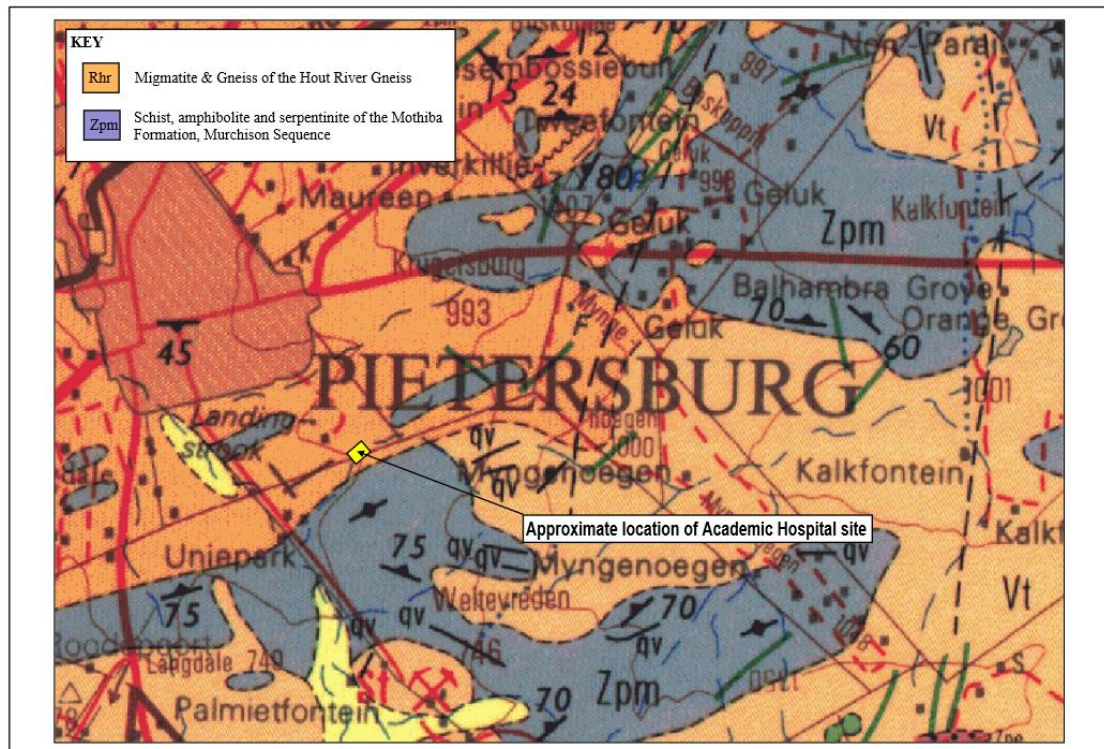


Figure 2: Regional Geology Plan, New Academic Hospital, Polokwane

Figure 2 above indicates that the site is underlain by migmatite and **gneiss** of the Hout River Gneiss. This was confirmed during the current investigation. Residual soils have developed from the weathering of the gneiss bedrock and include overlying transported soil horizons. The general soil profile is as follows.

The upper soil layer typically comprises between 0,1m and 0,6m of loose intact slightly clayey silty sand **transported hillwash** (average thickness 0,3m). Locally the hillwash is overlain by 0,4m to 0,9m of very loose varying to loose layered silty fine sand with scattered gravel. These soils are of **fill** origin and have an average thickness of the order of 0,6m), see test pits TP12 to TP16. No fill was encountered in the remaining test pits across the site.

The localised fill and transported hillwash horizons are underlain by loose varying to medium dense intact slightly clayey silty sand with abundant subrounded quartz gravel and cobbles. These soils represent the **transported pebble marker** horizon and extend to depths varying between 0,5m and 1,4m below present ground level (average depth

0,75m). In the vicinity of test pits TP4, TP7 and TP18 the pebble marker forms the upper soil layer, the aforementioned hillwash and fill horizons being absent from the soil profile in these instances.

The pebble marker is generally underlain by **reworked residual gneiss** comprising loose to medium dense / medium dense intact / weakly ferruginised slightly clayey gravelly silty sand / slightly clayey silty gravelly sand. The reworked zone extends to depths varying between 0,8m and 1,9m below present ground level (average depth 1,25m).

The reworked residual gneiss is underlain by dense jointed silty sandy gravel / gravelly silty sand **residual gneiss**. The residual gneiss soils typically contain scattered to abundant zones of closely to medium jointed highly weathered **very soft rock gneiss** along with abundant zones of loose to medium dense / medium dense **reworked residual gneiss**. Locally the residual gneiss / very soft rock gneiss contains zones of stiff jointed micaceous sandy silt **residual schist** (see test pits TP6 and TP14). The residual gneiss soils with intercalated reworked residual gneiss or very soft rock gneiss and/or localised residual schist persist to depths varying between 0,95m and 2,4m below present ground level (average depth 1,45m) at which depths refusal of the excavator occurred upon the underlying **soft rock gneiss bedrock**.

No perched water table or zones of seepage were noted in any of the test pits excavated across the site at the time of the fieldwork.

5 EXCAVATION PROCEDURES

The site has been evaluated in terms of excavation procedures as defined in the SANS documents (SANS1200D, DA and DB). Based on the criteria in the SANS documents the site can be classified as follows.

The site classifies as **soft excavation material** to depths varying between 0,8m and 1,9m below present ground level (average depth 1,1m).

Below these depths the site classifies as **intermediate excavation material** in the form of very soft rock gneiss with abundant zones of reworked / residual gneiss. The intermediate excavation material could be removed using medium to heavy earthmoving equipment. The intermediate excavation material extends to depths varying between 0,95m and 2,4m (average depth 1,45m).

Below these depths the site classifies as **hard rock excavation** upon soft rock or better gneiss bedrock. The gneiss bedrock would essentially require excavation by **blasting**.

6 EVALUATION OF FOUNDING CONDITIONS

The localised upper fill materials are considered to be potentially highly collapsible, even under their own self weight. The transported hillwash / pebble marker and underlying reworked residual gneiss soils are considered to be potentially highly compressible and/or collapsible. These soil layers are considered unsuitable for use as founding horizons for the employing of conventional foundation procedures, even for lightly loaded structures.

Owing to the anticipated high column loads associated with the development, it is recommended that the following founding solution be employed.

An allowable bearing pressure of 600kPa could be utilised for the soft rock or better gneiss bedrock. This founding horizon occurs at depths varying between 0,95m and 2,4m below present ground level (average depth 1,45m). Dependant on final earthworks levels **conventional and / or deeper than normal strip / spread foundations** could be employed as suitable foundation types. Under the above load conditions total and differential settlements would be negligible.

Further to the above, it is noted that the abovementioned founding horizon exhibits a highly undulatory bedrock topography with pockets of reworked / residual gneiss commonly occurring at / immediately above the gneiss bedrock. Intercalations of residual schist were also encountered locally within the gneiss bedrock (see test pits TP6 and TP14). As such, it is recommended that the foundations for the structure be placed upon the gneiss bedrock at the level of excavator refusal (25 ton or similar), with all efforts being made to ensure that the foundation excavations are taken down to a level such that the underlying gneiss bedrock is exposed across the full extent of the excavation. All pockets of loose / soft material would need to be excavated to spoil. This may require additional undercutting within the foundation excavations, following which levels could be reinstated utilising 10MPa mass concrete to the underside of the foundations. The foundation excavations should be inspected by an engineering geologist / geotechnical engineer prior to the placing of concrete so as to ensure that the correct founding horizon has been attained in all instances.

7 MATERIALS USAGE

Laboratory testing has been carried out on the soil samples obtained during the fieldwork. Based on analyses of the laboratory test results and our visual assessment from the fieldwork, the following comments are considered appropriate to the suitability of the on-site soils for use as construction material in bulk fill operations and as layerworks for access roads and parking areas.

- The upper 150mm of in situ soils across the site contains abundant organic matter and is thus unsuitable for use as construction material. This material should be removed to spoil prior to construction commencing. It is envisaged that in the vicinity of large trees, that at least the upper 0,5m of in situ soils, would have to be removed owing to the presence of abundant tree roots. This depth would have to be verified upon commencement of site clearing.
- The in-situ soils across the site (localised fill, transported hillwash / pebble marker, reworked / residual gneiss and/or very soft rock gneiss) are considered suitable for use as general fill and selected layer material. Should they be required for use as subbase then they would need to be stabilised. Further laboratory testing would however be required to determine suitable stabilising agents and to optimise mix ratios.
- The localised residual schist soils are considered to be moderately to highly plastic and are thus unsuitable for use as construction material. These soils should be removed to spoil if / where intersected in cut excavations.

Should materials need to be imported onto site for use in the construction of bulk fill terraces and as layerworks for access roads and parking areas then these materials should be of a minimum G7 quality. The laboratory test results are summarized in Table 1 below.

Table 1: Summary of laboratory test results, Polokwane Academic Hospital site

Test Pit No.	Depth of Sample (m)	Layer Description	Atterberg Limits			Grading Modulus (GM)	Mod AASHTO Data			CBR at Mod AASTHO Compaction				TRH-14 Classification	COLTO Classification
			Liquid Limit (LL)	Plasticity Index (PI)	Linear Shrinkage (LS)		Optimum Moisture Content (%)	Maximum Dry Density (kg/m ³)	Swell (%)	90%	93%	95%	98%		
TP5	0,6 - 1,0	Reworked residual gneiss	0	NP	0	1,99	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP17	1,1-1,5	Residual gneiss	29	13	5,5	2,22	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP3	0,1 - 0,6	Pebble Marker	28	14	6	2,50	6,1	2216	0,1	33	45	55	75	G6	G7
TP5	0,6 - 1,5	Reworked + residual gneiss	24	9	4	2,50	6,1	2199	0,1	37	53	67	96	G5	G5

8 SURFACE BEDS

The following comments are related to the surface bed recommendations.

- The surface beds could be placed conventionally on top of the in-situ soil within areas of cut. The upper 150mm of soil should however be ripped and recompacted to 90% of Mod AASHTO density at optimum moisture content prior to placing of concrete.
- An exception is seen in the vicinity of test pits TP12 to TP16 where the existing uncontrolled fill materials of loose / very loose consistency should be excavated and removed to spoil in their entirety. Levels should then be reinstated per the point below utilizing imported materials of a minimum G7 quality prior to the placing of surface beds across these portions of the site.
- Within areas of engineered fill, the fill should be compacted in 150mm thick layers to a minimum of 90% of Mod AASHTO density at optimum moisture content.
- Should the cut terrace excavations expose gneiss bedrock at final terrace level it should be ensured that there is cover of at least 300mm of engineered fill above the gneiss bedrock prior to placing of surface beds. This would be to provide a consistent foundation platform for the surface beds. This fill should be compacted in 150mm layers to 90% of Mod AASHTO density at optimum moisture content.
- All surface beds should be kept free of vertical external and internal walls and structural members. That is, the surface beds should be allowed to “float”. This would require that the surface bed be placed upon a polyethylene plastic geomembrane which is folded up on the perimeter between concrete and brickwork to serve both as a bond-breaker and an isolation joint between concrete and brickwork.

9 ACCESS ROADS & PARKING AREAS

Based on the laboratory test results and our visual assessment from the fieldwork the following comments are related to the recommendations for access roads and parking areas.

- For pavement design purposes, it is estimated that the upper in situ subgrade material at final terrace level would have a CBR of the order of 20 to 25 percent if compacted to 90% of Mod AASHTO density at optimum moisture content, and of the order of 35 to 40 percent if compacted to 93% of Mod AASHTO density at optimum moisture content.
- Should the cut terrace excavations expose gneiss bedrock at final terrace level it should be ensured that there is cover of at least 300mm of engineered fill

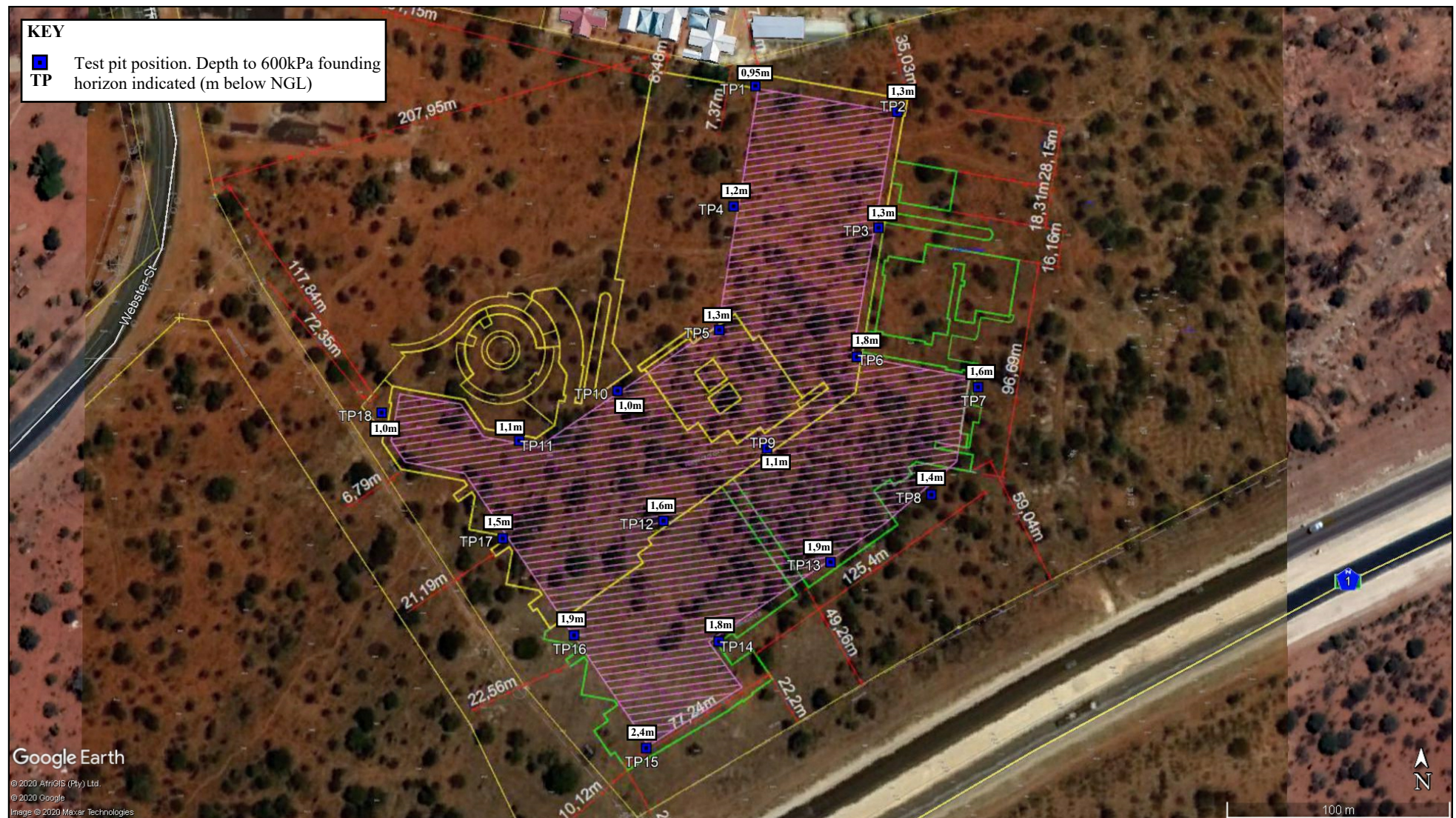
(including layerworks) above the gneiss bedrock prior to placing of final layerworks. This would be to provide a consistent foundation platform for the access roads / parking areas. This fill should be compacted in 150mm layers to the required layerworks design specification.

- Should brick paving be utilised for proposed access roads / parking areas, it is recommended that the layer immediately below the bedding sand be stabilised so as to seal the layerworks from stormwater ingress from above.

10 SUB-SURFACE DRAINAGE

No perched water table or zones of seepage were encountered in the test pit excavations across the site at the time of the investigation. However, the following comments are considered relevant to the design and construction of the development in terms of sub-surface drainage.

- Conventional drainage should be allowed for behind all retaining walls within areas of cut.
- Particular attention must be paid to ensure that the damp-proof membrane (DPM) and damp-proof course (DPC) is suitably installed in order to avoid problems in the future with rising damp.



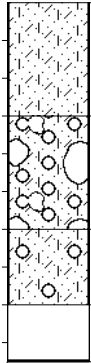
PROJECT: DVH-20-78
NEW ACADEMIC HOSPITAL DEVELOPMENT
POLOKWANE
NOVEMBER 2020

SITE PLAN INDICATING APPROXIMATE LOCATIONS
OF TEST PIT EXCAVATIONS. DEPTHS TO
RECOMMENDED FOUNDING HORIZON INDICATED

**DAVEL &
VAN HUYSSTEEN**
CONSULTING ENGINEERING GEOLOGISTS



Scale
1:20



0.00

Slightly moist to moist reddish brown loose intact slightly clayey silty sand. Hillwash. Contains abundant tree roots to 0,5m.

0.30

As above but loose to medium dense and contains abundant subrounded quartz gravel and cobbles. Pebble Marker.

0.60

Moist reddish brown mottled black loose to medium dense intact slightly clayey gravelly silty sand. Reworked residual gneiss.

0.80

Moist light yellow brown speckled off white light brown highly weathered widely jointed very soft rock gneiss with abundant zones of loose to medium dense reworked residual gneiss.

0.95

NOTES

- 1) Refusal at 0,95m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

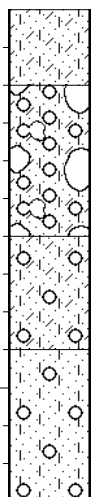
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DATE : 24/11/2020
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ELEVATION :
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Y-COORD : -48792

HOLE No: TP01



Scale
1:20



0.00

Moist reddish brown loose intact slightly clayey silty sand. Hillwash. Contains abundant roots to 0,15m.

0.20

As above but contains abundant subrounded quartz gravel and cobbles. Pebble Marker.

0.60

Moist reddish brown mottled off white black medium dense weakly ferruginised slightly clayey gravelly silty sand. Reworked residual gneiss.

0.90

Moist off white speckled orange brown mottled and blotched red brown dense with abundant zones of medium dense jointed gravelly silty sand. Residual gneiss with abundant zones of reworked residual gneiss.

1.30

NOTES

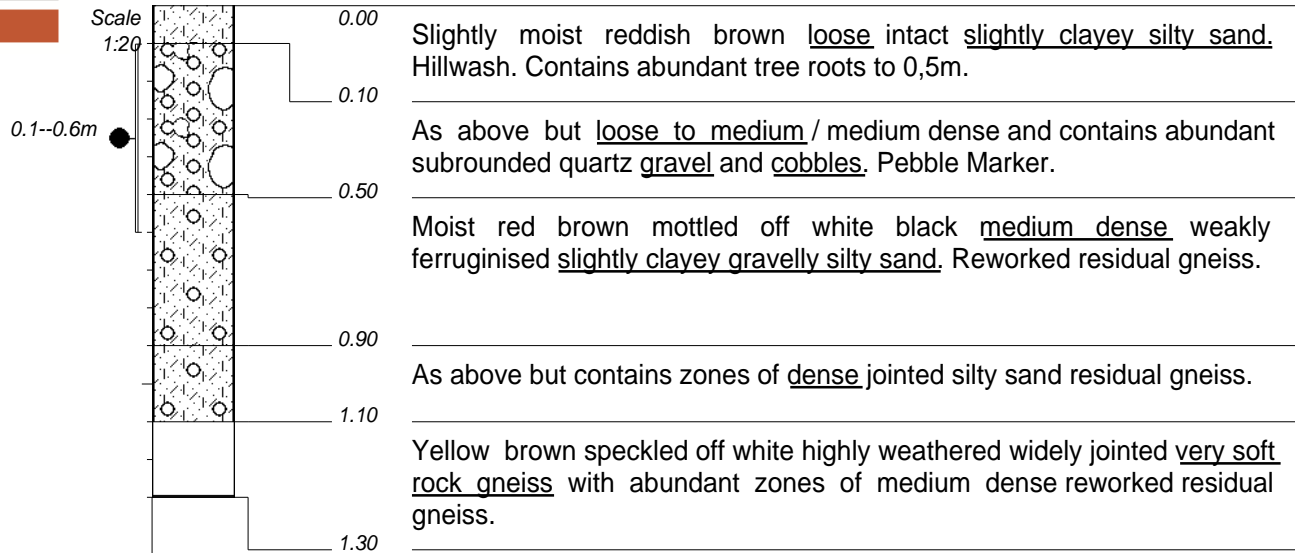
- 1) Refusal at 1,3m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
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PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

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ELEVATION :
X-COORD : 2646449
Y-COORD : -48855

HOLE No: TP02



NOTES

- 1) Refusal at 1,3m on soft rock gneiss.
- 2) No evidence of water.
- 3) Disturbed sample taken at 0,1--0,6m.

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PROFIED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

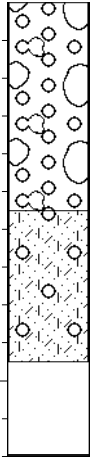
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ELEVATION :
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Y-COORD : -48846

HOLE No: TP03



Scale
1:20



0.00

Slightly moist to moist red brown and off white loose to medium dense intact slightly clayey silty sand with abundant subrounded quartz gravel and cobbles. Pebble Marker. Contains abundant roots to 0,15m.

0.55

Moist reddish brown mottled black loose to medium dense intact slightly clayey silty gravelly sand. Reworked residual gneiss.

0.95

Light yellow brown speckled off white highly weathered medium jointed very soft rock gneiss with abundant zones of loose to medium dense intact slightly clayey silty sand reworked residual gneiss.

1.20

NOTES

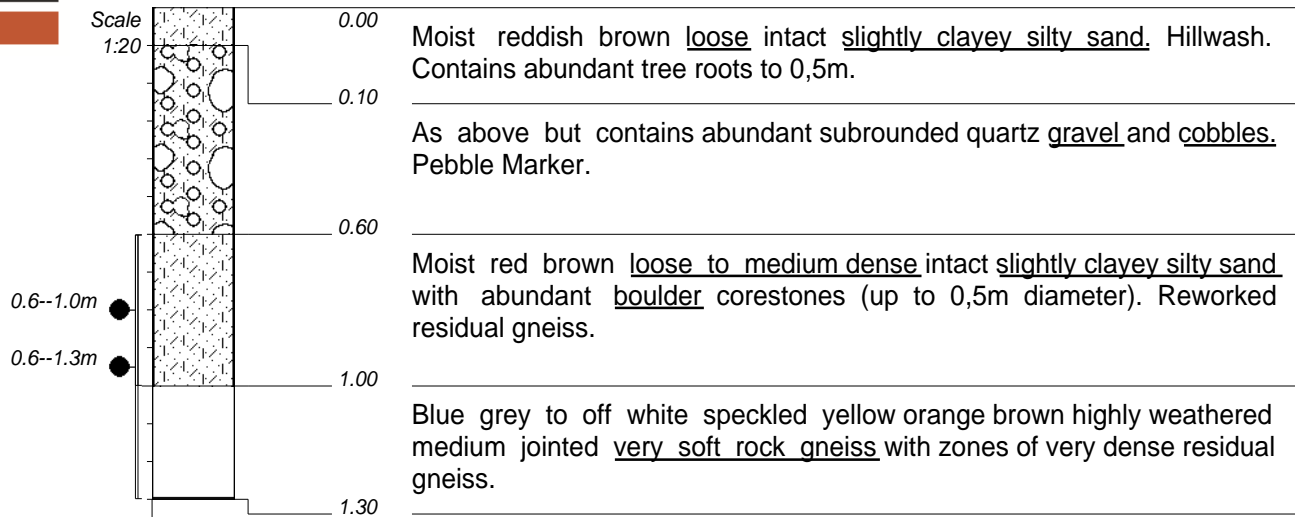
- 1) Refusal at 1,2m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
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SETUP FILE : STANDARD.SET

INCLINATION :
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ELEVATION :
X-COORD : 2646489
Y-COORD : -48781

HOLE No: TP04



NOTES

- 1) Refusal at 1,3m on soft rock gneiss.
- 2) No evidence of water.
- 3) Disturbed samples taken at 0,6--1,3m and 0,6--1,0m.

CONTRACTOR :
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DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

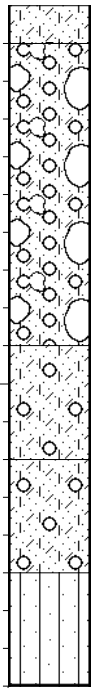
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ELEVATION :
X-COORD : 2646548
Y-COORD : -48775

HOLE No: TP05



Scale
1:20



0.00

0.10

0.90

1.20

1.50

1.80

Slightly moist dark brown loose intact slightly clayey silty sand. Hillwash. Contains abundant roots to 0,15m.

As above but contains abundant subrounded quartz gravel and cobbles. Pebble Marker.

Moist red brown mottled black off white loose to medium dense weakly ferruginised / intact slightly clayey gravelly silty sand. Reworked residual gneiss.

As above but medium dense to dense.

Moist olive green speckled and mottled dark brown stiff jointed and foliated slightly sandy micaceous silt. Reworked residual schist with abundant zones of very soft rock schist.

NOTES

- 1) Refusal at 1,8m on soft rock gneiss with abundant zones of very stiff to very soft rock schist.
- 2) No evidence of water.
- 3) Zone of stiff residual schist at 1,8m depth in centre of test pit.

CONTRACTOR :
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DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
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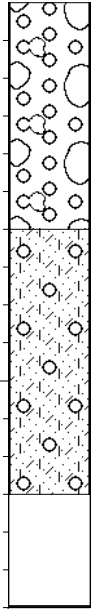
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Y-COORD : -48837

HOLE No: TP06



Scale
1:20



0.00

Moist reddish brown and off white medium dense intact slightly clayey silty sand with abundant subrounded quartz gravel and cobbles. Pebble Marker. Contains abundant roots to 0,15m.

0.60

Moist red brown mottled off white medium dense intact slightly clayey gravelly silty sand. Reworked residual gneiss with scattered zones of very soft rock gneiss.

1.30

Moist off white speckled yellow brown and red brown highly weathered closely jointed very soft rock gneiss.

1.60

NOTES

- 1) Refusal at 1,6m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
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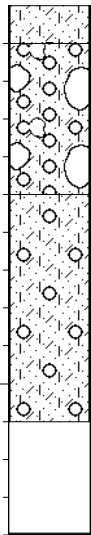
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ELEVATION :
X-COORD : 2646573
Y-COORD : -48891

HOLE No: TP07



Scale
1:20



0.00

0.10

0.50

1.10

1.40

Moist reddish brown loose intact slightly clayey silty sand. Hillwash. Contains abundant tree roots to 0,5m.

As above but contains abundant subrounded quartz gravel and cobbles. Pebble Marker.

Moist red brown loose to medium dense intact slightly clayey gravelly silty sand. Reworked residual gneiss.

Light yellow brown speckled off white streaked red brown highly weathered closely jointed very soft rock gneiss with scattered zones of dense residual gneiss abundant zones of medium dense reworked residual gneiss.

NOTES

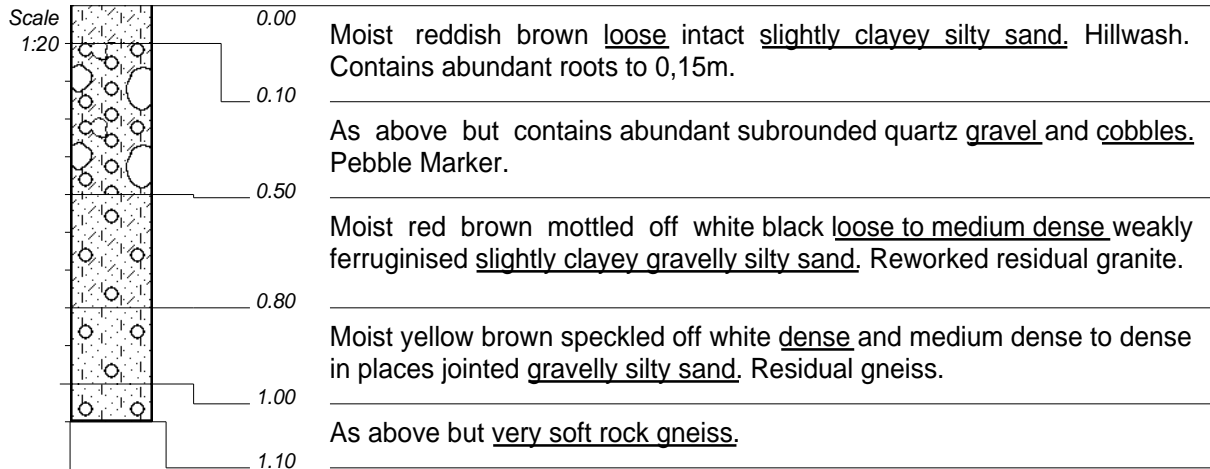
- 1) Refusal at 1,4m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
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ELEVATION :
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Y-COORD : -48871

HOLE No: TP08



NOTES

- 1) Refusal at 1,1m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
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DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

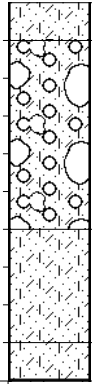
INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646600
Y-COORD : -48795

HOLE No: TP09



Scale
1:20



0.00

0.10

0.60

0.90

1.00

Slightly moist reddish brown loose intact slightly clayey silty sand. Hillwash. Contains abundant roots to 0,15m.

As above but contains abundant subrounded quartz gravel and cobbles. Pebble Marker.

Moist yellow orange brown speckled and streaked black medium dense jointed slightly clayey silty sand. Residual gneiss with abundant zones of intact reworked residual gneiss.

As above but very soft rock gneiss.

NOTES

- 1) Refusal at 1,0m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

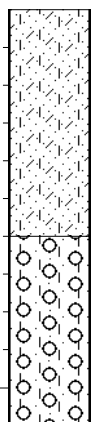
INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646572
Y-COORD : -48727

HOLE No: TP10



Scale
1:20



0.00

Slightly moist reddish brown loose intact slightly clayey silty sand. Hillwash. Contains abundant roots to 0,15m.

0.60

Moist olive brown speckled yellow off white dense jointed silty sandy gravel with scattered boulder corestones (up to 0,4m diameter). Residual gneiss with abundant zones of very soft rock gneiss.

1.10

NOTES

- 1) Refusal at 1,1m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

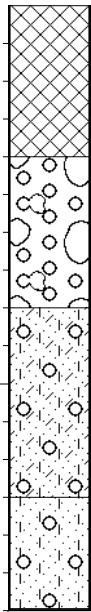
INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646597
Y-COORD : -48684

HOLE No: TP11



Scale
1:20



0.00

Slightly moist grey brown loose layered silty fine sand. Fill.

0.40

Moist reddish brown and off white medium dense intact slightly clayey silty sand with abundant subrounded quartz gravel and cobbles. Pebble Marker.

0.80

Moist red brown mottled off white black loose to medium dense intact slightly clayey gravelly silty sand. Reworked residual gneiss.

1.30

Moist yellow brown speckled off white dense with abundant zones of medium dense jointed gravelly silty sand. Residual gneiss with abundant zones of very soft rock gneiss and zones of medium dense reworked residual gneiss.

1.60

NOTES

- 1) Refusal at 1,6m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

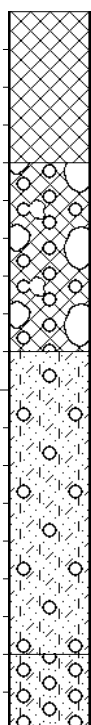
INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646631
Y-COORD : -48749

HOLE No: TP12



Scale
1:20



0.00

Slightly moist dark brown loose layered silty fine sand. Fill. Contains abundant roots to 0,15m.

0.40

As above but medium dense and contains abundant subrounded quartz gravel and cobbles. Pebble Marker.

0.90

Moist red brown and yellow brown in places loose to medium dense intact slightly clayey gravelly silty sand. Reworked residual gneiss.

1.70

As above but sandy gravel and contains abundant zones of very soft rock gneiss.

1.90

NOTES

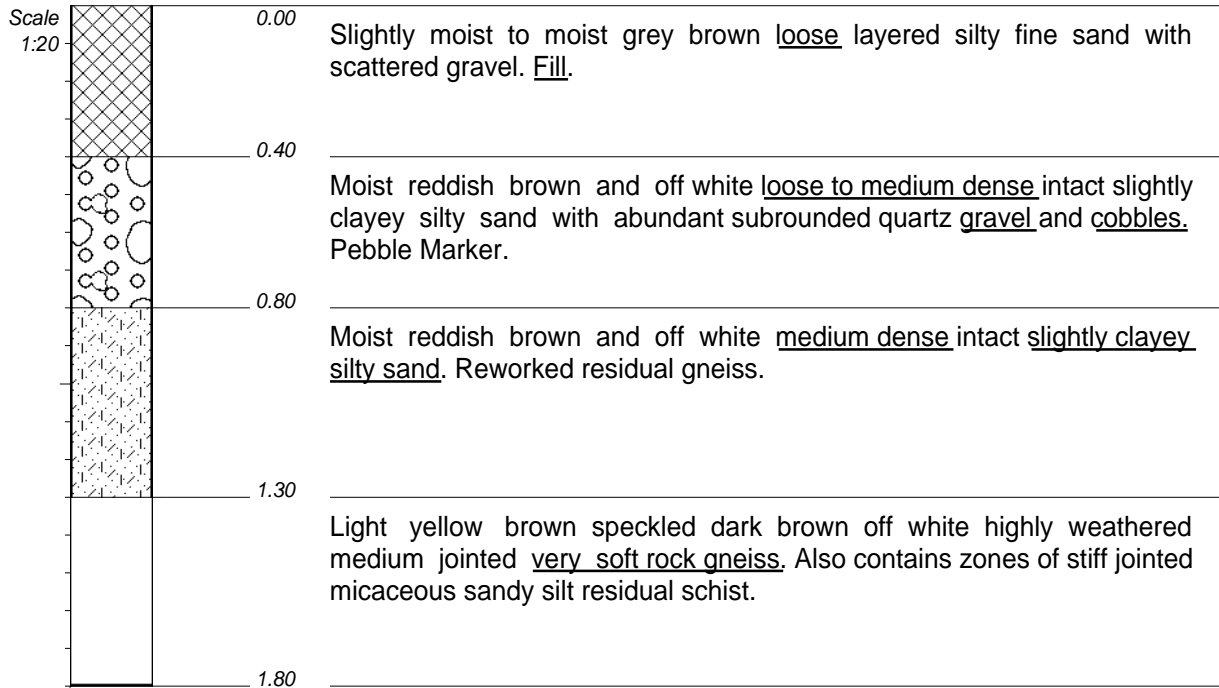
- 1) Refusal at 1,9m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646649
Y-COORD : -48826

HOLE No: TP13



NOTES

- 1) Refusal at 1,8m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFILED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

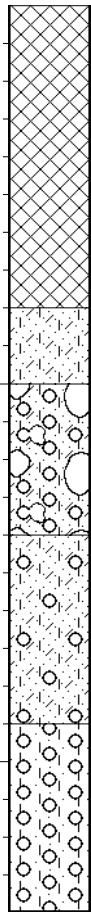
INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646686
Y-COORD : -48775

HOLE No: TP14



Scale
1:20



0.00

Slightly moist grey brown very loose layered silty fine sand. Fill.

0.80

Moist reddish brown loose to medium dense intact slightly clayey silty sand. Hillwash.

1.00

As above but contains abundant subrounded quartz gravel and cobbles. Pebble Marker.

1.40

Moist red brown and off white loose to medium dense and medium dense in places intact / weakly ferruginised slightly clayey gravelly silty sand. Reworked residual gneiss.

1.90

Moist light yellow brown speckled off white very dense with abundant zones of very soft rock jointed silty sandy gravel. Residual gneiss with abundant zones of very soft rock gneiss.

2.40

NOTES

- 1) Refusal at 2,4m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFIED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

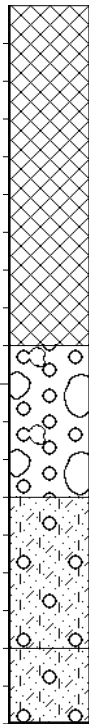
INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646732
Y-COORD : -48741

HOLE No: TP15



Scale
1:20



0.00

Slightly moist to moist grey brown very loose layered silty fine sand. Fill.

0.90

Moist red brown and off white medium dense intact slightly clayey silty sand with abundant quartz gravel and cobbles. Pebble Marker.

1.30

Moist red brown mottled off white black loose to medium dense intact / weakly ferruginised slightly clayey gravelly silty sand. Reworked residual gneiss.

1.70

As above but contains scattered zones of dense residual gneiss.

1.90

NOTES

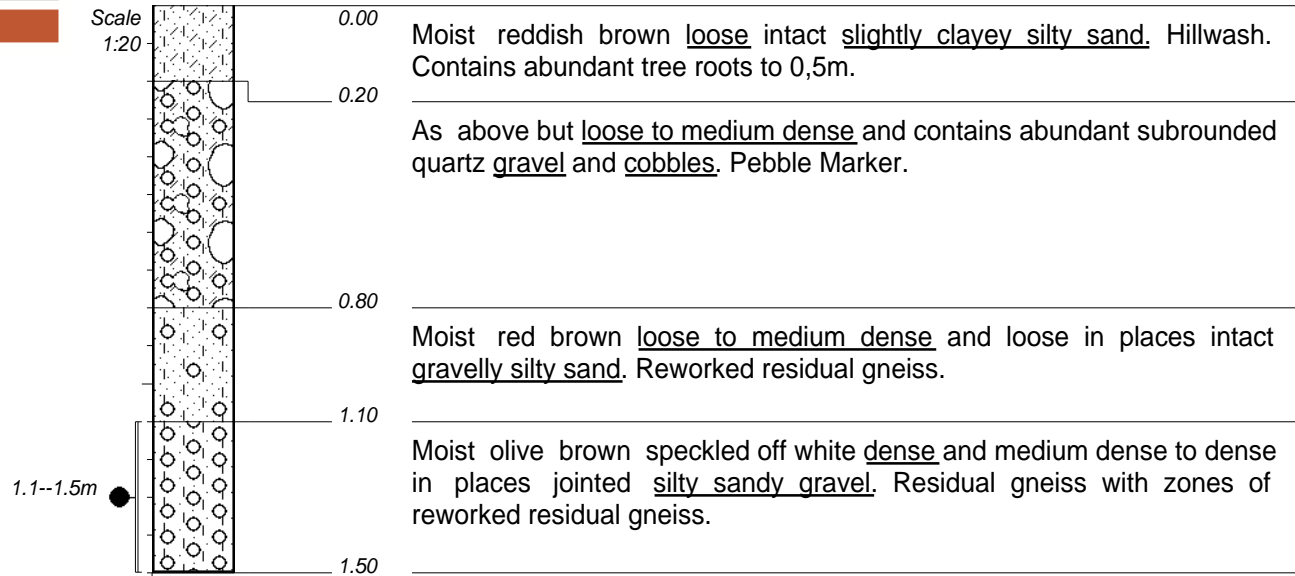
- 1) Refusal at 1,9m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFIED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646683
Y-COORD : -48710

HOLE No: TP16



NOTES

- 1) Refusal at 1,5m on soft rock gneiss.
- 2) No evidence of water.
- 3) Disturbed sample taken at 1,1--1,5m.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFIED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

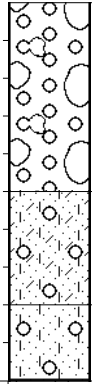
INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646640
Y-COORD : -48676

HOLE No: TP17



Scale
1:20



0.00

Moist reddish brown and off white medium dense intact slightly clayey silty sand with abundant subrounded quartz gravel and cobbles. Pebble Marker.

0.50

Moist red brown medium dense and loose to medium dense in places intact slightly clayey gravelly silty sand. Reworked residual gneiss.

0.80

Moist yellow brown speckled reddish brown off white dense and medium dense in places jointed silty gravelly sand. Residual gneiss with abundant zones of reworked residual gneiss.

1.00

NOTES

- 1) Refusal at 1,0m on soft rock gneiss.
- 2) No evidence of water.

CONTRACTOR :
MACHINE : Doosan 225 LCV
DRILLED BY :
PROFIED BY : J van Huyssteen
TYPE SET BY : JvH
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 24/11/2020
DATE : 26/01/2021 11:03
TEXT : ..micHospitalPolokwane.txt

ELEVATION :
X-COORD : 2646584
Y-COORD : -48619

HOLE No: TP18

Client : DAVEL & VAN HUYSSTEEN CONSULTING (PTY)
Address : 9 LANGWA STREET
 : STRIJDOMPARK
 : RANDBURG

Client Reference :
Order No. : Justin

Attention :
Facsimile :
E-mail : justin.davel@dvhgeotech.co.za; justin.vanhu

Date Received : 25/11/2020
Date Tested : 25/11/2020 - 12/01/2021
Date Reported : 13/01/2021

Project : Polokwane Hospital
Project No. : 2020-B-1574

Report Status : Final
Page : 1 of 5

Herewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

Test(s) conducted / Item(s) measured	Qty.	Test Method(s)	Authorized By**	Page(s)
Moisture Density Relationship	2.000	SANS 3001 GR30	S Pullen	3-4
Atterberg Limits <0.425mm	4.000	SANS 3001 GR10	S Pullen	2, 5
Sieve Analysis 0.075mm	4.000	SANS 3001 GR1	S Pullen	2, 5
California Bearing Ratio (CBR)	2.000	SANS 3001 GR40	S Pullen	5
Hydrometer Analysis	2.000	SANS 3001 GR3	S Pullen	2

Any test results contained in this report and marked with * in the table above are "not SANAS accredited" and are not included in the schedule of accreditation for this laboratory.

Any information contained in this test report pertain only to the areas and/or samples tested. Documents may only be reproduced or published in their full context.

While every care is taken to ensure that all tests are carried out in accordance with recognised standards, neither Civilab (Proprietary) Limited nor its employess shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequences thereof.

All interpretations, Interpolations, Opinions and/or Classifications contained in this report falls outside our scope of accreditation.


The following parameters, where applicable, were excluded from the classification procedure: Chemical modifications, Additional fines, Fractured Faces, Soluble Salts, pH, Conductivity, Coarse Sand Ratio, Durability (COLTO: G4-G9).

The following parameters, where applicable, were assumed: Rock types were assumed to be of an Arenaceous nature with Siliceous cementing material.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

This report is completely confidential between the parties (Civilab and Civilab's client) and shall not be disclosed to anybody else, unless agreed upon in writing or made publicly available by the client or required to make available by law.

Deviations in Test Methods:

Technical Signatory:	B. Mubini
Signature:	

**All results are authorized electronically by approved managers and/or technical signatories.

Client :	DAVEL & VAN HUYSSTEEN CONSULTING (PTY)		
Address :	9 LANGWA STREET	Client Reference :	
	STRIJDOPARK	Order No. :	Justin
	RANDBURG		
Attention :		Date Received :	25/11/2020
Facsimile :		Date Tested :	25/11/2020 - 12/01/2021
E-mail :	justin.davel@dvhgeotech.co.za; justin.vanhuy	Date Reported :	22/01/2021
Project :	Polokwane Hospital		
Project No. :	2020-B-1574	Report Status :	Final
		Page :	1 of 5

Herewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

Test(s) conducted / Item(s) measured	Qty.	Test Method(s)	Authorized By**	Page(s)
Moisture Density Relationship	2.000	SANS 3001 GR30	S Pullen	3-4
Atterberg Limits <0.425mm	4.000	SANS 3001 GR10	S Pullen	2, 5
Sieve Analysis 0.075mm	4.000	SANS 3001 GR1	S Pullen	2, 5
California Bearing Ratio (CBR)	2.000	SANS 3001 GR40	S Pullen	5
Hydrometer Analysis	2.000	SANS 3001 GR3	S Pullen	2

Any test results contained in this report and marked with * in the table above are "not SANAS accredited" and are not included in the schedule of accreditation for this laboratory.

Any information contained in this test report pertain only to the areas and/or samples tested. Documents may only be reproduced or published in their full context.

While every care is taken to ensure that all tests are carried out in accordance with recognised standards, neither Civilab (Proprietary) Limited nor its employess shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequences thereof.

All interpretations, Interpolations, Opinions and/or Classifications contained in this report falls outside our scope of accreditation.

The following parameters, where applicable, were excluded from the classification procedure: Chemical modifications, Additional fines, Fractured Faces, Soluble Salts, pH, Conductivity, Coarse Sand Ratio, Durability (COLTO: G4-G9).

The following parameters, where applicable, were assumed: Rock types were assumed to be of an Arenaceous nature with Siliceous cementing material.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

This report is completely confidential between the parties (Civilab and Civilab's client) and shall not be disclosed to anybody else, unless agreed upon in writing or made publicly available by the client or required to make available by law.

Deviations in Test Methods:

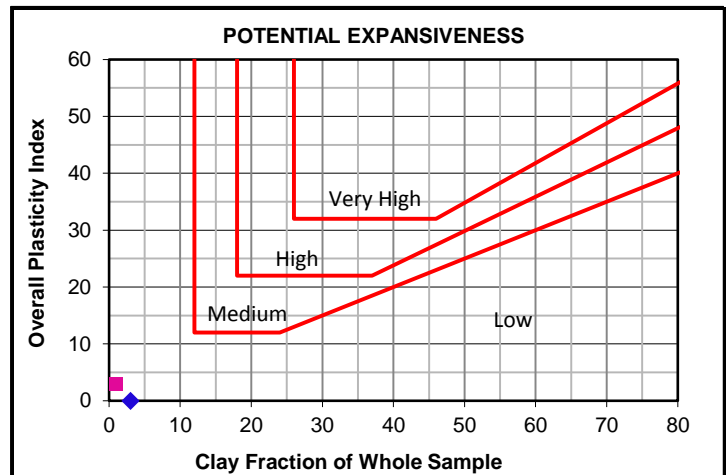
Technical Signatory:	
Signature:	

**All results are authorized electronically by approved managers and/or technical signatories.

Client :	DAVEL & VAN HUYSSTEEN CONSULTING (PTY)	Date Received:	25/11/2020
Project :	Polokwane Hospital	Date Reported:	13/01/2021
Project No :	2020-B-1574	Page No. :	2 of 5

FOUNDATION INDICATOR

Laboratory Number	2	4
Field Number	TP5	TP17
Client Reference		
Depth (m)	0.6-1.0	1.1-1.5
Position		
Coordinates	X	Y
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		



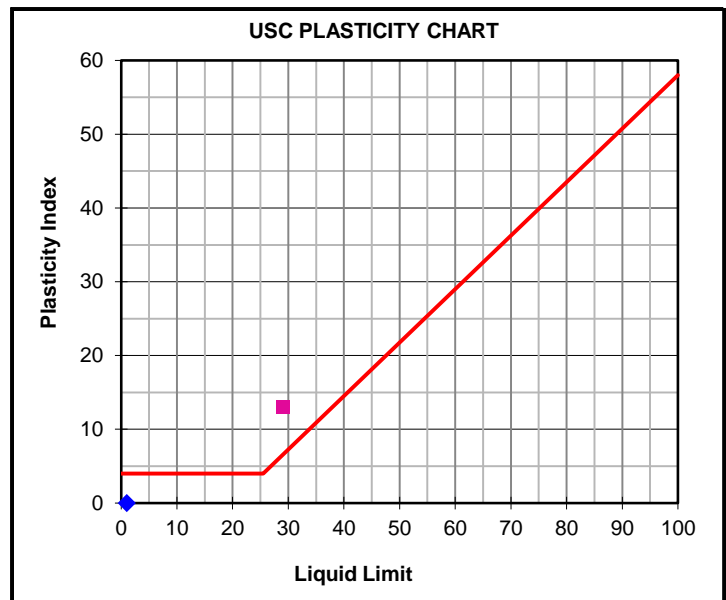
Moisture Content & Relative Density

Moisture Content (%)		
Relative Density (S.G.)		

Sieve Analysis (Wet Prep)

SANS 3001 GR1

Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	100	100
	50 mm	100	100
	37.5 mm	100	100
	28 mm	100	100
	20 mm	100	100
	14 mm	100	95
	5 mm	89	70
	2 mm	64	44
	1 mm	43	31
	0.425 mm	27	23
	0.250 mm	21	19
	0.150 mm	15	15
0.075 mm	10	11	
Grading Modulus		1.99	2.22



Hydrometer Analysis

SANS 3001 GR3

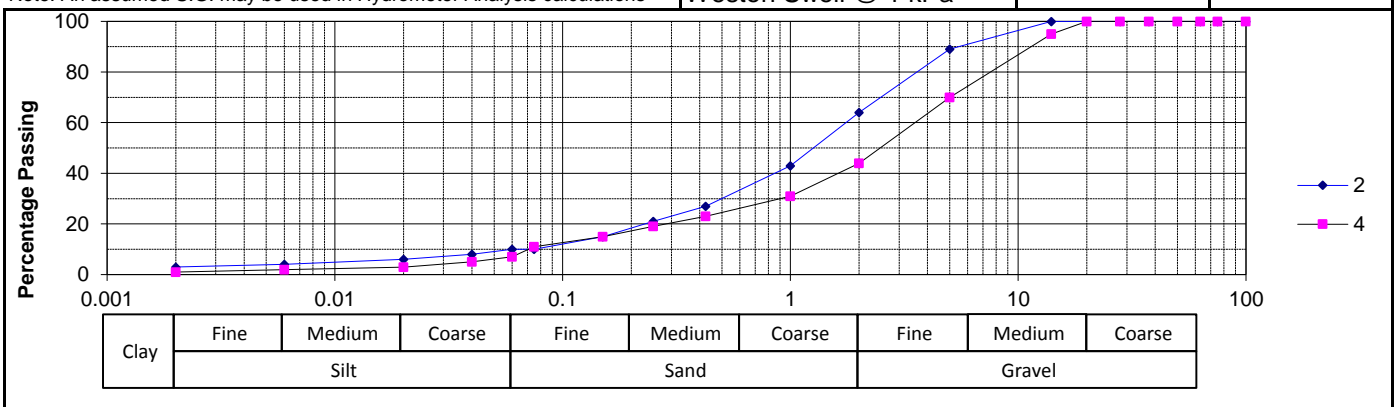
Percentage Passing	0.060 mm	10	7
	0.040 mm	8	5
	0.020 mm	6	3
	0.006 mm	4	2
	0.002 mm	3	1
Gravel	%	36	56
Sand	%	54	37
Silt	%	7	6
Clay	%	3	1

Note: An assumed S.G. may be used in Hydrometer Analysis calculations

Laboratory Number	2	4
Atterberg Limits -425 μ	SANS 3001 GR10	
Liquid Limit	%	29
Plasticity Index	%	NP
Linear Shrinkage	%	5.5
Overall PI	%	3

Classifications

HRB (AASHTO)	A-1-b(0)	A-2-6(0)
Unified (ASTM D2487)	SW-SM	SP-SC
Weston Swell @ 1 kPa		



Client : DAVEL & VAN HUYSSTEEN CONSULTING (PTY)

Date Received: 25/11/2020

Project : Polokwane Hospital

Date Reported: 13/01/2021

Project No: 2020-B-1574

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MOISTURE DENSITY RELATIONSHIP

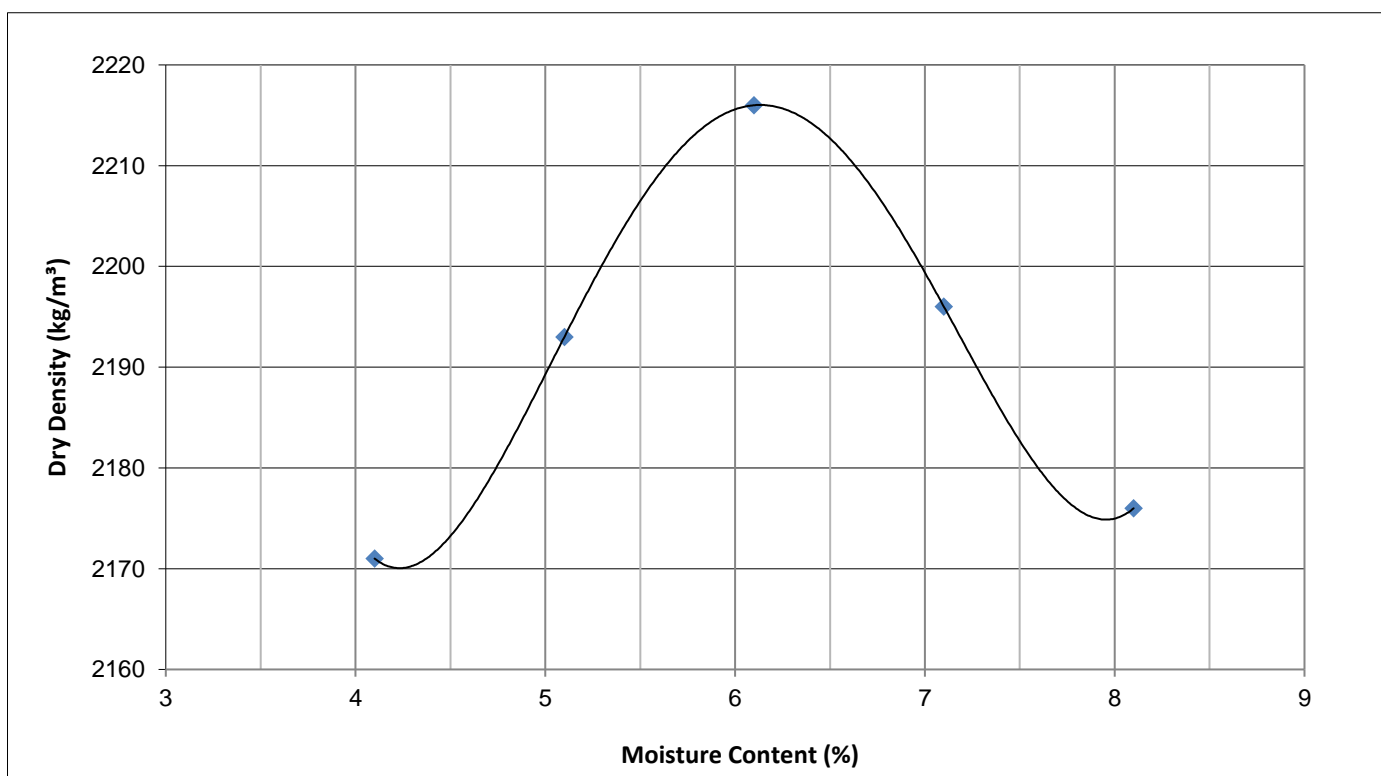
Laboratory Number	1
Field Number	TP3
Client Reference	
Depth (m)	0.1-0.6
Position	
Coordinates	X
	Y
Description	
Additional Information	
Calcrete / Crushed	
Stabilizing Agent	

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	2171	2193	2216	2196	2176	
Moisture Content	%	4.1	5.1	6.1	7.1	8.1	

Max. Dry Density	kg/m ³	2216
Optimum Moisture	%	6.1



Client : DAVEL & VAN HUYSSTEEN CONSULTING (PTY)

Date Received: 25/11/2020

Project : Polokwane Hospital

Date Reported: 13/01/2021

Project No: 2020-B-1574

Page No. : 4 of 5

MOISTURE DENSITY RELATIONSHIP

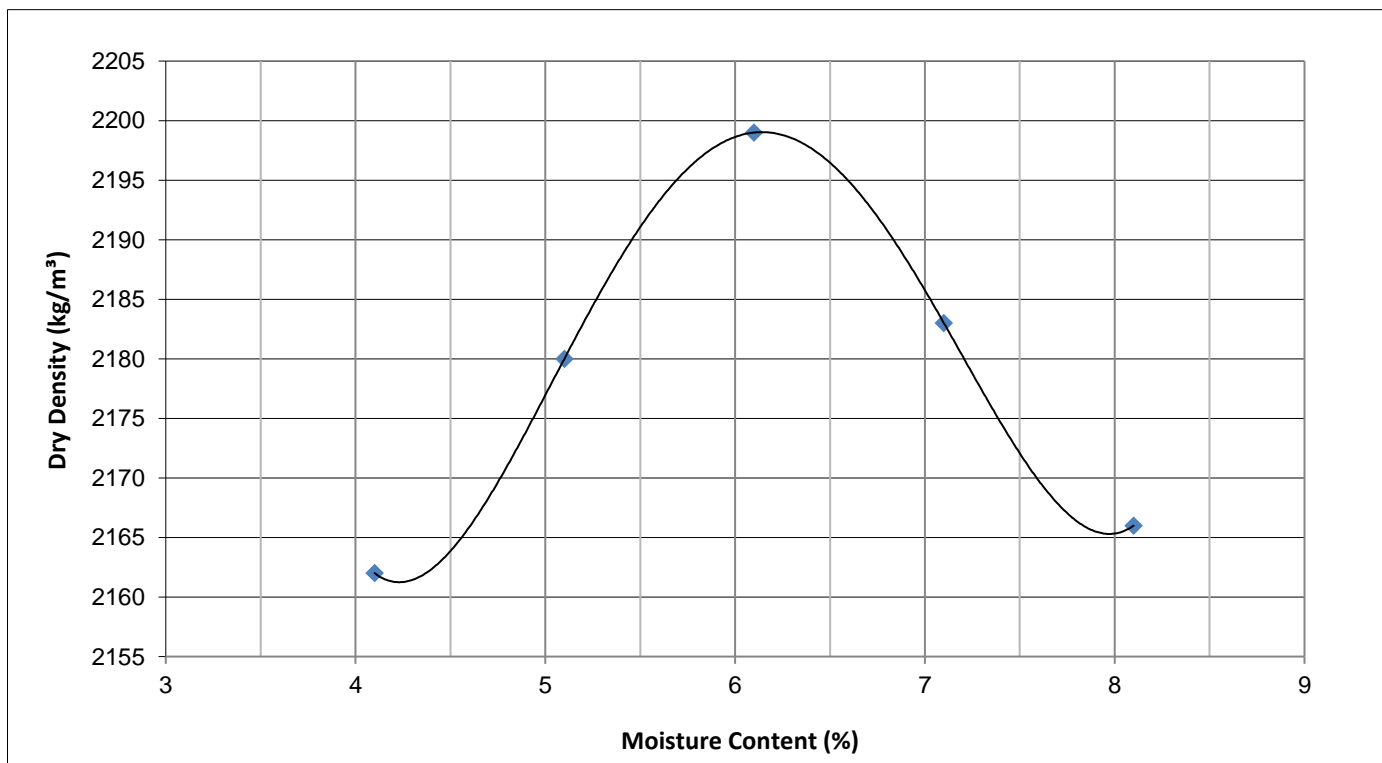
Laboratory Number		3
Field Number		TP5
Client Reference		
Depth (m)		0.6-1.5
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	2162	2180	2199	2183	2166	
Moisture Content	%	4.1	5.1	6.1	7.1	8.1	

Max. Dry Density	kg/m ³	2199
Optimum Moisture	%	6.1



Client : DAVEL & VAN HUYSSTEEN CONSULTING (PTY)

Date Received : 25/11/2020

Project : Polokwane Hospital

Date Reported : 13/01/2021

Project No. : 2020-B-1574

Page No. : 5 of 5

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	1	3
Field Number	TP3	TP5
Client Reference		
Depth (m)	0.1-0.6	0.6-1.5
Position		
Coordinates	X	
	Y	
Description		
Additional information		
Calcrete/Crushed		
Stabilizing Agent		

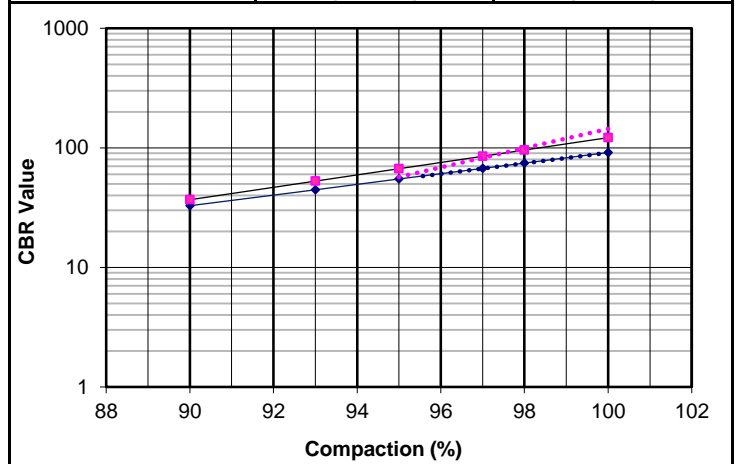
Laboratory No.	1	3
----------------	---	---

Maximum Dry Density & Optimum Moisture Content			SANS 3001 GR30
MDD	kg/m ³	2216	2199
OMC	%	6.1	6.1

California Bearing Ratio			SANS 3001 GR40
Compaction Data			
Moisture	%	6.1	6.1
Dry Density	kg/m ³	2230	2128
Compaction	%	100.0	95.4

Penetration Data			
CBR at	2.50 mm	91	57
	5.00 mm	128	67
	7.50 mm	136	72
Swell	%	0.1	0
Final Moisture (%)		7.0	8.4

Sieve Analysis (Wet preparation)			SANS 3001 GR1
Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	96	100
	50 mm	81	88
	37.5 mm	71	74
	28 mm	68	65
	20 mm	65	57
	14 mm	54	50
	5 mm	35	34
	2 mm	27	26
	1 mm	23	22
	0.425 mm	19	18
	0.250 mm	16	15
	0.150 mm	13	12
	0.075 mm	9	8
Grading Modulus		2.5	2.5



Soil Mortar Analysis		
Coarse Sand	30	31
Coarse Fine Sand	11	10
Medium Fine Sand	13	12
Fine Fine Sand	12	14
Silt and Clay	34	33

Interpolated CBR Data		
@ 100%	91	122
@ 98%	75	96
@ 97%	67	85
@ 95%	55	67
@ 93%	45	53
@ 90%	33	37
@ SANS3001 Midpoint	72	89

Atterberg Limits			SANS 3001 GR10
Liquid Limit (%)	28	24	
Plasticity Index (%)	14	9	
Linear Shrinkage (%)	6.0	4.0	

Classifications		
HRB (AASHTO)	A-2-6(0)	A-2-4(0)
COLTO	G7	G5
TRH14	G6	G5

