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GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED YOUTH DEVELOMENT CENTRE AT MANDENI, KWAZULU-NATAL.

BD 1347/REV 01

30 JULY 2019

COMPILED BY:

THABO HLONGWANE
ENGINEERING GEOLOGIST

APPROVED BY:

BAZI DUKHAN , PR ENG
SENIOR GEOTECHNICAL ENGINEER

Report Summary Sheet

Client: **Delca Systems** **Attention:** **Mr. Simphiwe Mkhize**	**Client Contract No. N/A**
Title of Report: Geotechnical investigation report for the proposed youth development centre at Mandeni, KwaZulu-Natal.	
Summary: This report deals with the geotechnical assessment of the founding conditions for the proposed youth development centre at Mandeni.	
Keywords: Foundation Indicator Mod CBR Uncontrolled fill Colluvium	
Project Carried out By: Basdaeu Anirudh Dukhan, Pr Eng (Senior Geotechnical Engineer) Thabo Hlongwane (Engineering Geologist)	
BAZI DUKHAN CONSULTING ENG CC **Project No: BD1347**	Geotechnical assessment of the founding conditions for the proposed youth development centre at Mandeni.

Document Revision Record

Rev No.	Issue Date	Reason for Issue	Prepared By	Reviewed By
0	10/07/2019	Preliminary report	T.M Hlongwane	B.A Dukhan
1	30/07/2019	Final report	T.M Hlongwane	B.A Dukhan

Contents

1. INTRODUCTION AND TERMS OF REFERENCE

The report represents the findings of a preliminary geotechnical site investigation for the proposed youth development centre at Mandeni.

1.1 Preamble

Bazi Dukhan Consulting Engineers cc was appointed by Mr. Simphiwe Mkhize of Delca Systems to undertake a geotechnical investigation for the proposed youth development centre at Mandeni, KwaZulu-Natal. It is understood that all the envisaged structures on site will comprise of single storey prefabricated shipping containers.

1.2 Background

According to the architectural drawing that was provided, it is anticipated that the proposed development centre will consist of the following:

- Offices
- Access road and parking bays
- Educational centre
- General shops
- Food stalls
- Shisanyama
- Split units

1.3 Purpose

The geotechnical investigation was undertaken to ascertain the geological conditions that underlain the site and to identify geotechnical considerations that are needed for the design and construction of the proposed development. The geotechnical investigation will further assist in providing recommendations for the foundation, earthworks, drainage, pavement design and excavatibility.

1.4 Terms of references

(i) To give foundation recommendations for the proposed youth development centre.

(ii) To provide pavement design layerworks recommendations for access roads and parking bays.

(iii) To establish the nature and relevant engineering properties of soil and rock strata underlying the area.

(iv) To comment on any other geotechnical aspects on site.

2. INFORMATION SUPPLIED

A site layout plan of the proposed youth development centre was issued by Mr. Simphiwe Mkhize of Delca Systems. The issued architectural drawing was in a PDF format and it was sent electronically to the consultant. In addition, Mr. Mkhize provided a programme of anticipated work to be undertaken by the consultant during the site investigation. The programme was sent via email by Mr. Mkhize.

In addition to the above supplied information, the following information was utilised for the purpose of the geotechnical investigation.

- The 1:250 000 Geological Map of Durban (2930), compiled by the South African Geological Survey 1988.
- Google Earth imagery of the site (2019).

3. SITE DESCRIPTION

3.1 Location

The study area is located at Mandeni, KwaZulu-Natal. The site may be located using the following central coordinates 29°08'32.45"S and 31°24'11.92"E. The proposed site is approximately 70m west of Mandeni Mall (Figure 1).

Figure 1: Aerial view of the site.

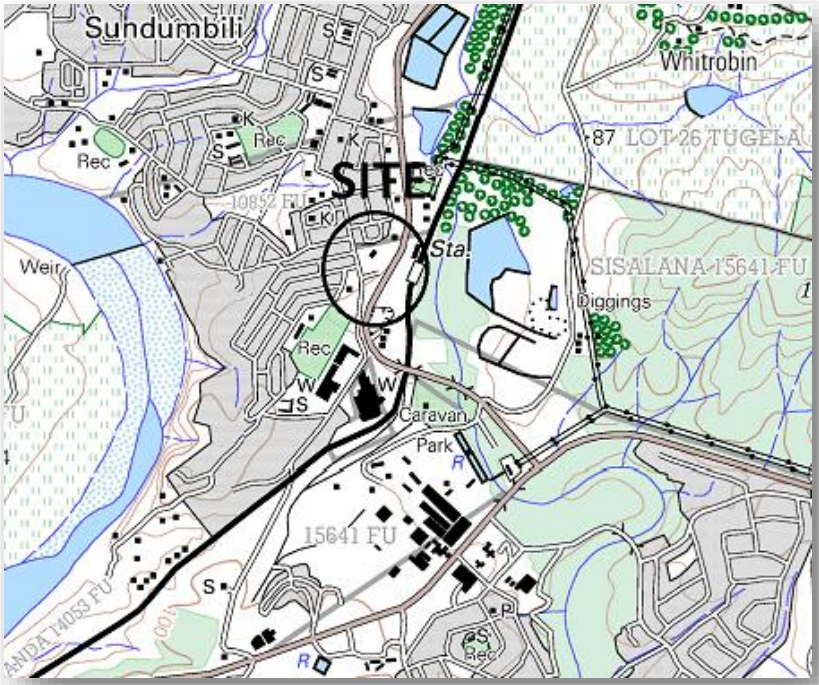

Figure 2: Topographical map of the site.

Figure 2 above shows a topographical map of Mandeni. As shown on the topographical map there are no waterbodies that intercept the site. Tugela River is approximately 1.5km on the western flank of the site. According to the topographical map there is a perennial stream on the eastern boundary of the site.

3.2 Existing Structures

At the time of the investigation, there were no existing structures on site. A marker post showing an existing Transnet pipe line was noted on the eastern flank of the site.

Figure 3: Site at the time of the investigation.

4. FIELDWORK

Field work associated with this investigation was carried out on the 27th of June 2019. All the geotechnical information considered necessary to assess the stability of the site in terms of the proposed development was recorded in Drawing No BD-1347-GE-001-R-00 and the profiles as revealed in the inspection pits, was logged by a Professional Senior Geotechnical Engineer and an Engineering Geologist using the “Guidelines for Soil and Rock Logging in South Africa”, (2001)”.

4.1 Test Pitting

A total of Five (5) test pits, designated TP1 – TP5 were excavated on site using hand tools, in order to identify the subsoil the nature of the prevailing subsoil with depth for the proposed development. The test pits were excavated down to a maximum depth of 1.30m below Existing Ground Level (EGL) (TP1). The subsoil as revealed by the inspection pits are included in Appendix B of the report.

4.2 Dynamic Penetrometer Light (DPL) Tests

A total of Five (5) Dynamic Penetrometer Light (DPL) tests were undertaken adjacent to the test pits. The results of the DPL tests were used to evaluate the consistency of the underlying material and the depth of refusal on the underlying material. The DPL tests across the site provided information on the in situ relative densities of the subsoil down to a maximum depth of 2.1m below EGL. At each test position, the GPS coordinates of the positions were recorded. The results are summarised and included in Appendix B and C at the end of this report. The test positions are shown on Drawing No BD-1347-GE-001-R-00 in Appendix A.

It must be noted that, it is not possible to recover the subsoil material from the DPL's rods. It is also not possible to know precisely what material the DPL rod refused on e.g. refusal on bedrock, obstruction or very stiff/very dense subsoil material. The actual depth to bedrock was not encountered on site.

5. GEOLOGY AND SUBSOILS

From a study of the Geological maps available for the area, it was found that the area is underlain by Diamictite; subordinates varved shale and boulder shale. A Geological Map of the area (Durban 2930 1:250 000) is included in Appendix A: Drawing No. BD-1347-GE-002-R-00.

The prevailing subsoil strata that underlie site at shallow depths are shown in Appendix B of this report in the form of test pit logs. The material encountered on site during the site investigation comprises uncontrolled fill, colluvium, pebble marker and residual tillite.

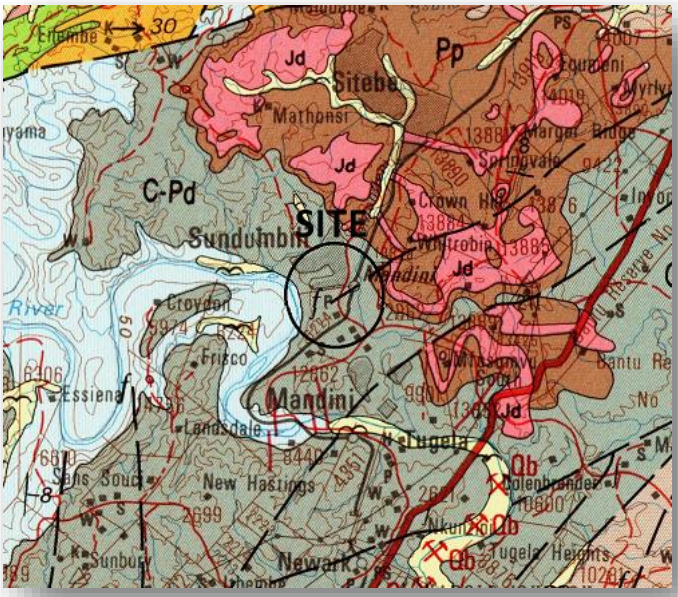

Figure 4: Regional geology of Mandeni.

Uncontrolled Fill

Fill material was noted in the upper profile of TP1, TP3, TP4 and TP5. It was noted that the layer of uncontrolled fill extended from ground level down to a maximum depth of 0.90m (TP4). In general the horizon was described as moist, brown mottled yellowish orange, dense, silty SAND with rootlets, plastic, cloth and builder's rubble.

Figure 5: Fill retrieved from a test pit.

Colluvium

A layer of colluvium was noted in the upper soil profile in TP1 – TP3, this layer was described as moist, dark brown, medium dense, silty SAND with rootlets. The layer was noted from a minimum depth of 0.0 m down to a maximum depth of 0.90m.

Figure 6: Typical test pit showing subsoil profile.

Figure 6 above shows the various soil horizons encountered on site. The layer of residual tillite is overlain by a pebble marker horizon, and the pebble marker horizon layer is overlain by a layer of colluvium material.

Pebble Marker

A layer of pebble marker was noted in TP2 and TP4, the layer extended between from a minimum depth of 0.60m down to a maximum depth of 1.30m. This layer was described as abundant (>50%) angular to subangular gravel tightly compacted in a matrix of moist, brown, loose, silty SAND. The layer of pebble marker indicates the transition between residual and transported material.

Residual Tillite

A layer of residual tillite was noted at the base of TP1, TP2 and TP5. The layer extended from 0.45m down to 1.20m below existing ground level. This layer was typically described as very moist, orange stained black, medium dense, slightly clayey SAND.

6. GROUNDWATER

No groundwater seepage was noted at the time of the investigation in the test pits. A perched water table is anticipated during rainy seasons.

7. LABORATORY TESTS

A total of Five (5) disturbed samples were retrieved for laboratory testing. The samples were subjected to MOD CBR testing to determine the efficiency of the material for use in the construction of roads and or platforms on site. The foundation indicator test was undertaken in order to determine the Atterberg limits and potential expansiveness of the clay.

7.1 Foundation Indicator Test

A total of Two (2) disturbed soil samples were retrieved on site for laboratory testing and subjected to foundation indicator testing (as per TMH1 test methods A2 to A4). These samples were considered to be representative of the material on site. In-situ soils usually consist of a mixture of various grain sizes; therefore, soils are usually classified in terms of their proportions of gravel, sand, silt and clay.

The most widely used classification system for geotechnical engineering purposes is the Unified Soil Classification System (USCS). The material types in the upper soil profile were very similar and variations occurred mostly in colour.

Table 1: Summary of Foundation Indicator Test Results

Test Pit	Depth (m)	Description	Particle size (%)				Atterberg Limits %				GM	Potential Expansiveness	Unified Classification	U.S. Highway Classification
			Clay	Silt	Sand	Gravel	LL	PI	LS	WPI				
TP1	0.9 – 1.2	Dark grey speckled orange reddish olive, dark brown CLAY, Ferricrete	12.4	25.6	25.9	36.1	50	20	10	10.5	1.46	L	ML	A – 7 - 6
TP2	0.9 – 1.2	Yellow dark brown speckled orange clayey SAND, Residual Tillite	8.0	30.0	45.0	17.0	30	13	6	8.7	1.12	L	CL-ML	A - 6

Where:

ML: Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity.

CL: Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.

L: Low Potential Expansion

GM: Grading Modulus.

LL: Liquid Limit.

PI: Plasticity Index.

LS: Linear Shrinkage.

Table 1 above show the following:

According to the Unified Soil Classification System (USCS), the soil generally classifies as ML and CL, i.e. inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity and Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.

The samples were retrieved from site and were taken to the laboratory for analysis. The laboratory results show that the materials are primarily composed of sand, silt, gravel and clay.

The Equivalent PI for TP1 is 20, while the Equivalent PI for TP2 is 13. The former plot in medium and the latter in the low potential expansion region of the Van Der Merwe's chart. In general, an Equivalent PI greater than 13 implies that the soil may be subjected to heave. Therefore, the soil materials that were subjected to laboratory testing have low to medium potential expansion.

7.2 Compaction Test

A total of Three (3) samples were retrieved from TP1, TP2 and TP5 for MOD CBR testing. The maximum dry density and the optimum moisture content were determined. The samples were classified in accordance with the TRH 14 guidelines.

TP1 (0.50 – 0.9m) is dark brown slightly clayey fine SAND and Ferricrete, with a CBR strength of 8 at 95% Mod AASHTO density and classifies as G10 material in accordance with the TRH 14 Guidelines. The maximum dry density is 2099kg/m^3 while the optimum moisture content is 7.7%. TP2 (0.9 – 1.2) is yellowish dark brown speckled orange clayey

SAND and residual tillite, with a CBR strength of 4 at 95% Mod AASHTO density and classifies as worse than G10 material in accordance with the TRH 14 Guidelines. The maximum dry density is 1809kg/m^3 while the optimum moisture content is 11.1%.TP5 (0.5 – 1.0) is light olive dark brown speckled orange clayey SAND and weathered tillite, with a CBR strength of 7 at 95% Mod AASHTO density and classifies as G10 material in accordance to TRH 14 Guidelines. The maximum dry density is 1989kg/m^3 and the optimum moisture content is 11.1%.

The material is considered unsuitable for use in the construction of platforms and the upper layerworks. The platforms requires a material of G7 quality. The subbase layer requires a material of G5 quality or C4. The base material for the access road should be at least a G2 material. The platform, base and subbase material should also be obtained from a commercial source.

The Access Roads and parking lot will be asphalted. The Layerworks suggested for light vehicle loads is as follows:
30 mm Continuously graded Asphalt.
125 mm (base) G2 natural Gravel compacted to 98% Mod AASHTO dry density.
150 mm G5 (subbase) natural Gravel compacted to 95% Mod AASHTO dry density.
300 mm G7 (selected layer) natural Gravel compacted to 93% Mod AASHTO dry density.
Rip and Recompact in-situ G10 subgrade to 93% Mod AASTO dry density.

The brick paved areas should be assessed based on the anticipated loadings. A 60mm paving will normally be adequate followed by 20mm bedding sand placed over a stabilised C3 layer/ G5 natural Gravel. A G7 natural gravel layer should be adopted.

Table 2: Summary of Compaction Test Results

Test Pit	Depth (m)	Description	OMC (%)	Swell (%)	MDD (kg/m^3)	CBR at various densities						TRH 14
						90%	93%	95%	97%	98%	100%	
TP1	0.5 – 0.9	Dark brown slightly clayey SAND and Ferricrete	7.7	1.08	2099	3	5	8	11	14	20	G10
TP2	0.9 – 1.2	Yellowish dark brown speckled orange clayey SAND and Residual Tillite	11.1	0.15	1809	1	2	4	5	6	9	Worse than G10
TP5	0.5 – 1.0	Light olive dark greyish brown clayey sand and weathered Tillite and Ferricrete	11.1	0.31	1989	5	6	7	8	9	11	G10

8. DISCUSSIONS

8.1 Excavatibility

The upper soil profile is considered SOFT according to the latest SANS 1200 DA classification, this means it can easily be removed by a tractor loader backhoe (TLB) of flywheel power approximately 0.10 kW per mm of tined bucket width.

In areas where dense to very dense or stiff to very stiff residual tillite was encountered, INTERMEDIATE excavation is anticipated, this means that material can be removed by a back-acting excavator having a fly wheel power greater than 0.10kW for each mm of tined-bucket width or with the use of pneumatic tools before removal by a machine capable of removing soft material.

8.2 Drainage and Stormwater Disposal

Stormwater should be collected and piped off site. If this is not feasible, all stormwater should be channelled away from all the structures and building terraces, to discharge in a carefully controlled manner by means of surface spreaders/headwalls. This will be to Engineer's detail. A detailed stormwater management plan should be produced for the site.

Certain measures can be adopted to minimise the likelihood of collapse settlement; the most important being the minimization of water infiltration into the soil around the foundations. Profiling of the ground to load surface water away from the building and foundations will assist in this regard, as will paving the surrounding area.

Careful detailing of water service pipes should also be carried out to minimise the possibility of leakage. Furthermore, the water from stormwater downpipes must be collected and led away, and under no circumstances should it be allowed to discharge onto the ground near the foundations.

9. SITE CLASSIFICATION

In terms of SANS 10400 – H (2012, Edition 3) Clause 4.2.1, Table 1, page 11, the Site Class Designation is S1/P.

10. FOUNDING RECOMMENDATIONS

Based on geotechnical investigation report that was undertaken on the 27th of July 2019, it is recommended that that the proposed prefabricated containers that comprises of single storey structures be supported on pad footing foundations with concrete column stubs. The square pad footings should be at least 1.0x1.0m and 0.40m thick.

Field tests indicate that, competent founding depth is at approximately 1.5m below existing ground level. The founding depth should be between 1.3m – 1.5m from existing ground level excluding cut to fill, on soft rock Tillite bedrock with estimated allowable bearing pressure of 120 – 150 kPa. The pad footings should be reinforced both top and bottom (Y12 or as specified by the structural engineer) with Y10 links spaced according to Structural Engineer's specification.

If the inferred competent founding depth is deeper than 1.5m, it is recommended that the square pad footings should be founded on improved soil by adopting the following measures:

- The subsoil material should be removed to a depth of 1.5m below existing ground level. The lower 0.50m of the excavation should be replaced with an inert granular soil such as G5 and be compacted in 100mm layers to 95% Mod A.A.S.T.O maximum dry density.

Alternatively, a slab on the ground option may be adopted. This is designed as a lightly loaded raft foundation to support the container structure. The bearing pressure should be restricted to 50kPa for design of the raft foundations.

The findings detailed in this report are for a Shallow Geotechnical investigation and as such it is not recommended for providing design information during construction for piling. In the event that piling is required a deep subsoil investigation is required, preferably the drilling of boreholes to prove bedrock. The recommendations provided in this report is for shallow investigation. The depth to competent rock has not been proved for founding of piles.

11. CONCLUSIONS

A total of Five (5) Dynamic Penetrometer Light (DPL) tests were undertaken adjacent to the test pits. The results of the DPL tests were used to evaluate the consistency of the underlying material and the depth of refusal on the underlying material. The DPL tests across the site provided information on the in situ relative densities of the subsoil down to a maximum depth of 2.1m below EGL.

The upper soil profile is considered SOFT according to the latest SANS 1200 DA classification, this means it can easily be removed by a tractor loader backhoe (TLB) of flywheel power approximately 0.10 kW per mm of tined bucket width.

In terms of SANS 10400 – H (2012, Edition 3) Clause 4.2.1, Table 1, page 11, the Site Class Designation is S1/P.

Field tests indicate that, competent founding depth is at approximately 1.5m below existing ground level. The founding depth should be between 1.3 – 1.5m from existing ground level excluding cut to fill, on residual tillite with estimated allowable bearing pressure of 120 - 150kPa. The pad footings should be reinforced both top and bottom (Y12 or as specified by the structural engineer) with Y10 links spaced according to Structural Engineer's specification. The square pad footings should be at least 1.0x1.0m and 0.40m thick.

If the inferred competent founding depth is deeper than 1.5m, it is recommended that the square pad footings should be founded on improved soil by adopting the following measures:

- The subsoil material should be removed to a depth of 1.5m below existing ground level. The lower 0.50m of the excavation should be replaced with an inert granular soil such as G5 and be compacted in 100mm layers to 95% Mod A.A.S.T.O maximum dry density.

Alternatively, a slab on the ground option may be adopted. This is designed as a lightly loaded raft foundation to support the container structure. The bearing pressure should be restricted to 50kPa for design of the raft foundations.

12. REPORT PROVISIONS

This investigation is aimed at providing the engineers with an indication of the prevailing engineering geological conditions in the study area, with reference to proposed single storey prefabricated containers, KwaZulu-Natal.

While every effort has been made during the field-work phase of this investigation to identify the various soil and rock horizons, problems and distribution, it is impossible to guarantee that isolated zones of varying material have not been missed. The investigation was, however, thorough and conditions are not expected to vary a great deal from those described in this report.

The engineers are, nevertheless, strongly urged to inspect all excavations to assure themselves that conditions are not at variance with those described in this report. Disparities in sub-soil conditions should be referred to an expert.

Warning:

- Test pits were backfilled after the field investigation but were not re-compacted.
- Test pits positions could be surveyed in to record their exact positions.
- Test pits positions occur within the footprints of proposed structures and pavement areas.
-

13. REFERENCES

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APPENDIX A:

TEST POSITIONS – BD-1347-GE-001-R-00

GEOLOGICAL MAP – BD-1347-GE-002-R-00

REV	DATE	DRAWN	CHECKED	DESCRIPTION

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PROJECT

MANDENI YOUTH DEVELOPMENT CENTRE
MANDENI
KWAZULU-NATAL

DRAWING

TEST POSITIONS

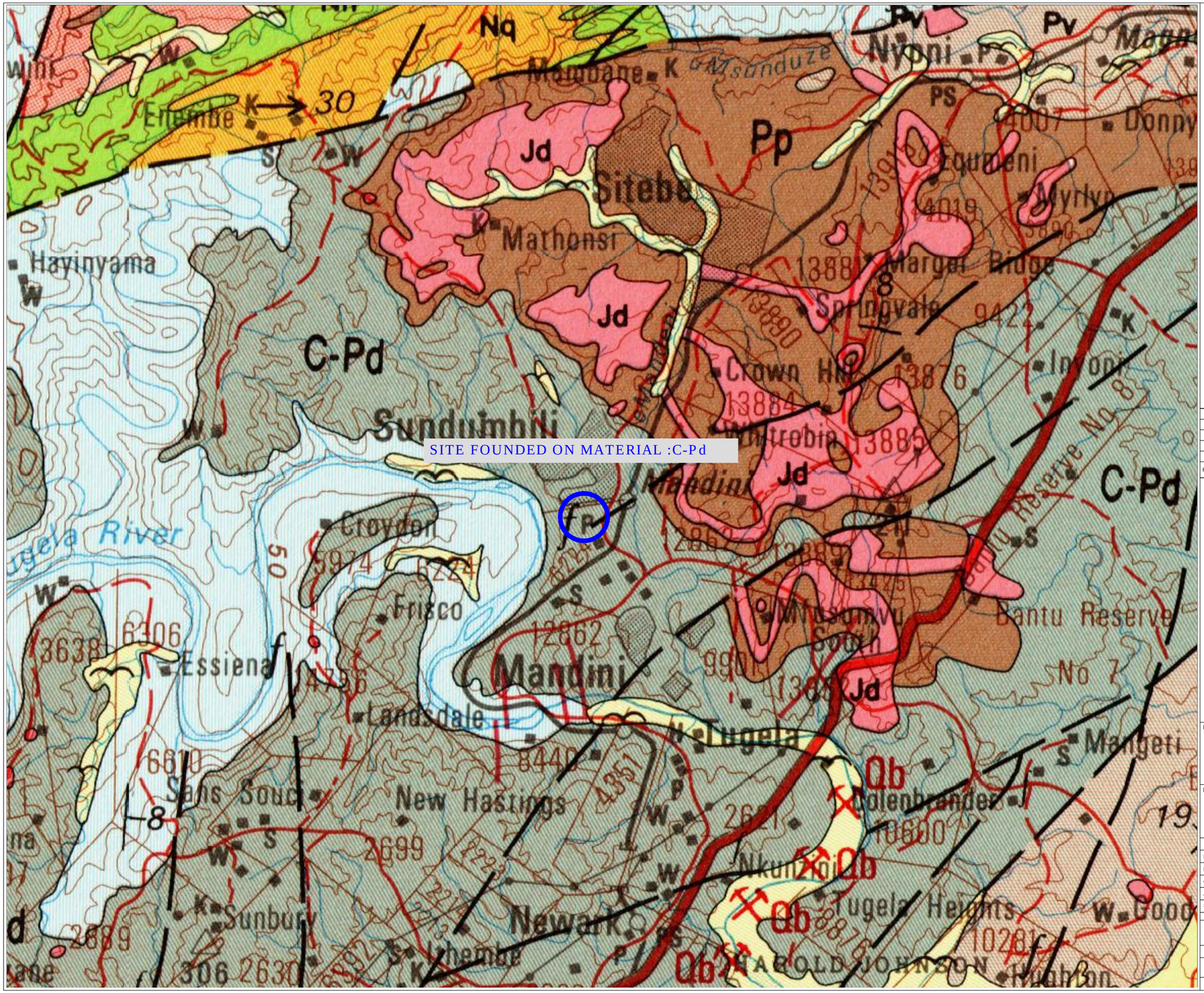
	RESPONSIBLE PERSON		DATE
DESIGNED	B.DUKHAN	Pr. Eng: 20070210	
DRAWN	T.M.HLONGWANE		
CHECKED	B.DUKHAN	Pr. Eng: 20070210	
APPROVED	B.DUKHAN	Pr. Eng: 20070210	
SCALE	NTS	SHEET SIZE	A3

PROJECT NUMBER DRAWING NUMBER STATUS REVISION

BD-1347-GE-001-R-00

DRAWING STATUS CODES :

R = REPORT
D = DRAFT
T = TENDER
P = PRELIMINARY
C = CONSTRUCTION
A = AS BUILT



REV	DATE	DRAWN	CHECKED	DESCRIPTION

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PROJECT

MANDENI YOUTH DEVELOPMENT CENTRE
MANDENI
KWAZULU-NATAL

DRAWING

GEOLOGICAL MAP

	RESPONSIBLE PERSON		DATE
DESIGNED	B.DUKHAN	Pr. Eng: 20070210	
DRAWN	TM.HLONGWANE		
CHECKED	B.DUKHAN	Pr. Eng: 20070210	
APPROVED	B.DUKHAN	Pr. Eng: 20070210	
SCALE	NTS	SHEET SIZE	A3

PROJECT NUMBER	DRAWING NUMBER	STATUS	REVISION
BD-1347-GE-002-R-00			

DRAWING STATUS CODES :

R = REPORT
D = DRAFT
T = TENDER
P = PRELIMINARY
C = CONSTRUCTION
A = AS BUILT

APPENDIX B:

INSPECTION PIT LOGS

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Email: bazi@bazidukhan.co.za

Delca Systems
Mandeni Youth Development Centre

HOLE No: TP 01
Sheet 1 of 1

JOB NUMBER: BD 1347

Scale 1:10

0.00 Moist, mustard brown, dense, clayey SAND with builder's rubble. **FILL**.

0.80 Very moist,dark brown, loose, silty SAND. **Colluvium**.

0.90 Very moist, olive grey, firm, shattered, gravelly CLAY. **Residual Tillite**.

1.20

NOTES

1) F.I sample taken @ 0.9m-1.20m.

2) MOD CBR sample taken @ 0.5m-0.9m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : T.M. Hlongwane

TYPE SET BY : A.A. Hurribunce
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : 27 June 2019
DATE : 27 June 2019

DATE : 10/07/2019 08:29
TEXT : ..RTHEREPORT\LOGS\LOGS.TXT

ELEVATION :
X-COORD : 29° 08' 34.48"S
Y-COORD : 31° 24' 11.33"E

HOLE No: TP 01

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Delca Systems
Mandeni Youth Development Centre

HOLE No: TP 02
Sheet 1 of 1

JOB NUMBER: BD 1347

Scale 1:10

0.00 Moist, dark brown, medium dense, silty SAND with rootlets. **Colluvium**.

0.60 Abundantly (>50%) sub-angular gravel, tightly compacted in matrix of loose, silty SAND. **Pebble Marker**.

0.80 Very moist, orange stained black, medium dense, silty, clayey SAND. **Residual Tillite**.

1.20

NOTES

1) MOD CBR sample taken @ 0.8m-1.20m.

2) F.I sample taken @ 0.9m-1.20m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : T.M. Hlongwane

TYPE SET BY : A.A. Hurribunce
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : 27 June 2019
DATE : 27 June 2019

DATE : 10/07/2019 08:29
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X-COORD : 29° 08' 33.49"S
Y-COORD : 31° 24' 12.08"E

HOLE No: TP 02

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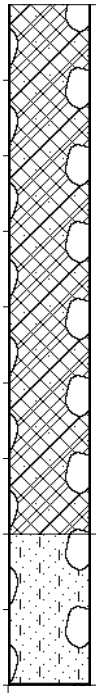
Delca Systems
Mandeni Youth Development Centre

HOLE No: TP 03
Sheet 1 of 1

JOB NUMBER: BD 1347

Scale 1:10



0.00

Slightly moist, mustard mottled brown, stiff, slightly sandy CLAY with occasional boulders. **Fill**.

0.70

Slightly moist, dark brown, medium dense, silty SAND with occasional boulders. **Colluvium**.

0.90

NOTES

1) Hand auger at 0.7m-0.9m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : T.M. Hlongwane

TYPE SET BY : A.A. Hurribunce
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : 27 June 2019
DATE : 27 June 2019

DATE : 10/07/2019 08:29
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ELEVATION :
X-COORD : 29° 08' 32.02"S
Y-COORD : 31° 24' 11.31"E

HOLE No: TP 03

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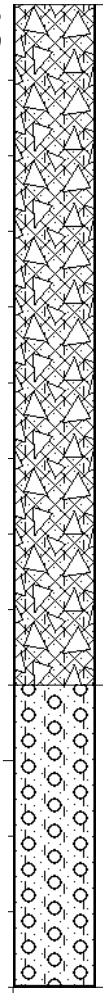
Delca Systems
Mandeni Youth Development Centre

HOLE No: TP 04
Sheet 1 of 1

JOB NUMBER: BD 1347

Scale 1:10



0.00 Moist, brown mottled, yellowish orange, dense, silty SAND with rootlets, plastic, fabric, builders rubble. **Fill**.

F.I

0.90 Abundantly (>50%) sub-angular gravel, tightly compacted in a matrix of moist, dark brown, loose, silty SAND. **Pebble Marker**.

1.30

NOTES

1) Hand auger at 0.9m-1.30m.

2) F.I sample taken @ 0.9m-1.30m

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : T.M. Hlongwane
TYPE SET BY : A.A. Hurribunce
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : 27 June 2019
DATE : 27 June 2019
DATE : 10/07/2019 08:29
TEXT : ..RTHEREPORT\LOGS\LOGS.TXT

ELEVATION :
X-COORD : 29° 08' 32.01"S
Y-COORD : 31° 24' 12.43"E

HOLE No: TP 04

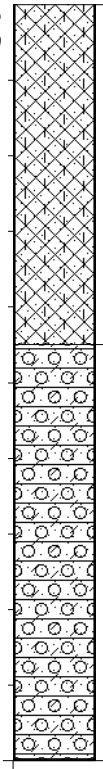
P.O Box 37612, Overport 4067
Tel: (031) 209 3900
Fax: (031) 309 8742
Email: bazi@bazidukhan.co.za

Delca Systems
Mandeni Youth Development Centre

HOLE No: TP 05
Sheet 1 of 1

JOB NUMBER: BD 1347

Scale 1:10



0.00 Moist, brown mottled mustard, dense, silty SAND with rootlets. **Fill**.

0.45

MOD

Moist, mustard, dense, clayey SAND. **Residual Tillite**.

F.I

1.00

NOTES

1) MOD CBR sample taken @ 0.5m-1.0m

2) F.I sample taken @ 0.8m-1.00m

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : T.M. Hlongwane

TYPE SET BY : A.A. Hurribunce
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : 27 June 2019
DATE : 27 June 2019

DATE : 10/07/2019 08:29
TEXT : ..RTHEREPORT\LOGS\LOGS.TXT

ELEVATION :
X-COORD : 29° 08' 31.01"S
Y-COORD : 31° 24' 11.80"E

HOLE No: TP 05

P.O Box 37612, Overport 4067
Tel: (031) 209 3900
Fax: (031) 309 8742
Email: bazi@bazidukhan.co.za

Delca Systems
Mandeni Youth Development Centre

LEGEND
Sheet 1 of 1

JOB NUMBER: BD 1347

	OCCASIONAL BOULDERS	{SA48}
	GRAVEL	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	TILLITE	{SA10}
	RUBBLE	{SA31}
	FILL	{SA32}
	DISTURBED SAMPLE	{SA38}

Name

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : A.A. Hurribunce
SETUP FILE : STANDARD.SET

DATE : 10/07/2019 08:29
TEXT : ..RTHEREPORT\LOGS\LOGS.TXT

LEGEND
SUMMARY OF SYMBOLS

APPENDIX C:

DYNAMIC PENETROMETER LIGHT (DPL) TESTS

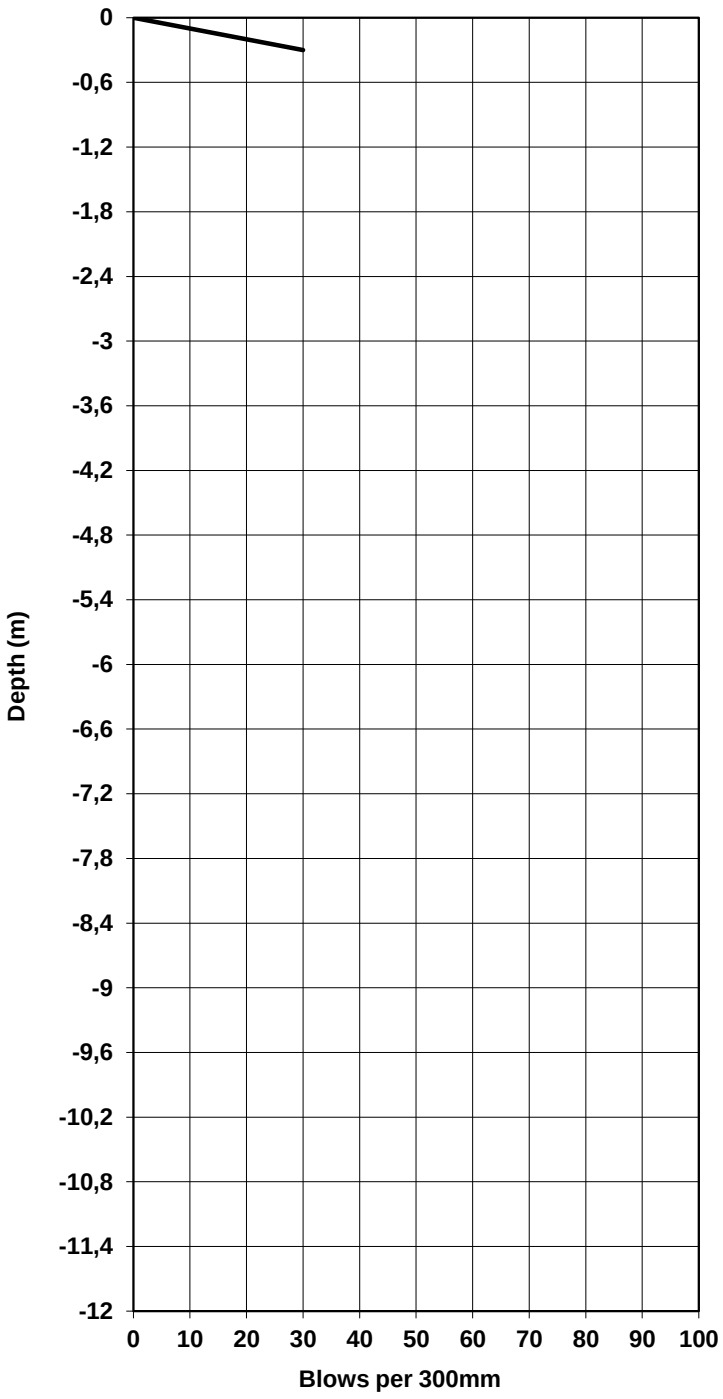
Client:	Delca Systems	Ref.No.:	BD 1347
Project:	**Mandeni Youth Development Centre**	Date:	27-Jun-2019
Section:		Operator:	THABO

Light Dynamic Penetrometer Probe (DPL) ***Test No. DPL 1***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angel
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency	Insitu Shear Strength
0	0		
0,3	30	Med.Dense	34 deg
0,6	R		
0,9			
1,2			
1,5			
1,8			
2,1			
2,4			
2,7			
3			
3,3			
3,6			
3,9			
4,2			
4,5			
4,8			
5,1			
5,4			
5,7			
6			
6,3			
6,6			
6,9			
7,2			
7,5			
7,8			
8,1			
8,4			
8,7			
9			
9,3			
9,6			
9,9			
10,2			
10,5			
10,8			
11,1			
11,4			
11,7			
12			



BAZI DUKHAN CONSULTING ENGINEERS cc
45 Swapo Road
Durban North
Phone 031 563 2106 / 083 231 8561
bazi@bazidukhan.co.za

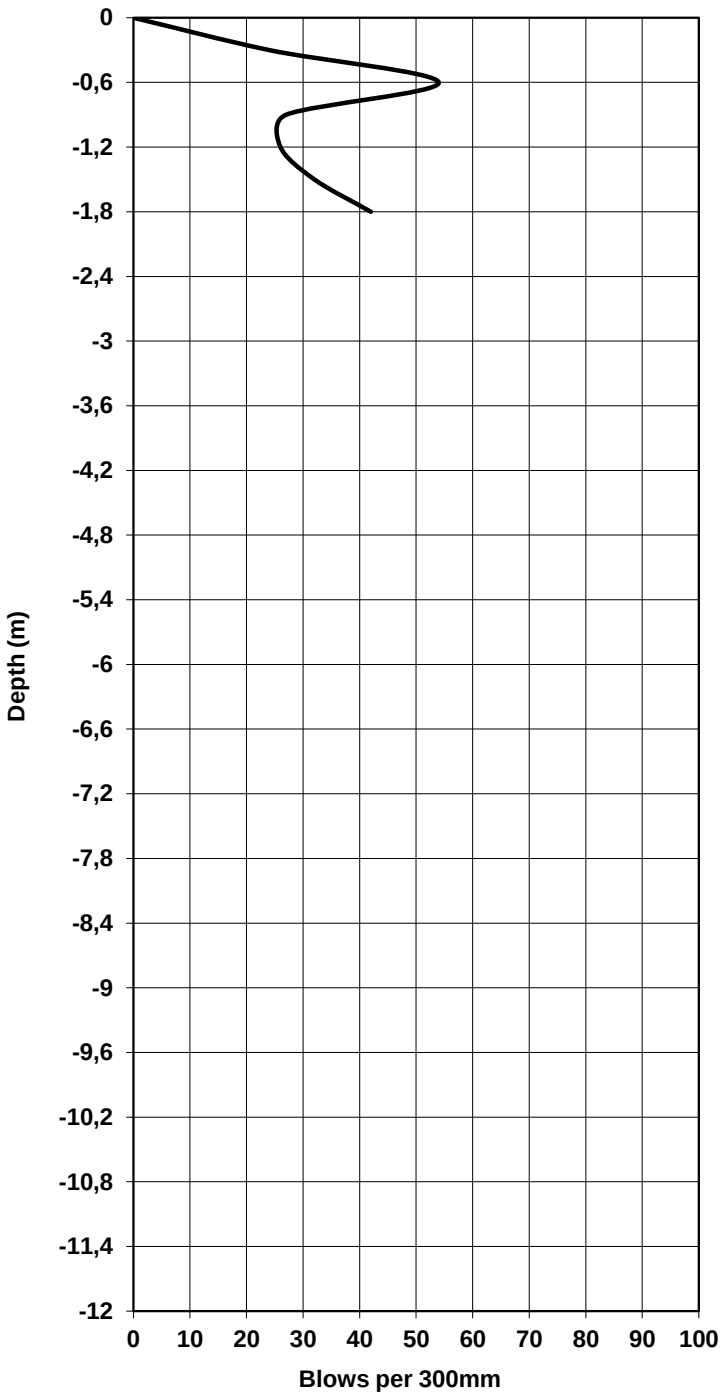
Client:	Delca Systems	Ref.No.:	BD 1347
Project:	**Mandeni Youth Development Centre**	Date:	27-Jun-2019
Section:		Operator:	THABO

Light Dynamic Penetrometer Probe (DPL) **Test No. DPL 2**

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angel
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency	Insitu Shear Strength
0	0		
0,3	24	Med.Dense	33 deg
0,6	54	Dense	37 deg
0,9	27	Med.Dense	34 deg
1,2	26	Med.Dense	34 deg
1,5	32	Med.Dense	35 deg
1,8	42	Dense	36 deg
2,1	R		
2,4			
2,7			
3			
3,3			
3,6			
3,9			
4,2			
4,5			
4,8			
5,1			
5,4			
5,7			
6			
6,3			
6,6			
6,9			
7,2			
7,5			
7,8			
8,1			
8,4			
8,7			
9			
9,3			
9,6			
9,9			
10,2			
10,5			
10,8			
11,1			
11,4			
11,7			
12			



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Client:	Delca Systems		Ref.No.: BD 1347
Project:	**Mandeni Youth Development Centre**		Date: 27-Jun-2019
Section:			Operator: THABO

Light Dynamic Penetrometer Probe (DPL) ***Test No. DPL 3***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angel
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency	Insitu Shear Strength
0	0		
0,3	33	Med.Dense	35 deg
0,6	R		
0,9			
1,2			
1,5			
1,8			
2,1			
2,4			
2,7			
3			
3,3			
3,6			
3,9			
4,2			
4,5			
4,8			
5,1			
5,4			
5,7			
6			
6,3			
6,6			
6,9			
7,2			
7,5			
7,8			
8,1			
8,4			
8,7			
9			
9,3			
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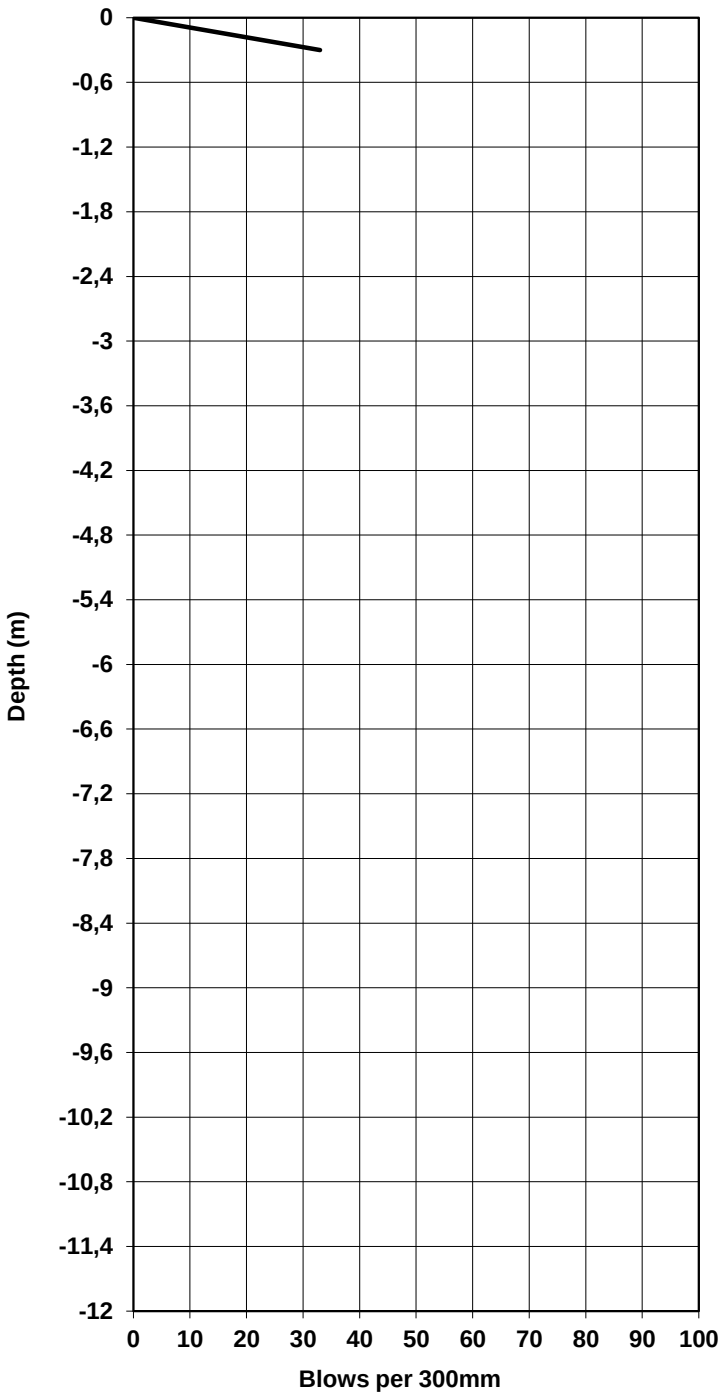
9,9			
10,2			
10,5			
10,8			
11,1			
11,4			
11,7			
12			



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Client:	Delca Systems	Ref.No.:	BD 1347
Project:	**Mandeni Youth Development Centre**	Date:	27-Jun-2019
Section:		Operator:	THABO

Light Dynamic Penetrometer Probe (DPL) ***Test No. DPL 4***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angel
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency	Insitu Shear Strength
0	0		
0,3	24	Med.Dense	33 deg
0,6	26	Med.Dense	34 deg
0,9	44	Dense	36 deg
1,2	60	Dense	37 deg
1,5	R		
1,8			
2,1			
2,4			
2,7			
3			
3,3			
3,6			
3,9			
4,2			
4,5			
4,8			
5,1			
5,4			
5,7			
6			
6,3			
6,6			
6,9			
7,2			
7,5			
7,8			
8,1			
8,4			
8,7			
9			
9,3			
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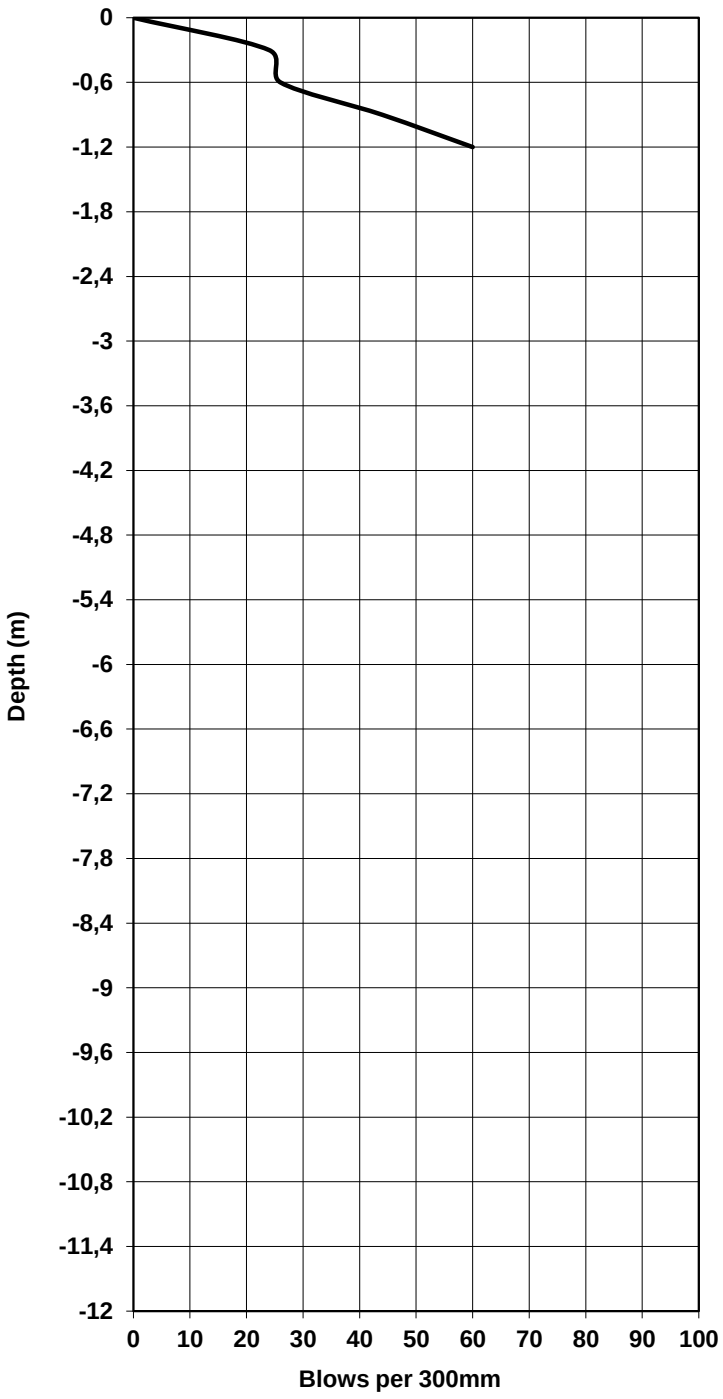
9,9			
10,2			
10,5			
10,8			
11,1			
11,4			
11,7			
12			



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Phone 031 563 2106 / 083 231 8561
bazi@bazidukhan.co.za

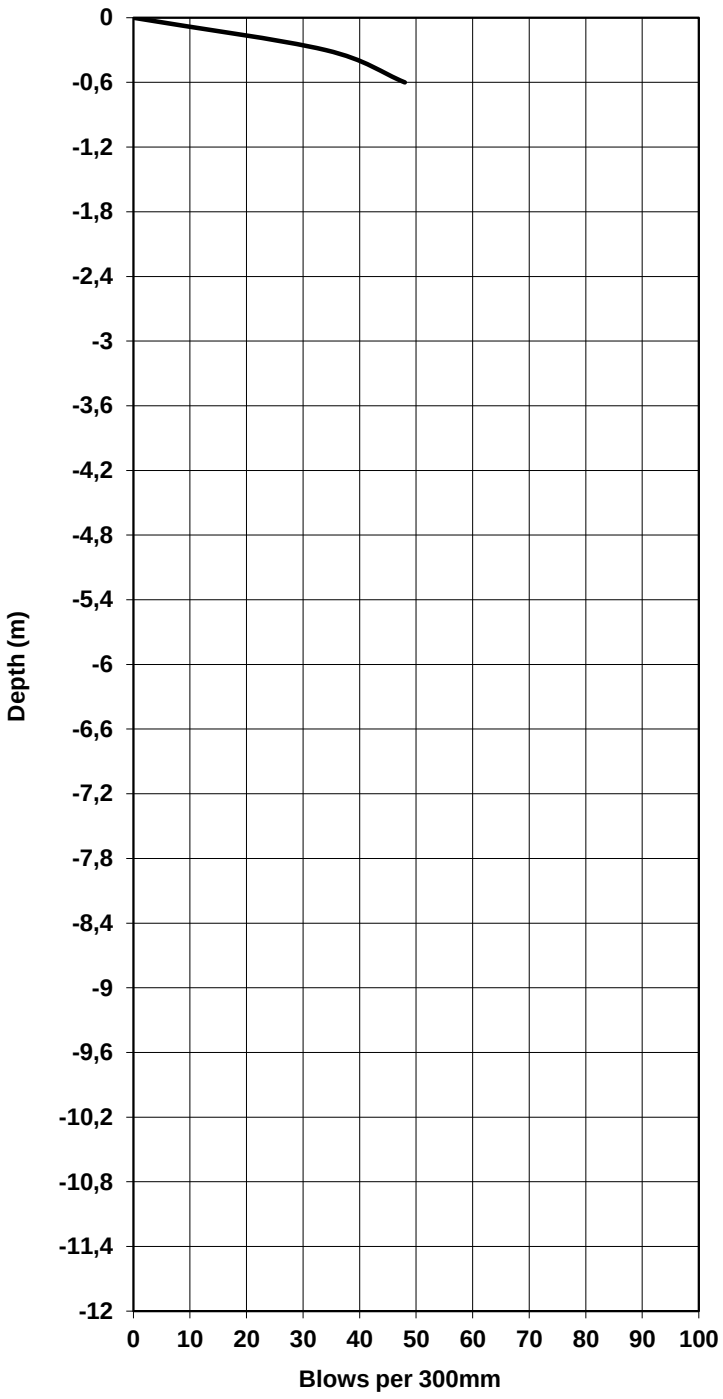
Client:	Delca Systems	Ref.No.:	BD 1347
Project:	**Mandeni Youth Development Centre**	Date:	27-Jun-2019
Section:		Operator:	THABO

Light Dynamic Penetrometer Probe (DPL) **Test No. DPL 5**

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angel
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency	Insitu Shear Strength
0	0		
0,3	34	Med.Dense	35 deg
0,6	48	Dense	36 deg
0,9	R		
1,2			
1,5			
1,8			
2,1			
2,4			
2,7			
3			
3,3			
3,6			
3,9			
4,2			
4,5			
4,8			
5,1			
5,4			
5,7			
6			
6,3			
6,6			
6,9			
7,2			
7,5			
7,8			
8,1			
8,4			
8,7			
9			
9,3			
9,6			
9,9			
10,2			
10,5			
10,8			
11,1			
11,4			
11,7			
12			



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APPENDIX D:

LAB RESULTS

ROADLAB
Civil Engineering Materials Testing Laboratory
(KZN (PTY) LTD

Unit 6
24 Edmund Morewood Street
Truroland Tongaat 4399
P O Box 63477 Verulam 4340
Tel: 032 944 5977 Fax: 032 944 5974
Cell: 082 867 9870
E-mail: durban@roadlab.co.za
www.roadlab.co.za

sanas Testing Laboratory
T0806

Client:	Bazi Dukhan Consulting Engineers CC	Date Sampled:	N/A
Address:	PO Box 37612 Overport 4067	Date Received:	01.07.19
		Date Tested:	03.07.19 – 12.07.19
Attention:	Mr B. Dukhan	Date Reported:	12.07.19
Project:	Mandeni Youth Development Centre	Clients Reference No:	BD 1347
		Order No:	BPO 215

TEST REPORT REFERENCE NUMBER: RD 1618/19

Dear Sir,

Enclosed herewith please find test reports(s) pertaining to the above-mentioned project. All tests were in accordance with the prescribed test method(s). Information herein consists of the following:

Material Classification and Foundation Indicators

Test Carried Out / Test Method					
SANS 3001 – GR 1	X	SANS 3001 – GR 50		SANS 3001 – AG 10	
SANS 3001 – GR 10		SANS 3001 – GR 51		SANS 3001 – AG 22	
SANS 3001 – GR 11	X	SANS 3001 – GR 53		SANS 3001 – AS 1	
SANS 3001 – GR 12	X	SANS 3001 – GR 54		SANS 3001 – AS 2	
SANS 3001 – GR 20	X	SANS 3001 – NG 5		SANS 3001 – AS 10	
SANS 3001 – GR 30	X	SANS 3001 – AG 1		SANS 3001 – AS 11	
SANS 3001 – GR 40	X	SANS 3001 – AG 2		SANS 3001 – AS 20	
SANS 3001 – GR 31		SANS 3001 – AG 4		SANS 3001 – GR 3	
X - Symbol denotes tests that were carried out & are Accredited		Total number of pages in this Report:		4	

Sample Information		Field Technician / Tested By
Sampler(s) Name:	Client	
Sampling Environmental Condition:	N/A	
NB: Sample Location and Test Positions Identified by Client		

TMH 5 (1981) - Sampling Method									
MA2		MB1		MC1		MC2		MB7	

TMH 5 (1981) - Sample Preparation			
MD1	X	MD2	

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

Yours faithfully

Technical Signatory: Mr J. Sarjooparsad

ROADLAB
Civil Engineering Materials Testing Laboratory
KZN (PTY) LTD

Unit 6
24 Edmund Morewood Street
Truroland Tongaat 4399
P O Box 63477 Verulam 4340
Tel: 032 944 6977 Fax: 032 944 6974
Cell: 082 567 9870
E-mail: durban@roadlab.co.za
www.roadlab.co.za

Client	Bazi Dukhan Consulting Engineers CC	**Our Ref No**	RD 1618/19
Project	Mandeni Youth Development Centre		
Attention	Mr B. Duhkan	**Date Reported**	12.7.19

MATERIAL CLASSIFICATION TEST REPORT

Laboratory Number		D3175	D3176	D3177	
Road Name		-	-	-	
Chainage (KM)		-	-	-	
Field Position		TP 1	TP 2	TP 5	
Layer		-	-	-	
Depth (mm)		0.5 - 0.9	0.9 - 1.2	0.5 - 1.0	
Date Sampled		N/A			
Sampled by		Client			
Material Description		Dark Brown slightly Clayey fine Sand + Ferricrete	Yellowish Dark Brown speckled Orange Clayey Sand + Residual Tillite	Light Olive + Dark Greyish Brown Clayey Sand + weathered Tillite + Ferricrete	
Sieve Analysis (Wet Preparation) SANS 3001 - GR 1					
Percentage Passing (mm)	100.0				
	75.0			100	
	63.0	100		97	
	53.0	94	100	95	
	37.5	93	99	89	
	28.0	90	97	81	
	20.0	88	85	77	
	14.0	81	85	71	
	5.00	75	66	56	
	2.00	67	47	42	
	0.425	55	34	28	
	0.075	27	17	13	
Grading Modulus		1.51	2.02	2.17	
Atterberg Limits - SANS 3001 - GR 10 - GR 12					
Liquid Limit	(%)	17	25	26	
Plasicity Index	(%)	5	8	11	
Linear Shrinkage	(%)	2.0	4.0	5.0	
Maximum Dry Density and Optimum Moisture Content SANS 3001 - GR30					
Maximum Dry Density	(kg/m3)	2099	1809	1989	
Optimum Moisture Content	(%)	7.7	11.1	11.1	
Califonia Bearing Ratio SANS 3001 - GR 40					
CBR @ 100% Compaction	%	20	9	11	
CBR @ 98% Compaction	%	14	6	9	
CBR @ 97% Compaction	%	11	5	8	
CBR @ 95% Compaction	%	8	4	7	
CBR @ 93% Compaction	%	5	2	6	
CBR @ 90% Compaction	%	3	1	5	
Swell @ 100% Compaction	%	1.08	0.15	0.31	
Method of preparation used:		N/A	N/A	N/A	
COLTO CLASSIFICATION		**Worse Than G9**	**Worse Than G9**	**Worse Than G9**	
TRH 14 (1985) CLASSIFICATION		**G10**	**Worse Than G10**	**G10**	

Remarks
The results reported relate only to the sample tested.
Further use of the above information is not the responsibility or liability of Roadlab KZN (Pty) Ltd.
Documents may only be reproduced or published in their full context.
Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.

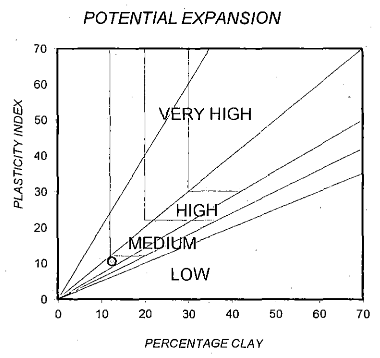
ROADLAB
Civil Engineering Materials Testing Laboratory

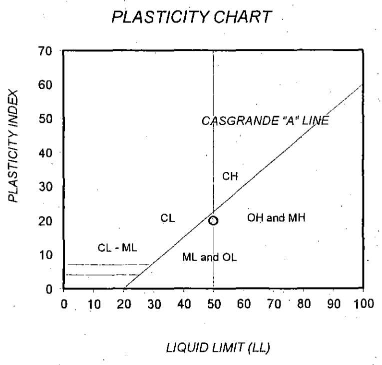
OUR REF : RD 1618/19

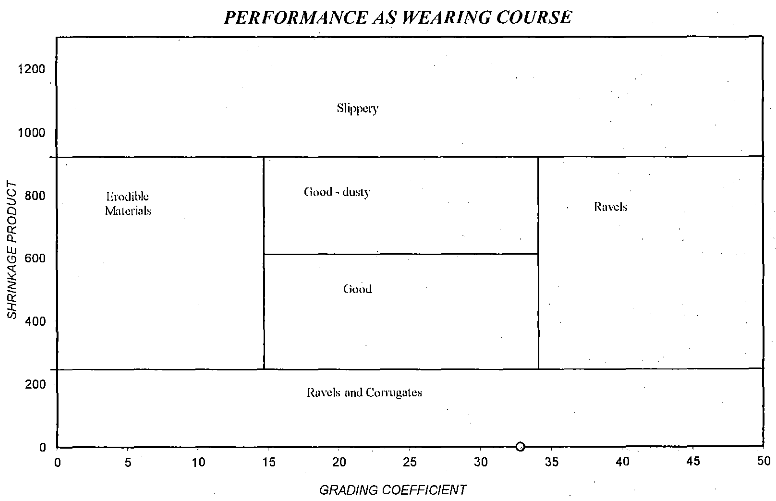
DATE RECEIVED : 01.07.19
SAMPLE No. : D3173
CLIENT: Bazi Dukhan Consulting Engineers CC
Field No.: TP 1
DEPTH (m).: 0.9 - 1.2
PROJECT: Mandeni Youth Development Centre
SAMPLE DESCRIPTION : Dark Grey speckled Orange Reddish Olive + Dark Brown Clay + Ferricrete
Your Ref No:-
MOSITURE CONTENT (%): -

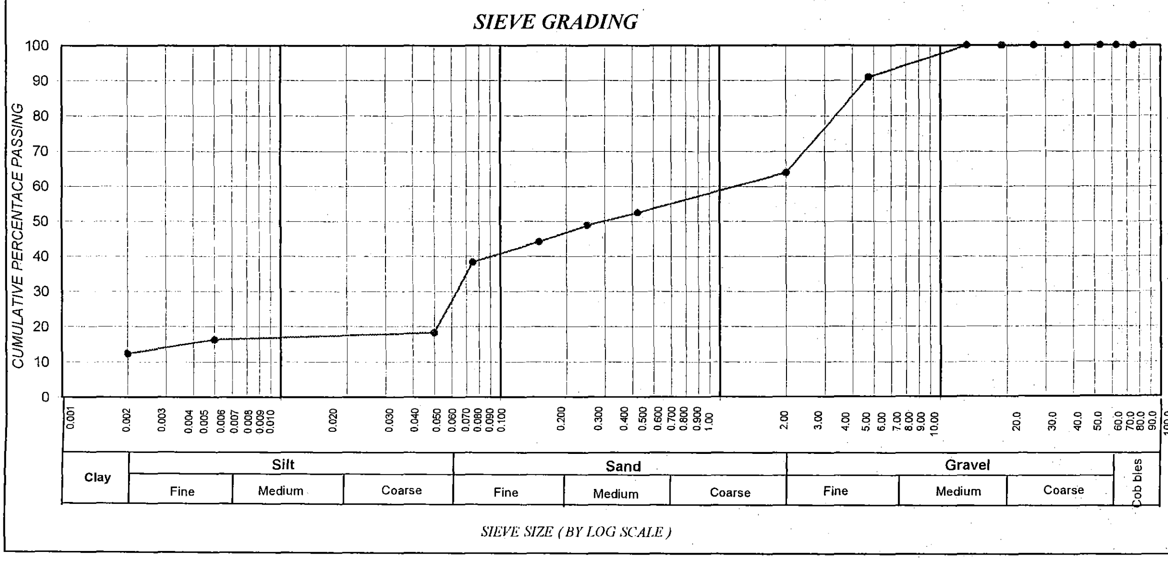
FOUNDATION INDICATOR RESULTS (SANS 3001 - GR1,GR10,GR11,GR20 & #SANS 3001 GR 3:2014)

Weighted PI		**10.5**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	91
	2.000	64
	0.425	53
	0.250	49
	0.150	44
	0.075	38
	0.050*	18
	0.005*	16
	0.002*	12.4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	18
	0.425 - 0.250	6
	0.250 - 0.150	7
	0.150 - 0.075	9
	< 0.075	60
Effective size		0.002
Uniformity Coefficient		727.6
Curvature Coefficient		1.4
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		32.8
Grading modulus		1.46
Atter-berg Limits	Liquid Limit	50
	Plasticity Index	20
	Linear Shrinkage	10.0
	PI < 0.075	
Unified Soil Classification		SC
U.S. Highway Classification		A-7-6
#pH - Value		N/A
Moisture Content		N/A
Compactibility Factor		N/A
#Conductivity mS/cm		N/A









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
12.4	25.6	25.9	36.1

Remarks: Test Marked # SANS GR3 is not Accredited.

ROADLAB
Civil Engineering Materials Testing Laboratory

OUR REF : RD 1618/19

CLIENT: Bazi Dukhan Consulting Engineers CC

PROJECT: Mandeni Youth Development Centre

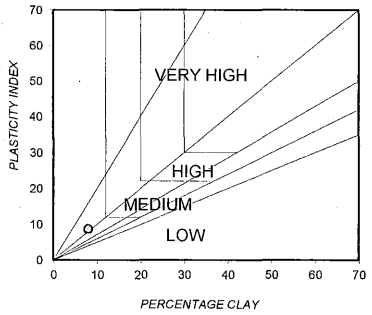
Your Ref No:-

DATE RECEIVED : 01.07.19
SAMPLE No. : D3174
Field No.: TP 2
DEPTH (m).: 0.9 - 1.2
SAMPLE DESCRIPTION : Yellow + Dark Brown speckled Orange Clayey Sand + Residual Tllite
MOSITURE CONTENT (%): -

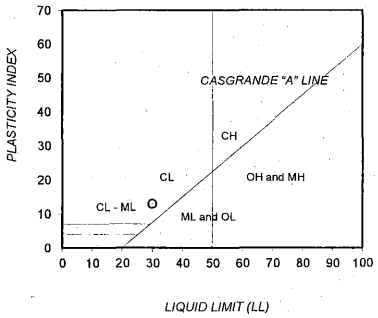
FOUNDATION INDICATOR RESULTS (SANS 3001 - GR1,GR10,GR11,GR20 & #SANS 3001 GR 3:2014)

Weighted PI		**8.7**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	96
	2.000	83
	0.425	67
	0.250	61
	0.150	50
	0.075	38
	0.050*	18
	0.005*	10
	0.002*	8.0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	19
	0.425 - 0.250	8
	0.250 - 0.150	13
	0.150 - 0.075	15
	< 0.075	45
Effective size		0.006
Uniformity Coefficient		43.9
Curvature Coefficient		3.1
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		16.3
Grading modulus		1.12
Atter-berg Limits	Liquid Limit	30
	Plasticity Index	13
	Linear Shrinkage	6.0
	PI < 0.075	
Unified Soil Classification		SC
U.S. Highway Classification		A-6
#pH - Value		N/A
Moisture Content		N/A
Compactibility Factor		N/A
#Conductivity mS/cm		N/A

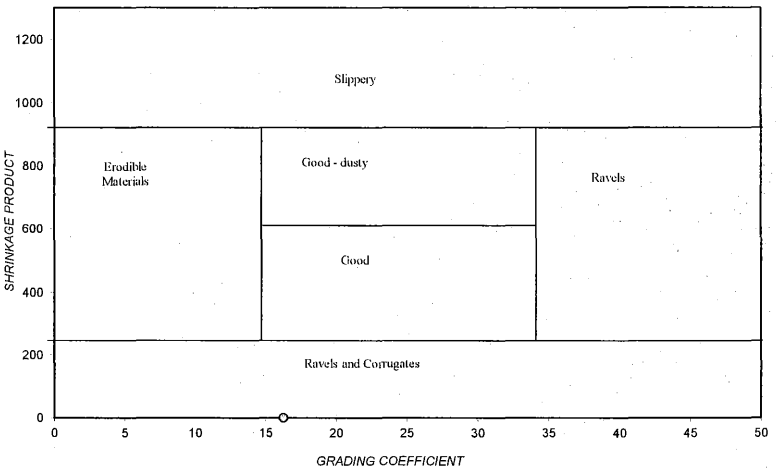
POTENTIAL EXPANSION



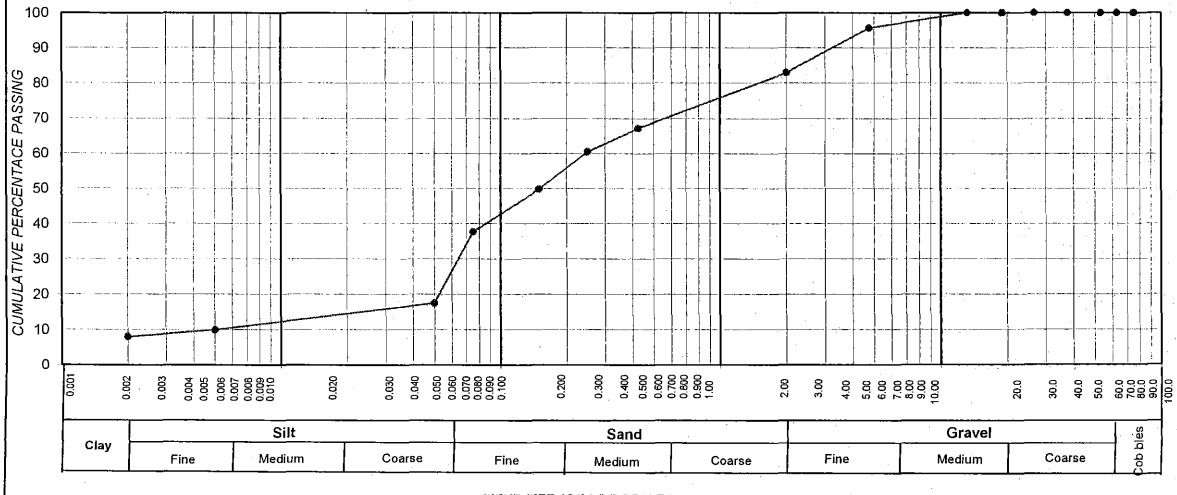
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
8.0	30.0	45.0	17.0

Remarks: Test Marked # SANS GR3 is not Accredited.