

Final Geotechnical Investigation Report for Mbobeleni Primary School as Part of the Implementation of Sanitation Programme at Various Schools in the Eastern Cape Province



For



By

ILZ Consulting

Final Geotechnical Investigation Report for Mbobeleni Primary School as Part of the Implementation of Sanitation Programme at Various Schools in the Eastern Cape Province

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1 INTRODUCTION

iLZ Consulting (Pty) Ltd was appointed by The Mvula Trust to undertake geotechnical investigations at various schools for the Implementation of Sanitation Programme at Various schools in Eastern Cape Province (Sanitation 17).

The aim of the investigation was to:

- a. To assess the subsoil conditions pertaining to the site and their suitability for the proposed development,
- b. To provide foundation recommendation for the proposed development and to comment on the excavability of the site,
- c. To comment on any other geotechnical aspect of the site.

This report contains results of the geotechnical investigation carried out at **Mbobeleni Primary School**, highlighting the following

- General soil/rock profile on-site,
- Groundwater occurrence,
- Excavability classification,
- Recommendations for foundations.

Although considered unlikely, should significant variations from the inferred conditions become apparent during construction, the advice of a geotechnical professional must be sought.

2 INFORMATION AVAILABLE

Information made available to or sourced by iLZ at the time of investigation comprised of the following:

- Terms of reference
- Site Development Plan (Google Earth image with test positions)
- GPS Coordinates of the schools
- 1:250 000 Geological Map Sheets

3 SITE LOCATION AND ACCESSIBILITY

Mbobeleni Primary School is located in Mdina, a village approximately 20km northeast of Libode, under the OR Tambo District Municipality in the Eastern Cape Province, South Africa. Access is via gravel roads from Libode. (see **Figure 3-1**). The school has 3 classroom blocks, an admin block, a kitchen, and 2 existing toilets for learners and teachers.

The approximate central coordinates are -31.449490° Lat and 29.100620° Long. The coordinates are WGS84.

Topographically, the site is located on a relatively gentle terrain towards the north with grass cover.

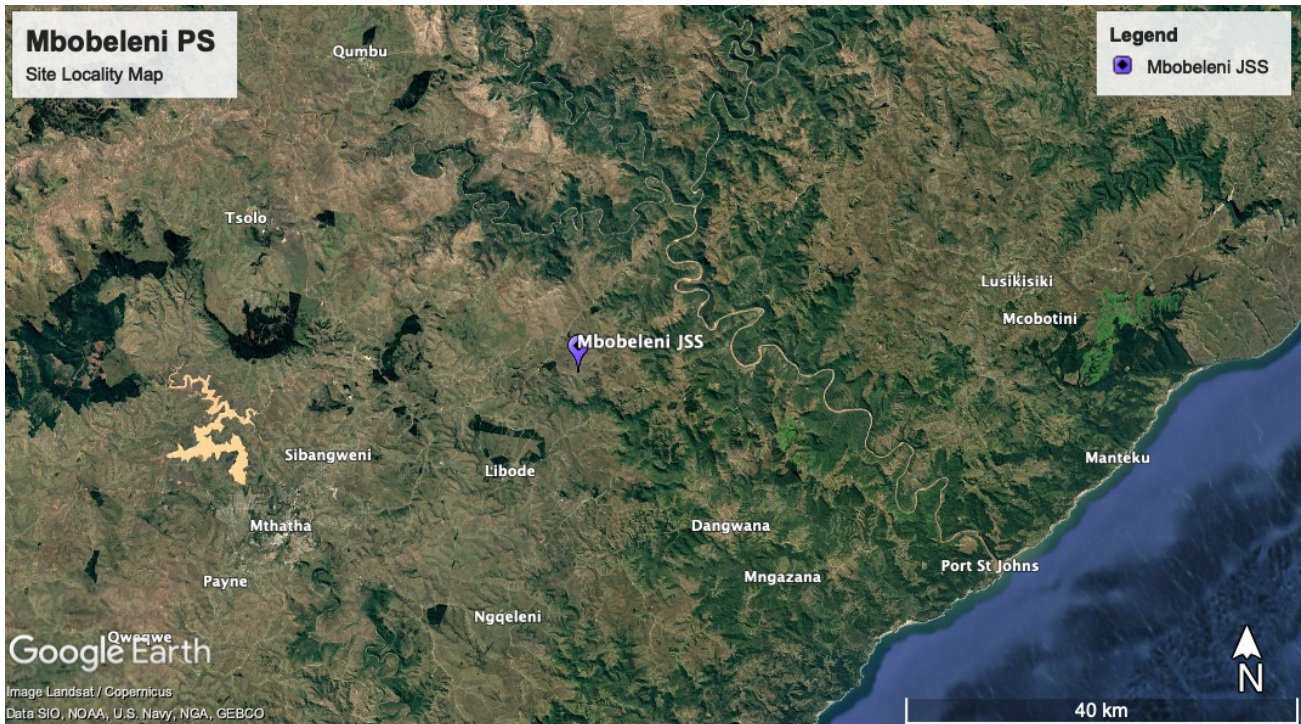


Figure 3-1: Locality Map relative to Libode.

4 FIELD WORK

Geotechnical site investigation was undertaken on the 12th of June 2026 and comprised of the following:

- Siting of 2 trial pits using SDP's of where the proposed structures positions:
 - New ablutions (boys, girls, and staff)
- Test pits were excavated using hand tools and profiled by an Engineering Geologist using SANS 633 guidelines.
- Penetrometer tests (DCP) tests were conducted adjacent to each trial pit

These positions are all marked in **Figure 4-1** below as per the provided SDP.



Figure 4-1: Trial pit positions.

4.1 Soil/rock Profiling

Two trial pits, labelled TP1 and TP2, were excavated manually with pick and shovel at locations designated for the proposed new ablutions, i.e. proposed positions as per SDP. The excavation focused on areas planned for boys, girls and staff. The trial pits were all excavated to a maximum depth of 1.50 meters below the existing ground level (mbgl).

The subsoils were profiled by an Engineering Geologist following the SANS 633 guidelines.

4.2 Dynamic Cone Penetrometer (DCP) Test

Two Dynamic Cone Penetrometer tests (DCP), designated DCP1 and DCP2, were conducted adjacent to the test pits. The tests were all advanced to a maximum refusal depth of 1.30m to 1,60m below existing ground level. The tests were done to primarily ascertain excavation classification and to estimate the bearing capacity of the local soils.

5 REGIONAL GEOLOGY

According to **3128 Umtata** 1:250 000 Geological Map Series, the site is underlain by the Adelaide Subgroup (Pa) mudstones and sandstones. Dolerite intrusions are known to occur in the area as shown in **Figure 5-1** below.

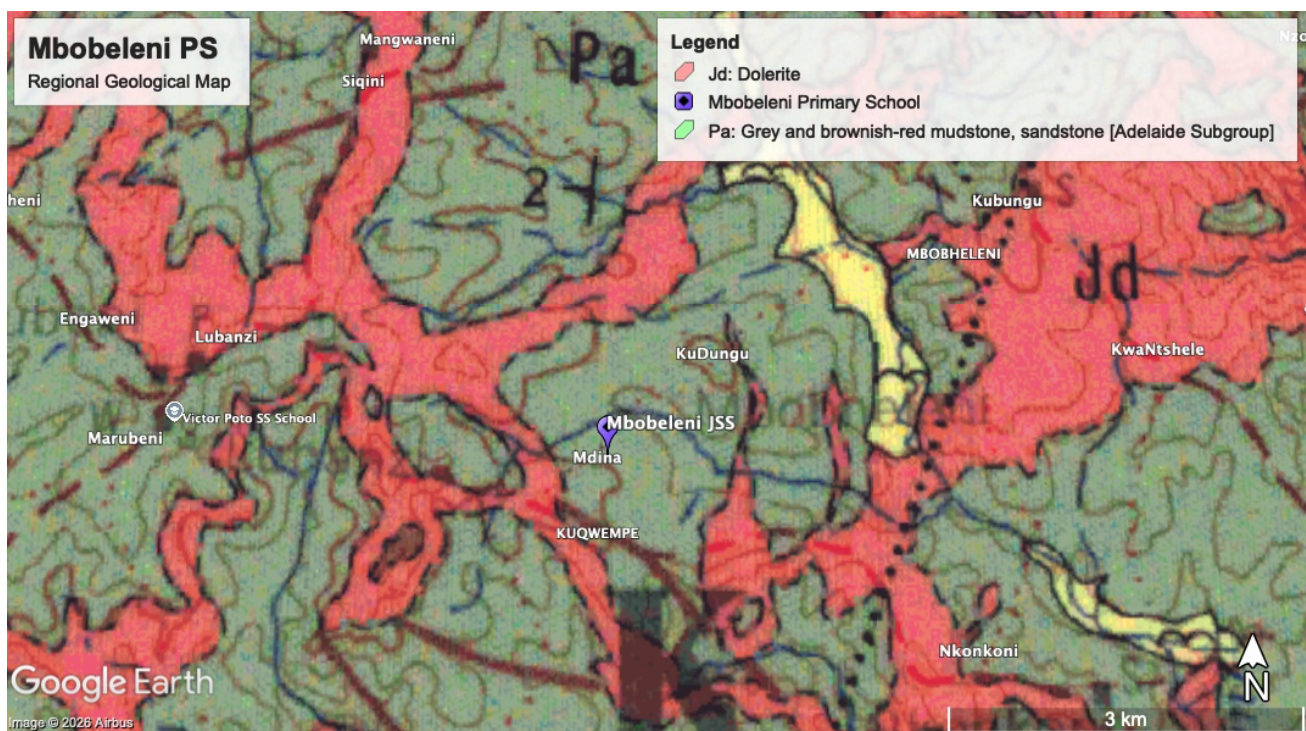


Figure 5-1: Regional geology of the site.

5.1 Local Geology

Field investigations show that the site is underlain by colluvial soils and weathered mudstone bedrock in TP1 and TP2.

The detailed logs are attached in **Appendix A** of this report, while a description of each layer is given below.

5.1.1 Colluvium

This horizon was encountered in both pits occurring from surface to 0.40m below existing ground level. It was described as slightly moist, grey, firm, intact, fine to grained, sandy silt with roots.

5.1.2 Reworked residual

This horizon is a band of gravel which forms the line of demarcation between the transported soils which overlie it and residual soils. It was encountered in both pits occurring at 0.30m to 0.70m below existing ground level. It was described as moist, grey, soft to firm, intact, fine to medium grained, sandy silty with ferruginised nodules ~2mm in diameter.

5.1.3 Residual Mudstone

This horizon forms as a result of complete weathering of the underlying bedrock. It was encountered in both pits overlying the weathered mudstone at depths 0.6m to 1.40m below existing ground level.

5.1.4 Weathered Mudstone (Pa)

This weathered bedrock was encountered throughout the site at depths ranging from 1.10m to 1.50m. It was described as greenish grey, stained light brown to red, completely to highly weathered, highly fractured, fine grained, very soft to soft mudstone.

The rock strength is expected to increase with depth.

5.2 Groundwater Occurrence

No groundwater seepage was encountered during the investigation.

However, the presence of ferruginised nodules indicates a seasonal fluctuation in water table during periods of prolonged rainfall, thus an increase in the occurrence and magnitude of groundwater seepage flow can be anticipated resulting in perched groundwater at the soil/rock interface.

6 LABORATORY TEST RESULTS

In order to assess more accurately the engineering properties of the various materials encountered on site and their suitability for use for construction of road layers, the following materials classification tests were carried out on selected samples during the investigation:

- Atterberg Limit and Linear Shrinkage Determinations
- Mod AASHTO and California Bearing Ratio
- Hydrometer

A summary of the laboratory results is presented below in **Table 6-1** and the detailed results are included in **Appendix C**.

Table 6-1: Summary of Results of Particle Size Distribution Analysis, Atterberg Limit Determinations, MOD AASHTO and CBR Tests.

Pit No.	Depth (m)	Atterberg Limits %			GM	Modified AASHTO		CBR Values (%) Compaction MDD				Classification and Activity
		LL	PI	LS		MDD (kgm3)	OMC %	90	93	95	100	
TP1	0.60-1.10	45	25	11.0	0.25							A-7-6(23), MEDIUM
TP3	0.60-1.10	45	25	11.0	0.25	1787	18.7	3.3	3.6	3.9	4.6	A-7-6(23), WT G10

LL - Liquid Limit
LS - Linear Shrinkage
PI - Plasticity Index

MDD – Maximum Dry Density
OMC – Maximum Moisture Content
GM – Grading Modulus

7 MATERIAL CLASSIFICATION AND USAGE

The laboratory test results, and the visual assessment conducted on-site have been used as an indication of suitability for use of the materials encountered on-site for the construction of pavement layers.

The classification and recommended usage are summarized in **Table 7-1** below.

Table 7-1: Material Classification and Usage.

Material Type	Classification Details	Recommended Use and Subgrade Treatment
Residual Mudstone	PI = 25 LS = 11.0 GM = 0.25 Classify as, A-7-6(23) and Worse than G10 in terms of TRH14. It has medium heave potential.	Fair to poor subgrade quality. Clayey material will need to be boxed out or spoiled.

8 GEOTECHNICAL APPRAISAL

8.1 Bearing Capacity

Dynamic Cone Penetration can assist in determining the estimated allowable safe bearing pressures (EASBP) of the soils. **Appendix B** shows that EASBP below 0.6m ranges between 43kPa to 362kPa.

8.2 Site Classification

The evaluation of the foundation soils and subsequent classification of the site into foundation classes has been carried along the guidelines as proposed by Watermayer and Tromp (1992) and the Structural Division of the SAICE as prescribed by the NHBRC. Based on the geology and the soil profiles encountered during investigation; the site class for is **H2**.

Table 8-1: NHBRC Residential Site Classification

TYPICAL FOUNDING MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Rock (excluding mud rocks which may exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R
Fine grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	< 7,5	50%	H
		7,5 – 15	50%	H1
		15 – 30	50%	H2
		> 30	50%	H3
Silty sands, sands, sandy and gravelly soils	COMPRESSIBLE AND POTENTIALLY COLLAPSABLE SOILS	<5	75%	C
		5-10	75%	C1
		>10	75%	C2
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	COMPRESSIBLE SOILS	<10	50%	S
		10-20	50%	S1
		>20	50%	S2
Contaminated soils, Controlled fill, Dolomitic areas, Landslip, Landfill, Marshy areas Mine waste fill, mining subsidence Reclaimed areas, Uncontrolled fill, Very soft silts/silty clays	VARIABLE	VARIABLE		P

8.3 Foundation Recommendations

- Position TP1 and TP2
 - The proposed location is underlain by residual mudstone and weathered mudstone. These residual soils have soft consistencies and may be classified as **H2** according to NHBRC. Based on the penetrometer tests, the structures should therefore be placed on residual sandstone using medium raft foundations.

Reinforcement of the foundations will be determined by the Structural Engineer based on the prevailing site conditions.

8.4 Excavatibility

SANS 1200 has been used to assess the excavatibility of the material underlying the site. The SANS 1200 excavation classification are shown in **Table 8-2** below.

Table 8-2: SANS 1200D excavation class descriptions- restricted excavation

Excavation Class	Description
Soft	Excavation in material that can be efficiently removed by a back-acting excavator of flywheel power approximately 0.10 kW per millimetre of tined-bucket width, without the use of pneumatic tools such as paving breakers
Intermediate	Excavation in material that requires a back-acting excavator of flywheel power exceeding 0.10 kW per millimetre of tined-bucket width or the use of pneumatic tools before removal by equipment equivalent to that specified for soft excavation.
Hard	Hard rock excavation shall be excavation in material (excluding boulder excavation) that cannot be efficiently removed without blasting or wedging and splitting.
Boulder (excavation class A)	Excavation in material containing more than 40% by volume of boulders of size in the range of 0.03-20m ³ , in a matrix of soft or smaller boulders.

Based on the site investigation i.e. trial pit profile and penetrometer tests, the ease of excavation according to SANS 1200D can be expected as shown in **Table 8-3** below. Furthermore, the excavation classification for 1.5 to 2.5m has been inferred based on the penetrometer tests.

Table 8-3: Excavation classification

Location	Excavation classification	
	0-1.5m	1.5-2.5m
Position TP1	Soft	Interm to hard
Position TP2	Soft	Interm to hard

9 CONCLUSION

This draft report contains the results of a geotechnical investigation carried out for the proposed new ablutions facilities at Jama Primary School.

The site is considered suitable for the proposed development from a geotechnical perspective provided the recommendations given in this report are adhered to.

The site is considered suitable for the proposed development from a geotechnical perspective provided the recommendations given in this report are adhered to.

The material classifies as worse than G10 according to TRH14, thus the material will need to be boxed out or spoiled.

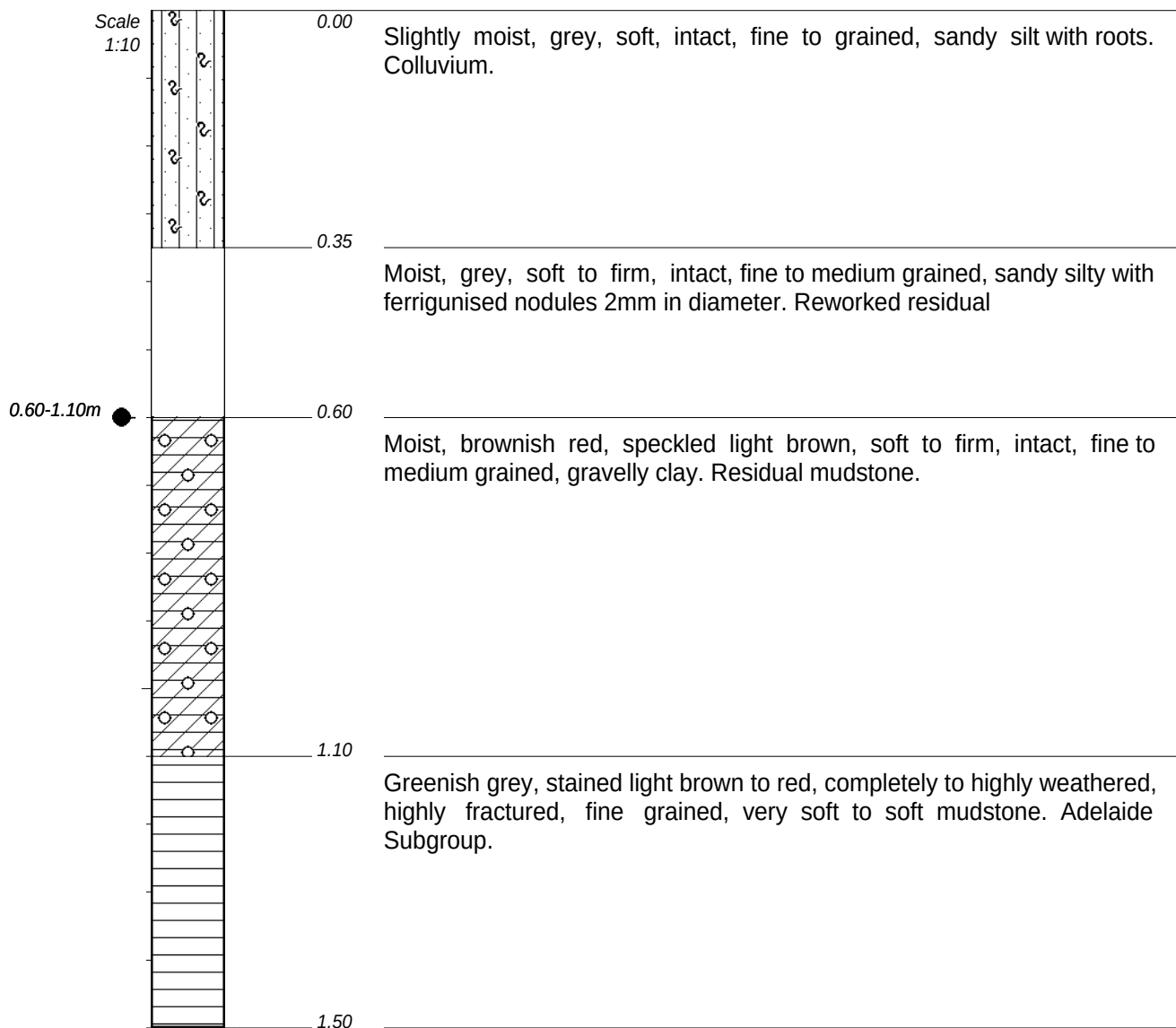
Finally, the ground conditions described in this report refer specifically to those encountered in the inspection pits and DCP test conducted on site.

It is therefore quite possible that conditions at variance with those discussed above can be encountered elsewhere. It is advised that a competent person be called to advise on the way forward should conditions at variance be encountered.

10 REFERENCES

- SANS 633: Soil profiling and rotary percussion borehole logging on dolomite land in Southern Africa for engineering purposes, 2012.
- 1: 250 000 Scale Geological Map. Sheet **3028 Kokstad**. Published by South African Council for Geoscience.
- Code of Practice _ the Safety of Persons Working in Small Diameter Shafts and Test Pits for Civil Engineering Purposes – Geotechnical Division of SAICE –2003.
- Draft TMH 6. Special Methods. Method ST6. Measurement of the In Situ Strength of Soils by the Dynamic Cone Penetrometer (DCP), (1984).
- SANS 10400-P (2010): The application of the National Building Regulations Part P: Drainage

APPENDIX A: GEOLOGICAL PROFILES



NOTES

- 1) End of hole at 1.50m weathered mudstone.
- 2) No groundwater seepage.
- 3) No sidewall collapse.
- 4) MOD-CBR-ind sample at 0.60-1.10m.
- 5) F-ind sample at 0.60-1.10m.

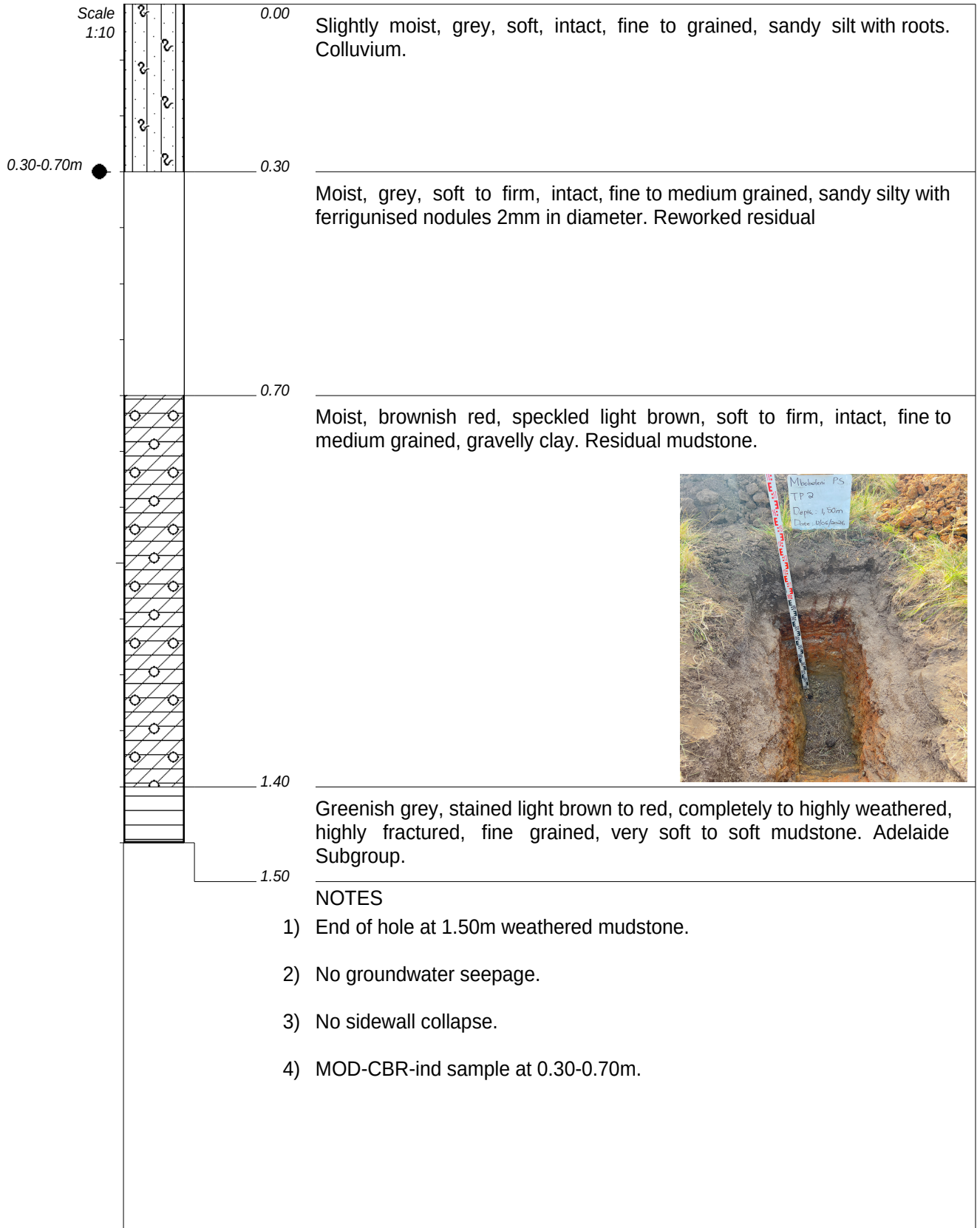


CONTRACTOR :
MACHINE : Pick and Shovel
DRILLED BY :
PROFIED BY : A Mdlalose
TYPE SET BY : A Mdlalose
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12/06/2026
DATE : 01/07/2026 11:15
TEXT : ..IPS\Log\MbobeleniPS.txt

ELEVATION :
X-COORD : 29.100869°
Y-COORD : -31.448659°

HOLE No: TP1



CONTRACTOR :
MACHINE : Pick and Shovel
DRILLED BY :
PROFILED BY : A Mdlalose
TYPE SET BY : A Mdlalose
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 12/06/2026
DATE : 01/07/2026 11:15
TEXT : ..iPS\Logs\MbobeleniPS.txt

ELEVATION :
X-COORD : 29.101910°
Y-COORD : -31.449565°

HOLE No: TP2

JOB NUMBER: 26_056_Mbobeleni PS

Name ●		GRAVELLY	{SA03}
		SANDY	{SA05}
		SILT	{SA06}
		CLAY	{SA08}
		MUDSTONE	{SA12}
		DISTURBED SAMPLE	{SA38}
		ROOTS	{SA40}

CONTRACTOR :
 MACHINE :
 DRILLED BY :
 PROFILED BY :

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

INCLINATION :
 DIAM :
 DATE :
 DATE :

DATE : 01/07/2026 11:15
 TEXT : ..iPS\Logs\MbobeleniPS.txt

ELEVATION :
 X-COORD :
 Y-COORD :

LEGEND
 SUMMARY OF SYMBOLS

APPENDIX B: PENETROMETER TEST RESULTS



APPROXIMATE INSITU CBR FROM DCP

Project Name Mbobeleni PS

Date 2026/06/12

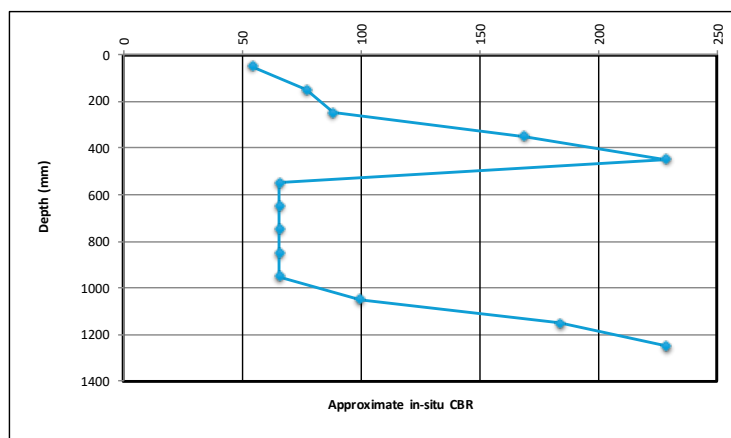
DCP No. 1

Hammer size 8kg with 20mm point

Applied Factor : 1 times Terzaghi's value

Applied Factor : times Terzaghi's value

SPT = 1.2 DN



Penetration Guide		
SPT mm/blow	DCP DN	Consistency
75 - 100	132-210	Very Dense
30 - 75	78-132	Dense
10 - 30	25-78	Med Dense
5 - 10	10 25	Loose
< 5	<10	Very Loose

NOTE :
Stated consistencies
do not apply to
cohesive materials.
Describe using "stiff
or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL

note: EASBP from Terzaghi & Peck p491 for 25mm settlement

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	3	50	33	4	5	54
2	100	200	150	5	150	20	6	9	77
3	200	300	250	6	250	17	7	12	88
4	300	400	350	10	350	10	12	23	169
5	400	500	450	14	450	7	17	35	228
6	500	600	550	4	550	25	5	7	66
7	600	700	650	4	650	25	5	7	66
8	700	800	750	4	750	25	5	7	66
9	800	900	850	4	850	25	5	7	66
10	900	1000	950	4	950	25	5	7	66
11	1000	1100	1050	7	1050	14	8	14	100
12	1100	1200	1150	11	1150	9	13	26	184
13	1200	1300	1250	14	1250	7	17	35	228

APPROXIMATE INSITU CBR FROM DCP

Project Name Mbobeleni PS

Date 2026/06/12

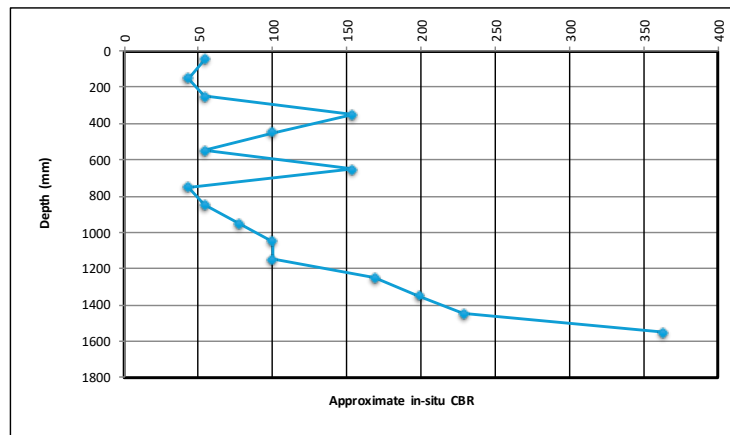
DCP No. 2

Hammer size 8kg with 20mm point

Applied Factor : 1 times Terzaghi's value

Applied Factor : 1 times Terzaghi's value

SPT = 1.2 DN



Penetration Guide		
SPT mm/blow	DCP DN	Consistency
75 - 100	132-210	Very Dense
30 - 75	78-132	Dense
10 - 30	25-78	Med Dense
5 - 10	10 - 25	Loose
< 5	<10	Very Loose

NOTE :

Stated consistencies
do not apply to
cohesive materials.
Describe using "stiff
or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL
note: EASBP from Terzaghi & Peck p491 for 25mm settlement

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	3	50	33	4	5	54
2	100	200	150	2	150	50	2	3	43
3	200	300	250	3	250	33	4	5	54
4	300	400	350	9	350	11	11	20	154
5	400	500	450	7	450	14	8	14	100
6	500	600	550	3	550	33	4	5	54
7	600	700	650	9	650	11	11	20	154
8	700	800	750	2	750	50	2	3	43
9	800	900	850	3	850	33	4	5	54
10	900	1000	950	5	950	20	6	9	77
11	1000	1100	1050	7	1050	14	8	14	100
12	1100	1200	1150	7	1150	14	8	14	100
13	1200	1300	1250	10	1250	10	12	23	169
14	1300	1400	1350	12	1350	8	14	29	199
15	1400	1500	1450	14	1450	7	17	35	228
16	1500	1600	1550	23	1550	4	28	68	362

APPENDIX C: LABORATORY TEST RESULTS

CLIENT : ILZ Consulting (Pty) Ltd
PHYSICAL ADDRESS : Unit 4, 36 Alexander Road, Westmead, 3610
ATTENTION : Mr A.I. Mdalose
PROJECT : Mbobeleni PS

TEST REPORT REFERENCE NUMBER: 101225

Dear Sir/Madam,

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

Date Received		17.06.2026					
Date Tested		23.06.2026 to 29.06.2026					
Sample Location		Refer to report					
Sampling Method		Unknown					
Sample Condition		Good					
Sampling Environmental Condition		Unknown					
Sampler(s) Name		Client					
Total Number of Pages		6					
Test Carried Out							
SANS3001 GR1	☒	SANS3001 GR11		SANS3001 AS1		SANS3001 AS2	
SANS3001 GR10	☒	SANS3001 GR12	☒	SANS3001 AS10		SANS3001 AG11	
SANS3001 GR20		SANS3001 GR30	☒	SANS3001 AS20		SANS3001 AG1	
SANS3001 GR31		SANS3001 GR40	☒	SANS3001 AG2/3		SANS3001 AG4	
SANS3001 GR50		SANS3001 GR51		SANS3001 AG5		SANS3001 AG10	
SANS3001 GR52		SANS3001 GR53		SANS3001 AG14		SANS3001 AG13	
SANS3001 GR54		SANS3001 GR55		SANS3001 AG20		SANS3001 AG21	
SANS3001 GR57		SANS3001 GR58		SANS5833		SANS3001 AG23	
SANS3001 GR5		ASTM D422	☒	SABS 865:1994#		SANS5849	
SANS3001 GR60		SANS3001 GR61		SANS6243		SANS6245	
TMH6 ST6#		SANS5836		ASTM D5		ASTM D36	
SANS3001 C03-2		SANS5831		UCT Manual Part 3		TMH1 B9	
☒ - Tick denotes tests that were carried out. #De-notes non-accredited test method							

We would like to take this opportunity of thanking you for your continued support.

Should you have any queries please do not hesitate to contact me.

Refer to Appendix A for Uncertainty of Measurement and notes on the Decision Rule

Yours faithfully

Technical Signatory,

Darren Samuel for Geosure (Pty) Ltd.

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	Reg.No.: 92/03145/07		
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	Mobile: +27(0) 72 870 2621	e-mail: lab@geosure.co.za	
HEAD OFFICE CONTACT INFO.:	Tel.: +27(0) 31 266 0458	Fax: 086 689 6506	
	Mobile: +27(0) 82 784 0544	e-mail:geosure@lafrica.com	
WEBSITE:	www.geosure.co.za		

Client : ILZ Consulting (Pty) Ltd
 Project : Mbobeleni PS

Our Ref. : 101225

Your Ref. : 26_056

Date Tested : 23.06.2026 to 25.06.2026

Attention : Mr A.I. Mdialose

Date Reported : 29.06.2026

Sample No.	T61902				
Field No.	TP1				
Position in Field	-				
Depth (m)	0.60-1.10				
Material Description	Light red with grey grvaelly clayey SILT (Residual Mudstone)				

Sieve Analysis (Wet Preparation) - SANS3001 GR 1 - Percent Passing Sieve Size

% Passing	100.0 mm	100			
	75.0 mm	100			
	63.0 mm	100			
	50.0 mm	100			
	37.5 mm	100			
	28.0 mm	100			
	20.0 mm	100			
	14.0 mm	100			
	5.00 mm	99			
	2.00 mm	93			
	0.425 mm	92			
	0.250 mm	92			
	0.150 mm	92			
	0.075 mm	89			

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

% Passing	0.060 mm	81			
	0.050 mm	76			
	0.040 mm	71			
	0.026 mm	64			
	0.015 mm	57			
	0.010 mm	47			
	0.0074 mm	44			
	0.0036 mm	39			
	0.0020 mm	33			
	0.0015 mm	30			

Mechanical analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size range

Coarse Sand	%	1			
Coarse Fine Sand	%	0			
Medium Fine Sand	%	0			
Fine Fine Sand	%	3			
Silt & Clay	%	96			
Grading Modulus		0.25			

Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)

Liquid Limit	%	45			
Plasticity Index	%	25			
Linear Shrinkage	%	11.0			
AASHTO Classification (Group Index)*		A-7-6 (23)			
Unified Classification*		CL			
Moisture Content	%				

Remarks:	Date Received: 17.06.2026
	Sampled by Client.
	*Opinions expressed herein fall outside the scope of SANAS accreditation.

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	Mobile:	+27(0) 82 784 0544	e-mail: geosure@lafrica.com
WEBSITE:		www.geosure.co.za	

Client : ILZ Consulting (Pty) Ltd

Job No. : 101225

Project : Mbobeleni PS

Your Ref.No. : 26_056

Date Tested : 23.06.2026 to 25.06.2026

Attention : Mr A.I. Mdlalose

Date Reported : 29.06.2026

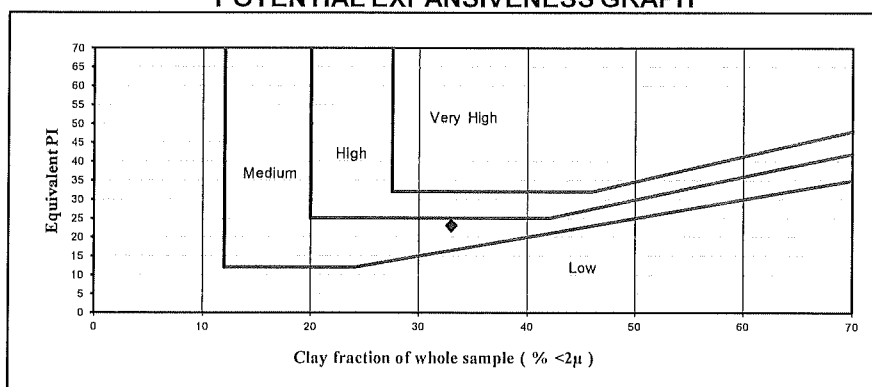
Sample Number : T61902

Field No. : TP1

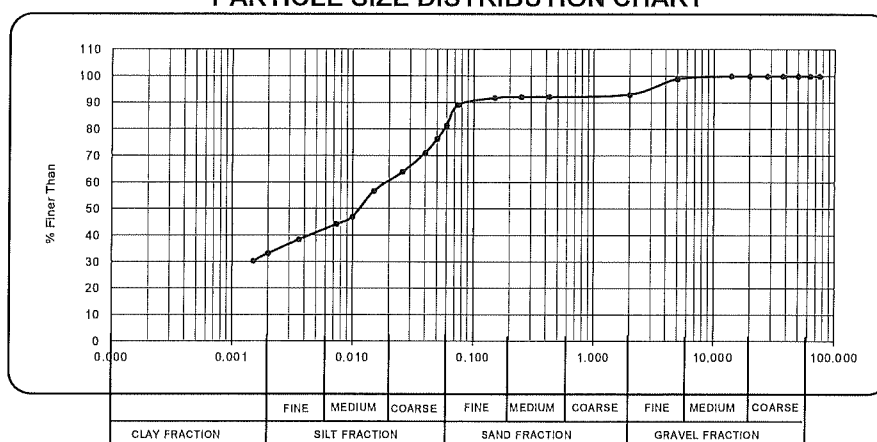
Sample Description : Light red with grey grvaelly clayey SILT (Residual Mudstone)

Equivalent PI : 23 Clay fraction of whole sample (% <2 μ) : 33

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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Client : ILZ Consulting (Pty) Ltd
 Project : Mbobeleni PS
 Attention : Mr A. I. Mdlalose

Your Ref No. : 26_056
 Our Ref No. : 101225
 Date Reported : 01/07/2026

Test Report - SANS 3001

Sample No.	T61902				
Field No.	TP1				
Position	-				
Depth (m)	0.60-1.10				
Method of Preparation	N/A				
Material Description	Light red with grey gravelly clayey SILT. Residual Mudstone				

Sieve Analysis - Percent Passing Sieve Size

Sieve Aperture (mm)	100.00				
	75.00				
	63.00				
	53.00				
	50.00				
	37.50				
	28.00				
	26.50				
	20.00				
	19.00				
	14.00				
	13.20	100			
	5.00	99			
	4.750	99			
	2.000	93			
	0.425	92			
	0.075	89			
Grading Modulus	0.25				

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

Coarse Sand	2.000 - 0.425	1			
Coarse-Fine Sand	0.425 - 0.250	0			
Medium-Fine Sand	0.250 - 0.150	0			
Fine-Fine Sand	0.150 - 0.075	3			
Silt and Clay	< 0.075	96			

Atterberg Limits SANS 3001 on <0.425 mm fraction

Liquid Limit	% or symbol	45			
Plasticity Index	% or symbol	25			
Linear Shrinkage	%	11.0			

Maximum Dry Density and Optimum Moisture Content

Maximum Dry Density (kg/m ³)	1787				
Optimum moisture content (%)	18.7				

California Bearing Ratio

CBR @100% Compaction	%	4.6			
CBR @ 98% Compaction	%	4.3			
CBR @ 97% Compaction	%	4.2			
CBR @ 95% Compaction	%	3.9			
CBR @ 93% Compaction	%	3.6			
CBR @ 90% Compaction	%	3.3			
Swell @100% Compaction	%	2.5			

COLTO Classification (1998)**	Cannot be Determined				
TRH 14 Classification (1985)**	Poorer than G10.				
AASHTO Classification (Group Index)**	A-7-6 (23)				
Unified Classification **	CL				

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

† Subject to further testing as required by COLTO. COLTO above uses only: Atterberg Limits (<0.425 mm fraction; not arithmetic mean), Nominal Max Size, Grading Curve, Coarse Sand Ratio, Grading Modulus, Strength (CBR), and Swell.

Check that Max Size <= 2/3 of compacted layer thickness.

** Opinions and interpretations expressed herein are outside the scope of SANAS accreditation

Version 6.01 25 March 2024

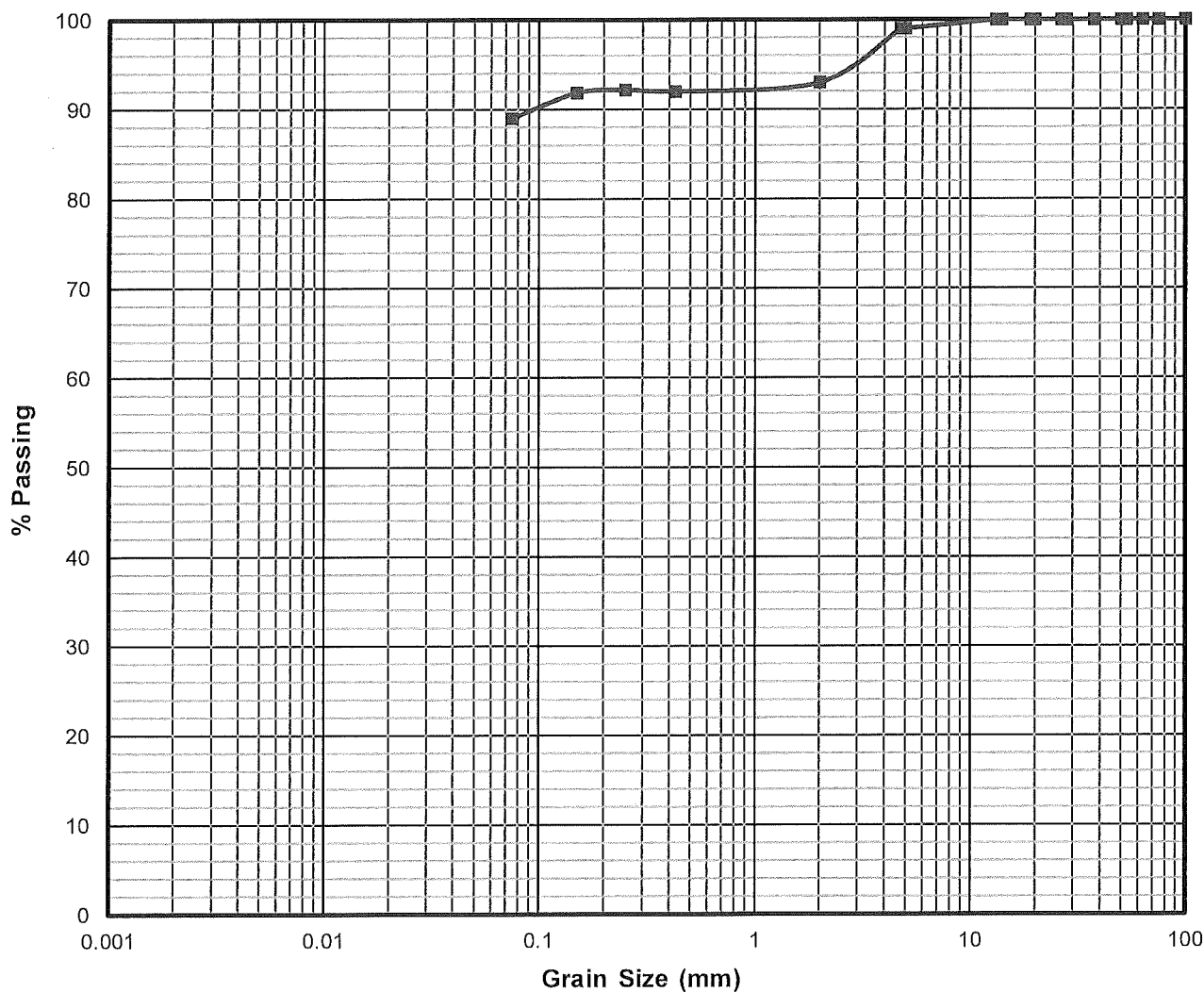
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Client : ILZ Consulting (Pty) Ltd
Project : Mbobeleni PS
Attention : Mr A. I. Mdlalose

Your Ref No.: 26_056
Our Ref No. : 101225
Date Reported : 01/07/2026

Grading Curve for Sample T61902 – SANS 3001



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse
	Silt			Sand			Gravel		

ck Red Line is the Grading Curve (COLTO Classification = Cannot be Determined) (TRH 14 Classification = Poorer than G'

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	5.00	13.20	14.00	19.00	20.00	26.50	28.0	37.5	50.0	53.0	63	75	100
Percentage Passing	89%	92%	92%	92%	93%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

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Client : ILZ Consulting (Pty) Ltd

Project : Mbobeleni PS

Attention : Mr A.I. Mdlalose

Your Ref No. : 26_056

Our Ref No. : 101225

Date Reported : 24.06.2026

SANS 3001 Moisture/Density Relationship

Sample No. : T61902

Method of preparation : N/A

Natural/Stabilised : Natural

Material Description : Lt.Rd.With Gr.Gravelly Clayey SILT (Residual Mud: Compaction Effort : Mod AASHTO

Field No. : TP1

Depth (m) : 0.60-1.10

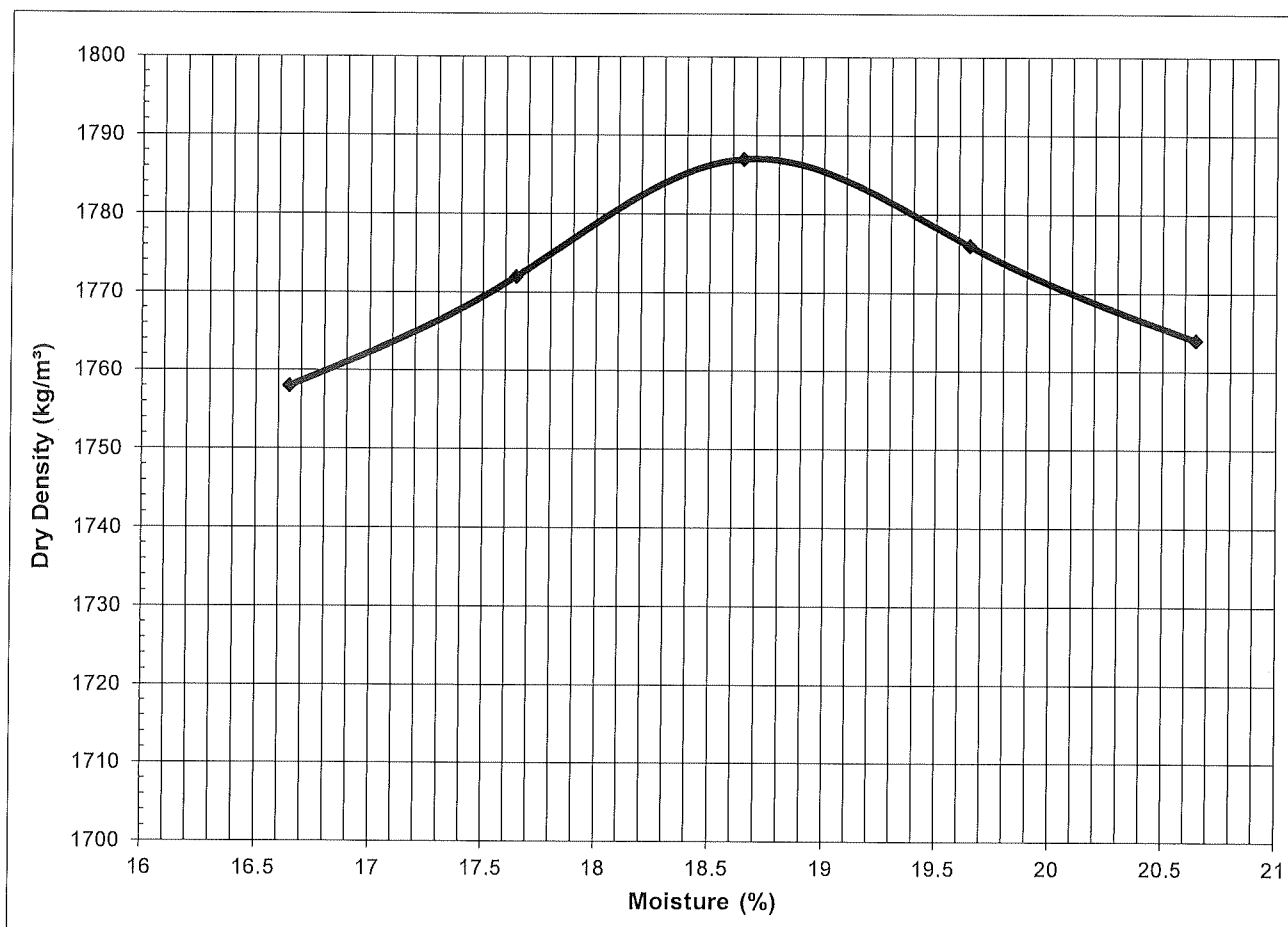
Origin : -

Maximum Dry Density (kg/m³) : 1787

Optimum Moisture Content (%) : 18.7

Plotted Values:

Moisture (%)	16.6	17.6	18.6	19.6	20.6
Dry Density (kg/m ³)	1758	1772	1787	1776	1764



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APPENDIX A

UNCERTAINTY OF MEASUREMENT AND DECISION RULE

Notes on Uncertainty:

1. ABBREVIATIONS: UoM = Uncertainty of Measurement; E.UoM = Expanded Uncertainty of Measurement
2. UoM for gravels, sands, cohesive materials and asphalt was determined from a reproducibility study
2. UoM for aggregates and concrete was determined from a repeatability study

Notes on Decision Rule:

1. The decision rule employed by this laboratory is based on ILAC-G9:03/2009
2. Decision rules are only applicable to classification of gravels, sands and cohesive materials
3. Contact GEOSURE for further information related to the decision rule

MATERIAL TYPE		GRAVELS AND CRUSHED STONE (G1 - G5)	SANDS (G8-G9)	COHESIVE MATERIALS (G5 - G9)
PROPERTY		E.UoM (K=2)	E.UoM (K=2)	E.UoM (K=2)
% Passing Sieve Aperture	100.0 mm	0.00	0.00	0.00
	75.0 mm	0.00	0.00	2.56
	63.0 mm	0.00	0.00	1.48
	50.0 mm	0.00	0.00	1.56
	37.5 mm	0.36	0.00	1.32
	28.0 mm	2.08	0.00	0.98
	20.0 mm	0.78	0.00	0.98
	14.0 mm	0.38	0.00	1.82
	5.00 mm	1.94	0.44	1.10
	2.00 mm	2.44	0.56	0.90
	0.425 mm	1.42	1.40	1.42
	0.075 mm	0.38	0.72	0.98
Mechanical Analysis (%)	CS	1.32	1.08	0.98
	CFS	1.32	0.66	0.00
	MFS	0.00	1.56	0.00
	FFS	0.74	0.92	1.02
	S+C	1.36	0.36	0.00
Grading Modulus		0.04	0.02	0.06
Atterberg Limits (%)	LL	0.00	0.00	1.60
	PI	0.00	0.00	0.64
	LS	0.00	0.00	0.22
CBR (%)	100% Comp.	18.36	8.24	2.70
	98% Comp.	9.24	7.50	1.10
	97% Comp	5.84	6.82	0.62
	95% Comp	1.32	3.04	0.40
	93% Comp.	1.94	2.44	0.66
	90% Comp.	3.54	1.50	0.66
	Swell @ 100%	0.04	0.00	0.92
MOD	MDD (kg/m ³)	5.74	3.42	7.76
	O.M.C (%)	0.08	0.12	0.50
Atterberg Limits (%) GR11	LL	0.55		
	PI	0.57		
	LS	0.13		
Nuclear Density				
Property		E.UoM (K=2)		
Wet Density (kg/m ³)		8.88		
Dry Density (kg/m ³)		11.36		
Moisture Content (%)		0.38		

AGGREGATE (SINGLE SIZED CRUSHED STONE)		
PROPERTY		E.UoM (K=2)
% Passing Sieve Aperture	100.0 mm	0.00
	75.0 mm	0.00
	63.0 mm	0.00
	50.0 mm	0.00
	37.5 mm	0.00
	28.0 mm	0.00
	20.0 mm	0.16
	14.0 mm	0.14
	10.0 mm	0.32
	7.1 mm	0.18
	5.0 mm	0.20
	2.0 mm	0.08
	1.0 mm	0.18
	0.600 mm	0.20
	0.425 mm	0.20
	0.300 mm	0.16
	0.150 mm	0.04
	0.075 mm	0.12
Fineness Mod.		0.00
Flak. Index	%	0.22
ALD	mm	0.12
ALD Comp.	mm	0.10
Sand Equiv		0.54
ACV (AG10)	%	0.10
10% FACT(AG10)	kN	1.08
ACV (AG15)	%	0.00
10% FACT(AG15)	kN	1.00
BD (AG20)	kg/m ³	0.38
AD (AG20)	kg/m ³	0.44
WA (AG20)	%	0.00
BD (AG21)	kg/m ³	22.76
AG (AG21)	kg/m ³	27.04
WA (AG21)	%	0.00
ARD (AG22)	kg/m ³	1.92
RD (AG23)	kg/m ³	2.04
PD (AG23)	kg/m ³	0.00
Eth. Glyc. (AG14)	EGDI	0.8
Water Soluble Salts (5849)	%	0.05
Meth. Blue (6243)	%	0.04
PSV	Friction Value	0.1
EC (GR60)	s/m	0.002
pH	pH	0.199

ASPHALT		
PROPERTY		E.UoM (K=2)
% Passing Sieve Aperture	37.5 mm	0.00
	28.0 mm	0.00
	20.0 mm	0.00
	14.0 mm	0.13
	10.0 mm	0.46
	7.1 mm	1.53
	5.00 mm	1.31
	2.00 mm	1.08
	1.00 mm	0.76
	0.600 mm	0.53
	0.425 mm	0.51
	0.300 mm	0.48
	0.150 mm	0.36
	0.075 mm	0.41
Blinder Cont.	%	0.15
Fineness Mod		0.04
BD	kg/m ³	4.22
Stability	kN	0.74
Flow	mm	0.09
MVD	kg/m ³	4.84

CONCRETE		
AGE		E.UoM (K=2)
7 Day Results		
Strength(MPa)		2.30
28 Day Results		
Strength(MPa)		1.26
Chloride Conductivity (ms/cm) C03-3		0.034
Porosity (%) C03-3		0.406
Oxygen Permeability (OPI)		0.068
Water Sorptivity UCT Manual Part 3 (0.5mm/hr)		0.218
Water Sorptivity - Porosity UCT Manual Part 3 (0.5mm/hr)		1.169
Alkali Reactivity (%)		0.002

