PHASE 1 GEOTECHNICAL REPORT

PROPOSED SUBSIDY HOUSING PROJECT ON ERF 325 PACALTDORP, GEORGE, WESTERN CAPE PROVINCE

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Declaration of independence:

The author of this report is independent professional consultant with no vested interest in the project, other than remuneration for work associated with the compilation of this report.

General limitations:

1. The investigation has been conducted in accordance with generally accepted engineering practice, and the opinions and conclusions expressed in the report are made in good faith based on the information at hand at the time of the investigation.
2. The contents of this report are valid as of the date of preparation. However, changes in the condition of the site can occur over time as a result of either natural processes or human activity. In addition, advancements in the practice of geotechnical engineering and changes in applicable practice codes may affect the validity of this report. Consequently, this report should not be relied upon after an eclipsed period of one year without a review by this firm for verification of validity. This warranty is in lieu of all other warranties, either expressed or implied.
3. Unless otherwise stated, the investigation did not include any specialist studies, including but not limited to the evaluation or assessment of any potential environmental hazards or groundwater contamination that may be present.
4. The investigation is conducted within the constraints of the budget and time and therefore limited information was available. Although the confidence in the information is reasonably high, some variation in the geotechnical conditions should be expected during and after construction. The nature and extent of variations across the site may not become evident until construction. If variations then become apparent this could affect the proposed project, and it may be necessary to re-evaluate recommendations in this report. Therefore, it is recommend that Outeniqua Geotechnical Services is retained to provide specialist geotechnical engineering services during construction in order to observe compliance with the design concepts, specifications and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction. Any significant deviation from the expected geotechnical conditions should be brought to the author’s attention for further investigation.
5. The assessment and interpretation of the geotechnical information and the design of structures and services and the management of risk is the responsibility of the appointed engineer.
EXECUTIVE SUMMARY

Outeniqua Geotechnical Services was appointed by Royal Haskoning to undertake a Phase 1 geotechnical site investigation for the proposed subsidy housing project on Erf 325, Pacaltsdorp, George in the Western Cape Province. A preliminary investigation was undertaken by this company in 2012 and this was followed by a Phase 1 subsurface investigation of the site which included a series of test pits, in situ tests and laboratory tests.

The project consists of the construction of single or double storey masonry units on vacant land with an area of approximately 75Ha. The topography of the site is characterised by gently to moderately sloping undulating terrain becoming steeper towards the valley lines which drain into tributaries of the Skaapkop River. The surface conditions on most of the site were generally dry at the time of the investigation, and access across the site with machinery was relatively easy apart from localised soft, wet areas as a result of recent rainfall.

The climate of the region can be classified as temperate and wet (Weinert Climatic-N No. ~1-2). The natural vegetation of the area is Garden Route Granite Fynbos (Mucina & Rutherford), although the vegetation has been completely transformed to grass and some localised clumps of alien trees, mainly along watercourses.

The geological map indicates that the site is underlain by granite of the Maalgaten Suite. The natural soil types consist of transported silty clayey fine sands or sandy silts (topsoils), pedogenic ferricrete gravel (nodules) and residual clay or clayey sand derived from the in situ weathering of the underlying granite. The residual clayey soils generally display low to medium plasticity and are potentially active. There is minor surficial uncontrolled fill soil on very localised parts of the site which will need to be removed or treated/compacted. The transported topsoil is generally loose/soft and highly compressible, but the underlying pedogenic and residual soils are significantly denser as seen in the DCP tests, although potentially collapsible.

Some earthworks and terracing of the site may be required to create level platforms for dwellings due to the sloping topography of the site. The envisaged foundation types for the proposed structures are lightly reinforced strip foundations at a nominal depth of 1m below NGL. The residual stiff/dense soils will have adequate bearing capacity for the envisaged structures but conventional compaction will be required to reduce potential settlement. Alternative methods can include shallow light rafts on compacted near-surface soils. All excavations will be easy/soft and no rock is expected to a depth of at least 2.5m. The in situ soils are generally not suitable for re-use in engineered fills and as a selected subgrade material in road pavements. Structural fill will have to be imported unless otherwise directed by the engineer. Storm water and subsoil drainage systems will have to take into account the site topography and the presence of perched water tables. The soils have poor drainage characteristics and subsurface seepage is common at shallow depths and this may affect earthworks. The site geology and geotechnical conditions are generally considered suitable for the proposed development but certain constraints will have an impact on development costs.
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1. **Introduction and terms of reference**

Outeniqua Geotechnical Services was appointed by Royal Haskoning DHV to undertake a Phase 1 geotechnical site investigation for the proposed subsidy housing project on Erf 325, Pacaltsdorp, George in the Western Cape (see Figure 1). The physical and geotechnical nature of the site needs to be investigated in order to facilitate the civil engineering design and town planning process.

![Figure 1: Locality map](image)

The investigation is carried out in accordance with the GFSH-2 guidelines published by the Department of Housing (2002).

The general purpose of the investigation is to:

- Describe the location, topography and geology of the proposed site;
- Investigate and describe the soil types and expected founding conditions;
- Highlight any problem soils, slope stability or drainage issues;
- Estimate the bearing capacity, settlement and/or swell potential of the soil;
- Classify the excavations in terms of SABS 1200D;
- Determine the suitability of the site for housing purposes and make recommendations for the design of earthworks, foundations and engineering services.
2. Information available

The following maps and plans were available for reference purposes and are reproduced in this report:

- Topocadastral data, obtained from the Directorate of Surveys & Mapping (see Figures 2&3);
- 1:250 000 Geological maps of the area, obtained from the Council for Geoscience;
- 1:1000000 Seismic Hazard Map of SA, obtained from the Council for Geoscience;
- A proposed site development plan, produced by Delplan.

Numerous other geotechnical reports for other developments in the vicinity of the site were also used for information purposes.

Figure 2: Aerial photo of site
3. Nature of the investigation

A preliminary investigation was conducted on this site in 2012 to determine the feasibility of the project in terms of geotechnical constraints. The general suitability of the site was investigated for subsidy housing purposes using available databases and spatial information as a pre-cursor to a detailed Phase 1 investigation. No red flags were uncovered in this investigation.

The Phase 1 subsurface investigation involved conducting a total of 35 test pits with a TLB/Backactor to a maximum depth of 2.5m. Representative samples of selected soil horizons were taken for the following lab tests:

- Foundation Indicator tests (TMH1 and ASTM) to determine gradings, Atterberg limits and potential expansiveness (tested at Outeniqua Lab in George);
- MOD/CBR/Indicator tests (TMH1) to determine the suitability for possible road pavement materials use (tested at Outeniqua Lab in George);
- pH and Conductivity tests (tested at Soillab in Cape Town);
- Consolidation tests (tested at Controlab in East London).

Handheld Dynamic Cone Penetrometer (DCP) tests were conducted from present ground level at every test position.
The confidence in the information gained from the investigation is high as it generally concurs with expected conditions and experience gained from other investigations in the area. Further investigations are not deemed necessary at this stage of the project. A Phase 2 investigation should be carried out during construction phase to obtain a more accurate classification of soils on individual erven for home enrolment and detailed design purposes.

4. Site description

The proposed site for development is a vacant block of land with an area of approximately 75Ha. The terrain is gently to moderately sloping and undulating, becoming steeper towards the valley lines. Some historical farming activity and disturbance to the natural ground level is evident in localised places.

The natural vegetation of the area is Garden Route Granite Fynbos, although this natural vegetation has been largely cleared due to historical farming activity and transformed to grass and alien trees (see Figures 4 & 5).

The climate of the region can be classified as a temperate, wet climate with warm summers and cold wet winters (Weinert climatic No.~1-2), and the surface conditions were generally dry at the time of the investigation, with localised wet, soft areas as a result of recent rain.

Figure 4: Photo looking southwest towards the site from TP32
5. **Geology**

The geological map indicates that the site is underlain by granite of the Maalgaten Suite which intruded into the country rocks of the Kaaimans Formation approximately 525 million years ago (see **Figure 6**). The natural soil types consist of dark to light brown transported clayey silty fine sands or sandy silts and light to dark red orange residual clay or clayey sand derived from the *in situ* weathering of the underlying granite (see **Figure 7**). There are no geological faults in the immediate vicinity of the site and the seismic activity of the area is generally considered low. The site is deemed to be macro-stable from a geological perspective.
Figure 6: Geological map

Figure 7: Typical soil types observed in test pits
6. Geotechnical Evaluation
6.1 Engineering and material characteristics
6.1.1 Topography, slopes and vegetation cover

Results of the investigation

The site is situated on gently to moderately sloping ground which becomes steeper towards the valley lines, which drain into tributaries of the Skaapkop River. The slope gradient ranges from approximately 1v:20h to 1v:4h. The vegetation cover generally consists of long grass, small bushes and scattered clumps of alien trees, which occur dominantly along the valley lines.

Effect on the proposed development

The terrain is generally suitable for housing purposes but some terracing and low retaining walls may have to be constructed to create level platforms, particularly nearer to the valleys. No difficult bush clearing is expected.

6.1.2 Soil types and rock

Results of the investigation

The natural soil types consist of transported silty fine sands or sandy silts (topsoil) and residual clay or clayey fine sand derived from the in situ weathering of the underlying granite. No rock was encountered in test holes.

A summary of the test pit data and the thickness of the different soil horizons is provided in Table 1.
Table 1: Summary of soil horizons recorded in test pits (in mm)

<table>
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<th>Test Pit No</th>
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<th>Transported soil</th>
<th>Pedogenic soil</th>
<th>Residual soil</th>
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**Effect on the proposed development**

The natural *in situ* soil types are dominantly fine grained and are typically sensitive to moisture. They are easy to excavate but can be difficult to work with and compact when wet. The geotechnical nature of the soils and their behavioural characteristics are dealt with in further detail in the chapters to follow.

**6.1.3 Grading, Atterberg limits and potential expansiveness**

**Results of the investigation**

Representative samples of various soil horizons were collected for Foundation Indicator tests in order to determine their basic geotechnical properties, estimate potential expansivity and evaluate their suitability as founding mediums. Abbreviated results of the tests are shown in Table 2.
Table 2: Grading and Atterberg limits test results summary

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<tr>
<th>Test Pit No</th>
<th>Sample Depth (mm)</th>
<th>Atterberg Limits</th>
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<td>200-700</td>
<td>21</td>
<td>44</td>
<td>11</td>
<td>42</td>
<td>15</td>
</tr>
<tr>
<td>31</td>
<td>900-1800</td>
<td>9</td>
<td>20</td>
<td>4</td>
<td>60</td>
<td>28</td>
</tr>
<tr>
<td>32</td>
<td>550-1050</td>
<td>26</td>
<td>56</td>
<td>13</td>
<td>54</td>
<td>20</td>
</tr>
<tr>
<td>32</td>
<td>1050-1700</td>
<td>17</td>
<td>37</td>
<td>8</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>35</td>
<td>700-1100</td>
<td>22</td>
<td>58</td>
<td>11</td>
<td>58</td>
<td>28</td>
</tr>
</tbody>
</table>

Notes: 1 Moisture content 2 Potential expansiveness (Skempton’s activity chart) 3 Unified Soil Classification System

The tests indicate that the soils can be classified into the following types:

**SC** – Clayey sands with Atterberg Limits above the A-line and with PI>7;
**SM** – Silty sands or clayey sands with PI<4 or Atterberg Limits below the A-line;
**CH** – Inorganic clays of high plasticity;
CL – Inorganic clays of low to medium plasticity;
ML – Inorganic silts of low to medium plasticity;
MH – Inorganic silts of high plasticity.

The tests indicate the soils are dominantly fine-grained, consisting of clay and silt-sized particles with lesser amounts of sand and gravel. The plasticity index varies considerably but is generally low to medium, ranging from 4 to 26.

**Effect on the proposed development**

The soils can be potentially problematic in terms of compressibility, where soil moisture is high, or expansiveness where soil moisture fluctuates, and will have to be treated with some caution. Foundation recommendations are given in Chapter 8.

### 6.1.4 Moisture/density relationship and CBR

**Results of the investigation**

Representative samples of near-surface soils were collected for Mod/CBR/Indicator tests in order to determine the moisture-density relationship, compaction and CBR properties for road subgrade purposes. The results of the tests are summarised in **Table 3**.

**Table 3: CBR test results summary**

<table>
<thead>
<tr>
<th>Test Pit No</th>
<th>Sample Depth (mm)</th>
<th>CBR at 100%</th>
<th>CBR at 98%</th>
<th>CBR at 95%</th>
<th>CBR at 93%</th>
<th>CBR at 90%</th>
<th>Swell (%)</th>
<th>PI (%)</th>
<th>GM</th>
<th>MDD/OMC</th>
<th>TRH14 Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0-700</td>
<td>23</td>
<td>20</td>
<td>17</td>
<td>14</td>
<td>10</td>
<td>0.12</td>
<td>SP</td>
<td>0.83</td>
<td>1967/10.5</td>
<td>G8</td>
</tr>
<tr>
<td>19</td>
<td>0-500</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>0.09</td>
<td>3</td>
<td>0.83</td>
<td>1814/14.8</td>
<td>G9</td>
</tr>
<tr>
<td>24</td>
<td>0-300</td>
<td>40</td>
<td>34</td>
<td>24</td>
<td>17</td>
<td>7</td>
<td>0.43</td>
<td>S</td>
<td>0.74</td>
<td>1944/10.8</td>
<td>G9</td>
</tr>
<tr>
<td>27</td>
<td>0-700</td>
<td>36</td>
<td>30</td>
<td>21</td>
<td>15</td>
<td>6</td>
<td>0.43</td>
<td>NP</td>
<td>0.74</td>
<td>1955/9.2</td>
<td>G10</td>
</tr>
<tr>
<td>30</td>
<td>300-950</td>
<td>98</td>
<td>83</td>
<td>60</td>
<td>44</td>
<td>21</td>
<td>0.00</td>
<td>6</td>
<td>2.52</td>
<td>2402/8.4</td>
<td>G5</td>
</tr>
</tbody>
</table>

The tests indicate that the *in situ* subgrade is generally marginal to poor quality (G8-10 i.t.o TRH14) with one sample of ferricrete gravel from TP30 falling into a G5 category as expected.

**Effect on the proposed development**

Road designs should allow for subgrade improvement, including ripping and recompaction of the roadbed and importation of a selected subgrade layer as standard procedure. Detailed recommendations for road construction are given in **Chapter 8.2**.
6.1.5 pH and conductivity

Results of the investigation

Samples of in situ soils were collected for soil chemistry tests (pH & Conductivity) in order to determine the aggressiveness of the soil which can affect buried services and concrete foundations. A summary of the results of the pH and conductivity tests are shown in Table 4.

Table 4: pH and conductivity test results summary

<table>
<thead>
<tr>
<th>Test Pit No.</th>
<th>Sample depth (mm)</th>
<th>pH</th>
<th>Conductivity (S/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>800-2900</td>
<td>7.7</td>
<td>0.04</td>
</tr>
<tr>
<td>8</td>
<td>900-2500</td>
<td>7.2</td>
<td>0.08</td>
</tr>
<tr>
<td>17</td>
<td>950-2400</td>
<td>7.1</td>
<td>0.03</td>
</tr>
<tr>
<td>21</td>
<td>950-1600</td>
<td>6.8</td>
<td>0.02</td>
</tr>
<tr>
<td>32</td>
<td>1050-1700</td>
<td>6.7</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Corrosion of metallic pipe fittings and concrete will be negatively influenced by low or high pH, and high conductivity (indicating high concentration of dissolved salts in the soils). An indication of the influence of pH and conductivity on the corrosiveness of soil is given in Table 5.

Table 5: Influence of pH and conductivity on the corrosiveness of soil

<table>
<thead>
<tr>
<th>pH</th>
<th>Conductivity (S/m)</th>
<th>Potential Corrosiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-8</td>
<td>&lt;0.1</td>
<td>Non corrosive</td>
</tr>
<tr>
<td>5-6 or 9-10</td>
<td>0.1-0.3</td>
<td>Mildly corrosive</td>
</tr>
<tr>
<td>3-4 or 11-12</td>
<td>0.3-0.5</td>
<td>Corrosive</td>
</tr>
<tr>
<td>&lt;3 or &gt;12</td>
<td>&gt;0.5</td>
<td>Highly corrosive</td>
</tr>
</tbody>
</table>

The lab results indicate non-corrosive soil conditions.

Effect on the proposed development

Standard HDPE or uPVC pipe products will be suitable and buried metallic valves and fittings should be powder coated as standard. Adequate rebar cover in buried concrete foundations is important to protect against rust.

6.1.6 Compressibility, collapse potential and bearing capacity

Results of the investigation

Soil compressibility is assessed by an experienced interpretation of soil profiles, laboratory tests and in situ tests. The tests indicate that the loose/soft transported soils are highly
compressible and will require adequate compaction to carry loads. Compaction may be difficult and impractical when soil is wet. However, DCP tests indicate that soil consistency generally improves with depth and the underlying pedogenic and/or residual horizons are more suitable to carry foundations and can probably be compacted with relative ease. Consolidation test results indicate that the residual clayey sands are potentially collapsible when saturated under load (0.4-3.6% collapse). Conservative calculations indicate 5-10mm total consolidation (C1 category) of a typical foundation under the expected loads. Localised surficial uncontrolled fill is unsuitable to carry loads and will also require treatment (ripping, selection and re-compaction).

**Effect on the proposed development**

Bearing capacity of residual soils is adequate for the proposed structures and conventional foundations with light reinforcement are envisaged but compaction of trenches is important to reduce settlement. Foundations are discussed in more detail in Chapter 8.

6.1.7 Swell / heave

**Results of the investigation**

Foundation Indicator test results indicate low potential expansion from residual clayey soils according to the Skempton activity chart but experience has shown this method can be misleading. Observations of soil samples from test pits also confirm micro-shattering and slickensiding which indicate clay activity. Conservative estimates of maximum total heave is between 5 and 15mm (H/H1 category).

**Effect on the proposed development**

Light reinforcement of foundations and improved site drainage is recommended to cater for the expected level of heave. Further details are provided in Chapter 8.

6.1.8 Soil moisture, permeability and groundwater

**Results of the investigation**

The site is located in a wet climatic area where prolonged rainfall is common. Subsurface infiltration is restricted by clayey residual soils with lower permeability than the overlying topsoil and pedogenic ferricrete and shallow perched water tables are expected across the entire site. Strong subsoil seepage is expected in areas adjacent to watercourses.

**Effect on the proposed development**

Subsoil drains are recommended along roads and on the upslope side of structures as a precaution.

6.1.9 Existing structures

**Results of the investigation**
The site is a “Greenfield” and there are no dwellings on the site. There has been some minor localised disturbance of the natural ground surface as a result of historical farming activities on the site.

**Effect on the proposed development**

No special measures will be required to relocate existing residents or demolish existing structures. Site clearance should address any localised heaps of spoil.

### 6.2 Slope stability and erosion

The natural slope gradients are generally gentle to moderate, becoming steeper towards the valleys and town planning will have to carry out a slope analysis. Slopes less than 1:4 are generally suitable for low-cost housing, but steeper slopes can be developed at higher costs. There are no signs of global slope instability on the site.

Temporary shallow excavations are likely to be generally stable at near vertical angles due to significant cohesion in the soils but deep excavations exceeding 1.5m high should be assessed by the engineer and/or a geotechnical specialist.

Erosion is not considered too problematic unless soils are loosened and stockpiled during heavy rainfall episodes.

### 6.3 Excavation classification with respect to services

Bedrock was not encountered in test holes and is not expected within a depth of at least 2.5m. All excavations to this depth can be classified as soft.

### 6.4 Impact of the geotechnical character of the site on subsidy housing developments

The site is classified in Table 6 in accordance with the subsidy variation document, issued by the Department of Housing in March 2007.

**Table 6: Site specific subsidy variations**

<table>
<thead>
<tr>
<th>Geotechnical Conditions</th>
<th>Category or type</th>
<th>Criteria</th>
<th>Precautionary measures</th>
<th>Applicable areas</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seepage / groundwater</td>
<td>Category 1</td>
<td>Permanent or perched water tables less than 1.0m below ground surface</td>
<td>Subsurface drainage/improved damp-proofing measures to houses, service trenches to be dewatered during construction</td>
<td>All areas</td>
<td>During wet season mainly</td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>Permanent or perched water tables more than 1m but less than 1.5m below ground level</td>
<td>Service trenches to be dewatered during construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geotechnical Conditions</td>
<td>Category or type</td>
<td>Criteria</td>
<td>Precautionary measures</td>
<td>Applicable areas</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------</td>
<td>----------</td>
<td>------------------------</td>
<td>-----------------</td>
<td>---------</td>
</tr>
<tr>
<td>Erodability of soil</td>
<td>Category 1</td>
<td>High risk (Erodability index 1-8)</td>
<td>Retaining walls &amp; earthworks to reduce slopes &amp; surface drainage</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>Medium risk (Erodability index 9-15)</td>
<td>Retaining walls &amp; earthworks to reduce slopes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Hard excavation</td>
<td>Category 1</td>
<td>Hard rock excavation to a depth of 1.5m</td>
<td>Additional cost of trench and foundation excavation</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>Boulder excavation to a depth of 1.5m</td>
<td>Additional cost of trench, foundation and road excavation</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Dolomite</td>
<td>Category 1</td>
<td>Risk class 1&amp;2 (Dolomite area class D2)</td>
<td>Additional cost of foundations</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>Risk class 3&amp;4 (Dolomite area class D3)</td>
<td>Additional cost of foundations</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Expansive Clays</td>
<td>Category 1</td>
<td>H1</td>
<td>Foundation design, building procedures and precautionary measures: Modified normal</td>
<td>All areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>H2</td>
<td>Foundation design, building procedures and precautionary measures: Light/medium raft</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 3</td>
<td>H3</td>
<td>Foundation design, building procedures and precautionary measures: Heavy raft</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Compressible and Collapsible soils</td>
<td>Category 1</td>
<td>C1</td>
<td>Foundation design, building procedures and precautionary measures: Modified normal</td>
<td>All areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>C2</td>
<td>Foundation design, building procedures and precautionary measures: Light or heavy raft</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Compressible soils</td>
<td>Category 1</td>
<td>S1</td>
<td>Foundation design, building procedures and precautionary measures: Modified normal</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>S2</td>
<td>Foundation design, building procedures and precautionary measures: Light or heavy raft</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Mining subsidence</td>
<td>Category 1</td>
<td>Old undermining to a depth of between 90-240m below surface where stope closure has ceased</td>
<td>Additional cost of foundations: Compaction below footings or raft</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>Old undermining to a depth of between 90-240m below surface where total extraction has taken place</td>
<td>Additional cost of foundations: additional earthworks or soil reinforcement</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Seismic activity</td>
<td>Category 1</td>
<td>Mining induced seismic activity &gt; 100cm/s²</td>
<td>Additional cost of foundations: Stiffened strip footings or raft</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Geotechnical Conditions</td>
<td>Category or type</td>
<td>Criteria</td>
<td>Precautionary measures</td>
<td>Applicable areas</td>
<td>Comment</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------</td>
<td>----------</td>
<td>------------------------</td>
<td>-----------------</td>
<td>---------</td>
</tr>
<tr>
<td>Topography</td>
<td>Category 1</td>
<td>Average ground slope flatter than 1:20</td>
<td>Increase depth of sewer &amp; provision of pump station</td>
<td>20%</td>
<td>Estimated from contour data</td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>Average ground slope of between 1:11 and 1:20</td>
<td>Terracing for houses &amp; additional earthworks to roads &amp; storm water control measures</td>
<td>30%</td>
<td>Estimated from contour data</td>
</tr>
<tr>
<td></td>
<td>Category 3</td>
<td>Average ground slope of between 1:7.5 and 1:10</td>
<td>Terracing for houses &amp; additional earthworks to roads &amp; storm water control measures</td>
<td>20%</td>
<td>Estimated from contour data</td>
</tr>
<tr>
<td></td>
<td>Category 4</td>
<td>Average ground slope of between 1:5 and 1:7.4</td>
<td>Terracing for houses &amp; additional earthworks to roads &amp; storm water control measures</td>
<td>20%</td>
<td>Estimated from contour data</td>
</tr>
<tr>
<td></td>
<td>Category 5</td>
<td>Average ground slope steeper than 1:5</td>
<td>Terracing for houses &amp; additional earthworks to roads &amp; storm water control measures</td>
<td>10%</td>
<td>Estimated from contour data</td>
</tr>
<tr>
<td>SCCCA</td>
<td>Southern Cape Coastal Condensation Area</td>
<td>Area subjected to severe condensation conditions</td>
<td>Plaster and paint on all external walls &amp; 6.4mm gypsum plasterboard ceilings &amp; 80mm thick glass fibre insulation</td>
<td>All areas</td>
<td>None</td>
</tr>
<tr>
<td>Location of development site</td>
<td>Site more than 20km from major centres</td>
<td>Additional cost of transportation</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Site classification

In terms of the South African Institution of Civil Engineering (SAICE) Code of Practice for Single Storey Structures of Masonry Construction (1995), the applicable site classifications are shown in Table 7 (also refer to Figure 8).
Table 7: SAICE site classification

<table>
<thead>
<tr>
<th>Geotechnical Constraint</th>
<th>Expected movement (mm)</th>
<th>NHBRC Site Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressible or collapsible soil (entire site)</td>
<td>5-10</td>
<td>C1</td>
</tr>
<tr>
<td>Active soil (entire site)</td>
<td>5-15</td>
<td>H-H1</td>
</tr>
<tr>
<td>Uncontrolled fill (localised)</td>
<td></td>
<td>P</td>
</tr>
</tbody>
</table>

Figure 8: Geotechnical map

8. Foundation recommendations and solutions

The following recommendations are given as a guideline based on the information gained from the investigation. Although the confidence in the information is high, some variation can be expected between the data points and the design engineers should take cognisance of this. The design of structures and services remains the responsibility of the appointed engineers. Any significant deviation from the expected geotechnical conditions should be brought to the author’s attention for comment.

8.1 Earthworks and structural foundations

Earthworks should be conducted in accordance with SABS 1200D, COLTO 3300 or other...
applicable standards. Foundations should be constructed in accordance with the NHBRC Home Builders Manual, SANS 10400-H and/or other applicable standards or as otherwise directed by the engineer.

The site may require some terracing and retaining walls to construct level platforms, especially nearer the valley lines. The recommended retaining wall system is concrete retaining block (CRB) walls. For planning purposes, the maximum safe height of a single-skin CRB wall with no reinforcement in the backfilling is 2m. Walls exceeding 2m may require basal reinforcement in the backfill or a second skin of blocks on the face. All retaining walls must have subsoil drains and free-draining backfill behind the wall. The recommended compaction of fill behind retaining walls and in is 95% Mod AASHTO density.

The recommended foundation system for the envisaged single and double-storey structures is lightly reinforced concrete strip foundations with an estimated allowable safe bearing pressure of 100kPa on well compacted residual soil at a nominal depth of 1m below NGL. Alternative systems could include light rafts on well compacted soil (min. 93% Mod AASHTO density). The soil obtained from excavations is unlikely to be suitable for use as filling material, but this is at the discretion of the engineer on site.

The following additional recommendations are provided at the discretion of the engineer:

- Localised heaps of uncontrolled fill that consist mainly of soil can be flattened and compacted during site clearance and earthworks. Any potentially deleterious fill material must be identified by the contractor for further attention of the engineer and should be carted to spoil.
- The finished floor level of all houses should be a minimum of 150mm above final ground level to prevent flooding.
- The ponding of storm water around the exterior of houses can be avoided by shaping the ground levels around the exterior to create a fall away from the house and constructing a 1m wide a concrete apron with a 10% fall away from the house. This will also assist in maintaining ground moistures stable and minimising erosion around the house.

8.2 Road pavements

Roads should be constructed in accordance with SAPEM, SABS 1200, COLTO 3000, TRH4, TRH14, The Red Book or other applicable standards, or as directed by the engineer.

Test results indicate that the subgrade is typically G8-10 quality with an inferred CBR of approximately 3-7.

General preparation of the road subgrade:

- Cut roadbed to line and level;
- Proof roll the *in situ* roadbed and compact to 90% of Mod. AASHTO density. Recommended moisture content before rolling is optimum moisture content (OMC) minus 2-3%;
- Remove any incompressible or wet soil and reinstate with imported G7 material or suitably drier organic-free *in situ* soil, as directed by the engineer.
Table 8 serves as a guideline for the design of a Category C flexible pavement in a wet region with a design life of 15 years with traffic loading of less than $3 \times 10^6$ E80s over 20 years (as per TRH4).

Table 8: Road layerworks recommendations (Cat C in wet climate)

<table>
<thead>
<tr>
<th>Layer</th>
<th>Material</th>
<th>Thickness mm</th>
<th>Required Compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal</td>
<td>Cape Seal</td>
<td>13/19</td>
<td>TBD by engineer</td>
</tr>
<tr>
<td>Base</td>
<td>Imported G2</td>
<td>150</td>
<td>100% MDD</td>
</tr>
<tr>
<td>Subbase</td>
<td>Imported G4</td>
<td>150</td>
<td>95% MDD</td>
</tr>
<tr>
<td>SSG</td>
<td>Imported G7 gravel</td>
<td>150</td>
<td>93% MDD</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seal</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Base</td>
<td>Interlocking cement pavers</td>
<td>80</td>
<td>n/a</td>
</tr>
<tr>
<td>Subbase</td>
<td>C4 (Imported G4/5)</td>
<td>150</td>
<td>95% MDD</td>
</tr>
<tr>
<td>SSG</td>
<td>Imported G7 gravel</td>
<td>150</td>
<td>93% MDD</td>
</tr>
</tbody>
</table>

9. Storm water drainage recommendations

The design and construction of storm water drainage should be carried out in accordance with The Red Book, SABS 1200LE, COLTO 2000, SANRAL Drainage Manual or other applicable standards, or as directed by the engineer.

Infiltration into the soil will be slow and restricted by fine grained soils of low permeability and a significant portion of rainfall will end up as run-off. The site generally has a positive slope and storm water can be directed into the natural watercourses that traverse the site. A well-planned road layout can assist with storm water management. Raised barrier kerbs, mountable or semi-mountable kerbs along roads are recommended in order to channel storm water along roads. The kerbs will also protect the road shoulder from erosion and edge break. Regularly spaced kerb inlets and storm water pipes are recommended to prevent storm water from overtopping kerbs and flowing into adjacent properties. Subsoil drains along upslope sides of roads and structures are recommended to cater for expected subsurface seepage across the site.

10. Special precautionary measures

The following special measures are recommended as a precaution:

- A geotechnical specialist should be involved in earthworks and the construction of foundations to assist the civil and structural engineers with quality control.
- Compaction control testing is essential during construction.

11. Conclusions

In terms of the geotechnical information gained from the investigation, the site is potentially suitable for the proposed development, but certain geotechnical constraints may affect development costs.
Appendix 1

Maps
PROJECT: Proposed new subsidy housing project
SITE: Erf 325, Pacaltsdorp, George

DRAWING: Locality map
DATE: 22 November 2013

Outeniqua Geotechnical Services
PO Box 3186
George Industria 6536
PROJECT: Proposed new subsidy housing project
SITE: Erf 325, Pacaltsdorp, George
DRAWING: Topography map
DATE: 22 November 2013

Legend
Project data
Erf 325 Pacaltsdorp George
Site boundary
Project data

ERF 325 Pacaltsdorp George

Site boundary

Legend

- Peninsula Fm
- Maalgaten Granite
- Kaaimans Group

PROJECT: Proposed new subsidy housing project
SITE: Erf 325, Pacaltsdorp, George
DRAWING: Locality map
DATE: 22 November 2013

Outeniqua Geotechnical Services
PO Box 3186
George Industria
6536
Appendix 2

Test pit profiles
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22.10.13
Excavator: TLB

**PD 1**

**Datum:** NGL
**Co-ords:** S34 00 11.1 E22 26 53.2

**Key to symbols:**
- ● Sample taken
- ▼ Groundwater

**Foundation Indicator**
- **(0 to 200)** Very moist, dark brown, loose, **CLAYEY SILTY SAND**, transported (Topsoil).
- **(200 to 900)** Moist, light red to light red orange, stiff, fissured & shattered, **GRAVELLY SANDY SILTY CLAY**, residual (Completely weathered granite).
- **(900 to 2000)** Moist, light red orange, dense, intact, **GRAVELLY CLAYEY SILTY SAND**, residual (Completely weathered granite).
- **(2000 to 2900)** Moist, light yellow orange, dense, intact, **SILTY GRAVELLY SAND**, residual (Completely weathered granite).

**Groundwater**

**Co-ords:** S34 00 11.1 E22 26 53.2

**Sample taken**

**Key to symbols:**
- ● Sample taken
- ▼ Groundwater

**Dynamic Cone Penetrometer (DCP)**

**Photo of Test Pit**

**PD 2**

**Datum:** NGL
**Co-ords:** S34 00 09.9 E22 26 57.9

**Key to symbols:**
- ● Sample taken
- ▼ Groundwater

**MOD/CBR/Indicator**
- **(0 to 700)** Very moist, dark brown, loose to medium dense, intact, **CLAYEY SILTY SAND**, transported (Topsoil).

**Perched water table @ 1200mm.**
**Geotechnical Soil Profile**

Client: Royal HaskoningDHV (Pty) Ltd  
Project: Erf 325, Pacaltsdorp, Housing Project  
Area: George  
Date: 22.10.13  
Excavator: TLB

**PD 3**  
Datum: NGL  
Co-ords: S34 00 08.7 E22 27 01.2  
Key to symbols:  
- ● Sample taken  
- ▼ Groundwater  

Foundation Indicator  
Very moist, dark brown, loose to medium dense, intact, **CLAYEY SANDY SILT**, transported (Topsoil).

Perched water table @ 500mm

Very moist, dark brown, loose to medium dense, intact, **CLAYEY SANDY SILTY SAND**, transported (Topsoil).  
Moist, dark brown to dark red orange, dense, fissured & slickensided, **GRAVELLY SILTY CLAYEY SAND**, residual (Completely weathered granite).

**PD 4**  
Datum: NGL  
Co-ords: S34 00 11.3 E22 27 02.7  
Key to symbols:  
- ● Sample taken  
- ▼ Groundwater  

Foundation Indicator  
Very moist, dark brown, loose to medium dense, intact, **CLAYEY SANDY Silt**, transported (Topsoil).  
Moist, dark brown to dark red orange, dense, fissured & slickensided, **GRAVELLY SILTY CLAYEY SAND**, residual (Completely weathered granite).
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacula, Housing Project
Area: George
Date: 22.10.13
Excavator: TLB

Datum: NGL
Co-ords: S34 00 12.7 E22 27 00.3

Key to symbols:
- Sample taken
- Groundwater

**Foundation indicator & Consolidation test**

**Perched water table @ 500mm.**

**PD 5**

Datum: NGL
Co-ords: S34 00 12.7 E22 27 00.3

Key to symbols: Sample taken

- 0 to 500:
  - Very moist, dark brown, loose to medium dense, intact, **CLAYEY SILTY SAND**, transported (Topsoil).
- 500 to 1400:
  - Moist, dark red orange, firm to stiff, intact, **GRAVELLY SANDY SILTY CLAY**, residual (Completely weathered granite).
- 1400 to 2300:
  - Moist, light red orange, dense, intact, **CLAYEY SILTY SANDY GRAVEL**, residual (Completely weathered granite).

**PD 6**

Datum: NGL
Co-ords: S34 00 14.2 E22 26 53.3

Key to symbols: Sample taken

- 0 to 450:
  - Very moist, dark brown, loose to medium dense, intact, **CLAYEY SILTY SAND**, transported (Topsoil).
- 450 to 600:
  - Very moist, light brown, dense, intact, **CLAYEY SILTY SANDY GRAVEL**, transported/pedogenic (Ferricrete layer).
- 600 to 1400:
  - Moist, dark red, stiff, fissured, **GRAVELLY SANDY SILTY CLAY**, residual (Completely weathered granite).
- 1400 to 2300:
  - Moist, light red orange, very dense, intact, **GRAVELLY SILTY CLAYEY SAND**, residual (Completely weathered granite).
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22.10.13
Excavator: TLB

PD 7
Datum: NGL  Co-ords: S34 00 19.0 E22 26 54.2

Key to symbols: ● Sample taken  ▾ Groundwater

Perched water table @ 700mm.

Very moist to wet, dark brown, loose to medium dense, intact, **SILTY SAND**, transported (Topsoil).

Very moist, dark red orange, dense, fissured, **CLAYEY SAND**, residual (Completely weathered granite).

Moist, light red orange, stiff, fissured & micro-shattered, **GRAVELLY SILTY SANDY CLAY**, residual (Completely weathered granite).

PD 8
Datum: NGL  Co-ords: S34 00 16.9 E22 26 58.9

Key to symbols: ● Sample taken  ▾ Groundwater

Perched water table & 450mm.

Very moist, dark brown, loose, intact, **CLAYEY SAND**, transported (Topsoil).

Very moist to wet, light brown, dense, intact, **CLAYEY SILTY SANDY GRAVEL**, transported/ pedogenic (Ferricrete layer).

Moist, dark red orange, stiff, fissured/shattered/slickensided, **GRAVELLY SANDY SILTY CLAY**, residual (Completely weathered granite).

Moist, light yellow orange to light red orange, stiff, fissured, **SILTY CLAY**, residual (Completely weathered granite).

Foundation Indicator
Perched water table @ 400mm.

Perched water table & 500mm.
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22. 10. 13
Excavator: TLB

**PD 11**
Datum: NGL
Co-ords: S34 00 19.1 E22 26 59.7

Key to symbols:
- ○ Sample taken
- ▼ Groundwater

**Foundation Indicator**

- **Very moist, dark brown, loose to medium dense, intact, CLAYEY SAND, transported & pedogenic. (Topsoil)**
- **Wet, light brown, dense, intact, CLAYEY SILTY SANDY GRAVEL, transported & pedogenic. (Ferricrete layer)**

**Water Seepage @ 500mm**

- **Moist to very moist, dark red to motled dark brown, GRAVELLY SILTY SANDY CLAY, residual. (Completely weathered granite)**
- **Moist, dark yellow orange, dense, intact, SILTY GRAVELY SAND, residual.**

**PD 12**
Datum: TOF
Co-ords: S34 00 20.1 E22 27 04.2

Key to symbols:
- ○ Sample taken
- ▼ Groundwater

**Moist, light red orange, loose to medium dense, intact, GRAVELY SILTY CLAYEY SAND, imported. (Fill -Soil)**

**Moist, dark brown, loose to medium dense, intact, SILTY SAND, transported. (Topsoil)**

**Moist, dark red brown, dense, intact, SILTY SANDY GRAVEL, transported & pedogenic. (Ferricrete)**

**Moist, dark red to dark red orange, stiff, micro-shattered & fissured, SILTY SANDY CLAY, residual (Completely weathered granite).**

**Moist, light yellow orange, dense, intact, SILTY SANDY GRAVEL, residual (Completely weathered granite).**
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22. 10. 13
Excavator: TLB

PD 13
Datum: NGL
Co-ords: S34 00 28.5 E22 26 57.6

Key to symbols:
● Sample taken
▼ Groundwater

Dynamic Cone Penetrometer (DCP)

Perched water table @ 400mm.

Very moist to wet, dark brown, loose, intact, SILTY SAND, transported (Topsoil).
Wet, dark red orange to light red orange, stiff, micro-shattered, SILTY SANDY CLAY, residual (Completely weathered granite).

Foundation Indicator

Very moist, light olive, dense, intact, GRAVELLY SILTY SAND, residual (Completely weathered granite).

PD 14
Datum: NGL
Co-ords: S34 00 27.6 E22 27 04.1

Key to symbols:
● Sample taken
▼ Groundwater

Dynamic Cone Penetrometer (DCP)

Very moist, dark brown, loose, intact, SILTY SAND, transported (Topsoil).
Moist, dark yellow orange, stiff, fissured, SILTY SANDY CLAYEY GRAVEL, residual (Completely weathered granite).
Moist, light red orange, dense to very dense, intact, SILTY SANDY GRAVEL, residual (Completely weathered granite).
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22.10.13
Excavator: TLB

**Foundation Indicator**

**PD 15**

Datum: NGL
Co-ords: S34 00 26.1 E22 27 08.2

Key to symbols:
- Circle: Sample taken
- Triangle: Groundwater

**Dynamic Cone Penetrometer (DCP)**

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<th>(mm/Blow)</th>
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<tbody>
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**Photo of Test Pit**

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**Description**

- **(0 to 200)**: Very moist to wet, dark brown, loose, intact, **SILTY SAND**, transported (Topsoil).
- **(200 to 400)**: Moist, dark red brown, medium dense/firm, intact, **CLAYEY SANDY GRAVEL**, residual (Completely weathered granite).
- **(400 to 1600)**: Moist, dark red orange, stiff, fissured, **GRAVELLY SILTY CLAYEY SAND**, residual (Completely weathered granite).
- **(1600 to 2800)**: Moist, light yellow orange, dense, intact, **SILTY GRAVELLY SAND**, residual (Completely weathered granite).

**PD 16**

Datum: NGL
Co-ords: S34 00 22.1 E22 27 15.3

Key to symbols:
- Circle: Sample taken
- Triangle: Groundwater

**Dynamic Cone Penetrometer (DCP)**

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**Photo of Test Pit**

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<th>(mm/Blow)</th>
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<tr>
<td>0</td>
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</tr>
<tr>
<td>-3000</td>
<td>-2500</td>
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</table>

**Description**

- **(0 to 650)**: Moist, dark brown, loose, voided, **SILTY SAND & BRICKS**, imported (Fill-rubble).
- **(650 to 1000)**: Moist, dark red brown to light red brown, medium dense, intact, **SILTY SAND**, transported (Topsoil).
- **(1000 to 2500)**: Moist, light yellow orange, dense, intact, **CLAYEY SILTY SANDY GRAVEL**, residual (Completely weathered granite).
Moist, light brown, dense, intact, **Silty Sandy Gravel**, residual (Completely weathered granite).

Moist, light brown, stiff, fissured, **Gravelly Silty Clayey Sand**, transported (Alluvium).

Moist, dark red orange, stiff, fissured & micro-shattered, **Gravelly Silty Sandy Clay**, residual (Completely weathered granite).

Moist, dark brown, loose to medium dense, intact, **Silty Sand**, transported (Topsoil).

Moist, light olive, dense, intact, **Clayey Silty Sandy Gravel**, residual (Completely weathered granite).
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22. 10. 13
Excavator: TLB

PD 19
Datum: NGL
Co-ords: S34 00 29.5 E22 27 12.3
Key to symbols:
- Sample taken
- Groundwater

Dynamic Cone Penetrometer (DCP)

Perched water table @ 800mm.

PD 20
Datum: NGL
Co-ords: S34 00 31.2 E22 27 09.0
Key to symbols:
- Sample taken
- Groundwater

Dynamic Cone Penetrometer (DCP)

Moist, dark red brown, stiff, micro-shattered, GRAVELLY SILTY SANDY CLAY, residual (Completely weathered granite with minor ferricrete nodules).
## Geotechnical Soil Profile

**Client:** Royal HaskoningDHV (Pty) Ltd  
**Project:** Erf 325, Pacaltsdorp, Housing Project  
**Area:** George  
**Date:** 22. 10. 13

**Excavator:** TLB

---

### PD 21

**Datum:** NGL  
**Co-ords:** S34 00 33.9 E22 27 11.3

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<td>0 to 300</td>
<td>Very moist, dark brown, loose to medium dense, intact, <strong>Silty Sand</strong>, transported (Topsoil).</td>
</tr>
<tr>
<td>300 to 650</td>
<td>Very moist to wet, dark red brown, medium dense to dense, intact, <strong>Silty Sandy Gravel</strong>, transported/pedogenic (Ferricrete).</td>
</tr>
<tr>
<td>650 to 1000</td>
<td>Moist to very moist, dark yellow orange, stiff, micro-shattered, <strong>Silty Sandy Clay</strong>, residual (Completely weathered granite).</td>
</tr>
<tr>
<td>1000 to 2500</td>
<td>Moist, light red, very stiff, fissured, <strong>Silty Clayey Sand</strong>, residual (Completely weathered granite).</td>
</tr>
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</table>

**Foundation indicator**

**Perched water table @ 950mm.**

---

### PD 22

**Datum:** NGL  
**Co-ords:** S34 00 30.1 E22 27 18.1

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</thead>
<tbody>
<tr>
<td>0 to 200</td>
<td>Very moist, dark brown, loose to medium dense, intact, <strong>Silty Sand</strong>, transported (Topsoil).</td>
</tr>
<tr>
<td>200 to 400</td>
<td>Moist, dark red brown, dense, intact, <strong>Silty Sandy Gravel</strong>, transported/pedogenic (Ferricrete).</td>
</tr>
<tr>
<td>400 to 1300</td>
<td>Moist, dark red orange, stiff, micro-shattered, <strong>Gravelly Silty Sandy Clay</strong>, residual (Completely weathered granite).</td>
</tr>
<tr>
<td>1300 to 1500</td>
<td>Moist, light red orange, very stiff, fissured, <strong>Silty Sandy Gravelly Clay</strong>, residual (Completely weathered granite).</td>
</tr>
<tr>
<td>1500 to 2500</td>
<td>Moist, light yellow orange, dense to very dense, intact, <strong>Silty Sandy Gravel</strong>, residual (Completely weathered granite).</td>
</tr>
</tbody>
</table>
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 09.10.13
Excavator: TLB

Photo of Test Pit
NGL

Datum: S34 00 05.7 E22 27 13.2
Co-ords: S34 00 29.2 E22 27 21.2

Key to symbols:
• Sample taken
▼ Groundwater

Dynamic Cone Penetrometer (DCP)

Moist, very moist, dark brown, loose to medium dense, intact, **SILTY SAND**, transported. (Topsoil)

(0 to 300)

Moist, dark red to brown, dense, fractured, **GRAVELLY SILTY SANDY CLAY**, transported & pedogenic (Some ferricrete)

(300 to 600)

Moist, dark red orange, stiff, micro shattered, **GRAVELY SILTY SANDY CLAY**, residual (Completely weathered granite)

(600 to 1400)

Light yellow orange, moist, dense, intact, **SILTY SANDY GRAVEL**, residual. (Completely weathered granite)

(1400 to 2600)

Foundation Indicator

PD23

PD24

Datum: NGL
Co-ords: S34 00 05.7 E22 27 13.2

Key to symbols:
• Sample taken
▼ Groundwater

Dynamic Cone Penetrometer (DCP)

Moist to very moist, dark brown, loose to medium dense, **CLAYEY SILTY SAND**, transported. (Topsoil)

(0 to 300)

MOD/CBR/Indicator

Very moist, dark brown to light brown, dense intact, **CLAYEY SILTY SANDY GRAVEL**, transported & pedogenic (Ferricrete layer)

(300 to 500)

Moist, dark red, very stiff, fissured & micro-shattered, **GRAVELY SILTY SANDY CLAY**, residual (Completely weathered granite)

(500 to 900)

Moist, dark red orange to light red orange, dense, fissured, **CLAYEY SILTY SANDY GRAVEL**, residual (Completely weathered granite)

(900 to 2500)

A B C D
Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22-Oct
Excavator: TLB

Geotechnical Soil Profile

PD 25
Datum: NGL
Co-ords: S34 00 07.1 E22 27 10.3

Key to symbols:
- Sample taken
- Groundwater

Foundation Indicator

Moist, to very moist, dark brown, loose to medium dense, intact, GRAVELLY CLAYEY SILTY SAND, transported (Minor ferricrete)
Moist, dark red orange, stiff, micro-shattered, GRAVELLY SILTY SANDY CLAY, residual (Completely weathered granite)
Moist, light yellow orange, dense, intact, SILTY SANDY GRAVEL, residual.

PD 26
Datum: NGL
Co-ords: S34 00 10.5 E22 27 09.2

Key to symbols:
- Sample taken
- Groundwater

Foundation Indicator

Very moist, dark brown, loose to medium dense, GRAVELLY CLAYEY SILTY SAND, transported (Minor ferricrete gravel)
Moist, dark red orange, very stiff, GRAVELLY SILTY SANDY CLAY, residual (Completely weathered granite)
Moist, light red orange, stiff, micro shattered, GRAVELLY SILTY CLAYEY SAND, residual (Completely weathered granite)
Moist, light yellow orange, dense, SILTY SANDY GRAVEL, residual (Completely weathered granite)
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 09.10.13
Excavator: TLB

PD 27
Datum: NGL
Co-ords: S34 00 13.9 E22 27 13.9

Key to symbols:

- ■ Sample taken
- ▼ Groundwater

MOD/CBR/Indicator

(0 to 700)
Very moist, dark brown, loose to medium dense, intact, SILTY SAND, transported (Topsoil)

(700 to 1250)
Moist to very moist, dark brown, stiff, micro-shattered, GRAVELLY SILTY SANDY CLAY, residual (Completely weathered granite)

Foundation Indicator

(1250 to 1600)
Moist, dark red orange, stiff, micro-shattered, GRAVELLY SILTY SANDY CLAY, residual (Completely weathered granite)

(1600 to 2300)
Moist, light yellow orange to light yellow orange, dense, intact, SILTY SANDY GRAVEL, residual (Completely weathered granite)

Water Seepage @ 1100mm

PD 28
Datum: NGL
Co-ords: S34 00 11.4 E22 27 18.1

Key to symbols:

- ■ Sample taken
- ▼ Groundwater

(0 to 200)
Very moist, dark brown, loose to medium dense, intact, GRAVELLY SILTY SAND, transported (Topsoil)

(200 to 700)
Moist, dark red brown, stiff, micro-shattered, GRAVELLY SILTY SANDY CLAY, residual (Completely weathered granite)

Foundation Indicator

(700 to 1800)
Moist, light red, very stiff, micro-shattered, SILTY SANDY CLAY, residual (Completely weathered granite)

(1800 to 2400)
Moist, dark yellow orange to light yellow orange, dense, intact, SILTY SANDY GRAVEL, residual (Completely weathered granite)

Water Seepage @ 300mm
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22.10.13
Excavator: TLB

PD 29
Datum: NGL
Co-ords: S34 00 07.8 E22 27 20.9
Key to symbols: ● Sample taken ▼ Groundwater

Dynamic Cone Penetrometer (DCP)

Sample taken

Groundwater

Photo of Test Pit

(Final to 450)

Very moist, dark red brown, loose to medium dense, intact, SILTY SAND, transported (Topsoil)

Very moist, dark red brown, dense, intact, SILTY SANDY GRAVEL, transported/residual (Ferricrete layer)

Moist, dark red orange, very stiff, micro-shattered, SILTY SANDY CLAY, residual (Completely weathered granite)

Moist, light red orange, very dense, intact, CLAYEY GRAVELLY SILTY SAND, residual (Completely weathered granite)

PD 30
Datum: NGL
Co-ords: S34 00 09.4 E22 27 25.2
Key to symbols: ● Sample taken ▼ Groundwater

Dynamic Cone Penetrometer (DCP)

Sample taken

Groundwater

Photo of Test Pit

(Final to 300)

Very moist, dark red brown, loose to medium dense, intact, SILTY SAND, transported (Topsoil)

Very moist, dark red brown, dense, intact, SILTY SANDY GRAVEL, transported/residual (Ferricrete layer)

Moist, dark red orange, very stiff, micro-shattered, SILTY SANDY CLAY, residual (Completely weathered granite)

Moist, light red orange, very dense, intact, CLAYEY GRAVELLY SILTY SAND, residual (Completely weathered granite)
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22.10.13
Excavator: TLB

**PD 31**
Datum: NGL
Co-ords: S34 00 13.5 E22 27 25.1

Key to symbols:
- ● Sample taken
- ▼ Groundwater

**Dynamic Cone Penetrometer (DCP)**

**Photo of Test Pit**

**Foundation Indicator**

- **A**
- **B**
- **C**
- **D**

<table>
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<th>Depth (mm)</th>
<th>(mm/Blow)</th>
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**Key to symbols:**
- Very moist, dark brown, loose to medium dense, intact, **SILTY SAND**, transported.
- Wet, dark red brown, dense, intact, **SILTY SANDY GRAVEL**, transported/pedogenic (Ferricrete gravel)
- Very moist, dark red brown to light brown, stiff, fissured, **SILTY CLAYEY SAND**, residual (Completely weathered granite)
- Moist, light red to light red orange, stiff to very stiff, fissured, **SILTY CLAYEY SAND**, residual (Completely weathered granite)

**Water seepage @ 900mm**

**PD 32**
Datum: NGL
Co-ords: S34 00 18.1 E22 27 22.9

Key to symbols:
- ● Sample taken
- ▼ Groundwater

**Dynamic Cone Penetrometer (DCP)**

**Photo of Test Pit**

**Foundation Indicator**

- **A**
- **B**
- **C**
- **D**

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**Key to symbols:**
- Very moist, dark brown, loose to medium dense, intact, **SILTY SAND**, transported (Topsoil)
- Moist, light red orange, stiff, fissured, **SILTY SANDY CLAY**, residual (Completely weathered granite)
- Moist, light yellow orange, stiff, fissured, **GRAVELLY SANDY CLAY**, residual (Completely weathered granite)
- Moist, light brown to light yellow orange, dense, intact, **CLAYEY SILTY SANDY GRAVEL**, residual (Completely weathered granite)
# Geotechnical Soil Profile

**Client:** Royal HaskoningDHV (Pty) Ltd  
**Project:** Erf 325, Pacaltsdorp, Housing Project  
**Area:** George  
**Date:** 22.10.13  
**Excavator:** TLB

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<th>Co-ords: S34 00 19.3 E22 27 28.1</th>
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### PD 33

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<th>Depth (mm)</th>
<th>Material Description</th>
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<tbody>
<tr>
<td>(0 to 650)</td>
<td>Moist, dark red brown, loose to medium dense, intact, <strong>SILTY SAND</strong> (Topsoil)</td>
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<tr>
<td>(650 to 950)</td>
<td>Moist, light yellow orange, medium dense, intact, <strong>SILTY SAND</strong>, transported (Alluvium)</td>
</tr>
<tr>
<td>(950 to 1850)</td>
<td>Moist, light red orange, stiff, fissured, <strong>GRAVELLY SANDY SILTY CLAY</strong>, residual (Completely weathered granite)</td>
</tr>
<tr>
<td>(1850 to 2900)</td>
<td>Moist, light yellow orange to light brown, dense, intact, <strong>CLAYEY SILTY SANDY GRAVEL</strong>, residual (Completely weathered granite)</td>
</tr>
</tbody>
</table>

### PD 34

<table>
<thead>
<tr>
<th>Depth (mm)</th>
<th>Material Description</th>
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<tr>
<td>(0 to 400)</td>
<td>Moist, dark brown, loose to medium dense, intact, <strong>SILTY SAND</strong>, transported</td>
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<tr>
<td>(400 to 950)</td>
<td>Moist, dark red brown, dense, intact, <strong>SILTY SANDY GRAVEL</strong>, transported/pedogenic (Ferricrete layer)</td>
</tr>
<tr>
<td>(950 to 2900)</td>
<td>Moist, light red orange to dark red orange, stiff to very stiff, intact, <strong>GRAVELLY SANDY SILTY CLAY</strong>, residual (Completely weathered granite)</td>
</tr>
</tbody>
</table>
Geotechnical Soil Profile

Client: Royal HaskoningDHV (Pty) Ltd
Project: Erf 325, Pacaltsdorp, Housing Project
Area: George
Date: 22.10.13
Excavator: TLB

Key to symbols:
- Sample taken
- Groundwater

Foundation Indicator

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<th>Depth (mm)</th>
<th>Soil Type and Description</th>
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<td>Moist, dark brown, loose to medium dense, intact, <strong>Silty Sand</strong>, transported (Topsoil)</td>
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<td>(300 to 700)</td>
<td>Very moist to wet, dark red brown, dense, intact, <strong>Silty Sandy Gravel</strong>, transported/residual (Ferricrete layer)</td>
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<td>Moist, dark yellow orange, stiff, micro-shattered, <strong>Silty Clay</strong>, residual (Completely weathered granite)</td>
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<td>(1100 to 1800)</td>
<td>Moist, light red, very stiff, fissured, <strong>Gravelly Silty Clayey Sand</strong>, residual (Completely weathered granite)</td>
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<td>(1800 to 2400)</td>
<td>Moist, light red orange, dense to very dense, intact, <strong>Clayey Silty Sandy Gravel</strong>, residual (Completely weathered granite)</td>
</tr>
</tbody>
</table>

Water seepage @ 700mm
Appendix 3

Lab test data
Notes:

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimens sampled by Shane Gallant
- The weather conditions are such that there is no detrimental effect on the sample taken.

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### TEST REPORT

**FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)**

**Material Description:** Dark Brown - Clayey Silt  
**Sample Number:** 53233  
**Position:** PD3 - Layer 1  
**Depth:** 0-400

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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<tbody>
<tr>
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<td>63.0</td>
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<td>37.5</td>
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<td>31</td>
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</table>

**Particle Size Distribution**

**Plasticity Chart**

**Potential Expansiveness**

---

**Notes:**

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimens sampled by: Shane Gallant
- The weather conditions are such that there is no detrimental effect on the sample taken.

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---

Directors/Direkteure:  
D McDonald  
Reg. Eng. Tech (Managing/Bestuurende)  
L Heathcote  
B-Tech. Civil  
Miss A Govender
### Notes:

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimen sampled by Shane Gallant
- The weather conditions are such that there is no detrimental effect on the sample taken.

---

**Unified Soil Classification**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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**Potential Expansiveness**

- **Clay Fraction Of Whole Sample**
- **Plasticity Index Of Whole Sample**

**Material Description:** Light Reddish Orange - Gravelly Sand

**Position:** PD3 - Layer 3

**Depth:** 800-2900

**Liquid Limit:** 28

**Linear Shrinkage:** 19.9

**Particle Size Distribution**

---

**FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)**

**Material Description:** Light Reddish Orange - Gravelly Sand

**Sample Number:** 53234

**Date Received:** May 09

**Date Reported:** 09/11/13

**Req. Number:** 3013/13

**Depth:** 800-2900

**Position:** PD3 - Layer 3

**Liquid Limit:** 28

**Linear Shrinkage:** 19.9

**Plasticity Index:** 6

---

**R-FIND-1-4**

**OUTENIQUA LAB (Pty) Ltd**

**P.O. Box 434, George 6530**

**Tel:** 044 874 3274  **Fax:** 044 874 5579  **e-mail:** llewelyn@outeniqualab.co.za

---

**Directors/Direkteure:**
- D McDonald
- Reg. Eng. Tech (Managing/Bestuurende)
- L Heathcote
- B-Tech. Civil
- Miss A Govender

---

**L Heathcote (Director)**

For Outeniqua Lab (Pty) Ltd.

---

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TEST REPORT

FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

Material Description: Dark Brown to Dark Reddish Orange - Clayey Silt Sand
Position: PD4 - Layer 2
Depth: 300-900

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<th>Sieve Size (mm)</th>
<th>% Passing</th>
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% Clay 19  % Silt 32  % Sand 35  % Gravel 14

Unified Soil Classification CL  PRA Soil Classification A-6

Plasticity Index 16  Insitu M/C% 21.6

Notes:
1. Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
2. All specimen sampled by: Shane Gallant
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L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.
TEST REPORT

FOUNDATION INDICATOR - (TMH 1 Method A1(a), A2, A3, A4, A5) & (ASTM Method D422)

Material Description: Dark Red Orange - Silty Clay
Sample Number: 53236
Position: PD5 - Layer 2
Depth: 500-1400

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</table>

% Clay 45  % Silt 39  % Sand 12  % Gravel 4

Unified Soil Classification: CL  PRA Soil Classification: A-6

Notes:

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L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.

TEST REPORT

FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

Material Description: Dark Red - Gravelly Clay
Sample Number: 53237
Position: PD6 - Layer 3
Depth: 600-1400

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</tbody>
</table>

% Clay 48  % Silt 10  % Sand 13  % Gravel 29

Unified Soil Classification MH  PRA Soil Classification A-7-5

Plasticity Chart

Potential Expansiveness

Notes:
- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimen sampled by: Shane Gallant
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For Outeniqua Lab (Pty) Ltd.
Notes:

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### TEST REPORT

**FOUNDATION INDICATOR** - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

<table>
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<tr>
<th>Material Description:</th>
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<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

### Plasticity Chart

- **A Line**
- **Potential Expansiveness**

---

**Notes:**

- *Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1*
- *All specimen sampled by: Shane Gallant*
- *The weather conditions are such that there is no detrimental effect on the sample taken.*

---

**1.** Sampling falls outside the scope of Outeniqua Lab's SANAS accreditation.

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---

**Directors/Direkteure:**
- D McDonald Reg. Eng. Tech (Managing/Bestuurende)
- L Heathcote B-Tech. Civil
- Miss A Govender

---

**For Outeniqua Lab (Pty) Ltd.**

L Heathcote (Director)

---

### Unified Soil Classification

- **MH**
- **PRA Soil Classification**

### PRA Soil Classification

- **A-7-5**

---

**OUTENIQUA LAB (Pty) Ltd**

Materials Testing Laboratory

Registration No: 95/0742107

6 Mirrorball Street, George : PO Box 3186, George Industria, 6536

Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za
Notes:

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimens sampled by : Shane Gallant
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L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.

Material Description: Dark Red Orange to Light Reddish Orange - Clay Silt

Position: PD13 - Layer 2

Depth: 400-1600

Sample Number: 29

Liquid Limit: 29

Linear Shrinkage: 7

Insitu M/C%: 21.7

% Passing

- 75.0: 100
- 63.0: 100
- 53.0: 100
- 37.5: 100
- 26.5: 100
- 19.0: 100
- 13.2: 98
- 9.5: 95
- 6.7: 93
- 4.75: 91
- 2.36: 88
- 1.18: 87
- 0.600: 85
- 0.425: 84
- 0.075: 81
- 0.0574: 77
- 0.0413: 73
- 0.0199: 58
- 0.0060: 47
- 0.0043: 43
- 0.0031: 42
- 0.0022: 38
- 0.0013: 38

Notes:
- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimen sampled by: Shane Gallant
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Tel: 044 874 3274 : Fax: 044 874 5579 : e-mail: llewelyn@outeniqualab.co.za
OUTENIQUA LAB (Pty) Ltd
Materials Testing Laboratory
Registration No. 95/0742107
6 Mirobal Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za

Customer: Royal HaskoningDHV (Pty) Ltd.
Project: Erf 325 - Palesltsdorp East Housing - George

Date Received: 09/11/13

Date Reported: 24/10/13

No. of Pages: 11/25

TEST REPORT

FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

Material Description: Dark Reddish Brown - Silty Clayey Gravelly Sand
Position: PD15 - Layer 2
Depth: 200-400

<table>
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<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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<tbody>
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<td>4.75</td>
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<td>0.0022</td>
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</tbody>
</table>

% Clay: 22         % Silt: 21         % Sand: 31         % Gravel: 26

Unified Soil Classification: SM
PRA Soil Classification: A-7-6

Plasticity Chart

Plasticity Index

Liquid Limit

Potential Expansiveness

Plasticity Index Of Whole Sample

Clay Fraction Of Whole Sample

Notes:

1. Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
2. All specimen sampled by: Shane Gallant
3. The weather conditions are such that there is no detrimental effect on the sample taken.

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L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.

Notes:

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---

Material Description: Dark Reddish Orange - Silty Sandy Clay
Sample Number: 53243
Position: PD17 - Layer 2
Depth: 250-930

<table>
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<tr>
<th>Sieve Size (mm)</th>
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</table>

% Clay: 44  % Silt: 24  % Sand: 25  % Gravel: 7

Unified Soil Classification: MH  PRA Soil Classification: A-7-5
Notes:

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimens sampled by: Shane Gallant
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Test Report

Foundation Indicator - (TMH 1 Method A1(a), A2, A3, A4, A5) & (ASTM Method D422)

Material Description: Dark Reddish Brown - Silty Clay
Sample Number: 53246

Position: PD19 - Layer 2
Liquid Limit: 44

Depth: 500-900
Plasticity Index: 21

Results reported in this Test Report relate only to the items tested and are an indication only of the sample provided and/or taken.

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For Outeniqua Lab (Pty) Ltd.

Notes:

1. Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
2. All specimens sampled by: Shane Gallant
3. The weather conditions are such that there is no detrimental effect on the sample taken.

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**Notes:**

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---

### Unified Soil Classification

- Material Description: Light to Dark Reddish Orange - Silty Clay
- Position: PD20 - Layer 3
- Depth: 850-2350

### Particle Size Distribution

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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<tbody>
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### Plasticity Chart

- A Line

### Potential Expansiveness

- A-6

---

**Attention:** Theo Adams

**Project:** Erf 325 - Pacaltsdorp East Housing - George

**Date Received:** 09/11/13

**Sample Number:** 53247

**Material Description:** Light to Dark Reddish Orange - Silty Clay

**Position:** PD20 - Layer 3

**Depth:** 850-2350

**Date Reported:** 24/10/13

**Sample Number:** 3013/13

---

**OUTENIQUA LAB (Pty) Ltd**

Materials Testing Laboratory

Registration No. 95/07742/07

6 Mirrorball Street, George  :    PO Box 3186, George Industria, 6536

Tel: 044 8743274   :   Fax: 044 8745779   :   e-mail: llewelyn@outeniqualab.co.za
Notes:

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- All specimens sampled by Shane Gallant
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1. Sampling falls outside the scope of Outeniqua Lab's SANAS accreditation.

OUTENIQUA LAB (Pty) Ltd
Materials Testing Laboratory
Registration No. 95/07742/07
6 Mirrorball Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8765779 : e-mail: llewelyn@outeniqualab.co.za

Customer : Royal HaskoningDHV (Pty) Ltd. Project : Erf 325 - Pacaltsdorp East Housing - George
PO Box 434 Date Received : 24/10/13
George Date Reported : 09/11/13
6530 Req. Number : 3013/13

Material Description: Dark Yellow Orange - Clay Silt
Position: PD21 - Layer 4
Depth: 950-1600

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<th>% Passing</th>
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% Clay 40 % Silt 49 % Sand 10 % Gravel 1

Unified Soil Classification CL-ML
PRA Soil Classification A-4

Plasticity Index

Potential Expansiveness

L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.

Notes:

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L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.
TEST REPORT

FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

Material Description: Dark Reddish Orange - Silty Clay
Sample Number: 53251

Position: PD25 - Layer 2
Depth: 350-1400

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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<tr>
<td>37.5</td>
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<td>26.5</td>
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<td>1.18</td>
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</table>

% Clay 38  % Silt 32  % Sand 12  % Gravel 18

Unified Soil Classification CL
PRA Soil Classification A-6

Plasticity Chart
A Line

Potential Expansiveness

Notes:
- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimens sampled by: Shane Gallant
- The weather conditions are such that there is no detrimental effect on the sample taken.

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L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.

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L Heathcote (Director)

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For Outeniqua Lab (Pty) Ltd.
L Heathcote (Director)

OUTENIQUA LAB (Pty) Ltd
Materials Testing Laboratory

Registration No. 95/0742/07
6 Mirrorball Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za

Customer : Royal HaskoningDHV (Pty) Ltd.
Project : Erf 325 - Pacaltsdorp East Housing - George

Date Received : 09/11/13

Date Reported : 24/10/13

Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
All specimen sampled by : Shane Gallant
The weather conditions are such that there is no detrimental effect on the sample taken.

TEST REPORT
FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

Material Description: Dark Reddish Brown to Light Brown - Silty Clay
Position: PD31 - Layer 3
Depth: 900-1800

Sample Number: 53257

Liquid Limit 20
Linear Shrinkage 4
Insitu M/C% 19.5

% Sand 60
% Gravel 4
% Clay 60
% Silt 28
% Sand 8
% Gravel 4

Unified Soil Classification CL
PRA Soil Classification A-4

Notes:
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2. All specimen sampled by : Shane Gallant
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For Outeniqua Lab (Pty) Ltd.

L Heathcote (Director)

TEST REPORT

FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Sample Number</th>
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</thead>
<tbody>
<tr>
<td>Light Reddish Orange - Silty Clay</td>
<td>53258</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Position</th>
<th>Liquid Limit</th>
<th>Linear Shrinkage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD32- Layer 2</td>
<td>56</td>
<td>13</td>
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<table>
<thead>
<tr>
<th>Depth</th>
<th>Plasticity Index</th>
<th>In-situ M/C%</th>
<th>Insitu M/C%</th>
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</thead>
<tbody>
<tr>
<td>350-1050</td>
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<table>
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<tr>
<th>Sieve Size (mm)</th>
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<td>63.0</td>
<td>100</td>
</tr>
<tr>
<td>53.0</td>
<td>100</td>
</tr>
<tr>
<td>37.5</td>
<td>100</td>
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<td>100</td>
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<td>13.2</td>
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<td>9.5</td>
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<td>6.7</td>
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<td>97</td>
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<td>2.36</td>
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<td>0.0012</td>
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</table>

Notes:
- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimen sampled by: Shane Gallant
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L. Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.

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For Outeniqua Lab (Pty) Ltd.

L Heathcote (Director)

May 09

Outeniqua Lab (Pty) Ltd
Materials Testing Laboratory
6 Mirrorball Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za

TEST REPORT

FOUNDATION INDICATOR - (TMH 1 Method A1(a), A2, A3, A4, A5) & (ASTM Method D422)

Material Description: Light Yellow Orange - Clayey Silty Sand

Position: PD32- Layer 3

Depth: 1050 - 1700

Sample Number: 53259

Liquid Limit 37

Linear Shrinkage 8

Plasticity Index 17

Insitu M/C% 15.6

% Sand
% Silt
% Clay
% Gravel

Unified Soil Classification CL
PRA Soil Classification A-6

L Heathcote (Director)
For Outeniqua Lab (Pty) Ltd.

Plasticity Chart

Plasticity Index

Liquid Limit

Particle Size Distribution

Cumulative percentage Passing

Particle Size (mm)

% Passing

75.0 100
63.0 100
53.0 100
37.5 100
26.5 100
19.0 100
13.5 100
9.5 100
6.7 100
4.75 98
2.36 89
1.18 75
0.600 62
0.425 57
0.075 54
0.0578 53
0.0415 51
0.0197 42
0.0061 32
0.0044 29
0.0031 28
0.0022 27
0.0013 27

Potential Expansiveness

Plasticity Index Of Whole Sample

Clay Fraction Of Whole Sample

0 5 10 15 20 25 30 35 40

Low

Potential Expansiveness

0 2 4 6 8 10 12 14 16 18 20

Low

Medium

High

Very High

Insitu M/C%
**Notes:**

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---

### TEST REPORT

**FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)**

<table>
<thead>
<tr>
<th>Material Description:</th>
<th>Dark Yellow Orange - Silty Clay</th>
<th>Sample Number:</th>
<th>53260</th>
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<tbody>
<tr>
<td>Position:</td>
<td>PD35- Layer 3</td>
<td>Liquid Limit</td>
<td>58</td>
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<tr>
<td>Depth:</td>
<td>700-1100</td>
<td>Plasticity Index</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In situ M/C%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### Particle Size Distribution

- **Cumulative percentage Passing**
- **Particle Size (mm)**

#### Plasticity Chart

- **Plasticity Index**
- **Liquid Limit**

#### Potential Expansiveness

- **Plasticity Index Of Whole Sample**
- **Clay Fraction Of Whole Sample**

---

**Material Description:**

- Dark Yellow Orange - Silty Clay

**Sample Number:** 53260

**Position:** PD35- Layer 3

**Depth:** 700-1100

**Liquid Limit:** 58

**Plasticity Index:** 22

**In situ M/C%:** N/A

---

**Notes:**

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- All specimen sampled by: Shane Gallant
- The weather conditions are such that there is no detrimental effect on the sample taken.

---

**Director/Direkteur:**

D McDonald  Reg. Eng. Tech (Managing/Bestuurende)  L Heathcote  B-Tech. Civil  Miss A Govender
The weather conditions are such that there is no detrimental effect on the sample taken.

Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1

Soil Mortar & Constants

Grading Modulus 0.83 0.83
Coarse Sand <2.0 >0.425 12.0 7.5
Med. <0.250 >0.150 55.1 57.5
Silt <0.075 32.9 34.9
Liquid Limit (%) SP 19
Plasticity Index (%) SP 3
Linear Shrinkage (%) 0.5 1.5

MOD 1967 1814
Opt Moisture Content (%) 10.5 14.8
Mould Moisture Con. (%) 10.8 14.8
@100% Mod AASHTO 99.7 100.1
Swell (%) 0.12 ≤1.5 ✓ 0.09 ≤1.5 ✓
100% NR (S) 95.8 96.0
Swell (%) 0.20 0.24
100% Proctor 92.9 93.1
Swell (%) 0.28 0.39
@100% Mod AASHTO 23 8
@98% Mod AASHTO 20 8
@95% Mod AASHTO 17 7
@93% Mod AASHTO 14 7
@90% Mod AASHTO 10 ≥10 * 7 ≥7 *

CBR 14 100

TRH 14 G8 G9
PRA System A-2-4 A-2-4
Unified System SM SM

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

Outeniqua Lab (Pty) Ltd.
Materials Testing Laboratory
Registration No. 950774207
6 Mirrormall Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyni@outeniqualab.co.za

Customer: Royal HaskoningDHV (Pty) Ltd.
PO Box 43
PO Box 43
Date Received: 10/05/13
Date Reported: 11/05/13
Reg. Number: 3013/13
No. of Pages: 1/3

Attention:
The uncertain () indicates that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (P) or non-compliant (N) opinion indicators are based on an approximate 95% level of confidence with reference to SANAS QM 18, Issue 2: 20 June 2007 Section 4.

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TEST REPORT

CALIFORNIA BEARING RATIO - (TMH 1 Method A1(a),A2,A3,A4,A5,A7,A8)

Material Indicators

<table>
<thead>
<tr>
<th>Sample Position (SV)</th>
<th>PD24 - Layer 1</th>
<th>PD27 - Layer 1</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Spec.</td>
<td>Spec.</td>
</tr>
<tr>
<td></td>
<td>G9 - TRH 14</td>
<td>G10 - TRH 14</td>
</tr>
<tr>
<td>Depth (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample No</td>
<td>53250</td>
<td>53253</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Material Description:

- Source: Trial Pit
- Colour: Dark Brown
- Soil Type: Clayey Silty Sand
- Classification: In-situ

Max. Stone size in hole (mm):

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>PD24</th>
<th>PD27</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75</td>
<td>96</td>
<td>99</td>
</tr>
<tr>
<td>9.4</td>
<td>94</td>
<td>99</td>
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<tr>
<td>19.0</td>
<td>100</td>
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<td>26.5</td>
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<td>37.5</td>
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<td>53.0</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>75.0</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Percentage Passing:

- >0.425 mm: 86%
- >0.075 mm: 45.5%
- >0.0 mm: 100%

Soil Mortar & Constants

<table>
<thead>
<tr>
<th>Property</th>
<th>PD24</th>
<th>PD27</th>
</tr>
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<tbody>
<tr>
<td>Grading Modulus</td>
<td>0.74</td>
<td>0.74</td>
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<tr>
<td>Coarse Sand &lt;2.00</td>
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<td>6.8</td>
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<tr>
<td>&lt;0.250 &gt;0.150</td>
<td>43.6</td>
<td>58.8</td>
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<tr>
<td>Silt &lt;0.075</td>
<td>48.6</td>
<td>34.4</td>
</tr>
<tr>
<td>Liquid Limit (%)</td>
<td>21</td>
<td>NP</td>
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<tr>
<td>Plasticity Index (%)</td>
<td>5</td>
<td>NP</td>
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<tr>
<td>Linear Shrinkage (%)</td>
<td>3.0</td>
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CVR / Density Relationship

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<th>Property</th>
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<tbody>
<tr>
<td>Max Dry Density (kg/m³)</td>
<td>1944</td>
<td>1955</td>
</tr>
<tr>
<td>Opt Moisture Content (%)</td>
<td>10.8</td>
<td>9.2</td>
</tr>
<tr>
<td>Mould Moisture Cond. (%)</td>
<td>11.1</td>
<td>9.1</td>
</tr>
<tr>
<td>100% Mod AASH/TO (%)</td>
<td>99.7</td>
<td>100.1</td>
</tr>
<tr>
<td>Swell (%) ≤1.5</td>
<td>0.43</td>
<td>0.43</td>
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<tr>
<td>100% NRB (%)</td>
<td>95.8</td>
<td>95.6</td>
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<tr>
<td>Swell (%) ≤1.5</td>
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<td>0.51</td>
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<tr>
<td>100% Proctor (%)</td>
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<tr>
<td>Swell (%) ≤1.5</td>
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<tr>
<td>100% Mod AASH/TO (%)</td>
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<td>98% Mod AASH/TO (%)</td>
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<td>95% Mod AASH/TO (%)</td>
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<td>93% Mod AASH/TO (%)</td>
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<td>90% Mod AASH/TO (%)</td>
<td>7</td>
<td>6</td>
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CBR

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<td>TRH 14</td>
<td>G9</td>
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<tr>
<td>Preparatory System</td>
<td>A-4</td>
<td>A-2-4</td>
</tr>
<tr>
<td>Unified System</td>
<td>SM-SC</td>
<td>SM</td>
</tr>
</tbody>
</table>

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- Specimens sampled by: Shane Gallant
- The weather conditions are such that there is no detrimental effect on the sample taken.

1. Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.
2. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (✓), non-compliant (✗) and uncertain (□) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2: 20 June 2007 Section 2.
3. The uncertain (□) indication that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (✓) or non compliant (✗) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2: 20 June 2007 Section 2.
4. The uncertain (□) indication that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (✓) or non compliant (✗) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2: 20 June 2007 Section 2.
5. The uncertain (□) indication that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (✓) or non compliant (✗) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2: 20 June 2007 Section 2.

L Heathcote (Director)  For Outeniqua Lab (Pty) Ltd
Technical Signatory

Directors: D McDonald (Reg. Eng. Tech. Civil) : L Heathcote (B-Tech. Civil) : Miss A Govender
Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.

In-situ Moisture Content (%)

For Outeniqua Lab (Pty) Ltd
L Heathcote (Director)

Material Indicators

Sieve Size

- Specifications sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 & MC1
- Specifications sampled by: Shane Gallant
- The weather conditions are such that there is no detrimental effect on the sample taken.

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256

Material Indicators

Sieve Analysis

Sieve Size

53256
SOILLAB
WESTERN CAPE

Attention: Lenaza

Customer: CGS Royal Haskoning DHV
Project: En 325: Plettiscorp East housing

PH and CONDUCTIVITY: pH - TMH1: A20; Conductivity: TMH1: A21T

<table>
<thead>
<tr>
<th>Sample</th>
<th>pH</th>
<th>Conductivity S/m</th>
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<td>PD1 - layer 1</td>
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</tr>
<tr>
<td>PD1 - layer 2</td>
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<td>PD1 - layer 3</td>
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<td>PD2 - layer 1</td>
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<tr>
<td>PD2 - layer 2</td>
<td>6.7</td>
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Yours truly,

SOILLAB Western Cape
### FOUNDATION INDICATOR REPORT

**CLIENT:** Oudtshoorn Geotechnical Services  
**PROJECT:** ERF 325 PACALTSDROP GEORGE  
**P.O. Box 3196**  
**GEORGE INDUSTRIA**  
**6536**  
**ATT:** Mr. I. Paton  
**DATE RECEIVED:** 2013-11-01  
**DATE TESTED:** 2013-11-12  
**DATE REPORTED:** 2013-11-22  
**TEST REPORT NO.:** 65175

#### SAMPLE NO.

<table>
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<th>500 - 1400</th>
<th>1150 - 1200</th>
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#### DESCRIPTION

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<th>cly st</th>
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#### SIEVE ANALYSIS % PASSING SIEVES: Method TMM1 A1(a) & A5

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<th>2.36 mm</th>
<th>1.18 mm</th>
<th>0.60 mm</th>
<th>0.30 mm</th>
<th>0.15 mm</th>
<th>0.075 mm</th>
<th>0.039 mm</th>
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<td>0.06 mm</td>
<td>50</td>
<td>40</td>
<td>33</td>
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<td>26</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0.02 mm</td>
<td>37</td>
<td>27</td>
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<tr>
<td>0.002 mm</td>
<td>35</td>
<td>26</td>
<td>16</td>
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#### HYDROMETER ANALYSIS: Method ASTM D422

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<td>0.06 mm</td>
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<tr>
<td>0.002 mm</td>
<td>35</td>
<td>26</td>
<td>16</td>
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</table>

#### ATTERBERG LIMITS: Method, TMM1 A2, A3 & A4

| LIQUID LIMIT | 43 | 26 | 24 |
| PLASTICITY INDEX | 18 | 13 | 8 |
| LINEAR SHRINKAGE | 5.5 | 6.0 | 4.0 |

#### PREDICTION OF HEAVY (VAN DER MERWE METHOD)

| PORE VOLUME | 14.0 | 12.5 | 8.0 |
| POTENTIAL EXPANSIVENESS | MILD LOW | LOW | LOW |

---

Technical Signature: [Signature]

Sample Prepared by: [Name]

Printed by: Control Lab
## CONSOLIDATION TEST

**CLIENT:** Oultonquin Geotechnical Services  
**PROJECT:** 325 Paarl  
**SAMPLE NO.:** R071  
**PROJECT NO.:** 66175  
**DEPT NO.:** 550-000/1  
**POS NO.:** 1136  
**BEAM RATIO:** 11

### SUMMARY OF READINGS

- **INITIAL DIAL READING:** 4.314 mm  
- **RING DIAMETER:** 70.8 mm  
- **H1:** 19.5 mm  
- **H2:** 10.4836 mm  
- **Dial Gauge Div:** 1

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<tr>
<th>LOAD (kN)</th>
<th>COMMENTS</th>
<th>PRESSURE (KPa)</th>
<th>DIAL READING (mm)</th>
<th>UNCORRECTED DEFLECTION (mm)</th>
<th>MACHINE CORRECTION (mm)</th>
<th>CORRECTED DEFLECTION (mm)</th>
<th>HEIGHT CHANGE (mm)</th>
<th>VOID RATIO</th>
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</table>

- **% COLLAPSE:** 0.4
CONSOLIDATION TEST

CLIENT: Outekene Geotechnical Service
PROJECT: ref. 325 Paalstadorp, George
PROJECT NO.: 66175
SAMPLE NO.: 9071
POSITION: P96
DEPTH: 550-600mm

SAMPLE DESCRIPTION: Silty Sand
STATE OF SAMPLE: Undisturbed

RULK DENSITY = 1871 kg/m³
DRY DENSITY = 1447 Kg/m³

INITIAL SATURATION = 20.30 %
INITIAL VOID RATIO = 0.8590 %

SPECIFIC GRAVITY (est) = 2.69
VOL. VÖIDS = 0.46207
VOL. SOILS = 0.53793
FINAL SATURATION = 0.92
FINAL MOISTURE CONTENT = 20.3 %
FINAL VOID RATIO = 0.6309

COLLAPSE 0.4
# CONSOLIDATION TEST

**CLIENT:** Outeniqua Geotechnical Services  
**PROJECT:** Ironside Precinct, George

**INITIAL DIAL READING:** 19.7 mm  
**RING DIAMETER:** 71 mm

<table>
<thead>
<tr>
<th>LOAD (kN)</th>
<th>PRESSURE (kPa)</th>
<th>DIAL READING (mm)</th>
<th>UNCOMPENSATED DEFLECTION (mm)</th>
<th>MACHINE DEFORMATION (mm)</th>
<th>HOEOMETER DEFORMATION (mm)</th>
<th>HEIGHT CHANGE (mm)</th>
<th>VOID RATIO</th>
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</thead>
<tbody>
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**% COLLAPSE:** 3.6
CONSOLIDATION TEST

CLIENT: Otteniqua Geotechnical Service
PROJECT: 925 Paarl, West Coast, George
SAMPLE NO.: 9072
PROJECT NO.: 68175
POSITION: P05
DEPTH: 509-1400mm

SAMPLE DESCRIPTION: Drilled core
STATE OF SAMPLE: Undisturbed
BULK DENSITY: 1.735
DRY DENSITY: 1.664 Kg/m³
INITIAL SATURATION: 11.980 %
INITIAL VOID RATIO: 0.8373

SPECIFIC GRAVITY (est): 2.69
VOL VOIDS: 0.45571
VOL SOLIDS: 0.54429
FINAL SATURATION: 0.36
FINAL MOISTURE CONTENT: 20.4 %
FINAL VOID RATIO: 0.5000

% COLLAPSE: 3.6

Diagram showing the relationship between effective normal stress (kPa) and void ratio.
## CONSOLIDATION TEST

### SUMMARY OF READINGS

**CLIENT:** Olifantsrivier Geotechnical Services  
**PROJECT:** mfl. 325 Paralldrop, George  
**PROJECT NO:** 68475  
**SAMPLE NO:** 5073  
**POSITION:** PD79  
**DEPTH:** 1150-1800 mm

<table>
<thead>
<tr>
<th>H1 = 19 mm</th>
<th>QUDOMETER NO: 13</th>
<th>BEAM RATIO: 11</th>
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</thead>
<tbody>
<tr>
<td>H2 = 12.4145 mm</td>
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</table>

**Dial Gauge Div:** 1

<table>
<thead>
<tr>
<th>LOAD (kg)</th>
<th>PRESSURE (Kpa)</th>
<th>DIAL READING (mm)</th>
<th>UNCORRECTED DEVIATION (mm)</th>
<th>MACH TRF CORR (mm)</th>
<th>CORRECTED DEVIATION (mm)</th>
<th>HEIGHT CHANGE (mm)</th>
<th>VOID RATIO</th>
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**% COllapse:** 1.0
# CONSOLIDATION TEST

**CLIENT:** Oudtshoorn Geotechnical Service  
**PROJECT:** erf. 325 Paarltdorp, George  
**PROJECT NO:** 66175  
**SAMPLE NO:** 9073  
**POSITON:** PD29  
**DEPTH:** 1150-1800mm

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>UA 1-5 at 325</th>
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<td>Final Void Ratio</td>
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<td>Initial Void Ratio</td>
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**Diagram:**

![Graph showing the relationship between Void Ratio and Effective Normal Stress (kPa)](image_url)
Appendix 4

DCP test data
TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 1
Datum Level: NGL

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TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 2
Datum Level: NGL

0 10 20 30 40 50 60 70 80 90 100

0 -200 -400 -600 -800 -1000 -1200 -1400 -1600 -1800 -2000

Depth (mm)

mm/Blow

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Datum Level: NGL

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 4

Datum Level: NGL

0

-200

-400

-600

-800

-1000

-1200

-1400

-1600

-1800

-2000

0 10 20 30 40 50 60 70 80 90 100

Depth (mm)

mm/Blow

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 5
Datum Level: NGL

mm/Blow

mm

Depth (mm)

0 10 20 30 40 50 60 70 80 90 100

0 -200 -400 -600 -800 -1000 -1200 -1400 -1600 -1800 -2000

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TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 6  Datum Level: NGL

Datum Level: NGL

mm/Blow

mm/Blow

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### TEST REPORT

**Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)**

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TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 8
Datum Level: NGL

Depth (mm)

0 10 20 30 40 50 60 70 80 90 100

mm/Blow

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 9
Datum Level: NGL

mm/Blow

---

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Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 10
Datum Level: NGL

Depth (mm)

mm/Blow

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 11

Datum Level: NGL

Depth (mm)

mm/Blow

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Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 12
Datum Level: NGL

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Datum Level: NGL

mm/Blow

0 10 20 30 40 50 60 70 80 90 100
-2000 -2000 -1800 -1600 -1400 -1200 -1000 -800 -600 -400 -200 0

0 10 20 30 40 50 60 70 80 90 100
-2000 -2000 -1800 -1600 -1400 -1200 -1000 -800 -600 -400 -200 0
TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 13
Datum Level: NGL

0
-200
-400
-600
-800
-1000
-1200
-1400
-1600
-1800
-2000
0 10 20 30 40 50 60 70 80 90 100

mm/Blow

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TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 14
Datum Level: NGL

0 10 20 30 40 50 60 70 80 90 100

mm/Blow

mm

Depth (mm)

0 200 400 600 800 1000 1200 1400 1600 1800 2000

0 10 20 30 40 50 60 70 80 90

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 15
Datum Level: NGL

Depth (mm)

0 10 20 30 40 50 60 70 80 90 100

mm/Blow

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 16
Datum Level: NGL

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No. of Pages: 16 of 35

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## TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

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### Datum Level:

NGL

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Members:  
D McDonald (Reg. Eng. Tech. Civil)  
I Paton (Pr.Sci.Nat. Geol)  
L Heathcote (B-Tech. Civil)  
Mass A Govender

Associates:  
A Cook Pr. Eng.

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Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 19

Datum Level: NGL

0 0
-200
-400
-600
-800
-1000
-1200
-1400
-1600
-1800
-2000

Depth (mm)

mm/Blow

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Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 20
Datum Level: NGL

Depth (mm):
0 10 20 30 40 50 60 70 80 90 100

mm/Blow:
0 10 20 30 40 50 60 70 80 90 100

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 21
Datum Level: NGL

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 22
Datum Level: NGL

Depth (mm)

mm/Blow

Datum Level:
NGL

Reference:

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Members:


TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 23  
Datum Level: NGL

Datum Level: NGL

mm/Blow

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

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Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 25

Datum Level: NGL

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 26
Datum Level: NGL

mm/Blow

0 10 20 30 40 50 60 70 80 90 100
-2000 -1800 -1600 -1400 -1200 -1000 -800 -600 -400 -200 0

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### TEST REPORT

**Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)**

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**Depth (mm)**

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**mm/Blow**

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 28
Datum Level: NGL

TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 29
Datum Level: NGL

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TEST REPORT
Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 30
Datum Level: NGL

mm/Blow

0 10 20 30 40 50 60 70 80 90 100
0 -200 -400 -600 -800 -1000 -1200 -1400 -1600 -1800 -2000

I Paton (Member)
For Outeniqua Geotech. Services cc.
Technical Signatory

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**TEST REPORT**

**Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)**

<table>
<thead>
<tr>
<th>Position</th>
<th>Datum Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>NGL</td>
</tr>
</tbody>
</table>

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I Paton (Member)
For Outeniqua Geotech. Services cc.
Technical Signatory

---

**Members:**
- D McDonald (Reg. Eng. Tech. Civil)
- I Paton (Pr.Sci.Nat. Geol)
- L Heathcote (B-Tech. Civil)
- Miss A Govender

**Associates:**
- A Cook Pr. Eng.
TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 32
Datum Level: NGL

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- L Heathcote (B-Tech. Civil)
- Miss A Govender

Associates:
- A Cook Pr. Eng.
TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 33
Datum Level: NGL

Depth (mm) vs. mm/Blow graph

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I Paton (Member)
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Technical Signatory
TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Datum Level: NGL

Position: 34

Depth (mm)

0 10 20 30 40 50 60 70 80 90 100

-200 -400 -600 -800 -1000 -1200 -1400 -1600 -1800 -2000

0 10 20 30 40 50 60 70 80 90 100

mm/Blow

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Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position: 35

Datum Level: NGL

mm/Blow

Depth (mm)

0 10 20 30 40 50 60 70 80 90 100

-200 -400 -600 -800 -1000 -1200 -1400 -1600 -1800 -2000

0 10 20 30 40 50 60 70 80 90 100

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