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Report to the Klipplaats Family Trust on a Geotechnical Investigation carried out for the Proposed Wembezi PLS, Portion 57 (of 1) of the Farm Klipplaat Drift No.1009, Estcourt, KwaZulu-Natal

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TABLE OF CONTENTS

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1. INTRODUCTION AND TERMS OF REFERENCE

Following on the recommendations provided in a report on a Preliminary Geotechnical Investigation submitted in April 2021, Gondwana Geo Solutions (Pty) Ltd, or GGS, were appointed by Mr Greg Cryer, Project Manager acting on behalf of the Klipplaats Family Trust to undertake a Geotechnical Investigation[1] for the proposed Wembezi PLS, Portion 57 (of 1) of the Farm Klipplaat Drift No.1009 in Estcourt, KwaZulu-Natal.

The total Wembezi PLS site area is about 19.79Ha. The western part of the site, some 28% of the site area, is to be developed as a shopping centre, the Wembezi Mall.

It is assumed that, subject to further information being available, that the remainder of the site will be developed as residential housing.

This report contains the findings of the geotechnical investigation. The results of the test pits, augered boreholes, dynamic cone penetrometer tests and laboratory test results are presented.

Recommendations are provided for excavation requirements, general earthworks, foundations, materials usage and onsite sanitation measures for the proposed development.

2. INFORMATION SUPPLIED

The following information was used in the geotechnical investigation:

- Report by GGS to Peter Jewell Consulting on a Preliminary Geotechnical Investigation carried out for the Proposed Wembezi PLS, Portion 57 (of 1) of the Farm Klipplaat Drift No.1009, Estcourt, KwaZulu-Natal Project No.: 21-030R01, dated April 2021
- Drawing referenced *"Klipplaat-Drift-Aerial"*
- Drawing referenced *" Klipplaat-Drift-Aerial2"*
- Drawing referenced *"Klipplaat-Drift-Cadastral"*
- Google Earth kmz file showing location of the site
- Development plan (most recent version) in electronic format titled: *"20211019 Wembesi Junxion: Proposed New Shopping Center – Wembezi Mall"*

3. SITE DESCRIPTION

The site, consisting of Portion 57 (of 1) of the Farm Klipplaat Drift No.1009, comprises approximately 19.79Ha hectares.

The site is bounded on the south / southeast by the P29 road, on the west / southwest by the P179 road, and to the northwest to northeast by adjacent farmland of further portions of the farm.

Topographically, the site is relatively flat becoming gently sloping towards the northwest.

The site is occupied by a dense tree line on the southern to southeastern portion, which parallels the P29 road and currently occupies roughly half of the site. A small farm stall area is located on the southwestern corner of the intersection of the P29 and the P179 Road. Further north past the tree line the site is covered in crops, which extend further beyond the site boundary into further portions of the farmland.

An Eskom suspended powerline servitude exists across the site; crossing through the centre of the site running from the southwest to the northeast, and lines passing through from the centre but from the southeast to the northwest.

[1] SANS634 (2012): Geotechnical Investigations for Township Development.

The general layout of the site is shown in Figure 1.

The following plates provide a more detailed perspective of the site:

Plates 1 & 2: South to southeastern boundary of the site adjacent to the P29 road covered by a tree line which spans across most of this half-portion of the site. Note Eskom suspended powerline.

Plates 3 & 4: Southeastern-most portion where currently the site is occupied by a small farm stall at the corner of the P29 and P179 road". This area will be incorporated into the Wembezi Mall as a Service Station site

Plates 5 & 6: Past the tree line the site is predominantly flat to gently sloping towards the west. Crops are located within this portion which extend to the north/northeast beyond the site into the neighbouring farmlands

4. FIELDWORK

The fieldwork for the investigation was carried out on the 6th September 2021 and comprised the following:

- Test Pits,
- Augered boreholes
- Dynamic Cone Penetrometer (DPL) tests, and
- Percolation tests

4.1 Test Pits

Fourteen test pits, designated TP1 through TP14, were dug to depth of between 1.20 and 3.00 metres below existing ground level (mbegl) using a CAT 428F TLB at the approximate positions shown in Figure 1.

The test pits were logged[2] and profiled by an Engineering Geologist. Samples were selected from the test pits for later laboratory testing in a commercial soils laboratory.

Detailed copies of the test pit profiles are provided in Appendix A.

4.2 Hand Augered Boreholes

Three hand augered boreholes, designated AH1 through AH3, were drilled to depths of between 0.40 and 2.5 mbegl at the approximate positions shown in Figure 1.

Spoil samples recovered from the auger flight were profiled by an Engineering Geologist.

Detailed copies of the borehole profiles are provided in Appendix B.

4.3 Dynamic Cone Penetrometer (Light) Tests

Twenty-eight Dynamic Cone Penetrometer (Light), or (DPL), tests, designated DPL1 through DPL28, were carried out at the approximate positions shown in Figure 1. The DPL tests were advanced to depths of refusal between 0.9 and 3.6m below existing ground level.

The DPL test comprises a 25mm diameter solid steel retractable cone driven vertically into the ground using a 10 kg hammer dropped through a height of 550mm. The resistance to penetration is measured in terms of number of blow counts per 300mm advance. It should be noted that the DPL tests can refuse on stiff/hard materials, boulders, cemented layers as well as bedrock. Due to the nature of the test, in which no samples are recovered, it is not possible to determine the materials on which refusal has occurred.

The results of the DPL tests, consisting of plots of blow count and inferred soil strength parameters against depth, are given in Appendix C.

4.4 Percolation Tests

Four percolation tests, designated PT1 through PT4, were carried out at the approximate positions shown in Figure 1. The tests were carried out in accordance with the requirements of eThekwini Municipality[3] and the results of the percolation tests are summarised in Table 1 below.

[2] Geoterminology Workshop (2002) – Guidelines for Soil and Rock Logging, SAIEG-AEG-SAICE (Geotech Div) pp47

[3] eThekwini Municipality: Guidelines for the Design and Approval of On-site (sub-surface) Disposal of Domestic Sewage. July 2005; Revision E; Guideline No 6

Table 1
Summary of Percolation Test Results and Ground Conditions

Time (min)	PT1	PT2	PT3	PT4
0	300	300	300	300
5	284	297	299	300
10	279	295	298	299
15	275	291	298	299
20	271	288	297	298
25	268	285	297	297
30	264	282	296	297
Depth (m)	0.6 - 0.9	0.6 - 0.9	0.6 - 0.9	0.6 - 0.9
Description of Soils	Moist reddish brown mottled yellowish brown firm to stiff intact sandy silty CLAY. Residual Siltstone.	Moist reddish brown firm to stiff intact sandy silty CLAY. Residual Siltstone.	Greyish brown to reddish brown dense intact highly to completely cemented gravelly clayey SAND. Ferricrete.	Greyish brown to reddish brown dense gravelly clayey SAND. Ferricrete.
Percolation Rate (mm/hr)	72	36	8	6
Result	Pass	Fail	Fail	Fail
Application Rate to Soakpit Wall area (l/m^2/day)	50	Not Permissible	Not Permissible	Not Permissible

5. SITE GEOLOGY

5.1 Regional Geology

The general geology of the area as shown in Figure 2 which is an extract of the geological map 1:250 000 series Durban 2930 published by the Council for Geosciences, shows most of the site to be underlain by the siltstones and subordinate, interlayered sandstones of the Estcourt Formation of the Beaufort Group, Karoo Sequence.

5.2 Site Geology

The site is generally underlain by a mantle of transported and residual soils which overlie the weathered siltstone and subordinate, interlayered sandstone beds that characterise the rocks of the Estcourt Formation in this area. These rocks are generally flat bedded and seldom show dipping strata more than about 5 degrees.

The ground conditions encountered beneath the site by the fieldwork is discussed in detail below.

5.2.1 Colluvium

A surficial layer of transported colluvial or hillwash between 0.5 and 0.7m thick occurs from surface. The colluvium generally comprises a greyish brown loose to medium dense intact silty clayey fine-grained sand.

5.2.2 Ferruginised Horizon

A well-developed ferruginized horizon of hardpan strength in the range very dense to very soft rock strength was encountered below the colluvial soils at the following positions, i.e. AH1, TP5, TP 7, and TP9 through TP14 (and related DPL tests). The hardpan ferricrete horizon therefore occurs from between 0.4 and 0.7m below existing ground level (begl). The TLB excavator used for the investigation refused on this layer at 1.6m depth on average, in the range 1.3 to 2.4mbegl. The total thickness of the hardpan ferricrete layer is expected to be in the range 1.5 to 2m, however, it can be expected to vary laterally across the site. Where detected, it disappears beneath most of the proposed shopping centre site area but is also encountered on the extreme western part of the site.

5.2.3 Residual Siltstone and Sandstone Soils

Underlying the colluvial soils residual siltstone soils, developed from the insitu weathering of the siltstone rocks, were encountered. The residual siltstone soils comprise reddish brown to brown medium dense intact silty clayey SAND. With depth they improve in consistency and weathered gravel becomes more common. The residual soils were only encountered in test pits TP 1 through TP4, TP6 and TP8, to an average depth of 1.8mbegl.

5.2.4 Bedrock

Apart from TP8 in which sandstone was encountered, the residual soils grade with depth into bedrock which can be described as yellowish brown to grey stained reddish brown completely weathered thinly bedded very soft to soft rock siltstone of the Estcourt Formation. With depth the siltstone improves to soft rock in strength.

The TLB used for the investigation was able to advance to the final depth of 3m in most cases without refusing on the completely to highly weathered siltstone.

Sandstone bedrock encountered in TP8 is described as orangey brown to greyish brown occasionally streaked dark grey completely weathered thinly bedded fine to medium grained, very soft rock in strength, occasionally intercalated with thin siltstone beds.

Plate 7: Typical residual siltstone soils extending to between 2.5 and 3m before grading into siltstone bedrock

Plate 8: Shallow refusal on hardpan ferricrete horizon

5.2.5 Detailed Site Geology Map

The information obtained from the fieldwork has been used to compile a detailed site geology map, shown in Figure 4.

6. GROUNDWATER

No groundwater seepage was observed in any of the tests put down, or on the rods of the DPL equipment after being withdrawn from the ground.

It can generally be expected, however, that groundwater seepage will occur at the interface between the transported soils and the residual soils/and or bedrock, particularly during or after periods of heavy rainfall. In the area underlain by the hardpan ferricrete, shallow perched groundwater zones can be expected.

7. LABORATORY TESTING AND MATERIALS ASSESSMENT

7.1 Laboratory Test Results

Laboratory tests comprising Foundation Indicator tests (Particle Size Analysis, Atterberg Limit Determination and CBR) were carried out on soil samples taken during the fieldwork.

Chemistry tests, consisting of electrical conductivity (Ec) and soil acidity (pH) were also carried out on selected samples.

The laboratory test results are summarised in Table 2 and Table 3 below, and the detailed results are attached in Appendix D.

Table 2
Summary of Results of Particle Size Distribution Analysis, Atterberg Limit Determinations and CBR tests

TP No.	Depth (m)	Description	Particle Size %				Atterberg Limits			GM	Modified AASHTO		CBR Values (%) Compaction MDD (%)					Swell (%)	Classification & Activity
			Clay	Silt	Sand	Gravel	LL	PI	LS%		MDD (kg/m³)	OMC %	90	93	95	98	100		
TP2	0.50-1.50	Reddish brown mottled yellowish brown silty clayey SAND. Residual Siltstone.	36.0	35.1	27.2	1.7	40	8.7	8	0.28									A-4(7); ML/OL; Low; Type D Gravel Wearing Course
TP3	0.50-2.50	Orange to reddish brown lightly to moderately cemented, gravelly silty clayey SAND. Residual Siltstone.	29.1	15.3	55.3	0.3	35.7	8.6	6	0.56	1709	16.5	4.3	7	8.9	9.4	9.5	1.09	A-4(2); SM; Low; G10; Type D Gravel Wearing Course
TP4	0.60-2.70	Reddish brown silty clayey SAND with siltstone gravel Residual Siltstone.	29.1	25.4	40.4	5.1	35.2	8.5	6.7	0.53									A-4(4); ML/OL; Low; Type D Gravel Wearing Course
TP7	0.00-0.60	Greyish brown silty clayey fine grained SAND. Colluvium	20.7	35.4	42.6	1.3	27.2	7.6	2	0.43	1738	10.9	4	5	5	7	9	0.45	A-4(2); CL/OL; Low; G10; Type A Gravel Wearing Course
TP8	0.60-1.70	Reddish brown to brown medium dense intact silty clayey SAND. Residual Siltstone.	38.2	32.0	28.0	1.8	41	9.2	8.7	0.29	1970	9.4	3	3	3	4	4	0.31	A-5(8); ML/OL; Low; G10; Type D Gravel Wearing Course
	1.70-2.40	Moist orangey brown medium dense to dense intact gravelly SAND. Residual Sandstone.	18.8	12.7	66.4	2.1	36.6	14.2	4	1.12	1843	13	3	5	6	7	8	0.00	A-2-6(1); SC; Low; G10; Type A Gravel Wearing Course

LL - Liquid Limit
PI - Plasticity Index
LS - Linear Shrinkage
GM - Grading Modulus
MDD - Maximum Dry Density
OMC - Optimum Moisture Content

Classification in Terms of:
USPRA[4]
Unified Soil Classification System[5]
D.H. Van Der Merwe (1964)[6]
COLTO[7]
TRH20 (1990)[8]
Suitability for Gravel Wearing Course
A - Erodible Materials
B - Ravels and Corrugates
C - Ravels
D - Slippery when Wet
E - Good

[4] US Public Roads Administration Classification (Modified from Allen 1945)
[5] ASTM D 2487-06 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). June 2006
[6] D.H. Van Der Merwe (1964). The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. The Civil Engineer, pp 103-107
[7] COLTO,: Committee of Land Transport Officials, Standard Specifications for Roads and Bridgeworks
[8] TRH20 (1990) - The Structural Design, Construction and Maintenance of Unpaved Roads, Committee of State Road Authorities

Table 3
Summary of Results of Conductivity and pH Values

TP No.	Depth (m)	Description	Conductivity µS/cm	pH Value	pH and Inferred Corrosivity[9]
TP2	0.50-1.50	Reddish brown mottled yellowish intact silty clayey SAND. Residual Siltstone.	200	4.5	Strongly acidic; Moderately Corrosive
TP3	0.50-2.50	Orange to reddish brown intact lightly to moderately cemented silty clayey SAND. Residual Siltstone.	130	4.9	Strongly acidic; Moderately Corrosive
TP8	1.70-2.40	Orange brown intact gravelly SAND. Residual Sandstone.	220	5.2	Strongly acidic; Moderately Corrosive

[9] Stapelberg FDJ, 2005. The Engineering Geology of the Western Cape & Environs

7.2 Materials Assessment

The materials have been assessed from both laboratory test results, and visual assessment carried out on site. This information is summarised in Table 4 below.

Table 4
Materials Classification and Usage

Material Type	Description	Classification Details	Recommended Use and Subgrade Treatment
Colluvium	Greyish brown silty clayey fine grained SAND	Clay = 20.7% Silt = 35.4% Sand = 42.6% Gravel = 1.3% PI = 7.6 GM = 0.43 MDD = 1738 OMC = 10.9% CBR @ 90%MDD = 4 CBR @ 93% MDD = 5 CBR @ 95% MDD = 5 CBR Swell @ 100%MDD = 0.45% A-4(2); CL/OL; Low; G10	This material is likely to be of G10 to G9 in quality, suitable for general subgrade and fill construction.
Ferricrete	Greyish brown to reddish brown occasionally white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete	Not tested	Anticipate good quality material in the range G8 to G6. Will be suitable for use as a selected material in the construction of roads and paved areas
Residual Siltstone	Orange to reddish brown lightly to moderately cemented, gravelly silty clayey SAND.	Clay = 10 to 38% Silt = 15 to 35% Sand = 28 to 66% Gravel = 1 to 5% PI = 8 to 9 GM = 0.29 to 0.56 MDD = 1709 to 1970 OMC = 9.5 to 16.5% CBR @ 90%MDD = 3 to 4 CBR @ 93% MDD = 3 to 7 CBR @ 95% MDD = 3 to 8 CBR Swell @ 100%MDD = 0.31 to 1.09% A-4(2) to A-5(8); SC to ML/OL; Low; G10 Strongly acidic; Moderately Corrosive	This material is on average G10 in quality. It will be suitable for general subgrade and fills.

Material Type	Description	Classification Details	Recommended Use and Subgrade Treatment
Residual Sandstone	Orange to reddish brown lightly to moderately cemented, gravelly silty clayey SAND.	Clay = 10 to 38% Silt = 15 to 35% Sand = 28 to 66% Gravel = 1 to 5% PI=8 to 9 GM = 1.12 MDD = 1843 OMC = 13% CBR @ 90%MDD = 3 CBR @ 93% MDD = 5 CBR @ 95% MDD = 6 CBR Swell @ 100%MDD = 0.0% A-2-6(1); SC; Low; G10; Strongly acidic; Moderately Corrosive	This material is average G10 in quality. It will be suitable for general subgrade and fills.

8. DEVELOPMENT RECOMMENDATIONS

8.1 Proposed Development

8.1.1 Proposed Wembezi Mall

The Geotechnical Investigation was carried out for the entire site known as Wembezi PLS, Portion 57 (of 1) of the Farm Klipplaat Drift No.1009 in Estcourt, KwaZulu-Natal. The site is some 19.79Ha in total. Some 28% of the site area, comprising the western part, is to be developed as a shopping centre, the Wembezi Mall.

The site layout of the proposed Wembezi Mall is shown in Figure 2. It will consist of shops which will be positioned on the NW boundary of the site. These will comprise anchor tenants as well as smaller shops. The southwestern part of the site will be open parking. A service station will be constructed at the western corner of the site near the junction of the P29 and P179 roads.

The following information has been provided:

AREA OF SHOPPING CENTRE SITE - 50 120m²
Proposed Coverage Area - 11 056m²
Proposed Coverage - 22.1%

AREA OF SERVICE STATION SITE - 5 032m²

PARKING:
Total Parking - 415 Bays

8.1.2 Remainder of Wembezi PLS Site Area

No details regarding the development of the remainder of the site have been provided. It is assumed that development as residential housing may be an option. It so, this would entail houses, roads and other infrastructure associated with residential developments.

8.2 Excavation Requirements

An indication of the depth to which Soft Excavation[10] can be carried out is obtained from the final depths of the test pits and the DPL tests. These depths are shown in Figure 2. In general, Soft Excavation to an average depth of about 3 metres below existing ground level is feasible beneath most of the site.

[10] SANS634:2012: Geotechnical Investigations for Townships: pp16, Table 5 - Classification of material for machine excavation

The area underlain by hardpan ferricrete material, shown in Figure 4 is excavatable by light earthmoving plant such as that used for the investigation (CAT 428F TLB) to an average depth of 1.6m depth, in the range 1.3 to 2.4mbegl. The total thickness of the hardpan ferricrete layer is expected to be in the range 1.5 to 2m, however, it can be expected to vary laterally across the site and appears to pinch out fairly rapidly to the west from TP6 onwards but occurs again at the extreme western part of the site.

All test pit sidewalls were stable on the day of fieldwork and trenches up to 1.2m below existing ground level will be stable with vertical sides for a period of 24 hours. However, trenches likely to be left open for any sustained period should be limited to prevent ongoing deterioration of trench stability, or should be laterally supported if left open indefinitely.

Trenches deeper than 1.2m should be shored to ensure safety of workers inside. Rainfall or groundwater seepage will potentially destabilise trenches and should be monitored closely. All excavations must be inspected daily by a competent person to confirm that they are safe for entry.

8.3 General Earthworks

It is recommended that all earthworks be carried out in accordance with SABS1200DM. In that the site is approximately level, cuts and fills are not expected to exceed about one to 1.5m in height or depth.

All vegetation should be cleared from the areas over which fills are to be built. In addition, the upper 200mm of topsoil noticeable organic content should be removed and stockpiled for later topsoiling of fill banks or general landscaping purposes.

Materials used for fill will be derived from any cut areas of the site and will most likely comprise a mixture of transported and residual soils with lesser amounts of weathered shale. These soils are generally on average G10 in quality. However, the soils will be moisture sensitive and will give compaction problems where the soil moisture content exceeds OMC.

All fills should be placed in layers not exceeding 200mm loose thickness and compacted to a minimum 93% Modified AASHTO maximum dry density. It expected that compaction of the relatively fine grained subgrade soils is best carried out using sheep's foot or stud rollers. Smooth drum rollers will result in biscuit layering typical of delaminating clayey fill materials.

All terraces and earthworks in general should be sloped to a gradient of not less than 1 vertical in 50 horizontal to prevent ponding and ingress of water into the subsoils. Surface drainage should be directed away from the crests of fill embankments to prevent over-topping and erosion of fill slopes.

Cut and fill slopes should be top-soiled and planted with grass as soon as possible. This will limit erosion of these slopes and the problems associated with wash-away of fill embankments. Continual maintenance of earth slopes is time consuming and costly to both the developer and the eventual owner of the property.

8.4 Drainage

8.4.1 Surface Drainage

A most important factor in the promotion of a stable site is the control and removal of both surface and ground water from the site. It is important that the design of the stormwater management system allow for the drainage of accumulated surface water from the building platforms. Disposal of stormwater should in any case conform to the Local Authority's requirements.

8.4.2 Sub-Surface Drainage

While groundwater was not observed in any of the test pits dug on the site, heavy rains can result in perched groundwater seepage in places, creating the need for subsoil drainage. If groundwater seepage is encountered during construction, these zones will need to be controlled with effective subsoil drains, particularly where water is likely to gain ingress into the structural layers of roads and paved areas. The occurrence of seepage at the base of road or platform cuts may also require similar treatment.

It should be expected that all cuttings will attract groundwater over time and judicious installation of subsoil drainage is strongly recommended to protect water ingress into the structural layers of roads and paving, as well as foundations.

8.5 Foundations

8.5.1 Wembezi Mall

No information has been provided for the buildings that will be constructed for the shopping centre development. Similar shopping centres elsewhere in rural settings suggest that the largest buildings will consist of at least double volume bulk store structures, steel framed, and partial brick and steel sheet clad with bricked in administration and retail areas. Mezzanine floors are likely. Floor loading and rack loads could be expected to range between 10 and 20kPa.

The colluvial soils occurring to an average depth of about 0.6m below existing ground level are not considered suitable for foundations of any kind. All foundations should be taken into the residual soils of at least firm consistency where a maximum allowable bearing pressure of 100kPa may be used for the design. Foundations may comprise conventional strip and pad footings of minimum widths 750mm and 1000mm, respectively, which should be founded in the firm/ stiff soils occurring from a minimum depth of 0.8m below existing ground level, however, the finished floor levels of the building platforms may impact on this founding depth.

The foundation indicator results of the residual materials (Table 2) indicate that the soils area of low expansiveness. However, given the depth of formation of the residual soils and relatively low groundwater level, heave can be expected to occur beneath foundations which are underlain by these soils. Total estimated heave of between 10 and 15mm should be allowed for in the design of foundations and surface beds. Differential values to be taken as 50% of these values.

It is recommended that for higher foundation loads that all foundations be taken into the weathered siltstone (or ferricrete layer) of at least stiff to very soft rock consistency / strength where a maximum allowable bearing pressure of 200kPa is recommended. Founding depths could therefore range between 1 and 1.5m below existing ground level in this case. Where underlain by the ferricrete horizon, founding depths would be much shallower, in the range 0.6 to 0.8mbegl.

8.5.2 Remainder of Wembezi PLS Site Area

Assuming that this area is to be developed as residential housing the site has been zoned in terms of the Site Classes H and H1 according to the NHBRC guidelines (NHBRC Heave Table - Appendix E), as shown in Figure 5.

Area underlain by Shallow Ferricrete

This area is underlain by a shallow ferricrete horizon. The ferricrete will dampen heave to estimated total values less than 7.5mm. Differential heave should be taken as 50% of this value.

- Foundations should comply with guidelines given for Site Class H in the NHBRC Heave table
- Minimum founding level = 0.6m begl
- Foundations to comprise minimum 0.6m wide strip footings, maximum bearing pressure = 60kPa for material of at least firm consistency
- Foundations must be designed for differential heave of 50% of the anticipated total heave value
- Drainage and plumbing precautions to apply

Area underlain by Deep Residual Soils

In this area, heave is expected to range between 10 and 20mm. Differential heave should be taken as 50%, with the following recommendations for foundations:

- Foundations for houses should consist of the Modified Normal type as given for Site Class H1 in the NHBRC Heave table
- Minimum founding level = 0.6m begl
- Foundations to comprise minimum 0.6m wide strip footings, maximum bearing pressure = 80kPa for material of at least firm consistency

- Accommodation of heave and mitigation of cracking as per NHBRC Heave Table
    - Movement or articulation joints – spacings between wall panels not to exceed 3m in length to accommodate heave deflections
    - Light reinforcement in masonry
    - Site drainage – ensure building has a 1m wide concrete surround constructed with appropriate falls to shed stormwater away from walls and foundations
    - Plumbing precautions to avoid leaking services in the vicinity of walls and foundations

8.6 General Recommendations for Foundations and Site Drainage

It is recommended that none of the following be positioned within 3m of new structures or within paved areas to limit localised variation of the insitu moisture content of the foundation soils:

- Flower beds, plants or trees, and
- Sewage or stormwater soakpits

It is recommended that GGS inspect all foundation excavations to confirm bearing pressure and depth of founding before concrete is cast.

8.7 Recommended Subgrade Treatment – Roads, Paved and Parking Areas

The insitu subgrade material are generally G10 in quality and will require ripping to at least 300mm depth below top of subgrade, wetting, and recompaction to minimum 93%MDD (or as per the Engineers design).

Care should be taken to identify more clayey material types during construction as these may require selective undercutting and replacement with a better-quality subgrade material such as a G8/G7.

8.8 Onsite Sanitation

The results of percolation tests PT1 through PT4 indicate that the subsoils beneath the area tested have very low to marginal percolation characteristics, of generally less than 50mm per hour. It can thus be concluded that the area tested is not suitable for the disposal of wastewater and sewage effluent via subsoil percolation, i.e. conventional septic tank-soakaway systems.

The disposal of wastewater and sewage effluent will need to employ alternative methods such as:

- Conservancy tank, or
- Patented package plant system

9. CONCLUSIONS

This report contains the findings of a Geotechnical Investigation carried out for the proposed Wembezi PLS, Estcourt in KwaZulu-Natal.

The site is generally underlain by a mantle of transported and residual soils which overlie the weathered siltstone and subordinate sandstone beds that characterise the rocks of the Estcourt Formation. These rocks are generally flat bedded and seldom show dipping strata more than about 5 degrees.

The report presents the results of the geotechnical investigation and provides recommendations for excavations requirements, general earthworks, foundations, materials usage and onsite sanitation measures for the proposed development.

Percolation test results show that the site is not suitable for the use of conventional septic tank-soakaway systems. Alternative onsite sewage disposal systems, such as conservancy tank or patented package systems, will need to be considered.

Finally, the information given in this report relates specifically to the positions of the test pits, boreholes and DPL tests carried out on this site. Variations in ground conditions may be encountered elsewhere on the site during construction. As a result, the construction phase of the project should be regarded as part of the geotechnical investigation and GGS consulted if ground conditions vary from those given in this report.

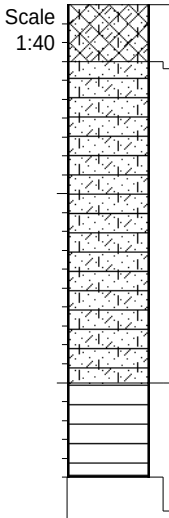
APPENDIX A

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP1**
Sheet 1 of 1

JOB NUMBER: 21-030



0.00 – 0.30: Dry greyish brown loose intact silty clayey fine grained SAND. Fill.

0.30 – 2.00: Moist reddish brown mottled yellowish brown loose to medium dense intact silty clayey SAND. Residual Siltstone.

2.00 – 2.50: Yellowish brown to grey stained reddish brown completely weathered thinly bedded very soft to soft rock SILTSTONE. Estcourt Formation. Beaufort Group.

NOTES

1) Final depth at 2.50m. Refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP1**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

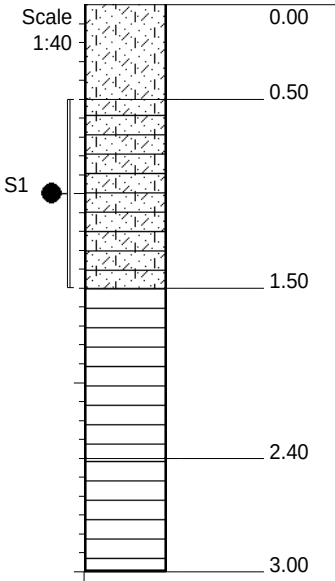
DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP2**
Sheet 1 of 1

JOB NUMBER: 21-030



0.00 Dry greyish brown loose intact silty clayey fine grained SAND. Colluvium.

0.50 Moist reddish brown mottled yellowish brown loose to medium dense intact silty clayey SAND. Residual Siltstone.

1.50 Reddish brown to yellowish brown streaked grey completely weathered thinly bedded very soft rock SILTSTONE. Estcourt Formation. Beaufort Group.

2.40 Yellowish brown to grey stained brown completely to highly weathered very soft to soft rock SILTSTONE. Estcourt Formation. Beaufort Group.

3.00

NOTES

1) Final depth at 3.00m. Terminated.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.50--1.50m (3 x Bulk)

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP2**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

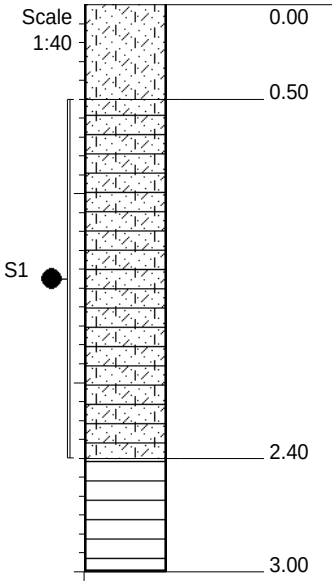
DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP3**
Sheet 1 of 1

JOB NUMBER: 21-030



0.00 Dry greyish brown loose intact silty clayey fine grained SAND. Colluvium.

0.50 Moist orangey to reddish brown medium dense intact lightly to moderately cemented silty clayey SAND. Residual Siltstone.

2.40 Reddish brown streaked grey completely weathered thinly bedded very soft to soft rock SILTSTONE. Estcourt Formation. Beaufort Group.

3.00

NOTES

1) Final depth at 3.00m. Refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.50--2.40 (3 x Bulk)

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

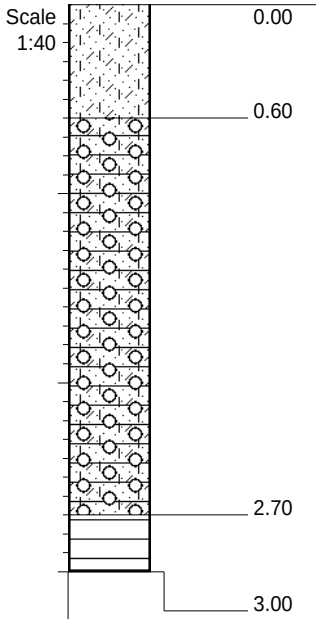
HOLE No: **TP3**

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP4**
Sheet 1 of 1

JOB NUMBER: 21-030



0.00 Dry greyish brown loose intact silty clayey fine grained SAND. Colluvium.

0.60 Moist reddish brown medium dense intact silty clayey SAND becoming gravelly with depth. Gravel comprises subangular to angular completely weathered fine to medium siltstone fragments. Residual Siltstone.

2.70 Reddish brown streaked grey completely weathered thinly bedded very soft rock SILTSTONE. Estcourt Formation. Beaufort Group.

3.00

NOTES

1) Final depth at 3.00m. Terminated.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP4**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

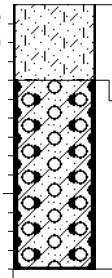
GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP5**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



0.00	Dry greyish brown medium dense intact silty clayey fine grained SAND. Colluvium.
0.40	Greyish brown to reddish brown occasionally white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.
1.40	

NOTES

1) Final depth at 1.40m. Refusal on highly cemented very dense ferricrete.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

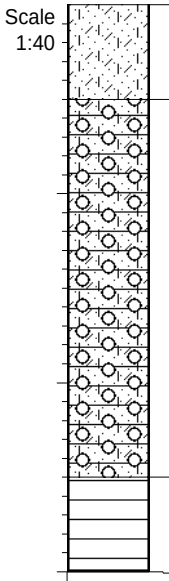
HOLE No: **TP5**

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP6**
Sheet 1 of 1

JOB NUMBER: 21-030



0.00	Dry greyish brown loose intact silty clayey fine grained SAND. Colluvium.
0.50	Moist reddish brown medium dense to dense with depth intact silty clayey SAND becoming gravelly with depth. Gravel comprises subangular to angular completely weathered fine to medium siltstone fragments. Residual Siltstone.
2.50	Reddish brown streaked grey completely weathered thinly bedded very soft rock SILTSTONE. Estcourt Formation. Beaufort Group.
3.00	

NOTES

1) Final depth at 3.00m. Terminated.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

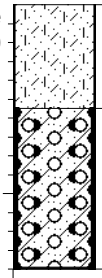
HOLE No: **TP6**

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP7**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



0.00	Dry greyish brown loose intact silty clayey fine grained SAND. Colluvium.
0.55	Greyish brown to reddish brown occasionally white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.
1.40	

NOTES

1) Final depth at 1.40m. Refusal on highly cemented very dense ferricrete.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

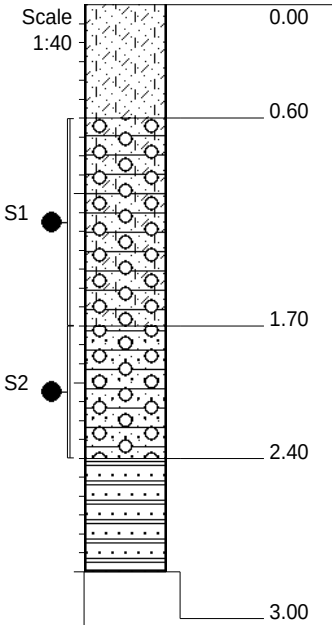
HOLE No: **TP7**

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP8**
Sheet 1 of 1

JOB NUMBER: 21-030



0.00 Dry greyish brown loose intact silty clayey fine grained SAND. Colluvium.

0.60 Moist reddish brown to brown medium dense intact silty clayey SAND. Gravel comprises subangular to angular completely weathered fine to medium siltstone fragments. Residual Siltstone.

1.70 Moist orangey brown medium dense to dense intact gravelly SAND. Gravel comprises subangular completely to highly weathered fine to medium sandstone and shell fragments throughout. Residual Sandstone.

2.40 Orangey brown to greyish brown occasionally streaked dark grey completely weathered thinly bedded fine to medium grained very soft rock SANDSTONE occasionally intercalated with thin siltstone beds. Estcourt Formation. Beaufort Group.

3.00

NOTES

1) Final depth at 3.00m. Terminated.

2) No groundwater seepage.

3) No sidewall collapse.

4) Samples taken :
S1 0.60--1.70m (3 x Bulk)
S2 1.70--2.40m (3 x Bulk)

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

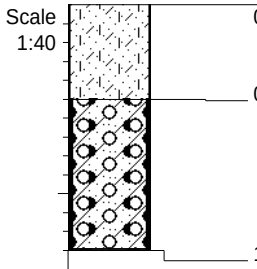
HOLE No: **TP8**

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP9**
Sheet 1 of 1

JOB NUMBER: 21-030



Dry greyish brown loose to medium dense intact silty clayey fine grained SAND. Colluvium.

Greyish brown to reddish brown occasionally white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.

NOTES

1) Final depth at 1.30m. Refusal on highly cemented very dense ferricrete.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP9**

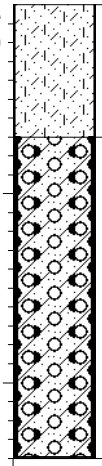
GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP10**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



0.00 Dry greyish brown loose to medium dense intact silty clayey fine grained SAND. Colluvium.

0.70 Greyish brown to reddish brown occasionally white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.

2.40

NOTES

1) Final depth at 2.40m. Refusal on highly cemented very dense ferricrete.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

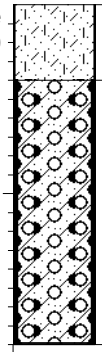
HOLE No: **TP10**

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP11**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



0.00 Dry greyish brown loose to medium dense intact silty clayey fine grained SAND. Colluvium.

0.40 Greyish brown to light brown occasionally streaked white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.

1.80

NOTES

1) Final depth at 1.80m. Refusal.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP11**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

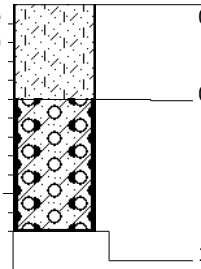
DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP12**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



0.00 Dry greyish brown loose to medium dense intact silty clayey fine grained SAND. Colluvium.

0.50 Greyish brown to reddish brown occasionally white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.

1.20

NOTES

1) Final depth at 1.20m. Refusal on highly cemented very dense ferricrete.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP12**

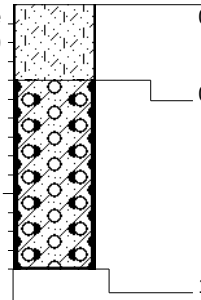
GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP13**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



Dry greyish brown loose to medium dense intact silty clayey fine grained SAND. Colluvium.

Greyish brown to light brown occasionally streaked white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.

NOTES

1) Final depth at 1.40m. Refusal on highly cemented very dense ferricrete.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP13**

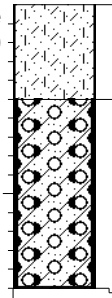
GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **TP14**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



Dry greyish brown loose to medium dense intact silty clayey fine grained SAND. Colluvium.

Greyish brown to light brown occasionally streaked white dense to very dense intact highly to completely cemented clayey SAND to sandy GRAVEL. Gravel comprises rounded to subrounded ferruginised nodules as well as completely fine to coarse cemented sandy clay. Hardpan Ferricrete.

NOTES

1) Final depth at 1.50m. Refusal on highly cemented very dense ferricrete.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE : CAT 428F TLB
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 06/09/2021
DATE : 06/09/2021

DATE : 27/10/2021 09:01
TEXT : ..gCentre\Logs\TP1TP14.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP14**

APPENDIX B

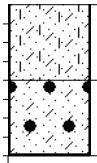
GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **AH1**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



0.00	Dry dark greyish brown silty clayey fine grained SAND. Colluvium.
0.40	Greyish brown and white clayey SAND. Ferricrete.
0.80	

NOTES

1) Final depth at 0.40m. Refusal on ferricrete.
2) No groundwater seepage.
3) AH1 tested near DPL17 position.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : EN
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 28/10/2021
DATE : 28/10/2021
DATE : 29/10/2021 08:54
TEXT : ..ngCentre\Logs\AH1AH3.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **AH1**

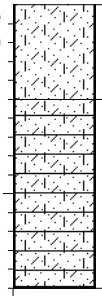
GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **AH2**
Sheet 1 of 1

JOB NUMBER: 21-030

Scale 1:40



0.00 Moist dark greyish brown silty clayey fine grained SAND. Colluvium.

0.50 Moist reddish brown silty clayey SAND. Residual Siltstone.

1.50

NOTES

1) Final depth at 1.50m. Refusal.
2) No groundwater seepage.
3) AH2 tested near DPL22 position.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : EN
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 28/10/2021
DATE : 28/10/2021
DATE : 29/10/2021 08:54
TEXT : ..ngCentre\Logs\AH1AH3.doc

ELEVATION :
X-COORD :
Y-COORD :

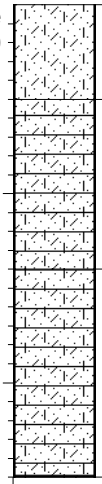
HOLE No: **AH2**

GONDWANA GEO SOLUTIONS

KLIPPLAATS FAMILY TRUST
Wembezi PLS, Portion 57 (of 1)
of the Farm Klipplaat Drift No. 1009

HOLE No: **AH3**
Sheet 1 of 1

JOB NUMBER: 21-030



0.00	Moist dark greyish brown silty clayey fine grained SAND. Colluvium.
0.50	Moist reddish brown mottled grey silty clayey SAND. Residual Siltstone.
1.40	Moist light brown to greyish brown silty clayey fine grained SAND. Residual Siltstone.
2.50	

NOTES

1) Final depth at 2.50m. Refusal.
2) No groundwater seepage.
3) AH3 tested near DPL24 position.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : EN
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 28/10/2021
DATE : 28/10/2021
DATE : 29/10/2021 08:54
TEXT : ..ngCentre\Logs\AH1AH3.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **AH3**

APPENDIX C

GONDWANA GEO SOLUTIONS

Consulting Geotechnical Engineers & Engineering Geologists

Cape Town Office:
13 Rocklands Road
Simonstown
CAPE TOWN
7975

Durban Office:
4 Haven Road
Westville
DURBAN
3629

Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No.**	**21-030**
Project:	**Wembezi PLS**	**Date:**	**06/09/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 1***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 2***

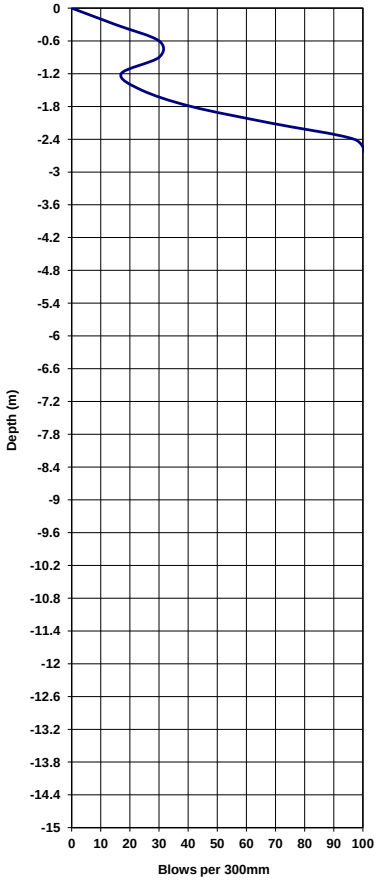
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 3***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

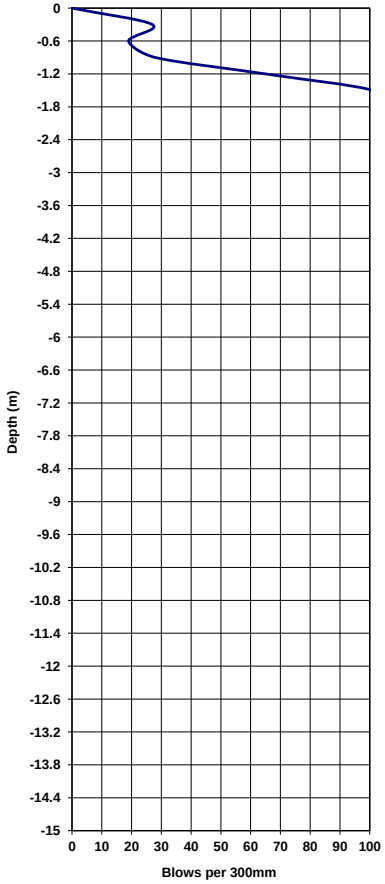
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	15	Loose
0.6	30	Med.Dense
0.9	30	Med.Dense
1.2	17	Med.Dense
1.5	24	Med.Dense
1.8	41	Dense
2.1	68	Dense
2.4	97	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

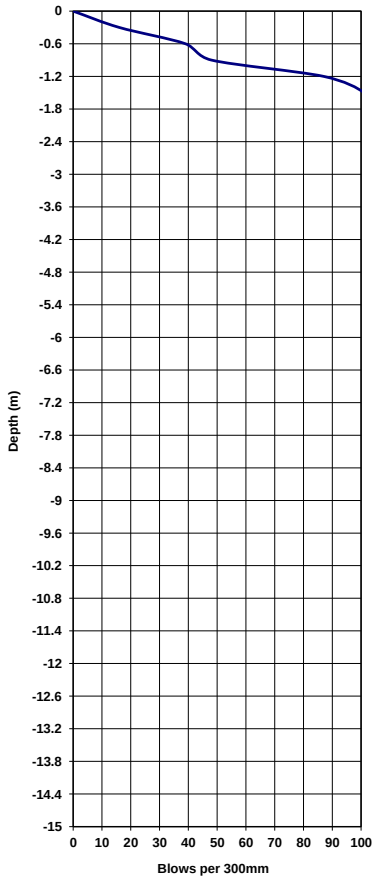
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	27	Med.Dense
0.6	19	Med.Dense
0.9	28	Med.Dense
1.2	65	Dense
1.5	101	Very Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	16	Med.Dense
0.6	39	Med.Dense
0.9	48	Dense
1.2	87	Dense
	Ref	



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3629

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Project:	**Wembezi PLS**	**Date:**	**06/09/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 4***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 5***

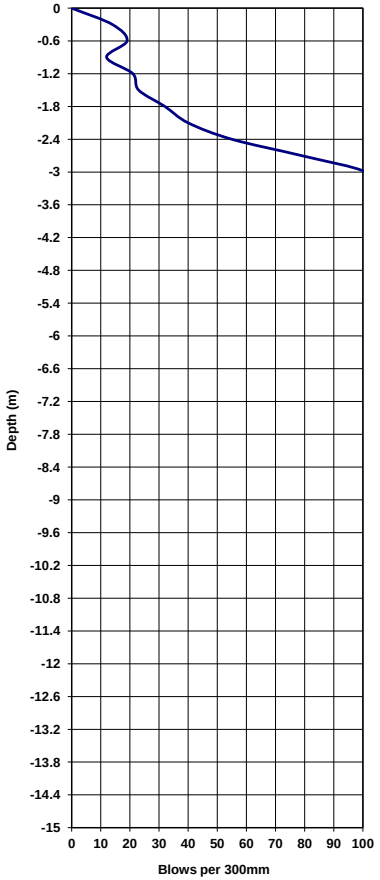
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 6***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

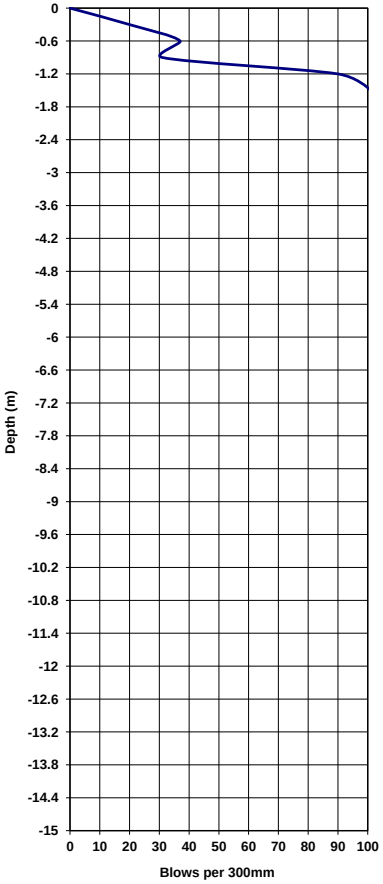
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	14	Loose
0.6	19	Med.Dense
0.9	12	Loose
1.2	21	Med.Dense
1.5	23	Med.Dense
1.8	32	Med.Dense
2.1	40	Med.Dense
2.4	55	Dense
2.7	79	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

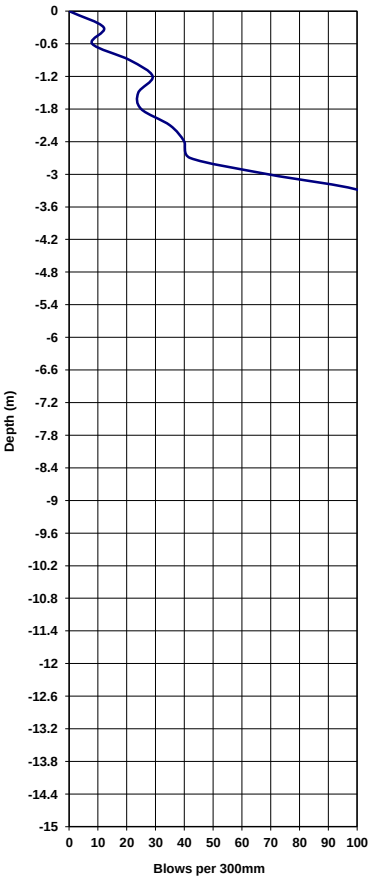
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	20	Med.Dense
0.6	37	Med.Dense
0.9	31	Med.Dense
1.2	90	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	12	Loose
0.6	8	Loose
0.9	21	Med.Dense
1.2	29	Med.Dense
1.5	24	Med.Dense
1.8	25	Med.Dense
2.1	35	Med.Dense
2.4	40	Med.Dense
2.7	42	Dense
3	69	Dense
	Ref	



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Project:	**Wembezi PLS**	**Date:**	**06/09/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 7***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 8***

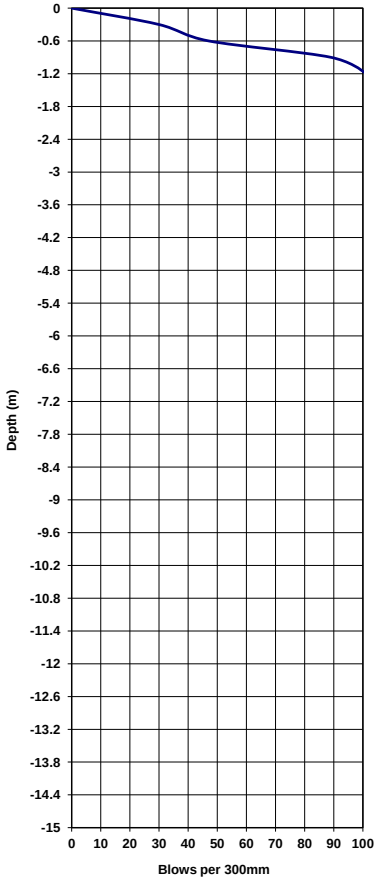
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 9***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

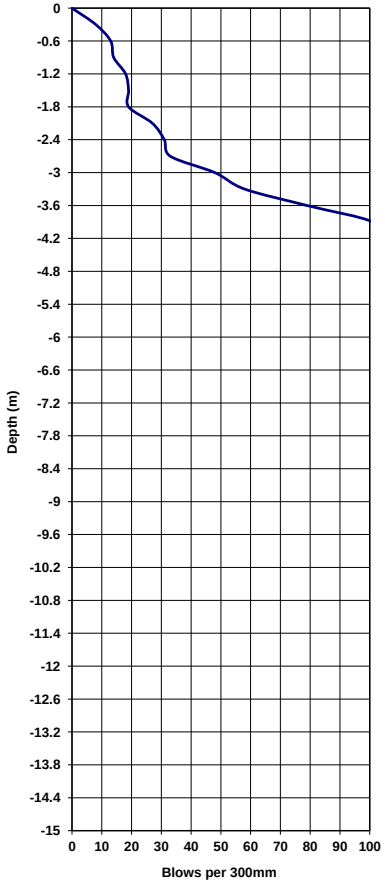
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	30	Med.Dense
0.6	47	Dense
0.9	89	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

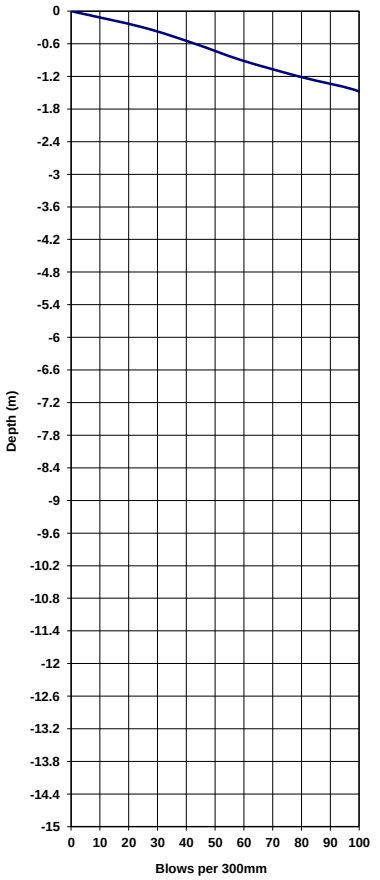
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	8	Loose
0.6	13	Loose
0.9	14	Loose
1.2	18	Med.Dense
1.5	19	Med.Dense
1.8	19	Med.Dense
2.1	27	Med.Dense
2.4	31	Med.Dense
2.7	33	Med.Dense
3	48	Dense
3.3	58	Dense
3.6	79	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	25	Med.Dense
0.6	43	Dense
0.9	59	Dense
1.2	79	Dense
	Ref	



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DURBAN
3629

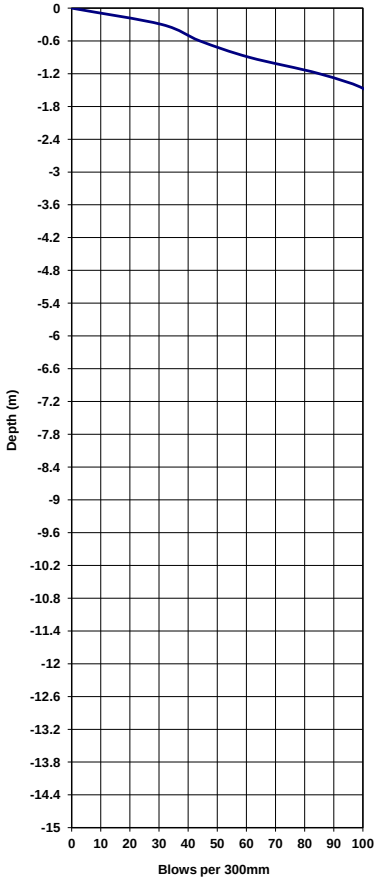
Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No. 21-030**
Project:	**Wembezi PLS**	**Date: 06/09/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator: EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 10***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	31	Med.Dense
0.6	44	Dense
0.9	61	Dense
1.2	85	Dense
	Ref	

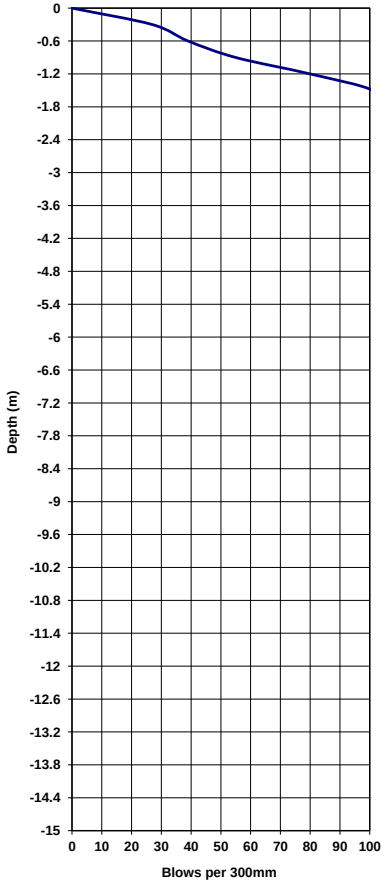


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 11***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	27	Med.Dense
0.6	39	Med.Dense
0.9	55	Dense
1.2	80	Dense
	Ref	

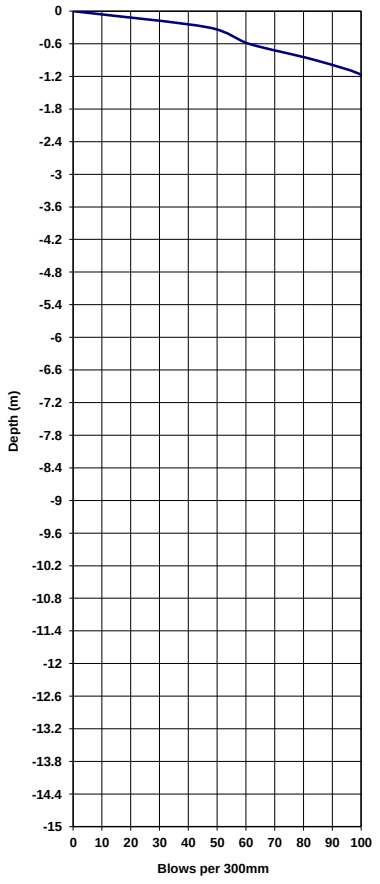


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 12***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	47	Dense
0.6	61	Dense
0.9	84	Dense
	Ref	



THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

GONDWANA GEO SOLUTIONS

Consulting Geotechnical Engineers & Engineering Geologists

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Westville
DURBAN
3629

Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No.**	**21-030**
Project:	**Wembezi PLS**	**Date:**	**06/09/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 13***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 14***

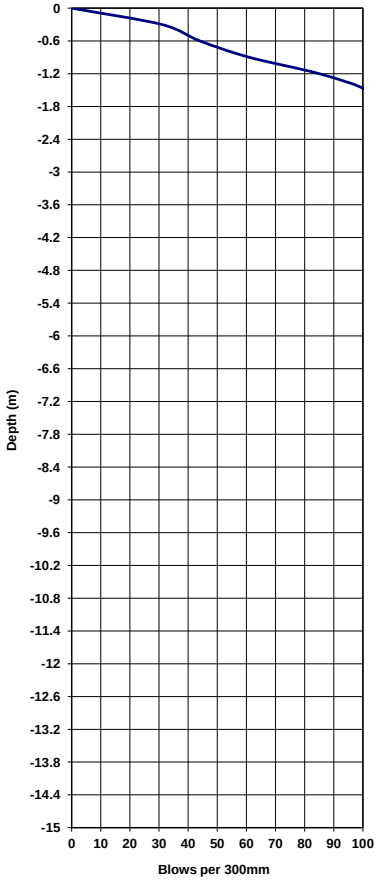
Light Dynamic Penetrometer Probe ----------

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

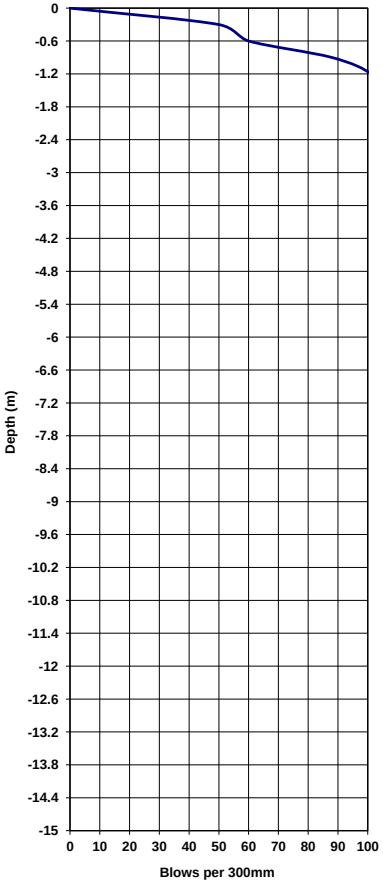
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	31	Med.Dense
0.6	44	Dense
0.9	61	Dense
1.2	85	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

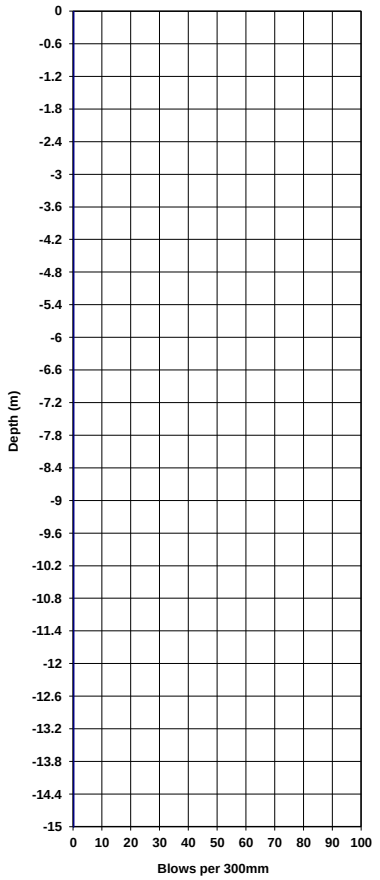
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	50	Dense
0.6	60	Dense
0.9	88	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		



GONDWANA GEO SOLUTIONS

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Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No.**	**21-030**
Project:	**Wembezi PLS**	**Date:**	**28/10/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

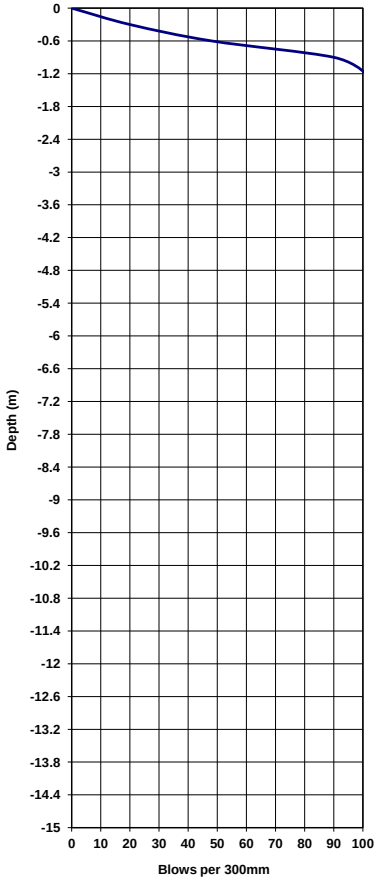
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 15***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	20	Med.Dense
0.6	48	Dense
0.9	90	Dense
	Ref	

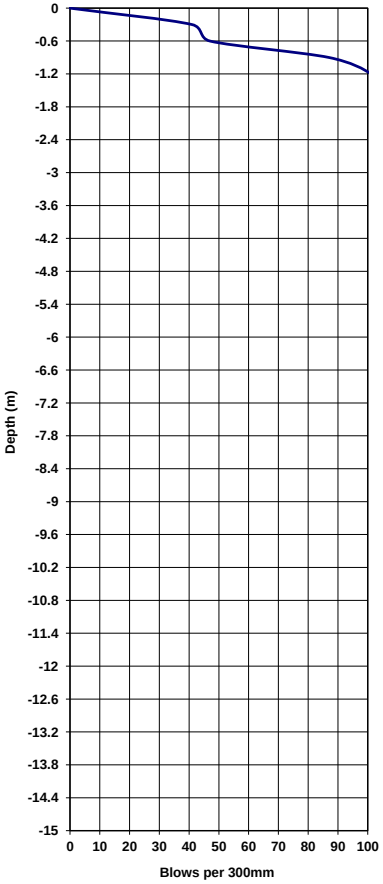


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 16***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	41	Dense
0.6	47	Dense
0.9	87	Dense
	Ref	

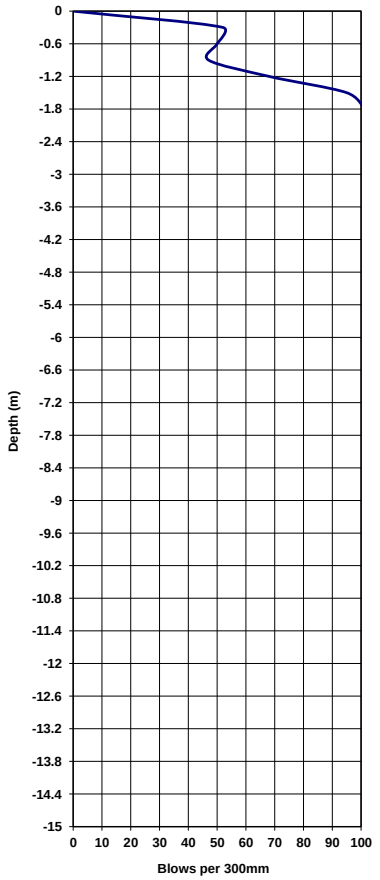


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 17***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	52	Dense
0.6	50	Dense
0.9	47	Dense
1.2	68	Dense
1.5	95	Dense
	Ref	



GONDWANA GEO SOLUTIONS

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13 Rocklands Road
Simonstown
CAPE TOWN
7975

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3629

Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No.**	**21-030**
Project:	**Wembezi PLS**	**Date:**	**28/10/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 18***

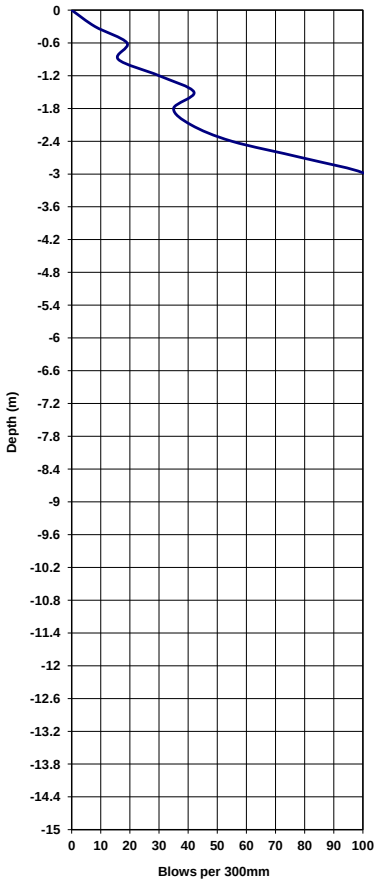
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 19***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 20***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

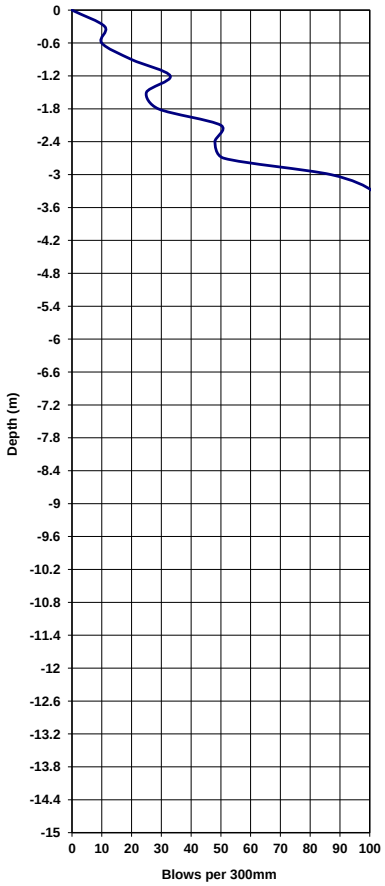
Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings
C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	8	Loose
0.6	19	Med.Dense
0.9	16	Med.Dense
1.2	30	Med.Dense
1.5	42	Dense
1.8	35	Med.Dense
2.1	41	Dense
2.4	55	Dense
2.7	79	Dense
	Ref	



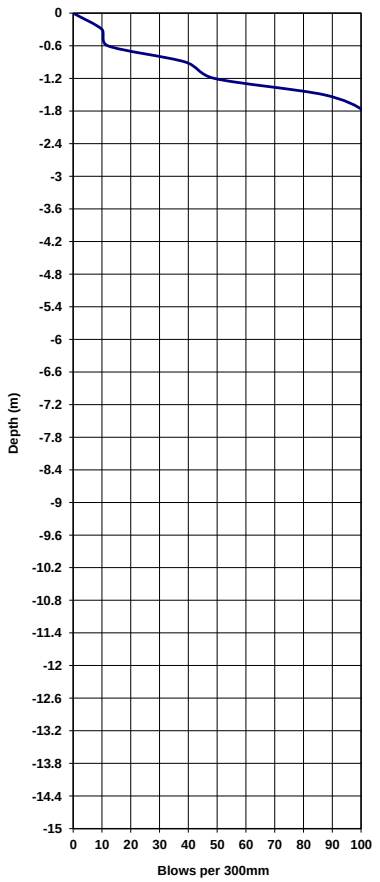
Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings
C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	11	Loose
0.6	10	Loose
0.9	20	Med.Dense
1.2	33	Med.Dense
1.5	25	Med.Dense
1.8	29	Med.Dense
2.1	50	Dense
2.4	48	Dense
2.7	51	Dense
3	87	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings
C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	10	Loose
0.6	12	Loose
0.9	39	Med.Dense
1.2	49	Dense
1.5	87	Dense
	Ref	



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7975

Durban Office:
4 Haven Road
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DURBAN
3629

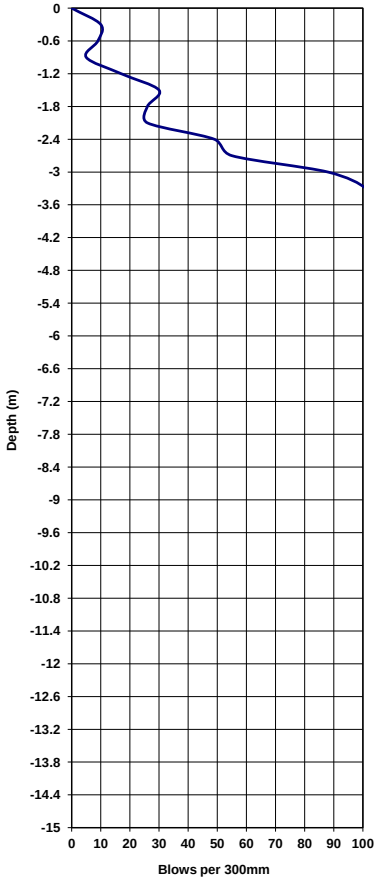
Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No.**	**21-030**
Project:	**Wembezi PLS**	**Date:**	**28/10/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 21***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	10	Loose
0.6	9	Loose
0.9	5	Very Loose
1.2	17	Med.Dense
1.5	30	Med.Dense
1.8	26	Med.Dense
2.1	26	Med.Dense
2.4	49	Dense
2.7	55	Dense
3	88	Dense
	Ref	

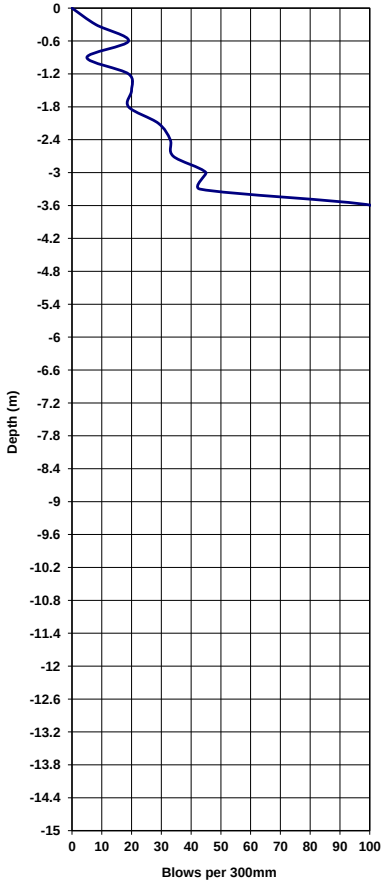


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 22***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	8	Loose
0.6	19	Med.Dense
0.9	5	Very Loose
1.2	19	Med.Dense
1.5	20	Med.Dense
1.8	19	Med.Dense
2.1	29	Med.Dense
2.4	33	Med.Dense
2.7	34	Med.Dense
3	45	Dense
3.3	43	Dense
	Ref	

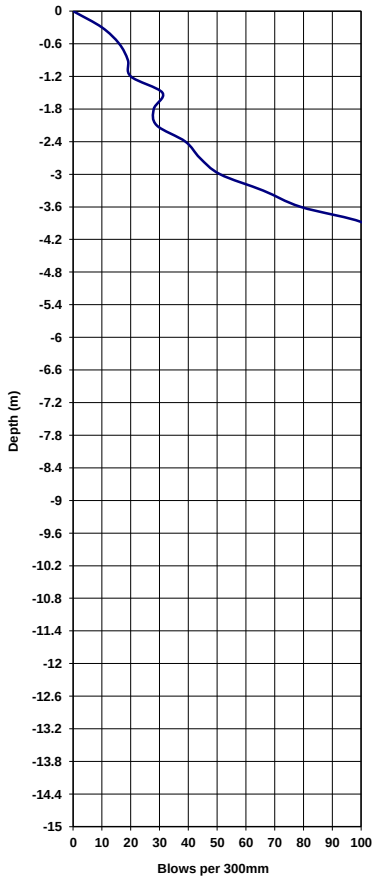


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 23***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	10	Loose
0.6	16	Med.Dense
0.9	19	Med.Dense
1.2	20	Med.Dense
1.5	31	Med.Dense
1.8	28	Med.Dense
2.1	29	Med.Dense
2.4	39	Med.Dense
2.7	44	Dense
3	51	Dense
3.3	66	Dense
3.6	79	Dense
	Ref	



THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

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Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No.**	**21-030**
Project:	**Wembezi PLS**	**Date:**	**28/10/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 24***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 25***

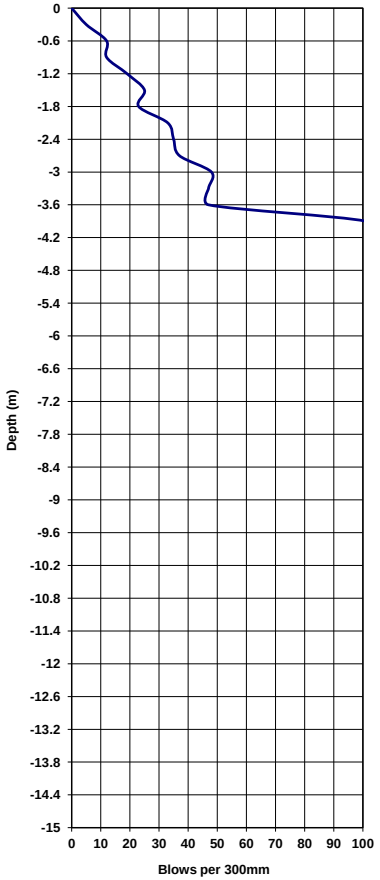
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 26***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

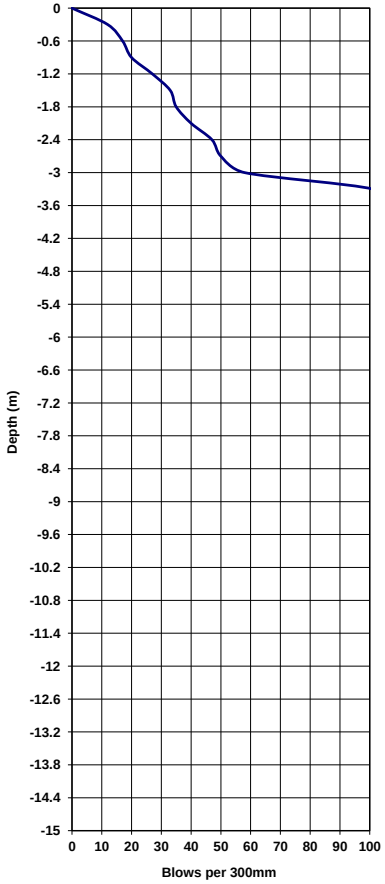
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	5	Very Loose
0.6	12	Loose
0.9	12	Loose
1.2	19	Med.Dense
1.5	25	Med.Dense
1.8	23	Med.Dense
2.1	33	Med.Dense
2.4	35	Med.Dense
2.7	37	Med.Dense
3	48	Dense
3.3	47	Dense
3.6	47	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

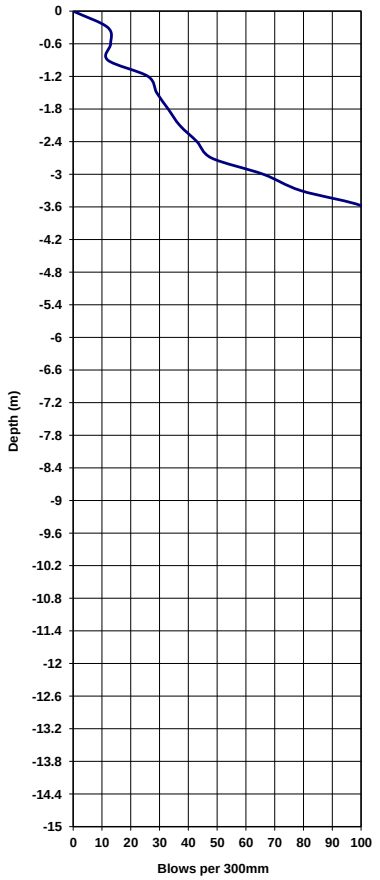
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	12	Loose
0.6	17	Med.Dense
0.9	20	Med.Dense
1.2	27	Med.Dense
1.5	33	Med.Dense
1.8	35	Med.Dense
2.1	40	Med.Dense
2.4	47	Dense
2.7	50	Dense
3	58	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	12	Loose
0.6	13	Loose
0.9	12	Loose
1.2	26	Med.Dense
1.5	29	Med.Dense
1.8	33	Med.Dense
2.1	37	Med.Dense
2.4	43	Dense
2.7	48	Dense
3	66	Dense
3.3	79	Dense
	Ref	



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Client:	**KLIPPLAATS FAMILY TRUST**	**Ref.No.**	**21-030**
Project:	**Wembezi PLS**	**Date:**	**28/10/2021**
Section:	**Portion 57 (of 1) of the Farm Klipplaat Drift No. 1009**	**Operator:**	**EN**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 27***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 28***

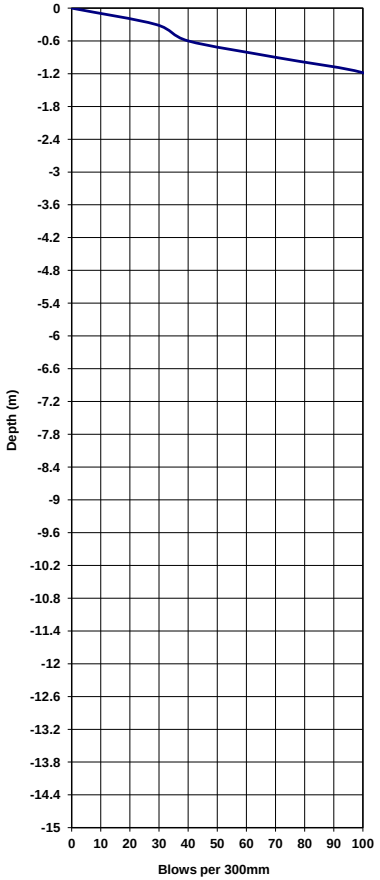
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

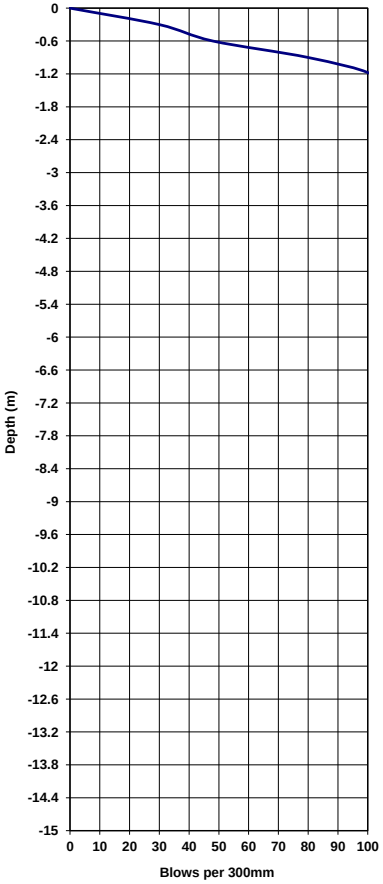
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	29	Med.Dense
0.6	40	Med.Dense
0.9	70	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

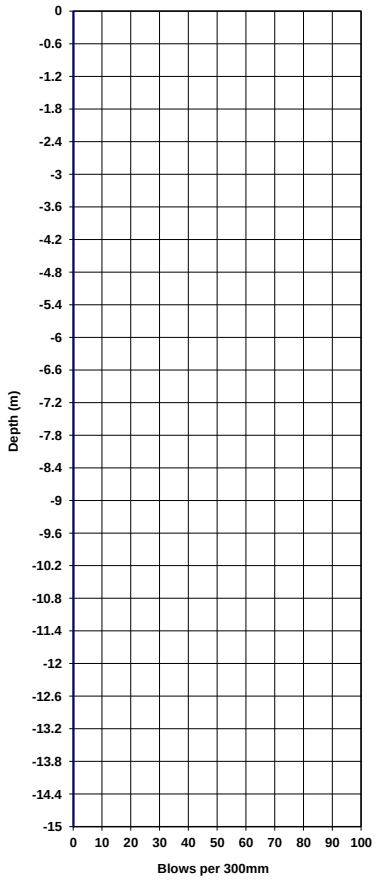
Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	30	Med.Dense
0.6	48	Dense
0.9	80	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		



APPENDIX D

Laboratory Test Summary

THEKWINI SOILS LABORATORY CC
VAT REG. 45902 10961
UNIT 16, Alexander Park
24 Alexander Road
WESTMEAD
3610
Tel : 087 898 2245
P. O. BOX 30464
MAYVILLE
4058

Job Description: Wembezi
Job no.: 9403
Date: 05-10-2021

Lab no.		09018	09019	09020	09021	09022	09023				
Location		TP 2	TP 3	TP 4	TP 7	TP 8	TP 8				
Depth		0,5 - 1,5	0,5 - 2,5	0,6 - 2,7	0,0 - 0,6	0,6 - 1,7	1,7 - 2,4				
Description		-	-	-	-	-	-				
		-	-	-	-	-	-				
Binder Material		-	-	-	-	-	-				
Particle Size (mm)	75										
	53										
	37,5										
	26,5										
	19										
	13,2			100							
	9,5	100		99	100	100	100				
	4,75	100	100	97	99	100	100				
	2	98	100	95	99	98	98				
	0,425	97	97	93	97	97	57				
	0,25	95	80	90	95	95	45				
	0,15	92	58	82	88	90	40				
	0,075	76	47	59	60	76	33				
	0,05	68	42	51	53	67	31				
	0,02	52	41	41	37	49	26				
	0,005	41	34	32	28	40	22				
	0,002	36	29	29	21	38	19				
Soil Mortar	Coarse Sand <2.0 >0.425mm	1,3	2,3	2,0	1,3	1,3	41,4				
	Fine Sand <0.425>0.05mm	32,0	56,3	47,5	46,2	32,9	40,6				
	Silt <0.05 >0.005	26,0	8,1	19,0	24,9	26,3	5,0				
	Clay <0.005	40,7	33,3	31,4	27,6	39,4	12,9				
Atterberg Limits	Liquid Limit	40	35,7	35,2	27,2	41	36,6				
	Plasticity Index	8,7	8,6	8,5	7,6	9,2	14,2				
	Linear Shrinkage	8	6	6,7	2	8,7	4				
	Natural MC	-	-	-	-	-	-				
Mod AASHTO Density	Density Kg/m^3		1709		1738	1970	1843				
	OMC		16,5		10,9	9,4	13				
CBR	100%		9,5		9	4	8				
	98%		9,4		7	4	7				
	95%		8,9		5	3	6				
	93% (Inferred)		7		5	3	5				
	90%		4,3		4	3	3				
	CBR Swell		1,09		0,45	0,31	0,00				
AASHTO Soil Classification		A - 4 (7)	A - 4 (2)	A - 4 (4)	A - 4 (2)	A - 5 (8)	A - 2 - 6 (1)				
Grading Modulus		0,28	0,56	0,53	0,43	0,29	1,12				
TRH 14 (1985)	WT = Worse Than		G10		G10	WT G10	G10				
pH		4,5	4,9				5,2				
Conductivity µS/cm		200	130				220				

MATERIALS ANALYSIS

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P. O. BOX 30464
MAYVILLE
4058

Project: Wembezi

Ref no.: 9403 **Lab no.:** 09018 **Borehole/Pit no.:** TP 2 **Fig no.:** -

Description: -

Depth: 0,5 - 1,5 -

Grading Analysis	
Grain Size (mm)	%Passing
75	100,0
53	100,0
37,5	100,0
26,5	100,0
19	100,0
13,2	100,0
9,5	100,0
4,75	99,9
2	98,3
0,425	97,0
0,25	95,4
0,15	91,6
0,075	76,3
0,05	67,5
0,02	51,8
0,005	41,2
0,002	36,0

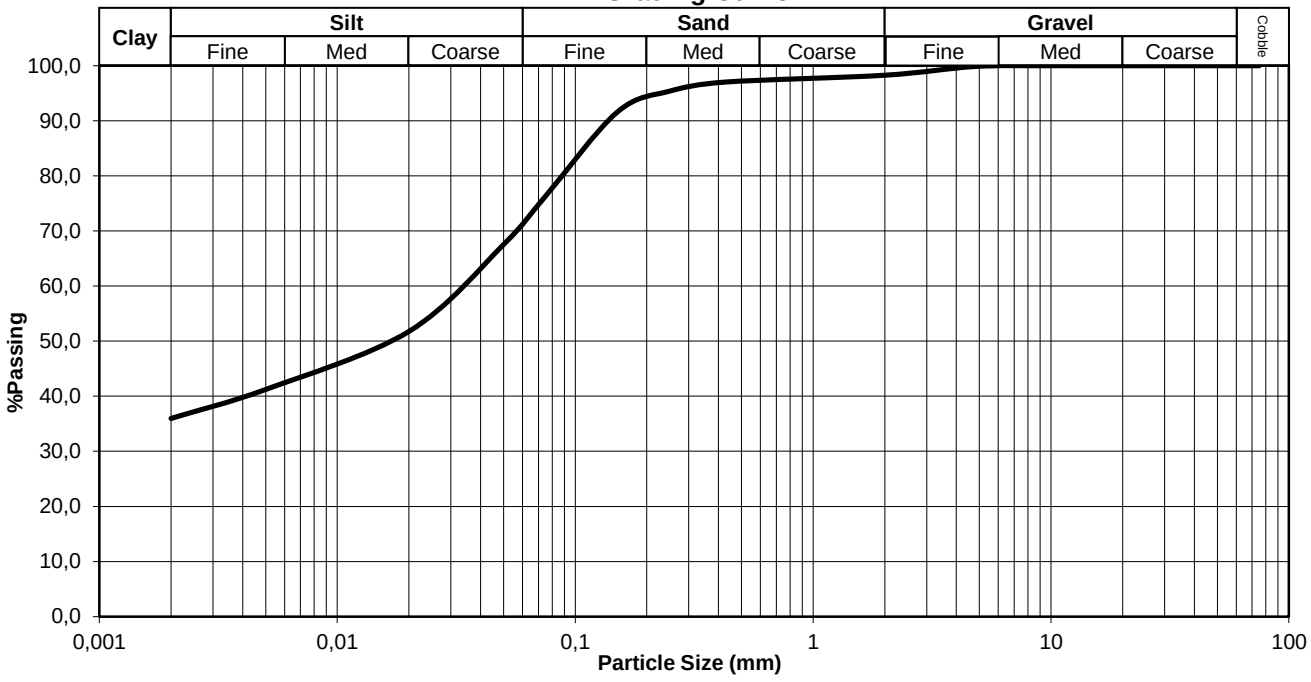
M.I.T SIZE CLASSIFICATION	
Cobble%	0,0
Gravel%	1,7
Coarse	0,0
Medium	0,1
Fine	1,6
Sand%	27,2
Coarse	1,1
Medium	3,7
Fine	22,4
Silt%	35,1
Coarse	19,3
Medium	9,8
Fine	6,0
Clay%	36,0

PLASTICITY	
Liquid Limit	40
Plasticity Index	8,7
Linear Shrinkage	8

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0,28

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	7
AASHTO Soil Classification	A - 4
Unified Classification	ML or OL

Grading Curve



Ref no.: 9403 Fig no.: -

MATERIALS ANALYSIS

THEKWINI SOILS LABORATORY CC
VAT REG. 45902 10961
UNIT 16, Alexander Park
24 Alexander Road
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MAYVILLE
4058

Project: Wembezi

Ref no.: 9403 **Lab no.:** 09019 **Borehole/Pit no.:** TP 3 **Fig no.:** -

Description: -

Depth: 0,5 - 2,5 -

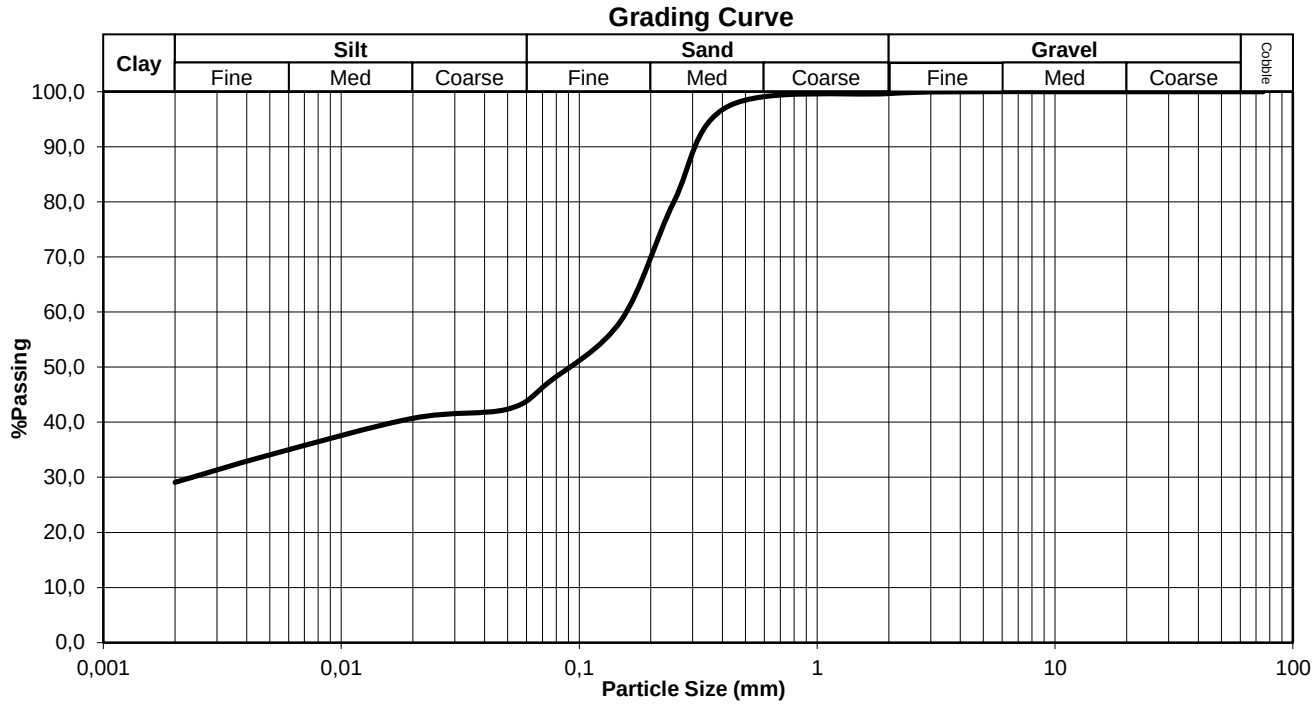
Grading Analysis	
Grain Size (mm)	%Passing
75	100,0
53	100,0
37,5	100,0
26,5	100,0
19	100,0
13,2	100,0
9,5	100,0
4,75	100,0
2	99,7
0,425	97,4
0,25	80,0
0,15	58,5
0,075	47,4
0,05	42,4
0,02	40,7
0,005	34,1
0,002	29,1

M.I.T SIZE CLASSIFICATION		
Cobble%		0,0
Gravel%	0,3	
Coarse		0,0
Medium		0,0
Fine		0,3
Sand%	55,3	
Coarse		2,0
Medium		28,4
Fine		24,9
Silt%	15,3	
Coarse		3,7
Medium		6,2
Fine		5,4
Clay%	29,1	

PLASTICITY	
Liquid Limit	35,7
Plasticity Index	8,6
Linear Shrinkage	6

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0,56

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	2
AASHTO Soil Classification	A - 4
Unified Classification	SM



Ref no.: 9403 Fig no.: -

MATERIALS ANALYSIS

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3610
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P. O. BOX 30464
MAYVILLE
4058

Project: Wembezi

Ref no.: 9403 **Lab no.:** 09020 **Borehole/Pit no.:** TP 4 **Fig no.:** -

Description: -

Depth: 0,6 - 2,7 -

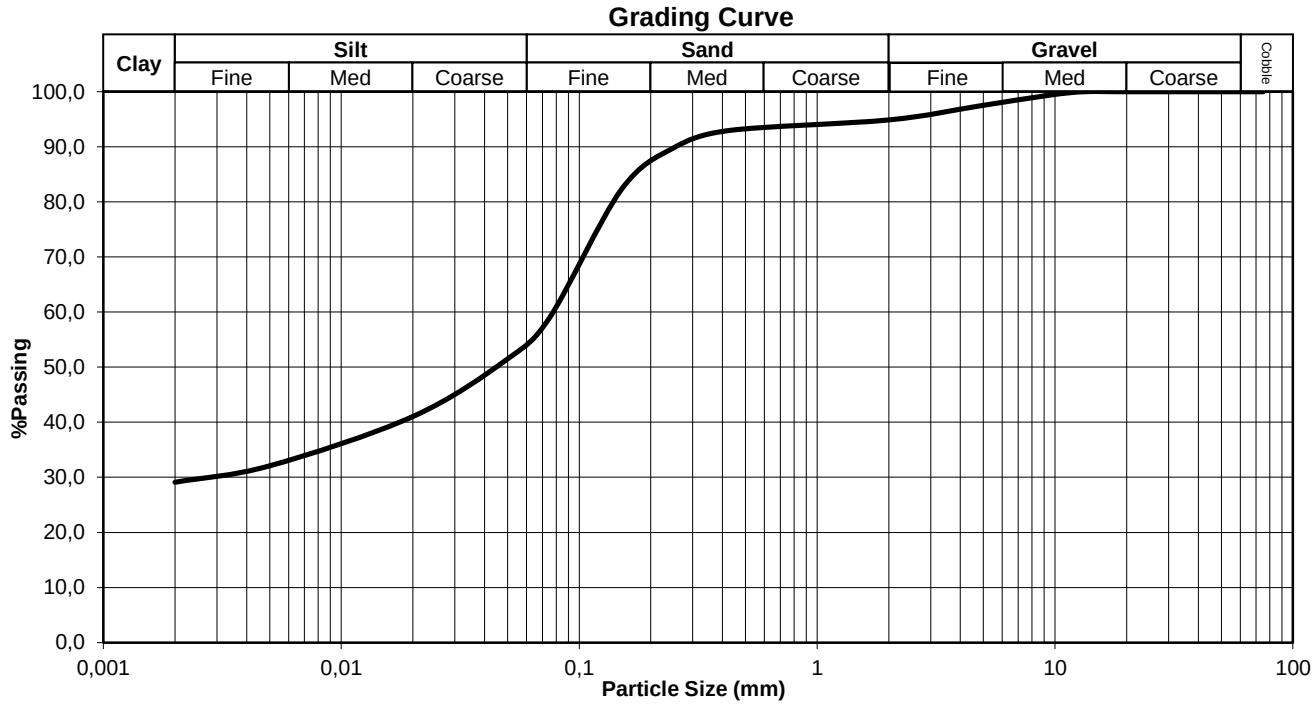
Grading Analysis	
Grain Size (mm)	%Passing
75	100,0
53	100,0
37,5	100,0
26,5	100,0
19	100,0
13,2	100,0
9,5	99,4
4,75	97,4
2	94,9
0,425	93,0
0,25	89,8
0,15	82,2
0,075	59,0
0,05	51,5
0,02	41,0
0,005	32,1
0,002	29,1

M.I.T SIZE CLASSIFICATION	
Cobble%	0,0
Gravel%	5,1
Coarse	0,0
Medium	2,1
Fine	3,0
Sand%	40,4
Coarse	1,7
Medium	7,2
Fine	31,5
Silt%	25,4
Coarse	13,4
Medium	8,4
Fine	3,6
Clay%	29,1

PLASTICITY	
Liquid Limit	35,2
Plasticity Index	8,5
Linear Shrinkage	6,7

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0,53

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	4
AASHTO Soil Classification	A - 4
Unified Classification	ML or OL



Ref no.: 9403 Fig no.: -

MATERIALS ANALYSIS

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P. O. BOX 30464
MAYVILLE
4058

Project: Wembezi

Ref no.: 9403 **Lab no.:** 09021 **Borehole/Pit no.:** TP 7 **Fig no.:** -

Description: -

Depth: 0,0 - 0,6 -

Grading Analysis	
Grain Size (mm)	%Passing
75	100,0
53	100,0
37,5	100,0
26,5	100,0
19	100,0
13,2	100,0
9,5	100,0
4,75	99,4
2	98,7
0,425	97,5
0,25	95,1
0,15	88,2
0,075	60,4
0,05	53,2
0,02	37,0
0,005	28,0
0,002	20,7

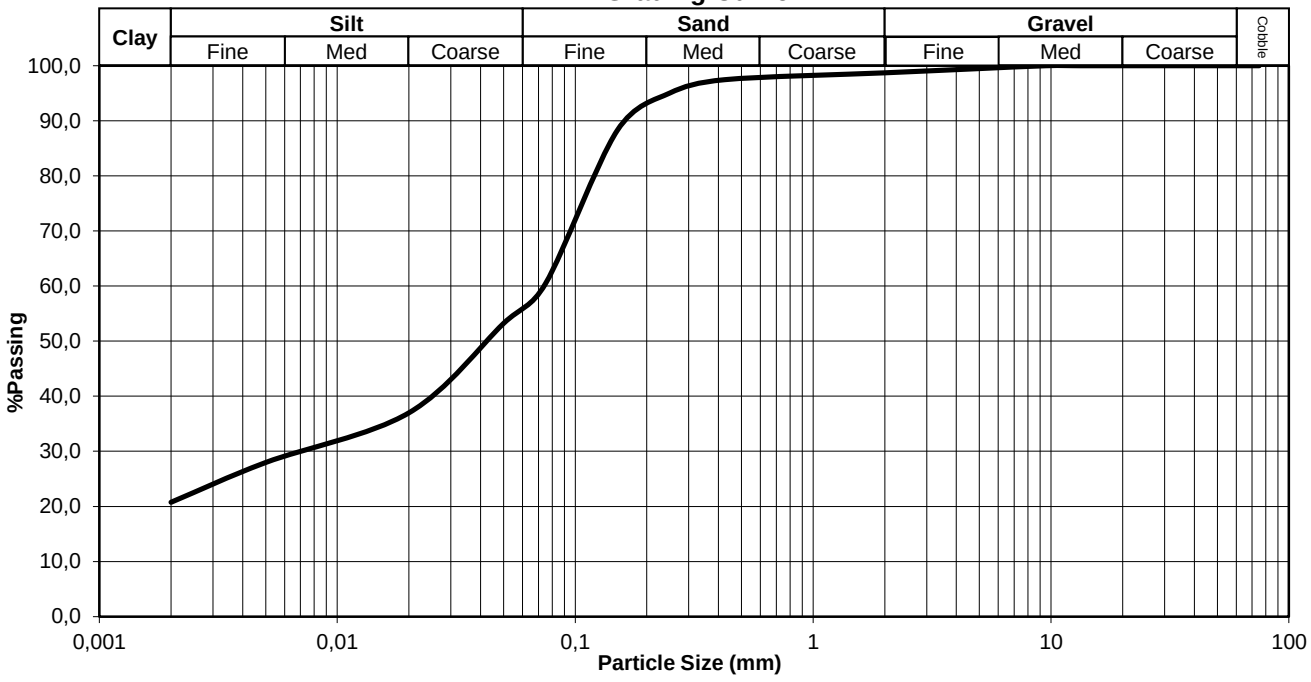
M.I.T SIZE CLASSIFICATION	
Cobble%	0,0
Gravel%	1,3
Coarse	0,0
Medium	0,4
Fine	0,9
Sand%	42,6
Coarse	1,1
Medium	6,0
Fine	35,5
Silt%	35,4
Coarse	19,1
Medium	8,4
Fine	7,8
Clay%	20,7

PLASTICITY	
Liquid Limit	27,2
Plasticity Index	7,6
Linear Shrinkage	2

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0,43

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	2
AASHTO Soil Classification	A - 4
Unified Classification	CL or OL

Grading Curve



Ref no.: 9403 Fig no.: -

MATERIALS ANALYSIS

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MAYVILLE
4058

Project: Wembezi

Ref no.: 9403 **Lab no.:** 09022 **Borehole/Pit no.:** TP 8 **Fig no.:** -

Description: -

Depth: 0,6 - 1,7 -

Grading Analysis	
Grain Size (mm)	%Passing
75	100,0
53	100,0
37,5	100,0
26,5	100,0
19	100,0
13,2	100,0
9,5	100,0
4,75	99,6
2	98,2
0,425	96,9
0,25	94,7
0,15	90,3
0,075	75,5
0,05	66,6
0,02	48,9
0,005	40,0
0,002	38,2

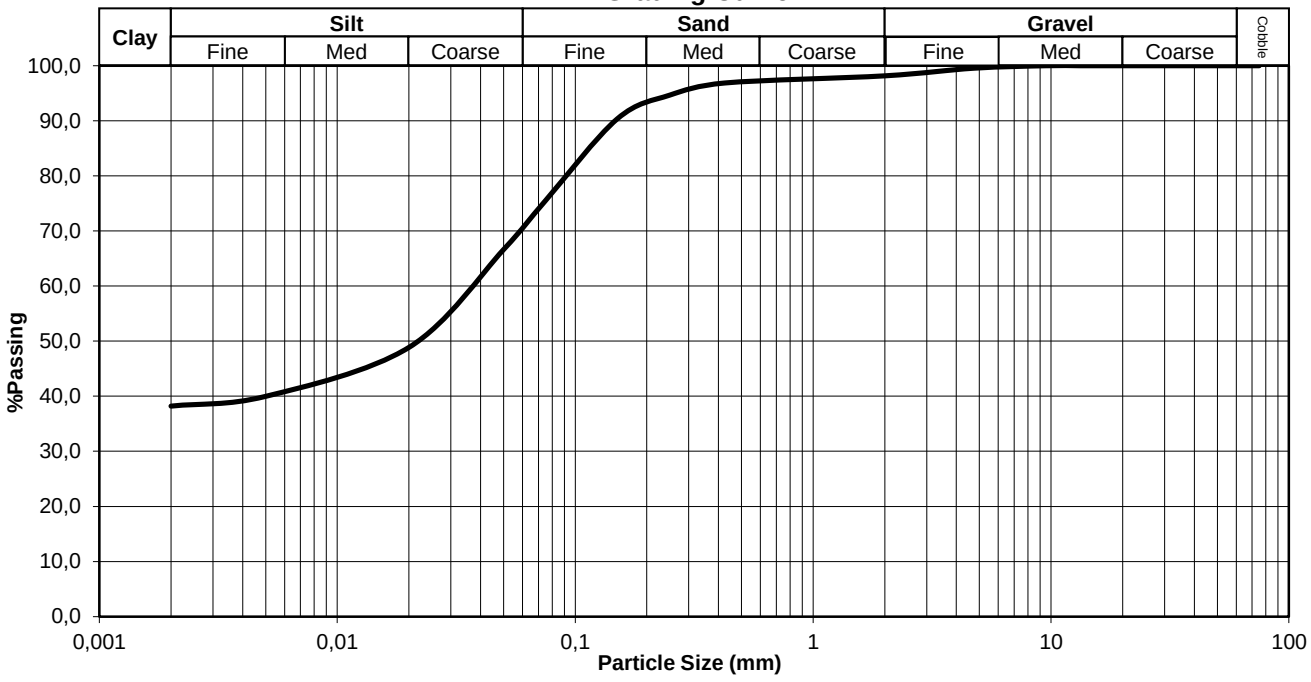
M.I.T SIZE CLASSIFICATION	
Cobble%	0,0
Gravel%	1,8
Coarse	0,0
Medium	0,3
Fine	1,5
Sand%	28,0
Coarse	1,2
Medium	4,5
Fine	22,3
Silt%	32,0
Coarse	21,3
Medium	8,3
Fine	2,4
Clay%	38,2

PLASTICITY	
Liquid Limit	41
Plasticity Index	9,2
Linear Shrinkage	8,7

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0,29

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	8
AASHTO Soil Classification	A - 5
Unified Classification	ML or OL

Grading Curve



Ref no.: 9403 Fig no.: -

MATERIALS ANALYSIS

THEKWINI SOILS LABORATORY CC
VAT REG. 45902 10961
UNIT 16, Alexander Park
24 Alexander Road
WESTMEAD
3610
Tel : 087 898 2245
P. O. BOX 30464
MAYVILLE
4058

Project: Wembezi

Ref no.: 9403 **Lab no.:** 09023 **Borehole/Pit no.:** TP 8 **Fig no.:** -

Description: -

Depth: 1,7 - 2,4 -

Grading Analysis	
Grain Size (mm)	%Passing
75	100,0
53	100,0
37,5	100,0
26,5	100,0
19	100,0
13,2	100,0
9,5	100,0
4,75	99,9
2	97,9
0,425	57,3
0,25	45,4
0,15	39,7
0,075	32,8
0,05	30,6
0,02	26,3
0,005	22,0
0,002	18,8

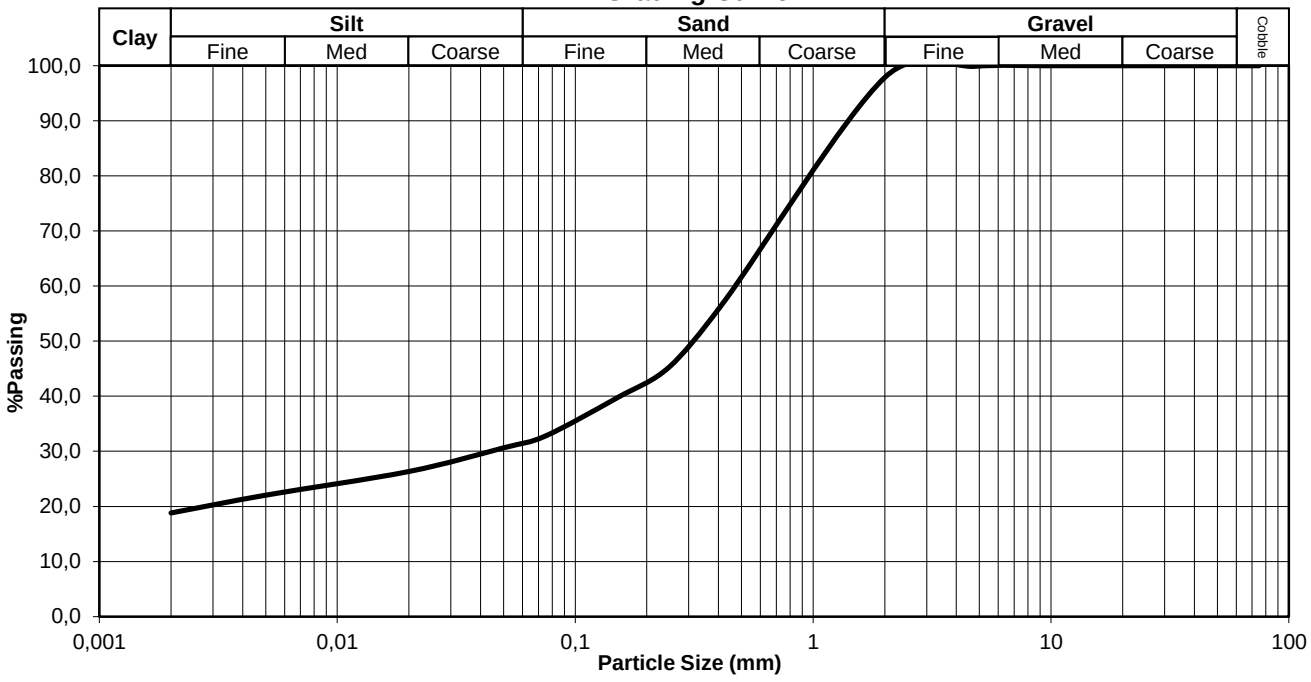
M.I.T SIZE CLASSIFICATION	
Cobble%	0,0
Gravel%	2,1
Coarse	0,0
Medium	0,1
Fine	2,1
Sand%	66,4
Coarse	36,0
Medium	19,3
Fine	11,1
Silt%	12,7
Coarse	5,2
Medium	4,0
Fine	3,5
Clay%	18,8

PLASTICITY	
Liquid Limit	36,6
Plasticity Index	14,2
Linear Shrinkage	4

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	1,12

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	1
AASHTO Soil Classification	A - 2 - 6
Unified Classification	SC

Grading Curve



Ref no.: 9403 Fig no.: -

APPENDIX E

Foundation design, building procedures and precautionary measures for single storey residential structures founded on expansive soil horizons. (NHBRC 1999)

SITE CLASS	ESTIMATED TOTAL HEAVE (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
H/R	< 7.5	Normal	• Normal construction (strip footing or slab-on-the-ground) foundation • Site drainage and service / plumbing precautions recommended
H1	7.5 - 15	Modified normal	• Lightly reinforced strip footings • Articulation joints at all internal / external doors and openings • Light reinforcement in masonry • Site drainage and plumbing / service precautions
		Soil raft	• Remove all or necessary parts of expansive horizon to 1.0m beyond the perimeter of the building and replace with inert backfill compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. • Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are <7.5mm, or construction type appropriate to residual movements • Site drainage and plumbing / service precautions
H2	15 - 30	Stiffened or cellular raft	• Stiffened or cellular raft or articulated lightly reinforced masonry • Site drainage and plumbing service precautions
		Piled construction	• Piled foundations with suspended floor slabs with or without ground beams • Site drainage and plumbing / service precautions
		Split construction	• Combination of reinforced masonry and full movement joints • Suspended floors or fabric reinforced ground slabs acting independently from the building • Site drainage and plumbing / service precautions
		Soil raft	• As for H1
H3	>30	Stiffened or cellular raft	• As for H2
		Piled construction	• As for H2
		Soil raft	• As for H1

APPENDIX F

KWAZULU-NATAL PROVINCE
ECONOMIC DEVELOPMENT, TOURISM AND ENVIRONMENTAL AFFAIRS
REPUBLIC OF SOUTH AFRICA

	(For official use only)
Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

1. This form is current as of May 2021. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.

PROJECT TITLE

Wembezi JunXion Commercial Development

DISTRICT MUNICIPALITY:

uThukela District Municipality

1. SPECIALIST INFORMATION

Specialist name:	Gondwana Geo Solutions (Pty) Ltd		
Contact person:	Mark Richter		
Postal address:	4 Haven Road, Westville, Durban		
Postal code:	3629	Cell:	083 461 6194
Telephone:	VOIP line 087-8050530	Fax:	
E-mail:	mark@ggsgeotec.co.za		
Professional affiliation(s) (if any)	SACNASP, MSAIEG		

Project Consultant / EAP:	Metamorphosis Environmental Consultants

Contact person:	Ms Vicki King		
Postal address:	P. O. Box 2116, Link Hills		
Postal code:	3625	Cell:	076 420 1441
Telephone:	031 – 756 7554	Fax:	
E-mail:	Vicki@metamorphosisdbn.co.za		
Professional affiliation(s) (if any)	IAIAsa, Reg EAP (EASPAPA), IWM, ELA		

2. DECLARATION BY THE SPECIALIST

I, Mark Vincent Richter

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:

GONDWANA GEO SOLUTIONS (PTY) LTD

Name of company:

4 March 2022

Date:

CURRICULUM VITAE

Mark Vincent Richter

POSITION

Managing Director

NATIONALITY

South African

CONTACT DETAILS

Email: mark@ggsgeotec.co.za
Tel: 083 461 6194

SUMMARY OF COMPETENCE AND EXPERIENCE

Mark Richter is an Engineering Geologist with 40 years' experience in Geotechnical Engineering Consulting and Engineering Geology. His experience ranges from numerous housing, building and infrastructure development projects in South Africa to internationally funded (World Bank, African Development Bank; USAID) road, rail and infrastructure related projects in Swaziland, Lesotho, Malawi, Mozambique, Botswana, Zambia, Zimbabwe, Congo, Kenya, Southern Sudan, Nigeria, Ethiopia, Gambia, Gabon, Madagascar, Uganda and Tanzania. Speciality work includes geotechnical investigations and related design work for housing developments, high-rise buildings, harbours and offshore construction works, airports, roads, railways, tunnels, LNG processing facilities, water supply infrastructure and dams, green or renewabke energy projects (wind and sun powered), agricultural (sugarcane) projects, fuel powered generation plants and powerlines.

PROJECT EXPERIENCE;

A selection of noteworthy projects completed are as follows:

Green or Renewable Energy Projects

- Geotechnical investigation for Oya Hybrid Energy Project at Touws River: this project comprised 324Ha of PV power plant area, diesel generator facility, substation and BESS unit, fifteen Wind Turbine Generators (WTG). The geotechnical investigation comprised test pitting using an excavator, Earth Resistivity Testing, and laboratory testing for the PV area; drilling of geotechnical boreholes was carried out at all WTG positions to assess founding conditions. Client Raubex Infra/ G7 Renewable Energy. 2021
- Geotechnical evaluation and reviews: crane pad foundation design, access road and hard standing for mast and blades for Copperton Windfarm Project – Prieska. 2019. Client Raubex / iX Engineers
- Geotechnical investigation for proposed Kleinzee Windfarm comprising site review mapping, drilling, pitting Client: Groundwater Consulting Services. 2020
- Verification of founding conditions for 26No windfarm masts – Loeriesfontein Windfarm, Northern Cape.. Client WorleyParsons. 2016/8

Sugarcane and Sugar-Fuels Projects

- Geotechnical investigation for the Feasibility Study for the proposed Kabalo Sugar Project at Kabalo, in south-central Democratic Republic of Congo (DRC). Preliminary evaluation of foundations for mill & factory building, housing estate. Materials investigations (crushed stone and gravel sources). 2018 Client: Bosch Projects
- Geotechnical investigation for the Feasibility Study for the proposed Humbe Sugar Estate near Cunene in southern Angola. Drilling for pumpstation foundations on the Cunene River. Foundation investigations for mill & factory building, housing estate. Materials investigations (crushed stone and gravel sources) for roads, balancing dams . 2013. Bosch Projects
- Geotechnical investigation for the Feasibility Study for the proposed Dombe sugar estate near Inchope in central Mozambique. Foundation investigations for mill & factory building, housing estate; River Intake towers. Materials investigations (crushed stone and gravel sources). 2007/8 Bosch Projects

Dams and Related Projects

- Augmented Geotechnical Investigation for proposed pumped-storage 23.5m high earth embankment reservoir, Waverenskroon Dam, Tulbagh. Initial site investigation evaluating geological and geotechnical information, laboratory testing, submission of geotechnical report to client SSI in 2012. Subsequent follow up providing design slopes, foundation grouting design and supervision services: 2021/22. Current appointment. Client: iX Engineers
- Geotechnical Investigation for proposed Farm Dam (Category 1) at Korhaan Hill, Empangeni. Site investigation evaluating geological and geotechnical current appointment. Client: McIlrath & Sons Farming
- Preliminary Geotechnical Assessment for the proposed Vreede Dam (15m earth embankment) in Newcastle, KZN. Site appraisal and review of geological and geotechnical information, submission of feasibility report to client. 2020. Client: BJFC
- Geotechnical investigations (Phases 1 & 2) carried out for the Proposed New Pentlands Dam, Empangeni, KZN. Search for Dam Construction Material. Investigation of dam foundations, drilling of boreholes and insitu packer testing. Laboratory testing. Analysis of dam stability conditions. Report on borrow materials, dam foundations, dam wall stability analyses and dam foundations. Client: Mr Dave Bell of Pylon Park, Empangeni, KZN. 2019/20
- Geotechnical investigation to evaluate the feasibility of refilling Dam A at De Zalze Winelands Golf Estate in Stellenbosch, Western Cape. Carry out test pitting, boreholes and installation of piezometers. Seepage analysis. Analysis of dam stability conditions. Report on feasibility of re-filling dam. Home Owners Association of De Zalze Winelands Golf Estate. 2019
- Geotechnical investigation for the proposed storage dam and head race tunnel for the Pavua Hydro-Electric Power Scheme near Inchope in central Mozambique. Drilling of geotechnical boreholes, geophysics, test pitting, insitu testing, rock and gravel quarry evaluation. Report on fieldwork. 2017. (Client: Eleqtra/ MWH Engineers UK)
- Geotechnical investigations for the proposed storage dam and headrace tunnel for the proposed Hydro-Electric Power Scheme at Mpatamanga (central Malawai) and Lower Fufu (northern Malawi). Drilling of geotechnical boreholes, geophysics, test pitting, insitu testing, rock and gravel quarry evaluation. Report on fieldwork. (World Bank Project). 2016
- Geotechnical investigation for the proposed storage dam and headrace tunnel for the Hydro-Electric Power Scheme at Batoka Gorge on the Zambezi River between Zambia and Zimbabawe. Drilling of geotechnical boreholes, geophysics, test pitting, insitu testing, rock and gravel quarry evaluation. Report on fieldwork. (World Bank Project). 2016
- Geotechnical investigations for the storage dam and headrace tunnel for the proposed Hydro-Electric Power Scheme on the Kagera River at Kakono in northwest Tanzania (Client: Norconsult) 2015
- Evaluation of geotechnical issues for Dam Safety Inspection for two large dams, Tiga Dam and Challawa Gorge Dam, part of the Hadejia-Jam'are Komododugu Yobe (HJKY) Basin near Kano, north-central Nigeria in 2015 (client: Royal Haskoning DHV):

  - Evaluate effect of blasting on excavation for new hydro-electric turbine tailrace tunnel at base of existing dam wall – Tiga Dam. Conduct inspections of box cutting and lateral support proposed by contractor. Conduct stability check on downstream wall embankment.
  - Conduct stability checks on dam wall – Challawa Gorge Dam. Evaluate causes of erosion and beaching adjacent to upstream wall.
- Geotechnical investigation for proposed Concordia Dam – Knysna. Carry out drilling investigation to evaluate founding conditions of 40m high earthwall dam. Report on suitability of dam site and engineering construction requirements. 2014 (Client: WorleyParsons).
- Geotechnical investigation for the new Shire Barrage structure at Liwonde – Norconsult (World Bank project/Norway).2014
- Geotechnical investigation, design of geotechnical issues and supervision of Mvutshane Dam (25m high earthwall off-channel storage dam) for Umgeni Water in Maphumulo, central KZN (2012 - 2014). Client MBB Engineers
- Geotechnical investigation and design of lateral support measures to unstable rock cuttings above the Headrace Canal for the Neusberg Hydro-Electric Power Scheme at Kakamas in the Northern Cape, RSA. 2014. (Client: Pennyfarthing Geotechnical Contractors
- Geotechnical investigation for Barrage over Shire River for Augmentation of the Upper Shire Hydro-Electric Project, Liwonde, Republic of Malawi – Norconsult (World Bank project/Sweden). Investigations for borrow areas, drilling of boreholes for position of new barrage structure. 2011
- Geotechnical investigation for proposed new Tulbagh Dam (Waverenskloof Dam) at Tulbagh, Western Cape. Investigations for borrow areas, test pitting, drilling of boreholes and insitu Lugeon testing. Carry out dam stability evaluation and breach analysis. Client SSI Engineers. 2011.
- Barrage over Shire River for Augmentation of the Upper Shire Hydro-Electric Project, Liwonde, Republic of Malawi – Norconsult (World Bank project/Sweden). Investigations for borrow areas, drilling of boreholes for position of new barrage structure. 2011
- Geotechnical investigations for the canals, holding dams and power station buildings. Augmentation of the Upper Shire Hydro-Electric Power Supply Scheme. 2009

Powerlines, Subtations, etc

- Geotechnical investigation for mast foundations for 132kV line between Dieprivier and Kareedouw, Eastern Cape. Conduct foundation investigations and provide recommendations for the founding of masts and associated anchors. Trans-Africa Projects. 2017
- Geotechnical investigation for mast foundations for 132kV line between Hotazel and Eldoret, Northwest Cape. Conduct foundation investigations and provide recommendations for the founding of masts and associated anchors. CVG Engineers. 2017
- Geotechnical Investigation for the Upgrading and Refurbishment of the Ulco-Holsdam 132kV Powerline in the Kimberley District, Northern Cape. CVG Engineers.2017
- Geotechnical investigation for 142 mast foundations for 66kVa line between Elliot and Cala, Eastern Cape. Conduct foundation investigations and provide recommendations for the founding of masts and associated anchors. 2000
- Carry out feasibility study for 400kV line 540km in length between Vredendal and Oranjemund (Namibian border). Airphoto interpretation, review of available information and terrain mapping.2010
- Geotechnical investigation for mast foundations for 132kV line between Grassridge and Melkhout (120 kms) in Eastern Cape. Conduct foundation investigations and provide recommendations for the ounding of masts and associated anchors.2012
- Geotechnical investigation for mast foundations for various 110kV lines in Maputo, Mozambique. Conduct foundation investigations and provide recommendations for the founding of masts and associated anchors. 2012
- Geotechnical investigation for 190 mast foundations for the 110kV line between Mopeia and Caia, Sofala Province Central Mozambique. Conduct foundation investigations and provide recommendations for the founding of masts and associated anchors.

- Geotechnical investigation conducted specifically for three mast foundations for 110kV line between Mopeia and Caia crossing over the Zambezi River Sofala Province Central Mozambique.2002

Gas and Oil Pipelines and Related Infrastructure

- Geotechnical investigations for access roads, airstrip and pioneer camp laydown areas for Anadarko Area 1 (Cabo Delgado Province). Provision of QA/QC laboratory for site improvement contracts and offshore marine sediment sample testing. Provision of onsite construction management personnel. Client: WorleyParsons SA, principal client Anadarko. 2012
- Supervision of Onshore Geotechnical investigations for Afungi site area: Anadarko Anadarko Area 1 (Cabo Delgado Province). Provision of supervision staff, interpretation of fieldwork and laboratory results, provision of factual and interpretive reports. Client INTECSEA (principal client Anadarko) 2011
- Geotechnical Investigation for the road, river and rail crossing locations of Nation Multi-Product Pipeline between Umlaas Road and Jamestown (450km). 2008
- Investigation of gas pipeline line (600km) between Temane and RSA. Geotechnical investigation for Gas Platform, Drilling Wells. Stability investigation of dolomite/limestone sinkholes. General materials and hard rock quarry investigation. 2005
- Geotechnical investigation for upgrade of Multi-Product Pipeline for CPMZ (Mozambique), between Beira and Zimbabwe. 2009
- Geotechnical Investigation for the ROMPCO gas transfer loop line Temane (Mozambique) and Secunda (South Africa). 2014
- Geotechnical investigation for Gas Power Plant FEED MEGPP for Sasol in Ressano Garcia, Southern Mozambique. Evaluation of founding conditions, earthworks resistivity profile, groundwater supply boreholes and materials. 2012 Client: Warstila.
- Preliminary Geotechnical investigation for Gas Power Plant for GigaWatt in Ressano Garcia, Southern Mozambique. Evaluation of founding conditions, earthworks resistivity profile and materials. 2011. Client: WorelyParsons.
- Gas Pipeline and Natural Gas Extraction Plant, Pande/Temane Gas Fields, Mozambique Investigation of line (600km) between Temane and RSA. Geotechnical investigation for Gas Platform, Drilling Wells. Stability investigation of dolomite/limestone sinkholes. General materials and hard rock quarry investigation.2004.
- Geotechnical investigations for buried and submerged gas pipeline reticulation connecting Temane Gas Field with Bazaruto Island group. Client: WK Construceous Lda. 2004
- Geotechnical investigation for upgrade of Multi-Product Pipeline for CPMZ, between Beira and Zimbabwe. 2008. Client: CPMZ, Mozambique
- Geotechnical investigation work for the ROMPCO loop line upgrade of 100km of the LNG 600mm diameter pipeline between Temane Gas field and Ressano Garcia. 2014 Client; WorleyParsons

Tunnels

- Provision of geotechnical services for Gautrain South section of the Gautrain Rail project as part of DGS drilling consortium to client Bombela Consortium Joint Venture. 2009/2010
- Geotechnical investigation for proposed new 7 km tunnel section of railway line through mountain area in Southern Malawi: Moatize to Port Nacala Coal Line. 2006
- Geotechnical investigation, and preliminary design, for proposed Howick Raw Water Transfer Tunnel, Howick, Kwazulu-Natal. 2000
- Provide geotechical services to the Durban Harbour Tunnel Consortium under lead contracting firm Hochtief in respect of contractual claim issues

Railways

- Geotechical investigation and design work for construction of rail spur, Richard Bay Port area – Thomson & van Eck. Design of high cutting and stability evaluation of cut slopes with dewatering measures.
- Geotechnical investigation for new and rehab lines for the Moatize to Port Nacala Coal line. Investigation of line route, subgrade evaluation, bridge foundations and high fills and cuttings.
- Geotechnical investigation for proposed new 7 km tunnel section of railway line through mountain area in Southern Malawi: Moatize to Port Nacala Coal line
- Geotechnical investigation, monitoring and design of remedial measure for settlement problems with iron ore carriage tippler at Saldanah, South African Ports Authority
- Geotechnical investigation for proposed new Tippler Unit , monitoring and design of remedial measure for settlement problems with iron ore carriage tippler at Saldanah, South African Ports Authority
- Repairs/upgrade to flood damaged Limpopo Rail Link, Maputo to Limpopo River (225km) Mozambique – WK Construction (main client USAID). Total length 225 km. Conduct structural inventory of drainage projects, carry out underwater inspections of flood and mine damaged structures. Location of borrow areas and hard rock quarries for ballast supply. Materials evaluation for rail line layerworks.
- Provision of laboratory contracts for acceptance and process control of rail rehabilitation project. Limpopo Rail Link, Maputo to Limpopo River (225km). 2002/3. WK Construceous Lda (principal client USAID).
- Geotechnical Investigation for the BFS (2006), FEL1& FEL2 (2009), FEL3 (2009) and FEL4 (2011) stages of the new Coal Line between Moatize and Nacala Port in Mozambique, passing through southeastern Malawi (total length 980 km). Investigation of new and rehabilitation lines. Investigation of bridges, cuttings, materials and subgrade support. Provision of geological teams, logging, sampling and reporting.
- Preliminary geotechnical evaluation of Proposed Chingola-Solwezi-Lumwana Freight Rail Link (Zambia) 2015
- BFS geotechnical investigation for Ncondezi Rail spur amd Mine layout, Ncondezi, near Moatize, central Mozambique. Client: WSP/ Ncondezi
- BFS Phase 1 Geotechnical investigation for the ENRC Rail Line from Tete to Nacala. Supervision of drilling works off a jackup barge. 2012. Client: Geomechanics/ Mott Macdonald
- Geotechnical investigation for the ENRC Coal Conveyor Line between Moatize and Tete, including Conveyor Bridge over Zambezi River. Investigation of conveyor centreline and drilling from floating barge on river to confirm founding for breide piers in river. 2012 (August). Client: RMCE, principal client ENRC

Marine and Harbours

- Evaluation of stability and integrity of piers : strike craft berth in military harbour on Salisbury Island, Durban. Underwater inspection, review of as-built drawings and remedial solutions.
- Durban Harbour: various design input for piled foundations for different phases of Floating dry dock, and associated jetty dolphins.
- Richards Bay Harbour: investigations for the design of piles and caissons for harbour wall construction.
- Geotechnical investigation and geotechnical services to Transnet for Pier 1 and Pier 2 of the proposed Durban Harbour Berth Deepening Feasibility Study – 2008
- Evaluation of integrity of pier and jetty structures at Namibe Harbour, Angola. Underwater inspection, materials evaluation and remedial solutions.
- BFS Offshore Phase 1 Geotechnical investigation for Nacala Port development for the ENRC Rail Line from Tete to Nacala, Central Mozambique. Supervision of drilling works off a jackup barge. 2012. Client: Geomechanics/ Mott Macdonald

- Geotechnical investigation for Nacala Port development for the Nacala Rail Corridor project. Supervision of drilling works off a jackup barge. 2010. Client: Ausenco Sandwell
- Core logging and drilling supervision for the Beira Coal Terminal expansion project, Beira Port, 2010.
- Geotechnical and Materials investigation for Phase 1 and Phase 2 : Prawn Farm at Mocimbo do Praia, Pemba (Cabo del Gado Province). Client: Indian Ocean Aquaculture (2005)
- Preliminary Geotechnical and Materials investigation for Prawn Farm at Mecufi, Pemba (Cabo del Gado Province). Client: Indian Ocean Aquaculture (2006)
- Geotechnical and Materials investigation for Prawn Farm at Quelimane Harbour (2006). Client: Aqua Pesca Limitada.
- Evaluation of founding conditions for new Quay wall, Beira Nave Harbour. Client: Frankpile Mozambique.
- Investigation and design of new floating small craft Jetty for Indigo Bay, Benguerra Island, Bazaruto Archipelago. Client: Wk Construceous Lda
- Assessment of vessel impact damage and design of repairs to existing quay wall structures – Maputo Harbour. Client: WK Construceous Lda

Airports, Airfields and Aerodromes

- Geotechnical investigation for Runway Extension : PE Airport (ACSA). 2005
- Materials and foundations investigations for new landing pad and Hangar for heli-pad at South African Air Force base (Durban International Airport) Pavement evaluation of existing runway at Margate Airport, Natal south coast, Kwazulu-Natal. 2000
- Evaluation of subgrade conditions for private airfield at Kashobwe Village near Lake Mweru, Democratic Republic of Congo. Review of existing pavement design. Evaluation of runway requirements.2000.
- Investigation and design of remedial measures to existing runways : Buenguerra Airfield, Indigo Airfield (Bazaruto Archipelago), Mozambique.

Municipal Intrastructure: Sewerage Treatment Works, Water Treatment Plants, Pipelines and Reservoirs

- **Mobeni Reservoir, City of Durban- Evaluation of Causes of Failure:** Appointed in 2019 to evaluate causes of cracking / failure of the Mobeni Resrvoir. Client: Ethekwini Water & Waste
- **New Raw Water Extraction Pumpstation on Umzimkulu River – Umzimkulu, KZN.** Carry out geotechnical investigation for new pumpstation. Drilling of boreholes. Submit geotechnical report giving recommendations for excavations, lateral support and dewatering. Design of lateral support measures, 2018 Client: MBB Engineers Pmb
- **New Phillipi Pipeline – Cape Flats.** Investigate 2.44km of pipeline. Test pitting, penetrometer testing and laboratory testing. Preparation of geotechnical report giving results of investigation and recommendations for earthworks, foundations, excavations, materials usage and subgrade preparation. 2017. Client: iX Engineers.
- **Port Desalination Plant and Associated Pipelines - Paarden Island.** Carry out Phase 1 geotechnical investigation. Test pitting, penetrometer testing and laboratory testing. Preparation of geotechnical report giving results of investigation and recommendations for earthworks, foundations, excavations, materials usage and subgrade preparation. 2017. Client: iX Engineers
- **Koeberg Desalination Plant and Associated Pipelines.** Carry out Phase 1 geotechnical investigation. Test pitting, penetrometer testing and laboratory testing. Preparation of geotechnical report giving results of investigation and recommendations for earthworks, foundations, excavations, materials usage and subgrade preparation. 2017. Client: iX Engineers.
- **Gordons Bay Reservoir.** Carry out and supervise test pitting, penetrometer testing and laboratory testing. Preparation of geotechnical report giving results of investigation and recommendations for earthworks, foundations, excavations, materials usage and subgrade preparation. 2017. Client: iX Engineers

- **Stellenbosch, Besaansklip and Velddrif, Reservoirs.** Designing the geotechnical investigations, siting trial holes, logging and sampling trial holes. Laboratory test results analysis and report writing with recommendations for the reservoir construction, and foundations. 2016 Client Worley Parsons
- **Stanford and Wellington WTW.** Designing the geotechnical investigations, siting trial holes, logging and sampling trial holes. Laboratory test results analysis and report writing with recommendations for the pipeline construction, and WTW foundations. 2016 Client Worley Parsons
- **GB2 Reservoir, Nongoma, Zululand.** Carry out geotechnical investigation for GB2 reservoir near Nongoma. Evaluation of general site stability. Inspection foundations and confirm depth of foundin. 2018 Client: Isimo Engineers.
- **Reservoirs 3-3 and 3-4, Umlalazi Municipality.** Carry out geotechnical investigation for reservoirs near Eshow, Zulunad. Evaluation of general site stability. Submission of geotechnical report with foundation recommendations. 2019 Client: BJFC Engineers.
- **New Sewage Treatment Plant – Umzimkulu, KZN**
  Carry out geotechnical investigation for underground treatment plant. Drilling of boreholes. Submit geotechnical report giving recommendations for excavations, lateral support and dewatering. Design of lateral support measures. 2015 Client: Loyiso Toyi Consulting Engineers

Cemetery and Burial Sites

- Detailed Geotechnical Investigation for Proposed Cato Ridge Cemetery (75Ha) 2020. Client: The Nile Trust. Mapping, test pitting, dynamic cone penetrometer tests, insitu permeability testing and laboratory testing. Submission of report giving findings and recommendations for development. Scoring of cemetery site attributes against recommended industry criteria
- Detailed Geotechnical Investigation for Proposed Gingindlovu Cemetery (10Ha) 2018. Client: Department of Works, Kwazulu-Natal. Mapping, test pitting, dynamic cone penetrometer tests, insitu permeability testing and laboratory testing. Submission of report giving findings and recommendations for development. Scoring of cemetery site attributes against recommended industry criteria

- **Cemetery Investigation │Louws Bos South site: Stellenbosch. | CK Rumboll Town Planners & Environmental Consultants │2018**
  Designing the geotechnical investigations, siting trial holes, logging and sampling trial holes. Dynamic Cone Penetrometer testing. Laboratory test results analysis and report writing with recommendations for the cemetery site.
- **Cemetery Investigation │Louws Bos site: Stellenbosch| CK Rumboll Town Planners & Environmental Consultants │2018**
  Designing the geotechnical investigations, siting trial holes, logging and sampling trial holes. Dynamic Cone Penetrometer testing. Laboratory test results analysis and report writing with recommendations for the cemetery site.
- **Cemetery Investigation │Calcutta site: Stellenbosch| CK Rumboll Town Planners & Environmental Consultants │2018**
  Designing the geotechnical investigations, siting trial holes, logging and sampling trial holes. Dynamic Cone Penetrometer testing. Laboratory test results analysis and report writing with recommendations for the cemetery site.

Highrise Buildings; Hospitals; University Buildings, Hostels & Social Housing, and Housing Projects

- Geotechnical Investigation for proposed New Hospital at Matatiele, Eastern Cape. 2021. Client: Green Door Environmental
- Report to GladAfrica on the Richards Bay Schools Upgrade Project: Development Bank of SA: Ntokozweni PS. Othobothino PS, OPhanzi PS, Northern KZN
- Report to Kantey & Templar on the Preliminary and Phase 1 Geotechnical Investigation carried out for the Shayamoya Township Upgrade Near Kokstad: 728 Sites. Reference No. 20-50R01. 2020. Client Kantey & Templer
- Geotechnical Investigation for Proposed Umkomaas Residential Development – No 1 Aquila Avenue Umkomaas. 2019. Client: Gateway Projects
- Report to Umsunguli Project Managers on the Results of Additional Percolation Tests carried out for Lions River Phase 3, KwaZulu-Natal Midlands. Project No.: 19-114R01. Client Umsunguli Project Managers
- Geotechnical Investigation for Low Cost Housing Project - Portions 26, 27 And 30 of Buffelsfontein 465 Jq – 194, Mooinooi, North West Province. 2019. Client: Simlab (Pty) Limited Report to Kantey and Templer on a Phase 1 Geotechnical Investigation forthe Proposed Willowdale Residential Development
- Proposed Portion (of1) of the Farm Melk Spruit No. 293, Kokstad, KwaZulu-Natal. 2018. Client Kantey & Templer.
- Report to Voigts Construction on a Geotechnical Investigation carried out for the Royal Albert Lodge, Albert Falls Dam, KwaZulu-Natal. Project No.: 18-156R01. Client Voights Construction
- Geotechnical Investigation for High Density Housing Development, Amanzi Heights, Amanzimtoti. 2018. Client: AlleyRoads Construction
- Report to iX Engineers on a Geotechnical Investigation for 200 Low Cost units – Greyton, Western Cape. 2019. Client iX Engineers
- Project No.: 18-169R01 Geotechnical investigation comprising site review mapping and walkover for Proposed Social Housing Developments at the Allenby, Eric Liberty and Plumer Sites: Witbank, Mpumalanga Province. Client: Social Housing Regulatory Authority. 2018
- Geotechnical investigation for the multi-storey extensions to the Students Union Building at Edgewood Campus, UKZN, Pinetown. The extensions to the building involved the addition of multi-storey components and enlargement of existing foundations to take on extra loading. (2018). Client Kantey & Templer
- Report to Kantey and Templer on a Phase 1 Geotechnical Investigation for the Proposed Willowdale Residential Development, Proposed Portion (of 1) of the Farm Melk Spruit No. 293, Kokstad, KwaZulu-Natal. Project No.: 18-169R01. December 2018. Client Kantey & Templer
- Report to Kantey and Templer on a Geotechnical Investigation for a Housing Development at Kokstad, KwaZulu-Natal. Reference : 11-050, dated : February 2011. Client : Kantey & Templer
- Enhlakahle Hostels – Greytown (2006). This project comprised the development of four 5-storey buildings to be constructed in Greytown, central KZN. Because of the deep weathering profiles developed from the insitu weathering of the dolerite and partially assimilated siltstone bedrock, several geotechnical boreholes were required to be drilled to confirm the founding conditions for piles. The piles used to support the buildings comprised Continuous Flight Augered (CFA) piles designed to support the foundation loads in bedrock. Client: CSM Consulting Services
- Kwezi Hostel Development, Estcourt. Carry out Phase 1 geotechnical investigation. 2006. Client CSM Consulting Services Pty) Ltd

- Klaarwater Station Housing Project Phase 1: this project comprised the development of a Hostel at Klaarwater. Geotechnical investigation was carried out in 2003. Client: Development Management Consultants
- Klaarwater Station Housing Project Phase 2: follow extensions to Phase 1 in 2005. Client: Development Management Consultants
- Enhlalakahle Township Developnment (492 sites) 2005 Carry out GFSH Phase 1 geotechnical investigation. Client: CSM Consulting Services.
- Remediation of 203 cracked hostel units (2003). Hostel nits comprised single storey buildings which cracked as a result of collapse settlements occurring under poorly designed and constructed foundation raft slabs. Remediation involved the underpinning of houses suing concrete pads and jacked piles as determined by site inspections and geotechnical investigation work.
- Merewent Hostels/Cluster Housing Infill. Carry out geotechnical investigation. 2002. Client: Arup (Pty) Ltd
- Geotechnical investigation for extensions G.J. Crookes Hospital near Scottburgh. As appointed by KZN administration. Geotechnical investigation involved the drilling of boreholes to confirm the depth to bedrock under site for the founding of piled foundations

SUMMARY OF EMPLOYMENT

2017 to present	Managing Director: Gondwana Geo Solutions (Pty) Ltd
2015 to 2017	Managing Director: MSJ Geotechnical Consulting Services (Pty) Ltd
2012 to 2015	National Geotechnical Manager RSA & Sub-Saharan Africa: WorleyParsons RSA
2011 to 2012	Managing Director: Moore Spence Jones (Pty) Ltd
2000 to 2009	Director: V3 Consulting Engineers (Pty) Ltd
1993 to 2010	Director: Moore Spence Jones (Pty) Ltd
	Director: MSJ Swaziland (Pty) Ltd
	Director: MSJ Mozambique Africa (Pty) Ltd
1991 to 1992	Associate Director: Moore Spence Jones (Pty) Ltd
1988 to 1991	Engineering Geologist: Bradford Conning & Partners
1986 to 1987	Business Analyst: Caltex Oil
1985	Full time Student: MBA: University of Cape Town
1982 to 1984	Engineering Geologist: Schwartz Tromp & Associates
1980 to 1981	Military Service: Engineer's Corps: South African Defence Force
1975 to 1979	Full time Student: BSc Hons: University of Witwatersrand

QUALIFICATIONS & AFFILIATIONS

- BSc (Hons) (Engineering Geology): University of Witwatersrand (1979)
- Master of Business Administration: University of Cape Town (1985)
- Member: South African Institute of Engineering Geology
  Reg No 89/119
- Member: South African Council for Natural Scientists.
  Pr SciNat Reg No 400148/88

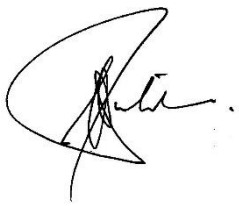
CPD COURSES ATTENDED

- 2019: SAIEG / SAICE. Design of Basal Reinforcement, presented Maccaferri

- 2019: SAIEG/ SAICE: Foundation Design Course, presented by Department of Civil Engineering: University of Stellenbosch
- 2020: SAIEG; Construction materials
- 2021: SAIEG / SANIRE: Slope stability Seminar

CERTIFICATION

I confirm that the above CV is an accurate description of my experience and involvement with the various projects listed above as well as the qualifications given.



M V RICHTER
GONDWANA GEO SOLUTIONS (PTY) LTD

FIGURES

KEY :

- **TP 1 / 2.50** — Approximate position of Test Pit showing final depth in metres below existing ground level.
- **DPL 1 / (2.4)** — Approximate position of Dynamic Cone Penetrometer Test (Light) showing depth to refusal in metres below existing ground level.
- **AH 1 / (0.90)** — Approximate position of Auger Hole showing depth to refusal in metres below existing ground level.
- **PT 1 / (0.90)** — Approximate position of Percolation Test showing final depth in metres below existing ground level.

0m 50m 100m 250m

Graphic Scale
1 / 5 000

NB : Please note that the bar scale supercedes the verbal scale due to print sizes etc.

Drawing prepared from Dwg. No. Lay4/Ver1/2020 Provided by Peter Jewell Consulting

DRAWING DESCRIPTION

Site Plan showing approximate positions of :

a.) Test Pits.

b.) Dynamic Cone Penetrometer Tests (Light)

c.) Auger Holes

d.) Percolation Tests

Scale 1 : 5000 (On A3 Original)

CLIENT

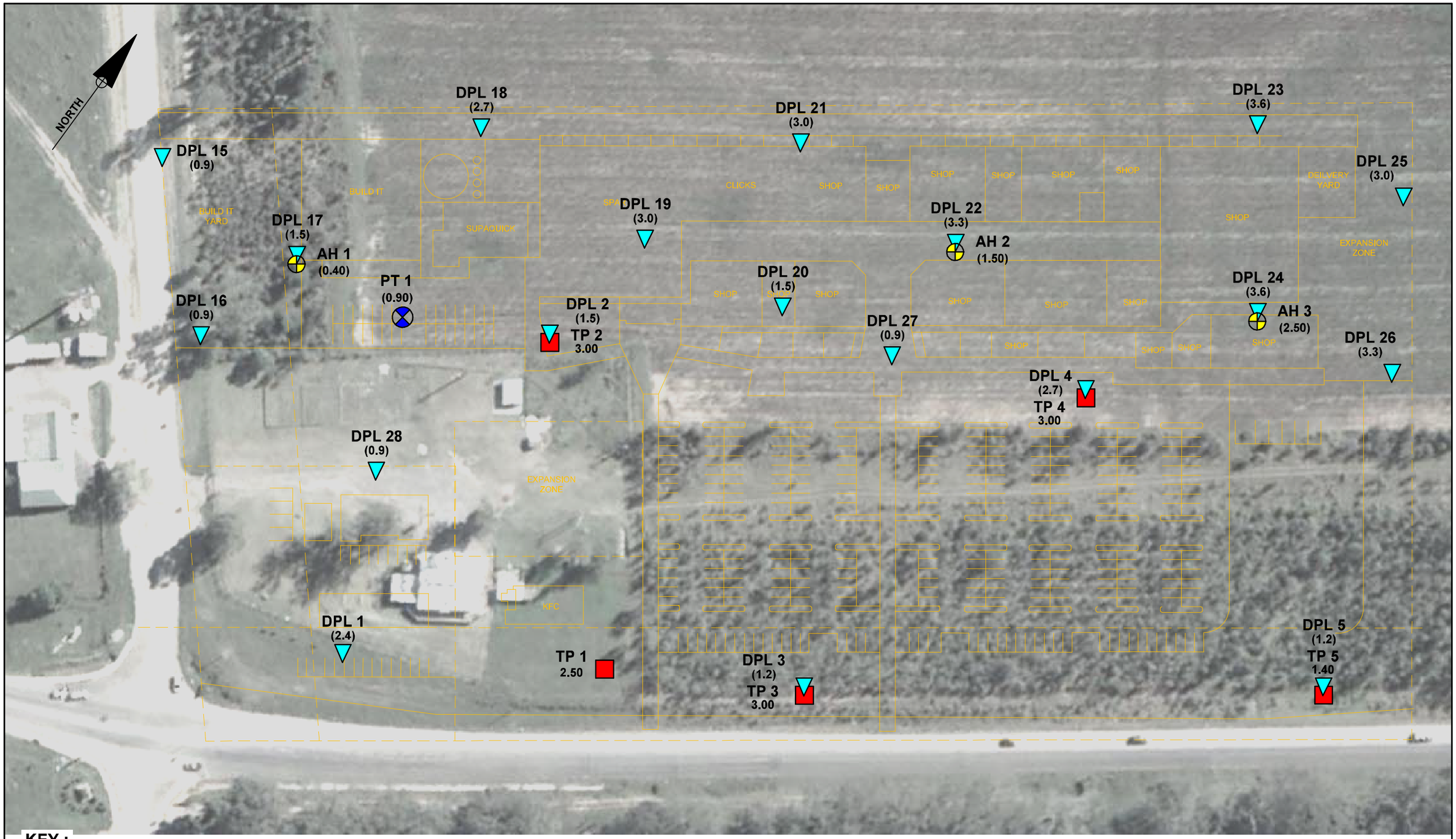
KLIPPLAATS FAMILY TRUST

PROJECT

Geotechnical Investigation for Wembezi PLS, Portion 57 (of 1) of the Farm Klippaat Drift No. 1099

GONDWANA GEO SOLUTIONS

DATE	26/10/2021
DRAWN	A.S.
CHECK	M.V.R.
REFERENCE No.	21 - 030
FIGURE No.	1
REV.	0



KEY :

TP 1 (2.50)	Approximate position of Test Pit showing final depth in metres below existing ground level.
DPL 1 (2.4)	Approximate position of Dynamic Cone Penetrometer Test (Light) showing depth to refusal in metres below existing ground level.
AH 1 (0.90)	Approximate position of Auger Hole showing depth to refusal in metres below existing ground level.
PT 1 (0.90)	Approximate position of Percolation Test showing final depth in metres below existing ground level.

0m 10m 20m 50m

Graphic Scale
1 / 1 000

NB : Please note that the bar scale supercedes the verbal scale due to print sizes etc.

Drawing prepared from Dwg. Proposed New Shopping Centre Provided by Shift Capital

DRAWING DESCRIPTION

Site Plan showing approximate positions of :

a.) Test Pits.

b.) Dynamic Cone Penetrometer Tests (Light)

c.) Auger Holes

d.) Percolation Tests

Scale 1 : 1000 (On A3 Original)

CLIENT

KLIPPLAATS FAMILY TRUST

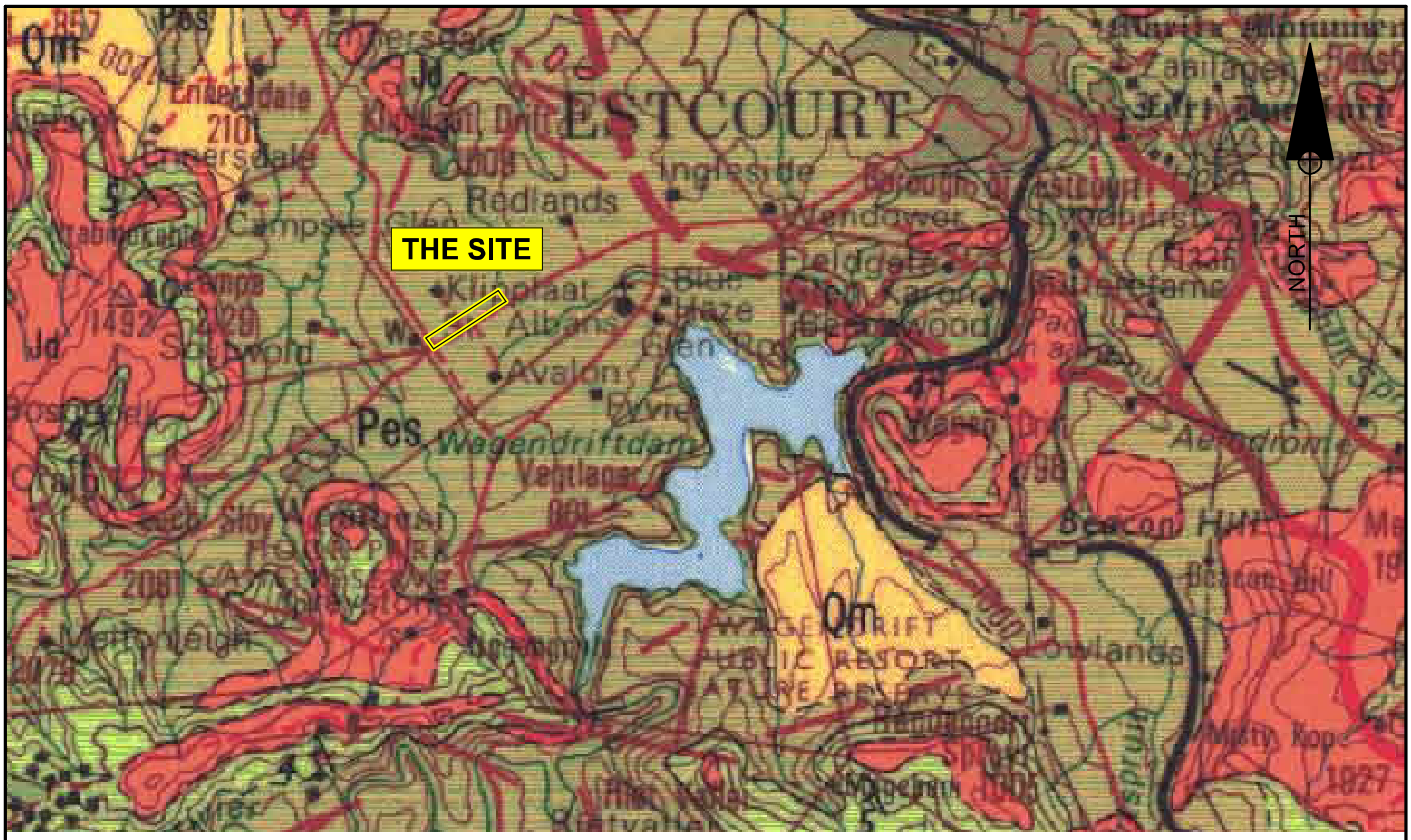
PROJECT

Geotechnical Investigation for Wembezi PLS, Portion 57 (of 1) of the Farm Klippaat Drift No. 1099

GONDWANA GEO SOLUTIONS

DATE	26/10/2021
DRAWN	A.S.
CHECK	M.V.R.
REFERENCE No.	21 - 030
FIGURE No.	2
REV.	0

21-030 Fig 2 Site Layout



0m 2km 4km 6km 8km 10km

Graphic Scale
1 / 100 000

NB : Please note that the bar scale supercedes the verbal scale due to print sizes etc.

LEGEND

Qm	Partly consolidated sediments; laterite; clay. Masotcheni Formation
Jd	Dolerite - Intrusive Rock
TRt	Fine to medium-grained sandstone;maroon, green and blue mudstone. Tarkastad Formation. BEAUFORT GROUP
Pes	Dark-grey shale (often carbon-rich); siltstone; sandstone. Estcourt Formation, BEAUFORT GROUP

Drawing prepared from 1 / 250 000 GEOLOGICAL SERIES : DRAKENSBERG 2928

DRAWING DESCRIPTION

Locality Plan showing Regional Geology

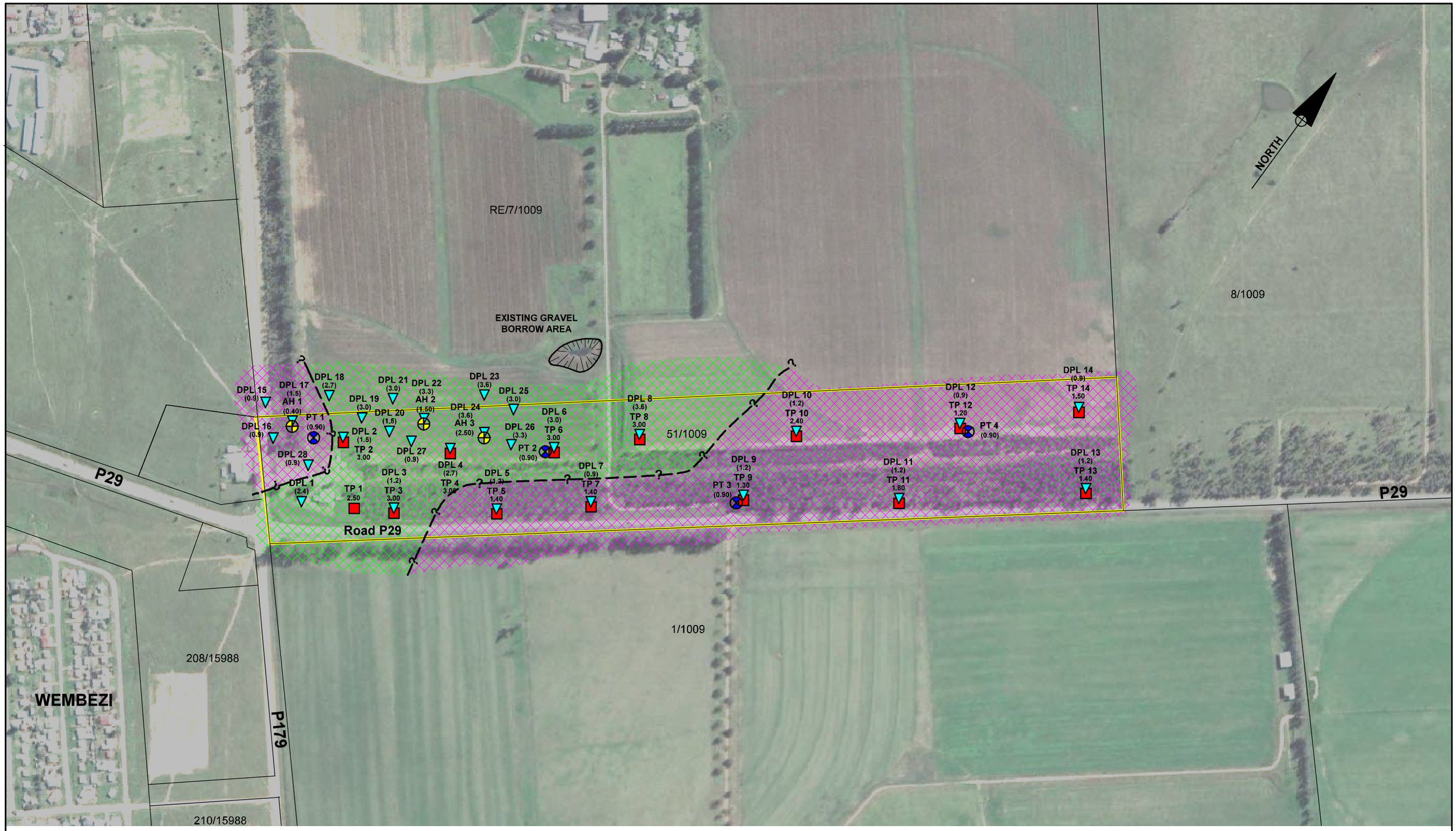
Scale 1 : 100 000 (On A4 Original)

CLIENT: **KLIPPLAATS FAMILY TRUST**

PROJECT: **Geotechnical Investigation for Wembezi PLS, Portion 57 (of 1) of the Farm Klippaat Drift No. 1099**

GONDWANA GEO SOLUTIONS

DATE	18/03/2021
DRAWN	A.S.
CHECK	M.V.R.
REFERENCE No.	21 - 030
FIGURE No.	3
REV.	0



KEY :

Area Underlain by Siltstone and Interlayered Sandstone

Area Underlain by Shallow Hardpan Ferricrete

0m 50m 100m 250m

Graphic Scale
1 / 5 000

NB : Please note that the bar scale supercedes the verbal scale due to print sizes etc.

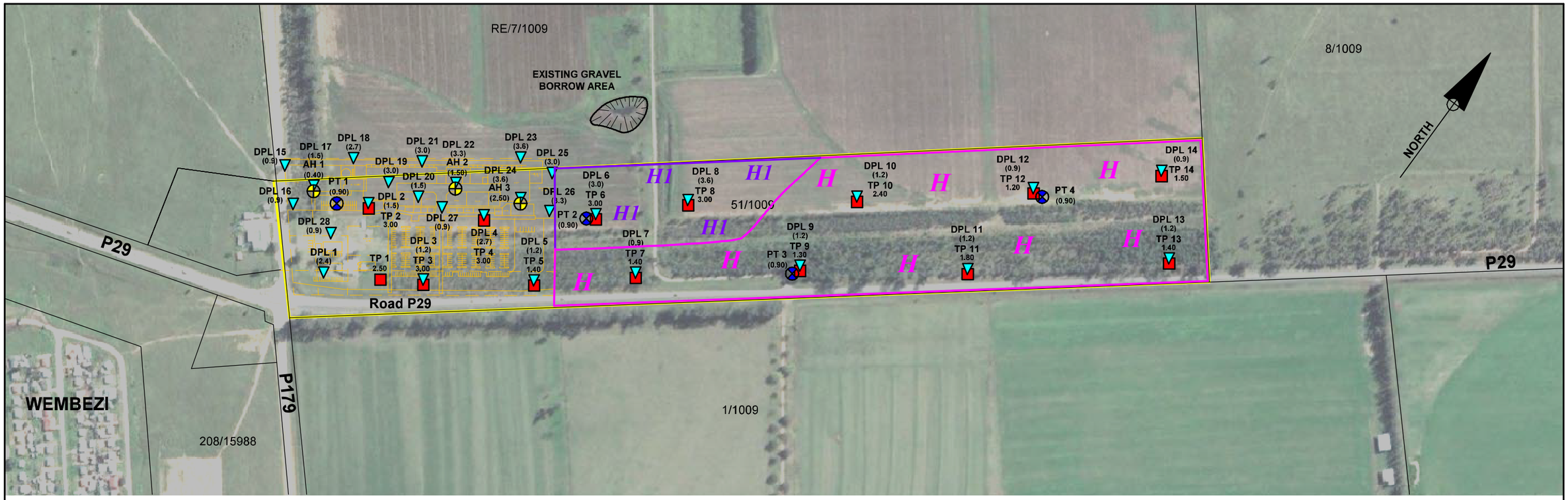
Drawing prepared from Dwg. No. Lay4/Ver1/2020 Provided by Peter Jewell Consulting

DRAWING DESCRIPTION: Site Plan showing Detailed Site Geology	CLIENT: KLIPPLAATS FAMILY TRUST PROJECT: Geotechnical Investigation for Wembezi PLS, Portion 57 (of 1) of the Farm Klippaat Drift No. 1099	DATE: 26/10/2021 DRAWN: A.S. CHECK: M.V.R. REFERENCE No.: 21 - 030 FIGURE No.: 4 REV.: 0

Scale 1 : 5000 (On A3 Original)

GONDWANA GEO SOLUTIONS

21-030 Fig 4 Detailed Site Geology.drg



Foundation design, building procedures and precautionary measures for single storey residential structures founded on expansive soil horizons. (NHBRC 1999)

SITE CLASS	ESTIMATED TOTAL HEAVE (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
H/R	< 7.5	Normal	• Normal construction (strip footing or slab-on-the-ground) foundation • Site drainage and service / plumbing precautions recommended
H1	7.5 - 15	Modified normal	• Lightly reinforced strip footings • Articulation joints at all internal / external doors and openings • Light reinforcement in masonry • Site drainage and plumbing / service precautions
		Soil raft	• Remove all or necessary parts of expansive horizon to 1.0m beyond the perimeter of the building and replace with inert backfill compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. • Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are <7.5mm, or construction type appropriate to residual movements • Site drainage and plumbing / service precautions
H2	15 - 30	Stiffened or cellular raft	• Stiffened or cellular raft or articulated lightly reinforced masonry • Site drainage and plumbing service precautions
		Piled construction	• Piled foundations with suspended floor slabs with or without ground beams • Site drainage and plumbing / service precautions
		Split construction	• Combination of reinforced masonry and full movement joints • Suspended floors or fabric reinforced ground slabs acting independently from the building • Site drainage and plumbing / service precautions
		Soil raft	• As for H1
H3	>30	Stiffened or cellular raft	• As for H2
		Piled construction	• As for H2
		Soil raft	• As for H1

0m 50m 100m 250m

Graphic Scale
1 / 5 000

NB : Please note that the bar scale supercedes the verbal scale due to print sizes etc.

Drawing prepared from Dwg. No. Lay4/Ver1/2020 Provided by Peter Jewell Consulting

DRAWING DESCRIPTION

Site Plan showing NHBRC Classifications

Scale 1 : 5000 (On A3 Original)

CLIENT
KLIPPLAATS FAMILY TRUST

PROJECT
Geotechnical Investigation for Wembezi PLS, Portion 57 (of 1) of the Farm Klippaat Drift No. 1099

GONDWANA GEO SOLUTIONS

DATE **26/10/2021**

DRAWN **A.S.**

CHECK **M.V.R.**

REFERENCE No. **21 - 030**

FIGURE No. **5**

REV. **0**

21-030 Fig 5 NHBRC.drg