

Report on Engineering Geological Investigation:
Test pit logs in KwaMhlanga for RDP houses development.

2012



Department of Geology

GTX 713

Date Excavated: 18 April 2012

Machine: Bell 315SG

Operator: Lesley

Date Excavated: 19 April 2012

Machine: Bell 315SG

Operator: Lianas

Location: Mpumalanga (KwaMhlanga)

Muravha Sedzani Elia

University of Pretoria

6/2/2012

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List of acronyms

AEGSA	Association of Engineering Geologists-South Africa
E_i	Photographic exposure
MCCSSO	Moisture, Colour, Consistency, Structure, Soil texture and Origin
RDP	Reconstruction and Development Programme
SAICE	South African Institution of Civil Engineering
SAIEG	South African Institute for Engineering and Environmental Geologists
SANS	South African National Standards
TP	Test pit

1. Introduction

Geotechnical investigations of this report were carried out by an Environmental and Engineering Geology masters student and Hydrogeology honours student from the University of Pretoria as a part of educational project under supervision of Matthys A. Dippenaar. A site is located in KwaMhlanga, Mpumalanga near the R573 road well-known as Moloto road and neighbouring villages are Kameelpoort, Tweefontein, Phola pan, etc. Test pits were excavated in the field and results were recorded from all test pits. Test pit is a hole excavated by hand or mechanical excavator for the purpose of direct and visual inspection of the vertical section of soil and rocks in a profile as a part of site investigation in geotechnical survey (SAICE 2010).

1.1 Aim and scope

The aim of this report is to provide detailed information and visual field inspection of geotechnical conditions from test pit logs on site for the purpose of Reconstruction and Development Programme (RDP) houses in KwaMhlanga village.

Objectives of the geotechnical investigation of the site include:

- Planning of the investigation
- Collection of available data from published documents.
- Excavation of test pits in the site
- Soil profiling and collecting samples from other test pits
- The data gathered will address the excavatability, material properties and other geotechnical features.

1.2 Available Information

Available information used to support the investigation was:

- Google Earth Imagery (©2012 AfriGIS & Cnes/Spot Image)
- Available published articles, SANS, Geotechnical code of practice and books

2. Site Description

2.1 Occurrence

A Google Map imagery of a site is provided below and it provides information about the vegetation and few terrain features. The image depicts the whole area of KwaMhlanga village, indicated as a red bordered area. An investigation site is situated in KwaMhlanga (area inside red border in the image below) area at an approximate coordinates of 25⁰22'41''S 028⁰42'19.14''E near R568 and R573 roads.

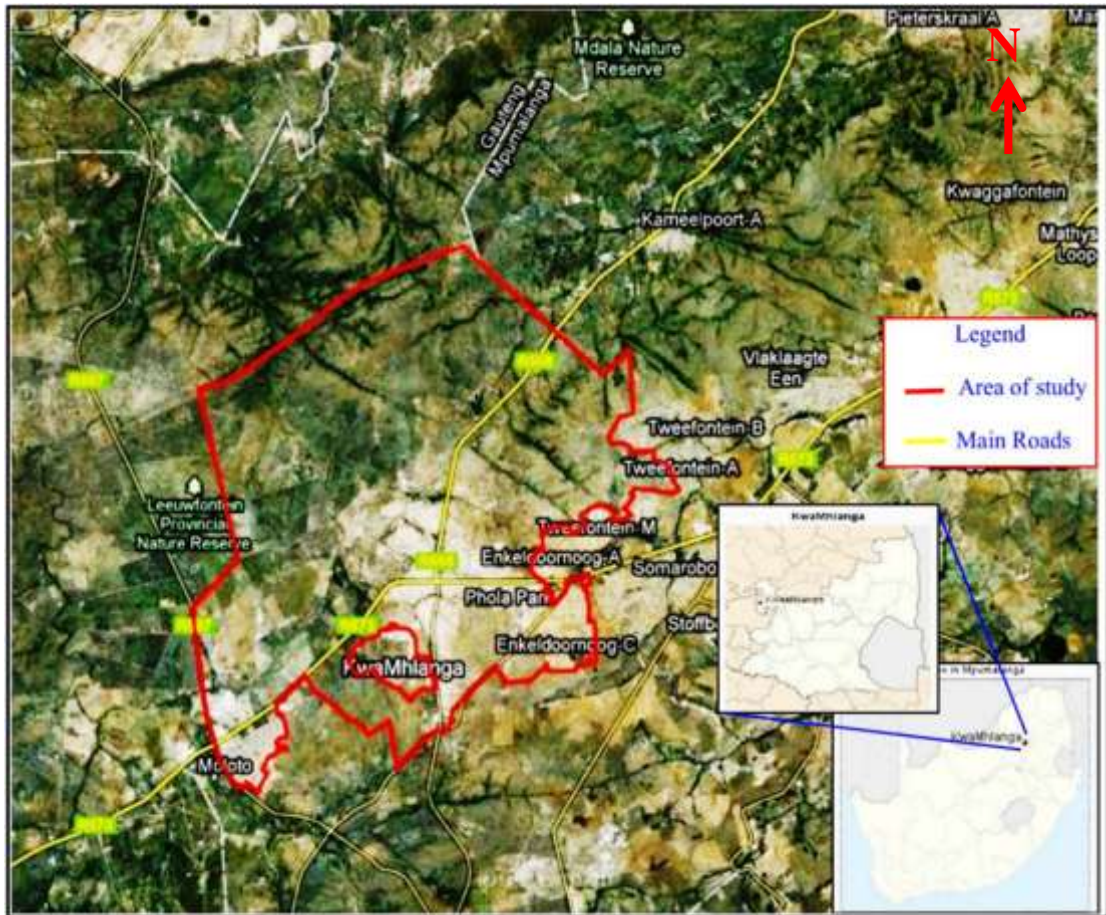


Figure 1: Locality of the study area (© 2012 Google Map)

KwaMhlanga is a village situated at Mpumalanga, South Africa in Thembisile Hani Municipality located in the western region of the Nkangala District municipality.

KwaMhlanga is a rural area characterised by high unemployment, low economic base and is isolated, with Ndebele as a common South African language (Nkangala district municipality 2010).

2.2 Description of Geology

An investigation site is situated in Mpumalanga and the insitu soil in all test pits at deeper depth is residual granite. Quartz was a predominant grain in the soils from all test pits and the insitu bedrock in all test pits was Lebowa granite. The bedrock was not weathered and in some test pits it was discoloured.

3. Methodology

The fieldwork was carried out on the 18 April 2012 by Muravha Elia and Brendon Jones, and completed on the 19th of April 2012 by Brendon Jones. The fieldwork comprises of test pitting, soil profiling and description of engineering geological, geological and hydrogeological conditions. The investigation was carried out based on a site investigation code of practice (SAICE 2010), SANS (2009) Geotechnical Investigations for Township Development and guidelines for soil and rock logging in South Africa (Brink and Bruin 1990). A Bell 315SG excavating machine was used to dig all test pits. Immediately after

excavation of a test pit, soil profiling was conducted and all the geotechnical, geological and hydrogeological conditions were recorded. All the vertical sections of soil in the profile were described in terms of their moisture condition, colour, consistency, structure, soil texture and origin (MCCSSO). MCCSSO provides basic information about the soil profile and make it easier to recognise geotechnical conditions of the area and also gives quantitative assessment of material properties (Brink and Bruin 1990). Guidelines of a site investigation were introduced and followed during the investigation.

Table 1: Typical guidelines for various stages of site investigation (SAICE 2010)

Category	Development	Phase	Data points	Special Considerations
Compact	Building (Brick or Concrete)	Feasibility	1 per structure	
		Design	3 per structure	Settlement sensitivity of finishes
	Factory (Steel Frame)	Feasibility	2 per ha	
		Design	4 per ha or 4 per structure	Crane & floor requirements
	Quarry or Borrow Pit	Feasibility	1 per 5ha	
		Design	2 per 1ha	
	Tower or Mast	Feasibility	1 per structure	
		Design	1 per 25m ²	
	Reservoir	Feasibility	1 per structure	
		Design	1 per 100m ²	
	Bridge	Feasibility	1 per abutment	
		Design	2 per abutment 1 per pier	
	Substation	Feasibility	2 per ha	
		Design	4 per ha	
Linear	Pipeline	Feasibility	1 per km	
		Design	4 per km	
	Road/Rail/Conveyor	Feasibility	2 per km	
		Design	5 per km	
	Canal	Feasibility	1 per km	
		Design	4 per km	
	Power Transmission	Feasibility	1 per km	
		Design	4 per km	
	Tunnels	Feasibility	2 per km	
		Design	5 per km	
Large	Housing Complex	Feasibility	1 per ha or 1 per structure	GFSH & NHBC requirements SANS10400 SAICE Code of Practice Van Rooy & Stiff (2001)
		Design	2 per structure	
	Harbour	Feasibility	1 per 5ha	
		Design	4 per ha or 5 per structure	
	Airport	Feasibility	1 per 10ha	
		Design	1 per ha or 5 per structure	
	Industrial complex	Feasibility	1 per ha	
		Design	10 per ha or 5 per structure	
	Power Plant	Feasibility	1 per ha	
		Design	10 per ha or 5 per structure	
	Dam	Feasibility	1 per 25ha basin 5 per km wall	Also dependent on the category of dam
		Design	1 per 10ha basin 10 per km wall	
Special	Dolomite stability	Feasibility	1 per structure	Council for Geoscience requirements Buttrick et al.
		Design	4+ per structure	
	Undermined Land	Feasibility	1 per ha 4 per km	Geophysical methods
		Design	2 per structure	

These guidelines for stages of a site investigation suggest the level at which the various types of investigation should be carried out and also provide scope, methodology and application ranges to be used during investigation (Van Rooy and Stiff 2001). RDP houses construction falls into large area development class according to the guidelines of site investigation as shown in Table 1. Housing complex requires one data point per hectare or one per structure according to the guidelines (Brink and Bruin 1990).

4. Results and Engineering geological constraints

In the investigation, twenty-six test pits were dug and their soil profiles were analysed and samples from some test pits were taken.

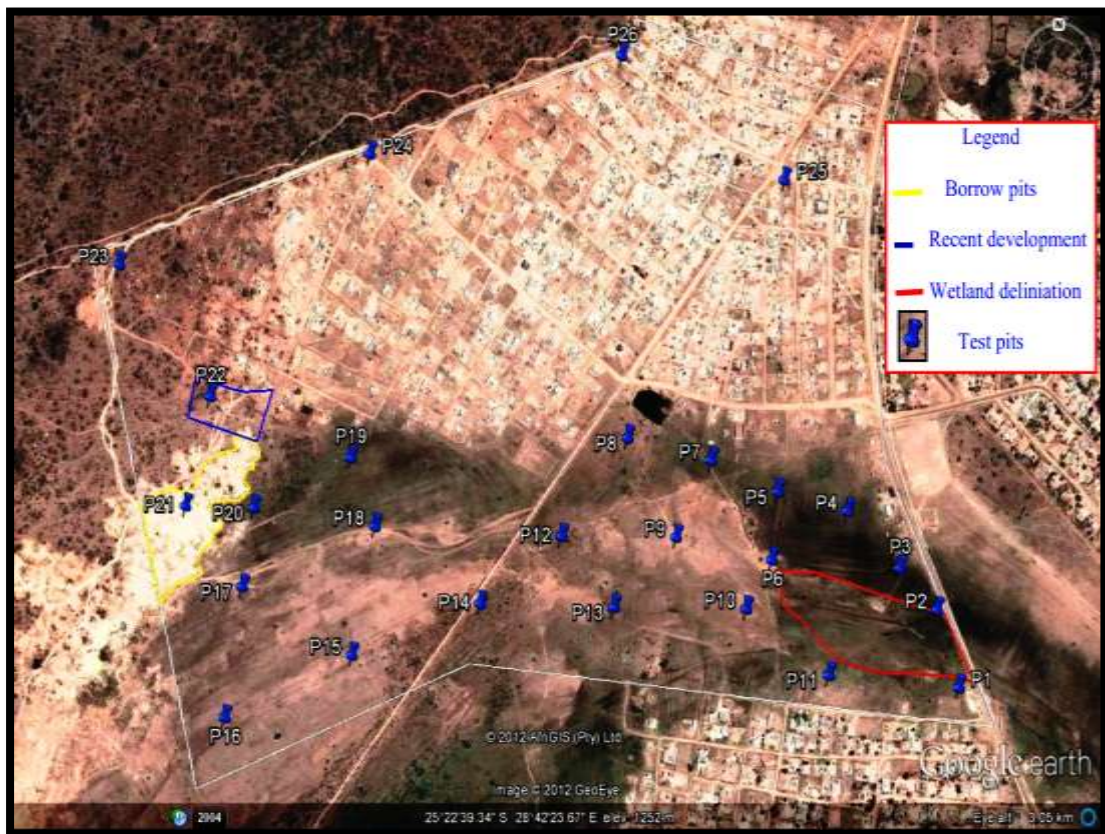


Figure 2: Location of all test pits, hydrological and geological conditions with development illustration (© 2012 Google Earth).

Figure two depicts the location of all test pits and other environmental features around the area. The photographic exposures of the area, all test pits and soil features are given in the APPENDIX A. and B. Recent development around the area of investigation and other engineering geological and hydrogeological features such as borrow pits and wetland delineations are provided in Fig. 2. Some other test pits were characterised by collapsible wall due to perched waters and type of soils present.

4.1 Site Stratigraphy

The soil profiles of all test pits are provided in the APPENDIX C. with the coordinates, depth (m) of soil layers in the profile from surface to a non-excavatable depth, description of all

layers in the profile according to the MCCSSO strategy and the note of other features such as hydrogeological conditions are also provided. The deepest test pit dug was 2.60m from the surface and was characterised by moist to wet layers with granite as bedrock. Table 2 below, provides a soil profile description of a deepest test pit as an example of stratigraphy description.

Table 2: Stratigraphic soil profile description of first test pit.

Number of Test pits	GPS coordinates	Depth (m)	MSSCCO profile description	Notes
TP1	25°22'55.91"S 028°42'41.93"E	0.00-0.30	Slightly moist, light red, loose, shattered, silty fine sand, Topsoil with abundant roots.	<ol style="list-style-type: none"> 1. Final depth at 2.60m. Refusal on Granite Bedrock. 2. Groundwater seepage at 1.00m. 3. Sidewall collapse at 1.00m. 4. No samples.
		0.30-1.00	Moist, light red, medium dense, shattered, silty clayey sand, Residual Granite with roots.	
		1.00-2.60	Wet, grey-brown stained orange-brown and blotched grey, medium dense, slightly gravelly silty sand with clay nodules, Residual Granite.	

4.2 Material Properties

Majority of soil type across the whole area of study is silty sands with minority of clay. The soil type is commonly characterised by light brown-red to orange and grey colours, with loose topsoil comprising of abundant grass and plant roots extending to a depth of about 30cm in average. The silty sand grains are approximately 2mm in diameter and the predominating sand grains are quartz grains in most cases.

4.3 Hydrogeology

The investigation site was characterised by perched waters, wetland delineations and dense green vegetation cover. Figure 2 clearly illustrates areas covered by vegetation and most of these areas consist of perched waters. Area characterised by wetland delineation is marked by a red bordered area in figure 2. Nine test pits contained perched waters at depth less than 2.5 m below the surface and other part of the site was covered with water at the surface. There is a stream that runs across the site and south western part of the site is dry with dense soils. The figure below is a profile of a third pit which was 0.95m deep from the surface. Immediately after excavating 0.4m, sidewalls started to collapse with increase in moisture and at depth of

0.5m we intersected groundwater seepage. At depth between 0.5-0.95m, there was abundance of pebbles and cobbles with very wet soils and increased seepage. Description of hydrogeological conditions of all test pits is given in the APPENDIX C.



Figure 3: Hydrogeological conditions illustration on a third test pit profile.

The engineering geological constrains from all the test pits were analysed and the results are given in the table below. Most test pits were characterised by different constraints such as collapsible soil, seepage, active soil, area of unstable natural slopes, excavatability and erodability of soil. More than five test pits had seepage waters which facilitated sidewall collapse. The area was covered with vegetation and traces of active soils were encountered in other test pits. Vegetation across the area reduced soil erodability and the area was characterised by uniform slopes.

Table 3: Engineering geological classification for urban development after Partridge, Wood and Brink (National department of housing 2002).

	Constraint	Site Condition	Class
A	Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness	1

B	Seepage	Permanent or perched water table less than 1.5 m below ground surface	2
C	Active Soil	Moderate soil heave potential predicted	2
D	Area of unstable natural slopes	Intermediate risk	2
E	Difficulty of excavation to 1.5m depth	Rock or hardpan pedocretes between 10 % and 40 % of the total volume (shallower than 1.50 m)	2
F	Erodability of soil	Low	1

Class: 1-Most favourable, 2-Intermediate, 3-Least favourable

5. Conclusion

The investigation site is situated in KwaMhlanga and underlain by Lebowa granite. A Bell 315SG excavating machine was used to dig all test pits and soil profiling was conducted after excavation and all the geotechnical, geological and hydrogeological conditions were recorded for each test pit. The visual inspection of vertical section of each soil profile was described in terms of its MCCSSO. Guidelines for site investigation were used and twenty-six test pits were dug. The investigation area was characterised by wetland delineation, borrow pits, recent development, vegetation cover, surface and subsurface water bodies. Nine test pits had water seepage and most of these pits experienced sidewall collapse. Engineering geological constraints recorded in a site include collapsible soil, seepage, active soil, area of unstable natural slopes, excavatability and erodability of soil.

6. References

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2. National department of housing. (2002). Geotechnical Site Investigations for Housing Development: Project linked Greenfield subsidy project development. Generic specification GFSH-2: Republic of South Africa
3. Nkangala district municipality (2010). Final Integrated Development Plan. Unknown publisher: South Africa. Pp 1-315
4. SANS [South African National Standards]. 2009. Geotechnical Investigations for Township Development. South African Bureau of Standards. Draft SANS 634:2009. Pretoria.
5. The South African Institution of Civil Engineering (2010). Site Investigation Code of Practice. 1st Edition. South African Institution of Civil Engineering - Geotechnical Division
6. Van Rooy, J.L and Stiff, J.S. (2001). Guidelines for urban engineering geological investigations in South Africa. Springer-Verlag: 59:285 –295

Appendix A. Photographic exposure of the area and soil features



Appendix B. Photographic soil profiles of all test pits















Appendix C. Stratigraphic soil profile description of all test pits

Number of Test pits	GPS coordinates	Depth (m)	MSSCCO profile description	Notes
TP1	25°22'55.91"S 028°42'41.93"E	0.00-0.30	Slightly moist, light red, loose, shattered, silty fine sand, Topsoil with abundant roots.	5 Final depth at 2.60m. Refusal on Granite Bedrock. 6 Groundwater seepage at 1.00m.
		0.30-1.00	Moist, light red, medium dense, shattered, silty clayey sand, Residual Granite with roots.	7 Sidewall collapse at 1.00m. 8 No samples.
		1.00-2.60	Wet, grey-brown stained orange-brown and blotched grey, medium dense, slightly gravelly silty sand with clay nodules, Residual Granite.	
TP2	25°22'51.94"S 028°42'40.48"E	0.00-0.10	Moist, light red, loose, shattered, slightly clayey silty fine sand, Topsoil with abundant roots.	1. Final depth at 0.90m. Groundwater table intersected.
		0.10-0.50	Wet, light red blotched brown and grey, loose, shattered, clayey sand with fine gravel, Residual Granite	2. Groundwater seepage at 0.20m. 3. Sidewall collapse at 0.20m.
		0.50-0.90	Very wet, grey blotched dark brown, loose, shattered, clayey sand, Residual Granite.	4. No samples. 5. Water ponding visible within adjacent to test pit.
TP3	25°22'49.82"S 028°42'37.95"E	0.00-0.20	Moist, dark brown, loose to medium dense, shattered, silty sand, Topsoil with abundant roots.	1. Final depth at 0.95m. Groundwater table

		0.20-0.50	Wet, grey brown streaked orange-brown, loose, shattered, silty fine to medium sand, Residual Granite	intersected. 2. Groundwater seepage at 0.50m.
		0.50-0.95	Very wet, light brown grey stained orange-brown at depth, loose, shattered to intact, sandy gravel with abundant pebbles and cobbles, Residual Granite.	3. Sidewall collapse at 0.40m. 4. No samples.
TP4	25°22'46.90"S 028°42'34.40"E	0.00-0.10	Moist, dark brown, speckled orange-brown, loose to medium dense, micro-shattered, silty sand, Topsoil with abundant roots.	1. Final depth at 1.25m. Groundwater table intersected.
		0.10-0.65	Wet, light grey-brown stained orange-brown with depth, loose, shattered, silty sand with abundant gravel with depth, Residual Granite.	2. Groundwater seepage at 1.10m. 3. Sidewall collapse at 0.60m.
		0.65-1.25	Moist to wet with depth, pale pink-brown stained dark orange-brown, loose, shattered, silty gravelly sand with clay nodules, Residual Granite.	4. Foundation indicator sample: 0.65-1.25m.
TP5	25°22'45.91"S 028°42'29.65"E	0.00-0.10	Moist, dark brown speckled orange-brown, medium dense, micro-shattered, slightly clayey silty fine sand, Topsoil with roots.	1. Final depth at 1.75m. Refusal on granite bedrock.
		0.10-0.75	Wet, light grey-brown stained orange-brown with depth, loose, shattered, silty sand with abundant gravel with depth and occasional boulders, Residual Granite.	2. Groundwater seepage at 1.00m. 3. Sidewall collapse at 0.40m. 4. No sample.

TP6	25 ⁰ 22'49.41"S 028 ⁰ 42'29.26"E	0.00-0.20	Slightly moist, light brown, loose to medium dense, micro-shattered, silty fine sand, Topsoil with few roots.	<ol style="list-style-type: none"> 1. Final depth at 0.95m. Refusal on very dense residual granite. 2. No groundwater seepage. 3. No sidewall collapse. 4. No sample. 	
		0.20-0.65	Dry, dark grey-brown, dense, intact, fine gravelly silty sand, Residual Granite.		
TP7	25 ⁰ 22'44.30"S 028 ⁰ 42'25.14"E	0.00-0.15	Moist, dark brown, loose, micro-shattered, silty sand, Topsoil with abundant roots.		<ol style="list-style-type: none"> 1. Final depth at 0.80m. Groundwater table intersected. 2. Groundwater seepage at 0.80m. 3. Sidewall collapse at 0.80m. 4. No sample.
		0.15-0.80	Wet, dark brown speckled orange-brown and blotched pale grey-brown, very loose to loose, shattered, silty sand, Residual Granite.		
		0.40-0.70	Dry, light brown stained orange-brown with depth, loose to medium dense, shattered, silty sandy gravel, Colluvium. Gravel fragments are sub-rounded and increase in size with depth.		
		0.70-1.05	Dry, dark reddish orange-brown, medium dense to dense with depth, shattered, silty sandy gravel with cobbles and pebbles, Ferruginised Residual Granite.		

TP9	25°22'48.26"S 028°42'22.75"E	0.00-0.20	Dry, light brown, medium dense, intact, silty sand, Topsoil with few roots.	<ol style="list-style-type: none"> Final depth at 0.65m. Refusal on very dense residual granite. No groundwater seepage. No sidewall collapse. Foundation indicator sample at 0.20-0.45m.
		0.20-0.45	Dry, dark brown blotched dark purple-brown, firm, shattered and slickensides, silty fine sandy clay, Residual Granite.	
		0.45-0.65	Dry, pale pink-brown speckled orange-brown, dense, shattered, silty sand, Residual Granite.	
TP10	25°22'51.92"S 028°42'27.53"E	0.00-0.30	Slightly moist, dark brown speckled pink-brown, loose, shattered, silty fine-sand, Colluvium.	<ol style="list-style-type: none"> Final depth at 0.65m. Refusal on very dense residual granite. No groundwater seepage. No sidewall collapse. Foundation indicator sample at 0.30-0.60m.
		0.30-0.60	Moist, dark brown speckled orange-brown, soft to firm, intact, fine sandy clay, Residual Granite.	
		0.60-1.55	Moist, pale pink-brown, stained orange-brown, medium dense to dense, shattered, slightly silty sand, Residual Granite.	
TP11	25°22'55.31"S 028°42'33.14"E	0.00-0.10	Slightly moist, dark brown speckled pink-brown, loose, shattered, silty fine-sand, Colluvium.	<ol style="list-style-type: none"> Final depth at 0.80m. Groundwater table intersected. Groundwater seepage at 1.40m.
		0.10-0.70	Moist, light brown speckled dark brown, loose, shattered, slightly clayey silty fine sand, Residual Granite.	

		0.70-1.70	Wet, pale brown stained orange-brown, medium dense becoming dense with depth, shattered, silty gravelly sand with clay nodules.	<ol style="list-style-type: none"> No sidewall collapse. No sample.
TP12	25°22'48.23"S 028°42'14.90"E	0.00-0.10	Slightly moist, dark brown speckled pink-brown, loose, shattered, silty fine-sand, Topsoil.	<ol style="list-style-type: none"> Final depth at 0.75m. Refusal on very dense residual granite. No groundwater seepage. No sidewall collapse. No sample.
		0.10-0.75	Dry, light brown stained orange-brown with depth, loose to medium dense, intact to shatter with depth, clayey silty fine sand with fine gravel at depth, Residual Granite.	
TP13	25°22'51.87"S 028°42'18.50"E	0.00-0.20	Slightly moist, dark brown speckled pink-brown, loose, shattered, silty fine-sand, Topsoil with abundant roots.	<ol style="list-style-type: none"> Final depth at 1.30m. Refusal on granite bedrock. Slight groundwater seepage at 1.10m. Sidewall collapse at 1.10m. No sample.
		0.20-0.80	Slightly moist, light brown stained orange-brown, loose, shattered, silty sand, Residual Granite.	
		0.80-1.10	Wet, grey stained orange-brown, loose, shattered, sandy clayey gravel, Residual Granite	
		1.10-1.30	Orange-brown speckled and blotched light brown and yellow-brown, highly weathered, medium to very coarse grained, very soft to soft rock, Granite, Lebowa Granite Suite.	
TP14	25°22'51.72"S 028°42'09.32"E	0.00-0.35	Dry, light brown, loose to medium dense, shattered, silty fine-sand, Topsoil with abundant roots.	<ol style="list-style-type: none"> Final depth at 0.65m. Refusal on granite bedrock.

		0.35-0.65	Dry, light brown stained orange-brown, medium dense to dense, shattered, silty gravelly sand becoming gravelly approaching bedrock, Ferruginised Residual Granite.	<ol style="list-style-type: none"> 2. No groundwater seepage. 3. No sidewall collapse. 4. No sample.
TP15	25 ⁰ 22'54.38"S 028 ⁰ 42'00.47"E	0.00-0.20	Dry, light brown, medium dense becoming loose, shattered, silty fine-sand, Topsoil with few roots.	<ol style="list-style-type: none"> 1. Final depth at 0.65m. Refusal on granite bedrock. 2. No groundwater seepage. 3. No sidewall collapse. 4. No sample.
		0.20-0.65	Dry, light yellow-brown stained dark purple orange-brown and dark purple-orange, loose, shattered, silty gravelly sand with increasing gravel cobbles and pebbles with depth, Ferruginised Residual Granite.	
TP16	25 ⁰ 22'57.64"S 028 ⁰ 41'51.67"E	0.00-0.20	Dry, light brown, loose to medium dense, shattered, silty fine-sand, Topsoil with few roots.	<ol style="list-style-type: none"> 1. Final depth at 0.90m. Refusal on ferruginised granite bedrock. 2. No groundwater seepage. 3. No sidewall collapse. 4. Foundation indicator sample at 0.20-0.50m.
		0.20-0.50	Moist, light brown speckled orange-brown, loose, shattered, silty fine sand with gravel at depth, Residual Granite.	
		0.50-0.90	Dry, light yellow-brown stained dark purple orange-brown and dark purple-orange, loose to medium dense, shattered, silty gravelly sand with increasing gravel cobbles and pebbles with depth, Ferruginised Residual Granite.	
TP17	25 ⁰ 23'00.51"S 028 ⁰ 41'34.19"E	0.00-0.25	Dry, light brown, loose, shattered, silty fine-sand, Topsoil with few roots.	<ol style="list-style-type: none"> 1. Final depth at 2.10m. Refusal on granite

		0.25-2.10	Moist becoming wet, orange-brown streaked and blotched grey, soft to firm with depth, shattered, silty sandy clay with gravel pebbles cobbles and boulders with depth, Residual Granite.	<p>bedrock.</p> <ol style="list-style-type: none"> Groundwater seepage at 1.10m. No sidewall collapse. Foundation indicator sample at 0.25-2.10m.
TP18	25 ⁰ 22'47.73"S 028 ⁰ 42'02.08"E	0.00-0.10	Slightly moist, light brown speckled and stained orange-brown, loose, shattered, silty sand with increasing gravel, Residual Granite.	<ol style="list-style-type: none"> Final depth at 1.25m. Refusal on granite bedrock. No groundwater seepage. No sidewall collapse. No sample.
		0.75-1.25	Dry, light yellow-brown stained dark purple orange-brown and dark purple-orange, loose, shattered, silty gravelly sand with increasing gravel cobbles and pebbles with depth, Ferruginised Residual Granite.	
TP19	25 ⁰ 22'44.18"S 028 ⁰ 42'00.40"E	0.00-0.15	Moist, dark brown, loose, shattered, silty sand, Topsoil with abundant roots.	<ol style="list-style-type: none"> Final depth at 1.10m. Refusal on granite bedrock. Groundwater table intersected at 1.00m. No sidewall collapse. No sample.
		0.15-1.10	Moist becoming very wet, pale pink-brown stained orange-brown, loose, shattered, silty clayey sand with gravel, Residual Granite.	
TP20	25 ⁰ 22'46.76"S 028 ⁰ 41'53.75"E	0.00-0.10	Dry, light brown, loose, shattered, silty fine-sand, Topsoil with few roots.	<ol style="list-style-type: none"> Final depth at 1.10m. Refusal on granite

		0.10-0.80	Slightly moist, light brown speckled and stained orange-brown, loose, shattered, silty sand with increasing gravel, Residual Granite.	bedrock. 2. Groundwater seepage at 1.50m.
		0.80-2.20	Moist becoming very wet, orange-brown streaked and blotched grey, soft, shattered, silty sandy clay with gravel pebbles cobbles and boulders with depth, Residual Granite.	3. Sidewall collapse at 2.10m. 4. Foundation indicator sample at 0.80-2.20m.
TP21	25°22'46.67"S 028°41'49.06"E	0.00-0.40	Dry, light brown streaked and mottles light grey and yellow-brown and stained orange-brown, loose to medium dense with depth, shattered, silty gravelly sand with cobbles and pebbles, Residual Granite.	1. Final depth at 0.65m. Refusal on granite bedrock. 2. No groundwater seepage. 3. No sidewall collapse. 4. Foundation indicator sample at 0.00-0.40m. 5. Test pit located within an exploited borrow pit.
TP22	25°22'41.03"S 028°41'50.82"E	0.00-0.15	Dry, light brown, loose, shattered, silty fine-sand, Topsoil with few roots.	1. Final depth at 2.00m. Refusal on very dense residual granite.
		0.15-2.00	Moist, orange-brown, loose becoming medium dense with depth, shattered, silty fine gravelly sand, Residual Granite.	2. No groundwater seepage. 3. No sidewall collapse. 4. Foundation

				indicator sample at 0.15-2.00m.
TP23	25°22'34.24"S 028°41'44.59"E	0.00-0.20	Dry, light brown, loose, micro-shattered, silty fine sand, Topsoil with abundant roots.	<ol style="list-style-type: none"> Final depth at 1.70m. Refusal on dense residual granite. No groundwater seepage. No sidewall collapse. No samples. Test pit located approximately 50m north-east of an existing borrow pit.
		0.20-1.70	Slightly moist, reddish brown speckled dark grey and light brown, loose becoming medium dense at depth, shattered, to intact, silty sand with abundant gravel and occasional cobbles and pebbles with depth, Residual Granite.	
TP24	25°22'25.01"S 028°42'03.45"E	0.00-0.25	Dry, light brown, loose, shattered, silty fine sand, Topsoil with abundant roots.	<ol style="list-style-type: none"> Final depth at 1.10m. Refusal on granite bedrock. No groundwater seepage. No sidewall collapse. No samples.
		0.25-1.10	Slightly moist, reddish-brown stained orange-brown, loose to medium dense, shattered to intact, silty gravelly sand with granite boulders at depth, Residual Granite.	
TP25	25°22'29.95"S 028°42'30.10"E	0.00-0.15	Dry, light brown, medium dense, shattered fine gravelly silty sand, Reworked Residual Granite (Roadworks)	<ol style="list-style-type: none"> Final depth at 1.65m. Refusal on very dense residual granite. No groundwater seepage.
		0.15-0.65	Slightly moist, light reddish brown stained orange-brown, loose, shattered, gravelly silty sand, Residual Granite.	

		0.65-1.65	Moist, reddish brown stained orange-brown streaked light grey, medium dense to dense, shattered, silty gravelly sand with clay nodules cobbles and pebbles, Residual Granite.	<ol style="list-style-type: none"> 3. No sidewall collapse. 4. No samples.
TP26	25°22'23.55"S 028°42'19.03"E	0.00-0.25	Dry, light brown, loose, shattered, silty fine sand, Topsoil with abundant roots.	<ol style="list-style-type: none"> 1. Final depth at 1.65m. Refusal on very dense residual granite. 2. No groundwater seepage. 3. No sidewall collapse. 4. No samples.
		0.25-0.50	Slightly moist, light brown stained orange-brown becoming orange-brown at depth, loose, shattered, gravelly silty sand, Residual Granite.	
		0.50-1.25	Slightly moist, reddish brown stained orange-brown streaked light grey, medium dense to dense, shattered, silty gravelly sand with clay nodules cobbles and pebbles, Residual Granite.	