450MW

EMERGENCY RISK MITIGATION POWER PLANT (RMPP) ON LOTS 1854 AND 1795, ALTON, RICHARDS BAY

PRELIMINARY GEOTECHNICAL INVESTIGATION

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09/2020	A	Creation of New Document	A.J.G
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DRAWINGS

1. BACKGROUND

Savannah Environmental (Pty) Ltd provided a project brief and description for the proposed new 450MW Emergency Risk Mitigation Power Plant (RMPP) including associated infrastructure, electricity transmission infrastructure and the LPG or Naphtha Storage Tanks, which is summarized below:

In a response to the procurement process by the Independent Power Producer Office ("IPP Office") which has been initiated in July 2020, for the procurement of up to 2000MW of dispatchable generation capacity from a range of technologies, in accordance with the new generation capacity required and as specified in the Integrated Resource Plan 2019 and accompanying ministerial determination from the Minister for the Department of Resources and Energy to which the National Energy Regulator of South Africa has concurred, Phinda Power Producers (Pty) Ltd ("Phinda") have proposed the construction of the following:

- a 450MW Emergency Risk Mitigation Power Plant (RMPP) with associated infrastructure as well as storage of up to 10,000m^3 of liquid petroleum gas ("LPG") or alternatively 60,000 metric tons of Naphtha with associated infrastructure; and
- electricity transmission infrastructure.

The IPP Office has initiated 2000MW of new generation capacity procurement under a programme to be administered by it and titled the Risk Mitigation Power Procurement Programme ("RMPPP"), targeting first generation and transmission of energy to the grid by 31 December 2021. The IPP Office is attempting to fast track the implementation of the 2000MW of new generation capacity to be procured under the RMPPP in order to alleviate the frequent load shedding being experienced in South Africa at present and is specifically targeting new generation capacity that can be brought onto the grid as quickly as possible.

450MW Emergency Risk Mitigation Power Plant (RMPP)

The 450MW Emergency Risk Mitigation Power Plant (RMPP) involves the construction of a gas-fired power station which will provide mid-merit power supply[1]

[1] Mid-merit electricity generation capacity refers to the generation of electricity which is adjusted according to the fluctuations in demand in the national grid. Baseload electricity generating capacity refers to the generation of electricity continuously for all hours of the day and night in order to satisfy the minimum demand required in the national grid.

to the electricity grid. The 450MW RMPP is planned to operate on a mid-merit basis at an average annual minimum dispatch rate of ~50% (i.e. operational between 5am and 9:30pm daily and being deployed on average for a minimum 72% over the year during this time period) and has been designed and developed as a power balance system to manage electricity demand during peak periods to stabilise the grid, as well as provide back up support for base load generation in the event of unscheduled maintenance on the coal fired power stations. The power station will have an installed capacity of up to 450MW, to be operated on LPG or naphtha and later converted from utilising LPG to natural gas. The natural gas or naphtha is to be supplied via a pipeline to the RMPP from the supply take-off point at the Richards Bay Harbour with LPG being supplied via truck from the import terminal at the Richards Bay harbour. The use of Naphtha or LPG and the associated infrastructure will be investigated further within the EIA phase and the preferred fuel source presented. The LNG terminal infrastructure and naphtha supply infrastructure at the port and the relevant pipelines do not form part of the scope of this assessment, whereas LPG infrastructure does form part of this report.

<u>450MW RMPP Electricity Transmission Infrastructure</u>

The establishment of the 450MW RMPP will simultaneously require the implementation of the 450MW RMPP Electricity Transmission infrastructure project to allow for the evacuation of the electricity produced by the Power Plant to the existing high voltage electricity transmission infrastructure in close proximity to the Power Plant.

The 450MW RMPP Electricity Transmission Infrastructure project is being undertaken as a separate application for environmental authorisation as:

- a basic assessment process is required for the transmission infrastructure; and
- Phinda wishes to secure a separate Environmental Authorisation for the 132kV transmission line as ultimately it is expected that the Environmental Authorisation will need to be transferred to Eskom when Eskom takes over ownership and control of the transmission infrastructure.

Due to the large number of existing high voltage transmission lines between the 450MW RMPP site and the electricity evacuation connection point, electricity

evacuation is proposed via underground transmission cables to connect to an existing unutilized 132kV transmission line.

2. TERMS OF REFERENCE

Davies Lynn & Partners (Pty) Ltd were originally requested by Ilifa Africa Engineers (Pty) Ltd on behalf of the Client, Moondream Trading (Pty) Ltd, to provide a quotation to undertake a Geotechnical Site Investigation for the proposed new Phinda Combined Cycle Power Plant (CCPP) Development on Lot 1854 in Alton, an industrial area of Richards Bay, which would be suitable for both the Rezoning Application to be lodged at the Local Authority as well as for the application for Environmental Authorization to be lodged at the Provincial Authority.

The geotechnical quotation was submitted on the 7th February 2019 (with Reference No. 18/3388). The Client requested clarification on whether this proposed geotechnical investigation would fulfill the requirements outlined in their email dated 19th February 2019, viz. to provide detailed founding recommendations for all the proposed structures as shown on the "*Proposed Possible Site Arrangement Layout Plan"* dated 24/10/2018 and provided by Ilifa Africa Engineers (Pty) Ltd. DLP responded to these queries in an email dated 25th February 2019 indicating that this proposal would not satisfy the detailed founding recommendations, and accordingly submitted a proposal for a Detailed Geotechnical Investigation dated 25th February 2019. It was then concluded that due to the preliminary nature of the project and in particular relating to the preliminary positioning of structures and facilities, which still needed to be finalized, that the first DLP proposal dated 7th February 2019 would provide the necessary information for the Rezoning Application and the Environmental Authorization.

This quotation was subsequently accepted by Ilifa Africa Engineers (Pty) Ltd on behalf of the Client, Moondream Trading (Pty) Ltd, in a Letter dated 8th July 2019, Referenced R15-012-00, with Purchase Order No. PO 0456 and Davies Lynn & Partners (Pty) Ltd were authorized to proceed with the Geotechnical Site Investigation. A Report titled "*Phinda Combined Cycle Power Plant (CCPP) on Lot 1854, Alton, Richards Bay – Preliminary Geotechnical Investigation*", referenced

18/3388-01 was subsequently issued by Davies Lynn & Partners (Pty) Ltd in September 2019.

On the 6th July 2020, the offices of DLP received an Email from Savannah Environmental (Pty) Ltd indicating that Savannah Environmental (Pty) Ltd had been appointed by Phinda Power Producers (Pty) Ltd to undertake the EIA processes for the various Phinda Power Producing facilities and that it was understood that there had been changes to the Scope of Work and that certain specialist study reports would need to be revised.

On the 15th July 2020, a second Email and Letter from Savannah Environmental (Pty) Ltd was received requesting an update to existing Specialist Reports, largely comprising the separation of the existing reports for each individual 450MW and 4000MW Power Producing facilities. Numerous Email correspondences and clarifications were subsequently received by DLP.

DLP were requested to provide quotations to undertake the required Specialist Report revisions as well as costing for the additional Scope of Works, by Savannah Environmental (Pty) Ltd, which was duly supplied on the 17th August 2020 and again on the 25th August 2020. The quotations were subsequently accepted by Savannah Environmental (Pty) Ltd on behalf of the Client, Phinda Power Producers (Pty) Ltd, in four (4No.) Letter of Appointments dated, 1st and 2nd September 2020 and DLP were authorized to proceed with the required additional investigations and Specialist Report revisions.

This Report documents the results of the **Preliminary Geotechnical Assessment for 450MW RMPP Power Plant**. This Report has largely been based on extracted information from the abovementioned Davies Lynn & Partners (Pty) Ltd's original Preliminary Geotechnical Investigation Report, referenced 18/3388-01 and dated September 2019, as well as from the supplied Wilson & Pass Incorporated Report, titled "*Report to Ilifa Africa Engineers – Geotechnical Investigation – Lot 1795, Richards Bay*", dated 5th July 2008, which presented the results of a shallow geotechnical investigation undertaken at the site of the proposed new LPG Storage Tanks on Lot 1795, Richards Bay (including in Appendix 4 of this Report).

3. SCOPE OF REPORT

This Report documents the findings of the preliminary geotechnical investigation carried out at the site of the proposed new 450MW Emergency Risk Mitigation Power Plant (RMPP) Development on Lot 1854 as well as a brief preliminary desktop geotechnical assessment of the site of the proposed new LPG Storage Tanks on the adjacent Lot 1795, both in Alton, Richards Bay. The fieldwork undertaken is outlined, a description of the site and the subsoil geology is given, and the field test results are presented as well as a review of the supplied Wilson & Pass Incorporated - Geotechnical Investigation Report for Lot 1795, Alton.

An assessment of the excavatability and typical founding conditions across the proposed site is provided and preliminary founding recommendations are made.

4. SITE DESCRIPTION

The site of the proposed 450MW Emergency Risk Mitigation Power Plant (RMPP) Development is located on a predominantly undeveloped area on Lot 1854 in Alton, an industrial area of Richards Bay, KwaZulu-Natal. The minimum and maximum topographical elevations across the site typically range between approximately 25m MSL in the south eastern portions of the site and rise up to 33m MSL across the north western portions of the site. The site is typically gently sloping and displays typical gentle inland hummocky type dune topography, while there are portions across the central and northern plateau areas of the site that are largely level. Along the eastern boundary of the site lies an approximately north-east to south-west trending natural surface water drainage feature, with ±6m difference in elevation between the base of the channel and the central flat lying plateau area. The existing vegetation across the site typically comprises predominantly grasses with low-lying shrubs, bushes and gum tree plantations. The abandoned and dilapidated industrial development of AAFC occurs across the central/western portions of Lot 1854 with illegal dumping located sporadically across the site.

The site of the proposed new LPG Storage Tanks is located on Lot 1795, Richards Bay which is to the immediate south of Lot 1854 and Kraft Link road. The site has been developed and currently houses a number of parallel warehouse structures.

5. FIELDWORK

The geotechnical field investigation carried out across the site of the proposed 450MW Emergency Risk Mitigation Power Plant (RMPP) Development on Lot 1854 in Alton, Richards Bay, comprised both shallow and deep subsurface investigations. The shallow geotechnical investigation comprised the excavation of Inspection Pits with the performance of Dynamic Cone Penetrometer (DCP) tests located adjacent to each Inspection Pit, whilst the deep geotechnical investigation comprised Borehole drilling.

The fieldwork carried out across Lot 1854 included the following:

i. Excavation, profiling and backfilling of Inspection Pits (IP's) across the proposed site. During the detailed investigation, a total of twenty (20No.) Inspection Pits (IP's) were excavated by TLB across both the 450MW and 4000MW Facilities, with four (4No.) located across the site, or within close proximity, of the proposed 450MW facility site, to depths ranging between **1.6m and 3m** below existing ground levels for the purpose of geotechnical profiling and material sampling. The logs of the Inspection Pits are presented in Figures 1.1 through 1.20 in Appendix 1 of this Report.

ii. Twenty (20No.) Dynamic Cone Penetrometer (DCP) tests were performed immediately adjacent to the twenty (20No.) Inspection Pits. The DCP tests were undertaken adjacent to the Inspection Pits in order to assess and correlate the relative densities of the shallow subsurface materials across site with the profiled descriptions from the Inspection Pits. The DCP tests were performed to maximum depths of **2.9m** below existing ground levels. The DCP test results are presented together with the Inspection Pit logs in Figures 1.1 to 1.20 in Appendix 1 of this Report.

iii. Three (3No.) Boreholes were drilled to depths ranging between 30.22m (BH 1-19), 30.12m (BH 2-19) and 32.00m (BH 3-19) below existing ground levels at selected positions across the sites of the 450MW and 4000MW Facility, with the southernmost BH 2-19 located within the area of the proposed 450MW Facility. The Boreholes were drilled using a 100mm Ø using rotary biodegradable mud drilling technique and incorporated Standard Penetration Tests (SPTs) at 1m vertical intervals. The disturbed samples recovered by the SPT Raymond Spoon were logged and used together with the SPT "N" values to develop a log sheet / Borehole profile. In order

to attempt to record both the shallow and deeper groundwater elevations across the site, the Boreholes were equipped with stand-pipe piezometers, comprising 6m long, 100mm Ø slotted screens surrounded by a silica sand "gravel" filter installed at depths ranging between 23m and 29m (BH 1-19 and BH 2-19), and between 7m and 13m (BH 3-19). The Borehole stand-pipe piezometers were protected with a custom-made circular plastic protective cover and lid. These protective covers will then be buried and covered with approx. 100mm of sand to conceal and safeguard the Boreholes from damage / vandalism and were subsequently marked with a concreted wooden stake positioned approx. 1m away from the Borehole. The Borehole logs are included in Appendix 2 of this Report.

iv. Material sampling of the representative subsoils was undertaken from the Inspection Pit excavations as well as from the Raymond Spoon sampler during the geotechnical Borehole drilling and were transported to a Commercial Soils Testing Laboratory for Sieve analyses, Hydrometer analyses, Atterberg Limits. Additionally, Natural Modified AASHTO maximum dry density compaction tests and California Bearing Ratio (CBR) tests were undertaken on the bulk samples of materials excavated from the Inspection Pits. The laboratory test results are presented in Appendix 3 of this Report

The locations of the various in-situ tests in relation to the proposed layout of the 450MW Emergency Risk Mitigation Power Plant (RMPP) Development are indicated on the Geotechnical Site Plan, Drawing No. 18-3388-01A - Figure 1, whilst Drawing No. 18-3388-01A - Figure 2 indicates the locations of the various in-situ tests with the Aerial Imagery of the site.

The geotechnical field investigation carried out at the site of the proposed LPG Storage Tanks on Lot 1795 in Alton, Richards Bay, was undertaken on the 11th June 2008 and has been summarized in the supplied Wilson & Pass Incorporated Report, titled "*Report to Ilifa Africa Engineers – Geotechnical Investigation – Lot 1795, Richards Bay*", dated 5th July 2008 (included in Appendix 4 of this Report). The geotechnical field investigation only comprised a shallow subsurface investigation involving the excavation of five (5No.) Inspection Pits with the performance of Dynamic Cone Penetrometer (DCP) tests located adjacent to each Inspection Pit. Material sampling of the representative subsoils was similarly undertaken from the Inspection Pit excavations and submitted to Soilco Laboratory in Durban for analysis.

6. LABORATORY TESTING

Three (3No.) disturbed bulk samples of the representative shallow subsoils encountered during the Inspection Pit excavations on Lot 1854, were submitted for laboratory testing and analysis.

The laboratory testing comprised the following :

- Sieve Analyses,
- Hydrometer Analyses,
- Atterberg limits,
- Natural Mod. AASHTO maximum dry density compaction tests;
- California Bearing Ratio (CBR) tests;

A summary of the results of the mechanical size analysis, compaction tests and CBR tests results are given below:

TABLE 6.1:
SUMMARY OF LABORATORY TEST RESULTS

Sample No.		IP 10	IP 12	IP 19
Lab No.		T21560	T21561	T21562
Inspection Pit No.		IP 10	IP 12	IP 19
Sample Depth (m)		2.0 – 2.5	0.5 – 1.5	1.5 – 2.5
Sample Type		Disturbed	Disturbed	Disturbed
Material Description		Silty CLAY	Silty Sand	Silty Sand
Soil Mortar	% Coarse Sand	4	8	4
	% Coarse-Fine Sand	21	33	25
	% Medium-Fine Sand	24	44	54
	% Fine-Fine Sand	3	6	7
	% Silt & Clay	49	9	8
	% Clay	43	5	2
Grading Modulus		0.55	0.99	0.99
Liquid Limit (LL)		42	NP	NP
Plasticity Index (PI)		18	NP	NP
Linear Shrinkage (LS)		8.0	0.0	0.0
Mod AASHTO Compaction	Dry Density (kg/m^3)	1789	1845	1740
	OMC %	15.6	9.4	8.3
CBR	100%	2.4	45	37
	98%	1.8	33	30
	97%	1.5	28	27
	95%	1.1	21	22
	93%	0.8	15	18
	90%	0.5	9.4	13
	CBR Swell (%)	3.1	0.0	0.0
COLTO Classification (1998)		CBD	G7	G7
TRH 14 Classification (1985)		<G10	G7	G7
AASHTO Soil Classification (Group Index)		A – 7 – 6 (0)	A – 3 (0)	A – 3 (0)
ASTM Unified Classification		SC	SP-SM	SP-SM

7. GEOLOGICAL CONDITIONS

7.1 Overview

Lot 1854 and Lot 1795 in Alton and the surrounding areas of Richards Bay are underlain by a cover of unconsolidated and partly consolidated sediments of aeolian and alluvial origin. These sediments are in turn underlain by weathered calcarenite and coquina of the Uloa Formation of Miocene age, which is then typically underlain by siltstones of the St Lucia Formation of Cretaceous age.

7.2 Shallow Surface Conditions

On the basis of the results of the Inspection Pits and DCP tests (IP 1 to IP 20), it is apparent that the Site is covered by aeolian and alluvial cover sands typically ranging between 1.1m and up to 3m in thickness. These sands are typically subdivided into two horizons, (i) the near surface *medium to dark grey to medium to dark brown, slightly silty to silty, fine to medium grained SANDS* which generally occurred as either a superficial horizon 0.1m to 0.4m in thickness or occur as a more well developed horizon ranging between 0.5m and up to 0.9m in thickness. Underlying these near surface sands occurred (ii) a lower sand horizon, typically described as *pale to medium grey to pale to medium greyish brown to pale to medium yellowish grey or yellowish brown, fine medium and occasionally coarse grained SAND*, this horizon was found to extend to depths ranging between 1.1m and up to a maximum of 3m below existing ground levels and was found to range between approximately 0.6m and up to 2.8m in thickness.

The abovementioned aeolian and alluvial cover sands that combined, extend to approximately 1.1m to 3m below EGL, are underlain by recent clays typically described as *pale grey blotched red, brown and yellow, very soft to soft or firm to stiff, sandy CLAY to SANDY CLAY* which was encountered at depths ranging between 1.1m and 3m below existing ground levels, or to the maximum extent of the Inspection Pit excavations.

7.3 Deep Surface Conditions

On the basis of the results of the Borehole drilling (BH 1-19, BH 2-19 and BH 3-19), it is apparent that underlying the aeolian and alluvial cover sands, the recent clays typically extend to depths ranging between 5.75m (BH 3-19) and up to 9.75m (BH 2-19). The in situ subsurface profile thereafter comprises largely interlayered medium dense to very dense (occasionally loose), slightly clayey / silty SANDS with isolated occurrences of stiff to very stiff SANDY CLAYs (typically between 11m and 13m depth and 1m to 2m in thickness) which were found to extend to depth ranging between approximately 24.45m and 25.46m below existing ground levels.

Underlying these unconsolidated sediments *(W5/W4) to (W5/W3) medium brownish grey blotched pale grey and dark brown, completely to highly weathered, highly jointed/fractured, soft to medium hard rock fragments interlayered with bands of fine silty sand, CALCERENTIE to SHELLY CONGLOMERATE* with minor coarser grained fine pebbles/gravels ranging in thickness between 10mm and up to 200mm was found to occur. This unit forms part of the Uloa Formation and has been subjected to karst like weathering which has resulted in a high transmissive lower groundwater aquifer unit.

Underlying the Uloa Formation, *(W5) to (W4/W3) dark grey slightly speckled pale grey (shell fragments), completely to highly weathered, slightly fractured/jointed, very soft to soft rock, SILTSTONE* of the St Lucia Formation was encountered at depths ranging between 28m and 30.5m below existing ground levels. The St Lucia Formation is an aquiclude and is anticipated to be more than 100m in thickness beneath the Alton area and increasing in thickness towards the east.

7.4 Groundwater Elevation

Groundwater seepage was encountered at depths ranging between 1.8m and up to 2.7m below existing ground levels in nine (9No.) of the twenty (20No.) Inspection Pit excavations. The standpipe piezometers installed in the Boreholes further reveal that the groundwater elevation is expected to be encountered at depths ranging between 2.25m (BH 3-19), 3.28m (BH 1-19) and up to 4.15m (BH 2-19) below existing ground levels. Additionally, the shallow, less permeable recent SANDY CLAY layers should be anticipated to retard vertical drainage and possibly give rise

to temporary perched seepage water after prolonged periods of heavy rainfall. There would thus be an advantage to carry out any deep excavations on the site during the relatively dry periods prior to the summer rains.

8. EXCAVATABILITY

The results of the excavations of the Inspection Pits using a TLB together with the results of the DCPs indicate that the class of excavation in terms of SABS 1200 D; Subclause 3.1.2 should be "soft excavation" to depths of at least 3m below EGL. Additionally, the drilling of Boreholes suggests that excavations to depths of approximately 25m below EGL can be considered "soft excavation".

9. BULK EARTHWORKS

9.1 General

The site of Lot 1854 in Alton is generally gently sloping, however due to the nature of the development, earthworks will be required to achieve level building platforms. If any significant earthworks and / or embankment construction are proposed, it is recommended that these operations be carried out in accordance with the current SANS 1200 series. In this regard, general fill for the formation of embankments or terraces should adhere to the following general precautions:

- Topsoil should be removed and stockpiled for later use.
- Any unsuitable clay materials should not be placed within 300mm of structures or floorslabs.
- The placement of general engineered fill materials should be placed in layers not exceeding 100 to 150mm, each layer individually compacted to at least 98% Mod. AASHTO maximum dry density.

The creation of any level buildings platforms across this site, which result in fill platforms ranging between say 1m to 2m in height above the natural ground levels, would apply regional loadings of approximately 18.5kN/m^2 to 37kN/m^2 to any underlying compressible clay layer.

9.2 Proposed Bulk Earthworks Operations

On the basis of the relatively loose and potentially collapsible near-surface sands and the presence of areas underlain by clays at shallow depths, it is evident that heavily loaded structures or structures intolerant of total or differential settlements require either deep founding measures or specific ground improvement measures suitable for the founding of these structures and the structural loads applied.

The following ground improvement / founding options include:

i. Bulk earthworks over-excavations to specific depths beneath foundations and backfilling with the excavated sands (as well as discrete G5 layers) in compacted layers up to platform elevations;
ii. The use of preload and surcharge load fills to consolidate the deep underlying clay horizons together with (i) above;
iii. The use of a grid of compacted Stone / Concrete columns also referred to as "Soil Reinforcement with Rigid Inclusions";
iv. The use of piles to transfer the high structural loads to a suitable founding medium beneath the deep clay zone.

Option (i) is usually the preferred Ground Improvement methodology, however, the use of Option (iii) comprising a grid of compacted Stone / Concrete columns or "Soil Reinforcement with Rigid Inclusions" could provide a comparatively economical founding solution with a relatively lower level of risk. As a result, any proposed extensive bulk earthworks operations, particularly planned for any large heavily loaded structures, the installation of the Stone Columns and the construction of an approximately 500mm thick "Load Distribution Platforms" (LDP) over the compacted Stone Columns and the construction of layerworks between the LDP's and the Platform Elevation could be a suitable alternate option.

The shallow founding of structures tolerant of total and differential settlements or relatively lightly loaded structures will require suitably designed ground improvement measures as part of the earthworks operation to ensure that:

- Any very loose to loose sands within the depth zone stressed by shallow foundations are either densely compacted or removed and replaced in densely compacted layers, and;
- Account is taken of any potentially compressible clay layers that are included within the depth zone stressed by the shallow foundations, in order to provide anticipated consolidation settlements.

10. GRADING SCHEME

In order to provide an indication of the preliminary founding of the proposed structures and the significant influence that reshaping of the existing topography and groundwater elevations will have on a founding assessment, two (2No.) inferred geological cross sections (A – A' and B – B') have been prepared and included in the Drawing Section of this Report.

A single platform or terrace will necessitate the removal of a portion, or the entire thickness, of the superficial sand cover across the elevated areas of the Site and either expose the recent clays at platform level or result in the clays being located close beneath platform level. This will impact on the shallow founding recommendations for single and double storey structures and the extent of ground improvement measures.

The preliminary founding assessment set out in this Report is based on the existing or natural ground elevations and does not take into consideration any future proposed Grading Scheme. The Detailed Geotechnical Report to be carried out once the most suitable layout options for the structures and the associated grading schemes are firmer, will provide detailed founding for individual structures based on the proposed platform / terrace elevations.

11. PRELIMINARY FOUNDING ASSESSMENT

At the time of preparing the Geotechnical Report the detailed architectural / structural layout drawings had not been finalized for the proposed 450MW Emergency Risk

Mitigation Power Plant (RMPP) Development. Additionally, the anticipated earthworks and platforms levels/elevations had not been finalized.

The development on Lot 1854 is anticipated to comprise a Power Block and auxiliaries, 132kV Substation, Naphtha Storage Facility, fuel pipe routing on site, laydown areas, offices, workshops, roads, stormwater dams and drainage, whilst the proposed LPG Storage Tanks on Lot 1795 is anticipated to comprise ten (10No.) 1000m^3 LPG Storage Vessels, with Decanting Gantry for standard Road Tankers, 2546m^3 Firewater Storage Tank with pumps, Security, Switchgear, Control Room, Office and Ablution Block structures as well as Generators, Air compressors and Nitrogen Backup structures.

As the precise locations of the abovementioned structures have not been fully finalized as well as the anticipated earthworks required, a preliminary founding report is provided outlining the most feasible founding solutions, for the following structures:

Lightweight Structures: Single or Double Storey Structures or Structures tolerant of differential settlements

Heavily Loaded Structures: Power Block/s and/or Structures intolerant of differential settlements

11.1 Lightweight Structures: Single or Double Storey Structures or Structures Tolerant of Differential Settlements

11.1.1 General Comments

A single-storey structure would under most circumstances be founded on shallow strip footings supporting load-bearing brickwork. A double storey structure could either be founded on shallow strip footings supporting load bearing brickwork or alternatively, by shallow isolated bases supporting columns of a concrete or steel framed structure with reinforced groundbeams supporting low brick infill panels with cladding above the brickwork.

11.1.2 Preliminary Founding Conditions

The geotechnical investigation undertaken across the site indicated that superficial granular sandy materials underlie the site to depths ranging between 1.1m and up to 3m below existing ground levels, which are in turn underlain by recent compressible clay materials. The DCP test results show that the granular sandy material and Recent clay materials across the site have variable relative densities to depths of at least 3m below existing ground levels. The subsurface densities are typically very loose to loose within the upper portion of the granular sandy subsurface profile, with the sands generally becoming medium dense to dense with increasing depth (with occurrences of both interlayered loose and very dense pockets of sands). The Recent clay deposits also show variable relative densities and are typically very soft to soft within the upper 200mm to 500mm becoming firm to stiff with increasing depth.

The variable very loose to loose sands over the Site, can result in potential Collapse type settlements, if subjected to foundation loadings and then subjected to partial or complete saturation, whilst the underlying thin layer of very soft to soft Recent clay materials being moderately to highly compressible, can result in excessive Consolidation type settlements.

11.1.3 Preliminary Founding Guidelines

In view of the anticipated loads exerted by the structural foundations coupled with the existence of superficial loose SANDS overlying very soft to soft to firm SANDY CLAYs occurring to depths ranging between approximately 1.1m and up to 9.75m below existing ground levels, ground improvement measures are considered necessary to ensure stable founding of these structures and prevent excessive collapse or consolidation settlements occurring.

The proposed ground improvement measures should generally comprise the excavation of the superficial SAND subsurface CLAY materials down to a depth of the stressed zone beneath the foundations, which typically extends to a depths equal to 1.5 times the least width of the foundation, i.e. the stressed zone of a 1m wide foundation founded at 1m depth will extend to a depth of approximately 2.5m below existing ground levels (i.e. 1m x 1.5 = 1.5m + 1m (founding depth) = 2.5m). The excavation can then be backfilled with the excavated and stockpiled sand in layers,

compacted to 98% modified AASHTO maximum dry density. To easily achieve the required 98% compaction, the backfill sands will need to be compacted at their optimum moisture content.

It is also recommended that in the areas of ground improvement, a 200mm thick cohesive G5 layer is incorporated in the compacted backfill at and immediately below founding level beneath the reinforced strip footings in order to achieve high densities directly below the G5 within the underlying compacted sands, and to provide a marker horizon to define the top of the founding elevation (wind will often move loose sand over the compacted sand surface and it is not possible to distinguish between the two).

An area of ground improvement at least 2.5m larger than the footprint of structures is usually recommended. The ground improvement measures should be carried out as a bulk excavation using a tracked excavator and ADT's to remove the clays and a 12T smooth drum vibratory roller to compact the stockpiled sandy materials in discrete layers.

Under these conditions a ground bearing pressure of up to 150kN/m^2 may be used in design with an allowance for a 25% overstress for transient loads.

This should translate to an angular distortion of less than 1 in 500 and thereby minimize or obviate cracking in the brickwork. It would be necessary to provide movement joints at regular intervals through the structure in terms of conventional building practice.

It is essential that the bases of the isolated pad footings and/or the bases of the strip footing excavations be inspected and tested with a DCP prior to casting to ensure that the foundations are underlain by the envisaged medium dense to dense mechanically compacted sands and not by any localized loose sands or sands disturbed during the excavation of the foundation trenches. Where such loose zones are identified within the bases of the strip foundations, the excavation and reinstatement of these loose sands to the required density will be crucial.

Groundwater seepage was encountered during the excavation of certain of the Inspection Pits across the site. In the event that the base of the excavation is saturated

upon excavation in the areas of ground improvement, the use of ≥200mm thick layer of 19mm (or finer) stone aggregate, entirely encased or wrapped in a heavy geofabric, can be installed to act as a pioneer layer across the base of the trench excavation. Once this layer is installed intermittent pumping of water from a sump in the stone aggregate layer could commence to maintain the water level below this level and the excavated sands can then be placed as an engineered fill over the geofabric encased stone in 300mm thick layers and compacted to 98% modified AASHTO maximum dry density up to the underside of the foundations.

11.1.4 Floor Slabs beneath Lightly Loaded Single / Double Storey Structures

The granular materials exposed across the Site are entirely suitable for use beneath floor slabs for lightly loaded floorslabs within the single / double storey structures. The placement of a thin (100mm) layer of compacted cohesive material over the sands (i.e. G5), however, will facilitate control of levels and act as a marker horizon during construction, as the wind on Site can result in movement of the sand surface which can be overlooked as the sands are all similar in colour and grain size.

11.2 Heavily Loaded Structures

It considered necessary that all heavily loaded structures and structures intolerant of differential movements will require to be supported by piled foundations. This is due to the potentially collapsible and moderately to highly compressible nature of the shallow subsurface profile under high loads for the large loaded areas where the stress increases are likely to result in longterm consolidation settlements.

11.2.1 Recommend Pile Types

Piles will normally be extended through the potentially collapsible sandy subsoils and underlying compressible clay horizons and be founded within the lower medium dense to dense SANDS. The following pile types are considered to be the most suitable and economical for general use on this Site.

a) Driven Cast in Place (DCIP) Pile (" Franki" type)
b) Pressure grouted Continuous Flight Auger (CFA) Pile

11.3 Pile Details

11.3.1 Driven Cast in Place Piles

The DCIP type pile is a displacement pile that supports the applied compressive load primarily in end-bearing on relatively denser layers. Where the need arises to install a considerable number of DCIP piles in a pile cap, it can be prone to problems associated with uplift of adjacent piles on installation of subsequent piles, if close centre-to-centre spacings are used in relatively denser sands in particular. This can be mitigated by arranging the order of pile installation to be scheduled such as to avoid accumulative uplift effects on individual piles. Pile reinforcement is also normally required to be extended to the bulbous base in such cases owing to the tensile uplift forces arising.

The driving resistance of the tube is measured in 250mm increments during installation and assists in confirming the selected / suitable pile founding level. The depth of penetration for ten standard blows ("or set") is then carried out at this selected depth to check that the founding conditions are suitable and if so, the expanded base is then constructed. The installation of a DCIP pile thus has a self-correcting check, if an unsuitable depth is incorrectly specified.

11.3.2 Pressure grouted Continuous Flight Auger (CFA) Piles

Pile test programmes have shown that these piles develop by far the major part of their load-carrying capacity in shaft friction, with only a very small contribution being provided by the pile end-bearing. Accordingly, for a given load capacity pile, the pressure grouted auger pile will usually require a considerably longer shaft length than the equivalent size driven cast-in-place pile for the conditions prevailing at this Site.

It is generally acknowledged that the load-bearing capacity of these piles can be greatly influenced by the skill of the piling rig operator in installing the pile, e.g. if the operator advances the continuous flight auger at a slower than optimum rate in unconsolidated sands below the groundwater table, in particular, the sides of the borehole move inwards, the sides decompress and loosen and the shaft friction calculated from the CPTu/Borehole tests are grossly overestimated.

Because of the uncertainties associated with design incorporating pressure grouted auger piles installed by various Contractors, it is common to call for Special Trial Piles at the commencement of the piling operation on a Site in order to validate pile load carrying capacities and to ensure that pile head settlements fall within the pile settlement acceptance criteria. Proof Load tests on working piles should be included in order to have some recourse to assessing a pile where installation has been problematic. The founding depths of CFA piles need to be selected prior to installation or founding conditions change.

11.4 General Preliminary Pile Founding Levels

11.4.1 Driven Cast-in-Place Piles

Analysis of the results of the three (3No.) Boreholes drilled out at selections locations across the Site has allowed a very preliminary determination of provisional pile founding levels for the following pile diameters and compressive load capacities.

Diameter (mm)	**Load Capacity in Compression (kN)**
360	500
410	750
520	1200
600	1500

Set out in Table 11.4.1 below, are the summaries of the anticipated depths below existing ground levels at each Borehole position for various sizes of DCIP piles each carrying the rated loads in compression that are given above with a Factor of Safety of 2,5.

TABLE 11.4.1

Summary of Preliminary Estimated DCIP Pile Founding Depths for Various Pile Diameters / Load Carrying Capacities in Compression at the Locations of the Boreholes

Probe No.	Depth of Borehole	Pile Founding Depth Below Existing Ground Elevation (m)			
		360mm	410mm	520mm	600mm
		500kN	750kN	1200kN	1500kN
BH 1-19	30.12	10.00	14.00	14.25	13.75
BH 2-19*	**30.22**	**13.75**	**15.00**	**15.75**	**15.50**
BH 3-19	32.00	17.00	18.25	19.00	19.00

*** BH 2-19 is located in the vicinity of the proposed 450MW RMPP Power Plant**

It is evident from the table above that piles are likely to found within the range 10m to 19m below existing ground levels if located on the positions of the Boreholes. It is essential that the founding depths of the DCIP piles are below the lower potentially compressible clay horizons, typically between 11m to 13m below existing ground levels, to prevent the effect of pile group settlements.

11.4.2 Pressure Grouted Continuous Flight Auger Piles (CFA)

Projection of accurate pile founding levels for the pressure grouted CFA piles necessarily must be based on the results of a pile testing programme undertaken at the Site. Based on the results of the three (3No.) Boreholes drilled out at selected locations across the Site, a very provisional determination of pile founding levels has been made for the following pile diameters and compressive load capacities:

Diameter	Load Capacity in Compression (kN)
300	425
350	550
400	750
450	950
500	1200
600	1500

Set out in Table 11.4.2 below, are the summaries of the anticipated depths below existing platform elevation at each Borehole position for various sizes of CFA piles, each carrying the rated loads in compression that are given above with a Factor of Safety of 2,5.

TABLE 11.4.2

Summary of Preliminary Estimated CFA Pile Founding Depths for Various Pile Diameters / Load carrying Capacities in Compression at the Locations of the Boreholes

Probe No.	Depth of Bore-hole	Pile Founding Depth Below Existing Platform Elevation (m)					
		300mmØ	350mmØ	400mmØ	450mmØ	500mmØ	600mmØ
		425kN	550kN	750kN	950kN	1200kN	1500kN
BH 1-19	30.12	16.25	16.75	17.25	17.75	19.00	19.25
BH 2-19*	**30.22**	**18.00**	**18.50**	**19.25**	**20.00**	**20.50**	**20.75**
BH 3-19	32.00	17.00	17.25	18.75	20.00	21.25	21.25

*** BH 2-19 is located in the vicinity of the proposed 450MW RMPP Power Plant**

It is evident from the table above that piles are likely to found within the range 16.25m to 21.25m below existing ground levels if located on the positions of the Boreholes.

11.5 Selection of Preferred Pile Type

The selection of the preferred pile type is normally determined by the costs of the lowest Piling Tender. In this case it is possible that the DCIP pile may have a marginal advantage in that:

- The pile with a lower risk of encountering unforeseen conditions
- The pile incorporates self-monitoring tests during driving of the tube to determine a suitable founding level
- It is an economical pile.
- If use is to be made of single piles to support structural column loads, it could substantially reduce the risk of possible excessive settlements and even cases of pile failure where incorrect founding levels are inferred for CFA piles.
- The use of DCIP piles is unlikely to require a Special Trial Pile testing programme, but rather only Proof Load Tests on working piles to validate the pile settlement acceptance criteria.

11.6 Selection of Pile Lengths

The selection of an accurate pile length for the piles at various points across the Site is only possible at the actual Borehole positions, and obviously less accurate when inferred in between these locations. Accordingly, since accurately inferring between 10m to 19m for the DCIP piles and 16.25m to 21.25m for the CFA piles is virtually impossible, it is essential that further Boreholes and CPTu tests are carried out systematically across the site, prior to the piling operations, to more accurately define the DCIP or CFA pile founding depths. Inexpensive DPSH tests could be carried out for the DCIP piles, if required. This can be incorporated into the piling contract.

11.7 Pile Testing

Pile testing prior to the commencement of the piling contract is normally an unwelcomed activity, being both expensive and time consuming. However, it is important to include in a Piling Tender, particularly where the Tenders submitted vary widely in their proposed pile lengths and therefore costs and where the Factor

of Safety against pile failure and acceptable risk is inherently different between Piling Contractors.

A Special Trial Pile (STP) is carried out on a pile or piles entirely separate from the working piles supporting the structural loads. The STP is normally required to be tested to a stipulated load of 2,5 times the Working Load in a specific testing procedure that will, during the test loading programme, provide pile load settlement data that will prove or otherwise that the pile fulfils the pile settlement acceptance criteria.

A Proof Load Test (PLT) on the other hand is carried out on a working pile up to a maximum of 1,5 times the Working Load to confirm that the pile fulfils the pile settlement criteria at both working load and at 1.5 times the working load.
Both Special Trial Pile(s) and Proof Load Tests should be costed in a Piling tender as they provide a means of ensuring that the Client receives the quality of piling required and a means of fairly adjudicating and managing the piling contract.

The Pile Settlement Acceptance Criteria for single piles is set out below:

TABLE 11.7

Pile Settlement Acceptance Criteria for Single Piles

Pile Acceptance Criteria	Piles <16m long	Piles 16 - 35m long
i. Maximum settlement at working load after 24 hours of sustained load	10mm	13mm
ii. Maximum settlement at 150 per cent of working load after 24 hours sustained load	18mm	23mm
iii. Residual settlement after removal of sustained load (i) above	6mm	8mm
iv. Residual settlement after removal of sustained load (ii) above	12mm	14mm

11.8 Floor Slab beneath Heavily Loaded Structures under Existing Subsurface Conditions

As the proposed floor loading of the heavily loaded areas and anticipated earthworks and / or platforms / terraces were not available at the time of writing this Report, it is presumed that potentially significant floor loadings could be applied. Under such circumstances the concrete floor slab would presumably need to be more than twice the thickness of a conventional 100mm thick surface bed and contain steel reinforcing mesh. Furthermore, the 200mm to 250mm thick concrete floor slab would probably need to be placed on a 300mm thick layer of well compacted G4 type material in order to provide support to the overlying reinforced concrete slab.

If the assumed high floor loadings are amended downwards, it would nevertheless still be recommended that the mesh reinforced conventional concrete surface bed be placed on a 300mm thick layer of well compacted G5 type granular material. However, detailed recommendations will need to be carried out once the most suitable layout options for the structures and the associated grading schemes are firmer.

12. TYPICAL ROAD PAVEMENT DESIGN

12.1 Subsurface Conditions

The subsurface conditions described in Section 7 of this report are augmented by the results of the DCP tests undertaken across site which together with the results of laboratory testing indicate that the sands encountered across the site should be classified as G7 according to TRH 14 criteria.

12.2 Preliminary Recommendations

The subsurface geological conditions indicate that the proposed roadway for large/heavy vehicles could be constructed using the following guidelines:

- The subsoil is boxed out to 630mm below proposed pavement level. The base of the excavation is scarified and the material at the base compacted to 93% modified AASHTO.
- Two (2No.) 150mm layers of the insitu stockpiled granular material (of at least G7 grade) be compacted to 98% modified AASHTO.
- Thereafter, a 150mm C4 layer (UCS 0,75 to 1,5MPa at 100% modified AASHTO and maximum size of 63mm) of imported inert granular material stabilized with 3% by mass of cement, and compacted to 95% modified AASHTO is placed
- A 150mm layer of imported inert granular G2 crusher run material is placed and compacted to 98% modified AASHTO
- Asphalt is placed as a compacted 40mm thick layer.

The abovementioned pavement design is reasonably conservative as the actual traffic loading and frequency are unknown.

Where general administrative parking is envisaged without the loading of heavy vehicles, the G7 subgrade is considered suitable for the construction of a pavement, which could typically comprise:

- The subsoil is boxed out to 600mm below proposed pavement level or to a level below the topsoil, whichever is greater. The excavation is recompacted in 150mm layers of in situ material (G7) to a depth of 450mm and at 93% modified AASHTO
- One (1No) 150mm layer of in situ G7 material (from below the topsoil) is compacted to 93% modified AASHTO
- Thereafter, a 150mm G6 layer (maximum size of 63mm) of imported inert granular material, compacted to 95% modified AASHTO is placed
- A 150mm layer of imported inert granular G4 material is placed and compacted to 98% modified AASHTO
- Asphalt is placed as a compacted 40mm thick layer.

The final selection of any pavement design must obviously only be undertaken by the appointed Civil Engineer after the necessary traffic information is known and the pavement design life has been calculated.

13. SITE DRAINAGE AND STORMWATER MANAGEMENT

The control of the roof stormwater discharge and surface flow from hardstanding areas surrounding the structures is essential as the surface sands are highly erodible. Some form of retention capacity based on $1m^3$ per $40m^2$ of roof area is often stipulated to reduce peak flows.

14. GENERAL

14.1 It is stressed that the Contractor appointed to construct the foundations must be made fully conversant with the operation and interpretation of hand operated DCP equipment, so that all shallow foundations are checked, approved and signed off prior to casting the foundations.

14.2 It is stating the obvious, but the protection of steel from corrosion in Richards Bay is a major issue and it may be worthwhile in the longterm to consult a Specialist for confirmation of specifications in this regard and with experience of the very aggressive conditions in Richards Bay.

15. FURTHER RECOMMENDED GEOTECHNICAL INVESTIGATIONS

The geotechnical field investigation carried out by Wilson & Pass Incorporated on Lot 1795 in Alton, Richards Bay, at the site of the proposed new LPG Storage Tanks, has been summarized in a Report titled "*Report to Ilifa Africa Engineers – Geotechnical Investigation – Lot 1795, Richards Bay*", dated 5th July 2008. This geotechnical investigation only comprised a **shallow subsurface investigation** involving the excavation of five (5No.) Inspection Pits with the performance of Dynamic Cone Penetrometer (DCP) tests located adjacent to each Inspection Pit. The Inspection Pits were largely confined to the central portions of Lot 1795 and not within the vicinity of the proposed LPG Storage Tanks, which are positioned across the southern portions of Lot 1795.

Accordingly, in order to provide sufficient preliminary detailed subsurface information, particularly relating to the provision of preliminary founding

recommendations for the anticipated highly sensitive and settlement intolerant LPG Storage Tanks, a deeper geotechnical investigation involving Borehole Drilling has been recommended. These boreholes will be dual-purpose Geotechnical and Geohydrological boreholes, allowing for both the preliminary determination of the pile founding levels (in the vicinity of the boreholes) for different pile types (i.e. DCIP and CFA piles), for a range of pile diameters at differing compressive load carrying capacities (when preliminary foundation costs are required in the future), as well as enabling the measurement of the ambient groundwater elevations across the site, providing the necessary information related to the direction of groundwater movement for the required Geohydrological Investigations and Reporting. The piezometers installed in the boreholes will also permit groundwater samples to be removed, when required, for baseline geochemistry data, i.e. groundwater entering and leaving the site.

Costed proposals to undertake the required additional Geotechnical, Geohydrological and Surface Water investigations have been provided by DLP in a Letter Quotation, referenced 18/3388 and dated 25th August 2020. The quotations were subsequently accepted by Savannah Environmental (Pty) Ltd on behalf of the Client, Phinda Power Producers (Pty) Ltd, in four (4No.) Letter of Appointments dated, 1st and 2nd September 2020 and DLP have been authorized to proceed with the required additional investigations and Specialist Report revisions. The results of the additional investigations will be issued as an Addendum to this Report.

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APPENDIX 1

Inspection Pit Logs and Dynamic Cone Penetrometer Tests

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 1

ELEVATION:

DEPTH (m)	DCP Blows/100mm	1	EQV. CBR.	DESCRIPTION
		2	4	Slightly moist, medium grey, loose, silty, fine to medium grained SAND.
		2	4	0.1m
		3	6	
		4	8	
0,5		5	10	
		4	8	
		3	6	Slightly moist, pale grey, loose, fine to medium grained SAND.
		3	6	
		3	6	
1,0		2	4	
		2	4	
		2	4	1.2m
		2	4	
		2	4	
1,5		2	4	
		3	6	Slightly moist, medium yellowish tan, loose becoming medium dense to dense, fine to medium grained SAND with abundant gravel.
		12	27	
		21	50	
		22	50	
2,0		28	50	
		26	50	2.1m
		17	41	
		10	22	
		4	8	Slightly moist, medium yellowish orange blotched red, dense to medium dense becoming very loose to loose, moderately clayey, fine to medium grained SAND.
2,5		0	<1	
		1	1	
		2	4	
		3	6	2.8m
		3	6	
3,0				Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE 2.6m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.1

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 2

ELEVATION:

DEPTH (m)	DCP Blows/100mm	2	EQV. CBR.	DESCRIPTION
		12	27	Slightly moist, dark grey, medium dense, silty, fine to medium grained SAND.
		13	30	
		12	27	
		13	30	0.4m
0,5		14	32	Slightly moist, pale grey becoming medium greyish brown, medium dense becoming loose, fine to medium grained SAND.
		15	36	
		11	25	
		10	22	
		7	15	
1,0		6	12	
		5	10	
		4	8	
		4	8	
		3	6	
1,5		3	6	
		3	6	
		3	6	1.7m
		3	6	Slightly moist, medium yellowish orange, loose, fine to medium grained SAND.
		4	8	
2,0		3	6	
		4	8	
		5	10	2.2m
		6	12	Slightly moist, pale yellowish grey, medium dense to dense, fine to medium grained SAND.
		7	15	
2,5		7	15	
		6	12	
		15	36	
		16	39	
		20	50	3.0m
3,0				Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.2

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

LOCATION: Richards Bay

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 3

ELEVATION:

DEPTH (m)	DCP Blows/100mm	3	EQV. CBR.	DESCRIPTION
		2	4	Slightly moist, dark grey, loose, silty, fine to medium grained SAND.
		2	4	
		5	10	0.3m
		5	10	
0,5		7	15	
		5	10	
		3	6	
		4	8	
		3	6	Slightly moist, pale brownish grey, loose becoming medium dense to dense, fine to medium grained SAND.
1,0		5	10	
		6	12	
		20	50	
		25	50	
		17	41	
1,5		14	32	1.5m
		9	20	
		5	10	
		3	6	
		1	1	
2,0		1	1	
		1	1	
		0	<1	Slightly moist, medium red blotched pale brownish grey and yellow, stiff becoming soft to very soft to firm, SANDY CLAY with abundant weathered gravel fragments.
		1	1	
		2	4	
2,5		3	6	
		2	4	
		4	8	
		3	6	
		3	6	
3,0				3.0m
				Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.3

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 4

ELEVATION:

DEPTH (m)	DCP Blows/100mm	4	EQV. CBR.	DESCRIPTION
		1	1	Slightly moist, dark brownish grey, loose, silty, fine to medium grained SAND. 0.2m
		2	4	
		4	8	Slightly moist to moist, medium tan brown, loose to very loose, silty, fine to medium grained SAND.
		4	8	
0,5		4	8	
		4	8	
		5	10	
		4	8	
		3	6	
1,0		2	4	
		2	4	
		2	4	
		2	4	
		2	4	
1,5		1	1	1.5m
		2	4	Slightly moist to moist, pale brownish grey becoming blotched pale brown, loose to medium dense, fine to medium grained SAND.
		2	4	
		4	8	
		5	10	
2,0		4	8	
		4	8	
		6	12	
		6	12	
		6	12	
2,5		5	10	
		5	10	
		4	8	
		5	10	2.8m
		5	10	Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
3,0				
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.4

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 5

ELEVATION:

DEPTH (m)	DCP Blows/100mm	5	EQV. CBR.	DESCRIPTION
		4	8	
		7	15	
		12	27	Slightly moist to moist, dark grey, loose to medium dense, silty fine grained SAND.
		11	25	
0,5		11	25	0.5m
		10	22	
		10	22	
		10	22	Moist, medium dark brown becoming pale grey, medium dense, fine to medium grained SAND.
		9	20	
1,0		7	15	
		7	15	1.1m
		6	12	
		4	8	
		3	6	
1,5		3	6	
		4	8	Moist, medium grey, firm, SANDY CLAY to loose to medium dense, moderately clayey SAND.
		5	10	
		5	10	
		4	8	
2,0		5	10	2.0m
		6	12	
		6	12	
		7	15	
		8	17	Wet, pale grey blotched red and brown, stiff to very stiff, SANDY CLAY.
2,5		9	20	
		8	17	
		12	27	2.7m
		12	27	
		13	30	
3,0				
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE 1.8m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.5

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

LOCATION: Richards Bay

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 6

ELEVATION:

DEPTH (m)	DCP Blows/100mm	6	EQV. CBR.	DESCRIPTION
		2	4	Slightly moist, dark grey, very loose to loose, fine to medium grained SAND.
		1	1	
		2	4	
		1	1	
0,5		1	1	
		2	4	
		1	1	
		1	1	
		1	1	0.9m
1,0		2	4	Slightly moist to moist to wet, pale grey to pale greyish brown, loose to medium dense, slightly clayey, fine to medium grained SAND.
		2	4	
		4	8	
		4	8	
		5	10	
1,5		6	12	
		6	12	
		7	15	
		8	17	
		9	20	
2,0		12	27	
		8	17	
		7	15	
		7	15	
		7	15	
2,5		7	15	2.5m
		6	12	Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
		4	8	
		4	8	Inspection Pit continually collapsed due to very slow groundwater ingress.
		4	8	
3,0				
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE 1.8m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.6

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

LOCATION: Richards Bay

INSPECTION PIT NO.
I.P. 7

ELEVATION:

DEPTH (m)	DCP Blows/100mm	7	EQV. CBR.	DESCRIPTION
		2	4	Slightly moist, dark grey, very loose to loose, silty, fine to medium grained SAND.
		2	4	
		1	1	
		1	1	
0,5		2	4	
		1	1	
		2	4	0.7m
		1	1	
		2	4	
1,0		2	4	
		3	6	Slightly moist to moist to wet, pale becoming medium greyish brown, loose to medium dense, fine to medium grained SAND.
		4	8	
		5	10	
		6	12	
1,5		7	15	1.5m
		8	17	
		9	20	
		16	39	
		17	41	
2,0		3	6	Moist to wet, medium orange brown blotched red, stiff becoming very soft to soft to firm, SANDY CLAY with abundant gravels.
		1	1	
		1	1	
		2	4	
		2	4	
2,5		4	8	
		5	10	
		6	12	2.7m
		7	15	
		9	20	Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
3,0				Inspection Pit gradually collapsed due to slow groundwater ingress
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE 2.3m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.7

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

LOCATION: Richards Bay

INSPECTION PIT NO.
I.P. 8

ELEVATION:

DEPTH (m)	DCP Blows/100mm	8	EQV. CBR.	DESCRIPTION
		1	1	
		2	4	
		1	1	
		3	6	
0,5		4	8	Slightly moist to moist, dark grey, loose to medium dense, fine grained SILTY SAND.
		6	12	
		6	12	
		5	10	0.4m
		6	12	
1,0		6	12	Moist, pale grey, medium dense, slightly clayey, fine to medium grained SAND.
		7	15	1.1m
		6	12	
		6	12	
		5	10	Moist to wet, medium grey, medium dense, moderately clayey, fine to medium grained SAND.
1,5		6	12	
		6	12	1.6m
		3	6	
		3	6	Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
		4	8	
2,0		4	8	Inspection Pit gradually collapsed due to moderate groundwater ingress
		6	12	
		8	17	
		8	17	
		10	22	
2,5		10	22	
		11	25	
		13	30	
		15	36	
		14	32	
3,0				
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE 1.8m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.8

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

LOCATION: Richards Bay

INSPECTION PIT NO.
I.P. 9

ELEVATION:

DEPTH (m)	DCP Blows/100mm	9	EQV. CBR.	DESCRIPTION
		3	6	Slightly moist, brownish grey, loose occasionally medium dense, silty, fine to medium grained SAND.
		3	6	
		4	8	
		6	12	
0,5		4	8	
		4	8	
		4	8	0.6m
		8	17	Slightly moist to moist, medium brown becoming pale grey, medium dense becoming loose to very loose, fine to medium grained SAND.
		3	6	
1,0		1	1	
		1	1	
		1	1	
		2	4	1.3m
		2	4	Slightly moist to moist, pale grey blotched orange brown and red, soft to firm becoming very stiff, SANDY CLAY.
1,5		2	4	
		2	4	
		3	6	
		4	8	
		4	8	
2,0		5	10	
		7	15	
		7	15	
		8	17	
		11	25	
2,5		14	32	
		24	50	
		13	30	
		25	50	2.7m
		20	50	Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
3,0				
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE 2.2m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.9

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 10

ELEVATION:

DEPTH (m)	DCP Blows/100mm	10	EQV. CBR.	DESCRIPTION
		4	8	Slightly moist, grey, loose to medium dense, silty, fine to medium grained SAND.
		7	15	
		5	10	
		6	12	
0,5		4	8	
		5	10	
		4	8	
		4	8	
		4	8	
1,0		3	6	
		3	6	
		6	12	Slightly moist, pale grey becoming blotched pale brown with depth, loose to medium dense, fine to medium grained SAND.
		7	15	
		9	20	
1,5		8	17	
		10	22	
		6	12	
		3	6	
		1	1	
2,0		1	1	
		1	1	
		3	6	Slightly moist to moist, pale grey blotched red and orange, very soft to firm becoming stiff to very stiff, SANDY CLAY.
		3	6	
		4	8	
2,5		6	12	
		7	15	
		7	15	
		11	25	
		11	25	Bulk Sample (2.0 - 2.5m)
3,0				
3,5				
4,0				
4,5				
5,0				

0.8m

1.9m

2.8m

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE 2.4m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.10

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 11

ELEVATION:

DEPTH (m)	DCP Blows/100mm	11	EQV. CBR.	DESCRIPTION
		2	4	Slightly moist, dark grey, loose, silty, fine grained SAND. 0.1m
		4	8	
		3	6	
		1	1	
0,5		1	1	
		2	4	
		3	6	
		4	8	
		2	4	
1,0		4	8	Slightly moist, medium orange tan, very loose to loose, fine to medium grained SAND.
		3	6	
		3	6	
		2	4	
		2	4	
1,5		2	4	
		2	4	
		4	8	
		3	6	1.8m
		3	6	
2,0		5	10	
		8	17	Slightly moist, pale yellowish grey, loose to medium grained, fine to medium grained SAND.
		23	50	
		31	50	
		34	50	2.4m
2,5		13	30	
		4	8	Slightly moist to moist, medium maroon blotched pale grey, very stiff becoming firm, SANDY CLAY with gravels.
		2	4	
		3	6	2.8m
		2	4	
3,0				
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.11

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 12

ELEVATION:

DEPTH (m)	DCP Blows/100mm	12	EQV. CBR.	DESCRIPTION
		5	10	Slightly moist, medium grey, loose, fine to medium grained SAND. 0.1m
		12	27	
		12	27	
		7	15	
0,5		7	15	
		6	12	
		4	8	
		3	6	
		2	4	
1,0		3	6	
		2	4	Slightly moist, medium orange tan, medium dense becoming loose, fine to medium grained SAND.
		2	4	
		2	4	
		2	4	
1,5		3	6	
		2	4	
		2	4	
		3	6	
		3	6	
2,0		3	6	
		3	6	2.1m
		5	10	Slightly moist, pale orange brown, medium dense to dense, fine to medium grained SAND.
		7	15	
		15	36	
2,5		25	50	2.5m
		12	27	Moist, medium maroon blotched pale grey, stiff becoming firm, SANDY CLAY with gravels.
		3	6	
		3	6	2.8m
		3	6	Bulk Sample (0.5m - 1.5m)
3,0				
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.12

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 13

ELEVATION:

DEPTH (m)	DCP Blows/100mm	13	EQV. CBR.	DESCRIPTION
		1	1	
		2	4	
		2	4	
		2	4	
0,5		2	4	Slightly moist, medium grey, loose, silty, fine to medium grained SAND.
		2	4	
		3	6	
		3	6	0.8m
		5	10	
1,0		5	10	
		9	20	Slightly moist, pale grey, loose to medium dense, fine to medium grained SAND.
		10	22	
		11	25	1.3m
		13	30	
1,5		12	27	
		13	30	
		15	36	
		13	30	
		11	25	
2,0		11	25	Moist, pale grey blotched pale orange, medium dense to dense becoming loose, fine to medium grained SAND.
		8	17	
		9	20	
		9	20	
		6	12	
2,5		5	10	
		5	10	
		5	10	
		6	12	2.8m
		7	15	
3,0				
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.13

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 14

ELEVATION:

DEPTH (m)	DCP Blows/100mm	14	EQV. CBR.	DESCRIPTION
		2	4	Slightly moist, medium grey, loose, silty, fine to medium grained SAND.
		3	6	
		3	6	
		3	6	
0,5		3	6	
		2	4	
		2	4	
		3	6	
		2	4	0.9m
1,0		3	6	Slightly moist to moist, pale grey becoming blotched pale brown with depth, loose to medium dense, fine to medium grained SAND.
		3	6	
		4	8	
		3	6	
		7	15	
1,5		6	12	
		6	12	
		7	15	
		9	20	
		10	22	
2,0		11	25	
		11	25	
		10	22	
		10	22	
		7	15	
2,5		6	12	
		4	8	
		4	8	
		4	8	2.8m
		5	10	Inspection Pit gradually collapsed.
3,0				
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE Not Encountered but moist conditions at 2.7m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.14

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

LOCATION: Richards Bay

INSPECTION PIT NO.
I.P. 15

ELEVATION:

DEPTH (m)	DCP Blows/100mm	15	EQV. CBR.	DESCRIPTION
0,5		3	6	Slightly moist, medium grey to medium brownish grey, loose, silty, fine grained SAND.
		5	10	
		3	6	
		3	6	
		3	6	
		3	6	
		2	4	
		3	6	
		3	6	0.9m
1,0		4	8	
		4	8	
		7	15	
		9	20	
		10	22	
1,5		13	30	Slightly moist, pale grey, loose to medium dense, fine to medium grained SAND.
		11	25	
		16	39	
		10	22	
		12	27	
2,0		10	22	
		5	10	
		6	12	
		5	10	
		3	6	
2,5		4	8	2.5m
		4	8	
		3	6	Slightly moist to moist, pale grey blotched red orange, firm, SANDY CLAY.
		4	8	
		4	8	2.9m
3,0				
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.15

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

LOCATION: Richards Bay

INSPECTION PIT NO.
I.P. 16

ELEVATION:

DEPTH (m)	DCP Blows/100mm	16	EQV. CBR.	DESCRIPTION
0,5		2	4	Slightly moist, medium grey, loose, silty, fine to medium grained SAND.
		4	8	
		2	4	
		2	4	
		3	6	
		3	6	
		2	4	
		3	6	
		4	8	
1,0		4	8	0.9m
		5	10	Slightly moist, pale grey becoming blotched pale brown, loose to medium dense, fine to medium grained SAND.
		7	15	
		8	17	
		11	25	
1,5		14	32	
		14	32	
		12	27	
		13	30	
		11	25	1.9m
2,0		5	10	Slightly moist to moist, pale grey blotched pale brown and red, stiff becoming firm to very soft, SANDY CLAY.
		3	6	
		2	4	
		2	4	
		1	1	
2,5		1	1	
		3	6	
		3	6	
		3	6	
		3	6	2.8m
3,0				
3,5				
4,0				
4,5				
5,0				

FROM	0	2	4	6	8	10	
TO	2	4	6	8	10	+	

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.16

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOGGED BY: A. Greet

LOCATION: Richards Bay

INSPECTION PIT NO.
I.P. 17

ELEVATION:

DEPTH (m)	DCP Blows/100mm	17	EQV. CBR.	DESCRIPTION
		1	1	
		6	12	Slightly moist, dark grey, very loose to medium dense, silty, fine to medium grained SAND.
		5	10	0.3m
		6	12	
0,5		4	8	
		2	4	
		3	6	
		5	10	
		6	12	
1,0		10	22	Slightly moist, pale grey, loose to medium dense, fine to medium grained SAND.
		8	17	
		4	8	
		2	4	
		2	4	
1,5		3	6	
		2	4	1.6m
		2	4	
		2	4	
		3	6	
2,0		5	10	
		3	6	
		6	12	Slightly moist to moist, pale grey blotched orange and red, soft to firm becoming stiff to very stiff, SANDY CLAY.
		5	10	
		6	12	
2,5		7	15	
		7	15	
		9	20	
		10	22	
		9	20	2.9m
3,0				
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE 2.6m
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.17

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 18

ELEVATION:

DEPTH (m)	DCP Blows/100mm	18	EQV. CBR.	DESCRIPTION
		1	1	Slightly moist, medium brown, loose to medium dense, silty, fine grained SAND.
		2	4	
		3	6	
		5	10	
0,5		7	15	
		8	17	
		11	25	0.6m
		10	22	Slightly moist, medium tan becoming pale grey, medium dense to loose, fine to medium grained SAND.
		13	30	
1,0		7	15	
		4	8	
		3	6	1.2m
		4	8	Slightly moist to moist, medium tan blotched pale and dark grey and red, firm becoming stiff to very stiff, silty, SANDY CLAY.
		2	4	
1,5		3	6	
		4	8	
		6	12	
		9	20	
		10	22	
2,0		9	20	
		11	25	
		13	30	
		10	22	
		12	27	
2,5		14	32	
		12	27	
		13	30	
		12	27	
		14	32	
3,0				3.0m
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.18

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 19

ELEVATION:

DEPTH (m)	DCP Blows/100mm	19	EQV. CBR.	DESCRIPTION
		2	4	Slightly moist, dark grey, loose, silty, fine to medium grained SAND.
		3	6	0.1m
		3	6	
		2	4	
0,5		1	1	
		2	4	
		2	4	
		1	1	
		1	1	Slightly moist, orange tan to brownish tan, very loose to loose, fine to medium grained SAND.
1,0		2	4	
		2	4	
		2	4	
		2	4	
		1	1	
1,5		2	4	1.5m
		2	4	
		2	4	
		5	10	
		4	8	
2,0		6	12	
		6	12	
		6	12	Slightly moist, pale greyish brown, loose to medium dense, fine to medium grained SAND,
		5	10	
		7	15	
2,5		8	17	
		12	27	
		11	25	
		6	12	
		7	15	2.9m
3,0				Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
				Bulk Sample (1.5 - 2.5m)
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.19

PROJECT: Geotechnical Investigation for the Proposed Development on Lot 1854, Alton

MACHINE: TLB

DATE: 6th - 8th August 2019

LOCATION: Richards Bay

LOGGED BY: A. Greet

INSPECTION PIT NO.
I.P. 20

ELEVATION:

DEPTH (m)	DCP Blows/100mm	20	EQV. CBR.	DESCRIPTION
		3	6	Slightly moist, dark grey, loose, silty, fine to medium grained SAND.
		2	4	
		2	4	
		4	8	
0,5		4	8	
		2	4	
		2	4	
		9	20	Slightly moist, medium brownish grey becoming pale grey, loose to medium dense to very dense, fine to medium grained SAND.
		11	25	
1,0		16	39	
		16	39	
		20	50	
		21	50	
		14	32	
1,5		13	30	
		15	36	
		24	50	
		9	20	Slightly moist, medium orange brown blotched red and pale grey, very stiff becoming firm to stiff, SANDY CLAY with abundant gravel between 1.5m - 2.5m (Ferricrete?)
		6	12	
2,0		4	8	
		5	10	
		5	10	
		5	10	
		5	10	
2,5		7	15	
		6	12	
		7	15	
		9	20	
		8	17	Soil Samples x 4 (0.5m, 1.0m, 1.5m, 2.0m)
3,0				
3,5				
4,0				
4,5				
5,0				
FROM	0 2 4 6 8 10			
TO	2 4 6 8 10 +			

0.4m

1.5m

2.8m

WATER TABLE Not Encountered
REFUSAL Not Encountered

The equivalent CBR values above are provided as an indication only.

DAVIES LYNN & PARTNERS

REF.No. 18/3388

FIG.No. 1.20

APPENDIX 2

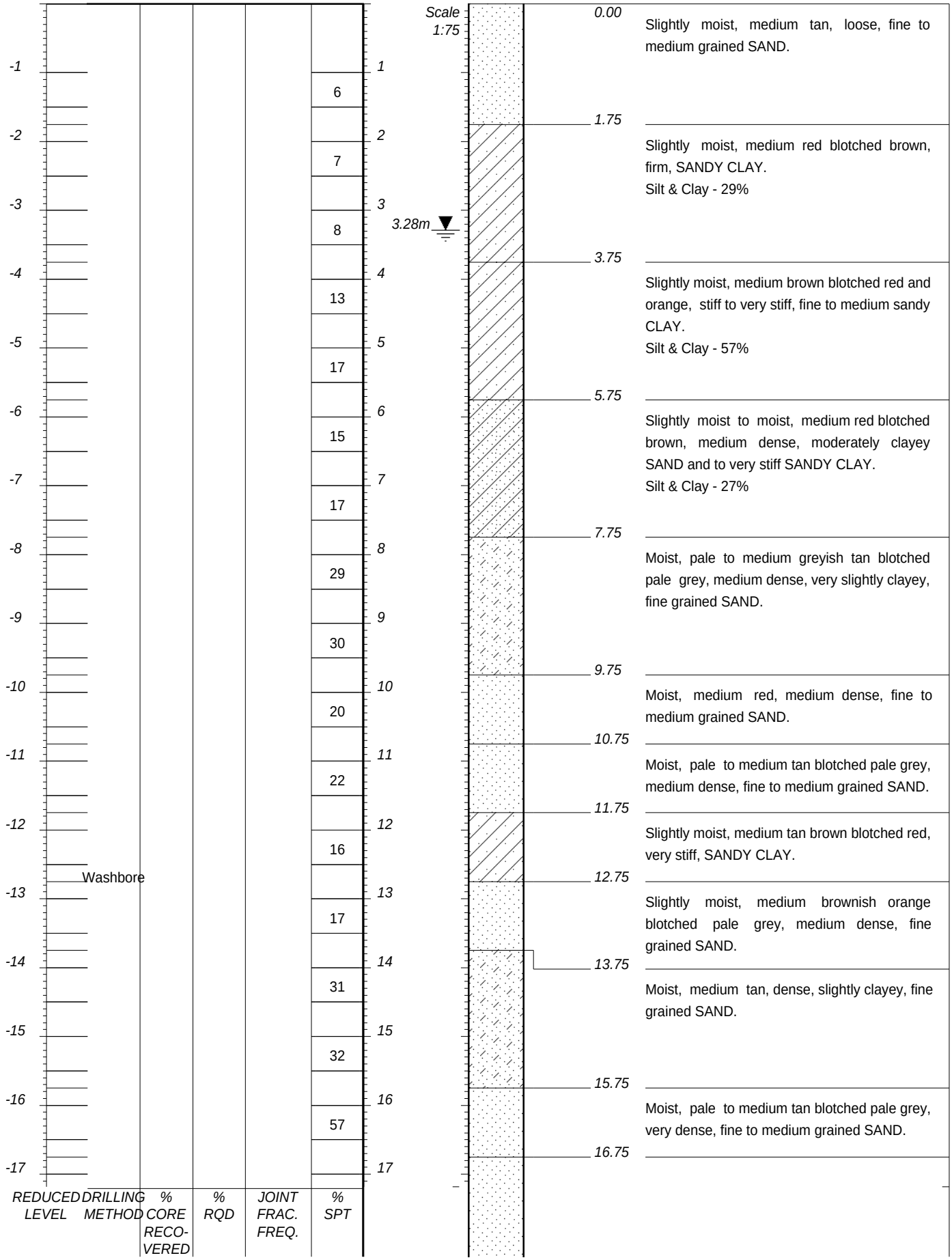
Borehole Profiles

DAVIES LYNN & PARTNERS (PROPRIETARY) LIMITED

PHINDA POWER PLANT, RICHARDS BAY

HOLE No: BH 1-19
Sheet 1 of 2

JOB NUMBER: 18-3388

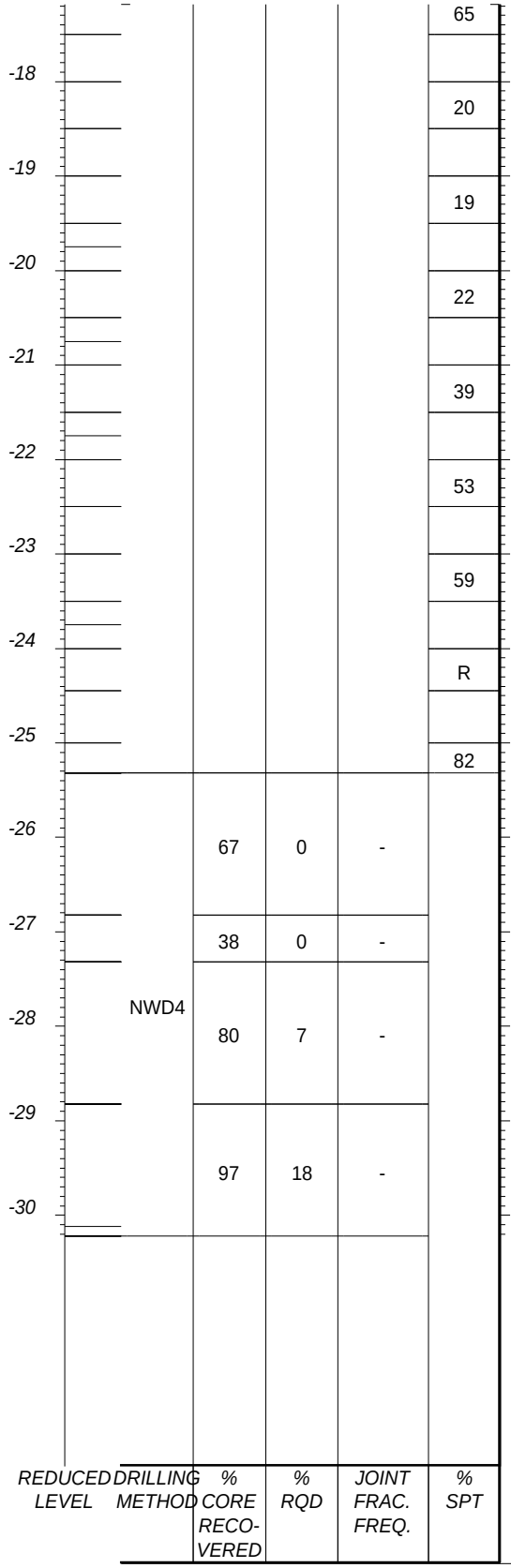


DAVIES LYNN & PARTNERS (PROPRIETARY) LIMITED

PHINDA POWER PLANT, RICHARDS BAY

HOLE No: BH 1-19
Sheet 2 of 2

JOB NUMBER: 18-3388



REDUCED LEVEL	DRILLING METHOD	% CORE RECO-VERED	% RQD	JOINT FRAC. FREQ.	% SPT
19.75					
20.75					
21.75					
23.75					
25.32	NWD4	67	0	-	65
		38	0	-	20
		80	7	-	19
		97	18	-	22
					39
					53
					59
					R
					82
30.12					
30.22					

Moist to wet, medium brownish tan, very dense becoming medium dense, fine grained SAND.

Wet, medium orange brown, medium dense, silty fine grained SAND.

Moist, medium orange tan to tan brown, dense, fine to coarse grained SAND.

Moist, medium brown to tan brown, very dense, silty, fine grained SAND.

Slightly moist, medium to dark brownish grey, very dense, SILTY SAND with very occasional shell fragments.

(W5/W3) medium brownish grey blotched pale grey and dark brown, completely to highly weathered, highly jointed/fractured, soft to medium hard rock (fragments), SANDSTONE to SHELLEY CONGLOMERATE interlayered with bands of fine SILTY SAND (predominantly) and minor coarser grained fine pebbles/gravels ranging in thickness from 10mm up to 200mm (Coquina - ULOA Fm)

(W5) dark grey occasionally speckled pale grey (shell fragments), completely weathered, no visible jointing, extremely soft to very soft rock SILTSTONE (Residual Cretaceous - St Lucia Fm).

NOTES

1) Water Table: 3.28m.

CONTRACTOR : Geopractica
MACHINE : TOHO DROD6
DRILLED BY : TUMI
PROFILED BY : A Greet

INCLINATION : Vertical
DIAM :
DATE : 19/07/2019
DATE : 26/07/2019

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

DATE : 03/09/2019 13:43
TEXT : ..\BPLogs\BH119&BH319.txt

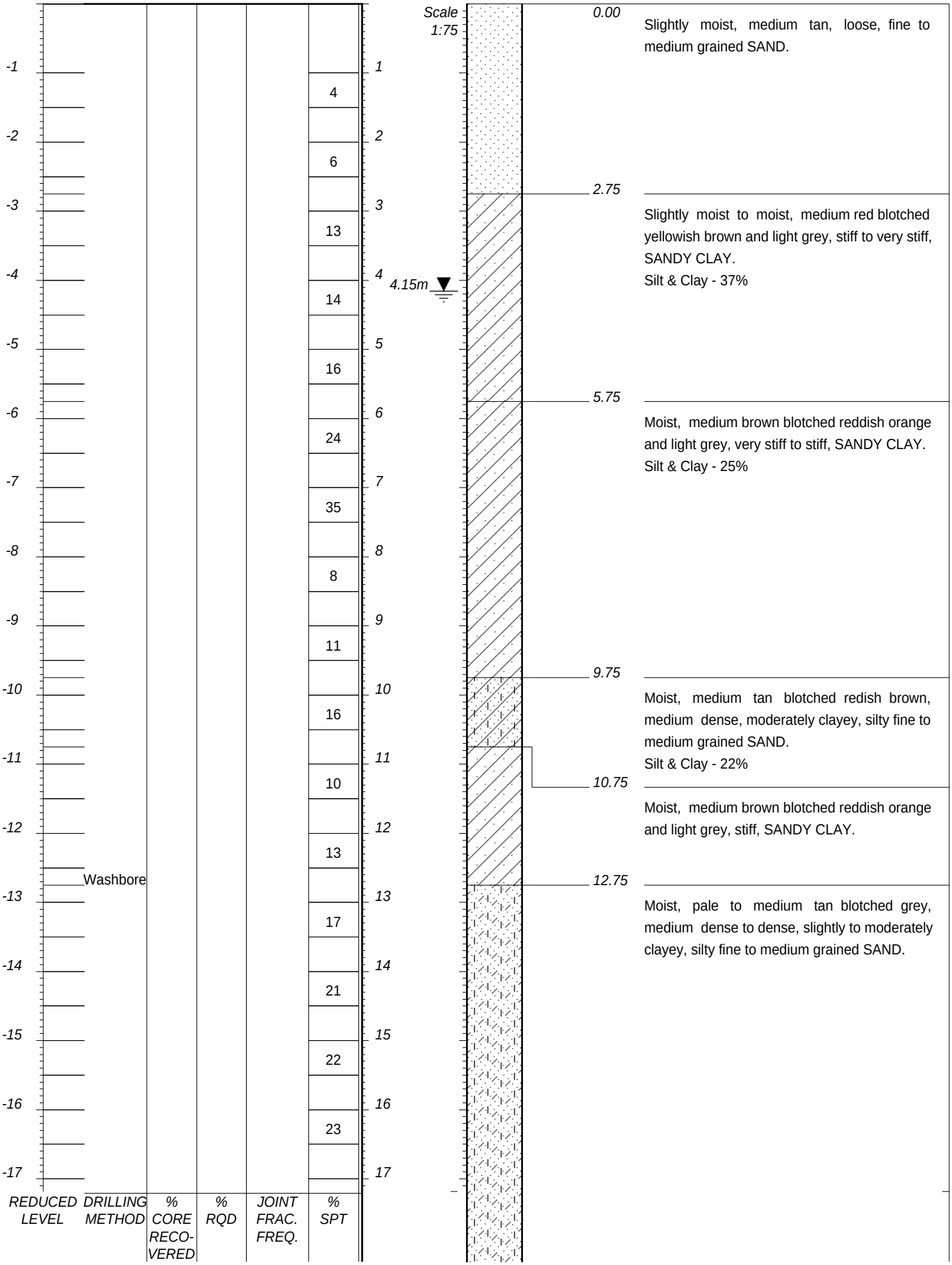
HOLE No: BH 1-19

DAVIES LYNN & PARTNERS (PROPRIETARY) LIMITED

MOONDREAM TRADING C/O ILIFA AFRICA
PHINDA POWER PLANT, RICHARDS BAY

HOLE No: BH 2-19
Sheet 1 of 2

JOB NUMBER: 18-3388



0.00 Slightly moist, medium tan, loose, fine to medium grained SAND.

2.75 Slightly moist to moist, medium red blotched yellowish brown and light grey, stiff to very stiff, SANDY CLAY.
Silt & Clay - 37%

5.75 Moist, medium brown blotched reddish orange and light grey, very stiff to stiff, SANDY CLAY.
Silt & Clay - 25%

9.75 Moist, medium tan blotched redish brown, medium dense, moderately clayey, silty fine to medium grained SAND.
Silt & Clay - 22%

10.75 Moist, medium brown blotched reddish orange and light grey, stiff, SANDY CLAY.

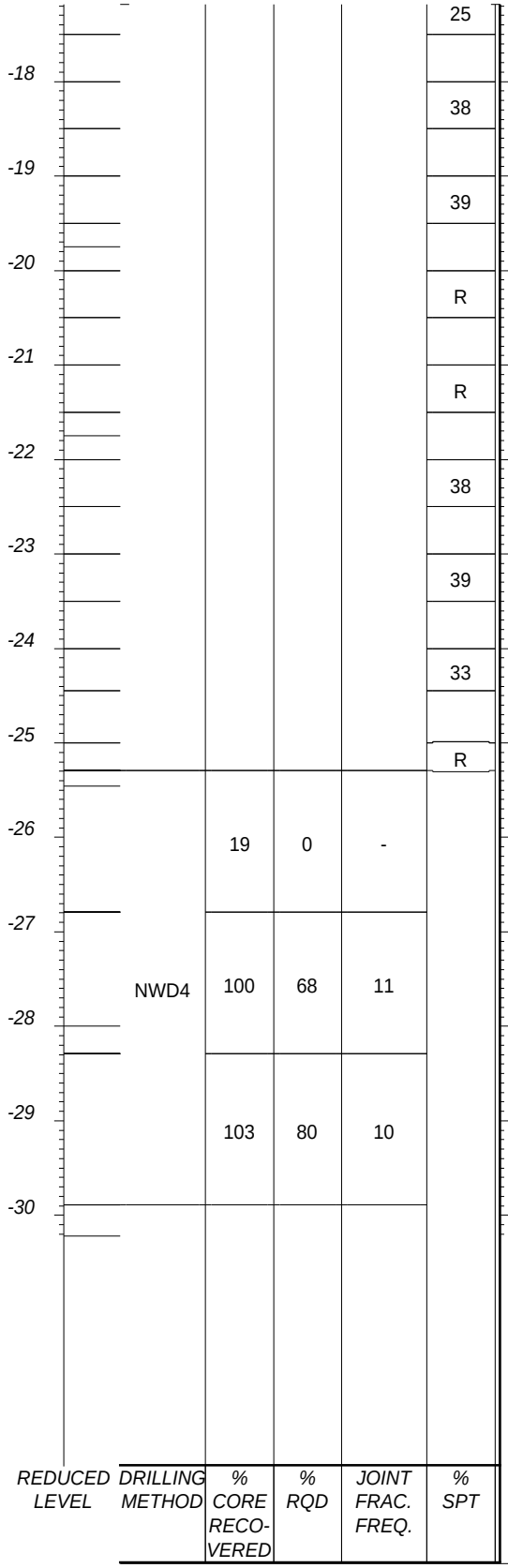
12.75 Moist, pale to medium tan blotched grey, medium dense to dense, slightly to moderately clayey, silty fine to medium grained SAND.

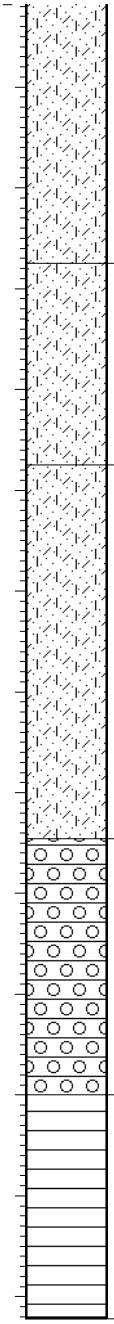
DAVIES LYNN & PARTNERS (PROPRIETARY) LIMITED

MOONDREAM TRADING C/O ILIFA AFRICA
PHINDA POWER PLANT, RICHARDS BAY

HOLE No: BH 2-19
Sheet 2 of 2

JOB NUMBER: 18-3388





REDUCED LEVEL	DRILLING METHOD	% CORE RECO-VERED	% RQD	JOINT FRAC. FREQ.	% SPT
19.75					
	NWD4	19	0	-	
21.75					
		100	68	11	
25.46					
		103	80	10	
28.00					
30.12					

Moist, pale orange brown, medium to very dense, slightly clayey, silty fine to medium grained SAND.

Moist, pale tan blotched medium grey and greenish grey, dense to very dense, moderately clayey, silty SAND with pebble sized rock fragments at base.

(W5/W4) medium to pale grey grey blotched light grey and medium brown, moderately clayey silty SAND to SANDY CLAY matrix supported SHELLEY CONGLOMERATE with abundant (W5/W4) cobble to boulder sized hard rock clasts and shell fragments. (Coquina - Uloa Fm)

(W5) dark grey speckled light grey, completely weathered, no visible jointing, extremely soft rock, SILTSTONE (Cretaceous - St Lucia Fm)

NOTES

1) Water Table: 4.15m.

CONTRACTOR : Geopractica
MACHINE : TOHO DROD6
DRILLED BY : TUMI
PROFILED BY : A Greet

TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

INCLINATION : Vertical
DIAM :
DATE : 19/07/2019
DATE : 26/07/2019

DATE : 03/09/2019 13:43
TEXT : ..\BPLogs\BH119&BH319.txt

ELEVATION :
X-COORD :
Y-COORD :

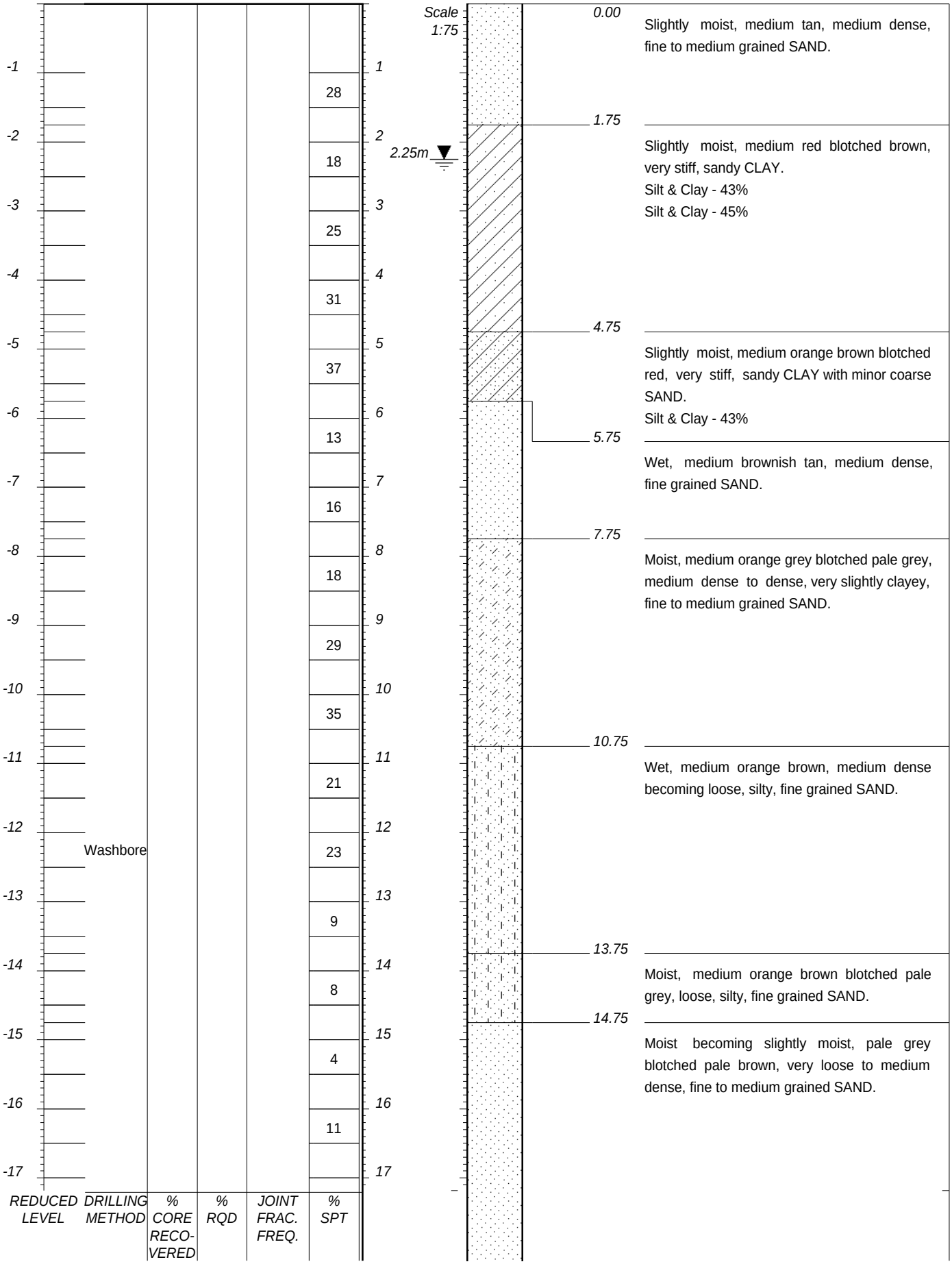
HOLE No: BH 2-19

DAVIES LYNN & PARTNERS (PROPRIETARY) LIMITED

MOONDREAM TRADING C/O ILIFA AFRICA
PHINDA POWER PLANT, RICHARDS BAY

HOLE No: BH 3-19
Sheet 1 of 2

JOB NUMBER: 18-3388

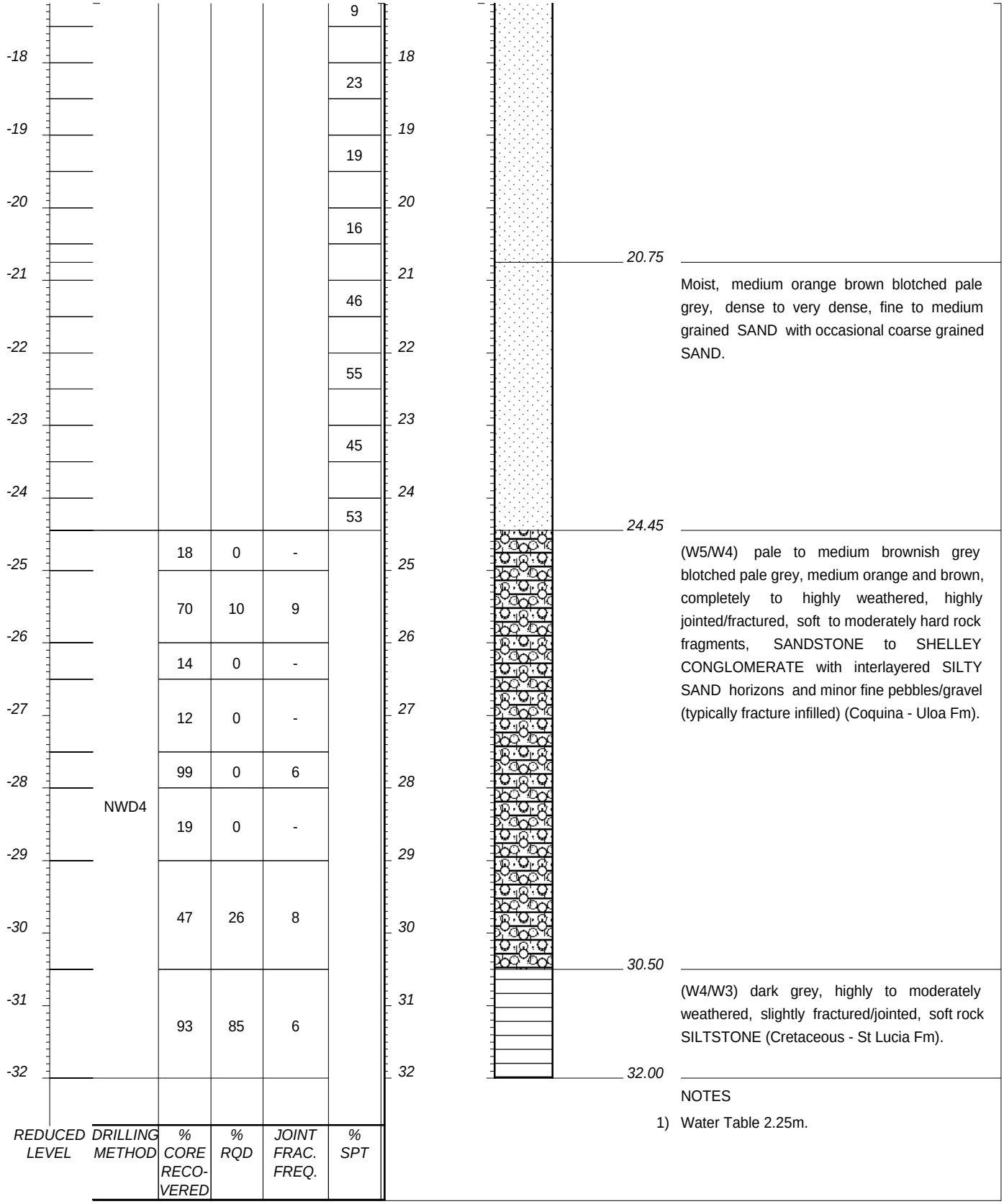


DAVIES LYNN & PARTNERS (PROPRIETARY) LIMITED

MOONDREAM TRADING C/O ILIFA AFRICA
PHINDA POWER PLANT, RICHARDS BAY

HOLE No: BH 3-19
Sheet 2 of 2

JOB NUMBER: 18-3388



REDUCED LEVEL	DRILLING METHOD	% CORE RECOVERED	% RQD	JOINT FRAC. FREQ.	% SPT
-18					9
-19					23
-20					19
-21					16
-22					46
-23					55
-24					45
-25					53
		18	0	-	
-26		70	10	9	
		14	0	-	
-27		12	0	-	
		99	0	6	
-28	NWD4	19	0	-	
-29		47	26	8	
-30					
-31		93	85	6	
-32					

20.75	Moist, medium orange brown blotched pale grey, dense to very dense, fine to medium grained SAND with occasional coarse grained SAND.
24.45	(W5/W4) pale to medium brownish grey blotched pale grey, medium orange and brown, completely to highly weathered, highly jointed/fractured, soft to moderately hard rock fragments, SANDSTONE to SHELLEY CONGLOMERATE with interlayered SILTY SAND horizons and minor fine pebbles/gravel (typically fracture infilled) (Coquina - Uloa Fm).
30.50	(W4/W3) dark grey, highly to moderately weathered, slightly fractured/jointed, soft rock SILTSTONE (Cretaceous - St Lucia Fm).
32.00	

NOTES

1) Water Table 2.25m.

CONTRACTOR : Geopractica
MACHINE : P90R
DRILLED BY : BOY-BOY
PROFILED BY : A Greet

INCLINATION : Vertical
DIAM :
DATE : 19/07/2019
DATE : 26/07/2019

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY :
SETUP FILE : BH1PG-A4.SET

DATE : 03/09/2019 13:43
TEXT : ..\BPLogs\BH119&BH319.txt

HOLE No: BH 3-19

APPENDIX 3

Laboratory Test Results

Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists

GEOSURE (Pty) Ltd

sanas Testing Laboratory T0483

CLIENT : Davies Lynn & Partners
PHYSICAL ADDRESS : Office 6 Dias House
Fairway Green Office Park, 3 Abrey Road
3610
ATTENTION : Mr A. Krebs
PROJECT : Phinda Power

TEST REPORT REFERENCE NUMBER: 46824

Dear Sir/Madam,
Enclosed herewith, please find the original reports pertaining to the above-mentioned project.

Date Received	**08.08.2019**		
Date Tested	12.08.2019 to 21.08.2019		
Sample Location	Refer to Report		
Sampling Method	N/A		
Sample Condition	Good		
Sampling Environmental Condition	N/A		
Sampler(s) Name	Client.		
Total Number of Pages	12		
Test Carried Out			
SANS3001 GR1	✓	ASTM D4972#	
SANS3001 GR10, GR12	✓	ASTM D888#	
SANS3001 GR30	✓	LSi (Carrier 1965)#	
SANS3001 GR40	✓	Hydrometer Analysis - ASTM D422	✓
TMH1 Method A10(b)		ASTM D7348 (LOI)#	
TMH1 Method A14app		BS 1377-5:1990 (Crumb Test)#	
TMH1 Method A15d		BS EN 1018#	
TMH1 Method A16T		BS EN ISO 9963-1:1996#	
✓ - Tick denotes tests that were carried out.		#Denotes non accredited methods	

We would like to take this opportunity of thanking you for your continued support.
Should you have any queries please do not hesitate to contact me.

Yours faithfully

Technical Signatory,
Bradley Hariram for Geosure (Pty) Ltd.

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Gauteng Branch
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Email: gauteng@geosure.co.za

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GEOSURE (Pty) Ltd

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email: geosure@iafrica.com www.geosure.co.za

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Your Ref No. : -
Our Ref No. : 46824
Date Reported : 22/08/2019

Test Report - SANS 3001

Sample No.	T21560	T21561	T21562		
Field No.	IP10	IP12	IP19		
Position	-	-	-		
Depth (m)	2.0-2.5	0.5-1.5	1.5-2.5		
Method of Preparation	N/A	N/A	N/A		
Material Description	Dark reddish blotched grey, light orange yellowish brown silty CLAY	Dark brown silty SAND	Light orange yellow silty SAND		

Sieve Analysis - Percent Passing Sieve Size						
Sieve Aperture (mm)	**100.00**					
	75.00					
	63.00					
	53.00					
	50.00					
	37.50					
	28.00					
	26.50					
	20.00					
	19.00					
	14.00					
	13.20			100		
	5.00			99		
	4.750			99		
	2.000	100	100	99		
	0.425	96	92	94		
	0.075	49	9	8		
Grading Modulus		0.55	0.99	0.99		
Mechanical analysis - Percent of Soil Mortar (<2 mm) for Grain Size range						
Coarse Sand	**2.000 - 0.425**	4	8	4		
Coarse-Fine Sand	**0.425 - 0.250**	21	33	25		
Medium-Fine Sand	**0.250 - 0.150**	24	44	54		
Fine-Fine Sand	**0.150 - 0.075**	3	6	7		
Silt and Clay	**< 0.075**	49	9	8		
Atterberg Limits SANS 3001 on <0.425 mm fraction						
Liquid Limit	% or symbol	42	NP	NP		
Plasticity Index	% or symbol	18	NP	NP		
Linear Shrinkage	%	8.0	0.0	0.0		
Maximum Dry Density and Optimum Moisture Content						
Maximum Dry Density (kg/m³)		1789	1845	1740		
Optimum moisture content (%)		15.6	9.4	8.3		
California Bearing Ratio						
CBR @100% Compaction	%	2.4	45	37		
CBR @ 98% Compaction	%	1.8	33	30		
CBR @ 97% Compaction	%	1.5	28	27		
CBR @ 95% Compaction	%	1.1	21	22		
CBR @ 93% Compaction	%	0.8	15	18		
CBR @ 90% Compaction	%	0.5	9.4	13		
Swell @100% Compaction	%	3.1	0.0	0.0		
COLTO Classification (1998)†**		Cannot be Determined	G7 (#)	G7 (#)		
TRH 14 Classification (1985)**		Poorer than G10.	G7	G7		
AASHTO Classification (Group Index)**		A-7-6 (6)	A-3 (0)	A-3 (0)		
Unified Classification **		SC	SP-SM	SP-SM		

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

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

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

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

Version 5.05 - 14 February 2018

Consulting Engineering Geologists, Geotechnical Engineers,
Geotechnicians & Geotechnical Quality Assurance Specialists
GEOSURE (Pty) Ltd

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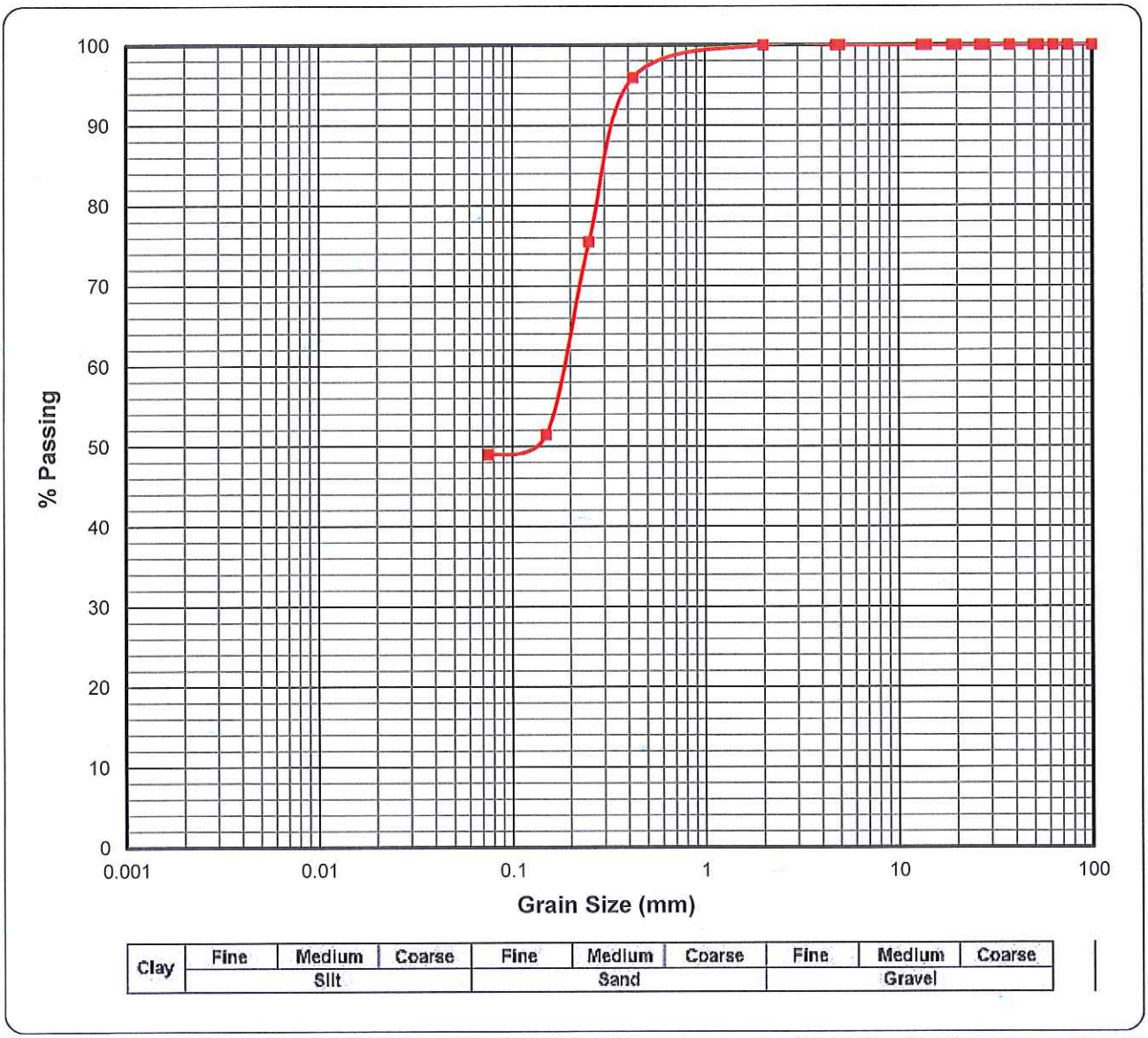
Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Your Ref No.: -
Our Ref No. : 46824
Date Reported : 22/08/2019

Grading Curve for Sample T21560 – SANS 3001



ck Red Line is the Grading Curve (COLTO Classification = Cannot be Determined) (TRH 14 Classification = Poorer than G1

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	5.00	13.20	14.00	19.00	20.00	26.50	28.0	37.5	50.0	53.0	63	75	100
Percentage Passing	49%	51%	76%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

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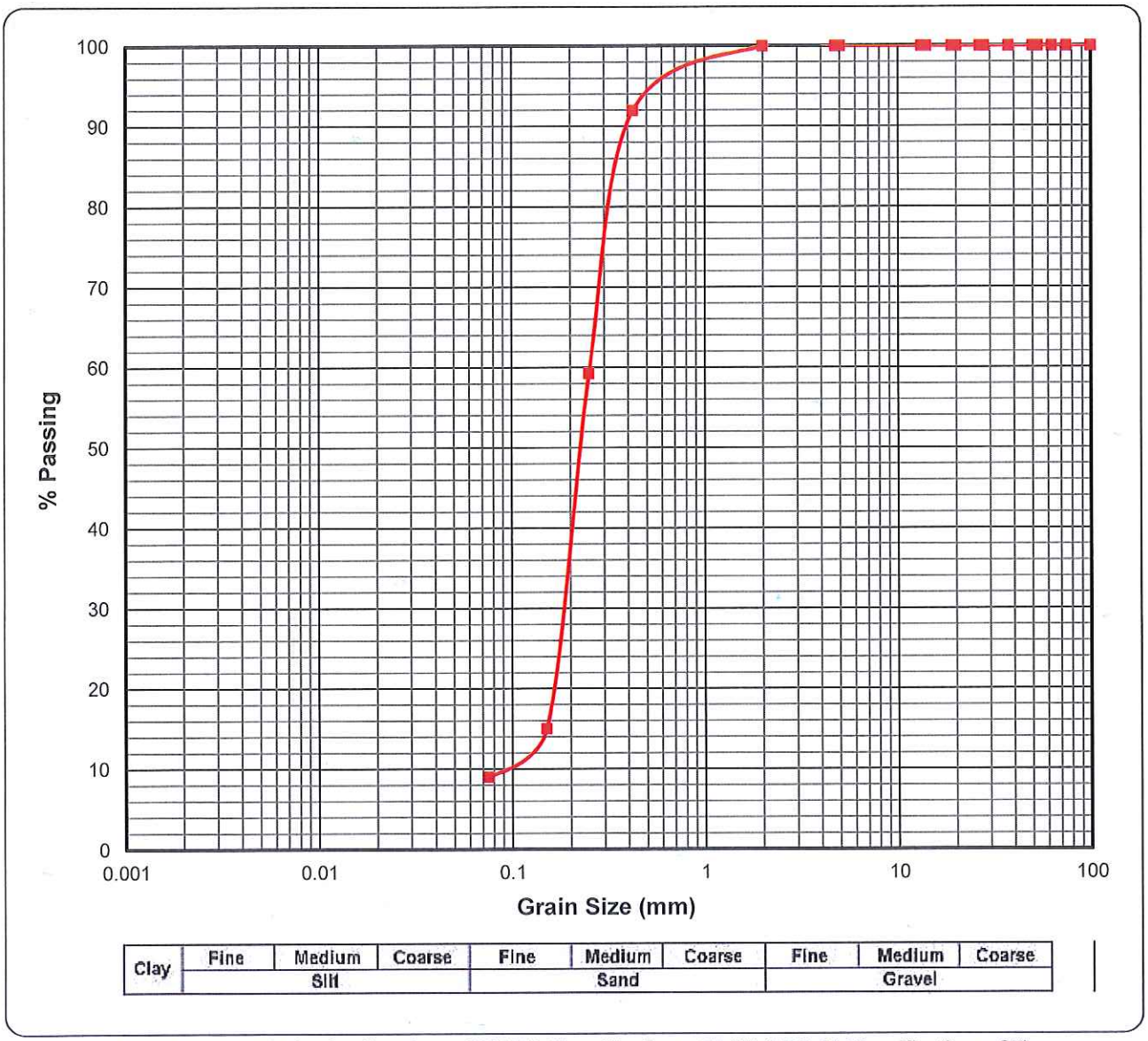
Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Your Ref No.: -
Our Ref No. : 46824
Date Reported : 22/08/2019

Grading Curve for Sample T21561 – SANS 3001



Thick Red Line is the Grading Curve (COLTO Classification = G7 (#)) (TRH 14 Classification = G7)

Sieve Aperture Size	0.075	0.150	0.015	0.026	0.05	0.06	5.00	13.20	14.00	19.00	20.00	26.50	28.0	37.5	50.0	53.0	63	75	100
Percentage Passing	9%	15%	59%	92%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Consulting Engineering Geologists, Geotechnical Engineers,
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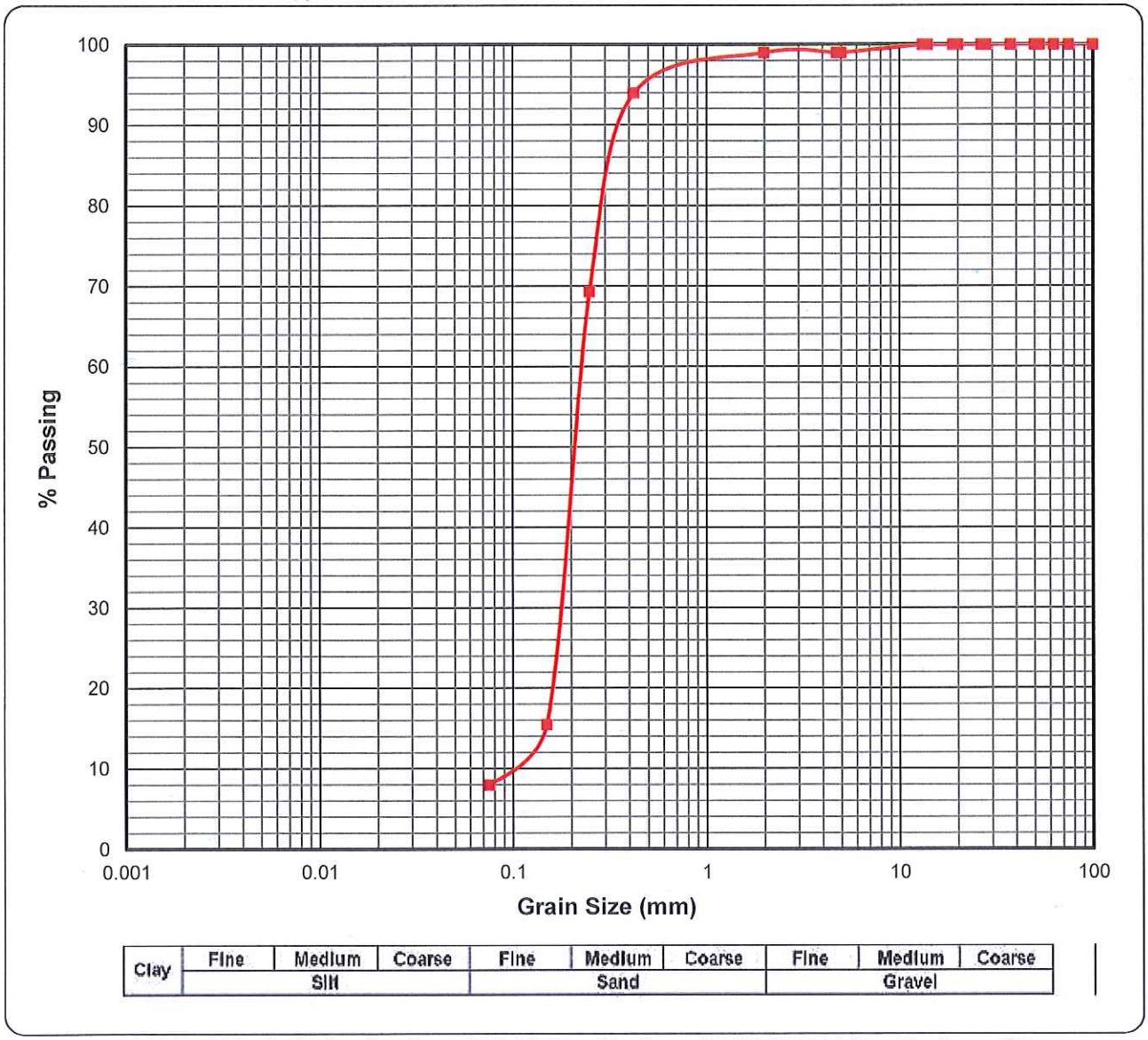
Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Your Ref No.: -
Our Ref No. : 46824
Date Reported : 22/08/2019

Grading Curve for Sample T21562 – SANS 3001



Thick Red Line is the Grading Curve (COLTO Classification = G7 (#)) (TRH 14 Classification = G7)

Sieve Aperture Size	0.075	0.150	0.250	0.425	2.00	4.75	5.00	13.20	14.00	19.00	20.00	26.50	28.0	37.5	50.0	53.0	63	75	100
Percentage Passing	8%	16%	69%	94%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists
GEOSURE (Pty) Ltd
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WEBSITE: www.geosure.co.za

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Our Ref. : 46824
Your Ref. : -
Date Tested : 12.08.2019 to 20.08.2019
Date Reported : 21.08.2019

Sample No.			T21560	T21561	T21562		
Field No.			IP10	IP12	IP19		
Position in Field			-	-	-		
Depth (m)			2.0-2.5	0.5-1.5	1.5-2.5		
Material Description			Dark reddish blotched grey light orange yellowish brown silty CLAY	Dark brown silty SAND	Light orange yellow silty SAND		
Sieve Analysis (Wet Preparation) - SANS3001 GR 1 - Percent Passing Sieve Size							
% Passing	100.0	mm	100	100	100		
	75.0	mm	100	100	100		
	63.0	mm	100	100	100		
	50.0	mm	100	100	100		
	37.5	mm	100	100	100		
	28.0	mm	100	100	100		
	20.0	mm	100	100	100		
	14.0	mm	100	100	100		
	5.00	mm	100	100	99		
	2.00	mm	100	100	99		
	0.425	mm	96	92	94		
	0.250	mm	76	59	69		
	0.150	mm	51	15	16		
	0.075	mm	49	9	8		
Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm)							
% Passing	0.060	mm	49	9	8		
	0.050	mm	49	9	8		
	0.040	mm	48	9	8		
	0.026	mm	48	9	7		
	0.015	mm	46	8	6		
	0.010	mm	46	7	5		
	0.0074	mm	46	6	4		
	0.0036	mm	44	5	2		
	0.0020	mm	43	5	2		
	0.0015	mm	43	5	2		
Mechanical analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size range							
Coarse Sand		%	4	8	4		
Coarse Fine Sand		%	21	33	25		
Medium Fine Sand		%	24	44	54		
Fine Fine Sand		%	3	6	7		
Silt & Clay		%	49	9	8		
Grading Modulus			0.55	0.99	0.99		
Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)							
Liquid Limit		%	42	NP	NP		
Plasticity Index		%	18	NP	NP		
Linear Shrinkage		%	8.0	0.0	0.0		
AASHTO Classification (Group Index)*			A-7-6 (6)	A-3 (0)	A-3 (0)		
Unified Classification*			SC	SW-SM	SP-SM		
Moisture Content		%	25.5	1.4	2.6		

Remarks: Date Received: 08.08.2019
Sampled by Client.
*Opinions expressed herein fall outside the scope of SANAS accreditation.

Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists
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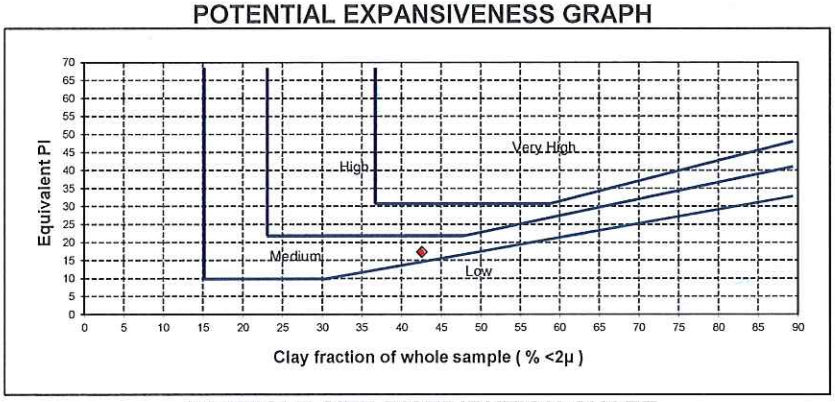
sanas T0493

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

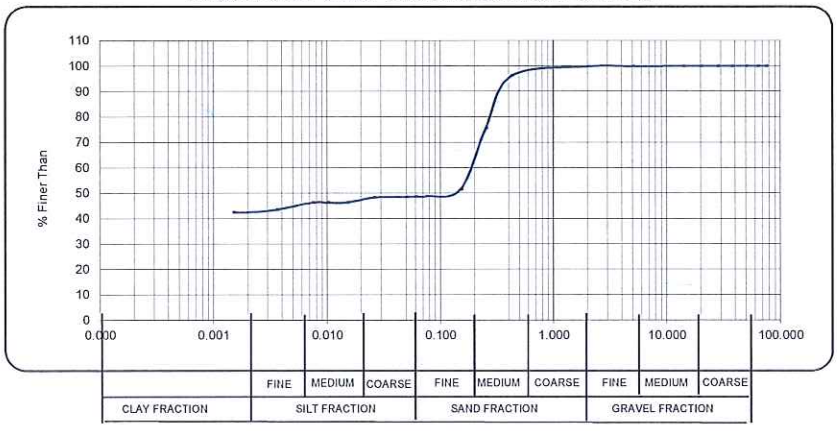
Job No. : 46824
Your Ref.No. : -
Date Tested : 12.08.2019 to 20.08.2019
Date Reported : 21.08.2019

Sample Number : T21560
Field No. : IP10
Sample Description : Dark reddish blotched grey light orange yellowish brown silty CLAY
Equivalent PI : 17 **Clay fraction of whole sample (% <2μ)** : 43

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists
GEOSURE (Pty) Ltd

Reg.No.: 92/03145/07
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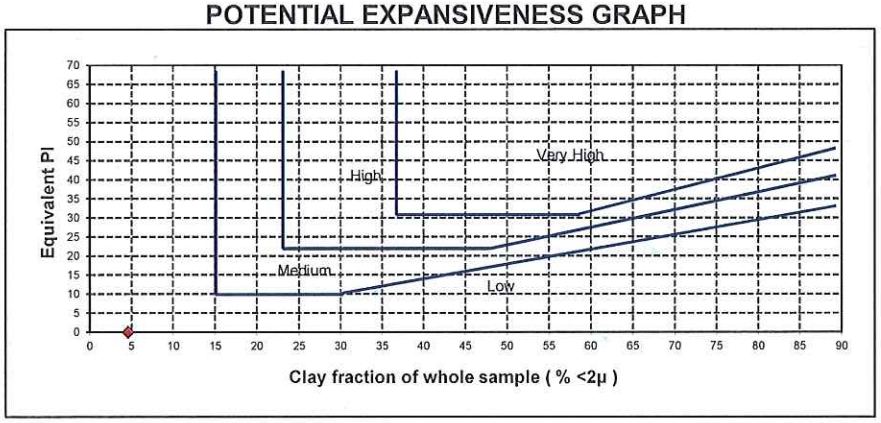
WEBSITE: www.geosure.co.za

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

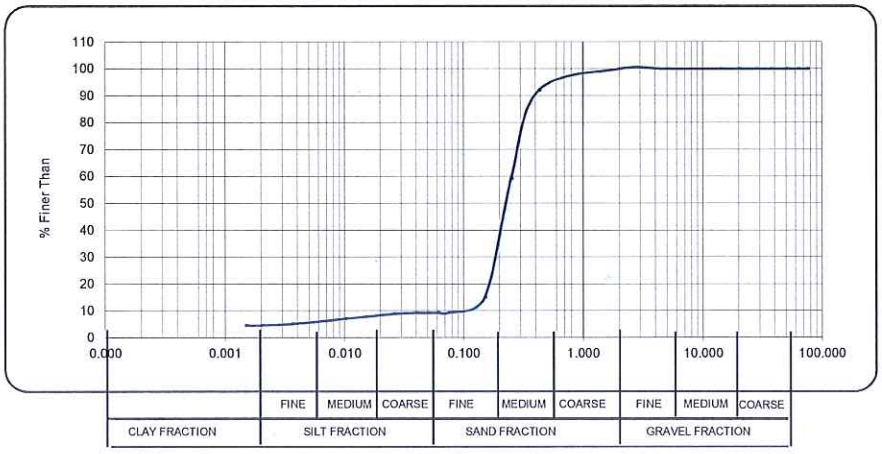
Job No. : 46824
Your Ref.No. : -
Date Tested : 12.08.2019 to 20.08.2019
Date Reported : 21.08.2019

Sample Number : T21561
Field No. : IP12
Sample Description : Dark brown silty SAND
Equivalent PI : NP **Clay fraction of whole sample (% <2μ)** : 5

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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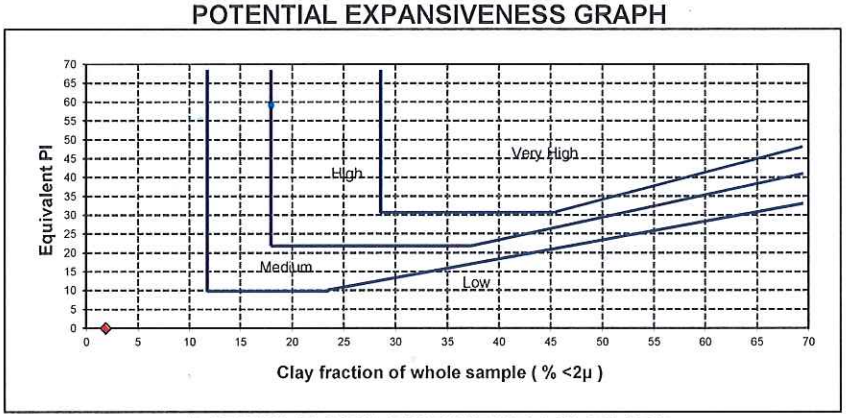
Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

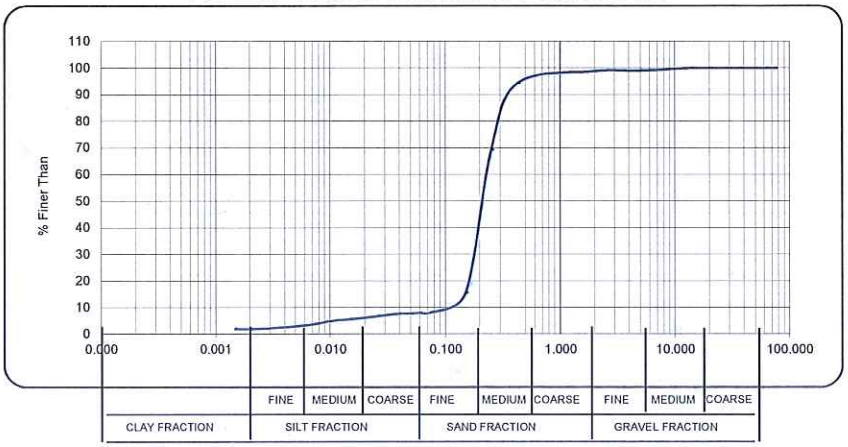
Job No. : 46824
Your Ref.No. : -
Date Tested : 12.08.2019 to 20.08.2019
Date Reported : 21.08.2019

Sample Number : T21562
Field No. : IP19
Sample Description : Light orange yellow silty SAND
Equivalent PI : NP **Clay fraction of whole sample (% <2μ)** : 2

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Your Ref No. : -
Our Ref No. : 46824
Date Reported : 16.08.2019

SANS 3001 Moisture/Density Relationship

Sample No. : T21560
Method of preparation : N/A
Natural/Stabilised : Natural
Material Description : Dk.Rd.Gr.Lt.Or.Yel

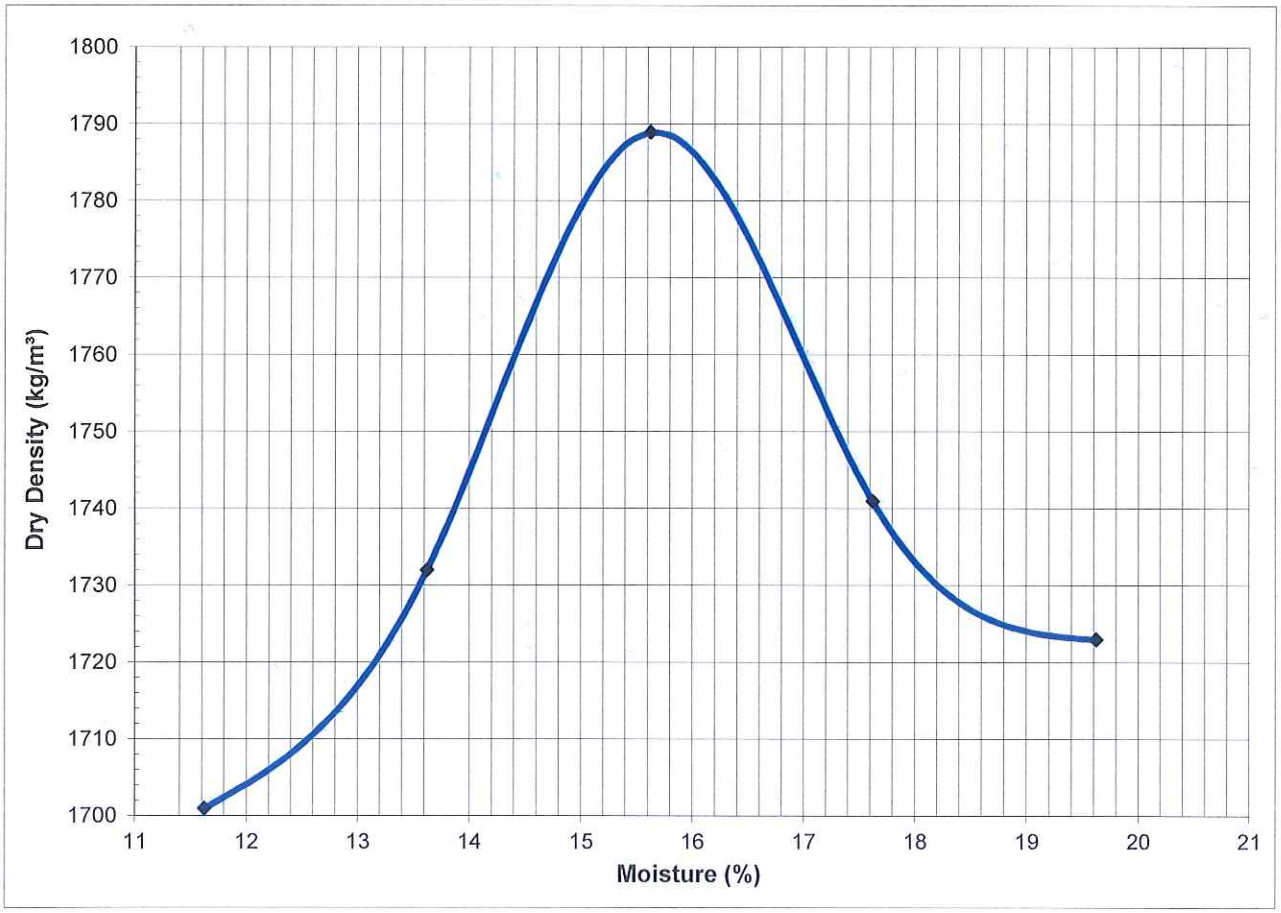
Field No. : IP10
Depth (m) : -
Origin : -
Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) **1789**

Optimum Moisture Content (%) **15.6**

Plotted Values:

Moisture (%)	11.6	13.6	15.6	17.6	19.6
Dry Density (kg/m³)	1701	1732	1789	1741	1723



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Client	**: Davies Lynn & Partners**	**Your Ref No.**	**: -**
Project	**: Phinda Power**	**Our Ref No.**	**: 46824**
Attention	**: Mr A. Krebs**	**Date Reported**	**: 14.08.2019**

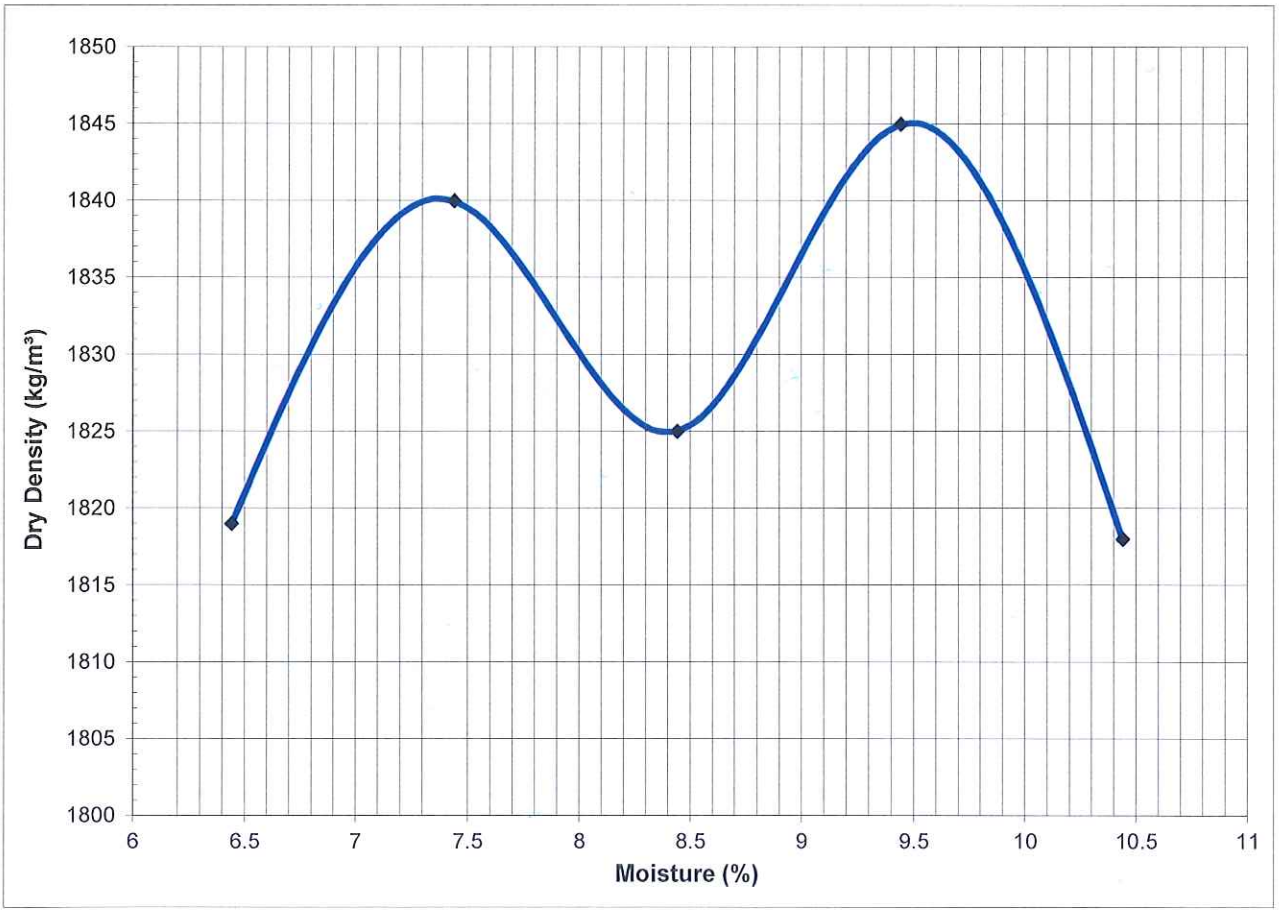
SANS 3001 Moisture/Density Relationship

Sample No.	: T21561	Field No.	: IP12
Method of preparation	: N/A	Depth (m)	: 0.5-1.5
Natural/Stabilised	: Natural	Origin	: -
Material Description	: Dk.Br.silty SAND	Compaction Effort	: Mod AASHTO

Maximum Dry Density (kg/m³) 1845 **Optimum Moisture Content (%) 9.4**

Plotted Values:

Moisture (%)	6.4	7.4	8.4	9.4	10.4
Dry Density (kg/m³)	1819	1840	1825	1845	1818



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Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Your Ref No. : -
Our Ref No. : 46824
Date Reported : 14.08.2019

SANS 3001 Moisture/Density Relationship

Sample No. : T21562
Method of preparation : N/A
Natural/Stabilised : Natural
Material Description : Lt.Or.Yell.silty SAND

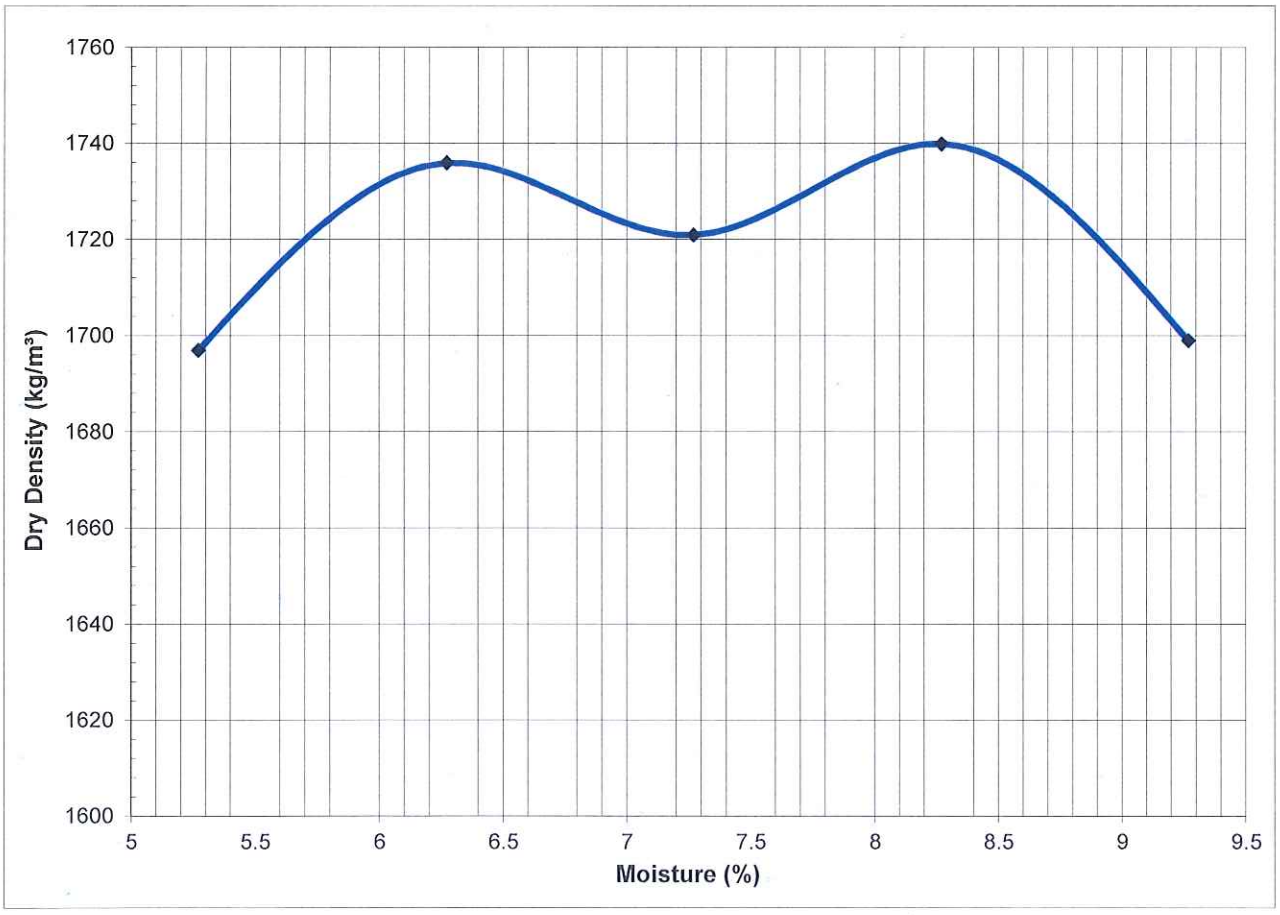
Field No. : IP19
Depth (m) : 1.5-2.5
Origin : -
Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) **1740**

Optimum Moisture Content (%) **8.3**

Plotted Values:

Moisture (%)	5.3	6.3	7.3	8.3	9.3
Dry Density (kg/m³)	1697	1736	1721	1740	1699



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Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists

GEOSURE (Pty) Ltd

sanas Testing Laboratory T0483

CLIENT : Davies Lynn & Partners
PHYSICAL ADDRESS : Office 6 Dias House
Fairway Green Office Park, 3 Abrey Road
3610
ATTENTION : Mr A. Krebs
PROJECT : Phinda Power

TEST REPORT REFERENCE NUMBER: 46841

Dear Sir/Madam,
Enclosed herewith, please find the original reports pertaining to the above-mentioned project.

Date Received	**21.08.2019**		
Date Tested	22.08.2019 to 29.08.2019		
Sample Location	Refer to Report		
Sampling Method	N/A		
Sample Condition	Good		
Sampling Environmental Condition	N/A		
Sampler(s) Name	Client.		
Total Number of Pages	12		
Test Carried Out			
SANS3001 GR1	✓	ASTM D4972#	
SANS3001 GR10, GR12	✓	ASTM D888#	
SANS3001 GR30		LSi (Carrier 1965)#	
SANS3001 GR40		Hydrometer Analysis - ASTM D422	✓
TMH1 Method A10(b)		ASTM D7348 (LOI)#	
TMH1 Method A14app		BS 1377-5:1990 (Crumb Test)#	
TMH1 Method A15d		BS EN 1018#	
TMH1 Method A16T		BS EN ISO 9963-1:1996#	
✓ - Tick denotes tests that were carried out.		#Denotes non accredited methods	

We would like to take this opportunity of thanking you for your continued support.
Should you have any queries please do not hesitate to contact me.

Yours faithfully

Technical Signatory,
Bradley Hariram for Geosure (Pty) Ltd.

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Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists
GEOSURE (Pty) Ltd

sanas T0480

Reg.No.: 92/03145/07

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WEBSITE: www.geosure.co.za

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Our Ref. : 46841
Your Ref. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample No.			T21704	T21705	T21706	T21707	T21708
Field No.			BH1	BH1	BH1	BH2	BH2
Position in Field			-	-	-	-	-
Depth (m)			2.00-2.45	4.00-4.45	6.00-6.45	3.00-3.45	6.00-6.45
Material Description			Light olive reddish brown clayey silty fine SAND	Light orange red light olive brown sandy silty CLAY	Light orange yellowish brown silty clayey fine SAND	Light reddish olive brown silty clayey SAND	Light orange olive brown silty clayey SAND
Sieve Analysis (Wet Preparation) - SANS3001 GR 1 - Percent Passing Sieve Size							
% Passing	100.0	mm	100	100	100	100	100
	75.0	mm	100	100	100	100	100
	63.0	mm	100	100	100	100	100
	50.0	mm	100	100	100	100	100
	37.5	mm	100	100	100	100	100
	28.0	mm	100	100	100	100	100
	20.0	mm	100	100	100	100	100
	14.0	mm	100	100	100	100	100
	5.00	mm	100	100	100	100	100
	2.00	mm	100	100	100	100	100
	0.425	mm	97	98	94	95	95
	0.250	mm	84	79	58	69	72
	0.150	mm	35	63	28	40	30
	0.075	mm	28	57	27	37	25
Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm)							
% Passing	0.060	mm	28	52	26	36	25
	0.050	mm	28	49	26	35	25
	0.040	mm	27	46	26	34	25
	0.026	mm	27	41	26	33	24
	0.015	mm	26	41	24	33	23
	0.010	mm	25	41	24	32	23
	0.0074	mm	25	40	23	32	23
	0.0036	mm	22	37	21	28	20
	0.0020	mm	19	35	20	26	19
	0.0015	mm	19	34	20	25	19
Mechanical analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size range							
Coarse Sand		%	2	2	6	5	5
Coarse Fine Sand		%	14	19	36	26	23
Medium Fine Sand		%	49	17	30	29	43
Fine Fine Sand		%	7	6	2	3	4
Silt & Clay		%	29	57	27	37	25
Grading Modulus			0.75	0.45	0.79	0.68	0.79
Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)							
Liquid Limit		%	26	40	33	36	29
Plasticity Index		%	8	16	10	12	8
Linear Shrinkage		%	3.0	7.5	4.5	5.5	3.5
AASHTO Classification (Group Index)*			A-2-4 (0)	A-6 (7)	A-2-4 (0)	A-6 (1)	A-2-4 (0)
Unified Classification*			SC	CL	SC	SC	SC
Moisture Content		%	19.9	24.2	20.5	21.9	20.9
Remarks:	Date Received: 21.08.2019						
	Sampled by Client.						
	*Opinions expressed herein fall outside the scope of SANAS accreditation.						

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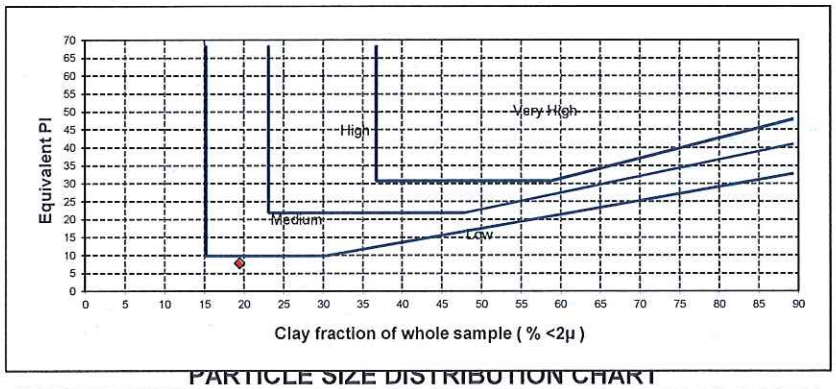
sanas T0493

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

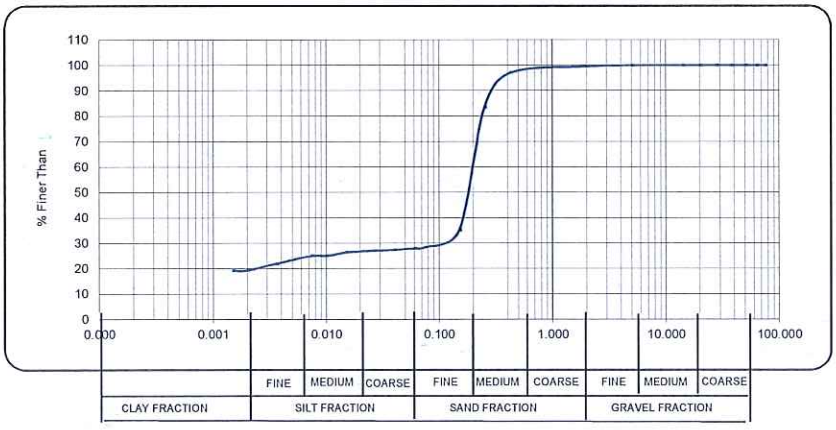
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21704
Field No. : BH1
Sample Description : Light olive reddish brown clayey silty fine SAND
Equivalent PI : 8 **Clay fraction of whole sample (% <2μ)** : 19

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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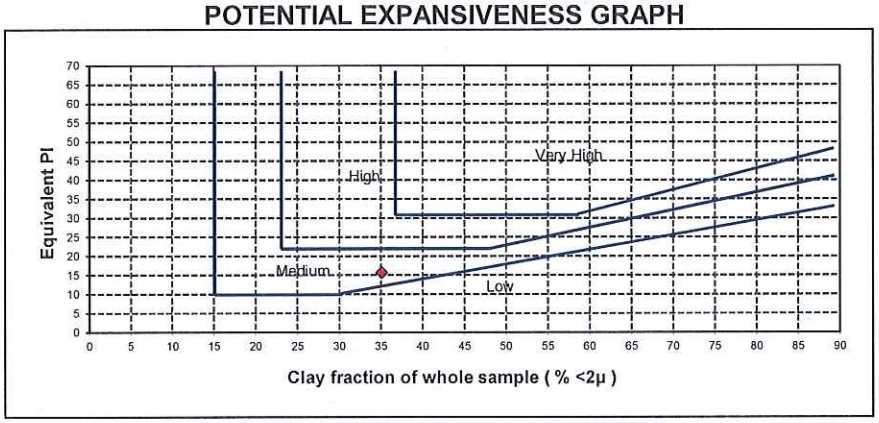
Project : Phinda Power
Attention : Mr A. Krebs

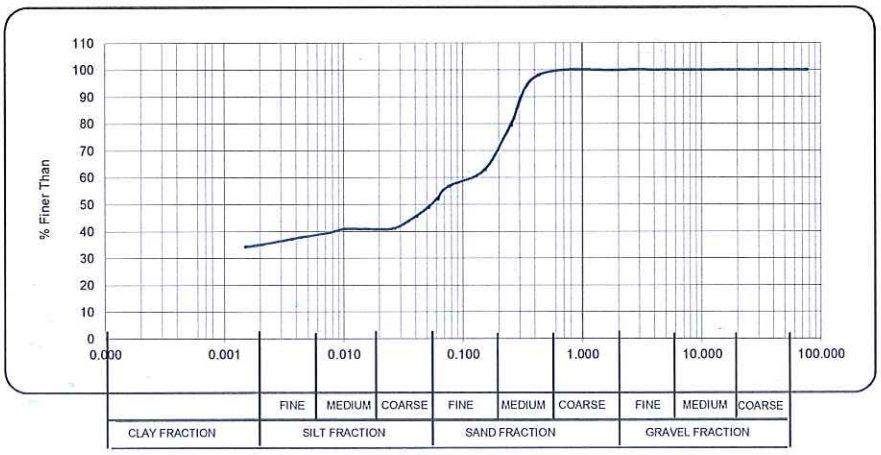
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21705
Field No. : BH1
Sample Description : Light orange red light olive brown sandy silty CLAY
Equivalent PI : 16 **Clay fraction of whole sample (% <2μ)** : 35

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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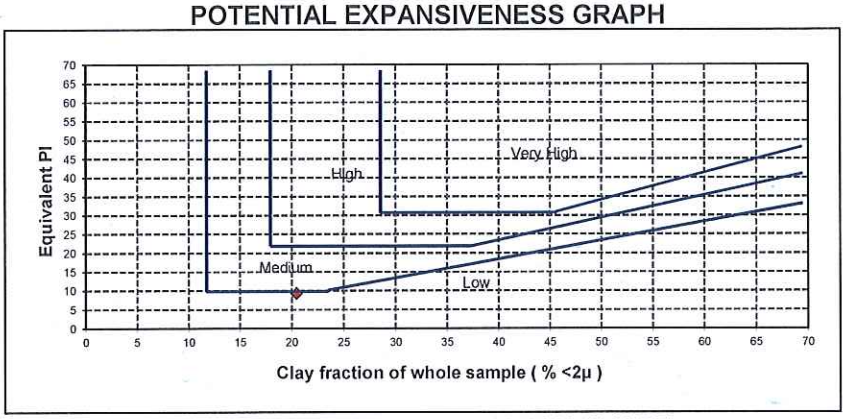
Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

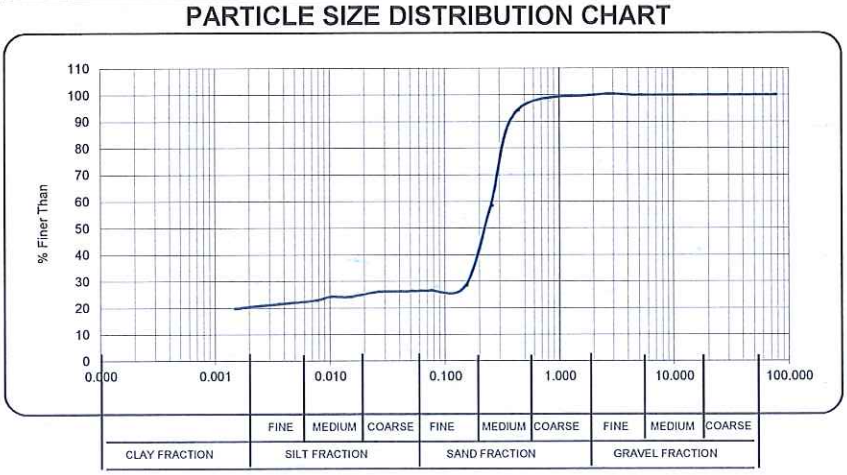
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21706
Field No. : BH1
Sample Description : Light orange yellowish brown silty clayey fine SAND
Equivalent PI : 9 **Clay fraction of whole sample (% <2μ)** : 20

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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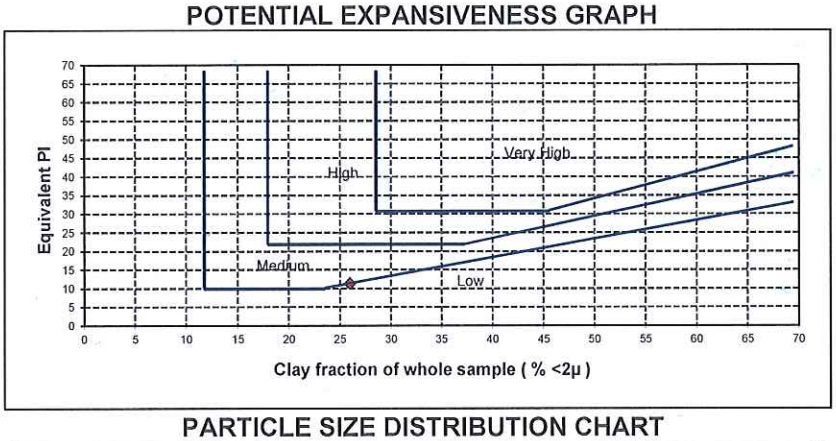
Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

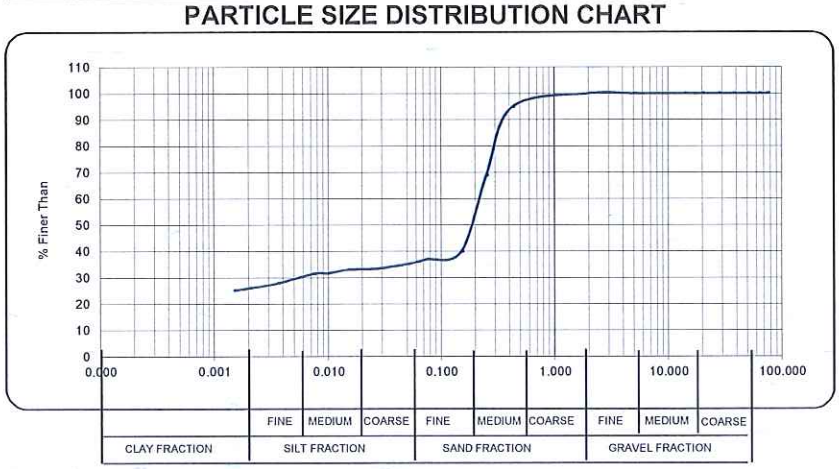
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21707
Field No. : BH2
Sample Description : Light reddish olive brown silty clayey SAND
Equivalent PI : 11 **Clay fraction of whole sample (% <2μ)** : 26

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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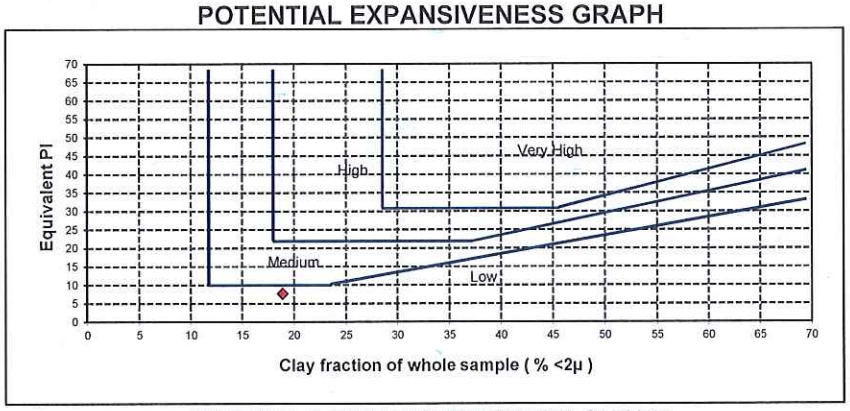
Mobile: +27(0) 82 784 0544 e-mail:geosure@iafrica.com
WEBSITE: www.geosure.co.za

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

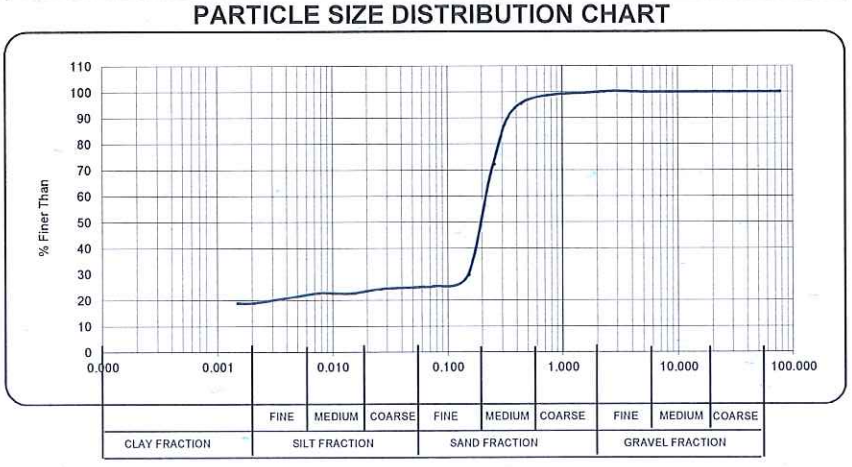
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21708
Field No. : BH2
Sample Description : Light orange olive brown silty clayey SAND
Equivalent PI : 8 **Clay fraction of whole sample (% <2μ)** : 19

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists
GEOSURE (Pty) Ltd
Reg.No.: 92/03145/07
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Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

Our Ref. : 46841
Your Ref. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample No.			T21709	T21710	T21711	T21712	
Field No.			BH2	BH3	BH3	BH3	
Position in Field			-	-	-	-	
Depth (m)			9.00-9.45	2.00-2.45	3.00-3.45	5.00-5.45	
Material Description			Light orange light yellowish brown slightly clayey silty SAND	Light grey dark reddish brown sandy silty CLAY	Light grey dark reddish brown sandy clayey SILT	Light orange dark yellowish brown sandy clayey SILT	
Sieve Analysis (Wet Preparation) - SANS3001 GR 1 - Percent Passing Sieve Size							
% Passing	100.0	mm	100	100	100	100	
	75.0	mm	100	100	100	100	
	63.0	mm	100	100	100	100	
	50.0	mm	100	100	100	100	
	37.5	mm	100	100	100	100	
	28.0	mm	100	100	100	100	
	20.0	mm	100	100	100	100	
	14.0	mm	100	100	100	100	
	5.00	mm	100	100	100	99	
	2.00	mm	100	100	100	96	
	0.425	mm	95	97	96	90	
	0.250	mm	70	81	75	72	
	0.150	mm	25	47	48	44	
	0.075	mm	22	43	45	41	
Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm)							
% Passing	0.060	mm	22	42	45	41	
	0.050	mm	22	42	45	41	
	0.040	mm	22	41	44	41	
	0.026	mm	22	41	44	41	
	0.015	mm	20	39	42	41	
	0.010	mm	19	37	41	39	
	0.0074	mm	19	37	40	38	
	0.0036	mm	17	34	38	36	
	0.0020	mm	15	32	35	34	
	0.0015	mm	15	30	35	34	
Mechanical analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size range							
Coarse Sand		%	5	3	4	6	
Coarse Fine Sand		%	24	16	21	19	
Medium Fine Sand		%	45	35	27	29	
Fine Fine Sand		%	3	3	3	3	
Silt & Clay		%	22	43	45	43	
Grading Modulus			0.83	0.60	0.59	0.73	
Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)							
Liquid Limit		%	21	42	40	37	
Plasticity Index		%	6	17	15	14	
Linear Shrinkage		%	2.5	8.0	7.0	6.5	
AASHTO Classification (Group Index)*			A-2-4 (0)	A-7-6 (4)	A-6 (3)	A-6 (2)	
Unified Classification*			SM-SC	SC	SC	SC	
Moisture Content		%	21.3	23.6	25.6	26.7	

Remarks: Date Received: 21.08.2019
Sampled by Client.
*Opinions expressed herein fall outside the scope of SANAS accreditation.

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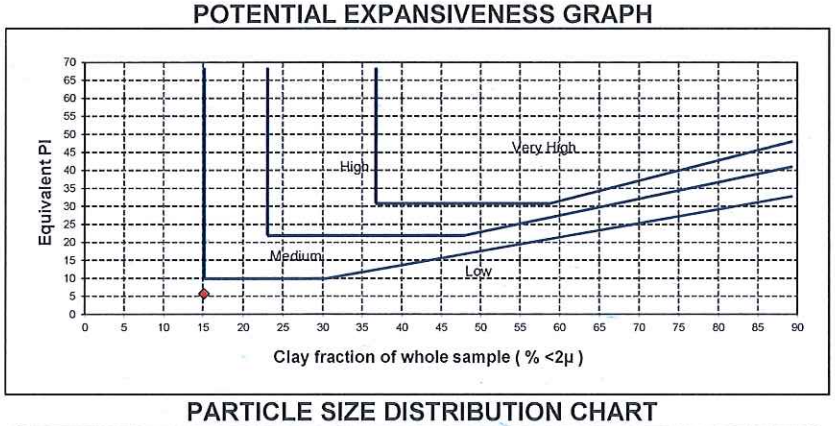
WEBSITE: www.geosure.co.za

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

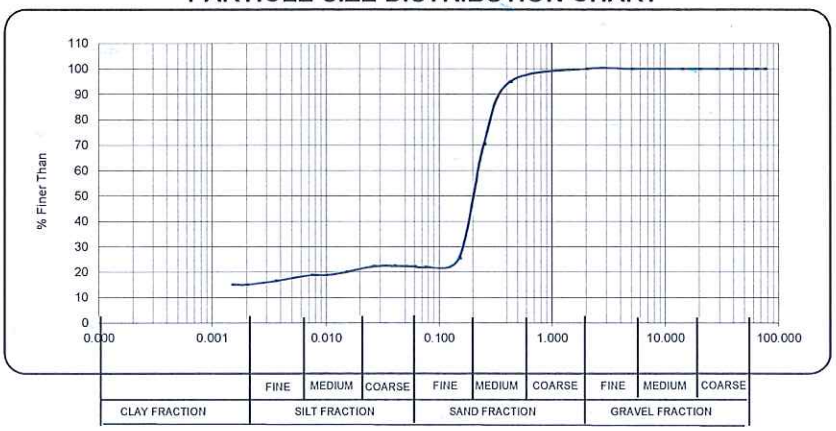
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21709
Field No. : BH2
Sample Description : Light orange light yellowish brown slightly clayey silty SAND
Equivalent PI : 6 **Clay fraction of whole sample (% <2μ)** : 15

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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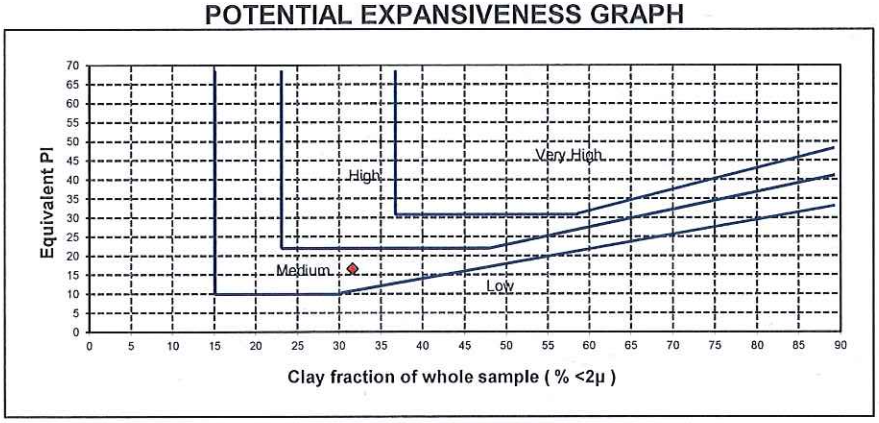
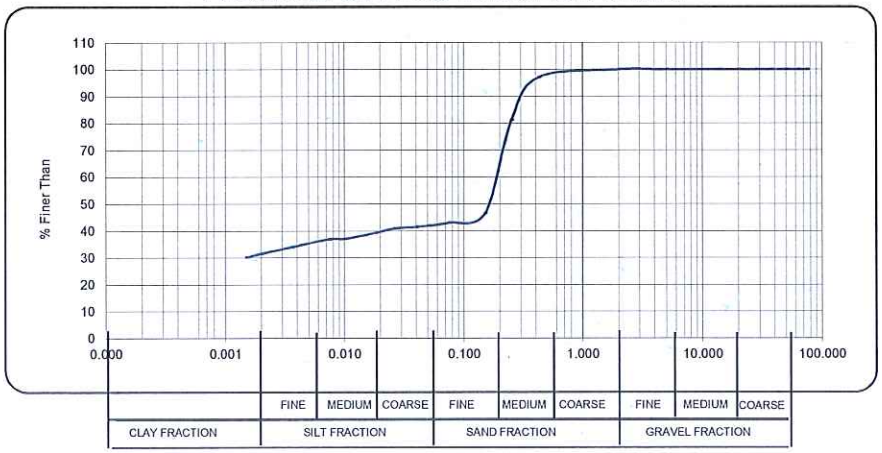
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21710
Field No. : BH3
Sample Description : Light grey dark reddish brown sandy silty CLAY
Equivalent PI : 17 **Clay fraction of whole sample (% <2μ)** : 32

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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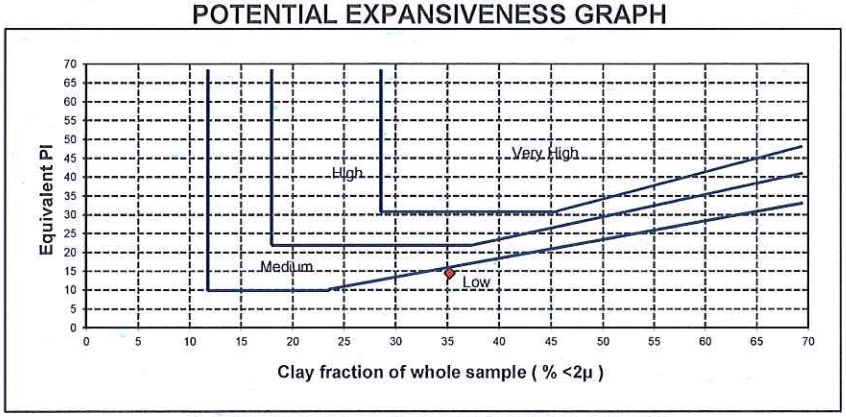
Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

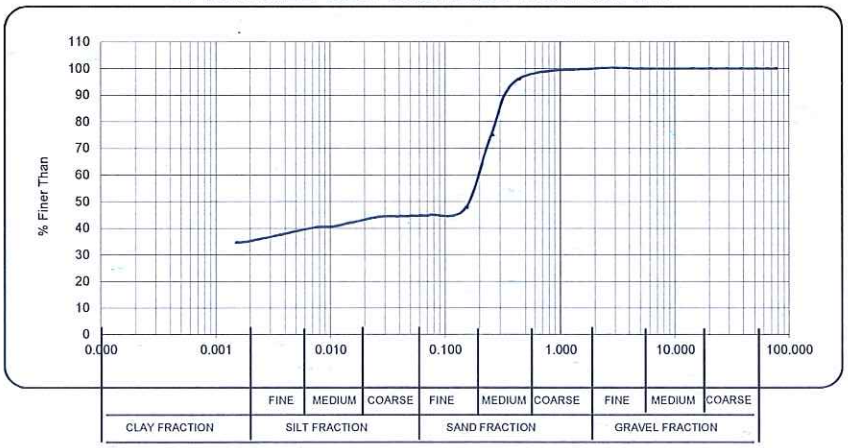
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21711
Field No. : BH3
Sample Description : Light grey dark reddish brown sandy clayey SILT
Equivalent PI : 14 **Clay fraction of whole sample (% <2μ)** : 35

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



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GEOSURE (Pty) Ltd

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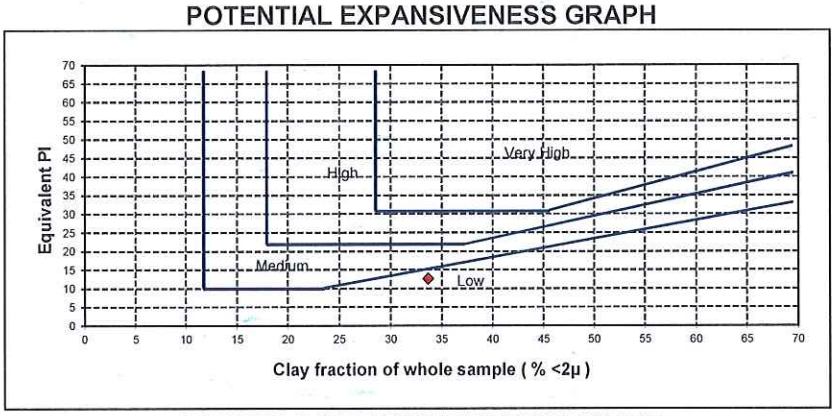
WEBSITE: www.geosure.co.za

Client : Davies Lynn & Partners
Project : Phinda Power
Attention : Mr A. Krebs

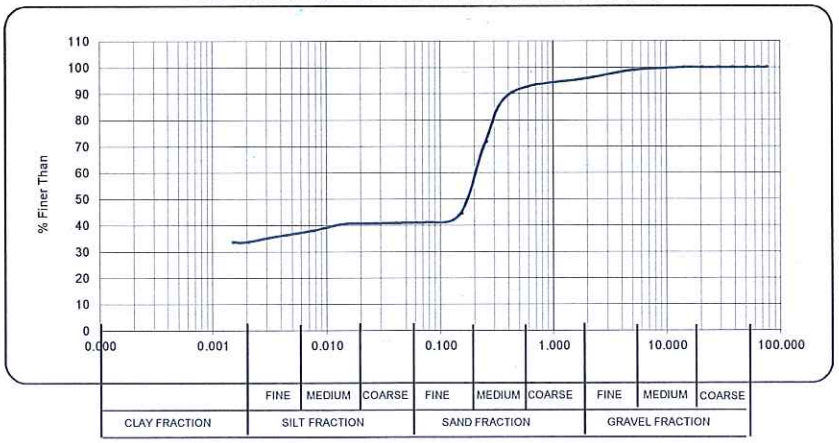
Job No. : 46841
Your Ref.No. : -
Date Tested : 22.08.2019 to 29.08.2019
Date Reported : 30.08.2019

Sample Number : T21712
Field No. : BH3
Sample Description : Light orange dark yellowish brown sandy clayey SILT
Equivalent PI : 13 **Clay fraction of whole sample (% <2μ)** : 34

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



APPENDIX 4

Wilson & Pass Incorporated

"Report to Ilifa Africa Engineers – Geotechnical Investigation Lot 1795, Richards Bay"
dated 5th July 2008

(52)

REPORT TO

ILIFA Africa Engineers

GEOTECHNICAL INVESTIGATION

LOT 1795, RICHARDS BAY

---

by

WILSON & PASS Incorporated

Consulting Geotechnical Civil Engineers, Durban

5 July 2008

Figure 1 : Location - Lot 1795, Richards Bay

INDEX

1. INTRODUCTION

1.1. Ilifa Africa Engineers instructed Wilson & Pass Inc to carry out geotechnical investigation of a property described as Lot 1/1795 Richards Bay, in Alton, in terms of Wilson & Pass Inc's offer to carry out such work dated 3 June 2008.

1.2. The site locality is shown in Figure 1.

1.3. Fieldwork for the investigation was carried out on 11 June 2008, including excavation of exploratory pits that were dug with an excavator kindly arranged by the project manager, Mr Nad Govender.

1.4. Wilson & Pass Inc provided a preliminary report on their investigation to Ilifa Africa Engineers dated 20 June 2008.

2. SCOPE OF THIS REPORT

2.1. This report describes the geotechnical investigation that was carried out and the results thereof.

2.2. Recommendations concerning design of structural foundations and paving are also provided, based upon the results of the investigation.

3. GEOTECHNICAL INVESTIGATION

3.1. Five exploratory pits, numbered 3, 4, 6, 7 and 8 were excavated by means of the TLB excavator provided by Mr Govender, on 11 June 2008, at the locations indicated in Figure 2.

3.2. The balance of the pits depicted thereon could not be dug due to breakdown of the excavator. It was however felt that those pits could be omitted because the information already gleaned was adequate.

3.3. The pits that were dug were examined by an experienced soils technician whose descriptive logs thereof are attached in Appendix A hereto.

3.4. Dynamic Cone Penetration (DCP) tests were carried out adjacent to the exploratory pits, the results of which are attached in Appendix B.

3.5. Representative samples of the soil were recovered from the pits, and subsequently subjected to index testing by Soilco Laboratory in Durban. The results of the tests are attached in Appendix C.

4. DESCRIPTION OF THE SITE

4.1. Location

4.1.1. The site is located in Alton, approximately midway between the Hillside Smelter and the Mondi plant, as shown in Figure 1.

4.1.2. As illustrated in Figure 2, the site covers a roughly rectangular area, measuring roughly 100m by 80m.

4.2. Topography

4.2.1. The site, which stands at an elevation of about +30m above sea level, slopes very gently down towards a minor stream outside of, and aligned roughly parallel to the eastern boundary of the site.

4.2.2. The stream drains to the south.

4.3. Geology

4.3.1. The site is underlain to some undetermined depths by greyish brown, loose, practically cohesionless, fine-grained sand, that would have been transported to, and deposited on the site by the action of the wind over a very long period (i.e. dune sand).

4.3.2. Based upon experience in the general vicinity, it can be expected that other layers of more cohesive soil, probably deposited in bodies of water, and

incorporating considerably greater proportions of silt and clay particles, underlie the cohesionless dune sand under this site.

4.3.3. Although the depth to the interface between the overlying dune sand and the (probable) more cohesive soil below is unknown, the total thickness of the various soil strata over the bedrock can be supposed to be more than 20m.

4.3.4. Minor earthworks were carried out on the site previously to accommodate earlier structures that have recently been demolished.

4.3.5. A certain amount of superficial soil, vegetation, and building rubble has been shifted across the site during the recent demolition work, and deposited over the lower, eastern side of the site. The thickness of such loose fill was observed to be about 1,0m in Pit 8.

4.4. Ground Water

4.4.1. Groundwater was not encountered in any of the exploratory pits (up to 2,5m deep).

4.4.2. The water table under the site must stand be above the level of the stream on the eastern side. The depth to the water table under the site is therefore probably not more than about 4m below the ground surface.

4.5. Properties of the Soil

4.5.1. Grading analysis of samples of the soil recovered from the upper 2m of the profile indicated that 87% thereof (by mass) comprised fine to medium grained sand particles, while only 9% were smaller (i.e. either silt or clay particles).

4.5.2. The fine-grained fraction of the soil was determined to be "Non-Plastic".

4.5.3. Such indicator properties are consistent with soil that has been transported by wind, without significant subsequently alteration.

4.5.4. A California Bearing Ratio (CBR) of 17% was determined on a sample of the soil that had been compacted to 100% Modified AASHTO density.

4.5.5. This soil classifies as a "G8" in terms of TRH 14.

5. PROPOSED DEVELOPMENT OF THE SITE

5.1. It is understood that it is proposed to construct a number of single storey, shed-type structures, each comprising single, steel-framed and steel-roofed, portal bays, supported on concrete columns, between which brick walls will be constructed.

6. RECOMMENDATIONS for ENGINEERING DESIGN

6.1. Structural Foundations

6.1.1. For the above type of building, pad foundations should be provided beneath the columns, and strip foundations beneath the walls, both designed to exert bearing pressures on the soil beneath that do not exceed 100kN/square metre.

6.1.2. The soffits of such foundations should be not less than 0,8m below both the existing ground surface and the original natural ground surface, and not less than 0.6m below the adjacent building terrace subgrade level, whichever is deeper.

6.1.3. These recommendations imply that foundations should be cast at least 0.8m below any fill. Such foundations will therefore be moderately deep on the eastern side of the site, where up to 1,0m of loose fill was observed, before earthworks had been carried out to suit the new development.

6.1.4. Different recommendations may apply to foundations for building types that are potentially more sensitive to differential settlement. Pile foundations may for instance be applicable to double storey or higher, brick walled buildings.

6.1.5. While it should not be essential to tie the column and wall foundations together with steel reinforcement, such connections would nevertheless be beneficial, to bridge over undetected, local, soft zones in the soil.

6.1.6. All of the foundation excavations should be inspected and approved by a competent person, who is familiar with foundation design and construction, and will be responsible therefore. Such person should require such excavations to

be either deepened where excessively loose material is observed, or else to over-excavated and then backfilled with thorough compaction in thin layers to 100% of Modified AASHTO density.

6.1.7. Joints between the brick walls and concrete columns should be detailed to accommodate slight differences in settlement between the column and wall foundations, so that slight opening or shear dislocations do not become unsightly or result in damp penetration.

6.2. Surface Bed Floors

6.2.1. The fine-grained sand covering the site represents moderately favourable subgrade beneath pavements and concrete surface beds, as evidenced by its measured California Bearing Ratio (CBR).

6.2.2. Being entirely cohesionless, such sand should be compacted to 100% of Modified AASHTO density where used as either general or selected fill.

6.2.3. Again due to its cohesionless character, such sand is vulnerable to loosening by traffic unless the surface is suitably confined by competent subbase and/or basecourse layers.

6.3. Roads and Drainage

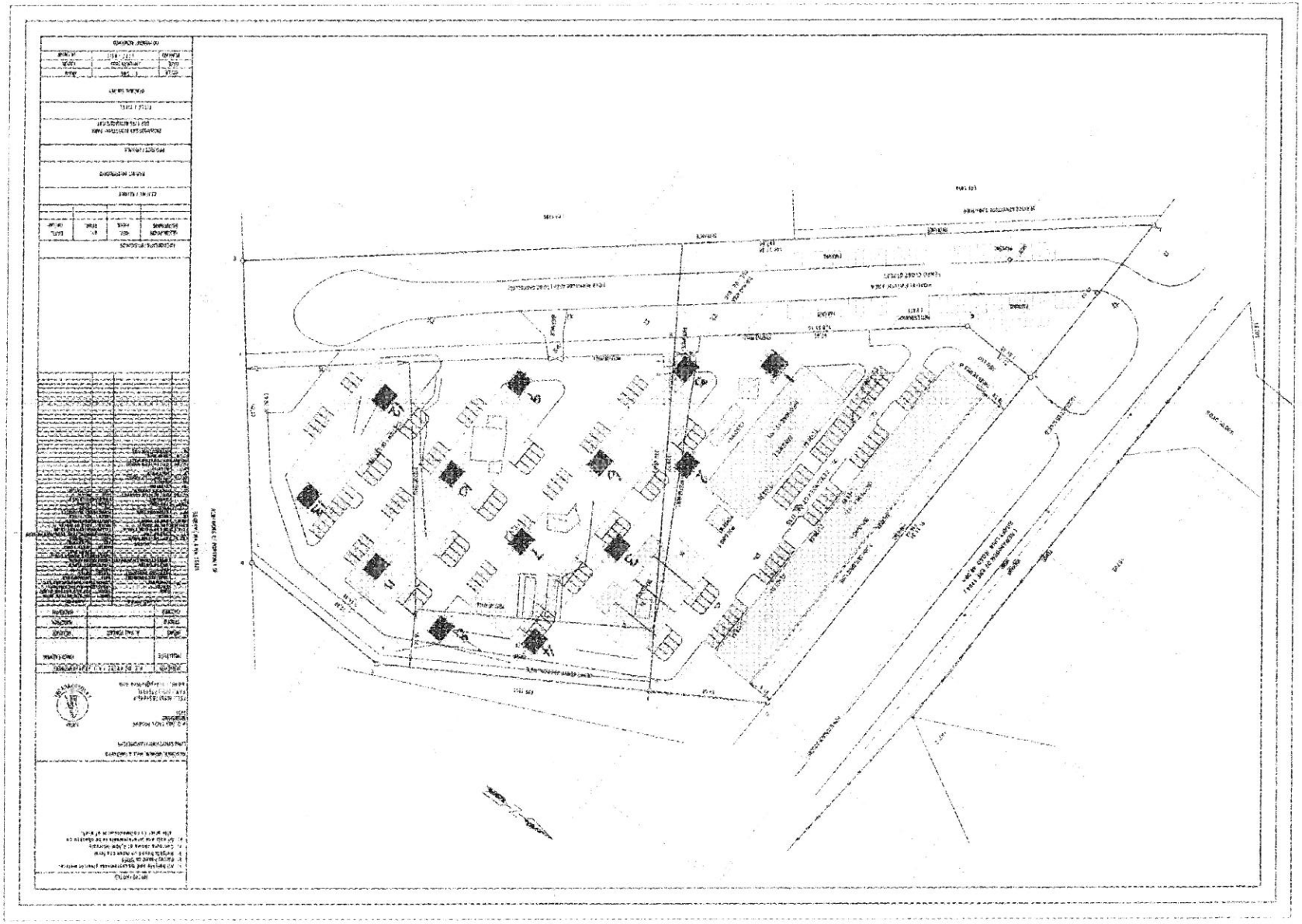
6.3.1. A large proportion of rainfall will readily infiltrate and percolate to depth, due to the considerable permeability of the dune sand.

6.3.2. Due to the cohesionless character of the sand, it will be vulnerable to erosion due to concentrated, rapidly flowing, stormwater runoff. Suitable energy dissipating structures should therefore be provided wherever concentrated flows are discharged.

End of Report

FIGURE 2

LOCATIONS OF EXPLORATORY PITS



APPENDIX A

DESCRIPTIVE LOGS OF EXPLORATORY HOLES

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1985/009585/07

25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15318 WESTMEAD 3608 KWAZULU - NATAL

TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client	Wilson & Pase Inc
Project	ERF 1795 Richards Bay
Job Card No.	128212
Date of Test	2008-06-13
Field Technician	M.E
Position	
Test Pit Number	TP 3
Chainage	
Diameter of TP	TLB

FIELD SOIL SURVEY TEST REPORT

Water Table	Soil Legend	Depth (mm)	DESCRIPTION
			Moisture; Colour; Consistency; Structure; Soil Type; Origin; Sampling; Laboratory Testing abbreviations (I = Ind; M = MOD; C = CBR);
		550	Slightly moist, dark brown, loose, fine SAND and occasional rubble, imported 4258 - IND/MOD/CBR
		1900	Slightly moist, light brown, loose, fine SAND, transported

Remarks : Excavation stopped - Test Pit Walls Collapsing
Foundation to 790mm depth on western side of pit

For Soilco : _____

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965/09585/07

25 WESTMEAD ROAD - WESTMEAD P.O.BOX 16318 WESTMEAD 3608 KWAZULU - NATAL

TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client	Wilson & Pass Inc
Project	ERF 1795 Richards Bay
Job Card No.	128212
Date of Test	2008-06-13
Field Technician	M.E
Position	
Test Pit Number	TP 4
Chainage	
Diameter of TP	TLB

FIELD SOIL SURVEY TEST REPORT

Water Table	Soil Legend	Depth (mm)	DESCRIPTION Moisture; Colour; Consistency; Structure; Soil Type; Origin; Sampling; Laboratory Testing abbreviations (I = Ind; M = MOD; C = CBR);
		500	Slighly moist, dark brown, loose, fine silty SAND, imported
		1700	Slighly moist, dark brown, loose, fine SAND, transported 4259 IND/HYDRO
		2100	Slighly moist, whitish brown, loose, fine SAND, transported 1xLarge

Remarks : Excavation stopped - Test Pit Walls Collapsing

For Soilco : _____

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No : 1965/09585/07

25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15318 WESTMEAD 3608 KWAZULU - NATAL

TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client	Wilson & Pass Inc
Project	ERF 1795 Richards Bay
Job Card No.	128212
Date of Test	2008-06-13
Field Technician	M.E
Position	
Test Pit Number	TP 6
Chainage	
Diameter of TP	TLB

FIELD SOIL SURVEY TEST REPORT

Water Table	Soil Legend	Depth (mm)	DESCRIPTION
			Moisture; Colour; Consistency; Structure; Soil Type; Origin; Sampling; Laboratory Testing abbreviations (I = Ind; M = MOD; C = CBR);
		300	Slightly moist, dark brown, medium dense, silty SAND and rubble, imported
			Slightly moist, light brown, loose, fine SAND, transported
		2400	½xLarge

Remarks : Excavation stopped - Test Pit Walls Collapsing

For Soilco : _____

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1985/09585/07

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TELEPHONE : 031 7904325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client	Wilson & Pass Inc
Project	ERF 1795 Richards Bay
Job Card No.	128212
Date of Test	2008-06-13
Field Technician	M.E
Position	
Test Pit Number	TP 7
Chainage	
Diameter of TP	TLB

FIELD SOIL SURVEY TEST REPORT

Water Table	Soil Legend	Depth (mm)	DESCRIPTION
			Moisture; Colour; Consistency; Structure; Soil Type; Origin; Sampling; Laboratory Testing abbreviations (I = Ind; M = MOD; C = CBR);
		300	Slightly moist, dark brown, loose, silty SAND and rubble, imported
			Slightly moist, orange brown, loose, fine SAND, transported
		2400	½xLarge

Remarks : Excavation stopped - Test Pit Walls Collapsing

For Soilco : _____

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg No. : 1995/09585/07

25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15318 WESTMEAD 3608 KWAZULU - NATAL

TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client	Wilson & Pass Inc
Project	ERF 1795 Richards Bay
Job Card No.	128212
Date of Test	2008-06-13
Field Technician	M.E
Position	
Test Pit Number	TP 8
Chainage	
Diameter of TP	TLB

FIELD SOIL SURVEY TEST REPORT

Water Table	Soil Legend	Depth (mm)	DESCRIPTION
			Moisture; Colour; Consistency; Structure; Soil Type; Origin; Sampling; Laboratory Testing abbreviations (I = Ind; M = MOD; C = CBR);
		1000	Slightly moist, dark brown, loose, silty SAND an rubble, imported
		2100	Slightly moist, dark black, loose, fine SAND, transported
		2500	Slightly moist, whitish brown, loose, fine SAND, transported

Remarks : Excavation stopped - Test Pit Walls Collapsing

For Soilco :

APPENDIX B

RESULTS OF

DYNAMIC CONE PENETRATION TESTS

DCP tests were carried out adjacent to exploratory pits.

Associated DCP tests and pits were assigned the same number.

SOILCO MATERIALS INVESTIGATIONS

CIVIL ENGINEERING MATERIALS TESTING LABORATORY
25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15318 WESTMEAD 3608 KWAZULU - NATAL
TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client : Wilson & Pass Inc — Job Card No: 126212

Project : ERF 1795 Richards Bay — Report Date : 2008-06-13

DYNAMIC CONE PENETROMETER

DCP No. & Position	1	2	3	4	5
Depth (mm)	No. of Blows	No. of Blows	No. of Blows	No. of Blows	No. of Blows
300	9	7	14	4	27
600	18	19	21	7	32
900	12	10	14	7	16
1200	8	8	9	5	9
1500	6	6	8	5	7
1800	7	7	8	5	6
2100	13	15	10	19	14
2400	12	11	15	27	12
2700	14	10	16	29	13
3000	14	15	17	22	15
3300	27	17	24	11	25
3600	6	12	22	12	17
3900	17	15	19	11	17
4200	23	27	27	13	24
4500	25	36	44	16	32
4800	30	43	41	27	40
5100	36	44	47	31	42
5400	40	47	39	36	44
5700	45	41	45	30	38
6000	43	39	44	41	41
Remarks	AS PER PLAN DCP Stopped				

This report is pertinent only to the area tested.

For Soilco.

SOILCO MATERIALS INVESTIGATIONS

CIVIL ENGINEERING MATERIALS TESTING LABORATORY
25 WESTMEAD ROAD - WESTMEAD P.O BOX 15318 WESTMEAD 3608 KWAZULU - NATAL
TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client : Wilson & Pass Inc — Job Card No: 128212

Project : ERF 1795 Richards Bay — Report Date : 2008-06-13

DYNAMIC CONE PENETROMETER

DCP No. & Position	6	7	8	9	10
Depth (mm)	No. of Blows	No. of Blows	No. of Blows	No. of Blows	No. of Blows
300	44	29	6	10	17
600	33	21	15	18	16
900	20	7	12	7	7
1200	8	5	7	6	5
1500	6	5	6	5	5
1800	5	2	7	7	6
2100	7	3	8	8	6
2400	10	9	13	7	8
2700	13	10	16	10	11
3000	20	14	17	12	12
3300	17	19	21	15	18
3600	7	21	18	9	10
3900	7	16	17	11	12
4200	13	22	21	13	13
4500	25	30	28	14	15
4800	35	36	34	22	23
5100	40	39	41	31	31
5400	38	41	39	37	29
5700	35	43	42	35	31
6000	39	38	40	36	34
Remarks	AS PER PLAN DCP Stopped				

This report is pertinent only to the area tested.

For Soilco:

SOILCO MATERIALS INVESTIGATIONS

CIVIL ENGINEERING MATERIALS TESTING LABORATORY
25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15316 WESTMEAD 3608 KWAZULU - NATAL
TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilsleb@mweb.co.za

Client : Wilson & Pass Inc

Job Card No: 128212

Project : ERF 1795 Richards Bay

Report Date : 2008-06-13

DYNAMIC CONE PENETROMETER

DCP No. & Position	11	12	13		
Depth (mm)	No. of Blows	No. of Blows	No. of Blows	No. of Blows	No. of Blows
300	13	11	12		
600	17	16	17		
900	9	7	9		
1200	5	5	7		
1500	6	5	6		
1800	5	5	5		
2100	7	5	6		
2400	8	8	8		
2700	12	10	11		
3000	13	12	13		
3300	15	18	17		
3600	10	8	11		
3900	13	10	12		
4200	11	7	14		
4500	14	12	14		
4800	22	21	21		
5100	35	32	35		
5400	31	34	38		
5700	37	35	34		
6000	35	37	37		
Remarks	AS PER PLAN DCP Stopped				

This report is pertinent only to the area tested.

For Soilco:

APPENDIX C

RESULTS OF

LABORATORY TESTS ON SAMPLES

RECOVERED FROM EXPLORATORY PITS

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965/09585/07

25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15318 WESTMEAD 3608 KWAZULU - NATAL

TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

a SANAS Accredited Testing Laboratory, No. T0213

Client	**Wilson & Pass inc**	**Job Card No**	**128212**
Project	**ERF 1795 Richards Bay**	**Date Received**	**2008-06-13**
Sampled by	**M.E.**	**Date Tested**	**2008-06-14/2008-06-21**
		Date Reported	**2008-06-23**

MATERIALS TEST REPORT

Laboratory Number		4258	4259		
Field Number		TP 3	TP 4		
Position in field					
Depth (mm)		0-550	500-1700		
Sample Description		Dk Br Fine Sand + Rubble	Dk Br Fine Sand		
Stabilising Agent		Natural	Natural		
Sieve Analysis (Wet Preparation) TMH1 - Method A1					
63.00 mm	Percentage Passing				
53.00 mm					
37.50 mm					
26.50 mm					
19.00 mm					
13.20 mm					
4.75 mm					
2.00 mm		100	100		
0.425 mm		93	93		
0.075 mm		7	6		
Grading Modulus		1.00	1.01		
Mechanical Analysis - TMH1 - Method A5					
Coarse Sand, (%)		6	7		
Coarse - Fine Sand, (%)		23	27		
Medium - Fine Sand, (%)		55	52		
Fine - Fine Sand, (%)		8	9		
Silt and Clay, (%)		7	6		
Atterberg Limits - TMH1 - Methods A2, A3, A4					
Liquid Limit, (%)		CBD	CBD		
Plasticity Index, (%)		NP	NP		
Linear Shrinkage, (%)		0.0	0.0		
Classification Group Index		A-3 (0)	A-3 (0)		
TRH 14 Classification (1985)		G8			
Maximum Dry Density and Optimum Moisture Content - TMH1 - Method A7					
Optimum Moisture Cont., (%)		12.5			
Max. Dry Density, (kg/m^3)		1737			
California Bearing Ratio - TMH1 - Method A8					
CBR @ 100% Compaction		17			
CBR @ 98% Compaction		14			
CBR @ 95% Compaction		12			
CBR @ 93% Compaction		12			
CBR @ 90% Compaction		13			
Swell @ 100% Comp. (%)		0.09			

The above test results are pertinent only to the samples received and tested at the laboratory. Deviation from TMH1, A8 : 98% compaction 20 blows, with 3 layers, with tamper mass of 4.53kg and drop of 457.2mm. Compaction of CBR specimens were done using Optimum Nominal Moisture Content and Maximum Wet Density, referred to as "the wet curve method". This report shall not be reproduced, except in full, without the prior consent of SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

For Soilco :

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965/09585/07
25 WESTMEAD ROAD - WESTMEAD - P.O. BOX 15318 - WESTMEAD - 3608 - KWAZULU - NATAL
TELEPHONE : 031 - 7004326 : TELEFAX 031 - 7001909 - email : soilslab@mweb.co.za
a SANAS Accredited Testing Laboratory, No. T0213

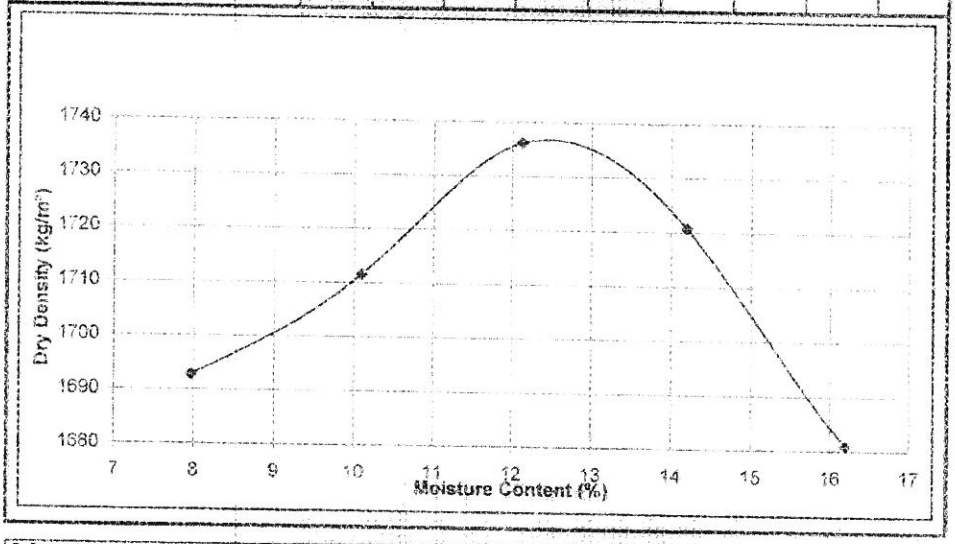
SANAS ACCREDITED LABORATORY

Client	Wilson & Pass Inc	Job Card No.	128212
Project	ERF 1795 Richards Bay	Date Received	2008-06-13
Sampled by	M.E.	Date Tested	2008-06-14
		Date Reported	2008-06-23

Laboratory Number	4258
Field Reference No.	TP 3
Position in field	
Depth (mm)	0-550
Material Description	Dk.Br.Fine Sand + Rubble

MOISTURE / DENSITY RELATIONSHIP - TMH1-METHOD (A7)

Moisture Content: (%)	8.0	10.1	12.1	14.2	16.2				
Dry Density : (kg/m^3)	1693	1712	1736	1721	1681				



Maximum Dry Density	1737 kg/m^3
Optimum Moisture Content	12.5 %

For Soilco : _____

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1995/005685/07

25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15818 WESTMEAD 3608 KWAZULU - NATAL

TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

Client : Wilson & Pass Inc

Project : ERF 1795 Richards Bay

Job Card No : 128212

Date Received : 2008-06-13

Date Tested : 2008-06-19

Sample delivered by : - Customer

Date Reported : 2008-06-21

HYDROMETER ANALYSIS TEST REPORT

Laboratory No.		4259				
Field No.		TP 4				
Position in Field						
Depth (mm)		900-1700				
Material Description		Dk.Br.Fine.Sand				
Stabilising Agent		Natural				

Sieve Analysis (Wet Preparation) TMH1 - Method A1 (a)

Sieve Aperture							
	75.0	mm					
	63.0	mm					
	53.0	mm					
	37.5	mm					
	26.5	mm					
	19.0	mm					
	13.2	mm					
	4.75	mm					
	2.00	mm	100				
	0.425	mm	83				
	0.075	mm	6				

Hydrometer Analysis (ASTM - D422)

Sieve Aperture							
	0.060	mm	7				
	0.050	mm	7				
	0.026	mm	7				
	0.015	mm	7				
	0.010	mm	7				
	0.0074	mm	6				
	0.005	mm	6				
	0.0036	mm	6				
	0.0026	mm	6				
	0.0015	mm	6				

Soil Mortar Analysis

Coarse Sand	%	7				
Fine Sand	%	79				
Silt	%	9				
Clay	%	6				

Atterberg Limits TMH 1 - Methods A2, A3, A4

Liquid Limit	%	CBD				
Plasticity Index	%	NP				
Linear Shrinkage	%	0				
Equivalent PI	%	0.0				
Classification (Group Index)		A-3 (0)				

For Soilco :

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1985/00585/07

25 WESTMEAD ROAD - WESTMEAD P.O.BOX 15318 WESTMEAD 3608 KWAZULU - NATAL

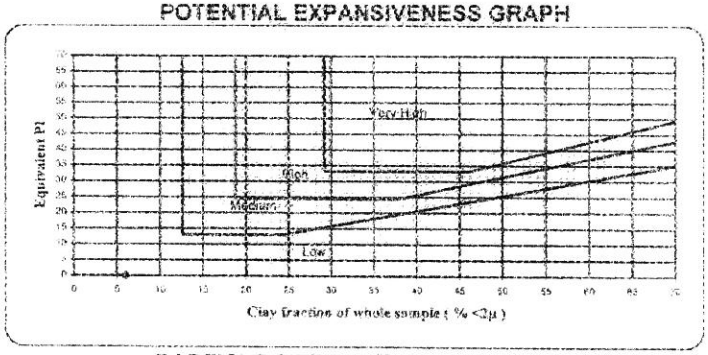
TELEPHONE : (031) 7004326 TELEFAX : (031) 7001909 email : soilslab@inweb.co.za

Client	: Wilson & Pass Inc	Job Card No.	: 128212
Project	: ERF 1795 Richards Bay	Date Received	: 2008-06-13
		Date Tested	: 2008-06-19
Sample Delivered by	: 0	Date Reported	: 2008-06-21

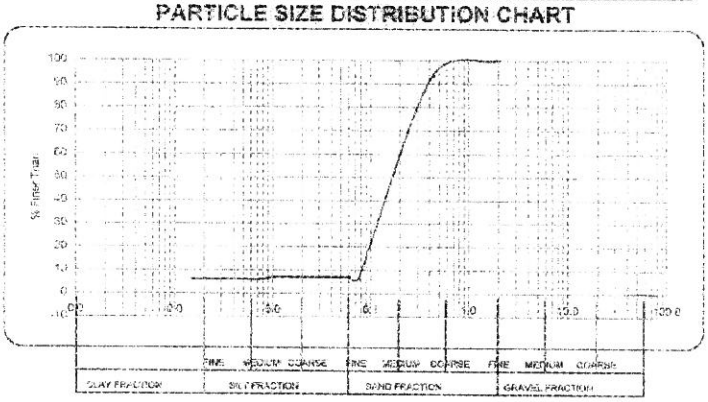
Sample Number	: 4259	Field or Pit Number	: TP 4
Position in field	: 0	Depth (mm)	: 500-1700
Sample Description	: Dk,Br,Fine,Sand		

Equivalent PI : 0 Clay fraction of whole sample (% <2μ) : 6

POTENTIAL EXPANSIVENESS GRAPH

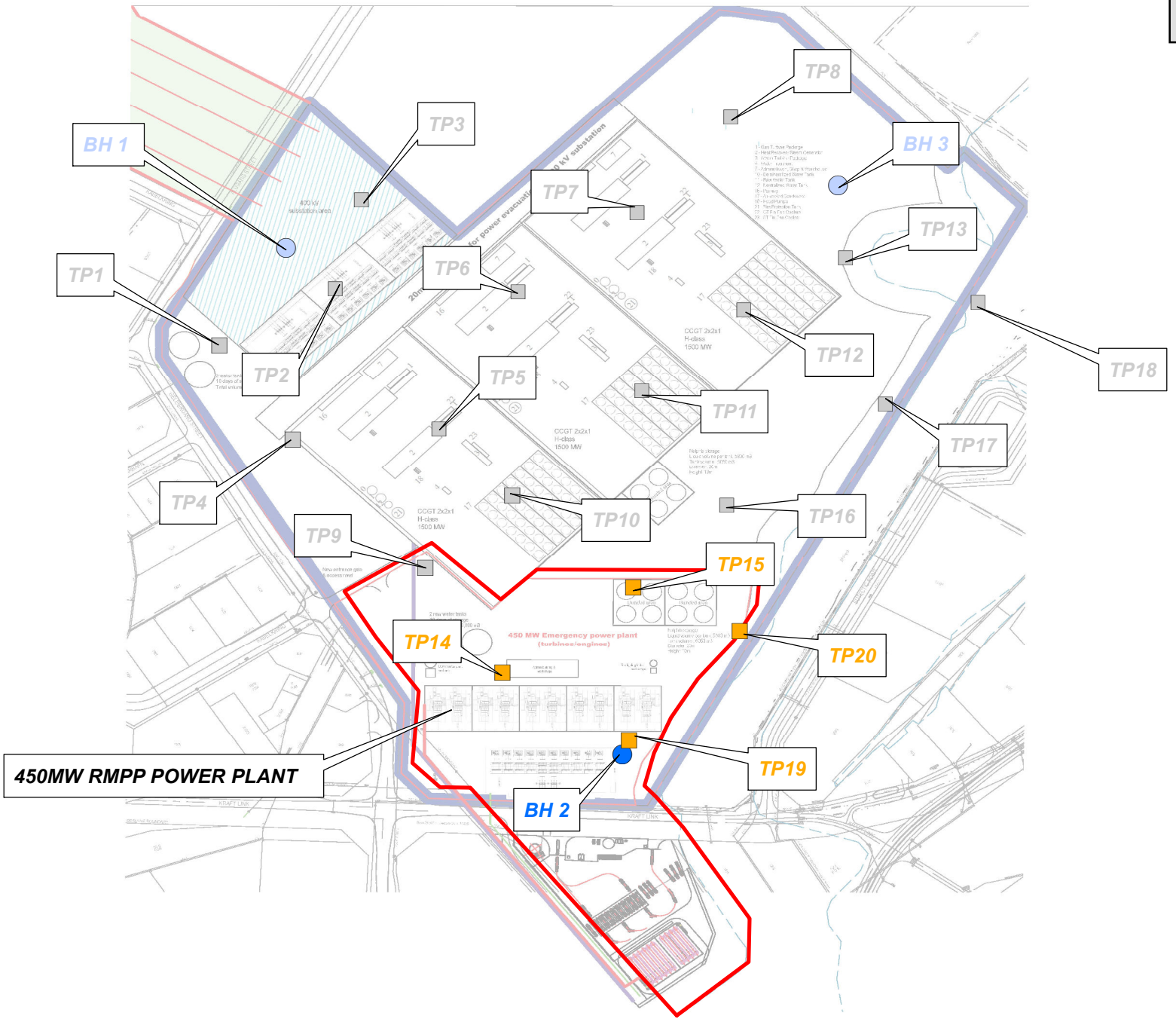


PARTICLE SIZE DISTRIBUTION CHART



For Soilco : _____

DRAWINGS



N
W
E
S

Meters
0 55 110 220

LEGEND:

- BOREHOLE NEAR 450MW RMPP POWER PLANT
- IP / DCP POSITIONS NEAR 450MW RMPP POWER PLANT
- BOREHOLE NEAR 4000MW CCPP POWER PLANT
- IP / DCP POSITIONS NEAR 4000MW CCPP POWER PLANT

DAVIES LYNN & PARTNERS

CLIENT:
PHINDA POWER PRODUCERS (PTY) LTD.

JOB TITLE:
450MW RMPP

FIGURE TITLE:
GEOTECHNICAL SITE PLAN

JOB NO.	FIGURE NO.
18 / 3388 -01A-GT	**FIGURE 1**

Meters
0 55 110 220

LEGEND:

- BOREHOLE NEAR 450MW RMPP POWER PLANT
- IP / DCP POSITIONS NEAR 450MW RMPPP POWER PLAN
- BOREHOLE NEAR 4000MW CCPP POWER PLANT
- IP / DCP POSITIONS NEAR 4000MW CCPP POWER PLANT

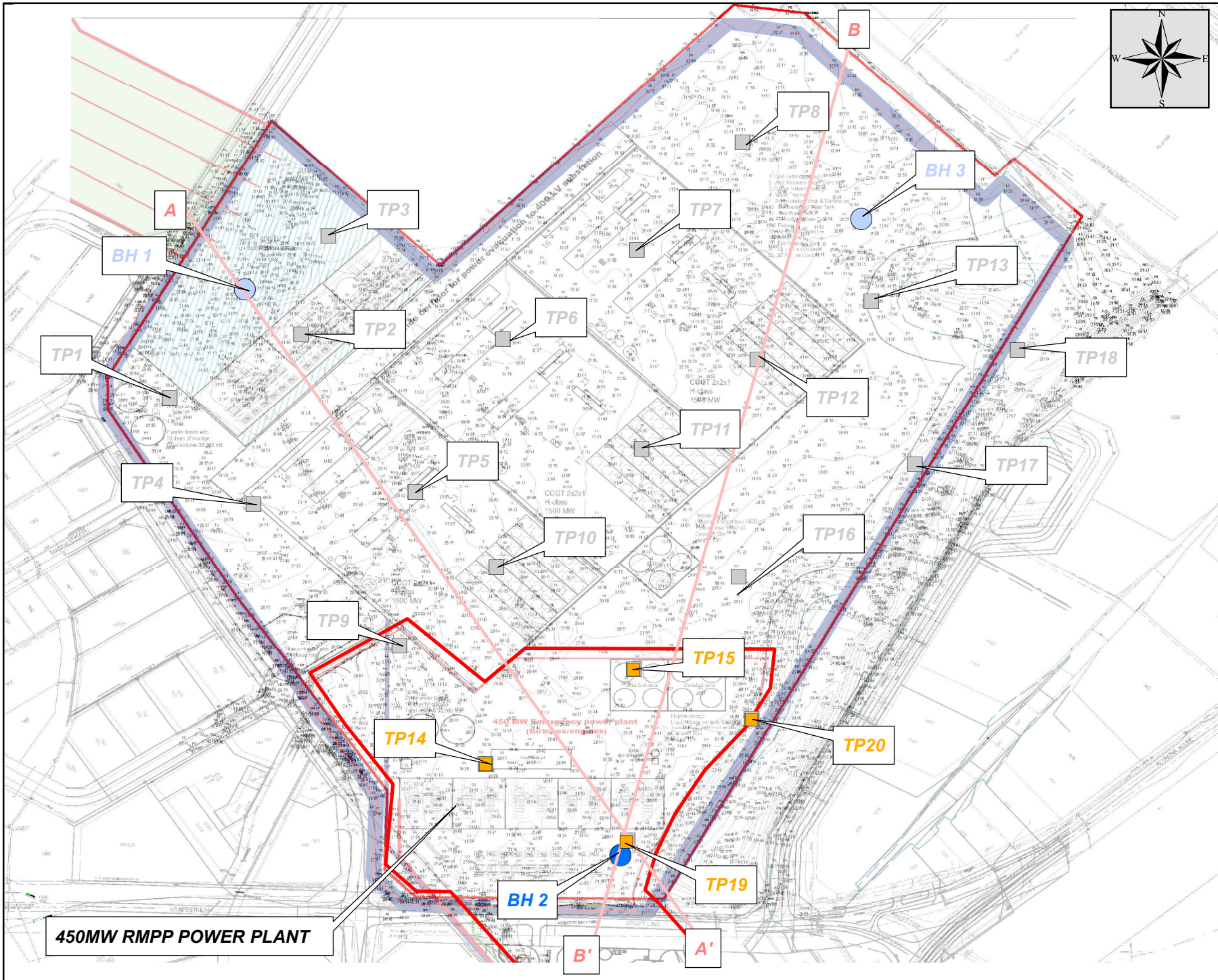
DAVIES LYNN & PARTNERS

CLIENT:
PHINDA POWER PRODUCERS (PTY) LTD.

JOB TITLE:
450MW RMPP

FIGURE TITLE:
GEOTECHNICAL SITE PLAN

JOB NO.	FIGURE NO.
18 / 3388 -01A-GT	**FIGURE 2**



Meters
0 40 80 160

LEGEND:

- BOREHOLE NEAR 450MW RMPP POWER PLANT
- IP / DCP POSITIONS NEAR 450MW RMPP POWER PLANT
- BOREHOLE NEAR 4000MW CCPP POWER PLANT
- IP / DCP POSITIONS NEAR 4000MW CCPP POWER PLANT
- CROSS SECTION LINE

DAVIES LYNN & PARTNERS

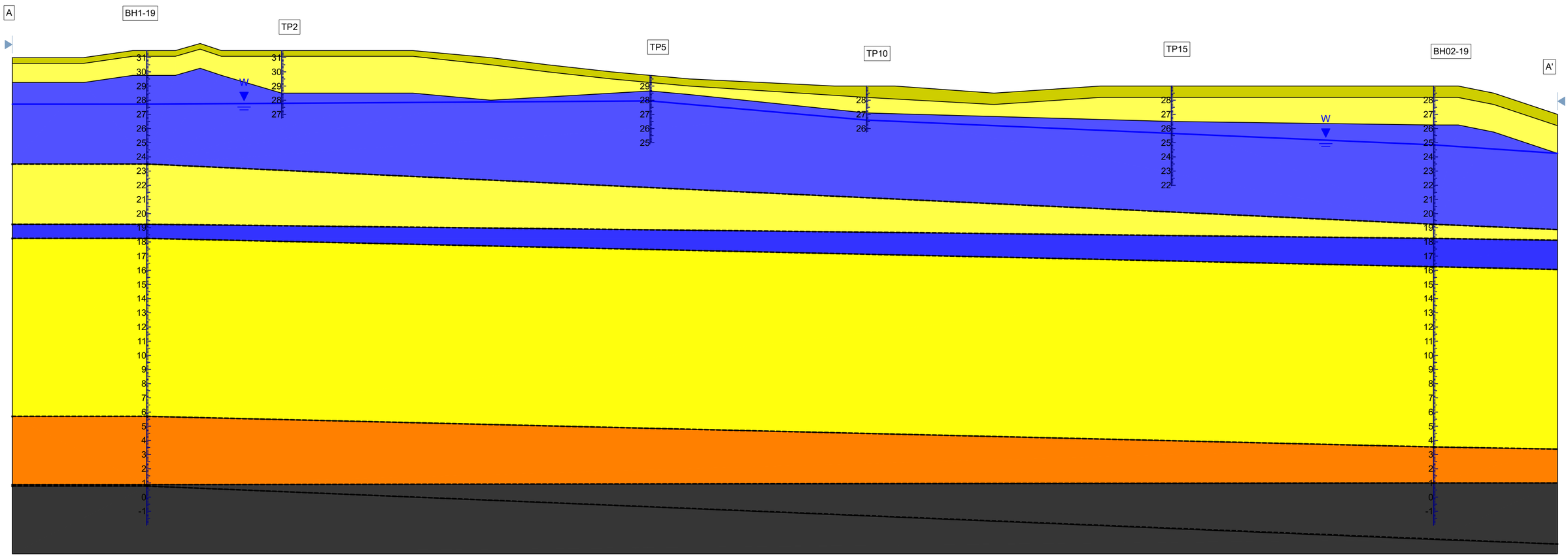
CLIENT: **PHINDA POWER PRODUCERS (PTY) LTD.**

JOB TITLE: **450MW RMPP**

FIGURE TITLE: **GEOTECHNICAL SITE PLAN**

JOB NO.	FIGURE NO.
18 / 3388 01A - GT	**FIGURE 3**

Material Name	Color
SAND 1	
SAND 2	
CLAY 1	
SAND 3	
CLAY 2	
SAND 4	
ULOA FORMATION	
ST LUCIA FORMATION	

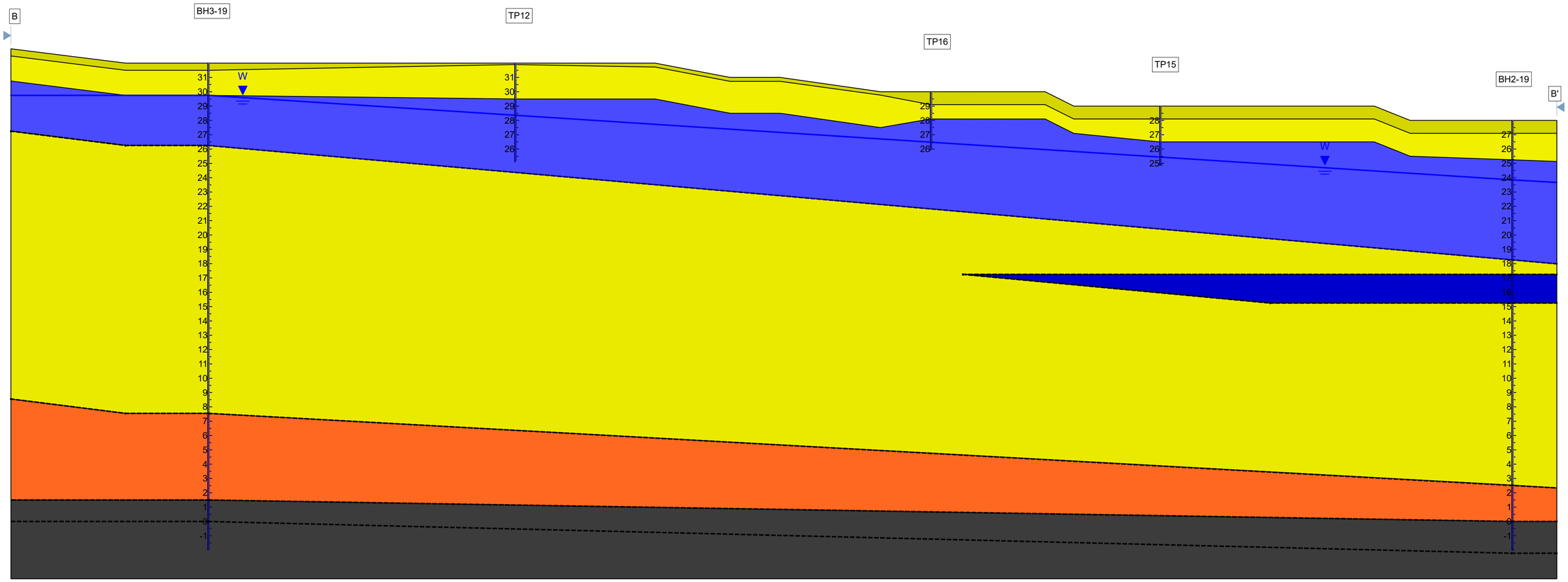


DAVIES LYNN & PARTNERS

SLIDE 8.028

Project	450MW RMPPP POWER PLANT		
Analysis Description	GEOLOGICAL CROSS SECTION		
Drawn By		Scale: V 1:200 H 1:1600 (A2)	Company: DAVIES LYNN & PARTNERS
Date: 2020/09/06			File Name: 18-3388-01A-GT-Figure 4 - Cross Section A-A

Material Name	Color
SAND 1	
SAND 2	
CLAY 1	
SAND 3	
CLAY 2	
ULOA FORMATION	
ST LUCIA FORMATION	



DAVIES LYNN & PARTNERS

SLIDE 8.028

Project	450MW RMPPP POWER PLANT		
Analysis Description	GEOLOGICAL CROSS SECTION		
Drawn By		Scale: V 1:200 H 1:1600 (A2)	Company: DAVIES LYNN & PARTNERS
Date: 2020/09/06			File Name: 18/3388-01A-GT - Figure 5 - Cross Section B-B