REPORT ON THE GEOTECHNICAL INVESTIGATION CARRIED OUT ON PORTIONS 337 & 338 OF THE FARM ELANDSHEUVEL NO 402-IP KLERKSDORP - NORTH WEST PROVINCE

Requested by:

MAXIM PLANNING SOLUTIONS (PTY) LTD

Detail reporting stage

Report by:

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1. INTRODUCTION

Geo Simplicity Geotechnical Engineering (Pty) Ltd was appointed to carry out a geotechnical investigation for the proposed subdivision of Portions 337 & 338 of the Farm Elandsheuvel No 402-IP, Klerksdorp - North West Province.

At the time of our fieldwork, the site was mainly covered by Savannah grassland and some scattered trees and shrubs.

The investigation was carried out at the request of Mr Johannes Benadé, representing our Client, Messrs Maxim Planning Solutions (Pty) Ltd.

Permission to proceed with the geotechnical investigation was granted via email and the fieldwork was carried out on 27 January 2022.

The samples for laboratory testing were handed over to Messrs Roadlab (Pty) Ltd for physical and chemical testing.

2. PURPOSE OF THE INVESTIGATION

The purpose of the geotechnical investigation is to:

- Establish the engineering properties of the soils and rock underlying the site, encountered during our fieldwork.
- Confirm the soil/rock horizons encountered during our fieldwork in accordance with standard practice.
- Identify any potential problem soils which may contribute to differential settlement and/or heave.
- Determine the allowable bearing capacity and settlement characteristics of the in-situ soils and/or rock.
- Determine excavatability within the in-situ materials.
- Confirm near surface groundwater occurrence and associated expected flow rates for dewatering purposes.
- Assess and provide recommendations with regards to slope stability.
- Provide recommendations with regards to the in-situ soils' corrosiveness.
- Provide the site class designation in accordance with the NHBRC.
- Put forward recommendations with regards to the founding of the proposed single and double storey structures.
- Provide an indication of the in-situ material's re-use potential with specific reference to bulk backfilling and pavement layers for access roads and parking pavements.

3. METHOD OF INVESTIGATION

3.1 *Digging of test holes and soil profiling*

In total, 15No representative test holes were dug as such not to damage any known underground services, and where it was safe and accessible to carry out our fieldwork.

The test holes were dug by means of a CAT 422E Tractor Loader & Backactor (TLB) supplied by Tigani Plant Hire located in Klerksdorp.

The machine was in an excellent working condition with no mechanical problems to be reported, allowing effective advance to its digging refusal which occurred within VERY SOFT ROCK TO SOFT ROCK AND HARDER, hardpan fully developed ferricrete - pedogenic or *very dense*, residual quartz porphyry, or to its maximum digging reach which were established to be between 2,5m and 3,0m below Ground Level at Geotechnical Investigation (GLG) stage, pending on the machine's orientation during digging.

The soil was profiled in-situ and it was carried out in accordance with the "Revised Guide to Soil Profiling for Civil Engineering Purposes in S.A." by Jennings, Brink and Williams, immediately after digging thereof by a professionally registered geotechnical engineer.

From a safety precautionary measure point of view, all test holes were thoroughly backfilled immediately after profiling was completed.

The test hole position locality plan (Figure 1: Test hole positions) is included in Annexure A of the report.

3.2 *Sampling and laboratory testing*

In total, 9No representative samples of the in-situ material were taken for laboratory testing.

The inherent poor in-situ soil consistency of the upper alluvium transported horizon, the occurrence of abundant scattered grass roots and/or gravel and larger sized material fragments, as well as ferricrete nodules in profile, made undisturbed sampling impossible.

However, sufficient visual information was gathered during soil profiling to carry out our assessment and to provide recommendations accordingly.

The following laboratory testing was carries out:

- 9No x Foundation Indicator Tests, which comprises of Atterberg Limits, dry and wet grading analysis (sieve analysis and hydrometer testing, respectively),
- 7No x pH and Conductivity Tests.

The purpose for requesting these tests to be carried out on representative samples are as follows:

- Foundation indicator testing: To provide basic classification of the soils in terms of potential expansiveness and to predict their re-use potential for backfill, and possibly, for pavement construction purposes.
- Chemical soil aggressiveness testing: To determine the proneness of the in-situ material to corrosivity with specific reference to underground services (stormwater, water reticulation and sewer pipes and electrical cables).

The laboratory test results are included in Annexure C of the report.

4. GEOLOGY AND GENERALIZED SOIL PROFILE

According to the 1:250 000 West Rand 2626 geological map, the site is underlain by Quartz Feldspar Porphyry of the Makwassie Formation, Platberg Group, Ventersdorp Supergroup and bordered by thick alluvium transported soils.

Alluvium transported, followed by a pedogenic horizon, in the form of partly and/or fully developed ferricrete, is generally underlain by residual quartz porphyry granular material over the largest portion of the site. However, no residual soils were encountered over the remaining, south western section of the site.

Quartz porphyry bedrock was however not encountered within full TLB excavation reach.

The regional geology of the site and surrounding area, together with the various soil horizons encountered during profiling are illustrated in the figure included in Annexure A and summarized in the following table, respectively.

The detailed material horizons, with specific reference to moisture content, colour, soil consistency, structure, soil type and origin are summarized in the comprehensive test hole profiles forming part of this report - see Annexure B.

The test hole photographs are attached (see Annexure D) to the report.

5. DISCUSSION AND RECOMMENDATIONS

5.1 *Topography and drainage*

The site under consideration generally falls slightly from the north to the south with an estimated slope in the order of 2%.

Therefore, at the time of our fieldwork, adequate surface water run-off with a very high probability of sporadic ponding is expected to occur on site during downpours.

It is therefore advisable that all new structural platforms be adequately shaped and drainage paths introduced in order to assist channelling of surface water run-off and to contribute towards the internal stability of structures.

5.2 *Mode of weathering*

The weathering products of rock depend mainly on the rock forming minerals (parent material), the climatic conditions under which they had formed and the time of exposure to weathering processes.

In arid conditions, the weathering of rock results mainly from mechanical disintegration through wind erosion and temperature changes. The resultant soil consists mainly of the original rock forming minerals without significant changes that have taken place of the mineral composition.

In warm humid conditions chemical decomposition is the dominant mode of weathering which may change the original rock forming minerals into secondary minerals within the zone of weathering. Minerals in this zone react with water, oxygen and carbon dioxide at atmospheric pressures to produce residual soils. The residual soils produced are a mixture of resistant primary minerals such as quartz, insoluble weathering products such as alumina or silica and new or secondary minerals such as clays. It may also contain soluble products such as chloride, sulphate and bicarbonate of sodium, potassium, magnesium, or calcium, which may subsequently be leached out.

Climate does not only determine the mode of weathering which is likely to take place, but also the rate of weathering. The effect of climate on the weathering process (i.e. soil formation) is determined by the climatic N-value defined by Weinert. A climatic N-value of > 5, is associated with arid regions, where mechanical disintegration is the predominant rock weathering mode and an N-value of < 5 is associated with the humid warm areas and a surplus of water, where chemical decomposition is the predominant rock weathering mode.

The climatic N-value of the site is approximately < 5, therefore chemical decomposition rather than mechanical disintegration of the parent rocks is deemed the principal mode of weathering.

5.3 *Problem soils*

5.3.1 *Collapse potential*

A collapsible grain structure was **not** noted in any of the material horizons encountered on site.

Therefore, no problems associated with collapse potential are foreseen for this development.

Soil description	Depth ranges encountered in test holes (m)														
	TH 01	TH 02	TH 03	TH 04	TH 05	TH 06	TH 07	TH 08	TH 09	TH 10	TH 11	TH 12	TH 13	TH 14	TH 15
Highly organic, sacrificial transported.	-	-	-	-	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1	0,0-0,1
Ranging between moist and very moist to wet, dark olive-brown or dark yellow and olive-brown in places, *massive*, fine to medium grained silty SAND with abundant scattered grass roots in profile. Alluvium transported.	0,0-0,9 *Loose* P = -	-	0,0-0,3 *Loose* P = -	-	-	-	-	-	-	0,1-0,3 *Loose* P = -	-	0,1-0,4 *Loose* P = -	0,1-0,3 *Loose* P = -	0,1-0,5 *Loose* P = -	0,1-0,5 *Loose* P = -
Ranging between slightly moist to moist and very moist to wet, light olive-brown, speckled black, *slightly ferruginous*, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile. Alluvium transported.	-	0,0-0,3 *Loose* P = -	0,3-0,6 *Loose to medium dense* P = +	0,0-0,1 *Loose to medium dense* P = -	0,1-0,3 *Loose to medium dense* P = -	0,1-0,3 *Loose to medium dense* P = -	0,1-0,3 *Loose to medium dense* P = +	0,1-0,3 *Loose to medium dense* P = -	0,1-0,3 *Loose to medium dense* P = -	0,3-0,6 *Loose* P = -	0,1-0,4 *Loose* P = -	0,4-0,7 *Loose* P = +	0,3-0,6 *Loose* P = -	0,5-1,1 *Loose* P = -	0,5-1,1 *Loose* P = -
Ranging between very moist and wet, dark yellow and orange-brown or olive-brown in places, speckled black and/or orange, *highly ferruginous*, fine to medium grained GRAVEL and highly weathered ferricrete nodules (with frequent scattered unweathered, extremely hard rock boulders (up to 1.1m dia) - TH08) in a fine to medium grained silty sand matrix. Partly developed ferricrete - pedogenic.	0,9-1,6 *Medium dense to dense* P = 100kPa	-	0,6-0,9 *Loose to medium dense* P = <30kPa 0,9-1,6 *Dense to very dense* P = 200kPa	0,1-0,7 *Medium dense to dense* P = 100kPa	0,3-0,65 *Medium dense to dense* P = 100kPa	0,3-0,6 *Loose to medium dense* P = <30kPa 0,6-1,0 *Dense to very dense* P = 200kPa	-	0,3-0,9 *Medium dense to dense* P = 100kPa	0,3-0,65 *Very dense* P = 100kPa	-	0,4-0,7 *Loose* P = - 0,7-1,0 *Dense to very dense* P = 100kPa	-	-	-	-
Moist to very moist, dark yellow-orange, speckled black, *slightly ferruginous*, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules and abundant scattered unweathered, extremely hard rock cobbles and small boulders (up to 0.3m dia) in places. Partly developed ferricrete - pedogenic.	-	-	-	-	-	-	-	-	-	0,6-2,5+ *Dense to very dense* P = 200kPa	-	0,7-1,5 *Dense* P = 60kPa 1,5-2,6+ *Medium dense* P = 60kPa	0,6-2,5+ *Dense to very dense* P = 200kPa	1,1-2,6+ *Medium dense* P = 60kPa	1,1-2,6+ *Medium dense* P = 60kPa
Ranging between slightly moist and wet, dark yellow and orange-brown, speckled black, *highly cemented and ferruginous*, RANGING BETWEEN VERY SOFT ROCK TO SOFT ROCK AND MEDIUM HARD ROCK HARDPAN with frequent scattered unweathered, very hard rock cobbles and boulders (up to 500mm dia) in profile. Fully developed ferricrete - pedogenic.	-	0,3-0,45+ *HARDPAN* P = 300kPa[1]	-	0,7-1,3+ *HARDPAN* P = 250kPa[1]	0,65-0,85+ *HARDPAN* P = 300kPa[1]	-	0,3-1,1 *HARDPAN* P = 100kPa	-	-	-	-	-	-	-	-
Very moist, dark yellow and orange-brown, speckled black, *highly ferruginous*, fine to medium grained GRAVEL and highly weathered ferricrete nodules with frequent scattered unweathered, extremely hard rock cobbles and boulders (up to 350mm dia) in a fine to medium grained silty sand matrix. Pebblemarker transported.	1,6-1,9 *Dense* P = 120kPa	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranging between very moist and wet, light beige-brown speckled black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL. Residual quartz porphyry.	1,9-3,0+ *Dense to very dense* P = 200kPa	-	1,6-2,3+ *Very dense* P = 250kPa	-	-	1,0-1,5+ *Very dense* P = 250kPa	1,1-1,6 *Medium dense to dense* P = 100kPa 1,6-2,5+ *Dense to very dense* P = 200kPa	0,9-1,1 *Medium dense to dense* P = 100kPa 1,1-1,7 *Dense* P = 150kPa 1,7-2,6+ *Dense to very dense* P = 200kPa	0,65-0,8 *Medium dense to dense* P = 100kPa 0,8-1,7 *Dense* P = 150kPa 1,7-2,6+ *Dense to very dense* P = 200kPa	-	1,0-1,7 *Medium dense to dense* P = 100kPa 1,7-2,6+ *Dense to very dense* P = 200kPa	-	-	-	-

Note:

P = Predicted allowable bearing capacity (total settlement < 10mm) of soil layer should conventional shallow foundations be considered (kPa)

[1] = Bearing capacity to be confirmed during construction by means of trenchexcavator test pitting to confirm hardpan thickness - see clauses 5.3.2 and 5.9.1 of report.

Summary of soil horizons encountered

5.3.2 *Compressibility and settlement*

When considering the behaviour of the in-situ soils, in terms of compressibility and associated potential settlement at *conventional, near surface shallow foundation elevation*, the following criteria needs to be considered:

- Bulk earthworks (cut/fill scenario) vs structural founding level/s.
- The structural column loads and associated bearing pressures for near surface founding purposes. Allowable bearing capacity requirements, ranging between 50kPa and 80kPa for the planned single and doubles storey structures, respectively, typically founded on conventional reinforced concrete shallow strip foundations, were used in our settlement analysis.
- The influence of the in-situ moisture content on the in-situ allowable bearing capacity and settlement of the different soil layers, especially when an increased in-situ moisture content and degree of saturation occur during the rainy season for instance.
- The consistency and structure of the in-situ soils in relation to the in-situ allowable bearing capacity and settlement of the different soil layers. Both parameters provides an indication of the material's inherent stiffness and associated strength.

At time of reporting nominal cut to fill operations associated with conventional platform preparation were planned for the stand.

Generally, intolerable settlement is expected to occur should conventional shallow foundations be placed within the alluvium transported soils, as well as the pebblemaker transported, partly developed ferricrete, pedogenic and residual quartz porphyry layers with *continuous* in-situ soil consistency of *less than medium dense and medium dense to dense*, should the allowable bearing capacity requirements of 50kPa and 80kPa be considered, respectively.

Shallow foundations may be placed within *continuous* VERY SOFT ROCK AND HARDER, fully developed ferricrete, pedogenic.

However, the thickness, degree of ferruginization and associated stiffness of the fully developed ferricrete, pedogenic horizon varies significantly across the site, both in the horizontal and vertical plane, where encountered.

Therefore, we strongly recommend that continuous VERY SOFT ROCK AND HARDER HARDPAN, fully developed ferricrete - pedogenic must due diligently be confirmed during the construction stage by means of traxcavator (25t excavator minimum) confirmation test pitting should these layers be considered as founding media and we hold ourselves to assist in this regard. Unknown and unforeseen potentially compressible horizons, possibly in the form of weaker residual quartz porphyry layers, may be encountered below a non-suspected thin, superficial hardpan ferricrete horizon.

The following table provides an indication of the minimum expected founding depths in relation to the allowable bearing capacity requirements of 50kPa and 80kPa, should conventional reinforced concrete shallow strip foundations in relation to the different soil horizons encountered during our fieldwork, be considered:

Test hole	Depth to founding (m)	
	$P_{Required}$ = 50kPa	$P_{Required}$ = 80kPa
TH01	0,9	0,9
TH02	0,3[1]	0,3[1]
TH03	0,9	0,9
TH04	0,1	0,1
TH05	0,3	0,3
TH06	0,6	0,6
TH07	0,3[1]	0,3[1]
TH08	0,3	0,3

Test hole	Depth to founding (m)	
	$P_{Required}$ = 50kPa	$P_{Required}$ = 80kPa
TH09	0,3	0,3
TH10	0,6	0,6
TH11	0,7	0,7
TH12	0,7	NE
TH13	0,6	0,6
TH14	1,1	NE
TH15	1,1	NE

$P_{Required}$ = Predicted Allowable bearing capacity required (kPa)

[1] = Bearing capacity to be confirmed during construction by means of traxcavator test pitting

NE = Not encountered within full TLB excavation depth

Recommended minimum conventional founding depths within untreated soils

No problems are foreseen with regards to intolerable settlement (differential settlement > 10mm), should our founding recommendations, noted under clause 5.9.1 & 5.9.2, be employed.

The predicted allowable bearing capacities of all the material horizons are provided within the detailed soil profiles annexed to the report - refer to Annexure B.

5.3.3 *Potential Expansiveness*

The laboratory test results of all soils encountered during profiling, indicate that the Plasticity Index (PI) of representative samples range between 2% and 16% with the PI of the whole sample (P_{whole} = PI x Percentage <0,425mm) of representative soil samples being calculated to vary between 0,6% and 10,1% and the associated percentage clay (%Clay) tested to vary between 2,8% and 7,4%.

According to Van der Merwe (1964) these material layers has a "Low" potential for swell and are not considered to be or potential expansive.

Therefore, no problems associated with potential heave/expansiveness are foreseen for this site.

5.4 *Groundwater*

Groundwater seepage, ranging from localized pinhole seepage to strong groundwater flow occurred in 60% of the test holes dug with groundwater standing between 100mm and 300mm in test holes, 30 minutes after digging was completed. Reference should be made to our detailed soil profiles, included in Annexure B of the report, for further details with regards to groundwater seepage.

Notwithstanding the TLB related fieldwork being carried out towards the middle of the rainy season (27 January 2022), a perched groundwater table may occur at the contact of weaker and more competent material horizons with depth, and especially during or towards the end of more profound rainy season.

In addition, ferruginization was noted in profile within the majority of material horizons encountered, which indicates a fluctuating groundwater table occurrence in the historical past.

We therefore recommend that proper surface run-off and subsurface drainage including damp proofing form part of the permanent works.

5.5 *Excavatibility*

The table following on the next page summarizes what we believe can be taken as the different classes of excavation in accordance with SANS 1200D: Earthworks, should the information gathered during test pitting be considered as a guideline.

In addition, very dense (almost bordering very soft rock hardness), residual quartz porphyry resulted in TLB refusal in test holes TH03 and TH06 and is expected to grade abruptly into medium hard rock and harder, quartz porphyry bedrock with depth, where encountered.

HARDPAN, fully developed ferricrete, pedogenic is expected to occur randomly across the site, and pending the degree of ferruginization and cementation, may be very difficult to penetrate indeed.

In test holes TH01, TH04, TH08, TH14 and TH015, numerous cobbles and boulders were encountered within the depth ranges shown above and is expected to occur elsewhere on the site.

Therefore, adequate (extra over) allowances for the effective removal of material representing **"Intermediate"**, **"Hard"** and **"Boulder class A & B"** excavation categories should be allowed for bulk earthworks budget purposes.

Insofar excavation within **"Hard"** material is concerned, excavation by means of power tools, such as seismic pneumatic rock breaker attached to a 25t traxcavator for instance, should be considered

as a minimum. Pre-splitting and controlled blasting may prove to be more economical when larger quantities need to be removed.

	Depth range in test holes in relation to GGL (m)				
Test position	Soft excavation	Intermediate excavation	Hard excavation	Boulder A (>40% of excavation volume)	Boulder B (<40% of excavation volume)
TH01	0,0-1,6; 1,9-3,0	NE	NE	1,6-1,9	NE
TH02	0,0-0,3	0,3-0,45+	0,3-0,45+	NE	NE
TH03	0,0-2,3	NE	NE	NE	NE
TH04	0,0-0,7	1,3+	NE	0,7-1,3	NE
TH05	0,0-0,65	0,65-0,85+	0,65-0,85+	NE	NE
TH06	0,0-1,5	NE	NE	NE	NE
TH07	0,0-2,5	NE	NE	NE	NE
TH08	0,0-0,3; 0,9-2,6	NE	NE	0,3-0,9	NE
TH09	0,0-2,6	NE	NE	NE	NE
TH10	0,0-2,5	NE	NE	NE	NE
TH11	0,0-2,6	NE	NE	NE	NE
TH12	0,0-2,6	NE	NE	NE	NE
TH13	0,0-2,5	NE	NE	NE	NE
TH14	0,0-2,3	NE	NE	2,3-2,6	NE
TH15	0,0-2,3	NE	NE	2,3-2,6	NE

Note: NE = Not encountered within test holes

Potential excavation categories encountered during test pitting

Excavation by means of 25t traxcavator should be allowed for bulk earthworks purposes for the effective digging advance within **"Boulder class A & B"** and **"Intermediate"** categories.

5.6 *Slope stability*

In test holes TH01, TH04, TH08, TH14 and TH015, numerous cobbles and boulders were encountered within the depth ranges shown above and is expected to occur elsewhere on the site. Localised sidewall collapse occurred where the bouldery material were encountered. Therefore, unsupported vertical or near vertical excavations should not be considered within the bouldery profile at all.

In addition, groundwater seepage, ranging from localized pinhole seepage to strong groundwater flow were noted in 60% of the test holes dug. Saturated conditions negatively impact the stability of sidewalls, which generally result in flatter sidewall slopes to be implemented to allow safe working conditions.

Therefore, sidewall stability can worsen drastically if water is to be encountered in excavations, albeit in the form of a perched water table and associated groundwater seepage, damaged water pipe or poor surface water run-off management which may result in water to accidently be draining into excavations during construction.

Therefore, excavation sides from GLG where bouldery material occur or deeper than 1m in the remaining areas must either be battered back to 1:1,5 (vertical:horizontal) or shored; allowing safe working conditions for workers in these excavations.

No deep *vertical* excavations are foreseen for this development. Composite lateral support systems may be considered where deeper vertical and near vertical excavations are required, or where space restrictions prohibit battered back sloping for instance.

Design parameters for these composite lateral support systems will be provided on request, if required.

5.7 *Soil aggressiveness and corrosivity*

The pH and conductivity of soil is generally determined to get an indication of the potential corrosiveness of the soil. The pH of a soil gives an indication of the acidity of the soil. As a general guideline Evans [6.8] notes that corrosion may take place in soil with a pH of less than 6 and that should the pH be less than 4.5, the problem may be serious. It should however be borne in mind that a low pH value is not necessarily an indication of serious corrosiveness as the pH of the surrounding soil will generally start to rise as soon as corrosion starts.

Should one view the pH values only of the 7No samples tested (pH ranges between 5.14 and 7.82), then some of the in-situ soils appear to be prone towards corrosivity.

However, corrosion is an electrochemical process whereby metals are changed and electrical energy is released. The conductivity of the soil therefore has a profound influence on the rate of corrosion of buried metallic objects.

Duligal [6.9] provides the following table for evaluation of the conductivity of soil:

Soil conductivity (mS/m)	Corrosion classification
More than 50	Extremely corrosive
26 - 50	Very corrosive
21 - 25	Corrosive
10 - 20	Mildly corrosive
Less than 10	Not generally corrosive

The soil corrosion classification can be summarized as follows:

Soil origin	Soil conductivity (mS/m)	Corrosion classification
Alluvium transported	10 - 39	Ranging between generally non-corrosive to being very corrosive
Partly developed ferricrete, pedogenic	26 - 159	Ranging between corrosive to being extremely corrosive
Fully developed ferricrete, pedogenic	8	Generally non-corrosive
Residual quartz porphyry	86	Extremely corrosive

We strongly recommend that a **"Very severe"** exposure condition rather be adopted as a minimum for concrete placed within the in-situ horizons encountered all in accordance with SANS 1200G: Concrete (Structural), especially should the variable degree of corrosivity and the expected fluctuating perched groundwater table be considered.

In addition, subsurface services (non-concrete) should be treated/sleeved to prevent possible damages due to corrosion.

According to SANS 1200G: Concrete (Structural), concrete used for foundations of structures within potentially aggressive soils should have the following minimum concrete cover and maximum water:cement ratio's:

Exposure conditions	Specified strength of concrete (MPa)					Minimum cover for various exposure conditions (mm)
	20	25	30	40	50	
Mild	20	20	15	15	15	
Moderate	40	40	30	25	20	
Severe	NA	50	40	40	35	
Very severe	NA	75	60	60	50	

Type of structures	Exposure conditions			
	Mild	Moderate	Severe	Very severe
Thin sections, reinforced piles, all sections with less than 25mm cover to reinforcement	*	0.53	0.48	0.4
Moderate sections, retaining walls, piers, beams	*	*	0.53	0.43
Exterior portions of mass concrete	*	*	0.53	0.43
Concrete slabs laid on ground	*	0.53	0.48	*
Concrete protected from the weather, inside buildings, or in ground below frost level	*	*	*	*
* In these cases the ratio will be based on strength for workability required				

The soil aggressiveness and corrosivity laboratory test results are included in Annexure C to the report.

5.8 *Site class designation*

The site, from a geotechnical site class designation point of view, class as S1 / S2 / R(Random HARDPAN fully developed ferricrete, pedogenic) in accordance with the NHBRC classification system.

The S1 designation applies to single storey structures, whilst the S2 designation applies to double storey structures.

5.9 *Founding recommendations*

5.9.1 *Structural founding*

Insofar structural founding is concerned, one of the following options may be considered:

Conventional shallow pad foundations

Conventional shallow foundations must be placed within pebblemaker transported, partly developed ferricrete, pedogenic and residual quartz porphyry layers with *continuous* in-situ soil consistencies of *medium dense and better or medium dense to dense and better*, should the allowable bearing capacity requirements of 50kPa and 80kPa be considered, respectively.

Shallow foundations may be placed within *continuous* VERY SOFT ROCK AND HARDER, fully developed ferricrete, pedogenic.

However, the thickness, degree of ferruginization and associated stiffness of the fully developed ferricrete, pedogenic horizon varies significantly across the site, both in the horizontal and vertical plane, where encountered.

Therefore, we strongly recommend that continuous VERY SOFT ROCK AND HARDER HARDPAN, fully developed ferricrete - pedogenic must due diligently be confirmed during the construction stage by means of traxcavator (25t excavator minimum) confirmation test pitting should these layers be considered as founding media and we hold ourselves to assist in this regard. Unknown and unforeseen potentially compressible horizons, possibly in the form of weaker residual quartz

porphyry layers, may be encountered below a non-suspected thin, superficial hardpan ferricrete horizon.

The following table provides an indication of the minimum expected founding depths in relation to the allowable bearing capacity requirements of 50kPa and 80kPa, should conventional reinforced concrete shallow strip foundations in relation to the different soil horizons encountered during our fieldwork, be considered:

Test hole	Depth to founding (m)	
	$P_{Required}$ = 50kPa	$P_{Required}$ = 80kPa
TH01	0,9	0,9
TH02	0,3[1]	0,3[1]
TH03	0,9	0,9
TH04	0,1	0,1
TH05	0,3	0,3
TH06	0,6	0,6
TH07	0,3[1]	0,3[1]
TH08	0,3	0,3

Test hole	Depth to founding (m)	
	$P_{Required}$ = 50kPa	$P_{Required}$ = 80kPa
TH09	0,3	0,3
TH10	0,6	0,6
TH11	0,7	0,7
TH12	0,7	NE
TH13	0,6	0,6
TH14	1,1	NE
TH15	1,1	NE

$P_{Required}$ = Predicted Allowable bearing capacity required (kPa)

[1] = Bearing capacity to be confirmed during construction by means of traxcavator test pitting

NE = Not encountered within full TLB excavation depth

Recommended minimum conventional founding depths within untreated soils

The bottom of *all* foundation excavations must however be completely dry and free of any loose material.

The in-situ predicted allowable bearing capacities of all the material horizons are provided within the detailed soil profiles annexed to the report - refer to Annexure B.

We recommend that 0,8m wide (minimum) apron slabs or equivalent be constructed around the perimeter of all structures, purely as an attempt to prevent moisture content fluctuations at near surface level which may contribute towards differential movement and controlled stormwater drainage management.

Unfortunately, near surface economical (<1,1m) founding is not achievable across the site.

To accommodate weaker/inadequate near surface founding conditions noted across the site, an engineered fill combined with reinforced concrete shallow strip foundations may be considered where near surface conventional founding is not deemed economical, or bulk earthworks result in areas of fill for instance.

Engineered fill combined with conventional shallow foundations

An engineered soil mattress/fill, comprising of 150mm thick **G6 (minimum)** engineered layers and compacted to 95% of Mod AASHTO at the materials optimum moisture content, may be formed prior to reinforced concrete shallow foundation construction. The engineered fill may be constructed within shallow foundation excavations only, or complete covering structural footprints fully.

We strongly recommend that *all* soils within foundation excavations be removed up to the first occurrence of pebblemaker transported, pedogenic and residual quartz porphyry layers with *continuous* in-situ soil consistencies of *medium dense and better or medium dense to dense and better*, respectively, should the allowable bearing capacity requirements of 50kPa and 80kPa be considered for single and double storey structures, respectively, founded on reinforced concrete strip foundations, be considered.

In areas where near surface excavation to competent founding is not reached, a minimum engineered fill with thickness of 0,45m (3 x 150mm thick compacted layers) and 0,75m (5 x 150mm thick compacted layers) must be introduced for the single and double storey structures, respectively.

The material must then be replaced with the recommended **G6** compacted engineered fill layers. The engineered fill must be formed to at least an area 0,5m (minimum) larger than foundation dimensions, or 1m where engineered fill cover complete structural footprints.

In addition, the foundation beds must then be compacted to a minimum of preferably 95% of Mod AASHTO density (93% should 95% not be possible), prior to new engineered fill construction.

Where complete saturated soil conditions occur, rock fill pioneer material, comprising of unweathered to slightly weathered, medium hard rock and harder rock fragments (particle size up to 300mm in dimension), may be introduced and rolled in prior to engineered fill construction to prevent unwanted pumping of foundation beds during engineered fill preparation works.

Reinforced shallow pad foundations may then be formed atop the new engineered fill.

We recommend that 0,8m wide (minimum) apron slabs or equivalent be constructed around the perimeter of all structures, as noted above.

We strongly recommend that a competent person check and accept all foundation excavations and engineered fill construction related installation methodologies and we confirm our availability to assist in arriving at a working model in this regard, should it be requested.

5.9.2 *Surface bed, access road and parking areas*

The founding of surface beds where engineered fill are not introduced over full structural footprints, access roads and parking areas are summarized as follows:

- Clear and remove the upper sacrificial non-engineered fill say to 0,2m as a minimum.
- Rip the upper say 300mm (minimum) of in-situ soils and pre-collapse the remaining alluvium transported soils. The excavated surface should be thoroughly compacted to a minimum of 93% Mod AASHTO in-situ density to pre-consolidate these soils.

  We are of the opinion that a significant reduction in material volume will occur, once the in-situ soils have been compacted. Import from stockpile or commercial resources **G10 and better** material in 150mm thick and compacted to 93% of Mod AASHTO at optimum moisture content prior to selected layer/surface bed preparation level, if required. Where complete saturated soil conditions occur, rock fill pioneer material, as noted under clause 5.8.1, may be introduced and rolled in prior to engineered fill construction to prevent unwanted pumping of surface and road beds, should pumping of the in-situ material occur.
- Import **G7** quality natural soils/gravels and compact in 150mm thick engineered fill layers to 95% of Mod AASHTO at optimum moisture content for all surface bed preparation and selected road layer works construction purposes. A minimum of one layer for both surface bed preparation and selected road pavement construction purposes, should be considered.
- Pending the final E80 traffic design count, up to 2No x 150mm thick layer, comprising of **G5/G6** material stabilized to **C3** & **C4** for base and subbase quality material (if applicable), respectively, should be considered for road pavement construction purposes.
- Interlocking block paving surfacing should preferably be considered as final road and parking area surfacing.

5.10 *Re-use potential of the in-situ material*

The laboratory test results of the in-situ soils with their associated classification in accordance with TRH14, are summarized in the table following on the next page.

Based on the foundation indicator related laboratory test results, the alluvium transported and fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile, partly developed ferricrete - pedogenic, as encountered in test holes TH10 and TH12 to

TH15 class between **G9** and **>G10** material. Therefore, the in-situ material may only be considered for bulk backfilling, should quality control related laboratory testing results meet the minimum **G10** requirement for fill material specifically.

The fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix, partly developed ferricrete - pedogenic, as encountered in test holes TH01, TH03 to TH06, TH08, TH09 and TH11, class between **G7** and **G8** material and may be considered for bulk backfilling, as well as selected and engineered fill, should quality control related laboratory testing confirm the minimum **G7** specification requirement specifically.

Insofar the VERY SOFT ROCK AND HARDER HARDPAN, fully developed ferricrete, pedogenic and residual quartz porphyry are concerned, the material class between **G6** and **G7** material and may be considered for bulk backfilling, selected (G7) and possibly subbase (G6) layer road pavement construction, should quality control related laboratory testing confirm the minimum **G7 or G6** specification requirement, respectively.

All oversize and organic material must be removed prior to re-use though, where encountered.

All **G5,** shortfall **G6** and **G7** material will have to be imported from commercial resources, if required.

We strongly recommend that confirmation quality assurance testing be carried out to confirm the noted material classifications for construction stage purposes.

We trust that our report meets with your expectations. Should you wish to discuss the above in any further detail, please do not hesitate to contact the undersigned.

Yours faithfully,

Petrus van Straten
Pr Tech Eng, ECSA, NHBRC, BSc Hons (Applied Sciences) Geotechnical Engineering

Geo Simplicity Geotechnical Engineering (Pty) Ltd

Soil type and origin	TH No	DS No	Depth range (m):	Layer thickness (m)	GM	PI	%<0,425	PI_{whole}	%Clay	Heave class	TRH14	Soil aggressiveness		
												pH	Cond	Degree
Fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile. Alluvium transported.	TH02	DS1	0,0-0,3	0,30	1,40	2	60	1,2	4,1	Low	G9/G10[1]	5,64	10	Mildly corrosive
MEDIUM HARD ROCK HARDPAN. Fully developed ferricrete - pedogenic.		DS2	0,3-0,45+	0,15+	2,13	2	30	0,6	2,8	Low	G7/G8[1]	7,26	8	Not generally corrosive
Fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile. Alluvium transported.	TH06	DS3	0,1-0,3	0,20	1,22	2	66	1,3	5,7	Low	G9/G10[1]	-	-	-
Fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix. Partly developed ferricrete - pedogenic.		DS4	0,3-1,0	0,70	2,01	16	33	5,3	3,0	Low	G7/G8[1]	6,87	26	Very corrosive
Fine to medium grained sandy GRAVEL. Residual quartz porphyry.		DS5	1,0-1,5+	0,50+	1,82	12	40	4,8	7,4	Low	G6/G7[1]	7,82	86	Extremely corrosive
Fine to medium grained silty SAND with frequent scattered grass roots in profile. Alluvium transported.	TH01	DS6	0,0-0,9	0,90	0,79	4	82	3,3	6,6	Low	G10/>G10[1]	5,14	18	Mildly corrosive

Soil type and origin	TH No	DS No	Depth range (m):	Layer thickness (m)	GM	PI	%<0,425	PI_{whole}	%Clay	Heave class	TRH14	Soil aggressiveness		
												pH	Cond	Degree
Fine to medium grained silty SAND with abundant scattered grass roots in profile. Alluvium transported.	TH10	DS7	0,1-0,3	0,20	1,04	5	70	3,5	5,3	Low	G10/>G10[1]	7,43	39	Very corrosive
Fine to medium grained silty SAND with frequent scattered fine to medium grained gravel and highly weathered, ferricrete nodules in profile. Alluvium transported.		DS8	0,3-0,6	0,30	0,94	8	72	5,8	6,2	Low	G9/G10[1]	-	-	-
Fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile. Partly developed ferricrete - pedogenic.		DS9	0,6-2,5+	1,90+	0,76	13	78	10,1	5,1	Low	G10/>G10[1]	7,72	159	Extremely corrosive

[1]Estimated TRH 14 classification. We strongly recommend that confirmation quality assurance testing be carried out to confirm the above material classification for construction purposes.

All oversize and organic material was removed during sampling process for representative laboratory testing purposes.

Summary of road building related laboratory test results

6 REFERENCES

6.1 JENNINGS, J.E, BRINK, A.B.A & WILLIAMS, A.A.B. Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa. Trans. S Afr. Inst. Civ. Engrs. Vol. 15, No. 1, 1973, pp3 to 12.

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6.4 Weinert, H.H. (1980). The Natural Road Construction Materials of Southern Africa. H & R Academia Publ., Pretoria, 298 pp.

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6.6 Collins, L.E. (1953). A Preliminary Theory for the Design of Underreamed Piles, in relation to the Leeuhof Clays of the Orange Free State. Proceedings of the S.A. Institution of Civil Engineers.

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6.8 SOUTH AFRICAN INSTITUTE OF CIVIL ENGINEERS. Code of Practice: Foundations and Superstructures for Single Storey Residential Buildings of Masonry Construction. Joint structural division, 1995, Johannesburg.

6.9 EVANS, U R. The Corrosion and Oxidation of Metals: Scientific principles and practical applications. Edward Arnold (Publishers) Ltd. 1977.

6.10 DULIGAL E. Significance of Soil Resistivity on Corrosivity. Unpublished report commicro-piled for Africon. 1996.

ANNEXURE A:

DRAWINGS

(TEST HOLE POSITIONS AND REGIONAL GEOLOGY)

GeoSimplicity	**Test hole positions** **Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP Klerksdorp - North West Province**	**Date: May 2022** **Client: Maxim Planning Solutions (Pty) Ltd** **Project No: G524**

Rm: Quartz feldspar-porphory of the Makwassi Formation, Platberg Group, Ventersdorp Supergroup

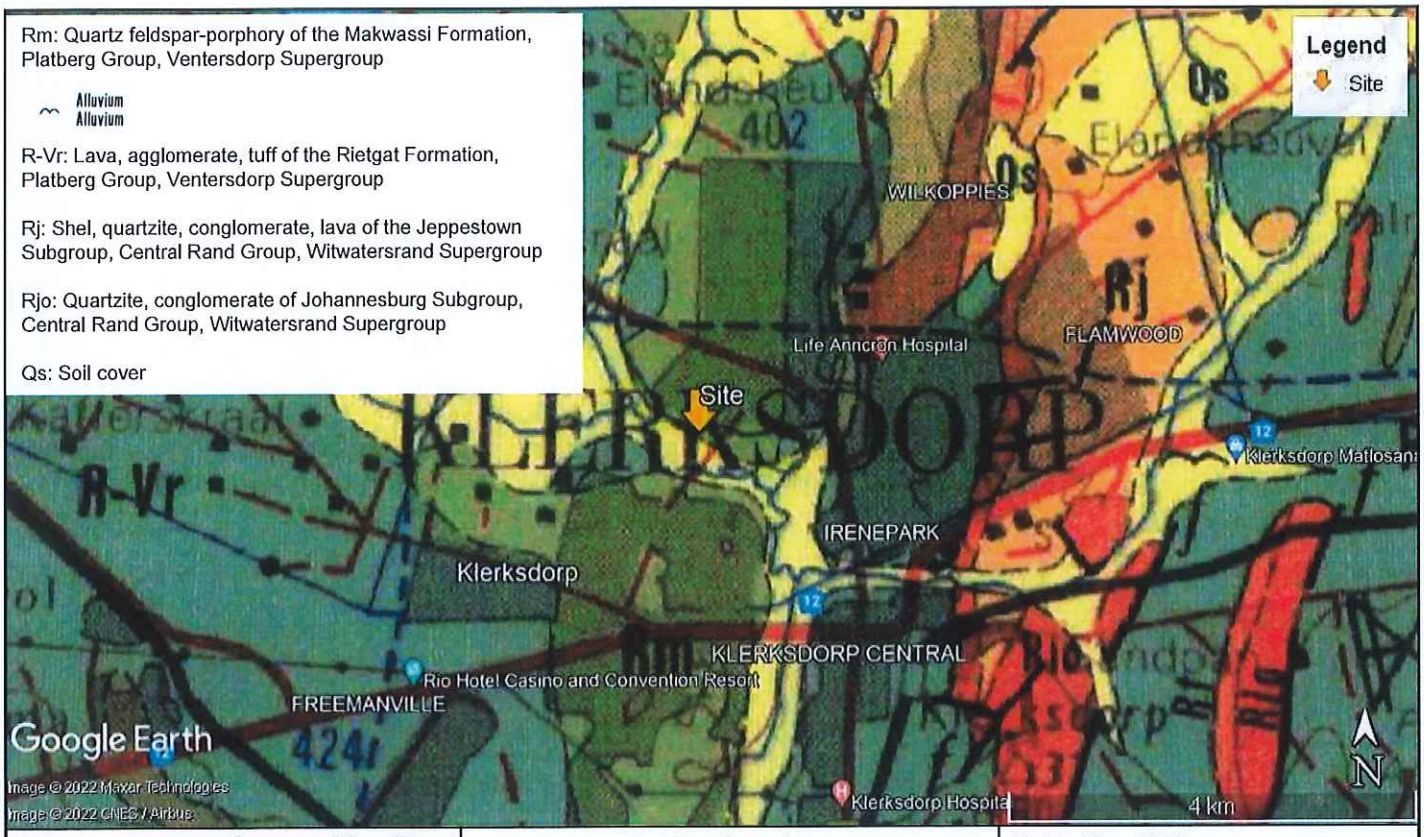
Alluvium
Alluvium

R-Vr: Lava, agglomerate, tuff of the Rietgat Formation, Platberg Group, Ventersdorp Supergroup

Rj: Shel, quartzite, conglomerate, lava of the Jeppestown Subgroup, Central Rand Group, Witwatersrand Supergroup

Rjo: Quartzite, conglomerate of Johannesburg Subgroup, Central Rand Group, Witwatersrand Supergroup

Qs: Soil cover



GeoSimplicity	**Regional geology** **Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP Klerksdorp - North West Province**	**Date: May 2022** **Client: Maxim Planning Solutions (Pty) Ltd** **Project No: G524**

ANNEXURE B:

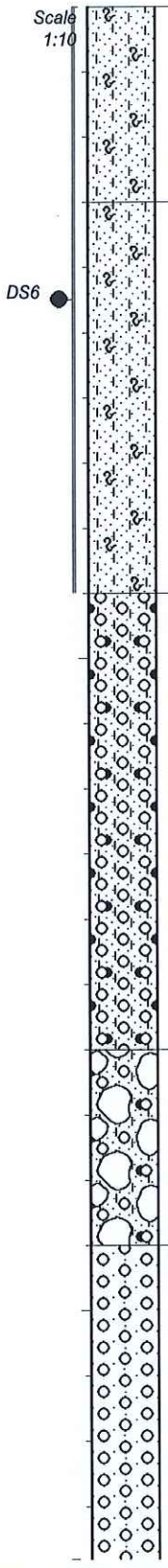
TEST HOLE PROFILES

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH01
Sheet 1 of 2

JOB NUMBER: G524



0.00

Moist, dark olive-brown, loose, massive, fine to medium grained silty SAND with abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30

Moist to very moist, dark yellow and olive-brown, loose, massive, fine to medium grained silty SAND with frequent scattered grass roots in profile.
Alluvium transported.
P = -

0.90

Very moist, dark yellow and orange-brown, speckled black, medium dense to dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = 100kPa

1.60

Very moist, dark yellow and orange-brown, speckled black, dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules with frequent scattered unweathered, extremely hard rock cobbles and boulders (up to 350mm dia) in a fine to medium grained silty sand matrix.
Pebblemarker transported.
P = 120kPa

1.90

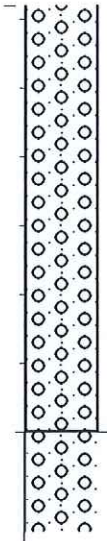
Very moist, light beige-brown speckled black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH01
Sheet 2 of 2

JOB NUMBER: G524



Very moist, light beige-brown speckled black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa

NOTES

1) No groundwater seepage encountered in test hole.
2) Digging to the maximum reach of the machine - no refusal.
3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.
5) Disturbed sample DS6 at mix 0.0m--0.9m for Foundation Indicator related laboratory testing.

CONTRACTOR : Tigani Plant Hire
MACHINE : CAT 422E TLB
DRILLED BY :
PROFILED BY : PF van Straten
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 27/01/22
DATE : 19/05/2022 10:27
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ELEVATION : GLG
X-COORD : S 26°50'44.8"
Y-COORD : E 26°39'05.3"

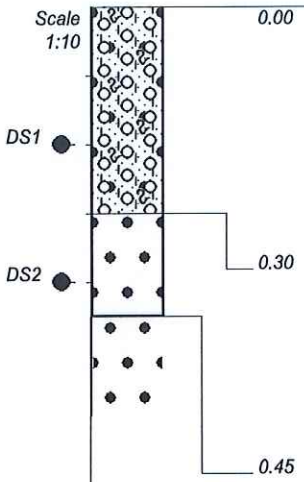
HOLE No: TH01

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH02
Sheet 1 of 1

JOB NUMBER: G524



0.00 – 0.30
Slightly moist to moist, light olive-brown, speckled black, loose to medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30 – 0.45
Slightly moist, dark yellow and orange-brown, speckled black, highly cemented and ferruginous, MEDIUM HARD ROCK HARDPAN.
Fully developed ferricrete - pedogenic.
P = 300kPa

0.45
Slightly moist, dark yellow and orange-brown, speckled black, highly cemented and ferruginous, MEDIUM HARD ROCK HARDPAN.
Fully developed ferricrete - pedogenic.
P = 300kPa

NOTES

1) No groundwater seepage encountered in test hole.
2) Digging refusal of machine encountered at 0.45m on medium hard rock hardpan, fully developed ferricrete - pedogenic.
3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered. However, bearing capacity to be confirmed during construction by means of traxcavator test pitting to confirm hardpan thickness - see clauses 5.3.2 and 5.9.1 of report.
5) Disturbed sample DS1 at 0.2m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sarnple DS2 at 0.4m for Foundation Indicator, pH and Conductivity related laboratory testing.

CONTRACTOR : Tigani Plant Hire
MACHINE : CAT 422E TLB
DRILLED BY :
PROFILED BY : PF van Straten
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 27/01/22
DATE : 19/05/2022 10:27
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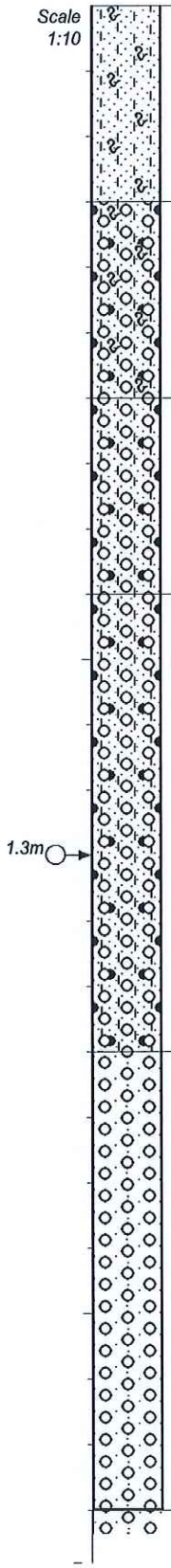
ELEVATION : GLG
X-COORD : S 26°50'46.9"
Y-COORD : E 26°39'07.5"
HOLE No: TH02

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH03
Sheet 1 of 2

JOB NUMBER: G524



0.00	Very moist to wet, dark olive-brown, loose, massive, fine to medium grained silty SAND with abundant scattered grass roots in profile. **Alluvium transported.** **P = -**
0.30	Very moist to wet, dark olive-brown, speckled black, loose to medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile. **Alluvium transported.** **P = -**
0.60	Very moist to wet, dark olive-brown, speckled black and orange, loose to medium dense, ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix. **Partly developed ferricrete - pedogenic.** **P = <30kPa**
0.90	Very moist to wet, dark yellow and orange-brown, speckled black, dense to very dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix. **Partly developed ferricrete - pedogenic.** **P = 200kPa**
1.60	Very moist, light beige-brown speckled yellow-orange and black, very dense, slightly ferruginous, fine to medium grained sandy GRAVEL. **Residual quartz porphyry.** **P = 250kPa**
2.30	

Very moist, light beige-brown speckled yellow-orange and black, very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 250kPa

NOTES

1) Pinhole groundwater seepage encountered at 1.3m. Approximately 100mm of water standing in test hole 30 minutes after digging was terminated.

2) Digging refusal of machine encountered at 2.3m on very dense, residual porphory.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

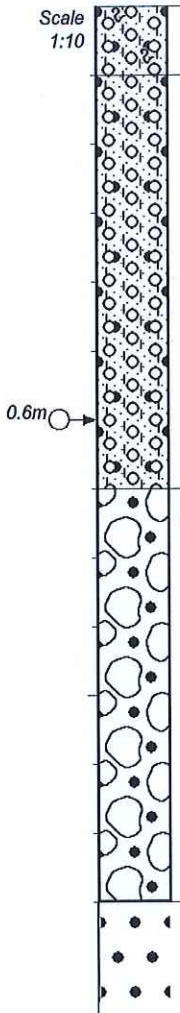
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH04
Sheet 1 of 1

JOB NUMBER: G524



0.00

Slightly moist to moist, light olive-brown, speckled black, loose to medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.10

Very moist to wet, dark yellow and orange-brown, speckled black, medium dense to dense to very dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = 100kPa

0.70

Wet, dark yellow and orange-brown, speckled black, highly cemented and ferruginous, VERY SOFT ROCK HARDPAN with frequent scattered unweathered, very hard rock cobbles and boulders (up to 500mm dia) in profile.
Fully developed ferricrete - pedogenic.
P = 250kPa

1.30

Wet, dark yellow and orange-brown, speckled black, highly cemented and ferruginous, VERY SOFT ROCK TO SOFT ROCK HARDPAN.
Fully developed ferricrete - pedogenic.
P = 250kPa

NOTES

1) Strong groundwater seepage encountered at 0.6m. Approximately 400mm of water standing in test hole 30 minutes after digging was terminated.

2) Digging refusal of machine encountered at 1.3m on very soft rock to soft rock hardpan, fully developed ferricrete - pedogenic.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered. However, bearing capacity to be confirmed during construction by means of traxcavator test pitting to confirm hardpan thickness - see clauses 5.3.2 and 5.9.1 of report.

CONTRACTOR : Tigani Plant Hire
MACHINE : CAT 422E TLB
DRILLED BY :
PROFILED BY : PF van Straten
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 27/01/22
DATE : 19/05/2022 10:27
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ELEVATION : GLG
X-COORD : S 26°50'49.7"
Y-COORD : E 26°39'05.3"

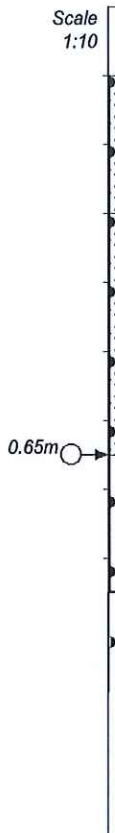
HOLE No: TH04

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH05
Sheet 1 of 1

JOB NUMBER: G524



0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist to wet, light olive-brown, speckled black, loose to medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30

Very moist to wet, dark olive-brown, speckled black and orange, medium dense to dense, ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = 100kPa

0.65

Wet, dark yellow and orange-brown, speckled black, highly cemented and ferruginous, MEDIUM HARD ROCK HARDPAN.
Fully developed ferricrete - pedogenic.
P = 300kPa

0.85

Wet, dark yellow and orange-brown, speckled black, highly cemented and ferruginous, MEDIUM HARD ROCK HARDPAN.
Fully developed ferricrete - pedogenic.
P = 300kPa

NOTES

1) Moderate groundwater seepage encountered at 0.65m. Approximately 150mm of water standing in test hole 30 minutes after digging was terminated.

2) Digging refusal of machine encountered at 0.85m on medium hard rock hardpan, fully developed ferricrete - pedogenic.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered. However, bearing capacity to be confirmed during construction by means of traxcavator test pitting to confirm hardpan thickness - see clauses 5.3.2 and 5.9.1 of report.

CONTRACTOR : Tigani Plant Hire
MACHINE : CAT 422E TLB
DRILLED BY :
PROFILED BY : PF van Straten
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 27/01/22
DATE : 19/05/2022 10:27
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ELEVATION : GLG
X-COORD : S 26°50'48.9"
Y-COORD : E 26°39'00.9"

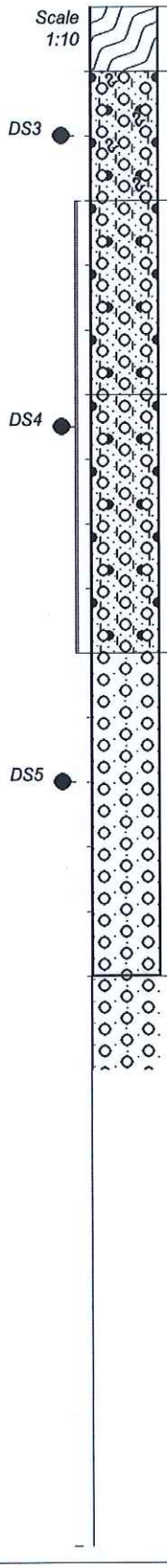
HOLE No: TH05

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH06
Sheet 1 of 2

JOB NUMBER: G524



Highly organic, sacrificial transported.
P = -

Very moist to wet, light olive-brown, speckled black, loose to medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

Very moist to wet, dark olive-brown, speckled black and orange, loose to medium dense, ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = <30kPa

Very moist to wet, dark yellow and orange-brown, speckled black, dense to very dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = 200kPa

Very moist, light beige-brown speckled yellow-orange and black, very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 250kPa

Very moist, light beige-brown speckled yellow-orange and black, very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 250kPa

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging refusal of machine encountered at 1.5m on very dense, residual porphory.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

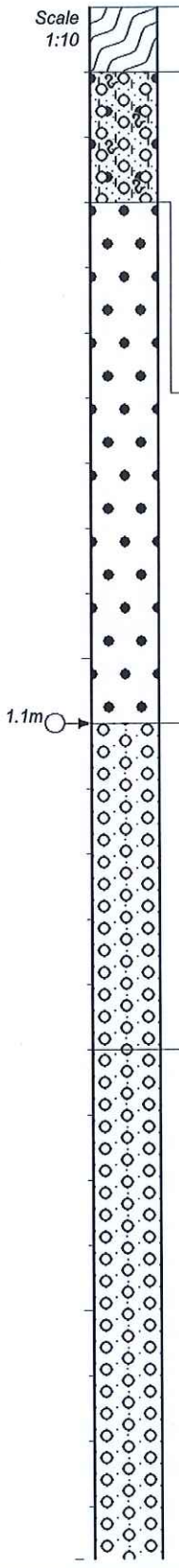
5) Disturbed sample DS3 at 0.2m for Foundation Indicator related laboratory testing.
Disturbed sample DS4 at mix 0.3m--1.0m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS5 at 1.2m for Foundation Indicator, pH and Conductivity related laboratory testing.

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH07
Sheet 1 of 2

JOB NUMBER: G524



0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist to wet, light olive-brown, speckled black, loose to medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30

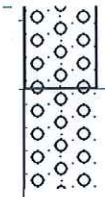
Very moist to wet, dark yellow and orange-brown, speckled black, highly cemented and ferruginous, VERY SOFT ROCK TO SOFT ROCK HARDPAN.
Fully developed ferricrete - pedogenic.
P = 100kPa

1.10

Wet, light beige-brown speckled yellow-orange and black, medium dense to dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 100kPa

1.60

Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa



2.50

Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa

NOTES

1) Strong groundwater seepage encountered at 1.1m. Approximately 300mm of water standing in test hole 30 minutes after digging was terminated.

2) Digging to the maximum reach of the machine - no refusal.

3) Unstable sidewalls with associated localized sidewall collapse encountered between 1.1m and 1.6m.

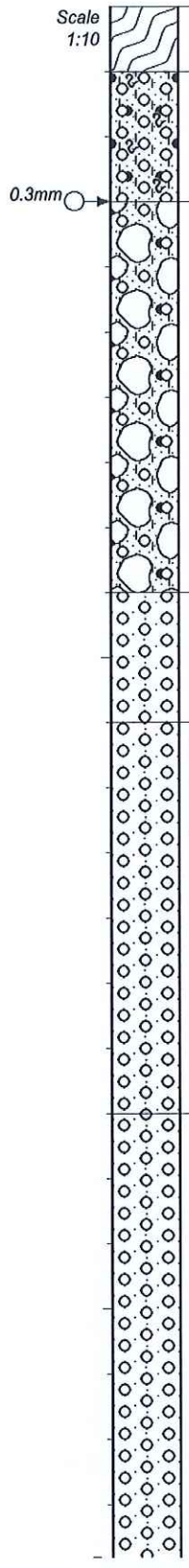
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH08
Sheet 1 of 2

JOB NUMBER: G524



0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist to wet, light olive-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30

Wet, dark yellow and orange-brown, speckled black, medium dense to dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules with frequent scattered unweathered, extremely hard rock boulders (up to 1.1m dia) in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = 100kPa

0.90

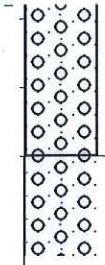
Wet, light beige-brown speckled yellow-orange and black, medium dense to dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 100kPa

1.10

Wet, light beige-brown speckled yellow-orange and black, dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 150kPa

1.70

Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa



Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa

NOTES

1) Strong groundwater seepage encountered at 0.3mm. Approximately 300mm of water standing in test hole 30 minutes after digging was terminated.

2) Digging to the maximum reach of the machine - no refusal. However, very difficult digging through boulders.

3) Unstable sidewalls with associated localized sidewall collapse encountered between 0.3m and 0.9m.

4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

CONTRACTOR : Tigani Plant Hire
MACHINE : CAT 422E TLB
DRILLED BY :
PROFILED BY : PF van Straten

TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 27/01/22

DATE : 19/05/2022 10:27
TEXT : ..ppydays\dotPLOT\G524.TXT

ELEVATION : GLG
X-COORD : S 26°50'54.5"
Y-COORD : E 26°39'02.8"

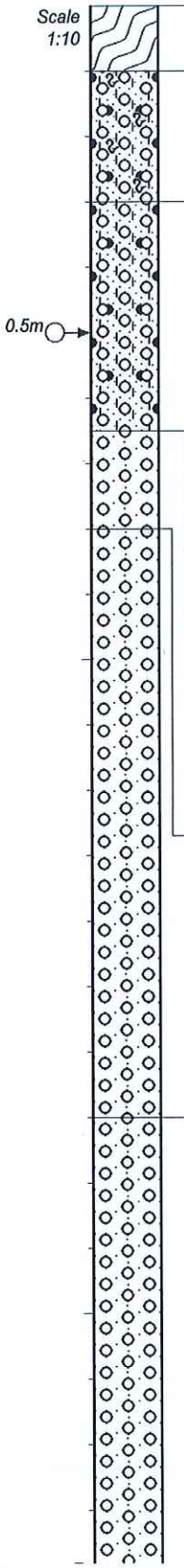
HOLE No: TH08

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH09
Sheet 1 of 2

JOB NUMBER: G524



0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist to wet, light olive-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel and highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30

Very moist to wet, dark yellow and orange-brown, speckled black, very dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = 100kPa

0.65

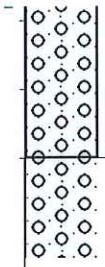
Very moist to wet, light beige-brown speckled yellow-orange and black, medium dense to dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 100kPa

0.80

Very moist to wet, light beige-brown speckled yellow-orange and black, dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 150kPa

1.70

Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa



2.60

Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa

NOTES

1) Pinhole groundwater seepage encountered at 0.5m. Approximately 100mm of water standing in test hole 30 minutes after digging was terminated.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

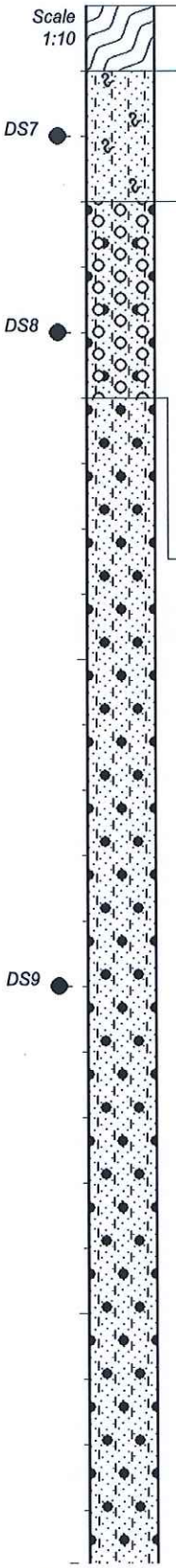
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH10
Sheet 1 of 2

JOB NUMBER: G524



0.00

Highly organic, sacrificial transported.
P = -

0.10

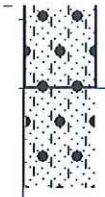
Slightly moist, light brown, speckled black, loose, massive, fine to medium grained silty SAND with abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30

Slightly moist, light beige-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel and highly weathered, ferricrete nodules in profile.
Alluvium transported.
P = -

0.60

Slightly moist, dark yellow-orange, speckled black, dense to very dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 200kPa



2.50

Slightly moist, dark yellow-orange, speckled black, dense to very dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 200kPa

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

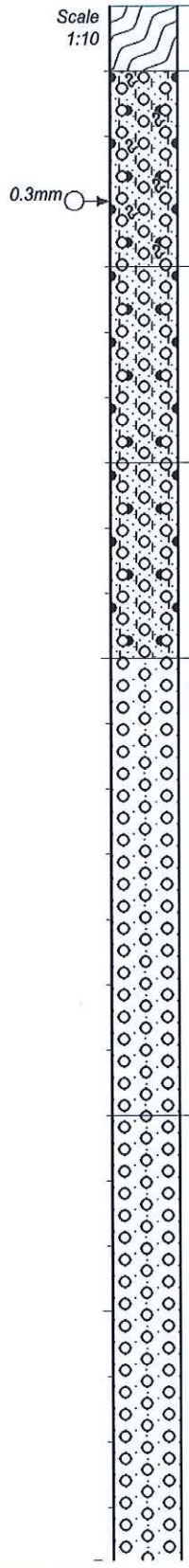
5) Disturbed sample DS7 at 0.2m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS8 at 0.5m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS9 at 1.5m for Foundation Indicator, pH and Conductivity related laboratory testing.

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH11
Sheet 1 of 2

JOB NUMBER: G524



0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist to wet, light olive-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel, highly weathered, ferricrete nodules and abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.40

Very moist to wet, light olive and beige-brown, speckled orange, loose, ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = -

0.70

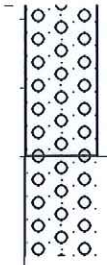
Wet, dark yellow and orange-brown, speckled black, dense to very dense, highly ferruginous, fine to medium grained GRAVEL and highly weathered ferricrete nodules in a fine to medium grained silty sand matrix.
Partly developed ferricrete - pedogenic.
P = 100kPa

1.00

Wet, light beige-brown speckled yellow-orange and black, medium dense to dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 100kPa

1.70

Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa



2.60

Wet, light beige-brown speckled yellow-orange and black, dense to very dense, slightly ferruginous, fine to medium grained sandy GRAVEL.
Residual quartz porphyry.
P = 200kPa

NOTES

1) Strong groundwater seepage encountered at 0.3mm. Approximately 300mm of water standing in test hole 30 minutes after digging was terminated.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

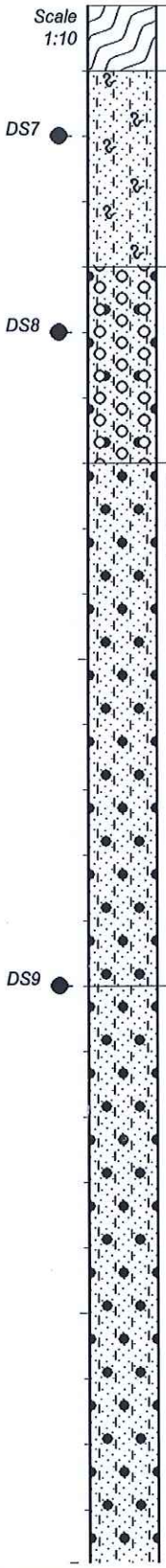
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH12
Sheet 1 of 2

JOB NUMBER: G524



0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist, light brown, speckled black, loose, massive, fine to medium grained silty SAND with abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.40

Very moist, light beige-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel and highly weathered, ferricrete nodules in profile.
Alluvium transported.
P = -

0.70

Moist to very moist, dark yellow-orange, speckled black, dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

1.50

Very moist, dark yellow-orange, speckled black, medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

2.60

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.

4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

5) Disturbed sample DS7 at 0.2m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS8 at 0.5m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS9 at 1.5m for Foundation Indicator, pH and Conductivity related laboratory testing.

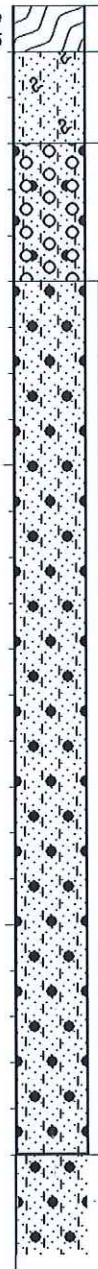
Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH13
Sheet 1 of 1

JOB NUMBER: G524

Scale 1:15



0.00

Highly organic, sacrificial transported.
P = -

0.10

Slightly moist, light brown, speckled black, loose, massive, fine to medium grained silty SAND with abundant scattered grass roots in profile.
Alluvium transported.
P = -

0.30

Slightly moist, light beige-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel and highly weathered, ferricrete nodules in profile.
Alluvium transported.
P = -

0.60

Slightly moist, dark yellow-orange, speckled black, dense to very dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 200kPa

2.50

Slightly moist, dark yellow-orange, speckled black, dense to very dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 200kPa

NOTES

1) No groundwater seepage encountered in test hole.
2) Digging to the maximum reach of the machine - no refusal.
3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

CONTRACTOR : Tigani Plant Hire
MACHINE : CAT 422E TLB
DRILLED BY :
PROFILED BY : PF van Straten
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 27/01/22
DATE : 19/05/2022 10:27
TEXT : ..ppydays\dotPLOT\G524.TXT

ELEVATION : GLG
X-COORD : S 26°50'56.2"
Y-COORD : E 26°38'53.8"

HOLE No: TH13

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH14
Sheet 1 of 2

JOB NUMBER: G524

Scale 1:10

0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist, light brown, speckled black, loose, massive, fine to medium grained silty SAND with abundant scattered grass roots in profile.
Alluvium transported.
P = -

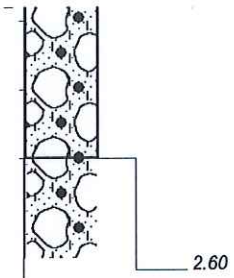
0.50

Very moist, light beige-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel and highly weathered, ferricrete nodules in profile.
Alluvium transported.
P = -

1.10

Very moist, dark yellow-orange, speckled black, medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

2.30



Very moist, dark yellow-orange, speckled black, medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules and abundant scattered unweathered, extremely hard rock cobbles and small boulders (up to 0.3m dia) in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

2.60

Very moist, dark yellow-orange, speckled black, medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules and abundant scattered unweathered, extremely hard rock cobbles and small boulders (up to 0.3m dia) in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

NOTES

1) No groundwater seepage encountered in test hole.
2) Digging to the maximum reach of the machine - no refusal.
3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

CONTRACTOR : Tigani Plant Hire
MACHINE : CAT 422E TLB
DRILLED BY :
PROFILED BY : PF van Straten
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 27/01/22
DATE : 19/05/2022 10:27
TEXT : ..ppydays\dotPLOT\G524.TXT

ELEVATION : GLG
X-COORD : S 26°50'58.6"
Y-COORD : E 26°38'55.1"
HOLE No: TH14

Geo Simplicity Geotechnical Engineering (Pty) Ltd

MAXIM PLANNING SOLUTIONS (PTY) LTD
Geotechnical Investigation on PTN's 337 & 338 of the Farm Elandsheuvel No 402-IP
Klerksdorp - North West Province

HOLE No: TH15
Sheet 1 of 2

JOB NUMBER: G524

Scale 1:10

0.00

Highly organic, sacrificial transported.
P = -

0.10

Very moist, light brown, speckled black, loose, massive, fine to medium grained silty SAND with abundant scattered grass roots in profile.
Alluvium transported.
P = -

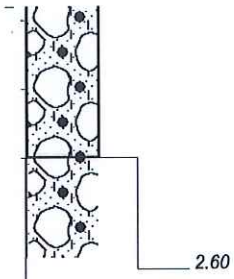
0.50

Very moist, light beige-brown, speckled black, loose, slightly ferruginous, fine to medium grained silty SAND with frequent scattered fine to medium grained gravel and highly weathered, ferricrete nodules in profile.
Alluvium transported.
P = -

1.10

Very moist, dark yellow-orange, speckled black, medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

2.30



Very moist, dark yellow-orange, speckled black, medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules and abundant scattered unweathered, extremely hard rock cobbles and small boulders (up to 0.3m dia) in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

2.60

Very moist, dark yellow-orange, speckled black, medium dense, slightly ferruginous, fine to medium grained silty SAND with frequent scattered highly weathered ferricrete nodules and abundant scattered unweathered, extremely hard rock cobbles and small boulders (up to 0.3m dia) in profile.
Partly developed ferricrete - pedogenic.
P = 60kPa

NOTES

1) No groundwater seepage encountered in test hole.
2) Digging to the maximum reach of the machine - no refusal.
3) Test hole sidewalls appear to be completely stable with no sidewall collapse to be reported.
4) P = Estimated allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be considered.

ANNEXURE C:

LABORATORY TEST RESULTS

ROADLAB

Roadlab Laboratories Pty Ltd
- Materials Testing
- Geotechnical & Road Investigations
- Mobile Lab Services
- Specialised Concrete & Forensic Investigations

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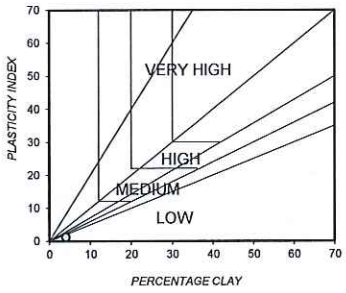
OUR REF : 92/GEO013-04-0001/22 **DATE RECEIVED :** 28-Jan-22
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH02 - DS1
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** 0.2m
SAMPLE No. : S/0278
SAMPLE DESCRIPTION : Dark Brown Silty Gravelly Sand

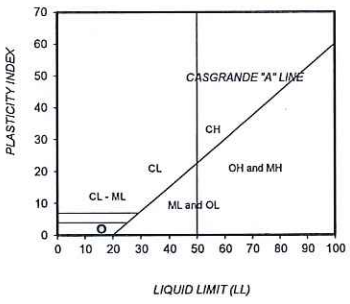
FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**1.2**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	99
	19.0	99
	13.2	98
	4.75	93
	2.000	80
	0.425	60
	0.250	50
	0.150	39
	0.075	21
	0.050*	13
	0.005*	5
	0.002*	4.1
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	25
	0.425 - 0.250	12
	0.250 - 0.150	13
	0.150 - 0.075	22
	< 0.075	27
Effective size		0.033
Uniformity Coefficient		13.8
Curvature Coefficient		0.8
Oversize Index		0.0
Shrinkage Product		51.8
Grading Coefficient		17.8
Grading modulus		1.40
Atter-berg Limits	Liquid Limit	16
	Plasticity Index	2
	Linear Shrinkage	0.9
	PI < 0.075	6
Unified Soil Classification		SM
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

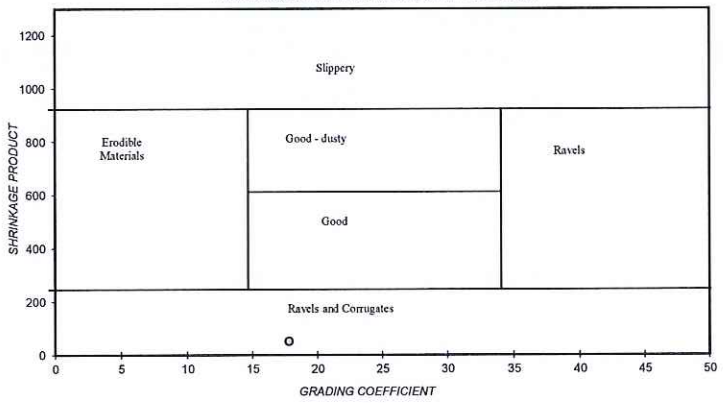
POTENTIAL EXPANSION



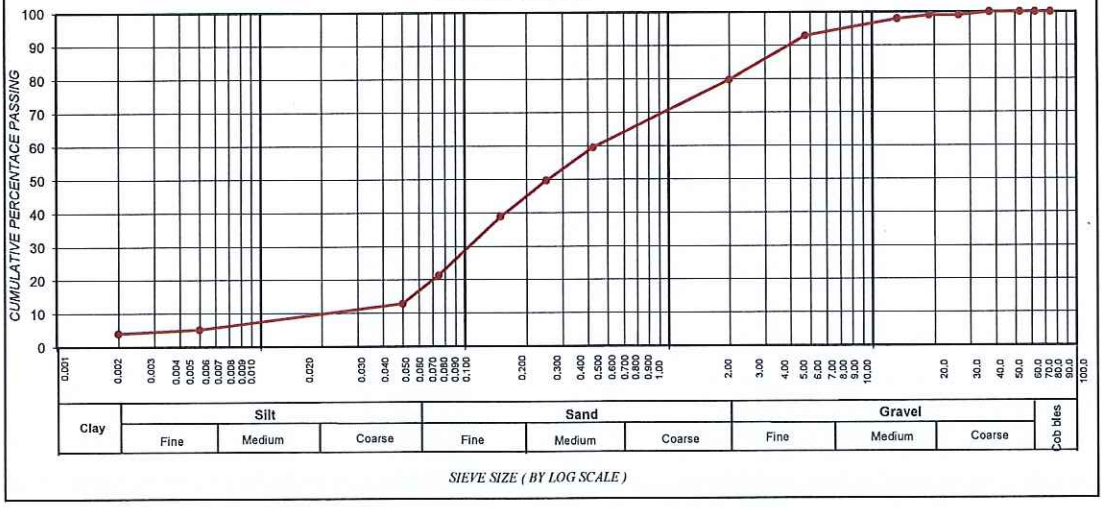
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.1	16.9	58.8	20.2

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CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH02 - DS2

SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** 0.4m

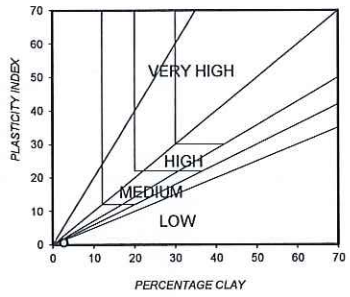
SAMPLE No. : S/0279

SAMPLE DESCRIPTION : Dark Brown Silty Sandy Gravel

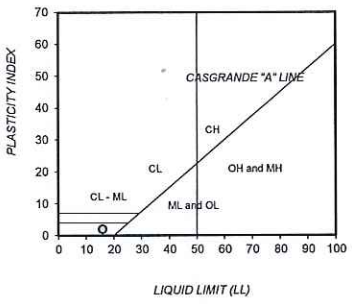
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)*

Weighted PI		**0.6**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	89
	37.5	86
	26.5	83
	19.0	80
	13.2	75
	4.75	57
	2.000	44
	0.425	30
	0.250	25
	0.150	21
	0.075	13
	0.050*	7
	0.005*	4
	0.002*	2.8
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	32
	0.425 - 0.250	11
	0.250 - 0.150	11
	0.150 - 0.075	18
	< 0.075	29
Effective size		0.063
Uniformity Coefficient		97.5
Curvature Coefficient		0.5
Oversize Index		14.0
Shrinkage Product		24.3
Grading Coefficient		22.2
Grading modulus		2.13
Atter-berg Limits	Liquid Limit	16
	Plasticity Index	2
	Linear Shrinkage	0.8
	PI < 0.075	6
Unified Soil Classification		SM
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

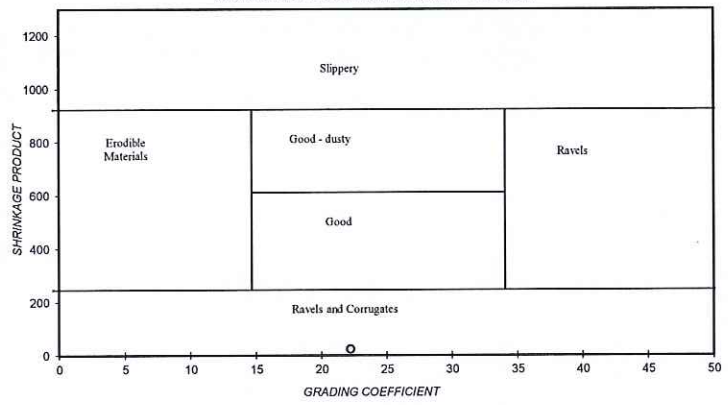
POTENTIAL EXPANSION



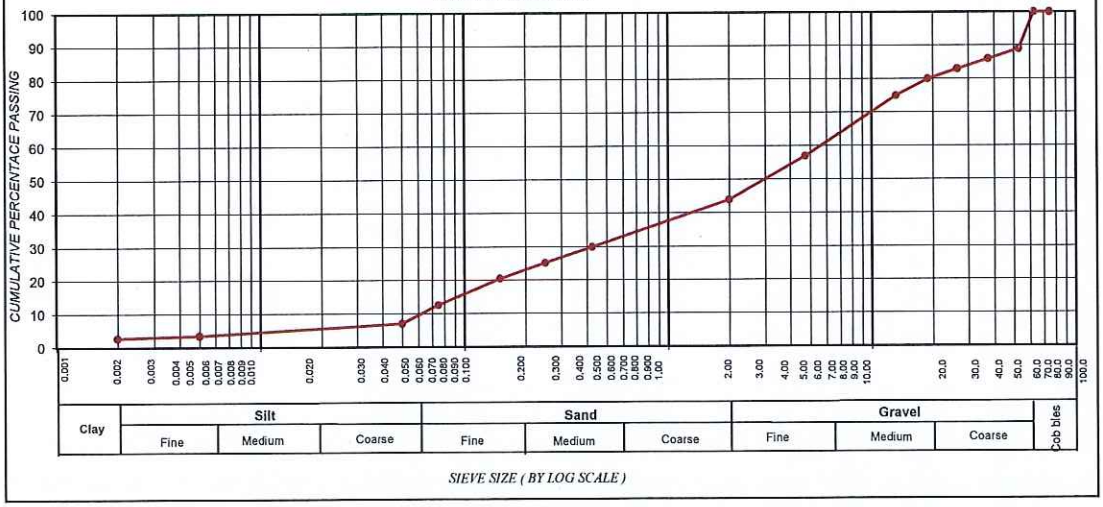
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.8	10.2	31.0	56.0

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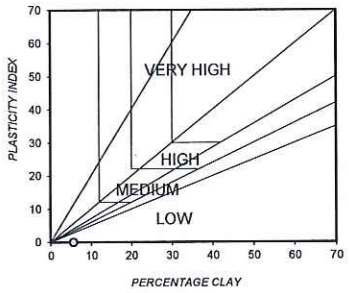
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH06 - DS3
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** 0.2m
SAMPLE No. : S/0280
SAMPLE DESCRIPTION : Light Yellow Gravelly Silty Sand

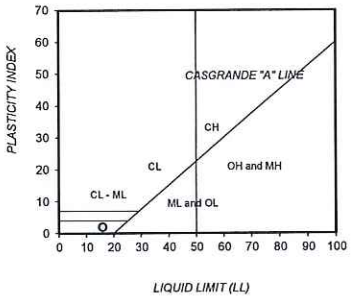
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	99
	4.75	90
	2.000	79
	0.425	66
	0.250	58
	0.150	50
	0.075	33
	0.050*	21
	0.005*	7
	0.002*	5.7
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	16
	0.425 - 0.250	10
	0.250 - 0.150	10
	0.150 - 0.075	21
	< 0.075	42
Effective size		0.014
Uniformity Coefficient		20.7
Curvature Coefficient		1.1
Oversize Index		0.0
Shrinkage Product		79.2
Grading Coefficient		18.9
Grading modulus		1.22
Atter-berg Limits	Liquid Limit	16
	Plasticity Index	2
	Linear Shrinkage	1.2
	PI < 0.075	6
Unified Soil Classification		SM
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

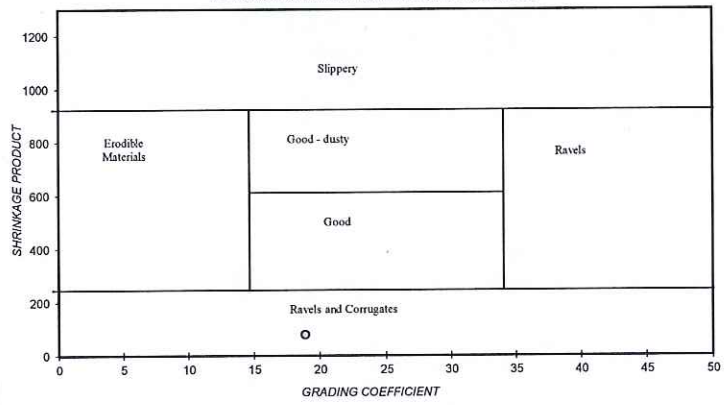
POTENTIAL EXPANSION



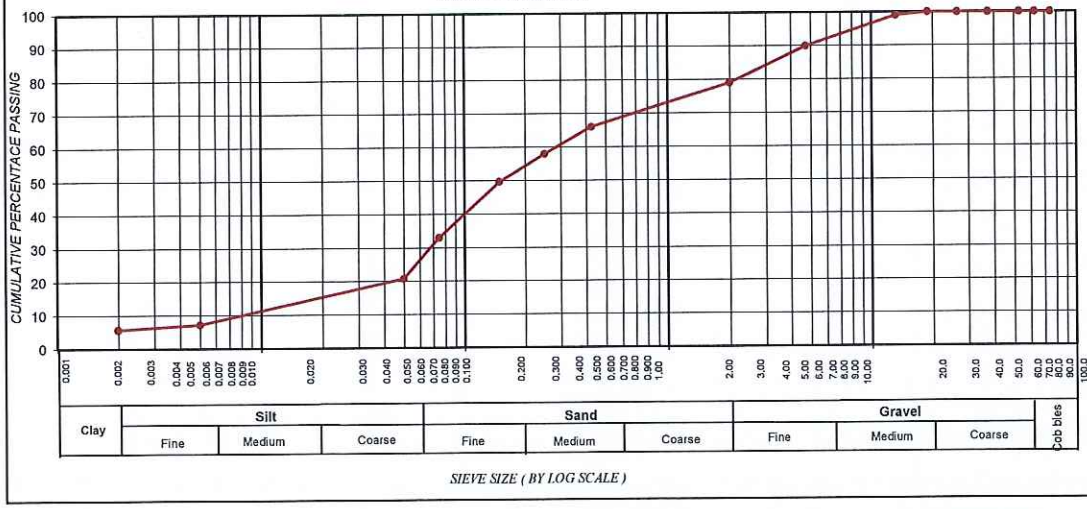
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
5.7	27.3	46.0	21.0

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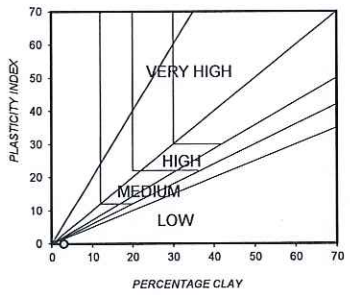
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH06 - DS4
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** mix 0.3-1.0
SAMPLE No. : S/0281
SAMPLE DESCRIPTION : Dark Yellow Sandy Silty Gravel

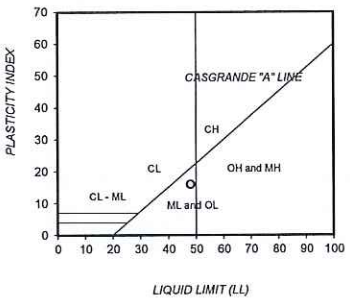
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	98
	13.2	90
	4.75	58
	2.000	41
	0.425	33
	0.250	30
	0.150	28
	0.075	25
	0.050*	13
	0.005*	4
	0.002*	3.0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	20
	0.425 - 0.250	7
	0.250 - 0.150	6
	0.150 - 0.075	8
	< 0.075	60
Effective size		0.034
Uniformity Coefficient		155.9
Curvature Coefficient		0.3
Oversize Index		0.0
Shrinkage Product		257.4
Grading Coefficient		34.2
Grading modulus		2.01
Atter-berg Limits	Liquid Limit	48
	Plasticity Index	16
	Linear Shrinkage	7.8
	PI < 0.075	23
Unified Soil Classification		SM
U.S. Highway Classification		A-2-6(0)
pH - Value		N/A
Conductivity mS/cm		N/A

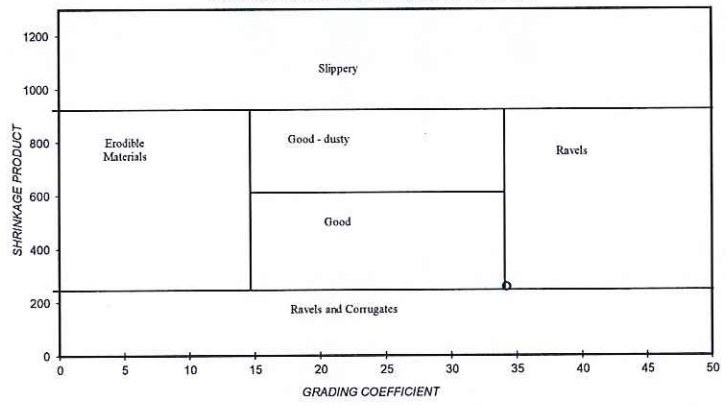
POTENTIAL EXPANSION



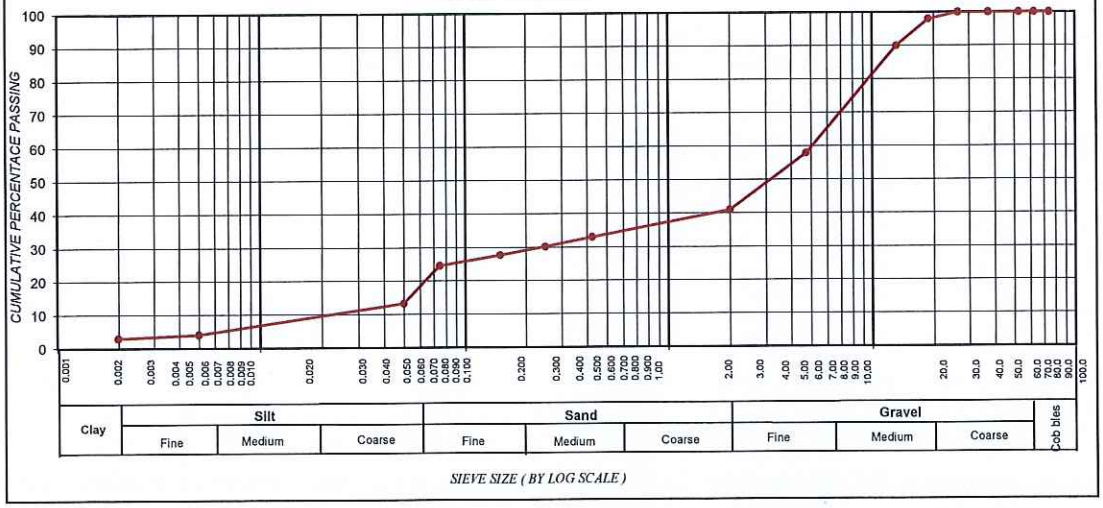
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	22.0	16.0	59.0

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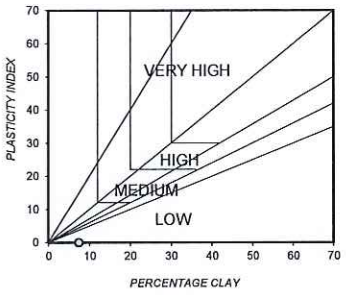
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH06 - DS5
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** 1.2m
SAMPLE No. : S/0282
SAMPLE DESCRIPTION : Dark Yellow Silty Sandy Gravel

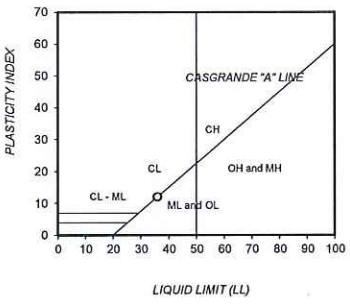
FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	99
	4.75	79
	2.000	53
	0.425	40
	0.250	34
	0.150	29
	0.075	25
	0.050*	18
	0.005*	10
	0.002*	7.4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	25
	0.425 - 0.250	12
	0.250 - 0.150	8
	0.150 - 0.075	9
	< 0.075	47
Effective size		0.006
Uniformity Coefficient		449.4
Curvature Coefficient		1.6
Oversize Index		0.0
Shrinkage Product		240.0
Grading Coefficient		37.1
Grading modulus		1.82
Atter-berg Limits	Liquid Limit	36
	Plasticity Index	12
	Linear Shrinkage	6.0
	PI < 0.075	20
Unified Soil Classification		SM
U.S. Highway Classification		A-2-6(0)
pH - Value		N/A
Conductivity mS/cm		N/A

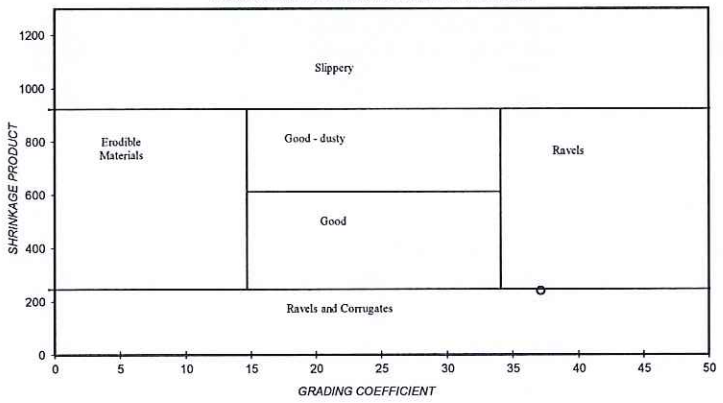
POTENTIAL EXPANSION



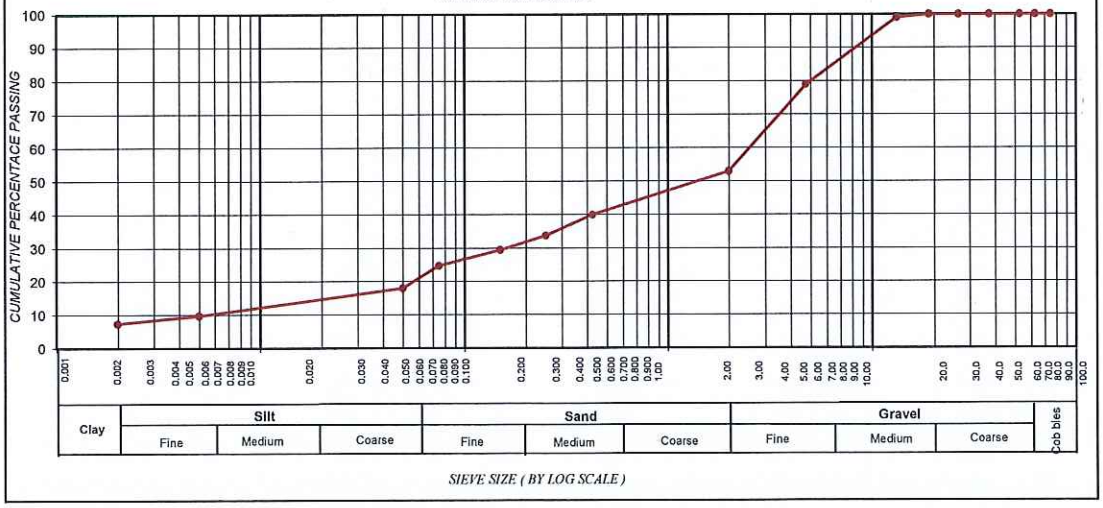
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
7.4	17.6	28.0	47.0

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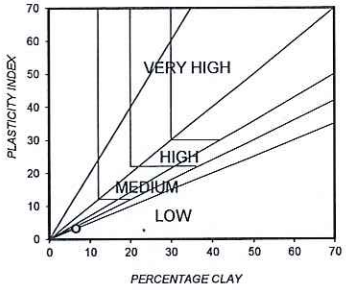
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH01 - DS6
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** mix 0.0-0.9
SAMPLE No. : S/0283
SAMPLE DESCRIPTION : Dark Brown Silty Sand

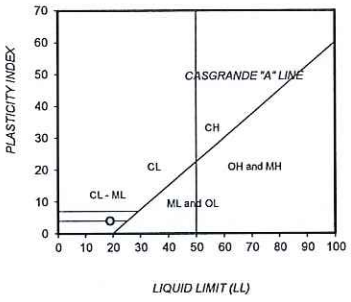
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)*

Weighted PI		**3.3**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	100
	2.000	98
	0.425	82
	0.250	73
	0.150	63
	0.075	41
	0.050*	24
	0.005*	10
	0.002*	6.6
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	16
	0.425 - 0.250	9
	0.250 - 0.150	11
	0.150 - 0.075	22
	< 0.075	42
Effective size		0.005
Uniformity Coefficient		29.5
Curvature Coefficient		5.2
Oversize Index		0.0
Shrinkage Product		157.4
Grading Coefficient		2.0
Grading modulus		0.79
Atter-berg Limits	Liquid Limit	19
	Plasticity Index	4
	Linear Shrinkage	1.9
	PI < 0.075	9
Unified Soil Classification		SM
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

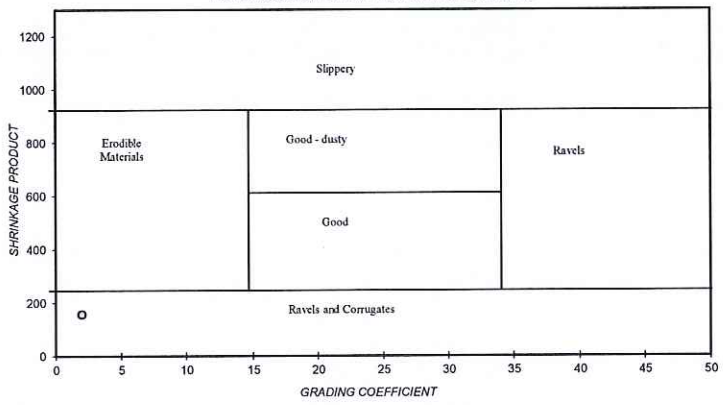
POTENTIAL EXPANSION



PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
6.6	34.4	57.0	2.0

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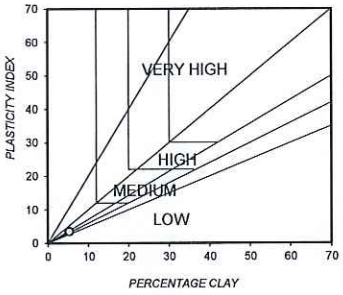
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH10 - DS7
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** 0.2m
SAMPLE No. : S/0284
SAMPLE DESCRIPTION : Light Red Brown Gravelly Silty Sand

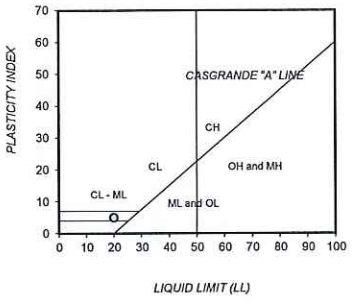
FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**3.5**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	99
	13.2	95
	4.75	87
	2.000	83
	0.425	70
	0.250	62
	0.150	55
	0.075	43
	0.050*	21
	0.005*	7
	0.002*	5.3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	16
	0.425 - 0.250	9
	0.250 - 0.150	9
	0.150 - 0.075	15
	< 0.075	51
Effective size		0.014
Uniformity Coefficient		15.3
Curvature Coefficient		1.2
Oversize Index		0.0
Shrinkage Product		136.5
Grading Coefficient		14.8
Grading modulus		1.04
Atter-berg Limits	Liquid Limit	20
	Plasticity Index	5
	Linear Shrinkage	2.0
	PI < 0.075	15
Unified Soil Classification		SM-SC
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

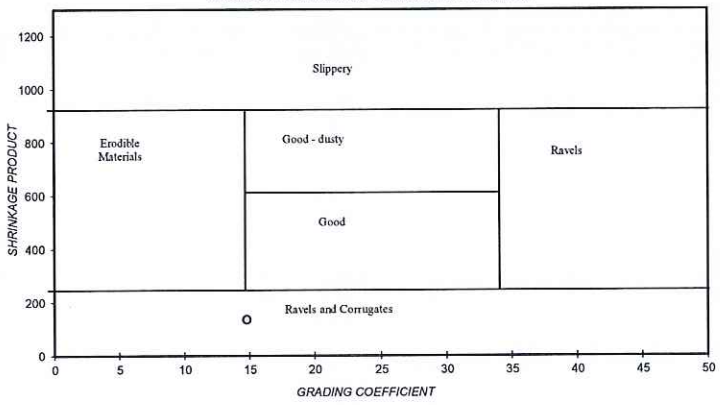
POTENTIAL EXPANSION



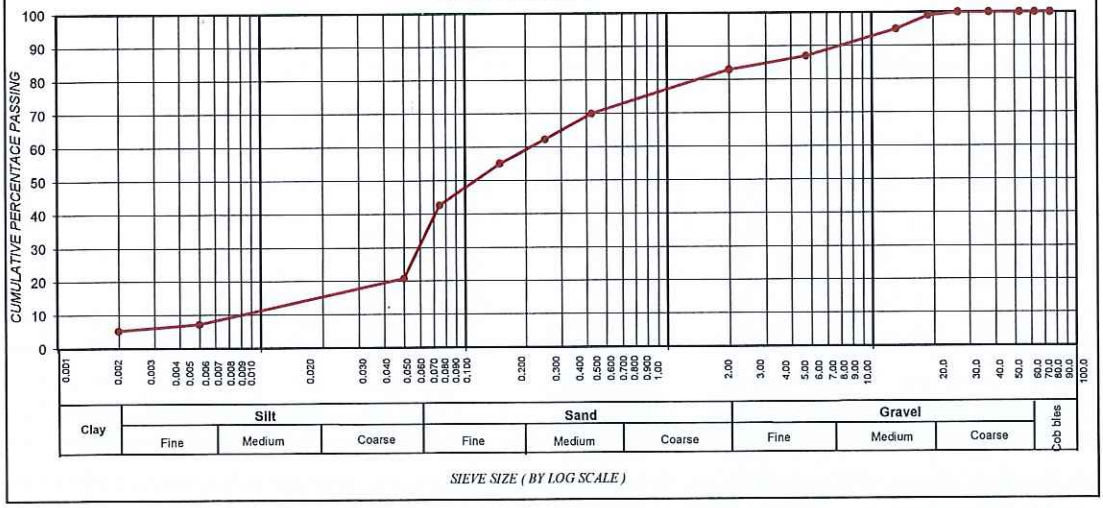
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
5.3	37.7	40.0	17.0

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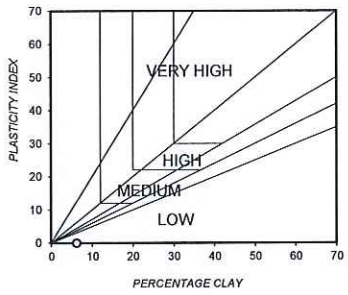
OUR REF : 92/GEO013-04-0001/22 **DATE RECEIVED :** 28-Jan-22
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH10 - DS8
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** 0.5m
SAMPLE No. : S/0285
SAMPLE DESCRIPTION : Light Brown Gravelly Sandy Silt

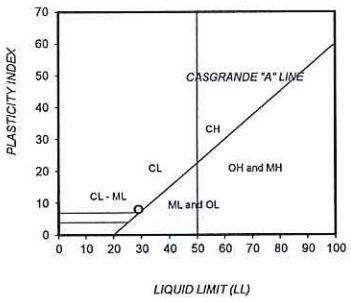
FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	99
	4.75	91
	2.000	86
	0.425	72
	0.250	65
	0.150	59
	0.075	48
	0.050*	23
	0.005*	8
	0.002*	6.2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	16
	0.425 - 0.250	9
	0.250 - 0.150	7
	0.150 - 0.075	12
	< 0.075	56
Effective size		0.011
Uniformity Coefficient		15.8
Curvature Coefficient		1.8
Oversize Index		0.0
Shrinkage Product		312.5
Grading Coefficient		12.7
Grading modulus		0.94
Atter-berg Limits	Liquid Limit	29
	Plasticity Index	8
	Linear Shrinkage	4.3
	PI < 0.075	18
Unified Soil Classification		SM-SC
U.S. Highway Classification		A-2-4(0)
pH - Value		N/A
Conductivity mS/cm		N/A

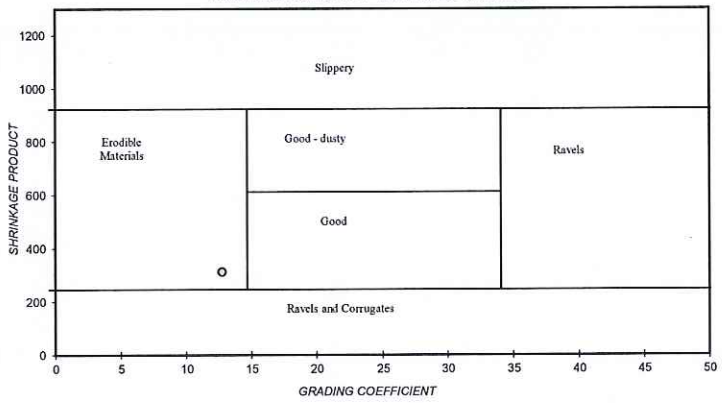
POTENTIAL EXPANSION



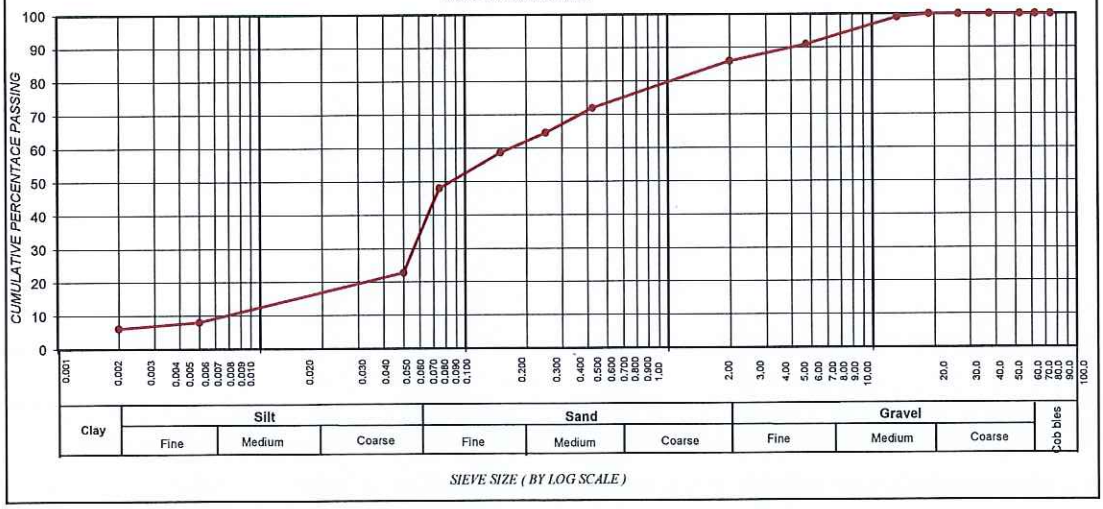
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
6.2	41.8	38.0	14.0

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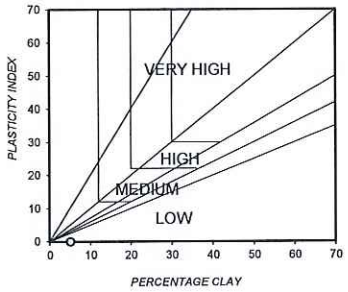
OUR REF : 92/GEO013-04-0001/22 **DATE RECEIVED :** 28-Jan-22
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD **CHAINAGE :** TH10 - DS9
SITE : G524 Geotechnical Investigation On Ptns 337 & 338 Of The Farm Elandsheuv **LAYER :** 1.5m
SAMPLE No. : S/0286
SAMPLE DESCRIPTION : Light Yellow Sandy Silt

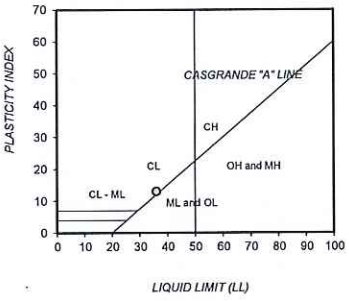
FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	97
	2.000	92
	0.425	78
	0.250	72
	0.150	66
	0.075	54
	0.050*	32
	0.005*	7
	0.002*	5.1
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	15
	0.425 - 0.250	7
	0.250 - 0.150	6
	0.150 - 0.075	13
	< 0.075	59
Effective size		0.010
Uniformity Coefficient		11.2
Curvature Coefficient		2.0
Oversize Index		0.0
Shrinkage Product		489.1
Grading Coefficient		7.8
Grading modulus		0.76
Atter-berg Limits	Liquid Limit	36
	Plasticity Index	13
	Linear Shrinkage	6.3
	PI < 0.075	20
Unified Soil Classification		SM-SC
U.S. Highway Classification		A-2-6(0)
pH - Value		N/A
Conductivity mS/cm		N/A

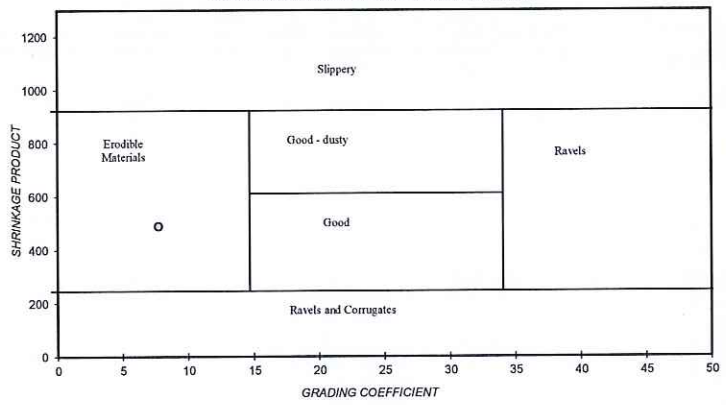
POTENTIAL EXPANSION



PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
5.1	48.9	38.0	8.0

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92/GEO013-04-0001/22

2022-02-11

Geo Simplicity Engineering (Pty) Ltd
1 Killoran Place
Bedfordview
2007

ATTENTION: Mr Petrus Van Straten

Test Report : G524 GEOTECHNICAL INVESTIGATION ON PTNS 337 & 338 OF THE FARM ELANDSHEUVEL NO. 402-IP, KLERKSDORP - pH & CONDUCTIVITY TEST RESULTS

Clients Marking: None
Sample Number: S/0278 - S/0286
Sample delivered to: Roadlab

Date Sampled: 2022/01/28
Date Received: 2022/01/28

Sample Number	Layer / Road :	Temperature (°C) : Conductivity	Conductivity (ms/m)	Temperature (°C) : pH	pH Value
S/0278	TH02 - DS1 : 0.2m	24°C	10.0	24°C	5.64
S/0279	TH02 - DS2 : 0.4m	24°C	8.0	24°C	7.26
S/0281	TH06 - DS4 : mix 0.3-1.0m	24°C	26.0	24°C	6.87
S/0282	TH06 - DS5 : 1.2m	24°C	86.0	24°C	7.82
S/0283	TH01 - DS6 mix 0.0 - 0.9m	24°C	18.0	24°C	5.14
S/0284	TH10 - DS7 : 0.2m	24°C	39.0	24°C	7.43
S/0286	TH10 - DS9 : 1.5m	24°C	159.0	24°C	7.72
					Page 1/1

Kind Regards

Mr N Herbst / Mr R Potgieter
Technical Signatory / Manager

Remarks :
The samples were subjected to analysis according to TMH 1
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 : Rehmat Ally

ANNEXURE D:

FIELDWORK PHOTOGRAPHS

Digging of test hole TH01 and showing typical groundwater standing in test holes where encountered

Typical alluvium transported (top left) and pedogenic (right) soil horizons encountered

Typical alluvium transported and pedogenic soils shown from the bottom of a test holes (top left) and residual quartz porphyry horizon (right) encountered