

Geotechnical Investigation Report for Ramafole Senior Secondary School as Part of the Implementation of Sanitation Programme at Various Schools in the Eastern Cape Province



For



By

ILZ Consulting



Geotechnical Investigation Report for Ramafole Senior Secondary School as Part of the Implementation of Sanitation Programme at Various Schools in the Eastern Cape Province

**Report
Version – Final**

July 2026

iLZ_26_056_Ramafole SSS

DOCUMENT ISSUE STATUS

Report Issue	Final	
Reference Number	iLZ_26_056_Ramafole SSS	
	Name	Signature
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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 **Ramafole Senior Secondary 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
- GPS Coordinates of the schools
- 1:250 000 Geological Map Sheets

3 SITE LOCATION AND ACCESSIBILITY

Ramafole Senior Secondary School is located in Santini, a village approximately 20km north of Mount Fletcher (Tlokoeng) and approximately 46km northeast of Matatiele, under the Alfred Nzo District Municipality in the Eastern Cape Province, South Africa. Access is via R56 which connects Mount Fletcher and Matatiele. (see **Figure 3-1**). The school has multiple classroom blocks, an admin

block, and existing toilets for learners and teachers. Rubble from demolished structure is situated next to the proposed site location.

The approximate central coordinates are $-30.550601^{\circ}\text{Lat}$ and $28.526323^{\circ}\text{Long}$. The coordinates are WGS84.

Topographically, the site is located on a relatively flat terrain with limited grass cover.

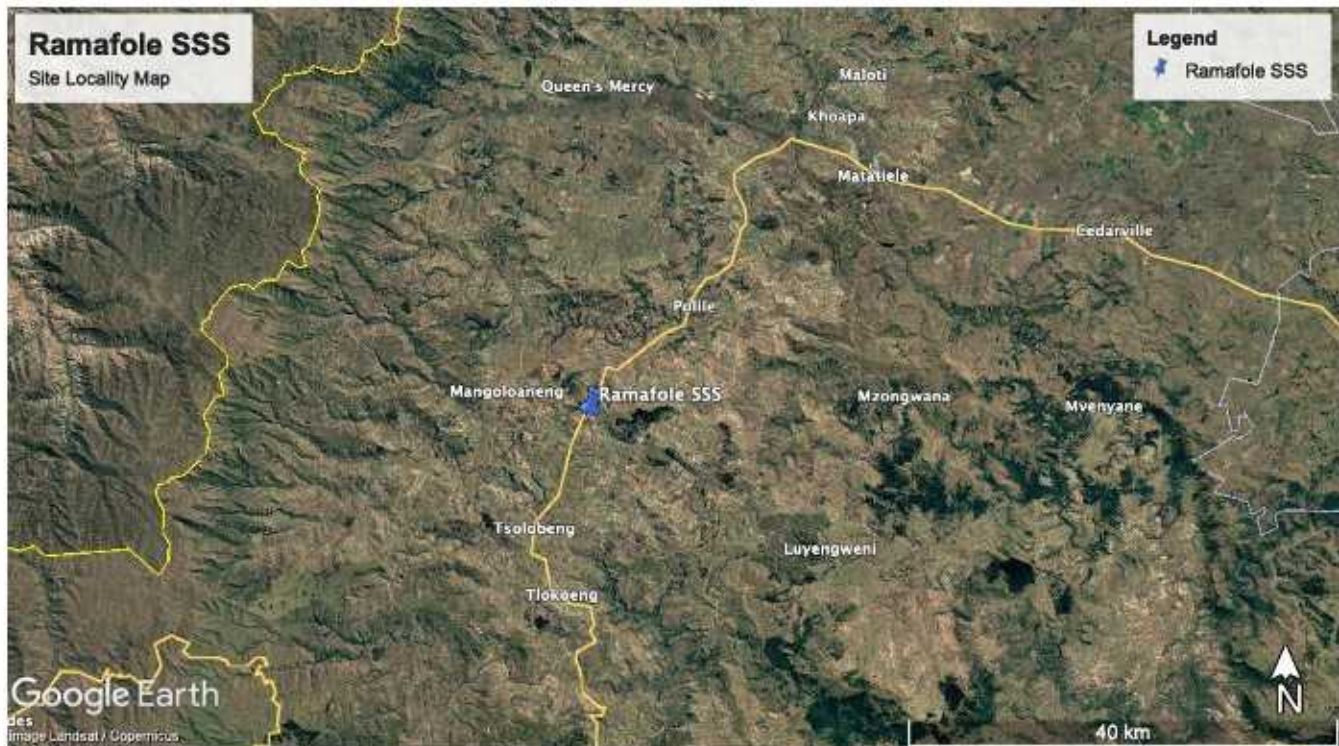


Figure 3-1: Locality Map relative to Matatiele and Tlokoeng (Mt Fletcher).

4 FIELD WORK

Geotechnical site investigation was undertaken on the 10th of July 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.

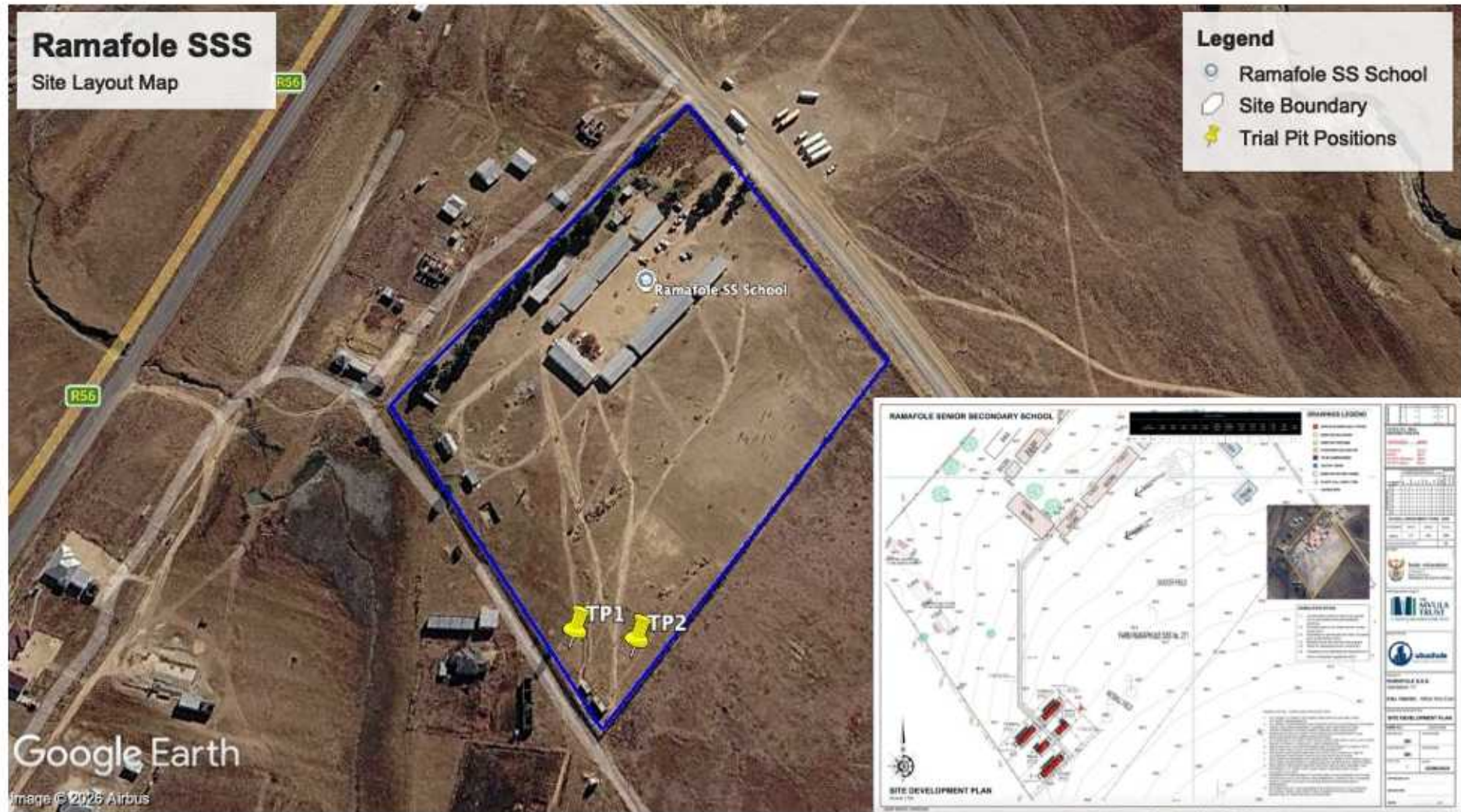


Figure 4-1: Trial pit positions.

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 refusal depth between 0.65 and 0.90 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 between 0.60m and 0.90m 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 **3028 Kokstad** 1:250 000 Geological Map Series, the site is underlain by the Molteno Formation (TRm) sandstones, mudstones and shales as shown in **Figure 5-1** below.

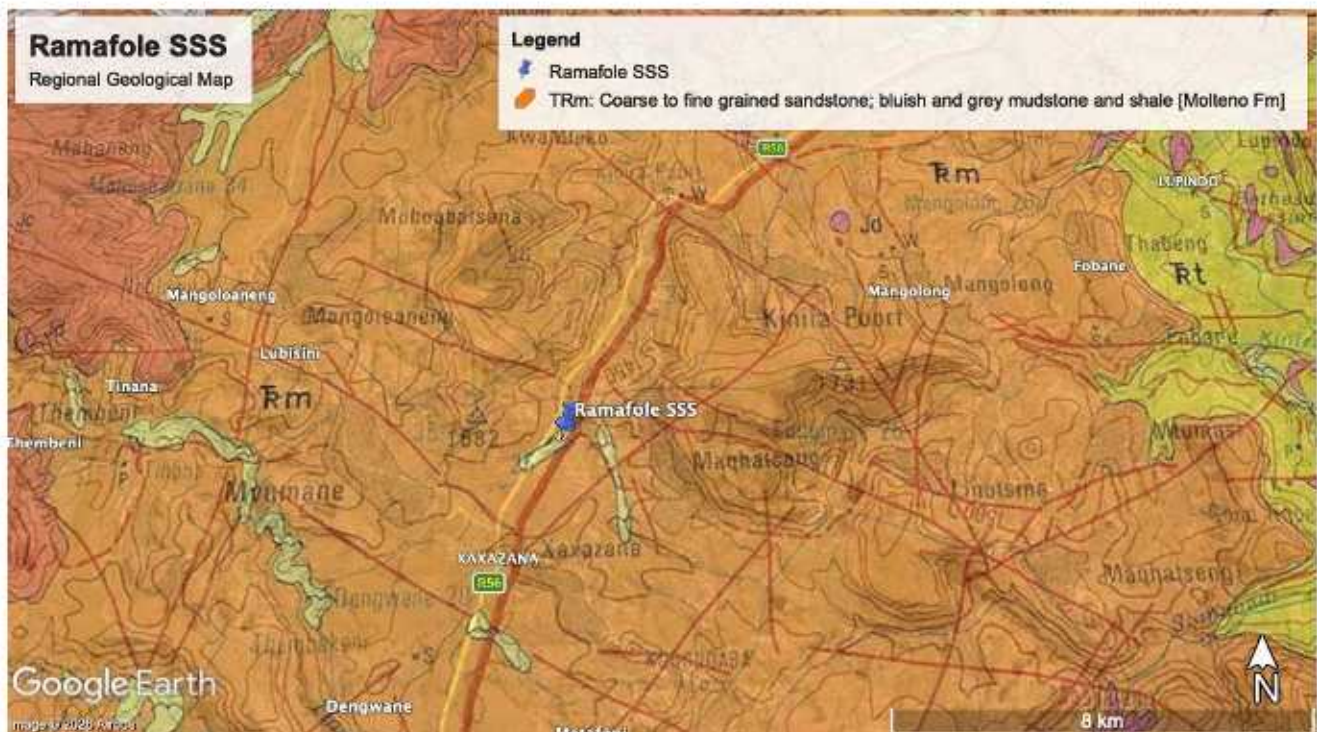


Figure 5-1: Regional geology of the site.

5.1 Local Geology

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

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 throughout the site at depths ranging from surface to 0.40m overlying the weathered mudstone. It was described as slightly moist to moist, yellowish brown, soft, intact, fine to medium grained, slightly sandy gravelly silt.

5.1.2 Weathered Mudstone (TRm)

The weathered tillite was encountered underlying the colluvial soils at depths ranging from 0.65 to 0.90m below existing ground level. It was described as yellowish brown, greenish brown, 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, perched groundwater levels may be encountered at the soil/rock interface during rainy season. If encountered during construction, it will need to be removed from foundations through dewatering.

6 GEOTECHNICAL APPRAISAL

6.1 Bearing Capacity

Dynamic Cone Penetration can assist in determining the estimated allowable safe bearing pressures (EASBP) of the soils. **Appendix B** shows that EASBP on the weathered mudstone ranges between 228kPa and 392kPa.

6.2 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 **R**.

Table 6-1: 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 7,5 – 15 15 – 30 > 30	50% 50% 50% 50%	H H1 H2 H3
Silty sands, sands, sandy and gravelly soils	COMPRESSIBLE AND POTENTIALLY COLLAPSABLE SOILS	<5 5-10 >10	75% 75% 75%	C C1 C2
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	COMPRESSIBLE SOILS	<10 10-20 >20	50% 50% 50%	S S1 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

6.3 Foundation Recommendations

- Position TP1 and TP2
 - The proposed location is underlain by colluvial soils, residual soils and weathered mudstone. The weathered mudstone bedrock may be classified as **R** according to NHBRC. The structures should therefore be placed on the weathered bedrock using conventional strip footings.

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

6.4 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 6-2** below.

Table 6-2: 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 6-3** below. Furthermore, due to shallow refusal of the trial pits and penetrometer tests, the excavation classification for 1.5 to 2.5m has been inferred based on the rock strength which is anticipated to increase with depth.

Table 6-3: Excavation classification

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

7 CONCLUSION

This report contains the results of a geotechnical investigation carried out for the proposed new ablutions facilities at Ramafole Senior Secondary School.

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

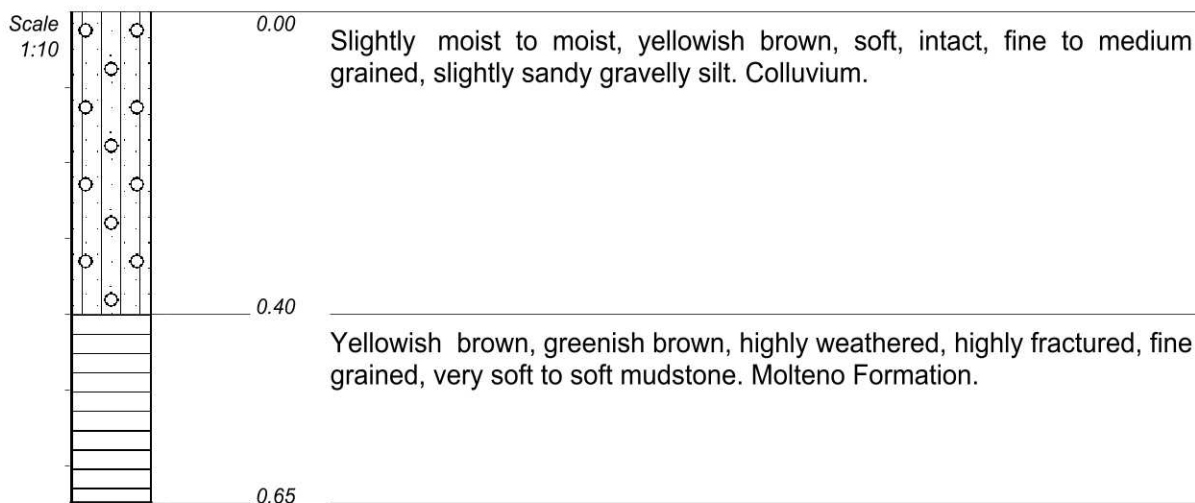
Finally, the ground conditions described in this report refer specifically to those encountered in the inspection pits and DCP test conducted on site.

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.

8 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 3128 Umtata. 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) Refusal at 0.65m weathered mudstone.
- 2) No groundwater seepage.
- 3) No sidewall collapse.

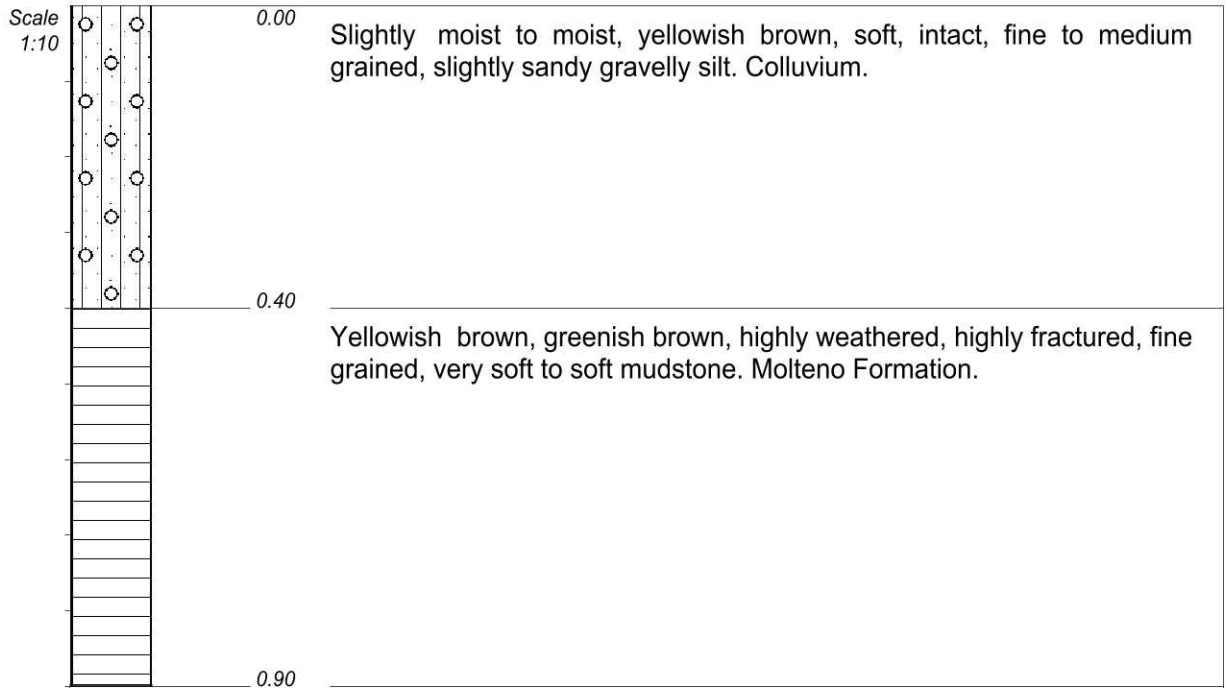


CONTRACTOR :
MACHINE : Pick and Shovel
DRILLED BY :
PROFILED BY : A Mdlalose
TYPE SET BY : A Mdlalose
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/07/2026
DATE : 13/07/2026 07:30
TEXT : ..SSS\Logs\RamafoleSSS.txt

ELEVATION :
X-COORD : 28.525977'
Y-COORD : -30.551624'

HOLE No: TP1



NOTES

- 1) Refusal at 0.90m weathered mudstone.
- 2) No groundwater seepage.
- 3) No sidewall collapse.



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

INCLINATION :
 DIAM :
 DATE :
 DATE : 10/07/2026
 DATE : 13/07/2026 07:30
 TEXT : ..SSS\Logs\RamafoteSSS.txt

ELEVATION :
 X-COORD : 28.526275'
 Y-COORD : -30.551661'

HOLE No: TP2

JOB NUMBER: 26_056_Ramafole SSS

	GRAVELLY	{SA03}
	SANDY	{SA05}
	SILT	{SA06}
	MUDSTONE	{SA12}

CONTRACTOR :
 MACHINE :
 DRILLED BY :
 PROFILED BY :

INCLINATION :
 DIAM :
 DATE :
 DATE :

ELEVATION :
 X-COORD :
 Y-COORD :

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

DATE : 13/07/2026 07:30
 TEXT : ..SSS\Log\Logs\RamafoleSSS.txt

LEGEND
 SUMMARY OF SYMBOLS

APPENDIX B: PENETROMETER TEST RESULTS



APPROXIMATE INSITU CBR FROM DCP

Project Name **Ramafote SSS**

Date 2026/07/10

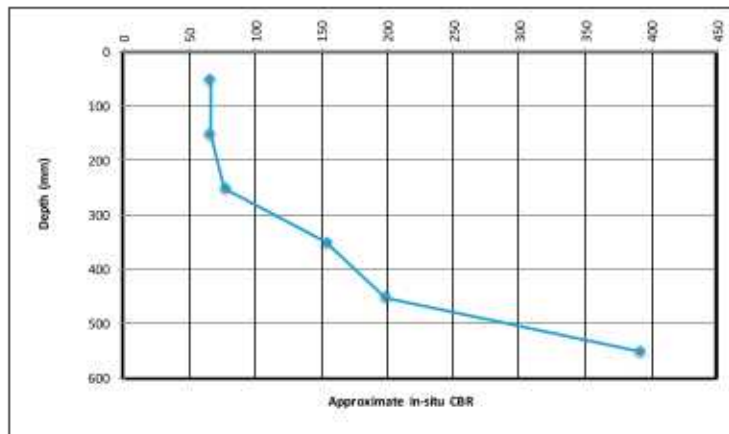
DCP No. 1

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	4	50	25	5	7	66
2	100	200	150	4	150	25	5	7	66
3	200	300	250	5	250	20	6	9	77
4	300	400	350	9	350	11	11	20	154
5	400	500	450	12	450	8	14	29	199
6	500	600	550	25	550	4	30	76	392

APPROXIMATE INSITU CBR FROM DCP

Project Name Ramafole SSS

Date 2026/07/10

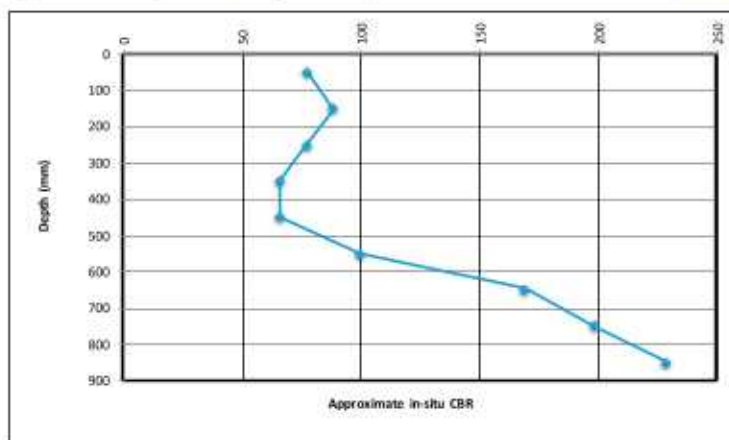
DCP No. 2

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	5	50	20	6	9	77
2	100	200	150	6	150	17	7	12	88
3	200	300	250	5	250	20	6	9	77
4	300	400	350	4	350	25	5	7	66
5	400	500	450	4	450	25	5	7	66
6	500	600	550	7	550	14	8	14	100
7	600	700	650	10	650	10	12	23	169
8	700	800	750	12	750	8	14	29	199
9	800	900	850	14	850	7	17	35	228