



## SUNDUMBILI MAGISTRATE OFFICE: ADDITIONAL ACCOMMODATION

# GEOTECHNICAL REPORT



- Geotechnical Engineering Services
- Engineering Geology
- Environmental and Groundwater
- Pile Integrity Testing
- SANAS Accredited Soil & Rock Laboratory
- Earthworks/Materials Supervision & Control
- Geotechnical Monitoring Systems
- Road Pavement Materials and Design
- Project Management

***Report to Singh Govender & Associates on the Results of  
an Augmented Geotechnical Investigation for the Proposed  
Additions to the Sundumbili Magistrates Court, near  
Mandini, iLembe District Municipality, KwaZulu-Natal***

***Reference: 269-16.R02***

***Revision 0***

***Dated: 1 June 2017***

***LEVEL 2 BEE CONTRIBUTOR***

• Postal Address: PO Box 1461, Westville, 3630, South Africa  
• Physical Address: 122 Intersite Avenue, Umgeni Business Park, Durban, 4001, South Africa  
• Tel: +27 (0)31 266 0458/0861 GEOSURE (436 7873) • Fax: 086 689 5506 • Mobile: +27 (0) 82 784 0544  
• E-Mail: [geosure@iafrica.com](mailto:geosure@iafrica.com) / [deven@gesoure.co.za](mailto:deven@gesoure.co.za)  
[www.geosure.co.za](http://www.geosure.co.za)

***Report to Singh Govender & Associates on the Results of  
an Augmented Geotechnical Investigation for the  
Proposed Additions to the Sundumbili Magistrates Court,  
near Mandini, iLembe District Municipality,  
KwaZulu-Natal***

**Reference : 269-16.R02**  
**Dated : 1 June 2017**

**GEOSURE (PTY) LTD**

*Geotechnical, Environmental & Groundwater Engineering Consultants  
Civil Engineering Soils Laboratory*

**Head Office & Laboratory**

122 Intersite Avenue, Umgeni Business Park, Durban, 4001, South Africa  
PO Box 1461, Westville, 3630

**Head Office**

Tel.: 031 266 0458 (International +2731 266 0458)  
Fax: 086 689 5506 (International +2786 689 5506)  
Cell: +27 (0)82 784 0544  
E-mail: [geosure@iafrica.com](mailto:geosure@iafrica.com) / [deven@geosure.co.za](mailto:deven@geosure.co.za)

**Civil Engineering Laboratory**

Tel: 031 701 9732  
Fax: 086 684 9785  
Cell: 072 870 2621  
E-mail: [lab@geosure.co.za](mailto:lab@geosure.co.za)

**Gauteng Branch**

PO Box 32381, Kyalami, 1684  
Tel: 0861 GEOSURE (436 7873)  
Cell: +27 (0)83 447 3556  
Fax: +27 086 689 8327  
E-mail: [gauteng@geosure.co.za](mailto:gauteng@geosure.co.za)

**[www.geosure.co.za](http://www.geosure.co.za)**

# Document Control Record

Document prepared by:

Geosure (Pty) Ltd  
 122 Intersite Avenue  
 Umgeni Business Park  
 Durban  
 South Africa  
 4001

Tel: 031 266 0458  
 Fax: 086 689 5506  
 E-mail: [geosure@iafrica.com](mailto:geosure@iafrica.com) / [deven@geosure.co.za](mailto:deven@geosure.co.za)  
 Website: [www.geosure.co.za](http://www.geosure.co.za)

A person using Geosure (Pty) Ltd documents must take note of the following:

- a) Electronic copies to be checked against original hard copy version to ensure accuracy.
- b) Using the documents or data for any purpose not agreed to in writing with Geosure (Pty) Ltd is prohibited.

Document Control		 <b>GEOSURE</b> (Pty) Ltd			
<b>Report Title</b>		Report to Singh Govender & Associates on the Results of an Augmented Geotechnical Investigation for the Proposed Additions to the Sundumbili Magistrates Court, near Mandini, iLembe District Municipality, KwaZulu-Natal			
<b>Report Reference</b>		269-16.R02	<b>Responsible Person</b>	Mr S. Singh	
<b>Client Name</b>		Singh, Govender & Associates	<b>Client Contact Details</b>	(031) 266 1753 <a href="mailto:sga@mweb.co.za">sga@mweb.co.za</a>	
Revision	Date	Revision Details/Status		Author	Reviewed By
R01	20/09/2016	Geotechnical Report with Recommendations		Mr L. Dalton	Mr D. Naidoo
R02	01/06/2017	Report on an Augmented Geotechnical Investigation including Geotechnical Boreholes and further recommendations to address increased structural loads		Mr L. Dalton	Mr. F. Smith
<b>Current Revision</b>		0			
Approval					
<b>Author Signature</b>				<b>Reviewer Signature</b>	
<b>Name</b>		Luke Dalton Pr. Sci. Nat.		<b>Name</b>	
<b>Title</b>		Engineering Geologist		<b>Title</b>	
				 Francis Smith Pr.Sci. Nat. Director	

***Report to Singh Govender & Associates on the Results of an  
Augmented Geotechnical Investigation for the Proposed Additions  
to the Sundumbili Magistrates Court, near Mandini, iLembe  
District Municipality, KwaZulu-Natal***

Reference: 269-16.R02

Date: 1 June 2017

**TABLE OF CONTENTS**

<b>1.</b>	<b>TERMS OF REFERENCE .....</b>	<b>1</b>
<b>2.</b>	<b>SCOPE OF REPORT .....</b>	<b>1</b>
<b>3.</b>	<b>INFORMATION REFERENCED.....</b>	<b>2</b>
<b>4.</b>	<b>SITE DESCRIPTION.....</b>	<b>2</b>
<b>5.</b>	<b>FIELDWORK .....</b>	<b>4</b>
5.1	TERRAIN RECONNAISSANCE .....	4
5.2	INSPECTION PITS .....	4
5.3	CBR DYNAMIC CONE PENETROMETER (DCP) TESTS .....	4
<b>6.</b>	<b>REGIONAL GEOLOGY AND INFERRED SUBSURFACE CONDITIONS.....</b>	<b>5</b>
<b>7.</b>	<b>GROUNDWATER.....</b>	<b>6</b>
<b>8.</b>	<b>LABORATORY TESTING .....</b>	<b>7</b>
<b>9.</b>	<b>DISCUSSION .....</b>	<b>9</b>
9.1	PROPOSED DEVELOPMENT .....	9
9.2	GENERAL STABILITY OF THE SITE.....	9
9.4	EXCAVATION CHARACTERISTICS .....	10
9.5	GENERAL EARTHWORKS .....	11
9.6	ANTICIPATED FOUNDING CONDITIONS.....	12
9.7	FOUNDATION RECOMMENDATIONS.....	12
9.8	SUBGRADE TREATMENT FOR SURFACE BEDS, DRIVEWAY AND PARKING AREAS .....	13
9.9	DRAINAGE .....	13
<b>10.</b>	<b>CONCLUSIONS .....</b>	<b>14</b>

Appendix A:	Inspection Pit Profiles and Borehole Profiles
Appendix B:	Results of CBR Dynamic Cone Penetrometer (DCP) Tests
Appendix C:	Laboratory Test Results
Figure 201:	Site Plan

## **Abbreviations and Expansions**

Abbreviation	Definition
AASHTO	American Association of State Highway and Transportation
CBR	California Bearing Ratio
CFA	Continuous Flight Auger
DCP	Dynamic Cone Penetrometer
DPSH	Dynamic Probe Super Heavy
DWS	Department of Water and Sanitation
EGL	existing ground level
Geosure	Geosure (Pty) Ltd
GM	grading modulus
IMC	insitu moisture content
IP	inspection pit
kN/m <sup>2</sup>	kilonewtons per metre square
LL	liquid limit
LS	linear shrinkage
m	metre (s)
MDD	maximum dry density
mm	millimetre
No.	number
PI	plasticity index
SABS	South African Bureau of Standards
SANS	South African National Standards
SPT	Standard Penetration Test
TLB	Tractor loader backhoe
TRH	Technical Recommendations for Highways (1985)

---

***Report to Singh Govender & Associates on the Results of an  
Augmented Geotechnical Investigation for the Proposed  
Additions to the Sundumbili Magistrates Court, near Mandini,  
iLembe District Municipality, KwaZulu-Natal***

---

Reference: 269-16.R02

Date: 1 June 2017

---

## 1. TERMS OF REFERENCE

Geosure (Pty) Ltd, hereafter referred to as *Geosure*, was requested by Mr S. Singh of Singh Govender & Associates to provide a proposal and cost estimate to carry out a geotechnical investigation for the proposed additions at the Sundumbili Magistrates Court, near Mandini, KwaZulu-Natal.

Geosure provided a proposal and cost estimate in a letter referenced p436a-16 (Sundumbili Magistrates Geotech)/ng and dated 26 July 2016.

Geosure were subsequently authorised by Singh Govender & Associates, hereafter referred to as *the Client*, to carry out the geotechnical investigation as proposed, in a letter of authorisation dated 22 August 2016.

Geosure issued a report referenced 269-16.R01, titled "*Report to Singh Govender & Associates on the Results of a Geotechnical Investigation for the Proposed Additions to the Sundumbili Magistrates Court, near Mandeni, iLembe District Municipality, KwaZulu-Natal*" and dated 20 September 2016.

At a meeting on 15 March 2017 between Geosure, the Client and the appointed project Architect, Architronic, on 15 March 2017, Geosure was informed that the original design had been amended from a three storey structure to a five-storey structure. The revised design results in a significant increase in anticipated foundation loads to approximately 7000kN. To allow for the increased column loads, depths to bedrock of adequate minimum rock strength required confirmation. As such, it was determined by the professional team that a supplementary geotechnical investigation comprising the drilling of geotechnical boreholes should be carried out.

Accordingly, Geosure submitted a proposal and cost estimate to carry out the supplementary geotechnical investigation in a letter referenced 269-16.002 (bhole prop 24-3-2017)/dn and dated 24 March 2017.

Geosure were subsequently authorised by Singh Govender and Associates to carry out the supplementary geotechnical investigation of the Sundumbili Magistrate Court site, as proposed, in an electronic mail dated 21 April 2017.

## 2. SCOPE OF REPORT

This augmented report details the results of a geotechnical investigation including a supplementary deeper investigation comprising the drilling of geotechnical boreholes, carried out for the proposed additions to the Sundumbili Magistrates Court, near Mandini, within the iLembe District Municipality, KwaZulu-Natal, hereafter referred to as "*the site*".

Information supplied indicates that the proposed development is to comprise a five-storey structure and semi-basement in the design.

The subsurface conditions underlying the site are described and comment is made on the general stability of the site. Revised recommendations for earthworks, drainage, materials excavatability, foundations, materials usage and subgrade treatment for roads and surface beds are provided.

### 3. INFORMATION REFERENCED

The following information was utilised to assist with the investigation and subsequent reporting:

- i. A set of architectural drawings referenced 1010.16-100 through 1010.16-108, titled “*Sundumbili Magistrates Court - Additional Accommodation, Upgrading, and Renovations of Existing Building, including Security Measures, Fencing and Lightning*”, dated January 2017 and prepared by archiTRONIC to various scales as shown on drawings;
- ii. An unreferenced digital copy of a drawing titled “*Mandeni Municipality Property Query*” prepared by the Mandeni Municipality to an unknown scale;
- iii. Geological Series, Sheet “*2930 Durban*”, dated 1988, and prepared by the Council for Geoscience to a scale of 1:250 000; and
- iv. Low-resolution satellite imagery sourced from Google Earth.

### 4. SITE DESCRIPTION

The site identified for the proposed additional development is located at the existing Sundumbili Magistrates Court, near Mandini, within the iLembe District Municipality, KwaZulu-Natal. The approximate latitude and longitude coordinates of the site are 29°8'4.03"South and 31°24'7.68"East, respectively.

The site is bound to the west and north by unnamed asphalt surfaced roads, and to the south and east by the Sundumbili South African Police Service Station.

With the exception of an existing single storey structure (the existing magistrate court building) occupying a limited part of the southern portion of the site, the site is undeveloped. A prefabricated structure also near the central part of the site, the site is undeveloped.

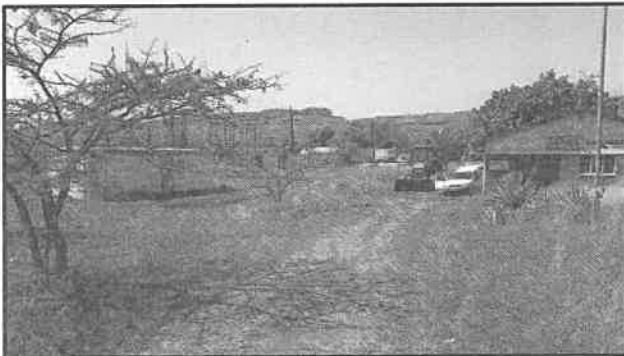
In terms of topography, the site is relatively elevated, located on the middle to upper reaches of a gently to moderately sloping hillside displaying an approximately regional easterly aspect. The site itself is, however, relatively level.

The regional and local contexts of the site are shown in Plate 1. General site overviews are given in Plate 2 through Plate 5. The general layout of the site is given in Figure 201 at the end of this report.

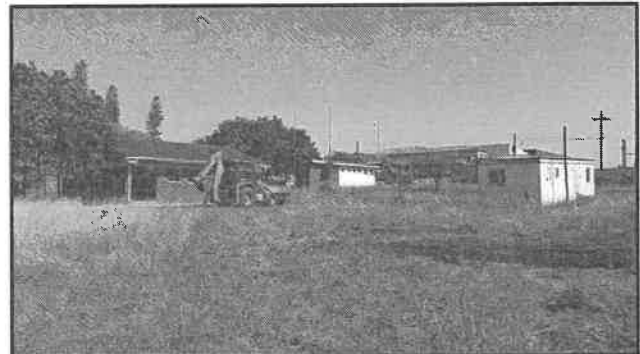




**Plate 1:** Local and regional contexts of the site demarcated in red (satellite imagery sourced from Google Earth).



**Plate 2:** General site view across southwestern portion of the site.



**Plate 3:** General site view across the northeastern portion of the site.



**Plate 4:** General view across the eastern portion of the site.



**Plate 5:** Existing single storey Magistrate Court building located on the site.

## 5. FIELDWORK

The fieldwork for the first phase/shallow geotechnical investigation was carried out on 16 September 2016 and comprised the following:

- Terrain Reconnaissance;
- Inspection pits; and
- CBR Dynamic Cone Penetrometer (DCP) tests.

The second phase of the investigation was carried out from 5 May to 10 May 2017 and comprised the drilling of geotechnical boreholes by the appointed specialist contractor.

### 5.1 Terrain Reconnaissance

A walkover reconnaissance was carried out to map features of geotechnical significance including landforms, surface geology and general drainage patterns.

### 5.2 Inspection Pits

Eight inspection pits, designated IP1 through IP8, were excavated by means of a TLB at the approximate positions shown in Figure 1. Inspection pits were advanced to refusal depths in the range 1.1m (IP3 refers) to 2.1m (IP8 refers) below EGL.

The inspection pits were profiled in accordance with the South African Geoterminology Guidelines (2002)<sup>1</sup>. Copies of the detailed profiles are given in Appendix A.

### 5.3 CBR Dynamic Cone Penetrometer (DCP) Tests

Eight CBR Dynamic Cone Penetrometer (DCP) tests, designated DC1 through DC8, were carried out at the approximate positions given in Figure 1, attached. The DCP tests were advanced to refusal depths in the range 0.8m (DC3 and DC5 refer) to 1.5m (DC2 refers).

The results of the DCP tests comprising plots of blow counts versus depth are given in Appendix B.

### 5.4 Geotechnical Boreholes

Three geotechnical boreholes, designated BH1 through BH3, were drilled by the appointed specialist subcontractor, Geopractica Contracting, at the approximate positions given in Figure 201, attached.

Boreholes were advanced by means of a rotary core drilling rig utilising a combination NXC and NWD4 core barrel. Boreholes were advanced to final depths in the range 6.0m (BH1 refers) to 7.5m (BH2 refers) below EGL.

The subsurface materials recovered from the boreholes was profiled using the South African Geoterminology Guidelines (2002)<sup>1</sup>. Copies of the detailed borehole profiles are given in Appendix A.

---

<sup>1</sup> Geoterminology Workshop (2002) – Guidelines for Soil and Rock Logging – SAIEG – AEG – SAICE (Geotechnical Division) pp. 47.

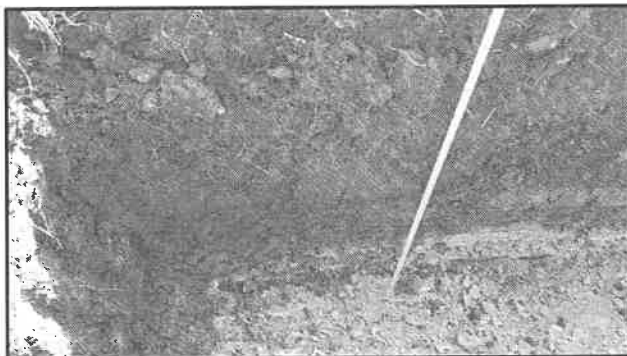
## 6. REGIONAL GEOLOGY AND INFERRED SUBSURFACE CONDITIONS

Inferring from the Council for Geoscience's Geological Series (1:250 000), Sheet "2930 Durban" the regional geology of the site and surrounds comprise predominantly tillite bedrock of the Dwyka Group and sandstone bedrock of the Natal Group. Shale bedrock of the Pietermaritzburg Formation is shown to occur approximately 1km to the southeast of the site. Several Jurassic Age dolerite intrusions are shown to occur to the north and east of the site. Several geological faults are shown to occur to the south east of the site.

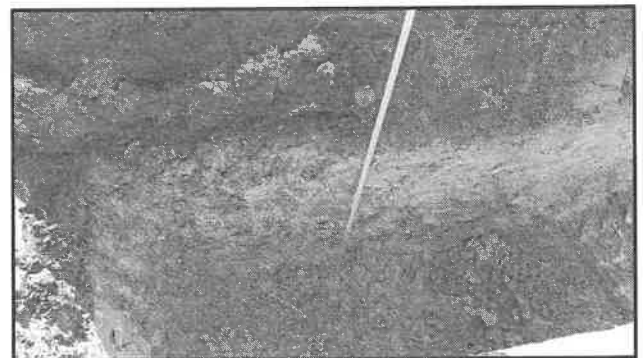
The geological units observed during the field investigation are generally described below, generally in order of increasing depth:

- a. **Fill** - Light brownish grey, loose to medium dense, fine to medium grained, silty to slightly clayey SAND with occasional gravel and roots. Fill was observed at IP1, IP2 and IP7, to occur from EGL to depths in the range 0.2m to 0.4m below EGL.
- b. **Colluvium** - Light brownish grey, firm, intact, sandy CLAY with fine roots. Colluvium was observed at IP3, IP4, IP5, IP6 and IP8, to occur from EGL to depths in the range 0.20m to 0.45m below EGL.
- c. **Residual tillite** - Dark grey mottled yellowish orange, intact, silty sandy CLAY to SANDY SILTY CLAY / Dark grey mottled orange, firm to stiff, intact, clayey sandy SILT /dark yellowish orange, firm to stiff, intact, slightly silty sandy CLAY with occasional tillite fragments. Tillite residuum was observed in all of the inspection pits and boreholes profiled, to occur from depths in the range 0.20m to 1.50m below EGL.
- d. **Weathered tillite bedrock** - Light yellow stained rusty brown, highly weathered, highly fractured, very soft-to-soft rock / light brown to dark brown blotched orange and olive occasionally streaked grey, moderately to highly weathered, very highly to highly fractured, soft to medium hard rock. Weathered tillite bedrock was observed at all of the inspection pits and boreholes profiled to commence from depths between 0.5m (IP5 refers) to 1.7m (IP8 refers).

The typical profiles observed on site are shown below in Plate 6 through Plate 10 below and overleaf.



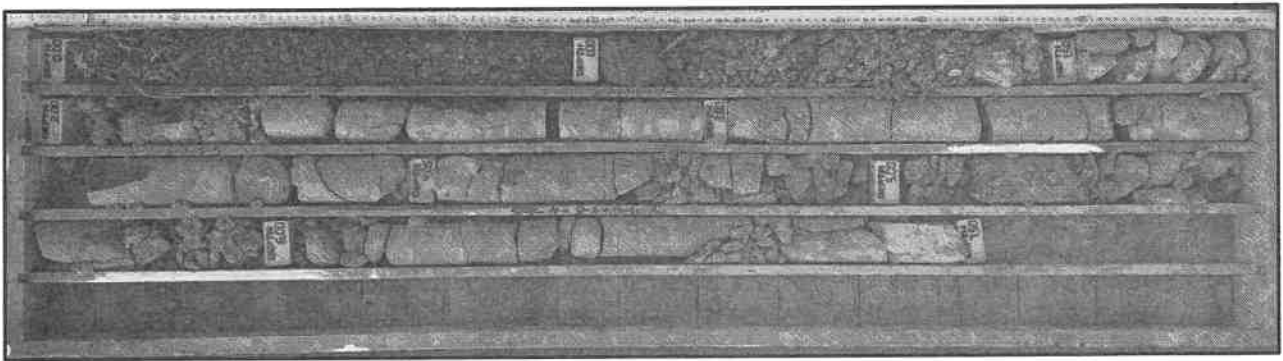
**Plate 6:** Typical soil and rock profile observed at IP1.



**Plate 7:** Typical soil and rock profile observed at IP6.



**Plate 8:** Soil and rock samples retrieved during the drilling of borehole BH1.



**Plate 9:** Soil and rock samples retrieved during the drilling of borehole BH2.



**Plate 10:** Soil and rock samples retrieved during the drilling of borehole BH3.

## 7. GROUNDWATER

Slight groundwater seepage was observed at IP1 and IP8, at depths of 1.7m and 1.4m below EGL respectively. A piezometer installed at BH1 was dry when dipped on the 7 June 2017.

A perched water table is considered likely both during and after periods of rainfall and/or during the high rainfall summer season. Although the possibility of perennial groundwater activity cannot be ruled out, the risk of a rise in a permanent groundwater condition on an elevated site of this nature is assessed to be low.

## 8. LABORATORY TESTING

The following laboratory tests were carried out on soil and bedrock samples retrieved during the investigation:

- Unconfined Compressive Strength (UCS).
- Grading Analysis to 0,075mm sieve with Atterberg Limit Determinations;
- California Bearing Ratio (CBR); and
- Modified AASHTO.

The results of the laboratory tests are summarised in Table 1 and Table 2 overleaf. Detailed laboratory test results are given in Appendix C.

**Table 1: Sundumbili Magistrates Court: Summary of UCS Test Results carried on rock samples retrieved from site.**

BH Number	Depth (m below EGL)	Strength (MPa)	Rock Strength Classification <sup>2</sup>
BH1	2.0	10.9	Medium Hard
BH1	5.7	16.3	Medium Hard
BH2	3.5	28.3	Hard
BH2	4.2	14.7	Medium hard
BH3	2.6	29.3	Hard
BH3	5.5	22.1	Medium Hard

<sup>2</sup> G. Byrne, A.D. Berry - "A Guide to Geotechnical Engineering in Southern Africa", Fourth Edition (2008), Table 3.3.8, Pp 57.

Table 2: Summary of Laboratory Test Results.

IP No	Depth (m)	Description	Particle Size %				Atterberg Limits %			GM	OMC (IMC) (%)	MDD (kg/m <sup>3</sup> )	%Swell	CBR (%)					Material Code & Classification
			Clay	Silt	Sand	Gravel	LL	PI	LS					90	93	95	97	98	
<b>COLLUVIUM</b>																			
IP4	0.0-0.4	Light brownish grey, gravelly sandy CLAY.	54	38	8	28	11	5.5	0.7	10.2	1975	0.8	11	14	16	19	20	23	A-6 (3) CL G8
<b>RESIDUAL TILLITE</b>																			
IP1	0.4-1.2	Dark grey, silty sandy GRAVEL.	27	31	42	18	5	2.0	1.64	8.1	2076	0.2	12	15	18	21	22	25	A-2-4 (0) SM-SC G7
IP3	0.45-0.90	Dark grey mottled orange, gravelly clayey sandy SILT.	14	31	19	28	12	6.0	1.1	(10.9)	-	-	-	-	-	-	-	-	A-6 (2) GC *Low
IP8	0.95-1.75	Dark yellowish orange, slightly silty sandy CLAY	38	22	13	56	24	11.5	0.7	(17.8)	-	-	-	-	-	-	-	-	A-7-5 (14) MH/OH *Medium
<b>WEATHERED TILLITE BEDROCK</b>																			
IP2	1.1-1.4	Light yellow stained rusty brown, highly weathered, very soft rock.	11	12	77	21	8	4.0	2.46	6.2	2109	0.5	16	17	20	27	31	42	A-2-4 (0) GP-GC G7

LL	-	Liquid Limit	-	Optimum Moisture Content	*Low	-	Expansiveness According to van der Merwe (1964)
PI	-	Plasticity Index	-	Linear Shrinkage	G7	-	Classification in Terms of TRH14 (1985)
A-2-4	-	AASHTO Classification	-	Not tested	MDD	-	Maximum Dry Density
IMC	-	In situ Moisture Content	-	Unified Classification	GM	-	Grading Modulus

---

## **9. DISCUSSION**

### **9.1 Proposed Development**

Limited information is available with regards to the proposed development. Inferring from the information received it is understood that the proposed development is to comprise a five storey building, including a semi basement in the design.

It is understood from information issued to Geosure by the Client that column loads of up to 7000kN are anticipated.

### **9.2 General Stability of the Site**

Based on the results of the fieldwork undertaken during this investigation, it is considered that this site is generally stable and suitable for development, provided that the recommendations given in this report are adhered to. Measures amount to no more than sound development controls appropriate to the site conditions expected and the development proposals known to Geosure.

### **9.3 Material Classification and Recommendations for Usage**

The materials occurring on the site have been classified in terms of the laboratory tests results. A general assessment of these materials, for use in the construction of fills, has been based on the results of the laboratory tests and the visual assessment made on site. The characteristics of the materials and their suitability for use in construction is summarised in Table 3.

The classification and suitability of materials available on the site should be confirmed by further laboratory testing undertaken during construction as part of process and acceptance control testing prior to the material being utilised during construction.

**Table 3: Field Characteristics of Materials and Recommended Usage (adapted from BS 6031 – 1981)**

Material Type	USC & (TRH14)	Drainage Characteristics	Shrinkage or Swelling Properties	Value as a Road Foundation	Coefficient of Bulking %	Recommended Usage
<b>FILL</b>						
Light brownish grey, silty to slightly clayey SAND.	Not Tested	-	-	-	-	Not considered suitable for use as select fill. May be considered for use as general fill subject to screening and removal of any large rock fragments.
<b>COLLUVIUM</b>						
Light brownish grey, gravelly sandy CLAY.	CL (G8)	Practically impervious	Medium	Fair to poor	20 - 40	Not suitable for use as select or general fill. Should be boxed out and spoiled when encountered at subgrade level. Consideration should be given to stockpiling the colluvium for use as topsoil/landscaping.
<b>RESIDUAL TILLITE</b>						
Dark yellowish orange, lightly silty sandy CLAY.	MH/OH (Not tested)	Practically impervious	High	Poor to very poor	-	Not suitable for use as select or general fill. Should be boxed and spoiled when encountered at or near subgrade level.
Dark grey, silty sandy GRAVEL / gravelly clayey sandy SILT	SM-SC / GC (G7)	Fair to practically impervious	Almost none to very slight	Fair to excellent	10-20 / 5 - 15	Suitable for use as general or select fill, subject to the screening and removal of large rock fragments.
<b>WEATHERED TILLITE BEDROCK</b>						
Light yellow stained rusty brown, highly weathered, very soft to soft rock.	GP-GC (G7)	Excellent to practically impervious	Almost none to very slight	Good to excellent	10-20	Suitable for use as general or select fill, subject to the screening and removal of large rock fragments.

#### 9.4 Excavation Characteristics

It is considered that the fill, colluvial soils, residual soils and very soft to soft tillite bedrock will be easily excavatable down to the refusal depths of the field tests, ie. 1.10m to 2.10m below EGL. These materials classify as SOFT in terms of SANS 1200 DA criteria which can easily be removed by hand tools or a TLB of flywheel power approximately 0,10kW per millimetre of tined bucket width.

Thereafter, excavation classifications into “soft to medium hard” weathered tillite bedrock are expected to grade, with depth, to INTERMEDIATE and subsequently to HARD. Excavation of these materials are likely to require large capacity plant equipped with pneumatic breakers or blasting.



Localised INTERMEDIATE to HARD excavation classes may be encountered at shallower depths. Therefore, an allowance for such conditions at shallower depth should be made in the Bill of Quantities.

The occurrence of relatively large hard rock tillite dropstones within the tillite residuum and tillite bedrock is known to occur. These may require large plant to remove and may result in overbreak when excavated.

Inferred excavation requirements for the various materials are summarised in Table 4 below.

**Table 4: Summary of Inferred Excavation Classifications in terms of SANS 1200 DA.**

Material Description	Inferred Excavation Classification in Terms of SANS 1200 DA
Fill	SOFT
Colluvium	SOFT
Residual Tillite	SOFT
Weathered Soft Tillite Bedrock	SOFT TO INTERMEDIATE
Weathered Medium Hard to Hard Bedrock	HARD
Hard to Extremely Hard Dropstones	HARD

The depths of the various excavation classes will be dependent on the prevailing subsoil and bedrock geology encountered at each specific location. The type/size of excavation plant and character of the underlying geology will determine actual excavation depths.

## 9.5 General Earthworks

Given the relatively level nature of the site, it is considered unlikely that significant bulk earthworks will be required. Nonetheless, some guidelines are given below.

All earthworks should be carried out in a manner to promote stable development of the site. It is recommended that earthworks be carried out along the guidelines given in SANS 1200 (current version).

Where natural ground slopes are steeper than 1 vertical to 6 horizontal (> 9°), the fill must be benched into the slope. Benches should be 0.5m deep and 2.0m wide.

Placement of fill layers should be undertaken in layers not exceeding 200mm thick when placed loose and compacted using suitable compaction plant to achieve 93% Modified AASHTO maximum dry density within 1 - 2% wet/dry of OMC.

Density control testing of placed fill material should be undertaken at regular intervals during fill construction.

Boulders larger than  $\frac{2}{3}$  of the layer thickness when loose should be removed from the fill material as these could complicate the compaction works, as well as cause piping within fills. Furthermore, large boulders in fills could cause later problems during construction of foundations.

Terraces should be graded to direct water away from the fill edges, and small earth bunds should be constructed along the crests of fills, to prevent overtopping and erosion of fill embankment slopes. These bunds should be a minimum 450mm wide and 300mm high.

Cut and fill slopes in soils should be formed to batters of 1 vertical to 2 horizontal and to a height not greater than 1.5m where retaining walls are not provided. Engineered fill slopes should be over constructed and thereafter trimmed back to the required position.

Cut and fill heights greater than 1.5m will need to be inspected and approved by an experienced, competent engineering geologist or geotechnical engineer.

## 9.6 Anticipated Founding Conditions

Inferring from the results of the field investigation, the geotechnical conditions encountered on site are anticipated to be characterised by the following:

- i. Shallow to moderately deep weathered tillite bedrock observed to occur across the extent of the site, from depths in the range 0.5m (IP5 refers) to 1.7m (IP8 refers) below EGL;
- ii. Potentially active clayey colluvial and residual soil, i.e. display cyclical volumetric changes in responses to changes in moisture content. Inferring from the laboratory test results the clayey residual tillite soils classify as “low” and “medium” potential expansiveness (van der Merwe, 1964); and
- iii. The potential for the development of a shallow perched groundwater condition across portions of the site.

## 9.7 Foundation Recommendations

Given the high column loads/foundation loads assumed for the purposes of this report it is considered that all foundation loads be transferred directly onto underlying competent tillite bedrock

Inferring from the results of the field investigation, it is considered that the reinforced spread/pad footings will be suitable for the proposed development. It is recommended that the foundation loads, measuring approximately 7000kN, be transferred through the overlying fill, colluvium, residuum and “very soft to soft” tillite bedrock to be founded on weathered tillite bedrock of at least “soft to medium hard” rock strength. On such founding medium, a maximum nett allowable bearing pressure of 1000kN/m<sup>2</sup> is considered applicable.

Inferring from the borehole samples, “soft to medium hard” tillite bedrock occurs from depths in the range 1.50m to 2.5m below EGL. Actual founding levels will be dependent on any geological variations within the weathered tillite bedrock and final platform levels.

Anticipated settlements for the proposed building structures founded on competent bedrock of at least “medium hard” rock strength will range are anticipated to range from 5mm to 10mm with differential settlement taken as 50% of total settlement.

All loose or soft material must be removed from the foundation excavations before concrete is cast.

The construction of a 1m wide concrete apron around the building structure is recommended in order to minimize seasonal subsurface moisture fluctuations beneath the surface bed floor.

The surrounding ground should be graded away from structures to limit infiltration of water into the soils immediately beneath floor level.

All footings and brickwork will need to be reinforced as determined by a structural engineer.

A provision for possible movements between floors and walls should be allowed for in the design e.g. provision of construction joints and use of appropriate softboard between walls and floors as per structural engineer's detail.

Given the variation in the underlying weathered tillite bedrock it is considered that a geotechnical professional such as Geosure be appointed to carry out regular inspections of foundation excavations during construction in order to evaluate the founding medium exposed with footing excavations and confirm bearing pressures.

### **9.8 Subgrade Treatment for Surface Beds, Driveway and Parking Areas**

Samples of materials occurring on site have been retrieved during the field investigation, and classified in terms of the results of the laboratory tests subsequently carried out by Geosure.

The sandy/gravelly colluvial and residual units and highly weathered very soft tillite bedrock classified as G7 in terms of TRH14 (1985). Depending on the final pavement and surface bed design, these materials should be ripped to between 300mm and 500mm and compacted to at least 93% Modified AASHTO dry density. This is subject to screening and removal of contaminants such as rock fragments/builders' rubble fragments and/or organic matter greater than  $\frac{2}{3}$  of the individual layer thickness.

Further laboratory testing is recommended during construction in order to monitor material quality utilised during construction.

The clayey colluvial soils and clayey tillite residuum is considered to be of marginal to poor quality in terms of TRH14 (1985). This material should, therefore, be undercut and replaced with a granular material of at least G8 quality compacted to at least 93% Modified AASHTO when found at or near subgrade/formation level.

The pavement formation layer for the proposed vehicular access and parking areas should be designed taking into account anticipated traffic loads, volumes and design life of the parking area and roads.

Design and construction of the surface bed floor should allow for a layer of inert hardcore at least 300mm thickness directly beneath floor level.

### **9.9 Drainage**

One of the most important factors in the stable development of the site is the control and removal of both surface and groundwater from the site.

Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the site, both during and after the development.

All terraces should be shaped to a gradient to prevent water ponding on the surface and should be graded to direct water away from any fill edges and foundations

Under no circumstances should disposal of stormwater by soakaway be considered. Stormwater from roofed and paved areas is to be collected, attenuated to engineer's design, and piped into the nearest municipal stormwater connection facility.

Provision should be made in the Bill of Quantities for subsoil drainage to engineer's detail to cater for the existing and potential perched groundwater flows.

## 10. CONCLUSIONS

This augmented report details the results of a geotechnical investigation including supplementary deeper investigation comprising the drilling of geotechnical boreholes, carried out for the proposed additions to the Sundumbili Magistrates Court, near Mandini, within the iLembe District Municipality, KwaZulu-Natal.

Based on the results of the fieldwork undertaken during this investigation, it is considered that this site is generally stable and suitable for development, provided that the recommendations given in this report are adhered to.

The general geology at the positions investigated is observed to comprise a mantle of fill, colluvium, and tillite residuum, overlying weathered tillite bedrock at relatively shallow depth.

Groundwater seepage was encountered at two of the inspection pits profiled. A perched groundwater condition is therefore considered likely both during and after periods of rainfall and/or during the high rainfall summer season.

One of the most important factors in the stable development of the site, including the construction of the semi-basement structure, is the control and removal of both surface and groundwater from the site. To address the potential risk of groundwater concentrations at the site, it is recommended that provision is made in the Bill of Quantities for suitable permanent subsoil drainage measures to engineer's detail. All stormwater from roofed and surfaced areas is to be piped in a controlled manner to the nearest municipal stormwater connection facility.

All earthworks should be carried out in a manner to promote stable development of the site. It is recommended that earthworks be carried out along the guidelines given in SANS 1200 (current version).

It is recommended that all foundation loads be transferred directly onto the underlying weathered "medium hard" tillite bedrock with a minimum UCS of 10MPa. On this basis spread footings foundations may be sized to net permissible foundation pressure of 1000kN/m<sup>2</sup>.

---

The ground conditions given in this report refer specifically to the field tests carried out on site. It is, therefore, quite possible that conditions at variance with those given in this report could be encountered elsewhere on site during construction. It is, therefore, important that Geosure (Pty) Ltd be appointed to carry out periodic inspections during construction. Any change from the anticipated ground conditions could then be taken into account to avoid unnecessary expense.





**APPENDIX A**



**INSPECTION PIT PROFILES AND  
BOREHOLE PROFILES**





P O Box 1461, Westville, 3630, South Africa  
 Tel: (031) 266-0458  
 email: geosure@iafrica.com

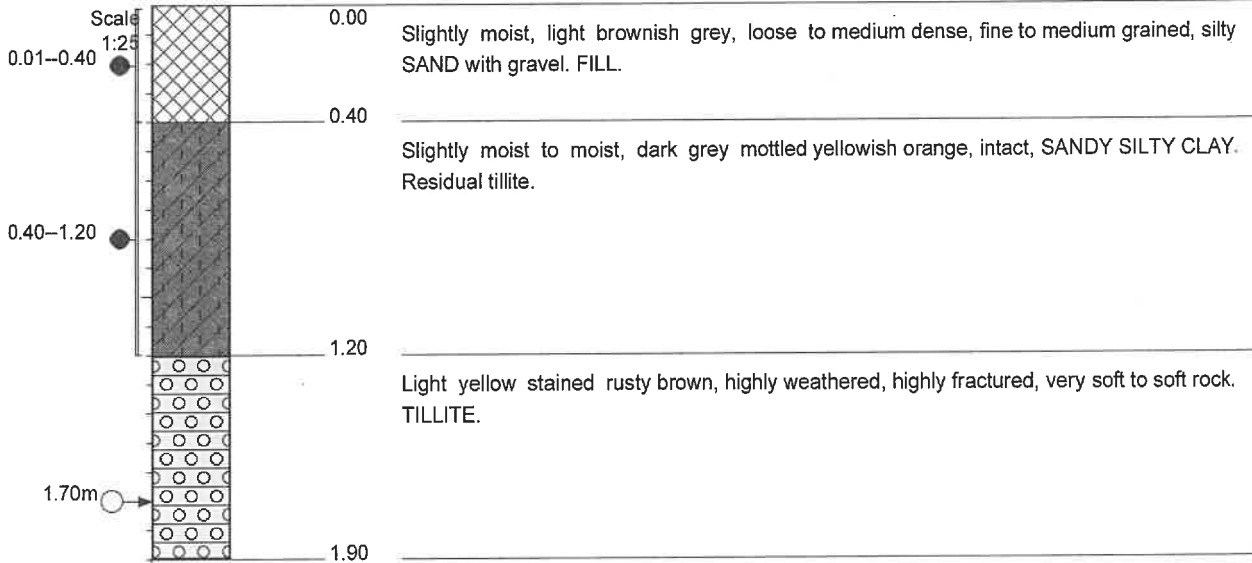
Geotechnical, Environmental &  
 Groundwater Engineering  
 Pile Integrity Testing & Civil  
 Engineering Laboratory

Fax: 086 689-5506  
 www.geosure.co.za

Singh Govender & Associates  
 Proposed Magistrates Court  
 Sundumbili near Mandeni  
 KZN

HOLE No: IP1  
 Sheet 1 of 1

JOB NUMBER: 269-16



NOTES

- 1) Slight groundwater seepage observed at 1,70m.
- 2) Samples taken at:  
 S1 0,01--0,40 (Ind)  
 S2 0,40--1,20 (2 x Bulk)
- 3) Refusal depth at 1,90m.

CONTRACTOR :  
 MACHINE : TLB Case 58OT 4x4  
 DRILLED BY :  
 PROFILED BY : E.Dada Mia  
 TYPE SET BY : K.Naidoo  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 01 September 2016  
 DATE : 01 September 2016  
 DATE : 20/09/16 15:48  
 TEXT : ..C:\LOGS\IPITS.TXT

ELEVATION : 087m  
 X-COORD : 31 24'08,0"E  
 Y-COORD : 29 08'04,1"S

HOLE No: IP1



Geotechnical, Environmental &  
Groundwater Engineering  
Pile Integrity Testing & Civil  
Engineering Laboratory

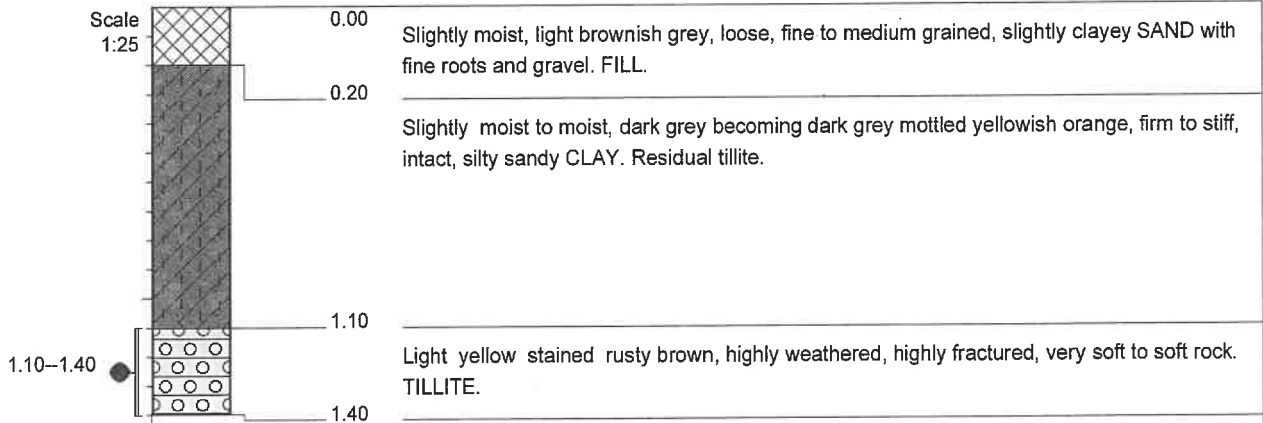
Singh Govender & Associates  
Proposed Magistrates Court  
Sundumbili near Mandeni  
KZN

HOLE No: IP2  
Sheet 1 of 1

JOB NUMBER: 269-16

P O Box 1461, Westville, 3630, South Africa  
Tel: (031) 266-0458  
email: geosure@iafrica.com

Fax: 086 689-5506  
www.geosure.co.za



NOTES

- 1) No groundwater seepage observed.
- 2) Sample taken at:  
S1 1,10--1,40 (2 x Bulk)
- 3) Refusal depth at 1,40m.

CONTRACTOR :  
MACHINE : TLB Case 58OT 4x4  
DRILLED BY :  
PROFILED BY : E.Dada Mia  
TYPE SET BY : K.Naidoo  
SETUP FILE : STANDARD.SET

INCLINATION :  
DIAM :  
DATE : 01 September 2016  
DATE : 01 September 2016  
DATE : 20/09/16 15:48  
TEXT : ..C:\LOGS\PITS.TXT

ELEVATION : 086m  
X-COORD : 31 24'08,5"E  
Y-COORD : 29 08'04,0"S

HOLE No: IP2





P O Box 1461, Westville, 3630, South Africa  
Tel: (031) 266-0458  
email: geosure@iafrica.com

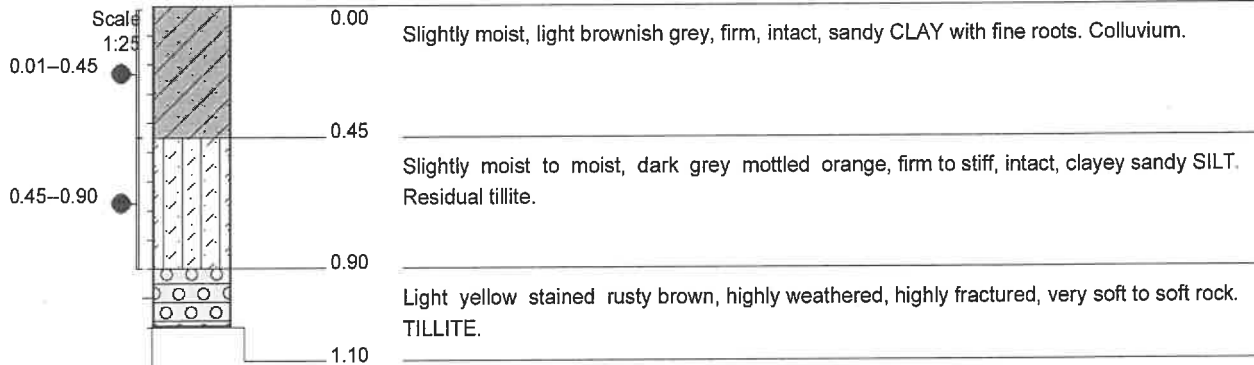
Geotechnical, Environmental &  
Groundwater Engineering  
Pile Integrity Testing & Civil  
Engineering Laboratory

Fax: 086 689-5506  
www.geosure.co.za

Singh Govender & Associates  
Proposed Magistrates Court  
Sundumbili near Mandeni  
KZN

HOLE No: IP3  
Sheet 1 of 1

JOB NUMBER: 269-16



#### NOTES

- 1) No groundwater seepage observed.
- 2) Samples taken at:  
S1 0,01--0,45 (Ind)  
S2 0,45--0,90 (Ind)
- 3) Refusal depth at 1,10m.

CONTRACTOR :  
MACHINE : TLB Case 58OT 4x4  
DRILLED BY :  
PROFILED BY : E.Dada Mia  
TYPE SET BY : K.Naidoo  
SETUP FILE : STANDARD.SET

INCLINATION :  
DIAM :  
DATE : 01 September 2016  
DATE : 01 September 2016  
DATE : 20/09/16 15:48  
TEXT : ..C:\LOGSPITS.TXT

ELEVATION : 088m  
X-COORD : 31 24'07,8"E  
Y-COORD : 29 08'03,6"S

HOLE No: IP3



P O Box 1461, Westville, 3630, South Africa  
 Tel: (031) 266-0458  
 email: geosure@iafrica.com

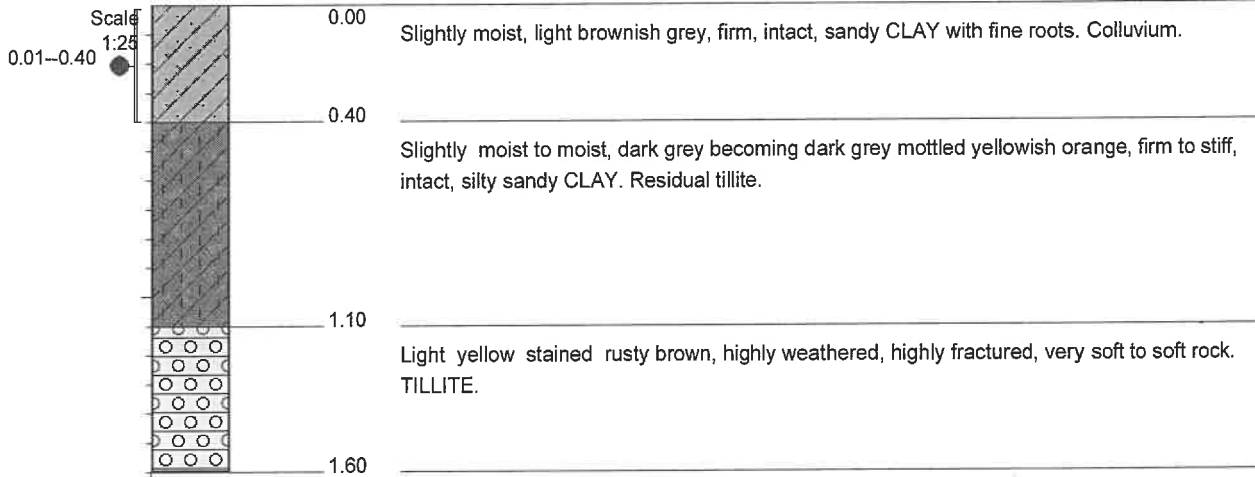
Geotechnical, Environmental &  
 Groundwater Engineering  
 Pile Integrity Testing & Civil  
 Engineering Laboratory

Fax: 086 689-5506  
 www.geosure.co.za

Singh Govender & Associates  
 Proposed Magistrates Court  
 Sundumbili near Mandeni  
 KZN

HOLE No: IP4  
 Sheet 1 of 1

JOB NUMBER: 269-16



NOTES

- 1) No groundwater seepage observed.
- 2) Sample taken at:  
 S1 0,01--0,40 (2 x Bulk)
- 3) Refusal depth at 1,60m.

CONTRACTOR :  
 MACHINE : TLB Case 58OT 4x4  
 DRILLED BY :  
 PROFILED BY : E.Dada Mia  
 TYPE SET BY : K.Naidoo  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 01 September 2016  
 DATE : 01 September 2016  
 DATE : 20/09/16 15:48  
 TEXT : ..C:\LOGSPITS.TXT

ELEVATION : 088m  
 X-COORD : 31 24'07,2"E  
 Y-COORD : 29 08'03,4"S

HOLE No: IP4



P O Box 1461, Westville, 3630, South Africa  
 Tel: (031) 266-0458  
 email: geosure@iafrica.com

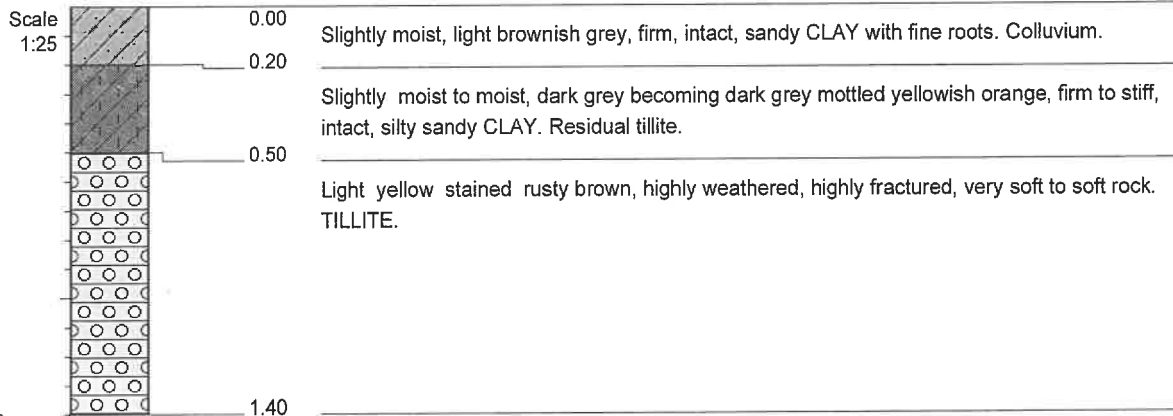
Geotechnical, Environmental &  
 Groundwater Engineering  
 Pile Integrity Testing & Civil  
 Engineering Laboratory

Fax: 086 689-5506  
 www.geosure.co.za

Singh Govender & Associates  
 Proposed Magistrates Court  
 Sundumbili near Mandeni  
 KZN

HOLE No: IP5  
 Sheet 1 of 1

JOB NUMBER: 269-16



NOTES

- 1) No groundwater seepage observed.
- 2) Refusal depth at 1,40m.

CONTRACTOR :  
 MACHINE : TLB Case 58OT 4x4  
 DRILLED BY :  
 PROFILED BY : E.Dada Mia  
 TYPE SET BY : K.Naidoo  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 01 September 2016  
 DATE : 01 September 2016  
 DATE : 20/09/16 15:48  
 TEXT : ..C:\LOGSPITS.TXT

ELEVATION : 088m  
 X-COORD : 31 24'07,1"E  
 Y-COORD : 29 08'03,8"S

HOLE No: IP5



P O Box 1461, Westville, 3630, South Africa  
 Tel: (031) 266-0458  
 email: geosure@iafrica.com

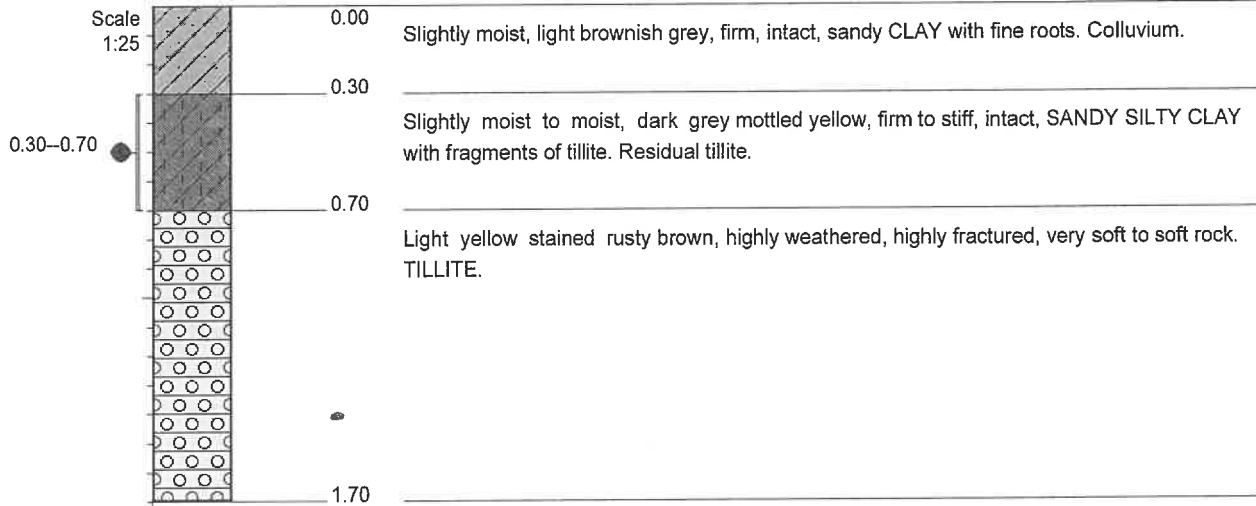
Geotechnical, Environmental &  
 Groundwater Engineering  
 Pile Integrity Testing & Civil  
 Engineering Laboratory

Fax: 086 689-5506  
 www.geosure.co.za

Singh Govender & Associates  
 Proposed Magistrates Court  
 Sundumbili near Mandeni  
 KZN

HOLE No: IP6  
 Sheet 1 of 1

JOB NUMBER: 269-16



NOTES

- 1) No groundwater seepage observed.
- 2) Sample taken at:  
S1 0,30--0,70 (Ind)
- 3) Refusal depth at 1,70m.

CONTRACTOR :  
 MACHINE : TLB Case 58OT 4x4  
 DRILLED BY :  
 PROFILED BY : E.Dada Mia  
 TYPE SET BY : K.Naidoo  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 01 September 2016  
 DATE : 01 September 2016  
 DATE : 20/09/16 15:48  
 TEXT : ..C:\LOGSPITS.TXT

ELEVATION : 088m  
 X-COORD : 31 24'07,8"E  
 Y-COORD : 29 08'03,7"S

HOLE No: IP6



P O Box 1461, Westville, 3630, South Africa  
 Tel: (031) 266-0458  
 email: geosure@iafrica.com

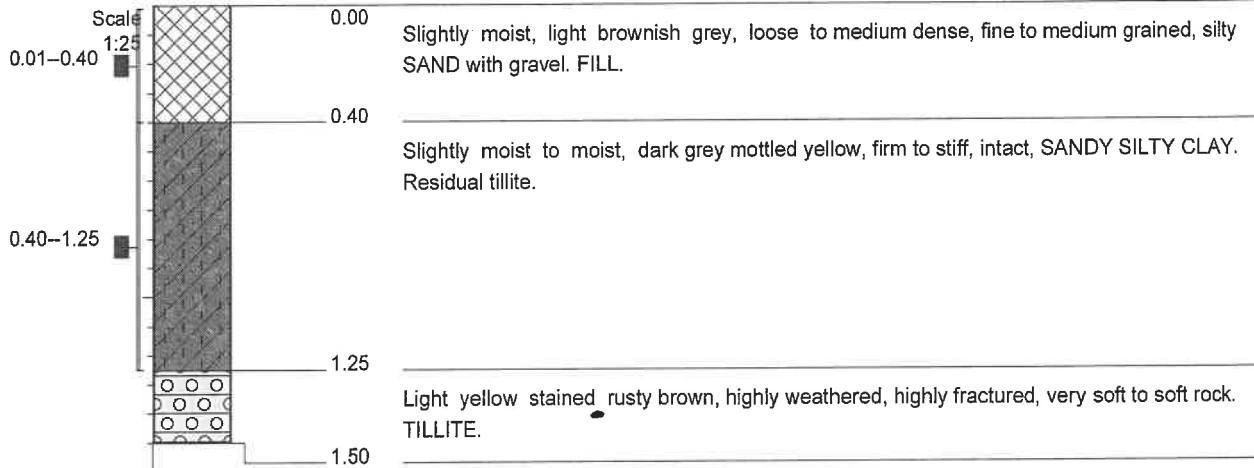
Geotechnical, Environmental &  
 Groundwater Engineering  
 Pile Integrity Testing & Civil  
 Engineering Laboratory

Fax: 086 689-5506  
 www.geosure.co.za

Singh Govender & Associates  
 Proposed Magistrates Court  
 Sundumbili near Mandeni  
 KZN

HOLE No: IP7  
 Sheet 1 of 1

JOB NUMBER: 269-16



NOTES

- 1) No groundwater seepage observed.
- 2) Samples taken at:  
 S1 0,01--0,40 (2 x Bulk)  
 S2 0,40--1,25 (Undisturbed)
- 3) Refusal depth at 1,50m.

CONTRACTOR :  
 MACHINE : TLB Case 58OT 4x4  
 DRILLED BY :  
 PROFILED BY : E.Dada Mia  
 TYPE SET BY : K.Naidoo  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 01 September 2016  
 DATE : 01 September 2016  
 DATE : 20/09/16 15:48  
 TEXT : ..C:\LOGSPITS.TXT

ELEVATION : 087m  
 X-COORD : 31 24'08,8"E  
 Y-COORD : 29 08'04,4"S

HOLE No: IP7



P O Box 1461, Westville, 3630, South Africa  
 Tel: (031) 266-0458  
 email: geosure@iafrica.com

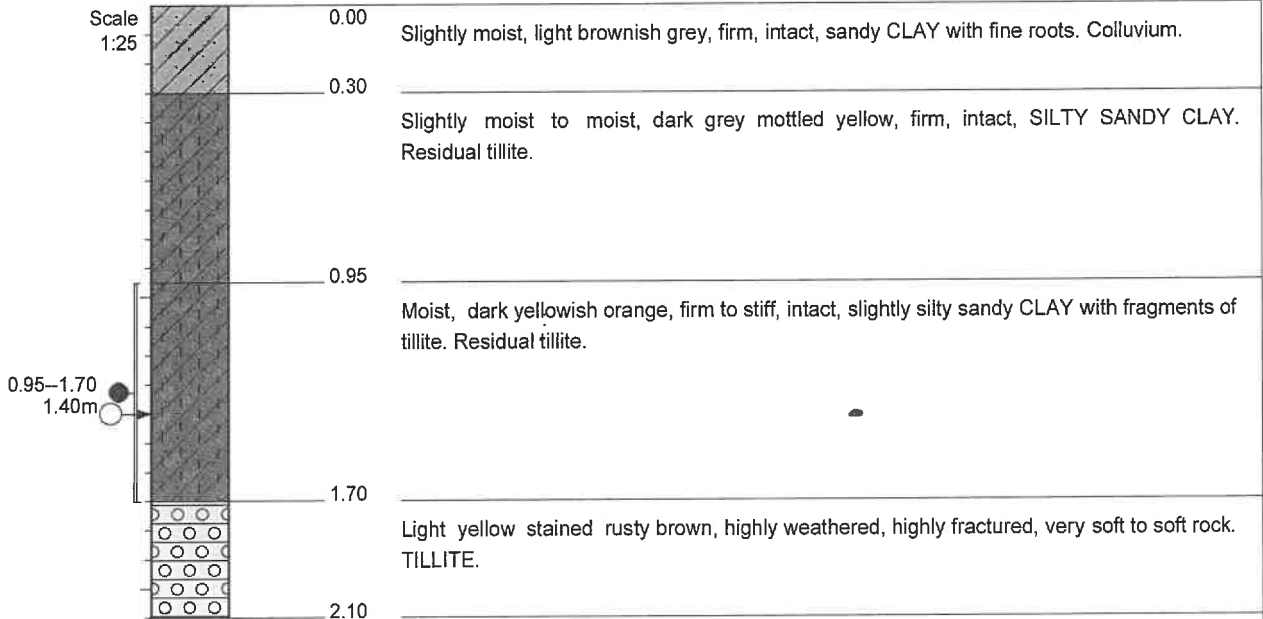
Geotechnical, Environmental &  
 Groundwater Engineering  
 Pile Integrity Testing & Civil  
 Engineering Laboratory

Fax: 086 689-5506  
 www.geosure.co.za

Singh Govender & Associates  
 Proposed Magistrates Court  
 Sundumbili near Mandeni  
 KZN

HOLE No: IP8  
 Sheet 1 of 1

JOB NUMBER: 269-16



NOTES

- 1) Slight groundwater seepage observed at 1,40m.
- 2) Sample taken at:  
S1 0,95--1,70 (Ind)
- 3) Refusal depth at 2,10m.

CONTRACTOR :  
 MACHINE : TLB Case 580T 4x4  
 DRILLED BY :  
 PROFILED BY : E.Dada Mia  
 TYPE SET BY : K.Naidoo  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 01 September 2016  
 DATE : 01 September 2016  
 DATE : 20/09/16 15:48  
 TEXT : ..C:\LOGSPITS.TXT

ELEVATION : 086m  
 X-COORD : 31 24'08,6"E  
 Y-COORD : 29 08'03,6"S

HOLE No: IP8



Geotechnical, Environmental &  
Groundwater Engineering  
Pile Integrity Testing & Civil  
Engineering Laboratory

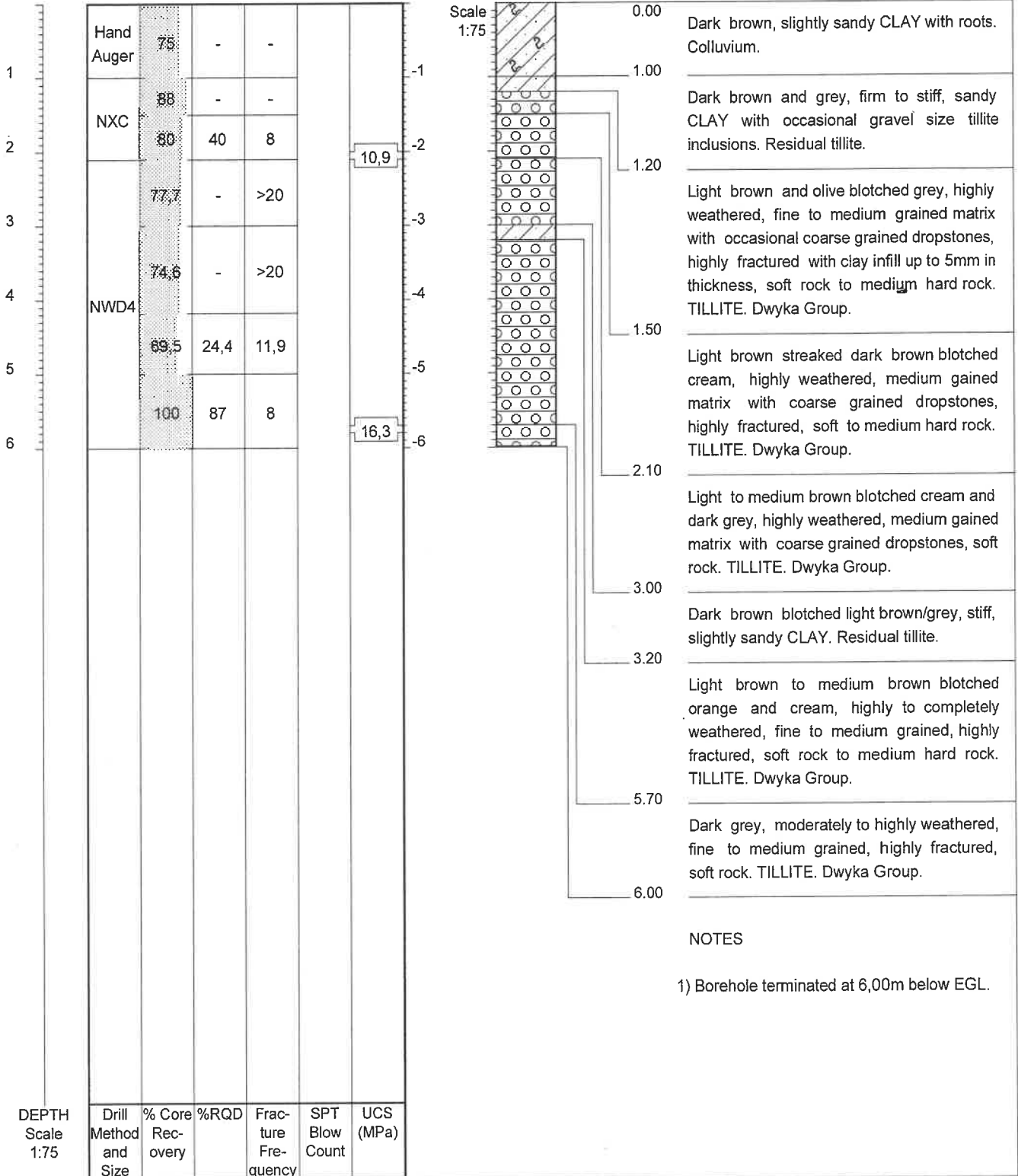
SMA Consultants cc  
Proposed Magistrates Court  
Sundumbili, Mandeni

HOLE No: BH1  
Sheet 1 of 1

JOB NUMBER: 269-16

P O Box 1461, Westville, 3630, South Africa  
Tel: (031) 266-0458  
email: geosure@iafrica.com

Fax: 086 689-5506  
www.geosure.co.za



CONTRACTOR : Geopractica  
MACHINE : D45  
DRILLED BY : -  
PROFILED BY : J.Venter

TYPE SET BY : K.Naidoo  
SETUP FILE : STANDARG.SET

INCLINATION : Vertical  
DIAM : NWD4  
DATE : 09 May 2017  
DATE :  
DATE : 22/06/17 08:24  
TEXT : ..C:\LOGS\BH1.TXT

ELEVATION :  
X-COORD : -3224225.4574  
Y-COORD : 39125.8466

HOLE No: BH1



P O Box 1461, Westville, 3630, South Africa  
 Tel: (031) 266-0458  
 email: geosure@iafrica.com

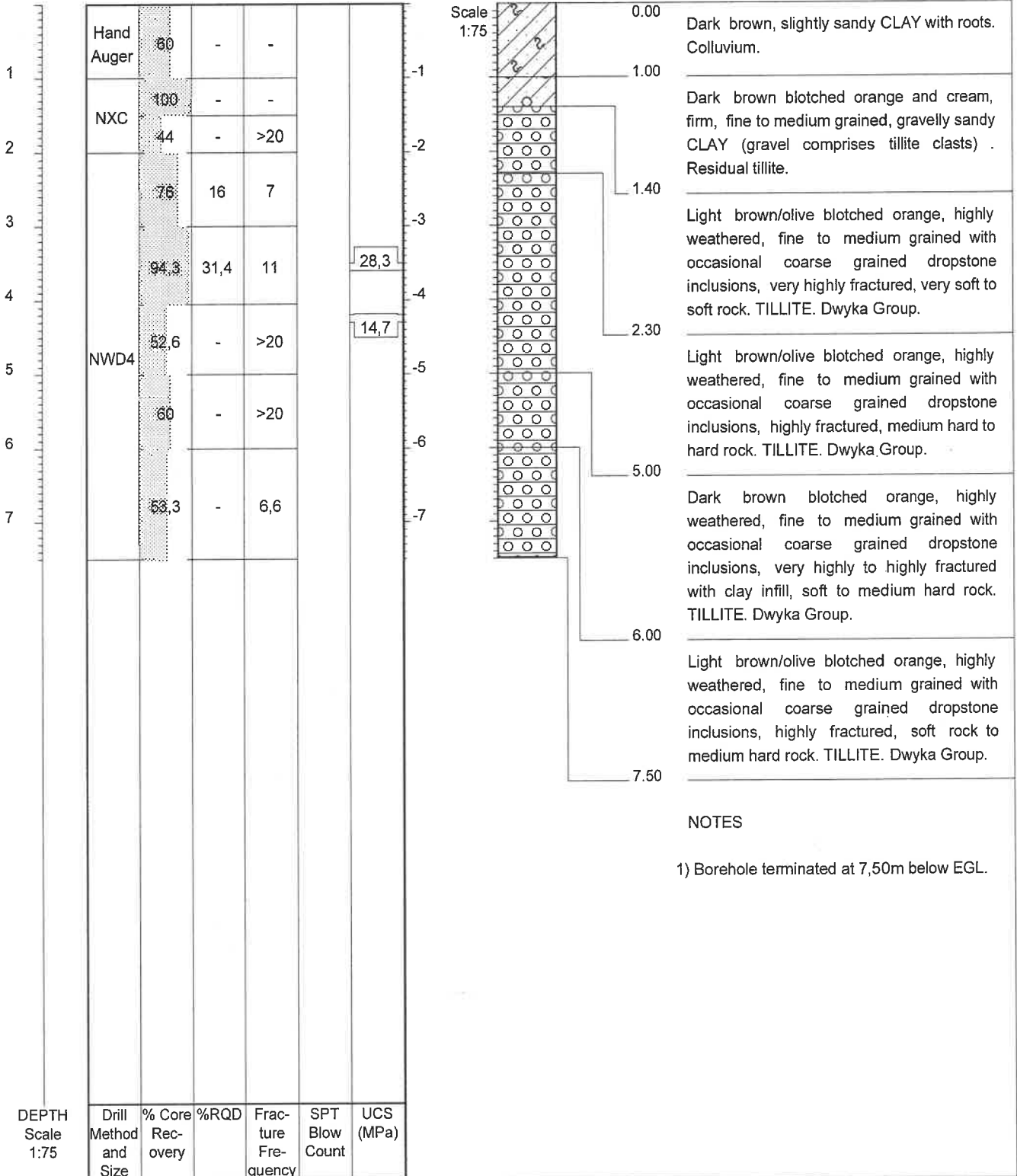
Geotechnical, Environmental &  
 Groundwater Engineering  
 Pile Integrity Testing & Civil  
 Engineering Laboratory

Fax: 086 689-5506  
 www.geosure.co.za

SMA Consultants cc  
 Proposed Magistrates Court  
 Sundumbili, Mandeni  
 Northern KZN

HOLE No: BH2  
 Sheet 1 of 1

JOB NUMBER: 269-16



NOTES

1) Borehole terminated at 7,50m below EGL.

CONTRACTOR : Geopractica  
 MACHINE : D45  
 DRILLED BY : -  
 PROFILED BY : J.Venter  
 TYPE SET BY : K.Naidoo  
 SETUP FILE : STANDARG.SET

INCLINATION : Vertical  
 DIAM :  
 DATE : 05 May 2017  
 DATE :  
 DATE : 22/06/17 08:26  
 TEXT : ..C:\LOGS\BH2.TXT

ELEVATION :  
 X-COORD : -3224245.4574  
 Y-COORD : 39120.5862

HOLE No: BH2





Geotechnical, Environmental &  
Groundwater Engineering  
Pile Integrity Testing & Civil  
Engineering Laboratory

SMA Consultants cc  
Proposed Magistates Court  
Sundumbili, Mandeni  
Northern KZN

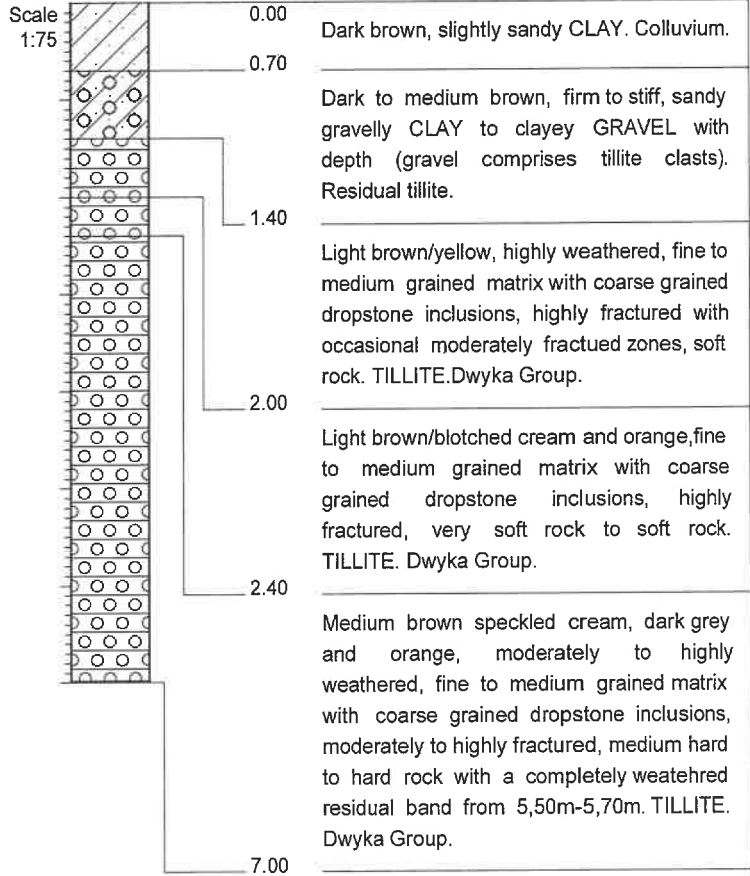
HOLE No: BH3  
Sheet 1 of 1

JOB NUMBER: 269-16

P O Box 1461, Westville, 3630, South Africa  
Tel: (031) 266-0458  
email: geosure@iafrica.com

Fax: 086 689-5506  
www.geosure.co.za

DEPTH Scale 1:75	Drill Method and Size	% Core Recovery	%RQD	Fracture Frequency	SPT Blow Count	UCS (MPa)
1	Hand Auger	85,7	-	-		
2	NXC	87,5	67,5	7,5		
3		100	40	14		
4	NWD4	96	33	>20	29,3	
5		90	-	-		
6		70	10	-	22,1	
7		93,3	35,4	12,3		



NOTES

1) Borehole terminated at 7,00m below EGL.

CONTRACTOR : Geopractica  
MACHINE : D45  
DRILLED BY : -  
PROFILED BY : J.Venter

TYPE SET BY : K.Naidoo  
SETUP FILE : STANDARG.SET

INCLINATION : Vertical

DIAM :  
DATE : 05 May 2017  
DATE :  
DATE : 22/06/17 08:26  
TEXT : ..C:\LOGS\BH3.TXT

ELEVATION :

X-COORD : -3224244.2271  
Y-COORD : 39163.6511

HOLE No: BH3



**APPENDIX B**



**RESULTS OF CBR DYNAMIC CONE  
PENETROMETER (DCP) TESTS**



# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com



Client: **Singh Govender & Associates**

Ref.No. 269-16

Project: **Proposed Magistrates Court**

Date: 16-Sep-2001

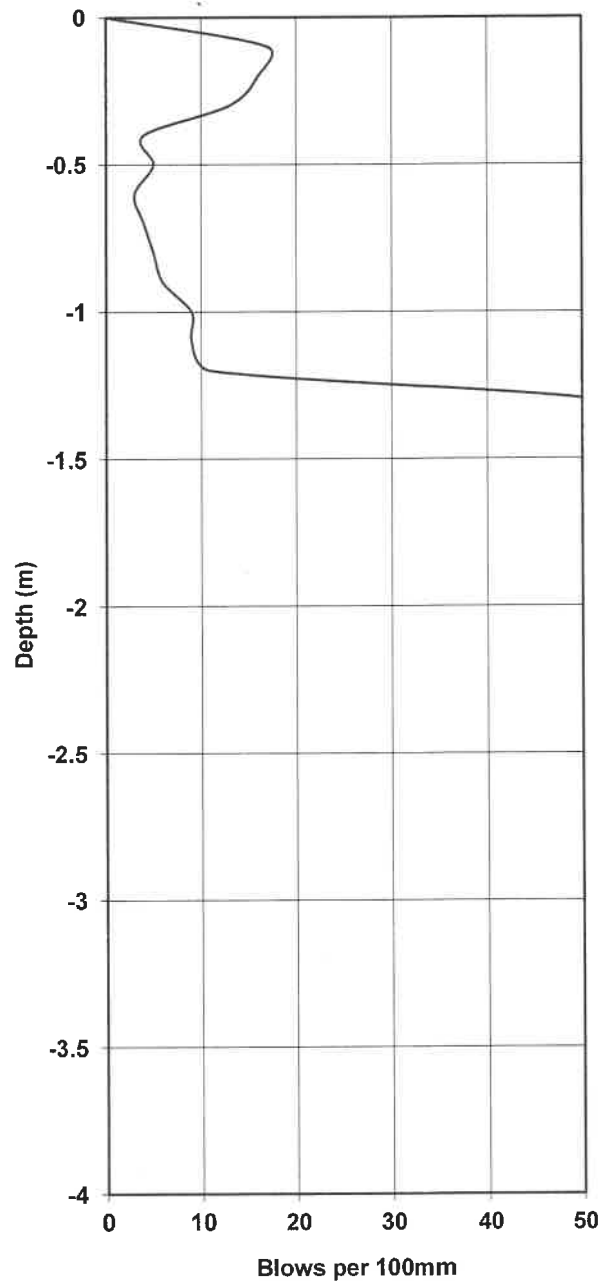
Section: **Sundumbili near Mandeni, KZN**

Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No.DC 1

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	17	Stiff	140 kPa	31
0.2	16	Stiff	130 kPa	29
0.3	13	Stiff	110 kPa	23
0.4	4	Soft	35 kPa	7
0.5	5	Firm	40 kPa	8
0.6	3	Soft	25 kPa	5
0.7	4	Soft	35 kPa	7
0.8	5	Firm	40 kPa	8
0.9	6	Firm	50 kPa	10
1	9	Stiff	75 kPa	15
1.1	9	Stiff	75 kPa	15
1.2	11	Stiff	90 kPa	19
	Refusal			



# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com



Client: **Singh Govender & Associates**

Ref.No. 269-16

Project: **Proposed Magistrates Court**

Date: 16-Sep-2001

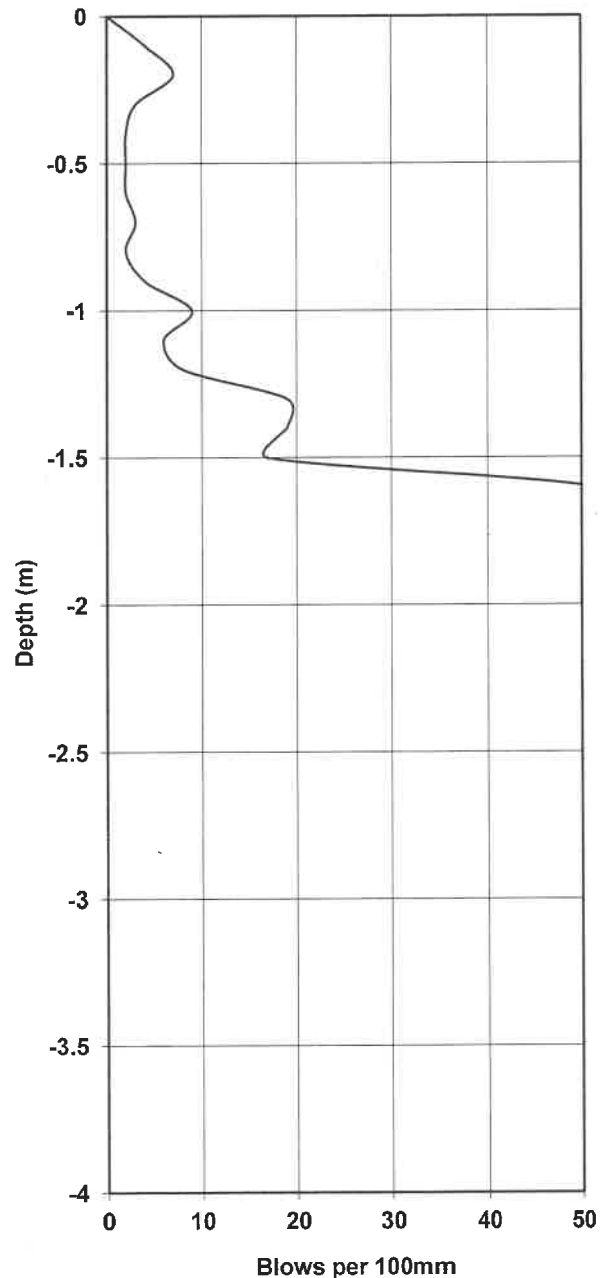
Section: **Sundumbili near Mandeni, KZN**

Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No.DC 2

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	4	Soft	35 kPa	7
0.2	7	Firm	60 kPa	12
0.3	3	Soft	25 kPa	5
0.4	2	Soft	20 kPa	3
0.5	2	Soft	20 kPa	3
0.6	2	Soft	20 kPa	3
0.7	3	Soft	25 kPa	5
0.8	2	Soft	20 kPa	3
0.9	4	Soft	35 kPa	7
1	9	Stiff	75 kPa	15
1.1	6	Firm	50 kPa	10
1.2	8	Firm	65 kPa	14
1.3	19	Very Stiff	>150 kPa	35
1.4	19	Very Stiff	>150 kPa	35
1.5	17	Stiff	140 kPa	31
	Refusal			



# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com



Client: **Singh Govender & Associates**

Ref.No. 269-16

Project: **Proposed Magistrates Court**

Date: 16-Sep-2001

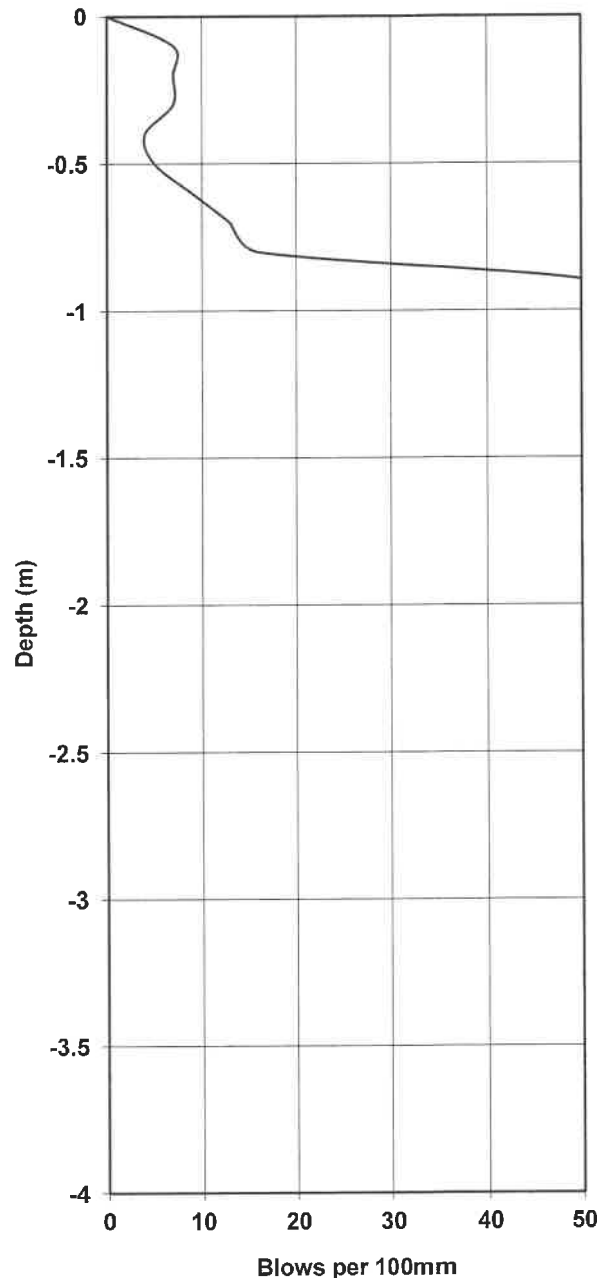
Section: **Sundumbili near Mandeni, KZN**

Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No.DC 3

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	7	Firm	60 kPa	12
0.2	7	Firm	60 kPa	12
0.3	7	Firm	60 kPa	12
0.4	4	Soft	35 kPa	7
0.5	5	Firm	40 kPa	8
0.6	9	Stiff	75 kPa	15
0.7	13	Stiff	110 kPa	23
0.8	16	Stiff	130 kPa	29
	Refusal			



# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com



Client: **Singh Govender & Associates**

Ref.No. 269-16

Project: **Proposed Magistrates Court**

Date: 16-Sep-2001

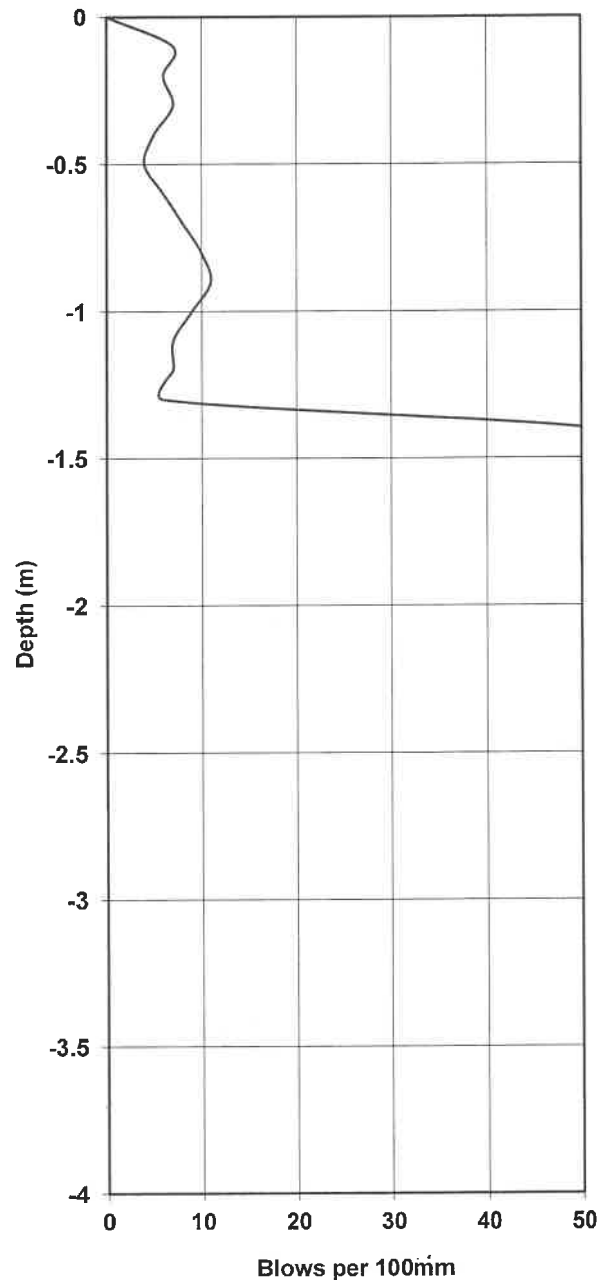
Section: **Sundumbili near Mandeni, KZN**

Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No. DC 4

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	7	Firm	60 kPa	12
0.2	6	Firm	50 kPa	10
0.3	7	Firm	60 kPa	12
0.4	5	Firm	40 kPa	8
0.5	4	Soft	35 kPa	7
0.6	6	Firm	50 kPa	10
0.7	8	Firm	65 kPa	14
0.8	10	Stiff	85 kPa	17
0.9	11	Stiff	90 kPa	19
1	9	Stiff	75 kPa	15
1.1	7	Firm	60 kPa	12
1.2	7	Firm	60 kPa	12
1.3	6	Firm	50 kPa	10
	Refusal			



# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com



Client: **Singh Govender & Associates**

Ref.No. 269-16

Project: **Proposed Magistrates Court**

Date: 16-Sep-2001

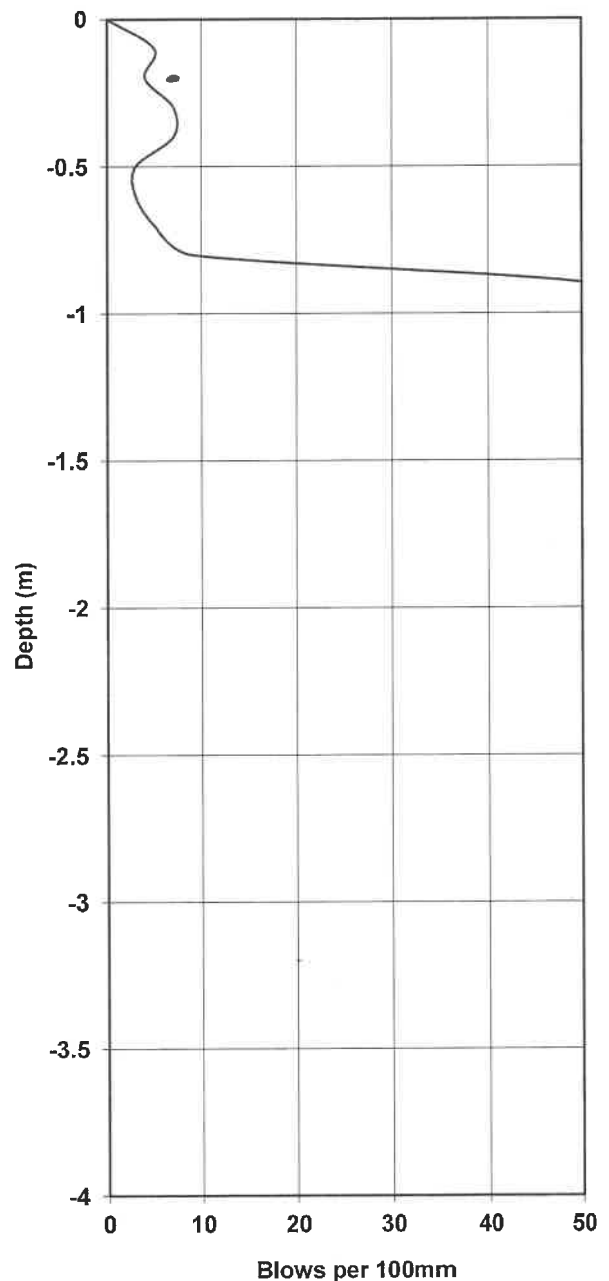
Section: **Sundumbili near Mandeni, KZN**

Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No.DC 5

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	5	Firm	40 kPa	8
0.2	4	Soft	35 kPa	7
0.3	7	Firm	60 kPa	12
0.4	7	Firm	60 kPa	12
0.5	3	Soft	25 kPa	5
0.6	3	Soft	25 kPa	5
0.7	5	Firm	40 kPa	8
0.8	9	Stiff	75 kPa	15
	Refusal			



# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com



Client: **Singh Govender & Associates**

Ref.No. 269-16

Project: **Proposed Magistrates Court**

Date: 16-Sep-2001

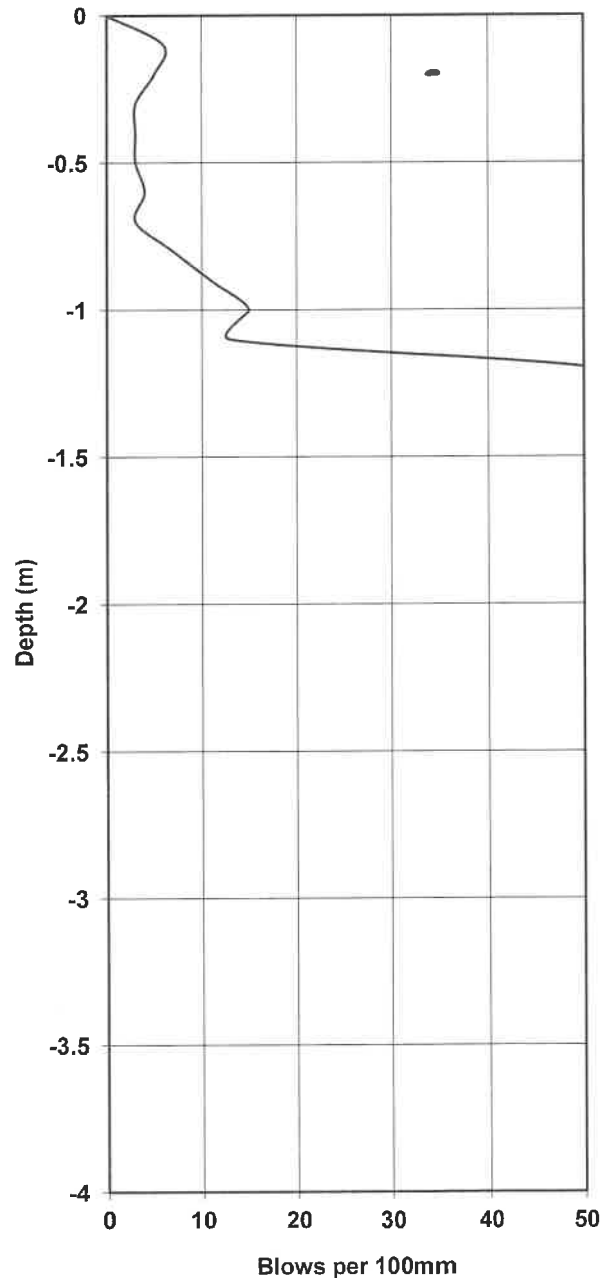
Section: **Sundumbili near Mandeni, KZN**

Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No.DC 6

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	6	Firm	50 kPa	10
0.2	5	Firm	40 kPa	8
0.3	3	Soft	25 kPa	5
0.4	3	Soft	25 kPa	5
0.5	3	Soft	25 kPa	5
0.6	4	Soft	35 kPa	7
0.7	3	Soft	25 kPa	5
0.8	7	Firm	60 kPa	12
0.9	11	Stiff	90 kPa	19
1	15	Stiff	125 kPa	27
1.1	13	Stiff	110 kPa	23
	Refusal			





# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com

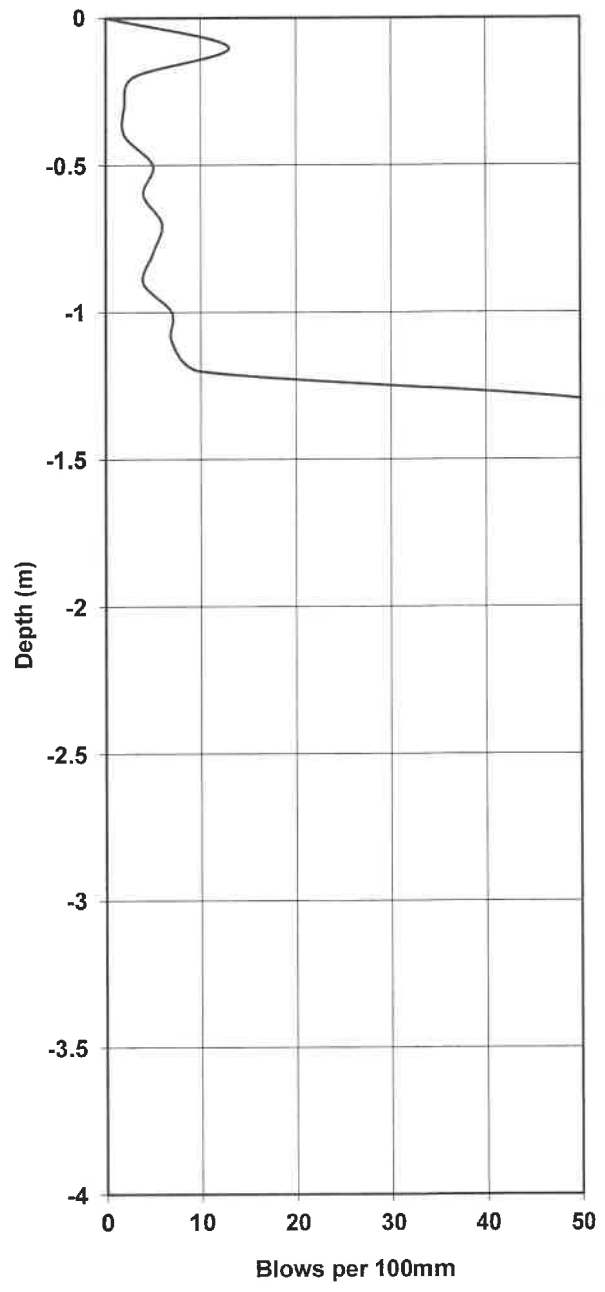


Client: <b>Singh Govender &amp; Associates</b>	Ref.No. 269-16
Project: <b>Proposed Magistrates Court</b>	Date: 16-Sep-2001
Section: <b>Sundumbili near Mandeni, KZN</b>	Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No.DC 7

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	13	Stiff	110 kPa	23
0.2	3	Soft	25 kPa	5
0.3	2	Soft	20 kPa	3
0.4	2	Soft	20 kPa	3
0.5	5	Firm	40 kPa	8
0.6	4	Soft	35 kPa	7
0.7	6	Firm	50 kPa	10
0.8	5	Firm	40 kPa	8
0.9	4	Soft	35 kPa	7
1	7	Firm	60 kPa	12
1.1	7	Firm	60 kPa	12
1.2	10	Stiff	85 kPa	17
	Refusal			



# GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

Tel: (031) 2660458

Fax: 086 689 5506

Email: geosure@iafrica.com



Client: **Singh Govender & Associates**

Ref.No. 269-16

Project: **Proposed Magistrates Court**

Date: 16-Sep-2001

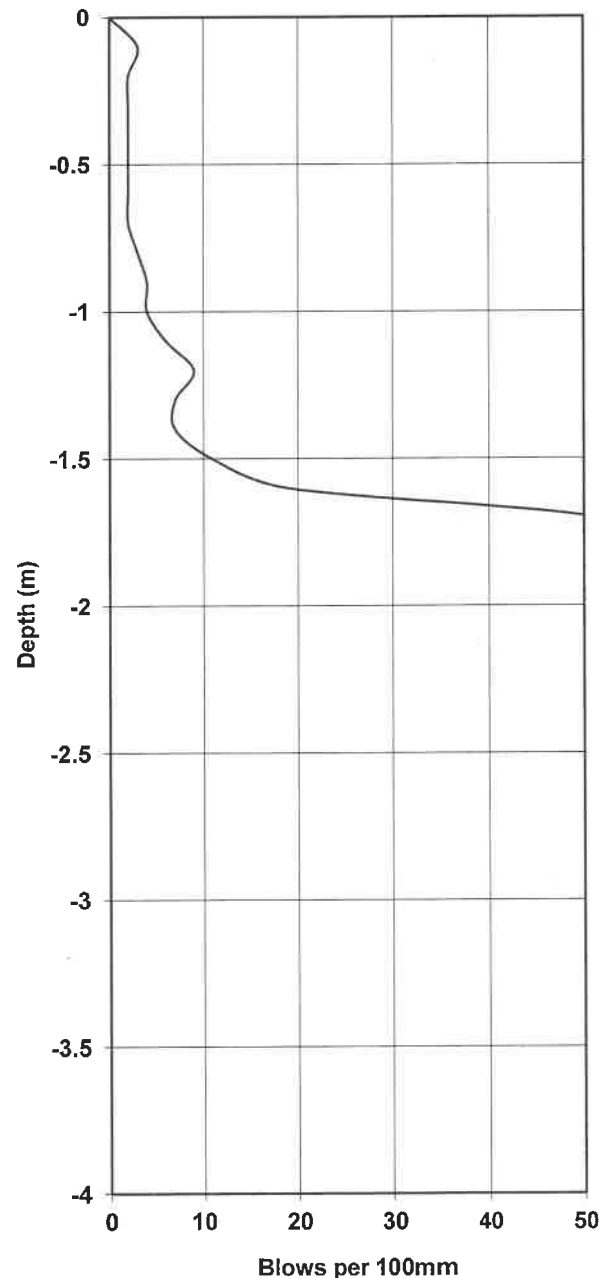
Section: **Sundumbili near Mandeni, KZN**

Operator: E.Dada Mia

## CBR Penetrometer Probe ----- Test No. DC 8

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	3	Soft	25 kPa	5
0.2	2	Soft	20 kPa	3
0.3	2	Soft	20 kPa	3
0.4	2	Soft	20 kPa	3
0.5	2	Soft	20 kPa	3
0.6	2	Soft	20 kPa	3
0.7	2	Soft	20 kPa	3
0.8	3	Soft	25 kPa	5
0.9	4	Soft	35 kPa	7
1	4	Soft	35 kPa	7
1.1	6	Firm	50 kPa	10
1.2	9	Stiff	75 kPa	15
1.3	7	Firm	60 kPa	12
1.4	7	Firm	60 kPa	12
1.5	11	Stiff	90 kPa	19
1.6	19	Very Stiff	>150 kPa	35
	Refusal			





**APPENDIX C**



**LABORATORY TEST RESULTS**



CLIENT : Geosure (Pty) Ltd  
 PHYSICAL ADDRESS : 122 Intersite Avenue  
 Umgeni Business Park  
 Durban  
 ATTENTION : Mr D. Naidoo  
 PROJECT : Sundumbili Court

**TEST REPORT REFERENCE NUMBER: 26547**

**Dear Sir/Madam,**

Enclosed herewith, please find the original reports pertaining to the above-mentioned project.

Date Received	<b>05.09.2016</b>		
Date Tested	07.09.2016 to 15.09.2016		
Sample Location	Refer to Report		
Sampling Method	N/A		
Sample Condition	Good.		
Sampling Environmental Condition	N/A		
Sampler(s) Name	Client.		
Total Number of Pages	11		
<b>Test Carried Out</b>			
TMH1 Method A1 & A5	<input checked="" type="checkbox"/>	TMH1 Method C3	
TMH1 Method A2, A3, A4	<input checked="" type="checkbox"/>	TMH1 Method C4a	
TMH1 Method A7	<input checked="" type="checkbox"/>	TMH1 Method B6	
TMH1 Method A8	<input checked="" type="checkbox"/>	Hydrometer Analysis - ASTM D422	<input checked="" type="checkbox"/>
TMH1 Method A10(b)		SANS 5863	
TMH1 Method A14app		SANS 5862-1	
TMH1 Method A15d		SANS 5860, 5861-1, 5861-2, 5861-3	
TMH1 Method A16T		TMH1 Method B9	
<input checked="" type="checkbox"/> - Tick denotes tests that were carried out.			

**We would like to take this opportunity of thanking you for your continued support.  
 Should you have any queries please do not hesitate to contact me.**

**Yours faithfully**

*K. Veeran*

**Technical Signatory,  
 Kris Veeran for Geosure (Pty) Ltd.**

This report may not be reproduced except in full, without written permission from Geosure (Pty) Ltd. While every care is taken to ensure the correctness of all tests and reports, neither Geosure (Pty) Ltd or its employees shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn there from or any consequence thereof. This report relates only to the sample/s tested.

<p><b>Head Office</b>                  122 Intersite Avenue, Umgeni Business Park, Durban                  4091, South Africa                  PO Box 1461, Westville, 3630, South Africa                  Tel.: +27 (0)861 GEOSURE / 0861 436 7873                  Fax: +27 (0)86 689 5506                  Mobile: +27 (0)82 784 0544                  E-mail: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a></p>	<p><b>Civil Engineering Laboratory</b>                  122 Intersite Avenue, Umgeni Business Park,                  Durban, 4091, South Africa                  PO Box 1461, Westville, 3630, South Africa                  Tel: 031 701 9732                  Fax: +27 (0) 86 684 9785                  Mobile: 072 870 2621                  E-mail: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a></p>	<p><b>Gauteng Branch</b>                  P. O. Box 32381, Kyalami 1684                  Tel.: 0861 GEOSURE / 0861 436 7873                  Fax: 086 689 8327                  Mobile: 083 377 6559                  Email: <a href="mailto:gauteng@geosure.co.za">gauteng@geosure.co.za</a></p>
--	--	---

<b>LABORATORY AND HEAD OFFICE ADDRESS:</b>	122 Intersite Avenue, Umgeni Business Park, Durban, 4091		
<b>LABORATORY CONTACT INFO.:</b>	Tel.: +27(0) 31 701 9732	Fax: 086 684 9785	
	Mobile: +27(0) 72 870 2621	e-mail: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	
<b>HEAD OFFICE CONTACT INFO.:</b>	Tel.: +27(0) 31 266 0458	Fax: 086 689 5506	
	Mobile: +27(0) 82 784 0544	e-mail: <a href="mailto:geosure@africa.com">geosure@africa.com</a>	
<b>WEBSITE:</b>	<a href="http://www.geosure.co.za">www.geosure.co.za</a>		

**Client** : Geosure (Pty) Ltd **Our Ref. : 26547**  
**Project** : Sundumbili Court **Your Ref. : 269-16**  
**Date Tested : 07.09.2016 to 13.09.2016**  
**Attention** : Mr D. Naidoo **Date Reported : 15.09.2016**

<b>Sample No.</b>	47881	47883	
<b>Field No.</b>	IP 3	IP 8	
<b>Position in Field</b>	Layer 2	Layer 3	
<b>Depth (m)</b>	0.45-0.90	0.95-1.70	
<b>Material Description</b>	Dark grey mottled orange sandy silty CLAY. Residual Tillite	Dark yellowish orange sandy silty CLAY. Residual Tillite	

**Sieve Analysis ( Wet Preparation ) - TMH1 - Method A1 (a) - Percent Passing Sieve Size**

<b>% Passing</b>	75.0 mm	100	100		
	63.0 mm	100	100		
	53.0 mm	100	100		
	37.5 mm	100	100		
	26.5 mm	100	100		
	19.0 mm	100	100		
	13.2 mm	100	98		
	4.75 mm	95	94		
	2.00 mm	81	87		
	0.425 mm	64	79		
0.075 mm	45	60			

**Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm)**

<b>% Passing</b>	0.060 mm	41	57		
	0.050 mm	38	55		
	0.040 mm	34	53		
	0.026 mm	30	50		
	0.015 mm	24	47		
	0.010 mm	21	44		
	0.0074 mm	20	42		
	0.0036 mm	16	39		
	0.0020 mm	14	38		
	0.0015 mm	14	36		

**Mechanical analysis - TMH1 - Method A5 - Percent of Soil Mortar (<2 mm) for Grain Size range**

<b>Coarse Sand</b>	%	21	8		
<b>Coarse Fine Sand</b>	%	9	6		
<b>Medium Fine Sand</b>	%	6	10		
<b>Fine Fine Sand</b>	%	9	6		
<b>Silt &amp; Clay</b>	%	56	70		
<b>Grading Modulus</b>		1.1	0.7		

**Atterberg Limits - TMH1 - Methods A2, A3, A4 (<0.425mm)**

<b>Liquid Limit</b>	%	28	56		
<b>Plasticity Index</b>	%	12	24		
<b>Linear Shrinkage</b>	%	6.0	11.5		
<b>AASHTO Classification (Group Index)*</b>		A-6 (2)	A-7-5 (14)		
<b>Unified Classification*</b>		GC	MH/OH±		
<b>Moisture Content</b>	%	10.9	17.8		

<b>Remarks:</b>	Date Received: 05.09.2016
	Sampled by Client.
	*Opinions expressed herein fall outside the scope of SANAS accreditation.

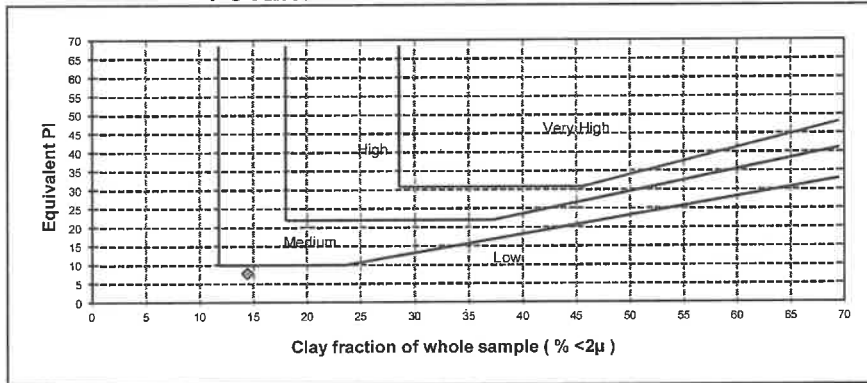
This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (PTY) LTD.

<b>LABORATORY AND HEAD OFFICE ADDRESS:</b>	122 Intersite Avenue, Umgeni Business Park, Durban, 4091		
<b>LABORATORY CONTACT INFO.:</b>	Tel.: +27(0) 31 701 9732	Fax: 086 684 9785	
	Mobile: +27(0) 72 870 2621	e-mail: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	
<b>HEAD OFFICE CONTACT INFO.:</b>	Tel.: +27(0) 31 266 0458	Fax: 086 689 5506	
	Mobile: +27(0) 82 784 0544	e-mail: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a>	
<b>WEBSITE:</b>	<a href="http://www.geosure.co.za">www.geosure.co.za</a>		

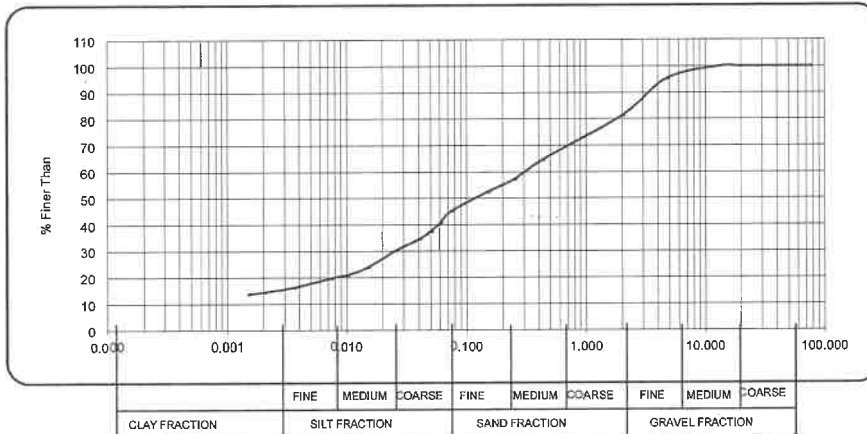
<b>Client</b> : Geosure (Pty) Ltd	<b>Job No.</b> : 26547
<b>Project</b> : Sundumbili Court	<b>Your Ref.No.</b> : 269-16
	<b>Date Tested</b> : 07.09.2016 to 13.09.2016
<b>Attention</b> : Mr D. Naidoo	<b>Date Reported</b> : 15.09.2016

<b>Sample Number</b>	: 47881		
<b>Field No.</b>	: IP 3		
<b>Sample Description</b>	: Dark grey mottled orange sandy silty CLAY. Residual Tillite		
<b>Equivalent PI</b>	: <span style="border: 1px solid black; padding: 2px;">8</span>	<b>Clay fraction of whole sample (% &lt;2µ)</b>	: <span style="border: 1px solid black; padding: 2px;">14</span>

### POTENTIAL EXPANSIVENESS GRAPH



### PARTICLE SIZE DISTRIBUTION CHART



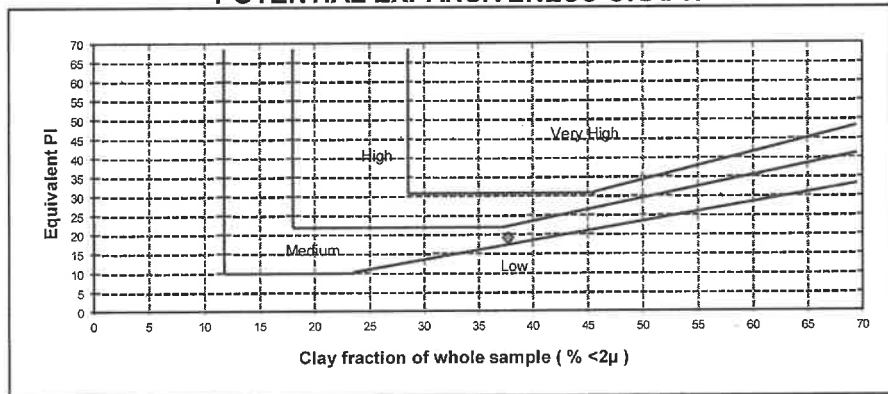
This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (PTY) LTD.

<i>Reg.No.: 92/03145/07</i>	
<b>LABORATORY AND HEAD OFFICE ADDRESS:</b>	122 Intersite Avenue, Umgeni Business Park, Durban, 4091
<b>LABORATORY CONTACT INFO.:</b>	Tel.: +27(0) 31 701 9732      Fax: 086 684 9785 Mobile: +27(0) 72 870 2621      e-mail: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>
<b>HEAD OFFICE CONTACT INFO.:</b>	Tel.: +27(0) 31 266 0458      Fax: 086 689 5506 Mobile: +27(0) 82 784 0544      e-mail: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a>
<b>WEBSITE:</b>	<a href="http://www.geosure.co.za">www.geosure.co.za</a>

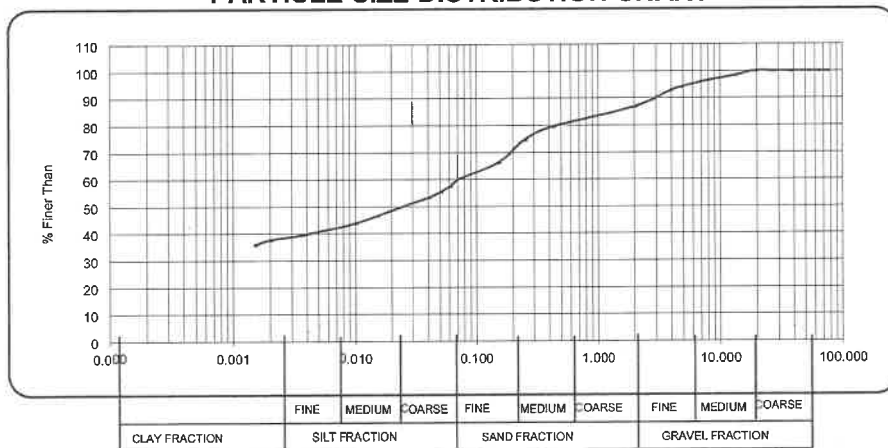
<b>Client</b> : Geosure (Pty) Ltd	<b>Job No.</b> : 26547
<b>Project</b> : Sundumbili Court	<b>Your Ref.No.</b> : 269-16
	<b>Date Tested</b> : 07.09.2016 to 13.09.2016
<b>Attention</b> : Mr D. Naidoo	<b>Date Reported</b> : 15.09.2016

**Sample Number** : 47883  
**Field No.** : IP 8  
**Sample Description** : Dark yellowish orange sandy silty CLAY. Residual Tillite  
**Equivalent PI** : 19    Clay fraction of whole sample (% <2µ) : 38

**POTENTIAL EXPANSIVENESS GRAPH**



**PARTICLE SIZE DISTRIBUTION CHART**



This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (PTY) LTD.

<b>LABORATORY:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091 P.O. Box 1461, Westville 3630 Mobile: +27(0)72 870 2621 Tel.: +27 (0)31 701 9732	Reg. No. : 92/03145/07  Fax: 086 684 9785 email: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	<b>HEAD OFFICE:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091, KwaZulu Natal, South Africa. Tel: +27 (0)31 266 0458 Fax: 086 689 5506 email: <a href="mailto:geosure@afrika.com">geosure@afrika.com</a> <a href="http://www.geosure.co.za">www.geosure.co.za</a>
--	--	---

Client : Geosure (Pty) Ltd	Your Ref No. : 269-16
Project : Sundumbili Court	Our Ref No. : 26547
Attention : Mr D. Naidoo	Date Reported : 15/09/2016

### Test Report

Sample No.	47879	47880	47882	
Field No.	IP 1	IP 2	IP 4	
Position	Layer 2	Layer 3	Layer 1	
Depth ( m )	0.4-1.2	1.1-1.4	0.0-0.4	
Material Description	Dark grey silty sandy clayey GRAVEL	Light yellow stained rusty brown highly weathered very soft rock. TILLITE	Light brownish grey gravelly sandy CLAY. Colluvium	

Sieve Analysis ( Wet Preparation ) TMH1 - Method A1 (a) - Percent Passing Sieve Size				
Sieve Aperture (mm)	75.00	88	88	88
	63.00	78	78	78
	53.00	100	78	78
	37.50	89	54	54
	26.50	83	52	100
	19.00	77	47	98
	13.20	75	40	97
	4.750	65	27	96
	2.000	58	23	92
	0.425	51	20	84
0.075	27	11	54	
Grading Modulus	1.64	2.46	0.70	
Mechanical analysis - TMH1 - Method A5 - Percent of Soil Mortar (<2 mm) for Grain Size range				
Coarse Sand	2.000 - 0.425	13	14	8
Coarse-Fine Sand	0.425 - 0.250	12	12	7
Medium-Fine Sand	0.250 - 0.150	14	12	10
Fine-Fine Sand	0.150 - 0.075	14	14	16
Silt and Clay	< 0.075	47	48	59
Atterberg Limits TMH1 - Methods A2, A3, A4 on <0.425 mm fraction				
Liquid Limit	% or symbol	18	21	28
Plasticity Index	% or symbol	5	8	11
Linear Shrinkage	%	2.0	4.0	5.5
Maximum Dry Density and Optimum Moisture Content - TMH1 - Method A7				
Maximum Dry Density (kg/m <sup>3</sup> )		2076	2109	1975
Optimum moisture content (%)		8.1	6.2	10.2
California Bearing Ratio - TMH1 - Method A8				
CBR @100% Compaction	%	25	42	23
CBR @ 98% Compaction	%	22	31	20
CBR @ 97% Compaction	%	21	27	19
CBR @ 95% Compaction	%	18	20	16
CBR @ 93% Compaction	%	15	17	14
CBR @ 90% Compaction	%	11	16	11
Swell @100% Compaction	%	0.2	0.5	0.8
TRH 14 Classification (1985)**		G7	G7	G8
AASHTO Classification (Group Index)**		A-2-4 (0)	A-2-4 (0)	A-6 (3)
Unified Classification **		SM-SC	GP-GC	CL

This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

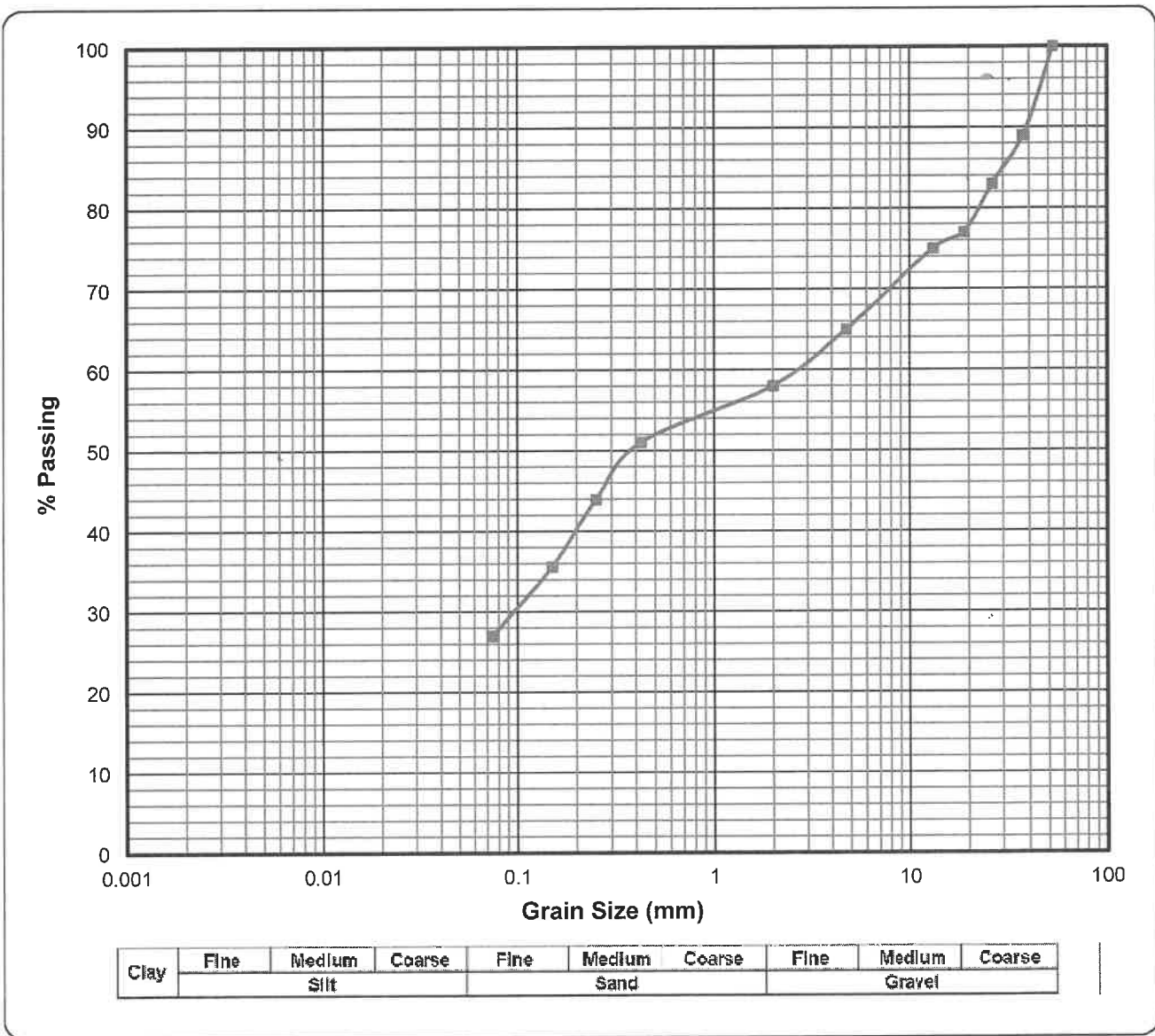
Remarks: \*Subject to further testing as required by TRH14.  
 \*Subject to further testing as required by TRH14.



<b>LABORATORY:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091 P.O. Box 1461, Westville 3630 Mobile: +27(0)72 870 2621      Fax: 086 684 9785 Tel.: +27 (0)31 701 9732      email: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	Reg. No. : 92/03145/07	<b>HEAD OFFICE:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091, KwaZulu Natal, South Africa. Tel: +27 (0)31 266 0458      Fax: 086 689 5506 email: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a> <a href="http://www.geosure.co.za">www.geosure.co.za</a>
--	------------------------	--

<b>Client : Geosure (Pty) Ltd</b> <b>Project : Sundumbili Court</b> <b>Attention : Mr D. Naidoo</b>	<b>Your Ref No.: 269-16</b> <b>Our Ref No. : 26547</b> <b>Date Reported : 15/09/2016</b>
---	--

### Grading Curve for Sample 47879 – TMH1 Method A1 (a)



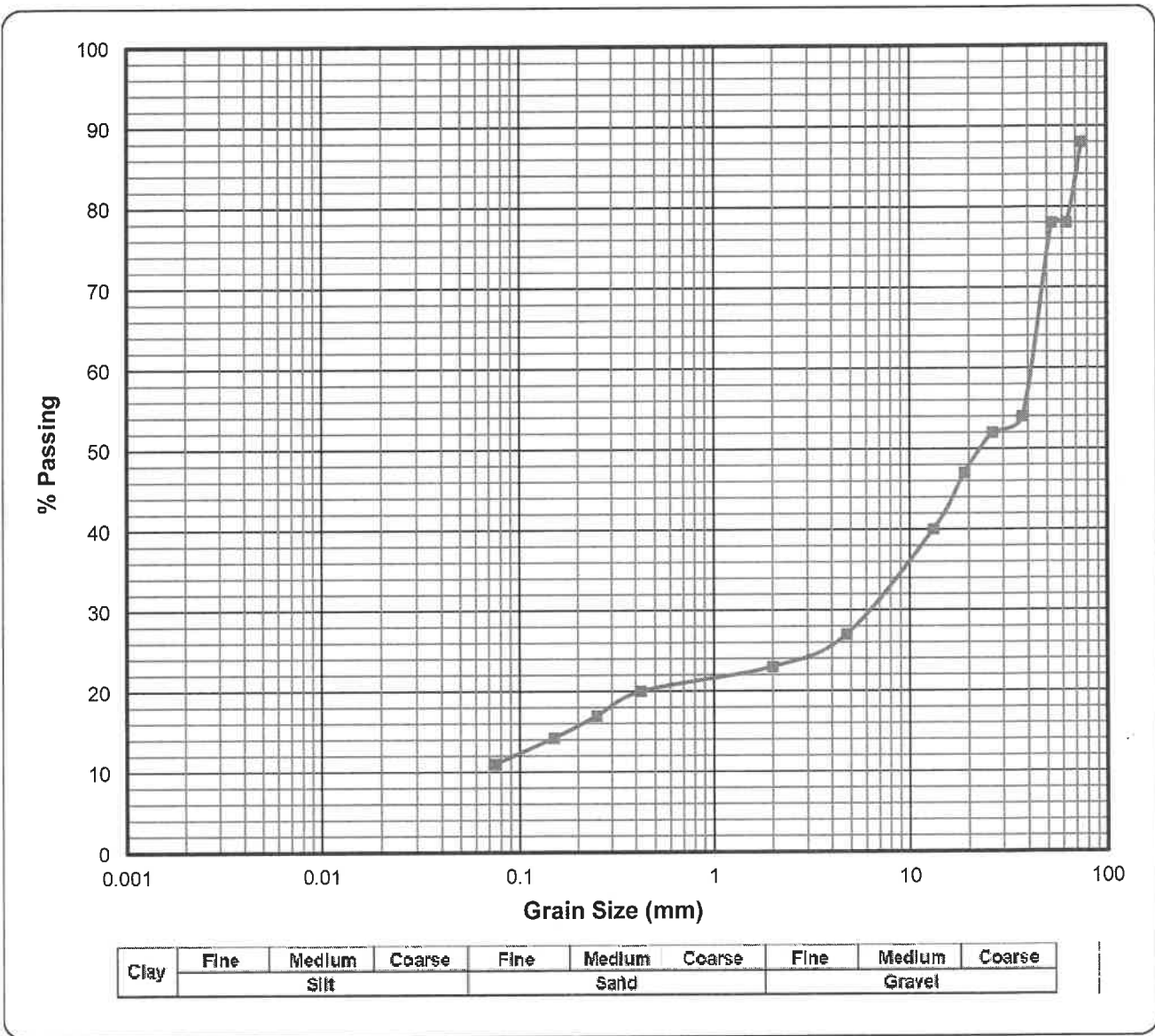
**Thick Red Line is the Grading Curve (TRH 14 Classification = G7)**

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	27%	36%	44%	51%	58%	65%	75%	77%	83%	89%	100%		

<b>LABORATORY:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091 P.O. Box 1461, Westville 3630 Mobile: +27(0)72 870 2621    Fax: 086 684 9785 Tel.: +27 (0)31 701 9732    email: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	Reg. No. : 92/03145/07	<b>HEAD OFFICE:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091, KwaZulu Natal, South Africa. Tel: +27 (0)31 266 0458    Fax: 086 689 5506 email: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a> <a href="http://www.geosure.co.za">www.geosure.co.za</a>
--	------------------------	--

<b>Client : Geosure (Pty) Ltd</b> <b>Project : Sundumbili Court</b> <b>Attention : Mr D. Naidoo</b>	<b>Your Ref No.: 269-16</b> <b>Our Ref No. : 26547</b> <b>Date Reported : 15/09/2016</b>
---	--

### Grading Curve for Sample 47880 – TMH1 Method A1 (a)



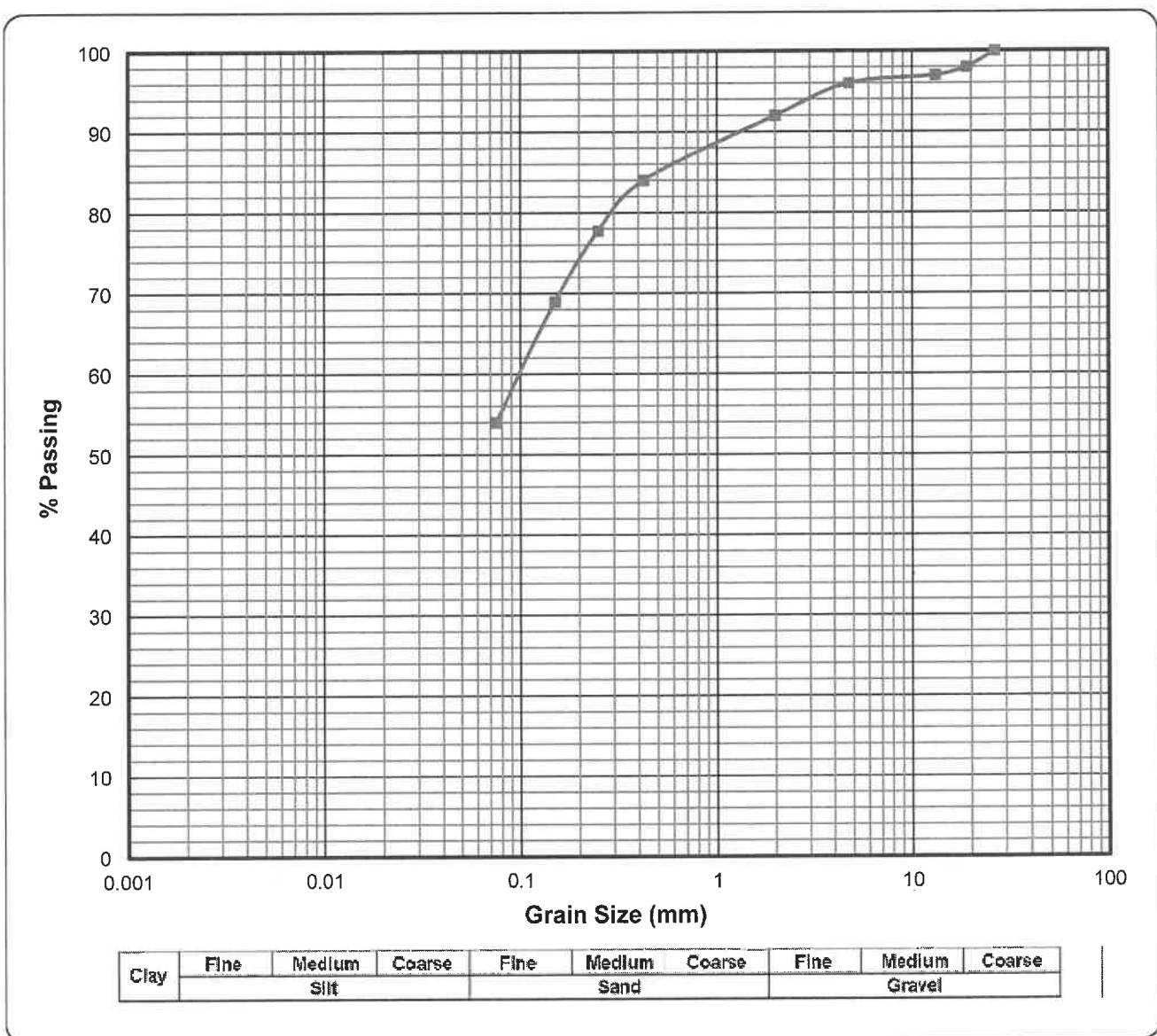
**Thick Red Line is the Grading Curve (TRH 14 Classification = G7)**

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	0	75
Percentage Passing	11%	14%	17%	20%	23%	27%	40%	47%	52%	54%	78%	0%	88%

<b>LABORATORY:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091 P.O. Box 1461, Westville 3630 Mobile: +27(0)72 870 2621      Fax: 086 684 9785 Tel.: +27 (0)31 701 9732      email: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	Reg. No. : 92/03145/07	<b>HEAD OFFICE:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091, KwaZulu Natal, South Africa. Tel: +27 (0)31 266 0458      Fax: 086 689 5506 email: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a> <a href="http://www.geosure.co.za">www.geosure.co.za</a>
--	------------------------	--

<b>Client : Geosure (Pty) Ltd</b> <b>Project : Sundumbili Court</b> <b>Attention : Mr D. Naidoo</b>	<b>Your Ref No.: 269-16</b> <b>Our Ref No. : 26547</b> <b>Date Reported : 15/09/2016</b>
---	--

### Grading Curve for Sample 47882 – TMH1 Method A1 (a)



**Thick Red Line is the Grading Curve (TRH 14 Classification = G8)**

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	13.2	19.0	26.5	37.5	53	63	75
Percentage Passing	54%	69%	78%	84%	92%	96%	97%	98%	100%				



**LABORATORY:**

122 Intersite Avenue, Umgeni Business Park, Durban, 4091  
 P.O. Box 1461, Westville 3630  
 Mobile: +27(0)72 870 2621  
 Tel.: +27 (0)31 701 9732

Reg. No. : 92/03145/07

122 Intersite Avenue, Umgeni Business Park, Durban, 4091

Fax: 086 684 9785

email: [lab@geosure.co.za](mailto:lab@geosure.co.za)

**HEAD OFFICE:**

122 Intersite Avenue, Umgeni Business Park,  
 Durban, 4091, KwaZulu Natal, South Africa.

Tel: +27 (0)31 266 0458 Fax: 086 689 5506

email: [geosure@iafrica.com](mailto:geosure@iafrica.com) [www.geosure.co.za](http://www.geosure.co.za)

**Client** : Geosure (Pty) Ltd  
**Project** : Sundumbili Court  
**Attention** : Mr D. Naidoo

**Your Ref No.** : 269-16  
**Our Ref No.** : 26547  
**Date Reported** : 15.09.2016

**Moisture/Density Relationship (TMH1: Method A7)**

Sample No. : 47879

Field No. : IP 1

Depth (m) : 0.4-1.2

Natural/Stabilised : Natural

Origin : Layer 2

Material Description : Dk.Gr.silty sandy clayey GRAVEL. Res. Tillite

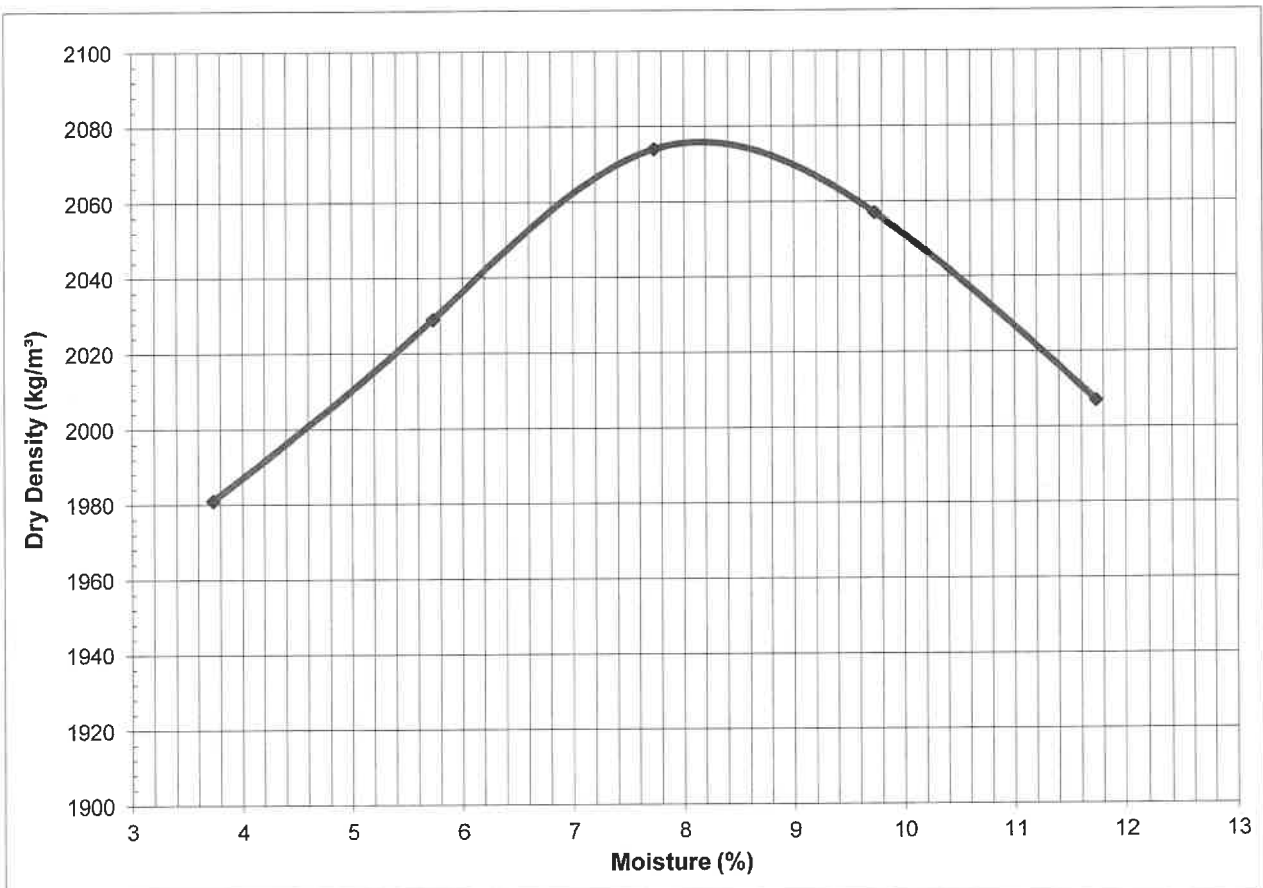
Compaction Effort : Mod AASHTO

**Maximum Dry Density (kg/m<sup>3</sup>)** 2076

**Optimum Moisture Content (%)** 8.1

Plotted Values:

Moisture (%)	3.7	5.7	7.7	9.7	11.7
Dry Density (kg/m <sup>3</sup> )	1981	2029	2074	2057	2007



**Remarks:** This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

<b>LABORATORY:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091 P.O. Box 1461, Westville 3630 Mobile: +27(0)72 870 2621 Tel.: +27 (0)31 701 9732	Reg. No.: 92/03145/07 Fax: 086 684 9785 email: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	<b>HEAD OFFICE:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091, KwaZulu Natal, South Africa. Tel: +27 (0)31 266 0458 Fax: 086 689 5506 email: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a> <a href="http://www.geosure.co.za">www.geosure.co.za</a>
--	---	---

<b>Client</b> : Geosure (Pty) Ltd <b>Project</b> : Sundumbili Court <b>Attention</b> : Mr D. Naidoo	<b>Your Ref No.</b> : 269-16 <b>Our Ref No.</b> : 26547 <b>Date Reported</b> : 15.09.2016
---	---

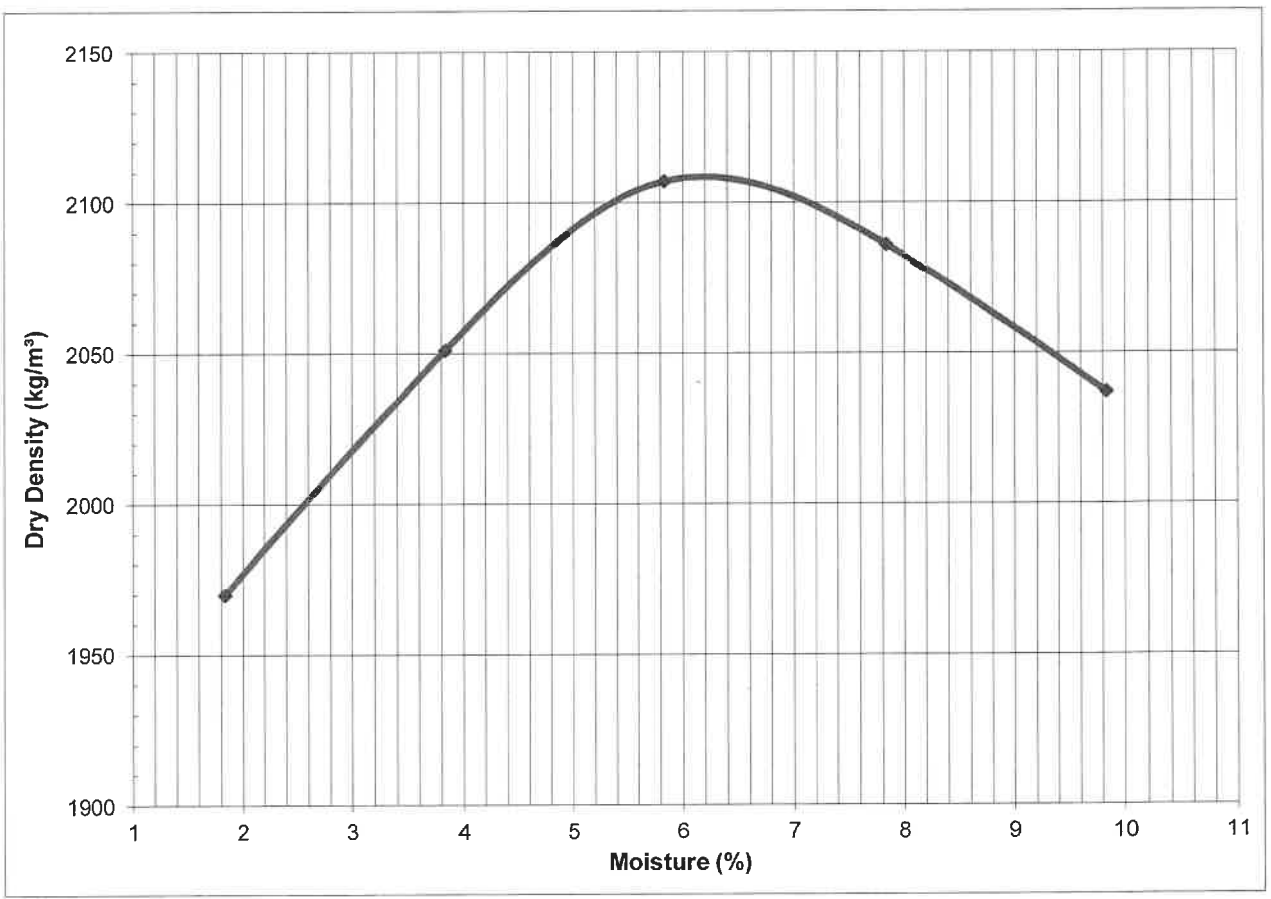
### Moisture/Density Relationship (TMH1: Method A7)

<b>Sample No.</b> : 47880  <b>Natural/Stabilised</b> : Natural <b>Material Description</b> : Lt.Yell.St.Rust.Br.Hi.Wth.very soft rock. TILLITE	<b>Field No.</b> : IP 2 <b>Depth (m)</b> : 1.1-1.4 <b>Origin</b> : Layer 3 <b>Compaction Effort</b> : Mod AASHTO
---	---

**Maximum Dry Density (kg/m<sup>3</sup>)**      2109                      **Optimum Moisture Content (%)**      6.2

Plotted Values:

Moisture (%)	1.8	3.8	5.8	7.8	9.8
Dry Density (kg/m <sup>3</sup> )	1970	2051	2107	2086	2037



**Remarks:** This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.



<b>LABORATORY:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091 P.O. Box 1461, Westville 3630 Mobile: +27(0)72 870 2621 Tel.: +27 (0)31 701 9732	Reg. No. : 92/03145/07 Fax: 086 684 9785 email: <a href="mailto:lab@geosure.co.za">lab@geosure.co.za</a>	<b>HEAD OFFICE:</b> 122 Intersite Avenue, Umgeni Business Park, Durban, 4091, KwaZulu Natal, South Africa. Tel: +27 (0)31 266 0458 Fax: 086 689 5506 email: <a href="mailto:geosure@iafrica.com">geosure@iafrica.com</a> <a href="http://www.geosure.co.za">www.geosure.co.za</a>
--	--	---

<b>Client</b> : Geosure (Pty) Ltd	<b>Your Ref No.</b> : 269-16
<b>Project</b> : Sundumbili Court	<b>Our Ref No.</b> : 26547
<b>Attention</b> : Mr D. Naidoo	<b>Date Reported</b> : 15.09.2016

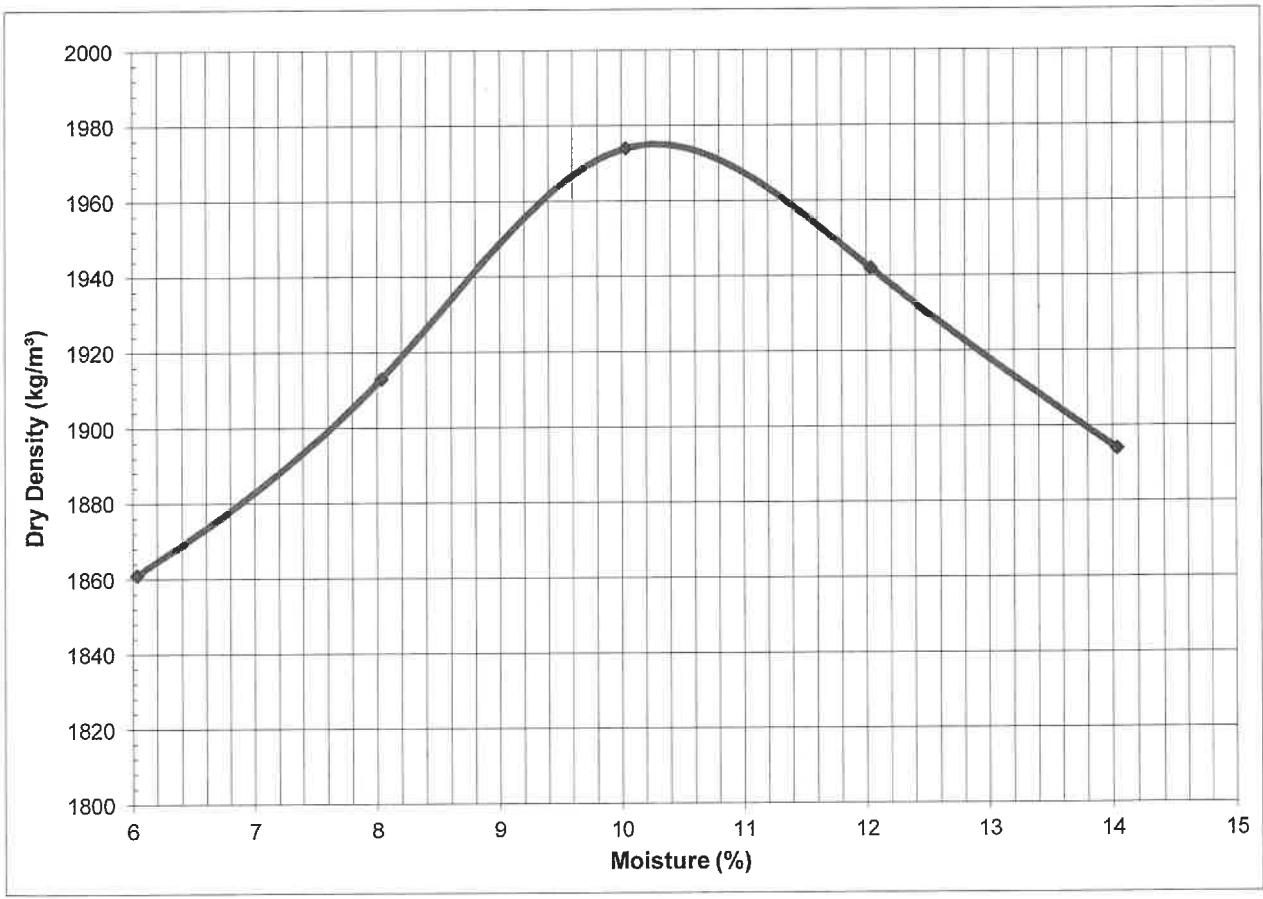
### Moisture/Density Relationship (TMH1: Method A7)

Sample No. : 47882	Field No. : IP 4
Natural/Stabilised : Natural	Depth (m) : 0.0-0.4
Material Description : Lt.Br.Gr. Gravelly sandy CLAY. Colluvium	Origin : Layer 1
	Compaction Effort : Mod AASHTO

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b> : 1975	<b>Optimum Moisture Content (%)</b> : 10.2
--	--

Plotted Values:

Moisture (%)	6.0	8.0	10.0	12.0	14.0
Dry Density (kg/m <sup>3</sup> )	1861	1913	1974	1942	1894



**Remarks:** This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

- Geotechnical Engineering Services
- Engineering Geology
- Environmental and Groundwater
- Pile Integrity Testing
- Civil & Geotechnical Engineering Laboratory
- Earthworks/Materials Supervision & Control
- Geotechnical Monitoring Systems
- Road Pavement Materials and Design
- Project Management

Ref: 30505

Date: 05.06.2017

Attention: Mr D. Naidoo

Re: Sundumbili Magistrates Court

Dear Sir,

Tabulated below are the results of the Unconfined Compressive Strength Tests conducted on various specimens as instructed by Mr D. Naidoo.

BH No.	Depth (m)	Strength (MPa)
BH 1	2.0	10.9
BH 1	5.7	16.3
BH 2	3.5	28.3
BH 2	4.2	14.7
BH 3	2.6	29.3
BH 3	5.5	22.1

We would like to take this opportunity to thank you for your continued support.  
Should you have any queries please do not hesitate to contact me.

Yours faithfully



**Technical Signatory,**  
**Bradley Hariram for Geosure (Pty) Ltd.**

This report may not be reproduced except in full, without written permission from Geosure (Pty) Ltd. While every care is taken to ensure the correctness of all tests and reports, neither Geosure (Pty) Ltd or its employees shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn there from or any consequence thereof. This report relates only to the sample/s tested.