



EARTH SCIENCE CONSULTANTS

Box 4177, Witbank, 1035
Reg No. 2002/014257/23
Vat No. 4710205925

ADMINISTRATION OFFICE
MPUMALANGA WITBANK
T: 013 656 0719
info@engeolabcc.co.za

GAUTENG PRETORIA
C: 082 950 8529
bertie@engeolabcc.co.za

KZN COASTAL MTUNZINI
T: 035 340 1108
C: 082 881 5370
paul@engeolabcc.co.za

KZN NORTHERN
PAULPIETERSBURG
C: 082 339 6111
mark@engeolabcc.co.za

KZN MIDLANDS HILTON
T: 033 343 1226
C: 083 628 3263
jacques@engeolabcc.co.za

2nd July 2019
Our Reference: LL3335

DLV Engineers
144 Mark Street
Vryheid
3100

Attention: Mr. Sashin Inderjeeth *BSc. Eng. (Civil)*

RE : Magobela Gravel Road: Geotechnical Report

Dear Sir,

Please find herewith some comments and recommendations, following the site visit to inspect the current road conditions and potential borrow material at Magobela, Umzinyathi DM.

Yours Faithfully

Mark Meyer
Pr. Sci. Nat.



REPORT ON A GEOTECHNICAL INVESTIGATION OF MAGOBELA ROAD, UMZINYATHI, NORTHERN KWAZULU-NATAL.



PROJECT: LL3335
DATE: July 2019
M Meyer
Pr.Sci.Nat.

REPORT ON A GEOTECHNICAL INVESTIGATION OF MAGOBELA ROAD, UMZINYATHI, NORTHERN KWAZULU-NATAL.

1. GENERAL SITE INFORMATION

1.1 Introduction

The findings of a geotechnical investigation on Magobela Road road roughly 15km north-west of Tugela Ferry are given in this report. The road, as well as the test pit positions are indicated on the *Locality Plan, Figure 1*, below.

The scope of work for the investigation specified amongst others the following investigation procedures:-

- i) Determine the site geology.
- ii) Establish the soil, weathered rock and outcrop profiles across the site and evaluate their engineering properties and influence on the proposed roads.
- iii) Assess the groundwater conditions and comment on the presence of perched or permanent water tables.
- iv) Assess the layer works of the existing road.
- v) Locate suitable surfacing material.
- vi) Establish the founding conditions at the water-course crossings.

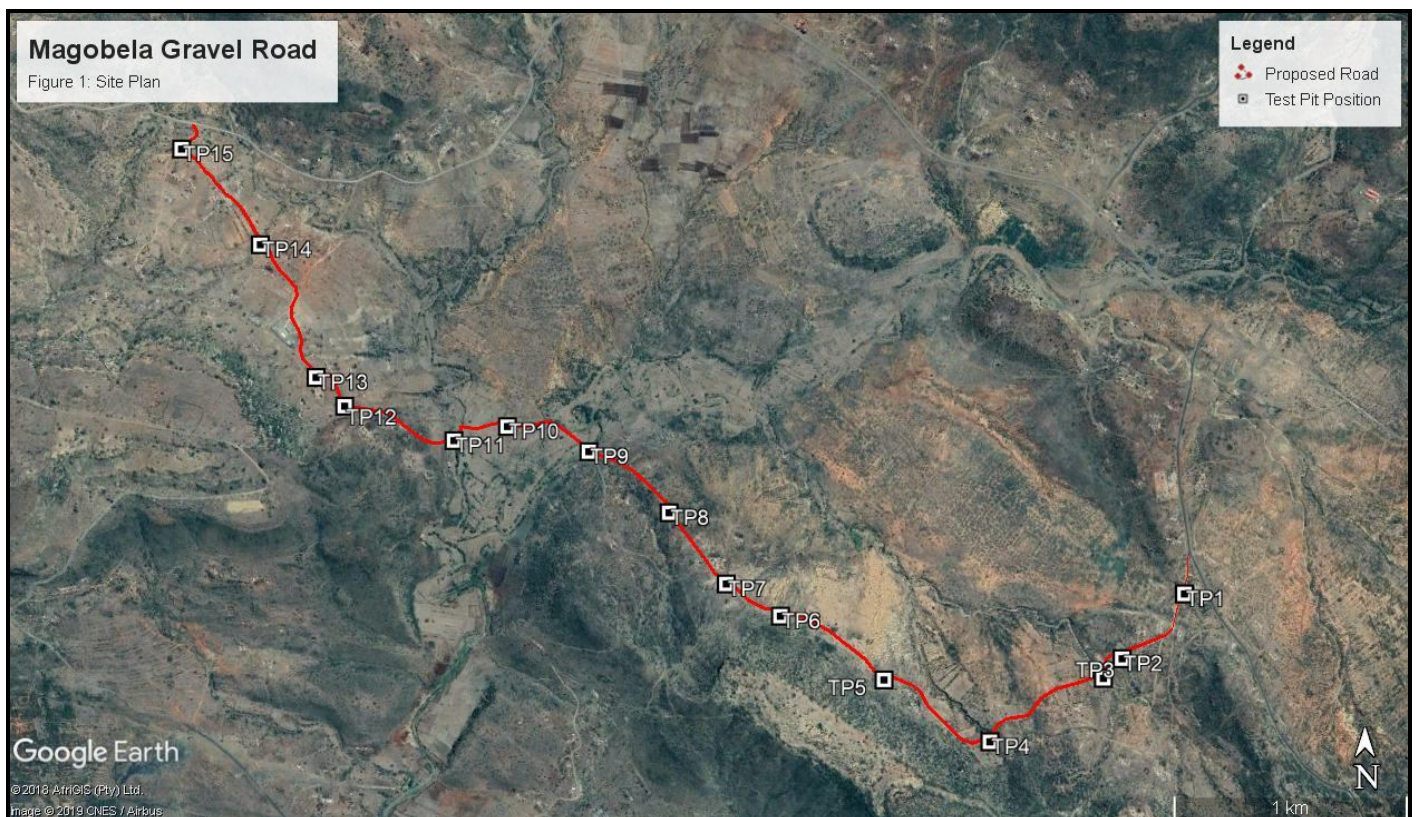


Figure 1: Locality plan, indicating the approximate test pit positions.

This report is based on information obtained from:

- Dundee geological map, sheet 2830 to scale of 1:250 000.
- Profiles of 15 test pits excavated at predetermined positions.
- Soil test results of a number of road indicator and compaction tests of representative disturbed soil samples taken during the field investigation from test pits as well as at the borrow pit.
- Aerial photographic data from Google Earth.
- Topographical survey of the site in digital format.

1.2 Site Observations

The investigation underlined the following important aspects encountered along the proposed road:-

- i) No seepage was encountered in any of the test pits (except at the two major stream crossings).
- ii) Generally medium dense to dense consistencies were observed in the majority of test pits with shallow (<1m) bedrock along most of the road.
- iii) Generally soft excavation is envisaged down to depths achieved during the investigation.
- iv) No problem soils impeding further development were observed.

1.3 Topography

The road has a generally moderate gradient becoming steep in places towards the stream crossings. The route crosses three minor and two significant water-courses.

1.4 Geology and Soils

According to the *Geological Sheet, 2830 Vryheid*, the proposed road is primarily underlain by Pietermaritzburg Formation shale with a short section underlain by intrusive dolerite between E1 and E2 and Vryheid Formation sandstone on the higher lying areas at E5-E7. An extract of the published geological map with the overlain test pit positions is shown below in *Figure 2*.

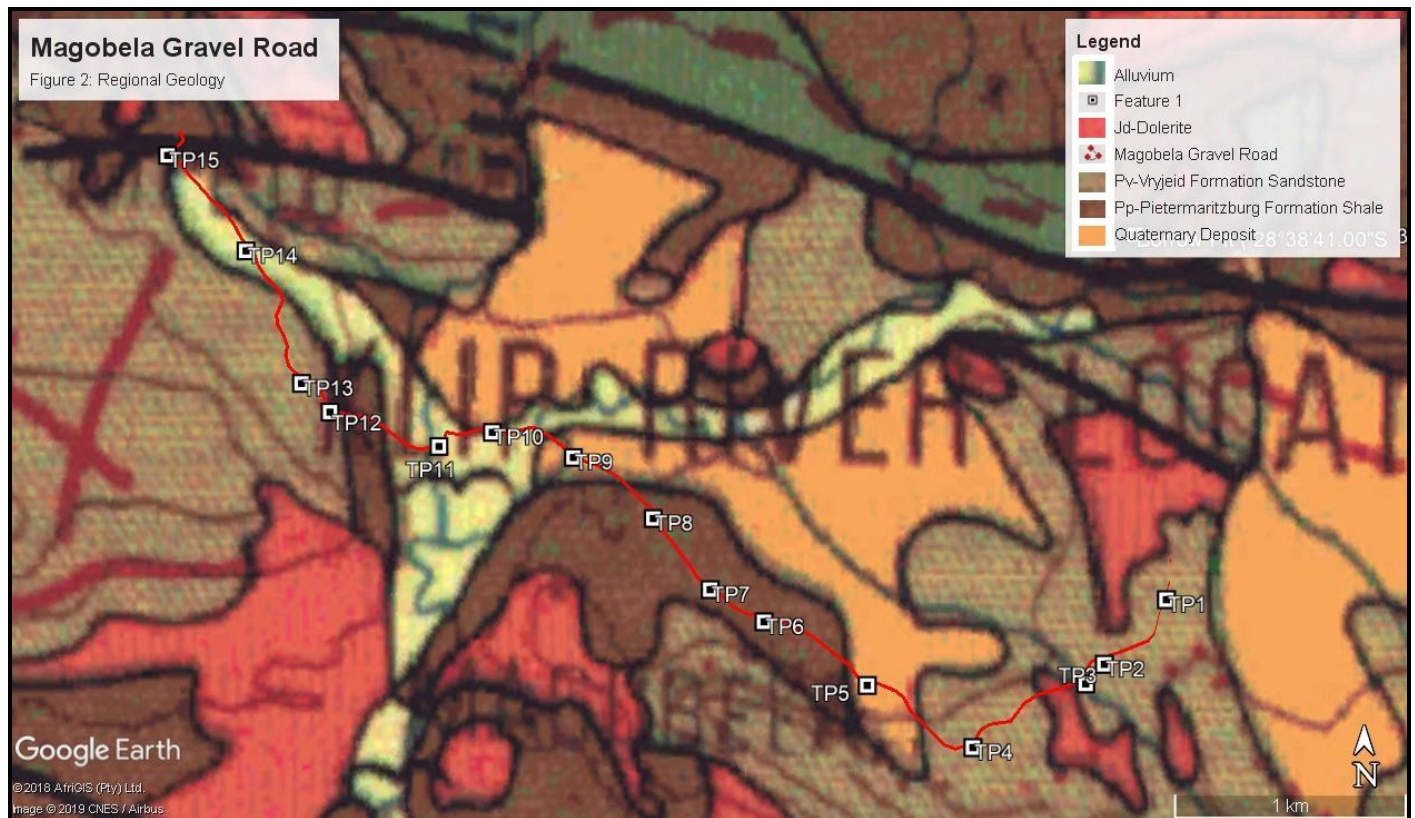


Figure 2: Extract of the published geological map showing that the study is primarily underlain by a range of mostly sedimentary deposits.

2. METHODS OF INVESTIGATION

2.1 Test Pitting and Profiling

Fifteen test pits were excavated by means of pick and shovel intervals on the proposed road to depths of around 1.0m below existing ground level or earlier refusal in order to expose the existing layer works (if any) and underlying soils.

The test pits were inspected and the excavation progress was observed to estimate the consistency of the soil profile. The profile assessments were done by a qualified, registered practitioner and the materials were described in terms of moisture, colour, consistency, structure, soil type and origin in accordance with the methods of *Jennings et al.* The soil profiles are included in *Appendix A*.

DCP tests adjacent to the test pits were completed adjacent to the test pits to confirm the in situ consistencies; all DCP tests (except DCP 10) refused at depths at less than 1,0m, and confirmed the meddium dense to dense consistencies.

2.2 Soil Sampling and Laboratory Testing

Small, disturbed indicator samples and bulk CBR samples were selected during the profiling of the test pits as well as the borrow areas to confirm the in-field assessments of the engineering properties of the various representative soil horizons. The disturbed and bulk soil samples were submitted to Soilco Material Testing Laboratories in Vryheid, for grading, classification and compaction tests, as detailed below. Copies of the laboratory test results are appended to this report and summarised in Table 2.2 below for convenience.

The following tests were carried out on the samples: -

- i) Six road indicator tests comprising particle size distribution analysis and Atterberg Limit tests. *These tests permit a basic classification of the soils and group them according to typical engineering properties.*
- ii) CBR and Compaction tests were completed on samples obtained from the borrow pit.

Table 2.2(A) Results of the Foundation Indicator Tests

Test Pit	Depth	Origin	Liquid Limit	P. Index	L. shrinkage	Grading M	CBR at 95% MOD AASHTO
Borrow Pit (Shale)	2.5-7m	Shale	28	10	5	2.31	7
Borrow Pit (Dolerite)	0-4m	Dolerite	31	10	5.5	2.62	20
TP2	0-1.1m	Weathered Sandstone	27	9	4.6	1.64	
TP3	1-0.13m	Colluvium	CBD	NP	0	1.54	
TP5	0-0.3m	Colluvium	26	11	5.5	0.86	
TP10	0-0.8m	Alluvium	22	9	4.4	0.58	

3. GEOTECHNICAL ASPECTS

3.1 Workability of Site Materials

3.1.1 Excavation Characteristics

TLB mechanical excavation operations will be adequate to excavate through the colluvium and residuum. Refusal was experienced in most test pits at depths of less than 1m, mostly on bedrock but also on boulders (TP6)

3.1.2 Compactability of Site Materials

As shown above the route traverses at least four geological units. Most of the underlying soils most likely conform to G9-G10 type material. The entire road has recently been graded and no imported surfacing material was noted.

3.1.3 Stability of Excavations

No collapse or imminent collapse of the test pit sidewalls was recorded in any of the test pits, further indicating the generally medium dense to dense soil conditions.

3.1.4 Problem soils

The majority of soils were at least medium dense to dense with no obvious problems. Soil cover is generally thin to no existent with the exception of the alluvial plain.

3.1.5 Seepage

No groundwater seepage was noted in any of the test pits. Good surface drainage measures should be in place.

3.1.6 Borrow Material

There is an existing borrow-pit roughly 1,5km north of the start of the road. Both shale and dolerite material has been used extensively from this borrow pit but there is still ample room for extension, primarily towards the east. The material from this borrow pit has been used to surface the gravel road accessing the Magobela area and seems to be performing satisfactorily, with minimal dirt in summer but slightly dusty in winter. Erosion channels were noted in some places on the road surfaced with this material, proper drainage measures and a maintenance programme would prevent further degradation. Both the shale and dolerite gravel is most useful, however, the dolerite material does have some oversized hard material that can not be used for surfacing as it is unlikely to be broken to medium gravel.

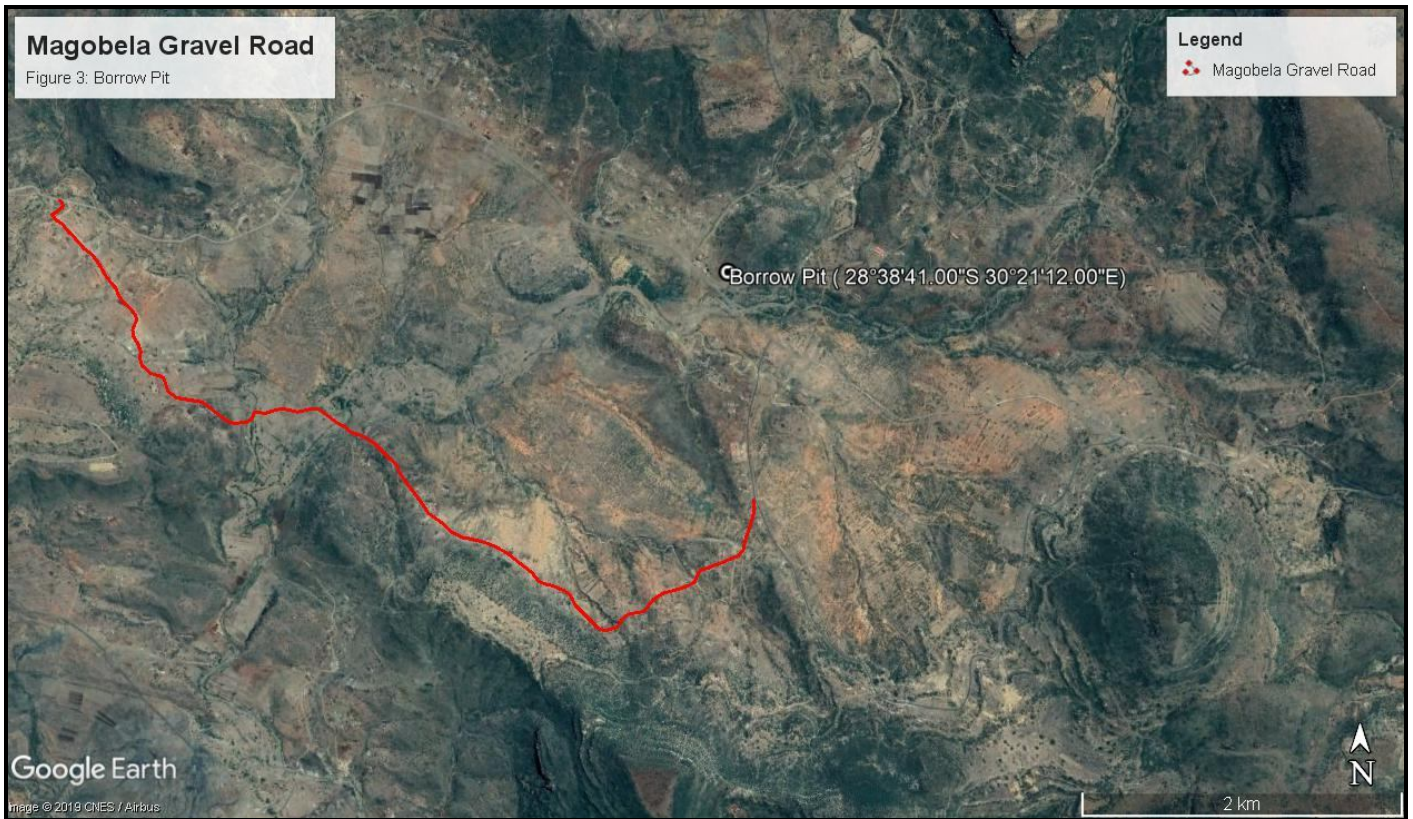


Photo2: View of the western wall of the borrow pit; note both dolerite (yellowish) and shale (dark grey) are present in the borrow pit.

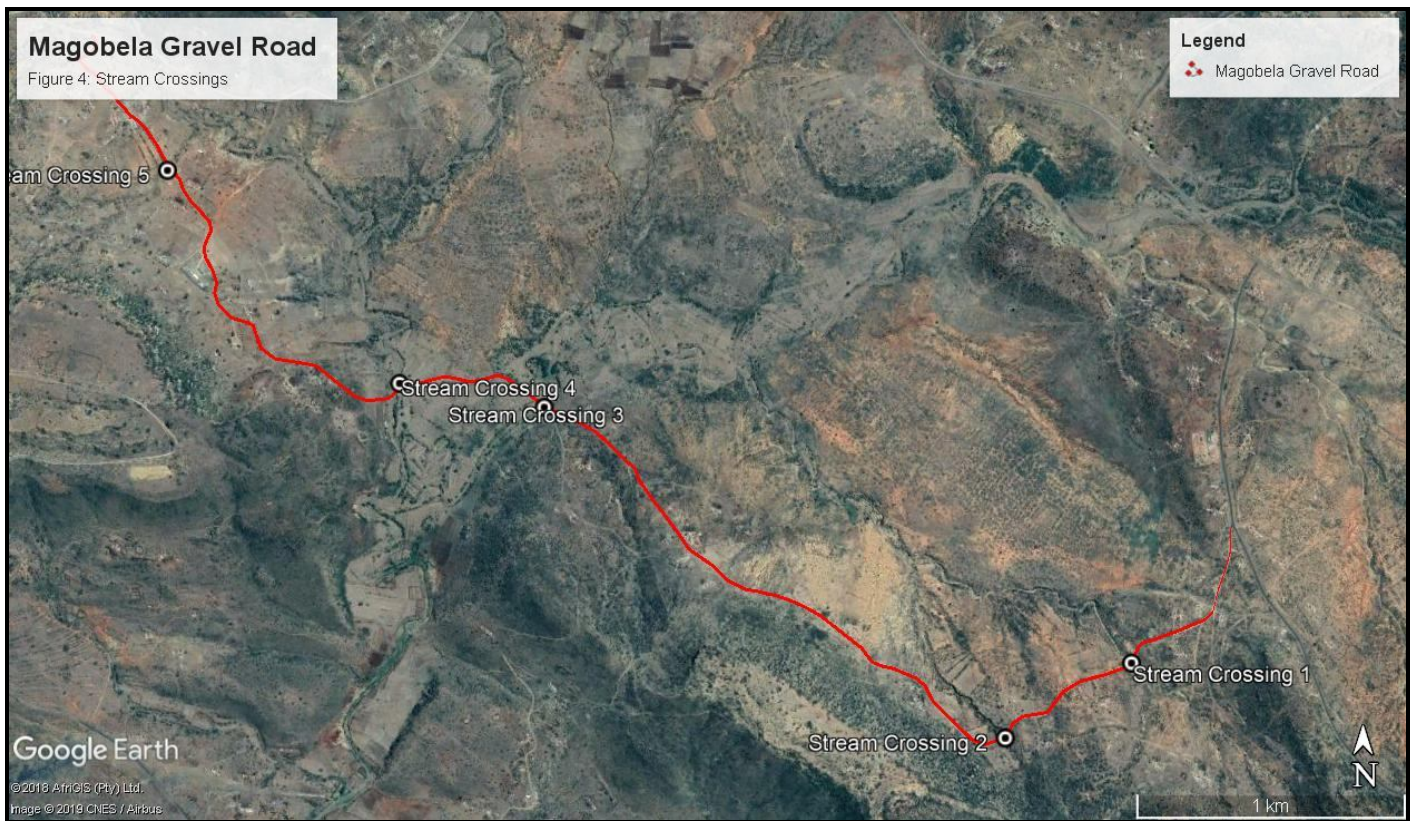
3.1.7 Current Layerworks

The entire road had recently been graded; no evidence of imported gravel was noted in any of the test pits.

3.1.8 Stream crossings

The route crosses three minor and two significant waterways

Crossing	Test pit	Founding of culvert	Condition at time of investigation (June 2019)
Crossing 1	TP3	0,2m on carbonaceous shale bedrock.	Dry
Crossing 2	TP4	1,2m on sandstone bedrock.	Dry
Crossing 3	TP9	Depending on design, alluvial boulder (0,3m diam average) bed at 0,7m.	Small stream
Crossing 4	TP11	1,0m on dolerite bedrock (undulating, not horizontal).	Small stream
Crossing 5	TP14	0,3m on shale bedrock.	Dry



4 CONCLUSIONS AND RECOMMENDATIONS

The site is stable for development provided that the recommendations given in this report are implemented.

Significant factors pertaining to the final design are as follows:

- Soft excavation (i.e. TLB) is anticipated for the majority of the site to depths as achieved in the test pits, Medium excavation is required if deeper excavation is required.
- Generally moderate slopes with only isolated short sections with steep inclines are anticipated.
- No imported surfacing material was noted in any of the test pits.
- No significant problem soils were observed.
- No Groundwater was encountered in any of the test pits.
- Five water-crossings are traversed by the route with generally shallow bedrock at all crossings, except crossing 3 where refusal occurred on a bed of alluvial boulders.

Every effort was made during the site investigation to ensure that generally accepted practices of our profession were used in the sub-surface evaluation of the site, and that the sampling and testing was representative of the soil/rock conditions observed on-site. However it is impossible under the constraints of a restricted investigation of this nature to guarantee that zones of poorer geological materials were not identified that could have a significant bearing on the outcomes of this investigation. The investigation has therefore attempted, through interpolation and extrapolation at known test locations, to identify problem issues of a geotechnical nature on which this report is based. Variances in soil and rock quality and quantity from those predicted may be encountered during construction and these should be recorded, however no warranty against these variations is expressed or implied, due to the geological changes that can occur over time due to natural processes, or human activity.

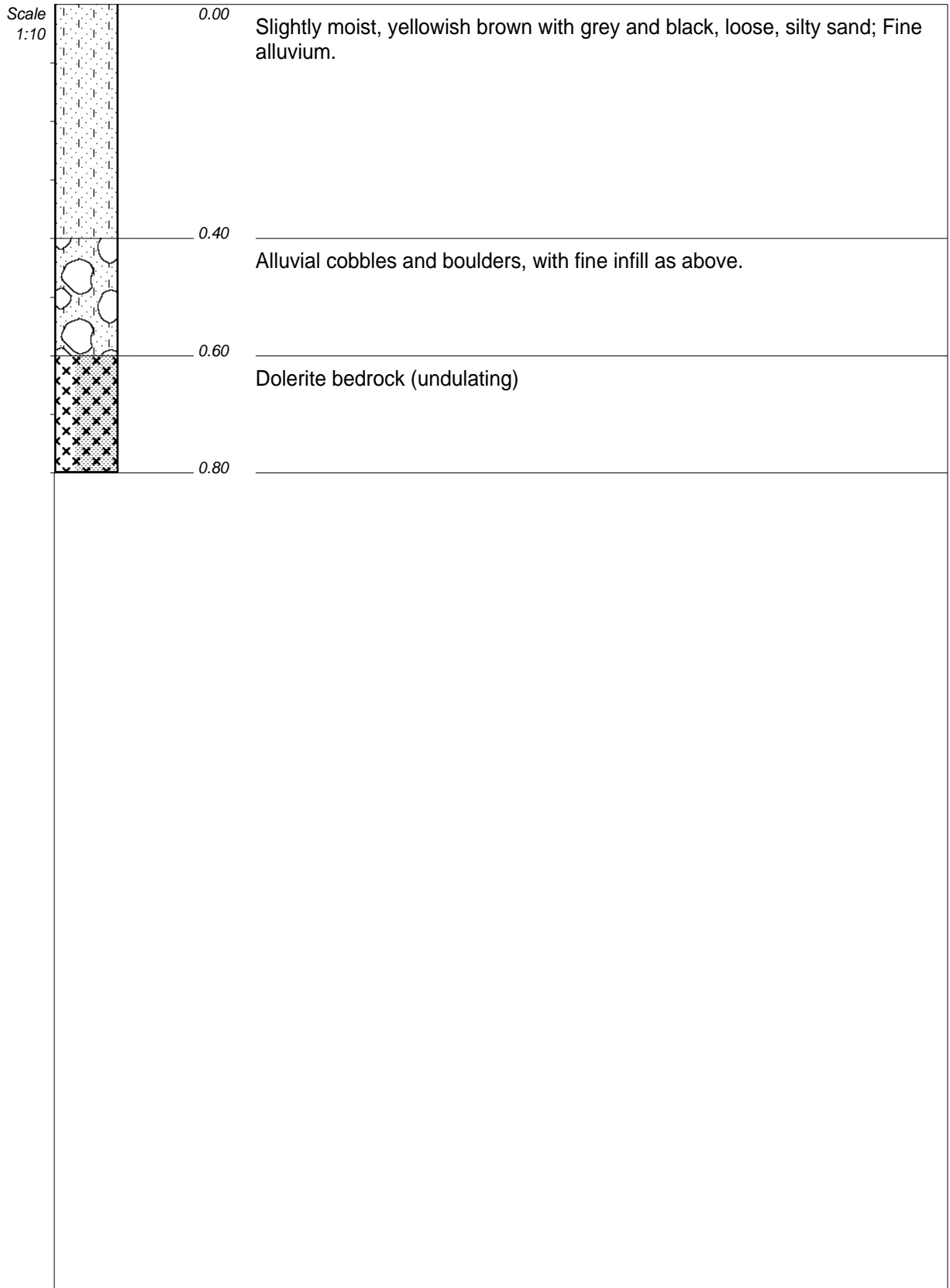
BIBLIOGRAPHY

1. **JENNINGS, J.E., BRINK, A.B.A. & WILLIAMS, A.A.B.** Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa. *Trans. S Afr. Inst. Civ. Engrs.* Vol.15, No.1, 1973, pp 3-12.
2. **JENNINGS, J.E. & KNIGHT, K.** A Guide to the Construction on, or with Materials Exhibiting Additional Settlement Due to Collapse. *6th Regional Conference for Africa on Soil Mechanics & Foundation Engineering.* Durban, South Africa, September 1975.
3. **BRINK, A.B.A.** *Engineering Geology of Southern Africa. Volume 1 - The First 2000 Million Years of Geological Time,* Building Publications, Pretoria, 1981, 319pp.
4. **BRAJA, M. DAS.** *Principles of Geotechnical Engineering.* 3rd Ed., PWS Publishing Co., Boston, 1993, 662pp.
5. **KIRSTEN, H.A.D.** A Classification System for Excavation in Natural Materials. *The Civil Engineer in S. Africa,* Vol.24, No.7, July 1982, pp 293-308.
6. **WEAVER, J.M.** Geological Factors Significant in the Assessment of Rippability. *The Civil Engineer in S. Africa,* December 1975, pp 313-316.
7. **Van der MERWE, D.H.** The Prediction of Heave from the Plasticity Index and the Percentage Clay Fraction. *The Civil Engineer in South Africa.* Vol. 6, No. 6, 1964.
8. **BELL, F.G.** *Foundation Engineering in Difficult Ground.* Newnes-Butterworths, London-Boston, 1978, 598pp.
9. **TMH: TECHNICAL METHODS FOR HIGHWAYS** - *Standard Methods of Testing Road Construction Materials;* TMH1, 1979, NITRR, Pretoria.
10. **TRH 14:** 1985. *Guidelines for Road Construction Materials.* Dept. of Transport South Africa. Committee of State Road Authorities, Technical Recommendations for Highways. Pretoria, pp 57. Reprint 1989.
11. **BELL, F.G.** *Engineering Properties of Soils and Rocks,* 2nd Ed., Butterworths, London, 1983, 149 pp.
12. **TOMLINSON, M.J.** *Foundation Design and Construction.* 4th Ed., Pitman Publishing, London. 793pp.
13. **Polish Code PN 59/B-03020, 1959:** Typical Values of Strength Parameters Φ and c' kPa.
14. **PARTRIDGE T.C., WOOD C.K. and BRINK A.B.A.** Priorities for Urban expansion within the Metropolitan Region: the Primacy of Geotechnical Constraints. *South Africa Geographical Journal.* Vol. 75, pp. 9-13, 1993.
15. **SOUTH AFRICAN INSTITUTE OF CIVIL ENGINEERS** - *Code of Practice: Foundations and Superstructures for Single Storey Residential Buildings of Masonry Construction;* Joint Structural Division, 1995, Johannesburg.
16. **INTERNATIONAL SOCIETY for SOIL MECHANICS and GEOTECHNICAL ENGINEERING (ISSMGE).** *The Flat Dilatometer Test (DMT) in Soil Investigations.* Report of the ISSMGE Technical Committee TC16, 2001, Bali Conference.
17. **EUROCODE 7: GEOTECHNICAL DESIGN.** *Part 3: Design Assisted by Field Testing, Section 9: Flat Dilatometer Test.* European Committee for Standardization. Brussels, 1997.
18. **ASTM 2001.** *Suggested Method for Performing the Flat Plate Dilatometer.* D18.02.10. 2001.
19. **MARCHETTI S. and MONACO P.** *Short Course on Flat Dilatometer (DMT).* Bali, May 2001.
20. **MONACO P., TOTANI G. & CALABRESE M.** *DMT-predicted vs Observed Settlements: A Review of the Available Experience.* Proc. 2nd Intl Conf. on Flat Dilatometer. 2006.
21. **ARROYO M. & MATEOS T.** *Embankment Design with DMT and CPTu. Prediction and Performance.* Proc. 2nd Intl Conf. on Flat Dilatometer. 2006.
22. **TERZAGHI K. & PECK R.B.** *Soil mechanics in engineering practice,* John Wiley, New York. 1948.
23. **TERZAGHI K. & PECK R.B.** *Soil mechanics in engineering practice,* John Wiley, New York. 1967.

Appendix A

Test Pit Profiles





CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S 28°39'11.48"
Y-COORD : E 30°19'20.07"



CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION : Vertical
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 27.6"
Y-COORD : E30 21' 17.8"

Scale
DS2A



0.00

Dry, light grey and yellowish, dense, intact, gravelly sand; Disturbed weathered Sandstone.

0.10

NOTES

- 1) Sampled as follows: DS2A at 0.0m--0.1m.

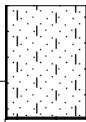
CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 41.3"
Y-COORD : E30 21' 07.4"



Scale
1:10



0.00

Dry, light grey speckled yellowish and black, very loose, silty Sand;
Alluvial deposit.

0.15

NOTES

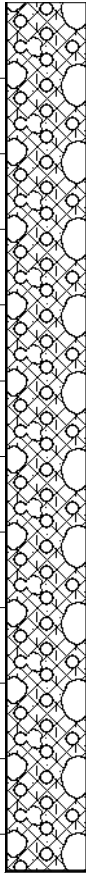
- 1) Refusal on Carbonaceous Shale.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 48.6"
Y-COORD : E30 20' 53.8"

Scale
1:10



0.00

Dry, light grey-brown, dense, silty sandy matrix with abundant gravel supported gravel and cobbles; Fill.

1.15

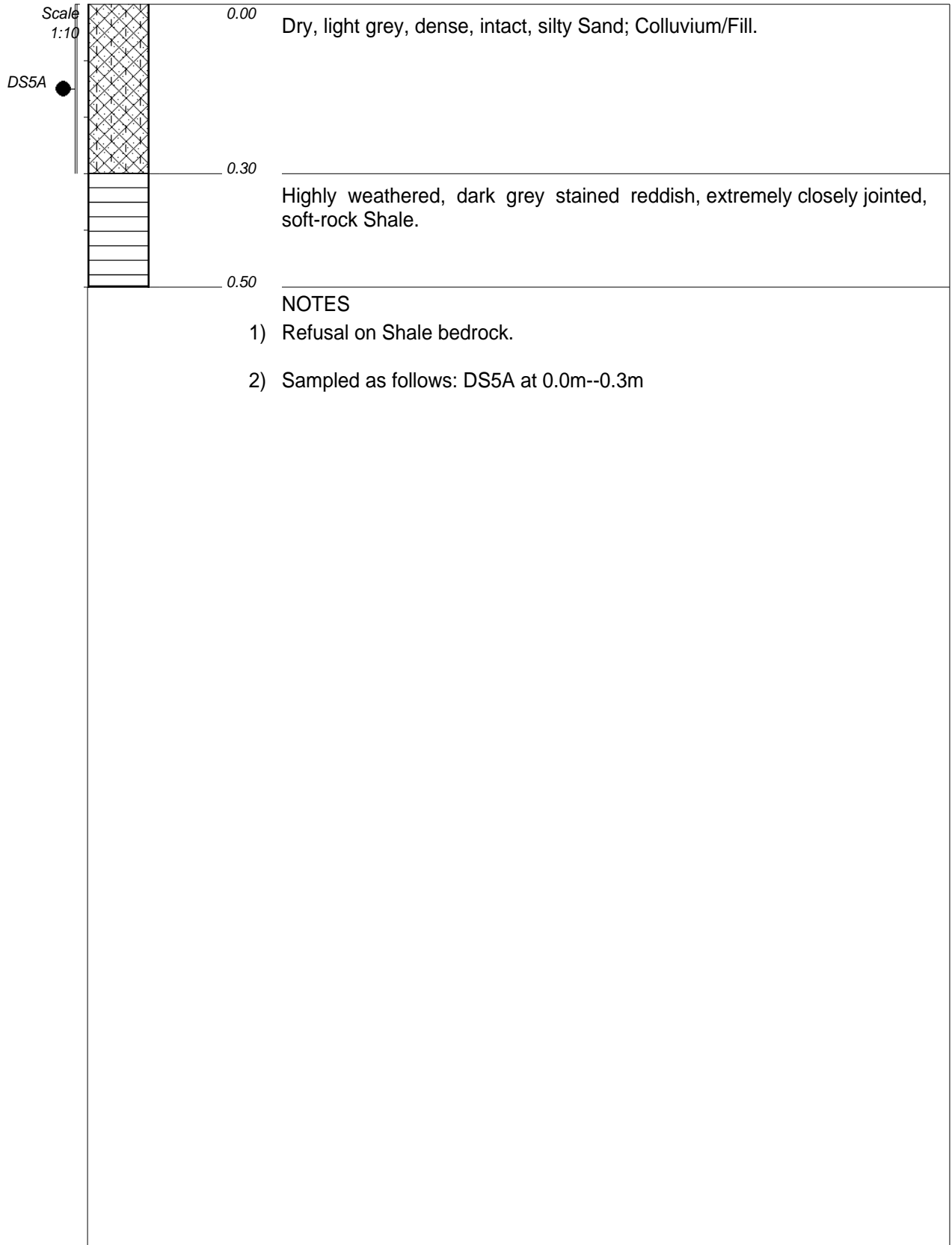
NOTES

- 1) Refusal on Sandstone bedrock.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 53.4"
Y-COORD : E30 20' 46.1"



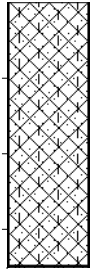
CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 44.7"
Y-COORD : E30 20' 29.9"



Scale
1:10



0.00

Dry, light grey, dense, intact, silty Sand; Colluvium/Fill.

0.35

NOTES

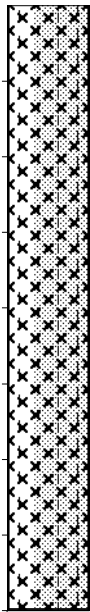
- 1) Refusal on large Sandstone boulders (not bedrock).

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 35.9"
Y-COORD : E30 20' 12.9"

Scale
1:10



0.00

Highly weathered, grey-brown speckled grey and stained red-orange brown, very closely jointed, hard rock dolerite with abundant silty infill along joints.

0.80

NOTES

- 1) Excavated as medium gravel material.
- 2) Slow excavation
- 3) No refusal
- 4) Scattered corestone boulders

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S 28°39'25.28"
Y-COORD : E 30°19'57.97"



Scale
1:10



0.00 Yellowish brown, very closely jointed, Shale outcrop.

0.20
NOTES

- 1) Refusal on shale outcrop.

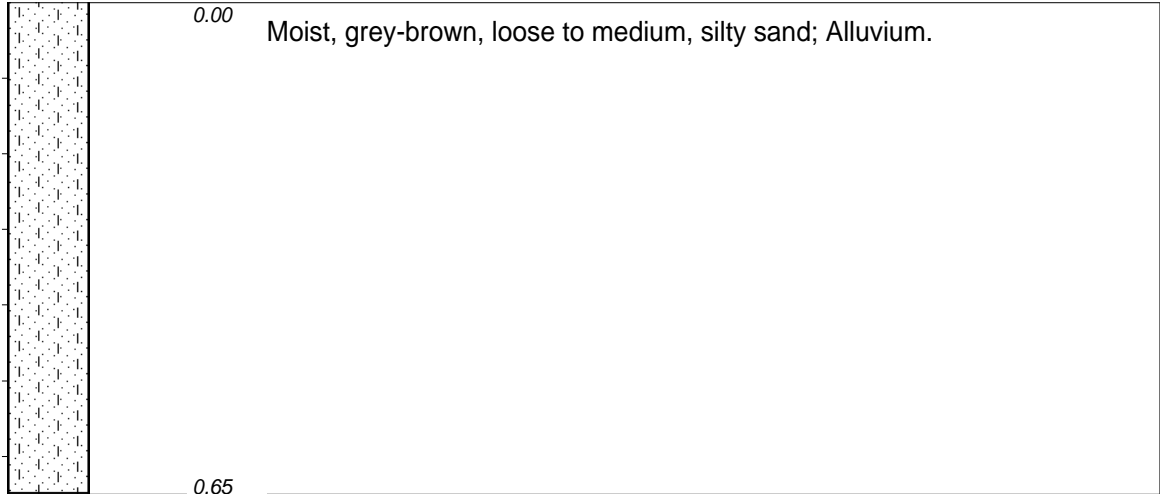
CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28°39'21.57"
Y-COORD : E30°19'54.98"



Scale
1:10



0.65

NOTES

- 1) Refusal on bed of alluvial boulders (>0,3m).

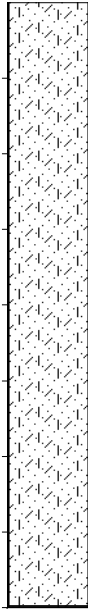
CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S 28°39'12.59"
Y-COORD : E 30°19'41.67"



Scale
1:10



0.00

Dry to slightly moist, greyish brown, firm to stiff, microshattered, slightly clayey silty sand; Colluvium.

0.80

NOTES

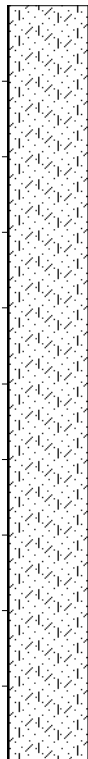
- 1) No refusal
- 2) No seepage

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 09.2"
Y-COORD : E30 19' 28.7"

Scale
1:10



0.00

Dry, grey-brown, medium dense to dense, microshattered, slightly clayey silty sand. Colluvium.

1.00

NOTES

- 1) No refusal
- 2) No seepage
- 3) Sandstone outcrop 30m further on road.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28 39' 06.5"
Y-COORD : E30 19' 02.5"



Scale
1:10



0.00

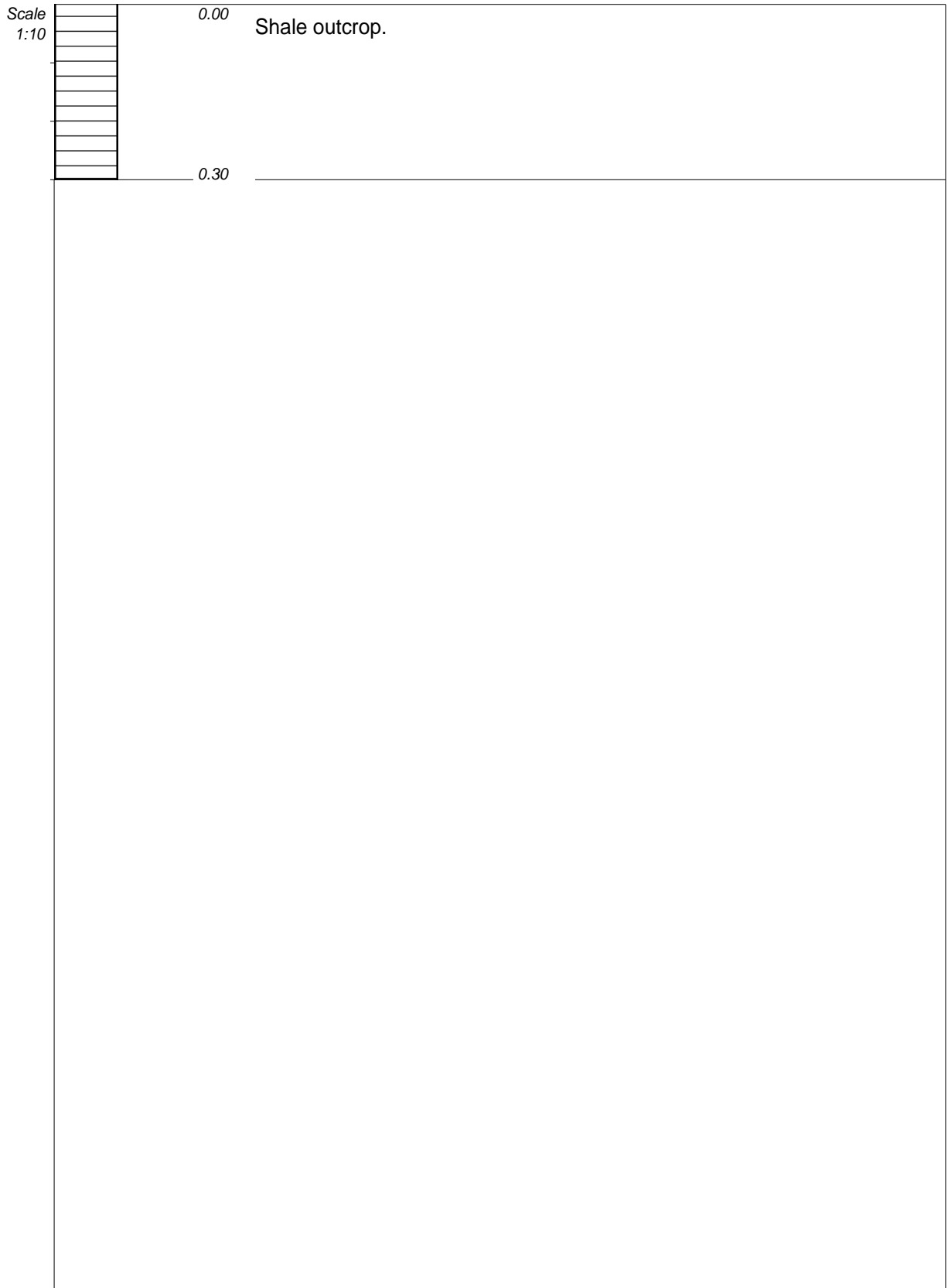
Highly weathered, grey-brown speckled grey and stained red-orange brown, very closely jointed, hard rock dolerite with abundant silty infill along joints.

0.10

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S 28°39'7.59"
Y-COORD : E 30°19'7.49"



CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : M Meyer
TYPE SET BY : A Nolan
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12 June 2019
DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

ELEVATION :
X-COORD : S28°38'43.42"
Y-COORD : E30°18'48.89"



	BOULDERS	{SA01}
	GRAVEL	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAYEY	{SA09}
	SANDSTONE	{SA11}
	SHALE	{SA12}
	DOLERITE	{SA18}{SA42}
	FILL	{SA32}
	DISTURBED SAMPLE	{SA38}
	COBBLES	{SA58}

Name ●

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

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

DATE : 02/07/2019 09:47
TEXT : ..AccessRoadJune2019mm.txt

Appendix B

Laboratory Test Results

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY



Reg. No. : 1965 / 009585 / 07

NOOTGEDAGHT FARM - LOUWSBURG ROAD - P.O. BOX 761 VRYHEID 3100 KWAZULU - NATAL

TELEPHONE : 034 9826012 TELEFAX : 034 9826013 email : soilco@vhd.dorea.co.za

Customer : Engeolab
 Project : Magobela Road
 Sampling Process : Samples Delivered by Customer

Job Card No. : 223090
 Date Received : 2019-06-13
 Date Tested : 2019-06-13 to 2019-06-24
 Date Reported : 2019-06-24

MATERIALS TEST REPORT

Laboratory Number	V1169			
Field Number	-			
Position in field	-			
Depth (mm)	-			
Sample Description	Dark Grey Shale + Dolerite.			
Stabilising Agent	Natural			

Sieve Analysis (Wet Preparation) SANS 3001 - GR 1

100.0 mm	Percentage Passing			
75.0 mm				
63.0 mm				
50.0 mm		100		
37.5 mm		91		
28.0 mm		87		
20.0 mm		85		
14.0 mm		82		
5.0 mm		60		
2.0 mm		36		
0.425 mm		17		
0.075 mm		17		
Grading Modulus SANS 3001 PR 5	2.31			

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand (%)	52			
Coarse - Fine Sand (%)	0			
Medium - Fine Sand (%)	0			
Fine - Fine Sand (%)	1			
Silt and Clay (%)	46			

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit (%)	28			
Plasticity Index (%)	10			
Linear Shrinkage (%)	5.0			

Classification

Classification Group Index	A - 2 - 4			
COLTO Classification #	-			
TRH 14 Classification (1985) #	G10			

Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30

Maximum Dry Density (kg/m ³)	1922			
Optimum Moisture Content (%)	11.3			

California Bearing Ratio - SANS 3001 - GR 40

CBR @ 100 % Compaction	15			
CBR @ 98 % Compaction	11			
CBR @ 95 % Compaction	7			
CBR @ 93 % Compaction	6			
CBR @ 90 % Compaction	4			
Swell @ 100 % Compaction	0.94			

Remarks : The Colto / TRH 14 Classifications are only based on the above results. Further testing may be required.

For Soilco - S. Jayraj (Technical Signatory)
 2015-05-12

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY



Reg. No. : 1965 / 009585 / 07

NOOTGEDAGHT FARM - LOUWSBURG ROAD - P.O. BOX 761 VRYHEID 3100 KWAZULU - NATAL

TELEPHONE : 034 9826012 TELEFAX : 034 9826013 email : soilco@vhd.dorea.co.za

Customer : Engeolab
 Project : Magobela Road
 Sampling Process : Samples Delivered by Customer

Job Card No. : 223090
 Date Received : 2019-06-13
 Date Tested : 2019-06-13 to 2019-06-24
 Date Reported : 2019-06-24

MATERIALS TEST REPORT

Laboratory Number	V1168			
Field Number	-			
Position in field	Dolerite Quarry			
Depth (mm)	-			
Sample Description	Br. Speckled Black Weathered Dolerite.			
Stabilising Agent	Natural			

Sieve Analysis (Wet Preparation) SANS 3001 - GR 1

100.0 mm	Percentage Passing			
75.0 mm				
63.0 mm		100		
50.0 mm		85		
37.5 mm		85		
28.0 mm		72		
20.0 mm		66		
14.0 mm		58		
5.0 mm		34		
2.0 mm		20		
0.425 mm		10		
0.075 mm		9		
Grading Modulus SANS 3001 PR 5		2.62		

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand (%)	50		
Coarse - Fine Sand (%)	2		
Medium - Fine Sand (%)	2		
Fine - Fine Sand (%)	3		
Silt and Clay (%)	44		

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit (%)	31		
Plasticity Index (%)	10		
Linear Shrinkage (%)	5.5		

Classification

Classification Group Index	A - 2 - 4		
COLTO Classification #	-		
TRH 14 Classification (1985) #	G8		

Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30

Maximum Dry Density (kg/m ³)	2115		
Optimum Moisture Content (%)	8.5		

California Bearing Ratio - SANS 3001 - GR 40

CBR @ 100 % Compaction	50		
CBR @ 98 % Compaction	34		
CBR @ 95 % Compaction	20		
CBR @ 93 % Compaction	13		
CBR @ 90 % Compaction	8		
Swell @ 100 % Compaction	0.39		

Remarks : The Colto / TRH 14 Classifications are only based on the above results. Further testing may be required.

For Soilco - S. J. ... (Technical Signatory)
 2015-06-13

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY



Reg. No. : 1965 / 009585 / 07

NOOTGEDAGHT FARM - LOUWSBURG ROAD - P.O. BOX 761 VRYHEID 3100 KWAZULU - NATAL

TELEPHONE : 034 9826012 TELEFAX : 034 9826013 email : soilco@vhd.dorea.co.za

Customer : Engeolab
Project : Magobela Road

Job Card No. : 223090
Date Received : 2019-06-13
Date Tested : 2019-06-13 to 2019-06-24
Date Reported : 2019-06-24

Sampling Process : Samples Delivered by Customer

MATERIALS TEST REPORT

Laboratory Number	V1164	V1165	V1166	V1167	
Field Number	Fill - Insitu	Fill - Insitu	Fill - Insitu	Fill - Insitu	
Position in field	TP2	TP3	TP5	TP10	
Depth (mm)	0 - 0.1	0 - 0.13	0 - 0.3	0 - 0.8	
Sample Description	Lt. Br. Weathered Sandstone + Ferricrete	Lt. Br. Sand.	Dk. Grey Sandy Clay	Dk. Br. Silty Sandy Clay.	
Stabilising Agent	Natural	Natural	Natural	Natural	

Sieve Analysis (Wet Preparation) SANS 3001 - GR 1

100.0 mm	Percentage Passing				
75.0 mm					
63.0 mm					
50.0 mm		100			
37.5 mm		95			
28.0 mm		92		100	
20.0 mm		87		99	
14.0 mm		82	100	98	
5.0 mm		70	99	96	
2.0 mm		64	96	92	100
0.425 mm		47	45	75	90
0.075 mm		25	5	47	53
Grading Modulus SANS 3001 PR 5		1.64	1.54	0.86	0.58

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand (%)	26	53	19	10
Coarse - Fine Sand (%)	14	24	10	13
Medium - Fine Sand (%)	14	13	12	13
Fine - Fine Sand (%)	8	5	7	11
Silt and Clay (%)	39	5	51	53

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit (%)	27	CBD	26	22
Plasticity Index (%)	9	N/P	11	9
Linear Shrinkage (%)	4.6	0.0	5.5	4.4

Classification

Classification Group Index	A - 2 - 4	A-3	A-5	A-4
COLTO Classification #				
TRH 14 Classification (1985) #				

Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30

Maximum Dry Density (kg/m ³)				
Optimum Moisture Content (%)				

California Bearing Ratio - SANS 3001 - GR 40

CBR @ 100% Compaction				
CBR @ 98% Compaction				
CBR @ 95% Compaction				
CBR @ 93% Compaction				
CBR @ 90% Compaction				
Swell @ 100% Compaction				

Remarks : The Colto / TRH 14 Classifications are only based on the above results. Further testing may be required.

For Soilco - S. Jeyaraj (Technical Signatory)
2015-05-07

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY



Reg. No. : 1965 / 009585 / 07

NOOIGEDATCH FARM - LOUWSBURG ROAD - P.O. BOX 761 - VRYHEID - 3100 - KWAZULU - NATAL

TELEPHONE : 034 - 982 6012 : TELEFAX 034 - 982 6013 - email : soilco@vhd.dorea.co.za

Client : Engeolab

Job Card No. : 223090

Project : Magobela Road

Date Received : 2019-06-13

Date Tested : 2019-06-18

Sampling Process : Samples Delivered by Customer

Date Reported : 2019-06-19

Laboratory Number : V1168

Field Reference No. :

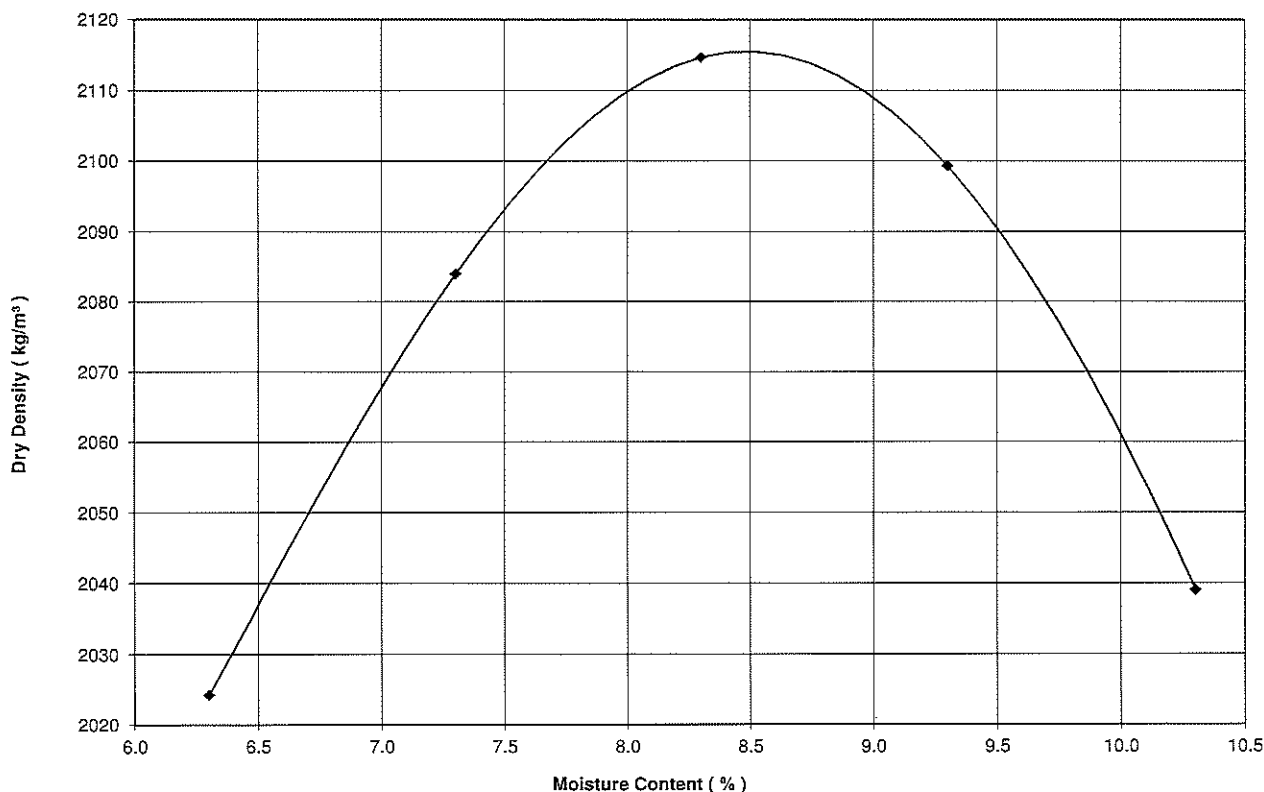
Position in field : Dol.Quarry

Depth (mm) :

Material Description : Brown Spekked Black Weathered Doleirte

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR30

Moisture Content; (%)	6.3	7.3	8.3	9.3	10.3	Maximum Dry Density	2115 kg/m³
Dry Density (kg/m ³)	2024	2084	2115	2099	2039	Optimum Moisture Content	8.5 %



The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Soilco Materials Investigations (Pty) Ltd.

Remarks :

Method of Preparation : Scalping Process

For Soilco :

[Signature]
(Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY



Reg. No. : 1965 / 009585 / 07

NOOIGEDATCH FARM - LOUWSBURG ROAD - P.O. BOX 761 - VRYHEID - 3100 - KWAZULU - NATAL

TELEPHONE : 034 - 982 6012 : TELEFAX 034 - 982 6013 - email : soilco@vhd.dorea.co.za

Client : Engeolab

Job Card No. : 223090

Project : Magobela Road

Date Received : 2019-06-13

Date Tested : 2019-06-18

Sampling Process : Samples Delivered by Customer

Date Reported : 2019-06-19

Laboratory Number : V1169

Field Reference No. :

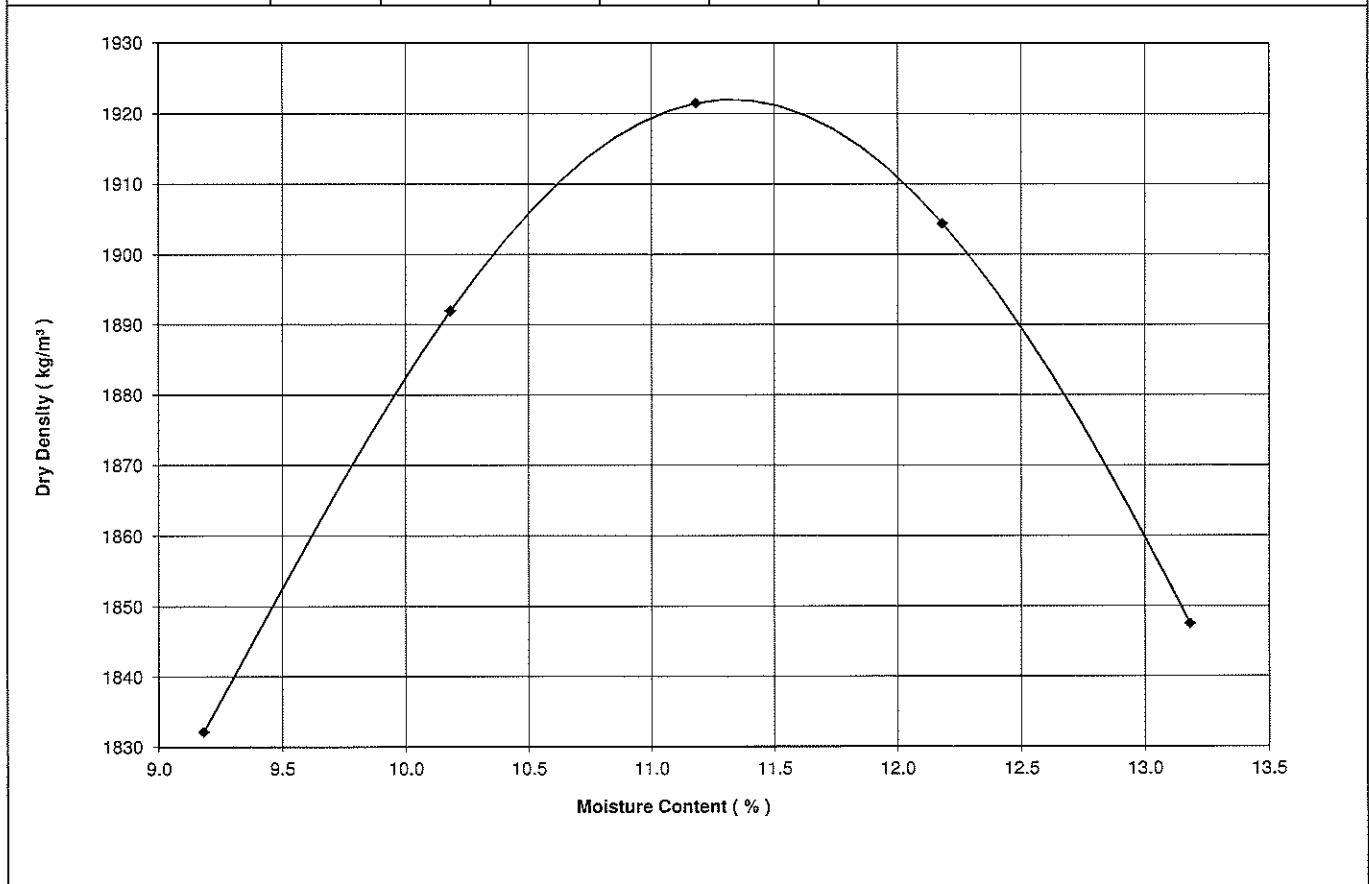
Position in field :

Depth (mm) :

Material Description : Dark Grey Shale + Dolerite

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR30

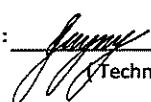
Moisture Content; (%)	9.2	10.2	11.2	12.2	13.2	Maximum Dry Density	1922 kg/m³
Dry Density (kg/m ³)	1832	1892	1922	1904	1848	Optimum Moisture Content	11.3 %



The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Soilco Materials Investigations (Pty) Ltd.

Remarks :

Method of Preparation : Scalping Process

For Soilco :  (Technical Signatory)