PHASE 1 NEAR SURFACE GEOTECHNICAL INVESTIGATION FOR THE PROPOSED TSHING EXTENSION 11 TOWNSHIP ON PORTION 3 OF THE FARM DOORNPAN 193 IP, NORTH WEST PROVINCE OF SOUTH AFRICA

PREPARED FOR:	PREPARED BY:
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REPORT REFERENCE

MGS/NDC/28/01/2022

SITE LOCATION

FARM NAME	CO-ORDINATES	
	LATITUDE	LONGITUDE
DOORNPAN 193 IP	26°18'11,23"S	26°47'25,049"E

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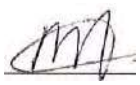
00	28/01/2022	L Mavhetha (Pr.Sci.Nat)		Final Report

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ACRONYMS AND ABBREVIATIONS

AASHTO : American Association of State Highway and Transportation Officials

ARS : Acceleration Response Spectra

Cand.Sci.Nat : Candidate Natural Scientist

CBR : Californian Bearing Ratio

CL : Clay

DCP : Dynamic Cone Penetrometer

M : Meter

MBGL : Meters Below Ground Level

MDD : Maximum Dry Density

NHBRC : The National Home Builders Registration Council

OMC : Optimum Moisture Content

Pr.Sci.Nat : Professional Natural Scientist

SACNASP : South African Council Natural Scientific Professions

SANAS : South African National Accreditation System

SANS : South African National Standards

TLB : Tractor Loader Backhoe

TP : Trial Pit

USC : Unified Soil Classification

EXECUTIVE SUMMARY

Client	Nkanivo Development Consultants
Consultant Company	Mutali Geoscience Solutions
Site location	26°18'11,23"S 26°47'25,049"E Portion 3 of the farm Doornpan 193 IP, Ventersdorp, North West
Purpose of investigation	Phase 1 near surface geotechnical investigation for the proposed Doornpan township establishment on portion 3 of the farm Doornpan 193 IP, North West province The main objective of the investigation was aimed at defining the founding materials and establishing broader geotechnical conditions and their suitability to the proposed Township establishment.
Regional geology	Stratigraphic records indicate that the site located in the Rietgat Formation of the Platberg Group in the Ventersdorp supergroup The Rietgat Formation is composed mainly of greenish-grey amygdaloidal and porphyritic lava, with interbedded shale, tuff, greywacke, conglomerate and impure limestone with algal structures. The site is located within the lithologies dominated by siliclastic sedimentary such as shale, surficial deposit including, laminated shale and organic mudstones.
Excavation conditions	Based on the test pits excavations, it is anticipated that site should classify as “soft to intermediate excavation” throughout, in accordance with SANS 1200 DA classification using similar plant as employed during this investigation. This means it can easily be removed by a tractor loader backhoe (TLB) of flywheel power >0.10 kW per mm of tined bucket width.
Top layer	Topsoil layer was observed in all of the trial pits. The material didn’t show road bearing capacity. There was no sample taken from this layer. The topsoil is characterised by an upper stratum of sandy Clay which have an average thickness of 0.4m
Laboratory Results	The samples were found to be non-plastic. The PI along with the clay content indicated that the samples exhibit low potential expansiveness. The samples indicated a grading modulus of 0.69

	to 2.34. Based on the grading modulus, Atterberg limits and grading analysis, the materials were classified as A-2-6(0) according to U.S. Highway Classification and G8 according to COLTO classifications
Site classification designation	soil class is "**R/S/H1**"
Foundation Design	**The recommended Foundation types in accordance with** SANS 10400H- Foundation: Modified Normal/ Reinforced Strip foundation/ Raft foundation

1. INTRODUCTION

Mutali Geoscience Solutions (Pty) Ltd was appointed by Nkanivo Development Consultants to conduct a Phase 1 near surface geotechnical investigation for the proposed Tshing Extension 11 Township on portion 3 of the farm Doornpan 193 IP, North West Province of South Africa. The project area measures approximately 88.46 hectares in extent and is having approximately 842 erven according to the Layout Plan.

2. OBJECTIVES OF THE STUDY

This report evaluates the geotechnical characteristics associated with the underlying geology and any geotechnical constraints that might affect structural integrity of the subject property. However, it is also essential to Identify engineering properties' potential influence on the design, construction and operation of the intended infrastructures. It must be noted that there were informal internal streets dividing the site during the course of the investigation.

The main objective of the investigation was aimed at defining the founding materials and establishing broader geotechnical conditions and their suitability to the proposed township establishment.

The following are some of the objectives of the conducted geotechnical investigation:

- To determine the geology of the site
- To establish in broad terms, the nature and relevant engineering properties of the upper soil and rock strata underlying the site.
- To ascertain the soil chemistry including pH determination and electrical conductivity of the soil.
- To comment on suitable excavation procedures for the installation of services.
- To present general foundation recommendations for the proposed development.
- To comment on any other geotechnical aspects as these may affect the development.
- Potential geotechnical limiting factors by determining the behavior and suitability of soil/rocks and their effects on the intended development;
- Assess excavation conditions
- Determine the presence or occurrence of groundwater from the surface to a maximum depth of 3 meters.
- Classification of the site material according to the TRH14 classification system

The geotechnical investigation was carried out in accordance with SAIEG and GFSH-2 guidelines and all NHBRC Home Building Manuals. This report presents findings on the geotechnical properties and characteristics of the surficial soils underlying the site, the investigation methodology and discusses recommendations for earthworks, drainage, ease of excavation and foundations.

3. INFORMATION USED IN THIS STUDY

The geotechnical investigation commenced with a desktop study using the existing geotechnical databases and maps pertaining, structural engineer specifications of the site were reviewed.

The following information was reviewed and consulted during the site investigation:

- Climate-data.org
- Expansive Roadbed Treatment for Southern Africa: D J Weston (1980) 4th Int. Conf. on Expansive Soils, Vol. 1, Denver pp 339-360;
- Geological Map of South Africa from the database of Council For Geoscience: Scale 1: 100 000 Sheet – Geological series 2829DB
- National Home Builders Registration Council: Home Builders Manual 2015;
- SAICE's Guidelines for Urban Engineering Geological Investigations;
- Schwartz, K. (1985). Collapsible soils. The Civil Engineer in South Africa, July, p379-393 and;
- South African Weather Service
- Technical Recommendations for Highways – TRH14 Guidelines for Road Construction Materials by the National Institute for Transport and road research of the Council for Scientific and Industrial Research, (1985);

4. SITE DESCRIPTION

4.1. Location

The general Geographical Positioning System (GPS) coordinates for proposed development are 26°47' 25, 049" E 26° 18' 11, 23" S at an average elevation of 1490 meters above sea level. Access to site is via gravel road and the unnamed internal streets. The project area measures approximately 88.46 hectares in extent and is having approximately 842 erven according to the Layout Plan.

The proposed site locality map is shown in Figure 1 below.

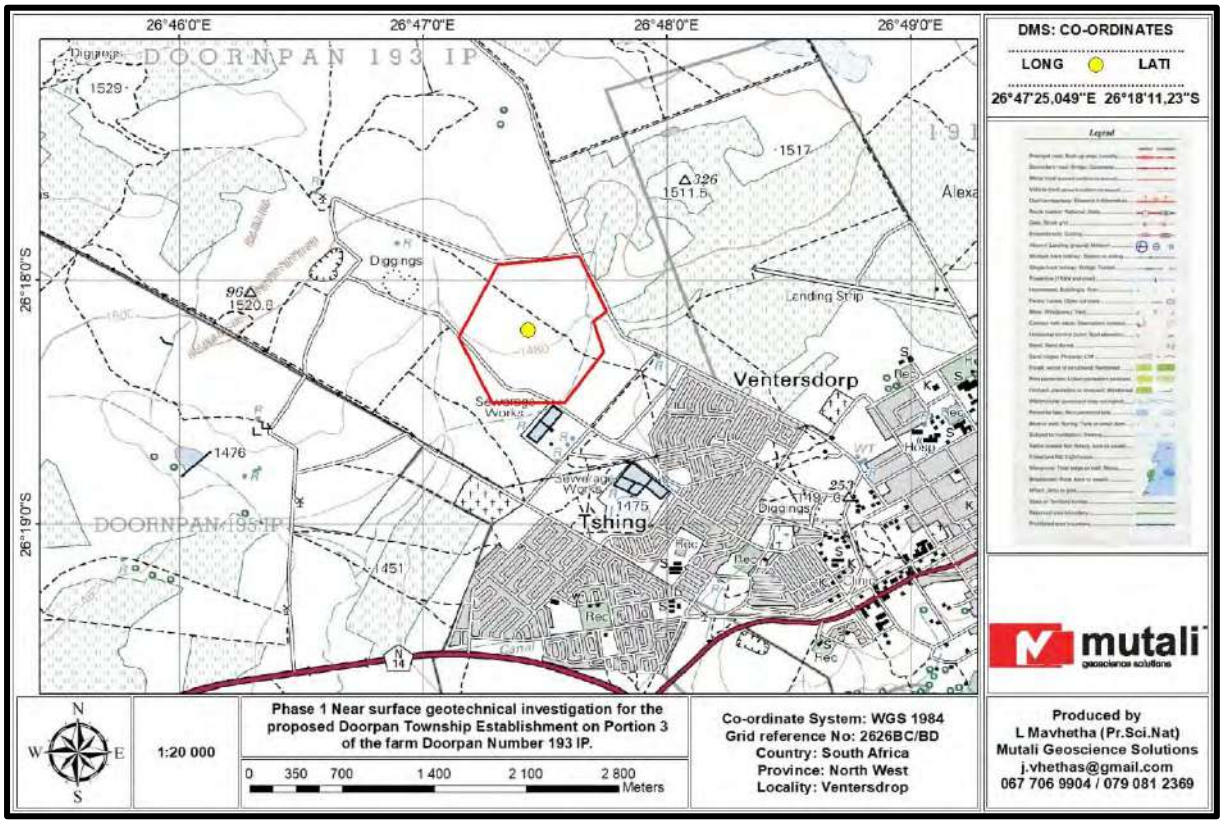

Figure 1: Locality Map of the site

4.2. Topography and drainage

The topography on site is of low relief and relatively flat gradient that have angle less than that of critical angle of repose, the general altitude of the proposed site is approximately 1490 meters above the sea level. There is no evidence of heavy soil erosion on the entire site. Drainage of water is expected to align with site topography, particularly during periods of heavy or prolonged rainfall.

4.3. Climate

The climate in Ventersdorp is warm and temperate. There is significant rainfall in summer month and driest seasons is winter which occasionally rainfall. This location is classified as Cwb by Köppen and Geiger. The average annual temperature is 25°C in Ventersdorp. In a year Ventersdorp receives approximately 346.1 mm rainfall.

Ventersdorp receive the greatest amount of precipitation (180 mm) in December. The warmest month of the year is in January, with an average temperature of 25°C while the lowest temperatures are experience in July at average of 10°C. During site investigations, the weather was cloudy no precipitation (rainfall) occurred.

The climatic condition plays a fundamental role in the development of a soil profile and the weathering of rock. Chemical decomposition is the predominant mode of rock weathering in areas where the climatic “N-value” is less than 5. In areas where the climatic N-value is between 5 and 10, disintegration is the predominant form of weathering, although some chemical decomposition of the primary rock minerals still takes place. Where the climatic N-value is greater than 10, secondary minerals do not develop to an appreciable extent and all weathering takes place by mechanical disintegration of the rock.

Weinert’s climatic N-value for the study area is less than 5. This implies that rocks are extensively weathered, often to depths of several metres, and decomposition is pronounced.

4.4. Land Use

The area of interest for geotechnical investigation is a vacant land in which some portion of the land is being utilized as an illegal waste disposal site. The site is suited adjacent to the township of Ventersdrop with a well-established residential area, schools, and medical facilities in less than 10 minutes’ drive.

5. SITE GEOLOGY

Table 1: Geological attributes of the site

Lithology	Formation	Group	Supergroup
Shale (siliciclastic rocks)	Reitgat Formation	Platberg Group	Ventersdorp Supergroup

The Rietgat Formation is composed mainly of greenish-grey amygdaloidal and porphyritic lava, with interbedded shale, tuff, greywacke, conglomerate and impure limestone with algal structures. Extract of regional geological map 2626BC/BD in figure 2 indicates that, the site is located within the lithologies dominated by siliciclastic sedimentary such as shale, surficial deposit including, laminated shale and organic mudstones.

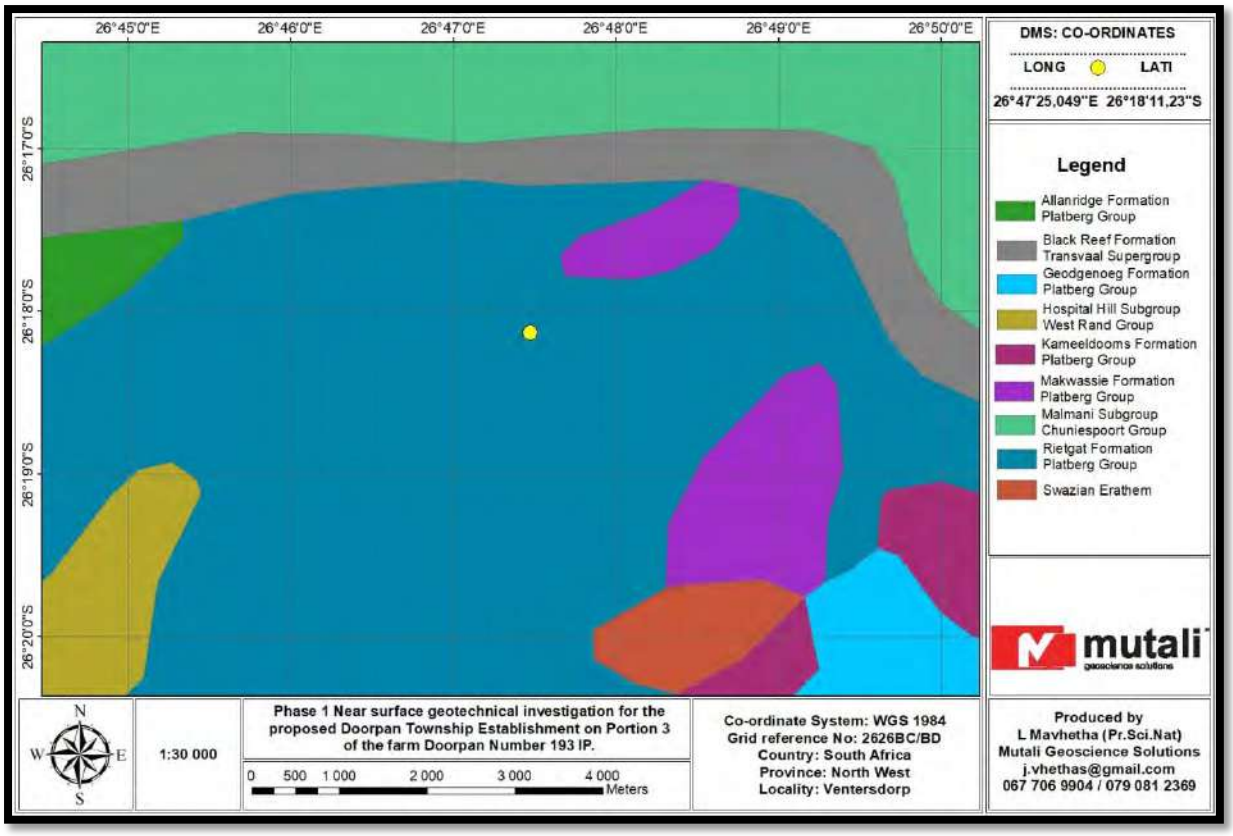

Figure 2: Extract of regional geological map (2626BC/BD) of the proposed site

6. SOIL PROFILES

Strata that were encountered in the test pits during the field investigations are given below. Moreover, the summary of the test pit profiles is shown in Table 2.

Top soils

The topsoil is characterised by an upper stratum of sandy Clay which have an average thickness of 0.4m in the range 0 to 0.9m below ground level. It is characterised by cohesive materials typically described as “Slightly moist, brownish, Loose, intact, ~Sandy clay”

Residual soils / Ferricrete

Residual soil was encountered in all test pits in some case ferricrete were observed with an average thickness of 1.4m in the range 0.7m to 2.3m below ground level. These soils originate from the in-situ weathering of the sedimentary rock shale which is underlined the site. This stratum is typically described as “Slightly moist, light brown, intact, _Medium dense, sub-rounded scattered nodules, Gravelly clay-Ferricrete”.

Shale Bedrock

Shale was found at a range between 0.75m to 2.5m. It must be noted that the flywheel TLB had a difficult time excavating in depth exceeding 0.75m. It must be noted that excavating beyond this depth may require power tools since the bedrock can be classified as hard excavation

Table 2: Summary of the test pit profiles

Test pits	Thickness of the layers			Water Seepage	End of hole	
	Topsoil	Residual / ferricrete soil	Bedrock		Depth (m)	Material
	Sandy Clay	Gravelly clay	Shale			
TP1	0-0.3m	0.3m-0.8m	0.8m-1.37m	None	1.37m	Gravelly Clay
TP2	0-0.28m	0.28m-0.9m	0.9m-1m	None	1m	Gravelly Clay
TP3	0-0.20m	0.2m-2.3m	2.3m-2.5m	None	2.5m	Sandy Silt
TP4	0-0.4m	0.4m-1.6m	1.6m-1.8m	None	1.8m	Gravelly Clay/Ferricrete
TP5	0-0.5m	0.5m-1.3m	1.3m-1.5m	None	1.5m	Gravelly Clay/Ferricrete
TP6	0-0.4m	0.4m-0.7m	0.7m-1.4m	None	1.4m	Gravelly sandy clay
TP7	0-0.33m	0.33m-0.83m	0.83m-1m	None	1m	Gravelly Clay
TP8	0-0.28m	0.28m-0.7m	0.7m-0.9m	None	0.9m	Gravelly Clay
TP9	0-0.26m	0.26m-0.77m	0.77m-0.8m	None	0.8m	Gravelly Sandy clay
TP10	0-0.32m	0.32m-0.68m	0.68m-0.75m	None	0.75m	Gravelly Clay Ferricrete
TP11	0-0.48m	0.48m-1.8m	1.8m-2.0m	None	2.0m	Gravelly Clay Ferricrete
TP12	0-0.40m	0.40m-1.2m	1.2m-1.4m	None	1.4m	Gravelly Clay
TP13	0-0.5m	0.5m-1.5m	1.5m-1.6m	None	1.6m	Gravelly Clay
TP14	0-0.48m	0.48m-1.5m	1.5m-1.7m	None	1.7m	Gravelly Clay
TP15	0-0.53m	0.53m-1.6m	1.6m-1.8m	None	1.8m	Gravelly Clay
TP16	0-0.4m	0.4m-1.5m	1.5m-1.6m	None	1.6m	Ferricrete

TP17	0-0.54m	0.54m-1.64m	1.64m-1.7m	None	1.7m	Gravelly Clay Ferricrete
TP18	0-0.4m	0.4m-1.2m	1.2m-1.35m	None	1.35m	Gravelly Clay
TP19	0-0.3m	0.3m-0.8m	0.8m-0.9m	None	0.9m	Sandy Clay
TP20	0-0.37m	0.37m-1m	1m-1.2m	None	1.2m	Gravelly Clay
TP21	0-0.4m	0.4m-1m	1m-1.1m	None	1.1m	Gravelly Clay
TP22	0-0.4m	0.4m-1.7m	1.7m-2.0m	None	2.0m	Gravelly Clay Ferricrete
TP23	0-0.3m	0.3m-1.2m	1.2m-2.2m	None	2.2m	Sandy Clay
TP24	0-0.5m	0.5m-1.9m	1.9m-2.0m	None	2.0m	Gravelly Clay
TP25	0-0.9m	0.9m-2.0m	2.0m-2.2m	None	2.2m	Gravelly Clay Ferricrete
TP26	0-0.6m	0.6m-1.7m	1.7m-2.0m	None	2.0m	Gravelly Clay
TP27	0-0.5m	0.5m-1.6m	1.6m-1.9m	None	1.9m	Gravelly Clay
TP28	0-0.3m	0.3m-1.1m	1.1m-1.3m	None	1.3m	Sandy gravelly clay
TP29	0-0.4m	0.4m-1.3m	1.3m-1.5m	None	1.5m	Gravelly sandy clay
TP30	0-0.36m	0.36m-0.9m	0.9m-1m	None	1m	Gravelly Clay Ferricrete

7. METHOD OF INVESTIGATION

The fieldwork was undertaken on the 08 May 2021 and comprised of the following:

- Desktop study
- Walk over survey and Pit excavations
- Test Pits profiling
- Soil Sampling

7.1. Desktop Study

The desk study comprises the review of existing regional, site and surface information. Sources of information include:

- Topographic maps, geological data such as lithology of nearby rock outcrops, landforms and erosion patterns;
- Existing geotechnical reports prepared for areas in close proximity to the site;
- Data on seismic aspects, such as ground motion and liquefaction potential.

7.2. Field Mapping

A walk-over survey was carried out on the proposed site to obtain as much information as possible of the subsurface conditions from existing soil. Shale outcrops were identified during the investigation.

7.3. Inspection of the test pits

The field investigation was conducted on the 08 May 2021. Based on the “Site Investigation Code of Practice” (SAICE Geotechnical Division, 2010), which provides standards for “acceptable engineering practice”, a total of 30 (Thirty) test pits were planned for the proposed development.

This chapter of the report describes the field work and activities that were conducted in order to assess the geotechnical conditions at the proposed site. Test pits were positioned using a hand held GPS and the position of the test pits is shown on figure 3. The method of investigation was based on a near surface investigation, to a maximum depth of 3 m below existing ground level using fly wheel TLB (Tractor-Loader-Backhoe) in order to obtain information on the subsurface soil; each pit was marked, photographed and profiled by a field engineering geologist in accordance with the current standard procedures proposed by Brink and Bruin (2002). The test pit photographs are presented in Appendix A of this report.

These included the following components:

- Excavation of 30 (Thirty) test pits with an aid of a fly wheel TLB (Tractor-Loader-Backhoe)
- Representative samples were retrieved from the test pits for laboratory testing at SANAS accredited laboratory.

Test pits were positioned using a hand held GPS, below is layout indicating the position of test pits on site.

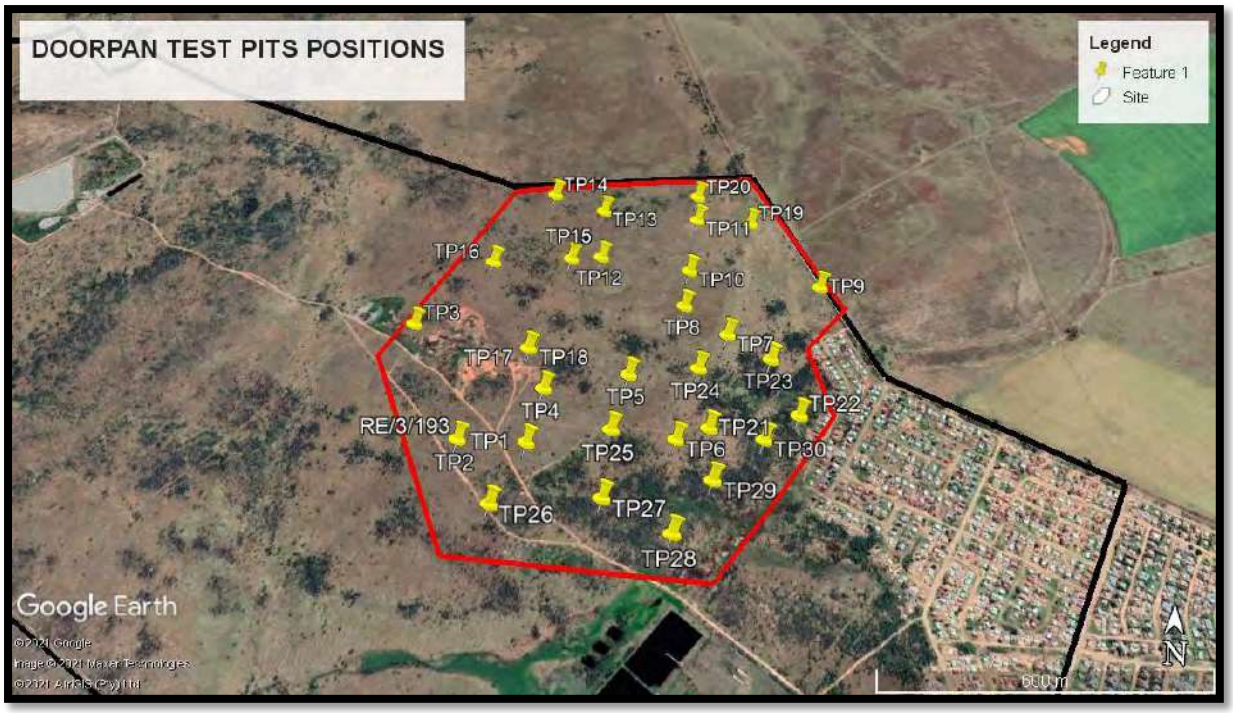

Figure 3: Test pit positions

8. LABORATORY RESULTS

The field work indicated a general homogeneity of the subsurface soils comprising of "Slightly moist, light brown, intact, _Medium dense, sub-rounded scattered nodules, Gravelly clay-Ferricrete". Representative disturbed subsoil samples retrieved from the inspection pits during the investigation were taken to a SANAS accredited commercial laboratory (RoadLab Germiston) to test Foundation Indicators, CBR, MOD, pH and conductivity in order to determine basic geotechnical engineering characteristics such particles distribution size, soil consistency, alkalinity and acidity, bearing capacity, etc. The samples tested aid in assessing the behavior of soils due to moisture changes particularly below foundations.

Standard foundation indicator tests were conducted on disturbed soil samples in order to determine its composition, to evaluate the heave and compressibility potential of these soils, and to calculate the maximum heave and/or differential settlement that can be expected. The following tests were conducted:

- 20 Atterberg Limits (plastic limit, liquid limit and plasticity index);
- 20 Grading analysis and;
- 4 MOD and 4 CBR
- 3 pH and 3 Conductivity

The laboratory tests were conducted in order to assist with the classification, description, and delineation of homogenous zones. The results of the foundation indicator, Mod, CBR,

Ph and Conductivity are presented in Appendix B and are summarized in Table 6. The samples were taken from the test pit position shown in figure 3.

Topsoil Material – Topsoil layer was observed in all of the trial pits. The material didn't show road bearing capacity. There was no sample taken from this layer. The topsoil is characterised by an upper stratum of sandy Clay which have an average thickness of 0.4m in the range 0 to 0.9m below ground level. It is characterised by cohesive materials typically described as "Slightly moist, brownish, Loose, intact, ~Sandy clay"

Residual soils – Twenty bulk samples were collected from the residual soil encountered in all test pits in some case ferricrete were observed with an average thickness of 1.4m in the range 0.7m to 2.3m below ground level. These soils originate from the in-situ weathering of the sedimentary rock shale which is underlined the site. This stratum is typically described as "Slightly moist, light brown, intact, _Medium dense, sub-rounded scattered nodules, Gravelly clay-Ferricrete".

Homogeneity of material underlying the site was observed hence a choice of twenty bulk representative samples. The samples were found to be non-plastic. The PI along with the clay content indicated that the samples exhibit low potential expansiveness. The samples indicated a grading modulus of 0.69 to 2.34. Based on the grading modulus, Atterberg limits and grading analysis, the materials were classified as A-2-6(0) according to U.S. Highway Classification and G8 according to COLTO classifications

PH and Conductivity – pH measurements conducted indicated that the pH of the area is 6.37 for TP06 at a depth of 0.4-1.4m, 5.71 for TP15 at a depth of 0.53-1.6m, and 5.71 for TP18 at a depth of 0.4-1.2. This pH of the site indicates more of acidic to neutral. Conductivity measurements indicated that the conductivity of the area is 24.0 ms/m around the site. The area can be classified as Slightly-corrosive (SC). Measures against corrosive materials (pipelines) installation must be taken into consideration.

Table 3: Summary of the foundation indicators test results

Sample No.	HRB (AASHTO)	Depth (m)	Atterberg Limit			GM	Grading analysis (%)				Potential expansiveness
			LL %	LS %	PI %		Clay	Silt	Sand	Gravel	
TP01	A-2-6(1)	0.3-0.8	33	8.0	16	1.87	15.8	6.9	27.2	50.1	Low
TP02	A-2-4(0)	0.28-0.9	28	4.0	8	1.73	11.4	13.7	28.0	46.9	Low
TP04	A-2-4(0)	0.4-1.6	20	5.0	10	1.64	17.8	11.2	28.4	42.5	Low
TP05	A-2-4(0)	0.5-1.3	22	4.0	8	1.94	13.2	7.9	26.1	52.8	Low
TP06	A-2-6(0)	0.4-1.4	29	6.0	12	1.66	14.5	13.1	30.6	41.8	Low
TP07	A-2-4(0)	0.38-0.83	19	4.0	8	1.73	14.0	12.0	26.8	47.2	Low
TP08	A-1-a(0)	0.28-0.7	18	2.0	4	2.34	3.9	4.5	24.9	66.7	Low
TP09	A-2-4(0)	0.26-0.77	19	4.0	8	2.2	7.3	6.5	25.1	61.1	Low
TP10	A-2-4(0)	0.32-0.68	23	4.0	8	2.23	4.7	7.2	26.7	61.4	Low

TP11	A-2-6(0)	0.48-1.8	30	7.0	14	2.12	12.8	6.6	16.7	64.0	Low
TP12	A-2-6(0)	0.4-1.2	31	7.0	15	1.98	15.0	6.9	22.3	55.6	Low
TP13	A-2-6(0)	0.5-1.5	29	7.0	14	1.75	13.9	11.0	32.1	43.0	Low
TP14	A-2-6(0)	0.48-1.5	22	6.0	12	1.81	14.9	10.6	23.5	51.0	Low
TP15	A-2-6(0)	0.53-1.6	24	6.0	12	1.92	15.9	7.7	22.6	53.9	Low
TP16	A-2-6(0)	0.4-1.5	26	6.0	12	1.80	16.0	9.6	24.4	50.0	Low
TP17	A-2-6(1)	0.54-1.64	28	8.0	15	1.53	23.9	9.3	27.9	38.9	Low
TP18	A-4(3)	0.4-1.2	24	5.0	10	0.69	34.9	17.1	37.9	10.1	Low
TP19	A-2-6(0)	0.3-0.8	22	6.0	12	1.81	16.3	9.3	24.3	50.1	Low
TP20	A-2-4(0)	0.37-1.0	23	5.0	10	1.72	13.6	11.5	29.9	45.0	Low
TP21	A-2-7(1)	0.4-1.0	43	14.0	28	1.99	13.2	6.7	24.9	55.2	Low

LL: Liquid Limit **PI**: Plasticity Index **LS:** Linear Shrinkage **GM:** Grading Modulus **NP: Non**-Plastic

Table 4: Summary of the CBR test results

Sample No.	HRB (AASHTO)	Depth (m)	CBR @						GM	Max. Swell (%)	OMC (%)	Max Dry Density (kg/m^3)	COLTO Classification
			90 %	93%	95%	97%	98%	100%					
TP4	A-2-4(0)	0.4-1.6	10	13	18	25	31	37	1.64	0.39	9.5	2011	G8
TP6	A-2-6(0)	0.4-1.4	7	10	15	18	27	32	1.66	0.42	10.1	1965	G8
TP15	A-2-6(0)	0.53-1.6	10	14	17	21	27	36	1.92	0.89	10.4	1960	G8
TP18	A-4(1)	0.4-1.2	4	8	11	16	18	22	0.69	0.32	11.2	1912	G9

GM: Grading Modulus **PI:** Plasticity Index **OMC:** Optimum Moisture Content **CBR: California** Bearing Ratio

9. HYDROGEOLOY

There is a non-perennial stream at the eastern boundary of the site. However, it is not visible on a satellite image due to the colour and density of vegetation on site. The locality map in figure 1 shows the availability of the non-perennial river on the eastern boundary of the site. The site drainage on site takes place by the means of sheet wash and infiltration. It is expected that periodic marshes may occur to the non-perennial stream during heavy rainfalls

Natural ground water seepage was not encountered in any of the test pits and there is no indication of temporary perched water tables in the soil profile, not even at the contact between soil and bedrock. It is therefore expected that if temporary perched water was to at the site, it would occur at bedrock level and only after unusually prolonged and substantial rain. Groundwater seepage is not expected to be problematic at shallow depths on this site.

10. GEOHAZARDS

10.1. Seismic Hazard / Activities

The seismic zones are determined from the seismic hazard map which represents peak ground acceleration with a 10% probabilistic of being exceeded in a 50-year period.

Two types of seismic activities occur in South Africa, namely:

- Regions of natural seismic activity (Zone I), and
- Regions of mining-induced and natural seismic activity (Zone II).

In accordance with the seismic hazard zones contained in SANS 10160-4, the site fall within Zone ll, as shown in Figure 4

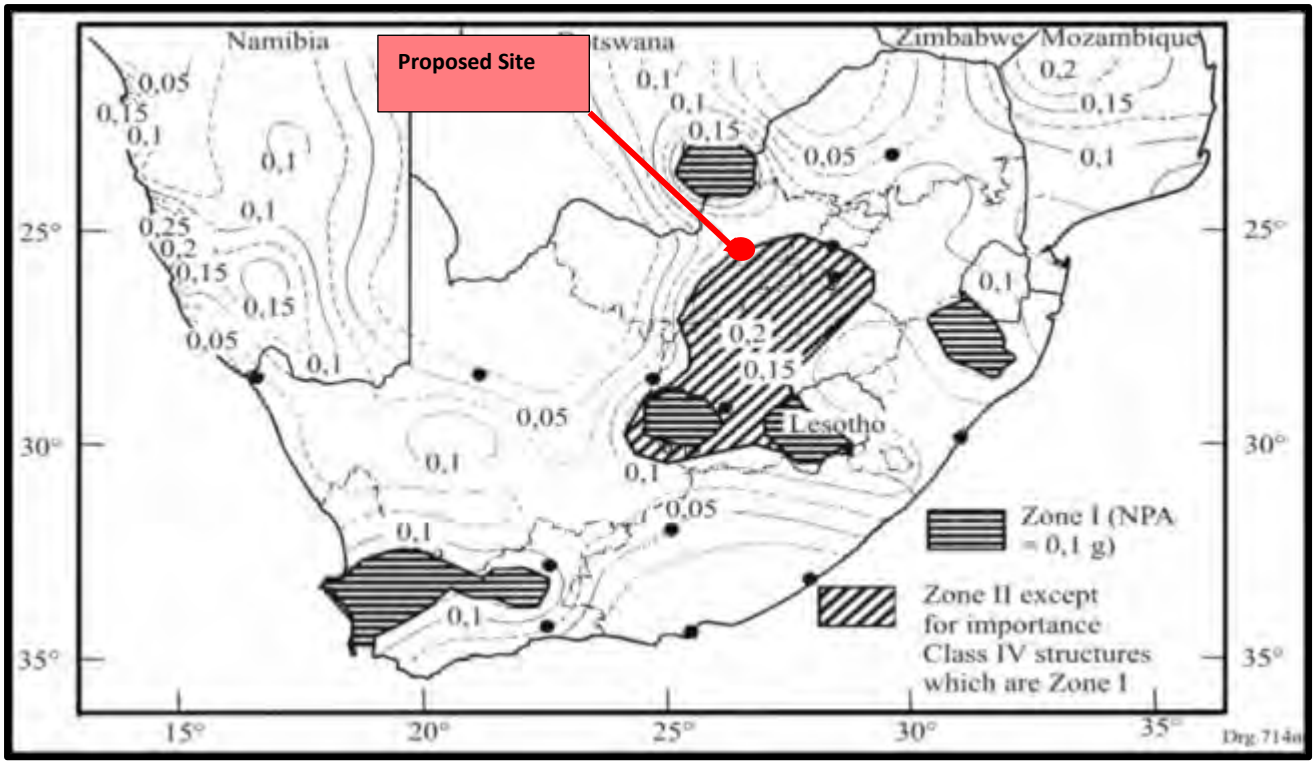

Figure 4: Seismic Hazard Zones of South Africa

Both the seismic hazard zones and the seismic hazard maps of South Africa produced by Kijko (2003), show the site is situated in the area where the peak ground acceleration is great than 10% probability of occurrence in a 50-year period is, approximately 0.16g to 0.24g. The seismic hazard map of South Africa is shown in Figure 5.

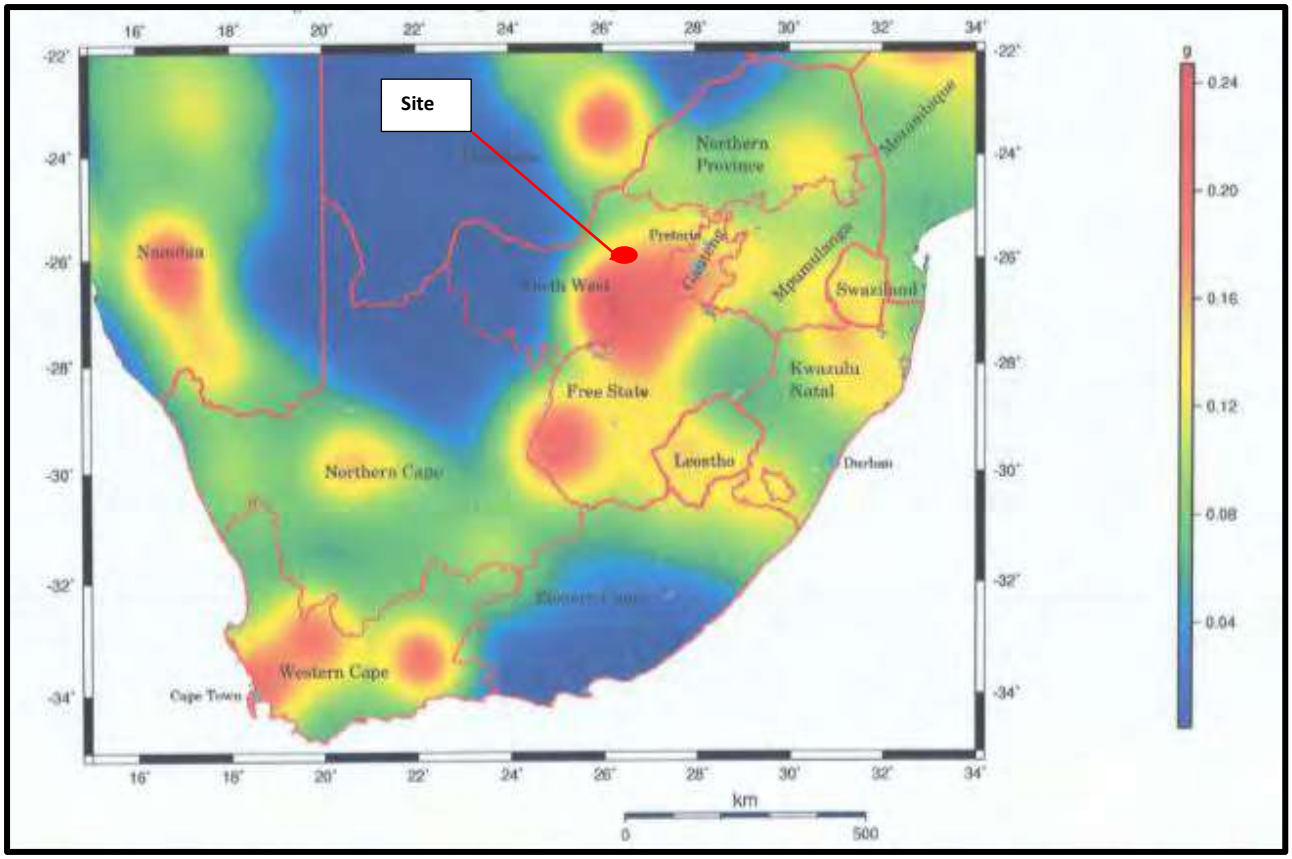

Figure 5: Seismic Hazard Map of South Africa, Kijko et. al. (2003)

10.2. Ground Subsidence

Subsidence occurs in areas with large underground cavities typically resulting from large scale shallow to very shallow underground mining and from dolomite/limestone dissolution. It may also appear where thick deposits of unconsolidated material exist.

No signs of previous subsidence were evident during the site investigation. The site can be classified as a mining active area, however, there are no underground mining directly below the site. Should the new information relating to mining activity or seismic activity later uncovered, the Department of Mineral Resources (DMR) will be consulted.

10.3. Sinkhole Formation

Similar to subsidence, sinkhole formation occurs in areas with very large to extremely large underground cavities resulting from poorly designed shallow underground activities. Dissolution of dolomites or limestone, over millions of years, may lead to cavity formations which later manifest as sinkholes.

The available geological maps and geological mapping from site investigations indicate that the site is not underlain by dolomite or soluble rocks/minerals.

10.4. Landslides and Mudslides

Though the site is underlain by mudrock (shale), the probability of landslides and mudslides occurring within this area are remote. This is primarily due to the low relief and relatively flat gradient that have angle less than that of critical angle of repose.

10.5. Falls and Rockslides

The probability of the occurrence of rock falls and rockslides is low due to the gentle gradient.

10.6. Volcanic Activities

South Africa has seen its last volcanic activity approximately 65 million years ago during the massive historical eruption of the Drakensberg Lava forming the Basaltic Drakensberg Mountain Ranges that we see today. Recent studies showed no signs for the possibility of volcanic eruption in the foreseeable future.

11. GEOTECHNICAL EVALUATION

This report focuses on the geotechnical site investigation and is aimed at determining various geotechnical properties of the near surface soil horizons in accordance with SAICE Code of Practice, SANS guidelines and NHBRC guidelines and the GFSH-2 document. Table 4 gives the basis of the soil site classification that was applied during the investigation and Table 5 gives the geotechnical classification for urban development

Table 5: Residential site class designations

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 COLLAPSIBLE SOILS	<5,0 5,0-10 >10	75% 75% 75%	C C1 C2
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	COMPRESSIBLE SOIL	<10 10-20 >20	50% 50% 50%	S S1 S2
Contaminated soils, Controlled fill, Dolomitic areas, Landslip Land fill, Marshy areas Mine waste fill Mining subsidence Reclaimed areas Very soft silt/silty clays Uncontrolled fill	VARIABLE	VARIABLE		P

Table 6: Geotechnical Classification for Urban Development (GFSH-2 Document)

Geotechnical Sub-Area	Definition
1	Areas recommended or favorable for development
2	Areas where development can be considered with certain precautionary measures.
3	Areas that are not recommended for development

Other related engineering geological characteristics such as collapse settlement, compressibility, slope stability groundwater etc. were evaluated. The geotechnical properties relevant to the development are discussed below.

11.1. Expansive soils

Active/expansive soils are defined as fine grained soils (generally with high clay content) that change in volume in response to the change in moisture content. These soils may increase in volume (heave/swell) upon wetting and decrease in volume (shrink) upon drying out. These soils are classified as (H) according to the SAICE site classes. Depending on the severity of the predicted movement, expansive soils can be classified as H, H1, H2 or H3 (Table 5).

The site is predominately underlain by gravel> sand >with some content of clay. The site is therefore classified with the soil site class **H1** according to the SAICE site classification system.

11.2. Collapsible soils

Collapsible soils are defined as soils that have a potential for collapse and are commonly open textured with a high void ratio (Brink, 1985). These soils are typically silty sands, sands, sandy and gravelly soils commonly found in colluvial and aeolian sands. Soils which exhibit potentially collapsible characteristics are classified with the soil site class 'C' according to the SAICE site classification system (Table 4)

The soils encountered on the site typically comprise of shale fragments and gravelly clay with no visual open-textured structures such as voids and pinholes which indicate collapse potential.

From the site fieldwork observations and laboratory results analysis it can be concluded that the site doesn't exhibit collapsible nature. Therefore, this class is not applicable for this site.

11.3. Compressible soils

Compressible soils are soils in which the bulk volume of the soil may gradually decrease with time when subjected to an applied load. These soils typically comprise fine grained soils such as clay, clayey sand and clayey silt with low plasticity, gravelly and sandy soil. According to the SAICE soil site class these soils are denoted as class 'S' and may very (S, S1, S2) depending on the severity of the bulk volume change (Table 4).

The site does exhibit compressible soil characteristics. The site is predominately underlain by gravel> sand >with some content of clay. The site is therefore classified with the soil site class **S** according to the SAICE site classification system and NHBRC manuals.

11.4. Soil site classification

A review of the test pit data indicates that the site is generally underlain by residual gravelly sand. The development potential has been broadly classified in terms of a Geotechnical Sub-Area based on field observations/investigation (geological, hydrogeological, and geomorphological). From the above discussion the site is classified into main soil area namely expansive and compressible soils:

The foundation design options as per SANS10400 H- soil class is "R/S/H1" in NHBRC Standards and manuals. The recommended Foundation types in accordance with SANS 10400H- Foundation: Modified Normal/ Reinforced Strip foundation/ Raft foundation

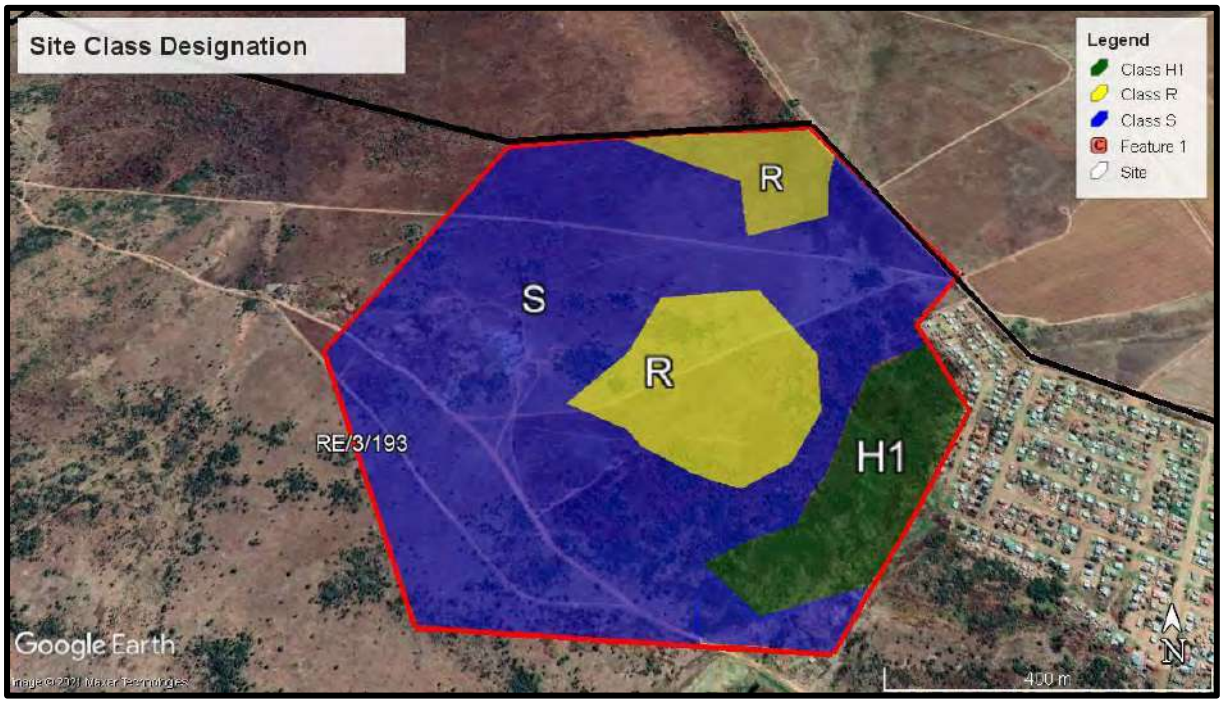

Figure 6: Soil Class Designation

Table 7: Geotechnical zones & NHBRC classification

SITE CLASS	DESCRIPTION	FOUNDATION RECOMMENDATION
R	Shale bedrock	Modified normal strip foundation
S	Residual soils	Reinforced strip foundation
H1	Alluvium soils	Raft foundation

11.5. Excavation Classification

The in-situ soils and highly weathered shale bedrock were excavated to a maximum depth of 2.5m below ground level.

Based on the test pits excavations, it is anticipated that site should classify as “soft to intermediate excavation” throughout, in accordance with SANS 1200 DA classification using similar plant as employed during this investigation. This means it can easily be removed by a tractor loader backhoe (TLB) of flywheel power >0.10 kW per mm of tined bucket width.

11.6. Stability of excavations sidewalls

It was noted during trail pit excavations that the sidewalls retain its initial condition without crumbling. This is a good indication for the behaviour of the materials; excavated ground must retain its stature vertically without unsupported.

For safety reasons, sidewalls of excavations deeper than 1.5 m should be battered back to 1:1 in dry conditions. Should oblique jointing or any seepage be noted, then the sidewalls may need to be battered at a much flatter gradient. This is only acceptable for excavation depths restricted to less than 3.0 m. All safety precautions should be adhered to. Should battering be deemed unpractical due to some site conditions, sidewalls should be supported by suitably designed shoring technique.

11.7. Construction Material suitability

The aim of this geotechnical site investigation report was to determine the different engineering geological properties of the surface and subsurface soils in accordance with the GFSH–2 guidelines of the NHBRC. The intention is to be able to recommend for the

founding levels for the foundation design for the proposed development. The soil was mainly composed of granular soils which are ideal for construction.

12. RECOMMENDATIONS

12.1. Foundations

The following foundation recommendations are based on information gathered on site through field observations; test pitting and laboratory testing. Although this investigation was conducted with all reasonable skill, care and diligence, some degree of variation may be expected between data points and design engineers should take cognizance of this. The design of structures and services remains the responsibility of the design engineers. Site specific investigations must be conducted for structures greater than the intended purpose.

It is important to note that foundation recommendations are based on fieldwork and laboratory test results interpretation. Based on site conditions and evaluation described in this report the following foundation types are recommended. **Modified normal/ *reinforced strip foundation/ Raft foundation***

The foundation recommendations include the following:

12.1.1. Reinforced strip foundation/Modified normal

The recommended foundation type is a ***reinforced strip foundation founded on a G8 engineered soil mattress***. The in-situ material can be utilised for founding material as there are of G8 material on site. Reinforcement should be designed by a competent person. The following construction procedures apply.

- All topsoil to be stripped to spoil;
- Foundation trenches for 600mm wide strip footing to be over-excavated to 1.0m wide by 1.6m deep below existing ground level;
- Excavation to be backfill with G8 quality material to a depth of 0.6m existing ground level;
- G8 material to be compacted in 150mm thick layers to 93% Mod AASHTO density at –1% to +2% OMC;
- Strip footings 500mm wide and adequately reinforced should be constructed at a depth of 0.6m;
- The allowable bearing capacity should be limited to 150kPa on the engineered soil mattress;
- Articulation joints at some internal doors and all external doors;

- Light reinforcement in masonry

12.1.2. Raft Foundation

Excavate the in-situ material down to 0.9 m – To spoil and stockpile [Excavated sand may be mixed with coarse materials (sand/concrete) and utilized for construction and foundation lining

- Bottom of excavation to be approved by a Geotechnical Engineer
- Import more competent material (G5/G7) and compact into layers of not more than 750 mm thickness,
- The foundation bed is then compacted by ramming
- Lay reinforcement on spacers over the foundation bed
- The foundation may stiffen by ribs or beams built in during construction which will add extra strength and rigidity

13. REFERENCE

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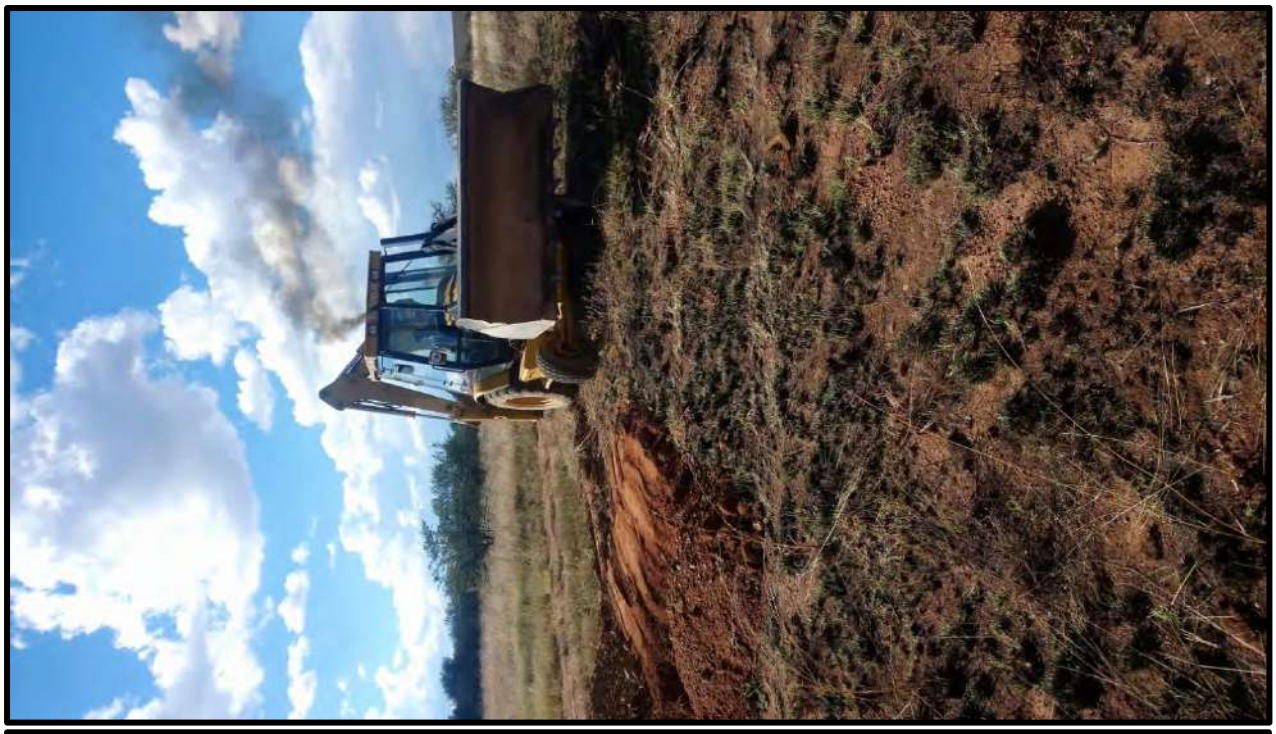
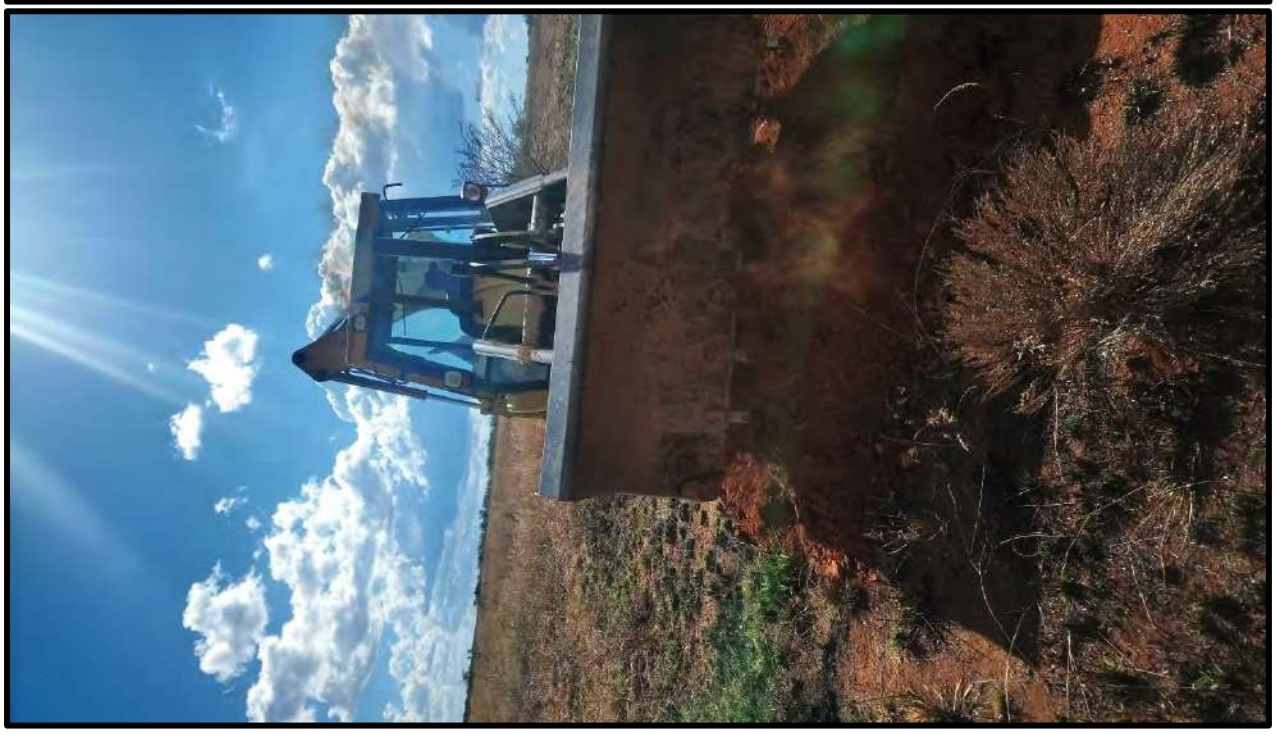
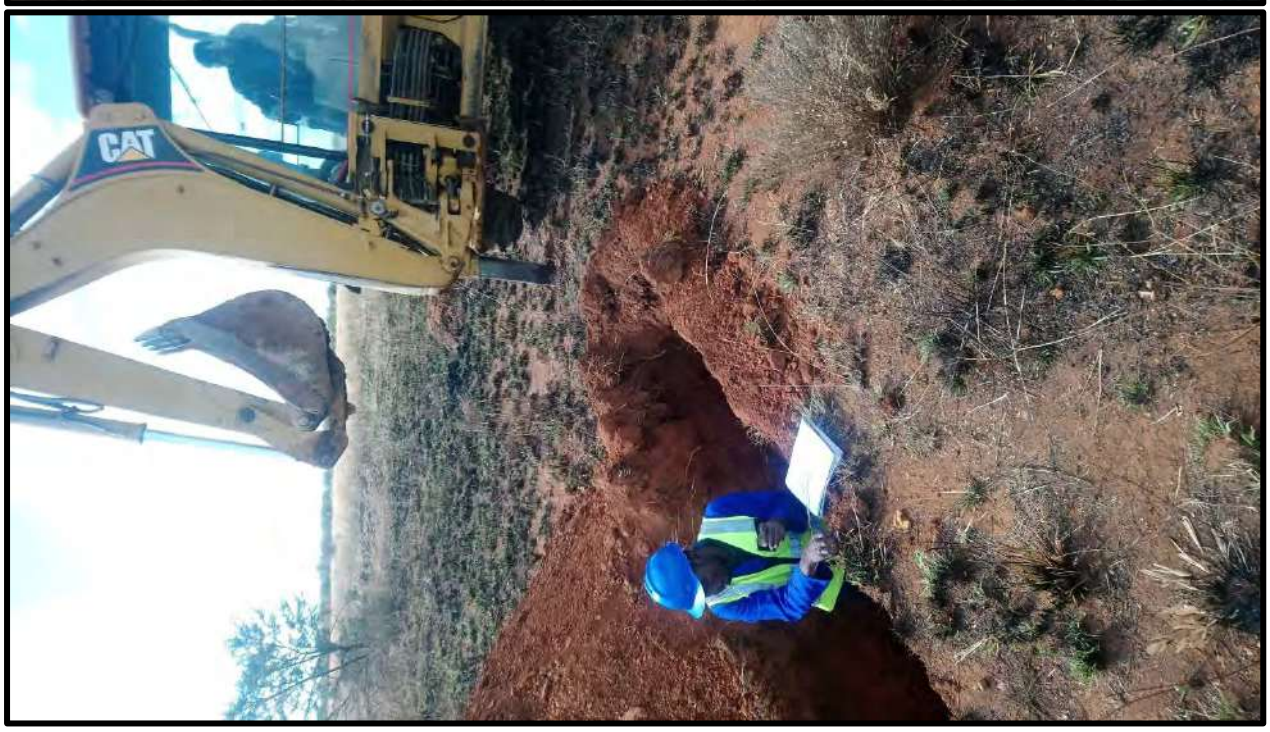
- SA Explorer weather services
- South African Institution of Civil Engineering (SAICE) – Geotechnical Division. Site investigation code of practice. 1st Ed, 2009.
- The South African Bureau of Standard, Standardised Specification of Civil Engineering Construction, SABS 1200 D_1988
- Van der westhuizen, W.A., de Bruiyn, H. and Meintjies, P.G. (2006). The ventersdorp Supergroup in The Geology of South Africa, Published jointly by the Geological Society of South Africa and The council for Geoscience in 2006 Pretoria, 691pp.

14. APPENDIX A: SITE PHOTOS



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15. APPENDIX B: LABORATORY RESULTS

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Germiston, JHB, 1400

Ref- 92/NKA001-05/0001/21 Date - 2021/06/09

Nkanivo Development Consultants

P.O 11948

Silver Lakes

Pretoria

Attention: Mr. L Mavhetha

Re: Doornpan Township Establishment – Foundation Indicator Test Results

Herewith please find attached the test results for the above-mentioned project as tested by Roadlab Laboratories.

Thank you

Kind Regards

Mr N Herbst / Mr R Potgieter

Technical Signatory / Manager

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP1
LAYER : 0.3-0.8m
SAMPLE No. : S/8630
SAMPLE DESCRIPTION : Dark Red Orange Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**6.3**	**Specifc Gravity**	**2.68**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	94
28.0	92
20.0	85
14.0	81
5.00	61
2.000	50
0.425	39
0.250	32
0.150	26
0.075	24
50 µm	22
5 µm	19
2 µm	15.8

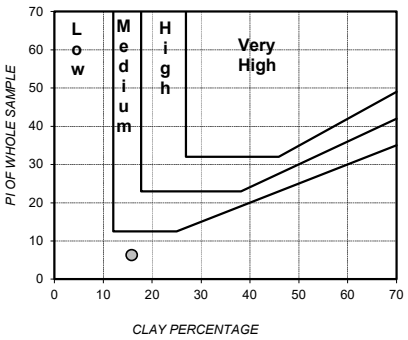
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	21
0.425 - 0.250	16
0.250 - 0.150	11
0.150 - 0.075	12
< 0.075	40

Effective size	0.002
Uniformity Coefficient	2387.8
Curvature Coefficient	5.0
Oversize Index	5.6
Shrinkage Product	315.8
Grading Coefficient	25.6
Grading modulus	1.87

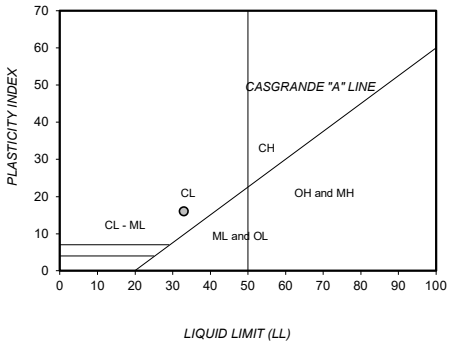
Atter-berg Limits	
Liquid Limit	33
Plasticity Index	16
Linear Shrinkage	8.0
PI < 0.075	20

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (1)

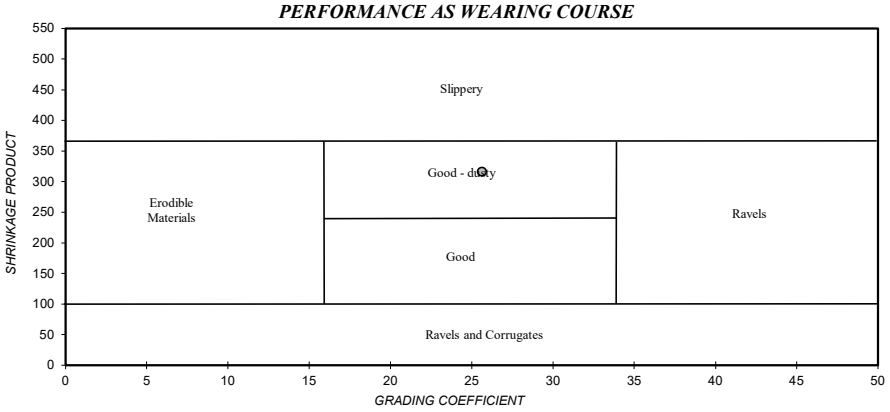
POTENTIAL EXPANSIVENES



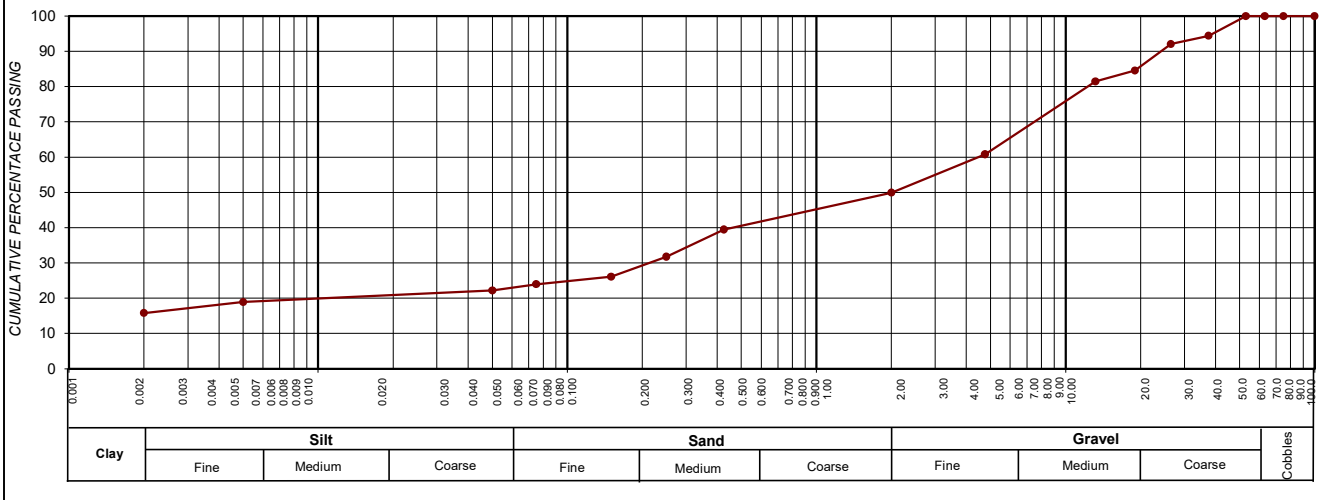
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
15.8	6.9	27.2	50.1

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP2
LAYER : 0.28-0.9m
SAMPLE No. : S/8631
SAMPLE DESCRIPTION : Dark Red Brown Clayey Silty Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**3.7**	**Specifc Gravity**	**2.67**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	98
28.0	94
20.0	91
14.0	87
5.00	61
2.000	53
0.425	46
0.250	39
0.150	33
0.075	28
50 µm	24
5 µm	16
2 µm	11.4

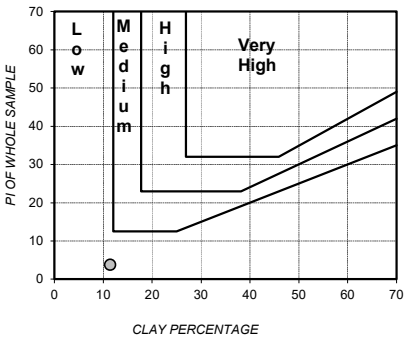
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	13
0.425 - 0.250	13
0.250 - 0.150	12
0.150 - 0.075	20
< 0.075	42

Effective size	0.002
Uniformity Coefficient	2301.9
Curvature Coefficient	1.2
Oversize Index	1.5
Shrinkage Product	185.2
Grading Coefficient	25.0
Grading modulus	1.73

Atter-berg Limits	
Liquid Limit	28
Plasticity Index	8
Linear Shrinkage	4.0
PI < 0.075	15

Unified Soil Classification	SC
U.S. Highway Classification	A-2-4 (0)

POTENTIAL EXPANSIVENES



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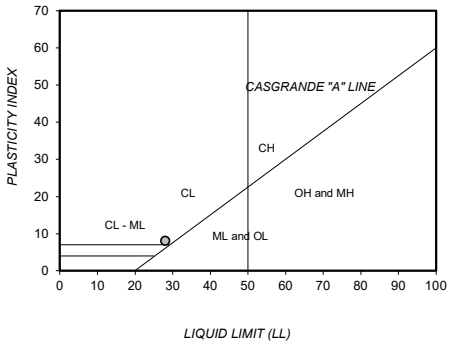
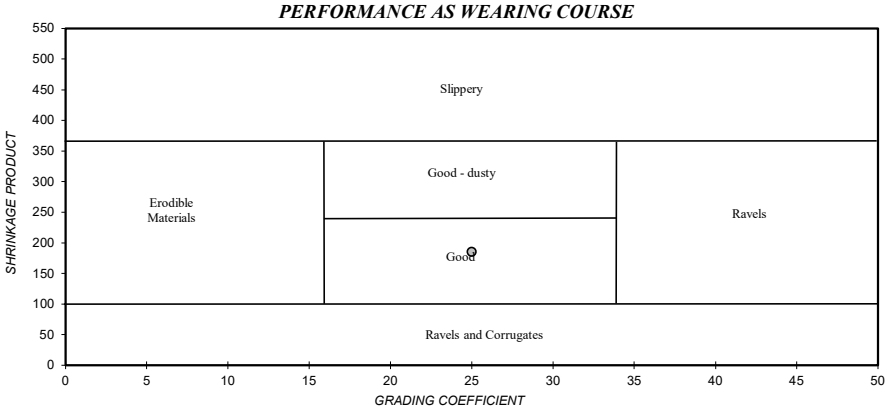
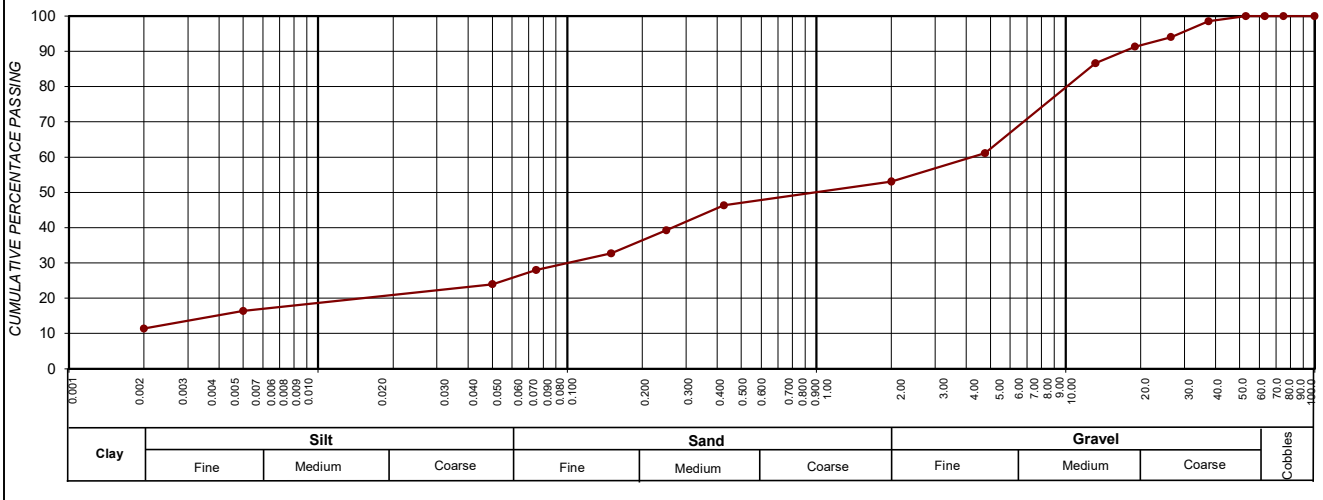


PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
11.4	13.7	28.0	46.9

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP4
LAYER : 0.4-1.6m
SAMPLE No. : S/8632
SAMPLE DESCRIPTION : Light Red Brown Silty Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**4.7**	**Specifc Gravity**	**2.67**

Sieve analysis Cumulative percentage passing (mm)

100.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
14.0	99
5.00	81
2.000	57
0.425	47
0.250	45
0.150	42
0.075	31
50 µm	27
5 µm	23
2 µm	17.8

Soil Mortar Analysis % < 2.00mm

2.000 - 0.425	17
0.425 - 0.250	4
0.250 - 0.150	6
0.150 - 0.075	18
< 0.075	54

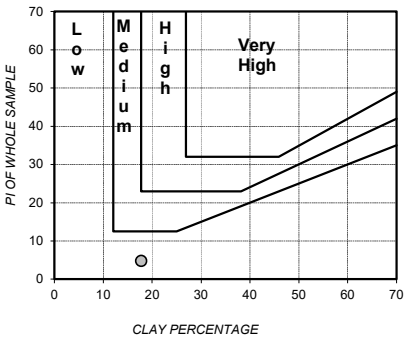
Effective size	0.002
Uniformity Coefficient	1161.9
Curvature Coefficient	1.0
Oversize Index	0.0
Shrinkage Product	237.1
Grading Coefficient	34.5
Grading modulus	1.64

Atter-berg Limits

Liquid Limit	20
Plasticity Index	10
Linear Shrinkage	5.0
PI < 0.075	14

Unified Soil Classification	SC
U.S. Highway Classification	A-2-4 (0)

POTENTIAL EXPANSIVENES



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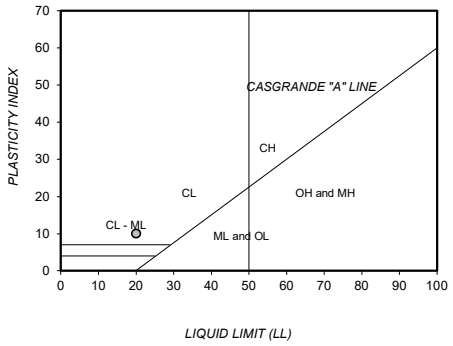

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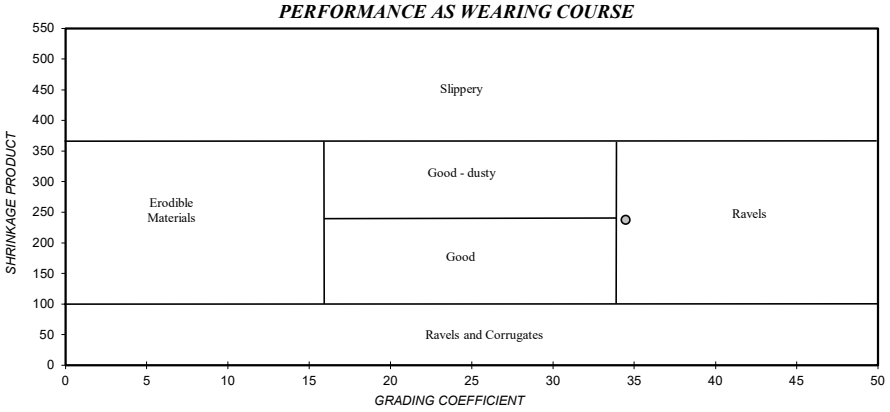

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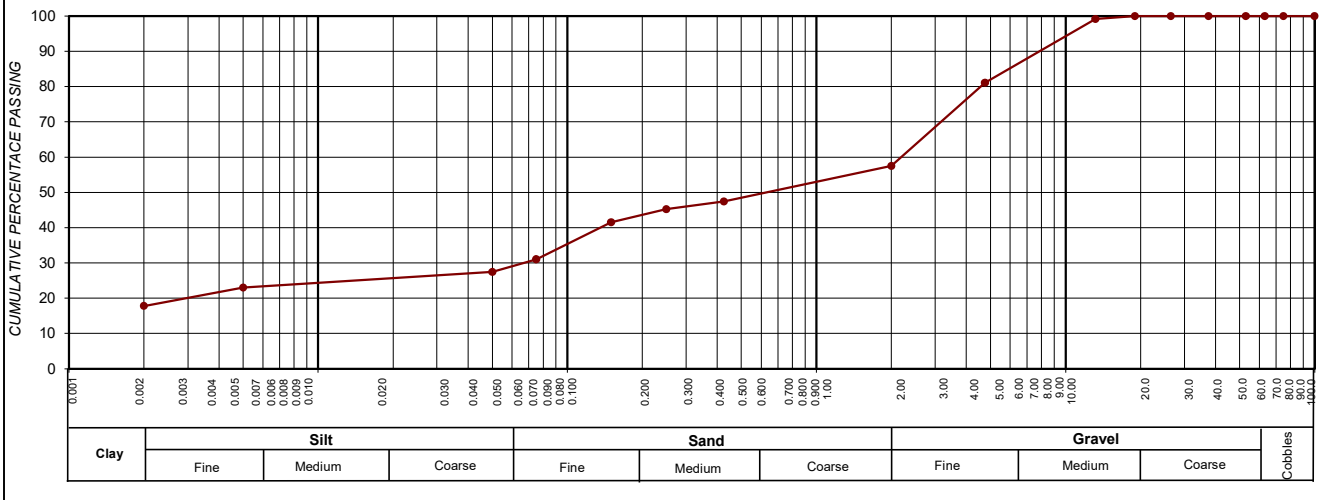

SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
17.8	11.2	28.4	42.5

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP5
LAYER : 0.5-1.3m
SAMPLE No. : S/8633
SAMPLE DESCRIPTION : Light Yellow Orange Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**3.0**	**Specifc Gravity**	**2.73**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	96
20.0	89
14.0	84
5.00	59
2.000	47
0.425	37
0.250	33
0.150	29
0.075	22
50 µm	20
5 µm	16
2 µm	13.2

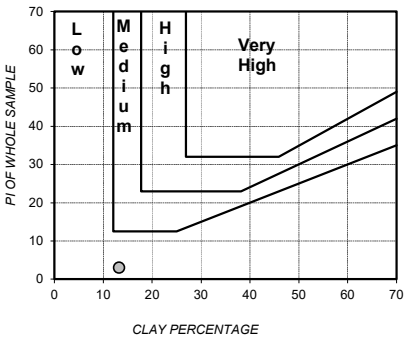
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	21
0.425 - 0.250	8
0.250 - 0.150	9
0.150 - 0.075	15
< 0.075	47

Effective size	0.002
Uniformity Coefficient	2702.4
Curvature Coefficient	2.6
Oversize Index	0.5
Shrinkage Product	148.6
Grading Coefficient	28.5
Grading modulus	1.94

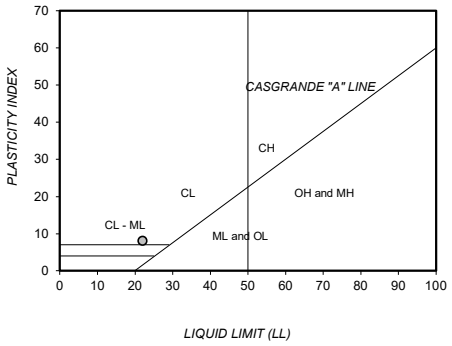
Atter-berg Limits	
Liquid Limit	22
Plasticity Index	8
Linear Shrinkage	4.0
PI < 0.075	16

Unified Soil Classification	SC
U.S. Highway Classification	A-2-4 (0)

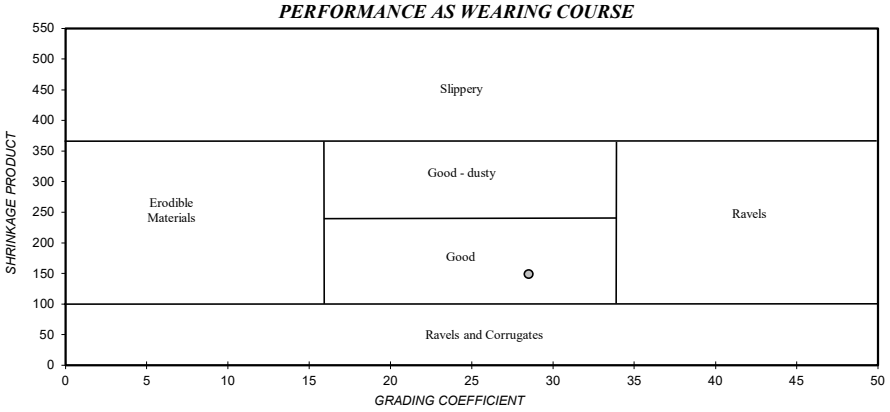
POTENTIAL EXPANSIVENES



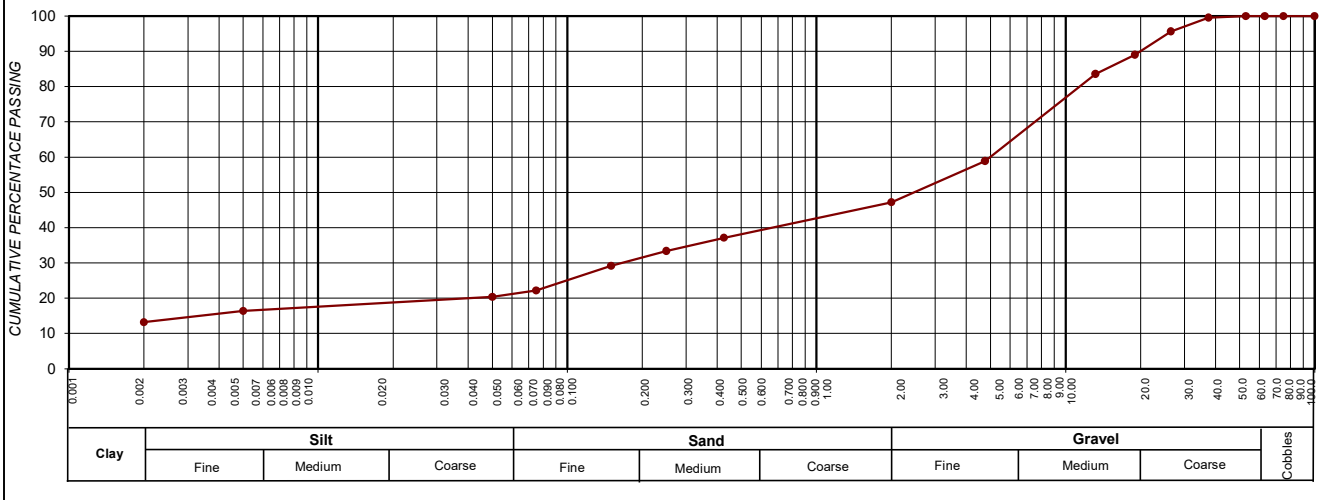
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
13.2	7.9	26.1	52.8

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP6
LAYER : 0.4-1.4m
SAMPLE No. : S/8634
SAMPLE DESCRIPTION : Dark Yellow Silty Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**5.6**	**Specifc Gravity**	**2.67**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	98
37.5	98
28.0	96
20.0	94
14.0	89
5.00	68
2.000	58
0.425	47
0.250	43
0.150	38
0.075	29
50 µm	27
5 µm	21
2 µm	14.5

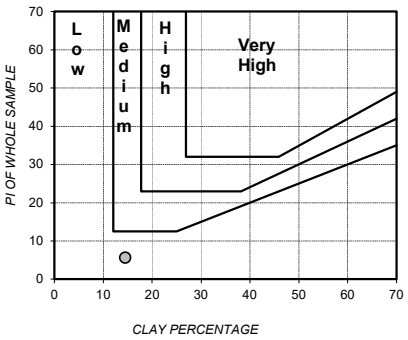
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	20
0.425 - 0.250	6
0.250 - 0.150	9
0.150 - 0.075	16
< 0.075	49

Effective size	0.002
Uniformity Coefficient	1266.4
Curvature Coefficient	1.5
Oversize Index	2.0
Shrinkage Product	279.8
Grading Coefficient	25.8
Grading modulus	1.66

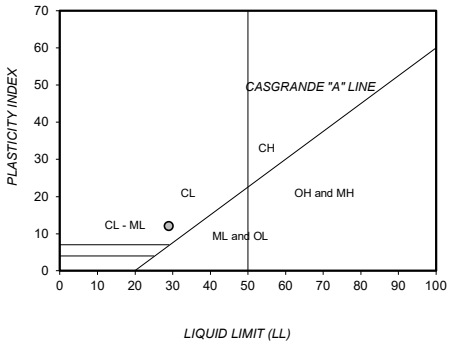
Atter-berg Limits	
Liquid Limit	29
Plasticity Index	12
Linear Shrinkage	6.0
PI < 0.075	15

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (0)

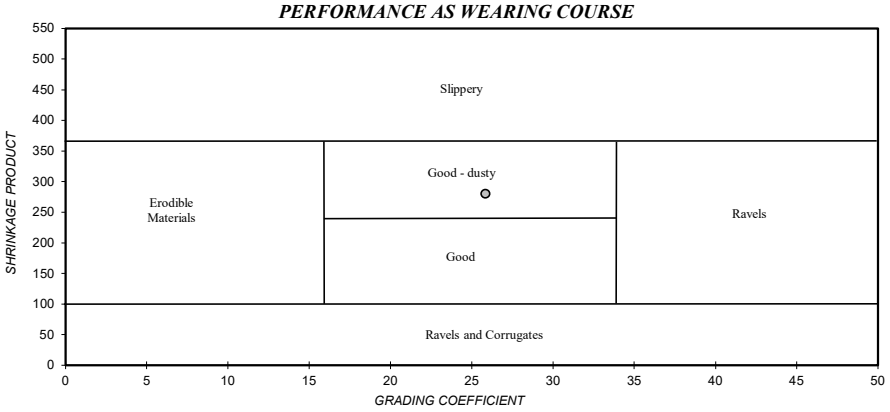
POTENTIAL EXPANSIVENES



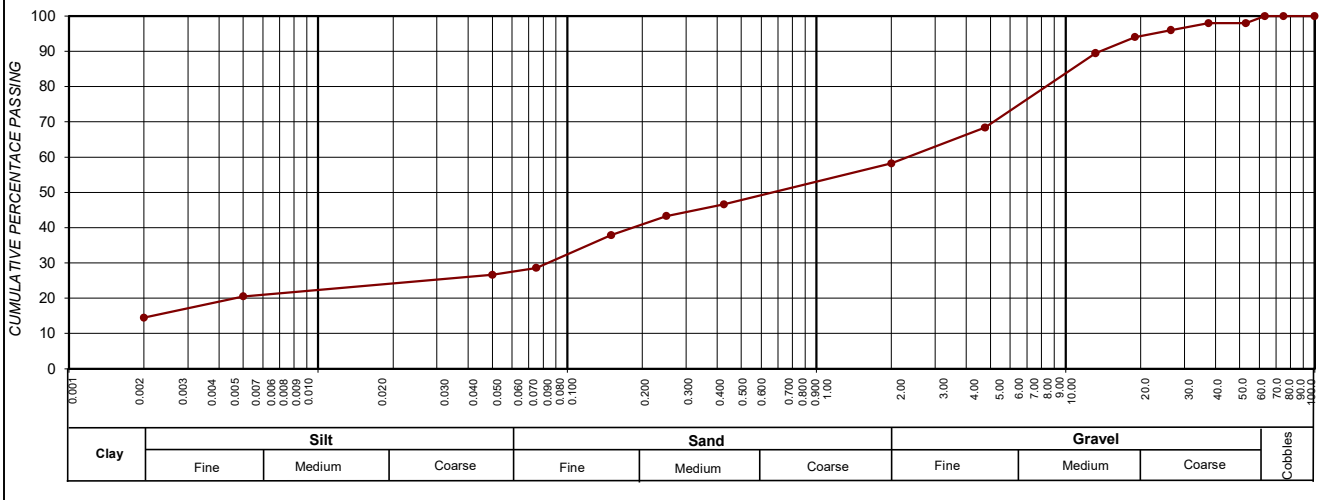
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
14.5	13.1	30.6	41.8

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP7
LAYER : 0.38-0.83m
SAMPLE No. : S/8635
SAMPLE DESCRIPTION : Light Yellow
Silty Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**3.7**	**Specifc Gravity**	**2.69**

Sieve analysis Cumulative percentage passing (mm)

100.0	100
75.0	100
63.0	100
50.0	96
37.5	92
28.0	84
20.0	83
14.0	78
5.00	59
2.000	53
0.425	46
0.250	42
0.150	34
0.075	28
50 µm	26
5 µm	19
2 µm	14.0

Soil Mortar Analysis % < 2.00mm

2.000 - 0.425	13
0.425 - 0.250	8
0.250 - 0.150	15
0.150 - 0.075	12
< 0.075	53

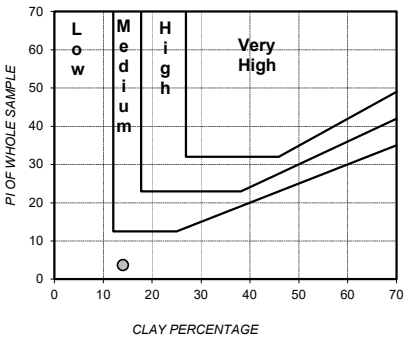
Effective size	0.002
Uniformity Coefficient	2698.2
Curvature Coefficient	1.0
Oversize Index	7.8
Shrinkage Product	183.7
Grading Coefficient	18.5
Grading modulus	1.73

Atter-berg Limits

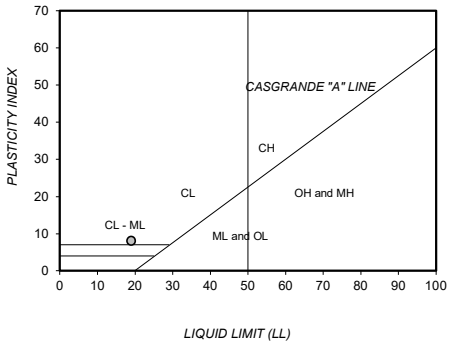
Liquid Limit	19
Plasticity Index	8
Linear Shrinkage	4.0
PI < 0.075	10

Unified Soil Classification	SC
U.S. Highway Classification	A-2-4 (0)

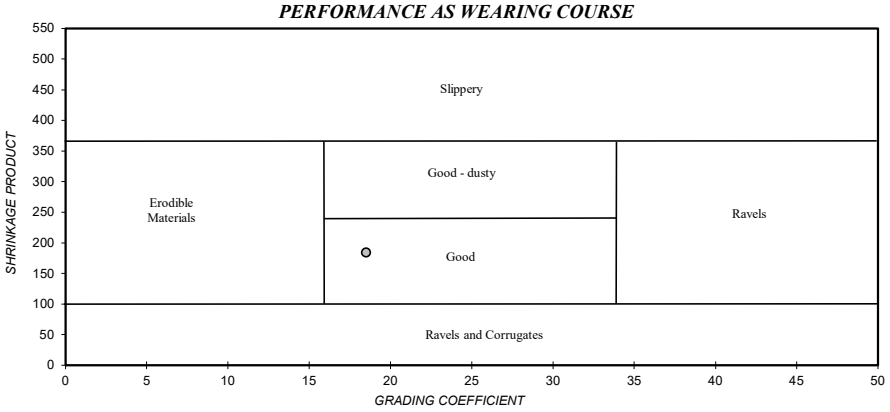
POTENTIAL EXPANSIVENES



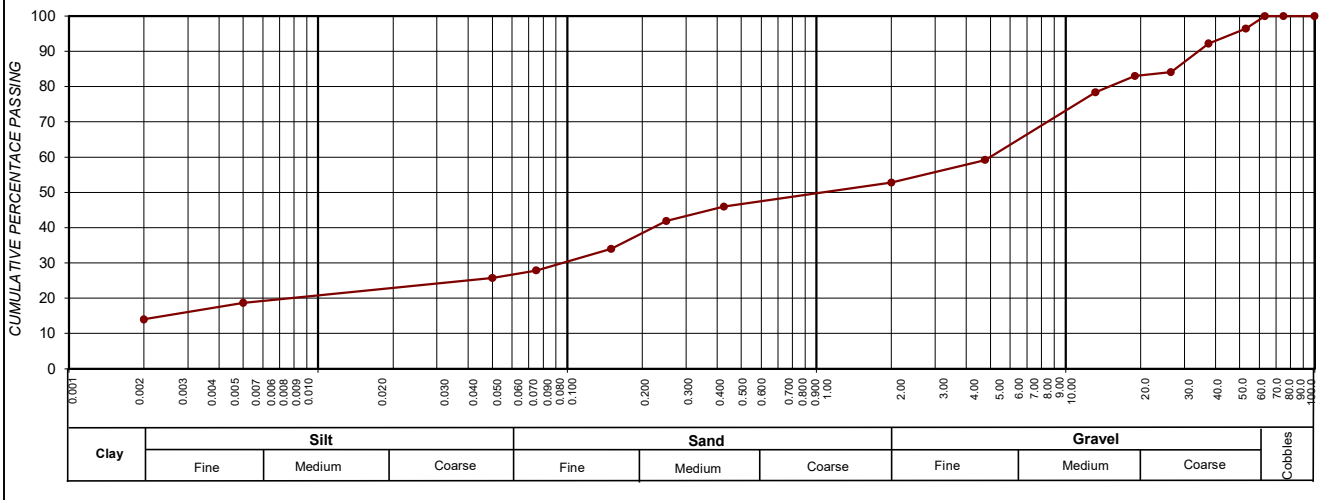
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
14.0	12.0	26.8	47.2

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP8
LAYER : 0.28-0.7m
SAMPLE No. : S/8636
SAMPLE DESCRIPTION : Dark Brown Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	1.0	Specifc Gravity	2.75

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	95
28.0	92
20.0	86
14.0	80
5.00	45
2.000	33
0.425	25
0.250	20
0.150	15
0.075	8
50 µm	8
5 µm	6
2 µm	3.9

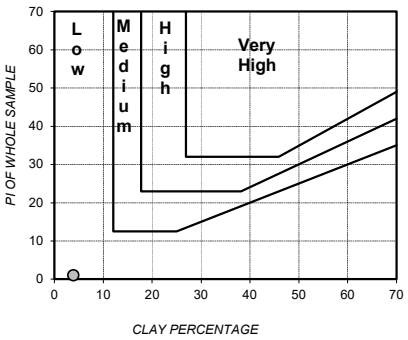
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	25
0.425 - 0.250	15
0.250 - 0.150	15
0.150 - 0.075	22
< 0.075	24

Effective size	0.096
Uniformity Coefficient	92.1
Curvature Coefficient	2.3
Oversize Index	5.5
Shrinkage Product	49.8
Grading Coefficient	26.3
Grading modulus	2.34

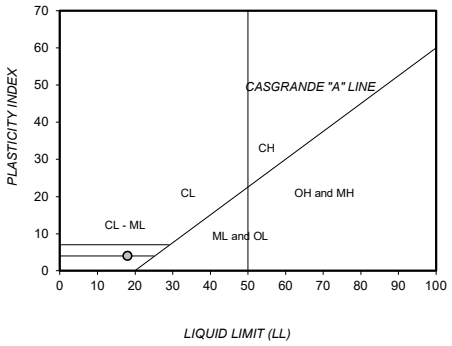
Atter-berg Limits	
Liquid Limit	18
Plasticity Index	4
Linear Shrinkage	2.0
PI < 0.075	8

Unified Soil Classification	GM & GC
U.S. Highway Classification	A-1-a (0)

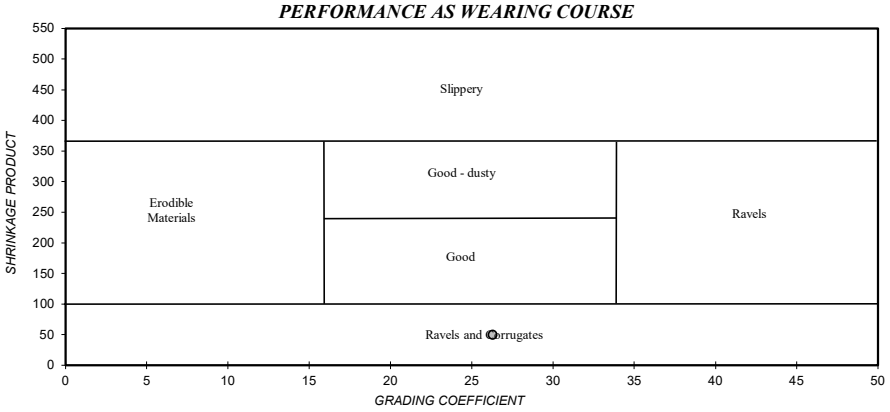
POTENTIAL EXPANSIVENES



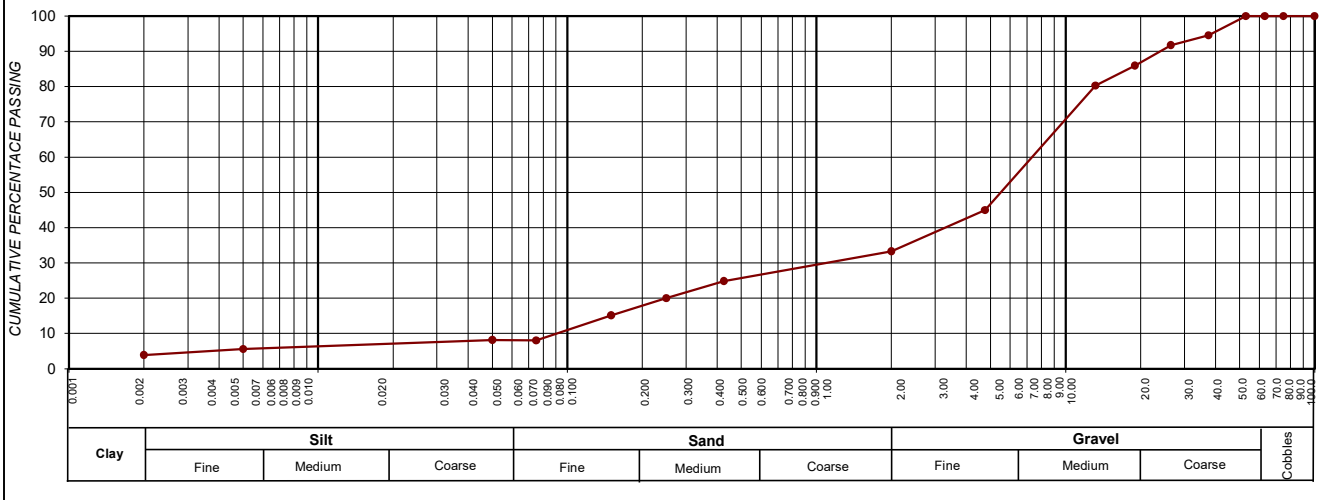
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.9	4.5	24.9	66.7

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP9
LAYER : 0.26-0.77m
SAMPLE No. : S/8637
SAMPLE DESCRIPTION : Light Yellow Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	2.1	Specifc Gravity	2.65

Sieve analysis Cumulative percentage passing (mm)

100.0	100
75.0	100
63.0	97
50.0	97
37.5	94
28.0	89
20.0	82
14.0	78
5.00	55
2.000	39
0.425	27
0.250	24
0.150	21
0.075	14
50 µm	13
5 µm	10
2 µm	7.3

Soil Mortar Analysis % < 2.00mm

2.000 - 0.425	31
0.425 - 0.250	7
0.250 - 0.150	7
0.150 - 0.075	18
< 0.075	37

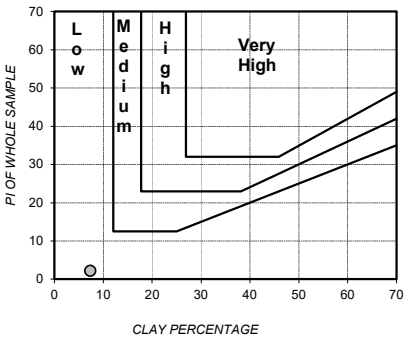
Effective size	0.005
Uniformity Coefficient	1424.0
Curvature Coefficient	21.3
Oversize Index	6.1
Shrinkage Product	106.7
Grading Coefficient	27.7
Grading modulus	2.20

Atter-berg Limits

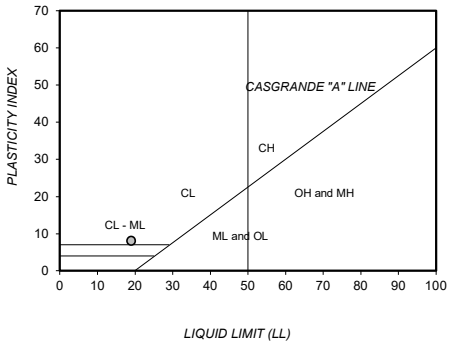
Liquid Limit	19
Plasticity Index	8
Linear Shrinkage	4.0
PI < 0.075	14

Unified Soil Classification	SC
U.S. Highway Classification	A-2-4 (0)

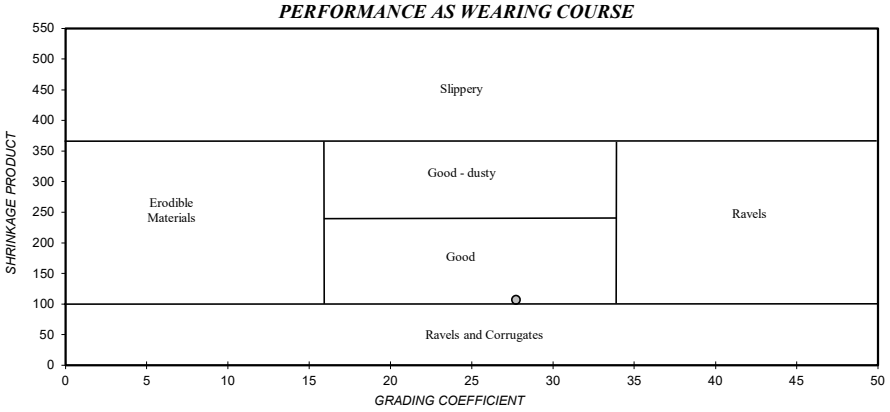
POTENTIAL EXPANSIVENES



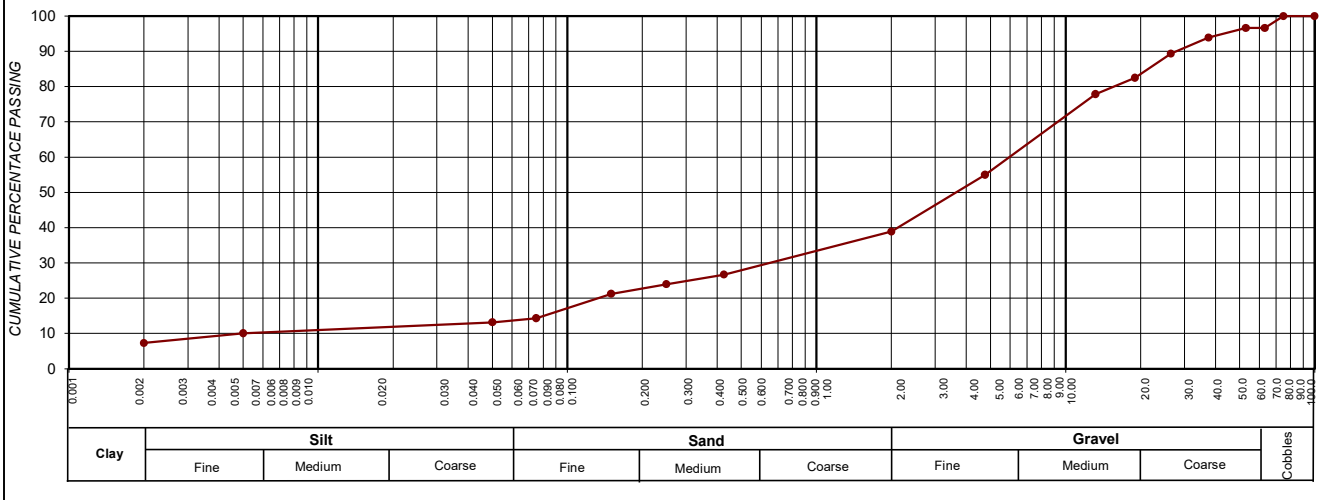
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
7.3	6.5	25.1	61.1

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP10
LAYER : 0.32-0.68m
SAMPLE No. : S/8638
SAMPLE DESCRIPTION : Dark Brown Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	1.9	Specifc Gravity	2.74

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	92
37.5	89
28.0	85
20.0	78
14.0	76
5.00	52
2.000	39
0.425	24
0.250	21
0.150	17
0.075	14
50 µm	11
5 µm	8
2 µm	4.7

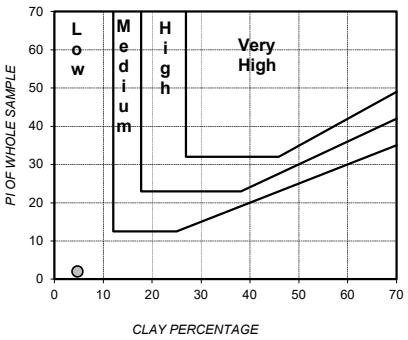
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	37
0.425 - 0.250	9
0.250 - 0.150	10
0.150 - 0.075	18
< 0.075	26

Effective size	0.038
Uniformity Coefficient	217.0
Curvature Coefficient	3.6
Oversize Index	11.2
Shrinkage Product	97.0
Grading Coefficient	23.9
Grading modulus	2.23

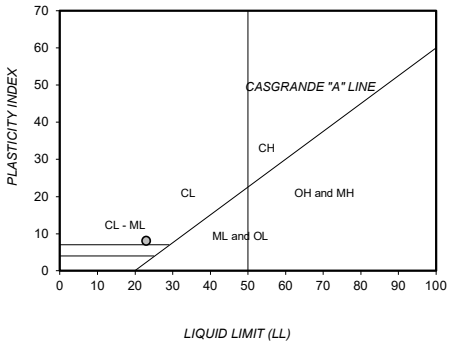
Atter-berg Limits	
Liquid Limit	23
Plasticity Index	8
Linear Shrinkage	4.0
PI < 0.075	16

Unified Soil Classification	SC
U.S. Highway Classification	A-2-4 (0)

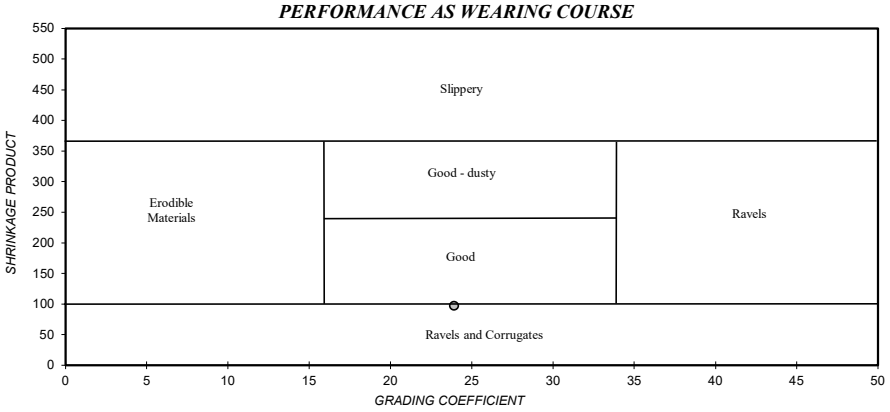
POTENTIAL EXPANSIVENES



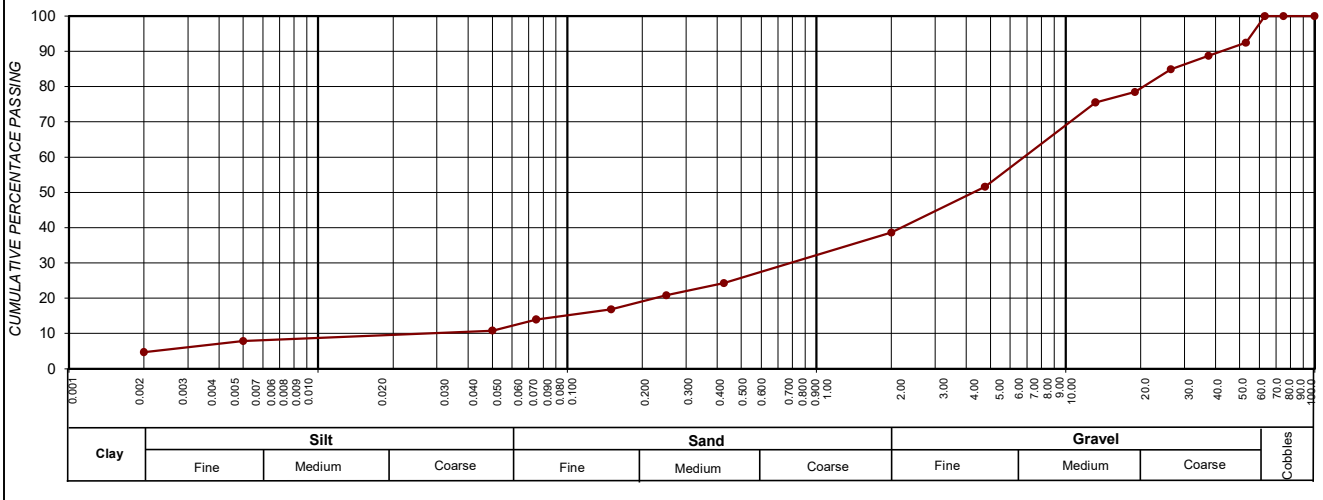
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.7	7.2	26.7	61.4

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP11
LAYER : 0.48-1.8m
SAMPLE No. : S/8639
SAMPLE DESCRIPTION : Dark Red Orange Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**4.3**	**Specifc Gravity**	**2.69**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	82
14.0	79
5.00	49
2.000	36
0.425	31
0.250	28
0.150	23
0.075	21
50 µm	19
5 µm	16
2 µm	12.8

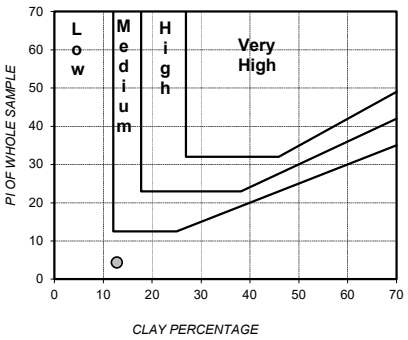
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	14
0.425 - 0.250	9
0.250 - 0.150	12
0.150 - 0.075	20
< 0.075	44

Effective size	0.002
Uniformity Coefficient	4190.0
Curvature Coefficient	8.4
Oversize Index	0.0
Shrinkage Product	216.6
Grading Coefficient	31.2
Grading modulus	2.12

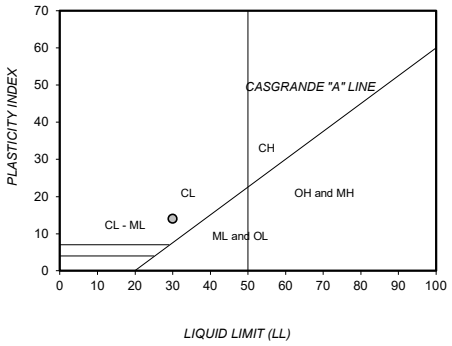
Atter-berg Limits	
Liquid Limit	30
Plasticity Index	14
Linear Shrinkage	7.0
PI < 0.075	16

Unified Soil Classification	GC
U.S. Highway Classification	A-2-6 (0)

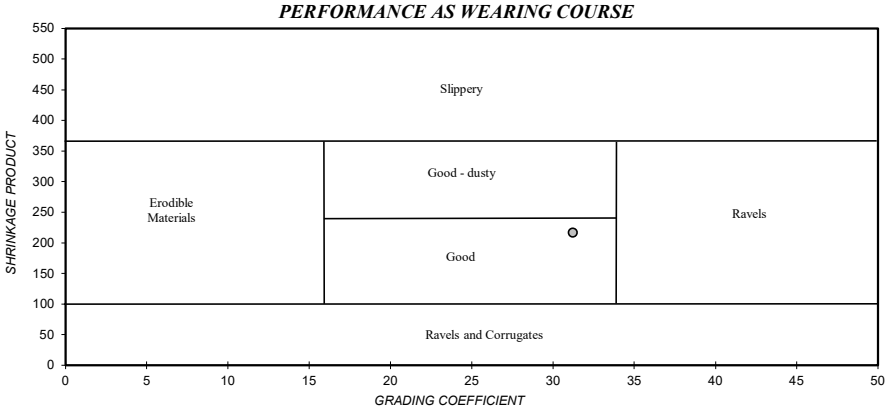
POTENTIAL EXPANSIVENES



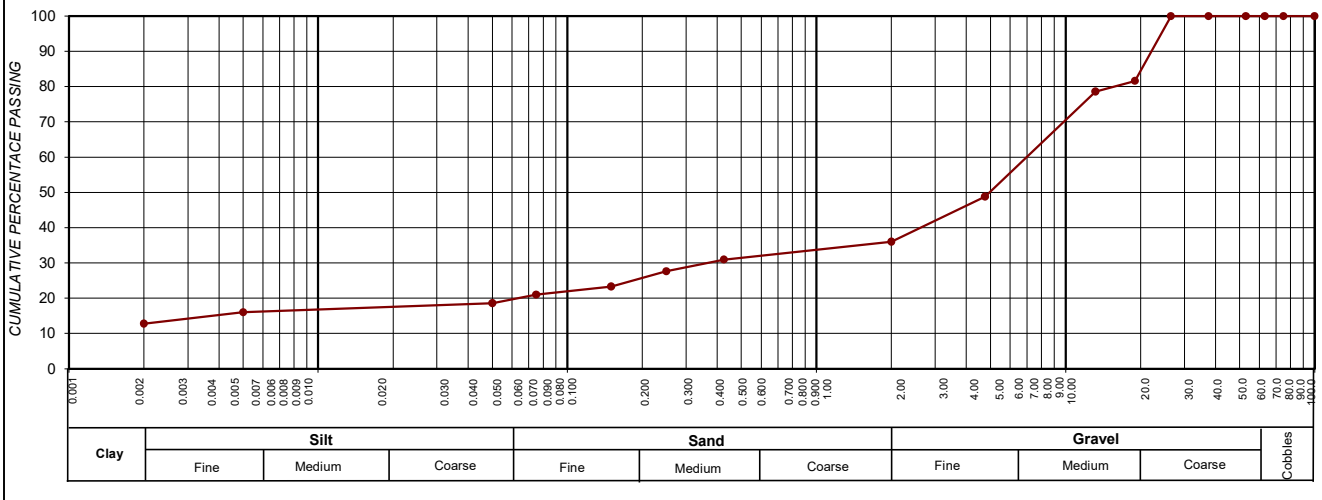
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
12.8	6.6	16.7	64.0

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP12
LAYER : 0.4-1.2m
SAMPLE No. : S/8640
SAMPLE DESCRIPTION : Light Yellow Orange Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**5.4**	**Specifc Gravity**	**2.74**

Sieve analysis Cumulative percentage passing (mm)

100.0	100
75.0	100
63.0	100
50.0	98
37.5	95
28.0	87
20.0	77
14.0	73
5.00	55
2.000	44
0.425	36
0.250	32
0.150	28
0.075	22
50 µm	21
5 µm	19
2 µm	15.0

Soil Mortar Analysis % < 2.00mm

2.000 - 0.425	19
0.425 - 0.250	9
0.250 - 0.150	9
0.150 - 0.075	13
< 0.075	49

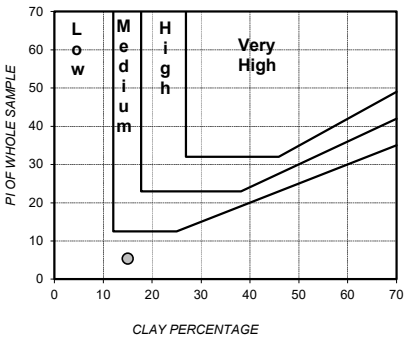
Effective size	0.002
Uniformity Coefficient	3764.7
Curvature Coefficient	2.9
Oversize Index	5.2
Shrinkage Product	251.4
Grading Coefficient	23.3
Grading modulus	1.98

Atter-berg Limits

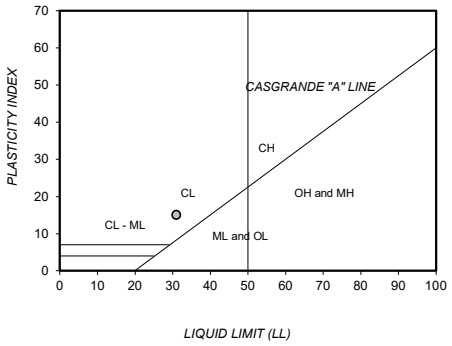
Liquid Limit	31
Plasticity Index	15
Linear Shrinkage	7.0
PI < 0.075	17

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (0)

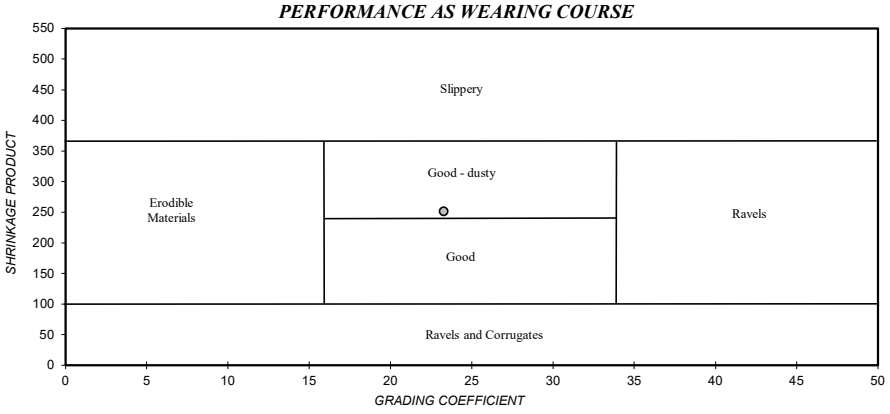
POTENTIAL EXPANSIVENES



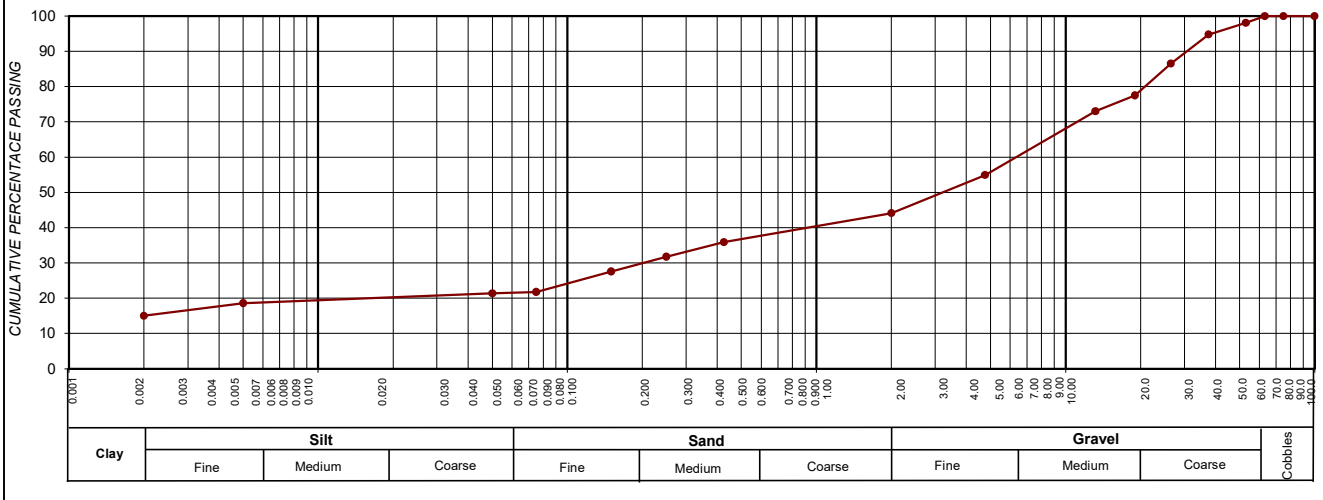
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
15.0	6.9	22.3	55.9

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP13
LAYER : 0.5-1.5m
SAMPLE No. : S/8641
SAMPLE DESCRIPTION : Light Red Brown Silty Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**6.0**	**Specifc Gravity**	**2.72**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	98
50.0	96
37.5	96
28.0	90
20.0	86
14.0	83
5.00	68
2.000	57
0.425	43
0.250	39
0.150	35
0.075	25
50 µm	24
5 µm	19
2 µm	13.9

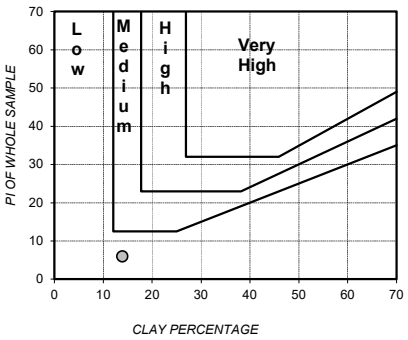
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	25
0.425 - 0.250	7
0.250 - 0.150	8
0.150 - 0.075	17
< 0.075	44

Effective size	0.002
Uniformity Coefficient	1391.1
Curvature Coefficient	2.3
Oversize Index	3.9
Shrinkage Product	299.2
Grading Coefficient	22.7
Grading modulus	1.75

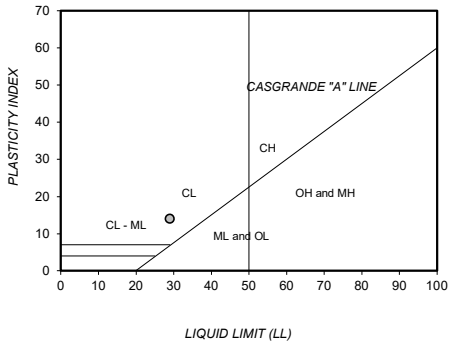
Atter-berg Limits	
Liquid Limit	29
Plasticity Index	14
Linear Shrinkage	7.0
PI < 0.075	16

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (0)

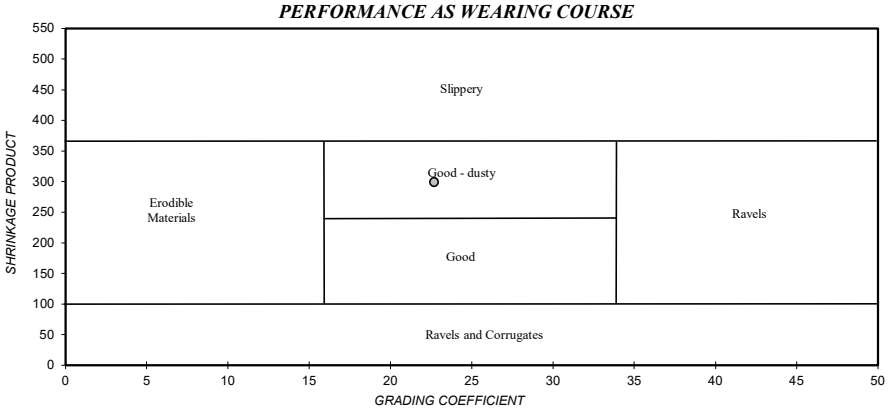
POTENTIAL EXPANSIVENES



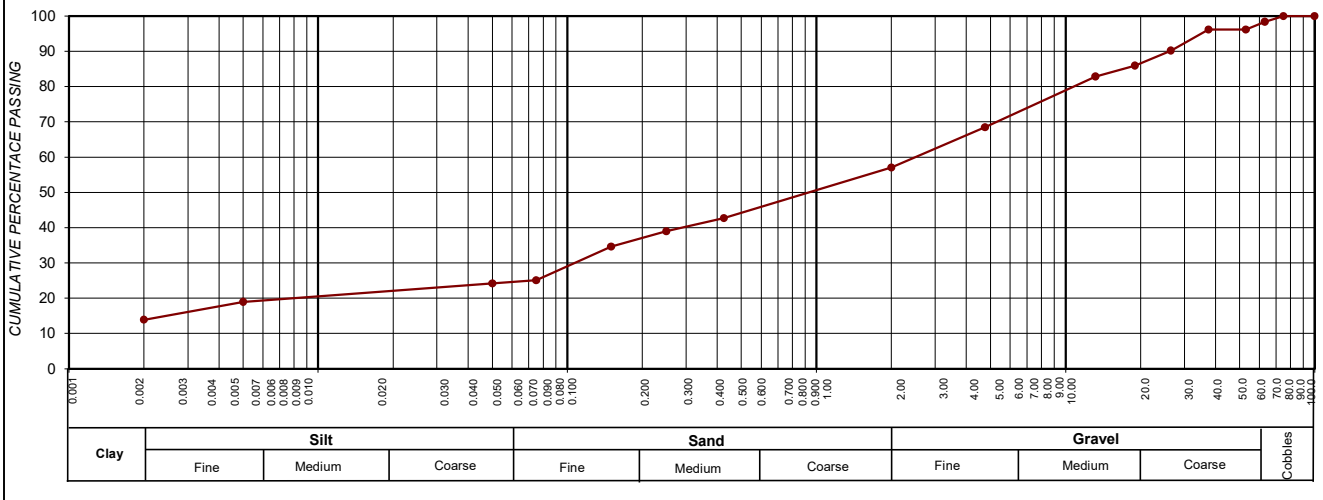
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
13.9	11.0	32.1	43.0

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP14
LAYER : 0.48-1.5m
SAMPLE No. : S/8642
SAMPLE DESCRIPTION : Dark Yellow Orange Silty Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**5.1**	**Specifc Gravity**	**2.67**

Sieve analysis Cumulative percentage passing (mm)

100.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	99
20.0	96
14.0	92
5.00	61
2.000	49
0.425	42
0.250	36
0.150	33
0.075	28
50 µm	24
5 µm	19
2 µm	14.9

Soil Mortar Analysis % < 2.00mm

2.000 - 0.425	14
0.425 - 0.250	12
0.250 - 0.150	6
0.150 - 0.075	11
< 0.075	57

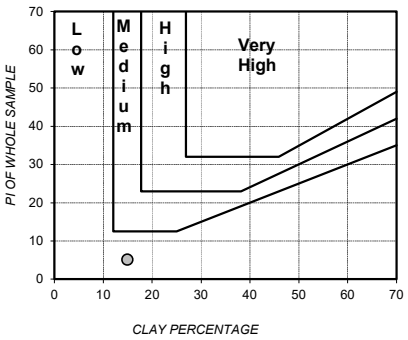
Effective size	0.002
Uniformity Coefficient	2421.3
Curvature Coefficient	1.1
Oversize Index	0.0
Shrinkage Product	254.4
Grading Coefficient	30.1
Grading modulus	1.81

Atter-berg Limits

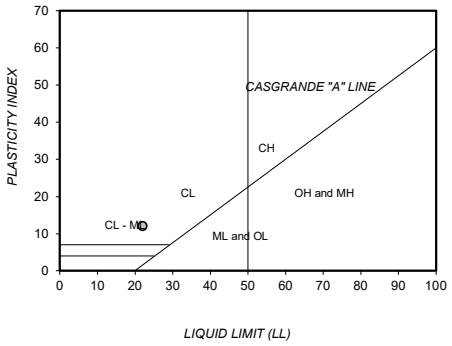
Liquid Limit	22
Plasticity Index	12
Linear Shrinkage	6.0
PI < 0.075	16

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (0)

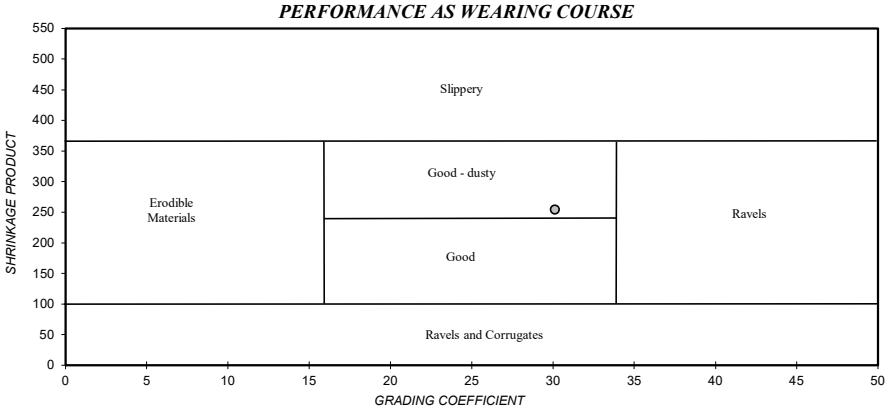
POTENTIAL EXPANSIVENES



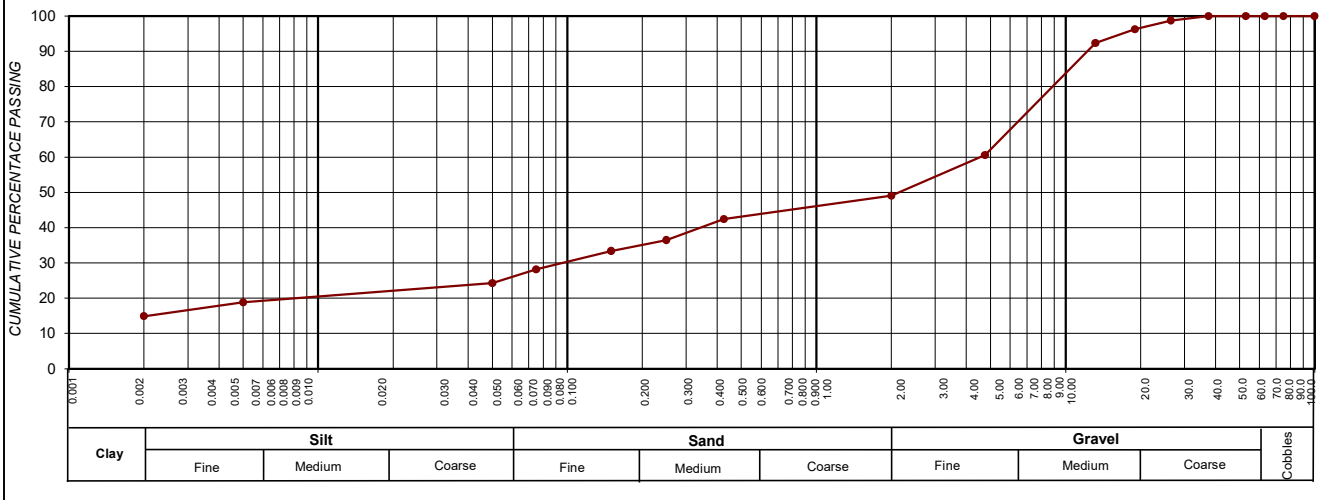
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
14.9	10.6	23.5	51.0

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP15
LAYER : 0.53-1.6m
SAMPLE No. : S/8643
SAMPLE DESCRIPTION : Dark Red Brown Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**4.3**	**Specifc Gravity**	**2.70**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
14.0	97
5.00	65
2.000	46
0.425	36
0.250	34
0.150	32
0.075	26
50 µm	22
5 µm	19
2 µm	15.9

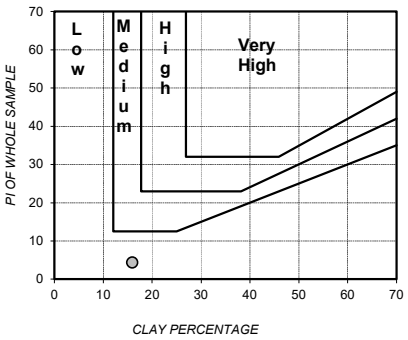
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	22
0.425 - 0.250	4
0.250 - 0.150	6
0.150 - 0.075	13
< 0.075	56

Effective size	0.002
Uniformity Coefficient	2109.7
Curvature Coefficient	1.9
Oversize Index	0.0
Shrinkage Product	216.5
Grading Coefficient	34.9
Grading modulus	1.92

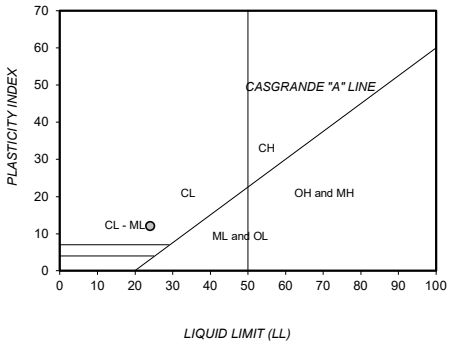
Atter-berg Limits	
Liquid Limit	24
Plasticity Index	12
Linear Shrinkage	6.0
PI < 0.075	16

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (0)

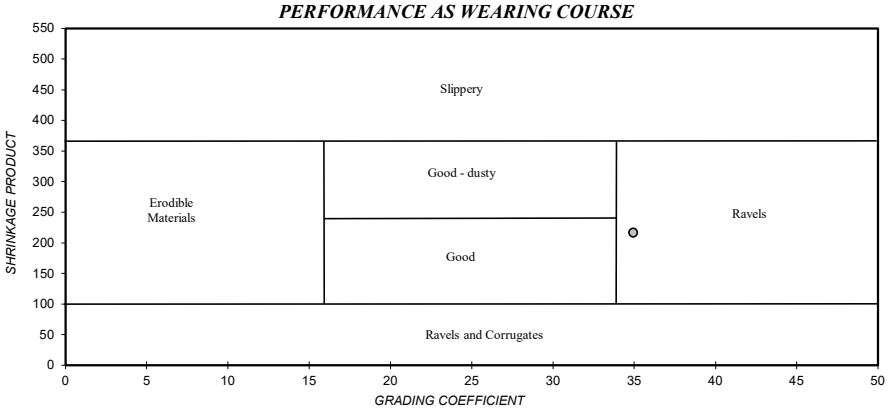
POTENTIAL EXPANSIVENES



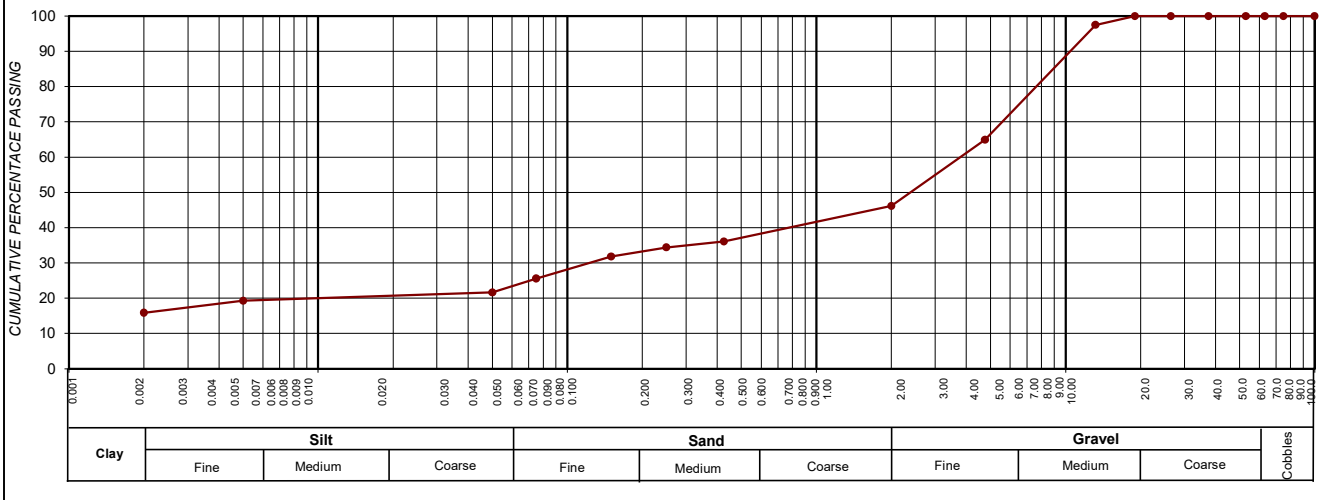
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
15.9	7.7	22.6	53.9

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP16
LAYER : 0.4-1.5m
SAMPLE No. : S/8644
SAMPLE DESCRIPTION : Light Red Brown Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**5.1**	**Specifc Gravity**	**2.66**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	98
14.0	94
5.00	67
2.000	50
0.425	42
0.250	39
0.150	35
0.075	28
50 µm	24
5 µm	20
2 µm	16.0

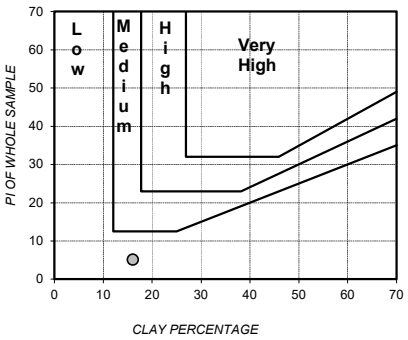
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	16
0.425 - 0.250	5
0.250 - 0.150	9
0.150 - 0.075	25
< 0.075	45

Effective size	0.002
Uniformity Coefficient	1870.6
Curvature Coefficient	1.2
Oversize Index	0.0
Shrinkage Product	253.0
Grading Coefficient	33.6
Grading modulus	1.80

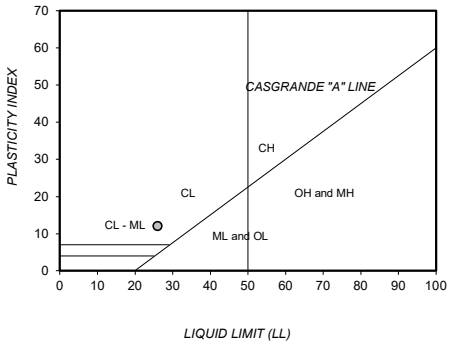
Atter-berg Limits	
Liquid Limit	26
Plasticity Index	12
Linear Shrinkage	6.0
PI < 0.075	17

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (0)

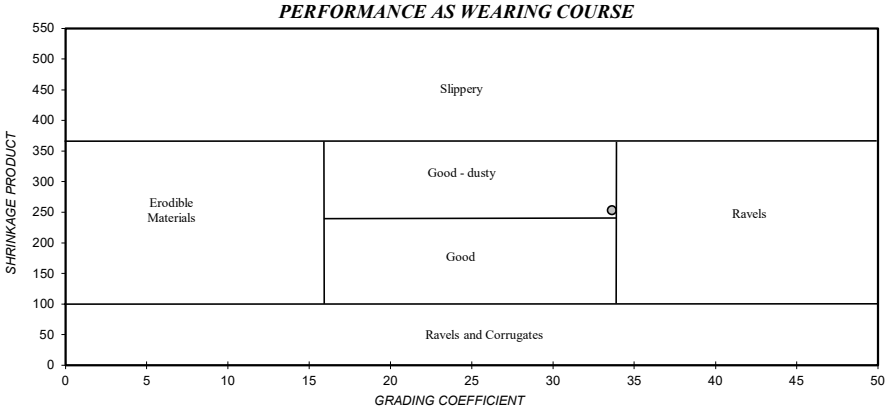
POTENTIAL EXPANSIVENES



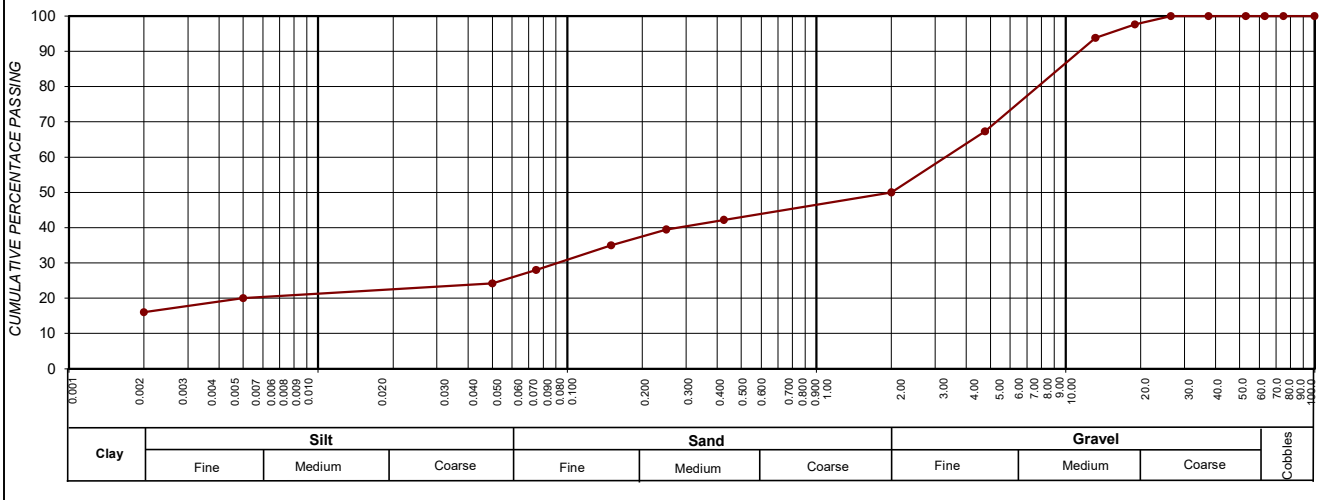
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
16.0	9.6	24.4	50.0

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP17
LAYER : 0.54-1.64m
SAMPLE No. : S/8645
SAMPLE DESCRIPTION : Dark Red Orange Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**8.0**	**Specifc Gravity**	**2.70**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	99
37.5	99
28.0	96
20.0	92
14.0	89
5.00	74
2.000	61
0.425	53
0.250	50
0.150	45
0.075	33
50 µm	32
5 µm	29
2 µm	23.9

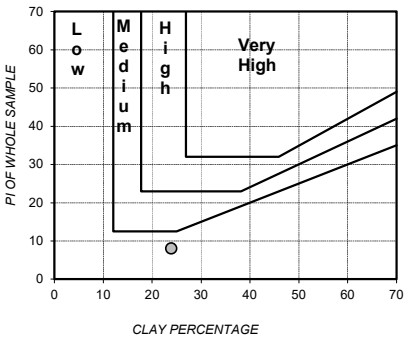
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	13
0.425 - 0.250	6
0.250 - 0.150	9
0.150 - 0.075	19
< 0.075	54

Effective size	0.002
Uniformity Coefficient	887.7
Curvature Coefficient	0.1
Oversize Index	1.4
Shrinkage Product	425.5
Grading Coefficient	26.2
Grading modulus	1.53

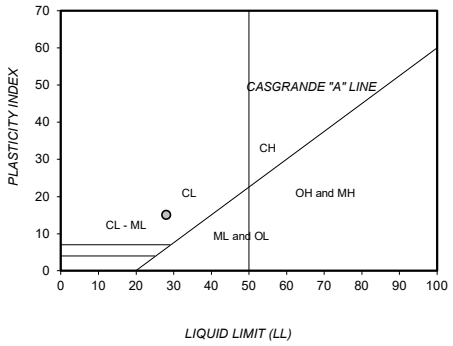
Atter-berg Limits	
Liquid Limit	28
Plasticity Index	15
Linear Shrinkage	8.0
PI < 0.075	22

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (1)

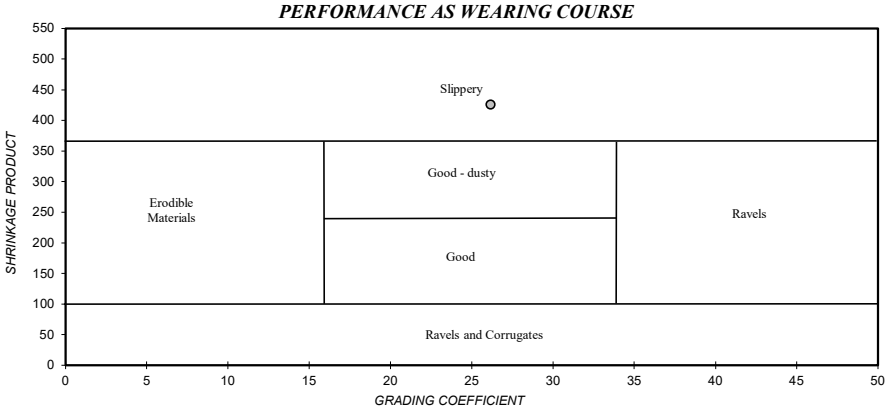
POTENTIAL EXPANSIVENES



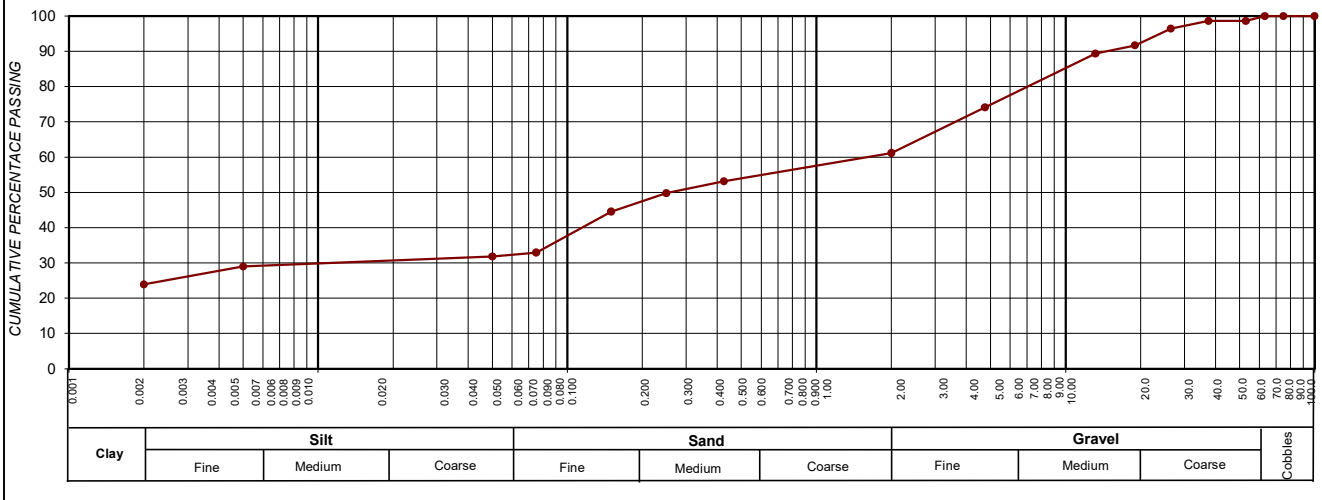
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
23.9	9.3	27.9	38.9

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP18
LAYER : 0.4-1.2m
SAMPLE No. : S/8646
SAMPLE DESCRIPTION : Dark Brown Gravelly Silty Clayey Sand

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**8.4**	**Specifc Gravity**	**2.70**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	100
28.0	100
20.0	100
14.0	99
5.00	94
2.000	90
0.425	84
0.250	75
0.150	64
0.075	57
50 µm	50
5 µm	43
2 µm	34.9

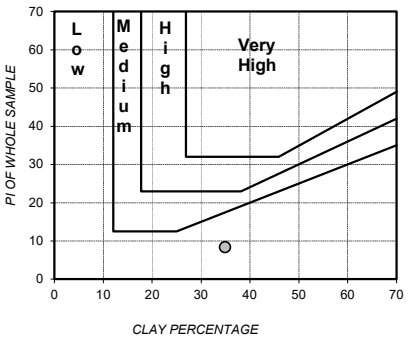
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	7
0.425 - 0.250	10
0.250 - 0.150	12
0.150 - 0.075	23
< 0.075	49

Effective size	0.002
Uniformity Coefficient	53.9
Curvature Coefficient	0.0
Oversize Index	0.0
Shrinkage Product	418.0
Grading Coefficient	9.5
Grading modulus	0.69

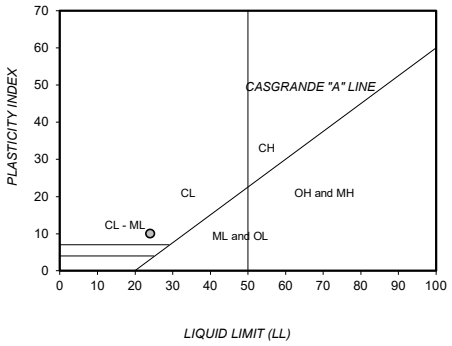
Atter-berg Limits	
Liquid Limit	24
Plasticity Index	10
Linear Shrinkage	5.0
PI < 0.075	14

Unified Soil Classification	CL
U.S. Highway Classification	A-4 (3)

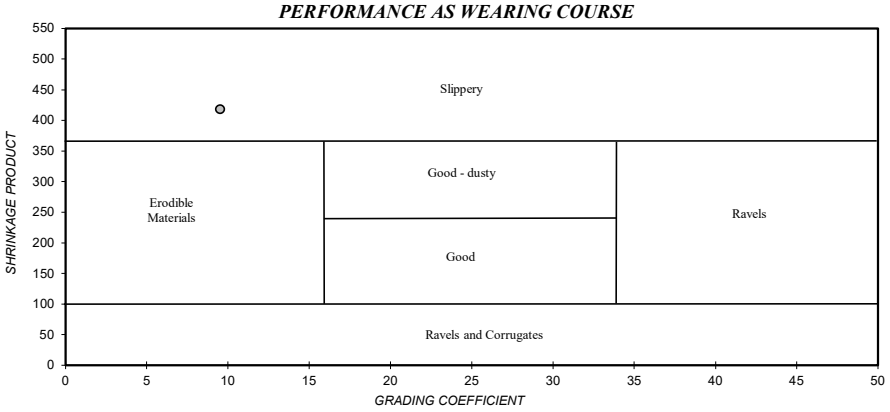
POTENTIAL EXPANSIVENES



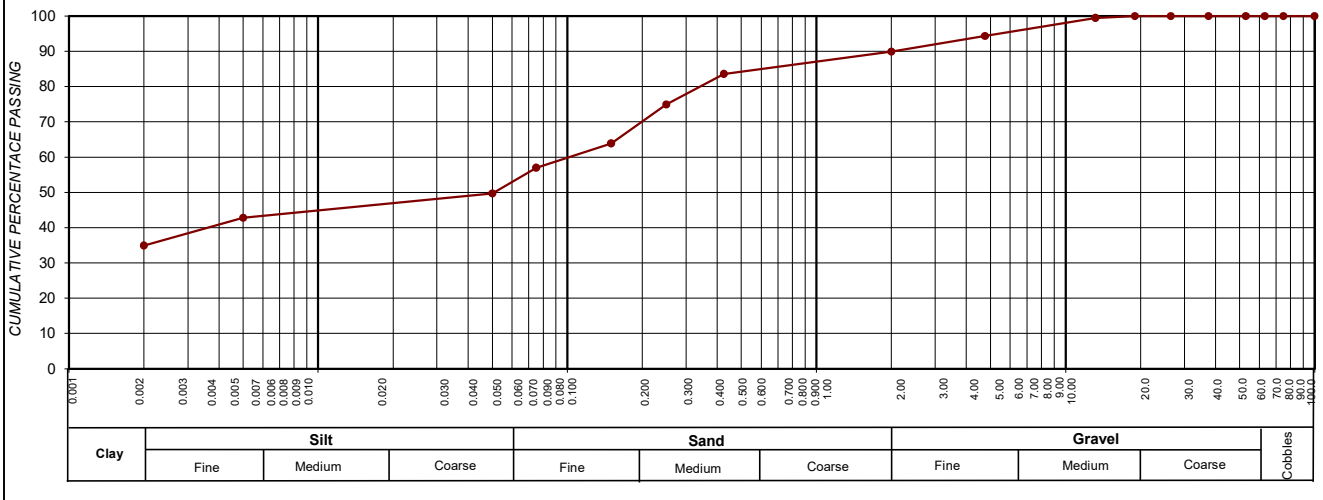
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
34.9	17.1	37.9	10.1

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

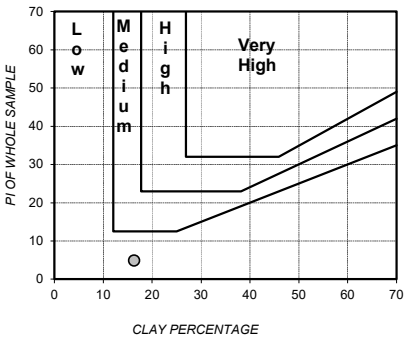
DATE RECEIVED : 10-May-21
POSITION : TP19
LAYER : 0.3-0.8m
SAMPLE No. : S/8647
SAMPLE DESCRIPTION : Dark Red Brown Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

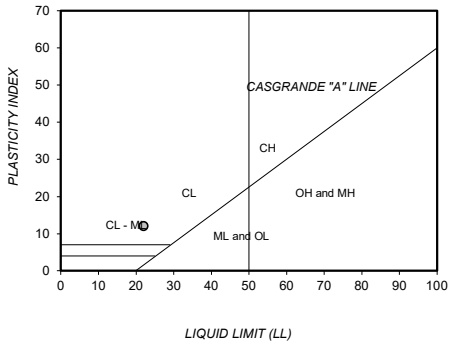
Weighted PI	**4.9**	**Specifc Gravity**	**2.57**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	98
37.5	98
28.0	96
20.0	93
14.0	90
5.00	68
2.000	50
0.425	41
0.250	34
0.150	29
0.075	28
50 µm	25
5 µm	21
2 µm	16.3

POTENTIAL EXPANSIVENES



PLASTICITY CHART



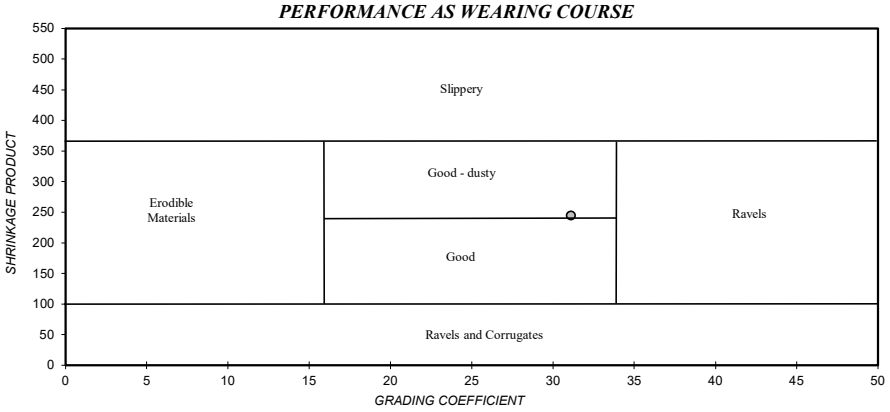
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	18
0.425 - 0.250	14
0.250 - 0.150	11
0.150 - 0.075	9
< 0.075	49

Effective size	0.002
Uniformity Coefficient	1846.8
Curvature Coefficient	4.2
Oversize Index	1.8
Shrinkage Product	244.5
Grading Coefficient	31.1
Grading modulus	1.81

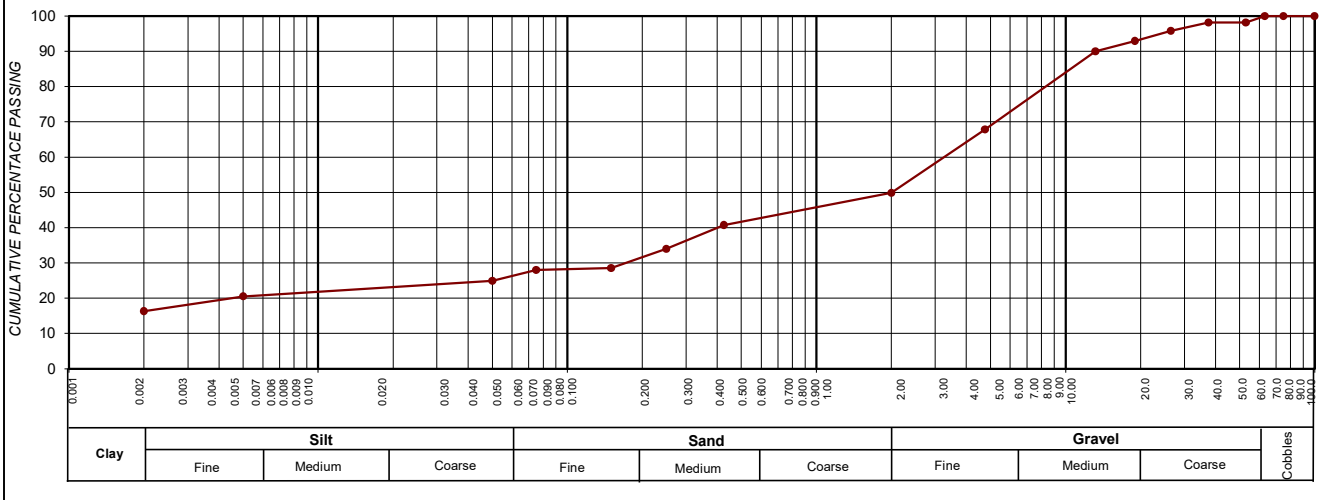
Atter-berg Limits	
Liquid Limit	22
Plasticity Index	12
Linear Shrinkage	6.0
PI < 0.075	16

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6 (0)

PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
16.3	9.3	24.3	50.1

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP20
LAYER : 0.37-1.0m
SAMPLE No. : S/8648
SAMPLE DESCRIPTION : Light Red Orange Silty Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**4.4**	**Specifc Gravity**	**2.69**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	100
37.5	99
28.0	99
20.0	97
14.0	95
5.00	77
2.000	55
0.425	44
0.250	38
0.150	33
0.075	29
50 µm	24
5 µm	17
2 µm	13.6

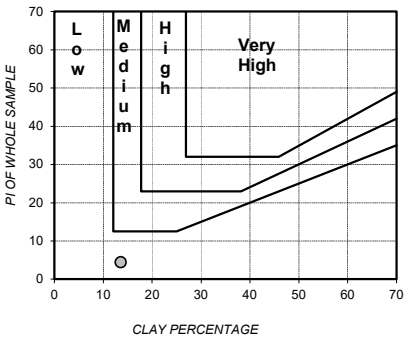
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	20
0.425 - 0.250	11
0.250 - 0.150	10
0.150 - 0.075	7
< 0.075	53

Effective size	0.002
Uniformity Coefficient	1346.1
Curvature Coefficient	1.7
Oversize Index	0.5
Shrinkage Product	218.9
Grading Coefficient	33.4
Grading modulus	1.72

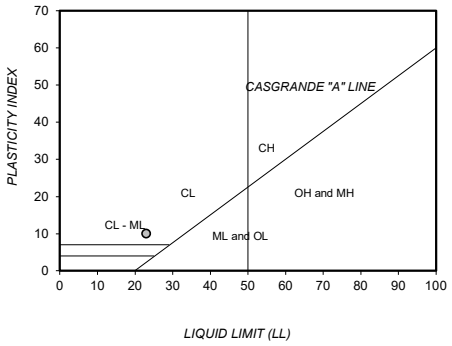
Atter-berg Limits	
Liquid Limit	23
Plasticity Index	10
Linear Shrinkage	5.0
PI < 0.075	14

Unified Soil Classification	SC
U.S. Highway Classification	A-2-4 (0)

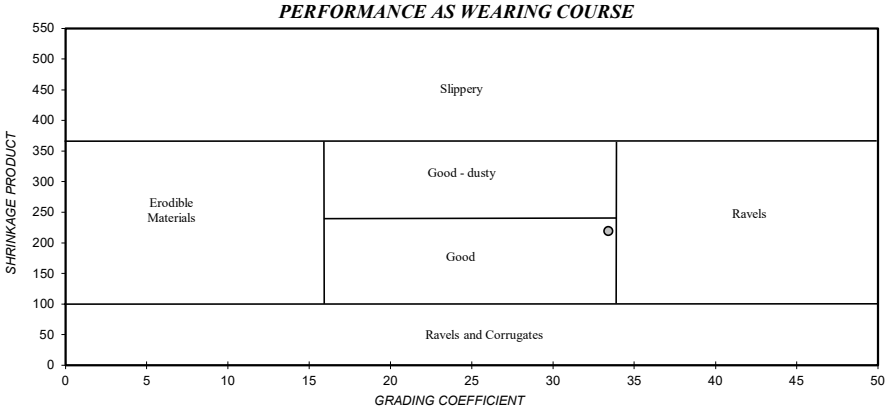
POTENTIAL EXPANSIVENES



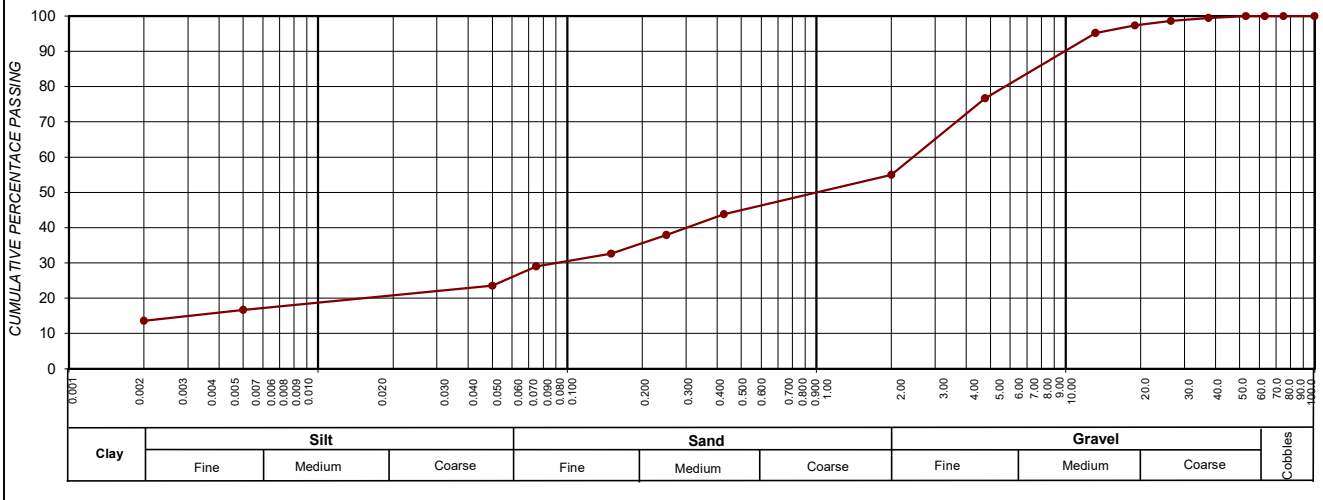
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
13.6	11.5	29.9	45.0

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OUR REF : 92/NKA001-05/0001/21
CLIENT : Nkanivo Development Consultants
PROJECT : Doornpan Township Establishment

DATE RECEIVED : 10-May-21
POSITION : TP21
LAYER : 0.4-1.0m
SAMPLE No. : S/8649
SAMPLE DESCRIPTION : Light Red Orange Clayey Sandy Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	**9.5**	**Specifc Gravity**	**2.69**

Sieve analysis Cumulative percentage passing (mm)	
100.0	100
75.0	100
63.0	100
50.0	94
37.5	90
28.0	86
20.0	82
14.0	79
5.00	59
2.000	45
0.425	34
0.250	31
0.150	28
0.075	22
50 µm	18
5 µm	16
2 µm	13.2

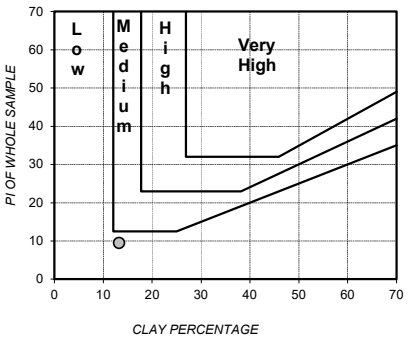
Soil Mortar Analysis % < 2.00mm	
2.000 - 0.425	24
0.425 - 0.250	7
0.250 - 0.150	7
0.150 - 0.075	12
< 0.075	50

Effective size	0.002
Uniformity Coefficient	2777.2
Curvature Coefficient	4.3
Oversize Index	9.9
Shrinkage Product	474.9
Grading Coefficient	24.4
Grading modulus	1.99

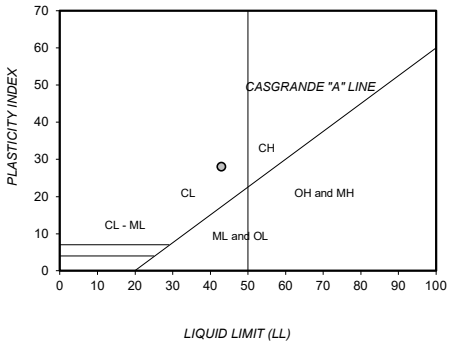
Atter-berg Limits	
Liquid Limit	43
Plasticity Index	28
Linear Shrinkage	14.0
PI < 0.075	14

Unified Soil Classification	SC
U.S. Highway Classification	A-2-7 (1)

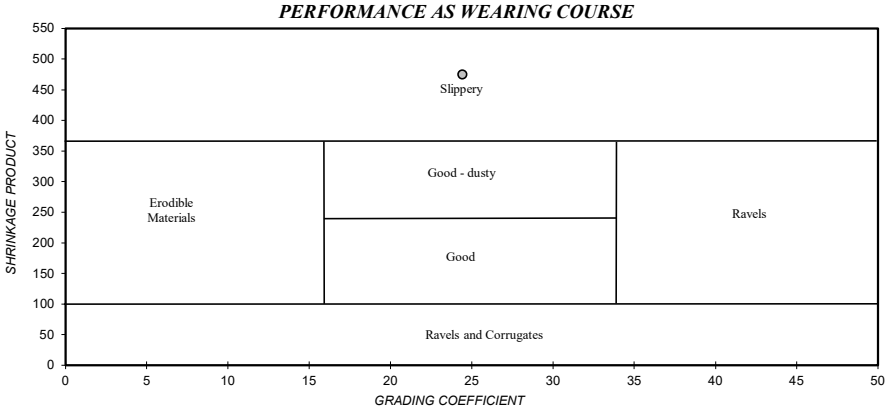
POTENTIAL EXPANSIVENES



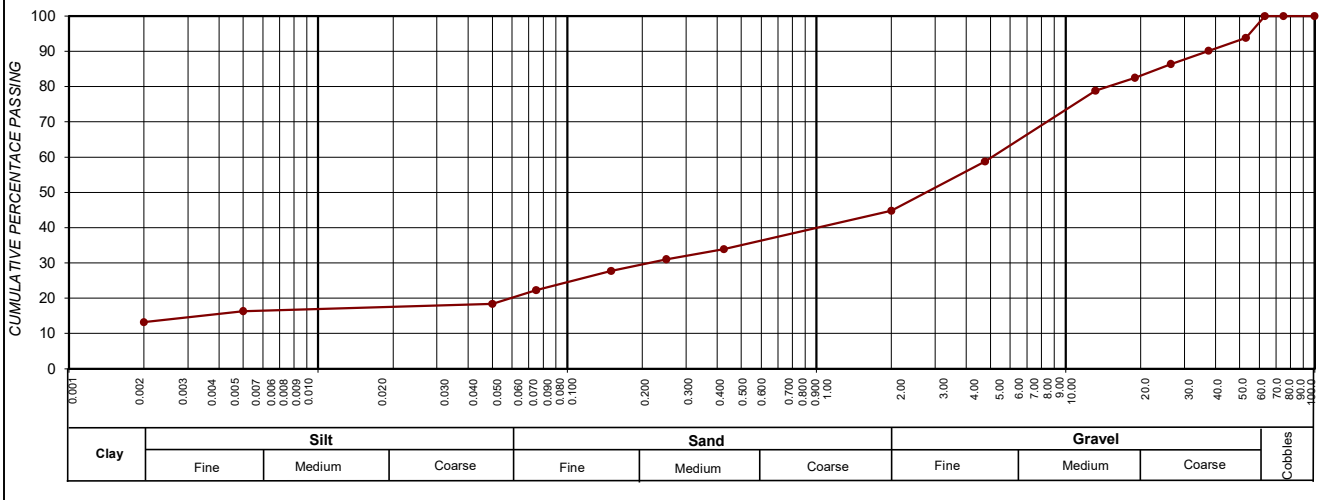
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
13.2	6.7	24.9	55.2

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92/NKA001-05/0001/21 **RG 16816 / COD** Date - 2021/06/09

Nkanivo Development Consultants
P.O Box 11948
Silver Lakes
Pretoria

Attention: **Mr. L Mavhetha**

Dear Sir

Test Report : **DOORNPAN TOWNSHIP ESTABLISHMENT - CBR TEST RESULTS (TRACK NO 13098-13099)**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (PTY)Ltd. In Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		2021/S8632	2021/S8634	2021/S8643	2021/S8646
CONTAINER USED FOR SAMPLING		Clients Bags	Clients Bags	Clients Bags	Clients Bags
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's	±70kg's	±70kg's
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist	Slightly Moist	Slightly Moist
HOLE No. / Km. / CHAINAGE		N/A	N/A	N/A	N/A
ROAD No. OR NAME		TP4	TP6	TP15	TP18
LAYER TESTED / SAMPLED FROM		0.4-1.6m	0.4-1.4m	0.53-1.6m	0.4-1.2m
DATE SAMPLED		2021/05/10	2021/05/10	2021/05/10	2021/05/10
DATE RECEIVED		2021/05/10	2021/05/10	2021/05/10	2021/05/10
CLIENTS MARKING		None	None	None	None
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Red Brown Silty Clayey Sandy Gravel	Dark Yellow Silty Clayey Sandy Gravel	Dark Red Brown Clayey Sandy Gravel	Dark Brown Gravelly Silty Clayey Sand
GRADING ANALYSIS - % PASSING SIEVES (SANS : METHOD GR1:2010)					
SIEVE ANA - LYSIS (mm) **(SANS GR1:2010)**	75.0	100	100	100	100
	63.0	100	100	100	100
	50.0	100	98	100	100
	37.5	100	98	100	100
	28.0	100	96	100	100
	20.0	100	94	100	100
	14.0	99	89	97	99
	5.00	81	68	65	94
	2.00	57	58	46	90
	0.425	47	47	36	84
	0.075	31	29	26	57
SANS 3001 - PR5					
Soil Mortar		56	58	46	90
Coarse Sand		18	21	22	7
Fine Sand		29	31	24	81
Coarse Fine Sand		4	5	4	10
Medium Fine Sand		7	10	4	49
Fine Fine Sand		18	16	15	22
Silt & Clay		54	48	54	12
Coarse Sand Ratio		0.1	0.2	0.2	0
ATTERBERG LIMITS ANALYSIS (SANS : METHOD GR10 ; GR11)					
ATTERBERG LIMITS **(SANS GR10; GR11)**	LL%	20.0	29.0	24.0	24.0
	P.I.	10.0	12.0	12.0	10.0
	LS%	5.0	6.0	6.0	5.0
GM		1.64	1.66	1.92	0.69
CLASSIFI - CATION	H.R.B.*	A-2-4(0)	A-2-6(0)	A-2-6(0)	A-4(1)
	COLTO*	G8	G8	G8	G9
	T.R.H. 14*	G8	G9	G8	G10
CALIFORNIA BEARING RATIO (SANS : METHOD GR40) / UNCONFINED COMPRESSIVE STRENGTH (SANS : METHOD GR53) (ITS GR54)					
MOD AASHTO **(SANS GR30)**	OMC%	9.5	10.1	10.4	11.2
	MDD(KG/M^3)	2011	1965	1960	1912
	COMP MC %	9.5	10.3	10.4	11.3
	% SWELL	0.39	0.42	0.89	0.32
C.B.R. **(SANS GR40)**	100%	37	32	36	22
	98%	31	27	27	18
	97%	25	18	21	16
U.C.S. **(SANS GR53)** MPA	95%	18	15	17	11
	93%	13	10	14	8
	90%	10	7	10	4
MOD ITS : DRY (kPa) **(GR54)**		N/A	N/A	N/A	N/A
ITS @ 95% : DRY (kPa)		N/A	N/A	N/A	N/A
STABILISED WITH	IN LAB				
	ON SITE	Neat	Neat	Neat	Neat
TEST TYPE		CBR / FOUND IND	CBR / FOUND IND	CBR / FOUND IND	CBR / FOUND IND
SAMPLED BY		Client	Client	Client	Client
DELIVERED BY		Client	Client	Client	Client
SAMPLING METHOD		**TMH5 - MB1**	**TMH5 - MB1**	**TMH5 - MB1**	**TMH5 - MB1**
ENVIRONMENTAL CONDITION WHEN SAMPLED		Hot	Hot	Hot	Hot
REMARKS & NOTES		None	None	None	None

Kind Regards

Mr. N Herbst / Mr R Potgieter
TECHNICAL SIGNATORY / MANAGER

Remarks :
*Opinions & Interpretations are not included in our schedule of Accreditation
SANAS Accredited Laboratory No. T 0296
The samples were subjected to analysis according to SANS 3001
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab
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Compiled By : Linda van Niekerk

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Ref - 92/NKA001-05/0001/21 Job no- RG 16816 Date- 2021/06/09

Nkanivo Development Consultants
P.O.Box 11948
Silver Lakes
Pretoria

ATTENTION: **Mr. L Mavtetha**

Test Report : **DOORNPAN TOWNSHIP ESTABLISHMENT - pH & CONDUCTIVITY TEST RESULTS**

Clients Marking: None
Sample Number: S/8634 - S/8646
Sample delivered to: Roadlab

Date Sampled: 2021/05/10
Date Received: 2021/05/10

Sample Number	Layer / Road :	Temperature (°C) : Conductivity	Conductivity (ms/m)	Temperature (°C) : pH	pH Value
S/8634	TP6:0.4-1.4m	24.0	18.0	24.0	6.37
S/8643	TP15:0.53-1.6m	24.0	11.0	24.0	5.71
S/8646	TP18:0.4-1.2m	24.0	15.0	24.0	5.71

PAGE 1/1

Remarks :
The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
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Compiled By : Linda van Niekerk

Kind Regards

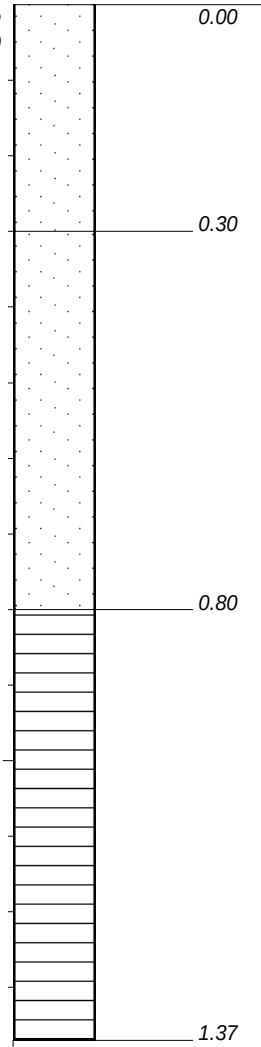
Mr N Herbst / Mr R Potgieter
Technical Signatory / Manager

16. APPENDIX C: SOIL PROFILES

Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP01
Sheet 1 of 1

JOB NUMBER: 000



Scale 1:10

0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.3 ● *0.30*

Slightly moist, light brown, intact, Medium dense, scattered sub-rounded nodules, Sandy gravelly clay. **FERRICRETE.**

0.8m ● *0.80*

Slightly weathered light brown shale. **BEDROCK.**

1.37

NOTES

1) Roots inclusion from a depth of 0.0 - 0.45m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1.37m
5) Disturbed sample taken at 0.3 - 0.8m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1484m
X-COORD : 26°47'21,12"E
Y-COORD : 26°18'21,23"S

HOLE No: TP01

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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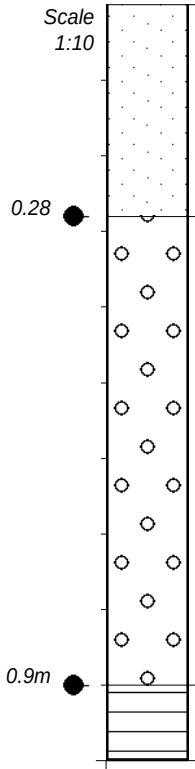
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP02
Sheet 1 of 1

JOB NUMBER: 000



0.00 — Slightly moist, brownish, Loose, intact, Sandy clay. **TOPSOIL.**

0.28 — Moist, light brown, intact, Medium dense, scattered fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

0.90 — Slightly weathered yellowish shale. **BEDROCK.**

1.00

NOTES

1) Roots inclusion from a depth of 0.0 - 0.42m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1 m
5) Disturbed sample taken at 0.28 - 0.9m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani
TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021
DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

ELEVATION : 1482m
X-COORD : 26°47'15,94"E
Y-COORD : 26°18'17,60"S

HOLE No: TP02

dotPLOT 7022

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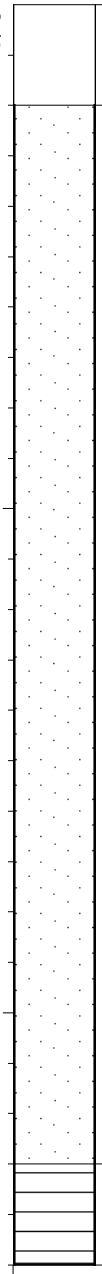
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP03
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:15



0.00 Slightly moist, greyish, Loose, intact, Silty clay. **TOPSOIL.**

0.20 Moist, greyish, intact, loose to medium dense, Sandy silt. **Rubble.**

2.30 Slightly weathered light brown shale. **BEDROCK.**

2.50

NOTES

1) Roots inclusion from a depth of 0.0 - 0.4m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 2.5 m
5) No Disturbed sample taken
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1486m
X-COORD : 26°47'11,03"E
Y-COORD : 26°18'11,54"S

HOLE No: TP03

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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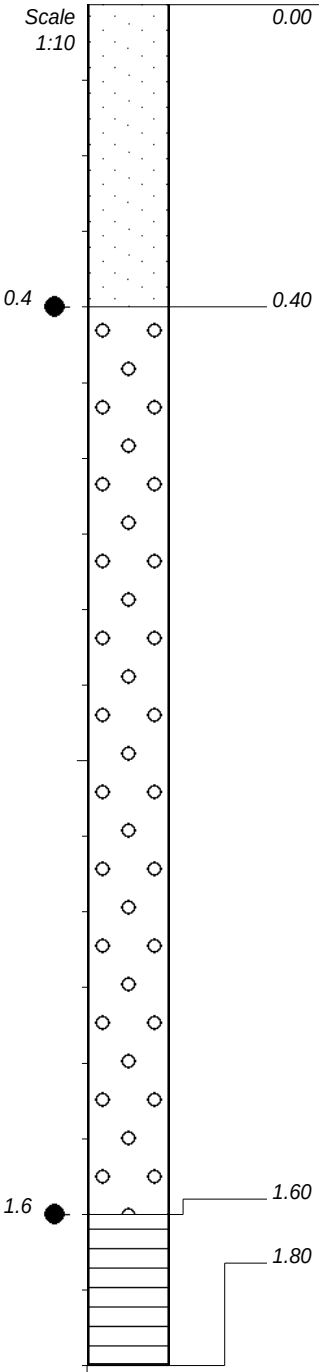
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP04
Sheet 1 of 1

JOB NUMBER: 000



0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.40 Moist, light brown, intact, Medium dense, sub-rounded scattered nodules, Gravelly clay. **FERRICRETE.**

1.60 Weathered yellowish shale. **BEDROCK.**

1.80

NOTES

1) Roots inclusion from a depth of 0 - 0.5m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1.8 m
5) Disturbed sample taken at 0.4 - 1.6 m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1485m
X-COORD : 26°47'22,03"E
Y-COORD : 26°18'16,88"S

HOLE No: TP04

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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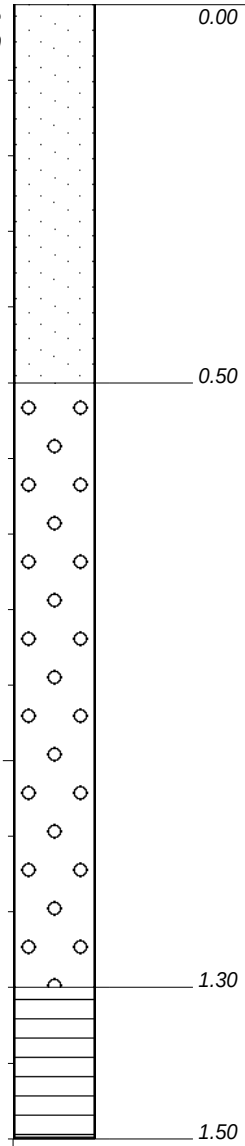
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP05
Sheet 1 of 1

JOB NUMBER: 000



0.00 — Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.50 — Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

1.30 — Slightly weathered Shale. **BEDROCK.**

1.50

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered at 1.5 m
4) Disturbed sample taken at 0.5 - 1.3 m
5) No Undisturbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1484m
X-COORD : 26°47'28,55"E
Y-COORD : 26°18'15,46"S

HOLE No: TP05

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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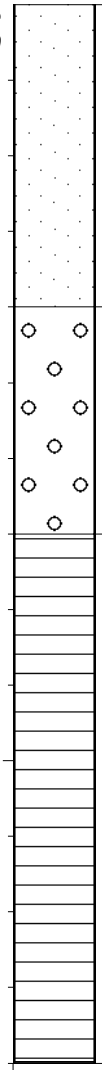
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP06
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:10



0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.40 Moist, light brown, intact, Medium dense to dense, scattered fragments of shale Gravelly sandy clay. **RESIDUAL SOIL.**

0.7 ● 0.70 Slightly Weathered Shale. **BEDROCK.**

1.4 ● 1.40

NOTES

1) Roots inclusion from a depth of 0 - 0.56m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1.4 m
5) Disturbed sample taken at 0.7 - 1.4 m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani
TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021
DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

ELEVATION : 1475m
X-COORD : 26°47'32,29"E
Y-COORD : 26°18'20,56"S

HOLE No: TP06

dotPLOT 7022

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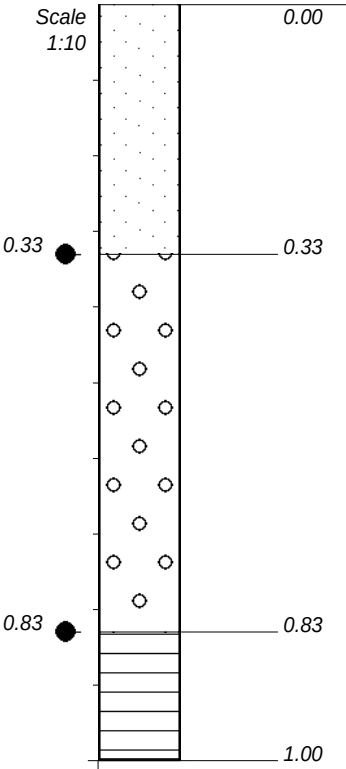
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP07
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brownish, Loose, intact, Sandy clay. **TOPSOIL.**

Slightly moist, light brown, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

Slightly weathered light brown shale. **BEDROCK.**

NOTES

1) Roots inclusion from a depth of 0 - 0.4m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1 m
5) Disturbed sample taken 0.33 - 0.83 m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani
TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021
DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

ELEVATION : 1479m
X-COORD : 26°47'36,38"E
Y-COORD : 26°18'11,54"S

HOLE No: TP07

dotPLOT 7022

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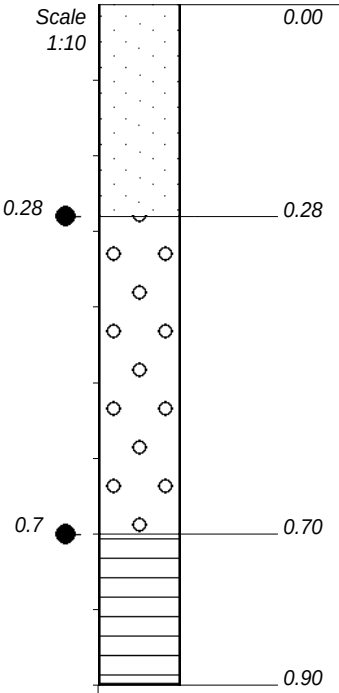
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP08
Sheet 1 of 1

JOB NUMBER: 000



0.00 — Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.28 — Slightly moist, light brown, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

0.70 — Slightly Weathered yellowish shale. **BEDROCK.**

0.90

NOTES

1) Roots inclusion from a depth of 0 - 0.45m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 0.9 m
5) Disturbed sample taken at 0.28 - 0.7 m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1488m
X-COORD : 26°47'32,91"E
Y-COORD : 26°18'9,10"S

HOLE No: TP08

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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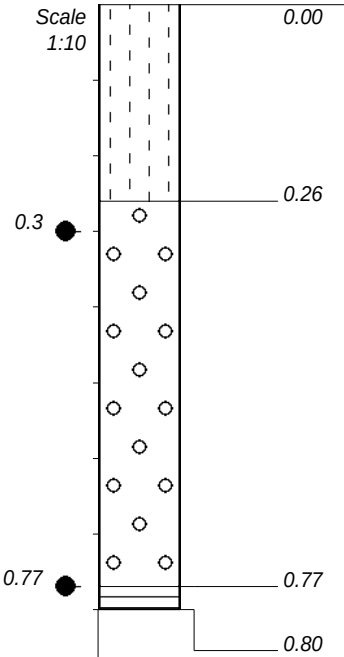
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP09
Sheet 1 of 1

JOB NUMBER: 000



Moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

Slightly moist, light brown, intact, Medium dense, scattered sub-rounded nodules, Gravelly sandy clayey. **RESIDUAL SOIL.**

Weathered light brown Shale. **BEDROCK.**

NOTES

1) Roots inclusion from a depth of 0 - 0.45m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 0.8 m
5) Disturbed sample taken 0.3 - 0.77 m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1480m
X-COORD : 26°47'44,15"E
Y-COORD : 26°18'6,80"S

HOLE No: TP09

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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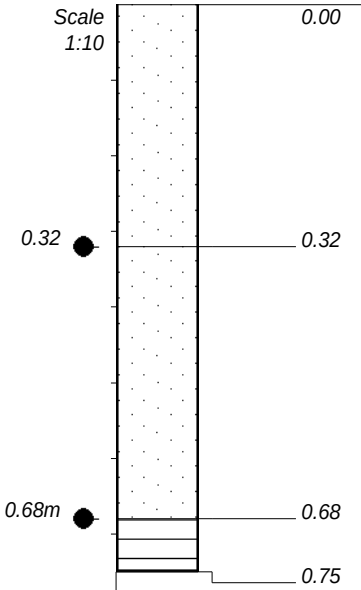
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP10
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

Moist, yellowish, intact, Medium dense, scattered fragments of shale Sandy gravelly clay. **RESIDUAL SOIL.**

Slightly weathered Shale. **BEDROCK.**

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered at 0.75 m
4) Disturbed sample taken at 0.32 - 0.68m
5) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1490m
X-COORD : 26°47'33,33"E
Y-COORD : 26°18'5,71"S

HOLE No: TP10

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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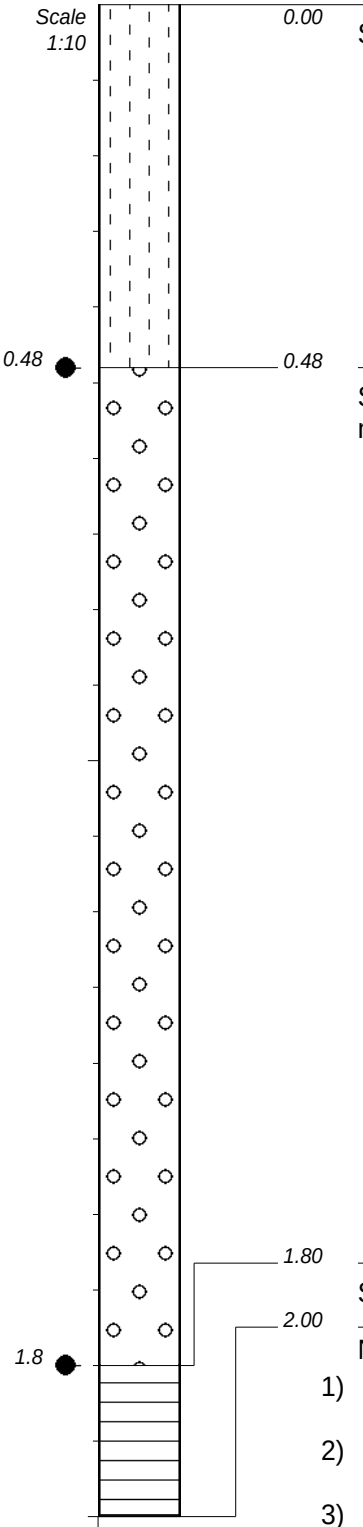
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP11
Sheet 1 of 1

JOB NUMBER: 000



0.00 Slightly moist, brownish, Loose, intact, Silty clayey. **TOPSOIL.**

0.48 Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

1.80 Slightly weathered light brown shale. **BEDROCK.**

2.00

NOTES

1) Stable side walls
2) No water seepage encountered
3) No Refusal encountered 2.8m
4) Disturbed sample taken at 0.48 - 1.8 m
5) No Undisturbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1486m
X-COORD : 26°47'34,02"E
Y-COORD : 26°18'0,40"S

HOLE No: TP11

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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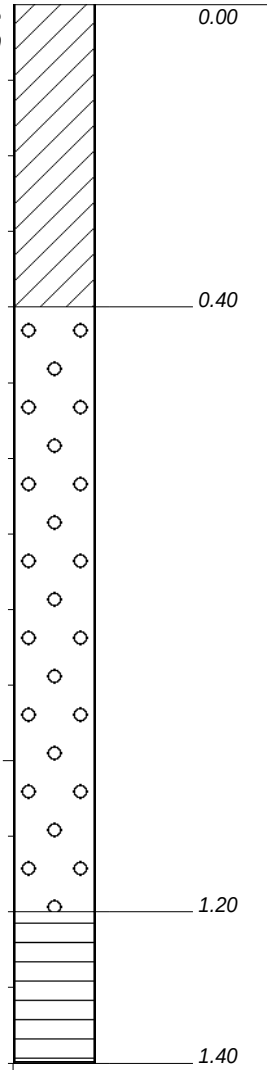
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP12
Sheet 1 of 1

JOB NUMBER: 000



Scale 1:10

0.00 Slightly moist, brownish, Loose, intact, Clay. **TOPSOIL.**

0.4 *0.40* Moist, light brown, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

1.2 *1.20* Slightly weathered yellowish Shale. **BEDROCK.**

1.40

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered 1.4m
4) Disturbed sample taken at 0.4 - 1.2 m
5) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1492m
X-COORD : 26°47'25,86"E
Y-COORD : 26°18'4,70"S

HOLE No: TP12

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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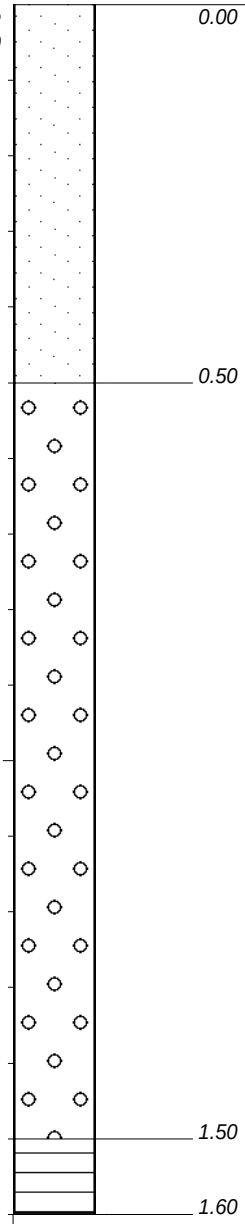
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP13
Sheet 1 of 1

JOB NUMBER: 000



0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.50 Moist, light brown, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

1.50 Slightly weathered light brown Shale. **BEDROCK.**

1.60

NOTES

1) Roots inclusion from a depth of 0 - 0.9m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered 1.6m
5) Disturbed sample taken at 0.5 - 1.6 m
6) No Undisturbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1496m
X-COORD : 26°47'25,81"E
Y-COORD : 26°17'59,88"S

HOLE No: TP13

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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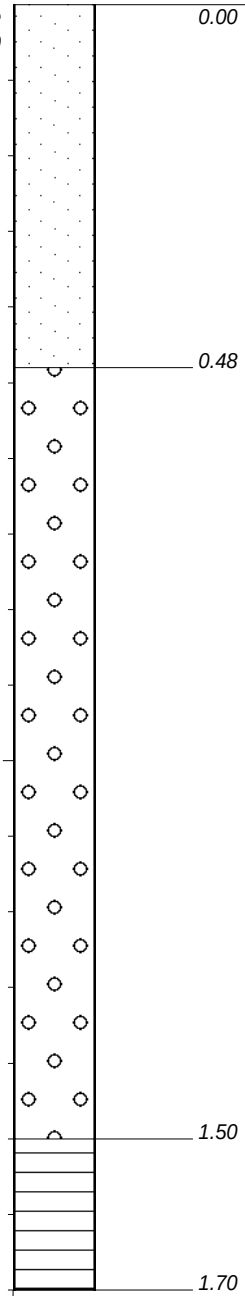
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP14
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

Moist, brownish mottled yellow, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

Slightly weathered light brown shale. **BEDROCK.**

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered 1.7m
4) Disturbed sample taken at 0.48 -1.5 m
5) No Undisturbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani
TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021
DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

ELEVATION : 1497m
X-COORD : 26°47'21,41"E
Y-COORD : 26°17'58,18"S

HOLE No: TP14

dotPLOT 7022

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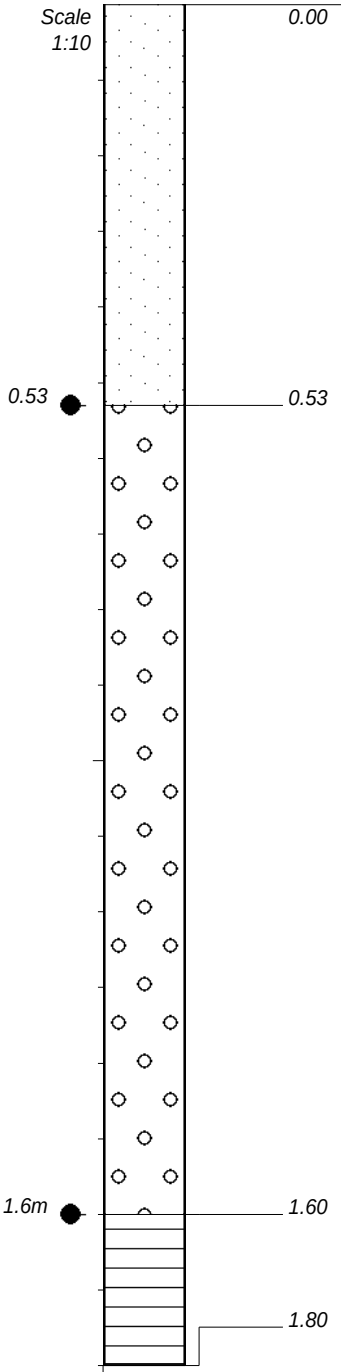
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP15
Sheet 1 of 1

JOB NUMBER: 000



0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.53 Moist, brownish mottled yellow, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

1.60 Slightly weathered light brown shale. **BEDROCK.**

1.80

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered 1.8m
4) Disturbed sample taken at 0.53 - 1.6m
5) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1491m
X-COORD : 26°47'23,29"E
Y-COORD : 26°18'4,91"S

HOLE No: TP15

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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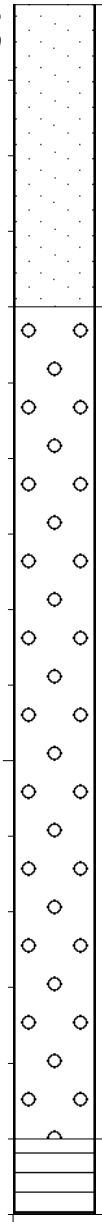
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP16
Sheet 1 of 1

JOB NUMBER: 000



0.00 Slightly moist, brownish, Loose, intact, Sandy clay. **TOPSOIL.**

0.40 Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

1.50 Slightly weathered light brown shale. **BEDROCK.**

1.60

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered at 1.6 m
4) Disturbed sample taken at 0.4 - 1.5m
5) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani
TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021
DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

ELEVATION : 1485m
X-COORD : 26°47'16,73"E
Y-COORD : 26°18'5,36"S

HOLE No: TP16

dotPLOT 7022

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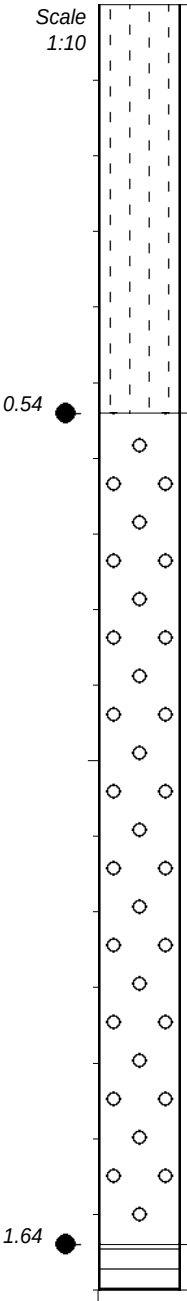
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP17
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brownish, Loose, intact, Silty clay. **TOPSOIL.**

Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

Slightly weathered light brown shale. **BEDROCK.**

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered at 1.7 m
4) Disturbed sample taken at 0.54 - 1.64 m
5) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1481m
X-COORD : 26°47'20,50"E
Y-COORD : 26°18'13,45"S

HOLE No: TP17

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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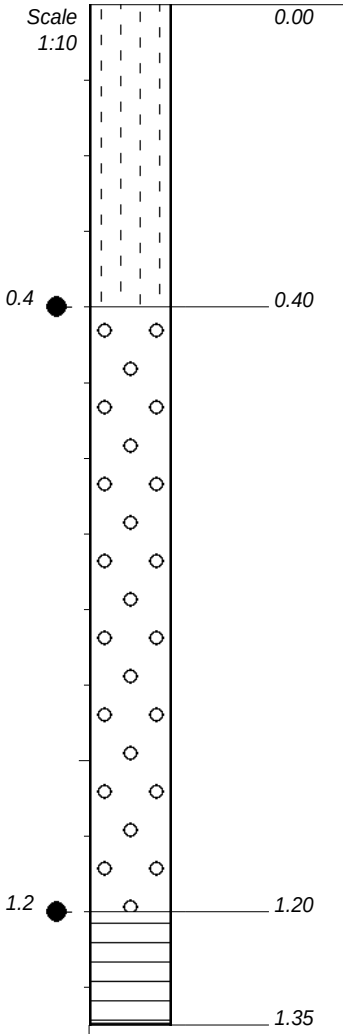
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP18
Sheet 1 of 1

JOB NUMBER: 000



0.00 — Slightly moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

0.40 — Moist, light brown mottled yellow, intact, Mediumd dense, scattered shale rock fragments Gravelly Clay. **RESIDUAL SOIL.**

1.20 — Slightly weathered light brown Shale. **BEDROCK.**

1.35

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered at 1.35 m
4) Disturbed sample taken 0.4 - 1.2 m
5) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1481m
X-COORD : 26°47'20,64"E
Y-COORD : 26°18'13,43"S

HOLE No: TP18

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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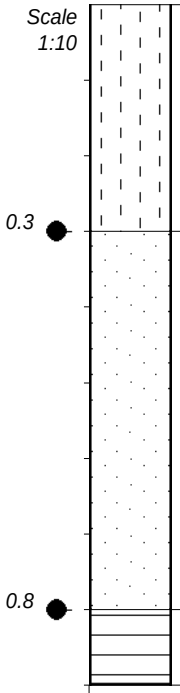
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP19
Sheet 1 of 1

JOB NUMBER: 000



0.00 Moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

0.30 Slightly moist, yellowish speckled black, intact, Medium dense, Sandy clay. **RESIDUAL SOIL.**

0.80 Slightly weathered yellowish Shale. **BEDROCK.**

0.90

NOTES

1) Roots inclusion from a depth of 0 - 0.3m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 0.9 m
5) Disturbed sample taken at 0.3 - 0.8 m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1488m
X-COORD : 26°47'38,63"E
Y-COORD : 26°18'0,47"S

HOLE No: TP19

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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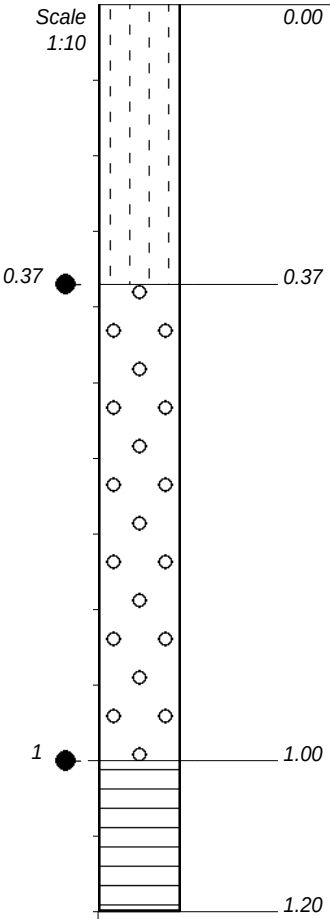
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP20
Sheet 1 of 1

JOB NUMBER: 000



Moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

Slightly Moist, light brown, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

Slightly weathered yellowish shale. **BEDROCK.**

NOTES

1) Roots inclusion from a depth of 0 - 0.2m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1.2 m
5) Disturbed sample taken at 0.37 - 1 m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1492m
X-COORD : 26°47'34,07"E
Y-COORD : 26°17'57,85"S

HOLE No: TP20

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

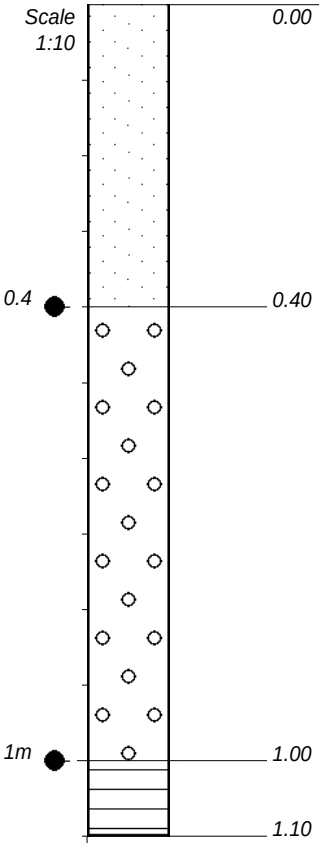
DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

dotPLOT

Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP21
Sheet 1 of 1

JOB NUMBER: 000



0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.40 Moist, light brown, intact, Medium dense, scattered fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

1.00 Slightly weathered light brown Shale. **BEDROCK.**

1.10

NOTES

1) Roots inclusion from a depth of 0 - 0.3m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1.1 m
5) Disturbed sample taken at 0.4 - 1m
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1482m
X-COORD : 26°47'34,77"E
Y-COORD : 26°18'19,55"S

HOLE No: TP21

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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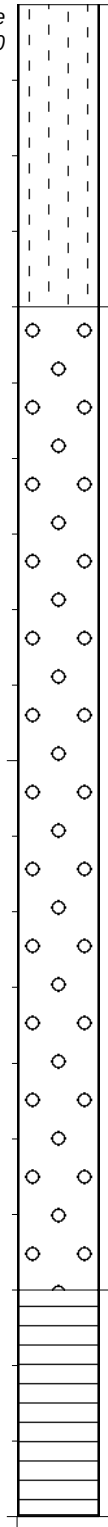
Phase 1 Near surface geotechnical investigation

HOLE No: TP22
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:10



0.00 Moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

0.40 Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

1.70 Slightly weathered light brown shale. **BEDROCK.**

2.00

NOTES

1) Stable side walls
2) No water seepage encountered
3) Refusal encountered at 2 m
4) No Disturbed sample taken
5) No Undisturbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1484m
X-COORD : 26°47'41,65"E
Y-COORD : 26°18'18,30"S

HOLE No: TP22

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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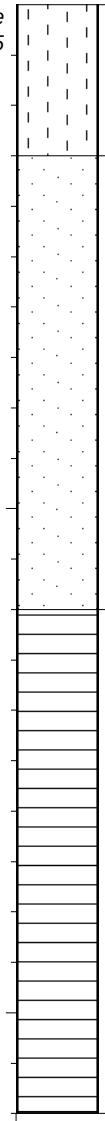
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP23
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:15



0.00 Moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

0.30 Slightly moist to moist, light brown, intact, Medium dense, scattered fragments of shale, Sandy clay. **RESIDUAL SOIL.**

1.20 Slightly weathered light brown shale. **BEDROCK.**

2.20

NOTES

1) Roots inclusion from a depth of 0 - 0.4m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 2.2 m
5) No Disturbed sample taken
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1490m
X-COORD : 26°47'39,76"E
Y-COORD : 26°18'13,61"S

HOLE No: TP23

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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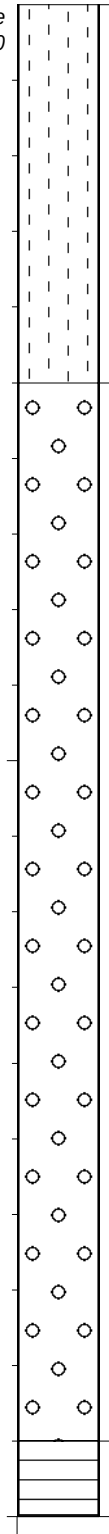
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP24
Sheet 1 of 1

JOB NUMBER: 000



0.00 Moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

0.50 Moist, light brown, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clayey. **RESIDUAL SOIL.**

1.90 Slightly weathered yellowish shale. **BEDROCK.**

2.00

NOTES

1) Roots inclusion from a depth of 0 - 0.45m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 2 m
5) No Disturbed sample taken
6) No Undisturbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1490m
X-COORD : 26°47'34,02"E
Y-COORD : 26°18'14,67"S

HOLE No: TP24

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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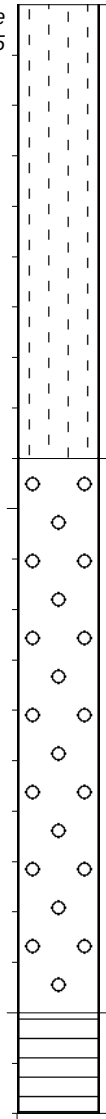
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP25
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:15



0.00 Moist, dark brown, intact, Loose, Silty clay. **TOPSOIL.**

0.90 Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

2.00 Slightly weathered light brown shale. **BEDROCK.**

2.20

NOTES

1) Roots inclusion from a depth of 0 - 0.4m
2) Stable side walls
3) No water seepage encountered
4) No refusal encountered at 2.2 m
5) No Disturbed sample taken
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1486m
X-COORD : 26°47'27,39"E
Y-COORD : 26°18'19,99"S

HOLE No: TP25

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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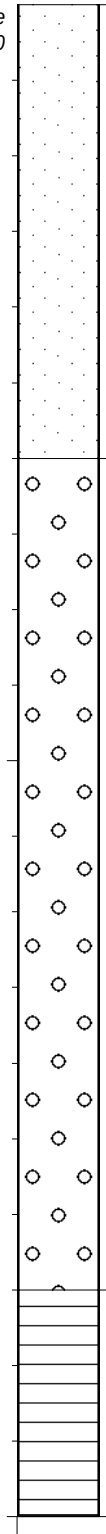
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP26
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:10



0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.60 Slightly moist, light brown, intact, Medium dense, scattered sub-angular fragments of shale, Gravelly clay. **RESIDUAL SOIL.**

1.70 Slightly weathered light brown shale. **BEDROCK.**

2.00

NOTES

1) Roots inclusion from a depth of 0 - 0.45m
2) Stable side walls
3) No water seepage encountered
4) No refusal encountered at 2.0 m
5) No Disturbed sample taken
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1490m
X-COORD : 26°47'18,92"E
Y-COORD : 26°18'25,92"S

HOLE No: TP26

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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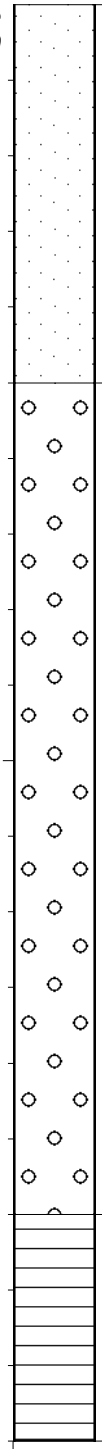
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP27
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:10



0.00 Slightly moist, brownish, Loose, intact, Sandy clayey. **TOPSOIL.**

0.50 Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

1.60 Slightly weathered yellowish Shale. **BEDROCK.**

1.90

NOTES

1) Roots inclusion from a depth of 0 - 0.46m
2) Stable side walls
3) No water seepage encountered
4) No refusal encountered at 2.8 m
5) No Disturbed sample taken
6) No Undisturbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1490m
X-COORD : 26°47'26,99"E
Y-COORD : 26°18'25,20"S

HOLE No: TP27

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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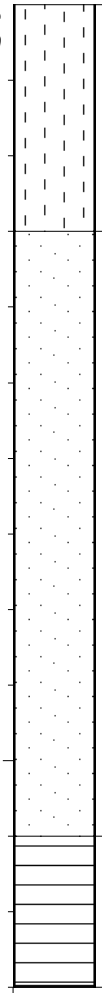
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP28
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:10



0.00 Slightly moist, brownish, Loose, intact, Silty clayey. **TOPSOIL.**

0.30 Moist, dark brown, intact, Medium dense, scattered fragments of shale Sandy gravelly clay. **RESIDUAL SOIL.**

1.10 Slightly weathered yellowish Shale. **BEDROCK.**

1.30

NOTES

1) Roots inclusion from a depth of 0 - 0.5m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1.3 m
5) No Disturbed sample taken
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1486m
X-COORD : 26°47'32,07"E
Y-COORD : 26°18'27,54"S

HOLE No: TP28

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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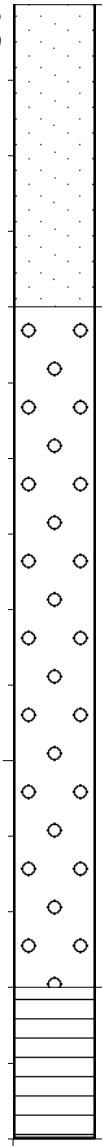
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP29
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:10



0.00 Slightly moist, dark brown, intact, Sandy silty clay. **TOPSOIL.**

0.40 Moist, greyish, intact, Medium dense, scattered fragments of shale Gravelly sandy clay. **RESIDUAL SOIL.**

1.30 Slightly weathered light brown shale. **BEDROCK.**

1.50

NOTES

1) Roots inclusion from a depth of 0 - 0.4m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1.5 m
5) No Disturbed sample taken
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1487m
X-COORD : 26°47'35,06"E
Y-COORD : 26°18'23,58"S

HOLE No: TP29

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

dotPLOT 7022

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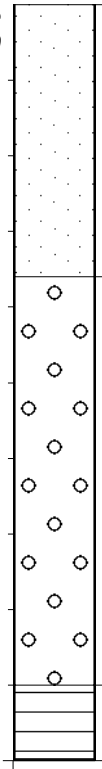
Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

HOLE No: TP30
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:10



0.00 Slightly moist, brownish, intact, loose, Sandy silty clay. **TOPSOIL.**

0.36 Slightly moist, light brown, intact, Medium dense, subrounded scattered nodules, Gravelly clay. **FERRICRETE.**

0.90 Slightly weathered light brown shale. **BEDROCK.**

1.00

NOTES

1) Roots inclusion from a depth of 0 - 0.3m
2) Stable side walls
3) No water seepage encountered
4) Refusal encountered at 1 m
5) No Disturbed sample taken
6) No Unditurbed sample taken

CONTRACTOR :
MACHINE : Tractor Loader Backhoe (TLB).
DRILLED BY :
PROFILED BY : Mavhetha Lavhelesani

INCLINATION :
DIAM : 0.7 m
DATE :
DATE : 08/05/2021

ELEVATION : 1493m
X-COORD : 26°47'38,90"E
Y-COORD : 26°18'20,30"S

HOLE No: TP30

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

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Nkanivo Development Consultant
Phase 1 Near surface geotechnical investigation

LEGEND
Sheet 1 of 1

JOB NUMBER: 000

	GRAVELLY	{SA03}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
	SHALE	{SA12}
Name ●	DISTURBED SAMPLE	{SA38}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

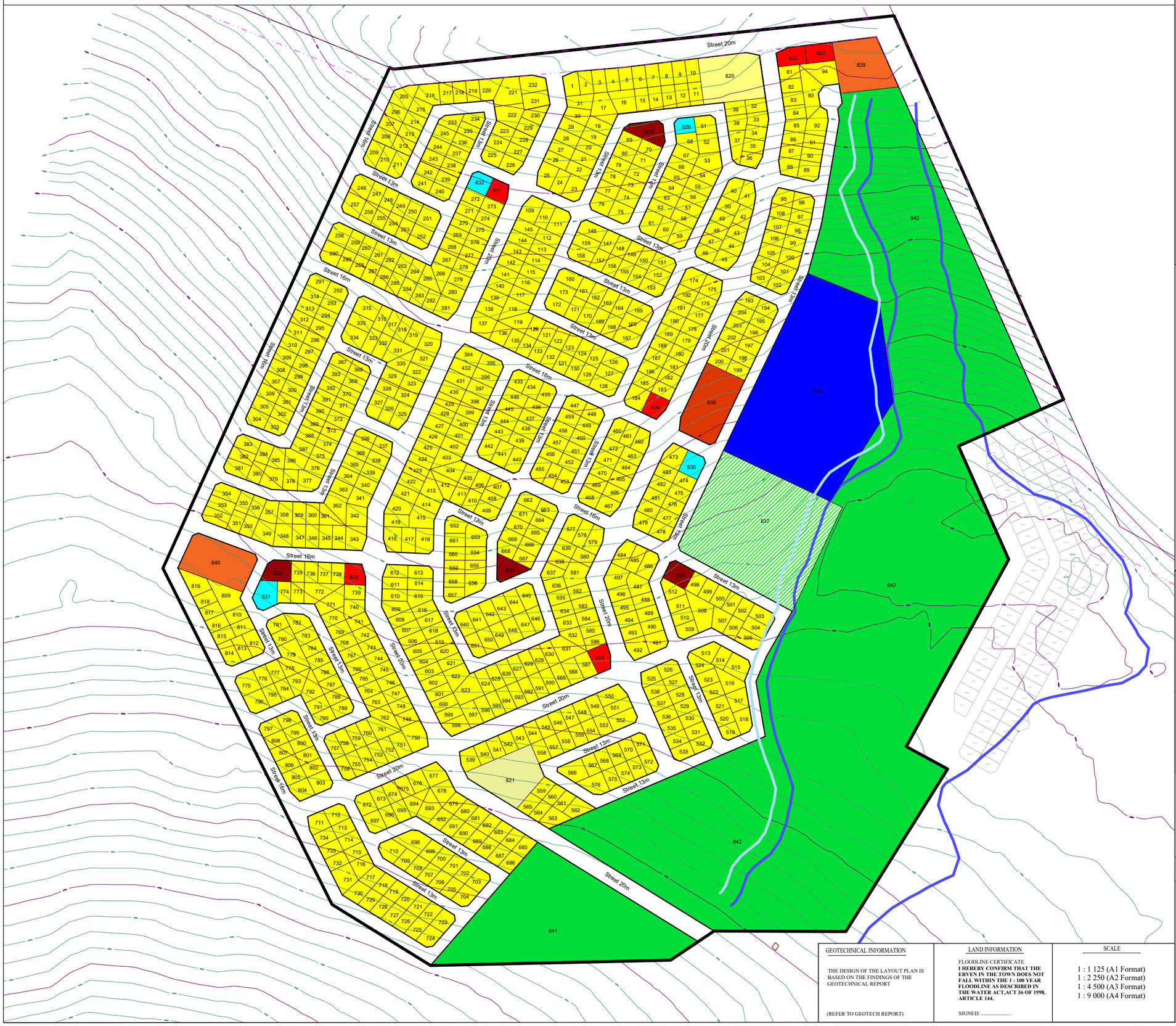
ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : Mavhetha Lavhelesani
SETUP FILE : STANDARD.SET

DATE : 24/05/2021 12:35
TEXT : ..00\Examples\Examples.TXT

LEGEND
SUMMARY OF SYMBOLS

17. APPENDIX D: SITE LAYOUT PLAN



PROPOSED TSHING EXTENSION 11 TOWNSHIP

PORTION 3 OF THE FARM DOORNPAN 193 IP

LOCALITY MAP

ZONING	LAND USES	ERVEN	TOTAL ERVEN	AREA (HA)	AREA (%)	NOTATION
RESIDENTIAL 1	DWELLING UNIT	1-819	819	36.76	41.56	🟨
RESIDENTIAL 2	FLATS/GROUPS UNITS	820-821	2	0.82	0.93	🟨
BUSINESS 1	COMMERCIAL USE	822-827	6	0.40	0.45	🟥
INSTITUTIONAL	SCHOOL	828	1	3.29	3.71	🟦
INSTITUTIONAL	CRECHE	829-832	4	0.25	0.32	🟦
INSTITUTIONAL	PUBLIC WORSHIP	833-836	4	0.31	0.35	🟥
RECREATIONAL	SPORTS CENTRE	837	1	1.93	2.18	▨
GOVERNMENT	CLINIC	838	1	0.42	0.47	🟧
MUNICIPAL	MUNICIPAL PURPOSES	839-840	2	0.76	0.86	🟧
PUBLIC OPEN SPACE	P.O.S	841-842	2	22.59	25.53	🟩
STREET				20.93	23.66	
TOTAL DEVELOPABLE AREA			842	88.46	100%	

NOTES:

1. ▬ Represents Proposed Township Boundary.
2. All areas and distances are approximate and subject to final survey
3. Average stand size is 400 m
4. Street width 20m, 16m and 13 m
5. ▬ Represents the 1: 100 Year Floodline
6. — · · — Represents a registered servitude
7. ▬ Represents the 20m Buffer

SURVEY NOTES:

CONTOUR INTERVALS 1 M IN ACCORDANCE TO REG. .....ORDINANCE ....
SURVEYOR GENERAL
SYSTEM WGS 84

CLIENT:

JB MARKS LOCAL MUNICIPALITY

CONSULTANTS	NAME	SIGNATURE
TOWN PLANNER (NKANIVO DEVELOPMENT CONSULTANTS)		
FLOOD LINE ENGINEER (-)		
LAND SURVEYOR (WINDUS M & ASSOCIATES SURVEYS)		
CONSULTING ENGINEER (DALIMEDE PROJECTS (PTY) LTD)		
GEOTECHNICAL ENGINEER (SOILKRAFT CC)		

DESIGNED: NYIKO BALOYI
CHECKED: SAMUEL CHAUKE
Tech.Pln (-)
DRAWING No: 2021- 001
DATE: 04/08/2021

COMPILED BY:

GEOTECHNICAL INFORMATION	LAND INFORMATION	SCALE
THE DESIGN OF THE LAYOUT PLAN IS BASED ON THE FINDINGS OF THE GEOTECHNICAL REPORT (REFER TO GEOTECH REPORT)	FLOODLINE CERTIFICATE **I HEREBY CONFIRM THAT THE ERVEN IN THE TOWN DOES NOT FALL WITHIN THE 1 : 100 YEAR FLOODLINE AS DESCRIBED IN THE WATER ACT,ACT 36 OF 1998, ARTICLE 144.** SIGNED:	1 : 1 125 (A1 Format) 1 : 2 250 (A2 Format) 1 : 4 500 (A3 Format) 1 : 9 000 (A4 Format)

CELL : 083 277 7347
TELL : 012 807 7445
eMail : info@nkanivo.co.za

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Unit 79, Block 5, Lombardy Business Park
66 Graham Road
Pretoria 0084