

REPORT

**ON THE ENGINEERING GEOLOGICAL INVESTIGATION OF
THE PROPOSED HOMESTEAD TOWNSHIP DEVELOPMENT
WITHIN THABONG, WELKOM AS PART OF THE MATJHABENG
MUNICIPALITY IN THE FREE STATE PROVINCE.**

**BY ROADLABPREHABJV (PTY) LTD (BLOEMFONTEIN) : CIVIL ENGINEERING
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July 2013**

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1. INTRODUCTION:

Wessel Badenhorst (RoadlabPrehabJV (Pty) Ltd.) was appointed by Phethogo Consulting (Bloemfontein), represented by Mr. Piet de Bie, to do an engineering geological investigation report on the above mentioned project for the determination of the suitability of the *in situ* material to be used as backfill material, the excavatability of the *in situ* material and the suitability of the investigation area for the proposed development. The investigation was undertaken according to the normal requirements for residential developments, as specified by the NHBRC for first phase development.

The following aspects were addressed in this report:

- 1.1 Geology and soil profiles
- 1.2 Geohydrology
- 1.3 Geotechnical conditions and recommendations

2. AVAILABLE INFORMATION

The following information was available: Site location, coordinates and a preliminary location plan indicating possible positions for the test pits to be excavated. The final test pit coordinates were determined based on the approximation of the test pit locations and are indicated on the laboratory test results and test pit profiles.

3. LOCALITY AND SITE DESCRIPTION

The site is located east of Thabong Ext 6, East of Welkom within the Municipal Area of the Mathjabeng Municipality in the North of the Free State Province.

The site encompasses a total of approximately 85 ha, situated approximately 10km east of the CBD of Welkom. Access to the site is gained via the M4 and the R70, which intersects with the N1, by taking a turn-off to the left (unknown street) just before entering Riebeeckstad.

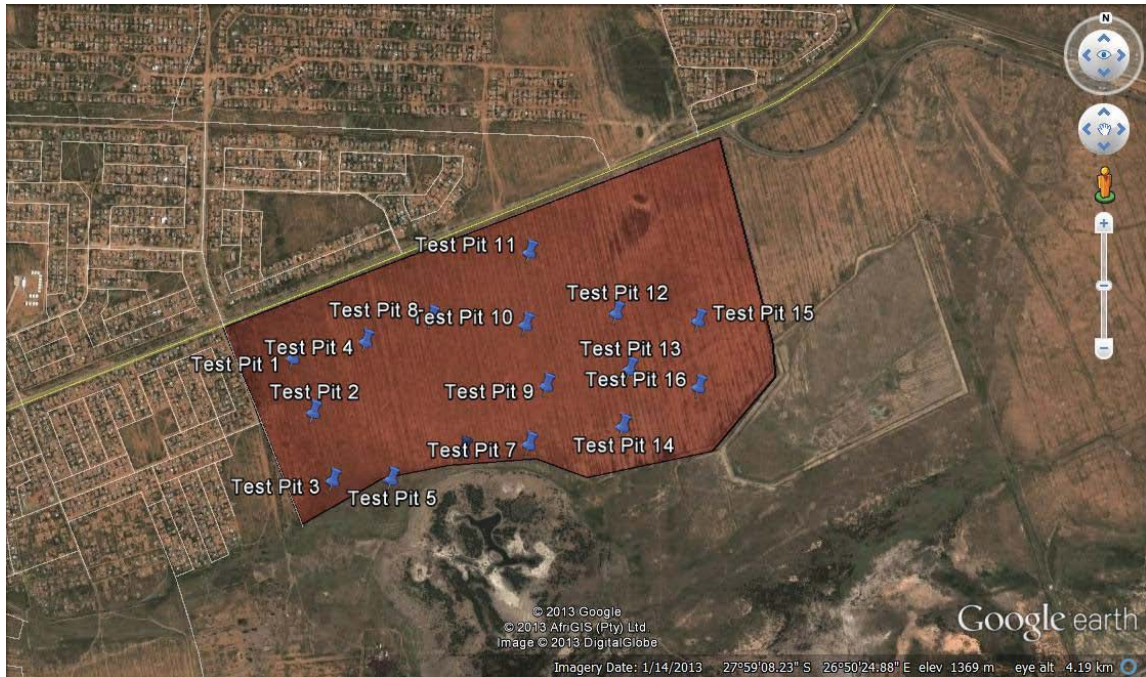


Figure 1: Site Layout Plan (Google Earth)

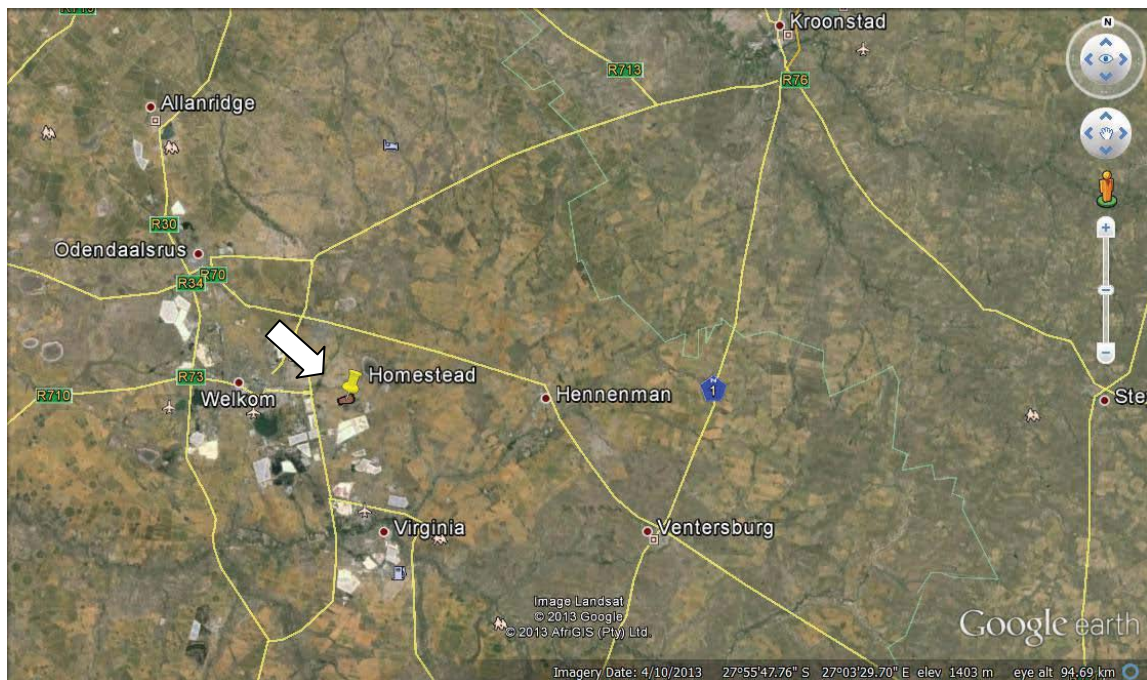


Figure 2: Site Location Plan (Google Earth)

Currently a small part of the site is occupied as part of an informal settlement. Typically the site is covered with grass and small shrubs with the exception of some trees. The slope of the site seems relatively flat. The location of services on the site is unknown and was not encountered during the investigation.

4. TOPOGRAPHY AND DRAINAGE

With the slope being relatively flat, drainage is a possible concern. It is recommended that a contour map be utilised to determine the best possible design in terms of drainage. It is to be ensured that the drainage provided on site should be sufficient in terms of its general requirements and design life. The site is located at an approximate altitude of 1360m above mean average sea level.

5. METHOD OF INVESTIGATION

The exact area of the investigation is unknown. Fifteen (15) test pits were excavated to approximately cover the proposed development area. The test pits were excavated with a TLB (8ton) and the soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973).

The test pit positions are indicated by GPS coordinates on the Profiles.

Disturbed samples of the most prominent soil horizons were taken and submitted for foundation indicator, and CBR tests. Undisturbed samples were taken to determine whether collapsibility is a possible concern. All test results are attached as Annexure B.

6. GEOLOGY AND SOIL PROFILE

The site is underlain by Adelaide Formation (Pa) of the Beaufort Group (Karoo Supergroup) consisting mainly of sandstone and mudstone. The site investigation showed that the site is mainly underlain by mudstone.

Aeolian deposits also occur on the site. These refer to silts and sands transported by wind. Aeolian deposits often pertain to collapsible or compressible material.

The area is classified as having a climatic N-value (after Weinert) between 2 and 5, which indicates chemical and mechanical weathering as the main forms of weathering.

Greyish brown and orange silty sands and clayey sands were typically encountered on site with weathered and decomposed mudstone encountered in some of the test pits. Calcrete was encountered in several of the test pits. This was recorded in the attached soil profiles included as Annexure A.

7. GEOHYDROLOGY

No ground or surface water was encountered during the investigation.

The climate around Welkom is essentially continental one with warm, wet summers and relatively cold winters. The average summer maximum is 31.3°C and the average winter minimum is 2.3°C. The average annual rainfall varies between 250mm and 500mm. Welkom is a moderate climatic region with a Weinert N-Value between 2 and 5.

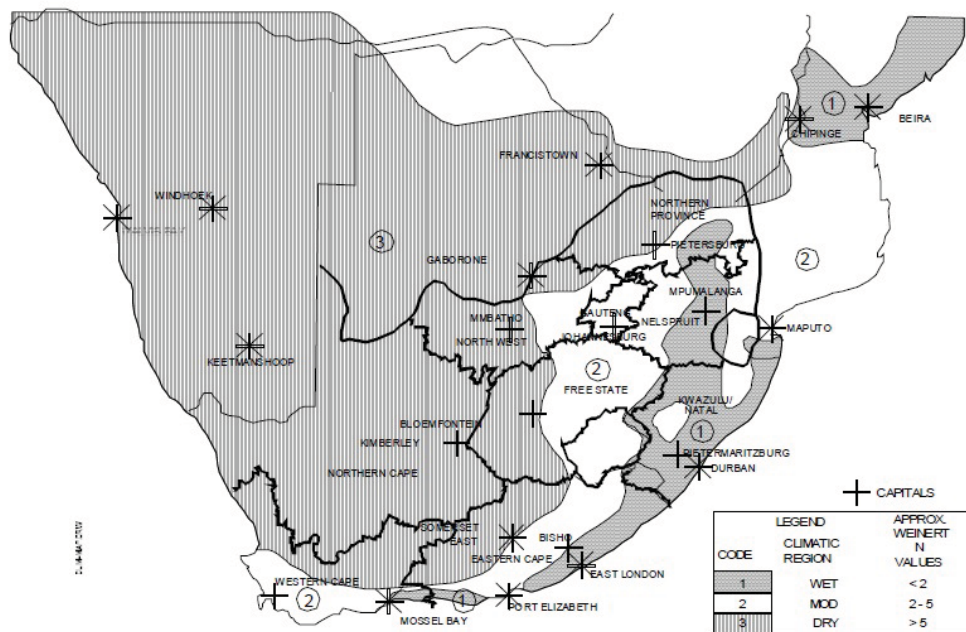


Figure 3: Macro Climatic Regions of South Africa – Taken from TRH3:2007 – adapted from Weinert, 1980

8. LABORATORY TEST RESULTS

8.1 The laboratory test results are attached as Annexure B.

8.2 **Potential expansiveness:** The potential expansiveness of the materials encountered on the site was calculated based on the method suggested by Van der Merwe (1964) and revised by Savage (2007). The following material characteristics are considered when applying this method:

- Clay content
- Plasticity index
- Liquid limit
- Linear shrinkage

The method of Van der Merwe (1964) was used to determine the potential heave of soil samples. In addition to Van der Merwe’s method, the plasticity index and linear shrinkage of soil samples were used to indicate the soils potential expansiveness.

From the laboratory test results the potential expansiveness of the soils on the site is **considered as medium**. (Please refer to figure 2, taken from “Identification of Problematic soils in Southern Africa” by the Department of Public Works – 2007.

Table 1: Potential Expansiveness

Test Pit	Depth (mm)	Plasticity Index	0.02mm Material Fraction	* Potential Expansiveness	* Estimated Differential Heave (van der Merwe, 1964)
Test Pit 1	400 – 1500	11	19	Low	0.0mm
	1500 – 3000	13	25	Medium	11.9mm
Test Pit 2	0 – 500	17	32	Medium	9.4mm
	1400 – 3000	13	23	Medium	12.9mm
Test Pit 3	0 – 800	6	24	Low	0.0mm
	800 – 1400	15	8	Low	0.0mm
	1400 – 2500	15	19	Medium	9.7mm
Test Pit 5	500 – 3000	14	13	Medium	24.5mm
Test Pit 6	600 – 1800	18	27	Medium	14.0mm
	1800 – 3000	15	3	Low	0.0mm
Test Pit 7	0 – 1000	8	21	Low	0.0mm
	1000 – 3000	12	16	Medium	17.6mm
Test Pit 9	400 – 1300	5	25	Low	0.0mm

Test Pit	Depth (mm)	Plasticity Index	0.02mm Material Fraction	* Potential Expansiveness	* Estimated Differential Heave (van der Merwe, 1964)
Test Pit 9	1300 – 2600	6	23	Low	0.0mm
	2600 – 3000	10	16	Low	0.0mm
Test Pit 11	300 – 1500	9	33	Low	0.0mm
	1500 – 3000	11	21	Low	0.0mm
Test Pit 12	1500 – 2500	12	21	Low	0.0mm
Test Pit 13	500 – 1800	7	24	Low	0.0mm
Test Pit 14	0 – 600	11	21	Low	0.0mm

Maximum Potential heave for any Test Pit is **24.5mm**.

* Based on van der Merwe (1964) – Improved by Savage (2007)

8.3 Excavatability of ground

Excavatability is defined as the ease with which the ground can be excavated to a depth of 3.0m. This is of importance for urban development as increased costs are associated with installing services or foundations in areas where difficulty is experienced with excavation. According to the test pits excavated on site, excavations up to a depth of 2.5meter should generally be feasible. The TLB used generally had no difficulty reaching depths up to 2.5meter, as indicated in the test pit profiles (Annexure A).

8.4 Collapse potential

Collapsible soils are soils, which can withstand relatively large imposed stresses with small settlements at low in situ moisture content but will decrease in volume causing relatively larger settlements when wetting occurs under a load. This volume change is associated with a change in the structure of the soil and can occur in any open structured silty sandy soils with a high void ratio. Colluvial soils situated on straight slopes, plains and residual soil are well drained and exhibit a low collapsibility.

Due to the nature of the soil, collapsibility and compressibility is a concern. It is recommended that the transported material found in the first 500mm is saturated with water and compacted with an impact roller or rammer to ensure a collapse prior to the

construction of any structures. Refer to Figure 3, taken from “Identification of Problematic soils in Southern Africa” by the Department of Public Works – 2007.

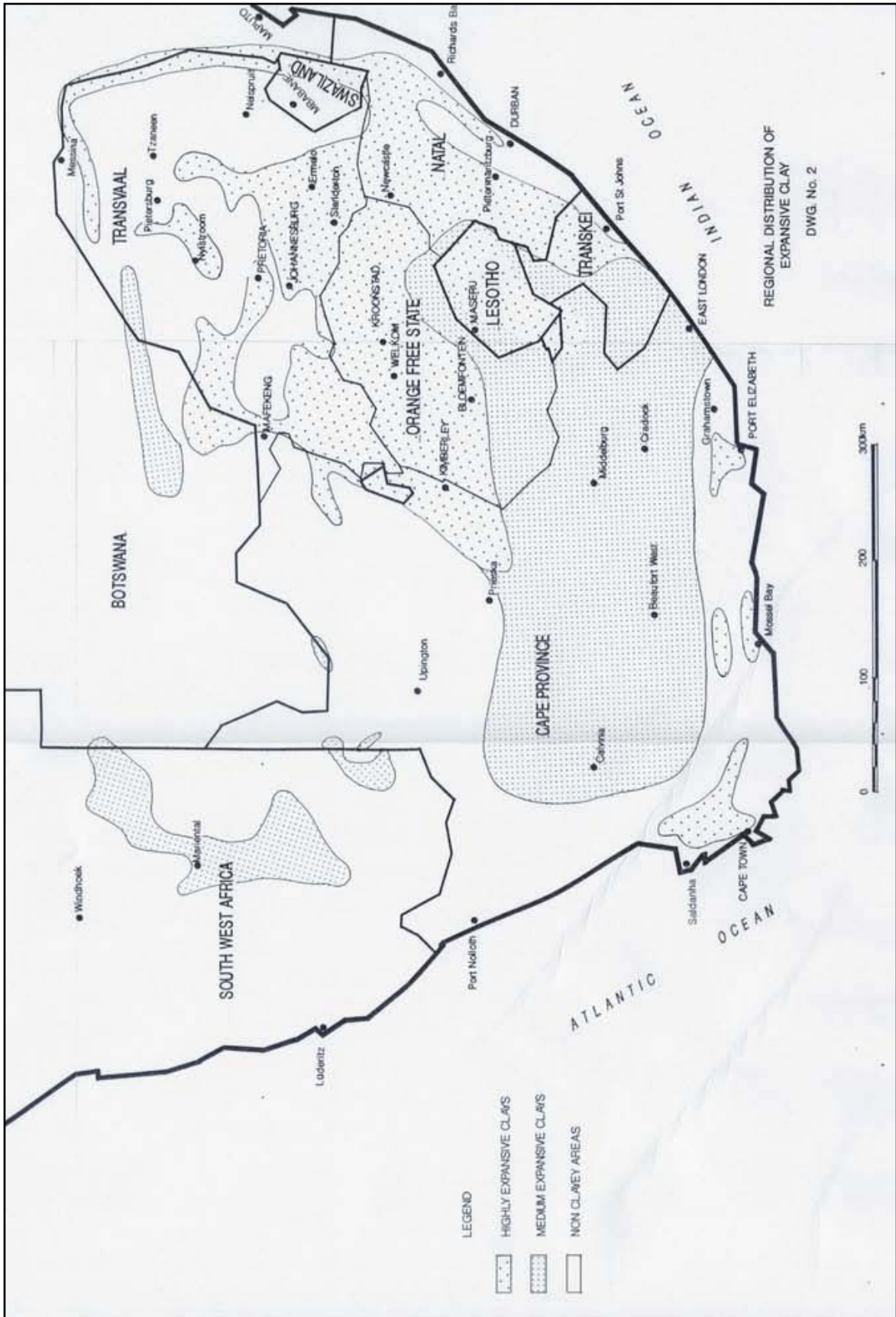


Figure 4: Regional Distribution of Expansive Clay

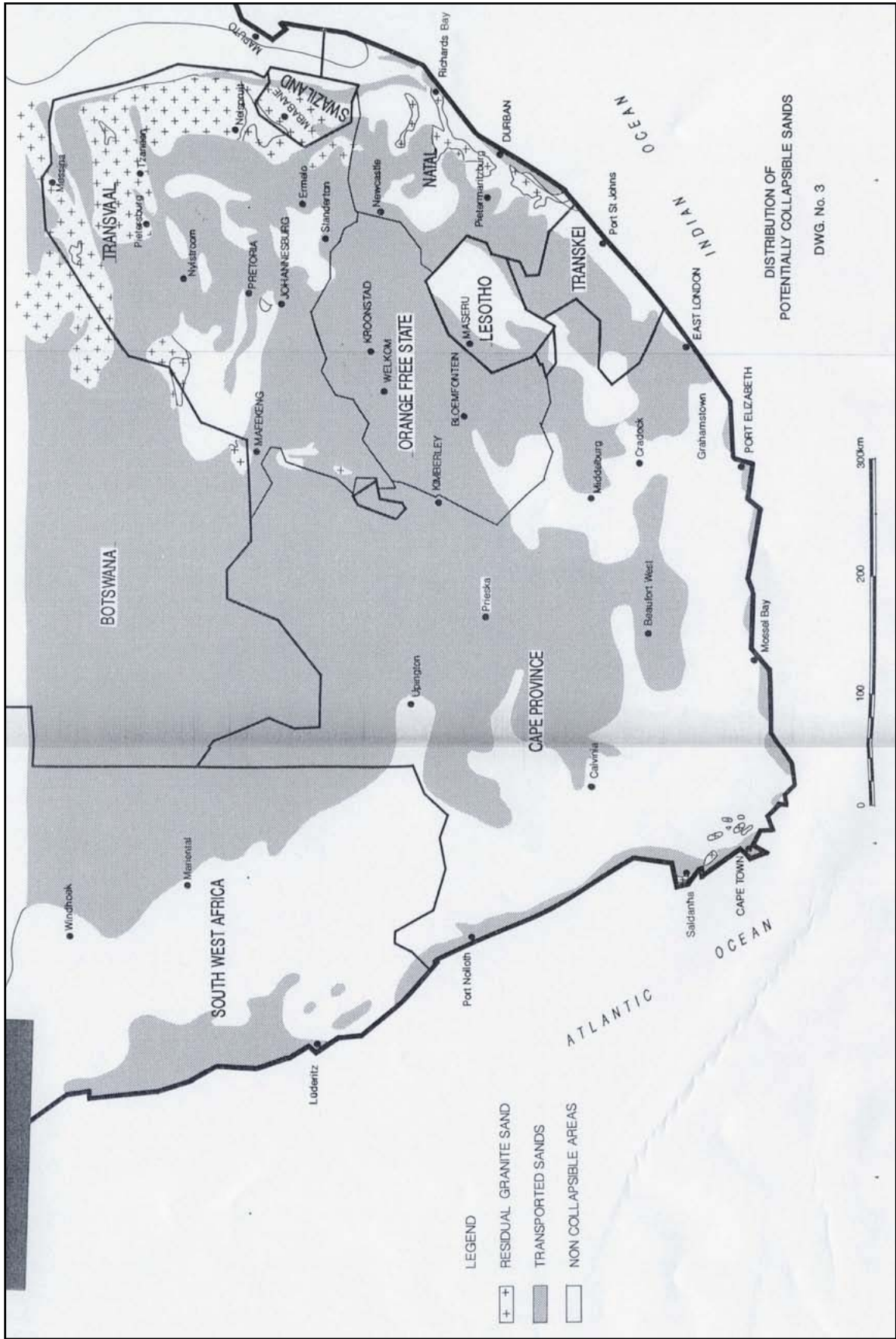


Figure 5: Distribution of Potentially Collapsible Sands

8.5 Compressibility

Given ideal conditions such as saturated moisture content and applied load, the soil will be compressible to a certain degree.

8.6 Erodibility

The erosion of soils is a function of the resistance of slope materials to entrainment and transport, and the potential of slope processes that promotes erosion. The resistance of soil to erosion is also related to the mechanical strength, cohesion and particle size of the material self. No erosion was evident during the investigation.

8.6 Dispersivity

A dispersive soil is prone to the desegregation or separation of clay particles from the soil mass on contact with water. These soils can be identified in the field by the presence of erosion gullies, piping and areas of stunted growth. The Emerson Crumb test can be used to identify the dispersivity of soil samples by determining the tendency of soil particles to deflocculate and go into suspension. There was no evidence of dispersivity on this site. No tests for dispersivity were done on the material sampled.

Dispersion can occur in any given soil with a high percentage of exchangeable sodium percentage (ESP), causing internal erosion and eventually piping through embankment dams. The tendency for dispersive erosion in a given soil depends upon such variables as the mineralogy and chemistry of the clay and the dissolved salts in the soil water and the eroding water.

8.7 Ground slope instability

This refers to an area comprising unstable geological materials that can move either gradually (creep) or suddenly as a slump or a slide. The risk of movement is determined by factors such as the nature of the slope (solid rock, colluvial material), gradient of slope, role of water, type and nature of vegetation cover, seismicity and impact of human

activities such as undermining of a slope. No such characteristics were observed during the investigation. The site and the gradient of slope is gentle and relatively flat.

8.8 California Bearing Ratio Tests (CBR)

Eight (8) CBR tests were done and the results can be summarised as follows:

Table 2: CBR Values

Test Pit	Depth (mm)	Californian Bearing Ratio at 95% MOD AASHTO
Test Pit 1	400 – 1500	3
	1500 – 3000	8
Test Pit 2	0 – 500	2
	1400 – 3000	2
Test Pit 3	800 – 1400	2
Test Pit 6	600 – 1800	10
Test Pit 11	1500 – 3000	3
Test Pit 14	0 – 600	4

The CBR Values are reasonably low, which indicates a relatively low bearing capacity estimated in the vicinity of 50 – 80 kPa.

9. ENGINEERING GEOLOGICAL ZONING

Based on the following summaries (Table 1 and Table 3), the NHBRC site zoning is:

Site Class C1/H2 – See Annexure E

The particle size analysis of the material on site is as follows: (Table 3)

Test Pit No.	Layer Thickness (mm)	Gravel >4.750mm	Sand >0.075-4.750mm	Silt >0.002-0.075mm	Clay <0.002mm
Test Pit 1	400 – 1500	1	64	16	19
	1500 – 3000	1	54	20	25
Test Pit 2	0 – 500	0	33	35	32
	1400 – 3000	1	52	24	23
Test Pit 3	0 – 800	0	67	9	24
	800 – 1400	21	60	11	8

Test Pit No.	Layer Thickness (mm)	Gravel >4.750mm	Sand >0.075-4.750mm	Silt >0.002-0.075mm	Clay <0.002mm
Test Pit 3	1400 – 2500	19	46	16	19
Test Pit 5	500 – 3000	2	63	22	13
Test Pit 6	600 – 1800	2	56	15	27
	1800 – 3000	42	50	5	3
Test Pit 7	0 – 1000	0	63	16	21
	1000 – 3000	6	29	49	16
Test Pit 9	400 – 1300	0	61	14	25
	1300 – 2600	0	59	18	23
	2600 – 3000	5	62	17	16
Test Pit 11	300 – 1500	0	59	8	33
	1500 – 3000	3	58	18	21
Test Pit 12	1500 – 2500	12	45	22	21
Test Pit 13	500 – 1800	0	53	28	19
Test Pit 14	0 – 600	0	59	20	21

Classification C refers to silty sands, sands, sandy and gravelly soils. Classification C1 refers to a total estimated settlement between 5.0mm and 10.0mm. Differential settlement equals approximately 75% of the total settlement expected.

Classification H refers to fine grained soils with moderate to very high plasticity, clayey sand, clay and other clay variant soils. Classification H2 refers to a total estimated heave between 15.0mm and 30.0mm. Differential heave equals approximately 50% of the total settlement expected.

(Reference: Home Building Manual, Part1, Section2, Table1: Residential site class designations)

10. GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations that could influence the proposed development were identified:

10.1 **Site Class H2/C1** : (*Stiffened or cellular raft, Piled Construction, Soil raft*), *Stiffened or cellular raft of articulated lightly reinforced masonry*,
Or

Piled construction – Piled foundation with suspended floor slabs with or without ground beams,

Or

Soil raft - Remove all or necessary parts of expansive horizon to 1.0m beyond the perimeter of the building and replace with inert backfill compacted to 93% MOD AASHTO density at -1% to +2% optimum moisture content. Normal construction with light reinforced strip footings with light reinforcement in masonry if residual movement is < 7.5mm, or construction type appropriate to residual movements.

10.2 Excavatability: Medium excavations can be expected on site – Refer to Annexure A. ***No blasting operations are foreseen. However an excavator might need to be used with some of the harder materials.***

10.3 Soil classification: The typical material found on site is silty sand with potential heave estimated as medium, although some materials are deemed to be low. Although it is not clear that expansive materials occur across the entire site, Welkom is deemed to have prevalent heaving clays. This is a factor which must be considered during the design phase.

10.4 Groundwater: No ground water was encountered during the investigation.

10.5 Stability of slopes and excavations: The sides of the test pits did not appear to fall in; therefore the excavations appear to be stable.

- 10.6 There seems to be an ant problem on site with copious amounts of ants encountered in various test pits.
- 10.7 It is recommended that no development takes place within the 100-year flood parameter.
- 10.8 The site conditions seem favourable for the proposed township development, subject to the aforementioned considerations.

11. REFERENCES

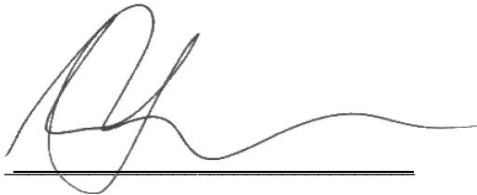
FIGURES:

- Figure 1: Obtained from Google Earth – www.google.com/earth
- Figure 2: Obtained from Google Earth – www.google.com/earth
- Figure 3: Taken from TRH3:2007, adopted from Weinert 1980.
- Figures 4 & 5: South African Institute for Engineering and Environmental Geologists. (2000) *A Short Workshop on Suggested Interpretation Techniques of Soil Movement*. Stellenbosch Business School.

OTHER REFERENCES:

- 1.) Van der Merwe D. (1964) The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. *Civil Engineer in South Africa June 1964*.
- 2.) Jennings, J E B, Brink, A B A and Williams A A B. (1973) Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa. *The Civil Engineer in S A, p 3-12. January 1973*.
- 3.) Weinert H H,(1980) The Natural Road Construction Materials of Southern Africa *Academica, Cape Town*.
- 4.) National Department of Housing: Geotechnical Site Investigations for Housing Developments – Generic Specifications GFSH-2, table 3 page 27, published in September 2002.

- 5.) NHBRC - Home Building Manual, Part1, Section2, Table1: Residential site class designations
- 6.) Savage P.F.(2007) Evaluation of Possible Swelling Potential of Soil
Proceedings of the 26th S A Transport Conference July 2007.



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Annexure A:

Soil profiles



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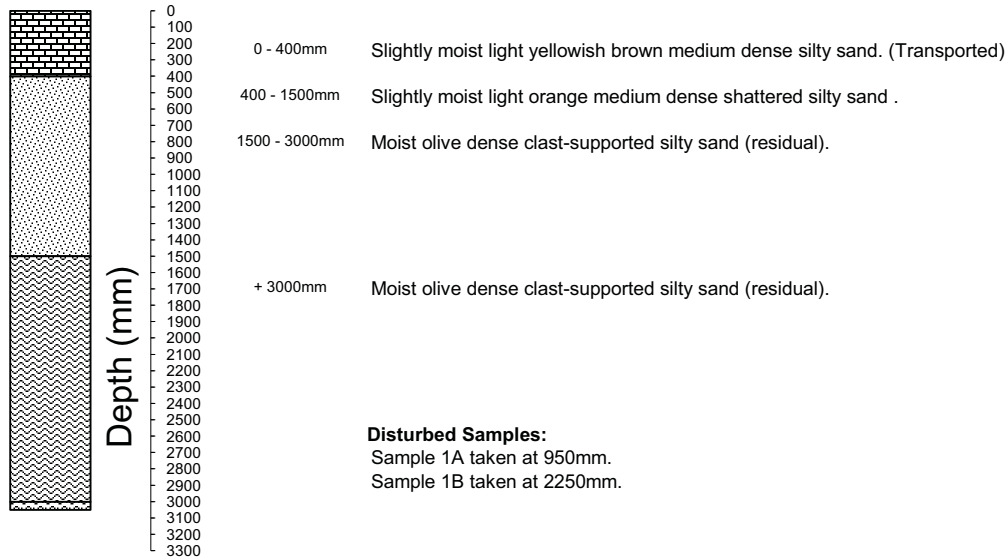
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Test Pit : 1 Coordinates: 27 Y0016521 X3096948 Date Profiled: 20/03/2013

CLIENT: Phethogo Consulting
PROJECT: Welkom - Homestead

Starting Depth: 0mm
End Depth: 3000mm





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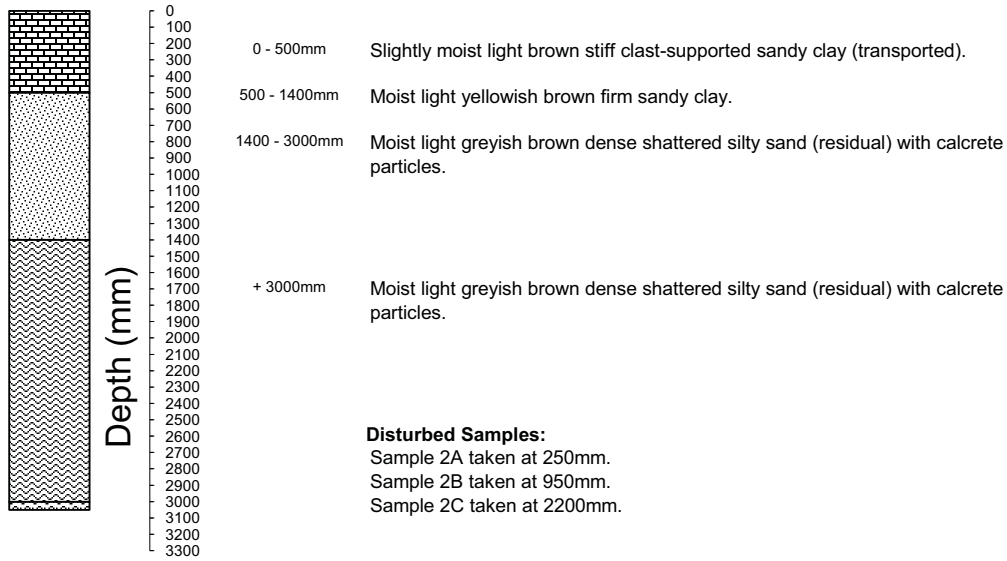
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Date Profiled: 20/03/2013

CLIENT: Phethogo Consulting
PROJECT: Welkom - Homestead

Starting Depth: 0mm
End Depth: 3000mm





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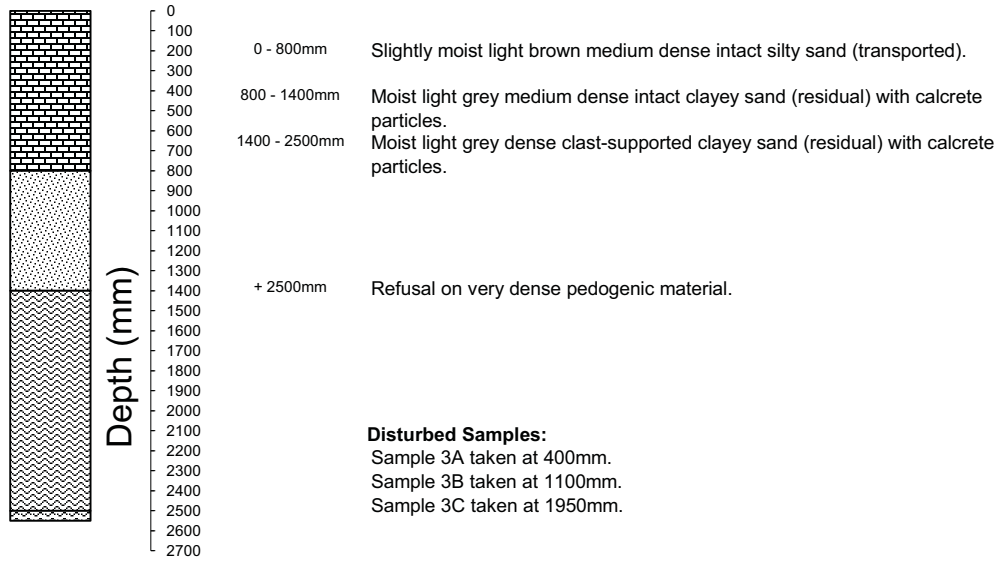
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PROJECT: Welkom - Homestead

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End Depth: 2500mm





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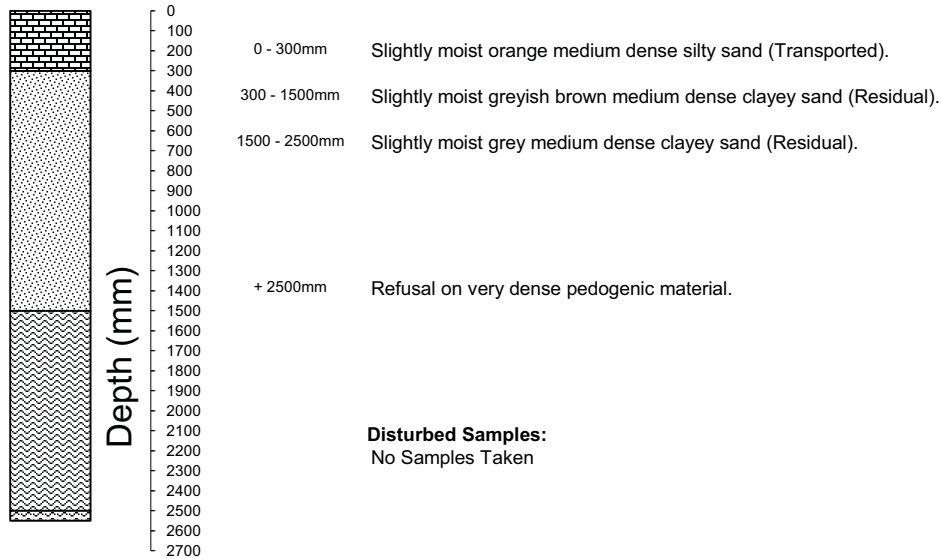
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Date Profiled: 20/03/2013

CLIENT: Phethogo Consulting
PROJECT: Welkom - Homestead

Starting Depth: 0mm
End Depth: 2500mm





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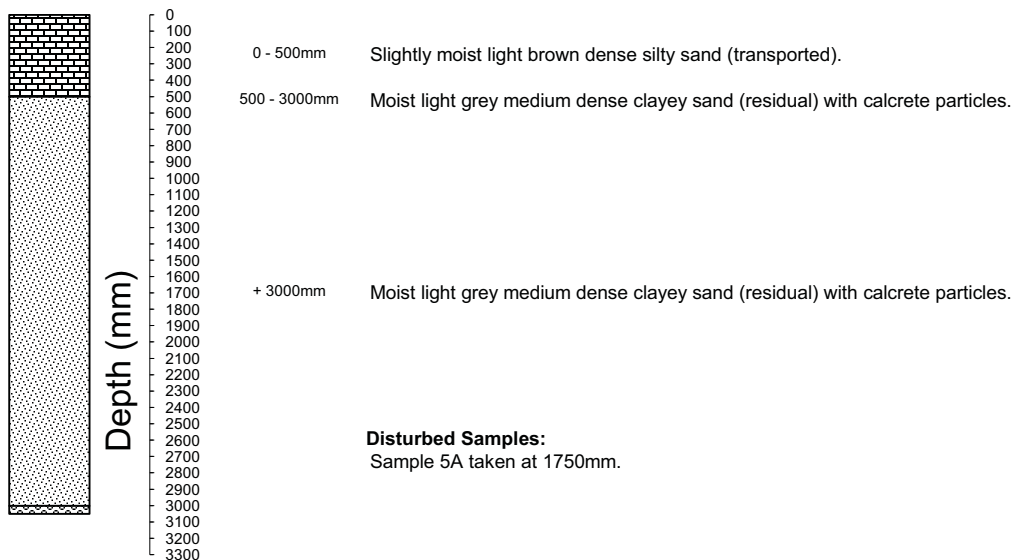
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Date Profiled: 20/03/2013

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Starting Depth: 0mm
End Depth: 3000mm





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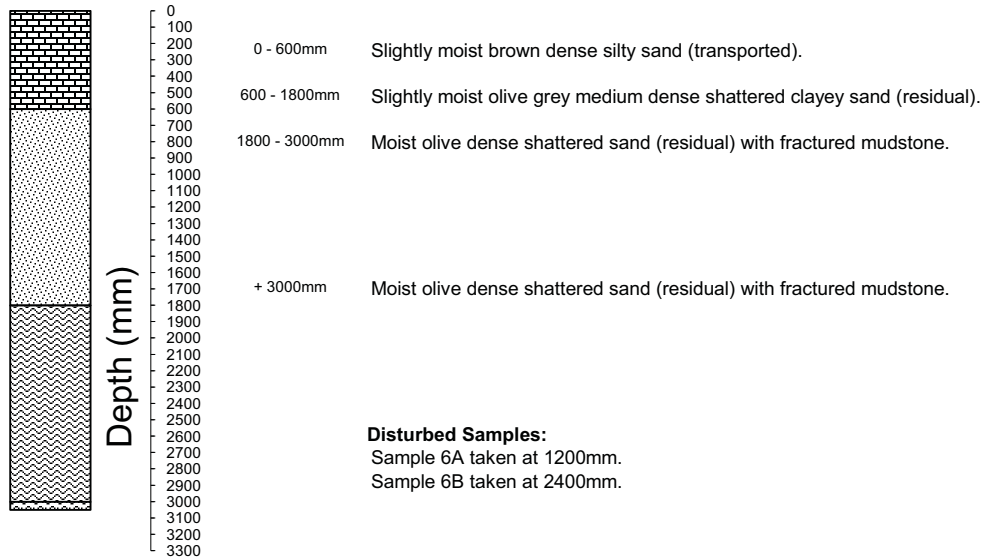
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End Depth: 3000mm





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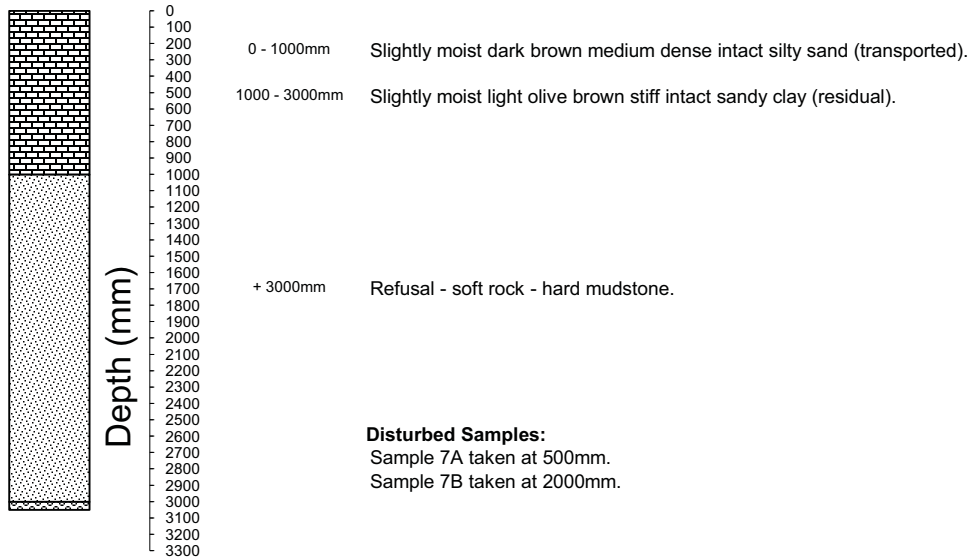
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Starting Depth: 0mm
End Depth: 3000mm





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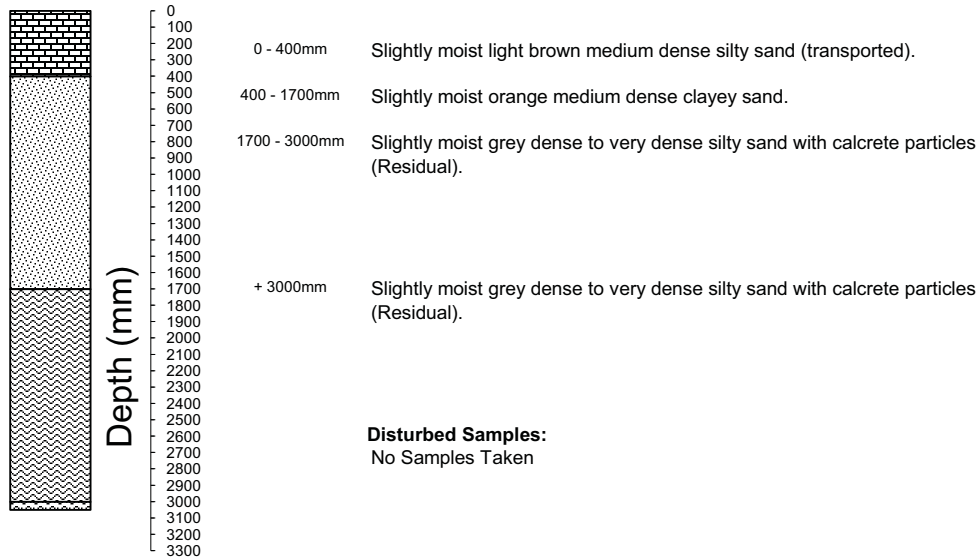
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Starting Depth: 0mm
End Depth: 3000mm





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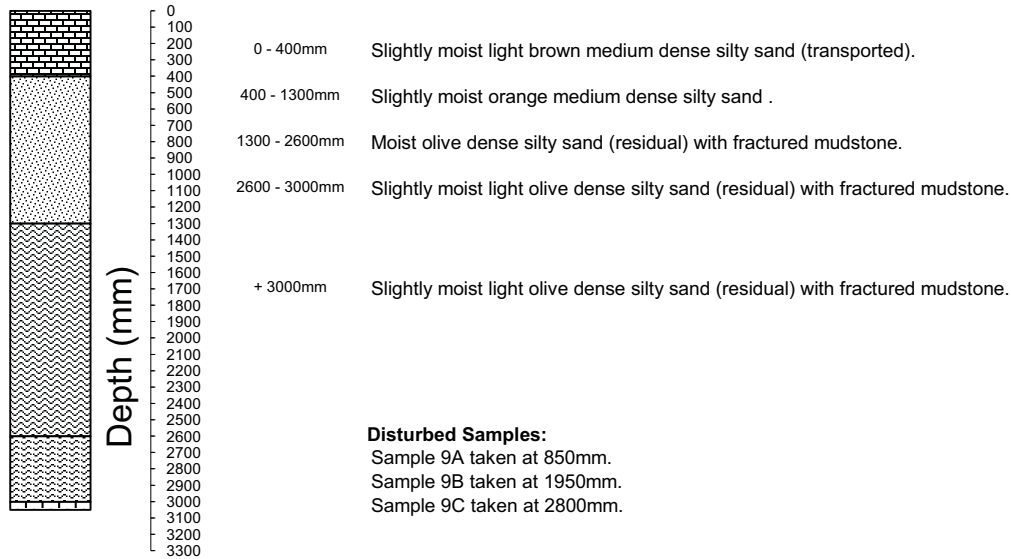
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Starting Depth: 0mm
End Depth: 3000mm





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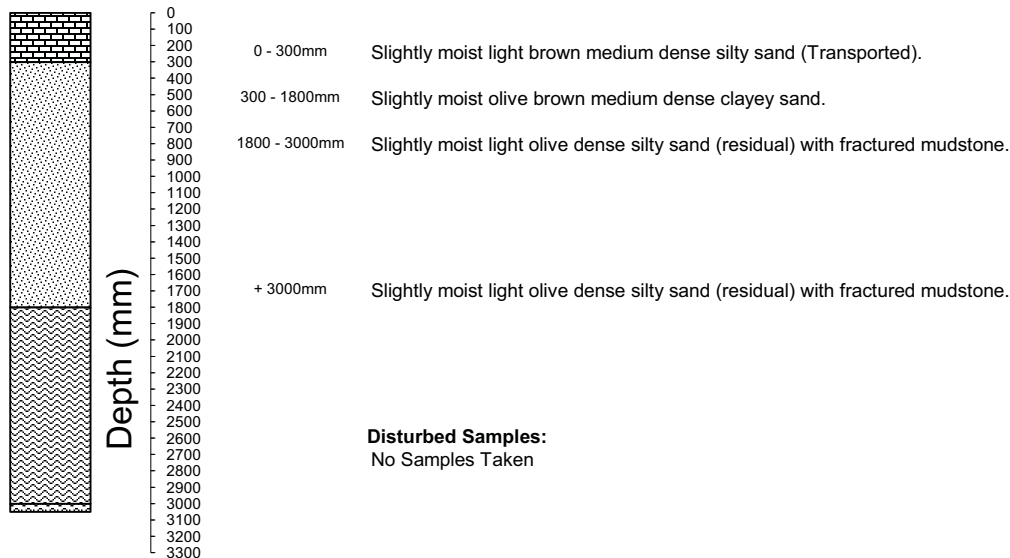
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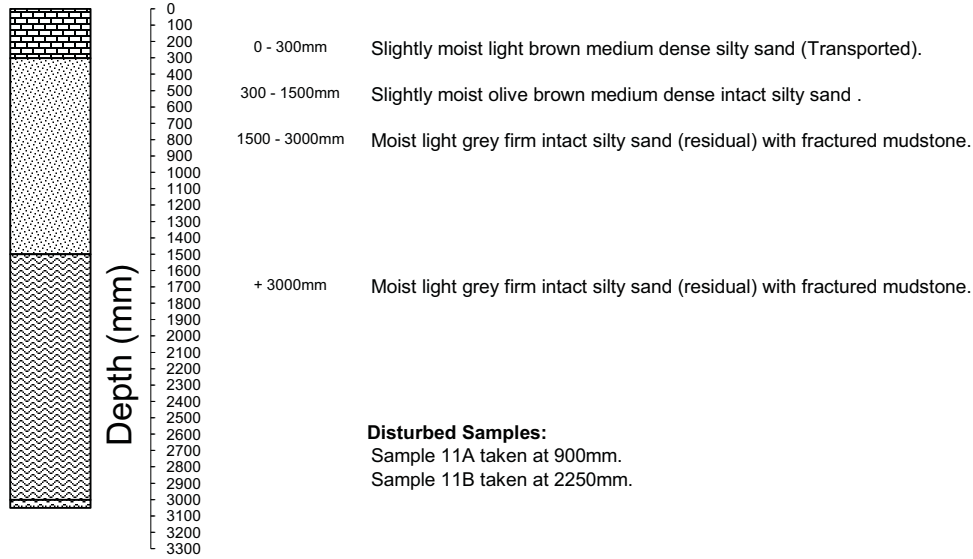
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End Depth: 3000mm





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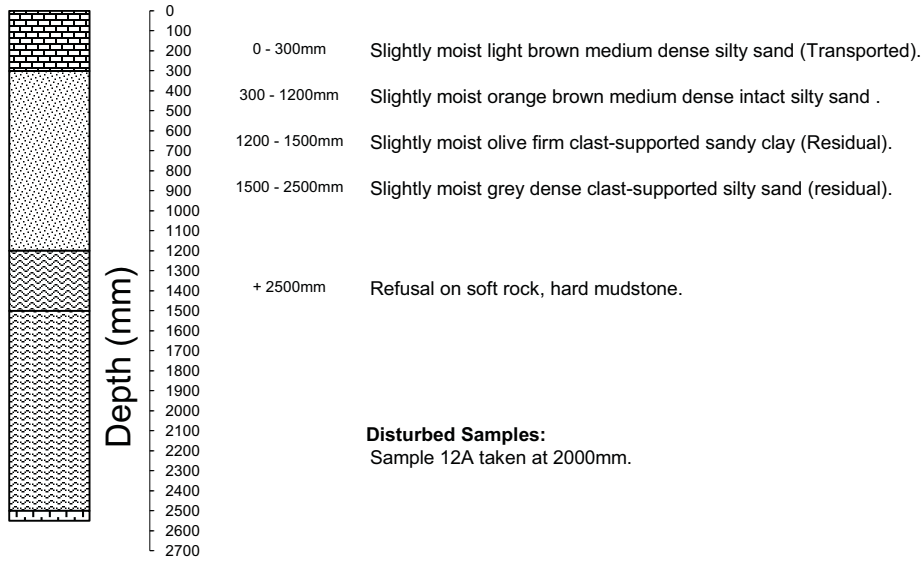
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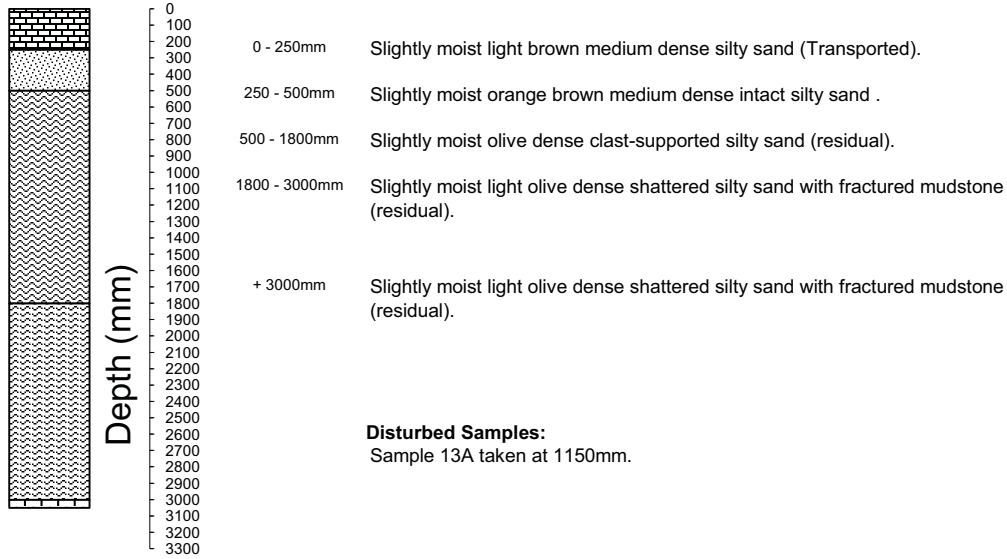
Test Pit : 13

Coordinates: 27 Y0015560 X3096928

Date Profiled: 20/03/2013

CLIENT: Phethogo Consulting
PROJECT: Welkom - Homestead

Starting Depth: 0mm
End Depth: 3000mm





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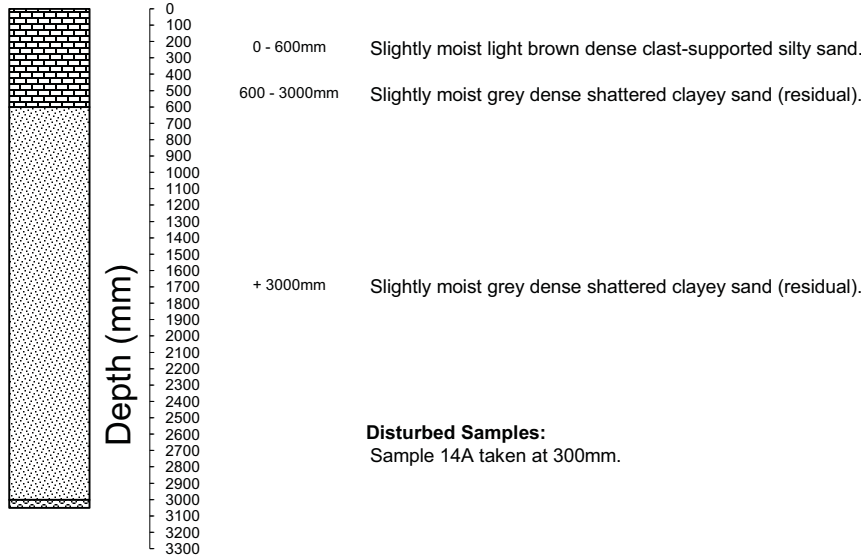
Test Pit : 14

Coordinates: 27 Y0015570 X3097091

Date Profiled: 20/03/2013

CLIENT: Phethogo Consulting
PROJECT: Welkom - Homestead

Starting Depth: 0mm
End Depth: 3000mm





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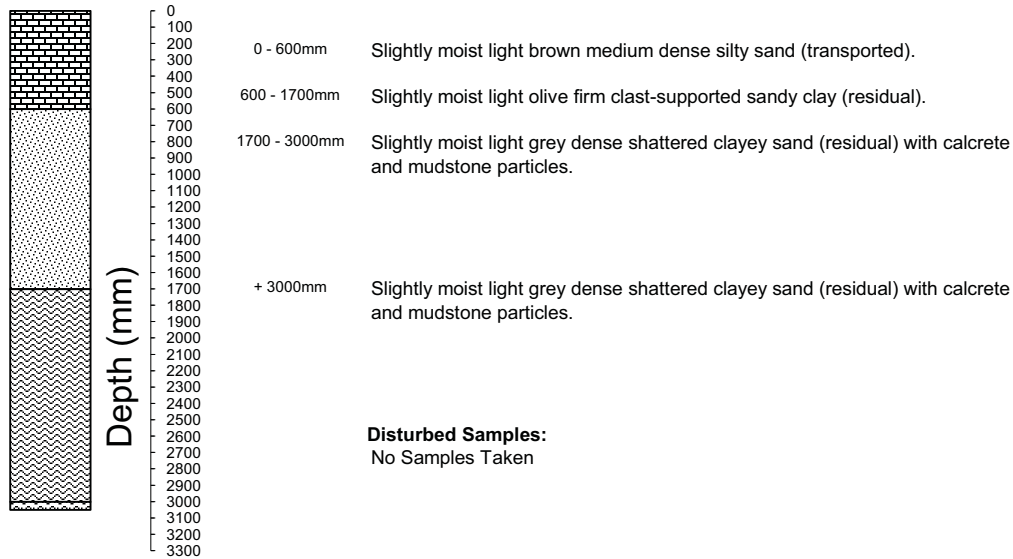
Test Pit : 15

Coordinates: 27 Y0015371 X3096780

Date Profiled: 20/03/2013

CLIENT: Phethogo Consulting
PROJECT: Welkom - Homestead

Starting Depth: 0mm
End Depth: 3000mm





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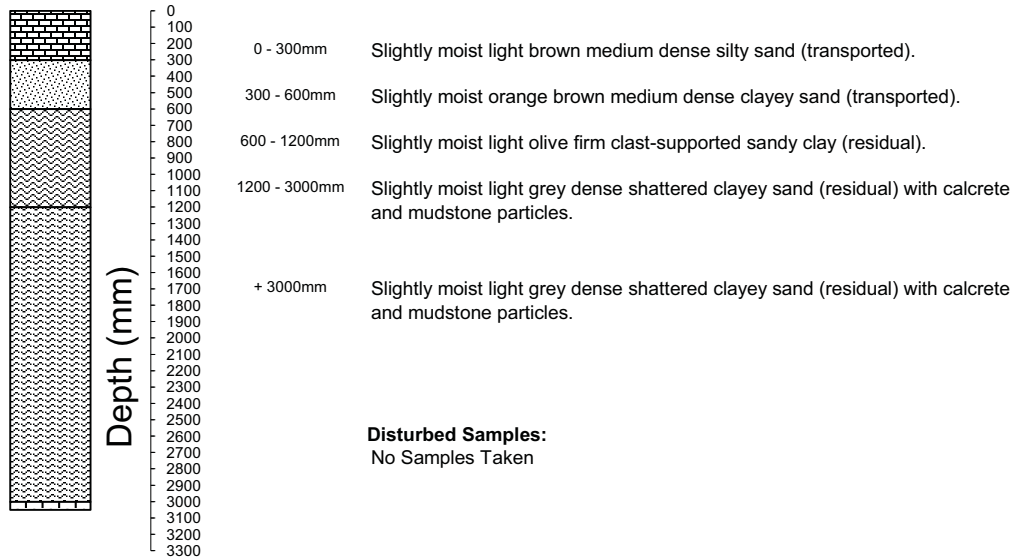
Test Pit : 16

Coordinates: 27 Y0015360 X3096968

Date Profiled: 20/03/2013

CLIENT: Phethogo Consulting
PROJECT: Welkom - Homestead

Starting Depth: 0mm
End Depth: 3000mm



Annexure B: Laboratory test results



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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 001 / 13 / Ind Cbr **Req No :** None **Order No :** None **Date** 24 / 06 / 2013

Phethogo Consulting
PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.		P792 / 13	P793 / 13	
CONTAINER USED FOR SAMPLING		Sampling Bag	Sampling Bag	
SIZE / WEIGHT OF SAMPLE		± 70 Kg	± 70 Kg	
MOISTURE CONDITION OF		Slightly Moist	Slightly Moist	
HOLE No. / Km. / CHAINAGE		Test pit 1A	Test pit 1B	
COORDINATES				
LAYER TESTED / SAMPLED FROM		400 - 1500mm	1500 - 3000mm	
DATE RECEIVED		20 / 03 / 2013	20 / 03 / 2013	
MATERIAL DESCRIPTION		Slightly moist light orange medium dense shattered silty sand .	Moist olive dense clast-supported silty sand (residual).	
SIEVE ANALYSIS(mm) (TMH A1a)	75.0			
	63.0			
	53.0			
	37.5			
	26.5			
	19.0			
	13.2	100	100	
	4.75	99	99	
	2.00	96	97	
	0.425	88	91	
0.075	35	45		
0.002	19 / *21	25 / *25		
ATTERBERG LIMITS (TMH A2&A3)	LL%	28	33	
	P.I.	11	13	
	LS%	5.0	6.2	
GM - GRADING MODULES		0.81	0.67	
MOD AASHTO (TMH A7)	MDD kg/m ³	1720	1709	
	OMC%	14.3	16.3	
Moulded density	MD1	99.8	100.5	
	MD2	94.6	94.9	
	MD3	89.5	91.4	
Swell %	S1	1.9	1.9	
	S2	2.0	1.3	
	S3	2.1	1.5	
C.B.R. (TMH A8)	100	3	11	
	98	3	10	
	97	3	9	
	95	3	8	
	93	2	8	
	90	2	7	
CLASSIFICATION	HRB			
	TRH 14			
	COLTO	Fill	Fill	

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab/ Prehab JV
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 002 /13 / Ind Cbr **Req No :** None **Order No :** None **Date** 24 /06 /2013

Phethogo Consulting
PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.	P794 / 13	P795/ 13	
CONTAINER USED FOR SAMPLING	Sampling Bag	Sampling Bag	
SIZE / WEIGHT OF SAMPLE	± 70 Kg	± 70 Kg	
MOISTURE CONDITION OF	Slightly Moist	Slightly Moist	
HOLE No. / Km. / CHAINAGE	Test pit 2A	Test pit 2B	
COORDINATES			
LAYER TESTED / SAMPLED FROM	0 - 500mm	1400 - 3000mm	
DATE RECEIVED	20 /03 /2013	20 /03 /2013	
MATERIAL DESCRIPTION	Slightly moist light brown stiff clast-supported sandy clay (transported).	Moist light greyish brown dense shattered silty sand (residual) with calcrete particles.	

SIEVE ANALYSIS(mm) (TMH A1a)	75.0		
	63.0		
	53.0		
	37.5		
	26.5		
	19.0		
	13.2		100
	4,75	100	99
	2,00	97	89
	0,425	92	81
	0,075	67	47
0,002	32 / *31	23 / *19	

ATTERBERG LIMITS (TMH A2&A3)	LL%	41	29
	P.I.	17	13
	LS%	8.5	5.6

GM - GRADING MODULES	0.44	0.83
----------------------	------	------

MOD AASHTO (TMH A7)	MDD kg/m ³	1947	1790
	OMC%	10.2	14.4
Moulded density	MD1	101.2	99.7
	MD2	95.8	95.4
	MD3	89.6	89.4
Swell %	S1	3.9	5.3
	S2	5.6	5.5
	S3	6.6	6.3
C.B.R. (TMH A8)	100	4	2
	98	3	2
	97	3	2
	95	2	2
	93	2	1
	90	1	1

CLASSIFICATION	HRB		
	TRH 14		
	COLTO	Fill	Fill

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 003 /13 / Ind Cbr **Req No :** None **Order No :** None **Date** 24 /06 /2013

Phethogo Consulting
PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.	P796 / 13	P797 / 13	P798 / 14
CONTAINER USED FOR SAMPLING	Sampling Bag	Sampling Bag	Sampling Bag
SIZE / WEIGHT OF SAMPLE	± 70 Kg	± 70 Kg	± 70 Kg
MOISTURE CONDITION OF	Slightly Moist	Slightly Moist	Slightly Moist
HOLE No. / Km. / CHAINAGE	Test pit 3A	Test pit 3B	Test pit 3C
COORDINATES			
LAYER TESTED / SAMPLED FROM	0 - 800mm	800 - 1400mm	1400- 2500mm
DATE RECEIVED	20 /03 /2013	20 /03 /2013	20/03 /2013
MATERIAL DESCRIPTION	Slightly moist light brown medium dense intact silty sand (transported).	Moist light grey medium dense intact clayey sand (residual) with calcrete particles.	Moist light grey dense clast-supported clayey sand (residual) with calcrete particles.
SIEVE ANALYSIS(mm) (TMH A1a)	75.0		
	63.0		
	53.0		
	37.5		100
	26.5		95
	19.0	100	95
	13.2		88
	4.75	100	79
	2.00	100	63
	0.425	98	43
0.075	33	19	
0.002	24 / *19	8 / *16	19 / *13
ATTERBERG LIMITS (TMH A2&A3)	LL%	23	42
	P.I.	6	15
	LS%	2.5	8.0
GM - GRADING MODULES	0.69	1.75	1.30
MOD AASHTO (TMH A7)	MDD kg/m ³		1829
	OMC%		12.3
Moulded density	MD1		99.7
	MD2		94.9
	MD3		91.2
Swell %	S1		1.8
	S2		2.4
	S3		2.6
C.B.R. (TMH A8)	100		3
	98		3
	97		3
	95		2
	93		2
	90		2
CLASSIFICATION	HRB		
	TRH 14		
	COLTO		Fill

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 004 /13 / Ind Cbr Req No : None Order No : None Date 24 /06 /2013

Phethogo Consulting
PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.	P811 / 13		
CONTAINER USED FOR SAMPLING	Sampling Bag		
SIZE / WEIGHT OF SAMPLE	± 70 Kg		
MOISTURE CONDITION OF	Slightly Moist		
HOLE No. / Km. / CHAINAGE	Test pit 5A		
COORDINATES			
LAYER TESTED / SAMPLED FROM	500 - 3000mm		
DATE RECEIVED	20 /03 /2013		
MATERIAL DESCRIPTION	Moist light grey medium dense clayey sand (residual) with calcrete particles.		
SIEVE ANALYSIS(mm) (TMH A1a)	75.0		
	63.0		
	53.0		
	37.5		
	26.5		
	19.0		
	13.2	100	
	4,75	98	
	2,00	84	
	0,425	67	
0,075	35		
0,002	13 / *23		
ATTERBERG LIMITS (TMH A2&A3)	LL%	39	
	P.I.	14	
	LS%	7.6	
GM - GRADING MODULES	1.14		
MOD AASHTO (TMH A7)	MDD kg/m ³		
	OMC%		
Moulded density	MD1		
	MD2		
	MD3		
Swell %	S1		
	S2		
	S3		
C.B.R. (TMH A8)	100		
	98		
	97		
	95		
	93		
CLASSIFICATION	HRB		
	TRH 14		
	COLTO		

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 005 /13 / Ind Cbr **Req No :** None **Order No :** None **Date** 24 /06 /2013

Phethogo Consulting
PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.		P799 / 13	P800 / 13	
CONTAINER USED FOR SAMPLING		Sampling Bag	Sampling Bag	
SIZE / WEIGHT OF SAMPLE		± 70 Kg	± 70 Kg	
MOISTURE CONDITION OF		Slightly Moist	Slightly Moist	
HOLE No. / Km. / CHAINAGE		Test pit 6A	Test pit 6B	
COORDINATES				
LAYER TESTED / SAMPLED FROM		600 - 1800mm	1800 - 3000mm	
DATE RECEIVED		20 /03 /2013	20 /03 /2013	
MATERIAL DESCRIPTION		Slightly moist olive grey medium dense shattered clayey sand (residual).	Moist olive dense shattered sand (residual) with fractured mudstone.	
SIEVE ANALYSIS(mm) (TMH A1a)	75.0			
	63.0			
	53.0			
	37.5		100	
	26.5		87	
	19.0		86	
	13.2	100	78	
	4,75	98	58	
	2,00	95	35	
	0,425	91	15	
0,075	42	8		
0,002	27 / *32	3 / *5		
ATTERBERG LIMITS (TMH A2&A3)	LL%	43	42	
	P.I.	18	15	
	LS%	6.2	7.1	
GM - GRADING MODULES		0.72	2.42	
MOD AASHTO (TMH A7)	MDD kg/m ³	1824		
	OMC%	11.2		
Moulded density	MD1	99.9		
	MD2	95.0		
	MD3	89.8		
Swell %	S1	2.2		
	S2	3.9		
	S3	5.4		
C.B.R. (TMH A8)	100	18		
	98	15		
	97	13		
	95	10		
	93	8		
	90	6		
CLASSIFICATION	HRB			
	TRH 14			
	COLTO	Fill		

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 006 /13 / Ind Cbr **Req No :** None **Order No :** None **Date** 24 /06 /2013

Phethogo Consulting
PO Box 43284
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ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.	P801 / 13	P802 / 13	
CONTAINER USED FOR SAMPLING	Sampling Bag	Sampling Bag	
SIZE / WEIGHT OF SAMPLE	± 70 Kg	± 70 Kg	
MOISTURE CONDITION OF	Slightly Moist	Slightly Moist	
HOLE No. / Km. / CHAINAGE	Test pit 7A	Test pit 7B	
COORDINATES			
LAYER TESTED / SAMPLED FROM	0 - 1000mm	1000 - 3000mm	
DATE RECEIVED	20 /03 /2013	20 /03 /2013	
MATERIAL DESCRIPTION	Slightly moist dark brown medium dense intact silty sand (transported).	Slightly moist light olive brown stiff intact sandy clay (residual).	

SIEVE ANALYSIS(mm) (TMH A1a)	75.0		
	63.0		
	53.0		
	37.5		
	26.5		
	19.0		100
	13.2		99
	4,75	100	94
	2,00	98	93
	0,425	96	88
	0,075	37	65
0,002	21 / *21	16 / *29	

ATTERBERG LIMITS (TMH A2&A3)	LL%	26	38
	P.I.	8	12
	LS%	3.5	5.9

GM - GRADING MODULES	0.69	0.54
----------------------	------	------

MOD AASHTO (TMH A7)	MDD kg/m ³		
	OMC%		
Moulded density	MD1		
	MD2		
	MD3		
Swell %	S1		
	S2		
	S3		
C.B.R. (TMH A8)	100		
	98		
	97		
	95		
	93		
	90		

CLASSIFICATION	HRB		
	TRH 14		
	COLTO		

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 007 /13 / Ind Cbr **Req No :** None **Order No :** None **Date** 24 /06 /2013

Phethogo Consulting
PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.	P803 / 13	P804 / 13	P805 / 13
CONTAINER USED FOR SAMPLING	Sampling Bag	Sampling Bag	Sampling Bag
SIZE / WEIGHT OF SAMPLE	± 70 Kg	± 70 Kg	± 70 Kg
MOISTURE CONDITION OF	Slightly Moist	Slightly Moist	Slightly Moist
HOLE No. / Km. / CHAINAGE	Test pit 9A	Test pit 9B	Test pit 9C
COORDINATES			
LAYER TESTED / SAMPLED FROM	400 - 1300mm	1300 - 2600mm	2600 - 3000mm
DATE RECEIVED	20 /03 /2013	20 /03 /2013	20 /03 /2013
MATERIAL DESCRIPTION	Slightly moist orange medium dense silty sand .	Moist olive dense silty sand (residual) with fractured mudstone.	Slightly moist light olive dense silty sand (residual) with fractured mudstone.
SIEVE ANALYSIS(mm) (TMH A1a)	75.0		
	63.0		
	53.0		
	37.5		
	26.5		
	19.0		
	13.2		100
	4.75	100	100
	2.00	98	100
	0.425	97	97
0.075	39	41	
0.002	25 / *17	23 / *21	16 / *25
ATTERBERG LIMITS (TMH A2&A3)	LL%	22	26
	P.I.	5	6
	LS%	2.1	2.4
GM - GRADING MODULES	0.66	0.62	0.93
MOD AASHTO (TMH A7)	MDD kg/m ³		
	OMC%		
Moulded density	MD1		
	MD2		
	MD3		
Swell %	S1		
	S2		
	S3		
C.B.R. (TMH A8)	100		
	98		
	97		
	95		
	93		
CLASSIFICATION	HRB		
	TRH 14		
	COLTO		

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 008 /13 / Ind Cbr Req No : None Order No : None Date 24 /06 /2013

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ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.		P806 / 13	P807 / 13	
CONTAINER USED FOR SAMPLING		Sampling Bag	Sampling Bag	
SIZE / WEIGHT OF SAMPLE		± 70 Kg	± 70 Kg	
MOISTURE CONDITION OF		Slightly Moist	Slightly Moist	
HOLE No. / Km. / CHAINAGE		Test pit 11A	Test pit 11B	
COORDINATES				
LAYER TESTED / SAMPLED FROM		300 - 1500mm	1500 - 3000	
DATE RECEIVED		20 /03 /2013	20 /03 /2013	
MATERIAL DESCRIPTION		Slightly moist olive brown medium dense intact silty sand .	Moist light grey firm intact silty sand (residual) with fractured mudstone.	
SIEVE ANALYSIS(mm) (TMH A1a)	75.0			
	63.0			
	53.0			
	37.5			
	26.5			
	19.0			
	13.2		100	
	4,75	100	97	
	2,00	100	96	
	0,425	97	92	
0,075	41	39		
0,002	33 / *27	21 / *26		
ATTERBERG LIMITS (TMH A2&A3)	LL%	33	32	
	P.I.	9	11	
	LS%	4.4	5.2	
GM - GRADING MODULES		0.62	0.73	
MOD AASHTO (TMH A7)	MDD kg/m ³		1789	
	OMC%		12.7	
Moulded density	MD1		99.6	
	MD2		94.3	
	MD3		90.4	
Swell %	S1		4.0	
	S2		4.6	
	S3		4.9	
C.B.R. (TMH A8)	100		4	
	98		3	
	97		3	
	95		3	
	93		2	
	90		2	
CLASSIFICATION	HRB			
	TRH 14			
	COLTO		Fill	

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 009 / 13 / Ind Cbr Req No : None Order No : None Date 24 / 06 / 2013

Phethogo Consulting
PO Box 43284
Heuwelsig/Bloemfontein
9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.	P808 / 13		
CONTAINER USED FOR SAMPLING	Sampling Bag		
SIZE / WEIGHT OF SAMPLE	± 70 Kg		
MOISTURE CONDITION OF	Slightly Moist		
HOLE No. / Km. / CHAINAGE	Test pit 12A		
COORDINATES			
LAYER TESTED / SAMPLED FROM	1500 - 2500mm		
DATE RECEIVED	20 / 03 / 2013		
MATERIAL DESCRIPTION	Slightly moist grey dense clast-supported silty sand (residual).		
SIEVE ANALYSIS(mm) (TMH A1a)	75.0		
	63.0		
	53.0		
	37.5		
	26.5		
	19.0	100	
	13.2	96	
	4,75	88	
	2,00	83	
	0,425	70	
0,075	43		
0,002	21 / *22		
ATTERBERG LIMITS (TMH A2&A3)	LL%	36	
	P.I.	12	
	LS%	6.7	
GM - GRADING MODULES	1.04		
MOD AASHTO (TMH A7)	MDD kg/m ³		
	OMC%		
Moulded density	MD1		
	MD2		
	MD3		
Swell %	S1		
	S2		
	S3		
C.B.R. (TMH A8)	100		
	98		
	97		
	95		
	93		
CLASSIFICATION	HRB		
	TRH 14		
	COLTO		

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
The results reported relate only to the sample tested
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 010 /13 / Ind Cbr Req No : None Order No : None Date 24 /06 /2013

Phethogo Consulting
PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.		P809 / 13			
CONTAINER USED FOR SAMPLING		Sampling Bag			
SIZE / WEIGHT OF SAMPLE		± 70 Kg			
MOISTURE CONDITION OF		Slightly Moist			
HOLE No. / Km. / CHAINAGE		Test pit 13A			
COORDINATES					
LAYER TESTED / SAMPLED FROM		500 - 1800mm			
DATE RECEIVED		20 /03 /2013			
MATERIAL DESCRIPTION		Slightly moist olive dense clast-supported silty sand (residual).			
SIEVE ANALYSIS(mm) (TMH A1a)	75.0				
	63.0				
	53.0				
	37.5				
	26.5				
	19.0				
	13.2				
	4,75	100			
	2,00	100			
	0,425	98			
0,075	47				
0,002	19 / *24				
ATTERBERG LIMITS (TMH A2&A3)	LL%	30			
	P.I.	7			
	LS%	3.6			
GM - GRADING MODULES		0.55			
MOD AASHTO (TMH A7)	MDD kg/m ³				
	OMC%				
Moulded density	MD1				
	MD2				
	MD3				
Swell %	S1				
	S2				
	S3				
C.B.R. (TMH A8)	100				
	98				
	97				
	95				
	93				
	90				
CLASSIFICATION	HRB				
	TRH 14				
	COLTO				

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :

* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
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Civil Engineering Material Testing Laboratories

Our Reference: Homestead / 011 /13 / Ind Cbr Req No : None Order No : None Date 24 /06 /2013

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PO Box 43284
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9332

ATTENTION: Mr. Piet De Bie

Test Report : Geotechnical Investigation: Homestead, Welkom

Please find the attached test results for the sample/s as submitted to and tested by Roadlab / Prehab JV in Bloemfontein.
The unambiguous description of the sample/s as received are as follows :

SAMPLE No.		P810 / 13	
CONTAINER USED FOR SAMPLING		Sampling Bag	
SIZE / WEIGHT OF SAMPLE		± 70 Kg	
MOISTURE CONDITION OF		Slightly Moist	
HOLE No. / Km. / CHAINAGE		Test pit 14A	
COORDINATES			
LAYER TESTED / SAMPLED FROM		0 - 600mm	
DATE RECEIVED		20 /03 /2013	
MATERIAL DESCRIPTION		Slightly moist light brown dense clast-supported silty sand.	
SIEVE ANALYSIS(mm) (TMH A1a)	75.0		
	63.0		
	53.0		
	37.5		
	26.5		
	19.0		
	13.2		
	4,75	100	
	2,00	98	
	0,425	92	
0,075	41		
0,002	21 / *22		
ATTERBERG LIMITS (TMH A2&A3)	LL%	28	
	P.I.	11	
	LS%	4.6	
GM - GRADING MODULES		0.69	
MOD AASHTO (TMH A7)	MDD kg/m ³	1826	
	OMC%	12.2	
Moulded density	MD1	99.9	
	MD2	94.9	
	MD3	89.9	
Swell %	S1	1.1	
	S2	1.3	
	S3	1.4	
C.B.R. (TMH A8)	100	5	
	98	5	
	97	5	
	95	4	
	93	4	
	90	3	
CLASSIFICATION	HRB		
	TRH 14		
	COLTO	Fill	

Kind Regards

Wessel Badenhorst
FOR ROADLAB / PREHAB JV

Remarks :
* 0.02mm Fraction calculated based on a paper by Savage (2007)
The samples were subjected to analysis according to TMH 1:1986 Methods A1(a), A2, A3, A5, A7, A8 and ASTM D422.
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Annexure C: Particle size distribution

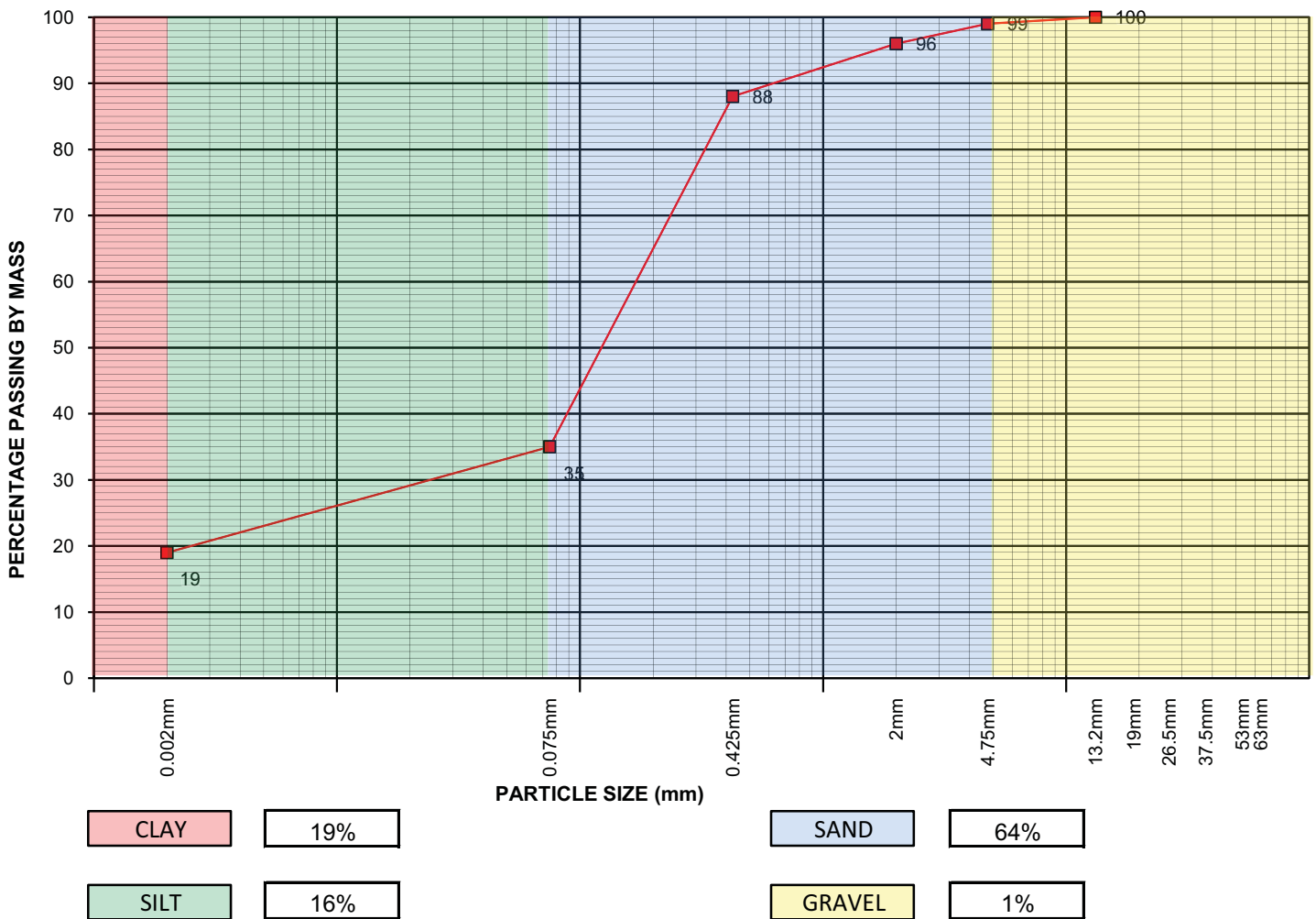


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Civil Engineering Material Testing Laboratories

TEST PIT: 1 LAYER: 400 - 1500 SAMPLE NR: 1A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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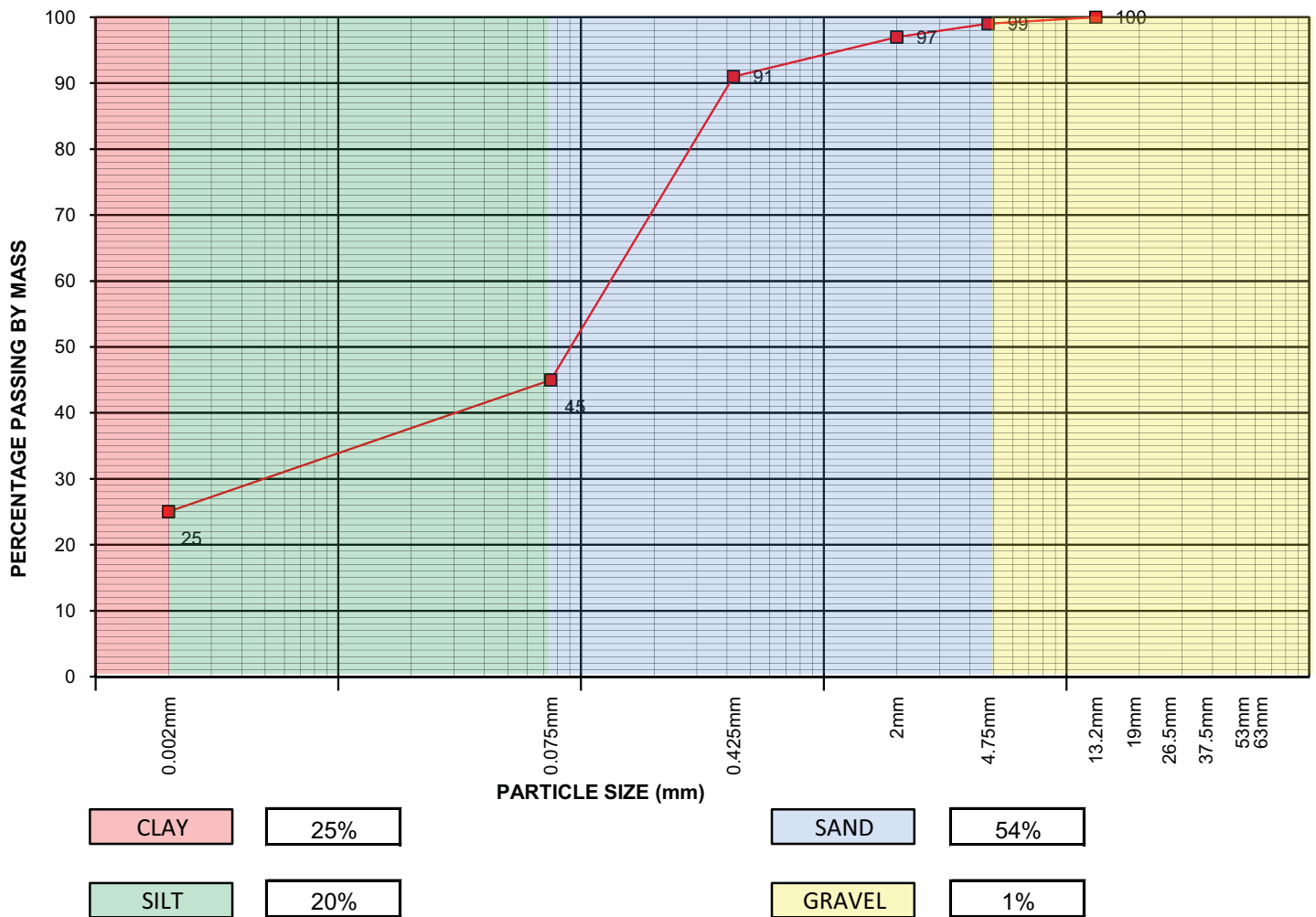


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TEST PIT: 1 LAYER: 1500 - 3000 SAMPLE NR: 1B DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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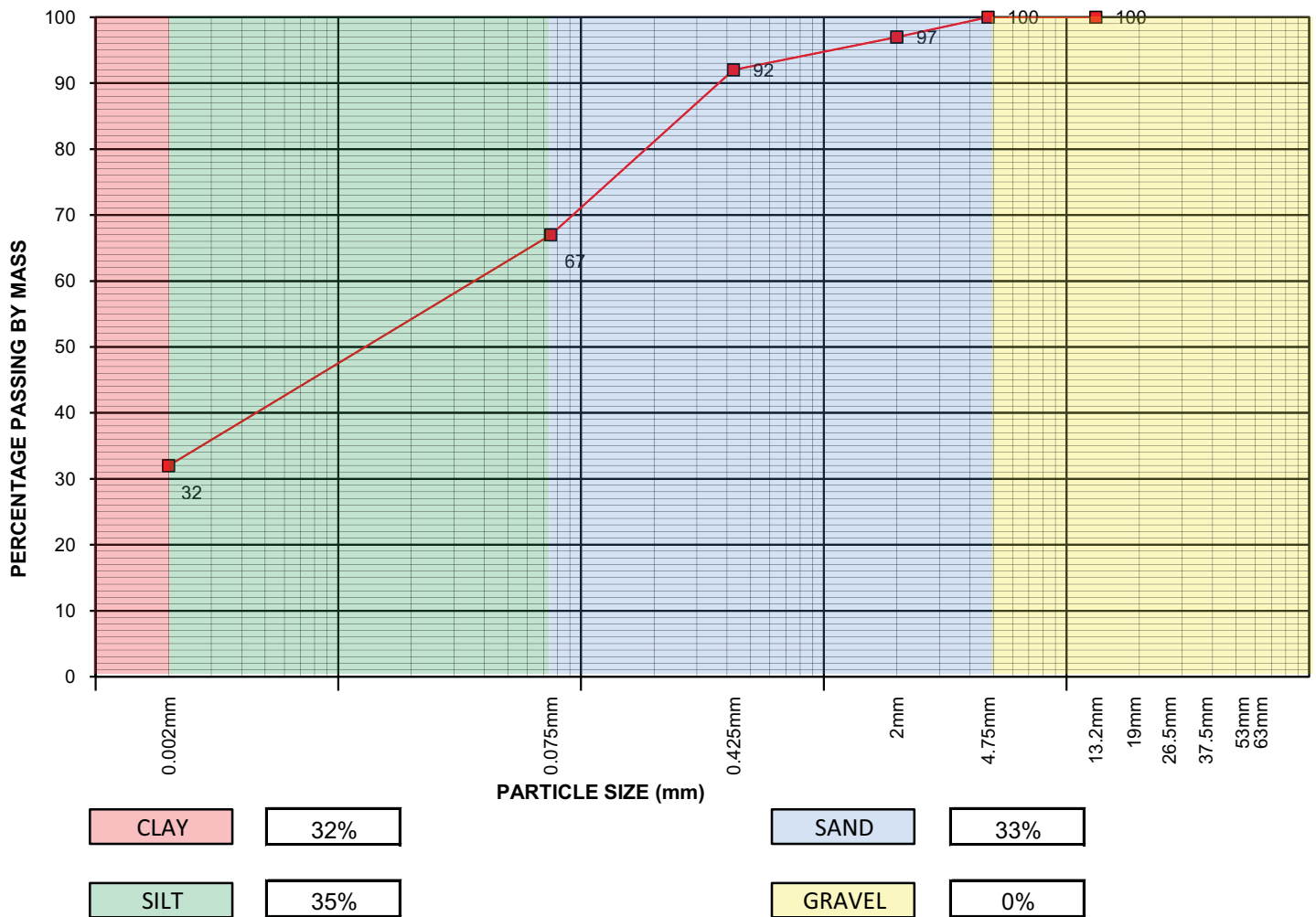


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Civil Engineering Material Testing Laboratories

TEST PIT: 2 LAYER: 0 - 500 SAMPLE NR: 2A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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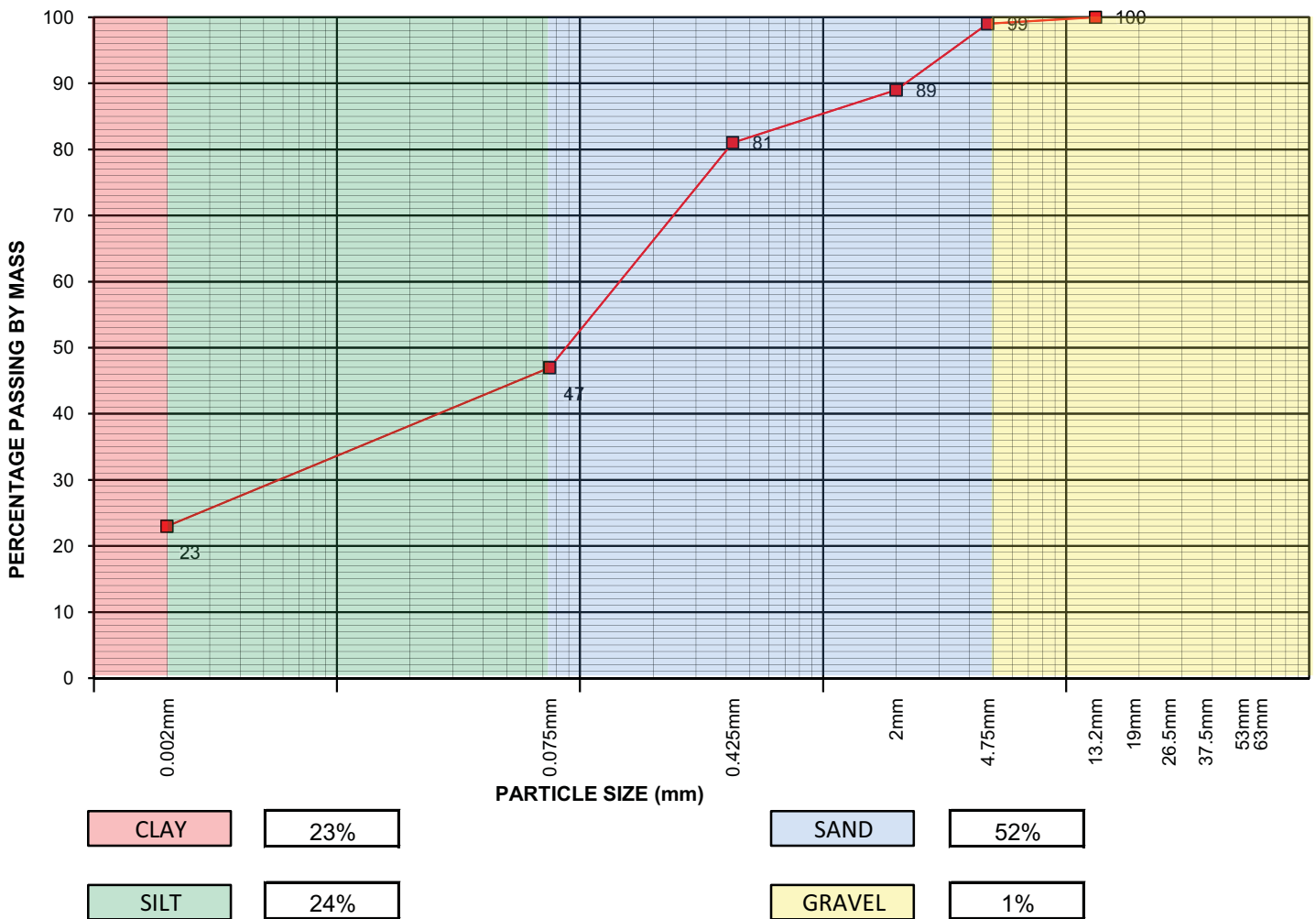


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TEST PIT: 2 LAYER: 1400 - 3000 SAMPLE NR: 2B DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
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Remarks :

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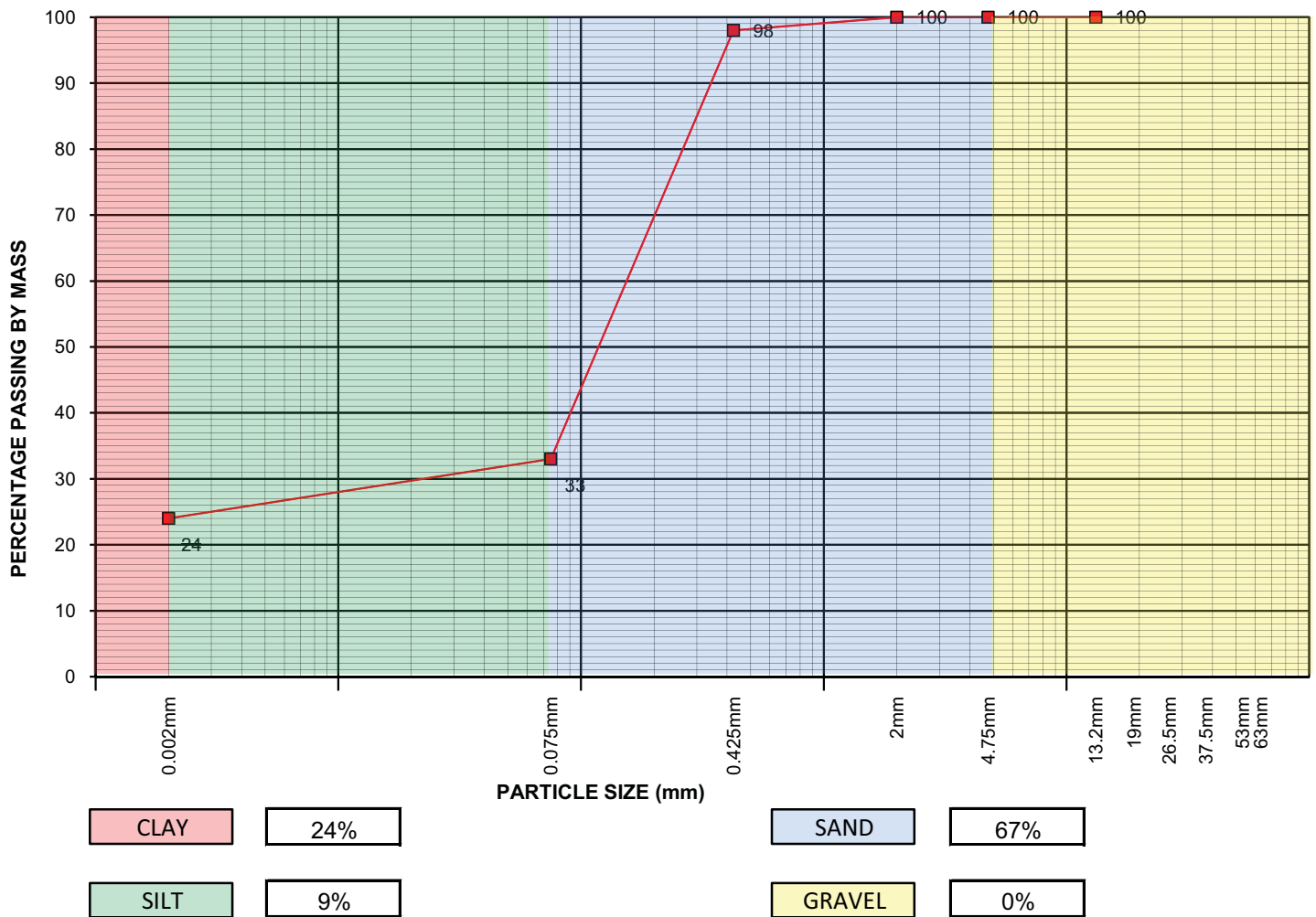


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TEST PIT: 3 LAYER: 0 - 800 SAMPLE NR: 3A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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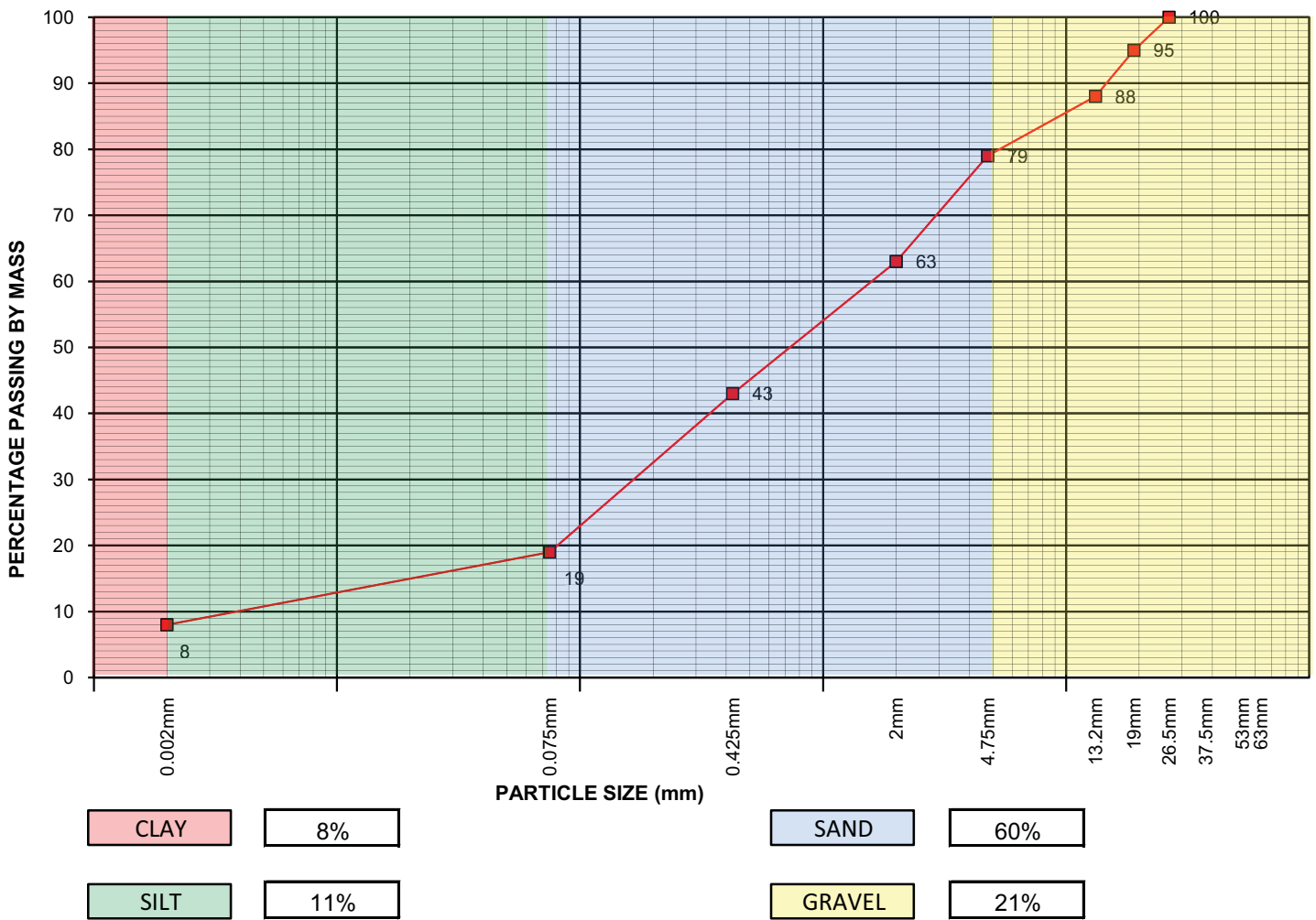


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Civil Engineering Material Testing Laboratories

TEST PIT: 3 LAYER: 800 - 1400 SAMPLE NR: 3B DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

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 FOR ROADLAB / PREHAB JV

Remarks :

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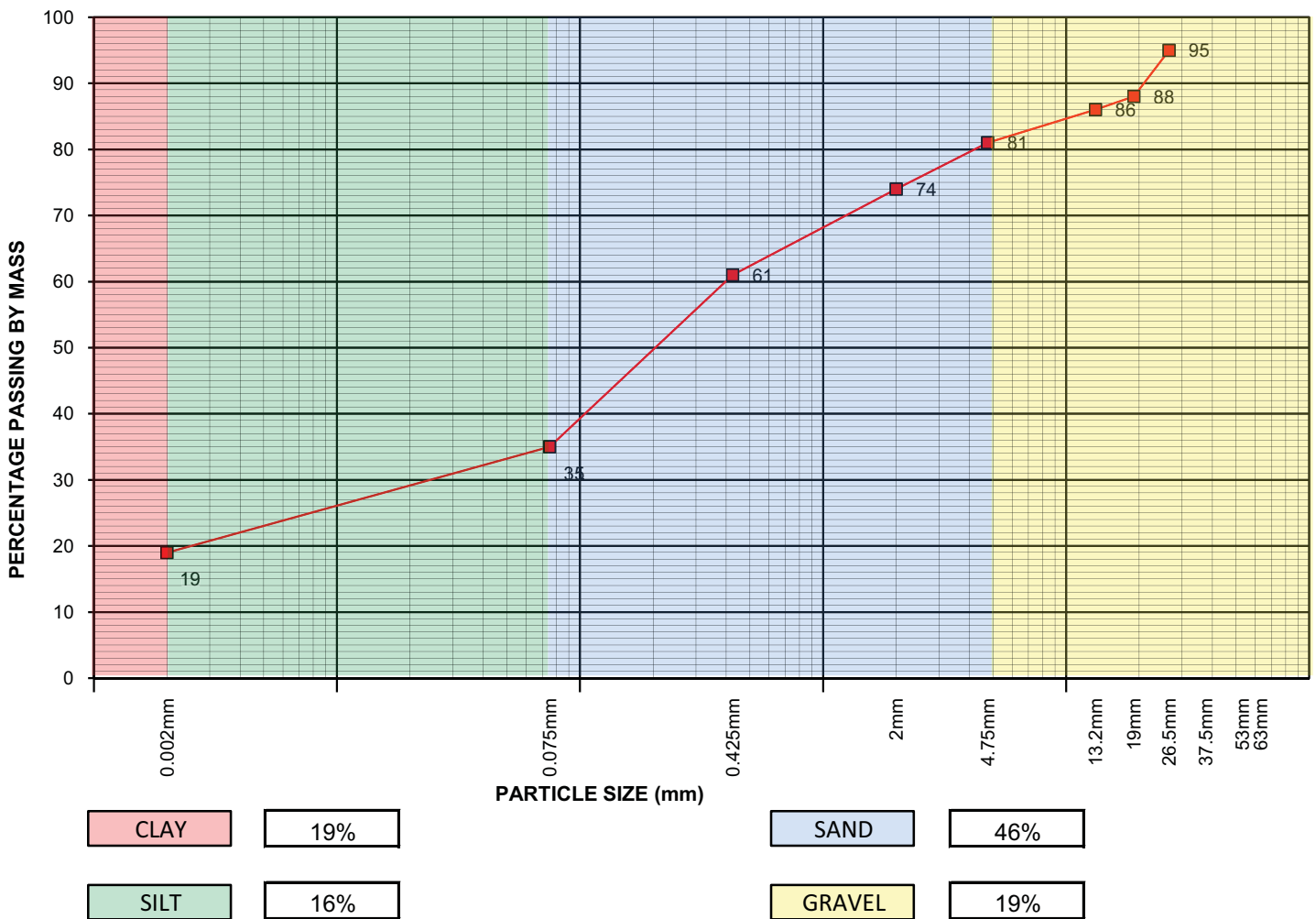


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TEST PIT: 3 LAYER: 1400 - 2500 SAMPLE NR: 3C DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

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 FOR ROADLAB / PREHAB JV

Remarks :

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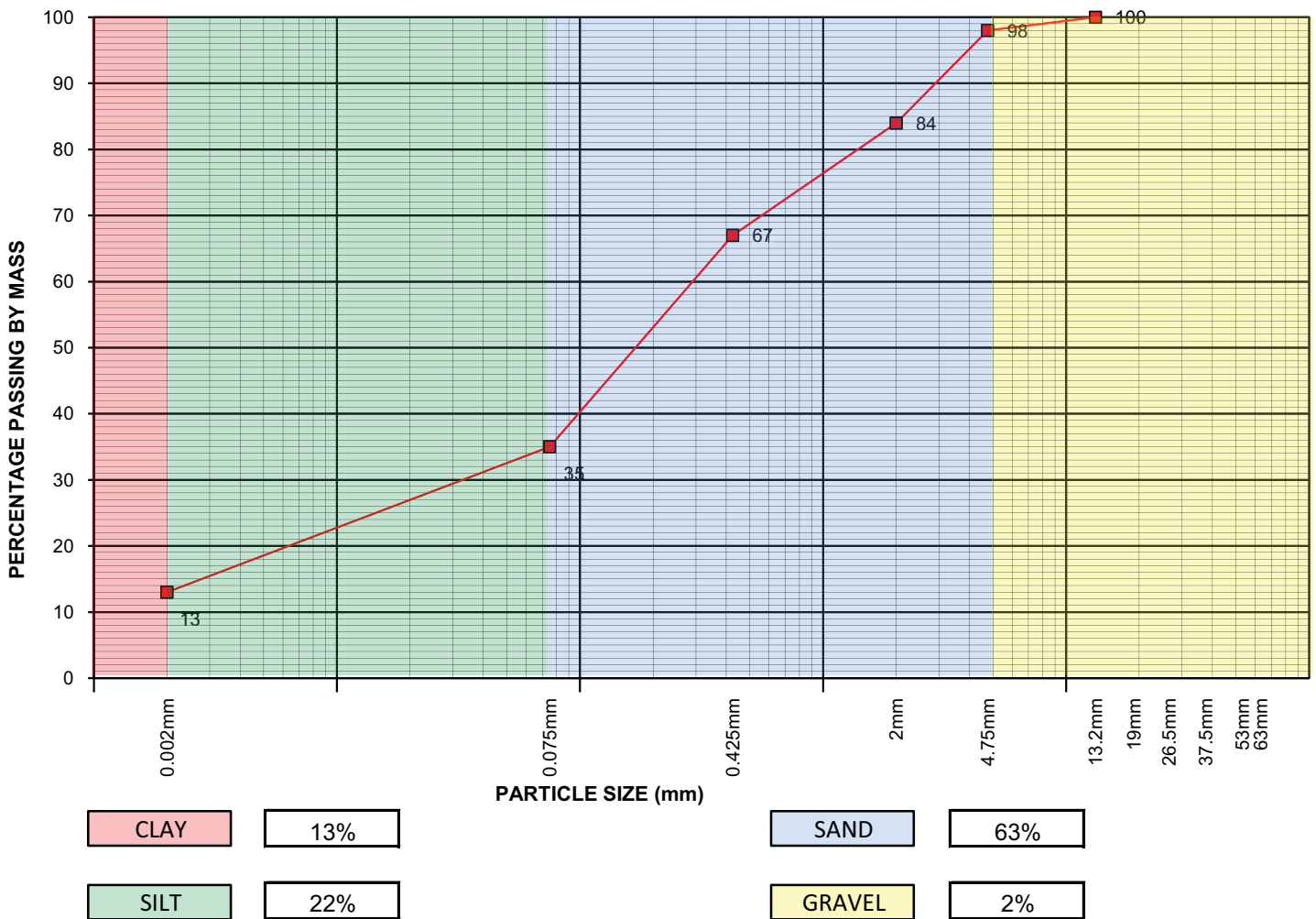


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Civil Engineering Material Testing Laboratories

TEST PIT: 5 LAYER: 500 - 3000 SAMPLE NR: 5A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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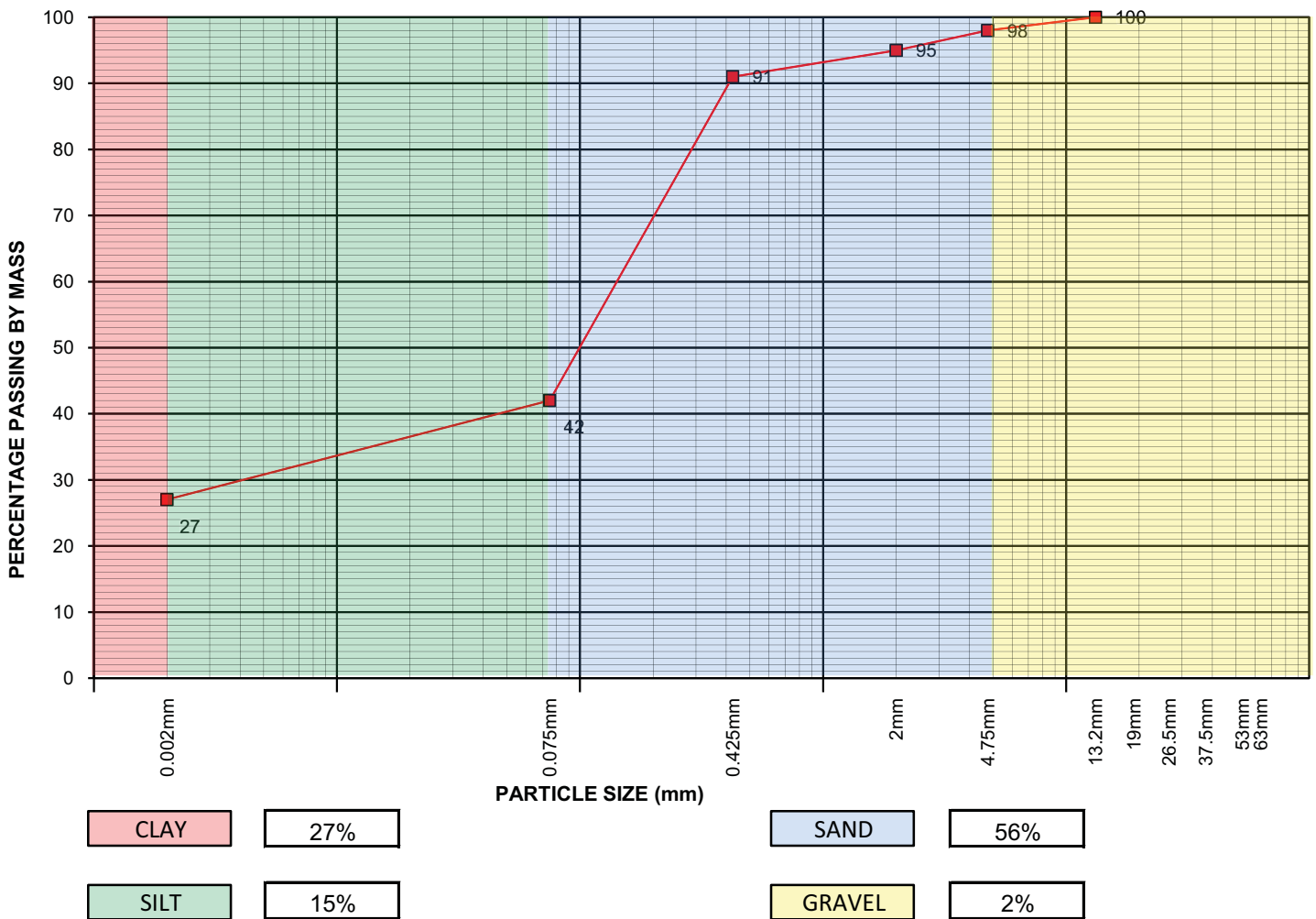


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Civil Engineering Material Testing Laboratories

TEST PIT: 6 LAYER: 600 - 1800 SAMPLE NR: 6A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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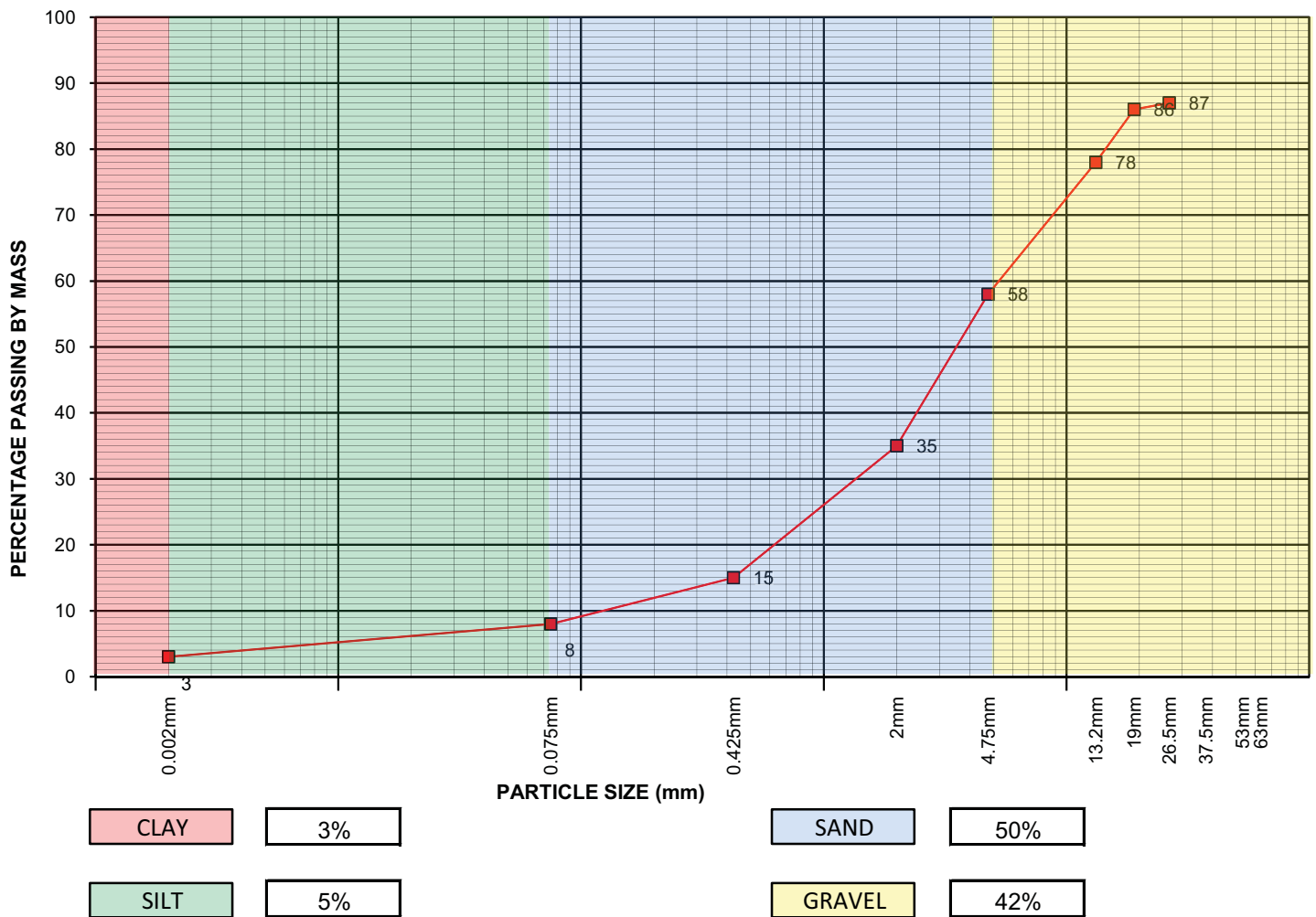


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Civil Engineering Material Testing Laboratories

TEST PIT: 6 LAYER: 1800 - 3000 SAMPLE NR: 6B DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

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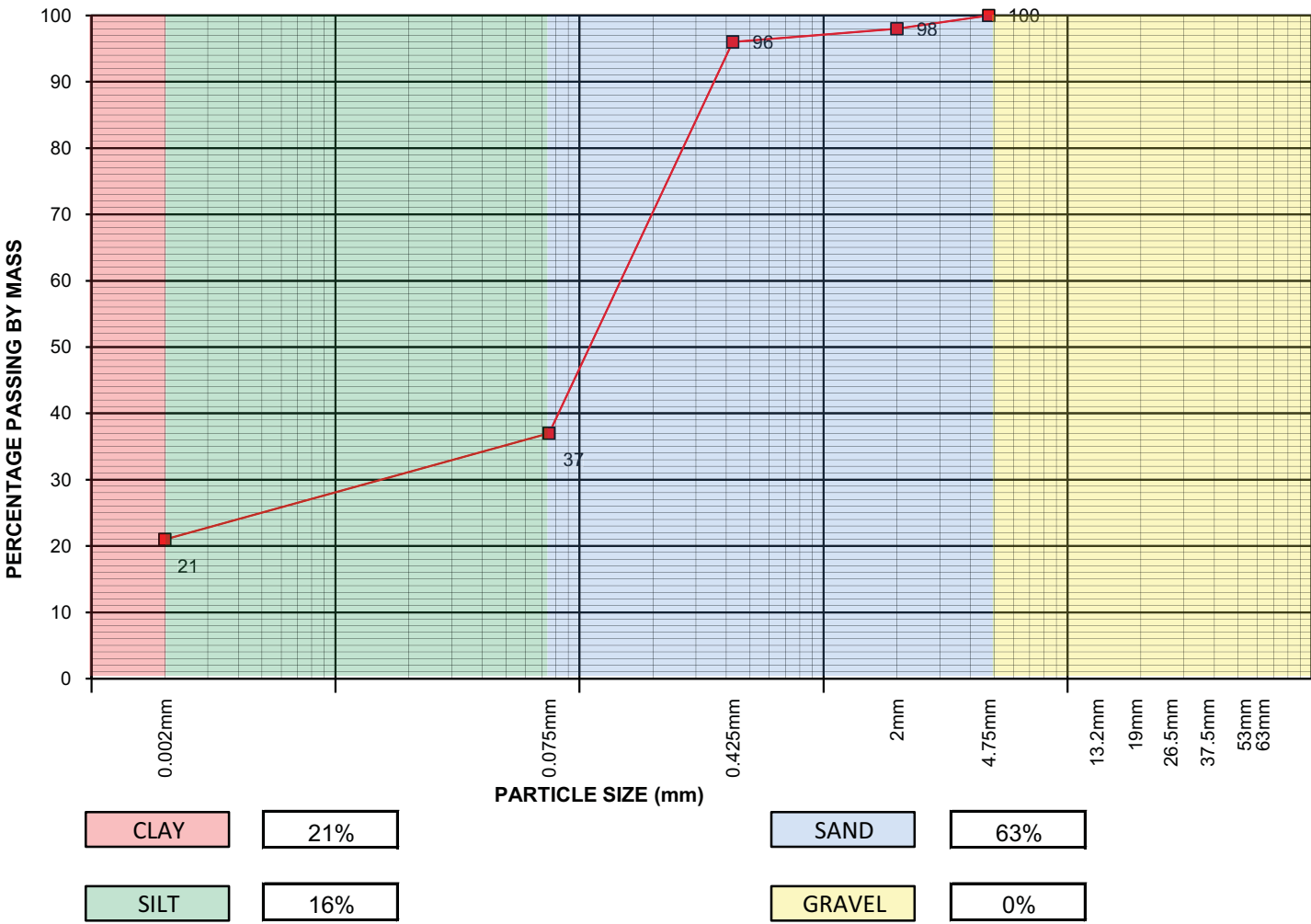


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Civil Engineering Material Testing Laboratories

TEST PIT: 7 LAYER: 0 - 1000 SAMPLE NR: 7A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

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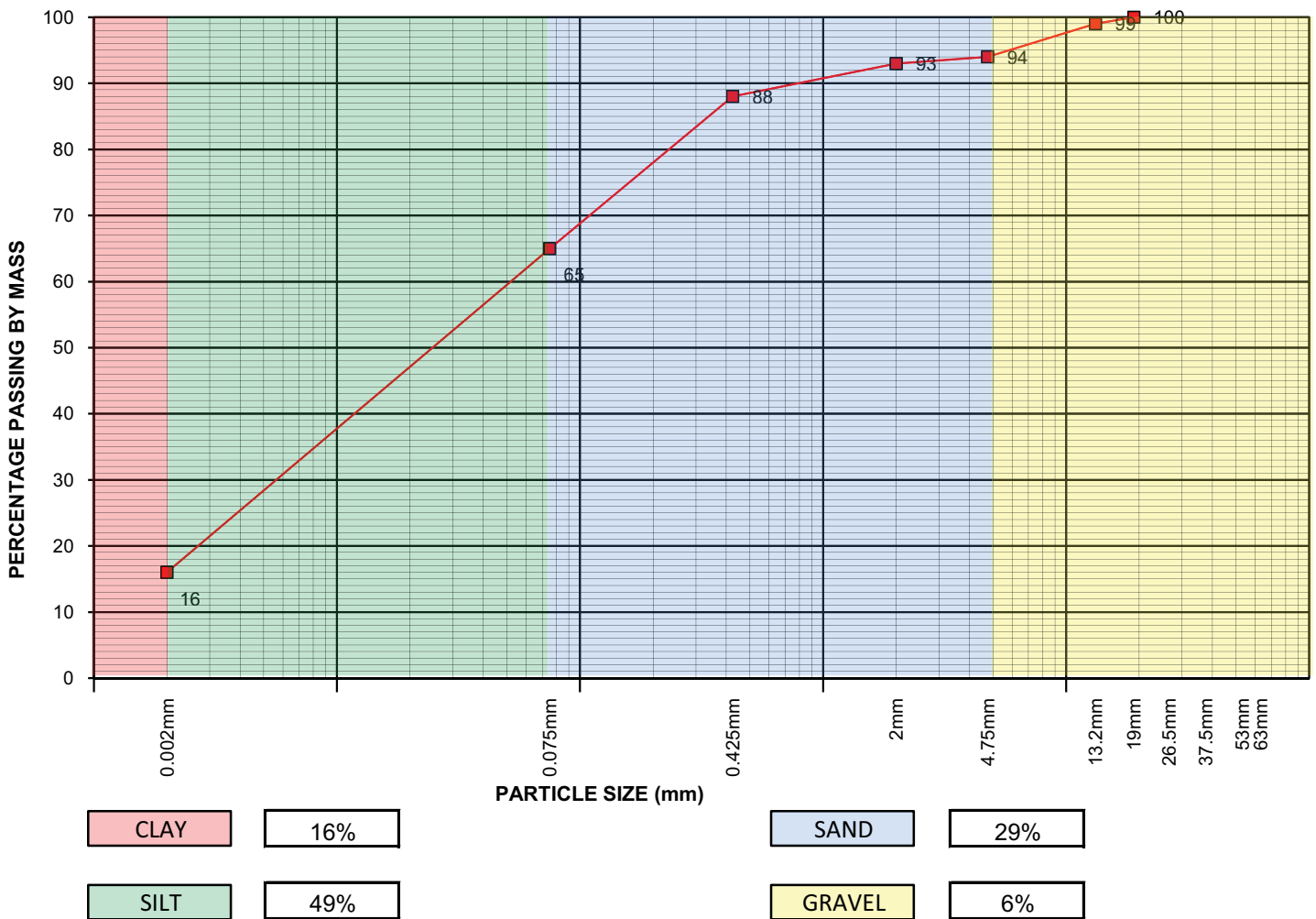


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Civil Engineering Material Testing Laboratories

TEST PIT: 7 LAYER: 1000 - 3000 SAMPLE NR: 7B DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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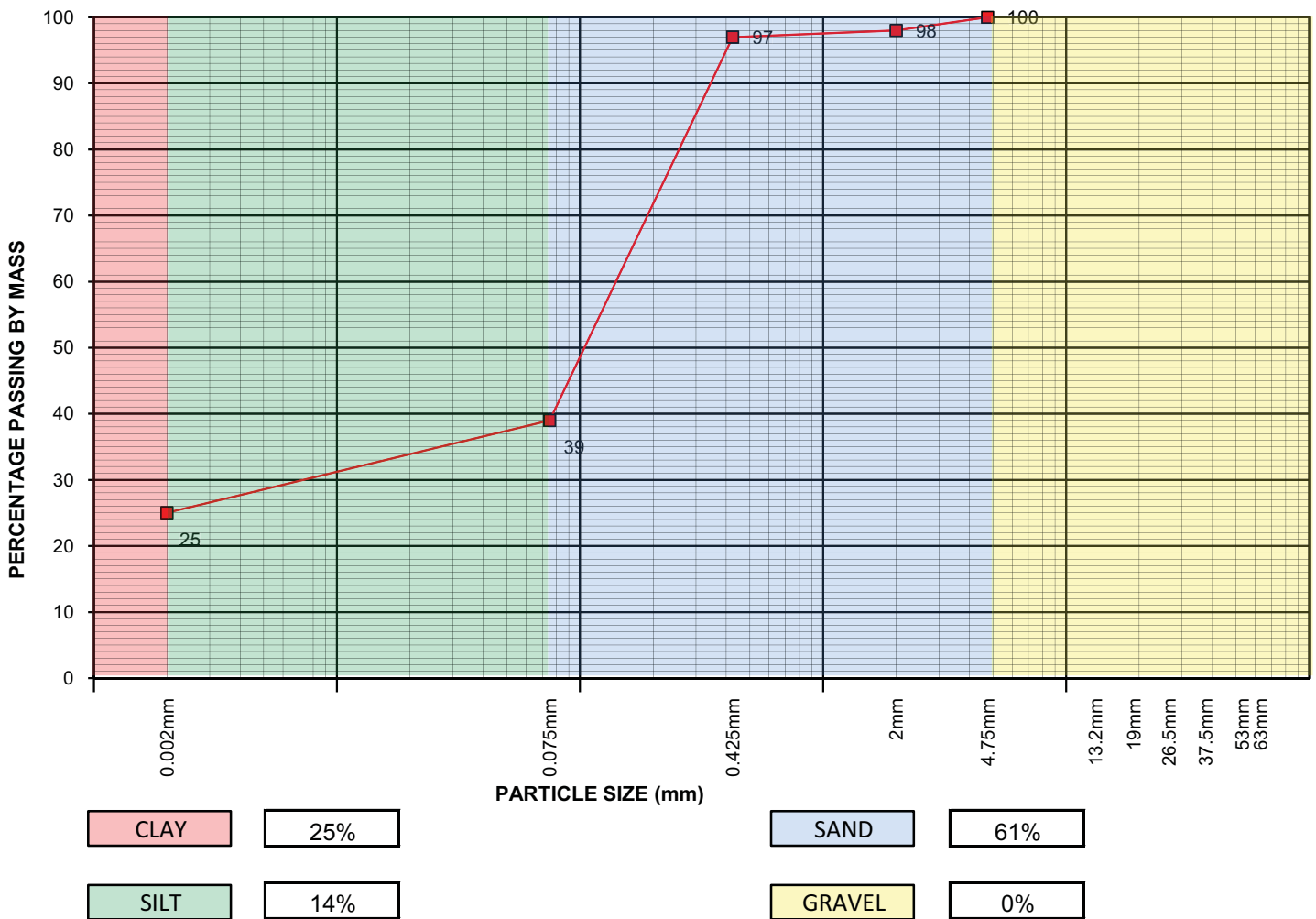


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Civil Engineering Material Testing Laboratories

TEST PIT: 9 LAYER: 400 - 1300 SAMPLE NR: 9A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards


 Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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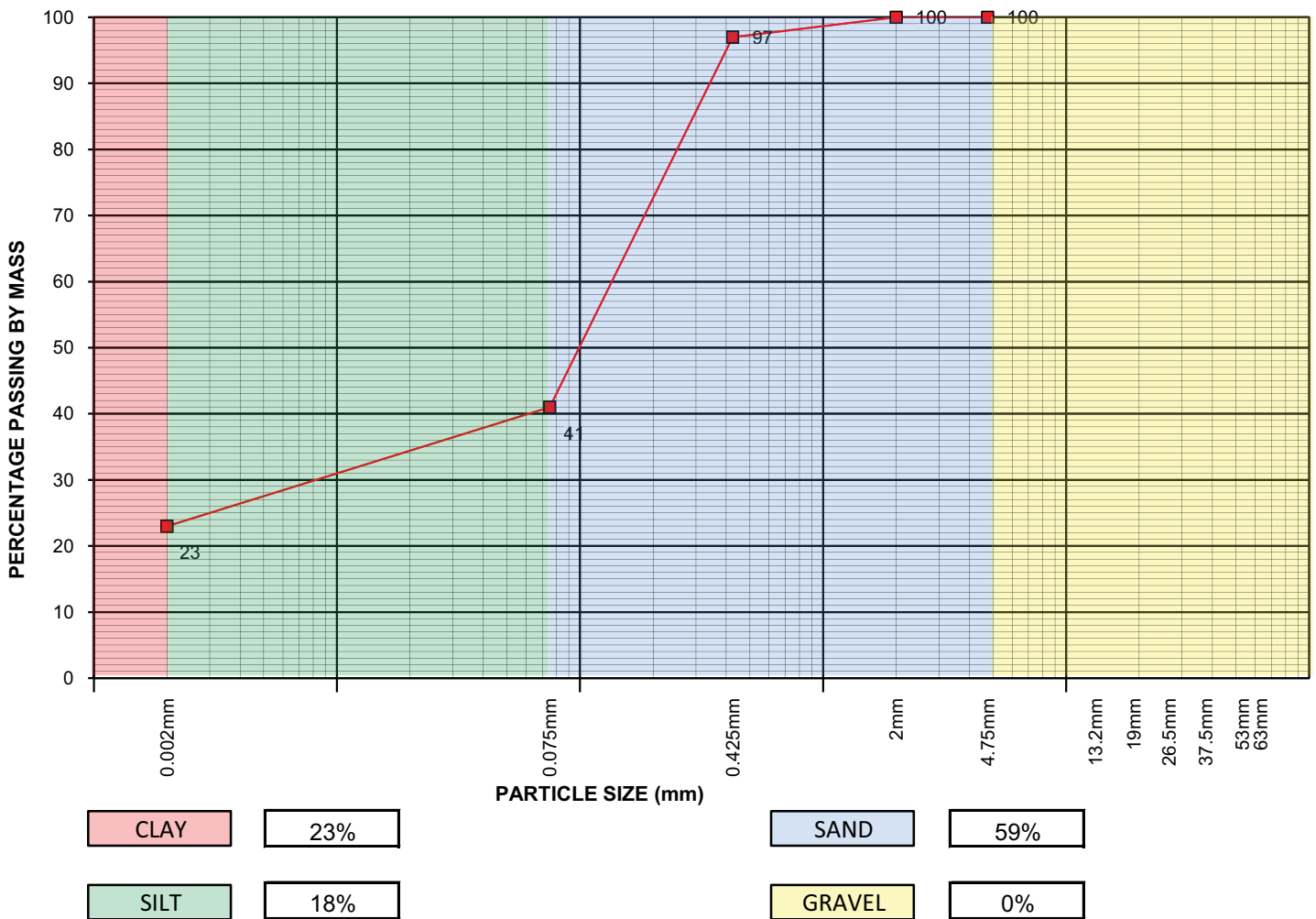


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Civil Engineering Material Testing Laboratories

TEST PIT: 9 LAYER: 1300 - 2600 SAMPLE NR: 9B DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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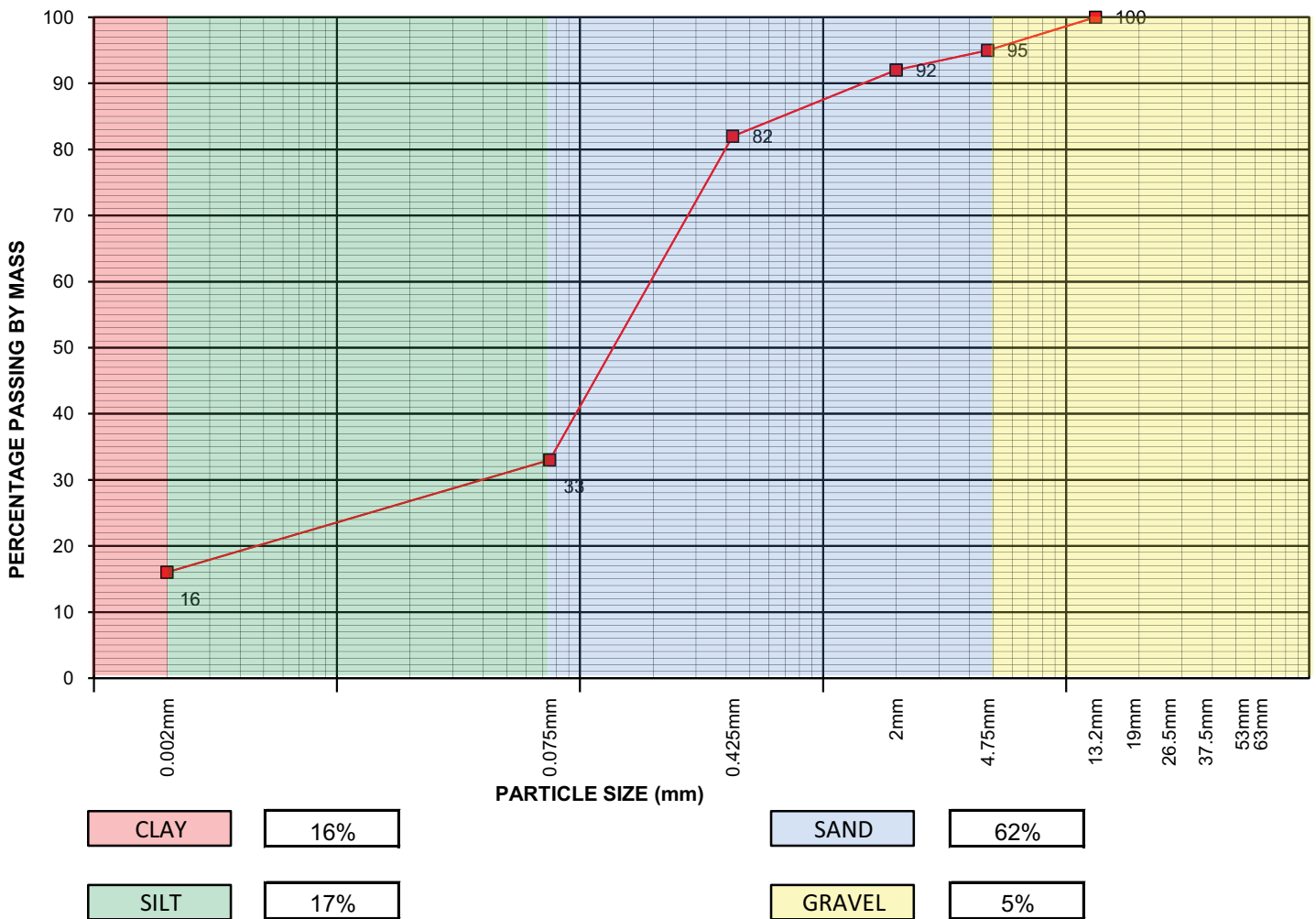


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Civil Engineering Material Testing Laboratories

TEST PIT: 9 LAYER: 2600 - 3000 SAMPLE NR: 9C DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards


 Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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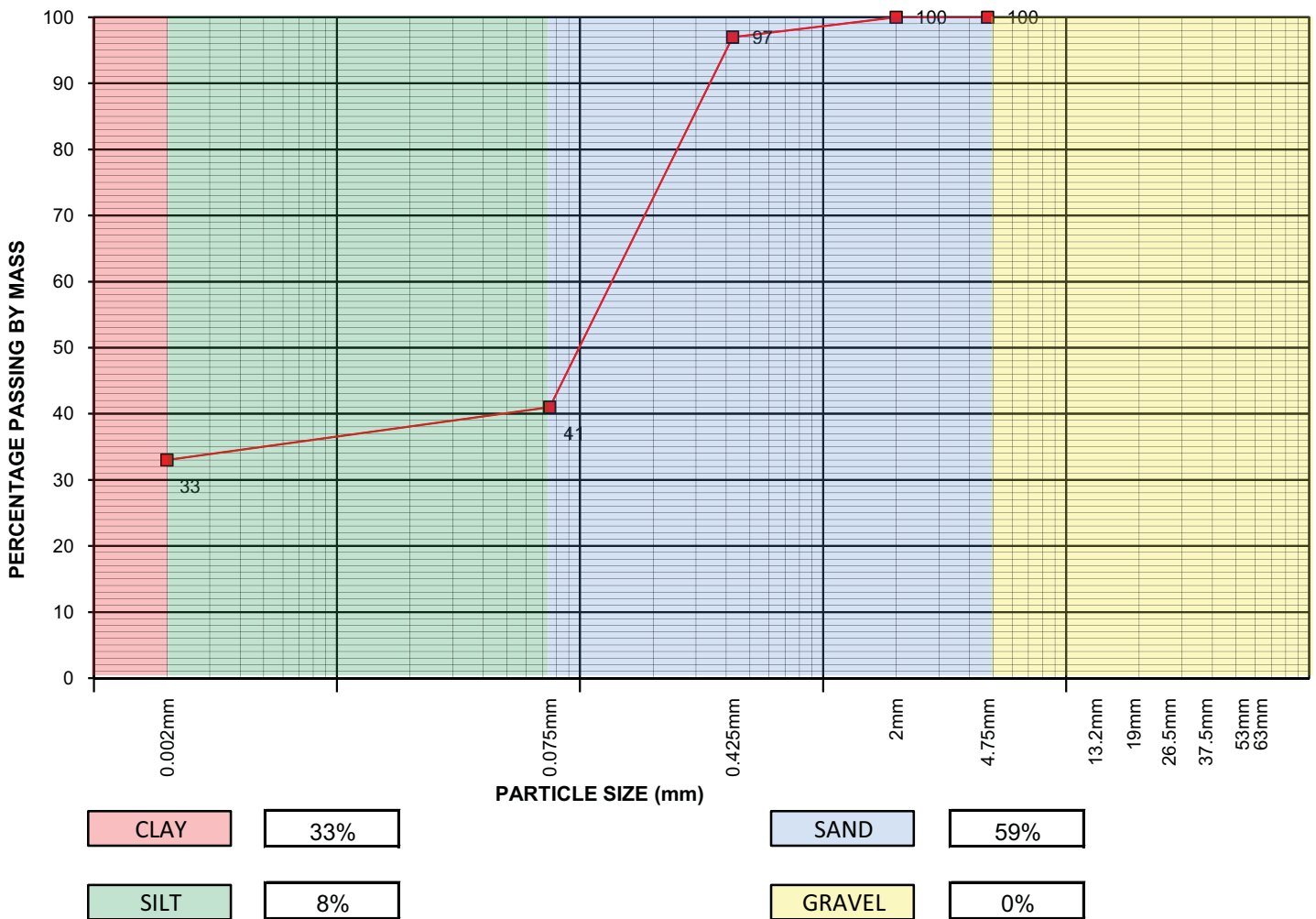


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Civil Engineering Material Testing Laboratories

TEST PIT: 11 LAYER: 300 - 1500 SAMPLE NR: 11A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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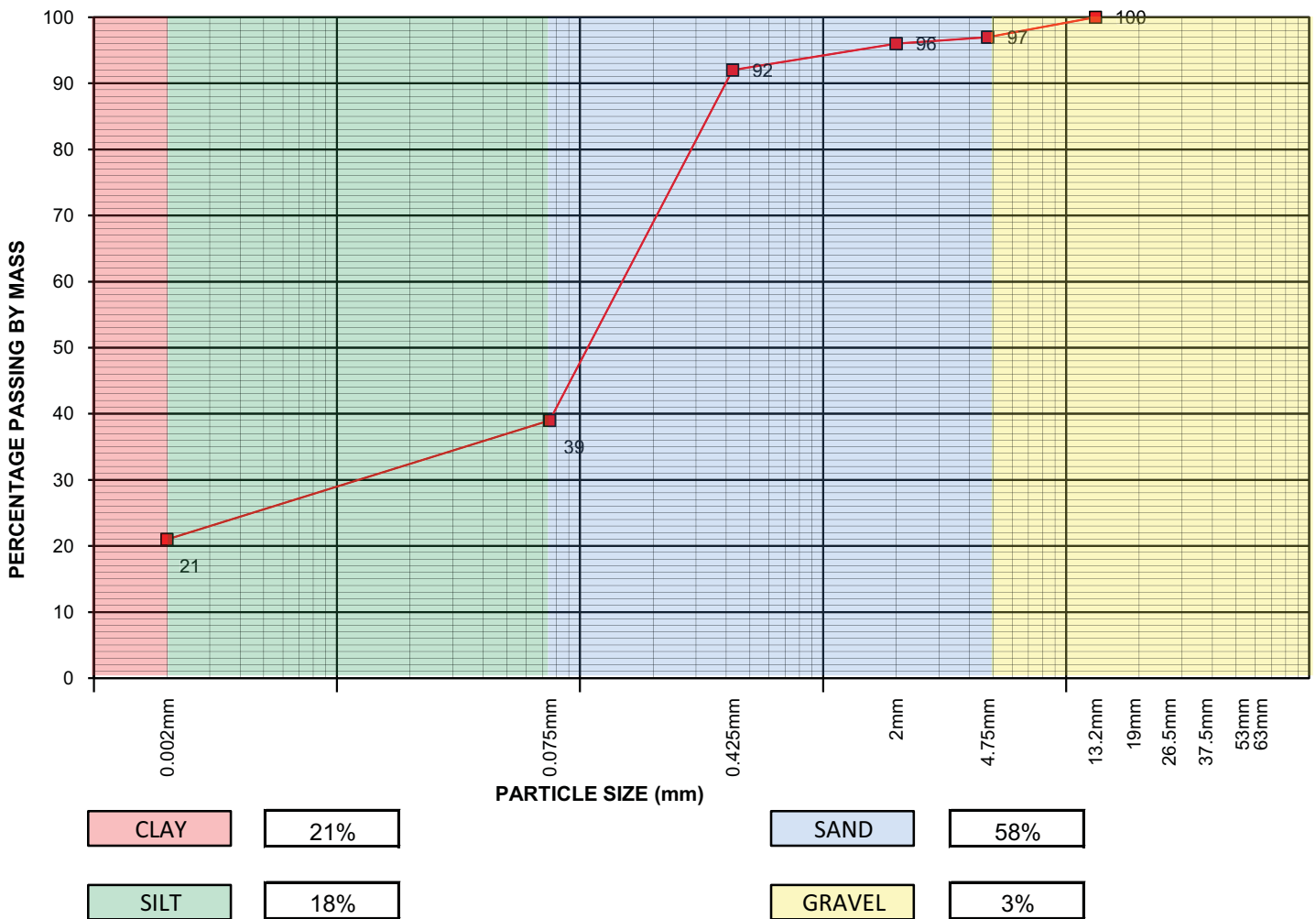


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Civil Engineering Material Testing Laboratories

TEST PIT: 11 LAYER: 1500 - 3000 SAMPLE NR: 11B DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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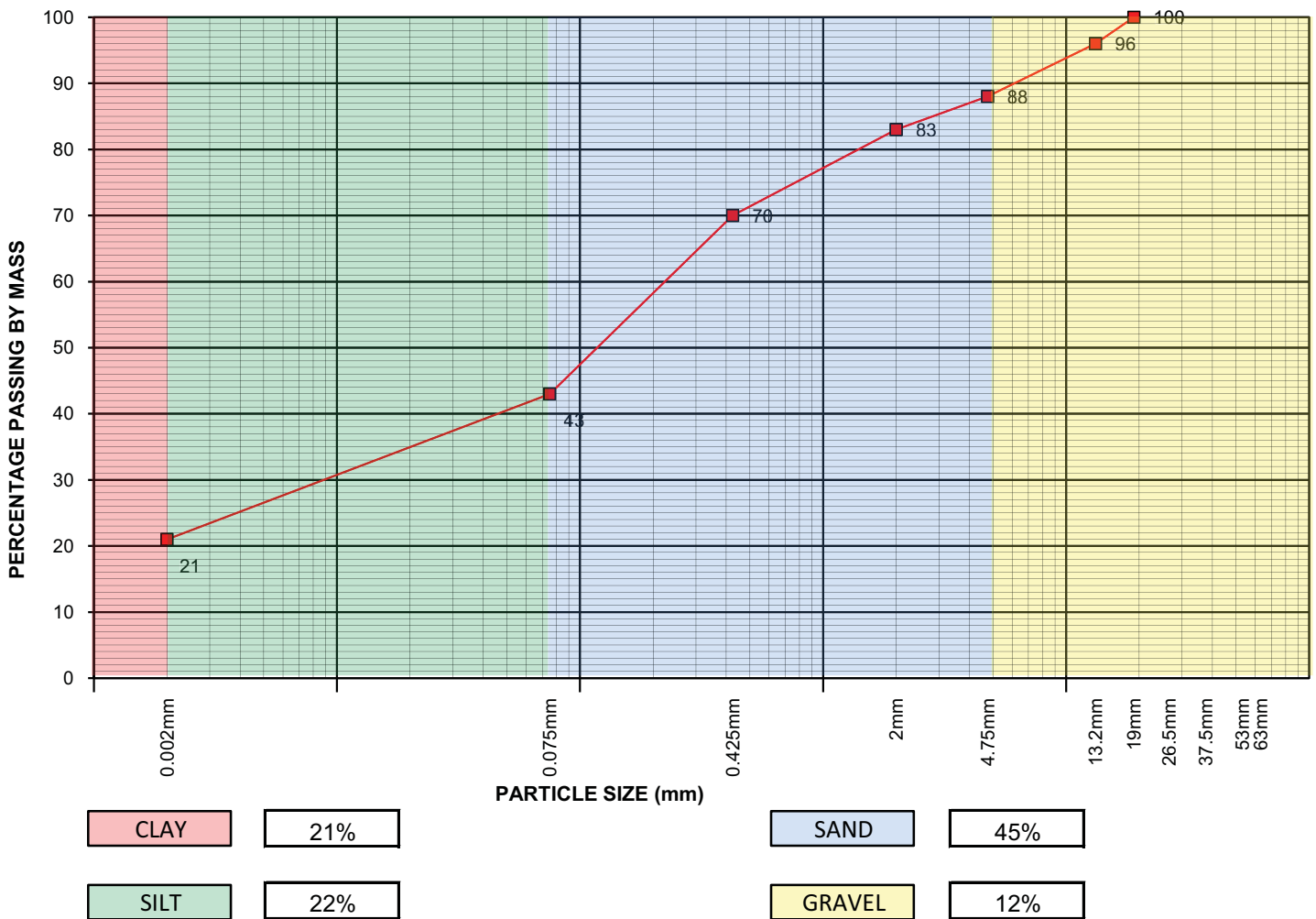


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Civil Engineering Material Testing Laboratories

TEST PIT: 12 LAYER: 1500 - 2500 SAMPLE NR: 12A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

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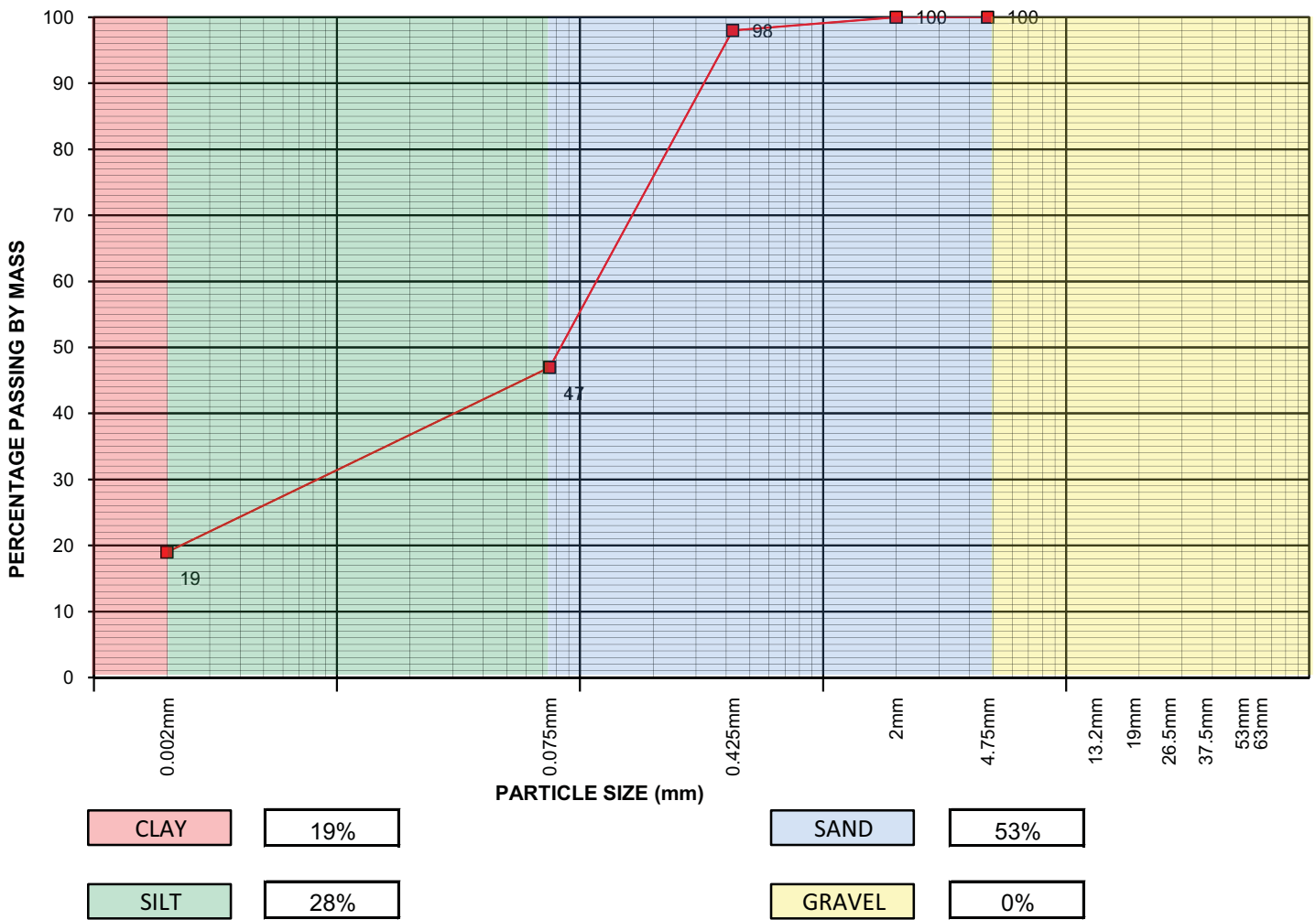


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Civil Engineering Material Testing Laboratories

TEST PIT: 13 LAYER: 500 - 1800 SAMPLE NR: 13A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards

Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

Remarks :

The results reported relate only to the sample tested
 Further use of the above information is not the responsibility or liability of Roadlab/ Prehab JV
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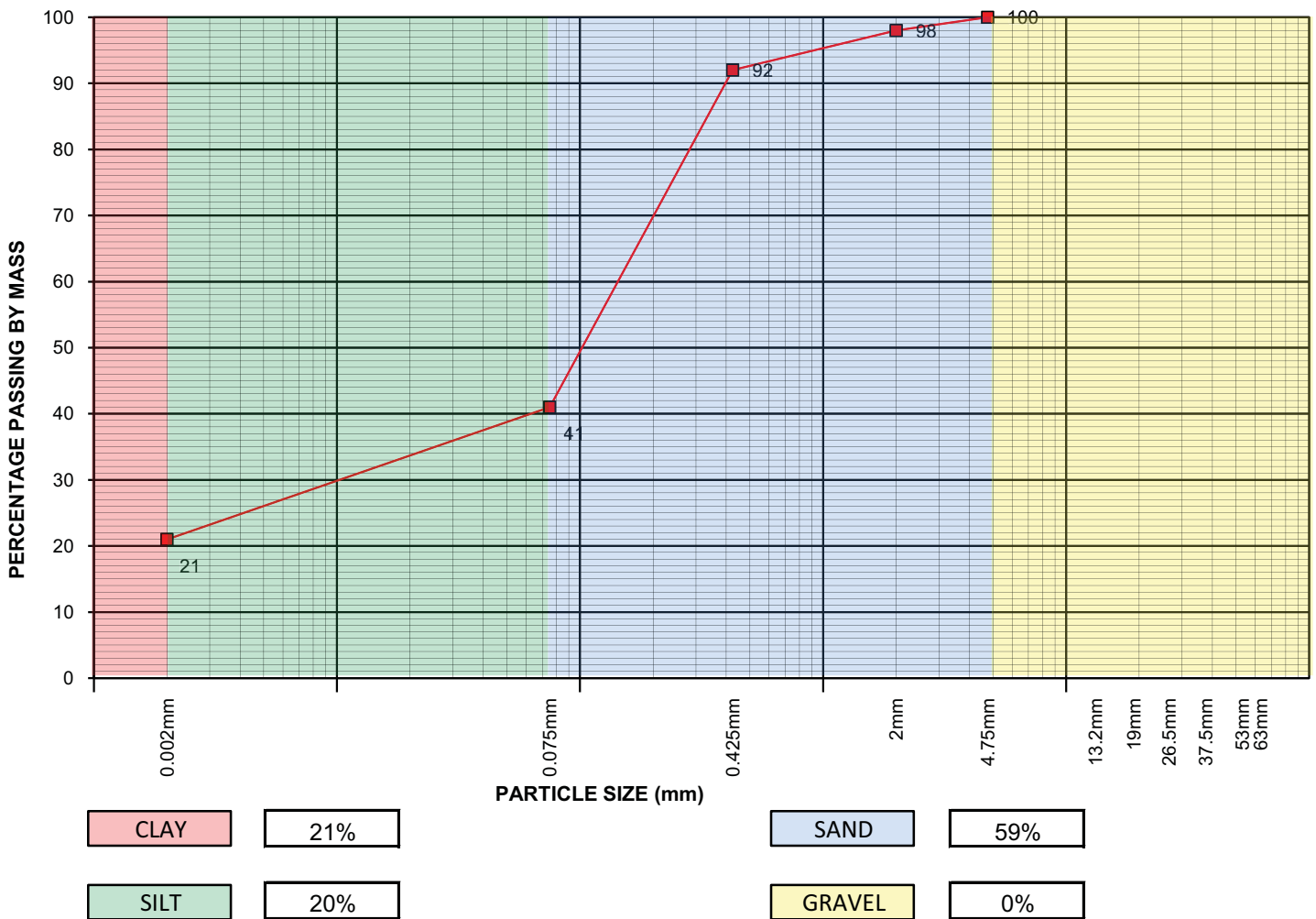


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Civil Engineering Material Testing Laboratories

TEST PIT: 14 LAYER: 0 - 600 SAMPLE NR: 14A DATE: 08/07/2013

PARTICLE SIZE ANALYSIS



Kind Regards


 Wessel Badenhorst
 FOR ROADLAB / PREHAB JV

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Annexure D: Site Photos



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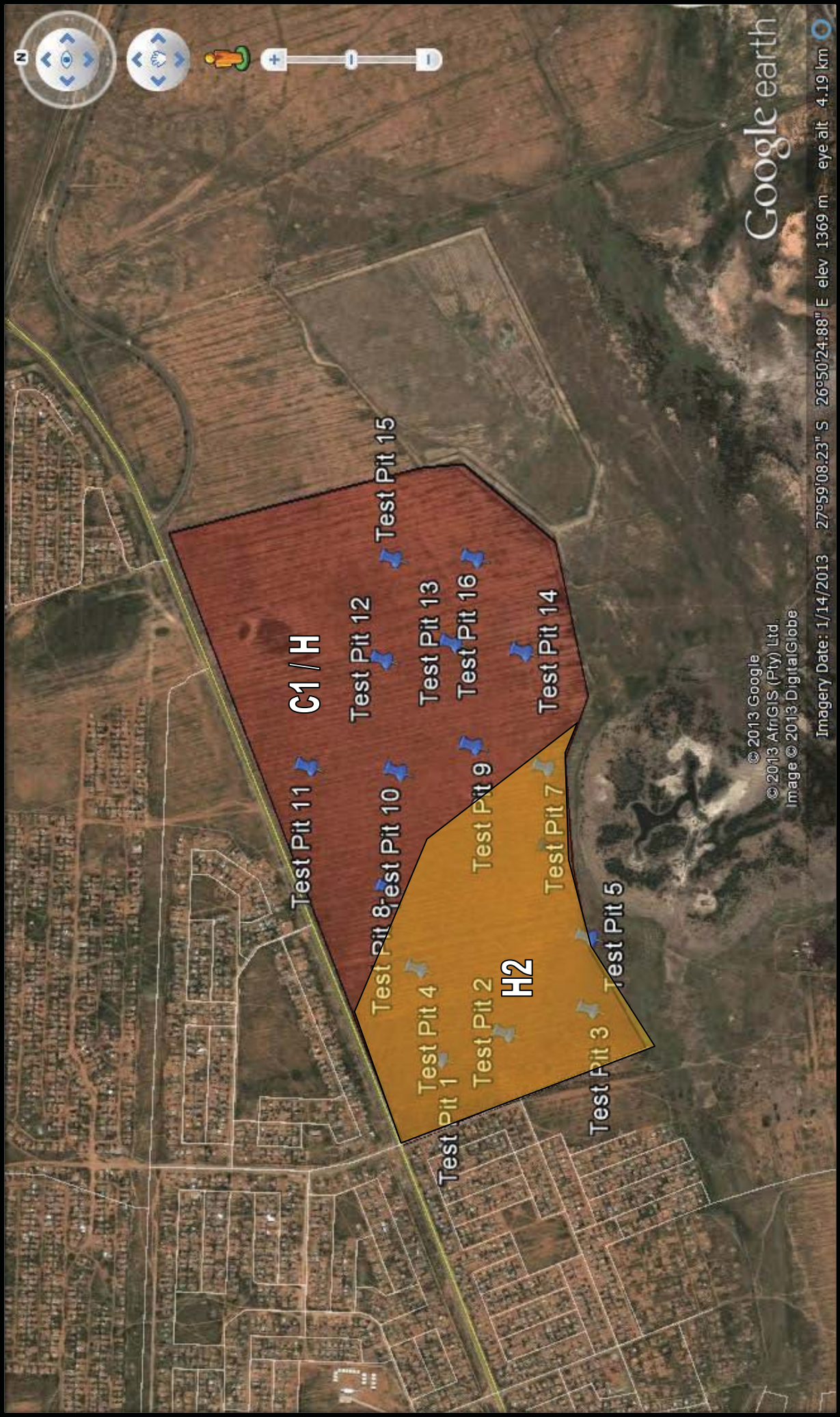
Email: roadlab.bloem@prehab.co.za

TYPICAL SITE PHOTOS



Annexure E:

Site Zoning



C1 / H

H2

Test Pit 11

Test Pit 12

Test Pit 13

Test Pit 16

Test Pit 14

Test Pit 8

Test Pit 10

Test Pit 9

Test Pit 7

Test Pit 4

Test Pit 1

Test Pit 2

Test Pit 5

Test Pit 3

Test Pit 15

Google earth

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Imagery Date: 1/14/2013 27°59'08.23" S 26°50'24.88" E elev 1369 m eye alt 4.19 km