REPORT ON ENGINEERING GEOLOGICAL INVESTIGATIONS UNDERTAKEN FOR TOWNSHIP PROCLAMATION PURPOSES: SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8 MPUMALANGA

Undertaken for Messrs Sisonke Development Planners

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1. CONCLUSIONS AND RECOMMENDATIONS

1.1. General

Based on the results of the investigation, Siyathuthuka Extension 5 has been divided into four geotechnical/soil zones, while Extensions 6, 7 and 8 have each been divided into two zones. The zones identified have similar soil profiles and related geotechnical constraints.

With the exception of those areas designated D_1 (Figures 2, 3 and 4), the proposed extensions are suitable for residential/township development providing the precautionary measures recommended are implemented.

1.2. Geotechnical considerations and founding recommendations

The Zones identified are delineated on **Figures 2** to **4** (**Appendix A**), while each zone's geotechnical characteristics are summarized in **Table 1**. The zonal prefix is based on the severity of the geotechnical or development constraint, or a combination of both, for a specific soil unit and applied as a worst case scenario. Postscript numerals are used to differentiate between zones with a similar prefix, and do not suggest an increase in severity. An explanation of the various constraint categories is as follows:

PREFIX	**CONSTRAINTS** - geotechnical and development		**COMMENTS**
	Geotechnical - primarily construction costs	**Development** - installation of services and roads	
A	Typically confined to C, S, H Site Classes[7].	Nominal *hardrock* (<10%) *excavation*[4], and/or no evidence of a shallow (<1.5m) perched water table, and/or gentle slopes (<6%).	No restrictions on development.
B	Typically confined to Site Classes[7] C≤2, S≤2, H≤2 or S / R.	10-50% *hardrock excavation*[4], and/or moderately steep (6 -15%) slopes, and/or seasonal perched water table at shallow (<1.5m) depth.	Developable, but with minor geotechnical and/or development constraints.
C	Typically confined to Site Classes[7] H_3, R and/or P.	Greater than 50% *hardrock excavation*[4], and/or steep slopes (>15%), and/or perennial perched water table at shallow (<1.5m) depth, and/or possible slope instability.	Developable but with more costly geotechnical and/or development constraints. More detailed geotechnical investigations may be required.
D	Areas typically classifying as Site Class[7] P, eg. areas of instability in soluble rock, uncontrolled fill, settlement due to dewatering, undermined ground etc.	Below the 1:100 year floodline, and/or swamps/marshes, and/or dispersive soils, and/or high risk of slope instability.	No development recommended, or more detailed geotechnical investigations required.

Table 1: Summary of geotechnical and development constraints for township development: Siyathuthuka Extensions 5, 6, 7 and 8 - to be read in conjunction with the report

Zone	Abbreviated soil profile to 2m	Interpolated Geotechnical Constraints							Lightly loaded residential structures: typically <50kPa							Potentially suitable for on-site sanitation		Possible uses for surficial horizons, i e <1m				
		Class of problem envisaged based on soil movement: 0 - most favourable; II/III - least favourable **Compressible soils:** Class 0: <10mm; Class I: 10-20mm; Class II: >20mm **Expansive soils:** Class 0: <7 5mm; Class I: 7 5 - 15mm; Class II: 15 - 30mm; Class III: >30mm **Collapsible soils:** Class 0: <5mm; Class I: 5 - 10mm; Class II: >10mm							Code of Practice[7]			Founding Considerations										
		Excavatability to 1 5m in terms of SABS 1200D		Depth to perched ground water table	Expansive	Collapsible	Compress-ible	Other geotechnical constraints	Predicted range in soil movements++ + ≈ heave - ≈ consolid	Site Class	Typical founding solutions - see **Notes**	Recommended founding horizon for conventional or deep foundations	Estimated bearing capacity** at conventional founding depth	Estimated range in founding depth	Distress noted in existing structures			base	subbase	selected	general fill	pipe bedding
		Classification	Trench instability ?																			
		[%]	[yes/no]	[m]	[Class]	[Class]	[Class]		[mm]				[kPa]	[m]	[y/n ; N/A]	Dry	Wet*					
B_1	TSMO becoming weakly ferruginous cemented with depth / pebble marker / completely weathered sandstone with intercalated shale and tillite locally	*soft* >80 *hardrock* <20	yes	<1 5	0	II	II	slopes typically 2 to 4%	*<50 (-)*	C_2	3 and 4	weakly ferruginous cemented TSMO or stiff residua	<15	0 8 - 1 4	N/A	yes	no	✗	✗	✔	✔	✔
C_1	sandstone outcrops with thin surficial regolith locally	*hardrock* >50 *soft* <50	no	<0 5	0	0	0	slopes <3%	*<10 (-)*	*R*	1	very soft rock sandstone, shale or tillite	>200	0 0 - 0 6	N/A	yes	no	✗	✗	✔	✔	✗
C_2	thin surficial regolith / nodular and hardpan ferricrete	*soft* >60 *hardrock* <40	no	<0 3 (perennial)	0	0	0	susceptible to surface seepage and marshy ground conditions locally; slopes <4%	*<10 (-)*	*R - S*	1	hardpan ferricrete or ferruginous cemented residua	>200	0 0 - 0 6	N/A	yes	no	✗	✔	✔	✔	✗
D_1	alluvium / sandstone or shale	*soft >90* *hardrock* <10	yes	0 0	0	0	II	drainage line / surface flow; mostly below 1:100 year floodline; or marshy ground conditions	*highly variable*	P_{marsh}	no development recommended				N/A	no	no	✗	✗	✗	✗	✗

Notes:
1 Conventional founding methods as per SABS 0161-1980 (as amended 1984, 1985 and 1986) Foundations placed on unfavourably dipping bedrock must be dowelled at regular intervals
2 Modified normal construction techniques - reinforced strip footings, wide strip footings, articulation joints, light reinforcing in masonry, site drainage and plumbing precautions[7] Construct walls independent of the floors
3 Compaction of *insitu* soils below individual footings - remove *in situ* soils to 1 5B (single storey) and 2B (double storey) - B = maximum footing width - and over a width of 1 5B before backfilling the excavation with suitable inert material in controlled layers; controlled layers must be a maximum of 150mm thick and compacted to a minimum of 93% Modified AASHTO density at -1 to +2% of optimum moisture content[7] Backfill material must comprise a minimum of a G7 material; alternatively, it may be possible to stabilized the in situ soils, e g for PI's greater than 15, but less than 25, the soils could be stabilized with 3 to 5% lime
4 Deep strip footings - found on competent horizon below the potentially problematical horizon Construct walls independent of the floors
5 Soil raft - remove *in situ* soils to 1 0m beyond the perimeter of the structure and to a depth of 1 5B (single storey) and 2B (double storey), or to competent material, before backfilling the excavation with suitable imported inert material - minimum of a G7 in terms of TRH 14 - in controlled layers as per Note 3; normal construction with site drainage requirements[7]
6 Split construction - combination of reinforced brickwork, blockwork and full movement joints with suspended floors or reinforced slabs acting independently from the structure Good site drainage and plumbing precautions[7]
7 Stiffened or cellular raft - stiffened or cellular raft with articulation joints or solid light reinforced masonry; good site drainage and plumbing precautions[7]
8 Dynamic compaction - directly engineer insitu material
9 Piled foundations using end-bearing or displacement type piles; floors to be suspended
(*FOUNDING COSTS GENERALLY INCREASE FROM 1 - 9*)

Comments: * = subject to confirmatory percolation tests; + = subject to confirmatory laboratory tests; b/l = beyond limit of present investigation; n/a = not applicable; N/A = not available; ** = for less than 10mm of settlement for a typical soil profile; ++ = for conventional strip footings founded at 0 6m and underlain by a typical soil profile
Additional comments on abbreviated soil profile: / = overlying; $_e$ = horizon may contain potentially expansive clays; ( ) = horizons in brackets may be present locally; TSMO = transported soils of mixed origin

Zones designated **B_1** comprise those areas characterised by mostly thick transported soils of mixed origin (TSMO), which often become weakly ferruginous cemented with depth, overlying completely weathered sandstone with intercalated shale horizons and tillite locally. The geotechnical characteristics of these zones are summarized as follows:

- Greater than 80% of the zone will classify as *soft excavation*[4] to 1.5m, with up to 20% *hardrock excavation*[4].
- Owing to the prevalence of pedocrete development with depth, these areas are susceptible to the development of a perched groundwater table after periods of prolonged precipitation, and mostly within 1.5m of ground level. It is therefore recommended that damp proofing measures be included throughout all structures, with subsoil drains behind all retaining structures.
- The topography is gently undulating with slopes typically less than 4%, which is ideal for residential development, but will require that stormwater control is adequately addressed.
- No expansive soils are envisaged in this zone. However, the TSMO is compressible and potentially collapsible, while the underlying residuum is *moderately* compressible. Taking cognisance of the maximum predicted settlement of approximately 50mm, with up to 20mm of collapse settlement possible under the present moisture regime, these areas have been classified as C_2 in terms of the Code of Practice[7]. To counteract the settlements envisaged, it is recommended that the substrate beneath the foundations be engineered in controlled layers; to this end, foundation excavations must be taken down to a depth and breadth of at least 1.5B (where B equals the maximum footing width), or down to competent material, e.g. weakly ferruginous cemented TSMO, before returning the excavated material in controlled layers to the desired founding level; controlled layers must be a maximum of 150mm thick and compacted to a minimum of 93% Modified AASHTO density at -1 to +2% of optimum moisture content. The backfill must comprise a minimum of a G7[4] quality material, and the TSMO should mostly suffice. The subgrade beneath all lightly loaded floors must also be engineered in controlled to a depth of at least 0.3m, and floor slabs must be cast independent of the walls.

Zones designated **C_1** comprise those areas characterised by sub-outcropping and outcropping sandstone with sporadic, intercalated shale horizons. The geotechnical characteristics of these zones are summarized as follows:

- In view of the sub-outcropping and/or outcropping sandstone and/or shale, *hardrock excavation*[4] is envisaged throughout greater than 50% of these areas to 1.5m, with less than 50% *soft excavation*[4].
- Owing to the prevalence of competent bedrock at shallow depth, these areas are susceptible to the development of a perched groundwater table after periods of prolonged precipitation, and probably within 0.5m of ground level. It is therefore recommended that damp proofing measures be included throughout all structures, with subsoil drains behind all retaining structures.
- The topography is gently undulating with slopes typically less than 3%, which is ideal for residential development, but will require that stormwater control is adequately addressed.
- No expansive soils are envisaged in these areas. Furthermore, the prevalence of competent bedrock at shallow depths will provide an ideal founding substrate for the residential structures. These areas have therefore been classified as *R* in terms of the Code of Practice[7] and conventional foundations will suffice. However, foundations must be placed on the bedrock sandstone or shale throughout, failing which the structures could be susceptible to increased differential settlement.

Zones designated **C_2** are geotechnically similar to those areas designated C_1, although with competent pedocrete present at shallow depth as opposed to sandstone or shale. The geotechnical characteristics of these zones are summarized as follows:

- Owing to the prevalence of competent pedocrete at shallow depth, *intermediate excavation*[4] is envisaged throughout greater than 50% of these areas to 1.5m, with less than 50% *soft excavation*[4], i.e. the pedocrete could not be penetrated with a backhoe, but a 20-ton excavator or similar should penetrate the material.
- The prevalence of competent pedocrete at shallow depths makes these areas susceptible to the development of a perennial perched groundwater table, mostly within 0.3m of ground level. Furthermore, marshy ground conditions and surface seepage may occur after periods of prolonged precipitation. To ensure these areas are habitable, it is paramount that subsoil drains are incorporated with the bulk services to lower the perched groundwater table and prevent water-logged ground conditions. Despite the installation of "regional" drains, subsoil drains are also

recommended around individual structures, with damp proofing measures throughout all-structures.

- As is typical of the areas earmarked for new extensions to Siyathuthuka, the topography is gently undulating with slopes mostly less than 4%, which are deemed ideal for township development. However, owing to the susceptible of these areas to marshy ground conditions, with surface seepage after periods of prolonged precipitation, stormwater control is deemed paramount.
- No expansive soils are envisaged in these areas. Furthermore, the prevalence of competent pedocrete at shallow depths, will provide an ideal founding substrate for residential structures. These areas have therefore been classified as *R - S* in terms of the Code of Practice[7] and conventional foundations will suffice, providing these are placed on competent pedocrete throughout.

Zones designated **D_1** comprises those areas falling below the 1:100 year floodline and adjoining areas characterised by marshy ground conditions. The soil profiles in these areas are similar to those of Zone B_1, i.e. transported soils overlying residua derived from the in situ weathering of sandstone, shale and tillite. The geotechnical characteristics of this zone are summarized as follows:

- Greater than 90% of the zone will classify as *soft excavation*[4] to a depth of 1.5m, with less than 10% *hardrock excavation*[4].
- These areas mostly fall below the 1:100 year floodline and/or are susceptible to perennial, marshy ground conditions.
- The marshy ground conditions and/or constraint of the 1:100 year flood line, makes these areas unsuitable for residential development. As such, they have been classified as P_{marsh} in terms of the Code of Practice[7]. No development is recommended, and these areas should ideally be zoned as private open space (POS).

General

Notwithstanding the mostly virgin grassveld characteristic of the areas earmarked for the proposed extensions, these areas border existing residential development with evidence mounds and pockets of fill locally (**Figure 3**). The possibility of areas of buried fill should therefore not be discounted, e.g. ash/waste/compost pits etc. Should fill of any nature be encountered in the foundation excavations, this material must be removed to spoil and be

replaced with suitable inert material in controlled layers - see not 3 (**Table 1**). Backfill must comprise a minimum of a G7[6] quality material.

Throughout the proposed township, it is recommended that the ground surface around individual structures be suitably landscaped to ensure that ponding of surface water does not occur near foundations. Furthermore, all downpipes should discharge well away from individual structures, and all water bearing services should be fitted with flexible joints at points of ingress and egress to structures or soil rafts.

While the susceptibility of the area to a perched groundwater table has been discussed in the various zones identified, it is imperative that measures are incorporated during the installation of bulk services to intercept and divert percolating groundwater. (This should provide a cost-effective means of removing the percolating groundwater). Failure to address this constraint adequately, could result in failure of surfaced roads, excessive damp in residential structures and marshy ground conditions in gardens, especially in Zones designated C_2.

1.3. Roads

The design of all roads must be undertaken by a Professional Engineer taking cognisance of the potentially collapsible TSMO prevalent in Zone B_1, shallow (<1.5m), perched, groundwater throughout most of the various extensions, shallow bedrock in Zone C_1 and hardpan ferricrete in Zone C_2.

The surficial TSMO prevalent throughout the townships is likely to classify as G7in terms of TRH14 - see interpolated soil parameters in the summary table of results in **Appendix C** - making these soils potentially suitable for use in the selected layers of paved areas and roadways. The hardpan ferricrete in Zone C_2 has been extensively exploited as a source or road building material, and it is envisaged that this material will classify as G5 in terms of TRH14, making it suitable for use as a subbase. Material for use in the base layers will have to be imported. Alternatively, the pedocrete can be stabilized with cement, of which 4% should suffice in yielding a C3/C4 material in terms of TRH14.

2. INTRODUCTION

2.1. Terms of reference

In terms of an appointment dated 11 November 2011 from Mr E van Veenhuyzen of Messrs Sisonke Development Planners, Geo3cc has undertaken an engineering geological investigation for township proclamation purposes. Our appointment follows the submission of a proposal and costing dated 26 October 2011 (Our Reference: GQ/1297/a/hjs).

The investigation has been carried out according to the requirements for township proclamation purposes as laid down by the Council for Geosciences and Provincial Administrations in terms of the Town Planning and Ordinance Act of 1986. The investigation has also taken cognisance of the published *Guidelines for Urban Engineering Geological Investigations*[5b] and the *Code of Practice*[7].

This report, together with the accompanying Engineering Geological Maps (**Figure 2** to **4, Appendix A**), summarizes the findings of the investigation.

2.2. Site details and physical characteristics

The proposed townships - Extensions 5, 6, 7 and 8 - with a combined area of approximately 110-hectares, are situated on the outskirts of Siyathuthuka, northwest of Belfast in Mpumalanga (**Figure 1**). The proposed townships are mostly undeveloped:

- Extensions 5, situated on the northwestern corner of Siyathuthuka, is characterized by gently sloping topography with grassveld throughout and a new cemetery at the southern end of the proposed township
- Extension 7, situated on the southeastern corner of Siyathuthuka, slopes gently to the east, with remnants of a farmstead at the southern end of the proposed township, while vegetation comprises grassveld and bluegum plantations
- Extensions 6 and 8, at the southern end of Siyathuthuka, slope gently to the south and are characterised by grassveld and the remnants of a bluegum plantation

2.3. Reference sources

The following maps and aerial photographs were consulted during our investigation:

- 1:250,000 Scale published Geographical Series Map of the area, Barberton 2530 and Pretoria 2528
- 3x Enlargements of 1:60,000 Scale published aerial photographs 858, 859 and 860, strip 1, job 996, date 1997. Chief Directorate of Survey and Mapping

3. SITE INVESTIGATION

3.1. Fieldwork

The fieldwork phase of the investigation was undertaken at the beginning of February 2012, and comprised the excavation of thirty-three pits with a Bell 315S backhoe. Each pit was excavated to refusal or to a depth of at least 2m. In addition, a further three typical sandstone exposures were profiled, although the positions of many more were recorded using a hand-held GPS and have been included in our evaluation. The positions of the pits, as indicated on **Figures 2** to **4**, were selected to probe the soil zones identified using the stereoscopic analysis of aerial photographs.

All pits and representative exposures were profiled according to standard procedures[5a] by a professionally registered engineering geologist and the resultant profiles are included in **Appendix B**.

3.2. Sampling and laboratory testing

During inspection of the *in situ* soils, seven *undisturbed*, six lump and twenty-eight indicator samples, representative of the soils present beneath the proposed township, were extracted from the sidewalls of the pits for laboratory testing purposes. The samples were submitted to the laboratories of Messrs EngeoLab in Nelspruit for testing according to our instructions.

The test results, in the format they were received from the laboratory, are included in **Appendix C**.

4. GEOLOGY AND SUBSOILS

4.1. Site geology

Based on information gleaned the fieldwork phase of the investigation, the bedrock beneath the extensions comprises mostly shale and sandstone. In terms of the published 1:250,000 scale geological series maps of the area, Pretoria 2528 and Barberton 2530, these sedimentary rocks belong to the Vryheid Formation (Pv) of the Ecca Group, Karoo Supergroup. Typically, this Formation is characterised by quartzitic cross-bedded sandstone, which is pebbly near its base, with gritty sandstone and shale, i.e. consistent with the rocks encountered. Anomalous to the area however, is the gravelly and bouldery residuum with a fine-grained matrix, noted in Extensions 6, 7 and 8. This sedimentary rock have been classified as tillite, suggesting it belongs to the slightly older Dwyka Formation

(Pd) of the Karoo Supergroup, i.e. underlies the sandstones and shale. However, the published geological series map only indicate tillite much further to the southwest.

Dolerite and diabase dykes are also prevalent in the area, although no such intrusions were documented during the fieldwork. Of concern with these intrusive bodies, is that the soils derived from the *in situ* weathering of these rock can vary from fine-grained, potentially expansive soils to very hard rock boulders in a fine-grained matrix. Since these intrusions can vary from a few metres to several hundred metres wide and may form expansive soils on weathering, their possible presence must be borne in mind during development of the townships.

4.2. Site soils

The basic soil parameters obtained from grading and Atterberg Limits tests are summarized in **Table 2**, while generalized soil profiles for the various zones encountered are discussed below.

Zone B_1 comprises those areas characterised by mostly thick transported soils of mixed origin (TSMO), comprising silty or clayey fine sand that often becomes weakly ferruginous cemented with depth, overlying deeply weathered sedimentary rocks comprising mostly sandstone with intercalated shale horizons that have yielded clayey sand and sandy clay residua respectively. Residual tillite encountered locally in Extensions 6, 7 and 8, comprises scattered gravels, cobbles and boulders, in a floury fine-grained matrix.

Zone C_1 comprises those areas characterised by sub-outcropping and outcropping sandstone, with intercalated sub-outcropping shale locally, and pockets of surficial regolith comprising silty sand (TSMO) or abundant gravels and cobbles (coarse colluvium).

Zone C_2 comprises those areas characterised by sub-outcropping and outcropping hardpan ferricrete with thin surficial regolith of mostly silty fine sand (TSMO).

Zone D_1 comprises the drainage lines traversing the proposed townships and incorporate the adjoining marshy areas that are deemed unsuitable for development. These areas are

Table 2: Laboratory determined soil properties

Test Pit No.	Soil Origin	Horizon Depth [m] From	To	Soil Constituents [%] clay [<0,002mm]	silt [0,002-0,06mm]	sand [0,06-2,0mm]	gravel [2,0-60mm]	Atterberg Limits LL	PI	PI*	GM	LS [%]	Activity 0,4 = kaolinite; 0,9 = illite; 1,5-6,0 = montmorillonite		Natural Moisture Content [%]	Classification UNIFIED	PRA
TP 8	TSMO	0.30	1.25	7	24	69		26	4	3	0.78	2.0	0.4	LOW		SM	A.4 (1)
TP 10	TSMO	0.30	0.65	8	24	60	8	27	5	4	0.92	2.0	0.5	LOW		SM	A.4 (1)
TP 13	TSMO	0.25	1.20	12	34	54		33	11	10	0.51	5.4	0.8	LOW		CL	A.6 (5)
TP 16	TSMO	0.20	0.60	9	29	59	3	24	3	3	0.66	1.3	0.3	LOW		SM	A.4 (3)
TP 18	TSMO	0.80	1.60	5	17	54	24	0	0		1.40	0.0		LOW	10.30	SM	A.2.4 (0)
TP 21	TSMO	0.30	0.60	2	16	63	19	0	0		1.35	0.0		LOW		SM	A.2.4 (0)
TP 22	TSMO	0.30	0.90	5	24	59	12	23	3	2	0.98	1.7	0.4	LOW		SM	A.4 (1)
TP 25	TSMO	0.20	1.60	9	34	54	3	30	4	4	0.63	2.0	0.4	LOW		SM	A.4 (4)
TP 28	TSMO	0.30	0.75	9	27	62	2	24	5	4	0.73	2.0	0.4	LOW		SM/SC	A.4 (2)
TP 33	TSMO	0.30	1.20	7	23	69	1	20	4	3	0.81	2.0	0.4	LOW	15.50	SM/SC	A.4 (1)
TP 8	f/c TSMO	1.25	1.70	3	15	38	44	0	0		1.77	0.0		LOW		SM	A.1.b (0)
TP 13	w/f/c TSMO	1.20	1.90	11	33	49	7	34	5	4	0.67	5.4	0.4	LOW	27.60	ML	A.4 (5)
TP 2	hardpan ferricrete	0.30	1.30	2	7	23	68	0	0		2.27	0.0		LOW		GM	A.1.a (0)
TP 21	residual sandstone / ti	0.85	1.50	3	16	46	35	0	0		1.69	0.0		LOW	12.50	SM	A.1.b (0)
TP 21	nodular ferricrete / pebble marker	0.60	0.85	1	3	19	77	0	0		2.57	0.0		LOW		GP	A.1.a (0)
TP 34	residual sandstone	0.50	2.10	17	41	38	4	44	12	10	0.52	5.4	0.6	LOW	17.10	ML	A.7.5 (8)
TP 4	residual sandstone	0.60	1.10	2	6	26	66	0	0		2.30	0.0		LOW		GP	A.1.a (0)
TP 12	r/ residual sandstone	0.65	1.60	8	21	31	40	28	6	3	1.56	2.7	0.4	LOW		SM/SC	A.2.4 (0)
TP 16	residual sandstone	0.70	1.30	4	20	33	43	26	2	1	1.64	1.0	0.3	LOW		SM	A.2.4 (0)
TP 29	r/residual sandstone	0.70	1.00	9	27	41	23	30	4	3	1.20	2.0	0.3	LOW		SM	A.4 (2)
TP 9	w/f/c r/ residual sands	1.30	2.30	4	18	44	34	26	6	3	1.53	2.7	0.8	LOW		SM/SC	A.2.4 (0)
TP 28	w/f/c r/ residual sands	0.75	1.60	9	29	47	15	32	6	4	1.04	3.0	0.4	LOW		SM	A.4 (2)
TP 29	residual tillite	1.00	2.10	11	30	46	13	28	7	5	0.92	3.4	0.5	LOW		SM/SC	A.4 (3)
TP 31	residual tillite	0.50	1.00	4	11	33	52	27	4	2	1.96	2.0	0.5	LOW		SM	A.1.b (0)
TP 31	residual tillite	1.00	2.20	5	18	38	39	28	8	4	1.65	3.4	0.8	LOW	13.70	SC	A.2.4 (0)
TP 6	residual shale	1.60	2.10	15	43	31	11	36	8	7	0.63	3.4	0.5	LOW		ML	A.4 (7)
TP 6	residual shale	0.40	1.60	20	38	40	2	35	13	12	0.43	5.4	0.6	MEDIUM		CL	A.6 (8)
TP 14	residual shale	1.00	1.60	19	34	38	9	34	9	8	0.61	34.0	0.4	LOW		ML	A.4 (7)

Notes: PI = plasticity index (*) = on whole sample
LL = liquid limit; LS = linear shrinkage;
GM = grading modulus; n/t = not tested;
w/ = weakly; f/c = ferruginous cemented
r/ = residual; r/r = reworked residual;
TSMO = transported soils of mixed origin.

characterised by transported and residual soils similar to those encountered in Zone B_1, albeit with the residuum usually more deeply weathered.

5. GEOTECHNICAL EVALUATION

5.1. Excavatability and material usage

The pits excavated beyond those areas of outcropping and sub-outcropping bedrock (**Zone C_1**, **Figures 2** and **4**), were mostly excavated without refusal to depths in excess of 1.5m, although the presence of more competent ferruginous cemented regolith locally in Zones B_1 and prevalence of it in Zone C_2, often resulted in refusal of the backhoe at depths varying from 0.5 to 1.5m. It is therefore recommended that in Zone B_1, allowance be made for up to 20% *hardrock excavation*[4] in the Bill of Quantities (BoQ) for excavations to 1.5m. In Zone C_1, characterised by sub-outcropping and outcropping sandstone and shale, the BoQ must make allowance for greater than 50% *hardrock excavation*[4], while Zone C_2, characterised by shallow ferricrete, it is recommended that the BoQ make allowance for greater than 50% *intermediate excavation*, since the pedocrete should be penetrated by larger plant, although it could not be penetrated using a backhoe. In Zone D_1, characterised by thick transported soils overlying unconsolidated residua, it is envisaged that greater than 90% of these areas are characterised by *soft excavation*[4].

After clearing and grubbing the road reserves in Zone B_1, the surficial regolith will comprise mostly TSMO. These soils typically classify as A.4 (1-4) in terms of the PRA Classification with a grading moduli mostly less than 1 (**Table 2**). Based on our experience with similar material, and taking cognisance of the interpolated TRH14 classification for these soils - see the summary table in **Appendix C** - the surficial regolith should mostly classify as G7[6], making them potentially suitable for use in the selected layers of paved areas and roadways and in high quality engineered fills. The ferruginous cemented TSMO prevalent at depth in Zone B_1 and pedocrete in Zone C_1, are likely to classify as A.1.a/b (0) in terms of the PRA classification with grading moduli mostly greater than 1.5 and an interpolated TRH14 classification of G5; these soils are therefore potentially suitable for use in the subbase layers of paved areas and roadways. (The hardpan ferricrete prevalent in the area has been extensively exploited for road building material, e.g. large borrow pit downslope from TP01 (**Figure 2**), with numerous similar borrow pits around the outskirts of Belfast). If sufficiently weathered, the sandstone outcrops in Zone C_1 should also provide a viable source of construction materials for roads if necessary. However, irregular weathering of

the shallow bedrock usually only makes for thin surficial deposits of potentially suitable regolith.

5.2. Groundwater

In general, the extensions are all susceptible to the development of a perched groundwater table to a greater or lesser degree. In Zone B_1 characterised by thicker unconsolidated regolith, a perched groundwater table is still envisaged on the pedocrete development prevalent with 1.5m of ground level. In Zone C_1 with outcropping and sub-outcropping bedrock, a perched groundwater table is envisaged within 0.5m of ground level. Zone C_2 is characterised by shallow pedocrete, which in itself is indicative of a perched groundwater table. These areas are therefore susceptible to the development of a perennial, perched groundwater table within 0.3m of ground level; marshy ground conditions with surface seepage locally, may also occur after periods of prolonged precipitation.

Zones designated D_1 comprise those areas mostly falling below the 1:100 year floodline. However, the outer boundaries of these areas (1:100 year floodline) have been extended, where necessary, to incorporate those areas characterised by marshy and water-logged ground conditions.

5.3. Potentially expansive soils

Plotting the Plasticity Index (whole sample) against the clay percentage on a Standard Activity diagram[8], for the soils tested (**Table 2**), revealed that an isolated sample of the residual shale classified as *medium*. However, this material has a linear shrinkage of only 5.4%, suggesting that it is unlikely to prove expansive. The remainder of the soils tested all classify as *low*.

5.4. Potentially collapsible and compressible soils

The open texture noted in the TSMO make these soils susceptible to consolidation and/or collapse settlement. To assess these properties, representative samples of the material were subjected to double oedometer tests and/or moisture, density and specific gravity determinations. Representative samples of the residual shale and sandstone, were also subjected to similar tests to assess their consolidation properties. The results from tests undertaken on the undisturbed samples are all summarized in **Table 3**.

Table 3: Summary of soil parameters from tests on undisturbed samples

Material	Pit position	Depth [m]	Profiled consistency	Dry density [kg/m^3]	e_0	OCR	Mois-ture [%]	Sr [%]	m_v x10^{-4} [m^2/kN]	cc	Collapse potential {est}^{2} [%]
TSMO	TP 8	0.70	loose	1,390	0.882	2.5	12.7	37.7	8.76	0.289	8.8 {10.6}
TSMO	TP 13	0.80	soft	1,210	1.164	3.4	29.3	66.0	7.23	0.369	3.7 {20.1}
TSMO*	TP 13	1.50	medium dense	1,473	0.779	nd	27.6	92.8	nd	nd	nd
TSMO*	TP 18	1.00	dense	1,949	0.339	nd	10.3	79.3	nd	nd	nd
TSMO	TP 22	0.60	loose	1,370	0.899	4.1	23.3	67.4	7.18	0.321	2.1 {11.6}
TSMO	TP 25	0.70	soft - firm	1,380	0.890	3.8	17.1	50.1	5.95	0.283	3.3 {11.1}
TSMO	TP 33	0.70	loose	1,560	0.673	nd	15.5	60.1	nd	nd	nd
residual shale	TP 6	0.70	firm	1,480	0.767	12.5	21.8	74.5	2.44	0.233	1.0
residual sandstone	TP 21	1.00	dense	1,890	0.392	nd	12.5	83.9	nd	nd	nd
residual sandstone*	TP 28	1.00	medium dense	1,400	0.867	11.8	22.6	68.3	2.04	0.279	0.6
reworked residual sandstone	TP 31	0.70	loose	1,450	0.802	1.7	11.3	36.8	10.20	0.249	nd
residual sandstone	TP 31	1.20	stiff	1,845	0.420	nd	13.7	85.5	nd	nd	nd
residual sandstone	TP 34	0.70	firm	1,586	0.652	nd	17.1	68.7	nd	nd	nd

Notes: E' - estimated deformation modulus; e_0 - initial void ratio; S_r - initial degree of saturation; nt - not tested; n/a - not applicable; OCR - over consolidation ratio; nt - not tested; n/a - not applicable; * - weakly ferruginous cemented.

Table 4: Coefficient of volume compressiblity (m_v)		
Consistency	Compressibility Class	Coefficient x 10^{-4} m^2/kN
very soft/loose	very high	> 15
soft/loose	high	3 - 15
medium dense/firm	moderate	1 - 3
dense/stiff	low	0.5 - 1
very dense/stiff	very low	< 0.5

The test results indicate that the TSMO are potentially collapsible, with the maximum recorded collapse of 8.8%. (The estimated collapse[2] for these soils varied from approximately 11% to 20%, and the discrepancy between the measured and estimated collapse is attributed to the elevated in situ moisture contents). In addition to these soils being collapsible, the calculated coefficient of volume compressibility (m_v) over the stress range of 100kPa greater than the overburden pressure (**Table 3**), classifies as *high* (**Table 4**).

With reference to double oedometer tests undertaken on undisturbed samples of the residua, only nominal collapse was recorded. However, the calculated coefficient of volume compressibility (m_v) over the stress range of 100kPa greater than the overburden pressure mostly classifies as *moderate*, with an isolated sample of the reworked residual sandstone classifying as *high* (**Table 4**).

5.5. Slope angles

Slopes throughout the areas earmarked for residential development - Extensions 5 to 8 - are less than 6%, which is deemed ideal for townships. However, the prevalence of a shallow perched groundwater table, with the possibility of surface seepage locally after periods of prolonged precipitation, dictates that storm water control will be paramount.

5.6. Settlement calculations and zonal (NHBRC) classification

The predicted settlement for light foundation pressures, i.e. less than 50kPa, based on our visual assessment of the soils and/or laboratory results suggests that:

- Foundations in Zone B_1 will typically be underlain by *highly* compressible and potentially collapsible TSMO, which in turn overlie residuum that is typically *moderately* (**Table 4**) compressible, grading into more competent residua with depth.

As such, conventionally dimensioned strip footings imposing 50kPa will be susceptible to a maximum of 50mm of settlement, of which approximately 20mm can be attributed to collapse at the current moisture contents. This zone has therefore been classified as C_2 in terms of the Code of Practice[7].

- Zone C_1 comprises those areas of sub-outcropping and outcropping sandstone with intercalated shale. Throughout most of these zones therefore, foundations for the lightly loaded structures can be placed directly on the bedrock present at shallow depth. As such, these areas classify as *R* in terms of the Code of Practice[7].
- Zone C_2 comprises those areas of sub-outcropping and outcropping hardpan ferricrete, or with pedocrete development at shallow depths. As in the case of Zone C_1, a competent founding substrate is envisaged at shallow depth and these areas have been classified as *R - S* in terms of the Code of Practice[7].
- Zones designated D_1 comprises those areas falling below the 1:100 year floodline and/or areas adjoining the drainage lines that are susceptible to marshy ground conditions. As such, these areas are deemed unsuitable for residential development and have been classified as P_{marsh} in terms of the Code of Practice[7].

6. REPORT PROVISIONS

While every effort was made during the fieldwork to identify the different soil and rock horizons and determine their distribution, guaranteeing that isolated zones of either poorer foundation material or hard rock excavation has not been identified is impossible under the constraints of an investigation of this nature. The investigation has therefore sought to highlight potential foundation and excavation problems and provide early warning to the municipal engineers and developers. Detailed geotechnical investigations must be undertaken for all new structures to confirm the constraints identified.

We trust that the above observations meet with your requirements of us in this project, and will make ourselves available to discuss our findings should there be any queries.

H.J. Schurink, Pr.Sci.Nat., GDE.
for Geo3cc.

7. REFERENCES

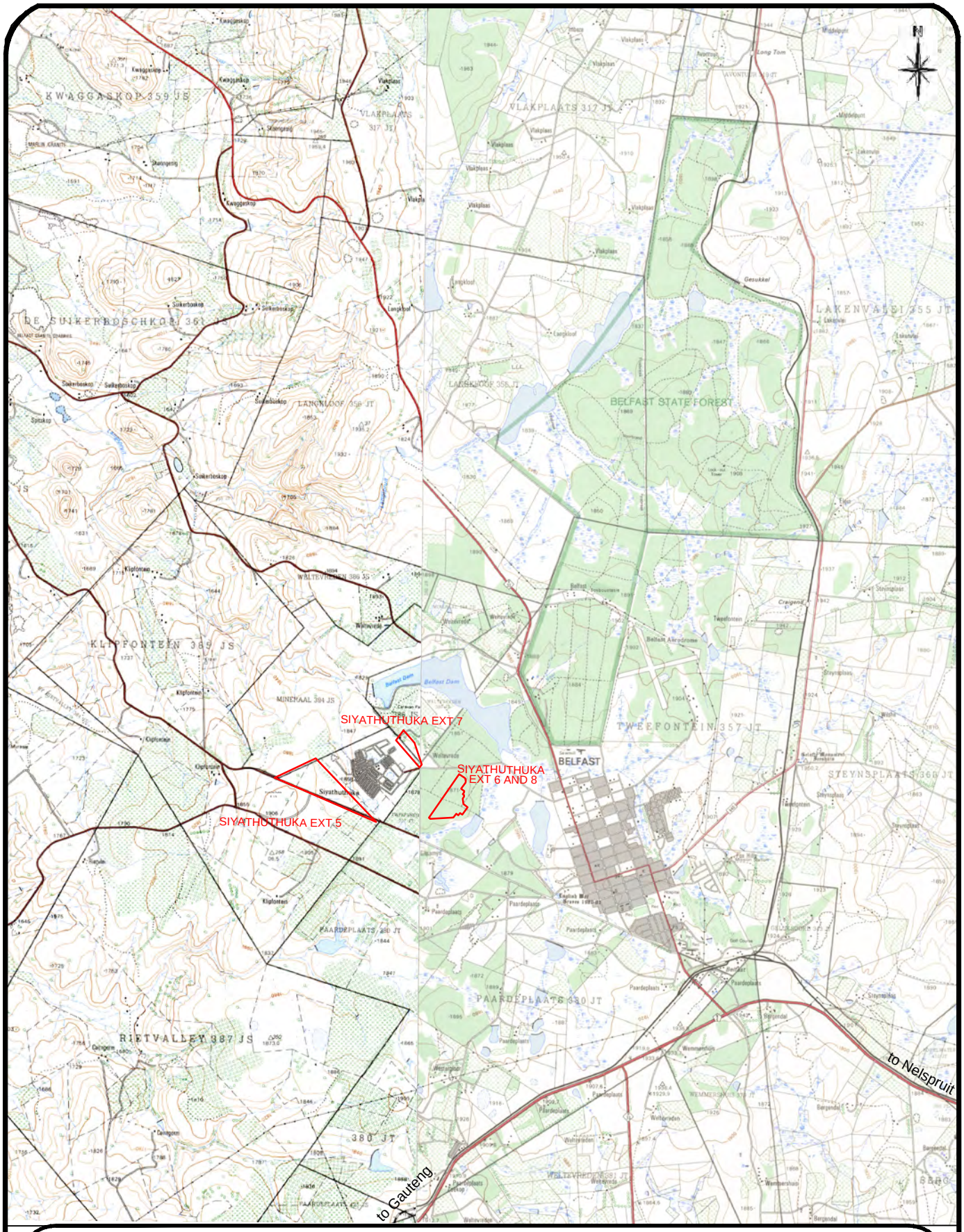
1. **Brink, A.B.A.** (1979). *Engineering Geology of Southern Africa.* Volume 1 - The first 2 000 million years of geological time, Building Publication, Pretoria, 319pp.
2. **Brink, A.B.A.** (1985). *Engineering Geology of Southern Africa*. Volume 4 - Post-Gondwana Deposits. Building Publications, Pretoria, 332pp.
3. **Jennings, J.E. and Knight, K.** (1975). *A guide to construction on or with materials exhibiting additional settlement due to collapse of grain structure*. Proceedings, 6th Regional Conference for Africa SM and FE Durban.
4. **South African Bureau of Standards** (1200 D) (1998). *Standardized Specification for Civil Engineering Construction D: Earthworks*.

5a. **South African Institute of Engineering Geologists**. (1990). *Guidelines for soil and rock logging - Geotechnology Workshop*.

5b. **South African Institute for Engineering Geologists**. (1997). Guidelines for Urban Engineering Geological Investigations.

6. **South Africa Department of Transport**, Committee of State Road Authorities, Technical Recommendations for Highways - TRH 14. (1985). *Guidelines for Road Construction Materials*. Government Press, Pretoria, p57. Reprint 1989.
7. **The Joint Structural Division of SAICE and IstructE.** (1995). *Code of Practice:- Foundations and Superstructures for Single Storey Residential Buildings of Masonry Construction*; Johannesburg.
8. **Van der Merwe, D.H.** (1974). *The prediction of heave from the plasticity index and percentage clay fraction of soils*. Trans. of the SA Inst. Civ. Eng. Vol 6, No 6, pp 103 - 107.

APPENDIX A
FIGURES 1 TO 4



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Siyathuthuka Extensions 5, 6, 7 and 8

Sisonke Development Planners

Project
999

Date
Feb. 2012

Scale
1:100 000 (A3)

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FIGURE 1

General Notes

1. Extract from 1 50 000 scale topographic series maps 2529DB and 2530CA.

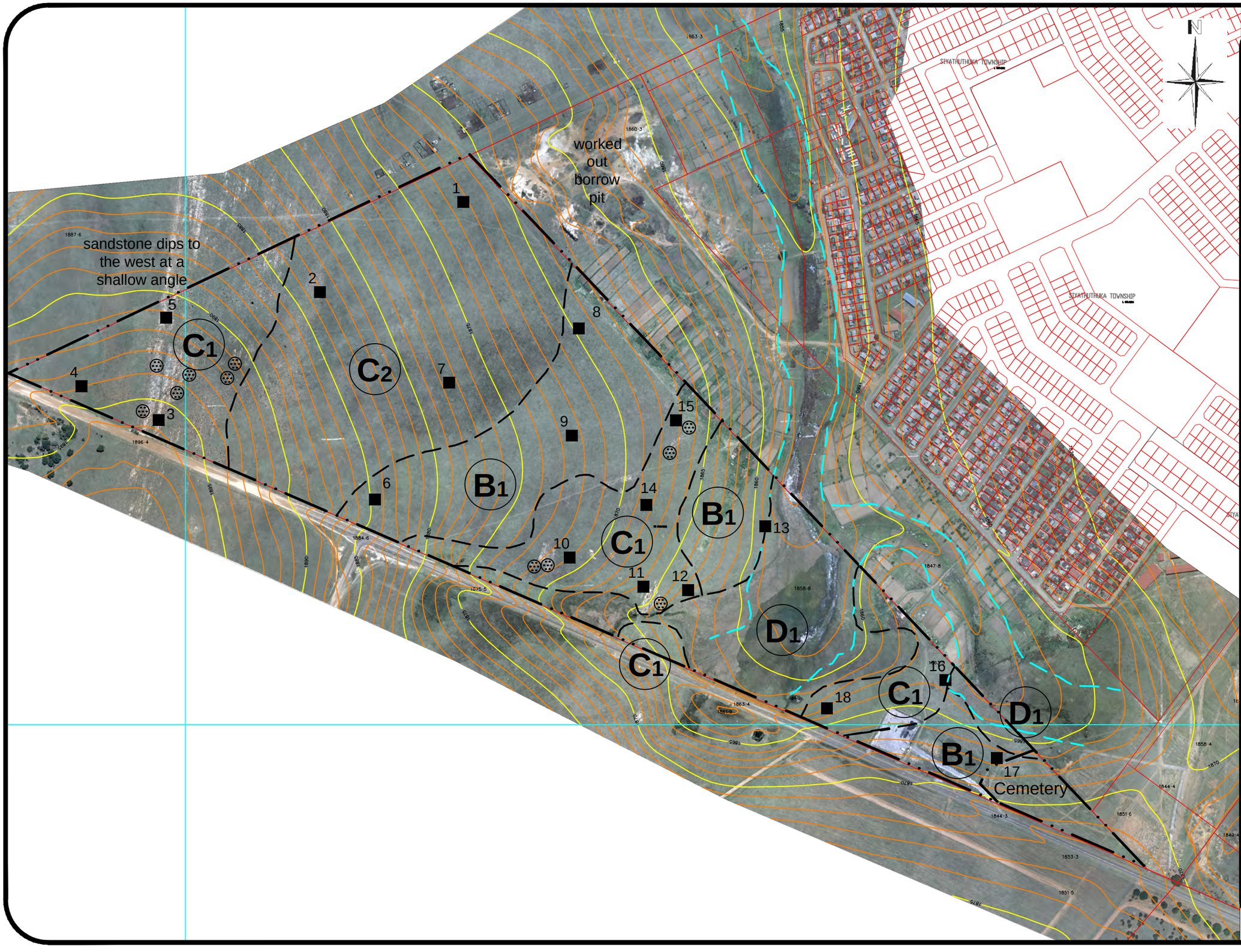
Table 1: Summary of geotechnical and development constraints for township development: Siyathuthuka Extensions 5, 6, 7 and 8 - to be read in conjunction with the report.

Zone	Abbreviated soil profile to 2m	Interpolated Geotechnical Constraints							Lightly loaded residential structures: typically <50kPa							Potentially suitable for on-site sanitation		Possible uses for surficial horizons, i.e. <1m				
		Class of problem envisaged based on soil movement: 0 - most favourable; II/III - least favourable. **Compressible soils:** Class 0: <10mm; Class I: 10-20mm; Class II: >20mm. **Expansive soils:** Class 0: <7.5mm; Class I: 7.5 - 15mm; Class II: 15 - 30mm; Class III: >30mm. **Collapsible soils:** Class 0: <5mm; Class I: 5 - 10mm; Class II: >10mm.							Code of Practice[7]			Founding Considerations									
		Excavatability to 1.5m in terms of SABS 1200D		Depth to perched ground water table	Expansive	Collapsible	Compress-ible	Other geotechnical constraints	Predicted range in soil movements++ + ≈ heave - ≈ consolid.	Site Class	Typical founding solutions - see **Notes**	Recommended founding horizon for conventional or deep foundations.	Estimated bearing capacity** at conventional founding depth	Estimated range in founding depth	Distress noted in existing structures			base	subbase	selected	general fill	pipe bedding
		Classification	Trench instability ?													Dry	Wet*					
		[%]	[yes/no]	[m]	[Class]	[Class]	[Class]		[mm]				[kPa]	[m]	[y/n ; N/A]							
B_1	TSMO becoming weakly ferruginous cemented with depth / pebble marker / completely weathered sandstone with intercalated shale and tillite locally	*soft* >80 *hardrock* <20	yes	<1.5	0	II	II	slopes typically 2 to 4%	*<50 (-)*	C_2	3 and 4	weakly ferruginous cemented TSMO or stiff residua	<15	0.8 - 1.4	N/A	yes	no	✗	✗	✔	✔	✔
C_1	sandstone outcrops with thin surficial regolith locally	*hardrock* >50 *soft* <50	no	<0.5	0	0	0	slopes <3%	*<10 (-)*	*R*	1	very soft rock sandstone, shale or tillite	>200	0.0 - 0.6	N/A	yes	no	✗	✗	✔	✔	✗
C_2	thin surficial regolith / nodular and hardpan ferricrete	*soft* >60 *hardrock* <40	no	<0.3 (perennial)	0	0	0	susceptible to surface seepage and marshy ground conditions locally; slopes <4%	*<10 (-)*	*R - S*	1	hardpan ferricrete or ferruginous cemented residua	>200	0.0 - 0.6	N/A	yes	no	✗	✔	✔	✔	✗
D_1	alluvium / sandstone or shale	*soft >90* *hardrock* <10	yes	0.0	0	0	II	drainage line / surface flow; mostly below 1:100 year floodline; or marshy ground conditions	*highly variable*	P_{marsh}	no development recommended				N/A	no	no	✗	✗	✗	✗	✗

Notes:
1. Conventional founding methods as per SABS 0161-1980 (as amended 1984, 1985 and 1986). Foundations placed on unfavourably dipping bedrock must be dowelled at regular intervals.
2. Modified normal construction techniques - reinforced strip footings, wide strip footings, articulation joints, light reinforcing in masonry, site drainage and plumbing precautions[7]. Construct walls independent of the floors.
3. Compaction of *insitu* soils below individual footings - remove *in situ* soils to 1.5B (single storey) and 2B (double storey) - B = maximum footing width - and over a width of 1.5B before backfilling the excavation with suitable inert material in controlled layers; controlled layers must be a maximum of 150mm thick and compacted to a minimum of 93% Modified AASHTO density at -1 to +2% of optimum moisture content[7]. Backfill material must comprise a minimum of a G7 material; alternatively, it may be possible to stabilized the in situ soils, e.g. for PI's greater than 15, but less than 25, the soils could be stabilized with 3 to 5% lime.
4. Deep strip footings - found on competent horizon below the potentially problematical horizon. Construct walls independent of the floors.
5. Soil raft - remove *in situ* soils to 1.0m beyond the perimeter of the structure and to a depth of 1.5B (single storey) and 2B (double storey), or to competent material, before backfilling the excavation with suitable imported inert material - minimum of a G7 in terms of TRH 14 - in controlled layers as per Note 3; normal construction with site drainage requirements[7].
6. Split construction - combination of reinforced brickwork, blockwork and full movement joints with suspended floors or reinforced slabs acting independently from the structure. Good site drainage and plumbing precautions[7].
7. Stiffened or cellular raft - stiffened or cellular raft with articulation joints or solid light reinforced masonry; good site drainage and plumbing precautions[7].
8. Dynamic compaction - directly engineer insitu material.
9. Piled foundations using end-bearing or displacement type piles; floors to be suspended.
(*FOUNDING COSTS GENERALLY INCREASE FROM 1 - 9*).

Comments: * = subject to confirmatory percolation tests; + = subject to confirmatory laboratory tests; b/l = beyond limit of present investigation; n/a = not applicable; N/A = not available; ** = for less than 10mm of settlement for a typical soil profile; ++ = for conventional strip footings founded at 0.6m and underlain by a typical soil profile.

Additional comments on abbreviated soil profile: / = overlying; $_e$ = horizon may contain potentially expansive clays; ( ) = horizons in brackets may be present locally; TSMO = transported soils of mixed origin.



General Notes

LEGEND

2 Profile positon and number

Township boundary

Geotechnical /soil boundary

1:100 Year floodline

B1 Zone designation

Position of sandstone (...) outcrops recorded during the fieldwork

Zone Classification
A - Ideal.
B - Minor constraints.
C - More serious constraints.
D - No development recommended.

Notes:
1 Detailed investigations required for all new structures.
2.Pit/Profile positions have not been surveyed.
3.Soil boundaries to be confirmed in the field.
4.Layout and basemap provided by Messrs Sisonke Development Planners.
5.1:100 Year flood-line provided by Messrs Consolv Consulting Engineers.
6.Areas of buried fill should not be discounted.

No.	Revision/Issue	Date

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Siyathuthuka Extension 5

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Project	Sheet
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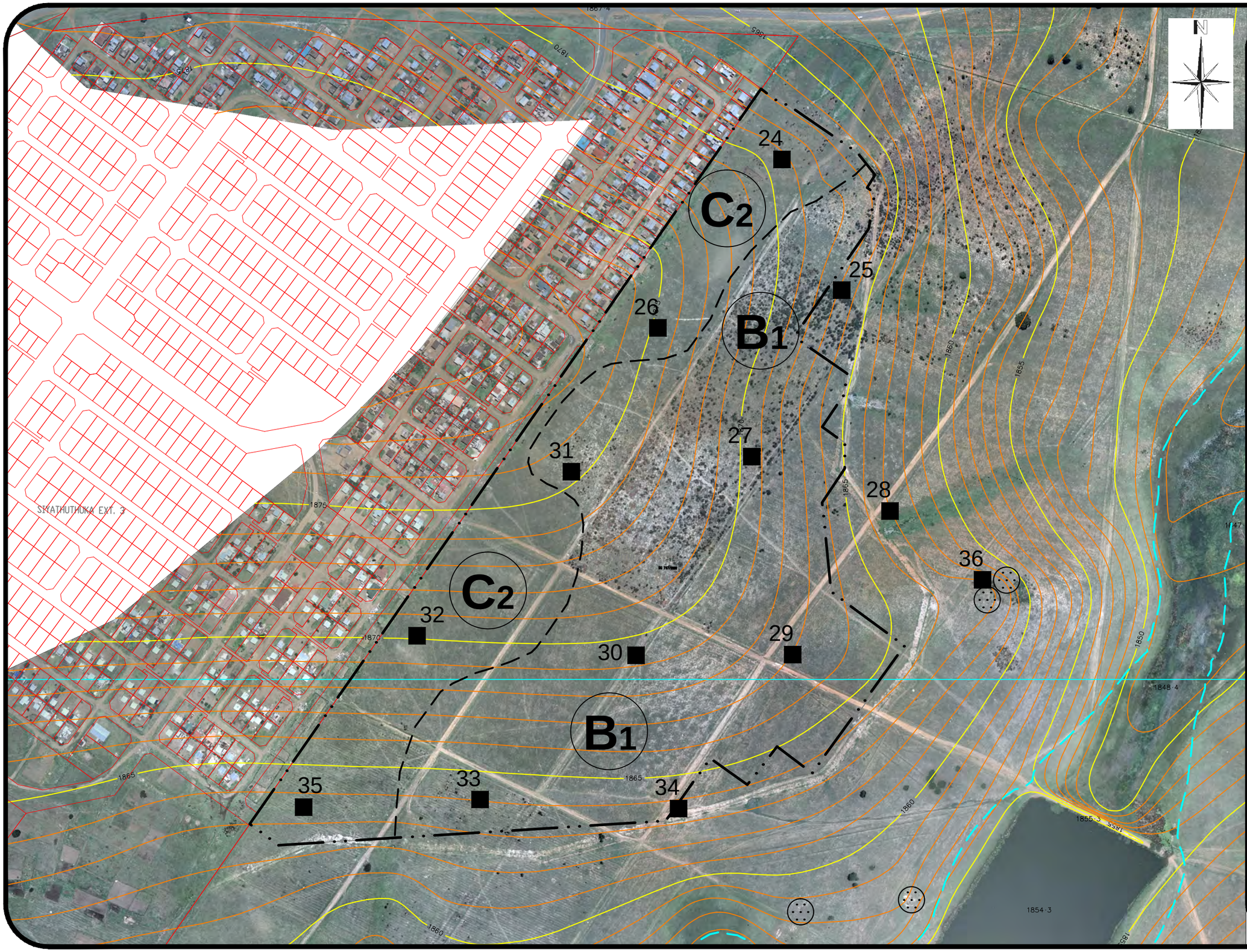
Scale: 1:6 000 (A3)	



General Notes

LEGEND

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Siyathuthuka Extensions 6 and 8

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Project	Sheet
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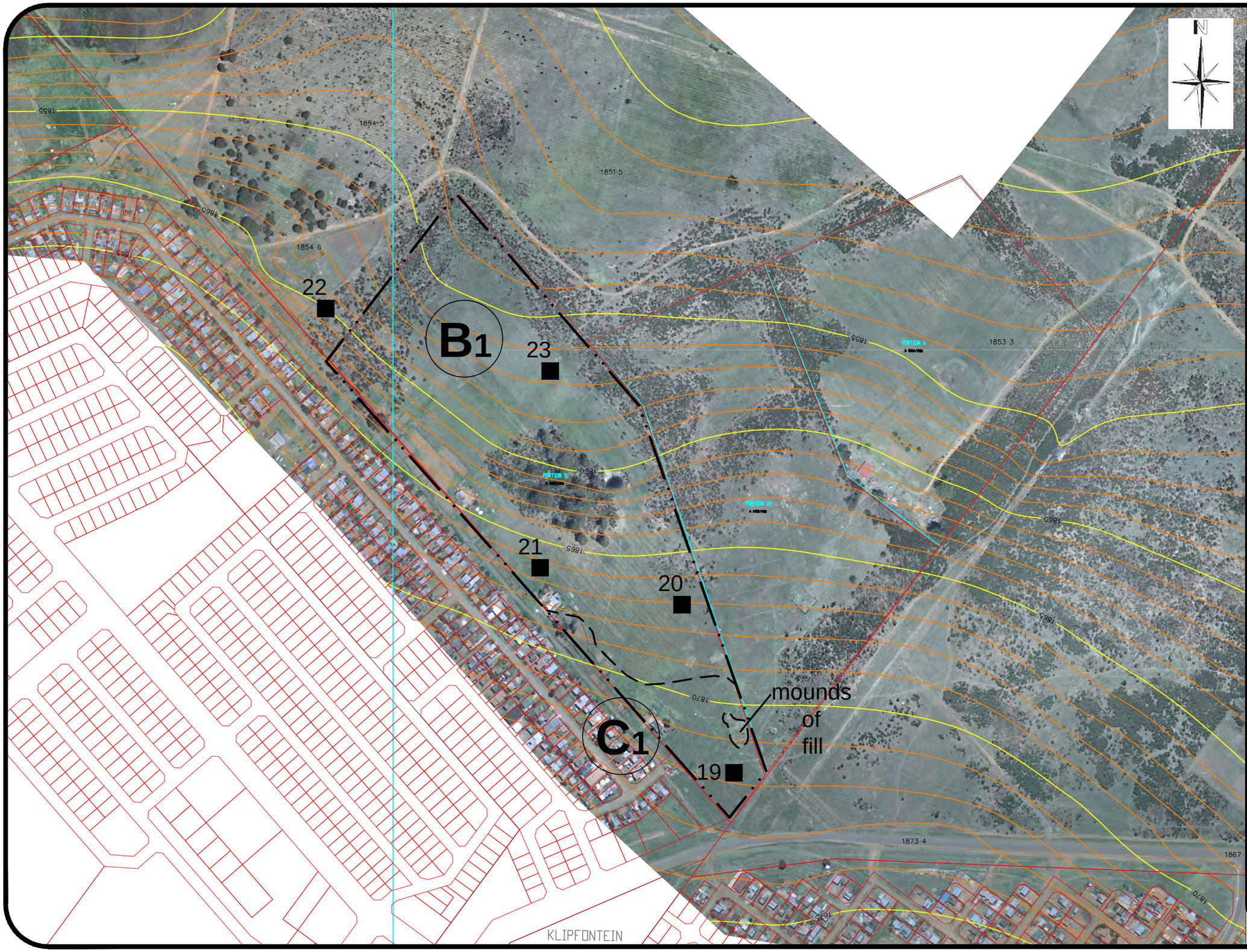
Scale: 1 : 4 000 (A3)	



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General Notes

LEGEND

2 Profile positon and number

Township boundary

Geotechnical /soil boundary

1:100 Year floodline

B1 Zone designation

Position of sandstone (...) outcrops recorded during the fieldwork

Zone Classification
A - Ideal.
B - Minor constraints.
C - More serious constraints.
D - No development recommended.

Notes:
1. Detailed investigations required for all new structures.
2. Pit/Profile positions have not been surveyed.
3. Soil boundaries to be confirmed in the field.
4. Layout and basemap provided by Messrs Sisonke Development Planners.
5. 1:100 Year flood-line provided by Messrs Consolv Consulting Engineers.
6. Areas of buried fill should not be discounted.

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999	FIGURE 4
Date: March 2012	
Scale: 1 : 4 000 (A3)	

APPENDIX B
SOIL PROFILES

SOIL DESCRIPTIVE TERMS

Descriptive Order - **1** Moisture **2** Colour **3** Consistency **4** Soil Structure **5** Soil Type **6** Origin

1. MOISTURE CONDITION - assessment of insitu conditions	
Dry	No water detectable; sample cannot be moulded
Slightly Moist	Water just discernable; sample can be moulded
Moist	Water easily discernable
Very Moist	Water can be squeezed out
Wet	Generally below the water table

2. COLOUR - described in profile, at natural moisture content unless otherwise specified	
Speckled	Very small patches of colour < 2mm
Mottled	Irregular patches of colour 2 - 6mm
Blotched	Large irregular patches 6-20mm
Banded	Approximately parallel bands of varying colour
Streaked	Randomly orientated streaks of colour
Stained	Local colour variations; associated with discontinuity surfaces

3(a) CONSISTENCY: GRANULAR SOILS - measure of the hardness or denseness of a soil

SPT "N"	GRAVELS & clean SANDS Generally free draining soils		Typical Dry Density(kg/m^3)
< 4	Very Loose	Crumbles very easily when scraped with geological pick	< 1450
4 - 10	Loose	Small resistance to penetration by sharp geological pick	1451 - 1600
>10 - 30	Medium dense	Considerable resistance to penetration by sharp end of geological point	1601 - 1750
>30 - 50	Dense	Very high resistance to penetration by sharp end of geological pick; requires many blows of pick for excavation	1751 - 1925
> 50	Very Dense	High resistance to repeated blows of geological pick; requires power tools for excavation	> 1925

3(b) CONSISTENCY: COHESIVE SOILS - measure of the hardness or denseness of a soil

SPT "N"	SILTS and CLAYS and combinations thereof with SANDS Generally slow draining soils (N = 0 material)		UCS (kPa)
<2	Very soft	Pick point can easily be pushed in to shaft of handle; easily moulded by fingers	< 50
2 - 4	Soft	Pick point can easily be pushed in 30 - 40 mm; moulded by fingers with some pressure; easily penetrated by thumb	50 - 125
5 - 8	Firm	Pick point penetrates up to 10mm; very difficult to mould with fingers; indented by thumb with effort; can just be penetrated with an ordinary hand spade	126 - 250
9 - 15	Stiff	Slight indentation produced by pushing pick point into soil; cannot be moulded by fingers; penetrated by thumb nail; requires hand pick for excavation	251 - 500
16 - 20	Very Stiff	Slight indentation produced by blow of pick point; requires power tools for excavation; indented by thumb nail with difficulty	501 -1000

4 **SOIL STRUCTURE** - presence or absence of fissures or other planes of weakness	
Intact	Structureless, no discontinuities identified
Fissured	Soil contains discontinuities which may be open or closed, stained or unstained and of variable origin
Slickensided	Contains highly polished shear surfaces, glossy and often striated
Shattered	Very closely to extremely closely spaced continuities resulting in gravel size soil fragments which are usually stiff to very stiff and difficult to break down
Micro-shattered	As above, but sand-sized fragments
Controlled / uncontrolled	Descriptive term for fill material; relates to whether the material has been engineered, i e controlled, or not, i e uncontrolled
Open textured	Contains small voids between individual grains-visible to the naked eye Alt pinholed
Stratified	Parallel bedding planes Laminated if layers are less than 20mm thick
Varved	Alternating silty and clayey layers
Foliated	Residual metamorphic texture

5. SOIL TYPE - soil texture described on the basis of the grain size of particles

SOIL TYPE	**PARTICLE SIZE [mm]**	**REMARKS**
CLAY	< 0 002	Feels sticky; soils hands; shiny when wet
SILT	0 002 - 0 06	Dilatant; dusts off once dry; chalky feel on teeth
SAND fine	0 06 -0 02	Gritty on teeth
SAND medium	0 2 - 0 6	Visible to naked eye
SAND coarse	0 6 - 2 0	Visible to naked eye
GRAVEL fine	2 - 6	Observed with the naked eye **Matrix-supported** - clasts supported by matrix **Clast-supported** - clasts touching (matrix may or may not be present)
GRAVEL medium	6 - 20	
GRAVEL coarse	20 - 60	
COBBLES	60 - 200	
BOULDERS	>200	

Fine grained soils: slightly <5%; clayey/silty 5-15%; very silty/clayey 15-35%
Gravels / cobbles and boulders: occasional <5%, scattered 5-20%, numerous 20-45%; abundant >45%

6. ORIGIN - origination of particular soil horizon	
Transported	Alluvium, hillwash, talus, colluvium etc
Residual	Weathered from parent rock
Pedocretes	Ferricrete, calcrete, laterite, silcrete, dorbank etc

DEGREE OF CEMENTATION OF PEDOCRETES		UCS (MPa)
Very weakly cemented	Some material can be crumbled between finger and thumb; disintegrates under knife blade to a friable state	0 1 - 0 5
Weakly cemented	Cannot be crumbled with fingers; some material can be crumbled by strong pressure between thumb and hard surface; under light hammer blows disintegrates to a friable state	0 5 - 2 0
Cemented	Material crumbles under firm blows of sharp pick point; grains can be dislodges with some difficulty by a knife blade	2 - 5
Strongly cemented	Firm blows of sharp pick point on hand held specimen show 1 - 3 mm indentations; grains cannot be dislodged by knife blade	5 - 10
Hardpan	Hand held specimen can be broken by single firm blow of hammer head; similar appearance to concrete	10 - 25

Reference: *Guide to soil profiling for Civil Engineering Purposes* - Geoterminology Workshop (1990) SAIEG - AEG - SAICE (Geotechnical Division)

ROCK DESCRIPTIVE TERMS

Description for rocks masses: A - description of rock B - description of discontinueties C - description of fracture filling

A. ROCK DESCRIPTION	Descriptive Order for rock description: **1** Colour **2** Weathering **3** Texture **4** Fracture and microtexture **5** Rock hardness **6** Rock type
1. Colour	Described wet

2. Weathering

Degree of Weathering	Extent of Discolouration	Fracture Condition	Surface Characteristics	Original Fabric	Grain Boundary Condition
Unweathered	No visible alteration	Closed or stained	Unchanged	Preserved	Tight
Slightly weathered	Fractures stained or discoloured < 20% of fracture spacing on both sides of fracture	Discoloured, may contain thin filling	Partial discolouration Often unweathered rock colour	Preserved	Tight
Moderately weathered	Staining or discolouration extends >20% of fracture spacing on both sides of fracture	Discoloured, may contain thick filling	Partial to complete discolouration Not friable except poorly cemented rocks	Preserved	Partial opening
Highly weathered	Extends throughout the rock	------	Friable and usually pitted	Mainly preserved	Partial separated
Completely weathered	Totally discoloured	------	Resembles a soil	Partially preserved	Complete separation of grains

3. Texture / **4. Microstructure and fracture spacing**

Classification	Size	Recognition	Separation	Spacing (foliation, cleavage, bedding, etc.)	Spacing (fractures, joints, etc.)	Fracture spacings/metre
Very fine grained	< 0,2	Individual grains cannot be seen with a hand lens	< 6	very intensely	Very highly	> 50
Fine grained	0,2 - 0,6	Just visible as individual grains under hand lens	6 - 20	intensely		
Medium grained	0,6 - 2,0	Grains clearly visible under hand lens, just visible to the naked eye	20 - 60	very thinly	Highly	5 - 50
Coarse grained	2 - 6	Grains clearly visible to the naked eye	60 - 200	thinly		
Very coarse grained	> 6	Grains measurable	200 - 600	medium	Moderately	~1 - 5
			600 - 2 000	thickly	Slightly	~ 1
			> 2 000	very thickly	Very Slightly	< 1

5. Rock Hardness

Hardness	Description	UCS (MPa)	Hardness	Description	UCS (MPa)
Very soft rock	Material crumbles under firm blow with geological pick point; can be peeled with a knife; too hard to cut undisturbed sample by hand	1 - 3	Hard rock	Breaks with difficulty, rings when struck Point load or laboratory test results necessary to distinguish between categories	25 - 70
Soft rock	Can just be scraped and peeled with a knife; 1-3mm indents with firm blow of geological pick	3 - 10	Very hard rock		70 - 200
Medium hard rock	Firm blows of pick head will break hand held specimen Cannot be scraped or peeled with a knife	10 - 25	Extremely hard rock		> 200

6. Rock Type	According to accepted lithographic terminology
B. DISCONTINUITY SURFACE DESCRIPTION:	Descriptive Order for joint description: **1** Type **2** Separation **3** Fill material **4** Roughness **5** Orientation
1. Type	Bedding planes, flow banding, foliation, joints, shears, faults, fractures

2. Seperation / **3. Fracture filling** / **4. Roughness of discountinuity planes**

Description	Separation	Description	Definition	Classification	Description
Closed	0	Clean	No fracture filling material	Smooth	Appears smooth and is essentially smooth to the touch May be slickensided
Very narrow	0 - 0,6	Stained	Colouration of rock only No recognisable filling	Slightly rough	Aspirities on the fracture surface are visible and can be distinctly felt
Narrow	0,6 - 2,0	Filled	Recognisable filling material	Medium rough	Asperities are clearly visible and fracture surface feels abrasive
Wide	2,0 - 6,0			Rough	Large angular asperities can be seen Some ridge and high side angle steps are evident
Very wide	6,0 - 20			Very rough	Near vertical steps and ridges occur on the fracture surface

5. Discontinuity orientation	Discontinuity inclinations (i e of joints, bedding, faults,etc) are measured with respect to the horizontal i e a vertical joint dips at 90° in orientated core the fracture inclinations are w r t the core axis
C. FRACTURE FILLING DESCRIPTION	Fracture filling should be described in terms of the MCCSSO Soil Classification

Note: All dimensions in mm unless otherwise stated REFERENCE: **South African Institute of Engineering Geologists**, 1990 *Guidelines for soil and rock logging - Geotechnology Workshop*

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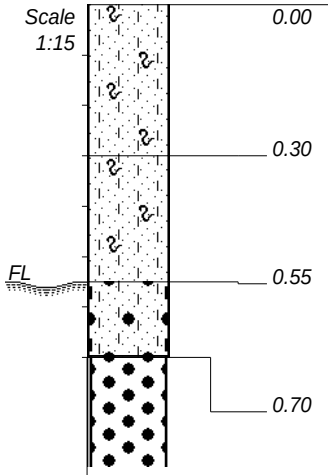
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP01
Sheet 1 of 1

JOB NUMBER: 999



Moist, brown (in profile brown), **medium dense**, intact, organic-rich silty fine SAND; numerous roots; topsoil.

Moist, brown, in profile brown becoming lighter brown with depth), **loose**, open textured, silty fine SAND; fine roots; transported soils of mixed origins.

Abundant FERRICRETE NODULES with occasional sandstone cobble, densely packed and weakly ferruginous cemented in a silty SAND matrix; overall consistency **dense**; nodular ferricrete (pebble marker).

Orange-brown, mottled brown and speckled black locally, **very dense**; HARDPAN FERRICRETE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) No samples taken.

4) Worked out borrow pit downslope suggests the ferricrete was exploited previously for road building material.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 150
COORD-E/y : -098 452

HOLE No: TP01
Extension 5

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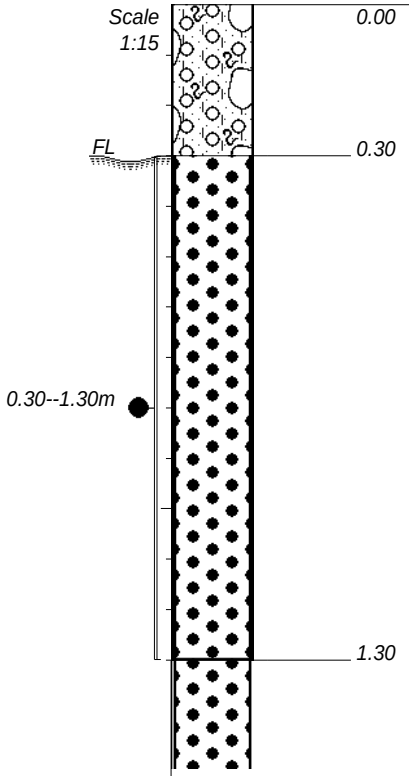
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP02
Sheet 1 of 1

JOB NUMBER: 999



Abundant hard and weathered, sandstone, GRAVELS, COBBLES and occasional boulders, densely packed in a brown, organic-rich silty fine SAND; overall consistency **dense**; fine roots; pebble marker.

Reddish brown speckled black, **dense - very dense**; HARDPAN FERRICRETE, with pockets up to 0.50m wide of yellowish brown, **loose**, open textured, silty SAND with numerous or sparse ferricrete concretions.

Reddish brown speckled black and mottled yellow-brown, **very dense**; HARDPAN FERRICRETE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 0.30--1.30m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 292
COORD-E/y : -098 219

HOLE No: TP02
Extension 5

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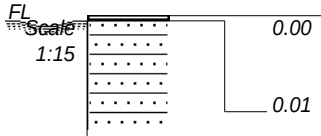
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP03
Sheet 1 of 1

JOB NUMBER: 999



White, slightly weathered, medium grained, highly fractured, **very hard rock**; SANDSTONE - ripple-marked with a low dip to the west.

NOTES

1) Profile recorded on sub-outcropping SANDSTONE, with pockets of surficial coarse colluvium - typical of the area.

2) No evidence of groundwater seepage.

3) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 503
COORD-E/y : -097 957

HOLE No: TP03
Extension 5

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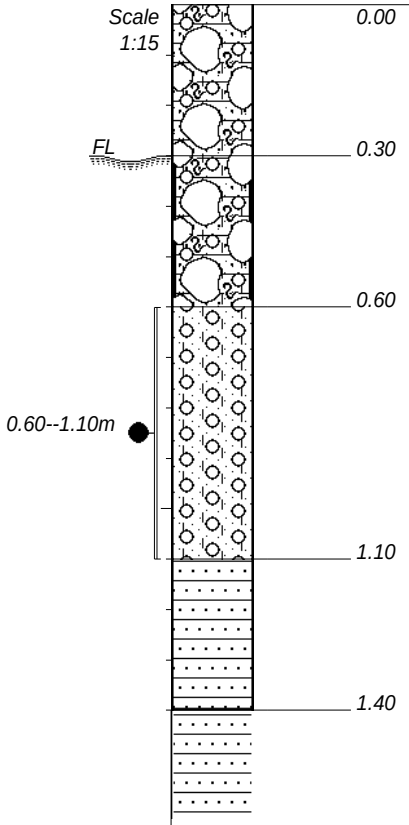
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP04
Sheet 1 of 1

JOB NUMBER: 999



0.00

Abundant hard and weathered, angular sandstone GRAVELS, COBBLES and BOULDERS, densely packed/jointed in a brown, silty fine SAND; overall consistency **dense**; numerous fine roots; SANDSTONE lens.

0.30

Below approximately 0.30m becomes ferruginous cemented.

0.60

Moist, yellow-brown (in profile yellow-brown) **medium dense**, weakly pinholed, silty SAND with numerous friable and hard, angular GRAVELS; residual sandstone.

1.10

Buff, highly weathered, medium grained, highly fractured, **very soft rock**; SANDSTONE with small pockets of **loose**, silty SAND.

1.40

Buff, highly weathered, medium grained, very highly fractured, **soft - hard rock**; SANDSTONE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 0.60--1.10m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 449
COORD-E/y : -097 831

HOLE No: TP04
Extension 5

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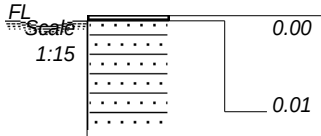
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP05
Sheet 1 of 1

JOB NUMBER: 999



White, slightly weathered, medium grained, highly fractured, **very hard rock**; SANDSTONE. (Dips at low angle to the west).

NOTES

1) Profile recorded on sub-outcropping SANDSTONE, with pockets of surficial coarse colluvium - typical of the area.

2) No evidence of groundwater seepage.

3) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 335
COORD-E/y : -097 968

HOLE No: TP05
outcrop; Extension 5

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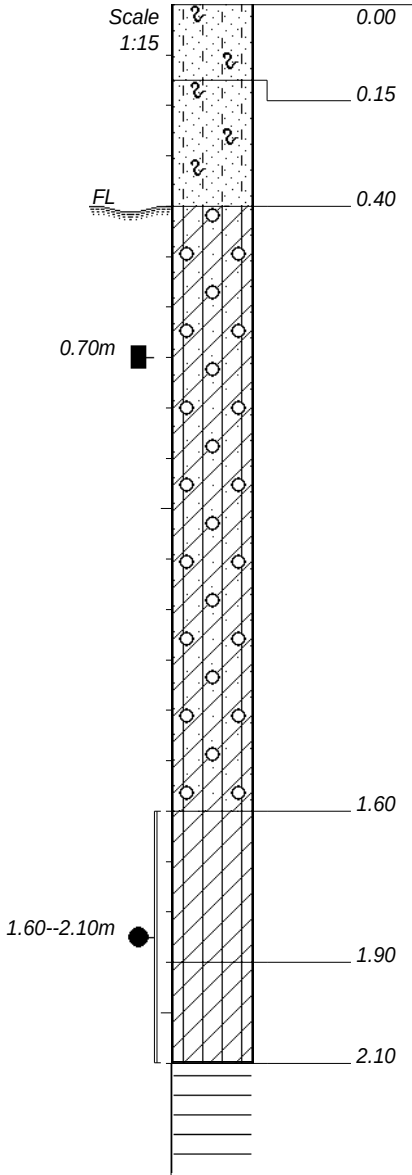
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP06
Sheet 1 of 1

JOB NUMBER: 999



Moist, brown (in profile brown), **very loose**, intact, organic-rich silty SAND; numerous fine roots; topsoil.

Moist, yellowish brown (in profile brown), **loose**, open textured, silty fine SAND; fine roots; transported soils of mixed origin.

Moist, buff (in profile pinkish banded/streaked reddish brown and buff), **firm**, near horizontally laminated, sandy SILT - CLAY with scattered weathered shale gravels and thin, **very soft rock** shale lenses; residual shale.

Moist, pale purplish (in profile pale purplish), **firm**, near horizontally laminated, CLAY - SILT; residual shale.

Below approximately 1.90m becomes **very stiff**.

Yellow-brown, highly weathered, near horizontally laminated, very fine-grained, **very soft rock**; SHALE.

NOTES

1) Pit excavated without refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 1.60--2.10m.

4) Undisturbed sample taken at 0.70m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 631
COORD-E/y : -098 310

HOLE No: TP06
Extension 5

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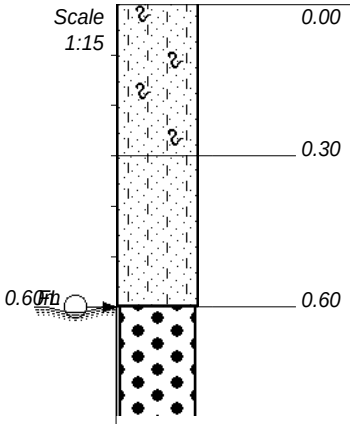
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP07
Sheet 1 of 1

JOB NUMBER: 999



Moist, dark brown (in profile dark brown), **soft**, open textured, organic-rich slightly clayey silty SAND; fine roots; topsoil.

Wet, yellowish brown (in profile yellow-brown), **firm**, open textured, silty fine SAND; occasional roots; transported soil of mixed origin.

Reddish brown speckled black, **very dense**; HARDPAN FERRICRETE.

NOTES

1) Pit excavated to refusal.

2) Slow groundwater seepage at 0.60m.

3) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 441
COORD-E/y : -098 429

HOLE No: TP07
Extension 5

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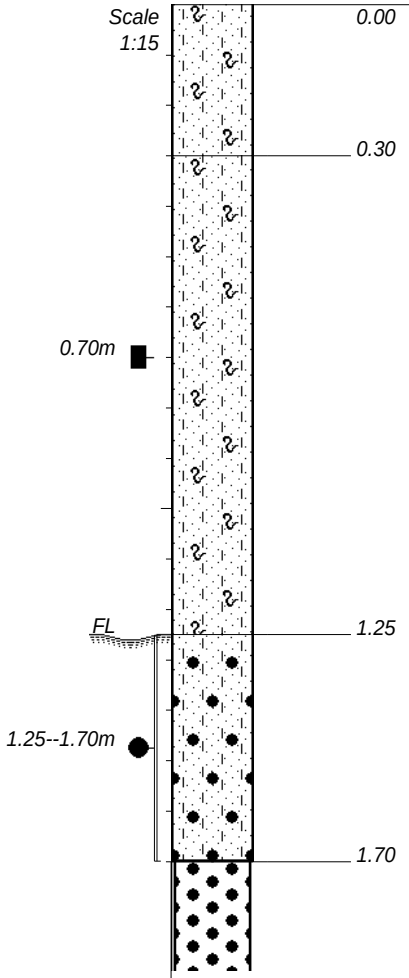
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP08
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.30: Moist, brown (in profile brown), **very loose**, open textured, silty fine SAND; numerous fine roots; topsoil.

0.30 – 1.25: Moist, yellow-brown (in profile yellow-brown), **loose**, open textured, silty fine SAND; roots; transported soil of mixed origin.

1.25 – 1.70: Moist, yellow-brown (in profile yellow-brown speckled reddish brown and black), **loose**, open textured, slightly clayey silty fine SAND with numerous ferricrete concretions; ferruginous cemented transported soils of mixed origin.

1.70+: Reddish brown speckled black, **very dense**; HARDPAN FERRICRETE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 1.25--1.70m.

4) Undisturbed sample taken at 0.70m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 352
COORD-E/y : -098 639

HOLE No: TP08
Extension 5

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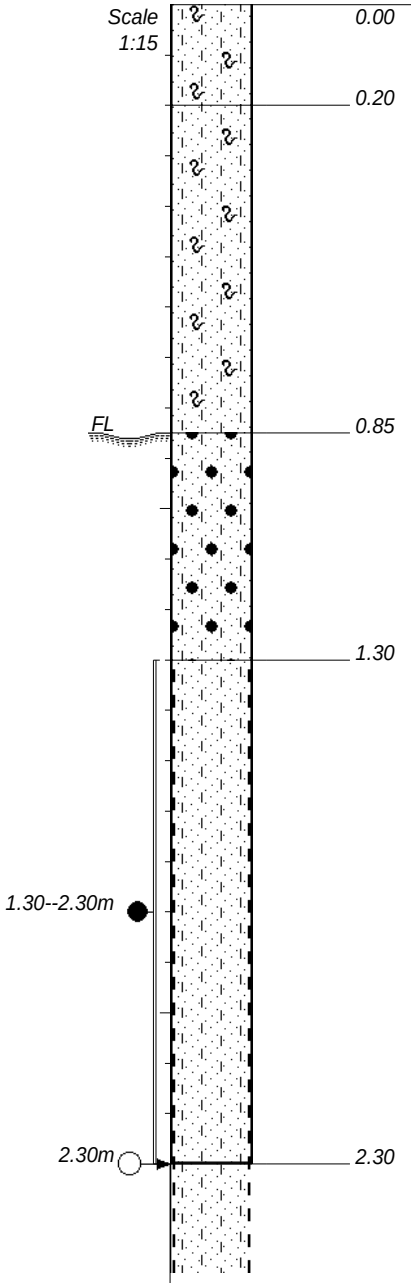
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP09
Sheet 1 of 1

JOB NUMBER: 999



Moist, brown (in profile brown), **very loose**, open textured, silty fine SAND; numerous fine roots; topsoil.

Moist, yellow-brown (in profile yellow-brown), **loose**, open textured, silty fine SAND with occasional sandstone gravels; roots; transported soil of mixed origin.

Abundant FERRICRETE CONCRETIONS, mostly densely packed in a yellow-brown, silty SAND matrix, locally ferruginous cemented; overall consistency **medium dense**; occasional fine roots; nodular ferricrete.

Moist, reddish brown (in profile reddish brown blotched various shades of reddish brown), **medium dense**, intact, weakly ferruginous cemented slightly clayey silty SAND with occasional subrounded gravels; weakly ferruginous cemented reworked residual sandstone.

NOTES

1) Pit excavated without refusal.

2) Slow groundwater seepage through the base of the pit.

3) Indicator sample taken at 1.30--2.30m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 524
COORD-E/y : -098 631

HOLE No: TP09
Extension 5

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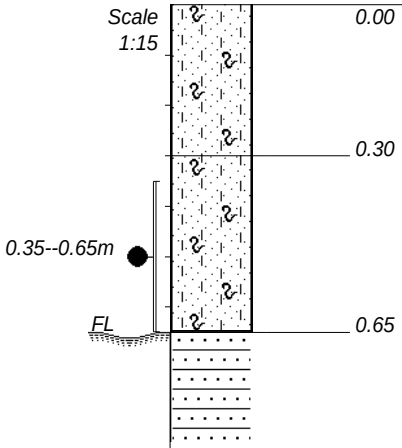
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP10
Sheet 1 of 1

JOB NUMBER: 999



Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; fine roots; topsoil.

Moist, reddish brown (in profile reddish brown), **loose**, open textured, silty fine SAND; fine roots; transported soil of mixed origin.

Buff, highly weathered, medium to coarse grained, highly fractured (stained reddish brown), **very soft rock**; SANDSTONE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 0.35--0.65m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 724
COORD-E/y : -098 627

HOLE No: TP10
Extension 5

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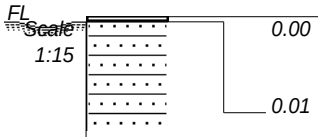
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP11
Sheet 1 of 1

JOB NUMBER: 999



Pinkish, slightly weathered, medium to very coarse-grained, highly fractured, **hard rock**; SANDSTONE - (290/12).

NOTES

1) Profile recorded on sub-outcropping sandstone.

2) No evidence of groundwater seepage.

3) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 773
COORD-E/y : -098 749

HOLE No: TP11
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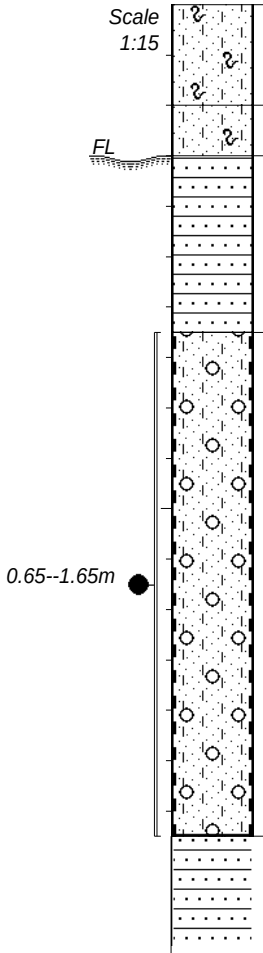
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP12
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.20: Moist, brown (in profile dark brown), **loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

0.20 – 0.30: Occasional weathered cobbles in a matrix as above suggest the pebble marker.

0.30 – 0.65: Buff, highly weathered, medium grained, near horizontally laminated, fine-grained, **very soft rock**; fine-grained SANDSTONE.

0.65 – 1.65: Moist, reddish brown (in profile reddish brown banded various shades of reddish brown and speckled black), **medium dense - dense**, near horizontally laminated, slightly clayey silty SAND with scattered friable gravels and weakly ferruginous cemented locally; reworked residual sandstone.

With depth includes lenses of sandy CLAY - SILT; reworked residual shale.

1.65+: Yellow-brown speckled black, highly weathered, medium-grained, **very soft rock**; SANDSTONE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 0.65--1.65m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 778
COORD-E/y : -098 822

HOLE No: TP12
Extension 5

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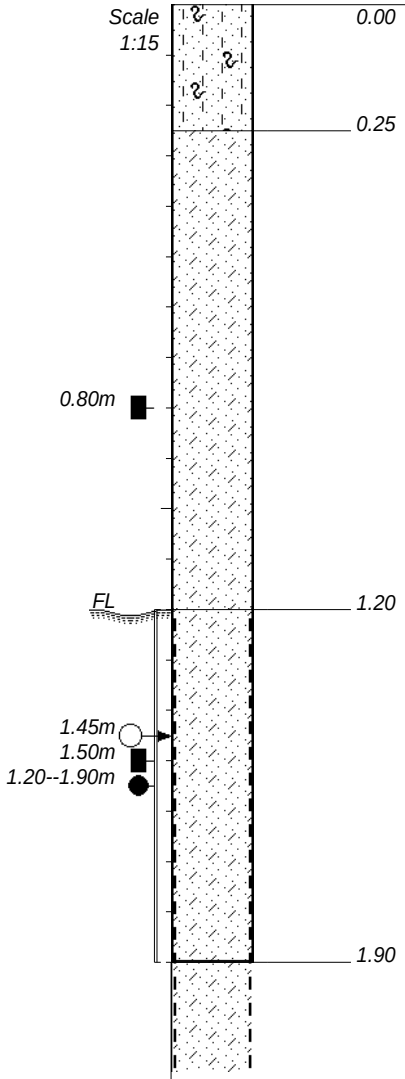
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP13
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.25: Moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous roots; topsoil.

0.25 – 1.20: Moist, reddish brown (in profile reddish brown), **soft**, open textured, clayey fine SAND; transported soils of mixed origin.

1.20 – 1.90: Moist, reddish brown (in profile reddish brown mottled yellow-brown), **medium dense**, weakly ferruginous cemented clayey fine SAND; weakly ferruginous cemented transported soils of mixed origin.

NOTES

1) Pit excavated without refusal.

2) Strong groundwater seepage - piping - at 1.45m.

3) Indicator sample taken at 1.20--1.90m.

4) Undisturbed sample taken at 0.80m.

5) Lump sample taken at 1.50m.

6) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 675
COORD-E/y : -098 947

HOLE No: TP13
Extension 5

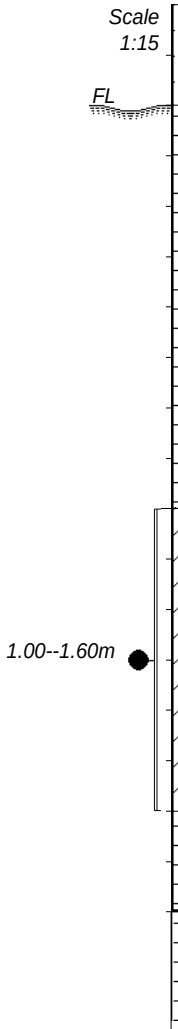
GEO3 CC
PO Box 6559
Helspruit
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP14
Sheet 1 of 1

JOB NUMBER: 999



0.00

Slightly moist, brown (in profile brown), **very loose**, open textured, silty fine SAND; numerous roots; topsoil.

0.20

Grey streaked reddish brown, moderately weathered, very fine-grained, near-horizontally laminated, very highly fractured, **soft rock**; SHALE.

1.00

Moist, greyish brown (in profile greyish brown streaked reddish brown), **stiff**, intact, CLAY - SILT; residual shale.

1.60

Grey streaked reddish brown, moderately weathered, very fine-grained, near-horizontally laminated, very highly fractured, **soft rock**; SHALE.

1.80

As above.

NOTES

1) Pit excavated to refusal.

2) Slow groundwater seepage through the base of the pit.

3) Indicator sample taken at 1.00--1.60m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 643
COORD-E/y : -098 752

HOLE No: TP14
Extension 5

GEO3 CC
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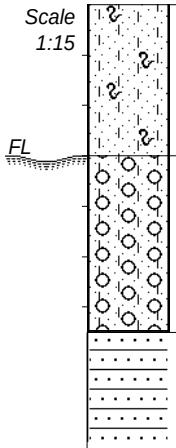
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP15
Sheet 1 of 1

JOB NUMBER: 999



Moist, dark brown (in profile dark brown), **loose**, open textured, silty fine SAND; fine roots; topsoil.

Moist, yellow-brown (in profile yellow-brown streaked reddish brown), **dense**, jointed (filled with brown, silty SAND), silty SAND with numerous friable GRAVELS; residual sandstone.

Yellow-brown, highly weathered, medium to coarse-grained, **very soft rock**; SANDSTONE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 502
COORD-E/y : -098 00

HOLE No: TP15
Extension 5

GEO3 CC
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Helspruit
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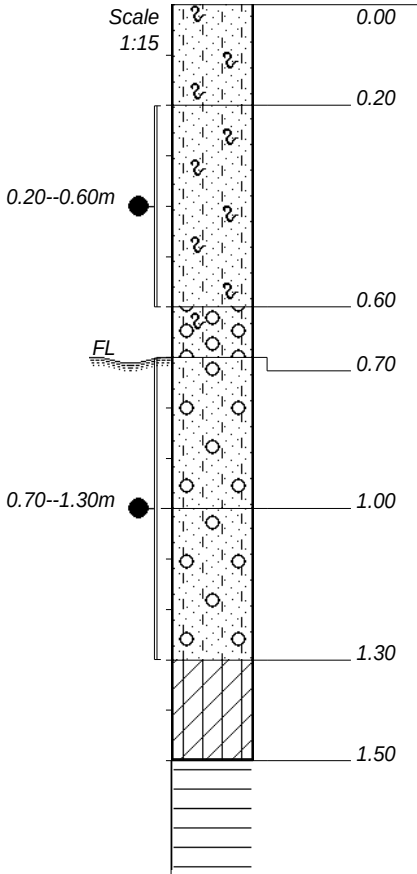
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP16
Sheet 1 of 1

JOB NUMBER: 999



Moist, brown (in profile brown), **very loose**, open textured, organic-rich silty SAND; numerous fine roots; topsoil.

Moist, yellow-brown (in profile yellow-brown), **loose**, open textured, silty fine SAND; fine roots; transported soils of mixed origin.

Scattered gravels in a matrix as above suggests the pebble marker.

Moist, reddish brown (in profile reddish brown banded buff), **medium dense**, near horizontally laminated, silty SAND with scattered friable gravels; residual sandstone.

Below approximately 1.00m becomes greyish brown.

Moist, black (in profile black streaked grey-brown), **firm**, horizontally laminated, CLAY - SILT; carbonaceous shale.

Black, highly weathered, medium to fine-grained, **very soft rock**; CARBONACEOUS SHALE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) Indicator samples taken at 0.20--0.60m and 0.70--1.30m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 926
COORD-E/y : -099 241

HOLE No: TP16
Extension 5

GEO3 CC
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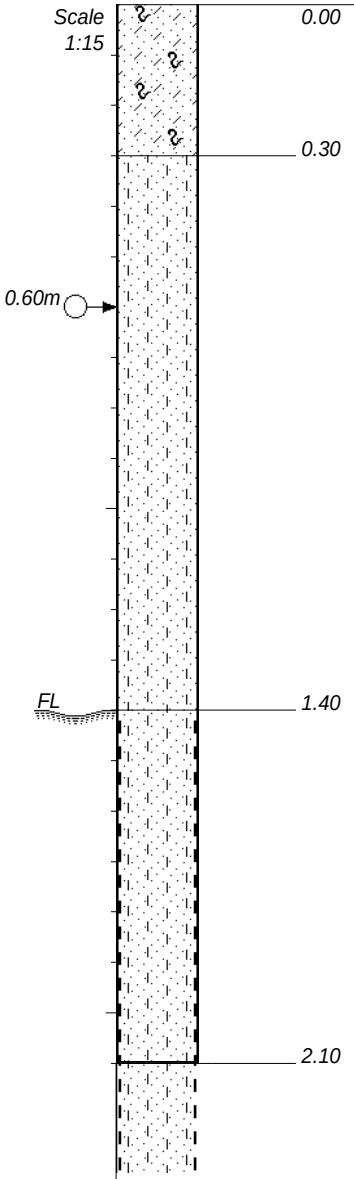
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP17
Sheet 1 of 1

JOB NUMBER: 999



Moist, dark brown (in profile dark brown), **soft**, open textured, organic-rich clayey fine SAND; numerous roots; topsoil.

Wet, yellow-brown (in profile yellow-brown), **very soft**, open textured, silty fine SAND; transported soils of mixed origin.

Moist, yellow-brown (in profile yellow-brown mottled reddish brown), **medium dense**, open textured, weakly ferruginous cemented silty fine SAND; weakly ferruginous cemented transported soil of mixed origin.

NOTES

1) Pit excavated without refusal.

2) Slow groundwater seepage at 0.60m.

3) No samples taken.

4) Profiled from spoils owing to collapsing sidewalls, which made the pit unsafe.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 842 057
COORD-E/y : -099 327

HOLE No: TP17
Extension 5

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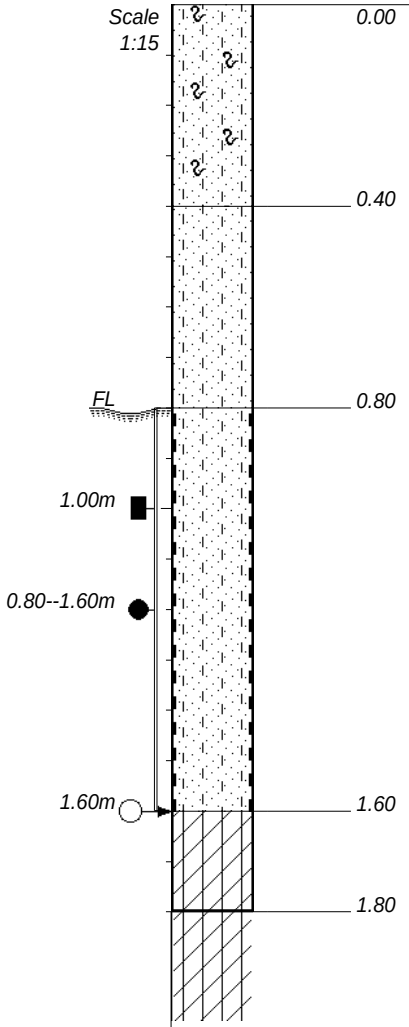
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP18
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.40: Slightly moist, brown (in profile brown), **very loose**, open textured, silty fine SAND; numerous roots; topsoil.

0.40 – 0.80: Moist, yellow-brown (in profile yellow-brown), **loose**, open textured, silty fine SAND with occasional weathered, sandstone cobbles; transported soils of mixed origin.

0.80 – 1.60: Slightly moist, orange-brown (in profile orange-brown mottled brown and reddish brown), **dense**, open textured locally, weakly ferruginous cemented silty fine SAND with occasional subrounded sandstone cobbles; weakly ferruginous cemented transported soils of mixed origin.

1.60 – 1.80: Moist, reddish brown (in profile reddish purplish mottled greyish), **firm**, CLAY - SILT; residual shale.

NOTES

1) Pit excavated without refusal.

2) Slow groundwater seepage at 1.60m.

3) Indicator sample taken at 0.80--1.60m.

4) Undisturbed sample taken at 1.00m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 971
COORD-E/y : -099 048

HOLE No: TP18
Extension 5

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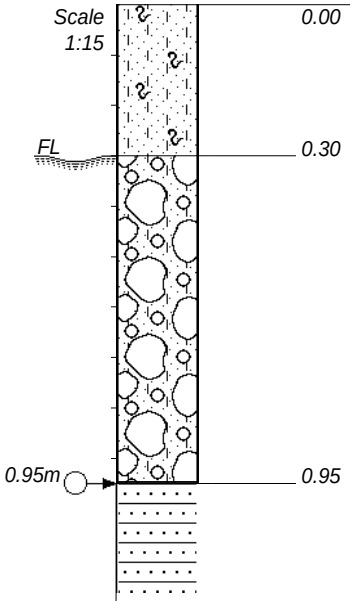
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP19
Sheet 1 of 1

JOB NUMBER: 999



Moist, reddish brown (in profile reddish brown), **very soft**, open textured, organic-rich silty fine SAND; numerous roots; topsoil.

Abundant weathered and hard, angular, sandstone GRAVELS, COBBLES and BOULDERS, densely packed/jointed in a reddish brown, silty SAND matrix; overall consistency **dense**; residual sandstone.

Grey- and yellow-brown, moderately to highly weathered, coarse-grained, fractured, **soft - hard rock**; SANDSTONE.

NOTES

1) Pit excavated to refusal.

2) Depth to sandstone bedrock varies from 0.50 to 0.95m.

3) Slow groundwater seepage through the base of the pit.

4) No samples taken.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 178
COORD-E/y : -100 367

HOLE No: TP19
Extension 7

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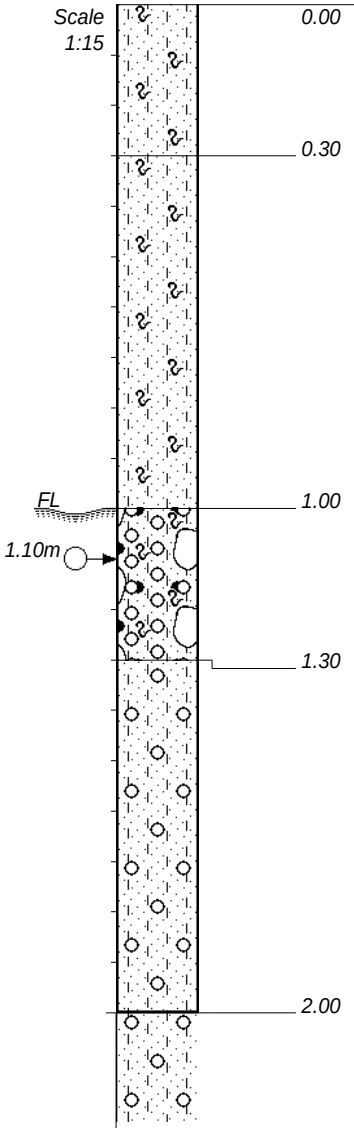
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP20
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.30: Moist, brown (in profile brown), **loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

0.30 – 1.00: Moist, reddish brown (in profile reddish brown), **loose**, open textured, silty fine SAND; fine roots; transported soils of mixed origin.

1.00 – 1.30: Abundant coarse, medium and fine GRAVELS, FERRICRETE CONCRETIONS and occasional sandstone cobbles and boulders, densely packed in a matrix as above; overall consistency **medium dense**; fine roots; pebble marker.

1.30 – 2.00: Moist, reddish brown (in profile reddish brown mottled various yellowish brown), **dense**, intact, silty SAND with scattered, friable gravels and cobbles; residual sandstone.

NOTES

1) Pit excavated without refusal.

2) Slow groundwater seepage at 1.10m.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 840 960
COORD-E/y : -100 159

HOLE No: TP20
Extension 7

GEO3 CC
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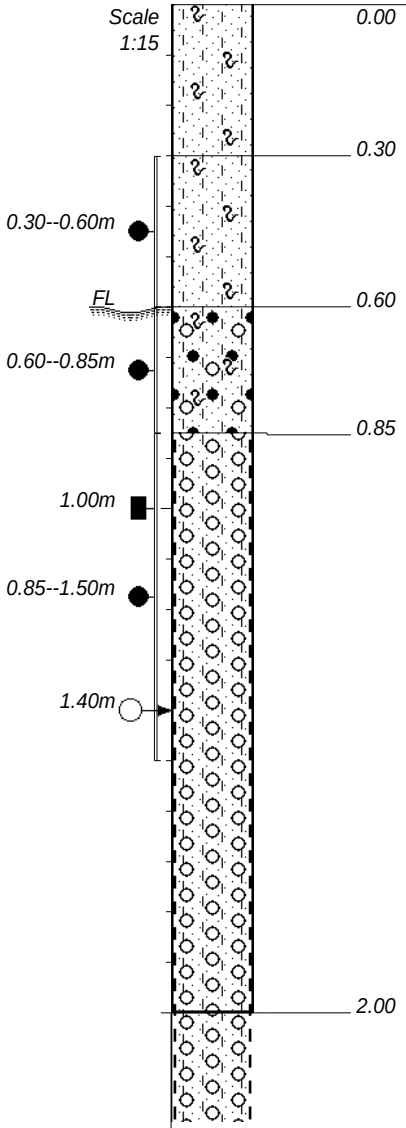
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP21
Sheet 1 of 1

JOB NUMBER: 999



Moist, brown (in profile brown), **loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

Moist, reddish brown (in profile reddish brown), **loose**, open textured, silty fine SAND; fine roots; transported soils of mixed origin.

Abundant FERRICRETE CONCRETIONS and scattered gravels, densely packed in a matrix as above; overall consistency **medium dense**; fine roots; nodular ferricrete (pebble marker).

Moist, reddish brown (in profile reddish brown mottled various shades of reddish brown and pale brown), **dense**, pinholed locally, weakly ferruginous cemented silty SAND with numerous subrounded GRAVELS; residual tillite.

NOTES

1) Pit excavated without refusal.

2) Slow groundwater seepage at 1.40m.

3) Indicator samples taken at 0.30--0.60m, 0.60--0.85m and 0.85--1.50m.

4) Undisturbed sample taken at 1.00m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 7 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 000
COORD-E/y : -100 313

HOLE No: TP21
Extension 7

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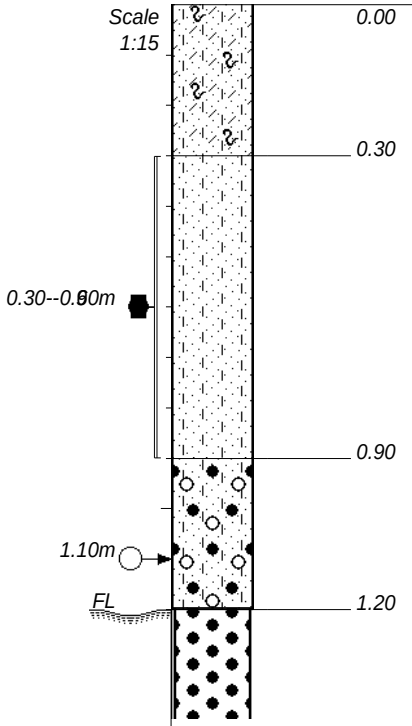
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP22
Sheet 1 of 1

JOB NUMBER: 999



Moist, brown (in profile brown), **soft**, open textured, organic-rich clayey silty fine SAND; numerous roots; topsoil.

Moist, yellow- brown (in profile yellow-brown), **loose**, open textured, silty fine SAND; occasional fine roots; transported soils of mixed origin.

Below approximately 0.90m becomes wet with scattered ferricrete concretions.

Reddish brown mottled brown, **very dense**; HARDPAN FERRICRETE (ferruginous cemented transported soils of mixed origin).

NOTES

1) Pit excavated to refusal.

2) Slow groundwater seepage at 1.10m.

3) Indicator sample taken at 0.30--0.90m.

4) Lump sample taken at 0.60m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 840 680
COORD-E/y : -099 926

HOLE No: TP22
Extension 7

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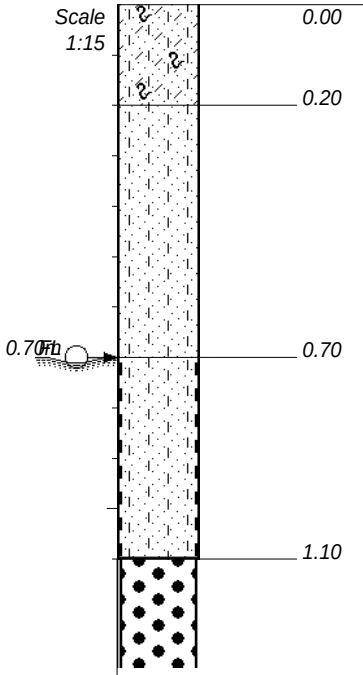
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP23
Sheet 1 of 1

JOB NUMBER: 999



Moist, brown (in profile brown), **soft**, open textured, organic-rich clayey silty fine SAND; numerous roots; topsoil.

Moist, yellow- brown (in profile yellow-brown), **loose**, open textured, silty fine SAND; occasional fine roots; transported soils of mixed origin.

Below approximately 0.70m becomes mottled reddish brown, **dense** and weakly ferruginous cemented.

Reddish brown speckled black, **very dense**; HARDPAN FERRICRETE (ferruginous cemented transported soils of mixed origin).

NOTES

1) Pit excavated to refusal.

2) Slow groundwater seepage at 0.70m.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 840 747
COORD-E/y : -100 169

HOLE No: TP23
Extension 7

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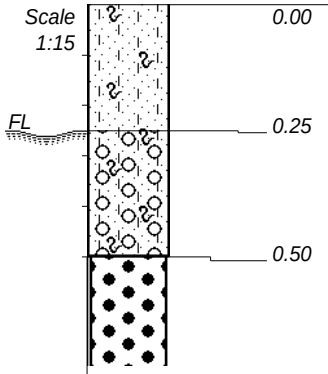
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP24
Sheet 1 of 1

JOB NUMBER: 999



Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich, silty fine SAND with occasional gravels; numerous fine roots; topsoil.

Abundant coarse, medium and fine, sub-rounded - sub-angular GRAVELS, densely packed in a brown, silty SAND matrix; overall consistency **loose**; fine roots; pebble marker.

Reddish brown speckled yellow-brown and black, **very dense**; HARDPAN FERRICRETE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

5) Extensive sub-outcropping hardpan ferricrete downslope.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 429
COORD-E/y : 0 099 674

HOLE No: TP24
Extensions 6 and 8

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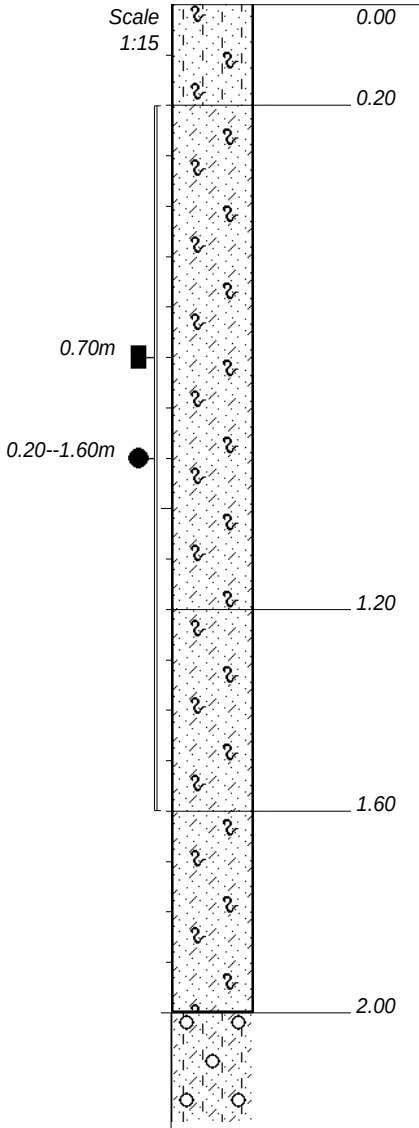
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP25
Sheet 1 of 1

JOB NUMBER: 999



Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous roots; topsoil.

Moist, yellowish brown (in profile yellowish brown), **soft - firm**, open textured, clayey fine SAND; roots; transported soils of mixed origin.

Below approximately 1.20m becomes mottled shades of reddish and yellowish brown and **firm**.

Below approximately 1.60m becomes pale brown speckled reddish brown.

Slightly moist - moist, buff (in profile yellow-brown speckled black), **firm**, intact, clayey silty SAND with scattered fine rounded gravels; residual sandstone.

NOTES

1) Pit excavated without refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 0.20--1.60m.

4) Undisturbed sample taken at 0.70m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 566
COORD-E/y : 0 099 606

HOLE No: TP25
Extensions 6 and 8

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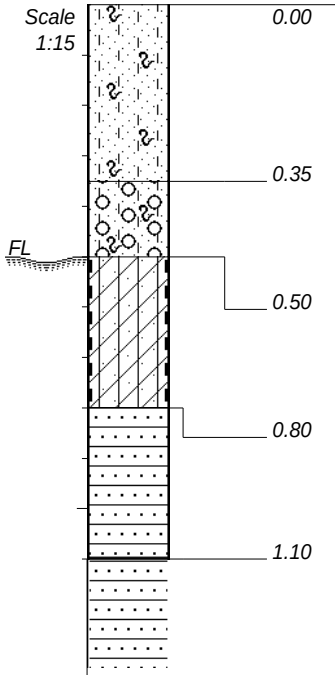
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP26
Sheet 1 of 1

JOB NUMBER: 999



Slightly moist, dark brown (in profile dark brown), **very loose**, open textured, organic- rich silty fine SAND; numerous fine roots; topsoil.

Abundant coarse, medium and fine, GRAVELS, densely packed in a matrix as above; overall consistency **medium dense**; fine roots; pebble marker.

Moist - wet, yellowish brown (in profile yellow-brown streaked pale brown), **stiff**, weakly ferruginous cemented sandy CLAY - SILT; weakly ferruginous cemented reworked residual shale.

Buff, highly weathered, medium grained, **very soft rock**; SANDSTONE.

As above.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 613
COORD-E/y : 0 099 805

HOLE No: TP26
Extensions 6 and 8

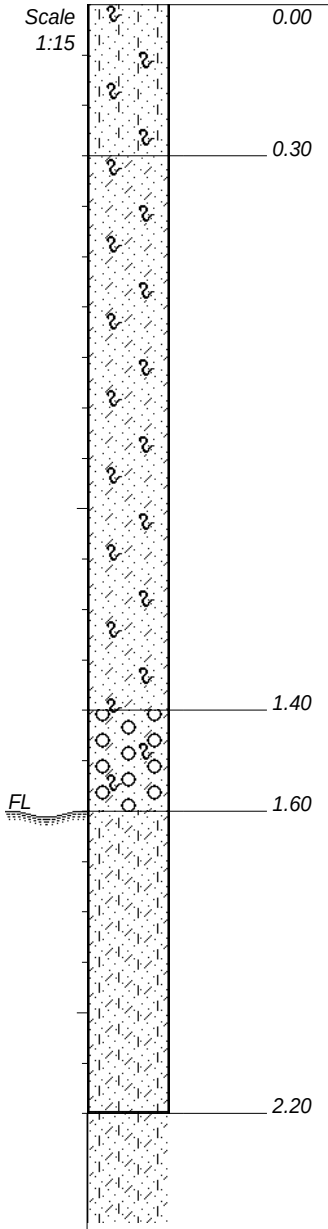
GEO3 CC
PO Box 6559
Helspruit
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP27
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.30: Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

0.30 – 1.40: Slightly moist, reddish brown (in profile reddish brown), **soft - firm**, open textured, clayey fine SAND; roots; transported soils of mixed origin.

1.40 – 1.60: Scattered, subrounded GRAVELS in a matrix as above suggests the pebble marker.

1.60 – 2.20: Slightly moist, reddish brown (in profile reddish brown speckled/streaked buff and dark red-brown locally), **firm**, intact, clayey silty fine SAND; residual sandstone.

NOTES

1) Pit excavated without refusal.

2) No groundwater seepage encountered.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 749
COORD-E/y : 0 099 699

HOLE No: TP27
Extensions 6 and 8

GEO3 CC
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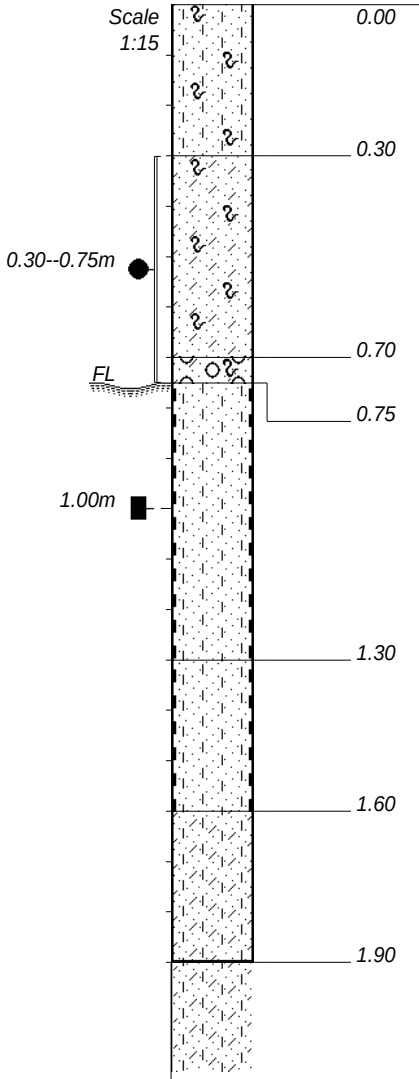
Helspruit
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP28
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.30: Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

0.30 – 0.70: Moist, yellowish brown (in profile yellowish brown), **soft - firm**, open textured, clayey fine SAND; roots; transported soils of mixed origin.

0.70 – 0.75: Occasional sandstone cobbles at 0.75m suggest the pebble marker.

0.75 – 1.60: Slightly moist - moist, reddish brown (in profile reddish brown mottled yellow- brown), **medium dense**, open textured, weakly ferruginous cemented slightly clayey silty fine SAND; weakly ferruginous cemented reworked residual sandstone.

Below approximately 1.30m becomes predominantly reddish brown.

1.60 – 1.90: Slightly moist, reddish brown (in profile reddish brown speckled/streaked buff and dark red-brown locally), **firm**, intact, clayey silty fine SAND; residual sandstone.

NOTES

1) Pit excavated without refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 0.30--0.75m.

4) Undisturbed sample taken at 1.00m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 805
COORD-E/y : 0 099 552

HOLE No: TP28
Extensions 6 and 8

GEO3 CC
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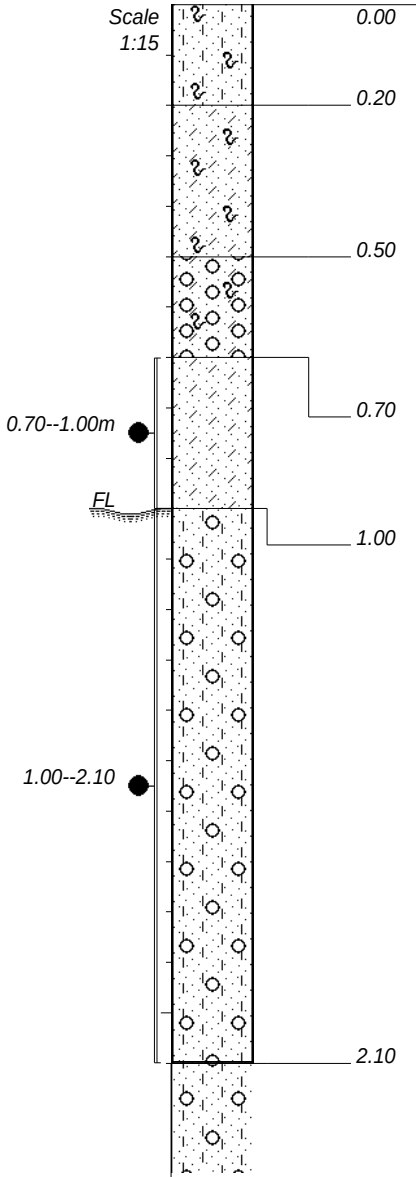
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP29
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.20: Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

0.20 – 0.50: Moist, yellowish brown (in profile yellowish brown), **soft - firm**, open textured, clayey fine SAND with occasional sandstone cobbles; roots; transported soils of mixed origin.

0.50 – 0.70: Abundant coarse, medium and fine, sub-rounded to sub-angular, weathered and hard, sandstone GRAVELS and COBBLES, loosely packed in a matrix as above; overall consistency **medium dense**; pebble marker.

0.70 – 1.00: Moist, yellowish brown (in profile yellowish brown speckled buff and light yellow-brown), **firm**, open textured, clayey fine SAND with occasional gravels; reworked residual sandstone.

1.00 – 2.10: Slightly moist, buff (in profile buff speckled yellow-brown), **firm**, intact, silty fine SAND with scattered gravels; residual fine-grained sandstone/tillite.

2.10: As above.

NOTES

1) Pit excavated without refusal.

2) No groundwater seepage encountered.

3) Indicator samples taken at 0.70--1.00m and 1.00--2.10.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 964
COORD-E/y : 0 099 653

HOLE No: TP29
Extensions 6 and 8

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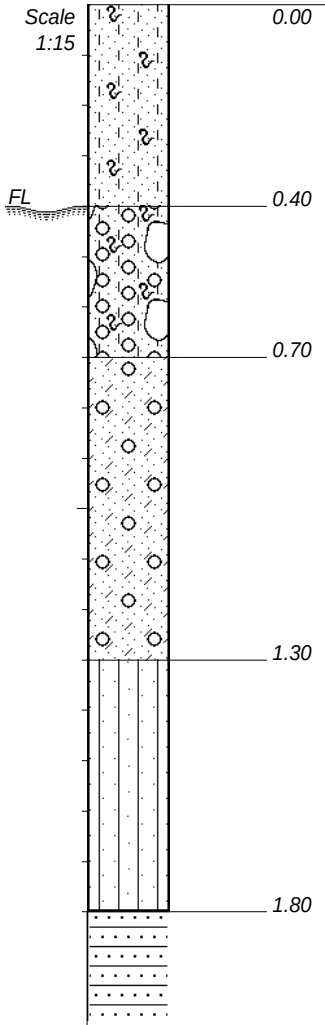
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP30
Sheet 1 of 1

JOB NUMBER: 999



0.00	Slightly moist, brown (in profile brown), **loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.
0.40	Abundant predominantly coarse, medium and fine, GRAVELS with occasional subrounded cobbles and boulders, densely packed in a matrix as above; overall consistency **medium dense**; fine roots; pebble marker.
0.70	Moist, yellow-brown (in profile yellowish brown mottled/speckled reddish brown), **firm**, intact, clayey SAND with scattered sub-rounded to sub-angular gravels and cobbles; reworked residual tillite.
1.30	Slightly moist, buff (in profile buff speckled reddish brown), **stiff**, weakly horizontally laminated, sandy SILT; residual siltstone.
1.80	Pale brown, highly weathered, medium-grained, **very soft rock**; SANDSTONE.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 965
COORD-E/y : 0 099 822

HOLE No: TP30
Extensions 6 and 8

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1300
Tel: (013) 758 1226

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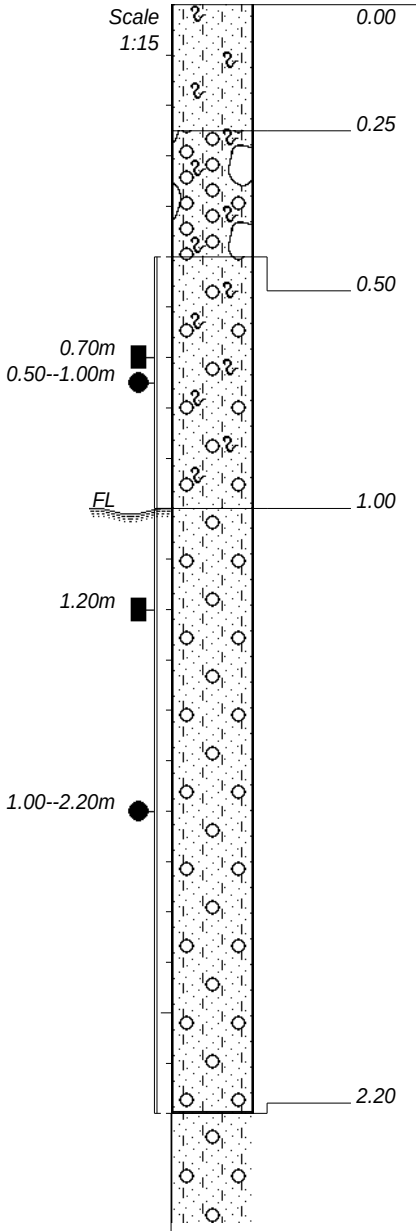
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP31
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.25: Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

0.25 – 0.50: Abundant coarse, medium and fine, weathered and hard, GRAVELS, COBBLES and occasional boulders, densely packed in a brown, silty SAND matrix; overall consistency **medium dense**; fine roots; pebble marker.

0.50 – 1.00: Slightly moist to moist, reddish brown (in profile reddish brown speckled buff and yellow- brown), **loose**, open textured slightly clayey silty SAND with scattered coarse, medium and fine gravels; occasional fine roots; reworked residual sandstone/tillite.

1.00 – 2.20: Slightly moist, buff (in profile buff mottled reddish brown), **stiff**, slightly clayey silty SAND with scattered gravels; residual sandstone/tillite.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) Indicator samples taken at 0.50--1.00m and 1.00--2.20m.

4) Undisturbed sample taken at 0.70m.

5) Lump sample taken at 1.20m.

6) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 768
COORD-E/y : 0 099 900

HOLE No: TP31
Extensions 6 and 8

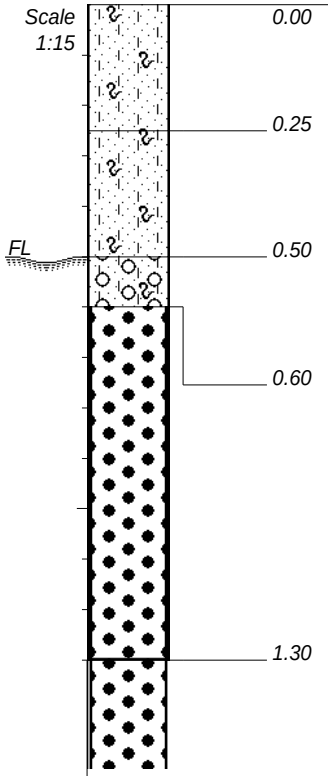
GEO3 CC
PO Box 6559
Helspruit
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP32
Sheet 1 of 1

JOB NUMBER: 999



Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

Moist, yellow-brown (in profile yellow-brown), **loose**, open textured, silty fine SAND; roots; transported soils of mixed origins.

Abundant coarse, medium and fine GRAVELS, densely packed and weakly ferruginous cemented locally to hardpan ferricrete, in a brown, silty SAND matrix; overall consistency **dense**; fine roots; pebble marker.

Reddish brown speckled black, **very dense**; HARDPAN FERRICRETE (ferruginous cemented residual sandstone/tillite).

As above.

NOTES

1) Pit excavated to refusal.

2) No groundwater seepage encountered.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 949
COORD-E/y : 0 100 059

HOLE No: TP32
Extensions 6 and 8

GEO3 CC
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1200
Tel: (013) 758 1226

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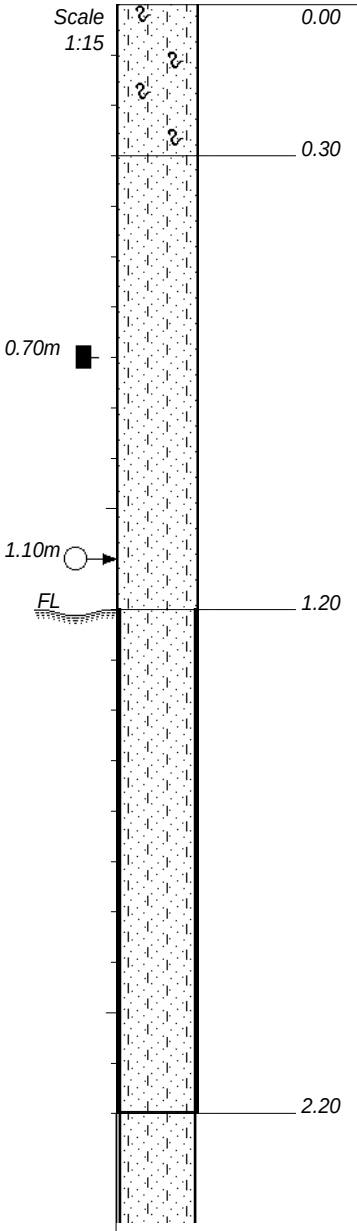
SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP33
Sheet 1 of 1

JOB NUMBER: 999



Slightly moist, brown (in profile brown), **very loose**, open textured, organic-rich silty fine SAND; numerous fine roots; topsoil.

Moist, yellow-brown (in profile yellow-brown), **loose**, open textured, silty fine SAND; occasional fine roots; transported soils of mixed origins.

Wet, reddish brown (in profile reddish brown mottled yellow-brown speckled black), **dense**, pinholed, ferruginous cemented silty fine SAND; ferruginous cemented transported soils of mixed origin.

NOTES

1) Pit excavated without refusal, but slow excavation.

2) Slow groundwater seepage at 1.10m.

3) Undisturbed sample taken at 0.70m.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 842 127
COORD-E/y : 0 099 991

HOLE No: TP33
Extensions 6 and 8

GEO3 CC
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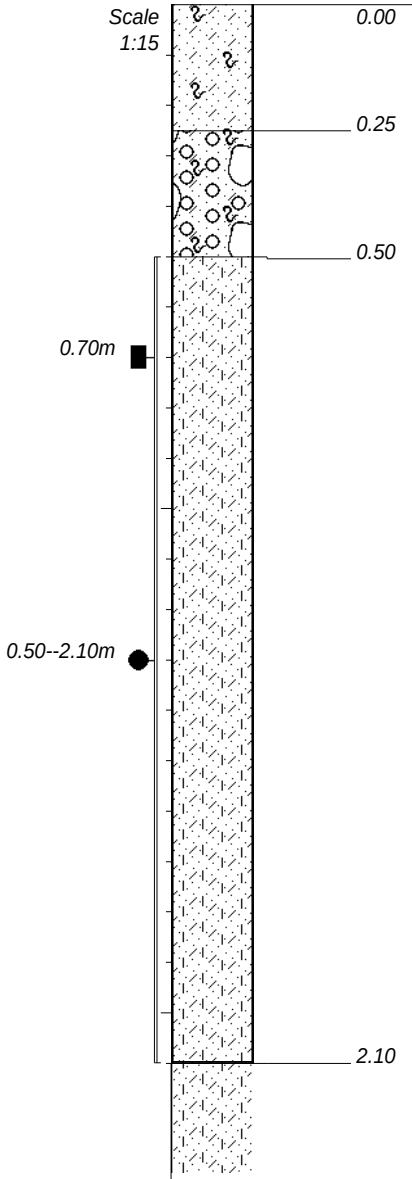
Helspruit
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP34
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.25: Slightly moist, reddish brown (in profile reddish brown), **stiff**, open textured, clayey fine SAND; numerous fine roots; topsoil.

0.25 – 0.50: Abundant coarse, medium and fine, weathered and hard GRAVELS, COBBLES and occasional boulders, densely packed in a matrix as above; overall consistency **dense**; fine roots; pebble marker.

0.50 – 2.10: Slightly moist, pinkish (in profile pinkish mottled yellow-brown), **firm**, intact, clayey silty fine SAND; residual sandstone.

NOTES

1) Pit excavated without refusal.

2) No groundwater seepage encountered.

3) Indicator sample taken at 0.50--2.10m.

4) Lump sample taken at 0.70m.

5) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 842 130
COORD-E/y : 0 099 776

HOLE No: TP34
Extensions 6 and 8

GEO3 CC
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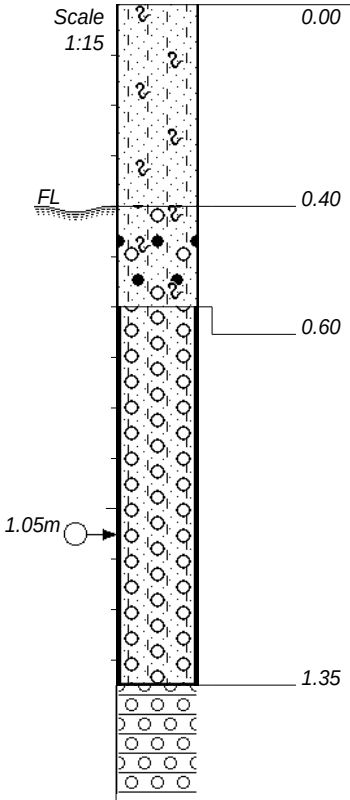
1300
Tel: (013) 758 1226

Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP35
Sheet 1 of 1

JOB NUMBER: 999



0.00 – 0.40: Moist, dark brown (in profile dark brown), **loose**, open textured, organic-rich silty fine SAND; roots; topsoil.

0.40 – 0.60: Abundant FERRICRETE CONCRETIONS and scattered gravels, densely packed in a wet, yellow-brown, silty SAND; overall consistency **medium dense**; fine roots; pebble marker.

0.60 – 1.35: Slightly moist, reddish brown (in profile reddish brown mottled yellow-brown), **dense**, intact, ferruginous cemented silty fine SAND with scattered coarse, medium and fine, sub-rounded to sub-angular GRAVELS and COBBLES; ferruginous cemented residual tillite.

1.35 +: Yellow-brown and buff, highly weathered, fine to coarse-grained, highly fractured, **soft rock**; TILLITE.

NOTES

1) Pit excavated to refusal.

2) Slow groundwater seepage at 1.05m.

3) No samples taken.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 842 136
COORD-E/y : 0 100 180

HOLE No: TP35
Extensions 6 and 8

GEO3 CC
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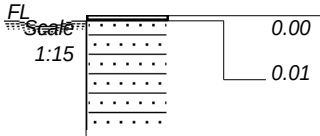
Sisonke Development Planners

SIYATHUTHUKA EXTENSIONS 5, 6, 7 AND 8, MPUMALANGA

HOLE No: TP36
Sheet 1 of 1

JOB NUMBER: 999



Greenish, highly weathered, medium grained, **soft rock**; SANDSTONE.

NOTES

1) Profile recorded on a bouldery outcrop extending along the

2) contour.

3) No evidence of groundwater seepage.

4) FL = interpolated minimum founding level for residential structures imposing up to 50kPa.

CONTRACTOR :
MACHINE : Bell 315S
DRILLED BY :
PROFILED BY : H. Schurink, Pr.Sci.Nat.
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 8 February 2012
DATE : 22/03/2012 14:46
TEXT : ..000\network\testpits.txt

ELEVATION :
COORD-S/x : 2 841 880
COORD-E/y : 0 099 451

HOLE No: TP36
Extensions 6 and 8

APPENDIX C
LABORATORY TEST RESULTS

Interpolated soil parameters based on available literature/experience - to be confirmed through appropriate laboratory tests before being used

Test Pit No.	Soil Origin	Horizon Depth [m] From	To	Basic: Relative Density	PI	Geotechnical: k [cm/s]	k [after Hazen] [cm/s]	k Classification	C	Kenny (1959) Ø effective	Ø	Cc (Skempton - Terzaghi & Peck)	Road: TRH 14	Group index	CBR @ MOD AASHTO 90 - 93%	100%
TP 8	TSMO	0.30	1.25	0.25	4	3.03E-004	2.50E-005	low	15	43	12	0.112 - 0.144	G8	1	23	121
TP 10	TSMO	0.30	0.65	0.25	4	4.33E-004	3.60E-005	low	14	41	14	0.119 - 0.153	G7	1	24	106
TP 13	TSMO	0.25	1.20	0.25	11	3.58E-005	2.25E-006	low	52	35	8	0.161 - 0.207	G8	5	13	46
TP 16	TSMO	0.20	0.60	0.25	3	2.46E-004	4.00E-006	low	16	45	10	0.098 - 0.126	G8	3	22	121
TP 18	TSMO	0.80	1.60	0.60	0	2.49E-003	2.25E-004	medium	13		33		G6	0	43	
TP 21	TSMO	0.30	0.60	0.25	0	1.04E-002	4.84E-004	medium	6		20		G6	0	42	
TP 22	TSMO	0.30	0.90	0.25	3	8.24E-004	8.10E-005	low	11	45	15	0.091 - 0.117	G7	1	28	139
TP 25	TSMO	0.20	1.60	0.35	4	9.50E-005	4.00E-004	low	26	43	11	0.140 - 0.180	G8	4	21	106
TP 28	TSMO	0.30	0.75	0.35	4	1.07E-004	4.00E-006	low	26	41	13	0.098 - 0.126	G8	2	21	106
TP 33	TSMO	0.30	1.20	0.25	4	3.38E-004	2.50E-005	low	15	43	12	0.070 - 0.090	G7	1	23	121
TP 8	f/c TSMO	1.25	1.70	0.25	0	2.13E-001	5.76E-004	high	4		27		G5	0	56	
TP 13	w/f/c TSMO	1.20	1.90	0.50	11	4.34E-005	2.25E-006	low	40	41	14	0.168 - 0.216	G8	5	20	106
TP 2	hardpan ferricrete	0.30	1.30	0.85	0	1.93E+000	3.97E-003	high	11		63		G5		78	
TP 21	residual sandstone / ti	0.85	1.50	0.75	0	1.25E-002	5.29E-004	medium	13		44		G5	0	53	
TP 21	nodular ferricrete / pebble marker	0.60	0.85	0.50	0	1.58E+002	2.89E-002	high	6		55		G5		95	
TP 34	residual sandstone	0.50	2.10	0.50	11	7.57E-006	1.00E-006	very low	115	34	11	0.238 - 0 306	G8	8	12	46
TP 4	residual sandstone	0.60	1.10	0.50	0	7.65E+000	5.63E-003	high	7		49		G5		79	
TP 12	r/ residual sandstone	0.65	1.60	0.60	5	2.40E-003	9.00E-006	medium	23	39	36	0.126 - 0.162	G6	0	35	121
TP 16	residual sandstone	0.70	1.30	0.50	2	1.34E-002	1.69E-004	medium	12	49	35	0.112 - 0.144	G5	0	46	159
TP 29	r/residual sandstone	0.70	1.00	0.50	4	5.14E-004	4.00E-006	low	20	43	25	0.140 - 0.180	G6	2	30	121
TP 9	w/f/c r/ residual sands	1.30	2.30	0.50	5	2.79E-003	1.69E-004	medium	20	39	32	0.112 - 0.144	G6	0	34	121
TP 28	w/f/c r/ residual sands	0.75	1.60	0.50	6	1.54E-004	9.00E-006	low	29	39	22	0.154 - 0.198	G8	2	24	106
TP 29	residual tillite	1.00	2.10	0.50	7	7.40E-005	3.24E-006	low	37	38	20	0.126 - 0.162	G8	3	21	92
TP 31	residual tillite	0.50	1.00	0.25	4	5.18E-001	5.76E-004	high	6	43	29	0.119 - 0.153	G5	0	51	139
TP 31	residual tillite	1.00	2.20	0.75	7	2.04E-003	1.21E-004	medium	34	37	43	0.126 - 0.162	G6	0	33	106
TP 6	residual shale	1.60	2.10	0.50	7	2.17E-005	1.00E-006	low	60	37	13	0.182 - 0.234	G8	7	17	70
TP 6	residual shale	0.40	1.60	0.50	11	5.14E-006	1.00E-006	very low	156	34	9	0.175 - 0 225	G8	8	11	35
TP 14	residual shale	1.00	1.60	0.75	68	7.53E-006	1.00E-008	very low	104	36	16	0.168 - 0 216	G8	7	15	61

Notes: PI = plasticity index (*) = on whole sample
LL = liquid limit; LS = linear shrinkage;
GM = grading modulus; n/t = not tested;
w/ = weakly; f/c = ferruginous cemented
r/ = residual; r/r = reworked residual;
TSMO = transported soils of mixed origin.

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 2	**Depth [m] :**	0.300-1.300	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0283

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	86	77	59	51	40	32	29	25	20	12	9	7	4	2	2	2	2

ATTERBERG LIMITS

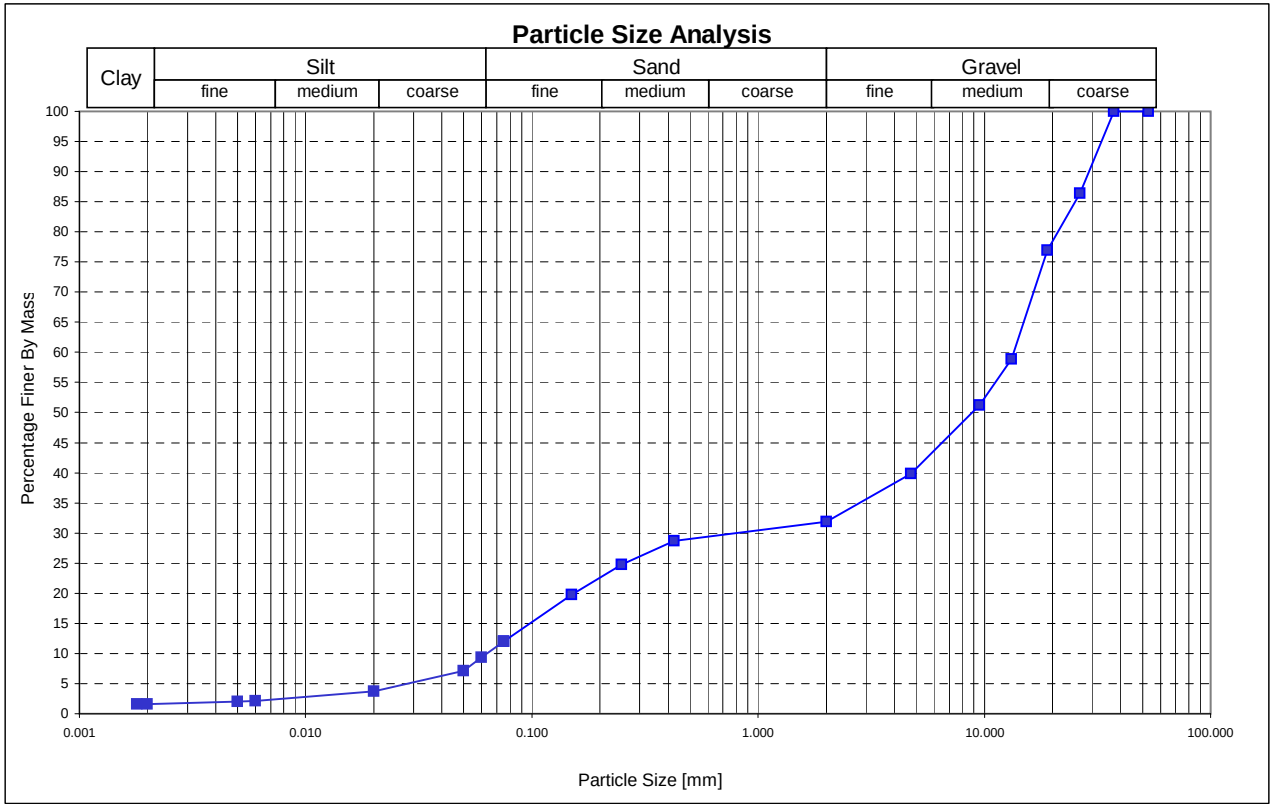
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
0	NP		0.0	2.27

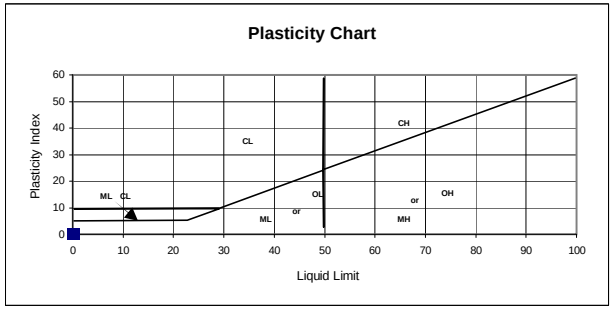
CLASSIFICATION

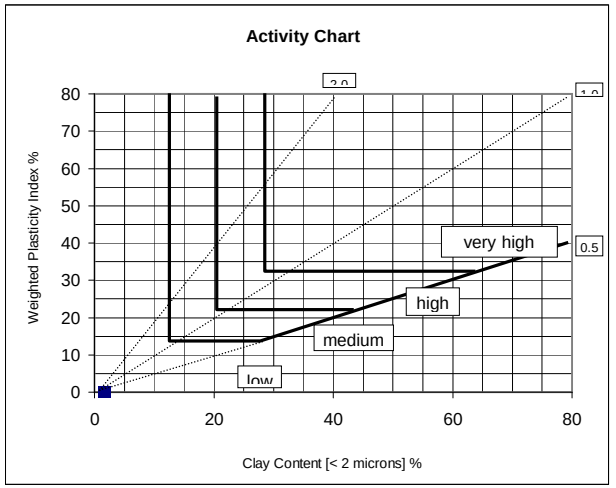
UNIFIED	PRA	TRH
GM	A.1.a (0)	

Soil constituents % :	**Clay :**	2	**Silt :**	8	**Sand :**	23	**Gravel :**	68	**Fines :**	29	**Soil description :** Dark Brown Soil

D_{10} :	0.063	**D_{30} :**	0.810	**D_{60} :**	13.495	**Uniformity coefficient :**	213	**Curvature coefficient :**	1	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC		PROJECT :	#999		Date	Job No.	1450
Position :	TP 4	Depth [m] :	0.600-1.000	Source :	INSITU	10-Feb-12	Sample No.	12/0284

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	80	68	59	54	46	34	26	22	16	10	8	7	4	2	2	2	1

ATTERBERG LIMITS

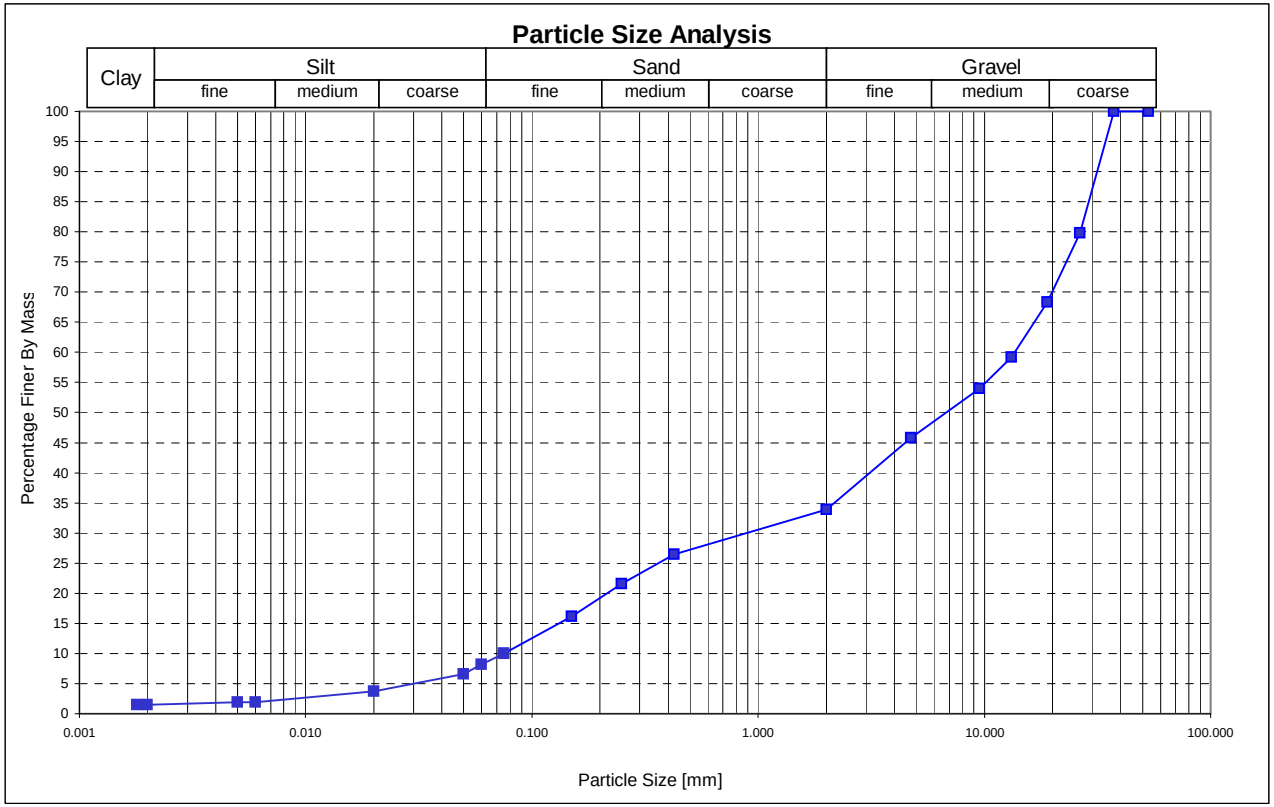
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
0	NP		0.0	2.30

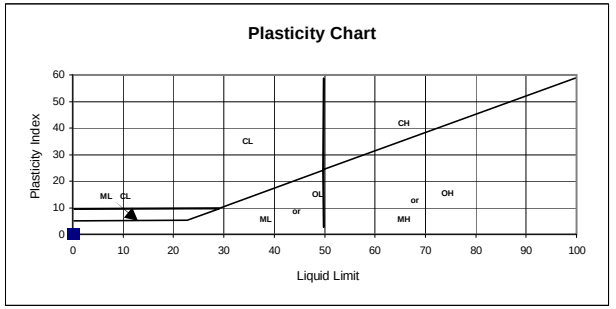
CLASSIFICATION

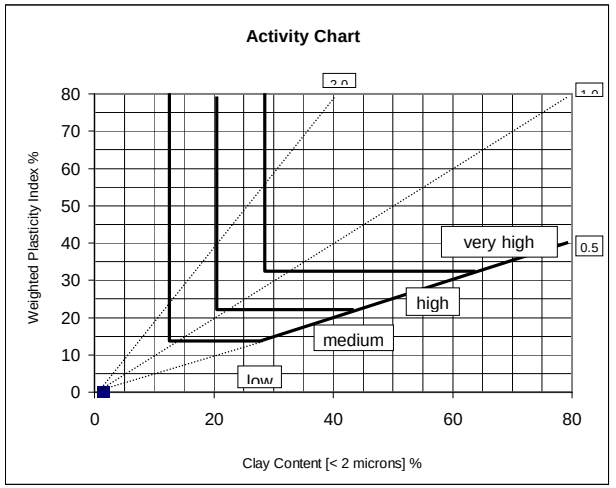
UNIFIED	PRA	TRH
GP	A.1.a (0)	

Soil constituents % :	Clay :	2	Silt :	7	Sand :	26	Gravel :	66	Fines :	26	Soil description :	Light Reddish Brown Soil

D_{10} :	0.075	D_{30} :	0.895	D_{60} :	13.654	Uniformity coefficient :	182	Curvature coefficient :	1	Active program :	YES







REMARKS: none

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999	**Date**	**Job No.** 1450
Position :	TP 6	**Depth [m] :** @ 0.70m	**Source :** INSITU	21-Feb-12	**Sample No.** 12/0285

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	100	98	91	87	82	68	59	52	41	30	29	20	19

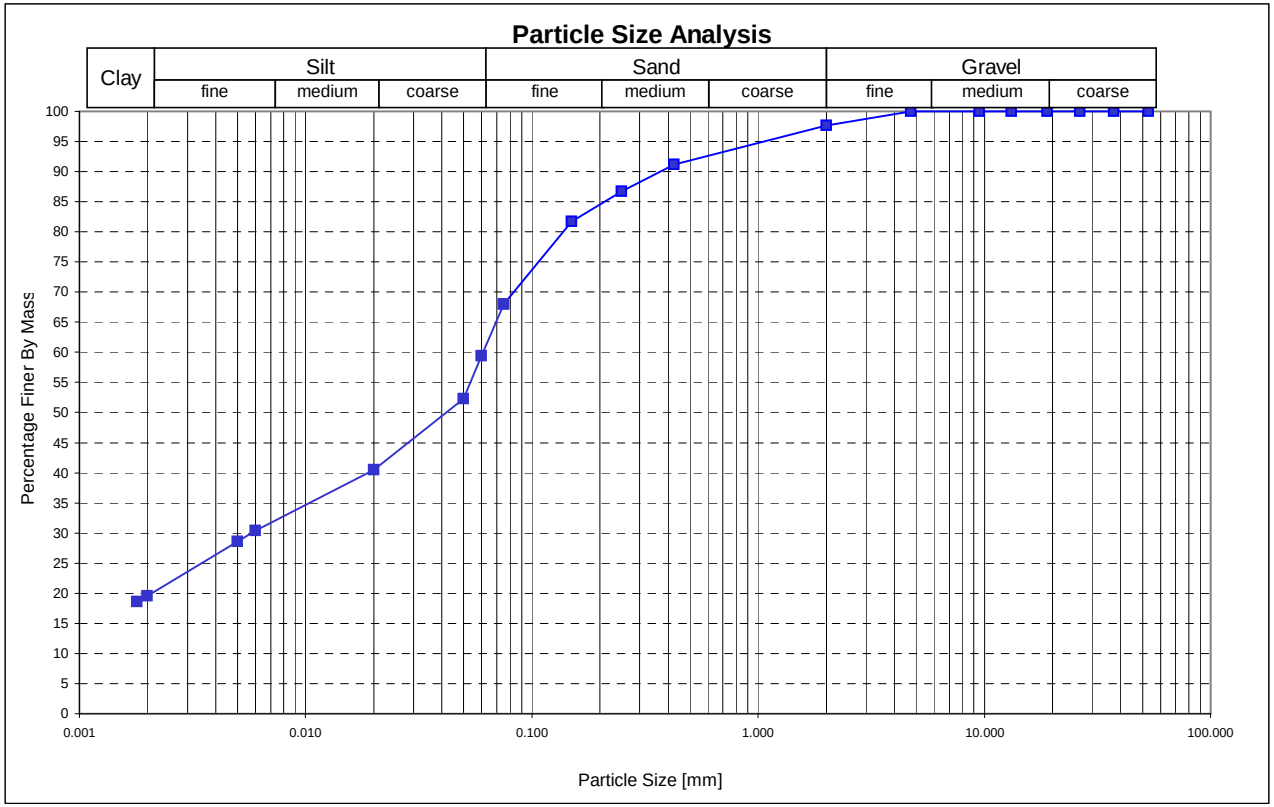
ATTERBERG LIMITS

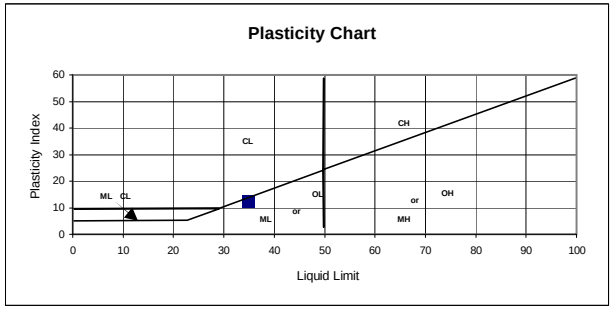
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
35	13	11	5.4	0.43

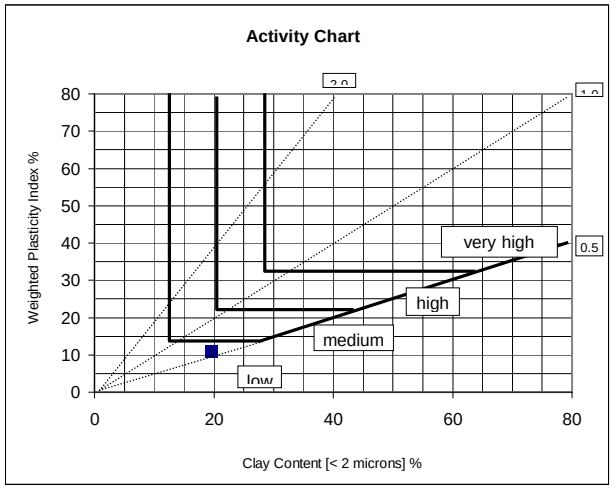
CLASSIFICATION

UNIFIED	PRA	TRH
CL	A.6 (7)	

Soil constituents % :	**Clay :** 20	**Silt :** 40	**Sand :** 38	**Gravel :** 2	**Fines :** 91	**Soil description :** Light Brown Soil
D_{10} :		**D_{30} :** 0.006	**D_{60} :** 0.061	**Uniformity coefficient :**		**Curvature coefficient :**	Active program : YES







REMARKS: **none**

CHECKED BY : G van Gelder

One Dimensional Consolidation Properties
(Oedometer)

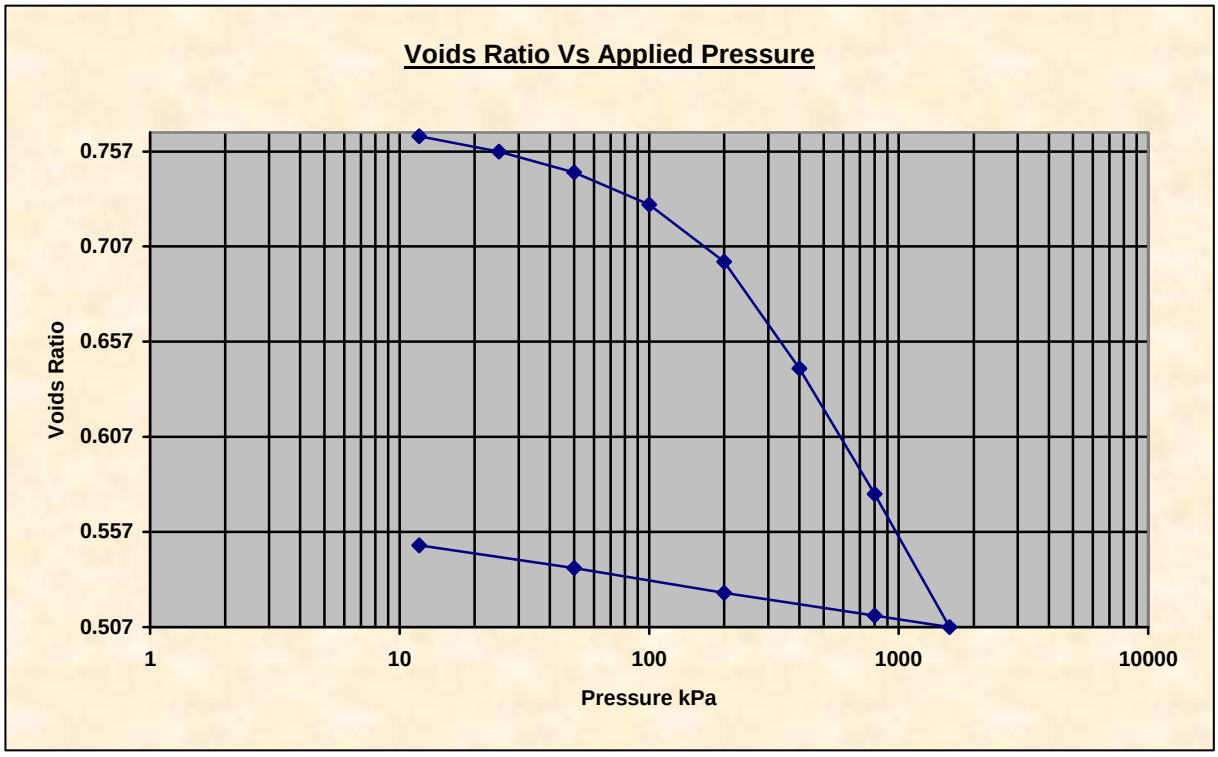
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 06	**Sample**	12-0285

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	50.00mm	**Orientation within Sample**	vertical
Specimen Mass	159.62 g	**Condition**	Inundated
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	1	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	116.00 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	11.32 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 06	**Sample**	12-0285

Initial Moisture Content*	21.8 % (trimmings: 23.5 %)	**Final Moisture Content**	21.4 %
Initial Bulk Density	1.81 Mg/m3	**Final Bulk Density**	2.05 Mg/m3
Initial Dry Density	1.48 Mg/m3	**Final Dry Density**	1.69 Mg/m3
Initial Void Ratio	0.7671	**Final Void Ratio**	0.5495
Initial Degree of Saturation	74.61%	**Final Degree of Saturation**	101.91 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.09 m2/MN	3.22 m2/yr
25.0 kPa	0.36 m2/MN	33.82 m2/yr
50.0 kPa	0.26 m2/MN	16.08 m2/yr
100.0 kPa	0.19 m2/MN	22.96 m2/yr
200.0 kPa	0.17 m2/MN	28.22 m2/yr
400.0 kPa	0.16 m2/MN	36.40 m2/yr
800.0 kPa	0.10 m2/MN	28.28 m2/yr
1600.0 kPa	0.06 m2/MN	26.74 m2/yr
800.0 kPa	0.01 m2/MN	---------
200.0 kPa	0.01 m2/MN	---------
50.0 kPa	0.06 m2/MN	---------
12.0 kPa	0.20 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120220
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

One Dimensional Consolidation Properties
(Oedometer)

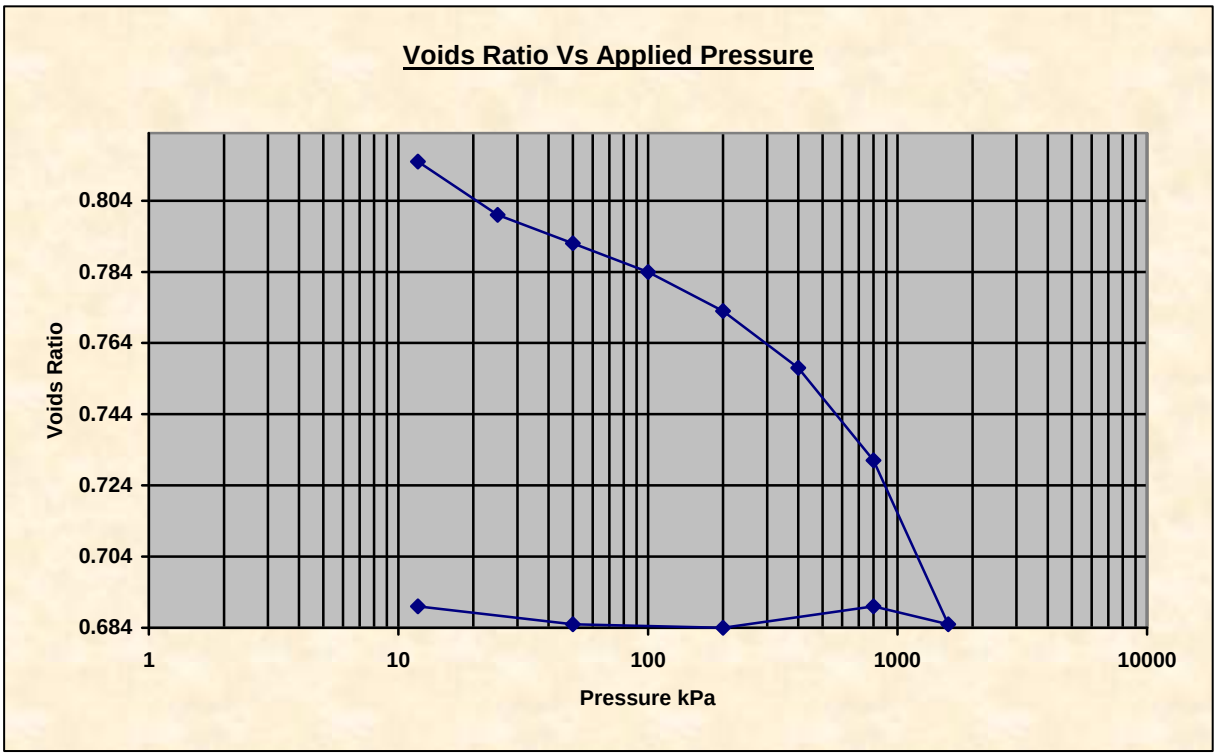
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 06	**Sample**	12-0285

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	75.00mm	**Orientation within Sample**	vertical
Specimen Mass	157.14 g	**Condition**	Natural Moisture
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	2	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	114.20 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.97 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 06	**Sample**	12-0285

Initial Moisture Content*	23.7 % (trimmings: 23.5 %)	**Final Moisture Content**	9.4 %
Initial Bulk Density	1.78 Mg/m3	**Final Bulk Density**	1.70 Mg/m3
Initial Dry Density	1.44 Mg/m3	**Final Dry Density**	1.55 Mg/m3
Initial Void Ratio	0.8228	**Final Void Ratio**	0.6898
Initial Degree of Saturation	75.57%	**Final Degree of Saturation**	35.89 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.38 m2/MN	---------
25.0 kPa	0.62 m2/MN	---------
50.0 kPa	0.17 m2/MN	---------
100.0 kPa	0.10 m2/MN	---------
200.0 kPa	0.06 m2/MN	---------
400.0 kPa	0.04 m2/MN	---------
800.0 kPa	0.04 m2/MN	---------
1600.0 kPa	0.03 m2/MN	---------
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.00 m2/MN	---------
12.0 kPa	0.07 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120220
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 6	**Depth [m] :**	1.600-2.100	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0286

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	96	89	83	81	77	65	58	53	37	24	23	15	14

ATTERBERG LIMITS

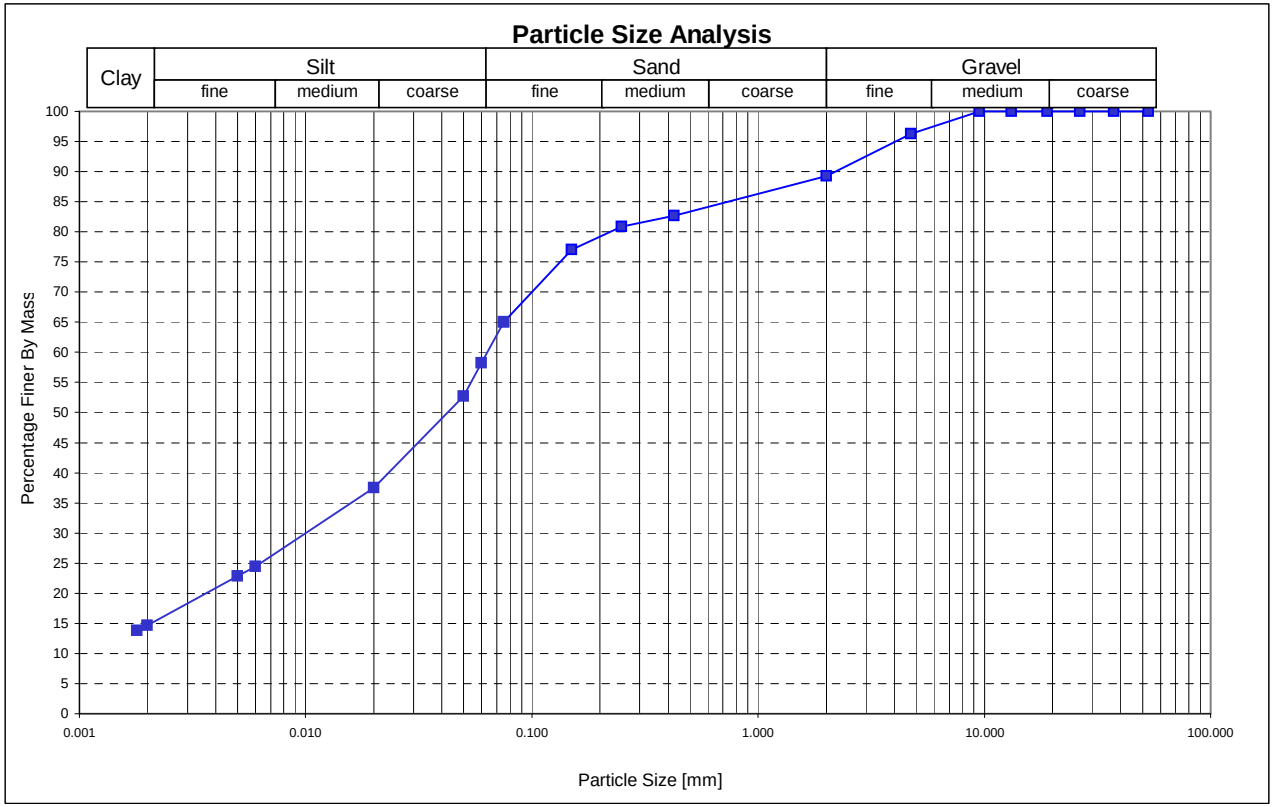
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
36	8	7	3.4	0.63

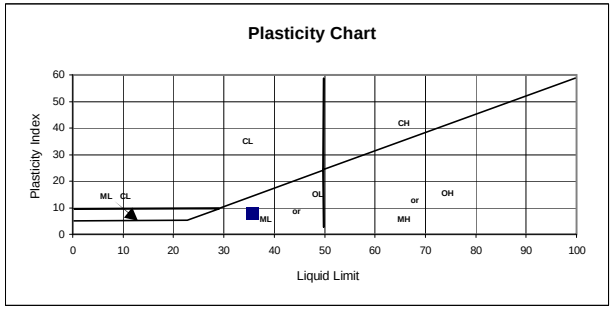
CLASSIFICATION

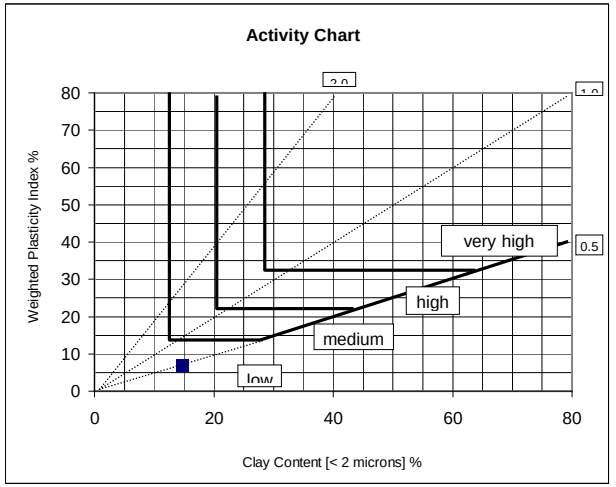
UNIFIED	PRA	TRH
ML	A.4 (6)	

Soil constituents % :	**Clay :**	15	**Silt :**	44	**Sand :**	31	**Gravel :**	11	**Fines :**	83	**Soil description :** Buff Soil

D_{10} :		**D_{30} :**	0.010	**D_{60} :**	0.064	**Uniformity coefficient :**		**Curvature coefficient :**		Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999	**Date**	**Job No.** 1450
Position :	TP 8	**Depth [m] :** @ 0.70m	**Source :** INSITU	21-Feb-12	**Sample No.** 12/0287

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	100	100	84	71	54	38	32	27	18	11	10	7	7

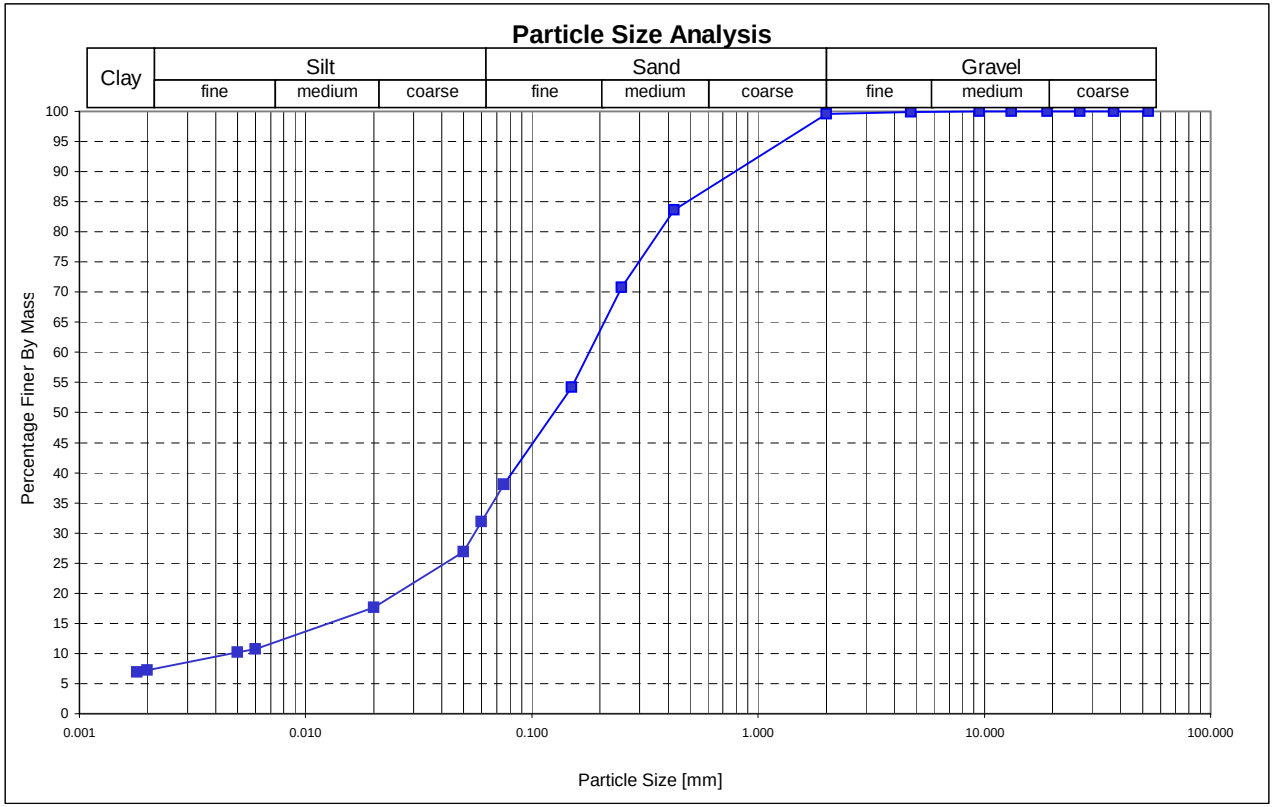
ATTERBERG LIMITS

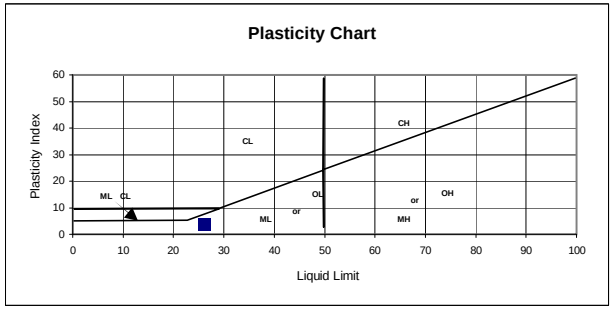
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
26	4	3	2.0	0.79

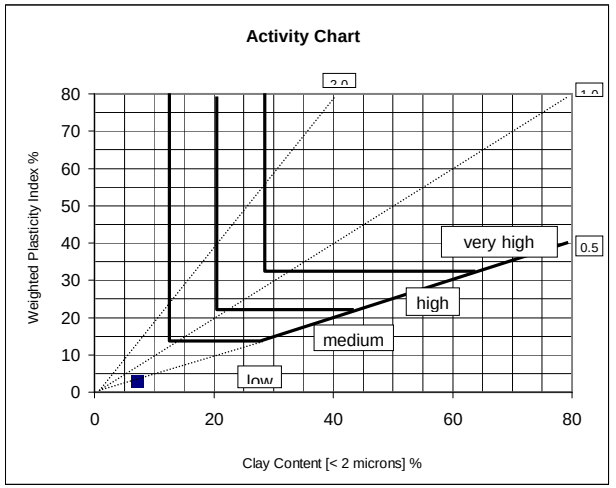
CLASSIFICATION

UNIFIED	PRA	TRH
SM	A.4 (1)	

Soil constituents % :	**Clay :** 7	**Silt :** 25	**Sand :** 68	**Gravel :** 0	**Fines :** 84	**Soil description :** Dark Yellowish Orange Soil
D_{10} : 0.005	**D_{30} :** 0.056	**D_{60} :** 0.179	**Uniformity coefficient :** 38	**Curvature coefficient :** 4	Active program : YES	







REMARKS: **none**

CHECKED BY : G van Gelder

One Dimensional Consolidation Properties
(Oedometer)

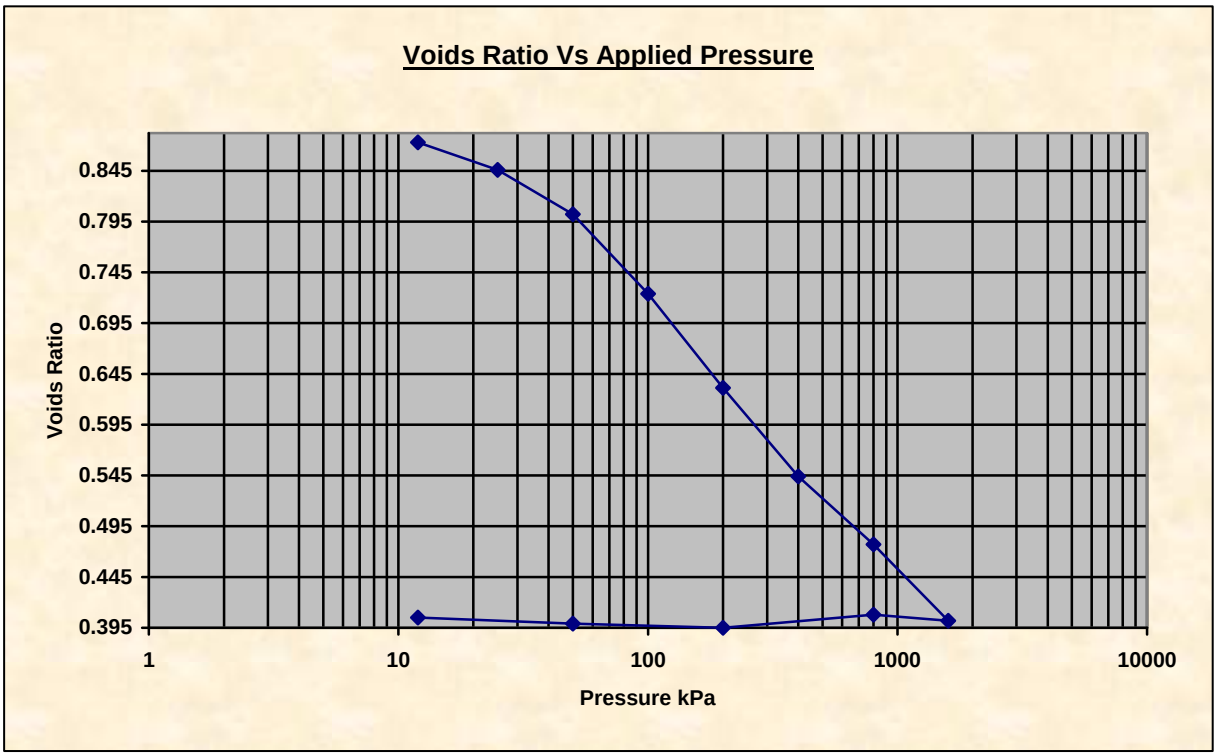
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 08	**Sample**	12-0287

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	60.00mm	**Orientation within Sample**	vertical
Specimen Mass	138.62 g	**Condition**	Inundated
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	3	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	116.74 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.63 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 08	**Sample**	12-0287

Initial Moisture Content*	12.7 % (trimmings: 12.3 %)	**Final Moisture Content**	13.8 %
Initial Bulk Density	1.57 Mg/m3	**Final Bulk Density**	2.12 Mg/m3
Initial Dry Density	1.39 Mg/m3	**Final Dry Density**	1.87 Mg/m3
Initial Void Ratio	0.8821	**Final Void Ratio**	0.4047
Initial Degree of Saturation	37.72%	**Final Degree of Saturation**	89.48 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.42 m2/MN	12.36 m2/yr
25.0 kPa	1.08 m2/MN	18.21 m2/yr
50.0 kPa	0.97 m2/MN	30.41 m2/yr
100.0 kPa	0.86 m2/MN	32.03 m2/yr
200.0 kPa	0.54 m2/MN	29.96 m2/yr
400.0 kPa	0.27 m2/MN	37.45 m2/yr
800.0 kPa	0.11 m2/MN	26.32 m2/yr
1600.0 kPa	0.06 m2/MN	19.71 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.02 m2/MN	---------
50.0 kPa	0.02 m2/MN	---------
12.0 kPa	0.12 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120220
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

One Dimensional Consolidation Properties
(Oedometer)

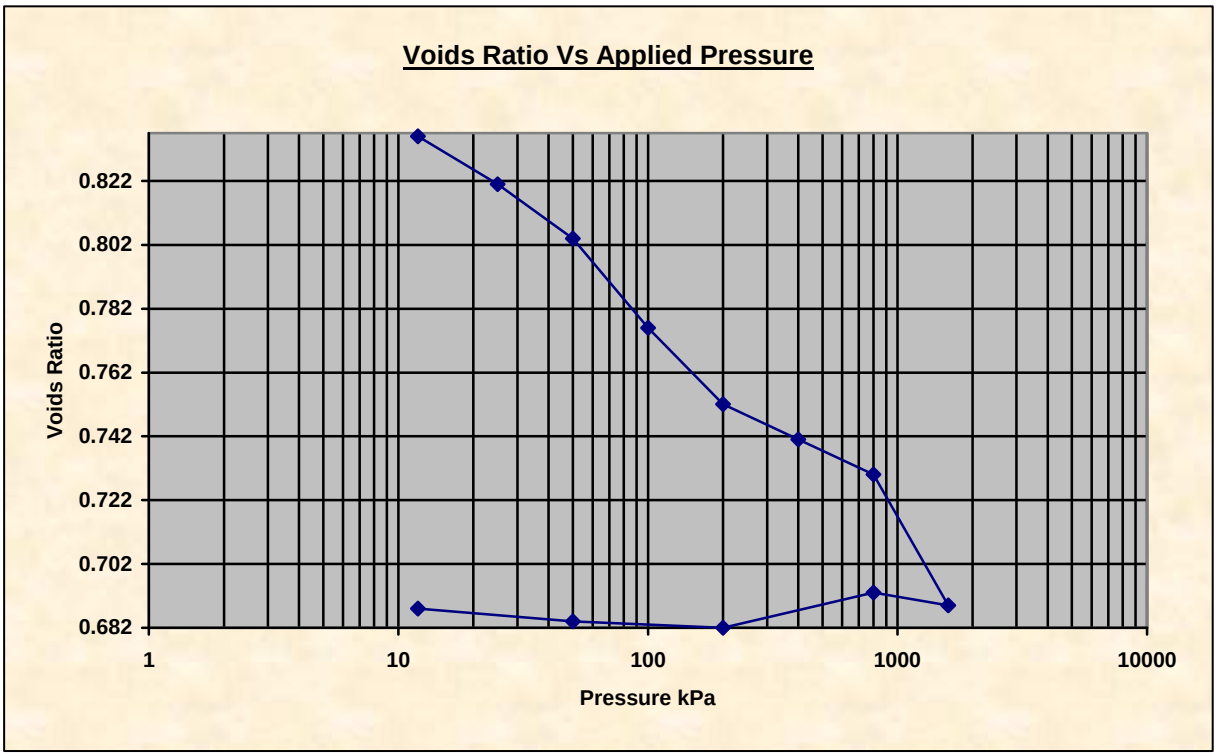
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 08	**Sample**	12-0287

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	75.00mm	**Orientation within Sample**	vertical
Specimen Mass	141.84 g	**Condition**	Natural Moisture
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	4	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	108.80 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.89 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 08	**Sample**	12-0287

Initial Moisture Content*	12.6 % (trimmings: 12.3 %)	**Final Moisture Content**	3.2 %
Initial Bulk Density	1.61 Mg/m3	**Final Bulk Density**	1.60 Mg/m3
Initial Dry Density	1.43 Mg/m3	**Final Dry Density**	1.55 Mg/m3
Initial Void Ratio	0.8373	**Final Void Ratio**	0.6879
Initial Degree of Saturation	39.34%	**Final Degree of Saturation**	12.09 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.07 m2/MN	39.75 m2/yr
25.0 kPa	0.62 m2/MN	7.74 m2/yr
50.0 kPa	0.37 m2/MN	16.70 m2/yr
100.0 kPa	0.32 m2/MN	35.03 m2/yr
200.0 kPa	0.13 m2/MN	2.08 m2/yr
400.0 kPa	0.03 m2/MN	3.58 m2/yr
800.0 kPa	0.02 m2/MN	4.92 m2/yr
1600.0 kPa	0.03 m2/MN	2.32 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.01 m2/MN	---------
12.0 kPa	0.06 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120220
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 8	**Depth [m] :**	1.250-1.700	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0288

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	93	90	79	70	60	56	47	39	29	20	18	16	9	5	5	3	3

ATTERBERG LIMITS

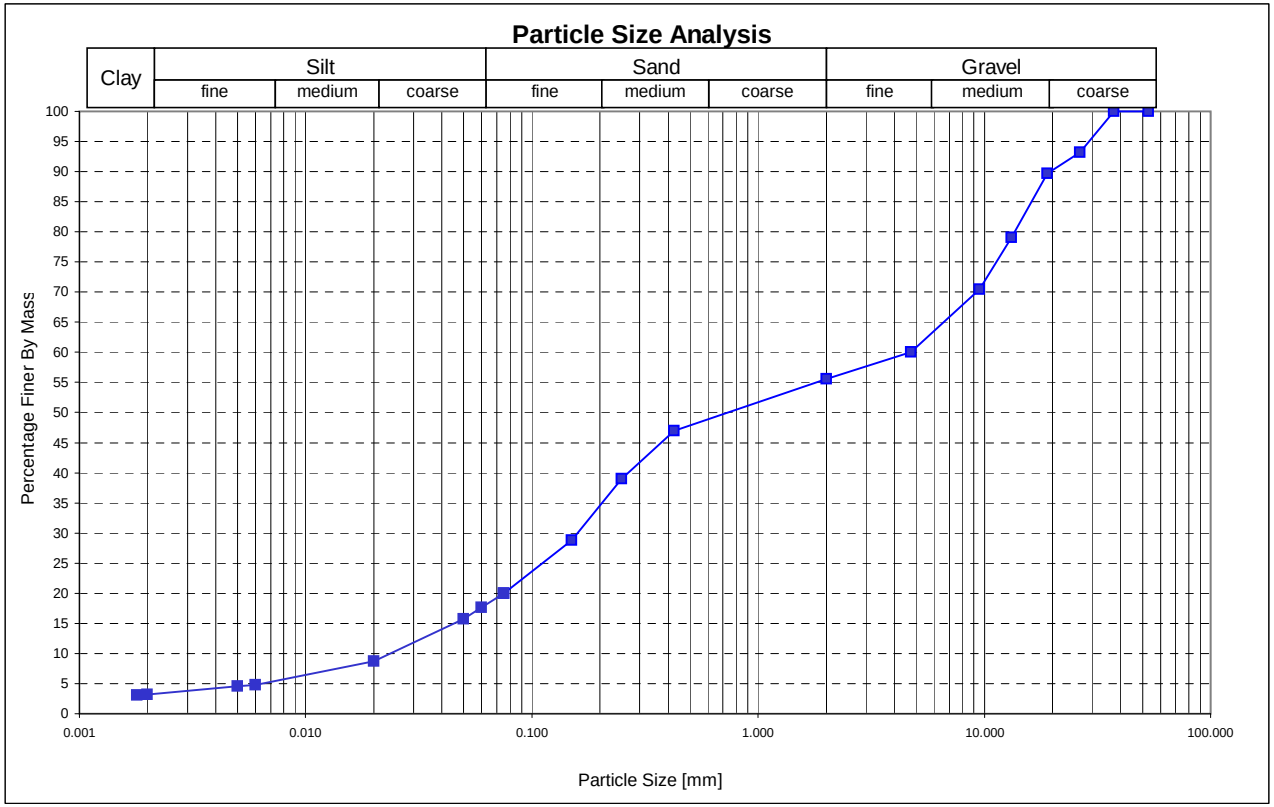
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
0	NP		0.0	1.77

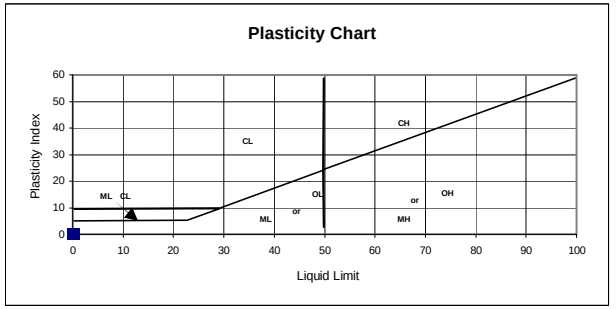
CLASSIFICATION

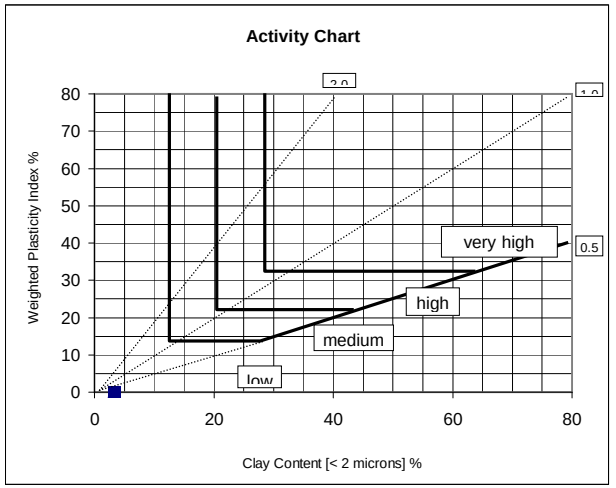
UNIFIED	PRA	TRH
SM	A.1.b (0)	

Soil constituents % :	**Clay :**	3	**Silt :**	14	**Sand :**	38	**Gravel :**	44	**Fines :**	47	**Soil description :** Dark Yellowish Orange Soil

D_{10} :	0.024	**D_{30} :**	0.159	**D_{60} :**	4.677	**Uniformity coefficient :**	198	**Curvature coefficient :**	0	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 9	**Depth [m] :**	1.300-2.300	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0289

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	93	85	74	66	55	47	36	26	23	20	12	6	6	4	4

ATTERBERG LIMITS

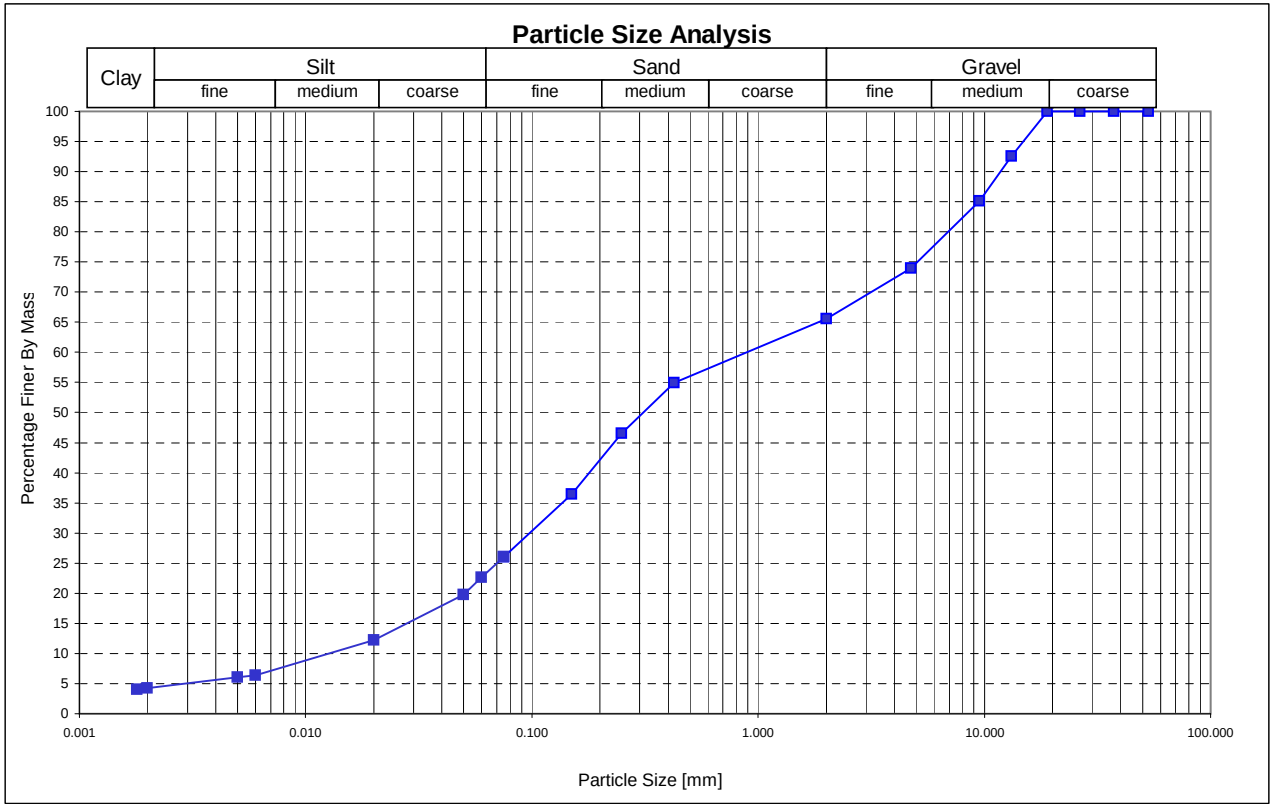
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
26	6	3	2.7	1.53

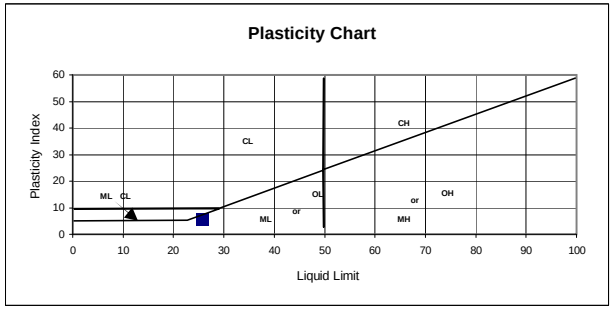
CLASSIFICATION

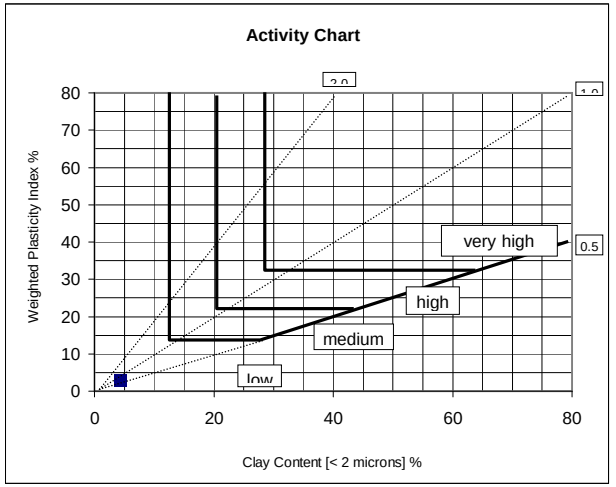
UNIFIED	PRA	TRH
SM/SC	A.2.4 (0)	

Soil constituents % :	**Clay :**	4	**Silt :**	18	**Sand :**	43	**Gravel :**	34	**Fines :**	55	**Soil description :**	Light Reddish Brown Soil

D_{10} :	0.013	**D_{30} :**	0.098	**D_{60} :**	0.884	**Uniformity coefficient :**	70	**Curvature coefficient :**	1	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999	**Date**	**Job No.** 1450
Position :	TP 10	**Depth [m] :** 0.300-0.650	**Source :** INSITU	10-Feb-12	**Sample No.** 12/0290

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	99	97	92	79	68	52	37	32	28	17	10	10	8	7

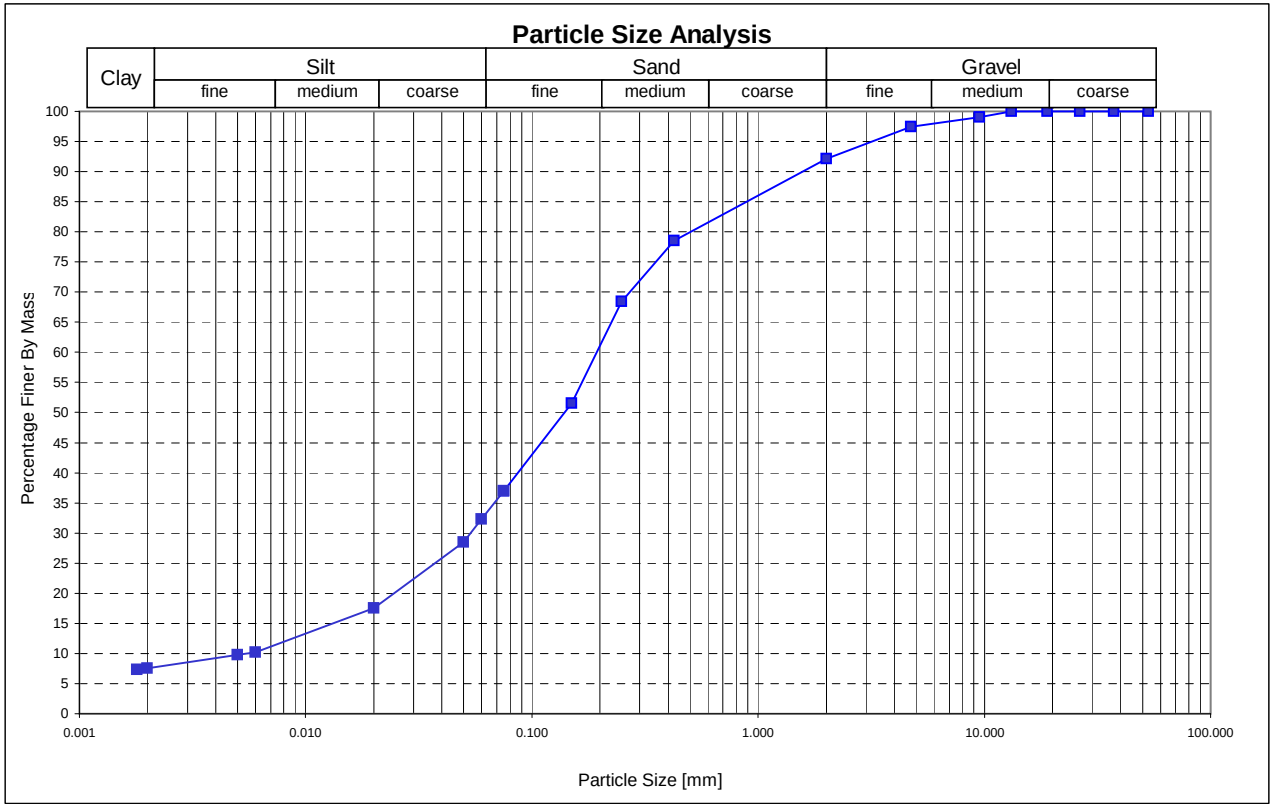
ATTERBERG LIMITS

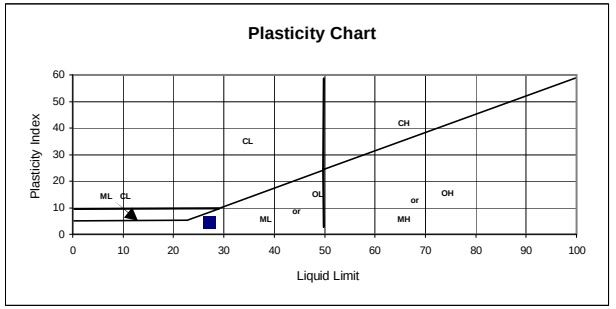
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
27	5	4	2.0	0.92

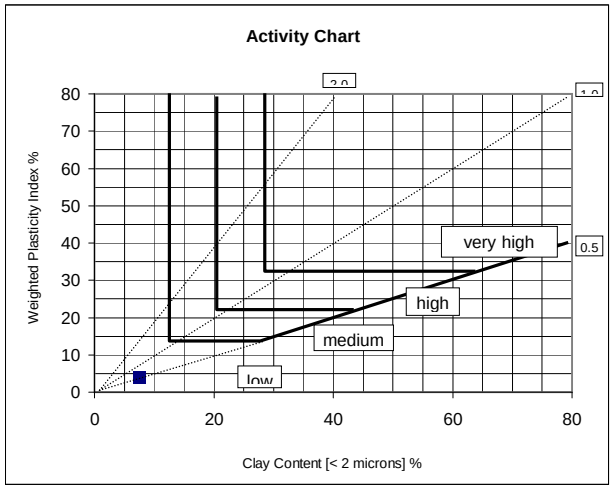
CLASSIFICATION

UNIFIED	PRA	TRH
SM	A.4 (0)	

Soil constituents % :	**Clay :** 8	**Silt :** 25	**Sand :** 60	**Gravel :** 8	**Fines :** 79	**Soil description :** Dark Brown Soil
D_{10} : 0.006	**D_{30} :** 0.054	**D_{60} :** 0.193	**Uniformity coefficient :** 35	**Curvature coefficient :** 3	Active program : YES	







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999	**Date**	**Job No.** 1450
Position :	TP 12	**Depth [m] :** 0.650-1.650	**Source :** INSITU	10-Feb-12	**Sample No.** 12/0291

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	92	85	70	60	50	47	42	34	29	25	18	13	12	8	8

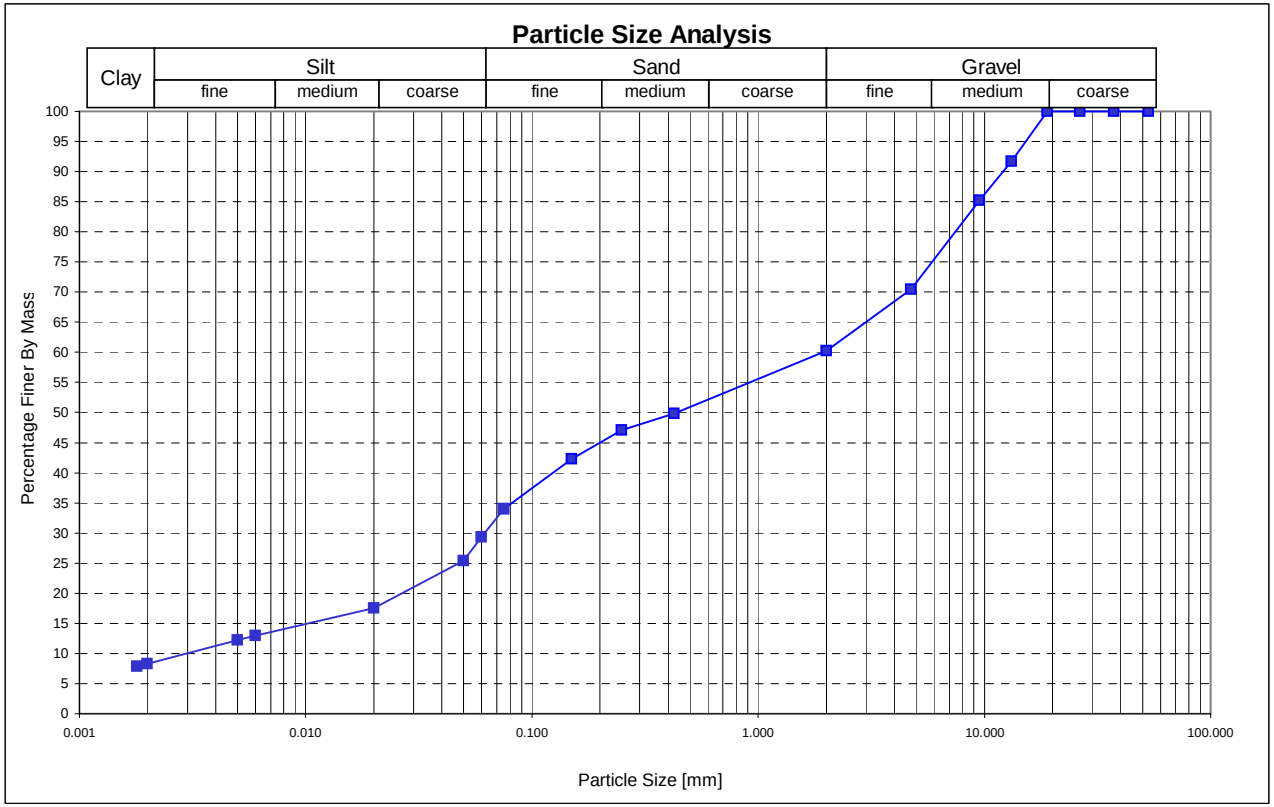
ATTERBERG LIMITS

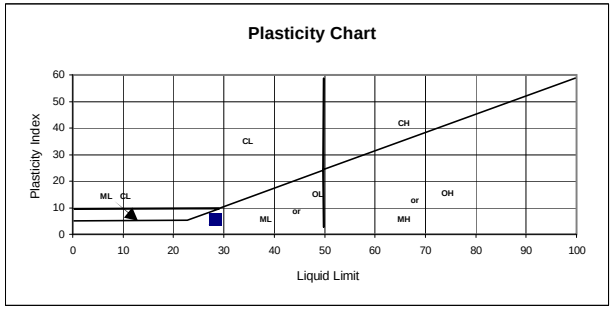
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
28	6	3	2.7	1.56

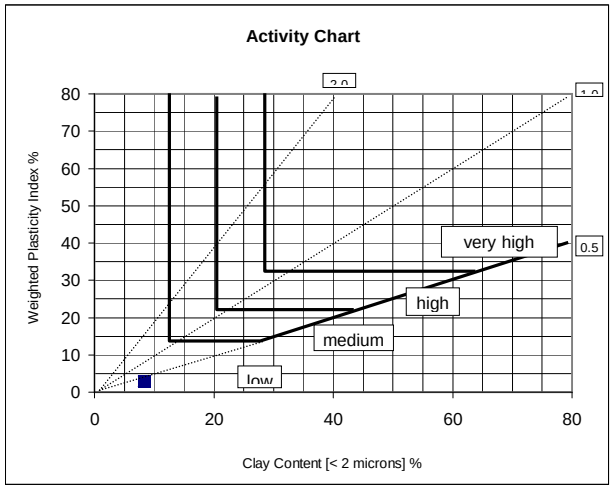
CLASSIFICATION

UNIFIED	PRA	TRH
SM	A.2.4 (0)	

Soil constituents % :	**Clay :** 8	**Silt :** 21	**Sand :** 31	**Gravel :** 40	**Fines :** 50	**Soil description :** Light Brown Soil
D_{10} : 0.003	**D_{30} :** 0.062	**D_{60} :** 1.913	**Uniformity coefficient :** 641	**Curvature coefficient :** 1	Active program : YES	







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999	**Date**	**Job No.** 1450
Position :	TP 13	**Depth [m] :** @ 0.80m	**Source :** INSITU	21-Feb-12	**Sample No.** 12/0292

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	100	100	92	86	78	57	47	38	27	18	17	12	12

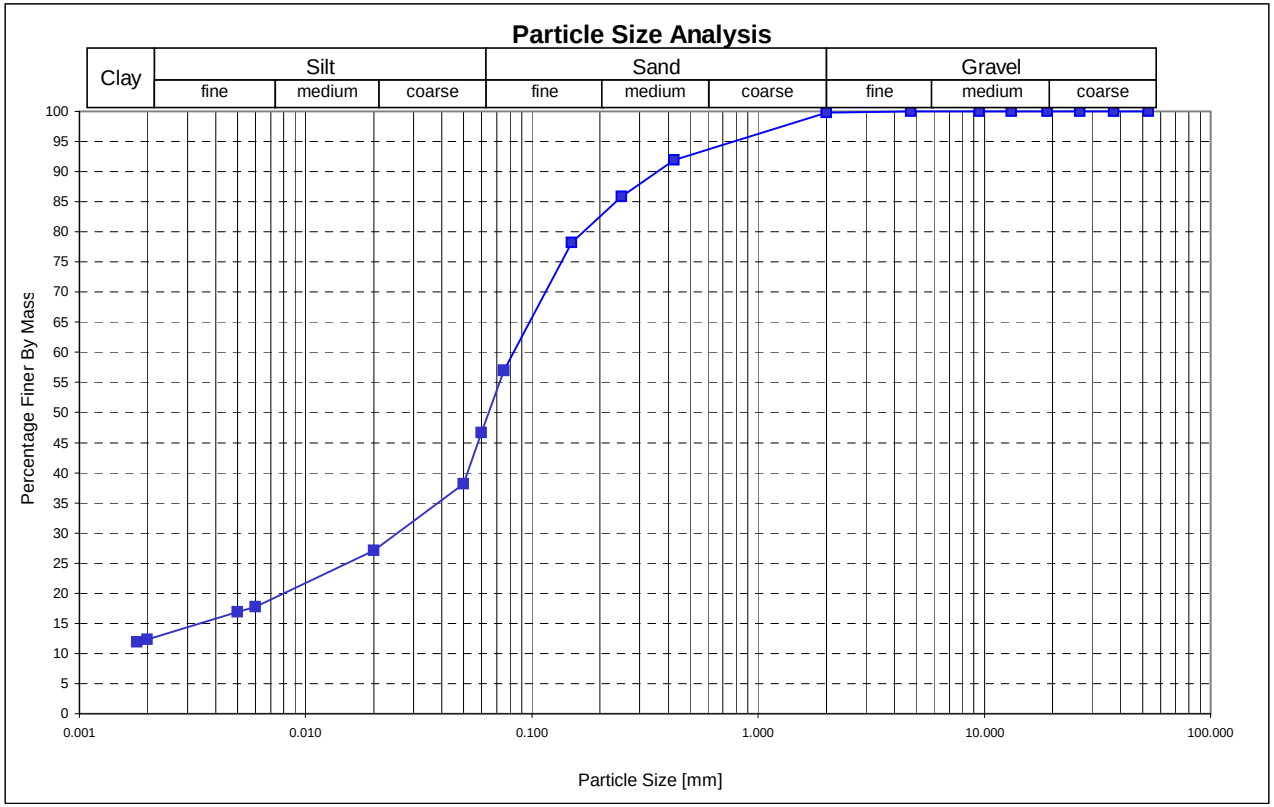
ATTERBERG LIMITS

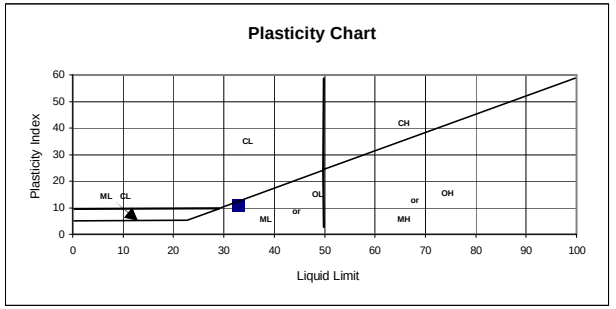
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
33	11	10	5.4	0.51

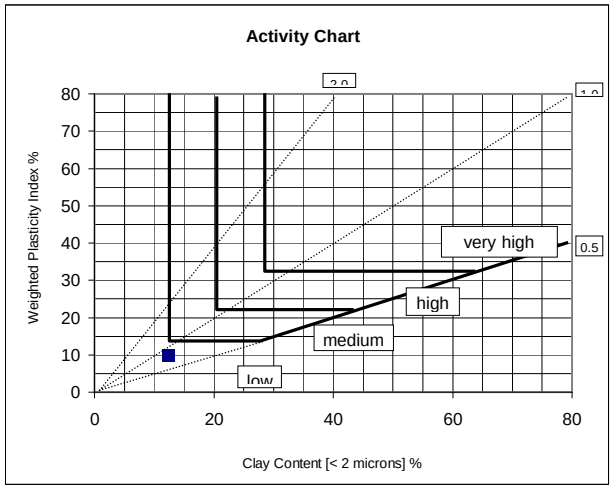
CLASSIFICATION

UNIFIED	PRA	TRH
CL	A.6 (4)	

Soil constituents % :	**Clay :** 12	**Silt :** 34	**Sand :** 53	**Gravel :** 0	**Fines :** 92	**Soil description :** Dark Reddish Brown Soil
D_{10} :		**D_{30} :** 0.025	**D_{60} :** 0.083	**Uniformity coefficient :**		**Curvature coefficient :**		Active program :	YES		







REMARKS: **none**

CHECKED BY : G van Gelder

One Dimensional Consolidation Properties
(Oedometer)

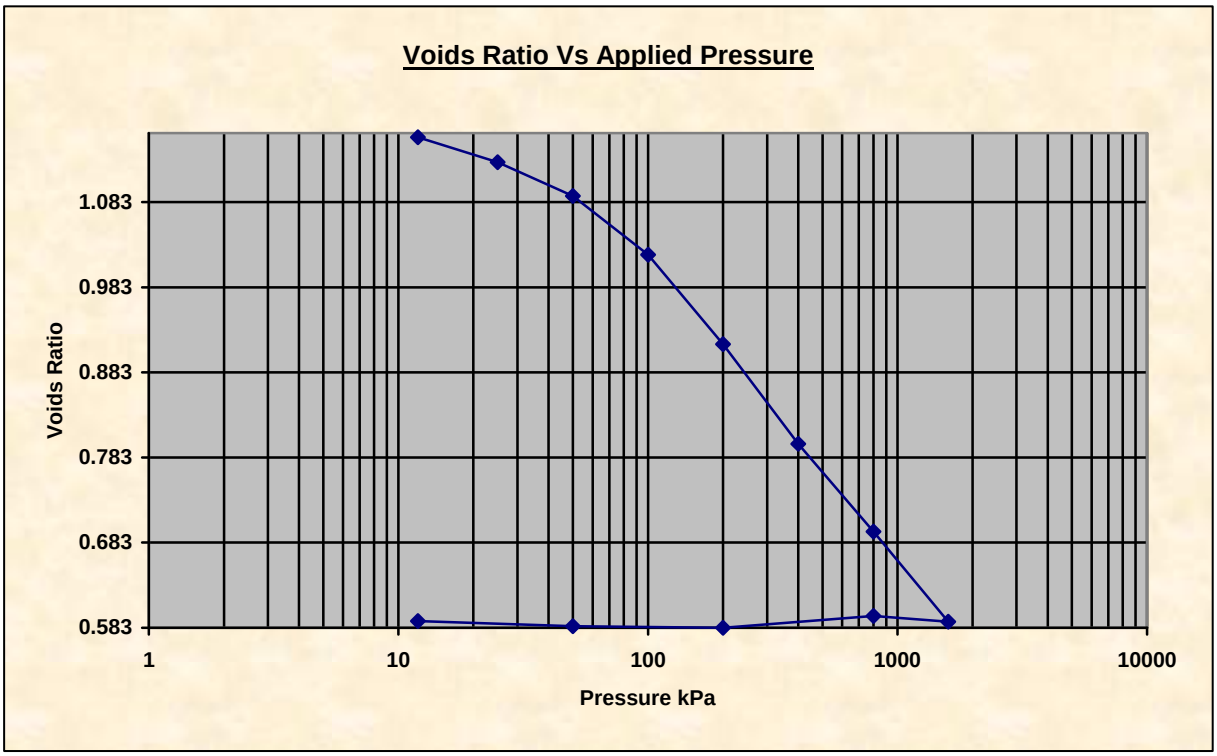
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 13	**Sample**	12-0287

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.80 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	50.00mm	**Orientation within Sample**	vertical
Specimen Mass	138.38 g	**Condition**	Inundated
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	5	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	108.40 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	9.24 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 13	**Sample**	12-0287

Initial Moisture Content*	29.3 % (trimmings: 28.6 %)	**Final Moisture Content**	20.6 %
Initial Bulk Density	1.57 Mg/m3	**Final Bulk Density**	1.99 Mg/m3
Initial Dry Density	1.21 Mg/m3	**Final Dry Density**	1.65 Mg/m3
Initial Void Ratio	1.1635	**Final Void Ratio**	0.5907
Initial Degree of Saturation	66.04%	**Final Degree of Saturation**	91.19 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.19 m2/MN	---------
25.0 kPa	1.03 m2/MN	37.88 m2/yr
50.0 kPa	0.74 m2/MN	30.67 m2/yr
100.0 kPa	0.66 m2/MN	32.46 m2/yr
200.0 kPa	0.52 m2/MN	47.46 m2/yr
400.0 kPa	0.30 m2/MN	45.96 m2/yr
800.0 kPa	0.14 m2/MN	25.77 m2/yr
1600.0 kPa	0.08 m2/MN	16.14 m2/yr
800.0 kPa	0.01 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.01 m2/MN	---------
12.0 kPa	0.09 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120220
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

One Dimensional Consolidation Properties
(Oedometer)

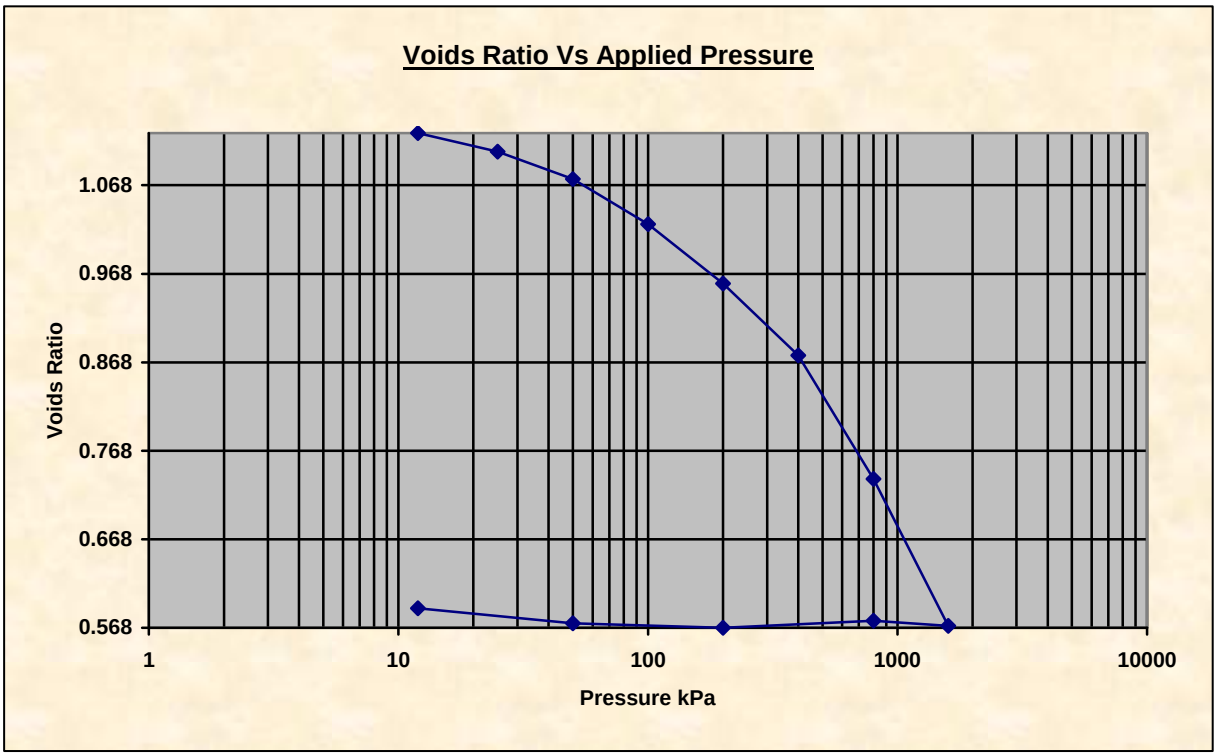
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 13	**Sample**	12-0292

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.80 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	75.00mm	**Orientation within Sample**	vertical
Specimen Mass	140.03 g	**Condition**	Natural Moisture
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	6	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	108.50 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	9.42 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 13	**Sample**	12-0292

Initial Moisture Content*	28.5 % (trimmings: 28.6 %)	**Final Moisture Content**	12.8 %
Initial Bulk Density	1.58 Mg/m3	**Final Bulk Density**	1.86 Mg/m3
Initial Dry Density	1.23 Mg/m3	**Final Dry Density**	1.65 Mg/m3
Initial Void Ratio	1.1238	**Final Void Ratio**	0.5896
Initial Degree of Saturation	66.37%	**Final Degree of Saturation**	57.08 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	-0.12 m2/MN	---------
25.0 kPa	0.76 m2/MN	20.60 m2/yr
50.0 kPa	0.59 m2/MN	30.59 m2/yr
100.0 kPa	0.49 m2/MN	33.96 m2/yr
200.0 kPa	0.33 m2/MN	29.93 m2/yr
400.0 kPa	0.21 m2/MN	27.94 m2/yr
800.0 kPa	0.19 m2/MN	35.58 m2/yr
1600.0 kPa	0.12 m2/MN	48.70 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.02 m2/MN	---------
12.0 kPa	0.28 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120220
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 13	**Depth [m] :**	1.200-1.900	**Source :**	INSITU

Date	**Job No.**	1450
21-Feb-12	**Sample No.**	12/0293

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	97	93	84	79	74	56	45	36	24	15	15	11	11

ATTERBERG LIMITS

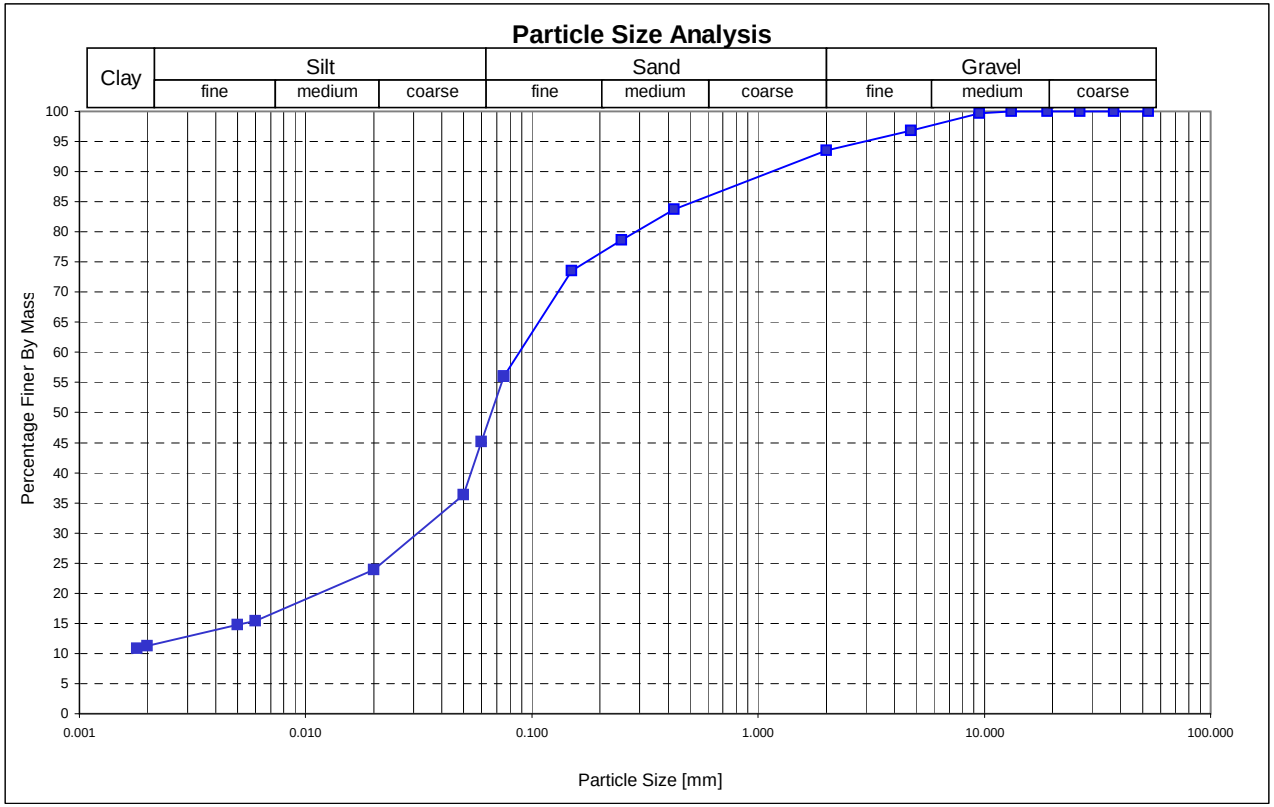
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
34	5	5	5.4	0.67

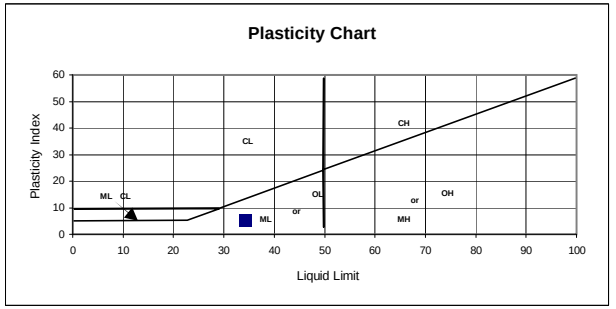
CLASSIFICATION

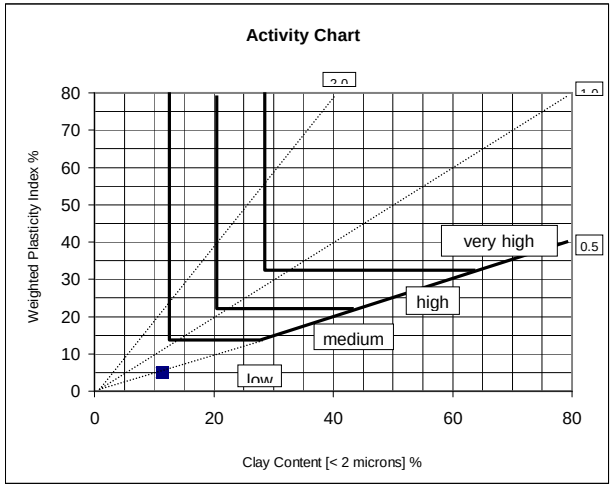
UNIFIED	PRA	TRH
ML	A.4 (4)	

Soil constituents % :	**Clay :**	11	**Silt :**	34	**Sand :**	48	**Gravel :**	7	**Fines :**	84	**Soil description :**	Dark Reddish Brown Soil

D_{10} :		**D_{30} :**	0.031	**D_{60} :**	0.088	**Uniformity coefficient :**		**Curvature coefficient :**		Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

Engeo Lab (Pty) Ltd

INSITU DENSITY & MOISTURE DETERMINATION

JOB NO: 1450 (#990)
DATE: 1-Mar-2012

Sample Number			0389					
Position			TP 13					
Depth			@ 1.50m					
Mass of sample in air	(g)	a	77.40					
Mass of waxed sample in air	(g)	b	81.60					
Mass of waxed sample in water @ 25^{o}C	(g)	c	35.90					
Mass of water displaced (b - c)	(g)	d	45.70					
Mass of wax (b - a)	(g)	e	4.20					
Density of wax	(kg/m^{3})	f	0.93					
Volume of wax (e / f)	(ml)	g	4.52					
Volume of sample (d - g)	(ml)	h	41.18					
Wet density of sample (a / h *100)	(kg/m^{3})	I	1879					
Dry density of sample (I / (100 + k) * 1000)	(kg/m^{3})	j	**1473**					
Mass Pan & Wet Mat.	(g)		78.14					
Mass Pan & Dry Mat.	(g)		73 34					
Mass Pan	(g)		55 93					
% Moisture	(%)	k	**27.6**					
Laboratory Determined Max. Dry Density	(kg/m^{3})	l						
Laboratory Determined O.M.C.	%	m						
Pecentage of Max. Dry Density (j/l*100)	%							
Percentage Wet (-) Dry (+) of O M.C. (m-k)	%							
Specific Gravity			**2.62**					
Void ratio			0.779					
Degree of saturation	%		92.8					

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 14	**Depth [m] :**	1.000-1.600	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0294

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	98	91	84	82	78	64	54	45	30	23	22	19	19

ATTERBERG LIMITS

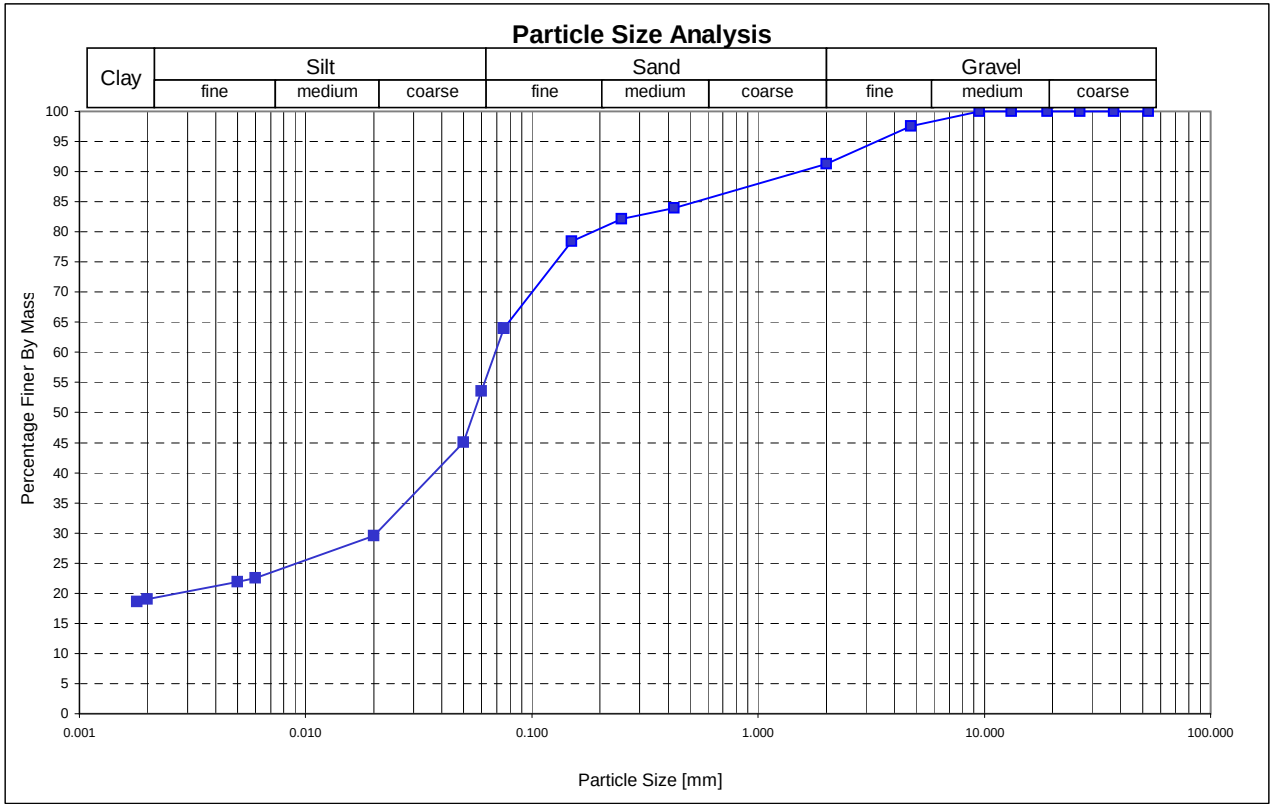
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
34	9	8	4.7	0.61

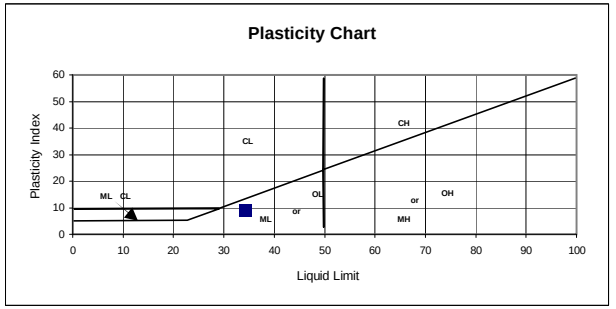
CLASSIFICATION

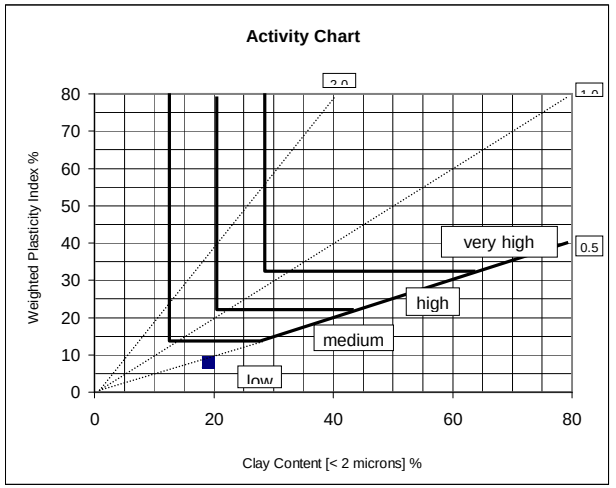
UNIFIED	PRA	TRH
ML	A.4 (6)	

Soil constituents % :	**Clay :**	19	**Silt :**	35	**Sand :**	38	**Gravel :**	9	**Fines :**	84	**Soil description :** Buff Soil

D_{10} :		**D_{30} :**	0.021	**D_{60} :**	0.069	**Uniformity coefficient :**		**Curvature coefficient :**		Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 16	**Depth [m] :**	0.200-0.600	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0295

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	99	99	97	92	87	72	45	38	33	22	15	14	9	9

ATTERBERG LIMITS

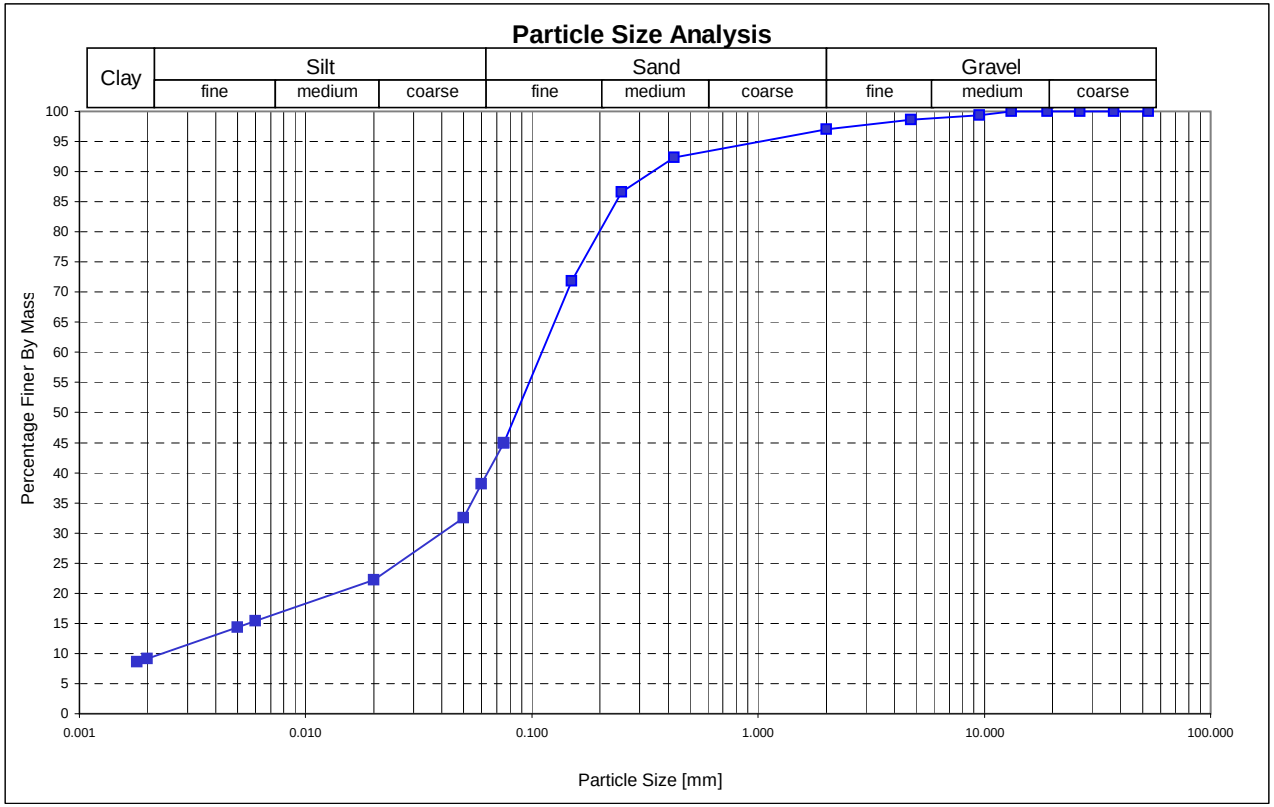
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
24	3	3	1.3	0.66

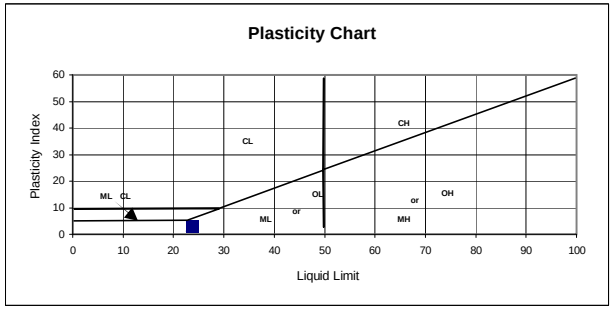
CLASSIFICATION

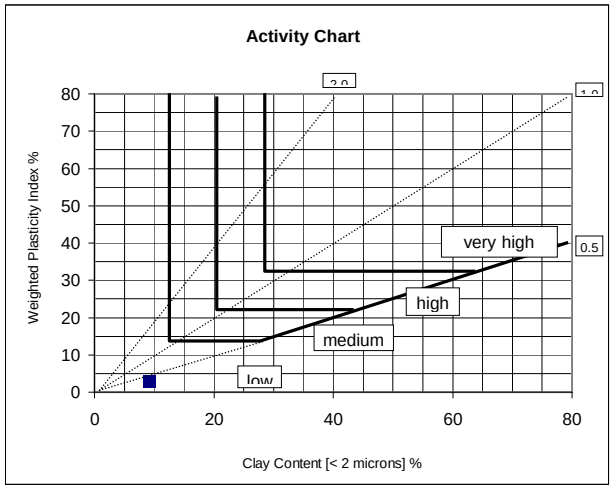
UNIFIED	PRA	TRH
SM	A.4 (2)	

Soil constituents % :	**Clay :**	9	**Silt :**	29	**Sand :**	59	**Gravel :**	3	**Fines :**	92	**Soil description :**	Dark Brown Soil

D_{10} :	0.002	**D_{30} :**	0.040	**D_{60} :**	0.110	**Uniformity coefficient :**	48	**Curvature coefficient :**	6	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999	**Date**	**Job No.** 1450
Position :	TP 16	**Depth [m] :** 0.700-1.300	**Source :** INSITU	10-Feb-12	**Sample No.** 12/0296

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	94	75	70	63	57	49	46	42	30	25	20	12	6	6	4	4

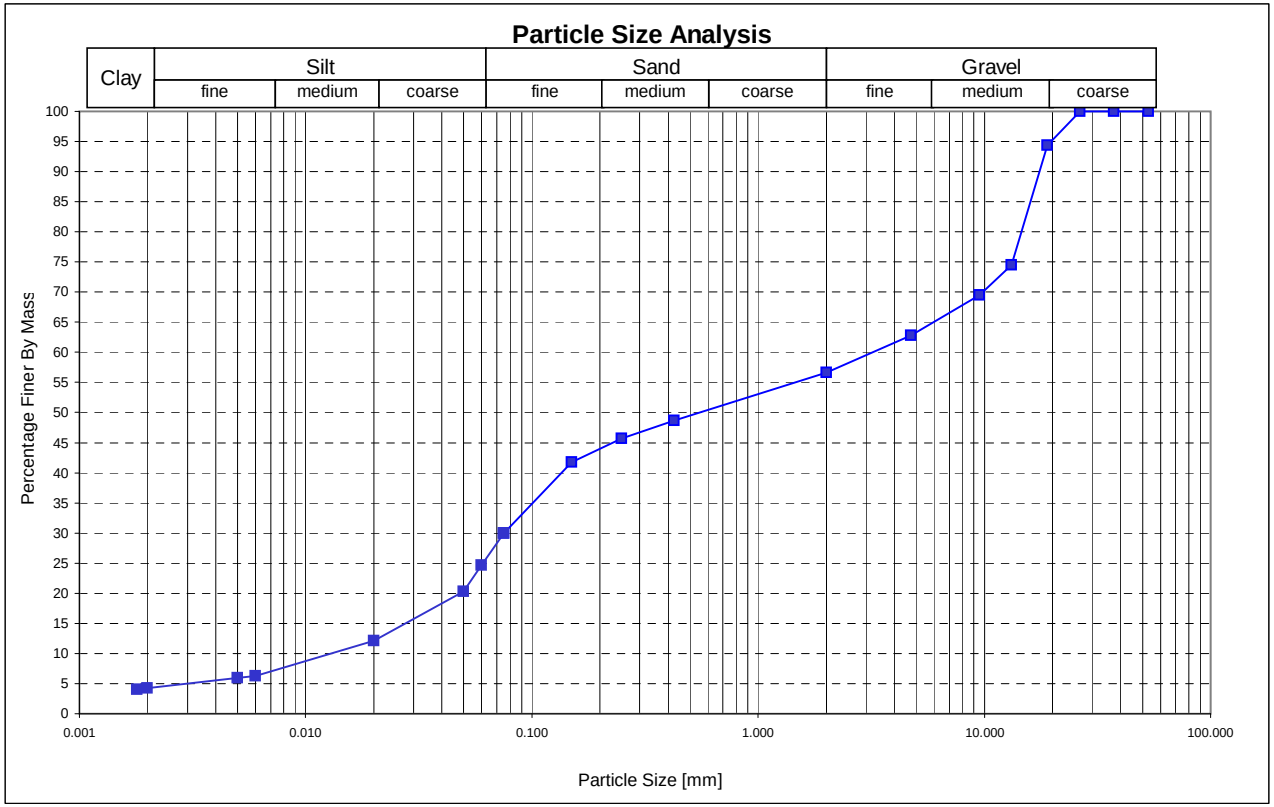
ATTERBERG LIMITS

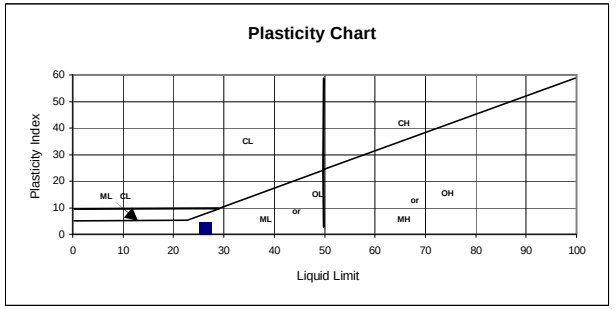
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
26	2		1.0	1.65

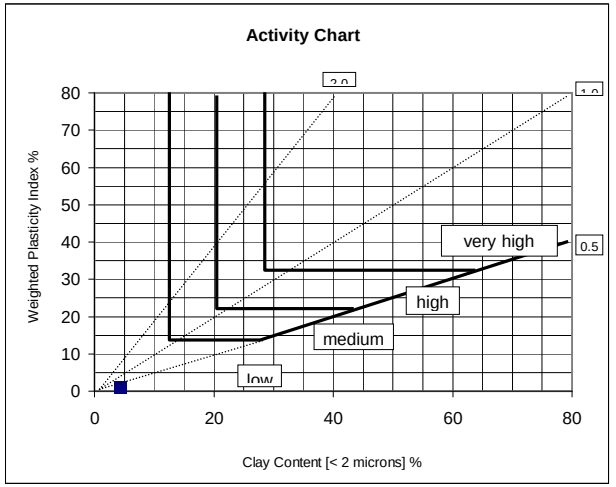
CLASSIFICATION

UNIFIED	PRA	TRH
SM	A.2.4 (0)	

Soil constituents % :	**Clay :** 4	**Silt :** 20	**Sand :** 32	**Gravel :** 43	**Fines :** 49	**Soil description :** Light Grey Soil
D_{10} : 0.013	**D_{30} :** 0.075	**D_{60} :** 3.207	**Uniformity coefficient :** 250	**Curvature coefficient :** 0	Active program : YES	







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 18	**Depth [m] :**	0.800-1.600	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0297

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	95	89	82	76	58	47	36	26	22	19	11	6	6	5	5

ATTERBERG LIMITS

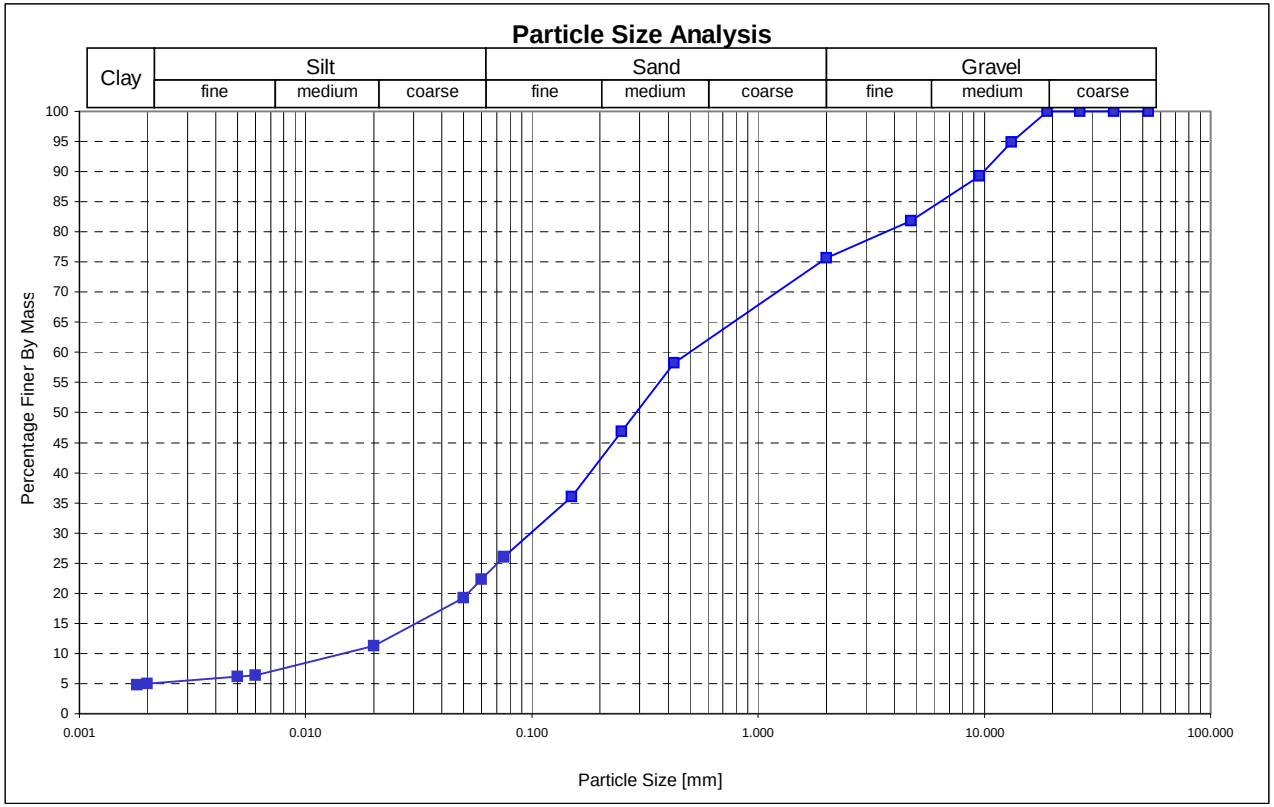
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
0	NP		0.0	1.40

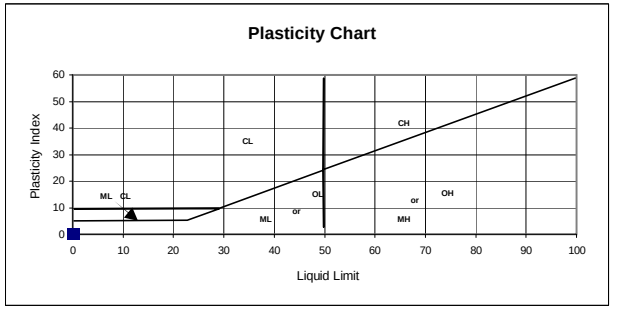
CLASSIFICATION

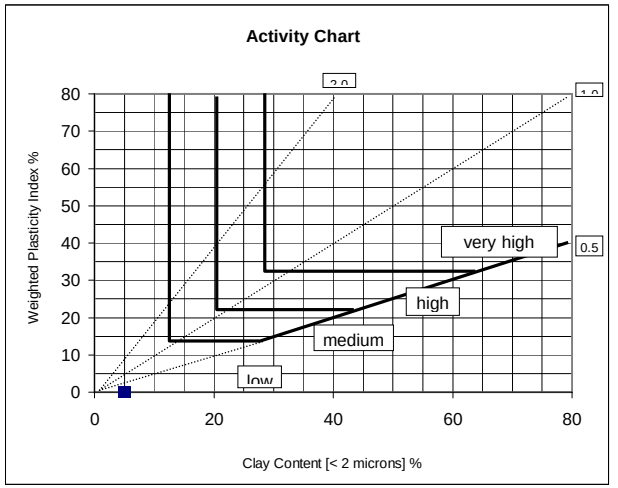
UNIFIED	PRA	TRH
SM	A.2.4 (0)	

Soil constituents % :	**Clay :**	5	**Silt :**	17	**Sand :**	53	**Gravel :**	24	**Fines :**	58	**Soil description :** Dark Yellowish Orange Soil

D_{10} :	0.015	**D_{30} :**	0.099	**D_{60} :**	0.497	**Uniformity coefficient :**	34	**Curvature coefficient :**	1	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

Engeo Lab (Pty) Ltd

INSITU DENSITY & MOISTURE DETERMINATION

JOB NO: 1450 (#990)
DATE: 1-Mar-2012

Sample Number			0298					
Position			TP 18					
Depth			@ 1.00m					
Mass of sample in air	(g)	a	142.60					
Mass of waxed sample in air	(g)	b	148.80					
Mass of waxed sample in water @ 25^{o}C	(g)	c	75.80					
Mass of water displaced (b - c)	(g)	d	73.00					
Mass of wax (b - a)	(g)	e	6.20					
Density of wax	(kg/m^3)	f	0.93					
Volume of wax (e / f)	(ml)	g	6.67					
Volume of sample (d - g)	(ml)	h	66.33					
Wet density of sample (a / h *100)	(kg/m^3)	I	2150					
Dry density of sample (I / (100 + k) * 1000)	(kg/m^3)	j	**1949**					
Mass Pan & Wet Mat.	(g)		83 91					
Mass Pan & Dry Mat.	(g)		81 32					
Mass Pan	(g)		56 07					
% Moisture	(%)	k	**10.3**					
Laboratory Determined Max. Dry Density	(kg/m^3)	l						
Laboratory Determined O.M.C.	%	m						
Pecentage of Max. Dry Density (j/l*100)	%							
Percentage Wet (-) Dry (+) of O M.C. (m-k)	%							
Specific Gravity			**2.61**					
Void ratio			0.339					
Degree of saturation	%		79.3					

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 21	**Depth [m] :**	0.300-0.600	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0299

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	99	96	81	62	52	37	22	18	16	9	3	3	2	2

ATTERBERG LIMITS

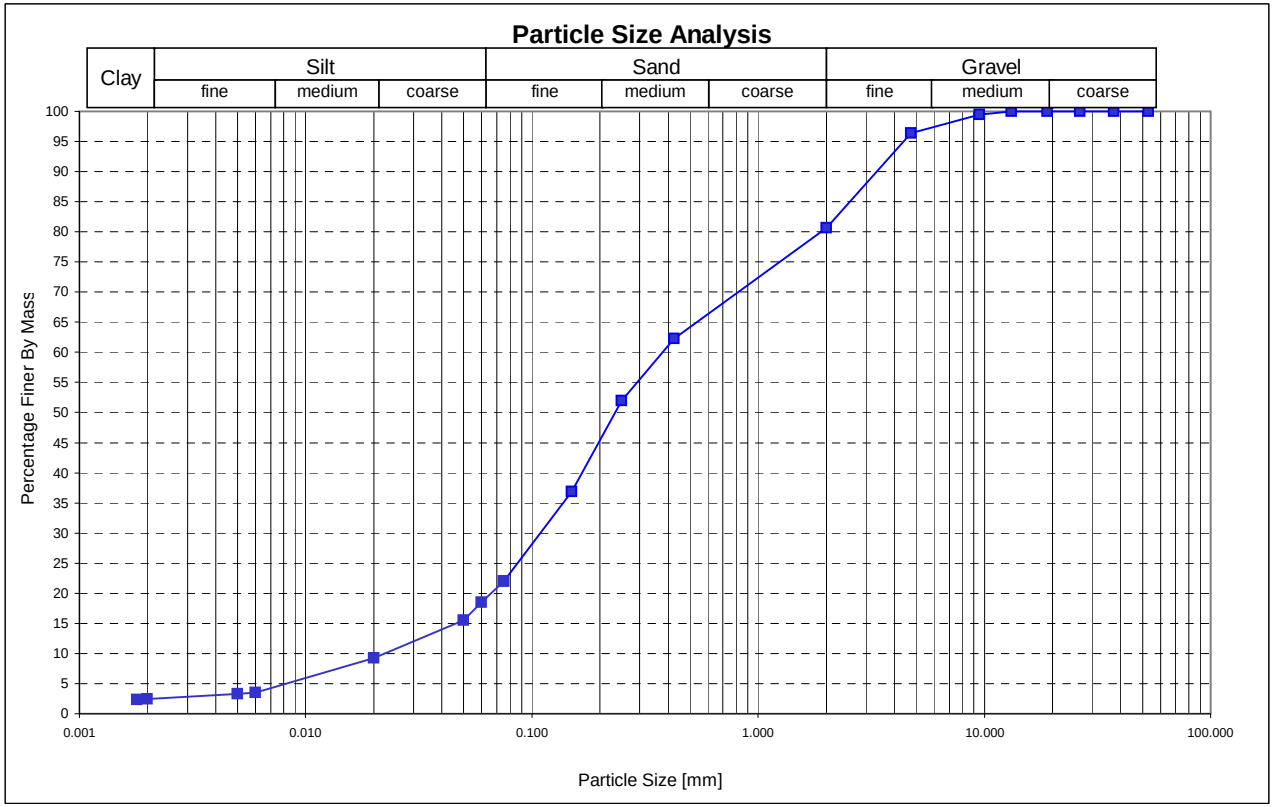
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
0	NP		0.0	1.35

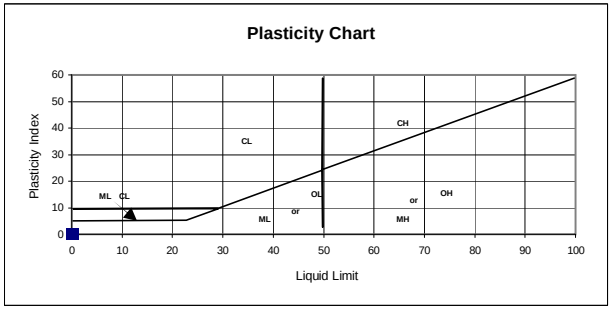
CLASSIFICATION

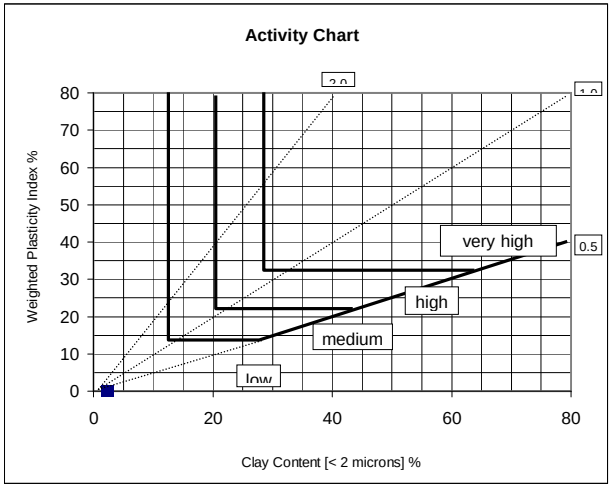
UNIFIED	PRA	TRH
SM	A.2.4 (0)	

Soil constituents % :	**Clay :**	2	**Silt :**	16	**Sand :**	62	**Gravel :**	19	**Fines :**	62	**Soil description :**	Dark Brown Soil

D_{10} :	0.022	**D_{30} :**	0.109	**D_{60} :**	0.378	**Uniformity coefficient :**	17	**Curvature coefficient :**	1	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC		PROJECT :	#999		Date	Job No.	1450
Position :	TP 21	Depth [m] :	0.600-0.850	Source :	INSITU	10-Feb-12	Sample No.	12/0300

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	86	80	66	52	36	23	15	12	9	5	4	4	2	1	1	1	1

ATTERBERG LIMITS

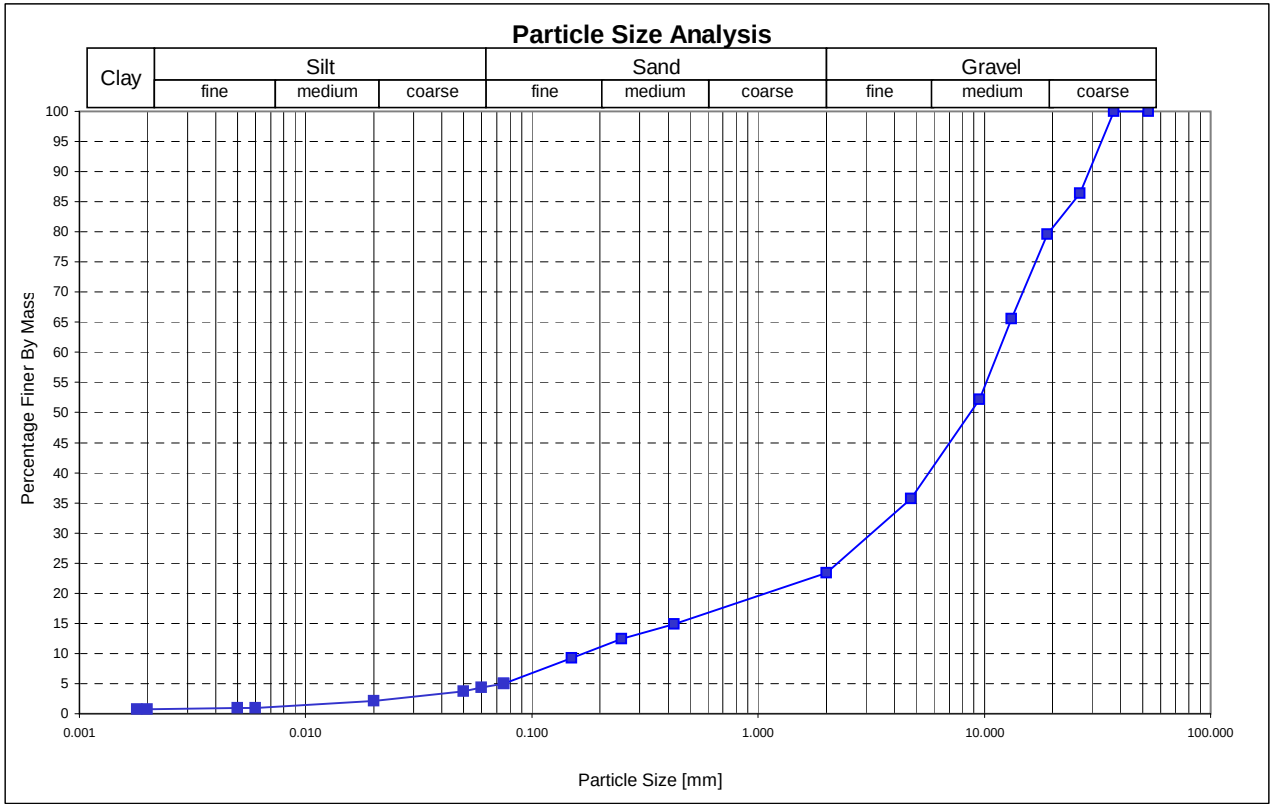
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
0	NP		0.0	2.57

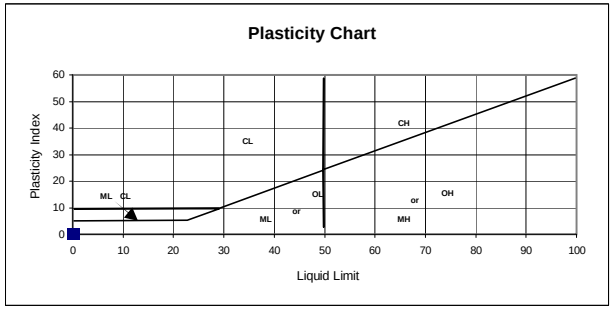
CLASSIFICATION

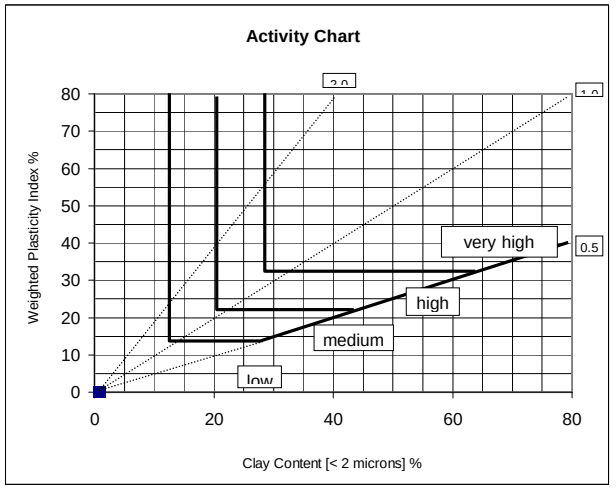
UNIFIED	PRA	TRH
GP	A.1.a (0)	

Soil constituents % :	Clay :	1	Silt :	4	Sand :	19	Gravel :	77	Fines :	15	Soil description :	Dark Brown Soil

D_{10} :	0.170	D_{30} :	3.186	D_{60} :	11.517	Uniformity coefficient :	68	Curvature coefficient :	5	Active program :	YES







REMARKS: none

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 21	**Depth [m] :**	0.850-1.500	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0301

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	98	96	80	65	44	37	31	22	19	17	9	4	4	3	2

ATTERBERG LIMITS

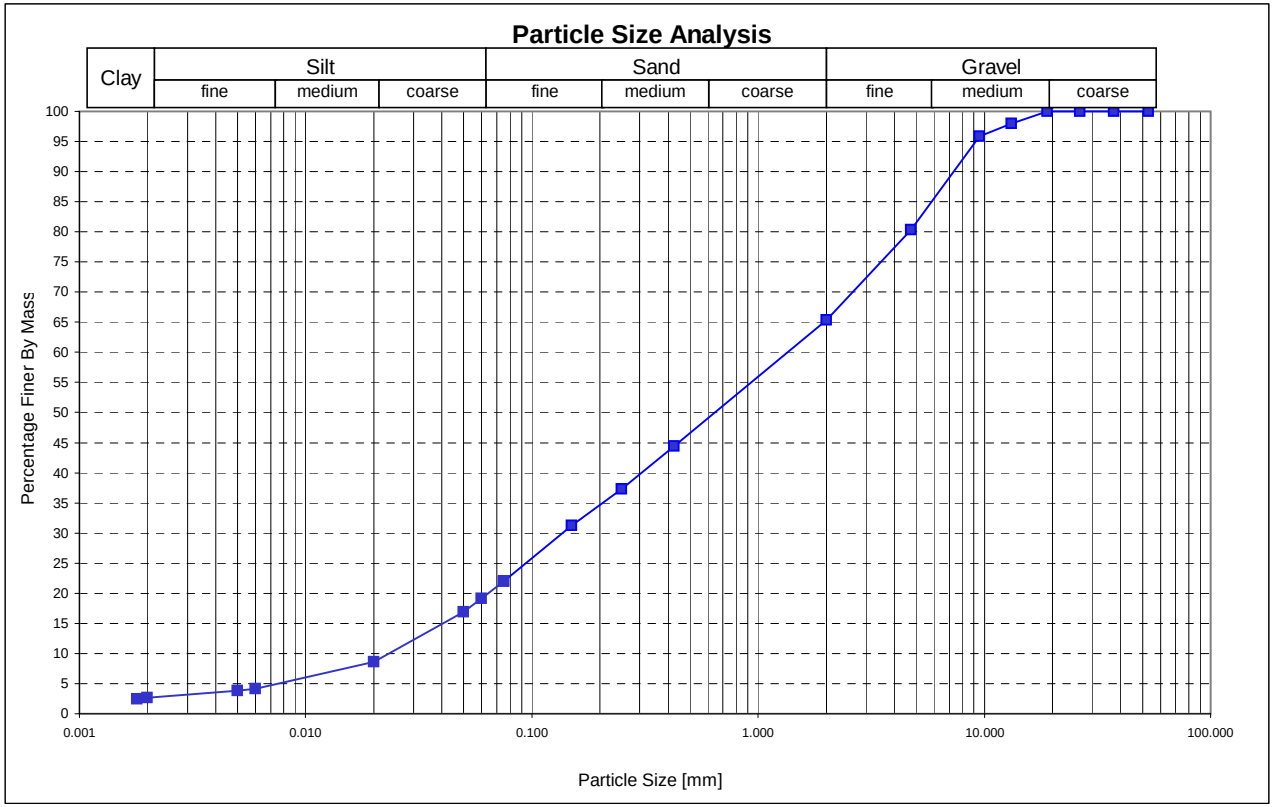
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
0	NP		0.0	1.68

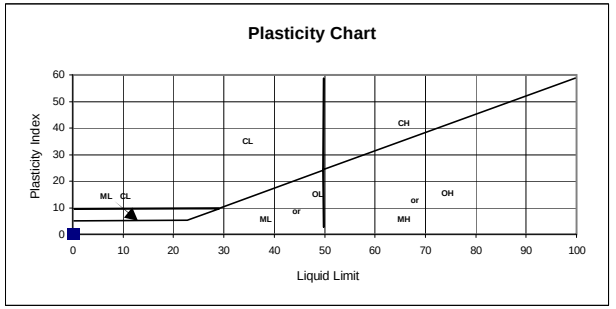
CLASSIFICATION

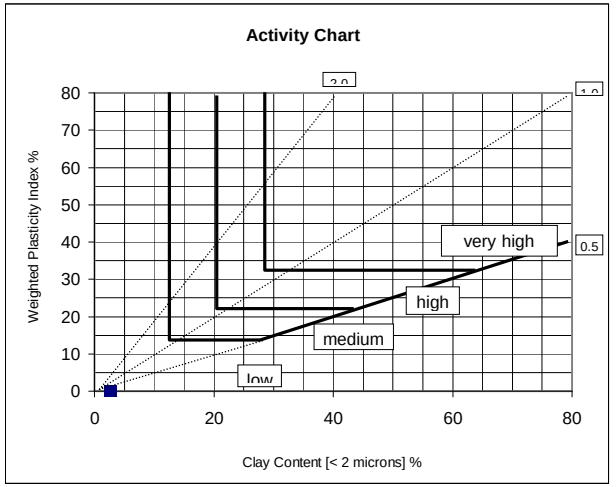
UNIFIED	PRA	TRH
SM	A.1.b (0)	

Soil constituents % :	**Clay :**	3	**Silt :**	17	**Sand :**	46	**Gravel :**	35	**Fines :**	44	**Soil description :** Pale Red Soil

D_{10} :	0.023	**D_{30} :**	0.136	**D_{60} :**	1.345	**Uniformity coefficient :**	58	**Curvature coefficient :**	1	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

Engeo Lab (Pty) Ltd

INSITU DENSITY & MOISTURE DETERMINATION

JOB NO: 1450 (#990)
DATE: 1-Mar-2012

Sample Number			0302					
Position			TP 21					
Depth			@ 1.00m					
Mass of sample in air	(g)	a	145.50					
Mass of waxed sample in air	(g)	b	153.30					
Mass of waxed sample in water @ 25^{o}C	(g)	c	76.50					
Mass of water displaced (b - c)	(g)	d	76.80					
Mass of wax (b - a)	(g)	e	7.80					
Density of wax	(kg/m^3)	f	0.93					
Volume of wax (e / f)	(ml)	g	8.39					
Volume of sample (d - g)	(ml)	h	68.41					
Wet density of sample (a / h *100)	(kg/m^3)	I	2127					
Dry density of sample (I / (100 + k) * 1000)	(kg/m^3)	j	**1890**					
Mass Pan & Wet Mat.	(g)		88 33					
Mass Pan & Dry Mat.	(g)		84.72					
Mass Pan	(g)		55 83					
% Moisture	(%)	k	**12.5**					
Laboratory Determined Max. Dry Density	(kg/m^3)	l						
Laboratory Determined O.M.C.	%	m						
Pecentage of Max. Dry Density (j/l*100)	%							
Percentage Wet (-) Dry (+) of O M.C. (m-k)	%							
Specific Gravity			**2.63**					
Void ratio			0.392					
Degree of saturation	%		83.9					

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 22	**Depth [m] :**	0.300-0.800	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0303

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	95	92	88	78	68	53	36	30	25	14	8	8	5	5

ATTERBERG LIMITS

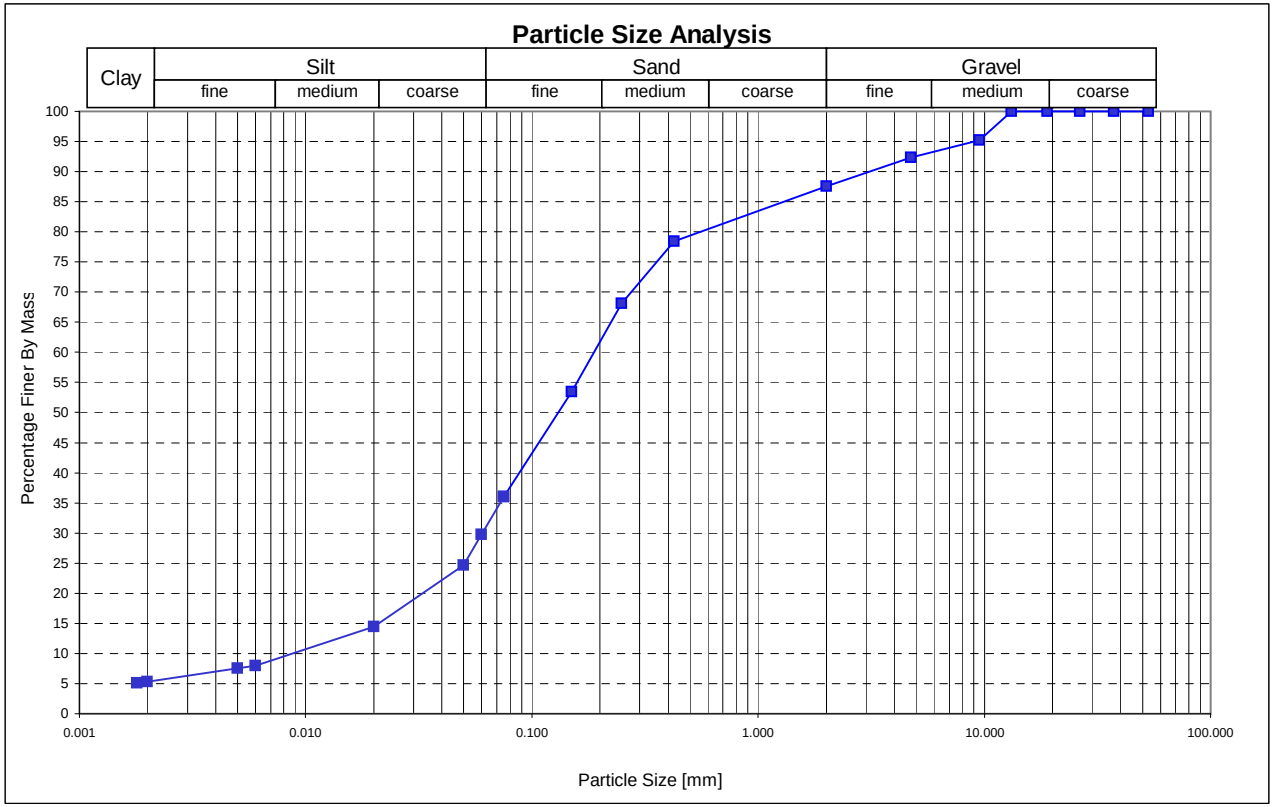
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
23	3	2	1.7	0.98

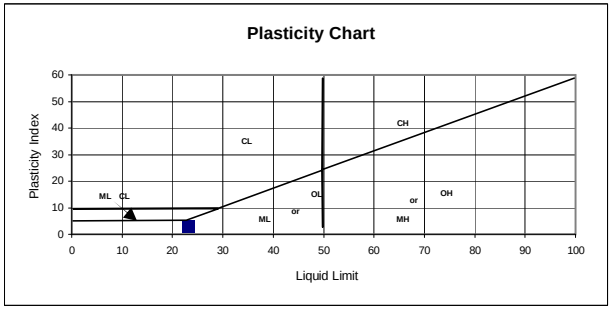
CLASSIFICATION

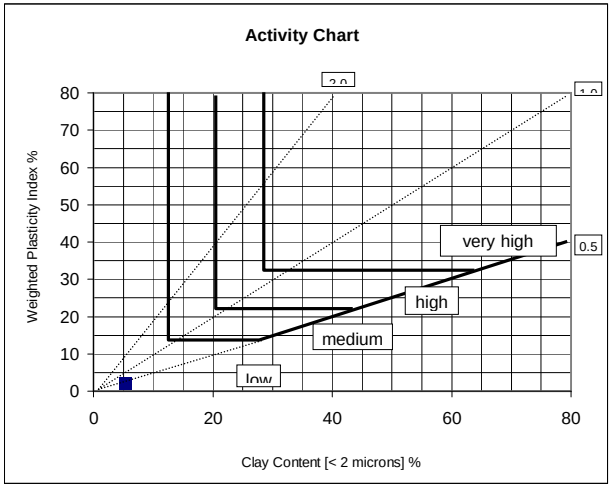
UNIFIED	PRA	TRH
SM	A.4 (0)	

Soil constituents % :	**Clay :**	5	**Silt :**	24	**Sand :**	58	**Gravel :**	12	**Fines :**	78	**Soil description :**	Dark Yellowish Orange Soil

D_{10} :	0.009	**D_{30} :**	0.061	**D_{60} :**	0.188	**Uniformity coefficient :**	22	**Curvature coefficient :**	2	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

One Dimensional Consolidation Properties
(Oedometer)

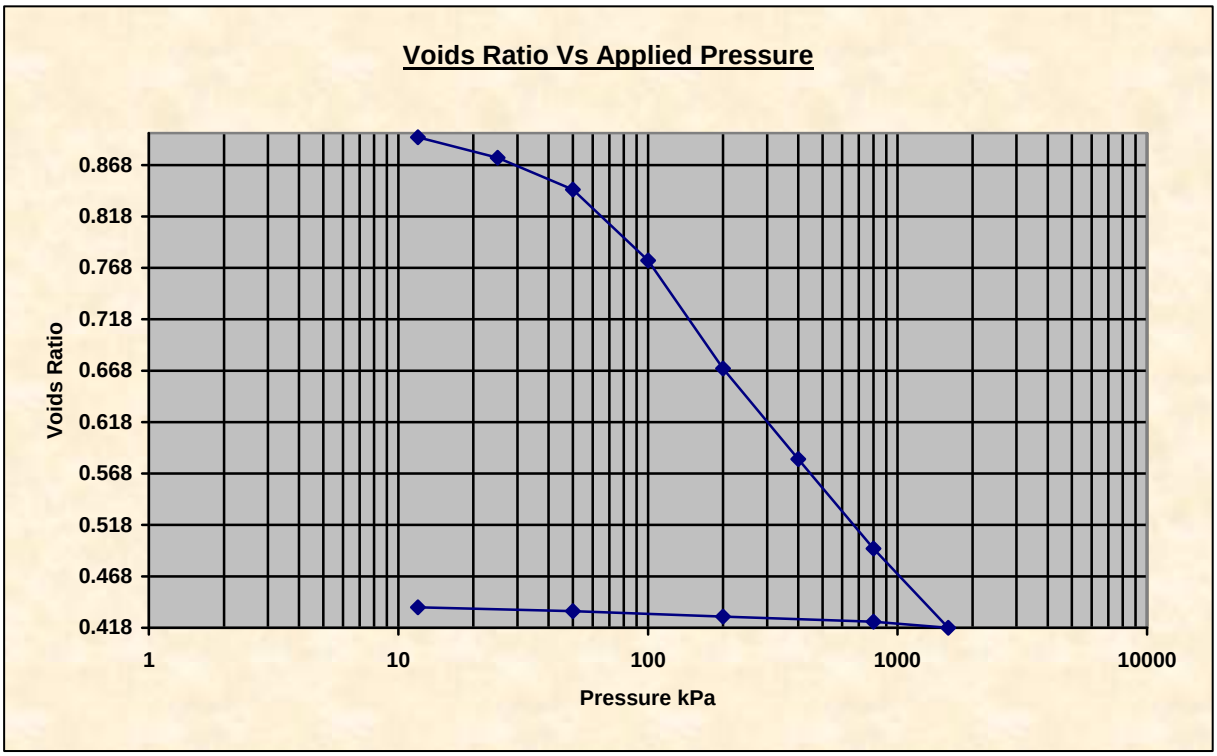
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 22	**Sample**	12-0304

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.60 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.60 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	50.00mm	**Orientation within Sample**	vertical
Specimen Mass	149.16 g	**Condition**	Inundated
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	1	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	116.00 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.53 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 22	**Sample**	12-0304

Initial Moisture Content*	23.3 % (trimmings: 22.7 %)	**Final Moisture Content**	16.5 %
Initial Bulk Density	1.69 Mg/m3	**Final Bulk Density**	2.11 Mg/m3
Initial Dry Density	1.37 Mg/m3	**Final Dry Density**	1.81 Mg/m3
Initial Void Ratio	0.8986	**Final Void Ratio**	0.4385
Initial Degree of Saturation	67.34%	**Final Degree of Saturation**	98.01 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.18 m2/MN	5.79 m2/yr
25.0 kPa	0.80 m2/MN	21.53 m2/yr
50.0 kPa	0.65 m2/MN	29.13 m2/yr
100.0 kPa	0.75 m2/MN	50.09 m2/yr
200.0 kPa	0.59 m2/MN	51.53 m2/yr
400.0 kPa	0.26 m2/MN	52.05 m2/yr
800.0 kPa	0.14 m2/MN	34.97 m2/yr
1600.0 kPa	0.06 m2/MN	25.50 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	0.01 m2/MN	---------
50.0 kPa	0.02 m2/MN	---------
12.0 kPa	0.09 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120302
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

One Dimensional Consolidation Properties
(Oedometer)

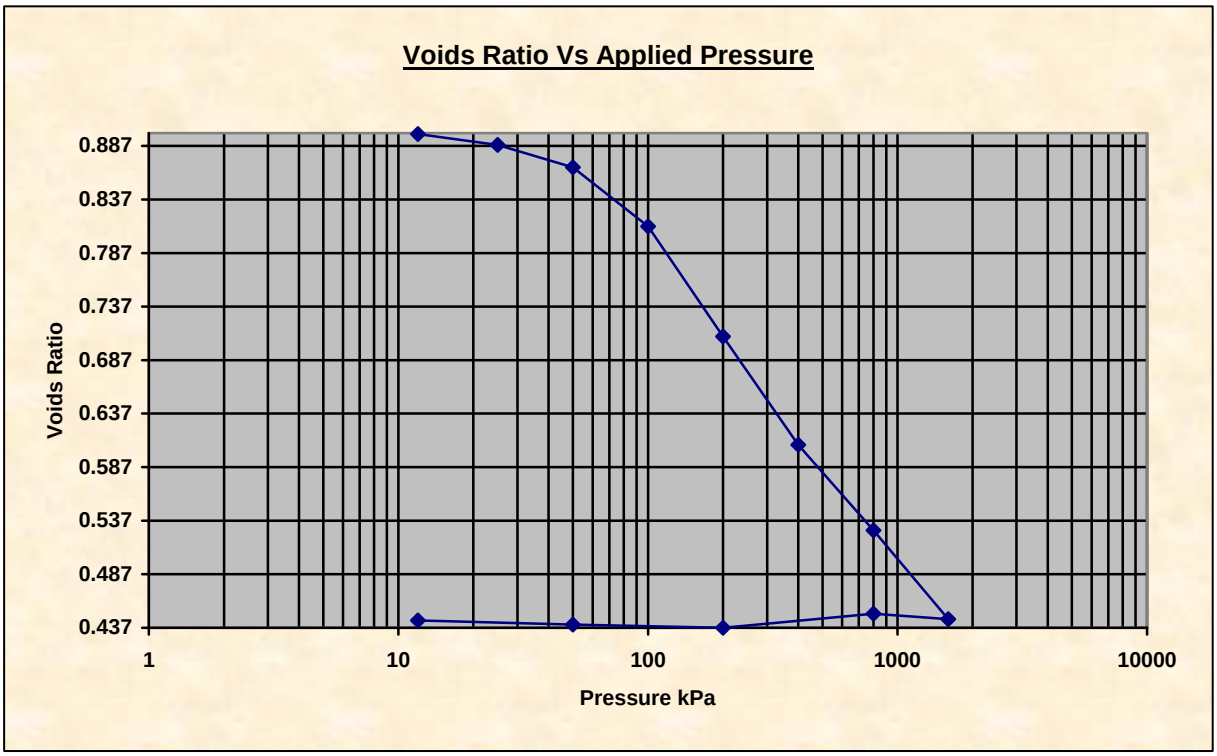
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 22	**Sample**	12-0304

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.60 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.60 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	100.00mm	**Orientation within Sample**	vertical
Specimen Mass	149.24 g	**Condition**	Natural Moisture
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	3	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	116.74 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.53 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 22	**Sample**	12-0304

Initial Moisture Content*	23.3 % (trimmings: 22.7 %)	**Final Moisture Content**	17.4 %
Initial Bulk Density	1.69 Mg/m3	**Final Bulk Density**	2.11 Mg/m3
Initial Dry Density	1.37 Mg/m3	**Final Dry Density**	1.80 Mg/m3
Initial Void Ratio	0.8986	**Final Void Ratio**	0.4445
Initial Degree of Saturation	67.53%	**Final Degree of Saturation**	101.52 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.05 m2/MN	----------
25.0 kPa	0.37 m2/MN	10.97 m2/yr
50.0 kPa	0.46 m2/MN	7.31 m2/yr
100.0 kPa	0.59 m2/MN	21.06 m2/yr
200.0 kPa	0.57 m2/MN	33.14 m2/yr
400.0 kPa	0.30 m2/MN	32.20 m2/yr
800.0 kPa	0.12 m2/MN	20.86 m2/yr
1600.0 kPa	0.07 m2/MN	26.15 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.02 m2/MN	---------
50.0 kPa	0.01 m2/MN	---------
12.0 kPa	0.08 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120302
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 25	**Depth [m] :**	0.200-1.600	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0305

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	99	97	90	81	68	50	44	39	26	16	15	9	8

ATTERBERG LIMITS

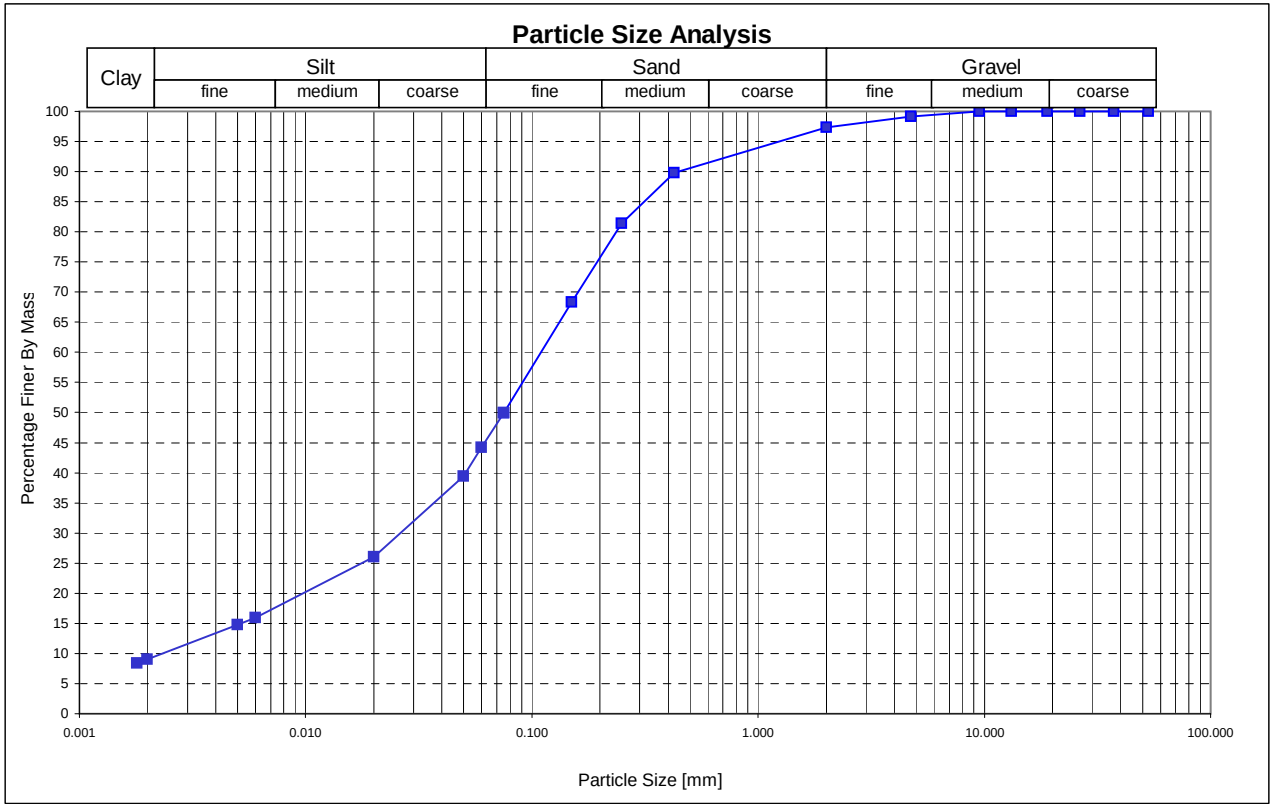
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
30	4	4	2.0	0.63

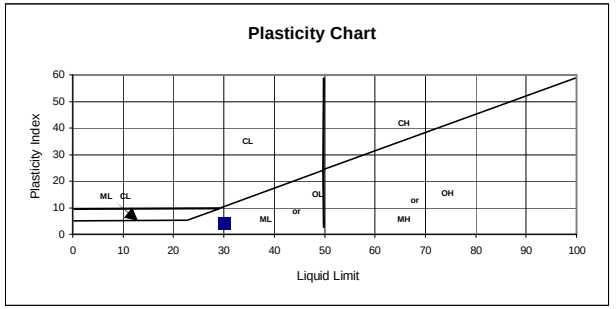
CLASSIFICATION

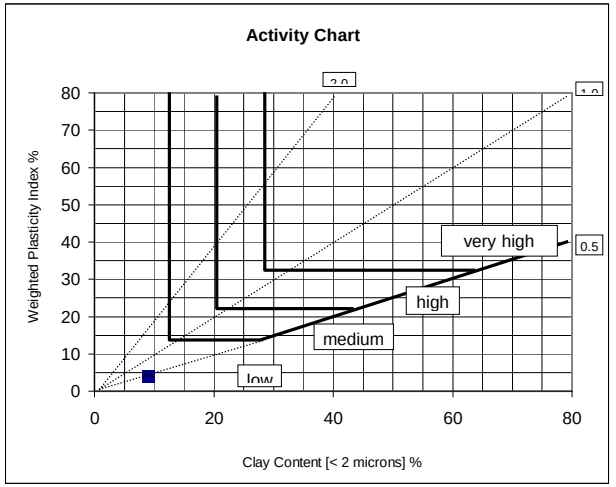
UNIFIED	PRA	TRH
SM	A.4 (3)	

Soil constituents % :	**Clay :**	9	**Silt :**	35	**Sand :**	53	**Gravel :**	3	**Fines :**	90	**Soil description :**	Dark Reddish Brown Soil

D_{10} :	0.002	**D_{30} :**	0.026	**D_{60} :**	0.109	**Uniformity coefficient :**	47	**Curvature coefficient :**	3	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

One Dimensional Consolidation Properties
(Oedometer)

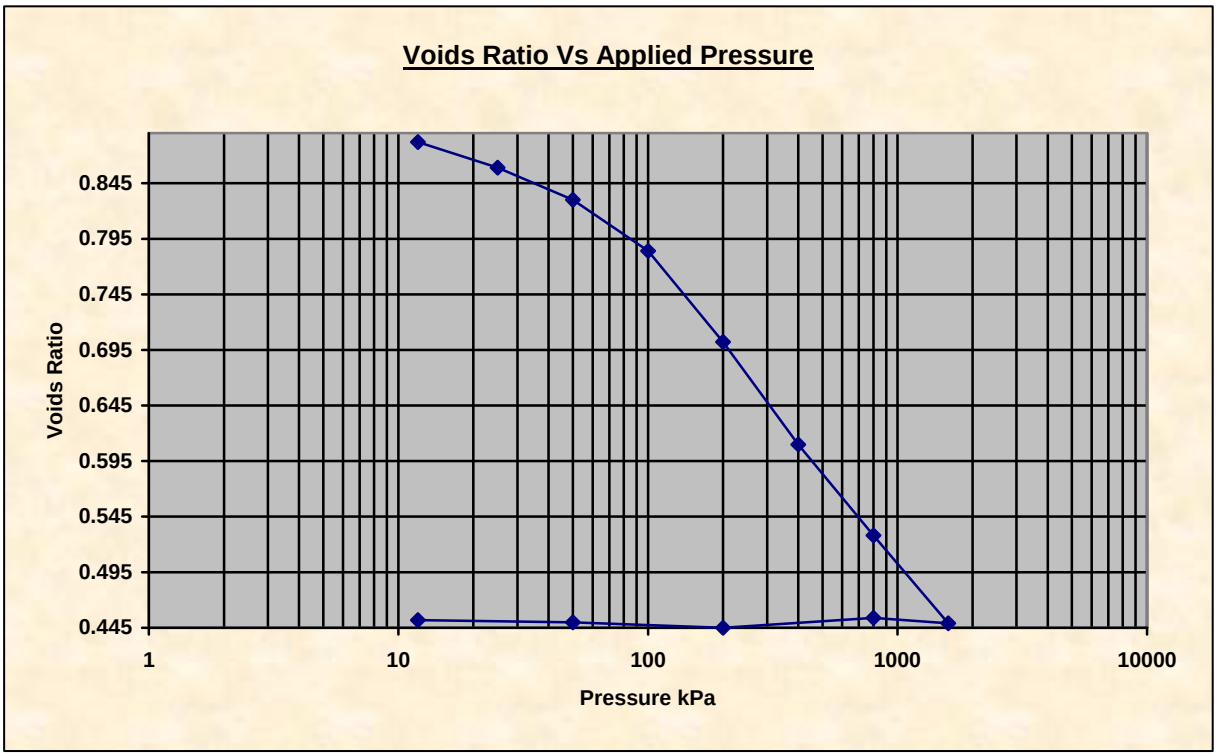
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 25	**Sample**	12-0306

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.61 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	40.00mm	**Orientation within Sample**	vertical
Specimen Mass	142.89 g	**Condition**	Inundated
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	5	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	108.41 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.58 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 25	**Sample**	12-0306

Initial Moisture Content*	17.1 % (trimmings: 16.2 %)	**Final Moisture Content**	17.7 %
Initial Bulk Density	1.62 Mg/m3	**Final Bulk Density**	2.12 Mg/m3
Initial Dry Density	1.38 Mg/m3	**Final Dry Density**	1.80 Mg/m3
Initial Void Ratio	0.8903	**Final Void Ratio**	0.4522
Initial Degree of Saturation	50.20%	**Final Degree of Saturation**	102.19 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.35 m2/MN	17.00 m2/yr
25.0 kPa	0.96 m2/MN	25.56 m2/yr
50.0 kPa	0.63 m2/MN	43.66 m2/yr
100.0 kPa	0.50 m2/MN	32.08 m2/yr
200.0 kPa	0.46 m2/MN	42.16 m2/yr
400.0 kPa	0.27 m2/MN	36.61 m2/yr
800.0 kPa	0.13 m2/MN	29.58 m2/yr
1600.0 kPa	0.06 m2/MN	21.57 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.03 m2/MN	---------
12.0 kPa	0.04 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120302
Checked By and Date:	hjs20120318
Approved By and Date:	hjs20120318

One Dimensional Consolidation Properties
(Oedometer)

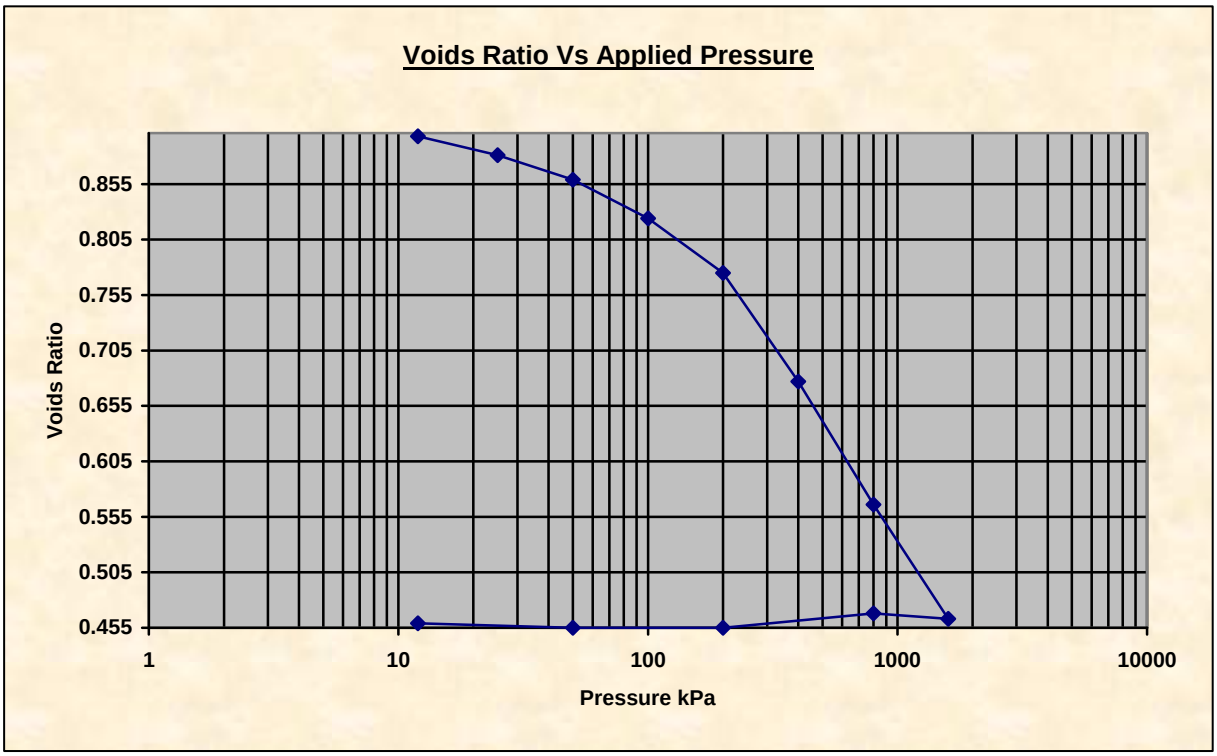
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 25	**Sample**	12-0306

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.61 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	140.00mm	**Orientation within Sample**	vertical
Specimen Mass	141.34 g	**Condition**	Natural Moisture
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	3	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	116.70 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.52 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 25	**Sample**	12-0306

Initial Moisture Content*	16.5 % (trimmings: 16.2 %)	**Final Moisture Content**	14.8 %
Initial Bulk Density	1.60 Mg/m3	**Final Bulk Density**	2.05 Mg/m3
Initial Dry Density	1.37 Mg/m3	**Final Dry Density**	1.79 Mg/m3
Initial Void Ratio	0.9012	**Final Void Ratio**	0.4595
Initial Degree of Saturation	47.85%	**Final Degree of Saturation**	84.29 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.13 m2/MN	0.31 m2/yr
25.0 kPa	0.68 m2/MN	46.51 m2/yr
50.0 kPa	0.48 m2/MN	45.68 m2/yr
100.0 kPa	0.38 m2/MN	35.82 m2/yr
200.0 kPa	0.27 m2/MN	34.62 m2/yr
400.0 kPa	0.28 m2/MN	34.47 m2/yr
800.0 kPa	0.17 m2/MN	37.02 m2/yr
1600.0 kPa	0.08 m2/MN	31.49 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.00 m2/MN	---------
12.0 kPa	0.08 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120312
Checked By and Date:	hjs20120318
Approved By and Date:	hjs20120318

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 28	**Depth [m] :**	0.300-0.750	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0307

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	99	98	88	74	56	41	37	33	22	15	14	9	9

ATTERBERG LIMITS

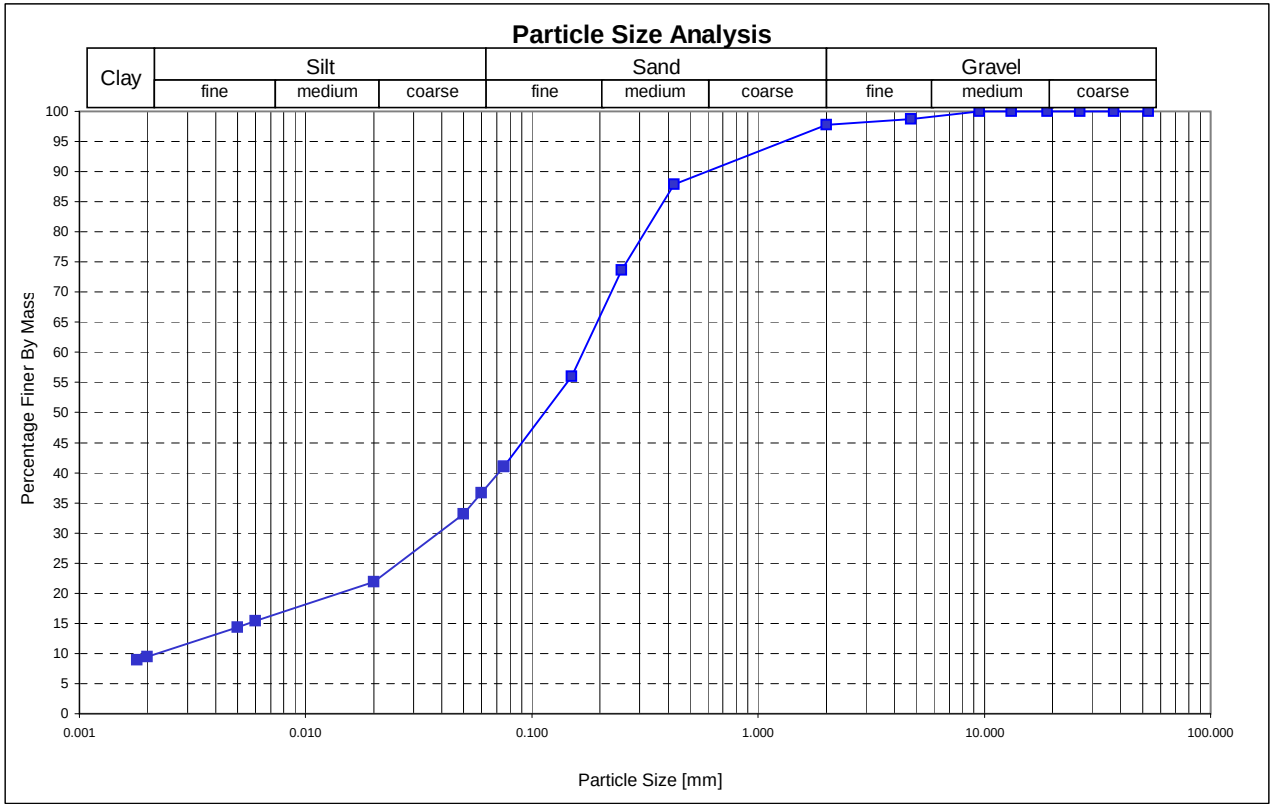
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
24	5	4	2.0	0.73

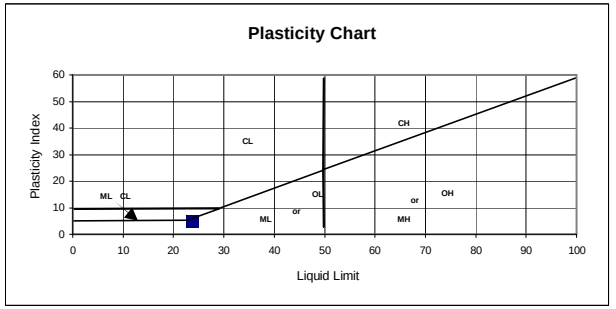
CLASSIFICATION

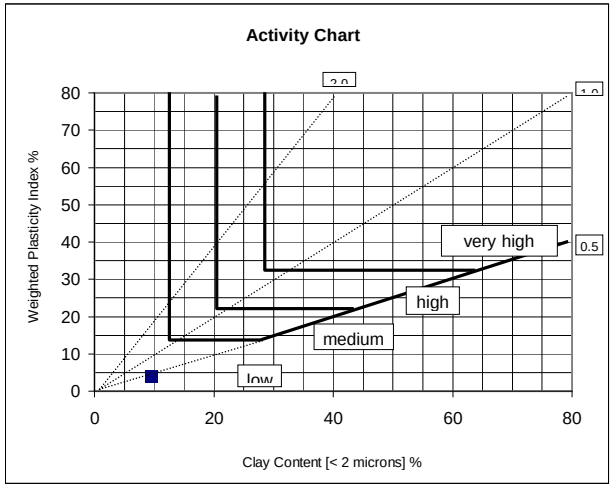
UNIFIED	PRA	TRH
SM/SC	A.4 (1)	

Soil constituents % :	**Clay :**	9	**Silt :**	27	**Sand :**	61	**Gravel :**	2	**Fines :**	88	**Soil description :**	Dark Yellowish Orange Soil

D_{10} :	0.002	**D_{30} :**	0.039	**D_{60} :**	0.168	**Uniformity coefficient :**	76	**Curvature coefficient :**	4	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 28	**Depth [m] :**	@ 1.000	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0308

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	100	85	68	63	55	43	38	34	24	15	14	9	8

ATTERBERG LIMITS

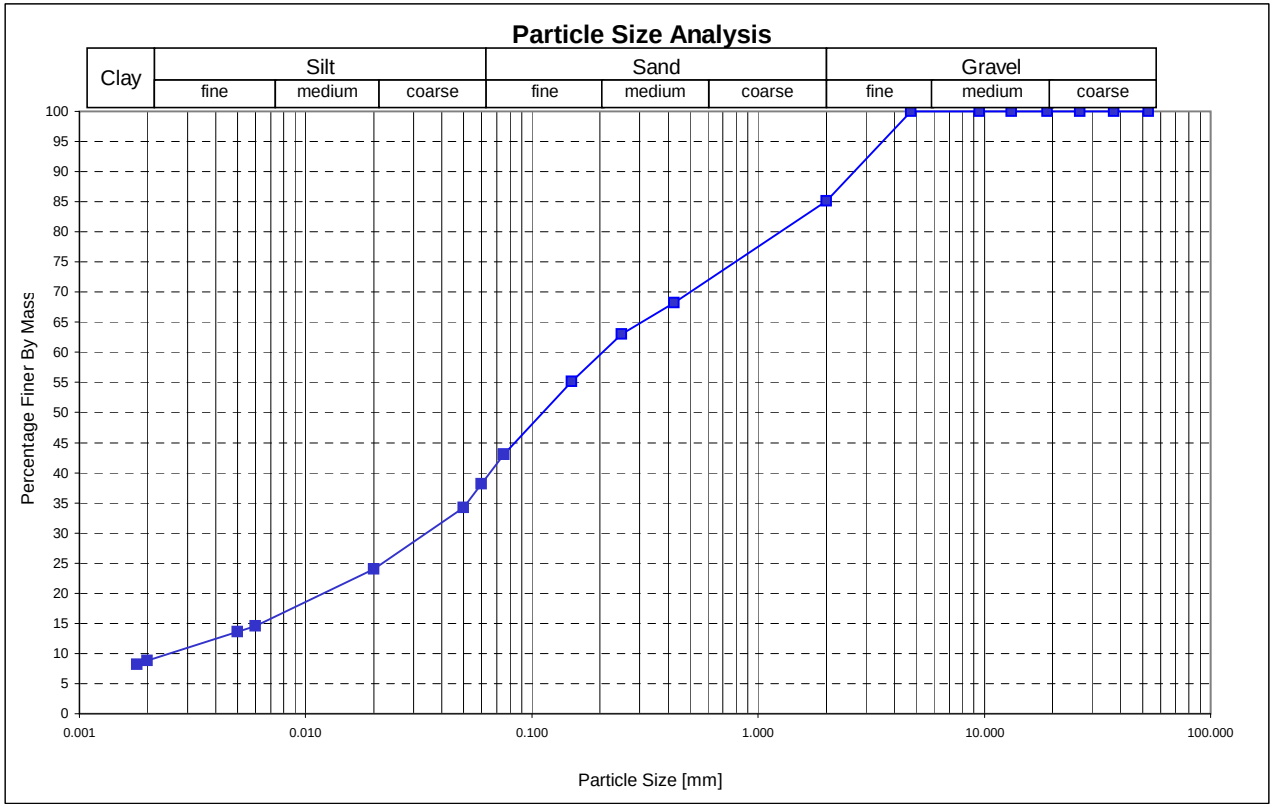
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
32	6	4	3.0	1.04

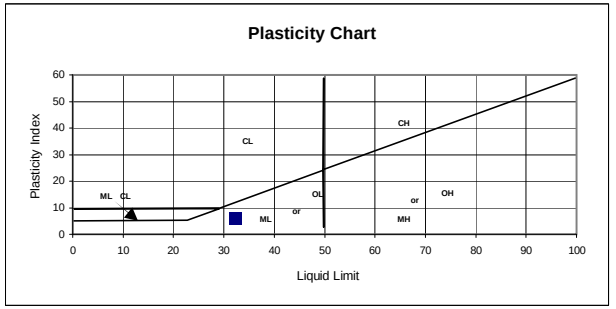
CLASSIFICATION

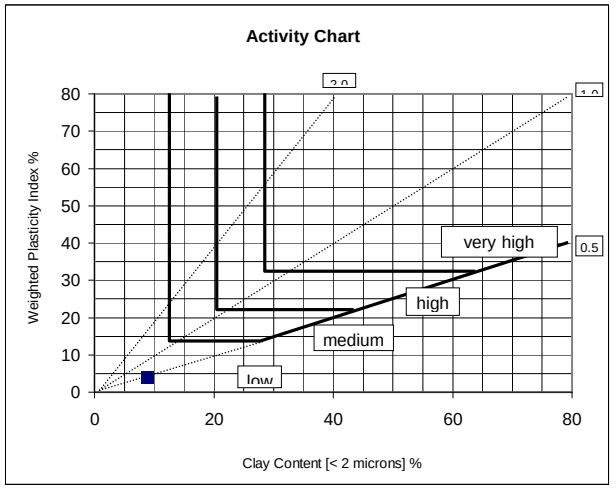
UNIFIED	PRA	TRH
SM	A.4 (2)	

Soil constituents % :	**Clay :**	9	**Silt :**	29	**Sand :**	47	**Gravel :**	15	**Fines :**	68	**Soil description :** Light Brown Soil

D_{10} :	0.003	**D_{30} :**	0.034	**D_{60} :**	0.205	**Uniformity coefficient :**	81	**Curvature coefficient :**	2	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

One Dimensional Consolidation Properties
(Oedometer)

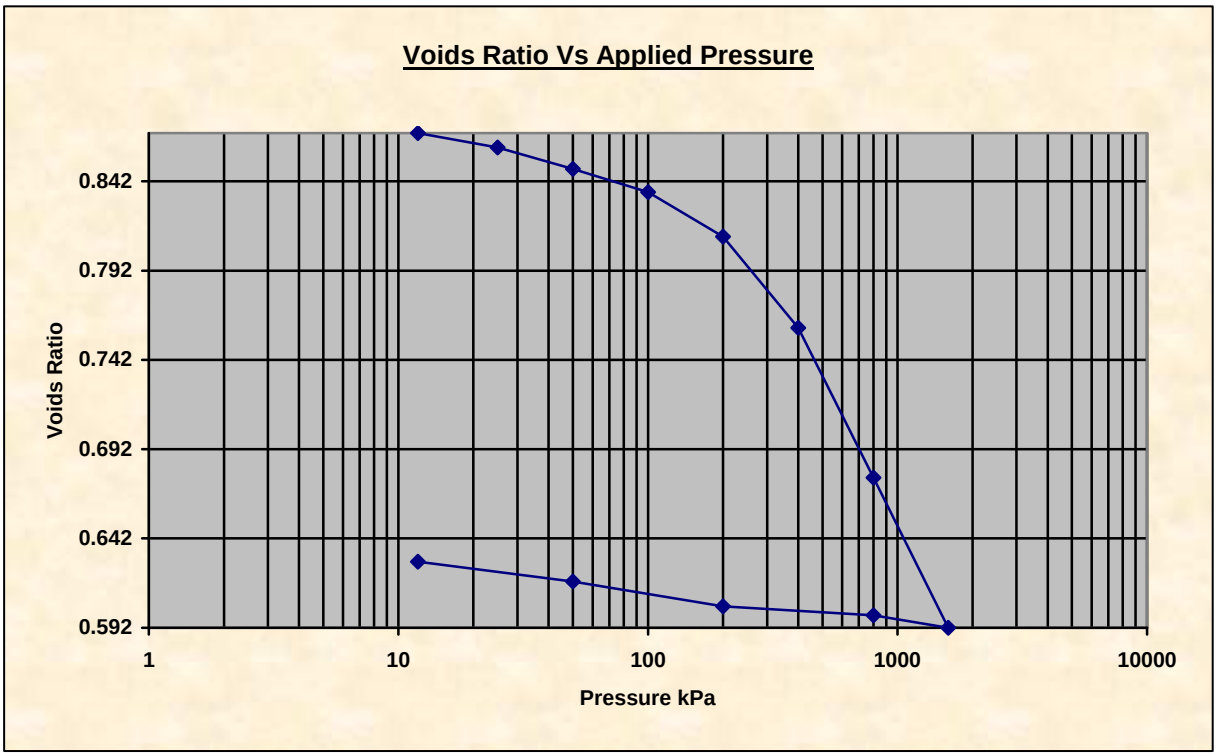
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 28	**Sample**	12-0308

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	1.00 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	60.00mm	**Orientation within Sample**	vertical
Specimen Mass	152.00 g	**Condition**	Inundated
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	6	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	108.47 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.71 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 28	**Sample**	12-0308

Initial Moisture Content*	22.6 % (trimmings: 22.1 %)	**Final Moisture Content**	25.4 %
Initial Bulk Density	1.72 Mg/m3	**Final Bulk Density**	2.02 Mg/m3
Initial Dry Density	1.40 Mg/m3	**Final Dry Density**	1.61 Mg/m3
Initial Void Ratio	0.8669	**Final Void Ratio**	0.6293
Initial Degree of Saturation	68.24%	**Final Degree of Saturation**	105.76 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	-0.11 m2/MN	57.10 m2/yr
25.0 kPa	0.33 m2/MN	35.28 m2/yr
50.0 kPa	0.27 m2/MN	25.94 m2/yr
100.0 kPa	0.14 m2/MN	30.35 m2/yr
200.0 kPa	0.13 m2/MN	20.80 m2/yr
400.0 kPa	0.14 m2/MN	29.43 m2/yr
800.0 kPa	0.12 m2/MN	37.13 m2/yr
1600.0 kPa	0.06 m2/MN	41.24 m2/yr
800.0 kPa	0.01 m2/MN	---------
200.0 kPa	0.01 m2/MN	---------
50.0 kPa	0.06 m2/MN	---------
12.0 kPa	0.19 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120307
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

One Dimensional Consolidation Properties
(Oedometer)

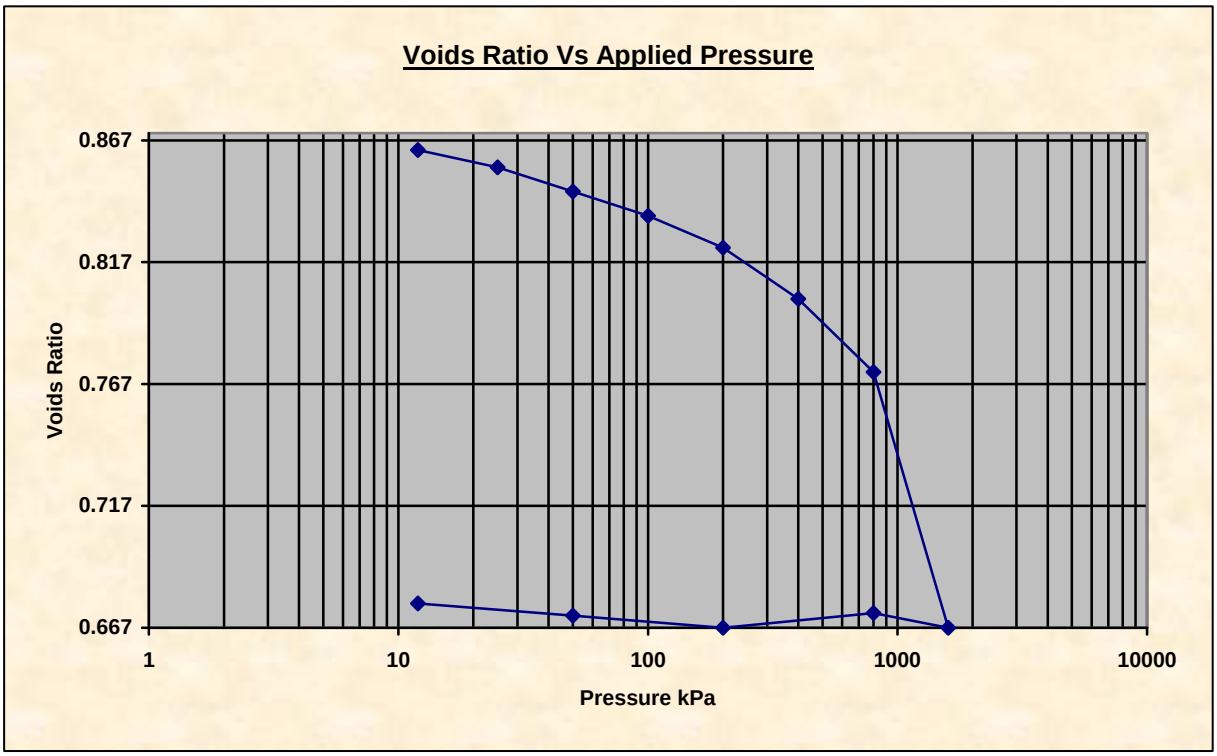
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 28	**Sample**	12-0308

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.62 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	1.00 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	130.00mm	**Orientation within Sample**	horizontal
Specimen Mass	153.00 g	**Condition**	Natural Moisture
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	2	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	114.18 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.70 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 28	**Sample**	12-0308

Initial Moisture Content*	23.6 % (trimmings: 22.1 %)	**Final Moisture Content**	19.4 %
Initial Bulk Density	1.73 Mg/m3	**Final Bulk Density**	1.87 Mg/m3
Initial Dry Density	1.40 Mg/m3	**Final Dry Density**	1.56 Mg/m3
Initial Void Ratio	0.8699	**Final Void Ratio**	0.6769
Initial Degree of Saturation	71.04%	**Final Degree of Saturation**	75.04 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.32 m2/MN	---------
25.0 kPa	0.27 m2/MN	---------
50.0 kPa	0.22 m2/MN	---------
100.0 kPa	0.11 m2/MN	---------
200.0 kPa	0.07 m2/MN	---------
400.0 kPa	0.06 m2/MN	---------
800.0 kPa	0.04 m2/MN	---------
1600.0 kPa	0.07 m2/MN	41.56 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.02 m2/MN	---------
12.0 kPa	0.08 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120312
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 29	**Depth [m] :**	0.700-1.000	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0309

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	97	94	87	77	63	57	49	40	36	33	23	15	14	9	9

ATTERBERG LIMITS

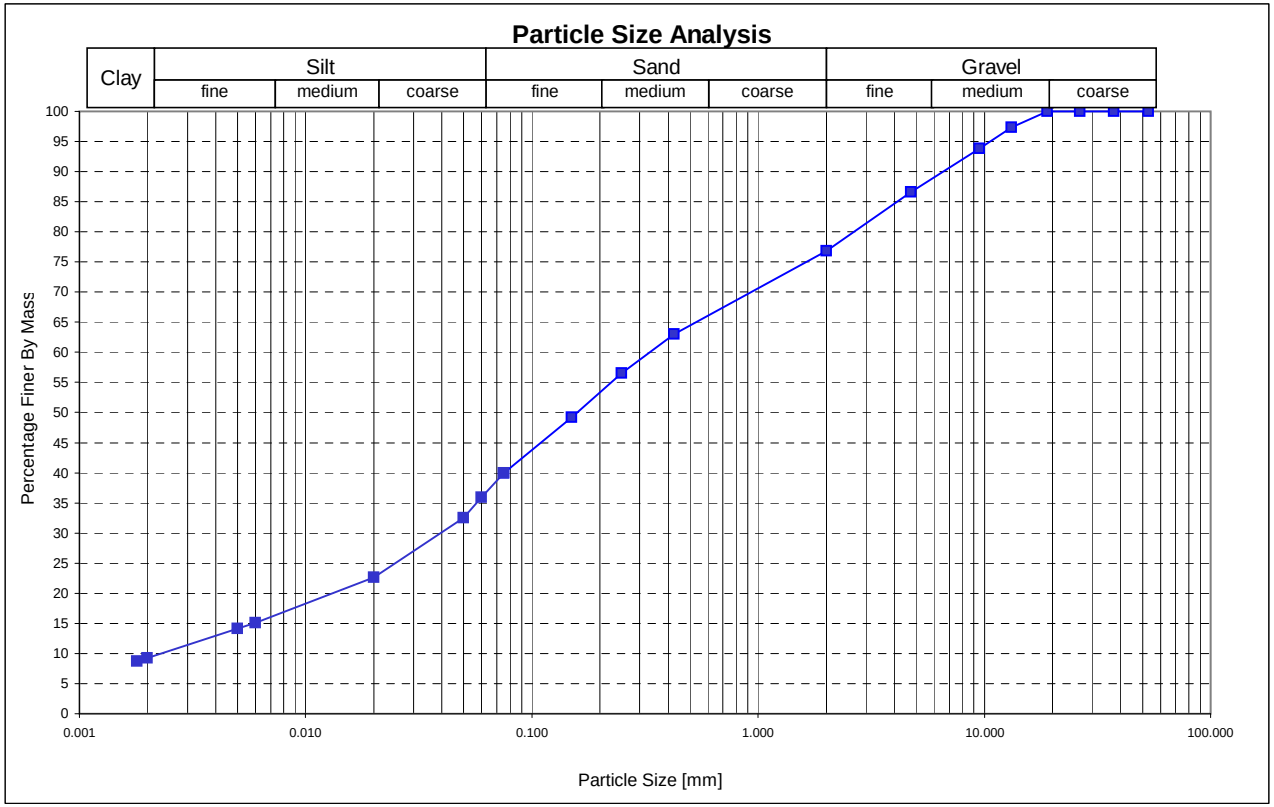
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
30	4	2	2.0	1.20

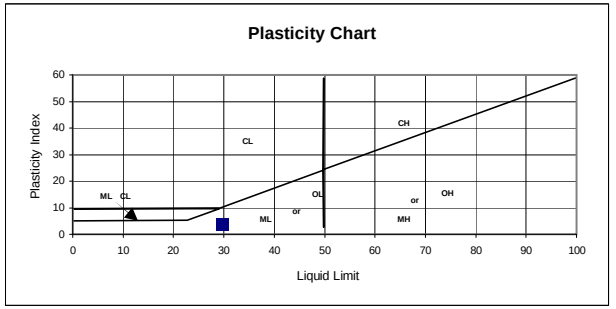
CLASSIFICATION

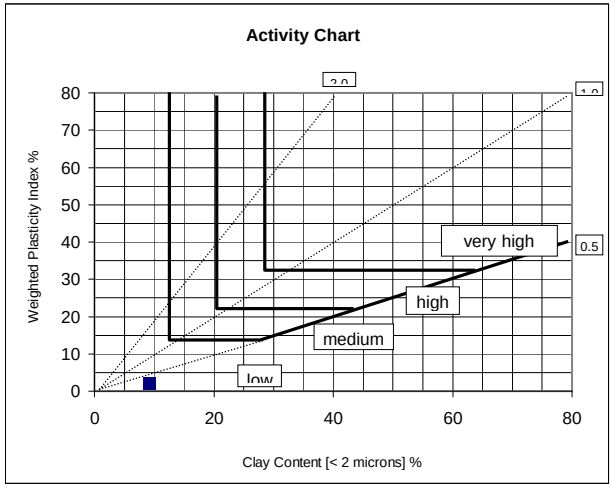
UNIFIED	PRA	TRH
SM	A.4 (1)	

Soil constituents % :	**Clay :**	9	**Silt :**	27	**Sand :**	41	**Gravel :**	23	**Fines :**	63	**Soil description :**	Light Reddish Brown Soil

D_{10} :	0.002	**D_{30} :**	0.040	**D_{60} :**	0.333	**Uniformity coefficient :**	145	**Curvature coefficient :**	2	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 29	**Depth [m] :**	1.000-2.100	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0310

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	99	97	94	87	73	66	58	48	41	36	25	16	15	11	10

ATTERBERG LIMITS

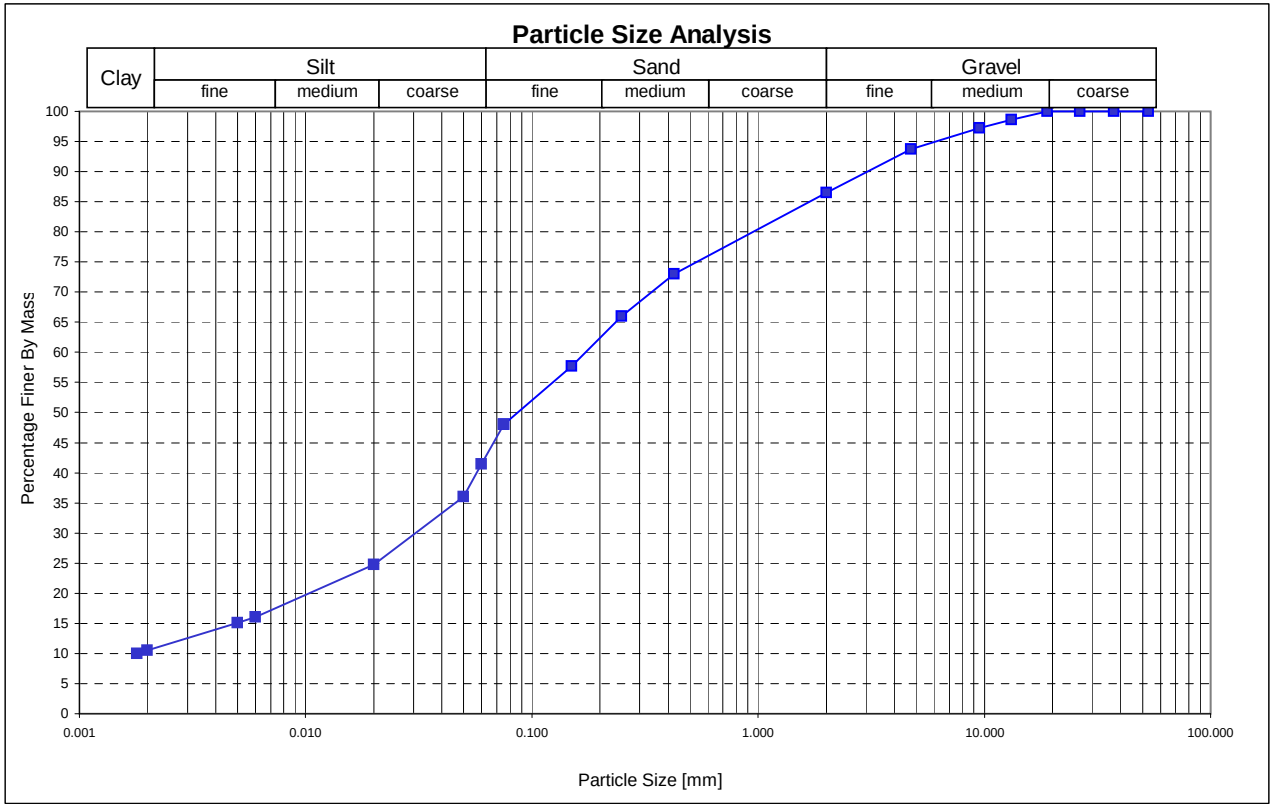
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
28	7	5	3.4	0.93

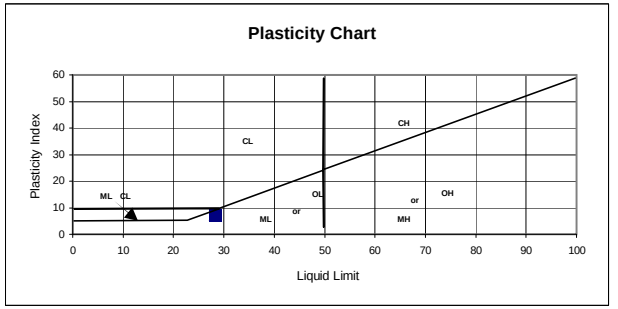
CLASSIFICATION

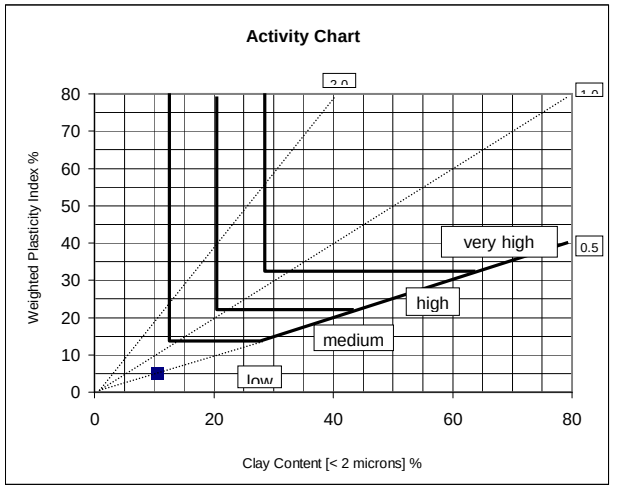
UNIFIED	PRA	TRH
SC	A.4 (3)	

Soil constituents % :	**Clay :**	11	**Silt :**	31	**Sand :**	45	**Gravel :**	13	**Fines :**	73	**Soil description :** Light Brown Soil

D_{10} :		**D_{30} :**	0.031	**D_{60} :**	0.172	**Uniformity coefficient :**		**Curvature coefficient :**		Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 31	**Depth [m] :**	0.500-1.000	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0311

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	84	79	73	66	57	48	38	34	27	18	15	13	9	7	6	4	4

ATTERBERG LIMITS

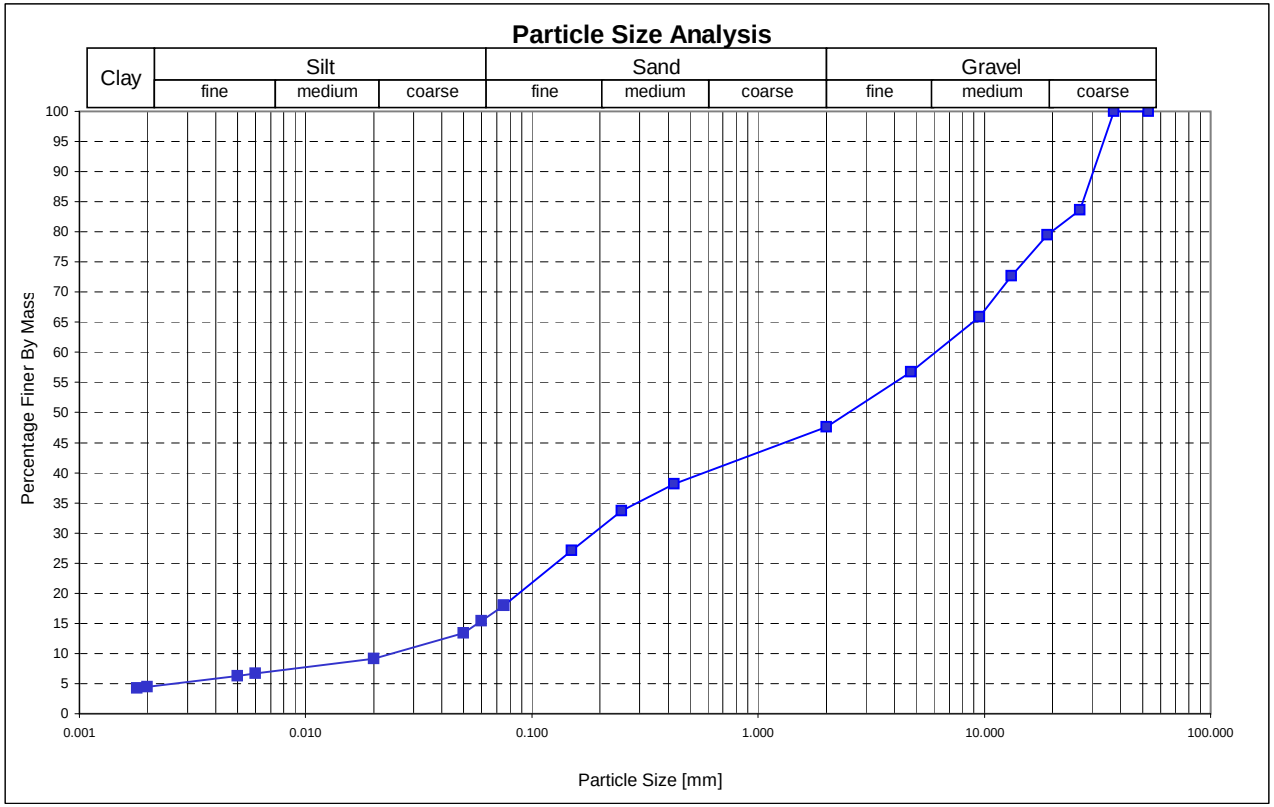
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
27	4		2.0	1.96

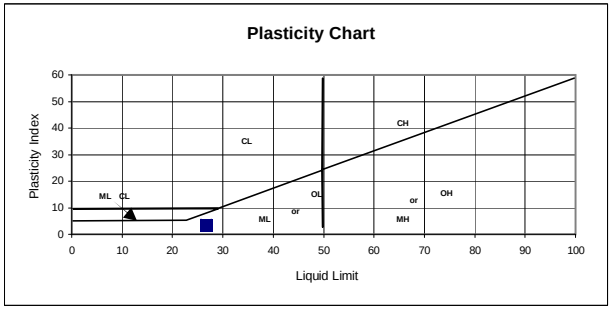
CLASSIFICATION

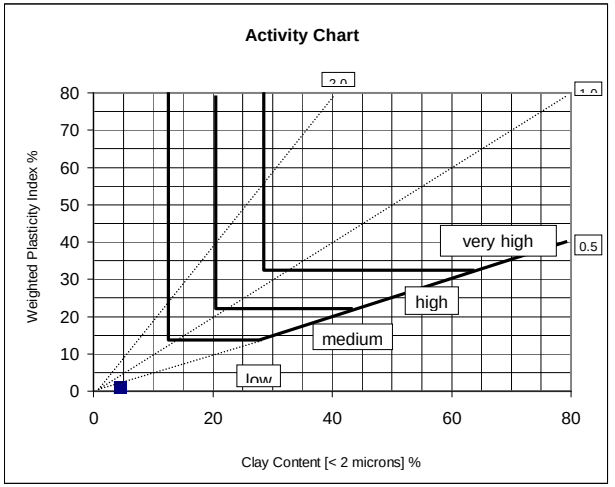
UNIFIED	PRA	TRH
SM	A.1.b (0)	

Soil constituents % :	**Clay :**	4	**Silt :**	11	**Sand :**	32	**Gravel :**	52	**Fines :**	38	**Soil description :**	Light Brown Soil

D_{10} :	0.024	**D_{30} :**	0.187	**D_{60} :**	6.094	**Uniformity coefficient :**	254	**Curvature coefficient :**	0	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

One Dimensional Consolidation Properties
(Oedometer)

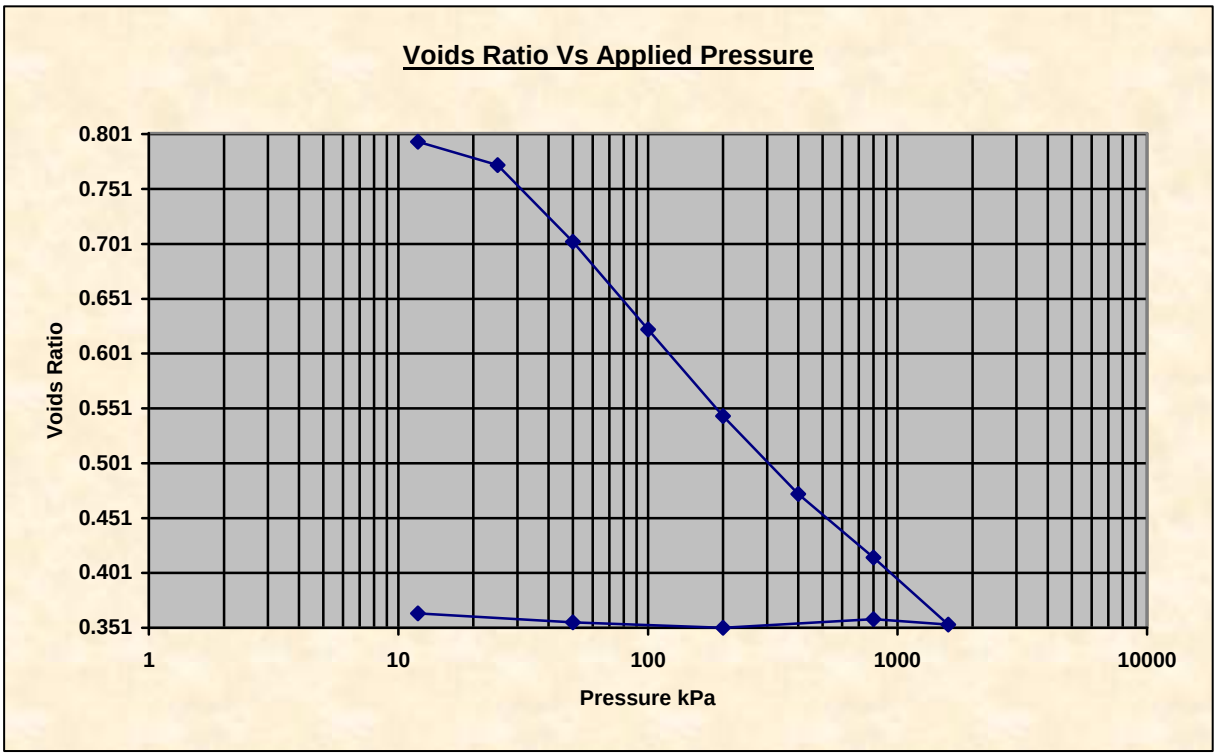
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 31	**Sample**	12-0312

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.61 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	50.00mm	**Orientation within Sample**	vertical
Specimen Mass	142.48 g	**Condition**	Inundated
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	4	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	108.76 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	11.10 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 31	**Sample**	12-0312

Initial Moisture Content*	11.3 % (trimmings: 8.1 %)	**Final Moisture Content**	14.2 %
Initial Bulk Density	1.61 Mg/m3	**Final Bulk Density**	2.19 Mg/m3
Initial Dry Density	1.45 Mg/m3	**Final Dry Density**	1.91 Mg/m3
Initial Void Ratio	0.8017	**Final Void Ratio**	0.3641
Initial Degree of Saturation	36.83%	**Final Degree of Saturation**	101.92 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.33 m2/MN	---------
25.0 kPa	0.93 m2/MN	32.48 m2/yr
50.0 kPa	1.58 m2/MN	21.07 m2/yr
100.0 kPa	0.93 m2/MN	28.96 m2/yr
200.0 kPa	0.49 m2/MN	34.29 m2/yr
400.0 kPa	0.23 m2/MN	39.11 m2/yr
800.0 kPa	0.10 m2/MN	31.93 m2/yr
1600.0 kPa	0.05 m2/MN	26.22 m2/yr
800.0 kPa	0.00 m2/MN	---------
200.0 kPa	-0.01 m2/MN	---------
50.0 kPa	0.03 m2/MN	---------
12.0 kPa	0.16 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120307
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

One Dimensional Consolidation Properties
(Oedometer)

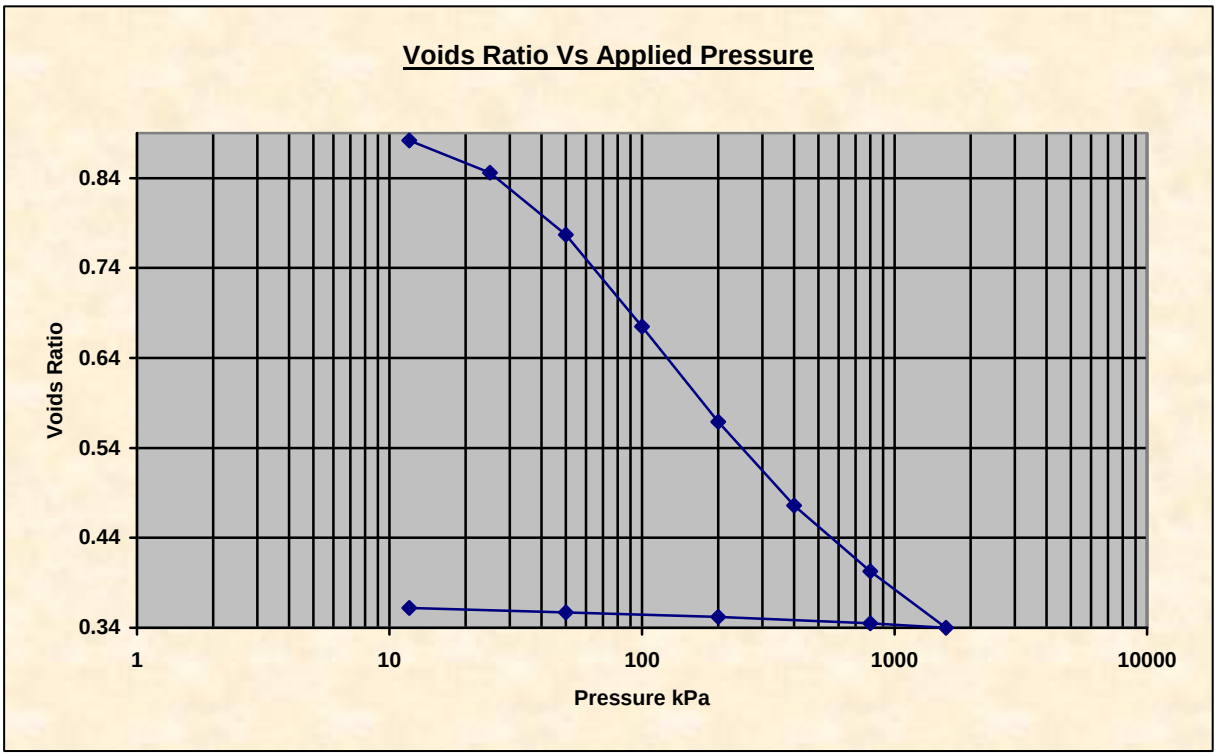
ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 31	**Sample**	12-0312

Test Details			
Standard	BS 1377: Part 5 : 1990 : Clause 3	**Particle Density**	2.61 Mg/m3
Sample Type	Block sample	**Lab Temperature**	20.0 deg.C
Sample Depth	0.70 m		
Sample Description			
Variations from Procedure	None		

Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	120.00mm	**Orientation within Sample**	vertical
Specimen Mass	136.44 g	**Condition**	Natural Moisture
Specimen Height	20.00 mm	**Preparation**	cut from undisturbed sample
Comments			

Test Apparatus			
Ring Number	1	**Ring Diameter**	75.00 mm
Ring Height	20.00 mm	**Ring Weight**	116.00 g
Lever Ratio	9.00 : 1		



Height of Solid Particles	10.58 mm	**Swelling Pressure**	0.0 kPa

One Dimensional Consolidation Properties
(Oedometer)

ENGEOLAB
Materials testing laboratory

Client	geo 3 cc	**Lab Ref**	
Project	#999	**Job**	1450
Borehole	TP 31	**Sample**	12-0312

Initial Moisture Content*	11.8 % (trimmings: 16.2 %)	**Final Moisture Content**	17.7 %
Initial Bulk Density	1.54 Mg/m3	**Final Bulk Density**	2.25 Mg/m3
Initial Dry Density	1.38 Mg/m3	**Final Dry Density**	1.92 Mg/m3
Initial Void Ratio	0.8903	**Final Void Ratio**	0.3625
Initial Degree of Saturation	34.70%	**Final Degree of Saturation**	127.48 %

- Calculated from initial and dry weights of whole specimen

Pressure (Loading Stages)	**Coefficient of Volume Compressibility (m_v)**	**Coefficient of Consolidation (c_v)**
0.00		
12.0 kPa	0.37 m2/MN	0.25 m2/yr
25.0 kPa	1.45 m2/MN	22.08 m2/yr
50.0 kPa	1.50 m2/MN	26.13 m2/yr
100.0 kPa	1.15 m2/MN	29.62 m2/yr
200.0 kPa	0.63 m2/MN	34.76 m2/yr
400.0 kPa	0.29 m2/MN	29.35 m2/yr
800.0 kPa	0.12 m2/MN	25.18 m2/yr
1600.0 kPa	0.06 m2/MN	24.84 m2/yr
800.0 kPa	0.01 m2/MN	---------
200.0 kPa	0.01 m2/MN	---------
50.0 kPa	0.02 m2/MN	---------
12.0 kPa	0.10 m2/MN	---------

Method of Time Fitting Used	Log Time

Tested By and Date:	gvg20120312
Checked By and Date:	hjs20120317
Approved By and Date:	hjs20120317

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 31	**Depth [m] :**	1.000-2.200	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0313

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	93	90	82	78	70	61	47	42	36	27	23	20	12	8	7	5	5

ATTERBERG LIMITS

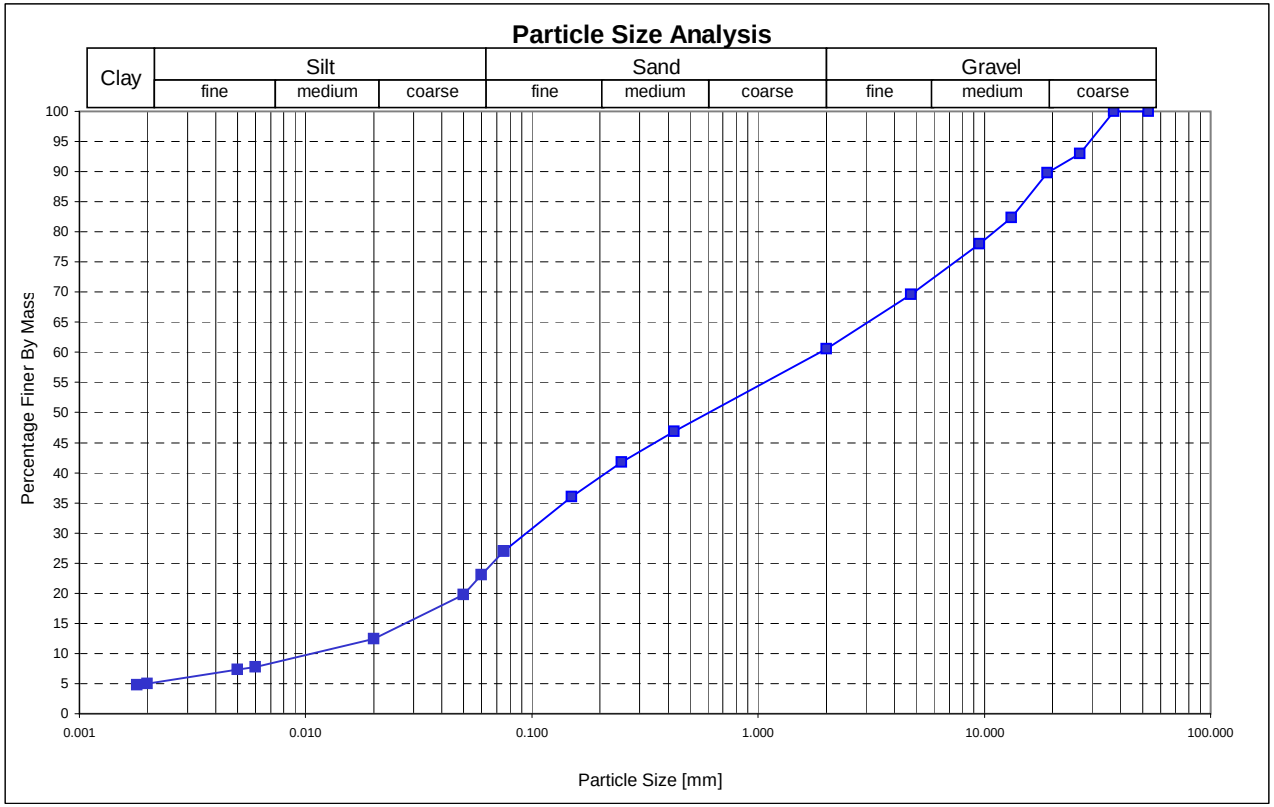
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
28	8	4	3.4	1.66

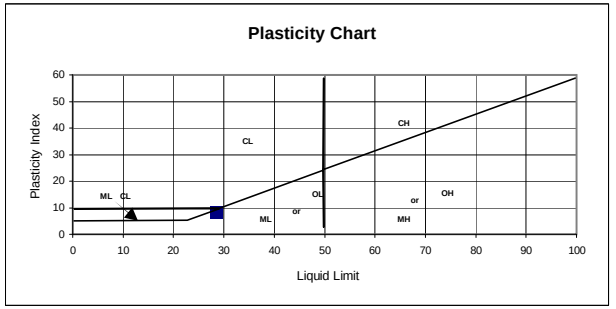
CLASSIFICATION

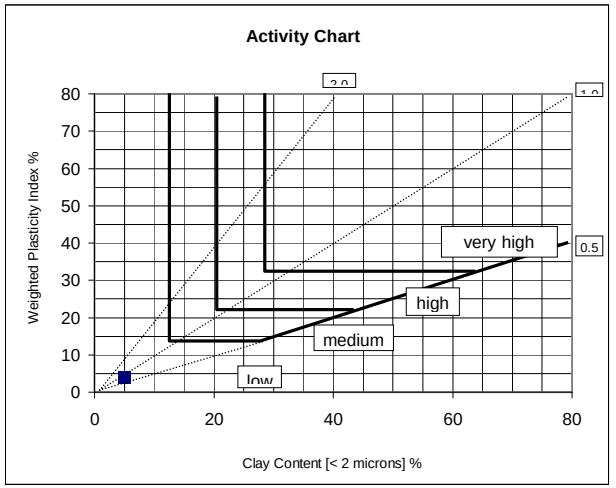
UNIFIED	PRA	TRH
SC	A.2.4 (0)	

Soil constituents % :	**Clay :**	5	**Silt :**	18	**Sand :**	37	**Gravel :**	39	**Fines :**	47	**Soil description :** Buff Soil

D_{10} :	0.011	**D_{30} :**	0.094	**D_{60} :**	1.883	**Uniformity coefficient :**	177	**Curvature coefficient :**	0	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

Engeo Lab (Pty) Ltd

INSITU DENSITY & MOISTURE DETERMINATION

JOB NO: 1450 (#990)
DATE: 1-Mar-2012

Sample Number			0314					
Position			TP 31					
Depth			@ 1.20m					
Mass of sample in air	(g)	a	122.90					
Mass of waxed sample in air	(g)	b	128.30					
Mass of waxed sample in water @ 25^{o}C	(g)	c	63.90					
Mass of water displaced (b - c)	(g)	d	64.40					
Mass of wax (b - a)	(g)	e	5.40					
Density of wax	(kg/m^3)	f	0.93					
Volume of wax (e / f)	(ml)	g	5.81					
Volume of sample (d - g)	(ml)	h	58.59					
Wet density of sample (a / h *100)	(kg/m^3)	I	2098					
Dry density of sample (I / (100 + k) * 1000)	(kg/m^3)	j	**1845**					
Mass Pan & Wet Mat.	(g)		83 24					
Mass Pan & Dry Mat.	(g)		79 94					
Mass Pan	(g)		55 81					
% Moisture	(%)	k	**13.7**					
Laboratory Determined Max. Dry Density	(kg/m^3)	l						
Laboratory Determined O.M.C.	%	m						
Pecentage of Max. Dry Density (j/l*100)	%							
Percentage Wet (-) Dry (+) of O M.C. (m-k)	%							
Specific Gravity			**2.62**					
Void ratio			0.420					
Degree of saturation	%		85.5					

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 33	**Depth [m] :**	@0.70m	**Source :**	INSITU

Date	**Job No.**	1450
21-Feb-12	**Sample No.**	12/0315

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	100	99	84	71	53	36	31	26	15	11	10	7	7

ATTERBERG LIMITS

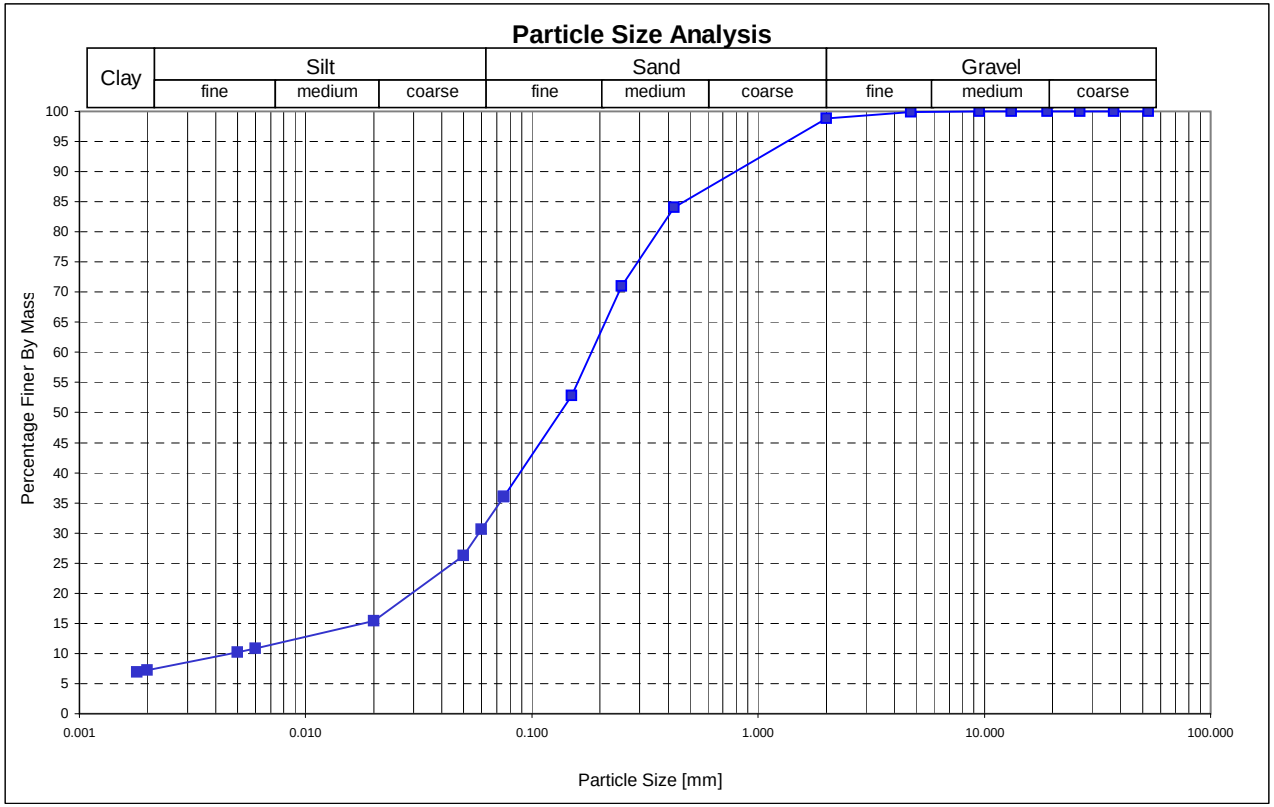
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
20	4	4	2.0	0.81

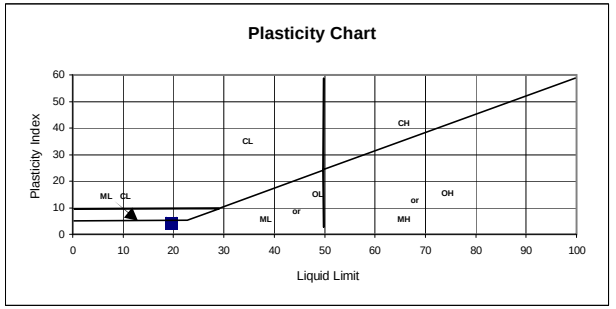
CLASSIFICATION

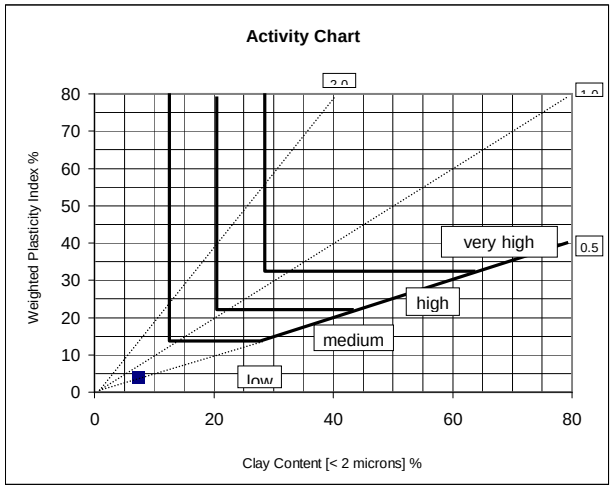
UNIFIED	PRA	TRH
SM/SC	A.4 (0)	

Soil constituents % :	**Clay :**	7	**Silt :**	23	**Sand :**	68	**Gravel :**	1	**Fines :**	84	**Soil description :** Dark Yellowish Orange Soil

D_{10} :	0.005	**D_{30} :**	0.058	**D_{60} :**	0.184	**Uniformity coefficient :**	39	**Curvature coefficient :**	4	Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

Engeo Lab (Pty) Ltd

INSITU DENSITY & MOISTURE DETERMINATION

JOB NO: 1450 (#990)
DATE: 1-Mar-2012

Sample Number			0315					
Position			TP 33					
Depth			@ 0.7m					
Mass of sample in air	(g)	a	124.70					
Mass of waxed sample in air	(g)	b	130.10					
Mass of waxed sample in water @ 25^{o}C	(g)	c	55.10					
Mass of water displaced (b - c)	(g)	d	75.00					
Mass of wax (b - a)	(g)	e	5.40					
Density of wax	(kg/m^{3})	f	0.93					
Volume of wax (e / f)	(ml)	g	5.81					
Volume of sample (d - g)	(ml)	h	69.19					
Wet density of sample (a / h *100)	(kg/m^{3})	I	1802					
Dry density of sample (I / (100 + k) * 1000)	(kg/m^{3})	j	**1560**					
Mass Pan & Wet Mat.	(g)		78 32					
Mass Pan & Dry Mat.	(g)		75 33					
Mass Pan	(g)		55 98					
% Moisture	(%)	k	**15.5**					
Laboratory Determined Max. Dry Density	(kg/m^{3})	l						
Laboratory Determined O.M.C.	%	m						
Pecentage of Max. Dry Density (j/l*100)	%							
Percentage Wet (-) Dry (+) of O M.C. (m-k)	%							
Specific Gravity			**2.61**					
Void ratio			0.673					
Degree of saturation	%		60.1					

EngeoLab (Pty) Ltd
Civil Engineering Materials Laboratory

FOUNDATION INDICATOR TEST RESULT

Tests undertaken in terms of TMH 1 Methods: A1a, A2, A3, A4, A5

CLIENT:	GEO 3 CC	**PROJECT :**	#999		
Position :	TP 34	**Depth [m] :**	0.500-2.100	**Source :**	INSITU

Date	**Job No.**	1450
10-Feb-12	**Sample No.**	12/0316

SIEVE ANALYSIS (% PASSING)

53.0mm	37.5mm	26.5mm	19.0mm	13.2mm	9.5mm	4.75mm	2.0mm	0.425mm	0.250mm	0.150mm	0.075mm	0.060mm	0.050mm	0.020mm	0.006mm	0.005mm	0.002mm	0.0018mm
100	100	100	100	100	100	99	96	87	84	78	65	59	54	40	29	27	17	16

ATTERBERG LIMITS

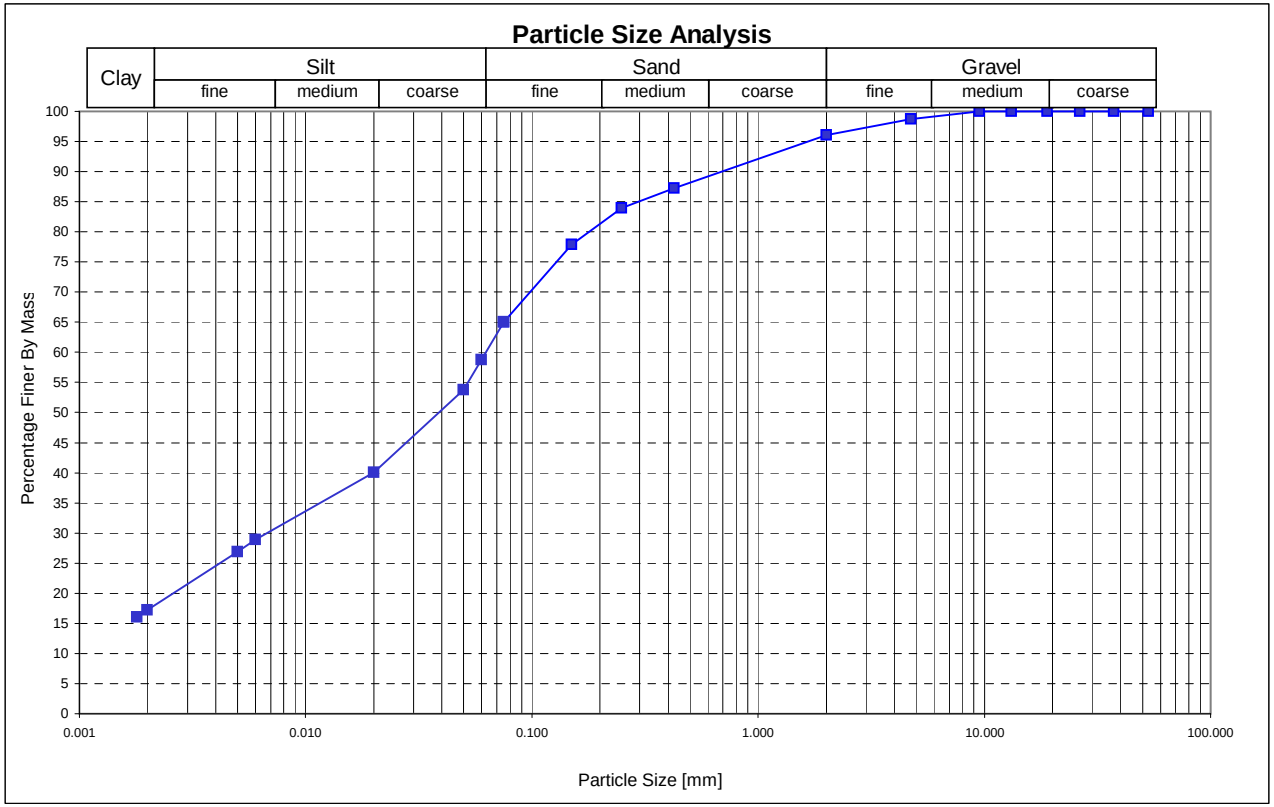
Liquid Limit	Plasticity Index	PI (weighted)	Linear Shrinkage	Grading modulus
44	12	11	5.4	0.52

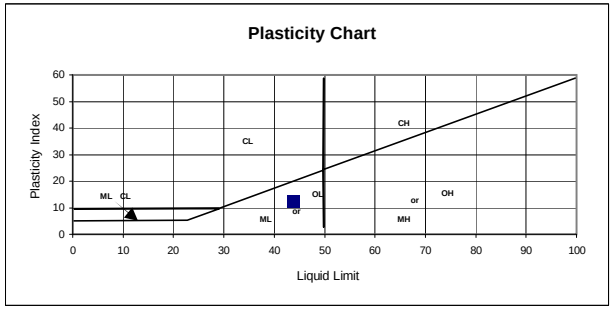
CLASSIFICATION

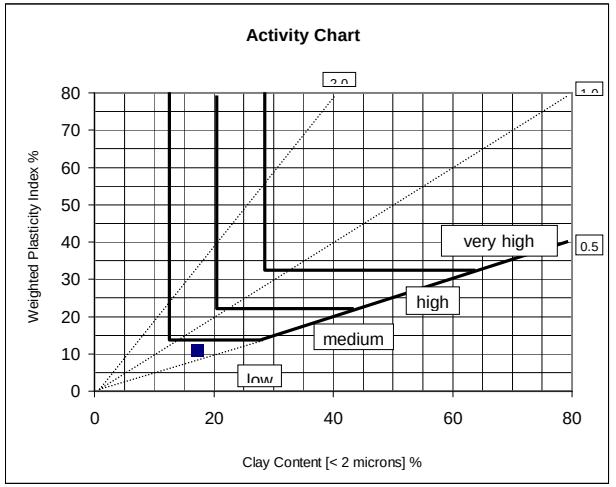
UNIFIED	PRA	TRH
ML	A.7.5 (8)	

Soil constituents % :	**Clay :**	17	**Silt :**	42	**Sand :**	37	**Gravel :**	4	**Fines :**	87	**Soil description :**	Light Reddish Brown Soil

D_{10} :		**D_{30} :**	0.007	**D_{60} :**	0.063	**Uniformity coefficient :**		**Curvature coefficient :**		Active program :	YES







REMARKS: **none**

CHECKED BY : G van Gelder

Engeo Lab (Pty) Ltd

INSITU DENSITY & MOISTURE DETERMINATION

JOB NO: 1450 (#990)
DATE: 1-Mar-2012

Sample Number			0317					
Position			TP 34					
Depth			@ 0.7m					
Mass of sample in air	(g)	a	98.80					
Mass of waxed sample in air	(g)	b	103.00					
Mass of waxed sample in water @ 25^{o}C	(g)	c	45.30					
Mass of water displaced (b - c)	(g)	d	57.70					
Mass of wax (b - a)	(g)	e	4.20					
Density of wax	(kg/m^3)	f	0.93					
Volume of wax (e / f)	(ml)	g	4.52					
Volume of sample (d - g)	(ml)	h	53.18					
Wet density of sample (a / h *100)	(kg/m^3)	I	1858					
Dry density of sample (I / (100 + k) * 1000)	(kg/m^3)	j	**1586**					
Mass Pan & Wet Mat.	(g)		79 21					
Mass Pan & Dry Mat.	(g)		75 80					
Mass Pan	(g)		55 90					
% Moisture	(%)	k	**17.1**					
Laboratory Determined Max. Dry Density	(kg/m^3)	l						
Laboratory Determined O.M.C.	%	m						
Pecentage of Max. Dry Density (j/l*100)	%							
Percentage Wet (-) Dry (+) of O M.C. (m-k)	%							
Specific Gravity			**2.62**					
Void ratio			0.652					
Degree of saturation	%		68.7					