OUTENIQUA
GEOTECHNICAL SERVICES

Consulting Geotechnical Engineers and Engineering Geologists

Head Office
23 Clyde St
Knysna
PO Box 964
Knysna
6570
044 3820502(T)
044 3820503(F)
iain@outeniqualab.co.za

21 July 2023

Samantha Teeluckdhari
Eco Route Environmental Consultancy

**RE: PROPOSED NEW CEMETERY FOR BITOU MUNICIPALITY ON PORTION 33 OF HILLVIEW 437, PLETTENBERG BAY**

The geotechnical report for the above proposed developed, compiled by Outeniqua Geotechnical Services, dated 16 September 2013, refers. The Provincial Department of Environmental Affairs and Development Planning has requested that, in order to consider the application for environmental authorisation, the applicability of this original geotechnical report must be verified.

To this end, the original report has been reviewed and the current status of the site has been investigated to determine any subsequent changes which may affect the outcome of the original investigation and recommendations made therein.

The proposed site layout has been indicated on plan by Marike Vreken Town Planners (Alternative 1 – preferred layout, dated 27.9.2016). This proposed layout takes advantage of an area with relatively more suitable geotechnical conditions, which were encountered in “Area D”, as identified in the geotechnical report.

Following a review of the available data, including latest aerial imagery, the site was then visited to ground-truth the desktop assessment.

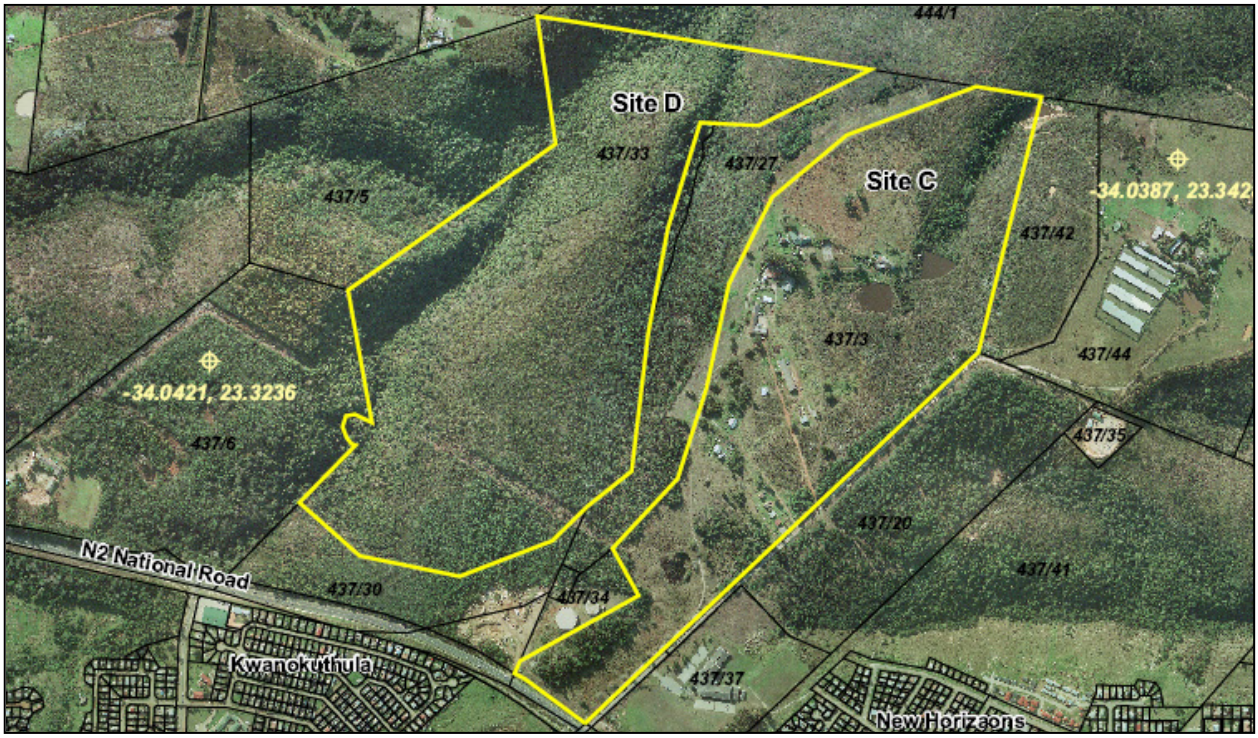
Based on the assessment of all available information, the original geotechnical report was deemed to be **applicable and valid** for use in the current environmental application process.

Yours faithfully

Iain Paton

# GEOTECHNICAL REPORT FOR A PROPOSED NEW CEMETERY IN PLETTENBERG BAY (BITOU MUNICIPALITY), WESTERN CAPE

16 September 2013




**Prepared by:**
**OUTENIQUA GEOTECHNICAL SERVICES**
**PO BOX 3186 GEORGE INDUSTRIA**
**6536**
**www.outeniqualab.co.za**

**Prepared for:**
**MARIKE VREKEN TOWN PLANNERS**
**PO BOX**
**KNYSNA**
**6570**

Ref: 2013\Marike Vreken\Bitou Cemetery\Geotech Report 16.9.2013 Rev0

Quality Control

| Revision No | Date | Prepared by: | Reviewed by: |
|---|---|---|---|
| 0 | 16.9.2013 | I.Paton Pr.Sci.Nat | D.McDonald Reg.Eng.Tech. |
| | |  |  |

Outeniqua Geotechnical Services cc is an independent consulting firm with no financial interest in the project, other than remuneration for work performed in the compilation of this report.

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## List of Appendices

# 1. Introduction
## 1.1 Background information

Outeniqua Geotechnical Services was appointed by Marike Vreken Town Planners on behalf of Bitou Municipality to conduct a geotechnical investigation for a proposed new cemetery facility for Plettenberg Bay. The envisaged development will consist of a graveyard, ablutions, maintenance rooms and possibly other community facilities.

Five potential sites (A to E) were identified by Bitou Municipality for an initial desk-top screening process, and from this exercise two potential sites were carried forward to a more detailed investigation (C and D). The detailed investigation involved conducting a subsurface investigation to determine if the sites are suitable in terms of the site geology and geotechnical conditions.

## 1.2 Terms of reference

The scope of work for the investigation is as follows:

- Determine soil conditions by way of excavating a limited number of test pits;
- Collect soil samples from representative horizons for laboratory testing to determine geotechnical parameters;
- Determine the suitability of the site for cemetery purposes in terms of the geotechnical parameters and provide recommendations for the design of possible structures and access roads.

# 2. Site description

The two sites that have been deemed worthy of further investigation, viz. Site C & D, are located adjacent to one another near the residential areas of Kwanokuthula and New Horizons in Plettenberg Bay (see **Figure 1**). Site C consists of three parcels of vacant land separated by natural drainage lines or existing dwellings on Portion 3 of Farm 437, which is privately owned by the Ebenezer Trust. Site D consists of a single parcel of land on Portion 33 of Farm 437, which is owned by SANRAL.

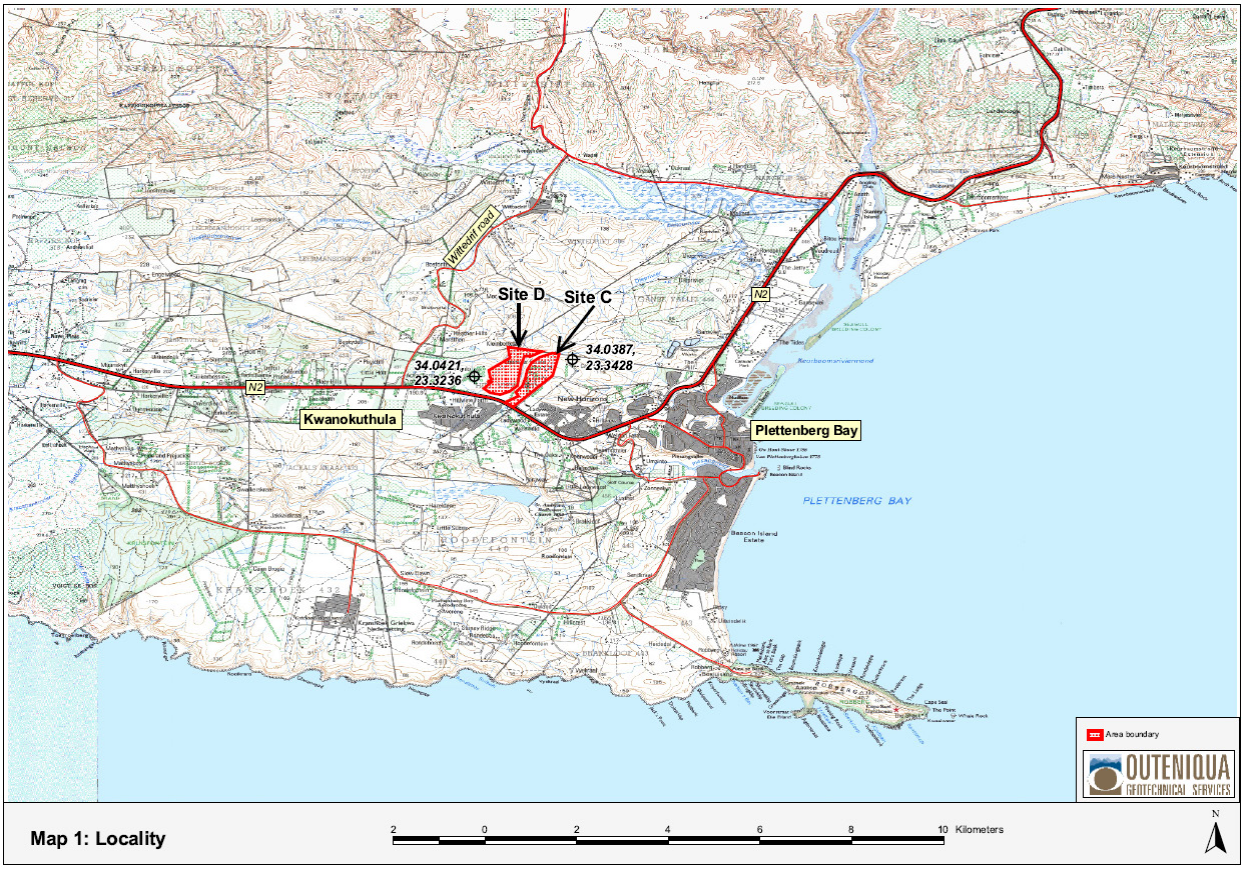



**Figure 1: Locality map**

The sites are positioned on gently undulating terrain at an altitude of 160-170m which then slopes steeply down into the surrounding valleys (see **Figures 2 & 3**). The vegetation is dominated by Fynbos on Site C and dense alien trees on Site D. There are well defined drainage lines along the valleys that surround the sites which flow towards the northeast into tributaries of the Bitou River.

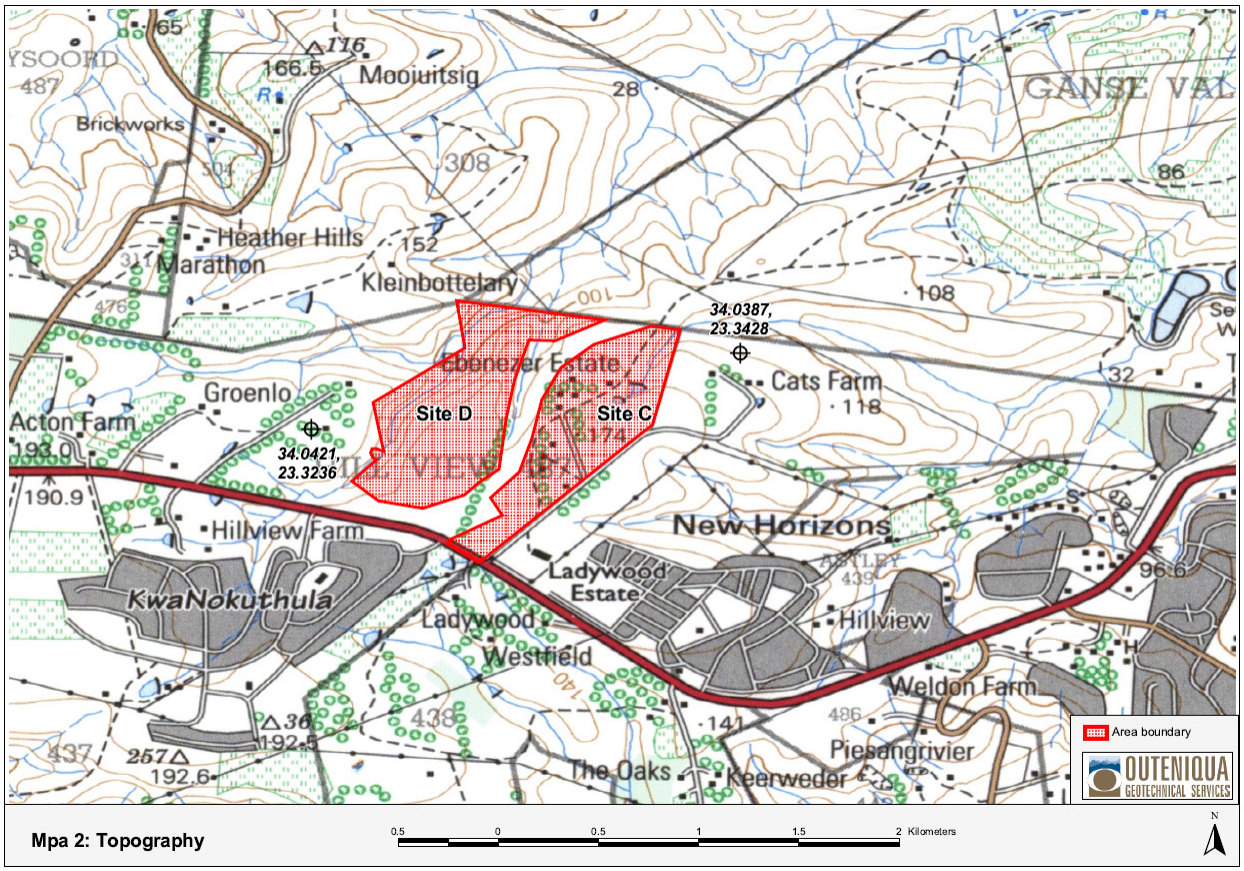



**Figure 2: Topography map**

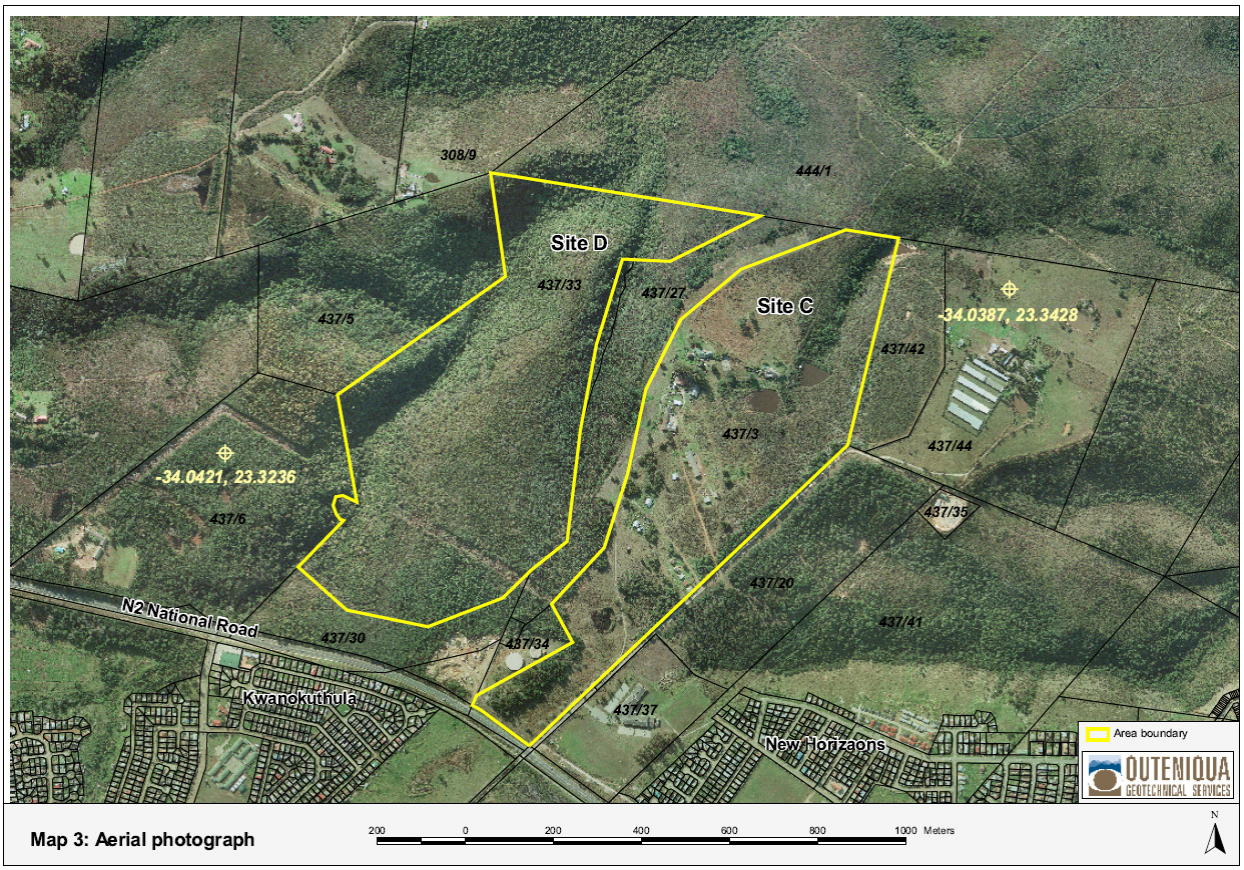



**Figure 3: Aerial photo of sites**

# 3. The method of investigation

## 3.1 Preliminary site information

The following information was obtained and studied as part of an initial desk study before the site work commenced:

- 1:250 000 Geological map of the area, obtained from the Council for Geoscience;
- Aerial imagery, obtained from Google Earth;
- 1:50 000 topographic maps, obtained from the Surveyor General.
- Cadastral plans for the area, obtained from the Surveyor General.

## 3.2 Regional geology

The 1:250 000 Geological map of the area (Sheet 3322) indicates that the sites are underlain by sedimentary rocks of the Peninsula, Cedarberg and Goudini Formations of the Table Mountain Group (see **Figure 4**). These basal rocks were deposited during the Ordovician to Silurian era and consist mainly of sandstone and shale formations. Sediments of the Uitenhage Group, which were deposited during the Cretaceous period, occur to the

north and south of the sites. Thick Quaternary alluvial sediments are found along natural drainage lines that surround the sites.

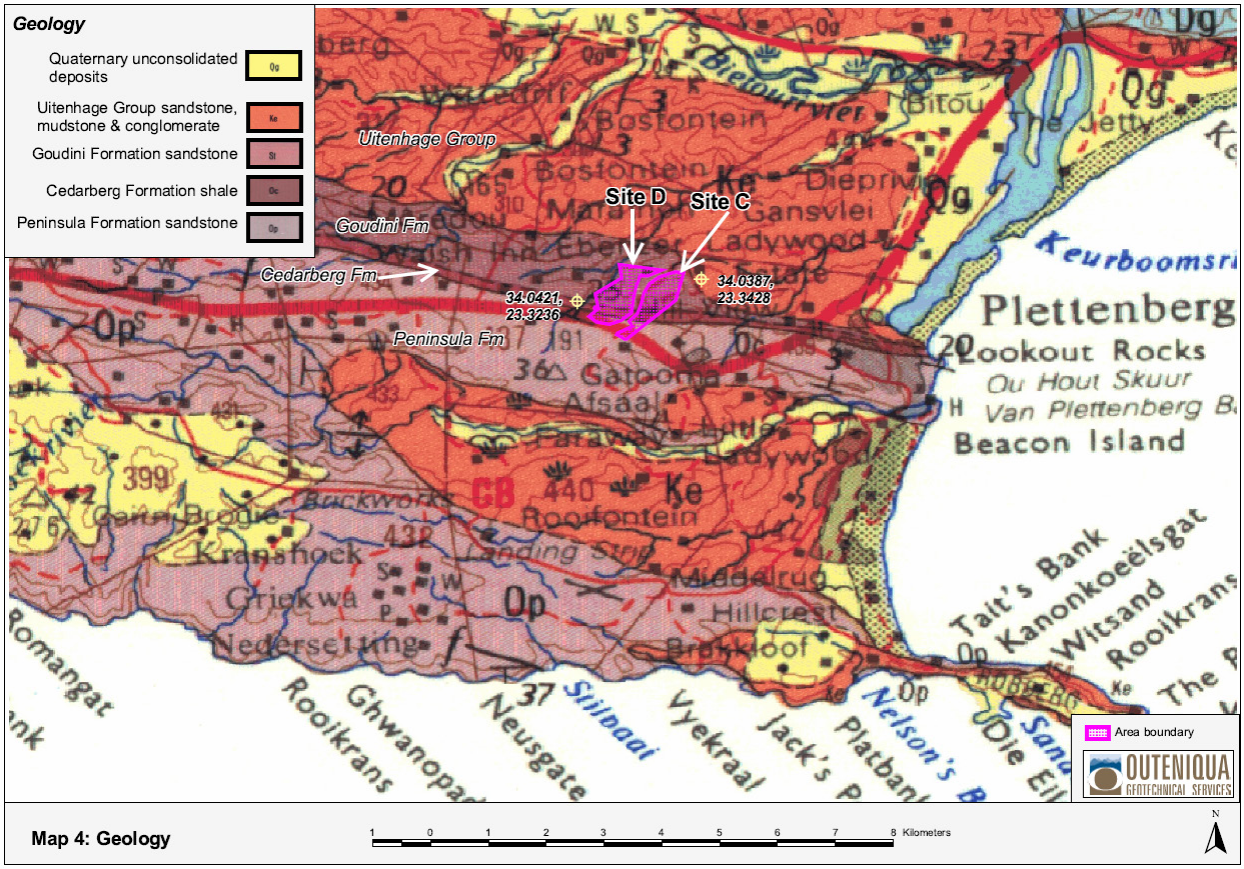



**Figure 4: Geological map**

The basal Table Mountain Group (TMG) rocks were subjected to orogenic (mountain building) compression events associated with the formation of the Cape Fold Belt. Subsequently these rocks were eroded along the coast during marine transgressions (rising sea levels) which resulted in process of gradual peneplanation and the formation of the African Surface, which is an erosional surface along the Southern Cape Coast at an altitude of 160-180m amsl. The sites are located on this African Surface peneplain. During subsequent marine regressions (lowering of sea level), the Uitenhage Group rocks were deposited in coastal embayments.

Although the area has had a chaotic tectonic history and numerous faults occur in the basal TMG, the region is now generally considered to have a low seismic activity risk.

## 3.3 Geotechnical tests

A subsurface investigation was conducted on the two preferred sites (C & D) to determine the thickness of the soil overburden, soil types, moisture conditions, soil permeability and

other geotechnical parameters. Six test pits were excavated on Site C and five test pits were excavated on Site D, as indicated in **Figure 5**. The test pits on Site C were excavated using a TLB/backactor and the pits on Site D were excavated using a 22ton tracked excavator due to accessibility problems caused by dense alien vegetation. The test pits were profiled by an engineering geologist and representative samples of various soil horizons were collected for laboratory testing to determine the engineering properties. The soil profiles and photographs of the test pits are included in **Appendix 2** of this report.

Soil samples were tested according to the standard TMH1 A1-6 test method (Foundation Indicator tests). The tests were performed by Outeniqua Lab in George. Details of the tests are included in **Appendix 3** of this report.

Dynamic cone penetrometer (DCP) tests were conducted from ground surface level at each test position to evaluate soil consistency. The tests were carried out according to the standard TMH6 ST6 method. Details of the tests are included in **Appendix 4** of this report.

# 4. Results of the investigation

## 4.1 Soil and rock types

***Site C***

Observations made in test pits indicate that the soil profile across the entire site is fairly consistent. The uppermost horizon is a silty sand colluvium (topsoil) which is underlain by a pedogenic ferricrete layer, followed by stiff to very stiff gravelly silty sandy clay. No rock was encountered in any of the test pits which were excavated to depth ranging from 1.8 to 2.5m. A summary of the soil types and thicknesses recorded in test pits is given in **Table 1**.

**Table 1**: Soil types and thicknesses (in mm)

| ***Test position No.*** | ***Imported material*** | ***Transported/ pedogenic soil*** | ***Residual soil*** | ***Rock*** | ***Total depth of test pit*** |
|---|---|---|---|---|---|
| 1 | - | 1100 | 1100 | - | 2200 |
| 2 | - | 750 | 1650 | - | 2400 |
| 3 | - | 1300 | 1000 | - | 2300 |
| 4 | - | 1100 | 1200 | - | 2300 |
| 5 | - | 1400 | 1100 | - | 2500 |
| 6 | - | 900 | 900 | - | 1800 |

***Site D***

Observations made in test pits indicate that the soil profile is generally consistent, but as one approaches the valley lines, the depth to bedrock decreases. The uppermost soil

horizon is a silty sand colluvium (topsoil) which is underlain by a pedogenic ferricrete layer, followed by stiff to very stiff residual gravelly silty clay and/or clayey gravel. Below the residual soil, very soft to soft sandstone rock was encountered in most test pits, at a depth ranging from 0.9 to >3m. A summary of the soil types and thicknesses recorded in test pits is given in **Table 2**.

**Table 2**: Soil types and thicknesses (in mm)

| *Test position No.* | *Imported material* | *Transported/ pedogenic soil* | *Residual soil* | *Rock* | *Total depth of test pit* |
|---|---|---|---|---|---|
| 1 | - | 900 | 600 | 1800 | 3300 |
| 2 | - | 1200 | 1700 | - | 2900 |
| 3 | - | 1100 | 1000 | 1200 | 3300 |
| 4 | - | 800 | 1000 | 400 | 2200 |
| 5 | - | 400 | 500 | 900 | 1800 |

### 4.1.1 Laboratory tests

Representative samples of residual clay horizons were collected for Foundation Indicator tests to determine the engineering properties. The results of the tests are shown in **Table 3**.

**Table 3**: Summary of Foundation Indicator test results

| *Test Pit No* | *Sample Depth (mm)* | *Atterberg Limits* | | | *Particle Analysis (%)* | | | | *MC** | *PE*** | *USC **** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *PI* | *LL* | *LS* | *Clay* | *Silt* | *Sand* | *Gravel* | | | |
| **Site C** | | | | | | | | | | | |
| C2 | 750-2400 | 15 | 29 | 7 | 57 | 30 | 10 | 3 | 16.5 | Low | CL |
| C4 | 1100-2300 | 15 | 33 | 7 | 59 | 19 | 4 | 18 | 18.1 | Low | CL |
| C6 | 900-1800 | 16 | 31 | 8 | 54 | 33 | 12 | 1 | 14.1 | Low | CL |
| **Site D** | | | | | | | | | | | |
| D1 | 900-1500 | 16 | 45 | 8 | 31 | 31 | 7 | 31 | 23.7 | Low | ML |
| D3 | 1100-2100 | 20 | 41 | 10 | 33 | 23 | 11 | 33 | 24.5 | Low | CL |
| D5 | 400-900 | 13 | 33 | 6.5 | 29 | 18 | 26 | 27 | 12.7 | Low | GC |

* Insitu Moisture Content ** Potential Expansiveness\Skempton activity *** Unified Soil Classification

The lab results confirm that the residual soils tested are classified as CL (clays with low plasticity), ML (silts with low plasticity) or GC (Clayey gravels), according to the Universal Soil Classification. The tests indicate that the residual soil on Site D contains more gravel particles (unweathered rock fragments) than Site C and this may be due to the closer

proximity to the underlying bedrock on Site D. The plasticity index of the clay on both sites is fairly similar ranging from 13 to 20. Based on the relationship between PI and clay fraction (Skempton's activity value), the potential expansiveness on both sites is low. However, experience has shown that medium levels of heave can occur.

### 4.1.2 *In situ* tests

Dynamic cone penetrometer (DCP) tests were conducted to assess soil consistency and estimate bearing capacity of the soils. The tests indicate that the upper 0.5-1.2m is typically loose to medium dense and this roughly corresponds to the transported soil horizon. Below 1.2m the soil generally stiffens up considerably and this concurs with observations in test pits. Recommendations for foundations are given in **Chapter 6.1**.

## 4.2 Groundwater, permeability and surface drainage

Shallow perched water tables were encountered in several test pits on Site C only. Slow groundwater seepage was noted from the sidewalls at the interface between the surficial transported/pedogenic horizons and the underlying residual clay of relatively low permeability, estimated at $10^{-7}$m/s.

Surface water on Site C will tend to flow towards the north in the northern parts of the site and eastwards in the southern parts. There is a natural drainage line and two small dams between the two southern parcels of land (see **Figure 5**).

Site D has a slightly steeper gradient, draining towards the west, north and east. There are 2 large drainage lines forming the eastern and western boundaries of the site (see **Figure 5**).

## 4.3 Slopes

The majority of Site C is generally quite flat (~1:35), becoming slightly steeper in the northern parts (~1:20). Site D is relatively flat in the southern portion, becoming progressively steeper closer towards the valley lines along the western and eastern boundaries. The proposed developable portion of this site is partly constrained to the southern portion by the surrounding slopes (see **Figure 5**).

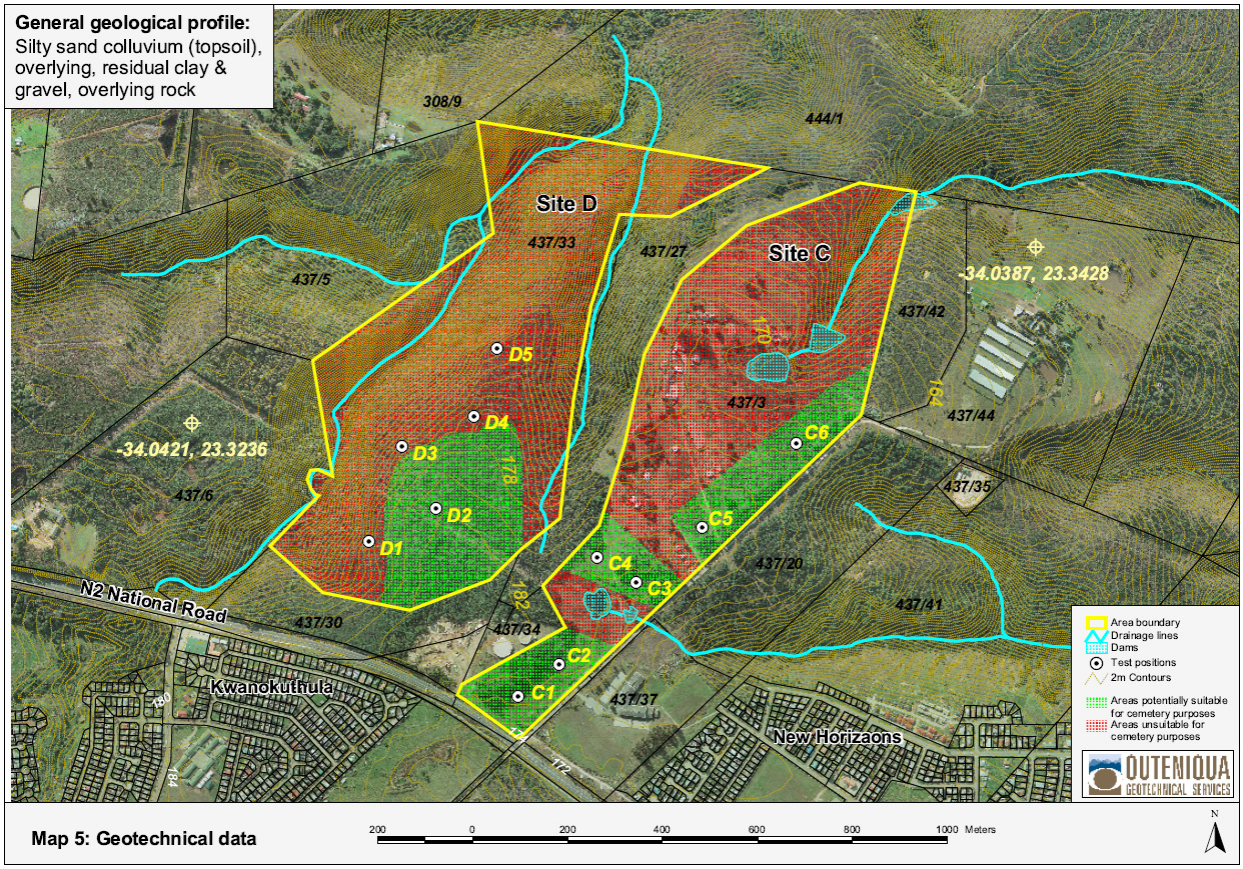



**Figure 5: Geotechnical map of sites**

## 5. Geotechnical assessment

The successful siting of a cemetery depends on a complex interaction of social, economic, geographic, environmental, geotechnical and geohydrological factors. The geotechnical and geohydrological factors are often overlooked and a number of cemeteries in South Africa have been developed without any regard to these factors, to the detriment of the environment. The lack of ideal cemetery sites in most urban areas in South Africa has meant that a certain amount of flexibility is needed in the selection process. However, there are certain constraints which are considered more important and are crucial to the successful operation of the cemetery.

Leachate emanating from cemeteries could potentially pollute groundwater, wetlands and/or domestic water sources if the cemetery is located in close proximity to such sources. Soil permeability and the presence of shallow water tables will have a significant effect on leachate dispersion. Groundwater and potential contamination thereof is covered in more detail in the Geohydrological report.

Other important geotechnical factors which can affect the suitability of a cemetery site include site topography (slopes), site drainage, excavatability, workability of the soil and stability of grave sidewalls.

**Table 4** is a summary of the table in **Appendix 5** which rates the main geotechnical constraints that influence the suitability of sites for cemetery purposes in order of perceived importance (adapted from Fisher, G.J. 1992). A rating of between 0 and 3 is assigned to each constraint, based on the suitability of the site with respect to each constraint. A rating of 0 denotes totally unsuitable conditions, 1 denotes unfavourable conditions, 2 denotes suitable conditions and 3 denotes ideal conditions. Constraints with ratings of 1 and less are highlighted in red and should be carefully considered as they may potentially flaw the site.

**Table 4:** Rating of geotechnical constraints

| **Geotechnical Constraint** | **Site C** | **Site D** |
|---|---|---|
| Excavatability | 2 | 1 |
| Permeability | 1 | 1 |
| Proximity to domestic water sources | 1 | 1 |
| Proximity to natural drainage features | 1 | 1 |
| Site drainage | 3 | 3 |
| Site topography | 3 | 3 |
| Basal buffer zone | 1 | 1 |
| Grave stability | 3 | 3 |
| Soil workability | 1 | 1 |
| Cemetery size | 3 | 3 |
| Proximity to existing roads & services | 3 | 2 |
| **TOTAL** | **22** | **20** |

It is evident from **Table 1** that the preferred site is Site C, but both sites carry unfavourable constraints and are considered marginally suitable, although this is not unusual in cemetery site selection. In terms of excavatability, both sites are underlain by stiff residual soil which will be difficult to dig through by hand (pick and shovel), but Site C is slightly softer and the depth to bedrock is greater. Only a portion of Site D is suitable because of the presence of shallow rock in the remaining area (see **Figure 5**). Soil permeability is very low on both sites and this is also deemed unfavourable because groundwater will tend to stagnate in graves with little recycling and dispersion and this may lead to anaerobic conditions. Medium soil permeability is considered favourable.

In terms of the proximity to domestic water sources and natural drainage features, reference should be made to the Geohydrological report. Poor basal buffer zone (distance between possible perched water tables and the bottom of the grave) and poor soil workability are also rated as unfavourable due to the presence of stiff soil on both sites.

An assessment of other geotechnical constraints that could potentially affect the design of proposed structures and services to be constructed on the site is tabulated in **Table 5**.

**Table 5**: Assessment of potential geotechnical constraints affecting structures

| ***Geotechnical Constraint*** | ***Effect on the proposed development*** | ***Severity*** | ***Comment*** |
|---|---|---|---|
| Collapsible & compressible soil | Soil horizons with a potentially collapsible or compressible fabric unsuitable for foundations. | Low | Moisture content of cohesive soil is important when placing foundations |
| Differential settlement | Foundations placed in different soil types may settle differentially. | Low | Uniform founding conditions and compaction is important. Engineer to inspect foundations. |
| Bearing capacity | Foundations placed on soils with low bearing capacity will display unsuitable settlement. | Low | Bearing capacity for light structures will not be a problem on stiff clay. Engineer to inspect all foundations. |
| Groundwater | Seepage, permanent or perched water tables affecting excavations. | Low to Medium | Shallow perched water tables are expected to 1.5m and can affect soil stability. Additional surface and/or subsoil drainage may be required. |
| Active soil | Heaving clays affecting foundation stability | Low to medium | Low to medium clay heave is expected. Foundations should be reinforced. |
| Excavations | Boulders or rock affecting excavations | Low | All excavations to 1.5m are soft. |
| | Unstable excavations requiring shoring | Low | Sidewalls of temporary shallow excavations are generally stable. Engineer to assess stability of deep (>1.5m) excavations. |
| Slope stability | Geological instability causing damage to structures founded on slopes | Low | The developable portions of the proposed sites are generally flat. |
| | Soil creep or erosion by storm water | Low | Minor surficial erosion during storms is expected. |
| Seismic activity | Structures at risk of damage due to seismicity | Low | MMS of less than IV with a 10% chance of being exceeded in 50 years. |
| Flood potential | Low lying areas affected by poor drainage. | Low | All sites are generally well drained. |
| Unconsolidated fill | Uncontrolled fill material affecting foundations | Low | No uncontrolled fill was encountered in test pits |
| Sources of construction material | Distance to sources of construction material affecting costs | Low | The material excavated from foundation trenches is not considered suitable for re-use for backfilling purposes, but engineer to assess on site. |

The sites have been classified according to the expected soil movements in terms of the Code of Practice for Foundations and Superstructures issued by the Joint Structural Division (JSD) of the South African Institution of Civil Engineering and Institution of Structural Engineers (SAICE/IStructE). This classification is given in **Table 6**.

**Table 6**: SAICE soil classification

| *Site* | *Main Geotechnical Constraints* | *Soil Class* | *Total expected heave (mm)* | *Total expected settlement (mm)* |
|---|---|---|---|---|
| Sites C & D | Compressible and/or collapsible soil | S-S1 | - | <20mm |
| | Active clay | H-H1 | <15mm | - |

# 6. Recommendations

## 6.1 Cemetery site

Neither of the proposed sites is ideal for cemetery purposes. However, in the absence of more suitable alternatives, it is recommended that the northern portion of Site C is developed first (see **Figure 5**) with the view to expanding further southward towards the N2 as the demand grows. The developable portion of Site D can also potentially be utilised as demand grows in the future.

Although there are municipal production boreholes located close to both sites, the groundwater flow is in the opposite direction and the development of the sites is unlikely to have a significant impact on this source. However, this should be evaluated carefully and monitored.

Grave excavation will be slow and difficult by hand and the municipality should consider the use of a TLB in this regard. Backfilling of graves will also be challenging with the *in situ* clayey material which can be blocky and difficult to compact. It is recommended that the topsoil and clay are mixed for backfilling to reduce voids (see **Figures 6 & 7**). Soil that is wet will not be suitable for backfilling and should be replaced with drier imported soil from any available source.

**Figure 6: Photo of excavated soil from Site C (TP C5)**

**Figure 7: Photo of excavated soil from Site D (TP D2)**

Site drainage is important to prevent ponding of surface water around the graveyard and deep v-channels are recommended throughout. This may also help increase the basal buffer zone between the corpse and the perched water table, and keep the surficial soil horizons in a drained state which will add stability to the grave sidewalls.

## 6.2 Foundations for structures

The design of foundations for structures lies within the consulting engineer's responsibility and the following recommendations are based on limited subsurface information. The recommendations are provided as a guideline for conceptual design and more detailed investigations should be undertaken for detailed design purposes.

The stiff residual soil is most suitable to carry foundation loads but foundations can be cast at shallower depths on well compacted pedogenic (ferricrete) or transported horizons (topsoil). A preliminary design bearing capacity is 75kPa. The recommended foundation types is conventional reinforced concrete strip foundations or light rafts. All foundation trenches should be inspected and approved by the engineer before casting.

## 6.3 Access roads

The topsoil subgrade generally has a poor CBR value (assume G9) and it is recommended that an allowance is made for an imported 150mm G7 selected gravel layer below the

subbase. The subgrade should be proof-rolled to identify wet or soft spots and wet material should be removed and replaced with suitably drier G7 fill material from commercial sources. The recommended layerworks are given in **Table 7**.

**Table 7:** Pavement design recommendations

| ***Layer*** | ***Material*** | ***Thickness*** | ***Required Compaction*** |
|---|---|---|---|
| Base | Interlocking cement pavers on 25mm sand bedding | 80mm-100mm | |
| Subbase | Imported G4/5 gravel stabilised to C4 (+/- 2-3% cement) | 150mm | 95% Mod AASHTO |
| SSG | Imported G7 | 150mm | 93% Mod AASHTO |
| | | OR | |
| Base | Imported G2/4 | | 98% Mod AASHTO |
| Subbase | Imported G5 | 150mm | 95% Mod AASHTO |
| SSG | Imported G7 | 150mm | 93% Mod AASHTO |

# 7. Conclusions

Both sites carry unfavourable geotechnical constraints and are therefore considered marginally suitable and should only be developed in the absence of more suitable sites. Some practical recommendations have been provided for consideration by the municipality, town planners and engineers.

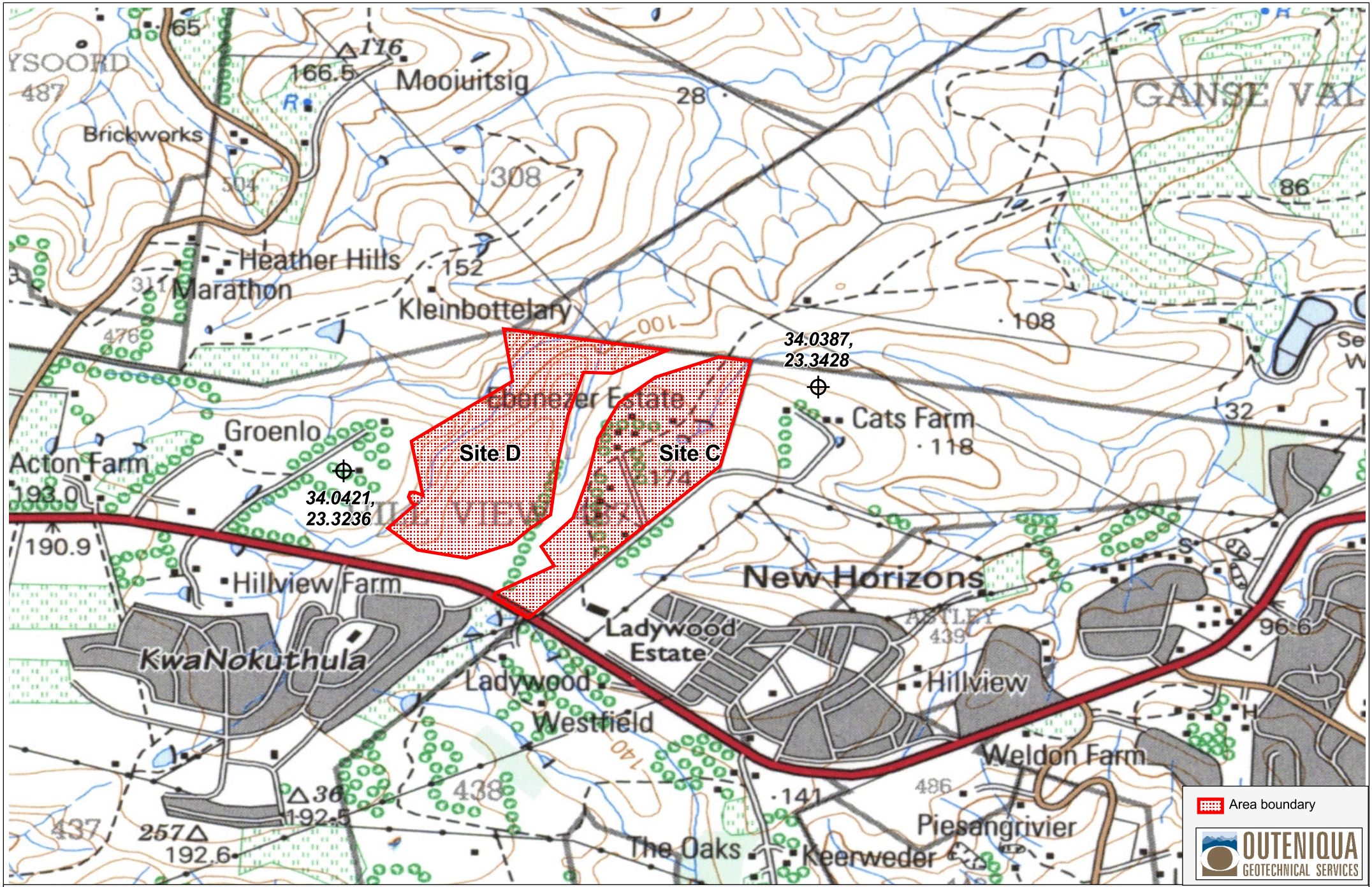
# 8. References

Fisher, G.J. (1992). A selection of cemetery sites in South Africa, Geological Survey of SA.

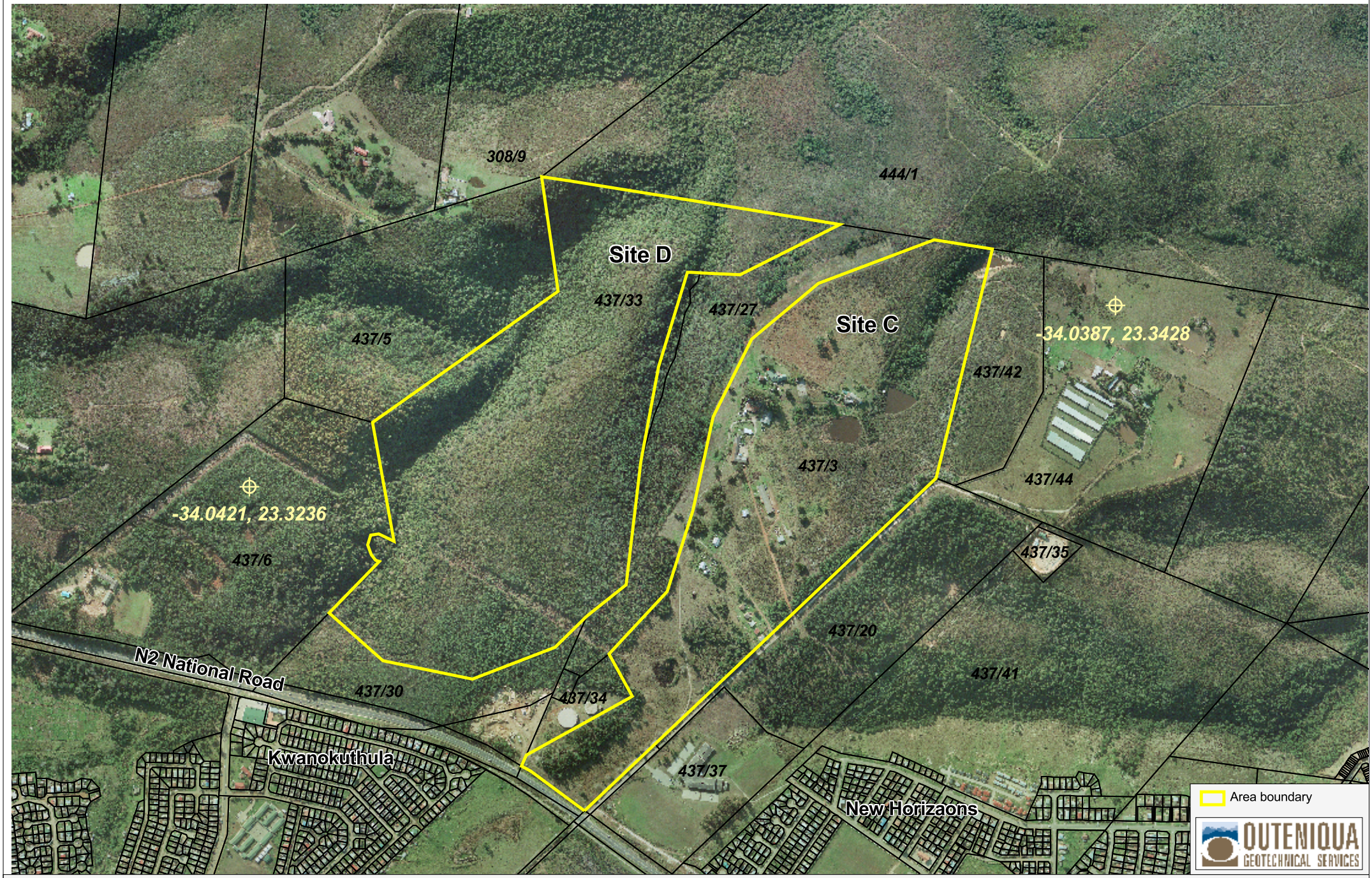
# Appendix 1

# Maps

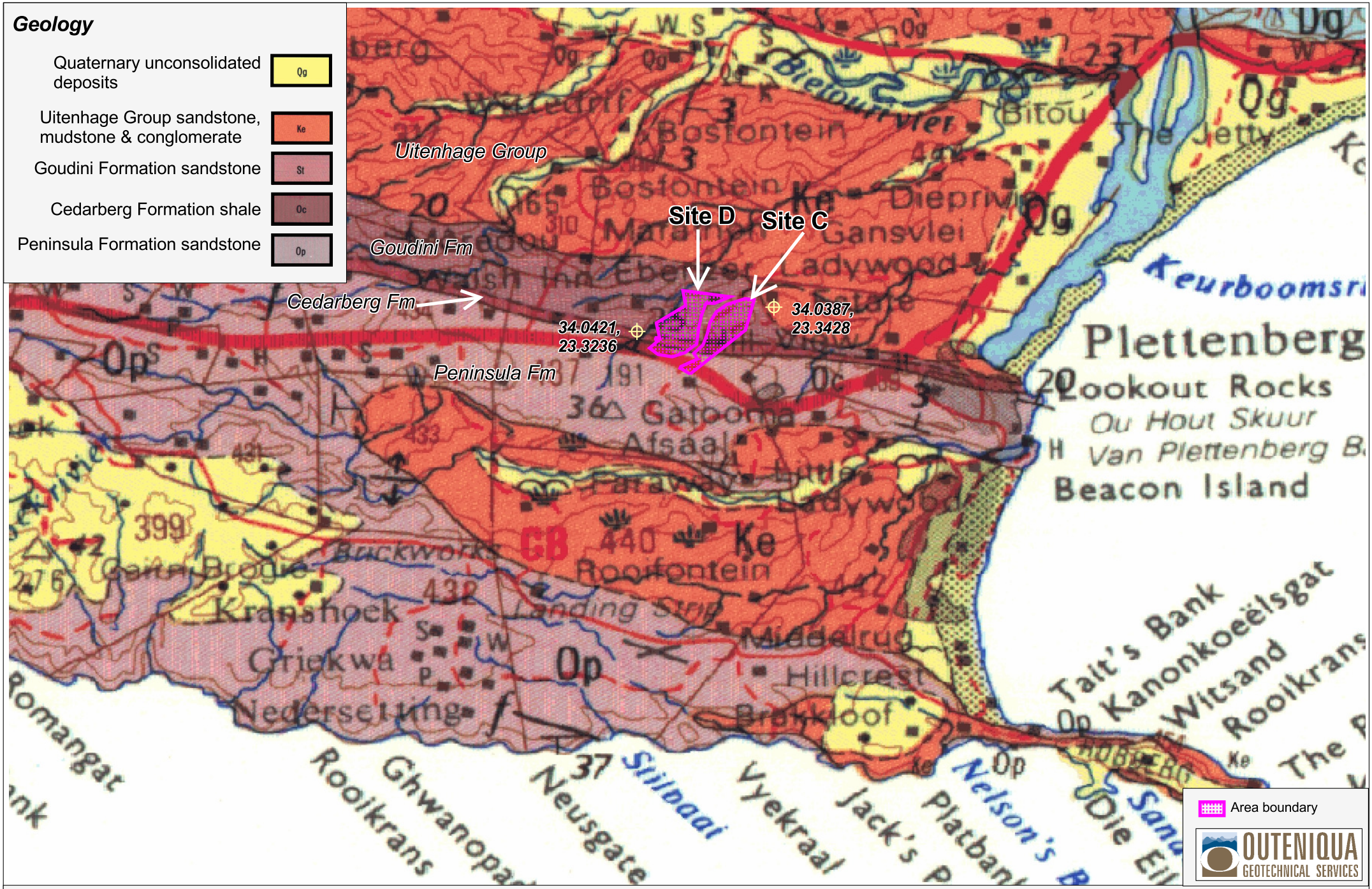

**Map 1: Locality**



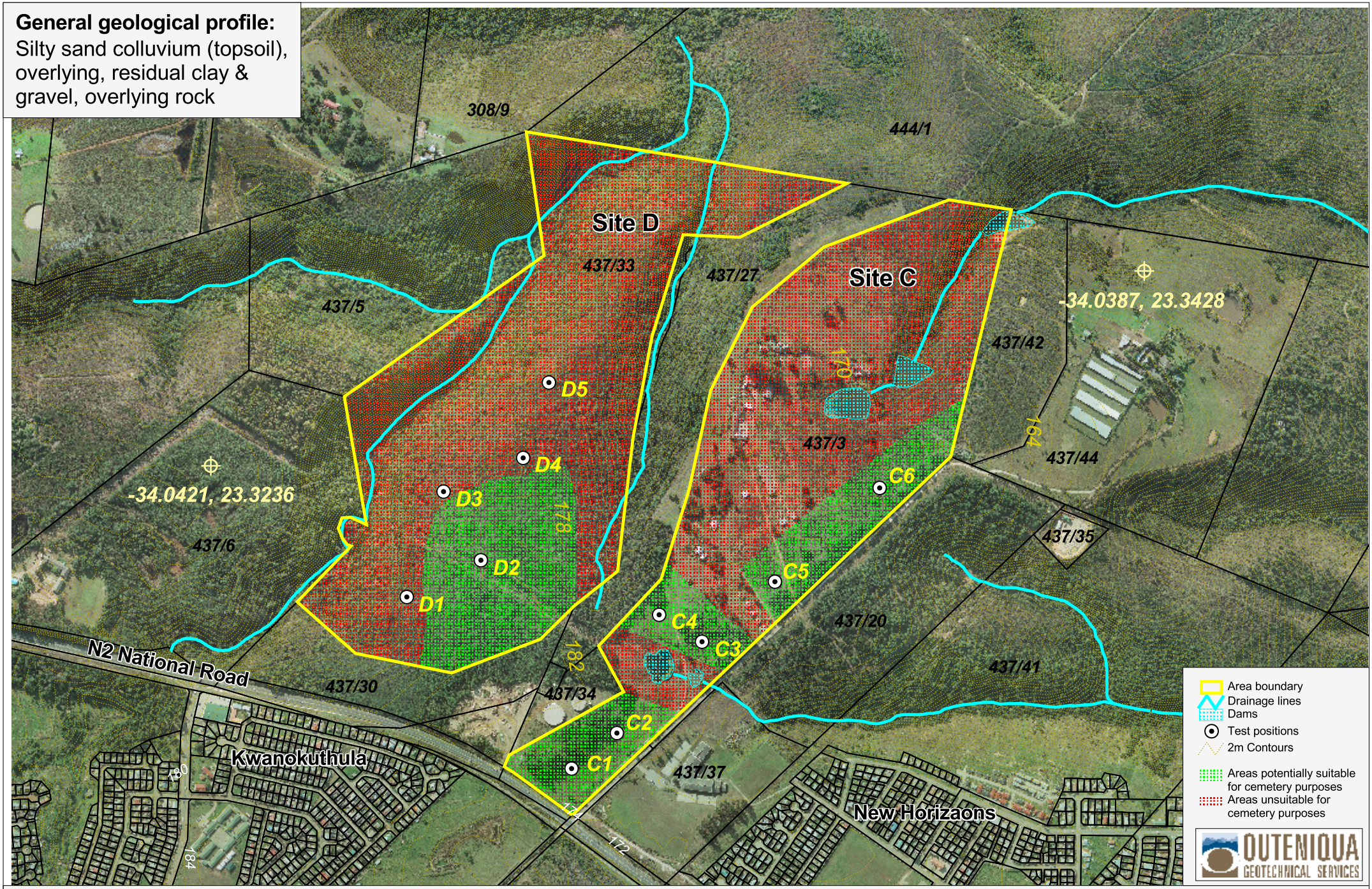

**Mpa 2: Topography**




**Map 3: Aerial photograph**


Geology
Quaternary unconsolidated deposits
Qg
Uitenhage Group sandstone, mudstone & conglomerate
Ke
Goudini Formation sandstone
St
Cedarberg Formation shale
Oc
Peninsula Formation sandstone
Op
Uitenhage Group
Goudini Fm
Cedarberg Fm
Peninsula Fm
Site D
Site C
34.0421, 23.3236
34.0387, 23.3428
Area boundary
OUTENIQUA GEOTECHNICAL SERVICES
Map 4: Geology
1 0 1 2 3 4 5 6 7 8 Kilometers
N

**General geological profile:**
Silty sand colluvium (topsoil), overlying, residual clay & gravel, overlying rock




**Map 5: Geotechnical data**

# Appendix 2

# Test pit profiles

# Geotechnical Soil Profile

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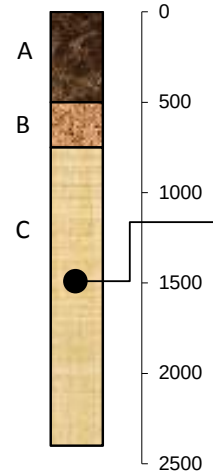
| | |
|---|---|
| Client: | Marike Vreken Town Planners cc |
| Project: | New Cemetery |
| Area: | Plettenberg Bay |
| Date: | 23. 08. 13 |
| Excavator: | TLB |

## C2

Datum: NGL | Co-ords: 23 Y-030650 X3768893

Key to symbols: ● Sample taken | Groundwater




(0 to 500) Moist, dark brown, loose, intact, **SILTY SAND**, transported (Topsoil)

(500 to 750) Very moist, dark red brown, loose to medium dense, intact, **GRAVELLY SILTY SAND**, transported/pedogenic (Ferricrete nodules)

(750 to 2400) Moist, dark red orange, stiff to very stiff, fissured, **SANDY GRAVELLY SILTY CLAY**, residual/pedogenic (ferricrete nodules)

**Foundation Indicator**

Dynamic Cone Penetrometer (DCP)

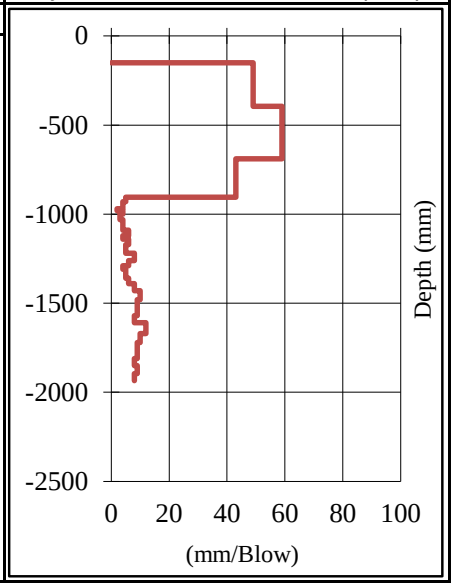
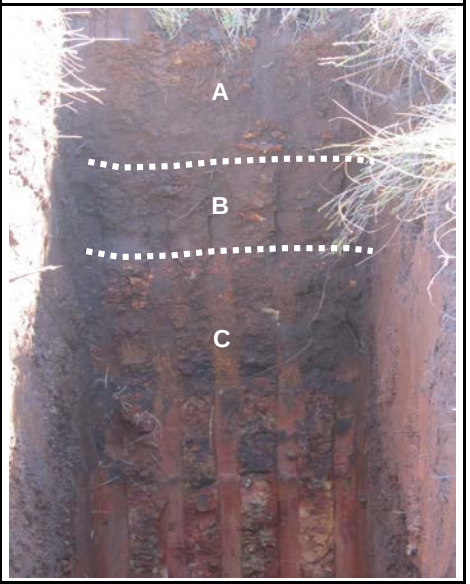


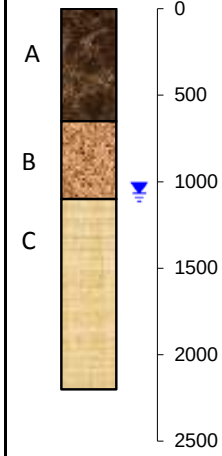

Photo of Test Pit




## C1

Datum: NGL | Co-ords: 23 Y-030563 X3768960

Key to symbols: ● Sample taken | Groundwater




(0 to 650) Moist, dark brown, loose, intact, **SILTY SAND**, transported (Topsoil)

(650 to 1100) Very moist to wet, dark red brown, medium dense, intact, **SILTY SANDY GRAVEL**, transported/pedogenic.

(1100 to 2200) Moist, dark red orange, stiff, micro-shattered/fissured, **SILTY SANDY CLAY**, residual

**Perched water table @ 1100mm**

Dynamic Cone Penetrometer (DCP)

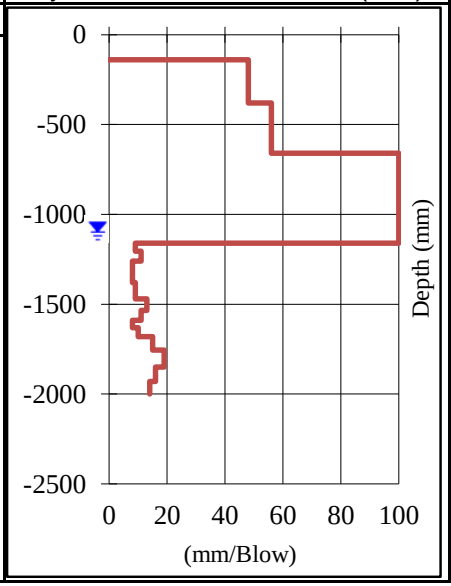
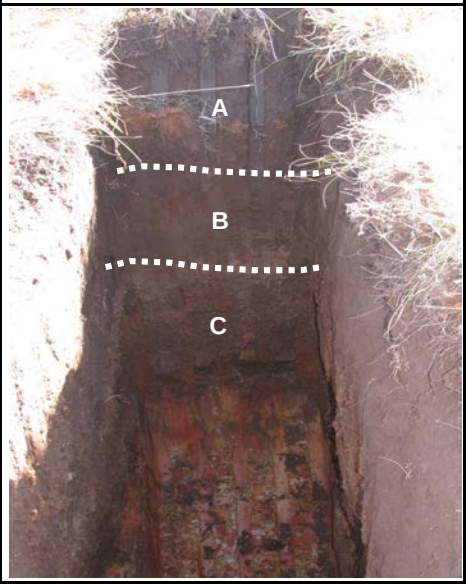



Photo of Test Pit



# Geotechnical Soil Profile

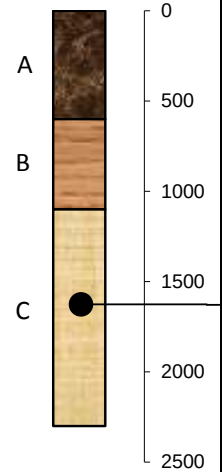
OUTENIQUA
GEOTECHNICAL SERVICES
CIVIL LABORATORIES

| | |
|---|---|
| Client: | Marike Vreken Town Planners cc |
| Project: | New Cemetery |
| Area: | Plettenberg Bay |
| Date: | 23. 08. 13 |
| Excavator: | TLB |

## C4

Datum: NGL | Co-ords: 23 Y-030731 X3768667

Key to symbols: ● Sample taken | Groundwater




(0 to 600) Moist, dark brown, medium dense, intact, **SILTY SAND**, transported (Topsoil)

(600 to 1100) Very moist, light brown, medium dense, intact, **CLAYEY SILTY SAND**, transported.

(1100 to 2300) Moist, dark yellow orange, dense/stiff, micro-shattered, **GRAVELLY SILTY CLAY**, residual?/pedogenic (Ferricrete nodules in clay)

**Foundation Indicator**

Dynamic Cone Penetrometer (DCP)

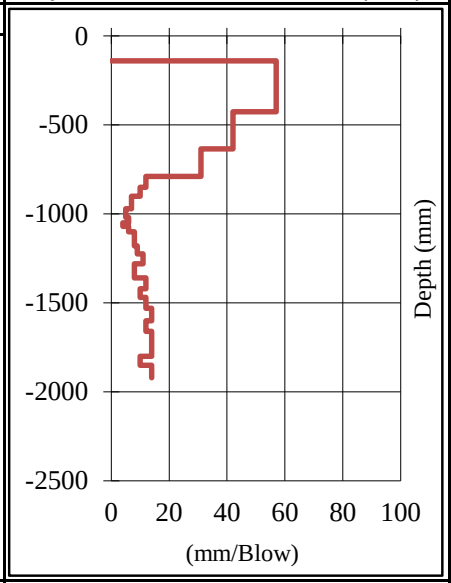
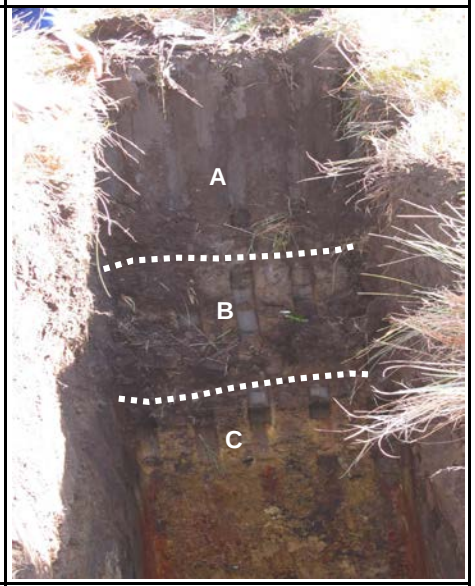


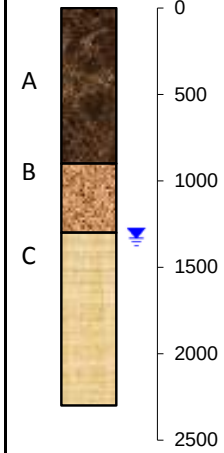

Photo of Test Pit




## C3

Datum: NGL | Co-ords: 23 Y-030813 X3768718

Key to symbols: ● Sample taken | Groundwater




(0 to 900) Moist, dark brown, medium dense, intact, **SILTY SAND**, transported (Topsoil)

(900 to 1300) Very moist to wet, dark red brown, dense, intact, **SILTY SANDY GRAVEL**, pedogenic (Ferricrete nodules)

(1300 to 2300) Moist, dark red orange, stiff to very stiff, fissured, **CLAYEY SILTY SANDY CLAY**, residual?

**Perched water table @ 1300mm**

Dynamic Cone Penetrometer (DCP)

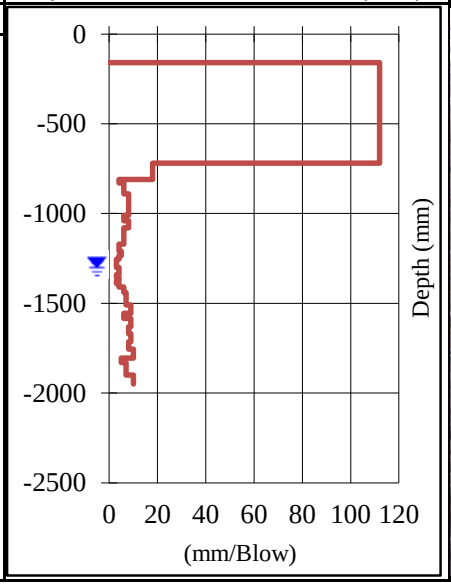
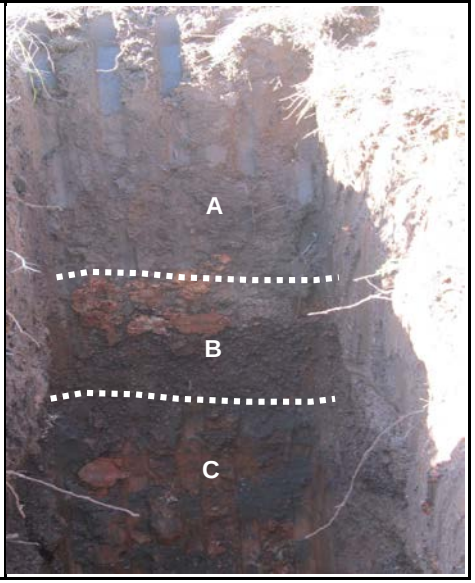



Photo of Test Pit



OUTENIQUA
GEOTECHNICAL SERVICES
CIVIL LABORATORIES

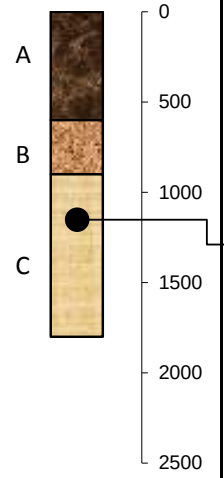
# Geotechnical Soil Profile

| | |
|---|---|
| Client: | Marike Vreken Town Planners cc |
| Project: | New Cemetary |
| Area: | Plettenberg Bay |
| Date: | 23.08.13 |
| Excavator: | TLB |

## C6

Datum: NGL | Co-ords: 23 Y-031151 X3768425

Key to symbols: ● Sample taken | Groundwater




(0 to 600) Moist, dark brown,loose, intact, **SILTY SAND**, transported (Topsoil)

(600 to 900) Moist, dark red brown, dense, intact, **SANDY SILTY GRAVEL & minor cobbles**, pedogenic/transported (Ferricrete nodules)

(900 to 1800) Moist, dark red orange, very stiff, fissured/shattered/slickensided, **SANDY SILTY CLAY**, residual?

**Foundation Indicator**

**TP stopped due to slow progress**

Dynamic Cone Penetrometer (DCP)

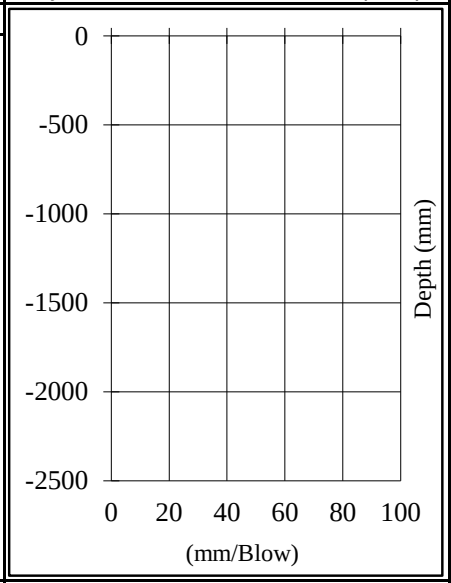
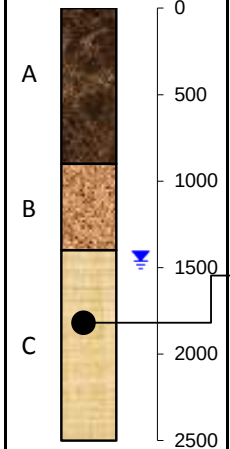



Photo of Test Pit


## C5

Datum: NGL | Co-ords: 23 Y-030951 X3768604

Key to symbols: ● Sample taken | Groundwater




(0 to 900) Moist, dark brown, loose, intact, **SILTY SAND**, transported (Topsoil)

(900 to 1400) Very moist to wet, dark red brown, dense, intact, **SANDY SILTY GRAVEL**, pedogenic/transported (Ferricrete layer)

(1400 to 2500) Moist to very moist, dark red orange, very stiff, fissured/shattered, **SANDY SILTY CLAY**, residual?

**Perched water table @ 1400mm**

Dynamic Cone Penetrometer (DCP)

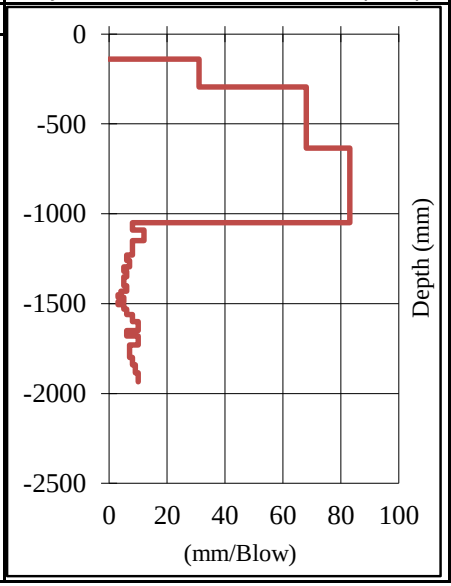
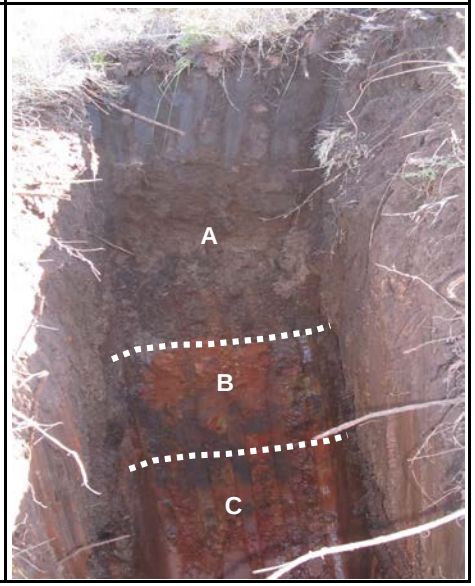



Photo of Test Pit



# Geotechnical Soil Profile

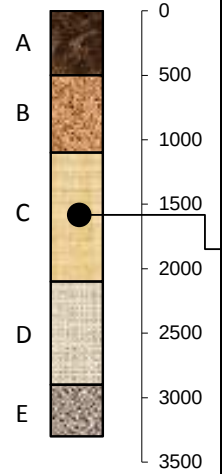
OUTENIQUA
GEOTECHNICAL SERVICES
CIVIL LABORATORIES

| | |
|---|---|
| Client: | Marike Vreken Town Planners cc |
| Project: | New Cemetery |
| Area: | Plettenberg Bay |
| Date: | 21.08.13 |
| Excavator: | Volvo EC210 Excavator |

## D3

Datum: NGL | Co-ords: 23 Y-030320 X3768432

Key to symbols: ● Sample taken | Groundwater




(0 to 500) Moist, dark red brown, medium dense, intact, **SILTY SAND**, transported (Topsoil)

(500 to 1100) Moist, dark brown to dark red orange, firm to stiff, micro-shattered/slickensided, **SANDY SILTY CLAYEY GRAVEL**, transported/pedogenic (Ferricrete)

(1100 to 2100) Moist, light brown, stiff, shattered/slickensided/fissured, **SANDY SILTY CLAYEY GRAVEL**, residual (Completely weathered sandstone)

**Foundation Indicator**

(2100 to 2900) Light yellow orange, highly weathered, highly fractured, very soft to soft, **SANDSTONE**.

(2900 to 3300) Light yellow to light olive, highly weathered, moderately fractured, soft to medium hard, **SANDSTONE**.

**Test pit stopped**

Dynamic Cone Penetrometer (DCP)

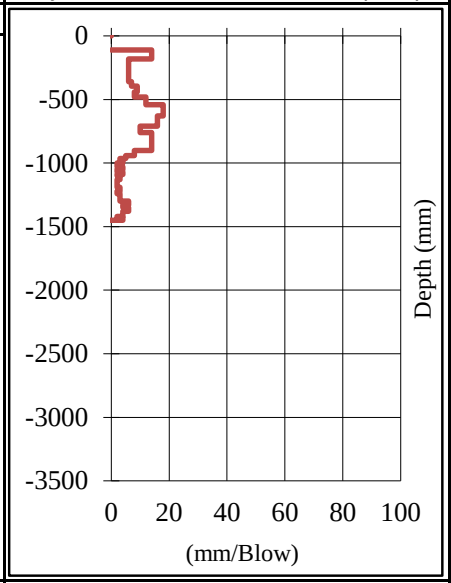
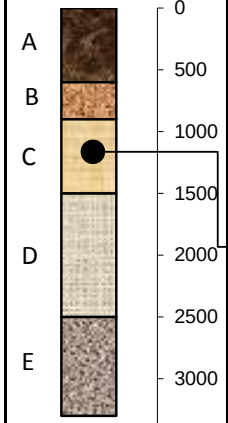



Photo of Test Pit


## D1

Datum: NGL | Co-ords: 23 Y-030250 X3768633

Key to symbols: ● Sample taken | Groundwater




(0 to 600) Moist, dark red brown, medium dense, intact, **SILTY SAND**, transported (Topsoil)

(600 to 900) Moist, dark brown to dark red brown, stiff, shattered, **GRAVELLY SANDY CLAYEY SILT**, transported/pedogenic (Some ferricrete nodules)

(900 to 1500) Moist, light yellow orange to light brown, stiff to very stiff, shattered/slickesided, **SANDY CLAYEY SILTY GRAVEL**, residual.

**Foundation Indicator**

(1500 to 2500) Light yellow orange, highly weathered, highly fractured, very soft to soft, **SANDSTONE**.

(2500 to 3300) Light yellow orange, highly weathered, highly fractured, soft to medium hard, **SANDSTONE**.

**Test pit stopped**

Dynamic Cone Penetrometer (DCP)

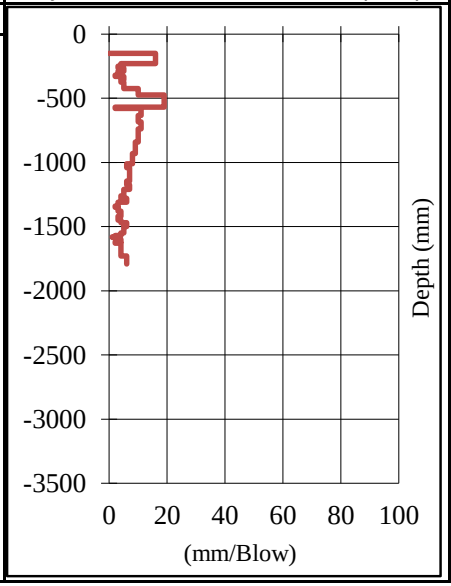
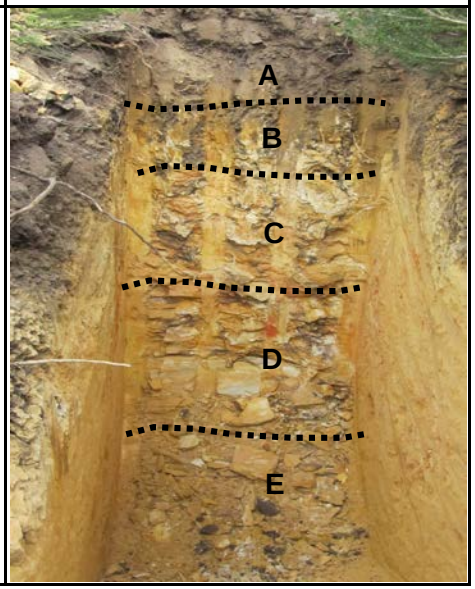



Photo of Test Pit



# Geotechnical Soil Profile

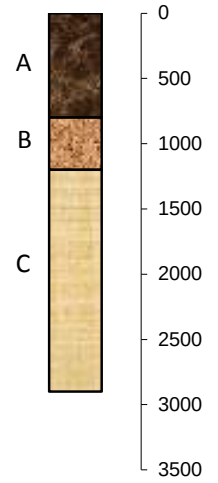
OUTENIQUA
GEOTECHNICAL SERVICES
CIVIL LABORATORIES

| | |
|---|---|
| Client: | Marike Vreken Town Planners cc |
| Project: | New Cementary |
| Area: | Plettenberg Bay |
| Date: | 21.08.13 |
| Excavator: | Volvo EC210 Excavator |

**D2**

Datum: NGL | Co-ords: 23 Y-030392 X3768563

Key to symbols: ● Sample taken | Groundwater




| | |
|---|---|
| (0 to 800) | Moist, dark red brown, loose, intact, **SILTY SAND**, transported (Topsoil) |
| (800 to 1200) | Moist, dark red orange, very dense, intact, **CLAYEY SILTY SANDY GRAVEL**, transported/pedogenic (Ferricrete nodules) |
| (1200 to 2900) | Slightly moist, light red ot light red orange, very stiff, fissured, **SILTY CLAYEY SAND**, residual (Completely weathered sandstone) |

**Test pit stopped**

Dynamic Cone Penetrometer (DCP)

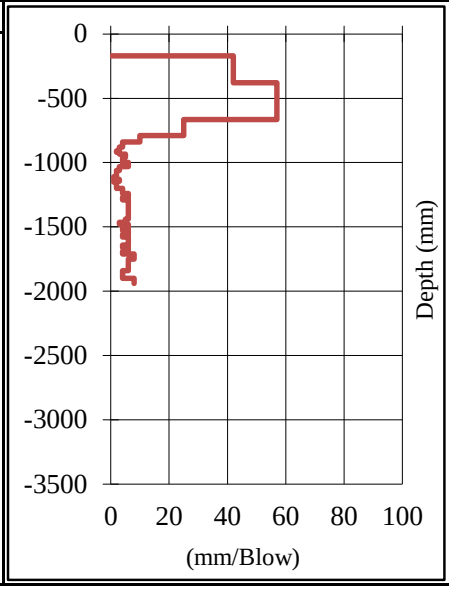



Photo of Test Pit

# Geotechnical Soil Profile

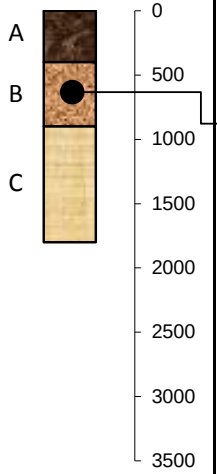
OUTENIQUA
GEOTECHNICAL SERVICES
CIVIL LABORATORIES

| | |
|---|---|
| Client: | Marike Vreken Town Planners cc |
| Project: | New Cemetery |
| Area: | Plettenberg Bay |
| Date: | 21.08.13 |
| Excavator: | Volvo EC210 Excavator |

## D5

Datum: NGL | Co-ords: 23 Y-030521 X3768224

Key to symbols: ● Sample taken | Groundwater




(0 to 400) Moist, dark red brown, loose to medium dense, intact, **SILTY SAND,** transported (Organic rich)

(400 to 900) Moist, dark red orange, dense, intact, **SILTY SANDY GRAVELLY CLAY**, residual (Completely weathered sandstone)

**Foundation Indicator**

(900 to 1800) Light red orange, highly weathered, moderately fractured, hard, **SANDSTONE**.

**Refusal @ 1800mm on hard sandstone.**

Dynamic Cone Penetrometer (DCP)

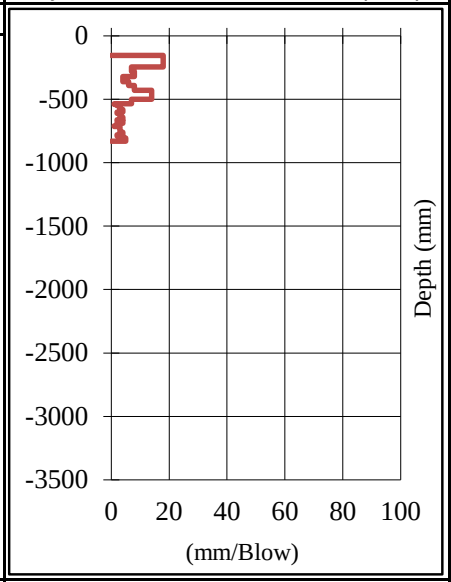
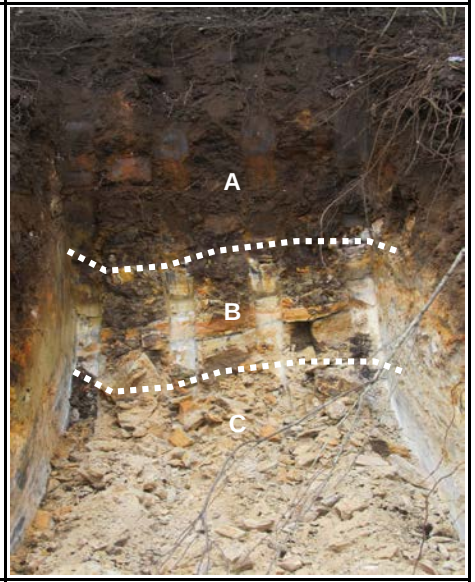


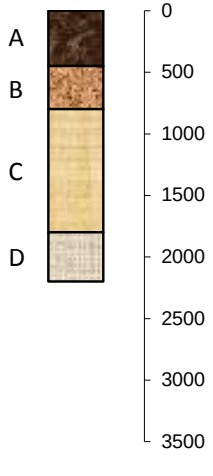

Photo of Test Pit




## D4

Datum: NGL | Co-ords: 23 Y-030471 X3768368

Key to symbols: ● Sample taken | Groundwater




(0 to 450) Moist, dark red brown, medium dense, intact, **SILTY SAND**, transported (Topsoil)

(450 to 800) Moist, dark red brown to dark red orange, stiff, micro-shattered/slickensided/fissured, **SANDY SILTY CLAY**, transported/pedogenic (Ferricrete nodules)

(800 to 1800) Moist, dark red orange to light brown, very stiff, micro-shattered/fissured, **GRAVELLY SANDY SILTY CLAY**, residual (Completely weathered sandstone)

(1800 to 2200) Light brown to light yellow orange, highly weathered, moderately fractured, hard, **SANDSTONE**.

**Refusal @ 2200mm on hard sandstone.**

Dynamic Cone Penetrometer (DCP)

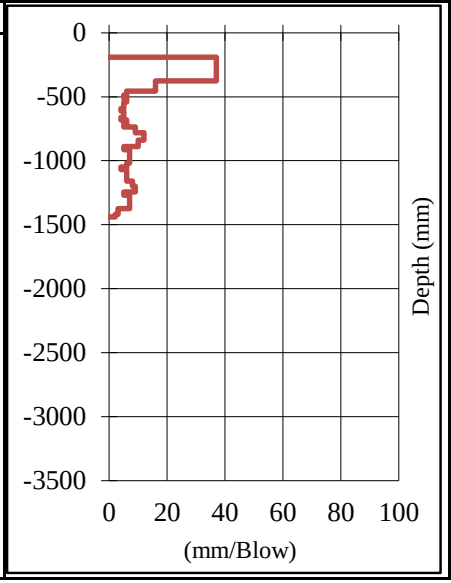
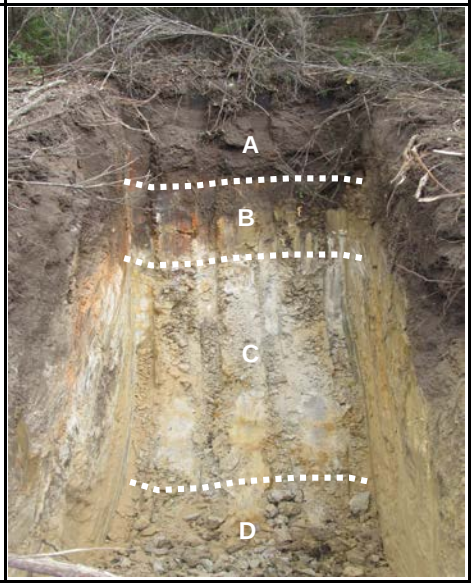



Photo of Test Pit



# Appendix 3

# Lab test data

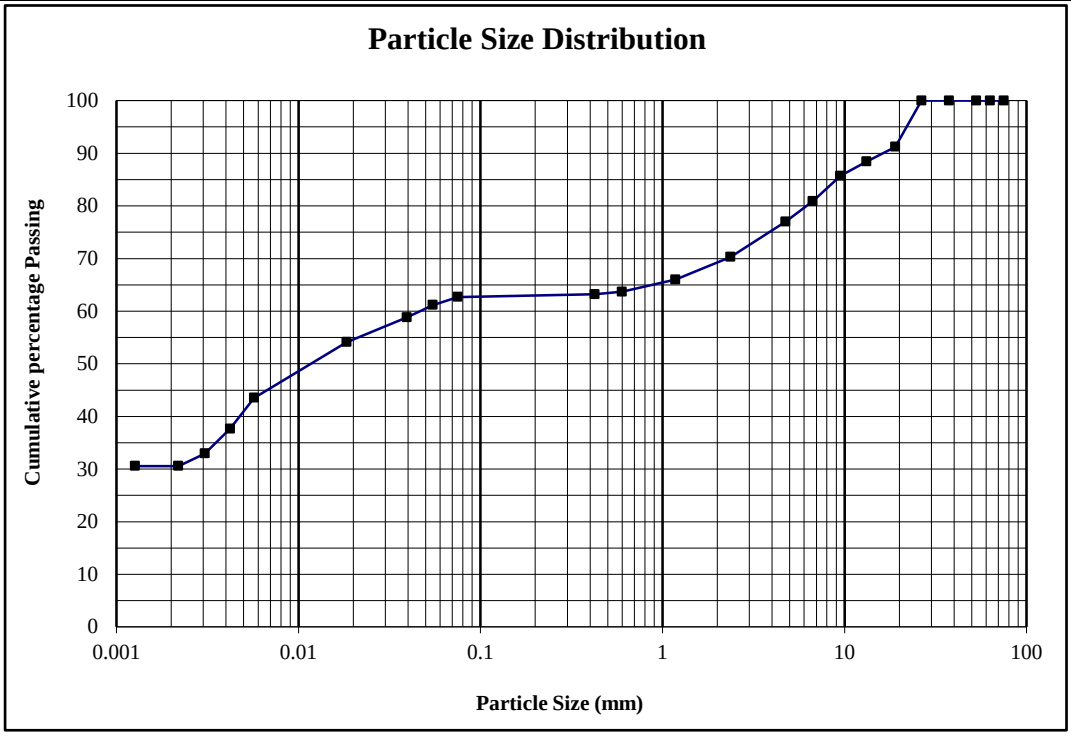
# OUTENIQUA LAB (Pty) Ltd
Materials Testing Laboratory
Registration No. 95/07742/07
6 Mirrorball Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za


| | | | |
|---|---|---|---|
| Customer : | Marike Vreken Town Planners cc | Project : | New Cemetery - Plettenberg Bay |
| | P O Box 2180 | Date Received : | 22/08/13 |
| | Knysna | Date Reported : | 01/09/13 |
| | 6570 | Req. Number : | 2390/13 |
| Attention : | Marike Vreken | No. of Pages : | 1/3 |

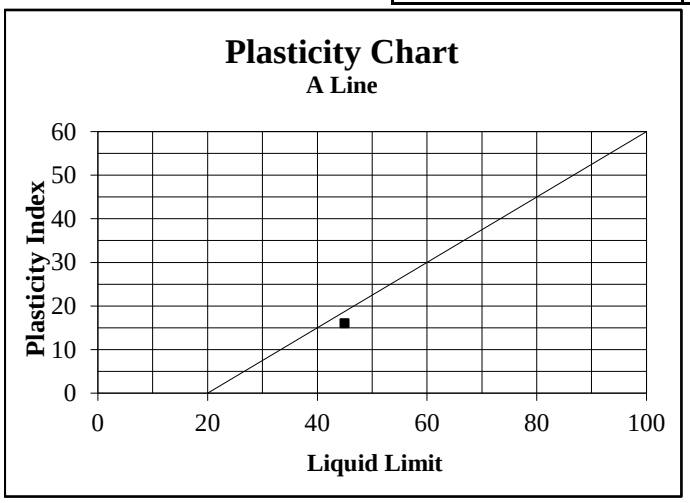
## TEST REPORT
## FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

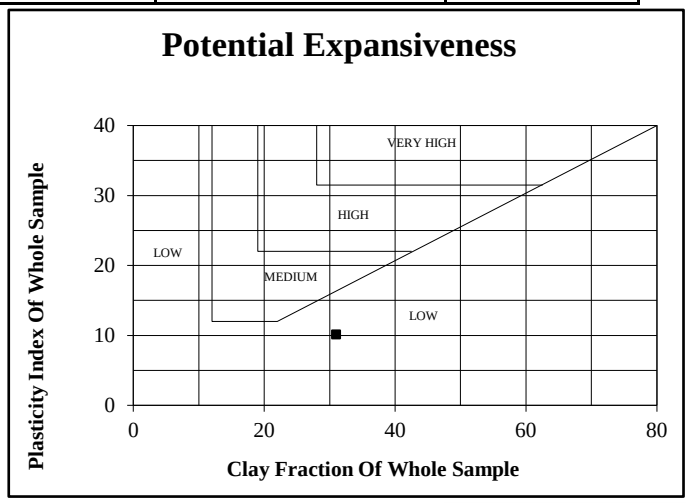
| | | | | | | |
|---|---|---|---|---|---|---|
| Material Description: | Light Yellowish Orange to Light Brown - Clay Silt Gravel | Sample Number: | 52417 | | | |
| Position: | D1 - Layer 3 | Liquid Limit | 45 | Linear Shrinkage | 8 | |
| Depth: | 900-1500 | Plasticity Index | 16 | Insitu M/C% | 23.7 | |

| Sieve Size(mm) | % Passing |
|---|---|
| 75.0 | 100 |
| 63.0 | 100 |
| 53.0 | 100 |
| 37.5 | 100 |
| 26.5 | 100 |
| 19.0 | 91 |
| 13.2 | 88 |
| 9.5 | 86 |
| 6.7 | 81 |
| 4.75 | 77 |
| 2.36 | 70 |
| 1.18 | 66 |
| 0.600 | 64 |
| 0.425 | 63 |
| 0.075 | 63 |
| 0.0547 | 61 |
| 0.0394 | 59 |
| 0.0184 | 54 |
| 0.0057 | 44 |
| 0.0042 | 38 |
| 0.0031 | 33 |
| 0.0022 | 31 |
| 0.0013 | 31 |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Clay | 31 | % Silt | 31 | % Sand | 7 | % Gravel | 31 |
| Unified Soil Classification | ML | | | PRA Soil Classification | | A-7-6 | |




**Notes:**

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

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

1. **Sampling falls outside the scope of Outeniqua Lab's SANAS accreditation.**
2. The test results are reported with an approximate 95% level of confidence.
3. This report (with attachments) is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Technical Director of Outeniqua Lab (Pty) Ltd.
4. Results reported in this Test Report relate only to the items tested and are an indication only of the sample provided and/or taken.
5. Measuring Equipment, traceable to National Standards is used where applicable.
6. While every care is taken to ensure the correctness of all tests and reports, neither Outeniqua Lab nor its employees shall be liable in any way whatever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequence thereof.

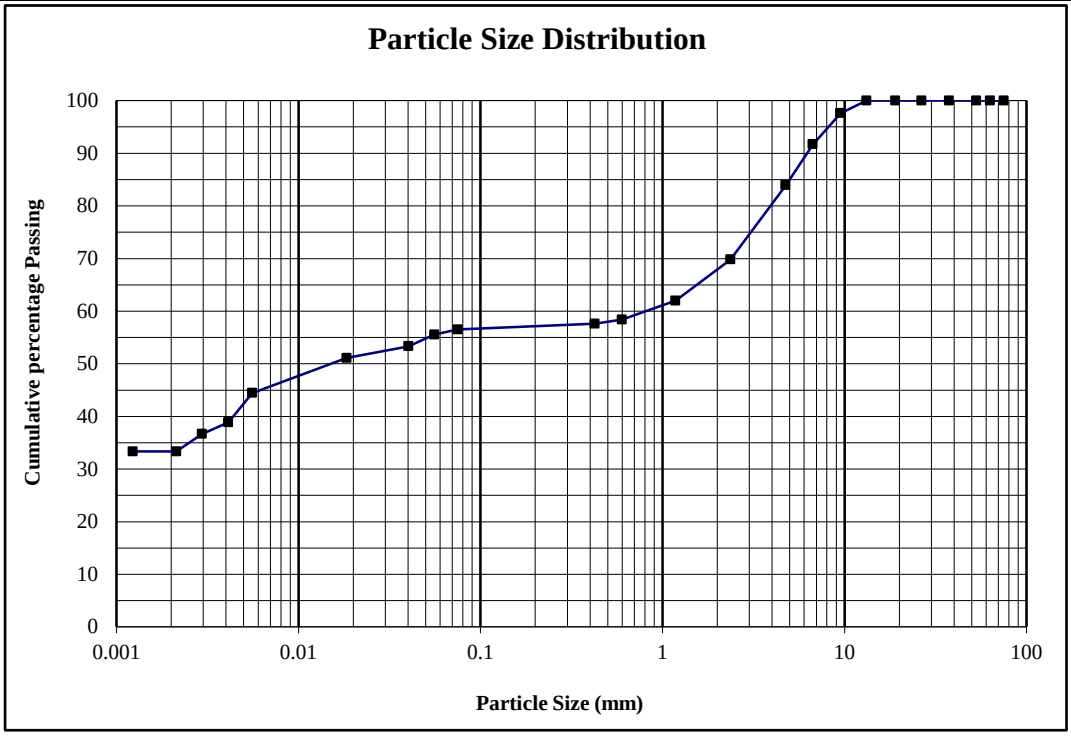
# OUTENIQUA LAB (Pty) Ltd
Materials Testing Laboratory
Registration No. 95/07742/07
6 Mirrorball Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za


| | | | |
|---|---|---|---|
| Customer : | Marike Vreken Town Planners cc | Project : | New Cemetery - Plettenberg Bay |
| | P O Box 2180 | Date Received : | 22/08/13 |
| | Knysna | Date Reported : | 01/09/13 |
| | 6570 | Req. Number : | 2390/13 |
| Attention : | Marike Vreken | No. of Pages : | 2/3 |

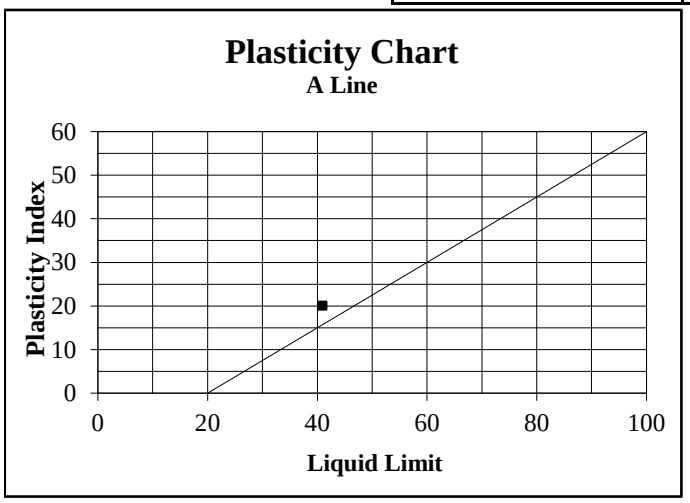
## TEST REPORT
## FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

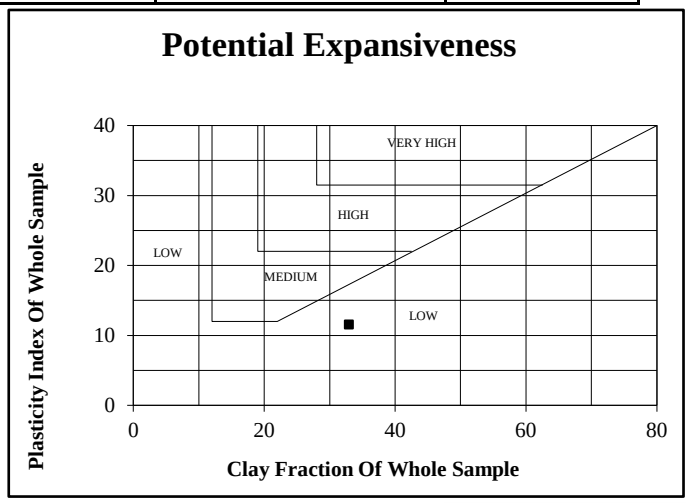
| | | | | | | |
|---|---|---|---|---|---|---|
| Material Description: | Light Brown - Silty Clay Gravel | Sample Number: | 52418 | | | |
| Position: | D3 - Layer 3 | Liquid Limit | 41 | Linear Shrinkage | 10 | |
| Depth: | 1100-2100 | Plasticity Index | 20 | Insitu M/C% | 24.5 | |

| Sieve Size(mm) | % Passing |
|---|---|
| 75.0 | 100 |
| 63.0 | 100 |
| 53.0 | 100 |
| 37.5 | 100 |
| 26.5 | 100 |
| 19.0 | 100 |
| 13.2 | 100 |
| 9.5 | 98 |
| 6.7 | 92 |
| 4.75 | 84 |
| 2.36 | 70 |
| 1.18 | 62 |
| 0.600 | 58 |
| 0.425 | 58 |
| 0.075 | 57 |
| 0.0558 | 56 |
| 0.0402 | 53 |
| 0.0184 | 51 |
| 0.0056 | 44 |
| 0.0041 | 39 |
| 0.0030 | 37 |
| 0.0021 | 33 |
| 0.0012 | 33 |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Clay | 33 | % Silt | 23 | % Sand | 11 | % Gravel | 33 |
| Unified Soil Classification | CL | | | PRA Soil Classification | | A-7-6 | |




**Notes:**

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

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

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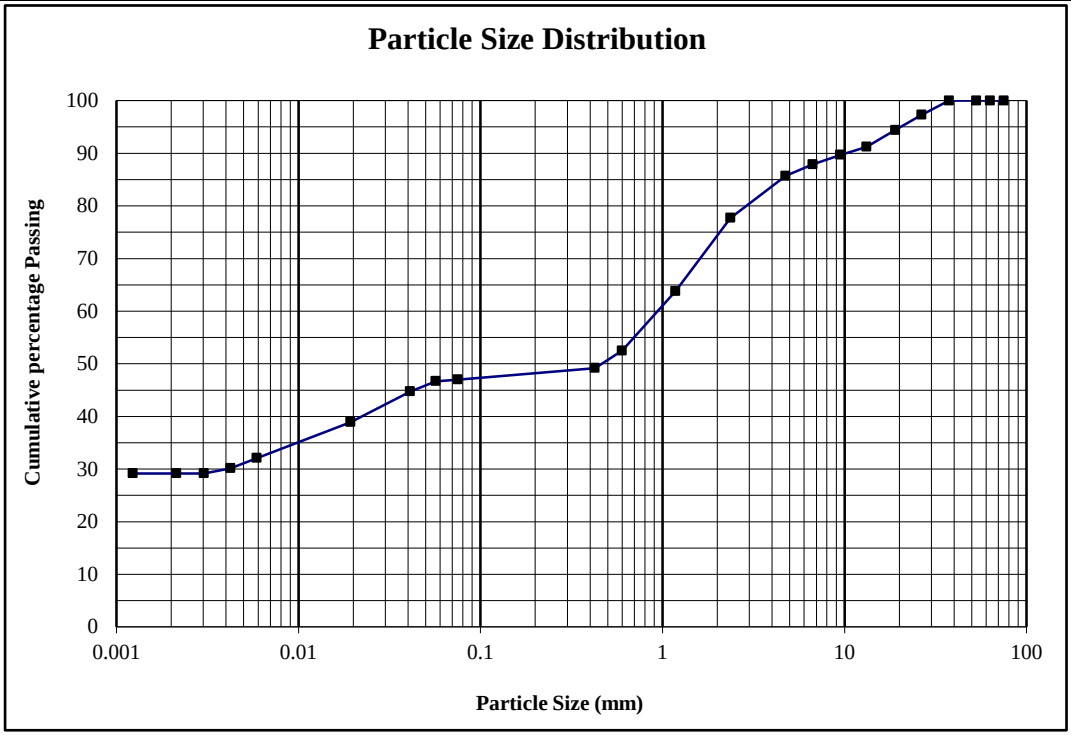
| Customer : | Marike Vreken Town Planners cc | Project : | New Cemetery - Plettenberg Bay |
| | P O Box 2180 | Date Received : | 22/08/13 |
| | Knysna | Date Reported : | 01/09/13 |
| | 6570 | Req. Number : | 2390/13 |
| Attention : | Marike Vreken | No. of Pages : | 3/3 |

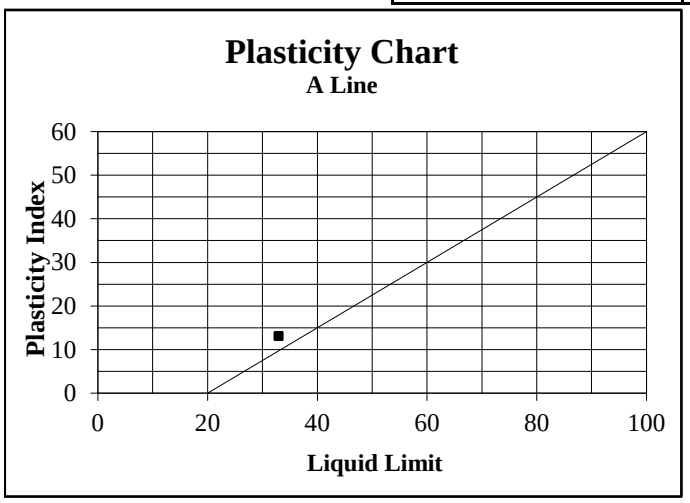
## TEST REPORT
## FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

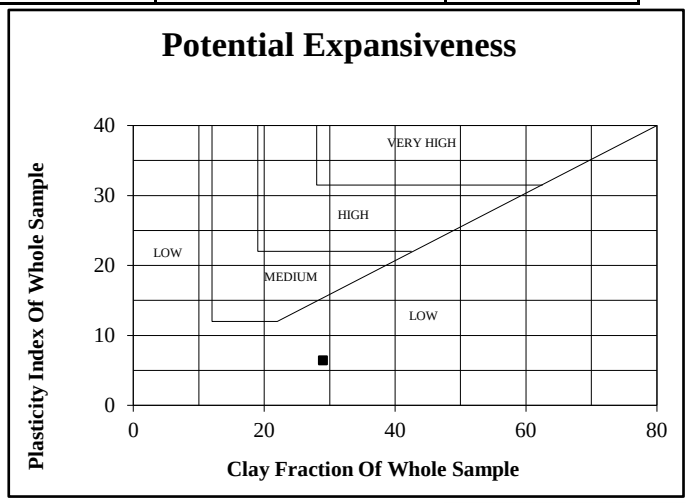
| | | | | | | |
|---|---|---|---|---|---|---|
| Material Description: | Dark Reddish Orange - Sandy Gravelly Clay | Sample Number: | 52419 | | | |
| Position: | D5 - Layer 2 | Liquid Limit | 33 | Linear Shrinkage | 6.5 | |
| Depth: | 400-900 | Plasticity Index | 13 | Insitu M/C% | 12.7 | |

| Sieve Size(mm) | % Passing |
|---|---|
| 75.0 | 100 |
| 63.0 | 100 |
| 53.0 | 100 |
| 37.5 | 100 |
| 26.5 | 97 |
| 19.0 | 94 |
| 13.2 | 91 |
| 9.5 | 90 |
| 6.7 | 88 |
| 4.75 | 86 |
| 2.36 | 78 |
| 1.18 | 64 |
| 0.600 | 53 |
| 0.425 | 49 |
| 0.075 | 47 |
| 0.0568 | 47 |
| 0.0411 | 45 |
| 0.0193 | 39 |
| 0.0059 | 32 |
| 0.0042 | 30 |
| 0.0030 | 29 |
| 0.0021 | 29 |
| 0.0012 | 29 |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Clay | 29 | % Silt | 18 | % Sand | 26 | % Gravel | 27 |
| Unified Soil Classification | GC | | | PRA Soil Classification | | A-6 | |




**Notes:**

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

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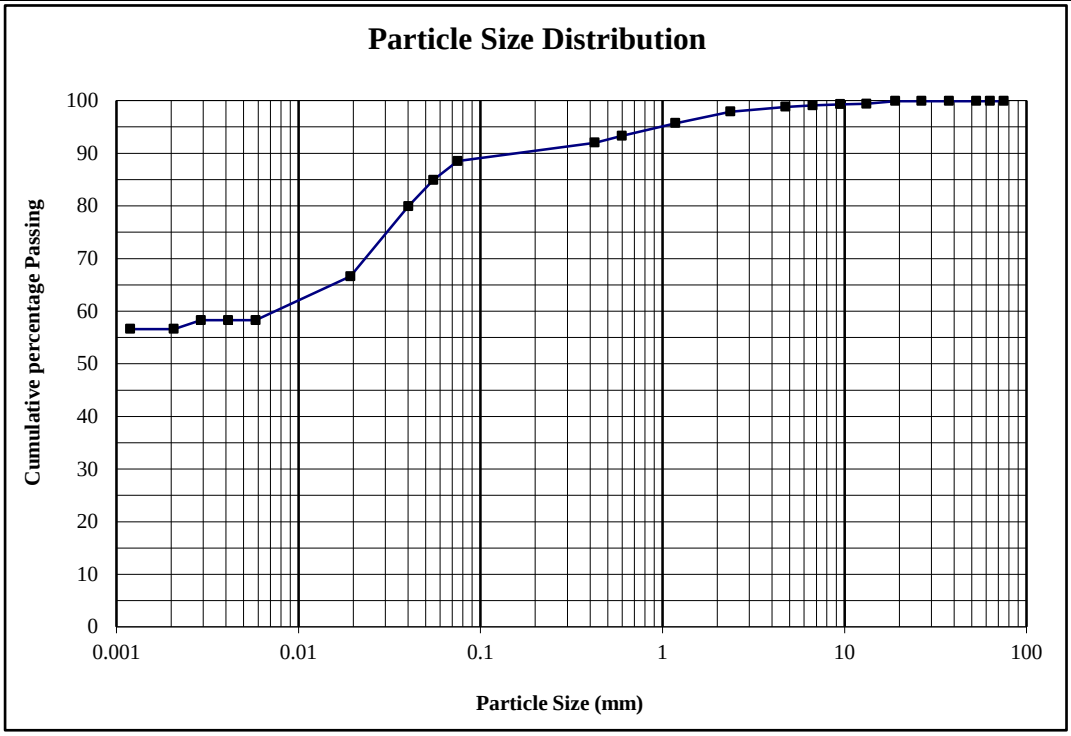
| | Knysna | Date Reported : | 05/09/13 |
| | 6570 | Req. Number : | 2545/13 |
| Attention : | Marike Vreken | No. of Pages : | 1/3 |

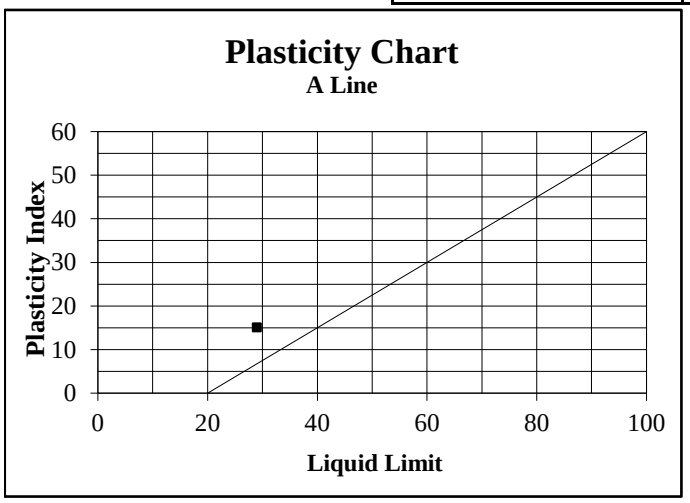
## TEST REPORT
## FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

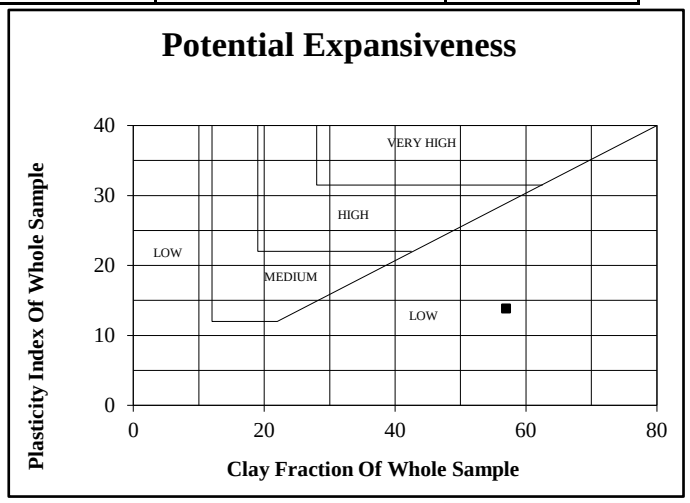
| | | | | | | |
|---|---|---|---|---|---|---|
| Material Description: | Dark Reddish Orange - Silty Clay | Sample Number: | 52502 | | | |
| Position: | C2 - Layer 3 | Liquid Limit | 29 | Linear Shrinkage | 7 | |
| Depth: | 750-2400 | Plasticity Index | 15 | Insitu M/C% | 16.5 | |

| Sieve Size(mm) | % Passing |
|---|---|
| 75.0 | 100 |
| 63.0 | 100 |
| 53.0 | 100 |
| 37.5 | 100 |
| 26.5 | 100 |
| 19.0 | 100 |
| 13.2 | 99 |
| 9.5 | 99 |
| 6.7 | 99 |
| 4.75 | 99 |
| 2.36 | 98 |
| 1.18 | 96 |
| 0.600 | 93 |
| 0.425 | 92 |
| 0.075 | 89 |
| 0.0551 | 85 |
| 0.0402 | 80 |
| 0.0193 | 67 |
| 0.0058 | 58 |
| 0.0041 | 58 |
| 0.0029 | 58 |
| 0.0021 | 57 |
| 0.0012 | 57 |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Clay | 57 | % Silt | 30 | % Sand | 10 | % Gravel | 3 |
| Unified Soil Classification | CL | | | PRA Soil Classification | | A-6 | |




**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.**

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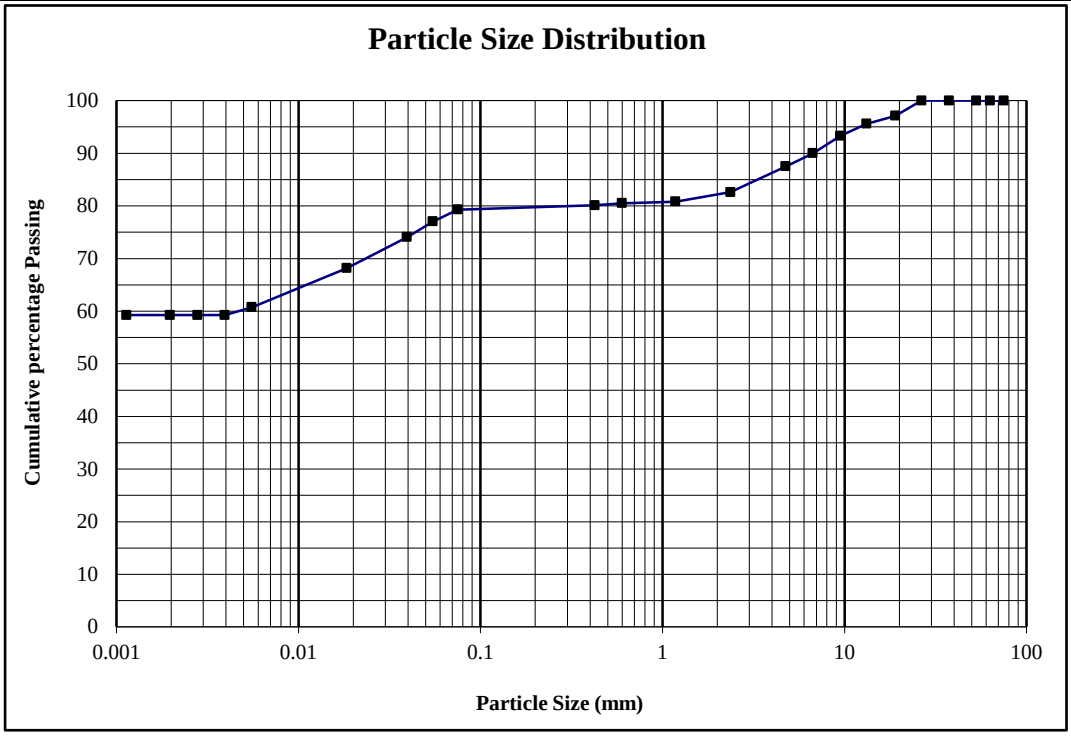
| | Knysna | Date Reported : | 05/09/13 |
| | 6570 | Req. Number : | 2545/13 |
| Attention : | Marike Vreken | No. of Pages : | 2/3 |

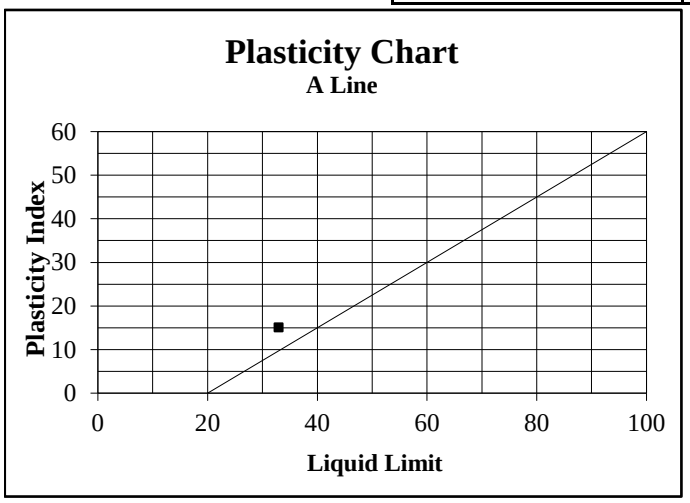
## TEST REPORT
## FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

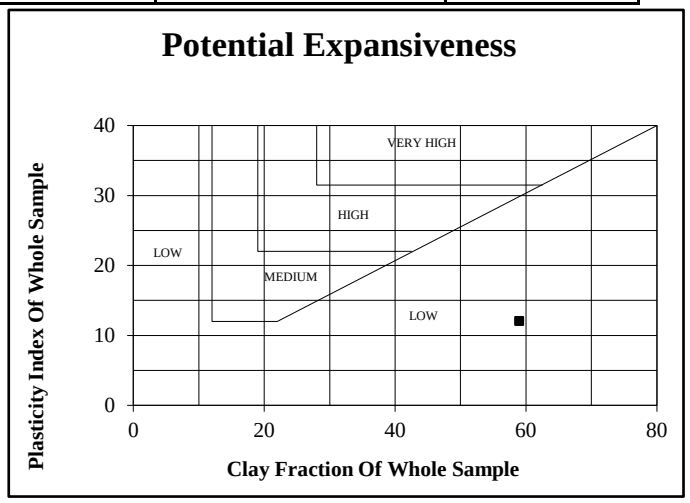
| | | | | | | |
|---|---|---|---|---|---|---|
| Material Description: | Dark Yellowish Orange - Gravelley Silty Clay | Sample Number: | 52503 | | | |
| Position: | C4 - Layer 3 | Liquid Limit | 33 | Linear Shrinkage | 7 | |
| Depth: | 1100-2300 | Plasticity Index | 15 | Insitu M/C% | 18.1 | |

| Sieve Size(mm) | % Passing |
|---|---|
| 75.0 | 100 |
| 63.0 | 100 |
| 53.0 | 100 |
| 37.5 | 100 |
| 26.5 | 100 |
| 19.0 | 97 |
| 13.2 | 96 |
| 9.5 | 93 |
| 6.7 | 90 |
| 4.75 | 88 |
| 2.36 | 83 |
| 1.18 | 81 |
| 0.600 | 81 |
| 0.425 | 80 |
| 0.075 | 79 |
| 0.0547 | 77 |
| 0.0394 | 74 |
| 0.0184 | 68 |
| 0.0055 | 61 |
| 0.0039 | 59 |
| 0.0028 | 59 |
| 0.0020 | 59 |
| 0.0011 | 59 |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Clay | 59 | % Silt | 19 | % Sand | 4 | % Gravel | 18 |
| Unified Soil Classification | CL | | | PRA Soil Classification | | A-6 | |




**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.**

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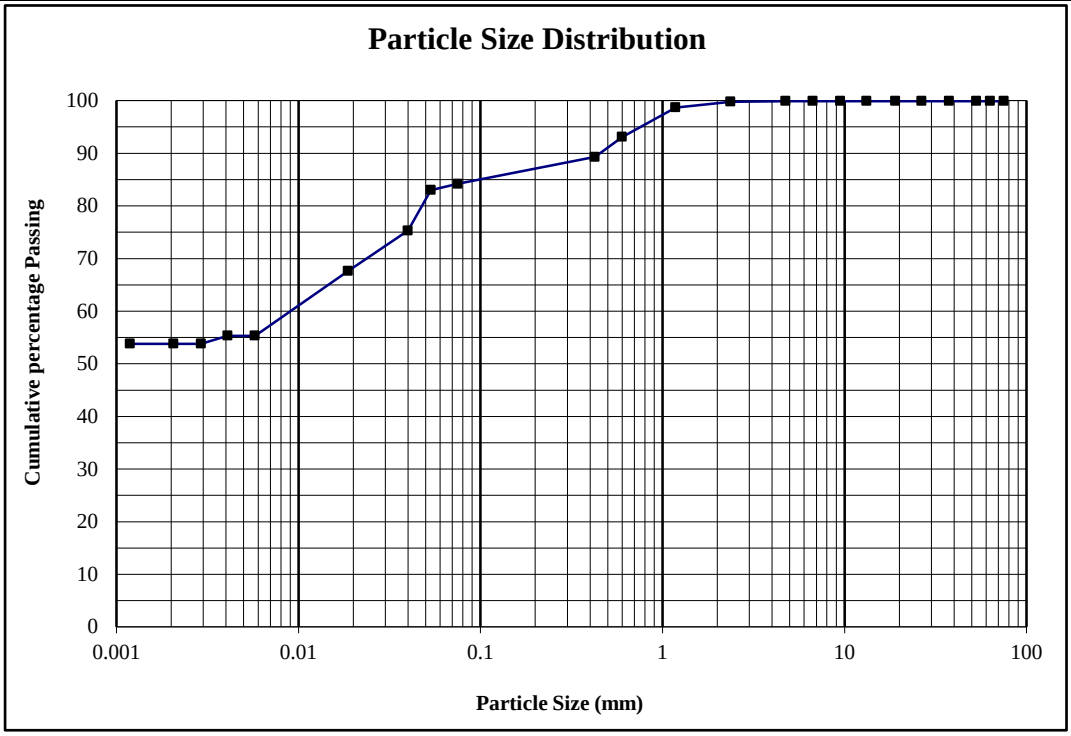
| | Knysna | Date Reported : | 05/09/13 |
| | 6570 | Req. Number : | 2545/13 |
| Attention : | Marike Vreken | No. of Pages : | 3/3 |

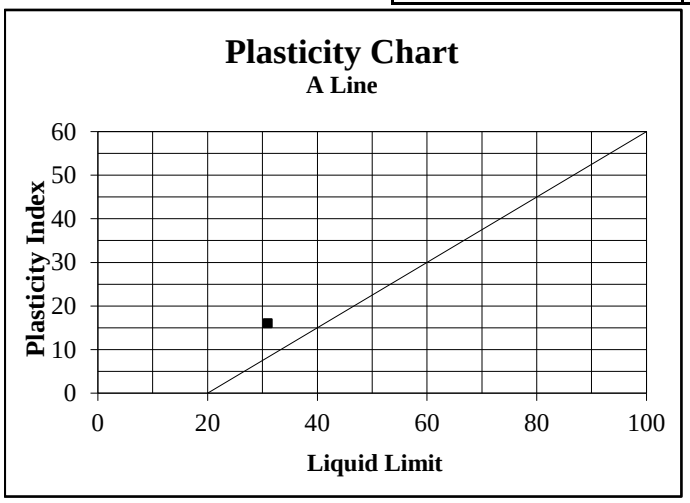
## TEST REPORT
## FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

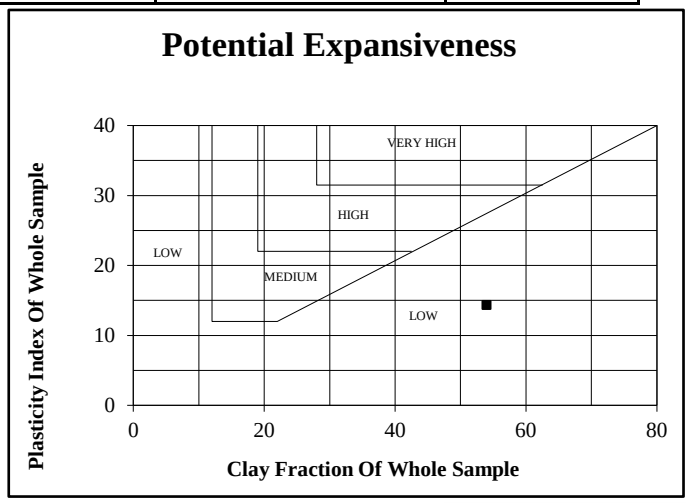
| | | | | | | |
|---|---|---|---|---|---|---|
| Material Description: | Dark Reddish Orange - Silty Clay | Sample Number: | 52504 | | | |
| Position: | C6 - Layer 3 | Liquid Limit | 31 | Linear Shrinkage | 8 | |
| Depth: | 900-1800 | Plasticity Index | 16 | Insitu M/C% | 14.1 | |

| Sieve Size(mm) | % Passing |
|---|---|
| 75.0 | 100 |
| 63.0 | 100 |
| 53.0 | 100 |
| 37.5 | 100 |
| 26.5 | 100 |
| 19.0 | 100 |
| 13.2 | 100 |
| 9.5 | 100 |
| 6.7 | 100 |
| 4.75 | 100 |
| 2.36 | 100 |
| 1.18 | 99 |
| 0.600 | 93 |
| 0.425 | 89 |
| 0.075 | 84 |
| 0.0533 | 83 |
| 0.0399 | 75 |
| 0.0187 | 68 |
| 0.0058 | 55 |
| 0.0041 | 55 |
| 0.0029 | 54 |
| 0.0021 | 54 |
| 0.0012 | 54 |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| % Clay | 54 | % Silt | 33 | % Sand | 12 | % Gravel | 1 |
| Unified Soil Classification | CL | | | PRA Soil Classification | | A-6 | |




**Notes:**

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- **All specimen sampled by : Shane Gallant**
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# Appendix 4

# DCP test data

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Geotechnical Engineering Consultants

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26 Cove Street, Knysna : PO Box 3186, George Industria, 6536

Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za


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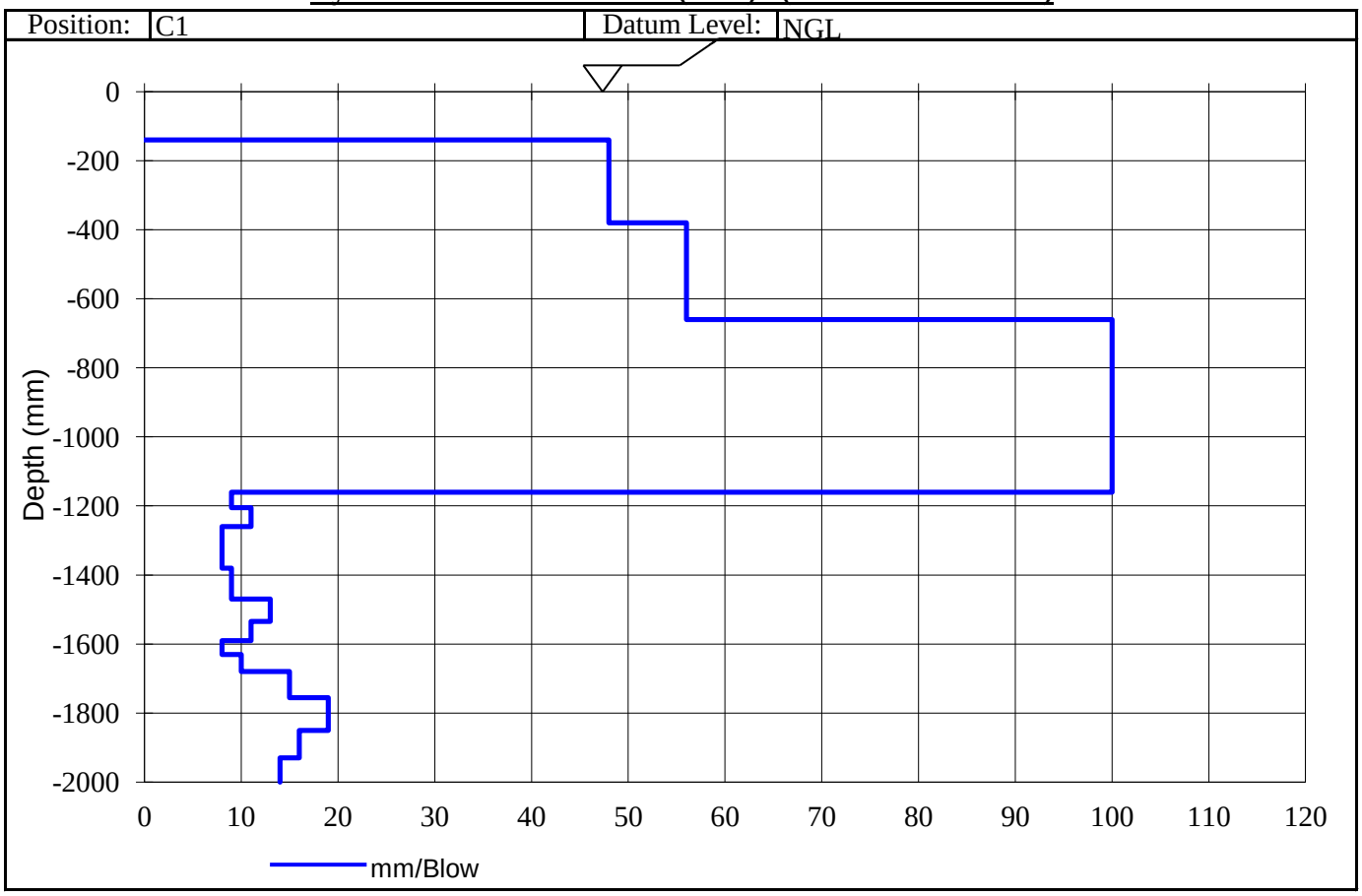
| | | Date Reported : | |
| | | Req. Number : | |
| Attention : | Marike Vreken Town Planners cc | No. of Pages : | 1 of 5 |

## TEST REPORT

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

Position: C1 Datum Level: NGL

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Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za


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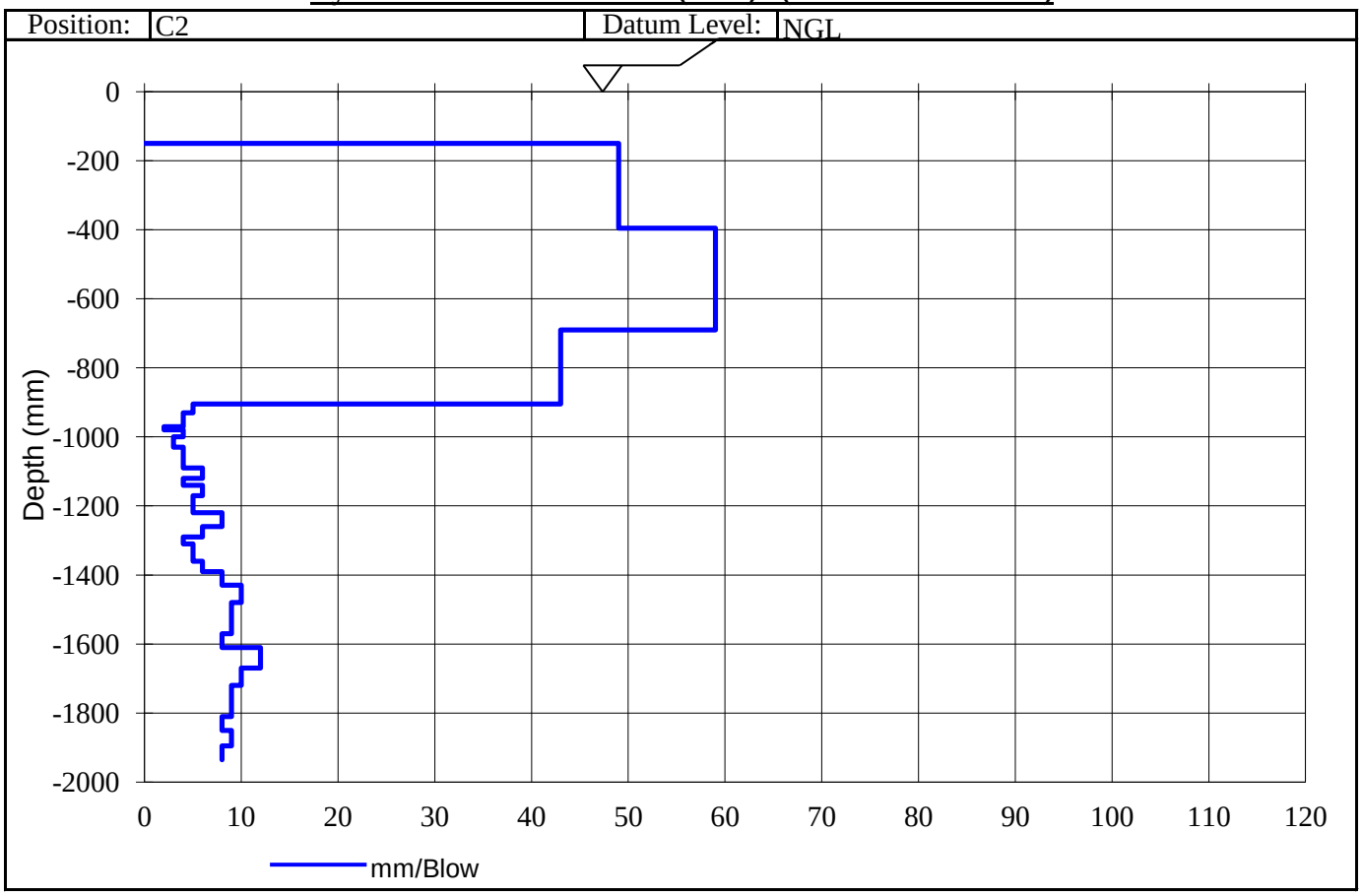
## TEST REPORT

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

Position: C2 Datum Level: NGL

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| | | Date Received : | 21.08.13 |
| | | Date Reported : | |
| | | Req. Number : | |
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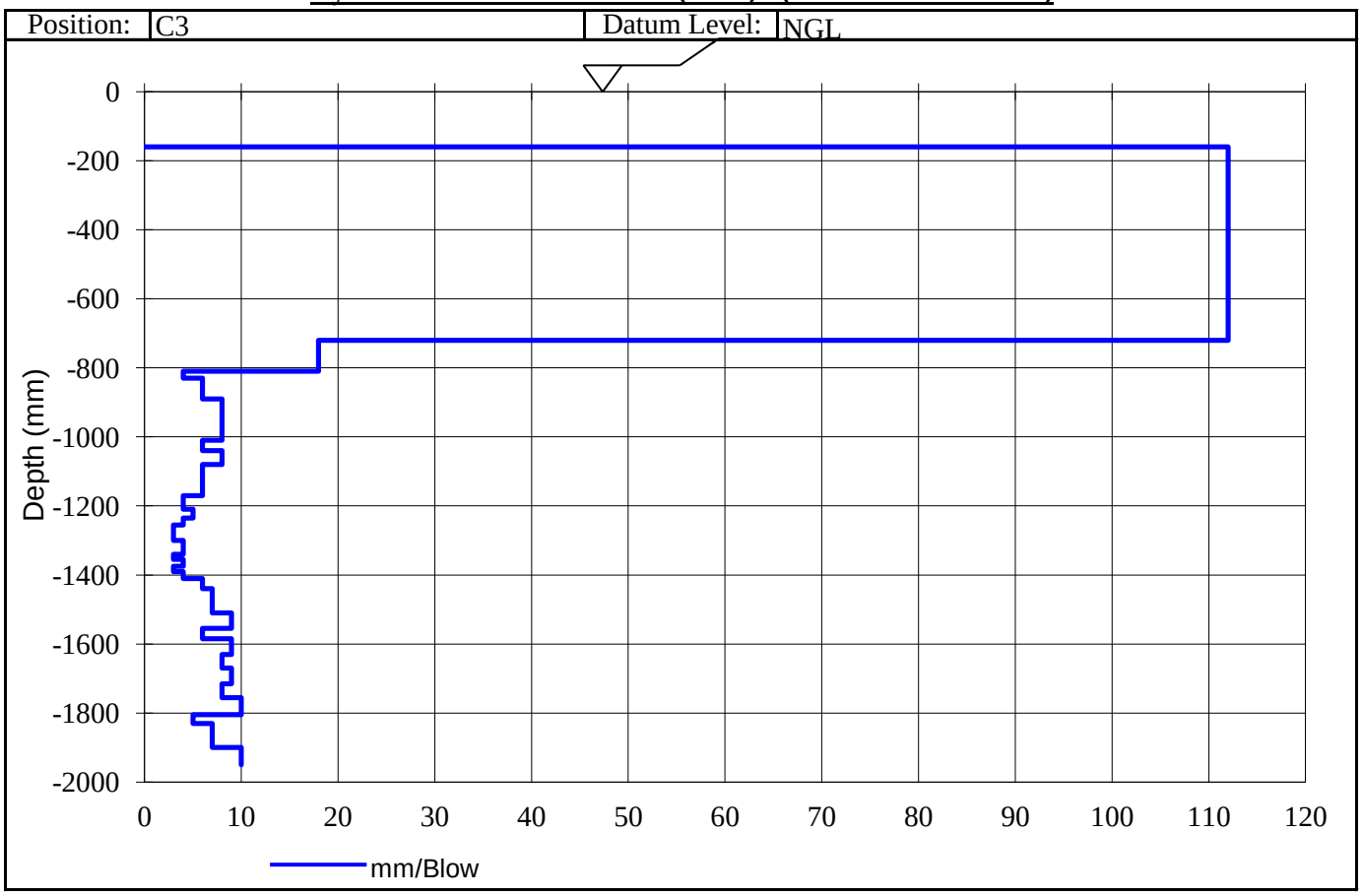
## TEST REPORT

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

Position: C3 Datum Level: NGL

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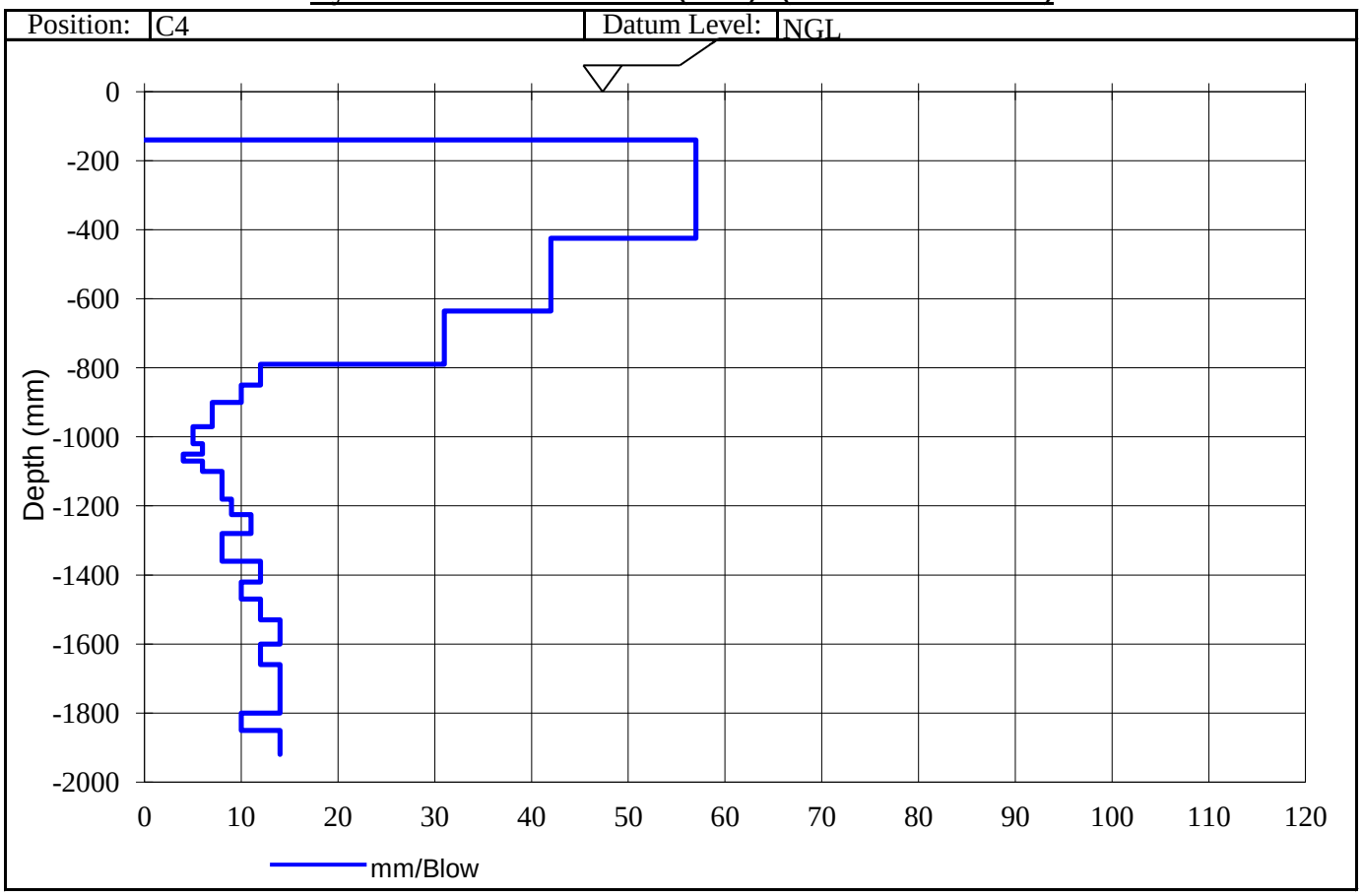
## TEST REPORT

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

Position: C4 Datum Level: NGL




**Notes:**

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# Outeniqua Geotechnical Services cc.

Geotechnical Engineering Consultants

Registration No. 1999/062743/23

26 Cove Street, Knysna : PO Box 3186, George Industria, 6536

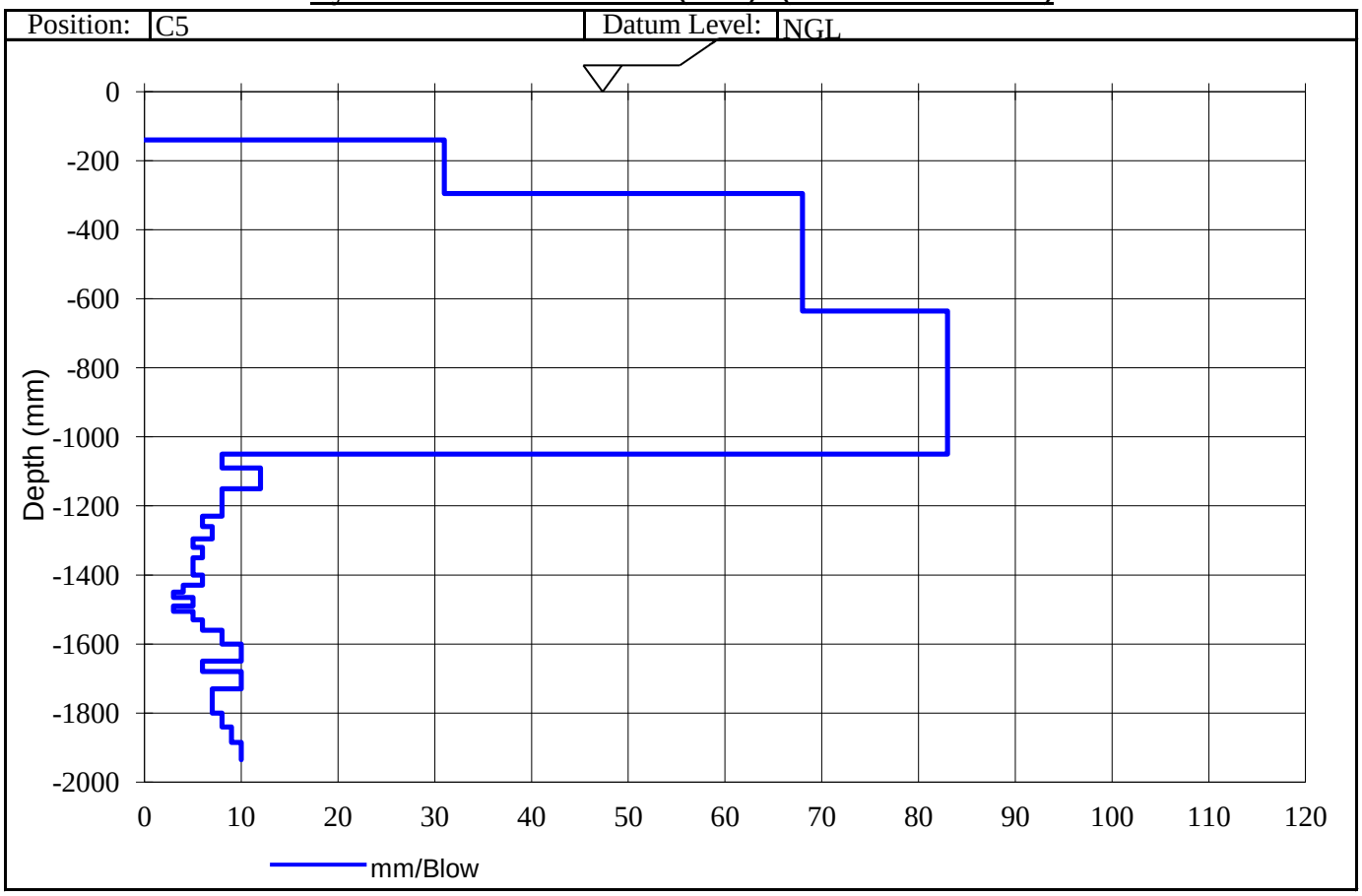
Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za


| | | | |
|---|---|---|---|
| Customer : | Marike Vreken Town Planners cc<br>31 Spring St<br>Knysna<br>6570 | Project : | New Cemetery, Plettenberg Bay |
| | | Date Received : | 21.08.13 |
| | | Date Reported : | |
| | | Req. Number : | |
| Attention : | Marike Vreken Town Planners cc | No. of Pages : | 5 of 5 |

## TEST REPORT

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

Position: C5 Datum Level: NGL

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| | | Date Received : | |
| | | Date Reported : | 21.08.13 |
| | | Req. Number : | |
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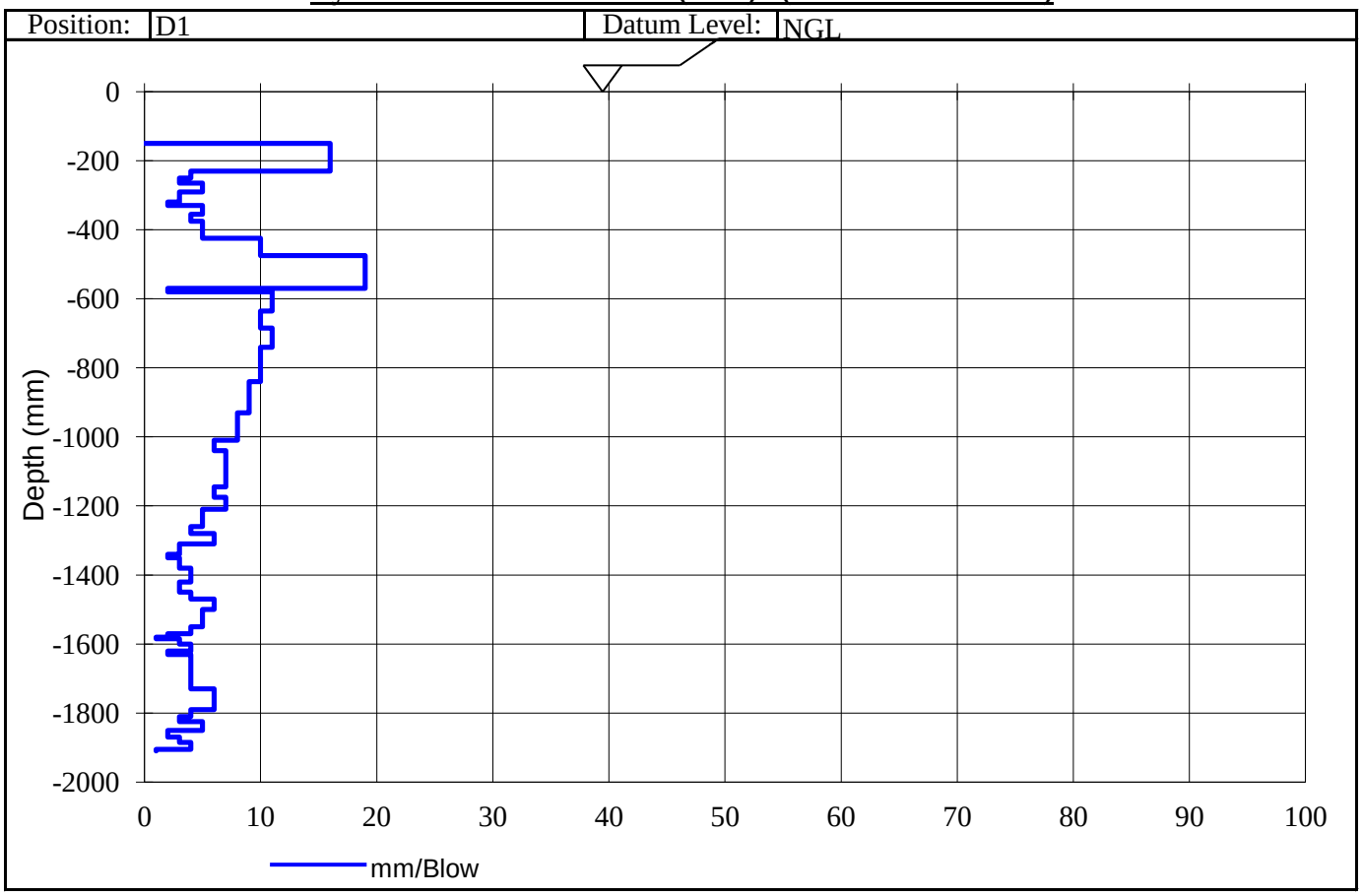
## TEST REPORT

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

Position: D1 Datum Level: NGL

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| | | Date Received : | |
| | | Date Reported : | 21.08.13 |
| | | Req. Number : | |
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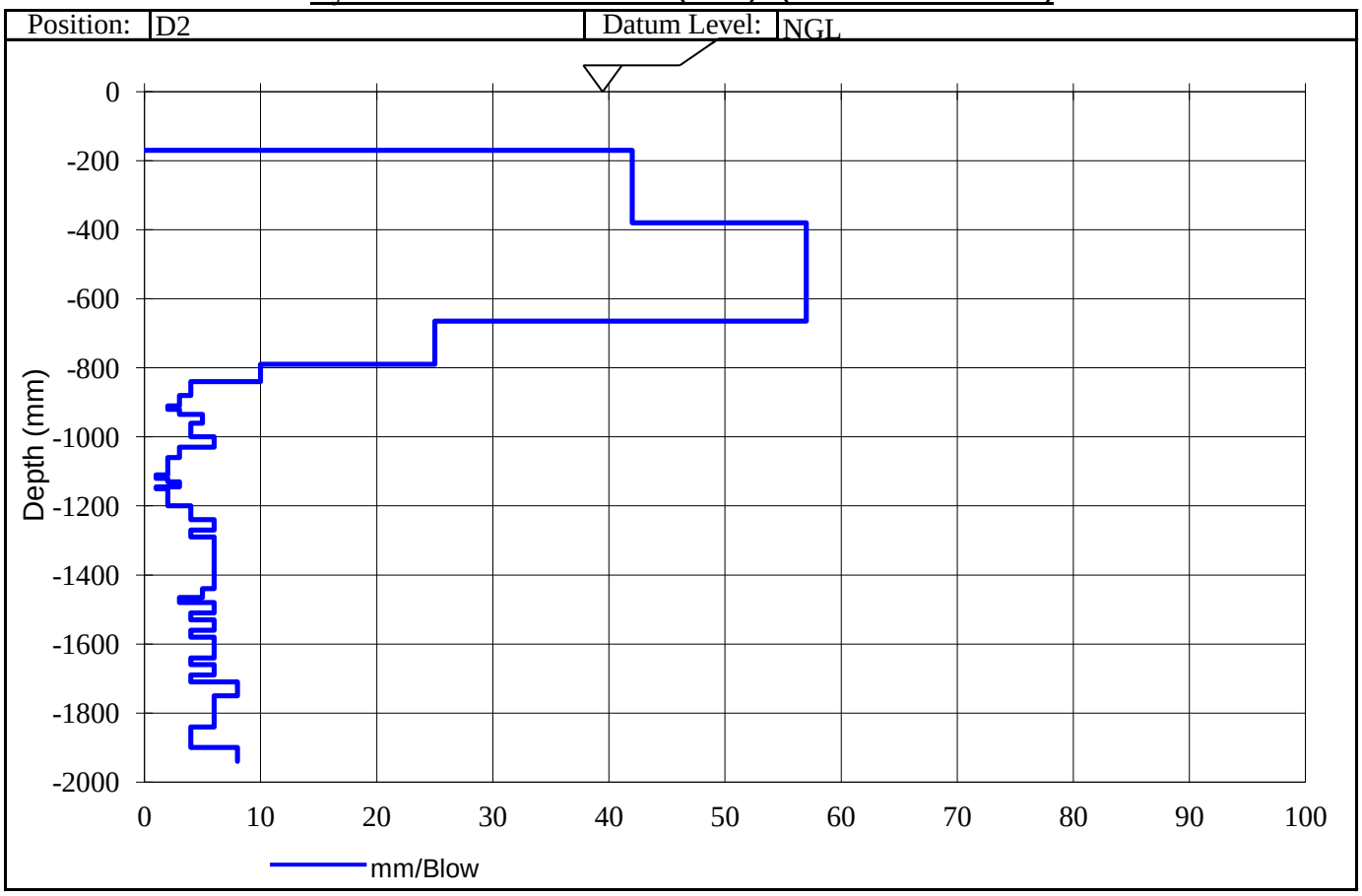
## TEST REPORT

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

Position: D2 Datum Level: NGL

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|---|---|---|---|
| Customer : | Marike Vreken Town Planners cc<br>31 Spring St<br>Knysna<br>6570 | Project : | New Cemetery, Plettenberg Bay |
| | | Date Received : | |
| | | Date Reported : | 21.08.13 |
| | | Req. Number : | |
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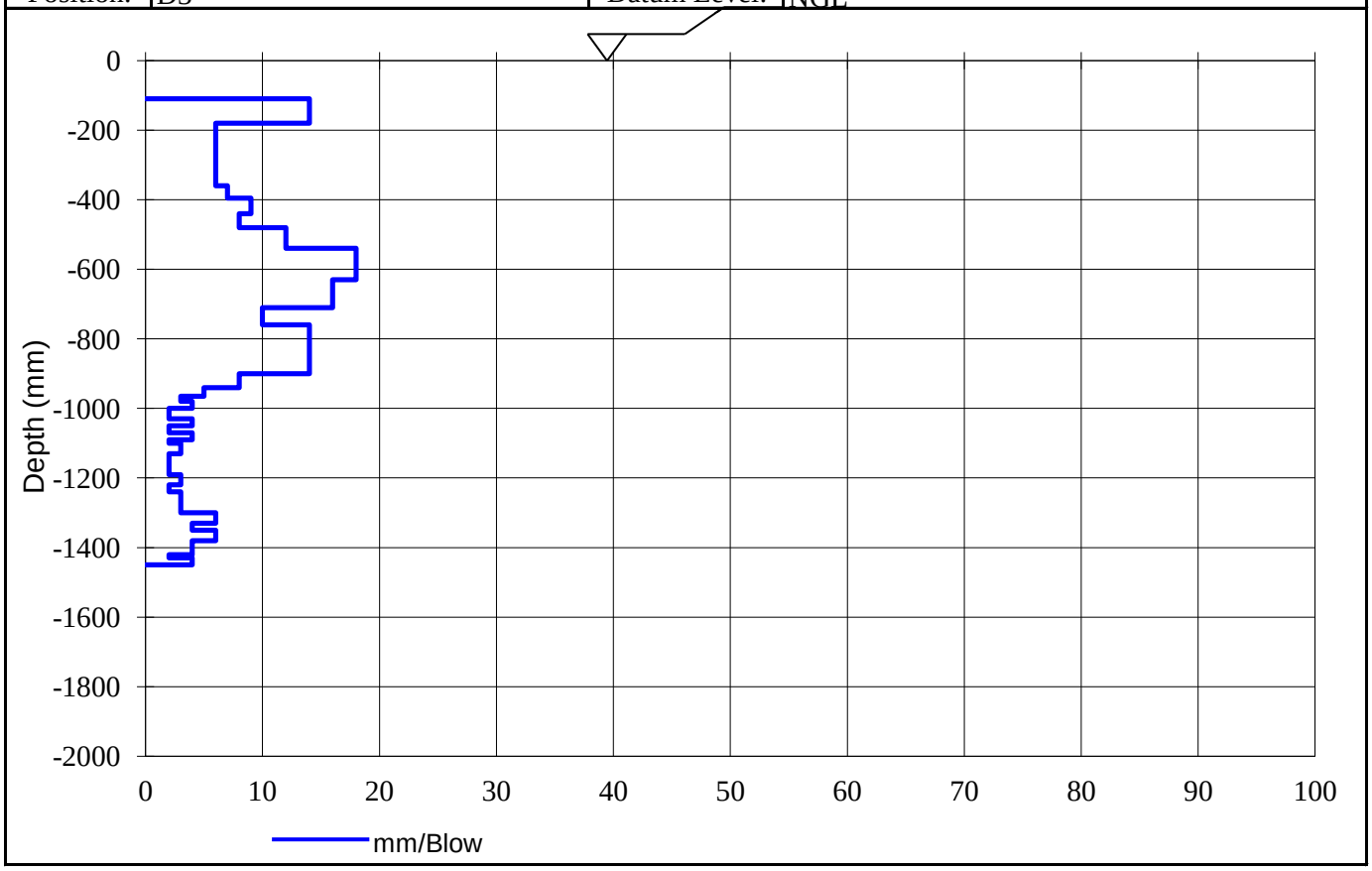
## TEST REPORT

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

Position: D3 Datum Level: NGL

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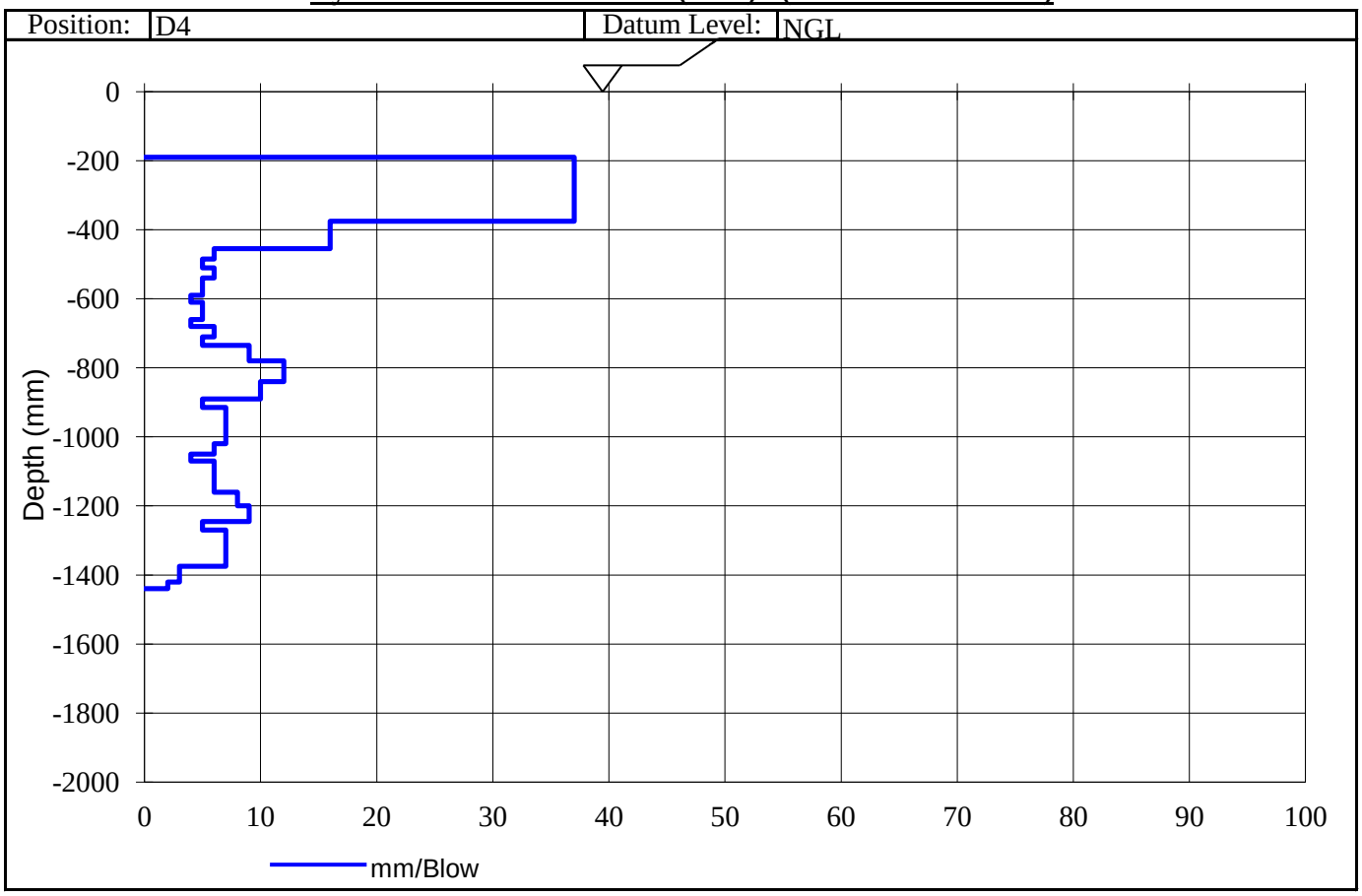
| | | Date Received : | |
| | | Date Reported : | 21.08.13 |
| | | Req. Number : | |
| Attention : | Marike Vreken | No. of Pages : | 2 of 5 |

## TEST REPORT

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

Position: D4 Datum Level: NGL

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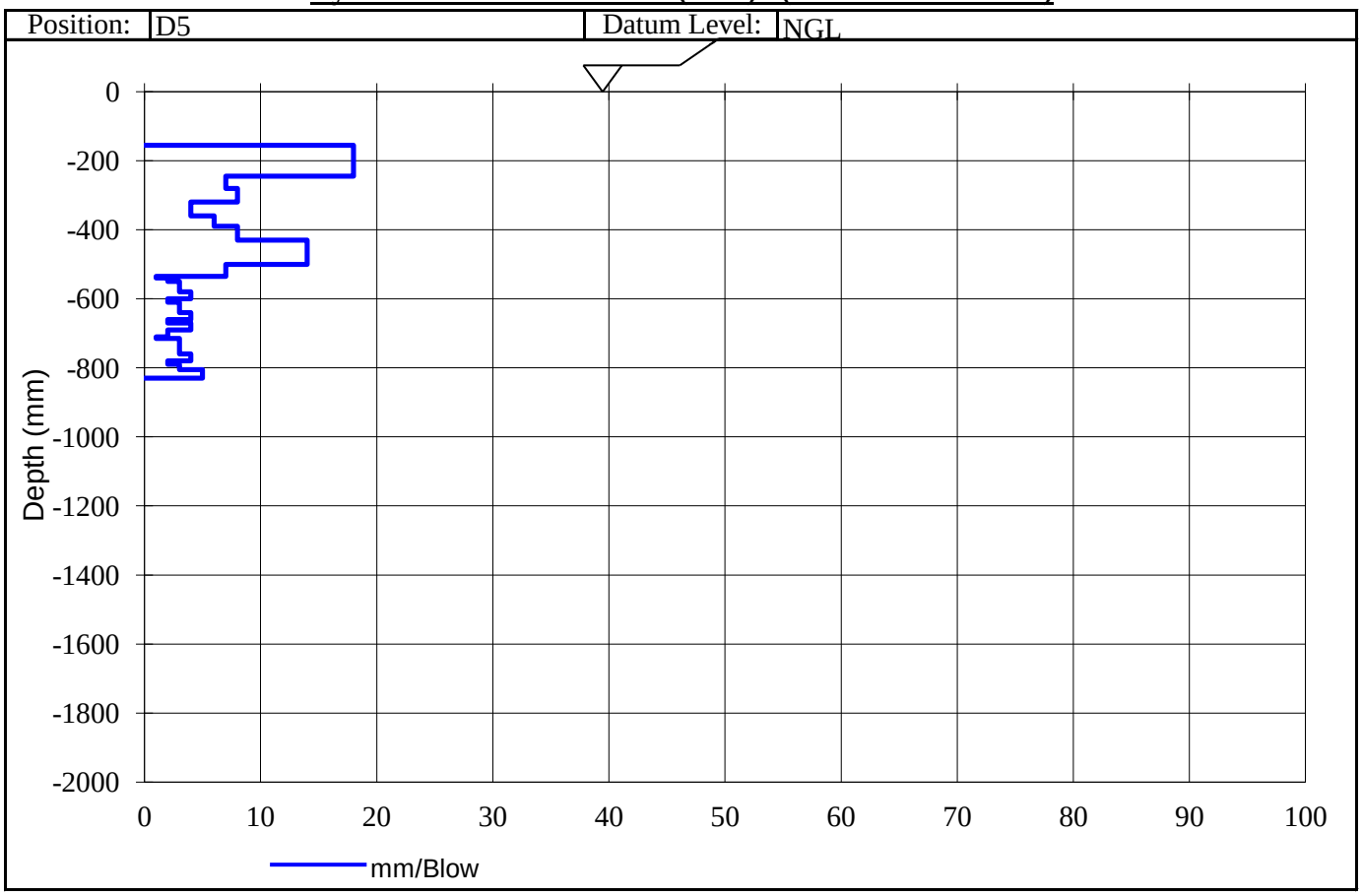
| | | Req. Number : | |
| Attention : | Marike Vreken | No. of Pages : | 1 of 5 |

## TEST REPORT

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

Position: D5 Datum Level: NGL

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# Appendix 5

# Site selection criteria

**Outeniqua Geotechnical Services**

**Cemetery Site Selection**

Municipality: Bitou

Date: 16 September 2013

| Site Name: | SITE C (Ptn 3/437) | Site rejected? | No | Total points: | 22 | | | |
|---|---|---|---|---|---|---|---|---|
| **No** | **Criteria** | **Totally unsuitable (0 Points)** | **Unfavourable (1 Point)** | **Suitable (2 Points)** | **Ideal (3 Points)** | **Points** |
| 1 | Excavatibility by hand to 2m | Very difficult e.g. shallow hard rock | Difficult e.g. shalow soft rock, very dense gravel, boulders or very stiff clay | Moderate e.g. Dense gravels, stiff clayey soil | Easy e.g. Sandy soil or firm clayey soil | 2 |
| 2 | Permeability | <$10^{-7}$cm/s (fat clay or intact silt) or >$10^{-4}$cm/s (clean sands & gravels) | $10^{-7}$cm/s to $10^{-6}$cm/s (gravelly, sandy or fissured clay/silt) | $10^{-6}$cm/s to $10^{-5}$cm/s (Clayey sand/gravel) | $10^{-5}$cm/s to $10^{-4}$cm/s (Silty sand/gravel) | 1 |
| 3 | Proximity to domestic water sources | <150m | 150-300m | 300-450m | >450m | 1 |
| 4 | Proximity to drainage features | <50m | 50-100m | 100-150m | >150m | 1 |
| 5 | Surface drainage | Very poor e.g. marshes or standing water | Poor e.g. depressions or flat ground in wet climatic areas | Moderate e.g. Flat ground in dry climatic areas | Good e.g. gentle slope | 3 |
| 6 | Topography | Slope >11° (1:5) | Slope 9° to 11°or <2° (1:6 to 1:5 or <1:30) | Slope 6° to 9° (1:10 to 1:6) | Slope 2° to 6° (1:30 to 1:10) | 3 |
| 7 | Basal buffer zone | <1m | 1-1.8m | 1.8-2.5m | >2.5m | 1 |
| 8 | Grave sidewall stability | Very loose/very soft and/or wet | Loose/soft and/or very moist | Medium dense/firm or dense but cohesionless and slightly moist to dry | Dense and slightly cohesive, stiff and slightly moist to dry | 3 |
| 9 | Soil workability | Fat clay (CH), elastic silt (MH), gravels with little or no fines (GW,GP) | Organic silt/clay (OL/OH) or lean clays (CL) | Lean silt (ML), clayey or silty gravel (GC,GM), sands with little or no fines (SW,SP) | Silty sand (SM) or clayey sand (SC) | 1 |
| 10 | Cemetery size | <1Ha | 1-3Ha | 3-6Ha | >6Ha | 3 |
| 11 | Proximity to existing roads & services | >500m | 250m-500m | 100m-250m | <100m | 3 |

| Site Name: | SITE D (Ptn 33/437) | Site rejected? | No | Total points: | 20 | | | |
|---|---|---|---|---|---|---|---|---|
| **No** | **Criteria** | **Totally unsuitable (0 Points)** | **Unfavourable (1 Point)** | **Suitable (2 Points)** | **Ideal (3 Points)** | **Points** |
| 1 | Excavatibility by hand to 2m | Very difficult e.g. shallow hard rock | Difficult e.g. shalow soft rock, very dense gravel, boulders or very stiff clay | Moderate e.g. Dense gravels, stiff clayey soil | Easy e.g. Sandy soil or firm clayey soil | 1 |
| 2 | Permeability | <$10^{-7}$cm/s (fat clay or intact silt) or >$10^{-4}$cm/s (clean sands & gravels) | $10^{-7}$cm/s to $10^{-6}$cm/s (gravelly, sandy or fissured clay/silt) | $10^{-6}$cm/s to $10^{-5}$cm/s (Clayey sand/gravel) | $10^{-5}$cm/s to $10^{-4}$cm/s (Silty sand/gravel) | 1 |
| 3 | Proximity to domestic water sources | <150m | 150-300m | 300-450m | >450m | 1 |
| 4 | Proximity to drainage features | <50m | 50-100m | 100-150m | >150m | 1 |
| 5 | Surface drainage | Very poor e.g. marshes or standing water | Poor e.g. depressions or flat ground in wet climatic areas | Moderate e.g. Flat ground in dry climatic areas | Good e.g. gentle slope | 3 |
| 6 | Topography | Slope >11° (1:5) | Slope 9° to 11°or <2° (1:6 to 1:5 or <1:30) | Slope 6° to 9° (1:10 to 1:6) | Slope 2° to 6° (1:30 to 1:10) | 3 |
| 7 | Basal buffer zone | <1m | 1-1.8m | 1.8-2.5m | >2.5m | 1 |
| 8 | Grave sidewall stability | Very loose/very soft and/or wet | Loose/soft and/or very moist | Medium dense/firm or dense but cohesionless and slightly moist to dry | Dense and slightly cohesive, stiff and slightly moist to dry | 3 |
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| 10 | Cemetery size | <1Ha | 1-3Ha | 3-6Ha | >6Ha | 3 |
| 11 | Proximity to existing roads & services | >500m | 250m-500m | 100m-250m | <100m | 2 |