

18 March 2020

Ref No: J00784 (Rev 3)

Oyster Capital
C/- Mr A McCarthy

Dear Andrew

RE: Preliminary Geotechnical Appraisal Report for the Waihoehoe Plan Change Area, Drury

1 INTRODUCTION

Oyster Capital (“Oyster”) is applying to Auckland Council for a Plan Change to the Auckland Unitary Plan (Operative in Part) (AUP) to rezone 48.9 hectares of Future Urban land in Drury East. It is proposed to rezone the land to a mix of residential zones (Terraced Housing and Apartment Buildings and Mixed Housing Urban) with provision for drainage reserves. The rezoning proposal provides capacity for up to 1054 dwellings. Additionally, a precinct is proposed with trigger rules that stage the release of development capacity with the delivery of required infrastructure.

Oyster has an interest in 18.4 hectares of land on the northern side of Waihoehoe Road as outlined in **Figure A** below. Oyster are experienced residential and land developers in Auckland and are currently undertaking large scale and high-quality housing developments in Whenuapai and Beachlands.

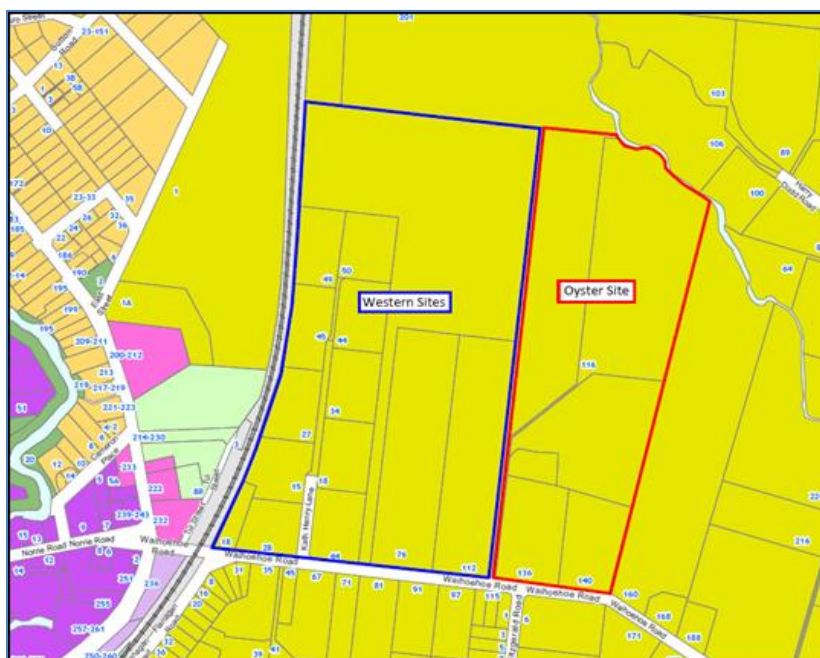


Figure A: Showing the Plan Change Area and the Oyster Capital land holdings (shown blue).

Lander Geotechnical Consultants Limited have been engaged by Oyster to undertake a reasonably comprehensive desktop and preliminary field investigation of geotechnical conditions of the above site as delineated on the attached Geology Overview Plan (Figure 01) and Site Investigation Plan (Figure 2) respectively.

2 SCOPE AND OBJECTIVES

Our brief principally relates to the preparation of a Preliminary Geotechnical Appraisal Report (PGAR), in order to support a comprehensive structure planning process and subsequent private plan change application for the area define on Figure 1.

More specifically, our scope of work for the PGAR comprises:

- Desktop review of geology in beneath the Waihoehoe Plan Change area.
- Summary of the main topographical feature present, soil types and underlying geology, areas of obvious historic land modification (e.g. fill), and potential constraints to future urban development.
- The results of the Lander Geotechnical preliminary geotechnical field investigation in No. 116 Waihoehoe Road to assess the nature, bearing qualities, liquefaction potential and relative uniformity of the subsoils to the depths likely to be affected by any future land development works and future building loads;
- Preparation of a PGAR presenting the findings of this preliminary work.

In preparing this report, Lander Geotechnical have reviewed the following previous report:

- Lander Geotechnical Consultants Limited, Preliminary Geotechnical Appraisal Report for 116, 122, 128, 132, 136 and 140 Waihoehoe Road, Drury, reference J00784, dated 19 October 2017

3 SITE SPECIFIC APPRAISAL

3.1 Site Description

3.1.1 General

Our study area (“the site”) comprises a number of separate properties, the legal descriptions and respective areas of each are able to be ascertained from Council’s GIS database if required. The site is bound by Waihoehoe Road to the south and neighbouring rural properties / farmlands on all other boundaries and it’s approximately outlined by the blue line depicted on the attached Figure 01.

Physical site investigations have been undertaken in the property of 116 Waihoehoe Road which is within the Plan Change area, as per Figure 02 attached. The majority of No.116 is in pasture and partially (towards the ‘front’ portion as defined on Figure 02 attached) used for forging factory. There are also numerous dwellings across the site mainly to wards the southern portion.

The geomorphology of the area is defined as featureless alluvial plains, apart from shallow manmade farm drains / drainage ditches. Except where hand auger HA104 has drilled, a up to 2.2m topsoil stockpile was identified, there were no obvious signs of large-scale instability or land modifications as a result our preliminary work.

3.2 Geology

Edbrooke, S. W. Institute of Geological and Nuclear Sciences. *Geology of the Auckland Area: Scale 1:250,000*. geological map 3. 2001 describes the lithology as Puketoka formation soils consisting of Pliocene to Pleistocene alluvial sedimentary soils. Composition includes inorganic rock derived sediments, pumiceous sediments and organic and peat soils. The Puketoka formation is generally more consolidated and therefore stiffer than younger Tauranga group soils.

3.3 Preliminary Borehole Findings

Our fieldwork was undertaken in No 116 Waihoehoe Road on 21 and 22 January 2019 and involved the drilling of 12 hand auger boreholes to depths of up to 5 metres. In-situ shear vane tests were taken at 0.5m intervals to assess the vane shear strengths of the underlying soil. Hand augers 01 to 04 from October 2017 as also appended as supplementary information. The positions are shown on the attached Figure 01. A summary of findings is as follows:

- Topsoil was encountered at all borehole locations and ranged between 100mm and 300mm in thickness (except HA104 where topsoil encountered up to 2.2m thick in a localised stockpile);
- Existing filling was encountered in HA101 and HA107 to a depth of 1.0m and 0.7m respectively. Topsoil stockpile was identified in vicinity of hand auger borehole HA104;
- The natural subsoils investigated by our boreholes predominantly consisted of inorganic orange, brown, green and grey silts, clays and sands with organic inclusions and staining in majority of our boreholes. Vane shear strengths measured within these deposits were typically returned readings between 51kPa to in excess of 205kPa indicating they were stiff to hard. Sensitivities to disturbance were typically in the range of 1.6 to 5.9 (insensitive to sensitive);
- Standing groundwater was encountered and measured at the completion of the drilling in HA102, HA105, HA106, HA107, HA108, HA109, HA110 and HA111 at 2.0m, 1.9m, 2.0m, 1.4m, 2.8m, 2.2m, 3.0m and 3.0m depth respectively. Groundwater was not encountered in our other borehole locations during the time of our investigation. Hand augers HA01 to 04 from 2017 showed the water table encountered at 0.4m, 1.0m and 1.0m respectively at the completion of the drilling;
- CPT testings refused on dense materials at between 11.0m and 14.0m depth below existing ground level.

3.4 Geotechnical Considerations

Published geology maps show that Puketoka Formation soils are present beneath the entire study area and it is sensible to conclude that ground conditions identified via the site investigations in No. 116 Waihoehoe Road will persist across the study area. Therefore, the considerations presented below are deemed to be relevant to the entire Waihoehoe Plan Change area.

3.4.1 Foundation for Buildings

Where inorganic natural ground is present, bearing capacity is expected to be in accordance with the limitations imposed by NZS 3604 where 300kPa geotechnical ultimate bearing capacity should be adopted. However, as is evident from the borehole findings to date the natural soils can contain pockets of weaker ground and/ or lenses of organics.

- Softer ground or lenses of organics can pose constraints to NZS3604 building foundations and residential end use, necessitating remediation during earthworks construction or specifically designed foundation solutions (i.e. “raft” foundations). Lander Geotechnical's experience in the delivery of hundreds of building platforms to the north-west (Hingaia Peninsular area) and west (Auranga Development area) indicates only a small proportion of lots may be affected by soft ground or organic soils, but in due course more intensive physical site investigation associated with a subdivision development scheme will substantiate this risk;
- The soils are likely to fall within AS2870 Class M to H expansive Site Class, and this is subject to laboratory testing of soil samples collected during later more intensive investigation for the Resource Consent phase(s) to support a specified subdivision scheme. Foundation design for end user will need to mitigate adverse effects from expansive soils;

3.4.2 Liquefaction Assessment

3.4.2.1 Earthquake Risk and Liquefaction Potential

A seismic liquefaction assessment has been carried out in accordance with the guidelines of MBIE module 3. Assessments were carried out using CLiq version 1.7 software. The Boulanger and Idriss (2014) method was applied to the CPT data that we have retrieved from site. This analysis has allowed for clays to soften and sands to liquefy under seismic loadings. A groundwater table of 1m below the surface has been adopted.

Peak ground Acceleration (PGA) were determined for both Serviceability Limit State (SLS) and Ultimate Limit State (ULS) criteria for each assessment. PGA was determined in accordance with NZS 1170.5 – 2004, assuming Class C soils across the site (based on our investigation). Calculations also take account for the seismic reduction factor of 0.65. Building Importance Level 2 has been assumed and based on this, a SLS (1/25yr return period) and ULS (1/500yr return period) PGA have been calculated as 0.03g and 0.12g respectively.

Based on the results presented in the outputs (attached), this analysis confirms that under an ULS earthquake the calculated maximum vertical settlements are up to 140mm. The maximum Liquefaction Potential Index (LPI) and Liquefaction Severity Number (LSN) are up to 1.546 and 20.416 respectively. These LPI and LSN figures indicate that a performance level of L2 can be assumed (based on Module 3 Guidelines, Table 5.1) and thus liquefaction effects can be considered to be moderate.

The zone of liquefaction is beyond 4m depth. It is considered likely the liquefaction induced settlement will occur relatively uncommonly (i.e. in a total fashion) across the landform, and according excessive differential settlements are unlikely to be a cause for concern, as indicated by the SLS results. However, because of the potential for total settlements any subdivision will need to be designed with this in mind, with regard to overland flows and flood plains.

No lateral displacements have been calculated as the landform of our study area is a featureless alluvial plan (which is overall flat).

3.4.2.2 Compositional Criterial of Soils

In soils consisting of greater than 30% fines (classified as dry mass passing through a 0.075mm sieve consistent with the particle size distribution tests carried out), liquefaction susceptibility can be classified as follows:

- Plasticity Index < 7: Susceptible to liquefaction;
- 7 < Plasticity Index < 12: Potentially susceptible to liquefaction;
- Plasticity Index > 12: Not susceptible to liquefaction.

The Atterberg classification results from the near surface soils indicate that the sample taken from HA100 at 0.5m to 1.0m with a PI of 56 indicating that is not susceptible to liquefaction, and the sample taken from HA110 at 0.5m to 1.0m with PI of 41 is also not susceptible to liquefaction.

3.4.3 Earthworks and Infrastructure

The natural deposits encountered across the site are typically of high strength and have good engineering characteristics for foundations and earthworks handling. Largely inorganic soils of relatively stiff to very stiff strength will be identified, although organic lenses and weaker sensitive layers are apparent in these materials.

- The natural soils may be prone to piping (internal) soil erosion particularly if they are found to contain high pumice content, however very little (if any) pumice was identified in our preliminary investigations for this report. Further geotechnical investigation should therefore assess this risk, especially if on-site stormwater management systems (e.g. rain gardens, attenuation ponds, etc.) are proposed.
- The identified materials can be sensitive to disturbance during earthworks and repetitive trafficking from heavy machinery, and some boreholes displayed isolated lenses that would have these characteristics. Careful site management and/ or subsoil drainage have been effective in minimising subgrade degradation issues on recent large residential developments in similar geology at the Drury area (i.e. Auranga). The deeper deposits in particular is likely to require conditioning prior to placement as filling as in-situ moisture contents will likely be higher than those required for optimum compaction.
- Deep trenches are prone to collapse especially where ground water conditions change rapidly and the materials are less cohesive, but this risk can be minimised by appropriate shoring or battering as required by legislation and safe construction practices.
- Road subgrades are prone to degradation once exposed to the elements but is normally dealt with by engineering design (e.g. subgrade improvement via undercutting and replacement, or lime stabilising, construction sequencing to reduce subgrade exposure time, etc.).
- Underfill drainage is usually adopted to control natural groundwater springs in the various drainage features that may be modified during development. They generally pose no constraints to end use if they are buried deep within engineered fills, or if this is not possible, they can be aligned to site boundaries to avoid future building platforms.

4 CONCLUSIONS

The site comprises topography and ground conditions that are reasonably well understood geotechnically. Precedence in this type of geology has been set via the large residential development in similar geology (e.g. Auranga & the Hingaia Peninsular). Provided there is due consideration to prevailing or perceived geotechnical issues during detailed site investigation for Resource Consent to support a subdivision scheme, then the study area as defined by Figure 01 herein is considered suitable for re-zoning to future urban use.

5 RECOMMENDATIONS

The assessments presented in this report are based on a desktop review and visual inspections, plus a limited number of shallow borehole tests on the prevailing landform.

It is recommended that:

- To support future development (i.e. Resource Consent / Subdivision design), further physical geotechnical site investigation that are commensurate with subdivision and earthworks scheme(s) should be undertaken to substantiate ground conditions and address any geotechnical constraints. Such investigations are expected to comprise (but are not limited to) further hand auger boreholes, trial pits using a hydraulic excavator, and soil sampling.
- Appropriate laboratory soil testing is undertaken to characterise engineering and earthworks handling properties, compressibility, permeability and susceptibility to erosion or dispersion.

6 LIMITATIONS

This report has been prepared solely for the use of our client, Oyster Capital, its professional advisers and the relevant Territorial Authorities in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by another person or entity. All future owner of this property should seek professional geotechnical advice to satisfy themselves as to its on-going suitability for their intended use.

For and on behalf of Lander Geotechnical Consultants Limited

Prepared By:



Alex Bu
Geotechnical Project Engineer
NZDE(Civil)

Reviewed and Authorised By:



Shane Lander
Principal Geotechnical Engineer
CMEngNZ, CPEng, IntPE(NZ)




Encl.

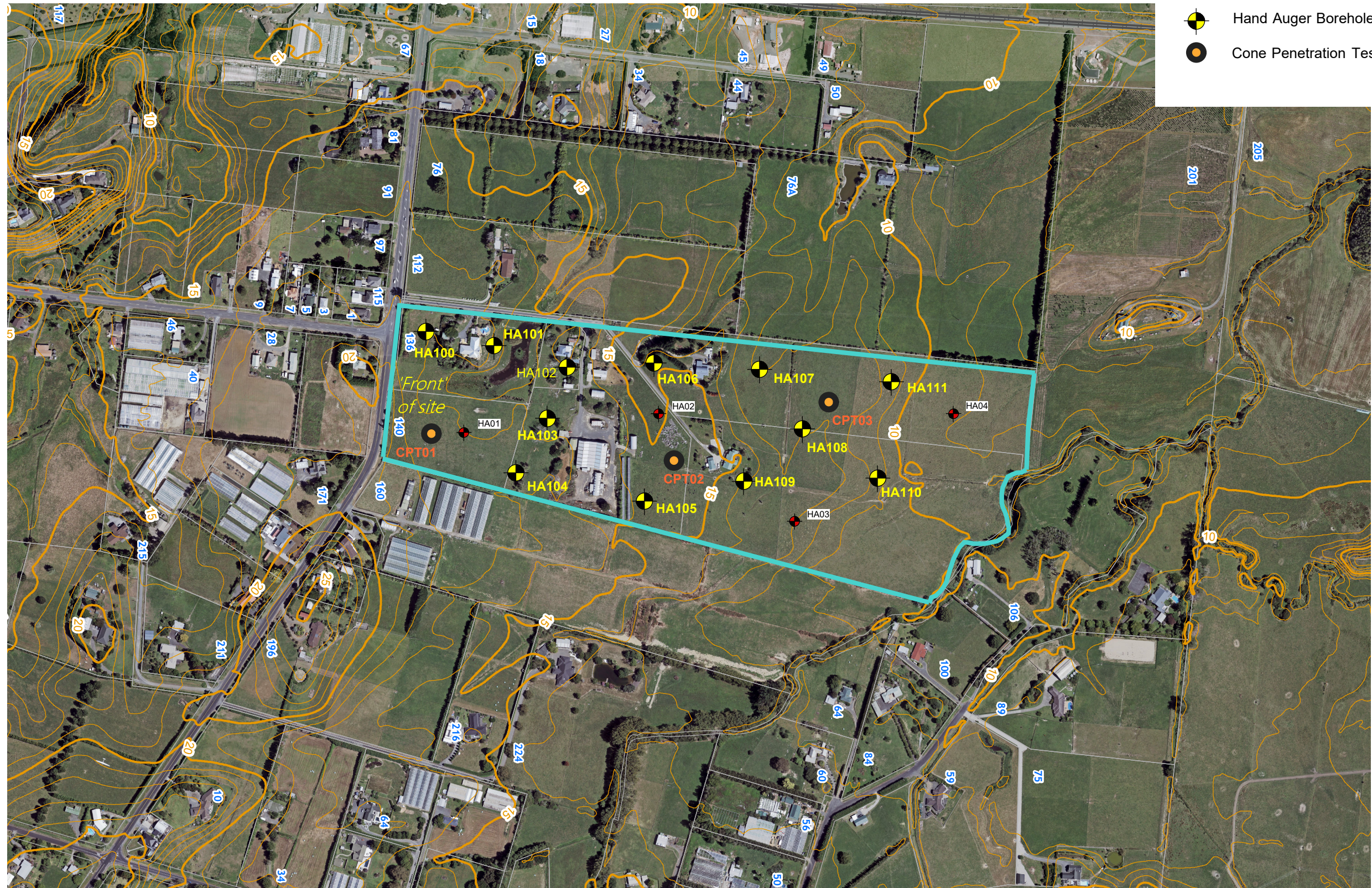


BASE PLAN SOURCE: GOGGLE EARTH

| | | | | | | | | | | | |
|----------|-------------|-------|----------|------|---------------|---------------|---|-------------|----------------------------------|------------|-----------|
| revision | description | drawn | approved | date | drawn | SL |  | client: | OYSTER CAPITAL | | |
| | | | | | approved | SGL | | project: | 116 WAIHOEHOE ROAD, DRURY | | |
| | | | | | date | 04/03/19 | | title: | GEOLOGY OVERVIEW PLAN | | |
| | | | | | scale | refer drawing | | project no: | J 00784 | figure no: | 01 |
| | | | | | original size | A3 | | | | | |

Legend and/or Notes:

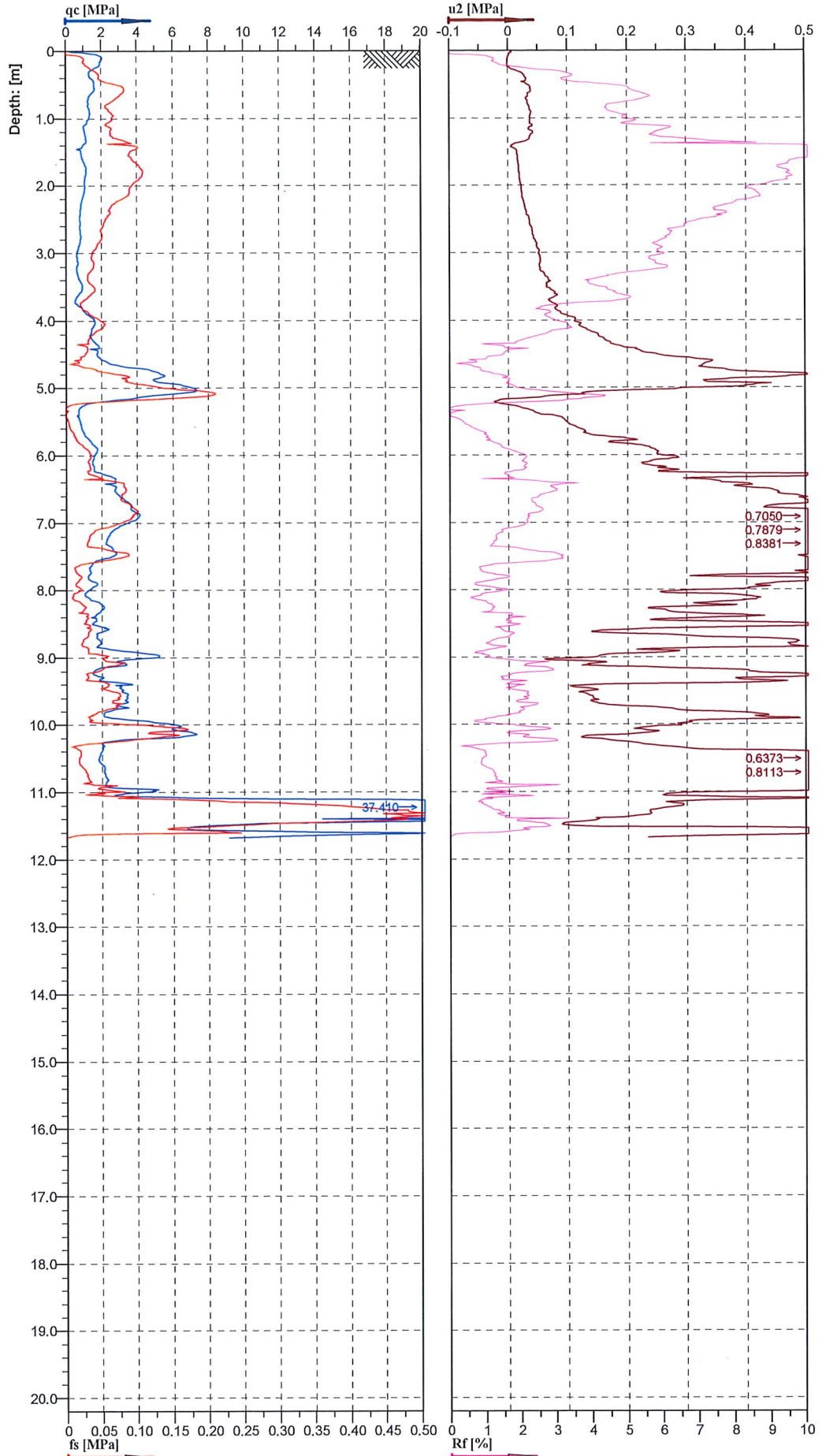
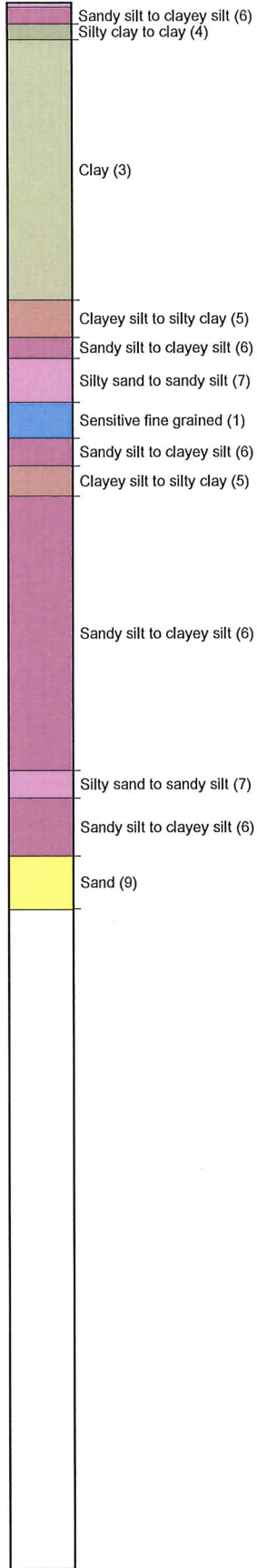
-  Hand Auger Borehole (October 2017)
-  Hand Auger Borehole
-  Cone Penetration Test



BASE PLAN SOURCE: AUCKLAND COUNCIL GEOMAPS DATABASE

| | | | | | | | | | | |
|----------|--|-------|----------|---------------|----------|------------|---|-------------|----------------------------------|------------|
| revision | description | drawn | approved | date | drawn | SL |  | client: | OYSTER CAPITAL | |
| | Rev A - site plan figure number relabelled | SL | sl | 4/03/19 | approved | <i>SGL</i> | | project: | 116 WAIHOEHOE ROAD, DRURY | |
| | Rev B - definition of 'front' added | SL | sl | 18/03/20 | date | 17.01.19 | | title: | SITE INVESTIGATION PLAN | |
| | | | | | scale | 1:5000 | | project no: | J 00784 | figure no: |
| | | | | original size | A3 | | | | | |

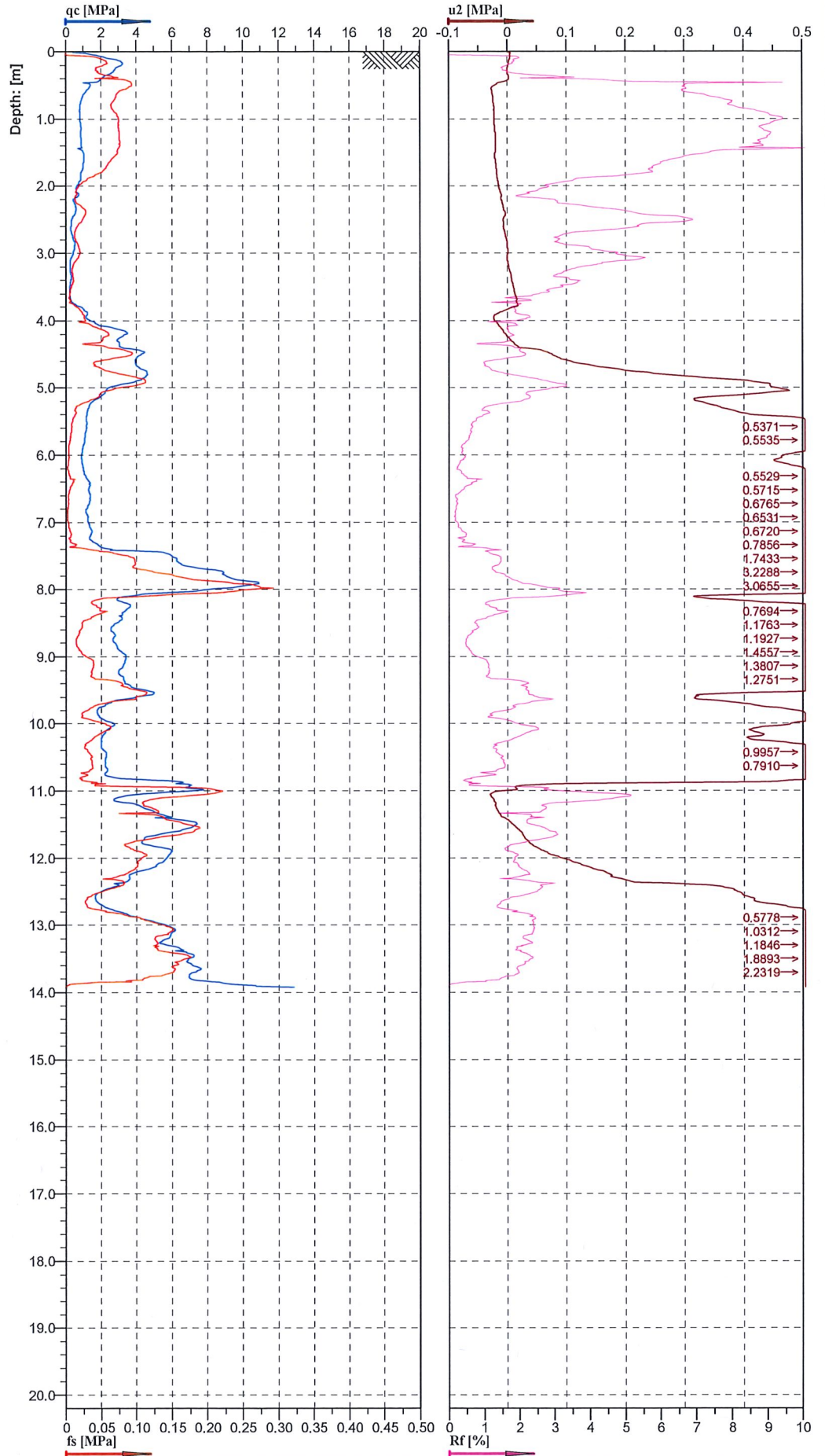
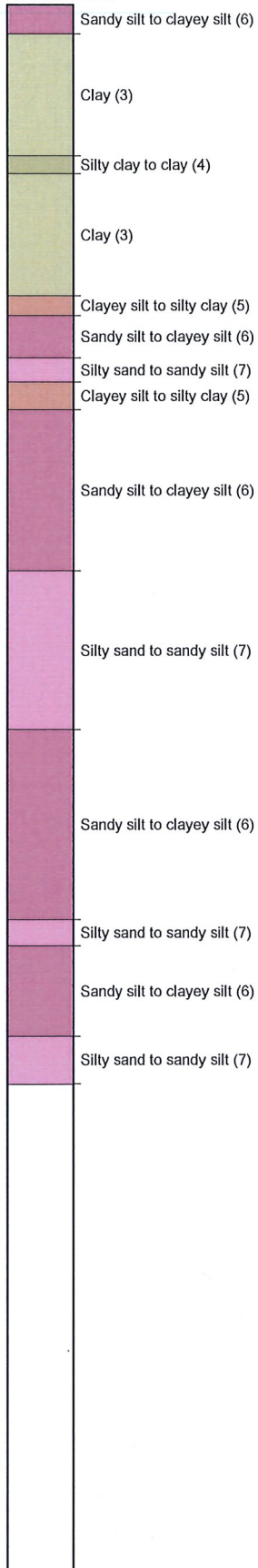
Classification by Robertson 1986



Cone No: S10CFIIP.1734
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

| | | | |
|--|-----------------------------|--|--------------------|
| Location: 116 Waihoehoe rd Drury | Position: X: 0 m, Y: 0 m | Ground level: 0.000 | Test No.: CPT01 |
| Project ID: Lander 116 Waihoehoe rd | Client: Landers | Date: 22/01/2019 | Scale: 1 : 85 |
| Project: Lander 116 Waihoehoe rd | | Page: 1/1 | Fig.: |
| | | File: Lander 116 Waihoehoe rd_CPT01.GEF | |

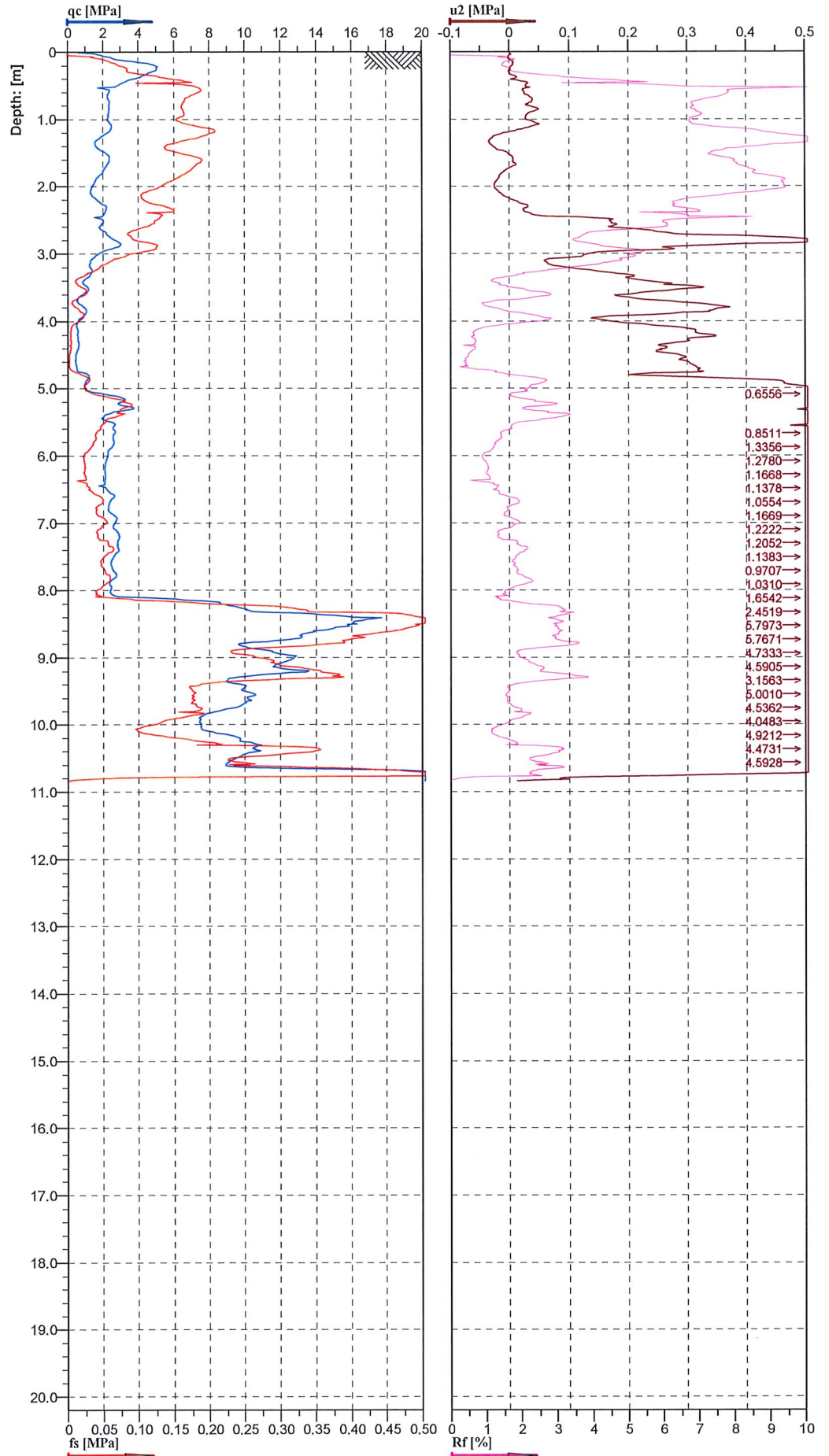
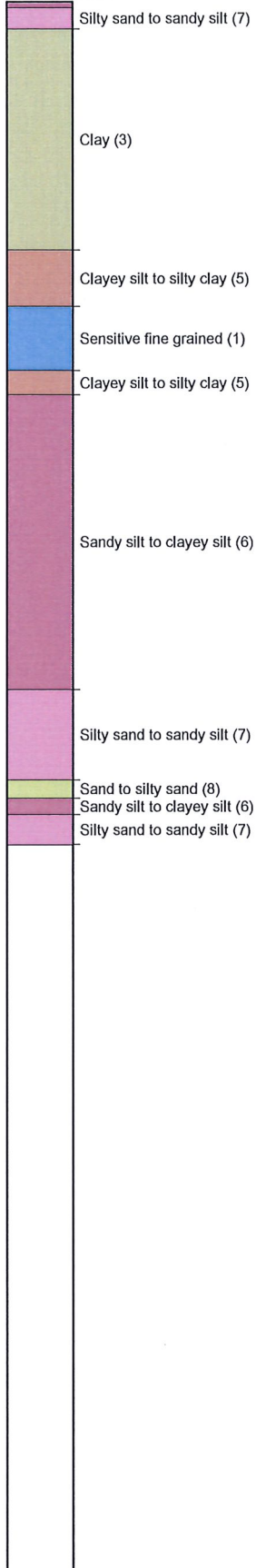
Classification by
Robertson 1986



Cone No: S10CFIIP.1734
Tip area [cm²]: 10
Sleeve area [cm²]: 150


| | | | |
|--|-----------------------------|------------------------|--------------------|
| Location: 116 Waihoehoe rd Drury | Position: X: 0 m, Y: 0 m | Ground level: 0.000 | Test No.: CPT02 |
| Project ID: Lander 116 Waihoehoe rd | Client: Landers | Date: 22/01/2019 | Scale: 1 : 85 |
| Project: Lander 116 Waihoehoe rd | | Page: 1/1 | Fig.: |
| File: Lander 116 Waihoehoe rd_CPT02.GEF | | | |

Classification by
Robertson 1986



Cone No: S10CFIIP.1734
Tip area [cm²]: 10
Sleeve area [cm²]: 150


| | | | |
|--|-----------------------------|------------------------|--------------------|
| Location: 116 Waihoehoe rd Drury | Position: X: 0 m, Y: 0 m | Ground level: 0.000 | Test No.: CPT03 |
| Project ID: Lander 116 Waihoehoe rd | Client: Landers | Date: 22/01/2019 | Scale: 1 : 85 |
| Project: Lander 116 Waihoehoe rd | | Page: 1/1 | Fig.: |
| File: Lander 116 Waihoehoe rd_CPT03.GEF | | | |


| | | | | | | | | | | | | | | | |
|---|---------------------------------|---|-------------|--------------------------------|-------------------|----------------------|---------------------------------|------------------|--|-----------|--|----------|--|-------|--|
| Client : MATIRA TRUST | | | | Auger Borehole No. HA01 | | | | | | | | | | | |
| Project Location : 116, 122, 128, 132, 136, 140 WAIHOEHOE RD, DRURY | | | | Sheet 1 of 4 | | | | | | | | | | | |
| Job Number: J00784 | | | | Vane Head: 1900 | Logged By: MVC | Processor : LJ | Date: 10.10.17 | | | | | | | | |
| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear(kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details | | | | | | |
| | Description: Refer to site plan | | | | | | | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | | | | | | | |
| TOPSOIL | | | | [diagonal lines] | | | | | | | | | | | |
| clayey SILT, yellow/brown. Stiff, moist, medium plasticity, sensitive, with minor manganese oxidate inclusions [ALLUVIUM] | | | | [cross-hatch] | 0.5 | ▽ | 66/11 | 6.0 | | | | | | | |
| becoming orange/grey | | | | [cross-hatch] | 1.0 | | 150/51 | 2.9 | | | | | | | |
| becoming very stiff, moderately sensitive | | | | [cross-hatch] | 1.5 | | 120/24 | 5.0 | | | | | | | |
| silty CLAY, light grey streaked orange. Very stiff, moist to wet, medium to high plasticity, sensitive | | | | [cross-hatch] | 2.0 | | 195/103 | 1.9 | | | | | | | |
| becoming slightly silty CLAY, orange and red flecked light grey, wet | | | | [cross-hatch] | 2.5 | | 137/69 | 2.0 | | | | | | | |
| becoming insensitve | | | | [cross-hatch] | 3.0 | | 137/57 | 2.4 | | | | | | | |
| becoming moderately sensitive | | | | [cross-hatch] | 3.5 | | | | | | | | | | |
| EOB at 3.0m. Target Depth. | | | | [cross-hatch] | 4.0 | | | | | | | | | | |
| | | | | [cross-hatch] | 4.5 | | | | | | | | | | |
| | | | | [cross-hatch] | 5.0 | | | | | | | | | | |
| | | | | [cross-hatch] | 5.5 | | | | | | | | | | |
| | | | | [cross-hatch] | 6.0 | | | | | | | | | | |
|  | | Comments: Groundwater encountered 0.5m. UTP = unable to penetrate. EOB = end of borehole. | | Borehole Diameter: 50mm | | Topsoil | | Sand | | Sandstone | | Plutonic | | +++++ | |
| | | | | Checked: AB | | Fill | | Gravel | | Siltstone | | No Core | | | |
| | | | | | | Clay | | Organic | | Limestone | | | | | |
| | | | | | | Silt | | Pumice | | Volcanic | | | | | |

| | | | | | | | | | |
|---|---------------------------------|----|-------------|--------------------------------|-------------------|----------------------|---------------------------------|------------------|--|
| Client : MATIRA TRUST | | | | Auger Borehole No. HA02 | | | | | |
| Project Location : 116, 122, 128, 132, 136, 140 WAIHOEHOE RD, DRURY | | | | Sheet 2 of 4 | | | | | |
| Job Number: J00784 | | | | Vane Head: 1900 | Logged By: MVC | Processor : LJ | Date: 10.10.17 | | |
| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear(kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| | Description: Refer to site plan | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | [Hatched Pattern] | | | | | |
| clayey SILT, yellow/brown mottled grey. Very stiff, moist, medium plasticity, sensitive, with minor topsoil leaching [ALLUVIUM] | | | | [Cross-hatch Pattern] | 0.5 | | 116/28 | 4.1 | |
| silty CLAY, orange mottled light grey. Very stiff, moist, high plasticity, with minor rootlets | | | | [Cross-hatch Pattern] | | | | | |
| becoming slightly silty CLAY, orange streaked light grey, moderately sensitive, with minor limonite | | | | [Cross-hatch Pattern] | 1.0 | ▽ | 120/54 | 2.2 | |
| becoming silty CLAY | | | | [Cross-hatch Pattern] | 1.5 | | 116/34 | 3.4 | |
| becoming slightly silty CLAY, light grey mottled yellow/brown, wet, without limonite | | | | [Cross-hatch Pattern] | 2.0 | | 84/31 | 2.7 | |
| becoming stiff | | | | [Cross-hatch Pattern] | 2.5 | | 133/50 | 2.7 | |
| becoming silty CLAY, dark orange/brown flecked light blue/grey, with minor limonite | | | | [Cross-hatch Pattern] | 3.0 | | 116/43 | 2.7 | |
| becoming very stiff with minor organic inclusion | | | | [Cross-hatch Pattern] | 3.5 | | | | |
| EOB at 3.0m. Target Depth. | | | | [Cross-hatch Pattern] | 4.0 | | | | |
| | | | | [Cross-hatch Pattern] | 4.5 | | | | |
| | | | | [Cross-hatch Pattern] | 5.0 | | | | |
| | | | | [Cross-hatch Pattern] | 5.5 | | | | |
| | | | | [Cross-hatch Pattern] | 6.0 | | | | |

| | | | | | | | | | | |
|---|---|--------------------|---------|-----------------------|---------|-----------------------|-----------|------------------|----------|-----------------------|
|  | Comments: | Borehole Diameter: | Topsoil | [Hatched Pattern] | Sand | [Dotted Pattern] | Sandstone | [Dotted Pattern] | Plutonic | [Cross-hatch Pattern] |
| | Groundwater encountered 1.5m. UTP = unable to penetrate. EOB = end of borehole. | 50mm | Fill | [Hatched Pattern] | Gravel | [Dotted Pattern] | Siltstone | [Z-pattern] | No Core | |
| | | Checked: | Clay | [Cross-hatch Pattern] | Organic | [Cross-hatch Pattern] | Limestone | [Brick Pattern] | | |
| | | <i>AB</i> | Silt | [Cross-hatch Pattern] | Pumice | [Cross-hatch Pattern] | Volcanic | [Wavy Pattern] | | |

| | | | | | | | |
|---|----|--|-------------|--|-----------------------|--|--|
| Client : MATIRA TRUST Project Location : 116, 122, 128, 132, 136, 140 WAIHOEHOE RD, DRURY Job Number: J00784 | | | | Auger Borehole No. HA03 Sheet 3 of 4 | | | |
| Vane Head: 1900 | | Logged By: MVC | | Processor : LJ | Date: 10.10.17 | | |
| Borehole Location: | mN | mE | Ground R.L. | | | | |
| Description: Refer to site plan | | | | | | | |
| SOIL DESCRIPTION | | | | | | | |
| TOPSOIL | | | | | | | |
| silty CLAY, yellow/brown. Very stiff, moist, medium to high plasticity, moderately sensitive [ALLUVIUM] | | | | | | | |
| becoming yellow/brown mottled grey, with minor limonite weathering | | | | | | | |
| becoming orange/brown streaked light grey, insensitive | | | | | | | |
| clayey SILT, light grey mottled orange/brown. Very stiff, moist, medium plasticity, moderately sensitive, with some limonite | | | | | | | |
| becoming hard | | | | | | | |
| at 3.0m, becoming very stiff EOB at 3.0m. Target Depth. | | | | | | | |
| | | | | | | | |
| | | Comments: Groundwater not encountered. UTP = unable to penetrate. EOB = end of borehole. | | Borehole Diameter: 50mm Checked: AB | | | |
| Topsoil | | Sand | | Sandstone | | | |
| Fill | | Gravel | | Siltstone | | | |
| Clay | | Organic | | Limestone | | | |
| Silt | | Pumice | | Volcanic | | | |
| Plutonic | | No Core | | | | | |

| Client : MATIRA TRUST | | | | Auger Borehole No. HA04 | | | | | |
|---|---|-----------------------|-------------|-------------------------|----------------|----------------------|----------------------------------|------------------|--|
| Project Location : 116, 122, 128, 132, 136, 140 WAIHOEHOE RD, DRURY | | | | Sheet 4 of 4 | | | | | |
| Job Number: J00784 | | | | Vane Head: 1900 | Logged By: MVC | Processor : LJ | Date: 10.10.17 | | |
| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| Description: Refer to site plan | | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | | | | | | |
| clayey SILT, orange/brown mottled grey. Very stiff, moist to wet, low plasticity, moderately sensitive, with some limonite [ALLUVIUM] | | | | | | | | | |
| becoming medium plasticity | | | | | 0.5 | | 100/43 | 2.3 | |
| becoming stiff, grey, saturated, with some fine sand, with trace organic inclusions, without limonite | | | | | 1.0 | ▽ | 97/43 | 2.3 | |
| becoming sensitive | | | | | 1.5 | | 84/21 | 4.0 | |
| with some decomposed roots | | | | | | | | | |
| fine sandy SILT with trace clay, blue/green. Medium dense, moist, no plasticity | | | | | 2.0 | | UTP | | |
| | | | | | 2.5 | | UTP | | |
| EOB at 3.0m. Target Depth. | | | | | 3.0 | | UTP | | |
| | | | | | 3.5 | | | | |
| | | | | | 4.0 | | | | |
| | | | | | 4.5 | | | | |
| | | | | | 5.0 | | | | |
| | | | | | 5.5 | | | | |
| | | | | | 6.0 | | | | |
|  | Comments: Groundwater encountered 1.5m. UTP = unable to penetrate. EOB = end of borehole. | Borehole Diameter: | Topsoil | Sand | Sandstone | Plutonic | | | |
| | | 50mm | Fill | Gravel | Siltstone | No Core | | | |
| | | Checked: <i>AB</i> | Clay | Organic | Limestone | | | | |
| | | | Silt | Pumice | Volcanic | | | | |

| | | | | | | | | | | | |
|--|--|--------------------|--------------------|--|---------|------------|------------|----------------------|---------------------------------|------------------|--|
| Client : OYSTER CAPITAL Project Location : 116 WAIHOEHOE ROAD, DRURY Job Number: J00784 | | | | Auger Borehole No. HA100 Sheet 1 of 12 | | | | | | | |
| Borehole Location: | | mN | mE | Ground R.L. | | Vane Head: | Logged By: | Processor : | Date: | | |
| Description: | | Refer to site plan | | | | 2153 | AB | AB | 21.01.19 | | |
| SOIL DESCRIPTION | | | | | | Legend | Depth (m) | Standing Water Level | Vane Shear(kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| TOPSOIL | | | | | | | | | | | |
| clayey SILT, orange/ brown. Very stiff, dry, low plasticity, moderately sensitive [NATURAL] | | | | | | | 0.5 | | 165/ 57 | 2.9 | |
| becoming yellow/ brown mottled orange/ brown, moist | | | | | | | 1.0 | | 157/ 76 | 2.1 | |
| silty CLAY, light grey streaked orange/ brown. Very stiff, moist, high plasticity, moderately sensitive | | | | | | | 1.5 | | 159/ 62 | 2.6 | |
| becoming pink and orange/ brown streaked light grey | | | | | | | 2.0 | | 146/ 62 | 2.4 | |
| | | | | | | | 2.5 | | 137/ 51 | 2.7 | |
| becoming grey and light yellow speckled pink | | | | | | | 3.0 | | 128/ 46 | 2.8 | |
| becoming purple and dark brown mottled brown/ grey, with some organic inclusions and staining | | | | | | | 3.5 | | 134/ 46 | 2.9 | |
| becoming stiff | | | | | | | 4.0 | | 99/ 40 | 2.5 | |
| becoming brown/ grey, without organic inclusions | | | | | | | 4.5 | | 139/ 71 | 2.0 | |
| becoming very stiff | | | | | | | 5.0 | | 161/ 76 | 2.1 | |
| EOB at 5.0m. Target Depth. | | | | | | | 5.5 | | | | |
| | | | | | | | 6.0 | | | | |
|  | Comments: Groundwater not encountered. UTP = unable to penetrate. EOB = end of borehole. | | Borehole Diameter: | Topsoil | Sand | Sandstone | Plutonic | | | | |
| | | | 50mm | Fill | Gravel | Siltstone | No Core | | | | |
| | | | Checked: | Clay | Organic | Limestone | | | | | |
| | | | Km | Silt | Pumice | Volcanic | | | | | |

| | | | | | | | | | | | |
|---|---------------------------------------|----|-------------|--|--|----------------------------|----------------------------------|-----------------------|--|----------|--|
| Client : OYSTER CAPITAL Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Auger Borehole No. HA101 Sheet 2 of 12 | | | | | | | |
| Job Number: J00784 | | | | Vane Head: 2153 | Logged By: AB | Processor : AB | Date: 22.01.19 | | | | |
| Borehole Location: | mN Description: Refer to site plan | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details | | |
| SOIL DESCRIPTION | | | | | | | | | | | |
| TOPSOIL | | | | | 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 | | | | | | |
| slightly clayey SILT with topsoil intermixed, dark brown. Stiff, moist, low to no plasticity, moderately sensitive [FILL] | | | | | | | | | | | |
| becoming mottled dark brown and light grey | | | | | | | | | | | |
| clayey SILT, orange/ brown. Very stiff, moist, low to no plasticity, moderately sensitive [NATURAL] | | | | | | | | | | | |
| silty CLAY, yellow/ brown streaked grey. Very stiff, moist, high plasticity, moderately sensitive | | | | | | | | | | | |
| with occasional pink streaks | | | | | | | | | | | |
| becoming mottled yellow/ brown and light grey | | | | | | | | | | | |
| becoming moist to wet | | | | | | | | | | | |
| becoming streaked pink, yellow/ brown and grey | | | | | | | | | | | |
| at 5.0m, becoming insensitive | | | | | | | | | | | |
| EOB at 5.0m. Target Depth. | | | | | | | | | | | |
| | | | | Comments: Groundwater not encountered. UTP = unable to penetrate. EOB = end of borehole. | | Borehole Diameter: 50mm | | Checked: <i>KM</i> | | | |
| | | | | Topsoil | | Sand | | Sandstone | | Plutonic | |
| | | | | Fill | | Gravel | | Siltstone | | No Core | |
| | | | | Clay | | Organic | | Limestone | | | |
| | | | | Silt | | Pumice | | Volcanic | | | |

Client : OYSTER CAPITAL
Project Location : 116 WAIHOEHOE ROAD, DRURY

Auger Borehole No. HA102

Sheet 3 of 12

Job Number: J00784


Vane Head: 2153
 Logged By: AB
 Processor: AB
 Date: 21.01.19


| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
|--|----|----|-------------|--------|-----------|----------------------|----------------------------------|------------------|--|
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | | | | | | |
| clayey SILT, orange/ brown. Hard, dry, low to medium plasticity [NATURAL] | | | | | 0.5 | | 205+ | | |
| becoming yellow/ brown mottled orange/ brown, moist, medium plasticity | | | | | 1.0 | | 205+ | | |
| silty CLAY, grey and yellow/ brown mottled orange/ brown. Very stiff, moist, high plasticity, moderately sensitive | | | | | 1.5 | | 114/ 57 | 2.0 | |
| becoming yellow/ brown and orange/ brown streaked light grey | | | | | 2.0 | ▽ | 102/ 57 | 1.8 | |
| becoming insensitive | | | | | 2.5 | | 85/ 39 | 2.2 | |
| becoming brown/ grey | | | | | 3.0 | | 105/ 34 | 3.1 | |
| becoming stiff, moist to wet, moderately sensitive | | | | | 3.5 | | 109/ 39 | 3.8 | |
| becoming saturated | | | | | 4.0 | | 96/ 46 | 2.1 | |
| becoming very stiff | | | | | 4.5 | | 73/ 43 | 1.7 | |
| becoming orange speckled brown/ grey, limited sample recovery due to groundwater suction | | | | | 5.0 | | 90/ 43 | 2.1 | |
| becoming stiff | | | | | 5.5 | | | | |
| becoming insensitive | | | | | 6.0 | | | | |
| at 5.0m, becoming moderately sensitive | | | | | | | | | |
| EOB at 5.0m. Target Depth. | | | | | | | | | |





Comments:
 Groundwater encountered 2.9m.
 UTP = unable to penetrate.
 EOB = end of borehole.

| | | | | | | | | |
|--------------------|---------|--|---------|--|-----------|--|----------|--|
| Borehole Diameter: | Topsoil | | Sand | | Sandstone | | Plutonic | |
| 50mm | Fill | | Gravel | | Siltstone | | No Core | |
| Checked: | Clay | | Organic | | Limestone | | | |
| KM | Silt | | Pumice | | Volcanic | | | |

| | | | | | | | | | |
|--|--|-----------------|-------------|---------------------------------|-----------|----------------------|----------------------------------|------------------|--|
| Client : OYSTER CAPITAL | | | | Auger Borehole No. HA103 | | | | | |
| Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Sheet 4 of 12 | | | | | |
| Job Number: J00784 | | Vane Head: 1900 | | Logged By: TK | | Processor: AB | | | |
| | | | | | | Date: 21.01.19 | | | |
| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| Description: Refer to site plan | | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | | | | | | |
| slightly clayey SILT, dark orange/ brown. Very stiff, moist, low plasticity, moderately sensitive, with trace organic staining [NATURAL] | | | | | | | | | |
| without organic staining | | | | | 0.5 | | 136/ 60 | 2.3 | Sample 1 Disturbed 0.5-1.0m |
| with some fine sand | | | | | 1.0 | | 142/ 66 | 2.3 | |
| becoming mottled grey/ orange and brown, with some limonite staining | | | | | | | | | |
| without limonite staining | | | | | | | | | |
| silty CLAY, light brown/ grey streaked orange/ brown and grey. Very stiff, moist, low to medium plasticity, moderately sensitive, with some organic inclusions | | | | | 1.5 | | 149/ 62 | 2.4 | |
| becoming streaked light brown/ grey and red/ orange | | | | | 2.0 | | 157/ 79 | 2.0 | |
| | | | | | 2.5 | | 175/ 86 | 2.0 | |
| becoming orange/ brown | | | | | 3.0 | | 127/ 67 | 1.9 | |
| becoming moist to wet, insensitive | | | | | 3.5 | | 111/ 57 | 1.9 | |
| clayey SILT, streaked light grey/ brown and orange/ brown. Very stiff, moist to wet, medium plasticity, insensitive, with trace rootlets | | | | | | | | | |
| at 3.5m, becoming orange/ brown mottled light brown/ grey, without rootlets | | | | | 4.0 | | 140/ 60 | 2.3 | |
| silty CLAY, grey. Very stiff, wet, medium to high plasticity, moderately sensitive | | | | | 4.5 | | 79/ 48 | 1.6 | |
| becoming wet | | | | | 5.0 | | 94/ 36 | 2.6 | |
| becoming stiff, insensitive, with trace fine sand | | | | | 5.5 | | | | |
| at 4.9m, becoming high plasticity | | | | | 6.0 | | | | |
| at 5.0m, becoming moderately sensitive | | | | | | | | | |
| EOB at 5.0m. Target Depth. | | | | | | | | | |
|  | Comments: Groundwater not encountered. UTP = unable to penetrate. EOB = end of borehole. | | | Borehole Diameter: | Topsoil | Sand | Sandstone | Plutonic | |
| | | | | 50mm | Fill | Gravel | Siltstone | No Core | |
| | | | | Checked: | Clay | Organic | Limestone | | |
| | | | | KM | Silt | Pumice | Volcanic | | |

| | | | | | | | | | | | |
|--|--|--------------------|----|--|--|--------------------|------------|----------------------|---------------------------------|------------------|--|
| Client : OYSTER CAPITAL Project Location : 116 WAIHOEHOE ROAD, DRURY Job Number: J00784 | | | | Auger Borehole No. HA104 Sheet 5 of 12 | | | | | | | |
| Borehole Location: | | mN | mE | Ground R.L. | | Vane Head: | Logged By: | Processor : | Date: | | |
| Description: | | Refer to site plan | | | | 1900 | TK | AB | 21.01.19 | | |
| SOIL DESCRIPTION | | | | | | Legend | Depth (m) | Standing Water Level | Vane Shear(kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| TOPSOIL | | | | | | | | | | | |
| with trace fine sand | | | | | | | 0.5 | | 60/ 23 | 2.6 | |
| with some rootlets | | | | | | | 1.0 | | 43/ 17 | 2.5 | |
| clayey SILT with topsoil intermixed, orange mottled brown. Very stiff, moist, low to medium plasticity, moderately sensitive [NATURAL] | | | | | | | 1.5 | | 73/ 14 | 5.2 | |
| silty CLAY with trace fine sand, orange/ brown streaked brown. Very stiff, moist, medium plasticity, insensitive | | | | | | | 2.0 | | 179/ 64 | 2.6 | |
| becoming streaked red and grey, with some limonite staining | | | | | | | 2.5 | | 175/ 57 | 3.1 | |
| becoming light grey, with some organic inclusions | | | | | | | 3.0 | | 175/ 99 | 1.8 | |
| becoming moderately sensitive | | | | | | | 3.5 | | 119/ 70 | 1.7 | |
| becoming moist to wet | | | | | | | 4.0 | | 164/ 76 | 2.2 | |
| becoming insensitive | | | | | | | 4.5 | | 179/ 99 | 1.8 | |
| becoming brown streaked grey | | | | | | | 5.0 | | 157/ 67 | 2.3 | |
| becoming orange/ brown, moderately sensitive, with trace organic inclusions | | | | | | | | | | | |
| EOB at 5.0. Target Depth. | | | | | | | | | | | |
|  Comments: Groundwater not encountered. UTP = unable to penetrate. EOB = end of borehole. | | | | | | Borehole Diameter: | Topsoil | Sand | Sandstone | Plutonic | |
| | | | | | | 50mm | Fill | Gravel | Siltstone | No Core | |
| | | | | | | Checked: | Clay | Organic | Limestone | | |
| | | | | | | Km | Silt | Pumice | Volcanic | | |

| | | | | | | | | | |
|--|--|----|-------------|---------------------------------|------------------|----------------------|---------------------------------|------------------|--|
| Client : OYSTER CAPITAL | | | | Auger Borehole No. HA105 | | | | | |
| Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Sheet 6 of 12 | | | | | |
| Job Number: J00784 | | | | Vane Head: 1900 | Logged By: TK | Processor : AB | Date: 21.01.19 | | |
| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear(kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| | Description: Refer to site plan | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | | | | | | |
| slightly clayey SILT, dark brown mottled light brown/ grey. Very stiff, moist, low plasticity, moderately sensitive [NATURAL] | | | | | | | | | |
| with trace limonite staining | | | | | 0.5 | | 172/ 67 | 2.6 | |
| becoming mottled dark orange, brown and grey, with trace organic inclusions | | | | | | | | | |
| becoming orange streaked grey | | | | | 1.0 | | 149/ 64 | 2.3 | |
| becoming orange mottled grey | | | | | | | | | |
| | | | | | 1.5 | | 115/ 54 | 2.1 | |
| pumiceous fine sandy CLAY, grey. Stiff, moist, low plasticity, insensitive | | | | | | ▽ | | | |
| becoming wet | | | | | 2.0 | | 73/ 47 | 1.6 | |
| silty CLAY, orange mottled light brown/ grey. Stiff, moist, medium plasticity, moderately sensitive, with some limonite staining | | | | | | | | | |
| becoming saturated | | | | | 2.5 | | 64/ 20 | 3.2 | |
| with limited sample recovery due to groundwater suction | | | | | | | | | |
| | | | | | 3.0 | | 60/ 17 | 3.5 | |
| | | | | | | | | | |
| | | | | | 3.5 | | 67/ 18 | 3.7 | |
| | | | | | | | | | |
| | | | | | 4.0 | | 51/ 20 | 2.6 | |
| | | | | | | | | | |
| | | | | | 4.5 | | 144/ 37 | 3.9 | |
| | | | | | | | | | |
| EOB at 5.0m. Target Depth. | | | | | 5.0 | | 127/ 56 | 2.3 | |
| | | | | | | | | | |
| | | | | | 5.5 | | | | |
| | | | | | | | | | |
| | | | | | 6.0 | | | | |
|  | Comments: Groundwater encountered 2.8m UTP = unable to penetrate. EOB = end of borehole. | | | Borehole Diameter: 50mm | Topsoil | Sand | Sandstone | Plutonic | |
| | | | | Checked: KM | Fill | Gravel | Siltstone | No Core | |
| | | | | | Clay | Organic | Limestone | | |
| | | | | Silt | Pumice | Volcanic | | | |

| | | | | | | | | | |
|---|---|----|-------------|--|------------------|----------------------|---------------------------------|------------------|--|
| Client : OYSTER CAPITAL Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Auger Borehole No. HA106 Sheet 7 of 12 | | | | | |
| Job Number: J00784 | | | | Vane Head: 2153 | Logged By: AB | Processor : AB | Date: 22.01.19 | | |
| Borehole Location: | mN Description: Refer to site plan | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear(kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | [Hatched Pattern] | 0.0 | | | | |
| slightly clayey SILT, mottled grey and orange/ brown. Hard, dry, low to no plasticity [NATURAL] | | | | [Cross-hatch Pattern] | 0.5 | | 205+ | | Sample 1 Disturbed 0.5-1.0m |
| becoming clayey SILT, orange mottled grey, moist, low to medium plasticity | | | | [Cross-hatch Pattern] | 1.0 | | 165/ 71 | 2.3 | |
| becoming very stiff, moderately sensitive | | | | [Cross-hatch Pattern] | 1.5 | | 165/ 66 | 2.5 | |
| becoming mottled orange/ brown and grey, with occasional limonite silt clast inclusions | | | | [Cross-hatch Pattern] | 2.0 | ▽ | 205+ | | |
| with occasional hardened clay clast inclusions becoming hard | | | | [Cross-hatch Pattern] | 2.5 | | 149/ 73 | 2.0 | |
| becoming saturated | | | | [Cross-hatch Pattern] | 3.0 | | 139/ 66 | 2.1 | |
| becoming very stiff | | | | [Cross-hatch Pattern] | 3.5 | | 128/ 60 | 2.1 | |
| becoming pink and orange streaked grey | | | | [Cross-hatch Pattern] | 4.0 | | 124/ 53 | 2.3 | |
| becoming green/ grey mottled orange and brown/ grey | | | | [Cross-hatch Pattern] | 4.5 | | 149/ 71 | 2.1 | |
| EOB at 5.0m. Target Depth. | | | | [Cross-hatch Pattern] | 5.0 | | 165/ 73 | 2.3 | |
| | | | | [Cross-hatch Pattern] | 5.5 | | | | |
| | | | | [Cross-hatch Pattern] | 6.0 | | | | |
|  | Comments: Groundwater encountered 2.3m. UTP = unable to penetrate. EOB = end of borehole. | | | Borehole Diameter: | Topsoil | Sand | Sandstone | Plutonic | |
| | | | | 50mm | Fill | Gravel | Siltstone | No Core | |
| | | | | Checked: | Clay | Organic | Limestone | | |
| | | | | <i>LM</i> | Silt | Pumice | Volcanic | | |

| Client : OYSTER CAPITAL | | | | Auger Borehole No. HA107 | | | | | |
|---|----|----|-------------|--------------------------|---------------|----------------------|----------------------------------|------------------|--|
| Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Sheet 8 of 12 | | | | | |
| Job Number: J00784 | | | | Vane Head: 1900 | Logged By: TK | Processor: AB | Date: 21.01.19 | | |
| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| Description: Refer to site plan | | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | | | | | | |
| clayey SILT with some topsoil intermixed, brown/ orange streaked grey/ orange and dark grey. Stiff, wet, low plasticity, moderately sensitive, with trace organic staining [FILL] | | | | | | | | | |
| becoming orange mottled orange/ brown, grey and dark grey, with trace rootlets | | | | | 0.5 | | 92/ 33 | 2.8 | |
| clayey SILT, grey/ brown. Very stiff, wet, low plasticity, moderately sensitive [NATURAL] | | | | | | | | | |
| at 0.9m, becoming light brown mottled grey/ brown | | | | | 1.0 | | 134/ 44 | 3.0 | |
| with some organic inclusions to 1.4m | | | | | | | | | |
| with some green clay clasts | | | | | | | | | |
| becoming stiff, saturated, sensitive, without green clay clasts | | | | | 1.5 | ▽ | 95/ 21 | 4.5 | |
| with trace fibrous wood inclusions to 2.2m | | | | | | | | | |
| becoming moderately sensitive | | | | | 2.0 | | 62/ 23 | 2.7 | |
| SILT with trace fine sand, green. Very stiff, saturated, high plasticity, moderately sensitive | | | | | | | | | |
| | | | | | 2.5 | | 115/ 32 | 3.6 | |
| | | | | | 3.0 | | 111/ 32 | 3.6 | |
| becoming stiff, insensitive | | | | | 3.5 | | 60/ 32 | 1.9 | |
| slightly sandy SILT, dark brown mottled green/ grey. Loose, wet, no plasticity, sensitive | | | | | | | | | |
| at 4.0m, becoming sandy SILT | | | | | 4.0 | | 164/ 37 | 4.4 | |
| clayey fine SAND, green/ grey. Very stiff, saturated, low to medium plasticity, sensitive, with trace organic inclusions | | | | | | | | | |
| | | | | | 4.5 | | 151/ 37 | 4.1 | |
| SAND, green/ grey. Loose, saturated, no plasticity, sensitive, with trace organic inclusions | | | | | | | | | |
| EOB at 5.0m. Target Depth. | | | | | 5.0 | | 149/ 32 | 4.7 | |
| | | | | | 5.5 | | | | |
| | | | | | 6.0 | | | | |



Comments:
 Groundwater encountered 1.5m.
 UTP = unable to penetrate.
 EOB = end of borehole.

Borehole Diameter: 50mm
 Checked: *KM*

| | | | | | | | |
|---------|--|---------|--|-----------|--|----------|--|
| Topsoil | | Sand | | Sandstone | | Plutonic | |
| Fill | | Gravel | | Siltstone | | No Core | |
| Clay | | Organic | | Limestone | | | |
| Silt | | Pumice | | Volcanic | | | |

Client : OYSTER CAPITAL
Project Location : 116 WAIHOEHOE ROAD, DRURY

Auger Borehole No. HA108

Sheet 9 of 12

Job Number: J00784

Vane Head: 2153
 Logged By: AB
 Processor: AB
 Date: 21.01.19


| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
|--|----|----|-------------|--------|-----------|----------------------|----------------------------------|------------------|--|
| Description: Refer to site plan | | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | | | | | | |
| slightly clayey SILT, mottled orange/ brown and grey. Hard, dry, low to no plasticity [NATURAL] | | | | | 0.5 | | 205+ | | |
| silty CLAY, grey streaked orange/ brown. Hard, moist, medium plasticity, moderately sensitive | | | | | 1.0 | | 201/ 71 | 2.8 | |
| becoming orange speckled light grey | | | | | 1.5 | | 201/ 71 | 2.8 | |
| becoming very stiff | | | | | 2.0 | | 114/ 46 | 2.5 | |
| becoming stiff, moist to wet | | | | | 2.5 | | 93/ 43 | 2.2 | |
| becoming light blue/ grey, saturated, high plasticity | | | | | 3.0 | ▽ | 108/ 46 | 2.3 | |
| becoming very stiff | | | | | 3.5 | | 124/ 51 | 2.4 | |
| fine sandy CLAY, blue/ grey mottled dark grey. Very stiff, saturated, medium plasticity, moderately sensitive, with limited sample recovery due to groundwater suction | | | | | 4.0 | | 169/ 60 | 2.8 | |
| becoming dark green/ grey | | | | | 4.5 | | 201/ 65 | 3.1 | |
| becoming hard | | | | | 5.0 | | 205+ | | |
| EOB at 5.0m. Target Depth. | | | | | 5.5 | | | | |
| | | | | | 6.0 | | | | |




Comments:
 Groundwater encountered 2.8m.
 UTP = unable to penetrate.
 EOB = end of borehole.

Borehole Diameter: 50mm
 Checked: *LM*

| | | | | | | | |
|---------|--|---------|--|-----------|--|----------|--|
| Topsoil | | Sand | | Sandstone | | Plutonic | |
| Fill | | Gravel | | Siltstone | | No Core | |
| Clay | | Organic | | Limestone | | | |
| Silt | | Pumice | | Volcanic | | | |

| | | | | | | | | | |
|---|---|----|-----------------------|---|------------------|----------------------|----------------------------------|------------------|--|
| Client : OYSTER CAPITAL Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Auger Borehole No. HA109 Sheet 10 of 12 | | | | | |
| Job Number: J00784 | | | | Vane Head: 2153 | Logged By: AB | Processor : AB | Date: 21.01.19 | | |
| Borehole Location: | mN Description: Refer to site plan | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | [Hatched Pattern] | | | | | |
| clayey SILT, orange/ brown. Hard, dry to moist, low to medium plasticity [NATURAL] becoming grey streaked orange/ brown, medium plasticity becoming very stiff, insensitive becoming moderately sensitive becoming orange/ brown mottled grey | | | | [Cross-hatch Pattern] | 0.5 | | 205+ | | |
| | | | | | 1.0 | | 146/ 76 | 1.9 | |
| | | | | | 1.5 | | 149/ 66 | 2.3 | |
| | | | | | 2.0 | | 165/ 66 | 2.5 | |
| becoming brown/ grey, saturated, with some fine to medium sand sized silt clast inclusions becoming orange speckled light blue/ grey becoming hard | | | | | 2.5 | ▽ | 169/ 71 | 2.4 | |
| | | | | | 3.0 | | 205+ | | |
| | | | | | 3.5 | | 205+ | | |
| | | | | | 4.0 | | UTP | | |
| | | | | | 4.5 | | UTP | | |
| EOB at 5.0m. Target Depth. | | | | | 5.0 | | UTP | | |
| | | | | | 5.5 | | | | |
| | | | | | 6.0 | | | | |
|  | Comments: Groundwater encountered 2.5m. UTP = unable to penetrate. EOB = end of borehole. | | Borehole Diameter: | Topsoil | Sand | Sandstone | Plutonic | | |
| | | | 50mm | Fill | Gravel | Siltstone | No Core | | |
| | | | Checked: <i>Km</i> | Clay | Organic | Limestone | | | |
| | | | | Silt | Pumice | Volcanic | | | |
| | | | | | | | | | |

| | | | | | | | | | |
|---|---|--------------------------|-------------|---------------------------------|------------------|----------------------|----------------------------------|------------------|--|
| Client : OYSTER CAPITAL | | | | Auger Borehole No. HA110 | | | | | |
| Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Sheet 11 of 12 | | | | | |
| Job Number: J00784 | | | | Vane Head: 1900 | Logged By: TK | Processor : AB | Date: 22.01.19 | | |
| Borehole Location: | mN Description: | mE Refer to site plan | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear (kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details |
| SOIL DESCRIPTION | | | | | | | | | |
| TOPSOIL | | | | [Hatched] | | | | | |
| slightly clayey SILT, brown/ orange. Very stiff, moist, low plasticity, moderately sensitive [NATURAL] becoming orange mottled orange/ brown | | | | [Cross-hatched] | 0.5 | | 151/ 76 | 2.0 | |
| becoming stiff | | | | [Cross-hatched] | 1.0 | | 92/ 46 | 2.0 | |
| silty CLAY, orange/ brown mottled grey. Very stiff, moist, medium plasticity, with some organic inclusions | | | | [Cross-hatched] | 1.5 | | 149/ 51 | 2.9 | |
| SILT with trace fine sand, orange mottled light grey. Very stiff, moist to wet, low to no plasticity, with trace clay, with some organic staining with trace medium sand sized clast inclusions with some organic inclusions becoming wet to saturated | | | | [Cross-hatched] | 2.0 | | 175/ 76 | 2.3 | |
| silty CLAY, orange. Very stiff, moist, medium plasticity, moderately sensitive, with some limonite staining | | | | [Cross-hatched] | 2.5 | | 127/ 54 | 2.4 | |
| clayey SILT, dark grey. Very stiff, wet to saturated, medium plasticity, moderately sensitive at 3.0m, becoming saturated becoming orange streaked blue/ grey becoming sensitive with some fibrous wood inclusions to 3.9m becoming green/ grey, moderately sensitive becoming hard | | | | [Cross-hatched] | 3.0 | ▽ | 177/ 50 | 3.5 | |
| | | | | [Cross-hatched] | 3.5 | | 140/ 32 | 4.4 | |
| | | | | [Cross-hatched] | 4.0 | | 175/ 64 | 2.7 | |
| | | | | [Cross-hatched] | 4.5 | | 205+ | | |
| EOB at 5.0m. Target Depth. | | | | [Cross-hatched] | 5.0 | | UTP | | |
| | | | | [Cross-hatched] | 5.5 | | | | |
| | | | | [Cross-hatched] | 6.0 | | | | |
|  | Comments: Groundwater encountered 3.0m. UTP = unable to penetrate. EOB = end of borehole. | | | Borehole Diameter: | Topsoil | Sand | Sandstone | Plutonic | |
| | | | | 50mm | Fill | Gravel | Siltstone | No Core | |
| | | | | Checked: | Clay | Organic | Limestone | | |
| | | | | KM | Silt | Pumice | Volcanic | | |

| | | | | | | | | | | | |
|--|----|----|-------------|---|------------------|----------------------|---------------------------------|------------------|--|----------|--|
| Client : OYSTER CAPITAL Project Location : 116 WAIHOEHOE ROAD, DRURY | | | | Auger Borehole No. HA111 Sheet 12 of 12 | | | | | | | |
| Job Number: J00784 | | | | Vane Head: 1900 | Logged By: TK | Processor : AB | Date: 21.01.19 | | | | |
| Borehole Location: | mN | mE | Ground R.L. | Legend | Depth (m) | Standing Water Level | Vane Shear(kPa) peak / residual | Soil Sensitivity | Sample and Laboratory / Other Test Details | | |
| Description: Refer to site plan | | | | | | | | | | | |
| SOIL DESCRIPTION | | | | | | | | | | | |
| TOPSOIL | | | | | | | | | | | |
| clayey SILT with some topsoil intermixed, brown. Very stiff, moist, low plasticity, moderately sensitive [NATURAL] | | | | | | | | | | | |
| becoming orange streaked brown | | | | | | | | | | | |
| becoming slightly clayey SILT, orange/ grey | | | | | | | | | | | |
| becoming orange mottled orange/ brown, hard | | | | | | | | | | | |
| becoming, wet, low to medium plasticity, with some fine sand, with some hardened clast inclusions | | | | | | | | | | | |
| becoming very stiff, orange streaked orange/ brown, sensitive | | | | | | | | | | | |
| becoming wet to saturated becoming light brown | | | | | | | | | | | |
| silty CLAY, light brown mottled light brown/ grey. Hard, wet, medium plasticity, sensitive | | | | | | | | | | | |
| becoming saturated | | | | | | | | | | | |
| becoming dark grey | | | | | | | | | | | |
| with trace fine sand to 4.0m | | | | | | | | | | | |
| becoming green mottled dark grey | | | | | | | | | | | |
| with some organic inclusions to 4.7m | | | | | | | | | | | |
| becoming grey, with trace fine sand | | | | | | | | | | | |
| at 5.0m, becoming moderately sensitive | | | | | | | | | | | |
| EOB at 5.0m. Target Depth. | | | | | | | | | | | |
| | | | | Comments: Groundwater encountered 2.9m. UTP = unable to penetrate. EOB = end of borehole. | | Borehole Diameter: | 50mm | Checked: | Km | | |
| | | | | Topsoil | | Sand | | Sandstone | | Plutonic | |
| | | | | Fill | | Gravel | | Siltstone | | No Core | |
| | | | | Clay | | Organic | | Limestone | | | |
| | | | | Silt | | Pumice | | Volcanic | | | |

LIQUEFACTION ANALYSIS REPORT

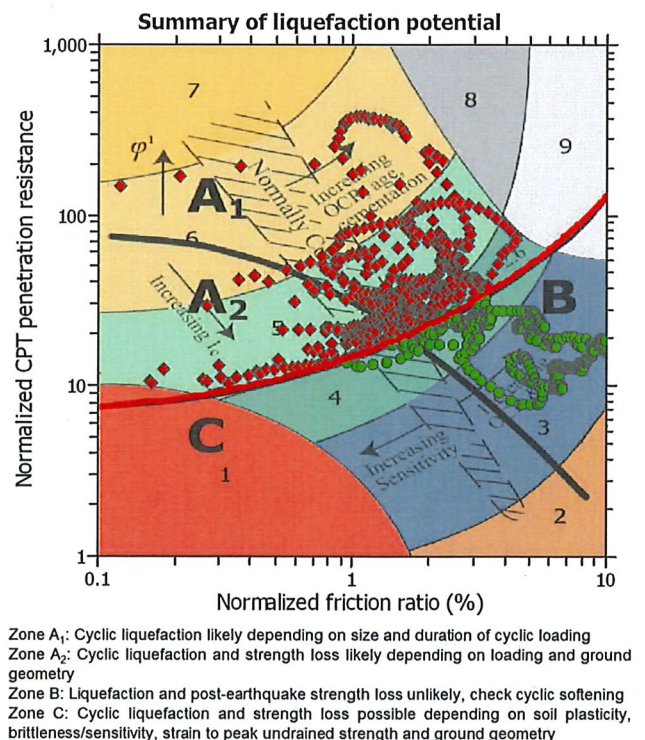
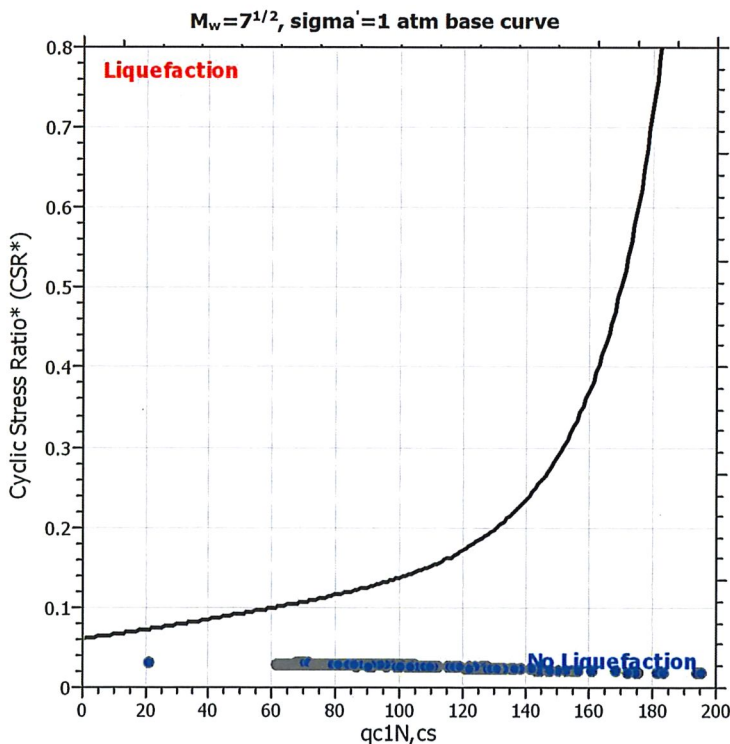
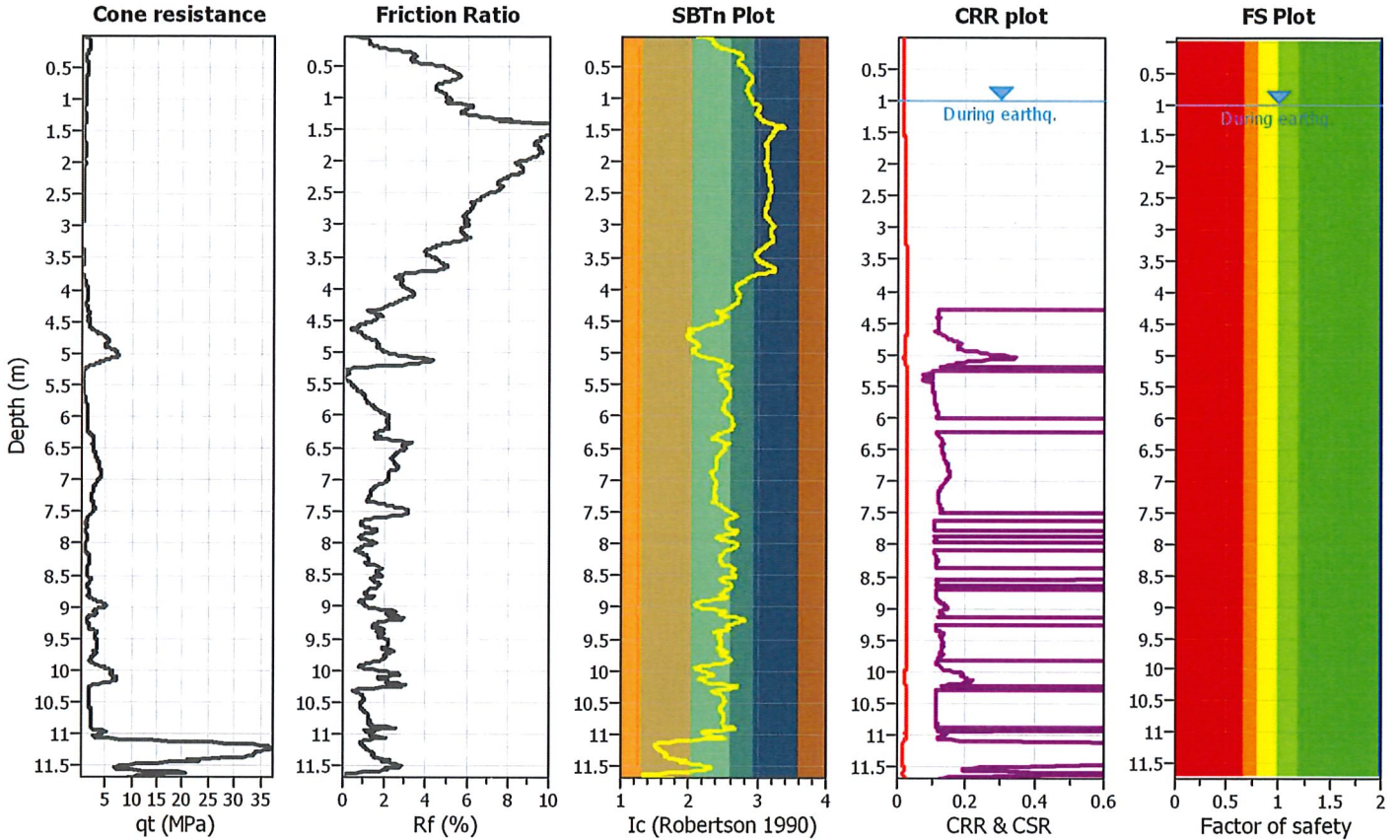
Project title : SLS(1/25)

Location : 116 Waihoehoe Road, Drury

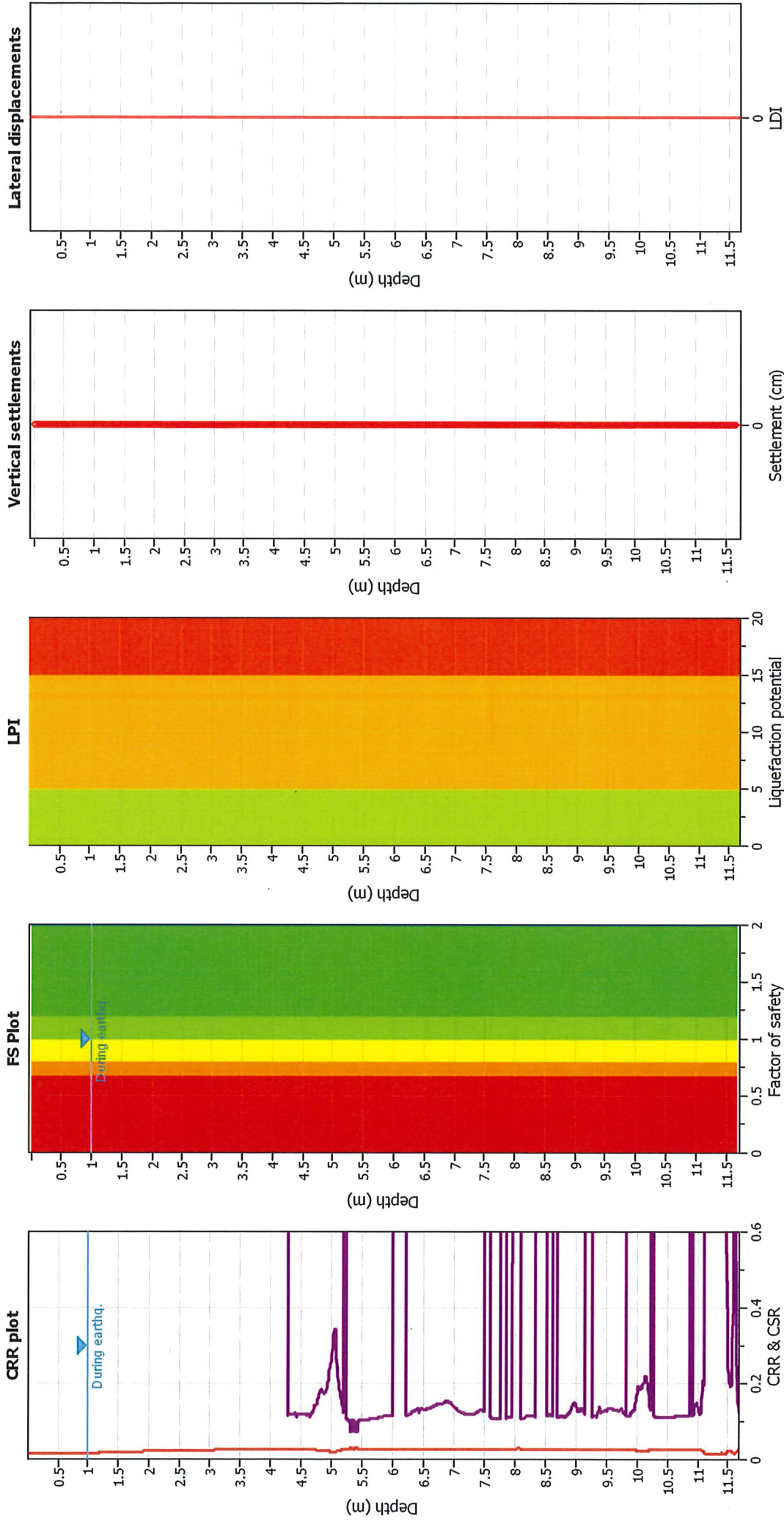
CPT file : Lander 116 Waihoehoe rd_CPT01

Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | B&I (2014) | G.W.T. (in-situ): | 1.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 1.00 m | Fill height: | N/A | applied: | Sands only |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude M_w : | 5.90 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.03 | Unit weight calculation: | Based on SBT | K_v applied: | Yes | MSF method: | Method based |



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on I_c value
 Earthquake magnitude M_w: 5.90
 Peak ground acceleration: 0.03
 Depth to water table (insttu): 1.00 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 I_c cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: No
 K_s applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: No
 Limit depth: N/A

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

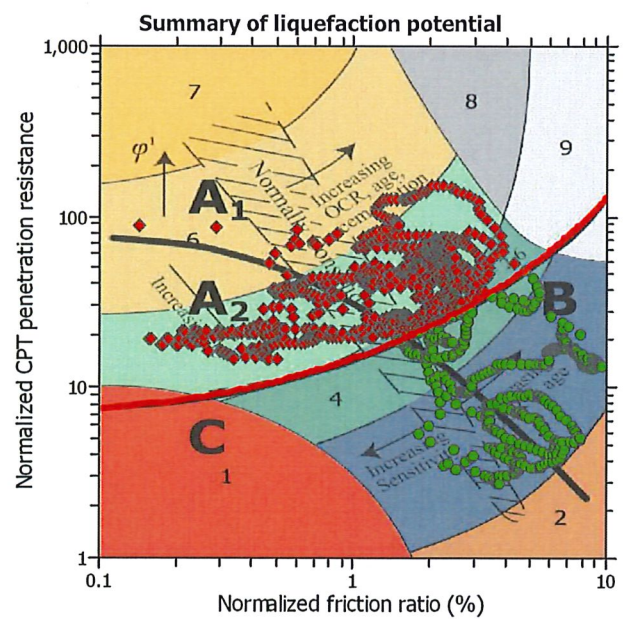
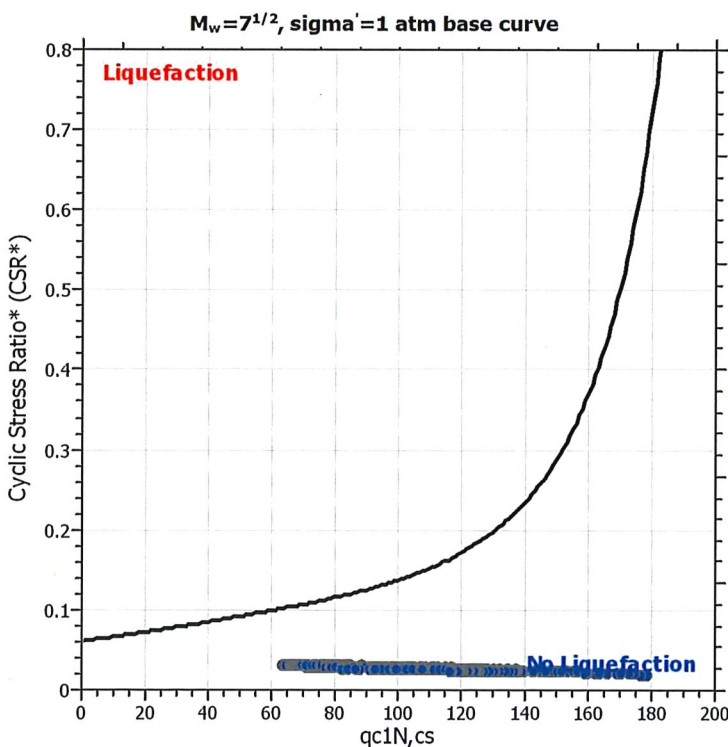
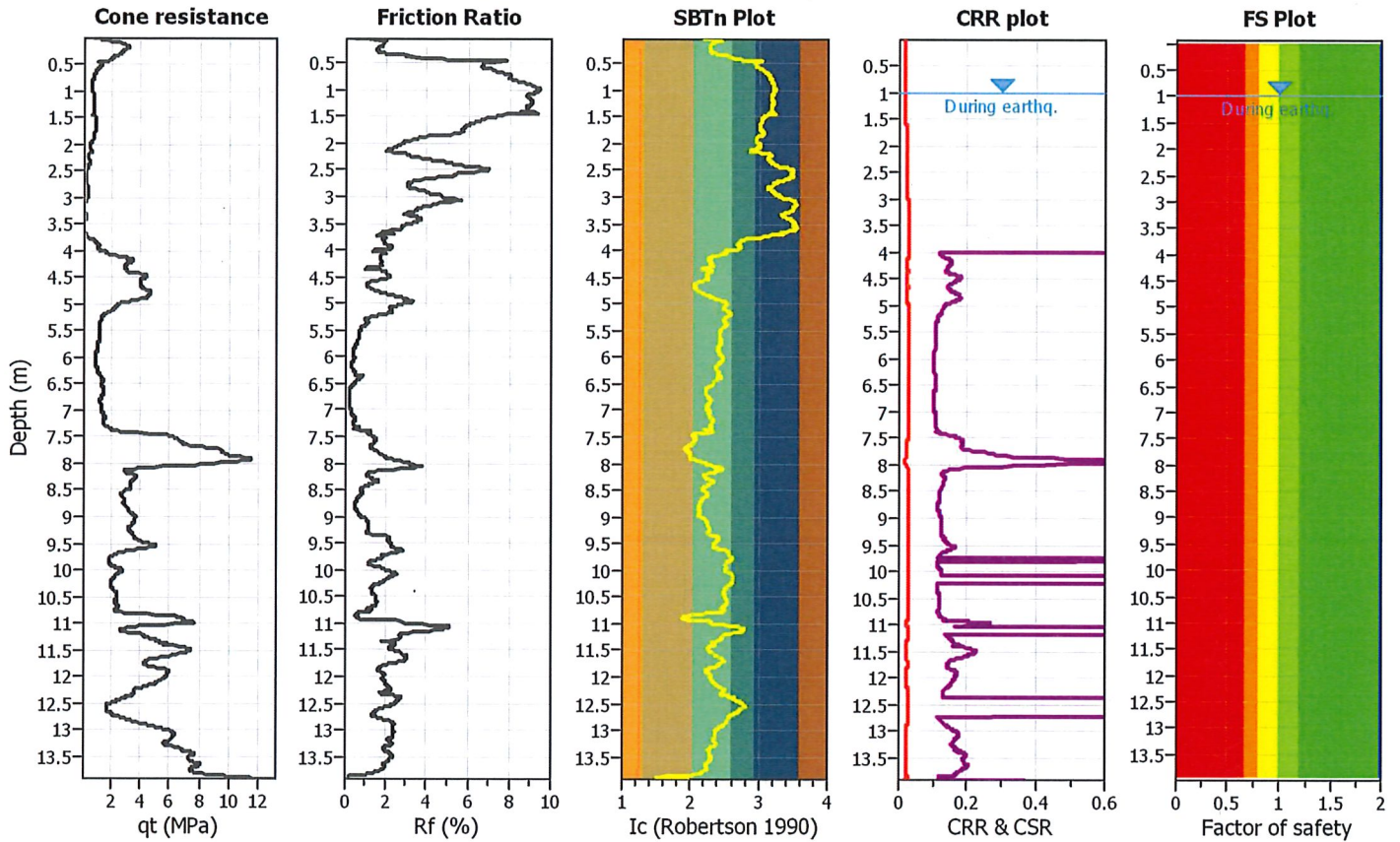
Project title : SLS(1/25)

Location : 116 Waihoehoe Road, Drury

CPT file : Lander 116 Waihoehoe rd_CPT02

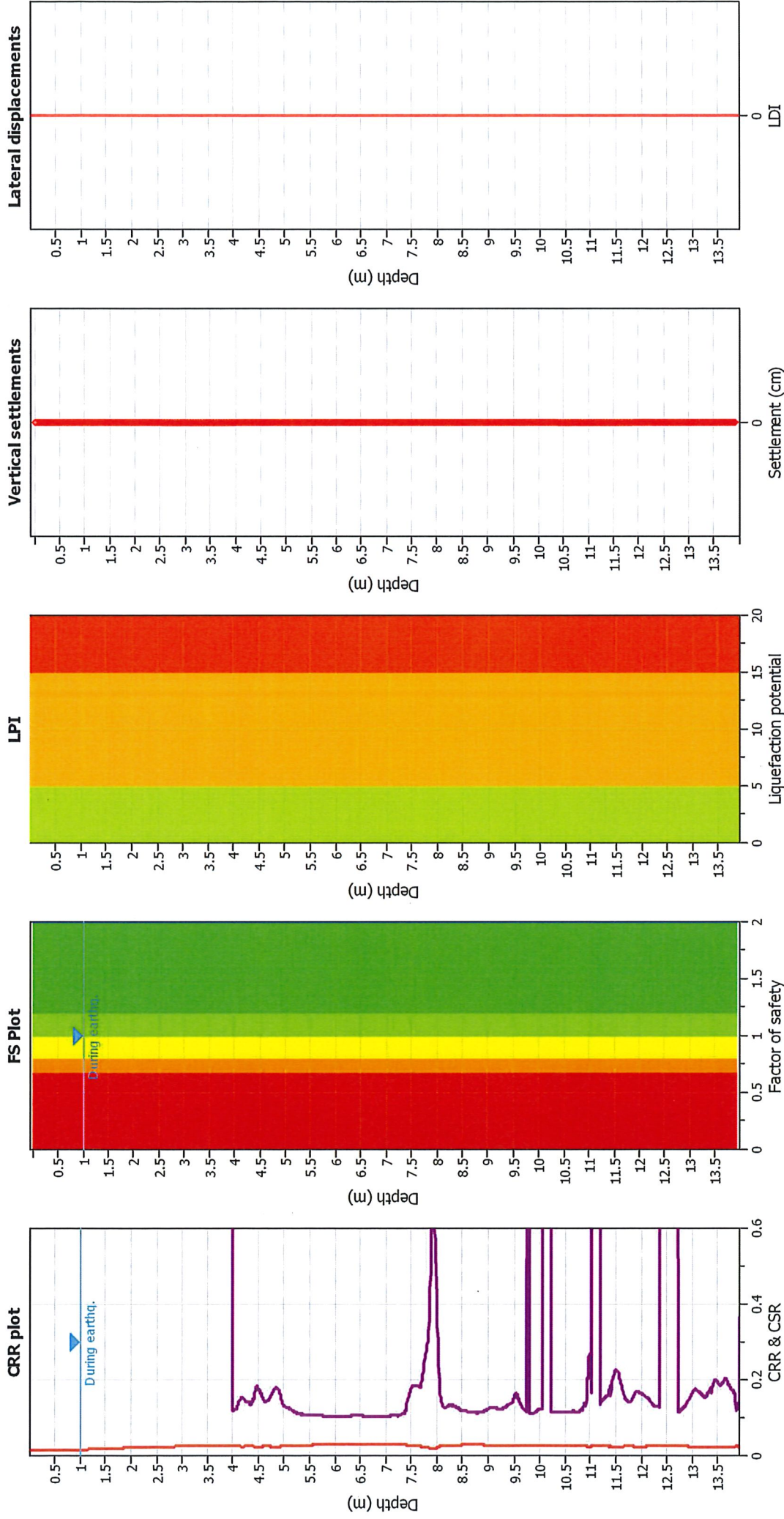
Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method: | B&I (2014) | G.W.T. (in-situ): | 1.00 m | Use fill: | No | Clay like behavior applied: | Sands only |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 1.00 m | Fill height: | N/A | Limit depth applied: | No |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth: | N/A |
| Earthquake magnitude M_w : | 5.90 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | MSF method: | Method based |
| Peak ground acceleration: | 0.03 | Unit weight calculation: | Based on SBT | K_0 applied: | Yes | | |



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on I_c value
 Earthquake magnitude M_w: 5.90
 Peak ground acceleration: 0.03
 Depth to water table (insitu): 1.00 m

Depth to GW (earthq.): 1.00 m
 Average results interval: 3
 I_c cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: No
 K_c applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: No
 Limit depth: N/A

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

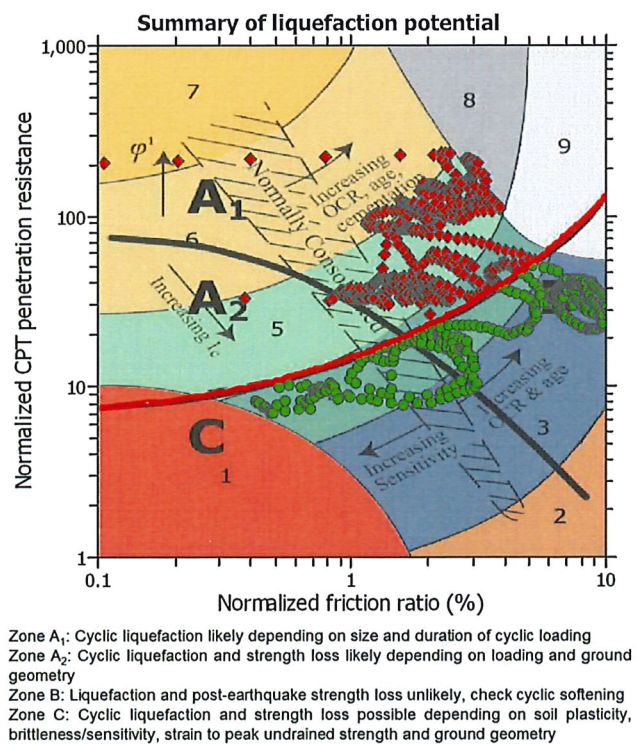
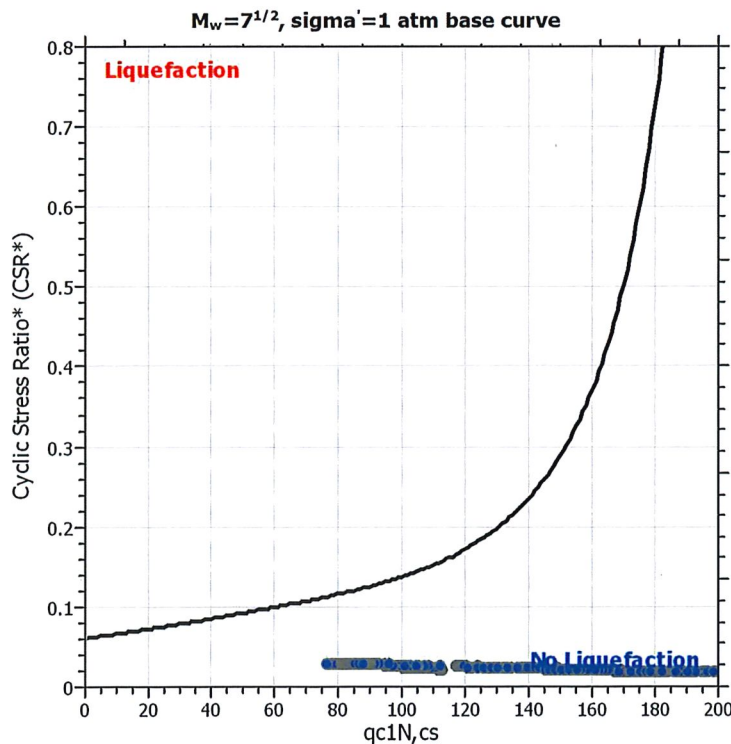
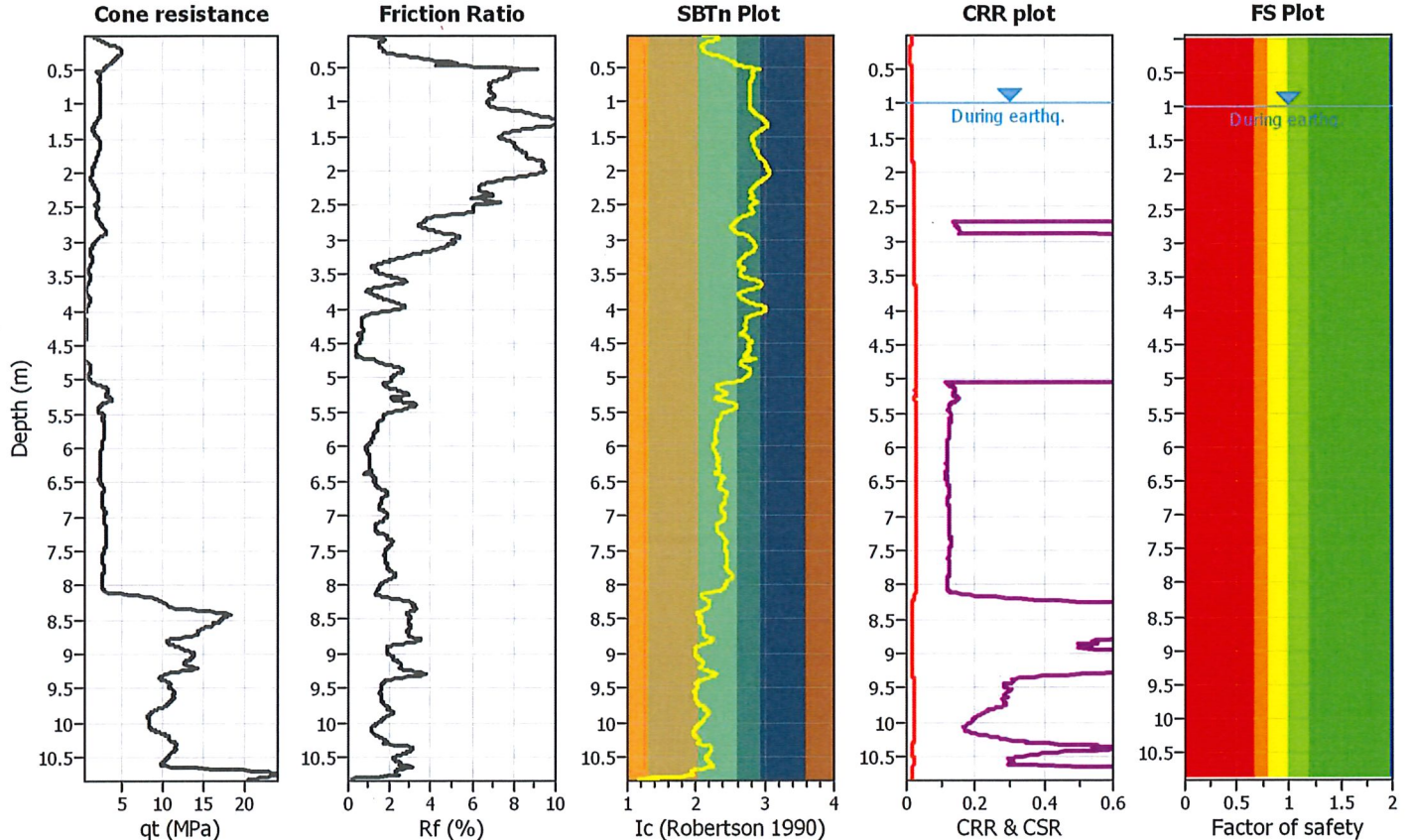
Project title : SLS(1/25)

Location : 116 Waihoehoe Road, Drury

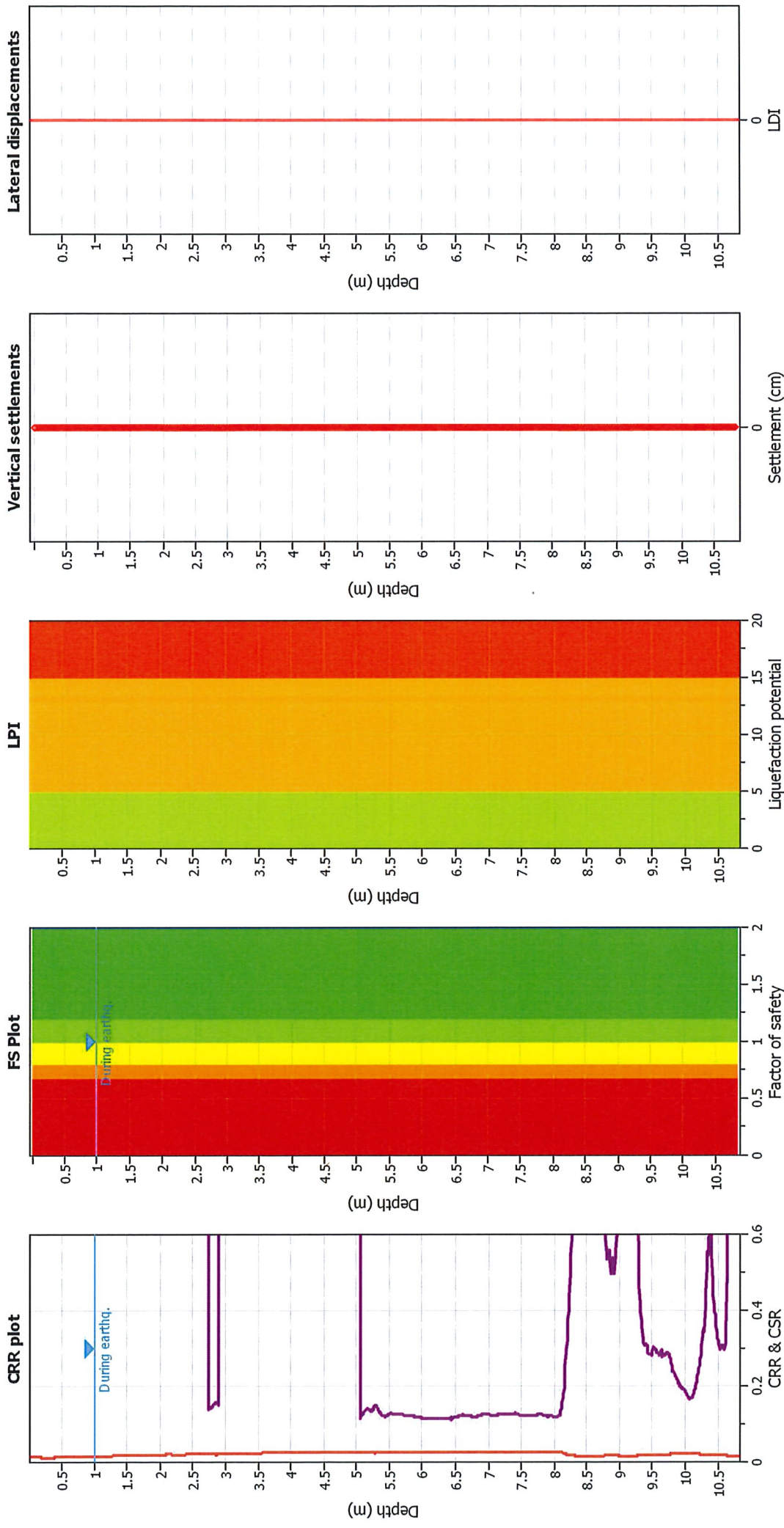
CPT file : Lander 116 Waihoehoe rd_CPT03

Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method: | B&I (2014) | G.W.T. (in-situ): | 1.00 m | Use fill: | No | Clay like behavior applied: | Sands only |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 1.00 m | Fill height: | N/A | Limit depth applied: | No |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth: | N/A |
| Earthquake magnitude M_w : | 5.90 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | MSF method: | Method based |
| Peak ground acceleration: | 0.03 | Unit weight calculation: | Based on SBT | K_0 applied: | Yes | | |



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 5.90
 Peak ground acceleration: 0.03
 Depth to water table (insitu): 1.00 m

Fill weight: N/A
 Transition detect. applied: No
 K_r applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: No
 Limit depth: N/A

Depth to GW (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk



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www.landergeotechnical.co.nz

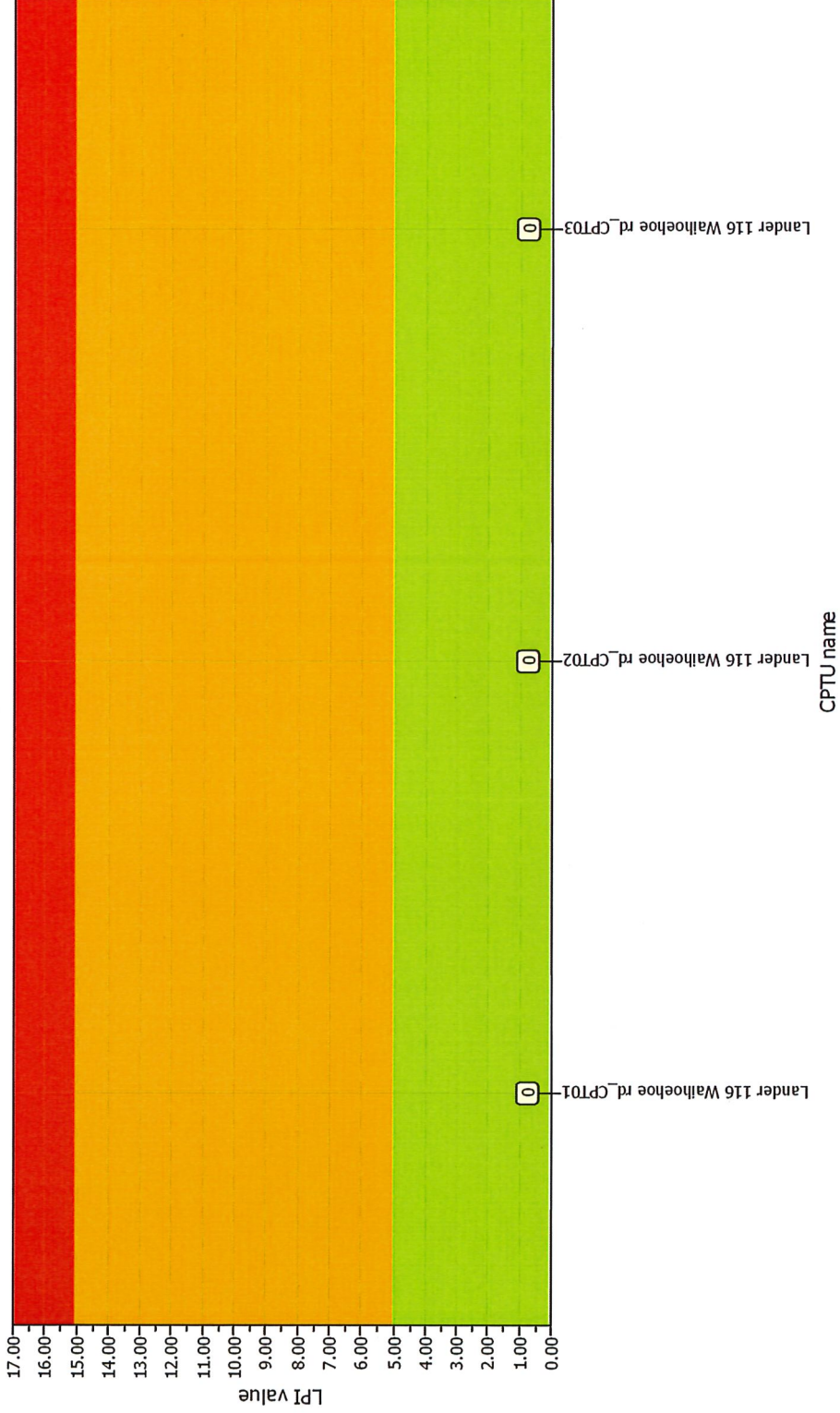
Project title : SLS(1/25)

Location : 116 Waihoehoe Road, Drury

Overall Liquefaction Potential Index report



Basic statistics
Total CPT number: 3
100.00% low risk
0.00% high risk
0.00% very high risk



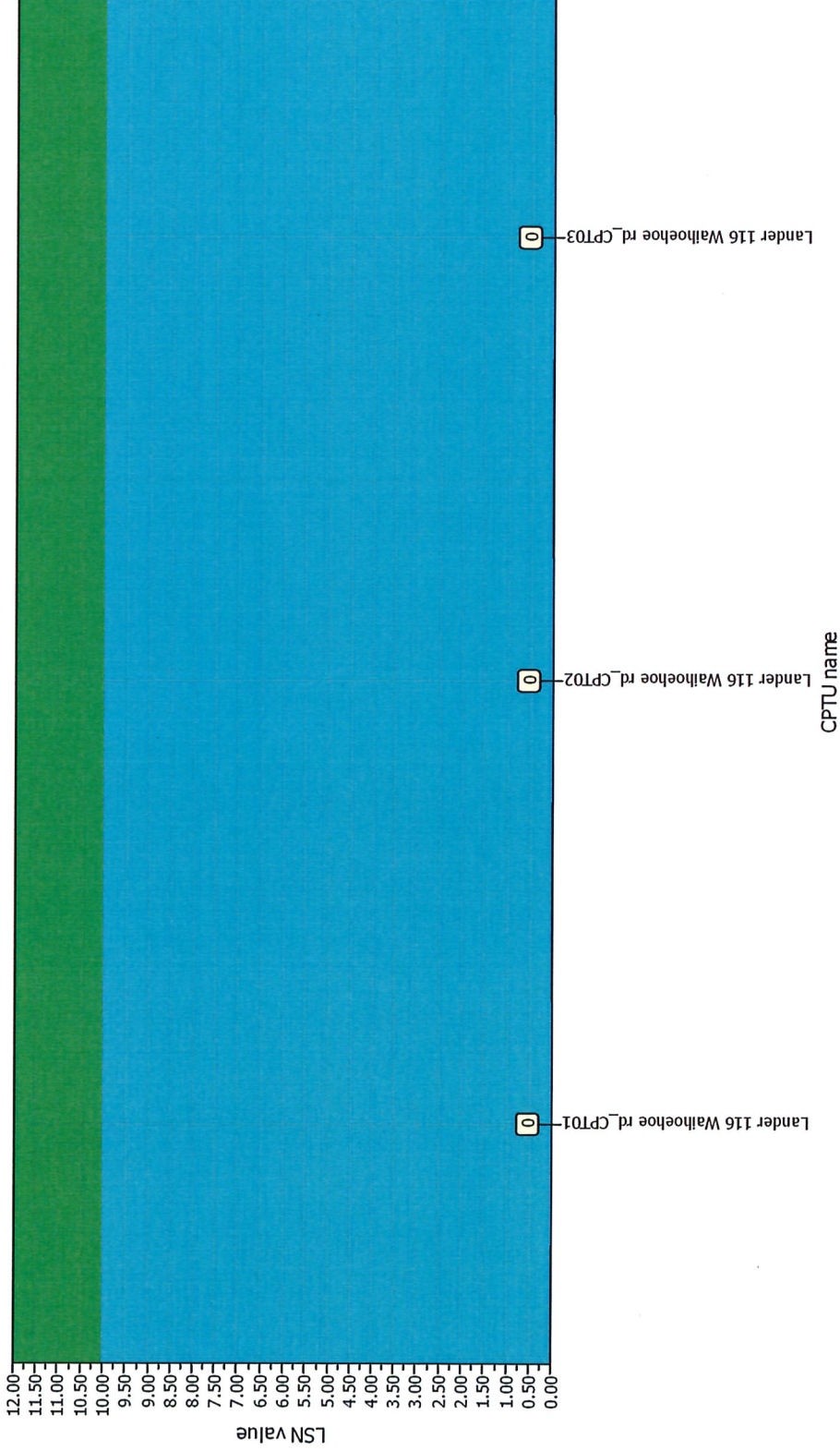


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Project title : SLS(1/25)

Location : 116 Waihoehoe Road, Drury

Overall Liquefaction Severity Number report



LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

Basic statistics

- Total CPT number: 3
- 100.00% little liquefaction
- 0.00% minor liquefaction
- 0.00% moderate liquefaction
- 0.00% moderate to major liquefaction
- 0.00% major liquefaction
- 0.00% severe liquefaction

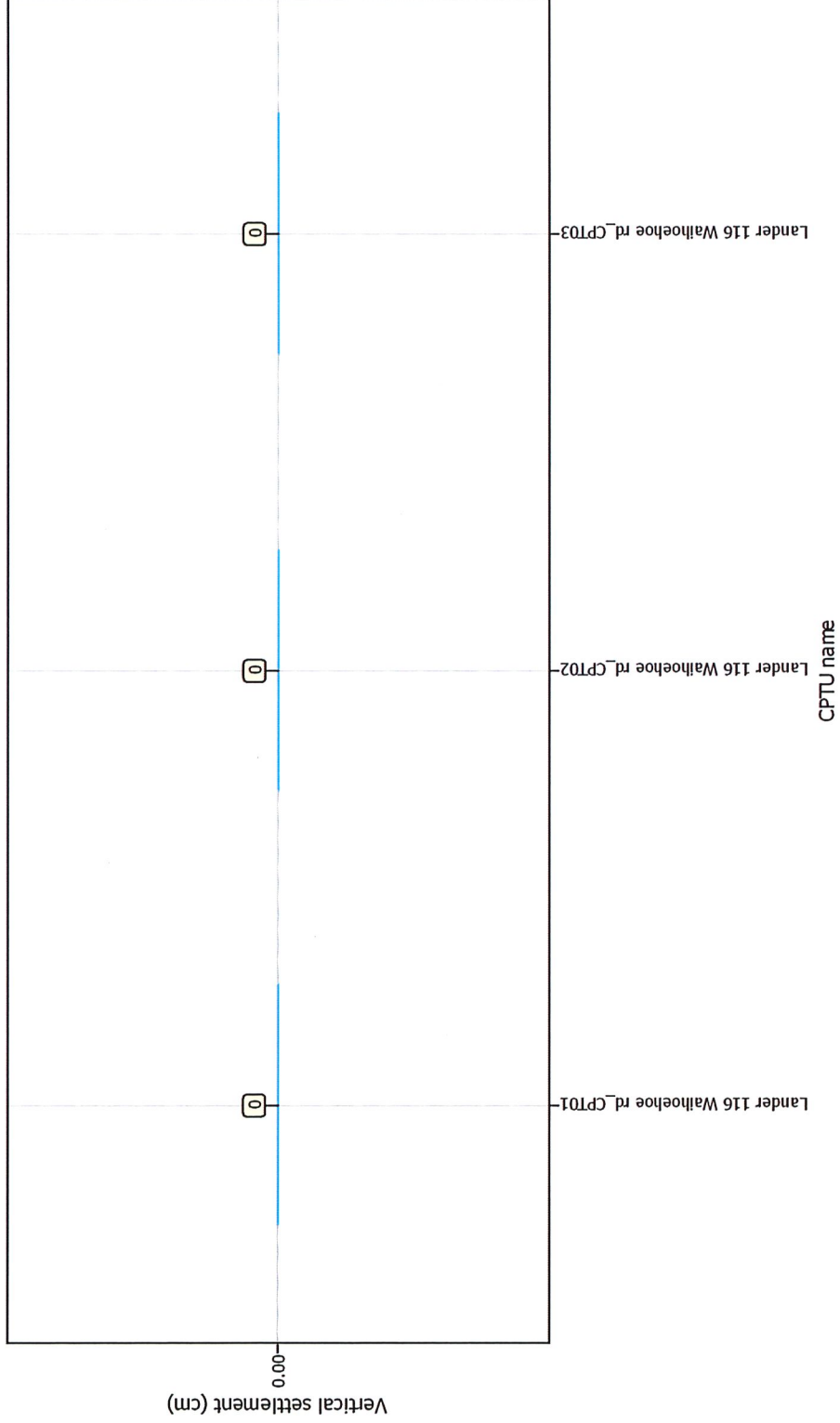


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Project title : SLS(1/25)

Location : 116 Waihoehoe Road, Drury

Overall vertical settlements report



LIQUEFACTION ANALYSIS REPORT

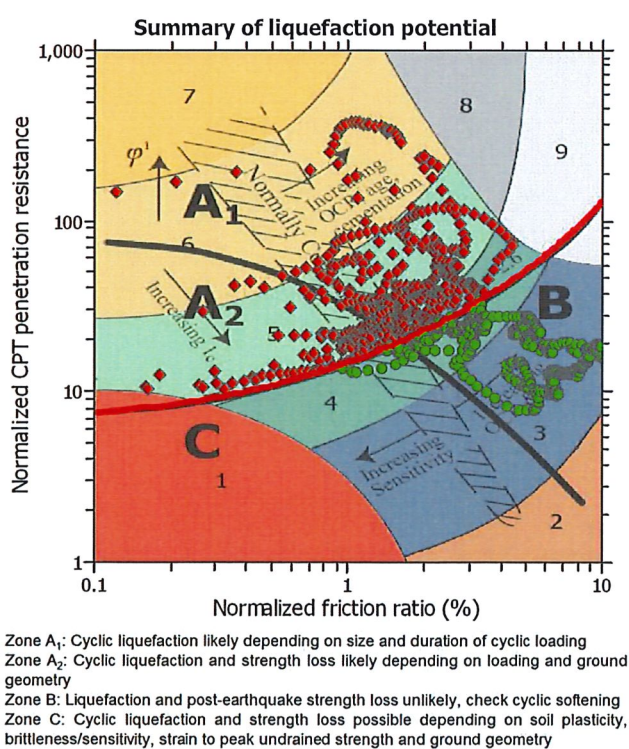
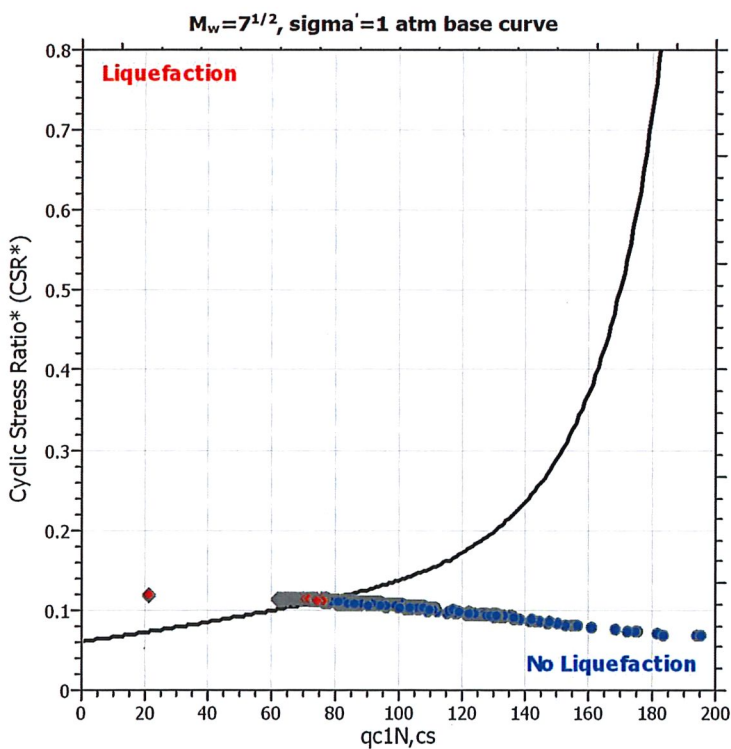
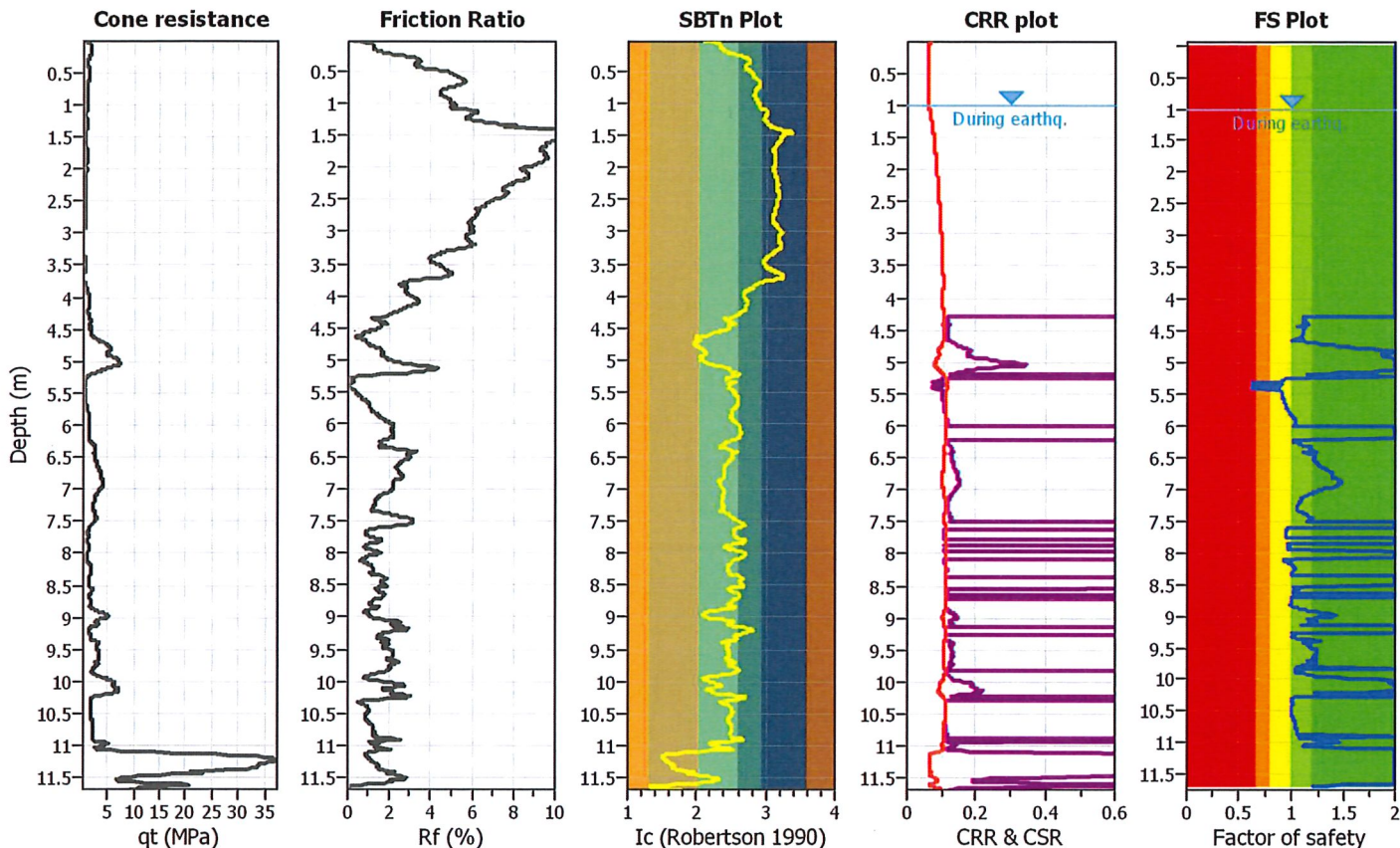
Project title : ULS(1/500)

Location : 116 Waihoehoe Road, Drury

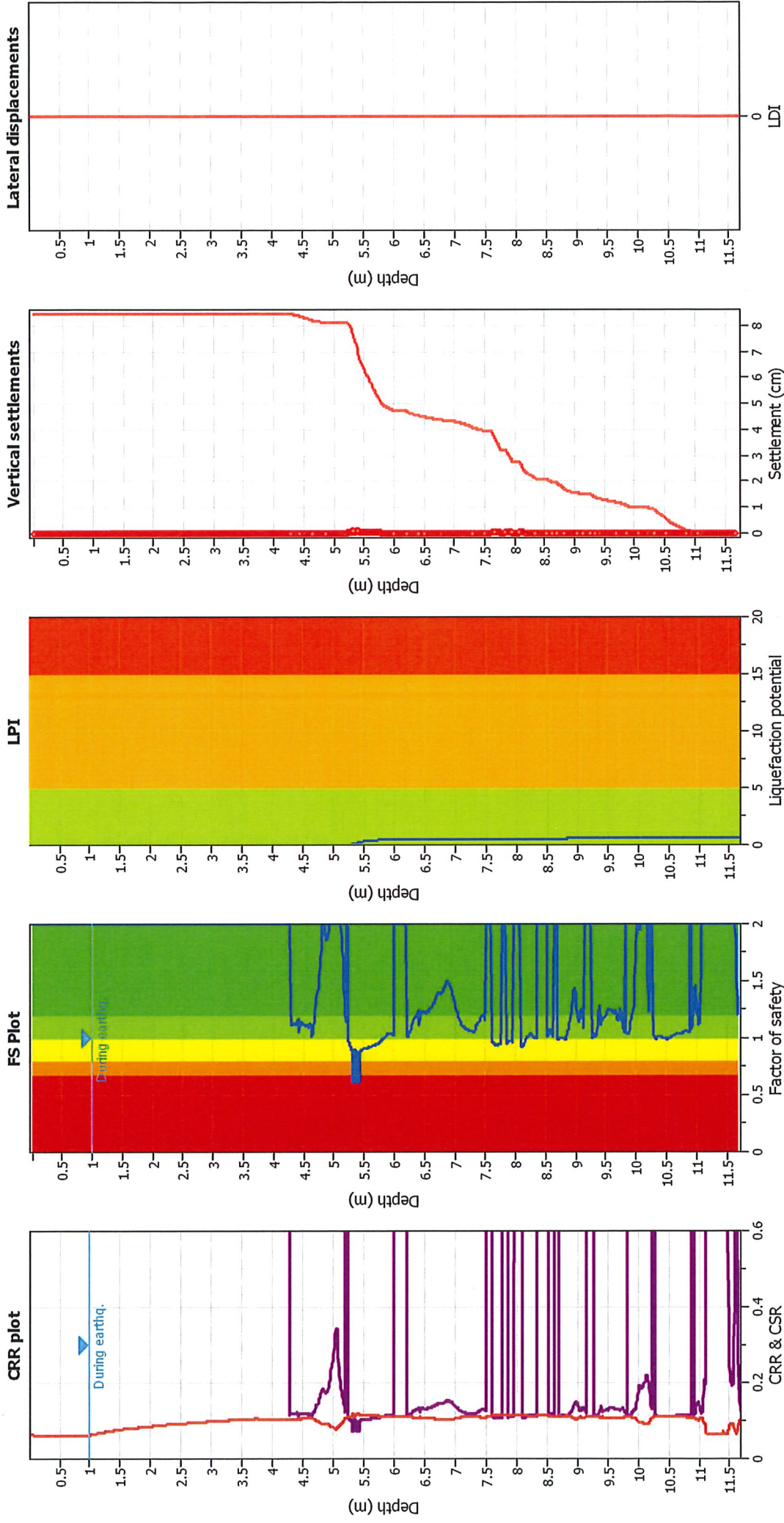
CPT file : Lander 116 Waihoehoe rd_CPT01

Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|-----------------------------|--------------|
| Analysis method: | B&I (2014) | G.W.T. (In-situ): | 1.00 m | Use fill: | No | Clay like behavior applied: | Sands only |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 1.00 m | Fill height: | N/A | Limit depth applied: | No |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth: | N/A |
| Earthquake magnitude M_w : | 5.90 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | MSF method: | Method based |
| Peak ground acceleration: | 0.12 | Unit weight calculation: | Based on SBT | K_f applied: | Yes | | |



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on I_c value
 Earthquake magnitude M_w: 5.90
 Peak ground acceleration: 0.12
 Depth to water table (insttu): 1.00 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 I_c cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: No
 K_v applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: No
 Limit depth: N/A

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

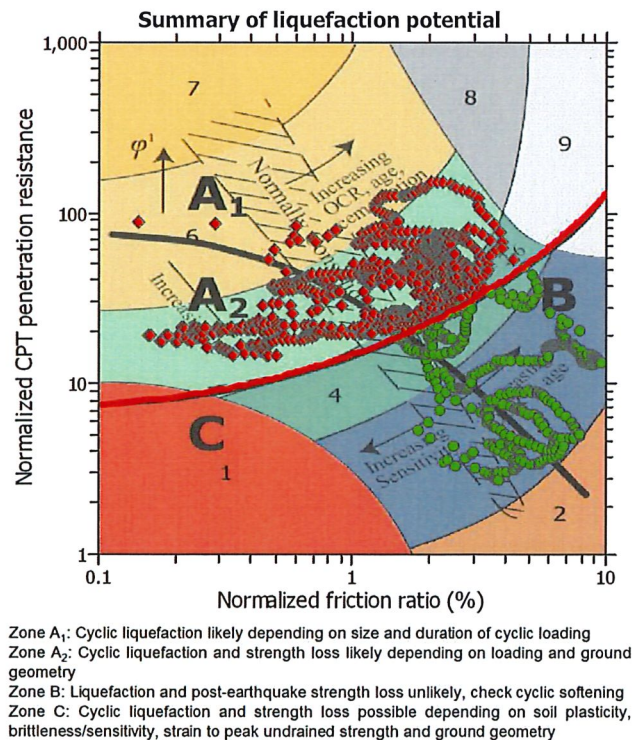
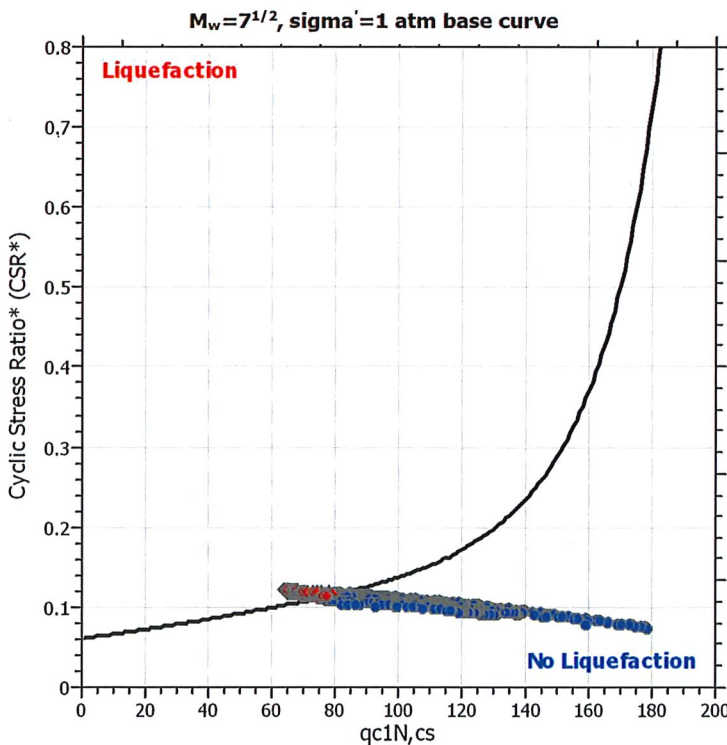
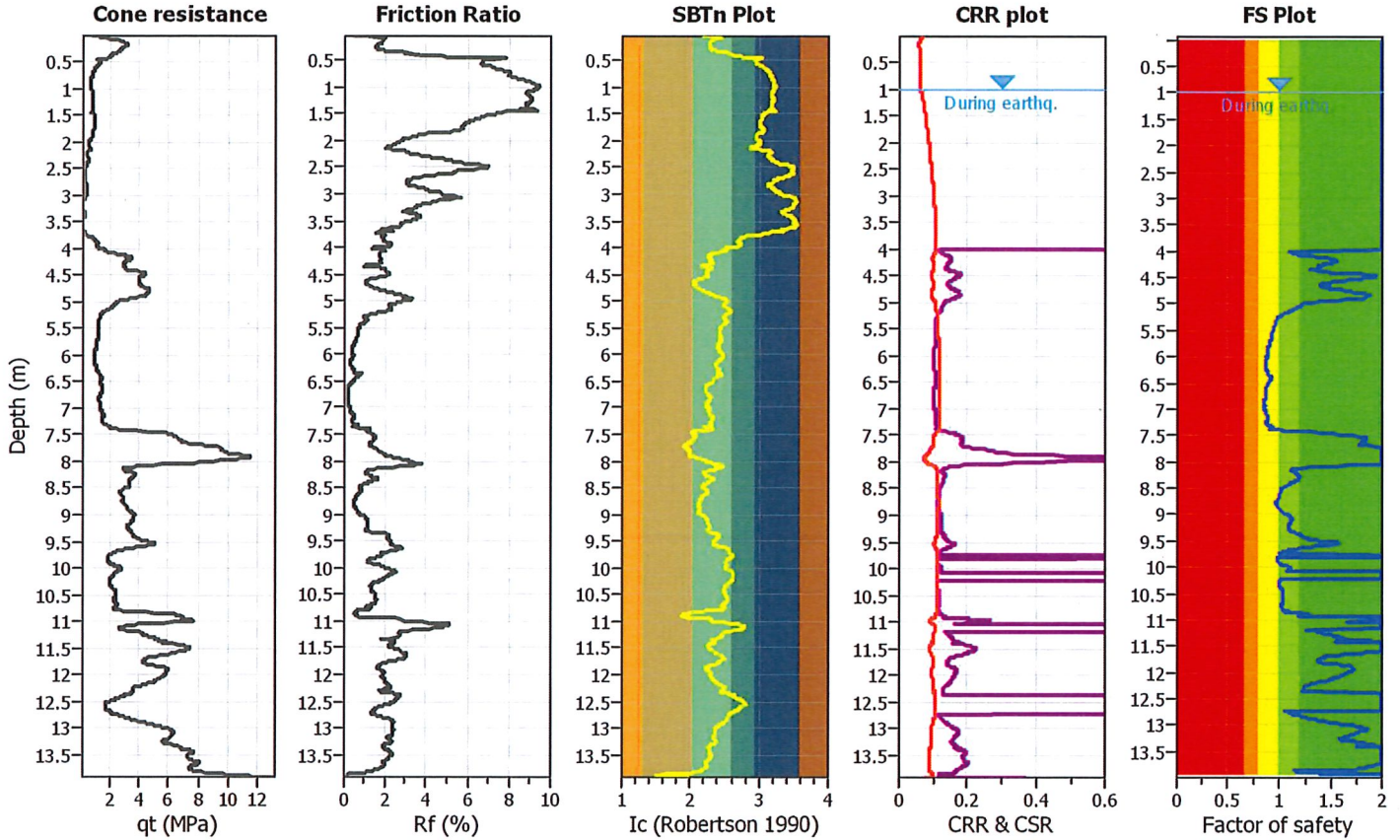
Project title : ULS(1/500)

Location : 116 Waihoehoe Road, Drury

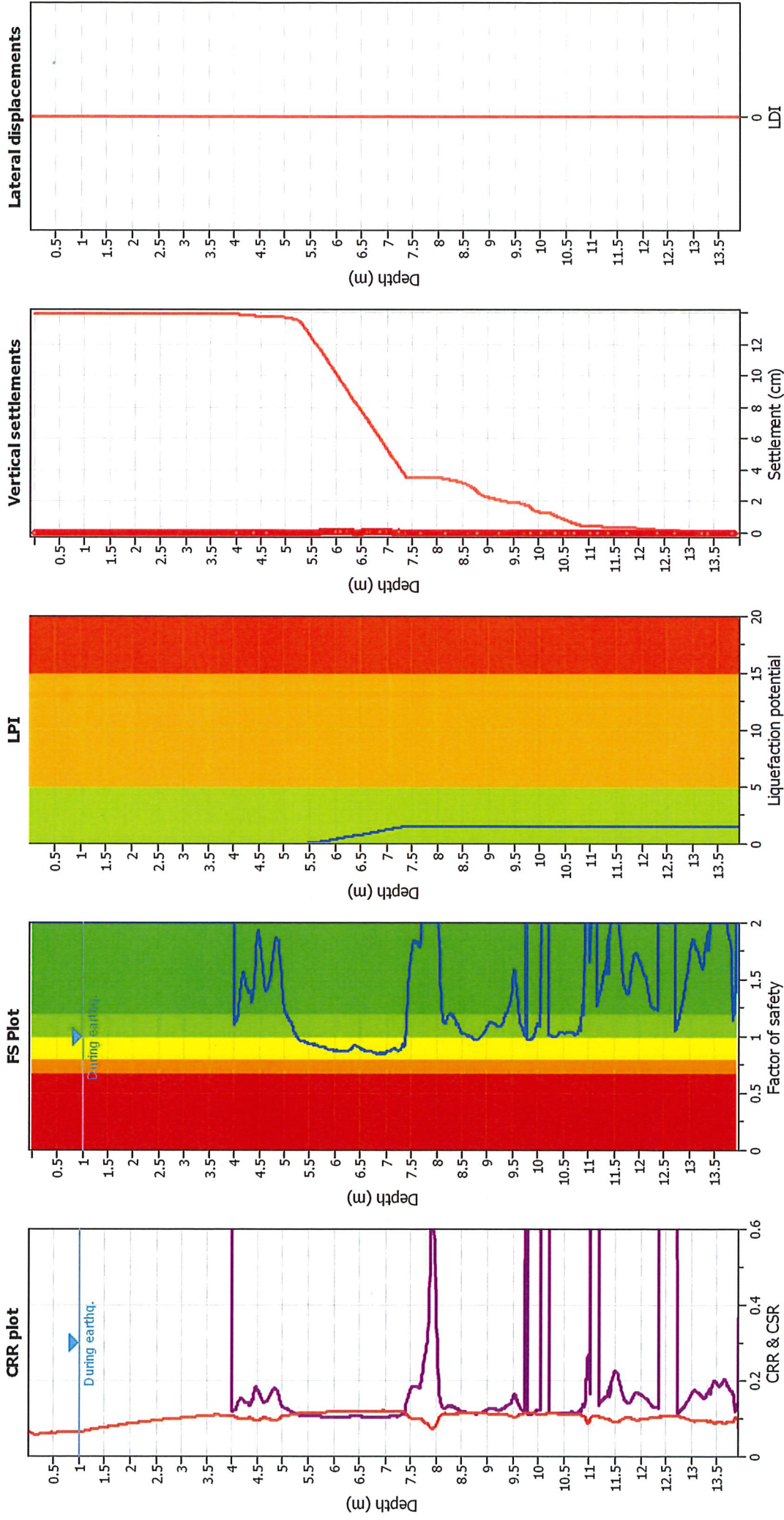
CPT file : Lander 116 Waihoehoe rd_CPT02

Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | B&I (2014) | G.W.T. (in-situ): | 1.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 1.00 m | Fill height: | N/A | applied: | Sands only |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude M_w : | 5.90 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.12 | Unit weight calculation: | Based on SBT | K_v applied: | Yes | MSF method: | Method based |



Liquefaction analysis overall plots



Input parameters and analysis data

| | | | |
|--------------------------------|----------------------|-----------------------------|--------------|
| Analysis method: | B&I (2014) | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Transition detect. applied: | No |
| Points to test: | Based on I_c value | K_{ϕ} applied: | Yes |
| Earthquake magnitude M_w : | 5.90 | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Limit depth applied: | No |
| Depth to water table (insitu): | 1.00 m | Limit depth: | N/A |
| | | Depth to GW (earthq.): | 1.00 m |
| | | Average results interval: | 3 |
| | | Unit weight calculation: | Based on SPT |
| | | Use fill: | No |
| | | Fill height: | N/A |

F.S. color scheme

| | |
|------------|---|
| Red | Almost certain it will liquefy |
| Orange | Very likely to liquefy |
| Yellow | Liquefaction and no liq. are equally likely |
| Green | Unlikely to liquefy |
| Dark Green | Almost certain it will not liquefy |

LPI color scheme

| | |
|--------|----------------|
| Red | Very high risk |
| Orange | High risk |
| Green | Low risk |

LIQUEFACTION ANALYSIS REPORT

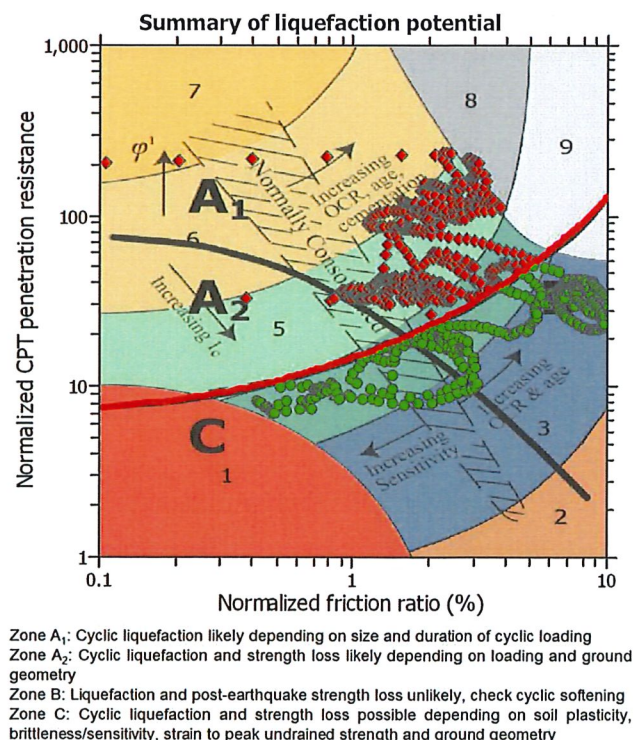
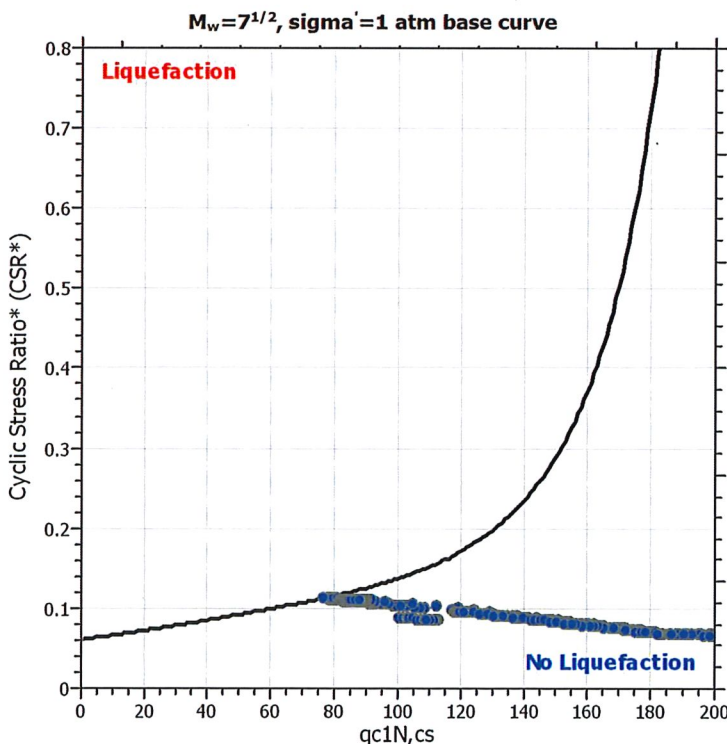
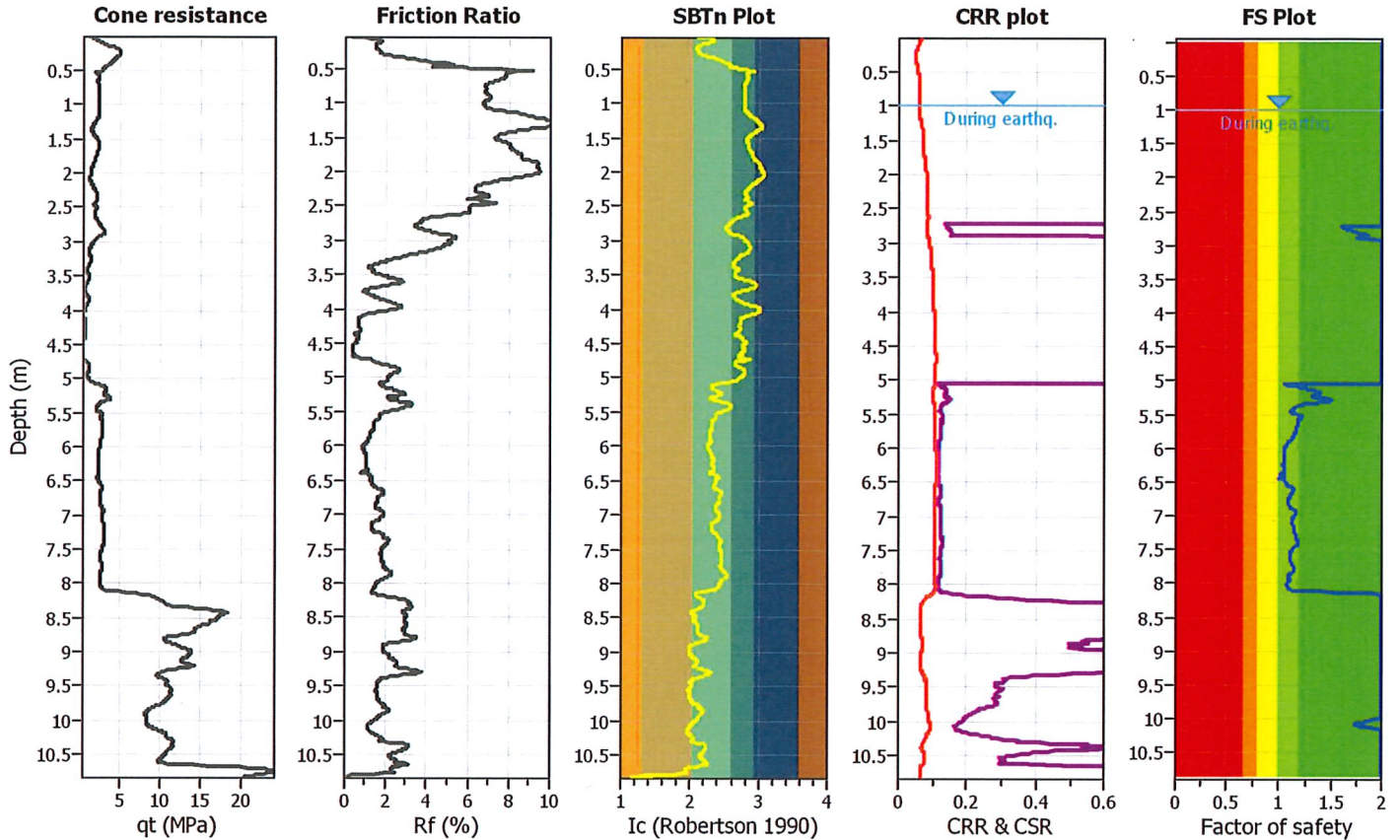
Project title : ULS(1/500)

Location : 116 Waihoehoe Road, Drury

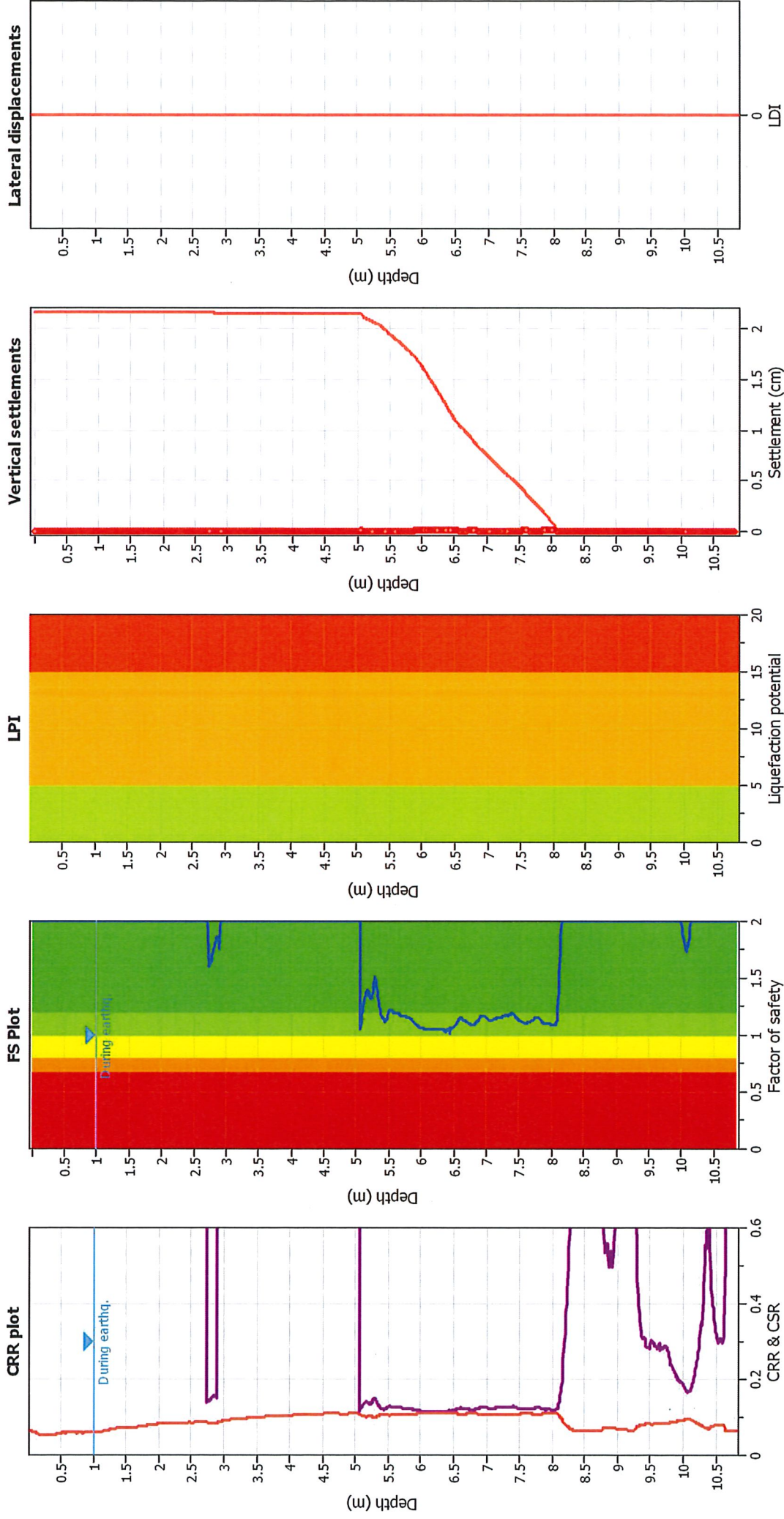
CPT file : Lander 116 Waihoehoe rd_CPT03

Input parameters and analysis data

| | | | | | | | |
|------------------------------|-------------------|---------------------------|--------------|-------------------------|-----|----------------------|--------------|
| Analysis method: | B&I (2014) | G.W.T. (in-situ): | 1.00 m | Use fill: | No | Clay like behavior | |
| Fines correction method: | B&I (2014) | G.W.T. (earthq.): | 1.00 m | Fill height: | N/A | applied: | Sands only |
| Points to test: | Based on Ic value | Average results interval: | 3 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude M_w : | 5.90 | Ic cut-off value: | 2.60 | Trans. detect. applied: | No | Limit depth: | N/A |
| Peak ground acceleration: | 0.12 | Unit weight calculation: | Based on SBT | K_v applied: | Yes | MSF method: | Method based |



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on I_c value
 Earthquake magnitude M_w: 5.90
 Peak ground acceleration: 0.12
 Depth to water table (in situ): 1.00 m

Depth to GW (earthq.): 1.00 m
 Average results interval: 3
 I_c cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: No
 K_σ applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: No
 Limit depth: N/A

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

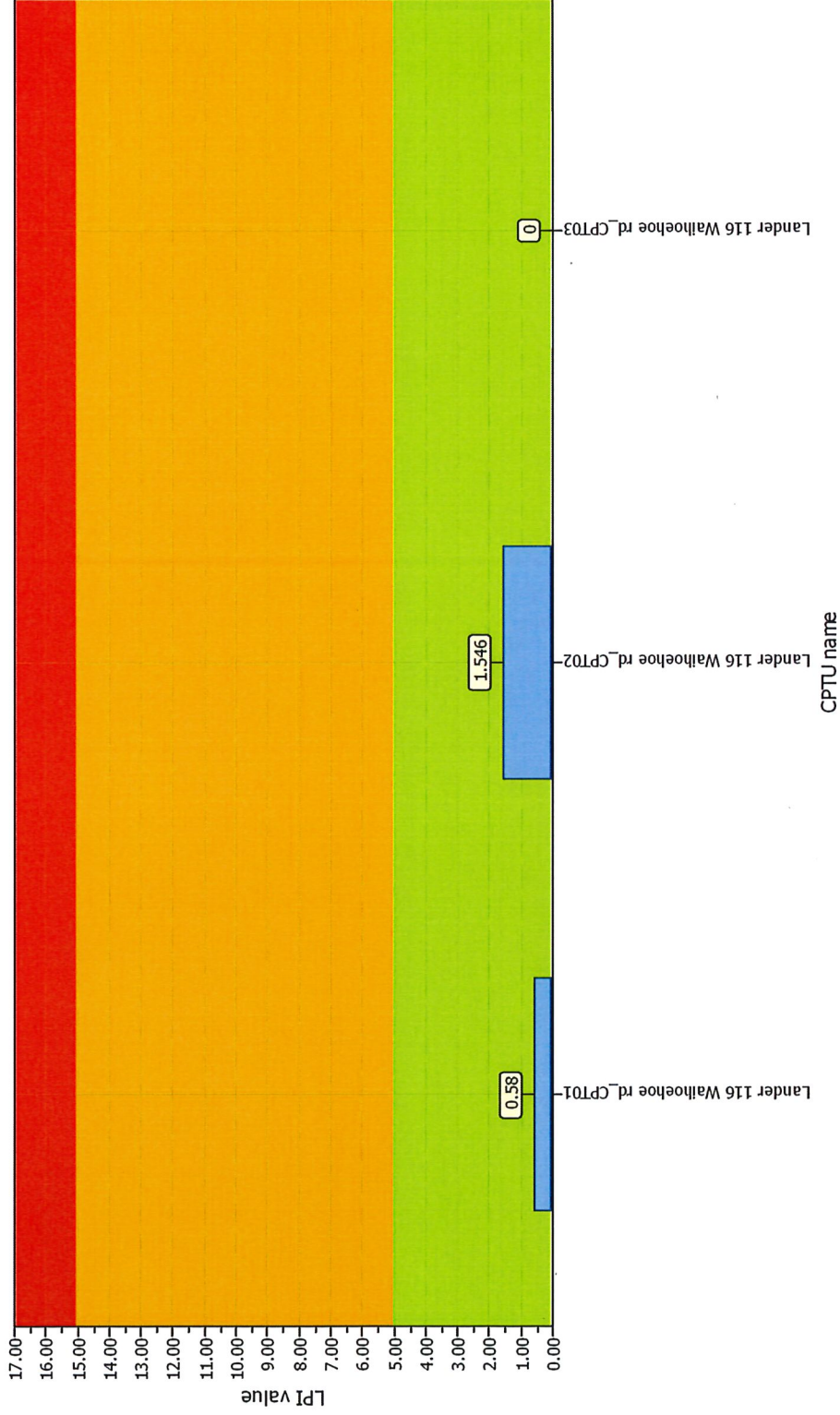


Lander Geotechnical Consultants Limited
Level 3, 3 Osterley Way
P O Box 97 385, Manukau, Auckland 2241
www.landergeotechnical.co.nz

Project title : ULS(1/500)

Location : 116 Waihoehoe Road, Drury

Overall Liquefaction Potential Index report



LPI color scheme
Very high risk
High risk
Low risk

Basic statistics

Total CPT number: 3
100.00% low risk
0.00% high risk
0.00% very high risk

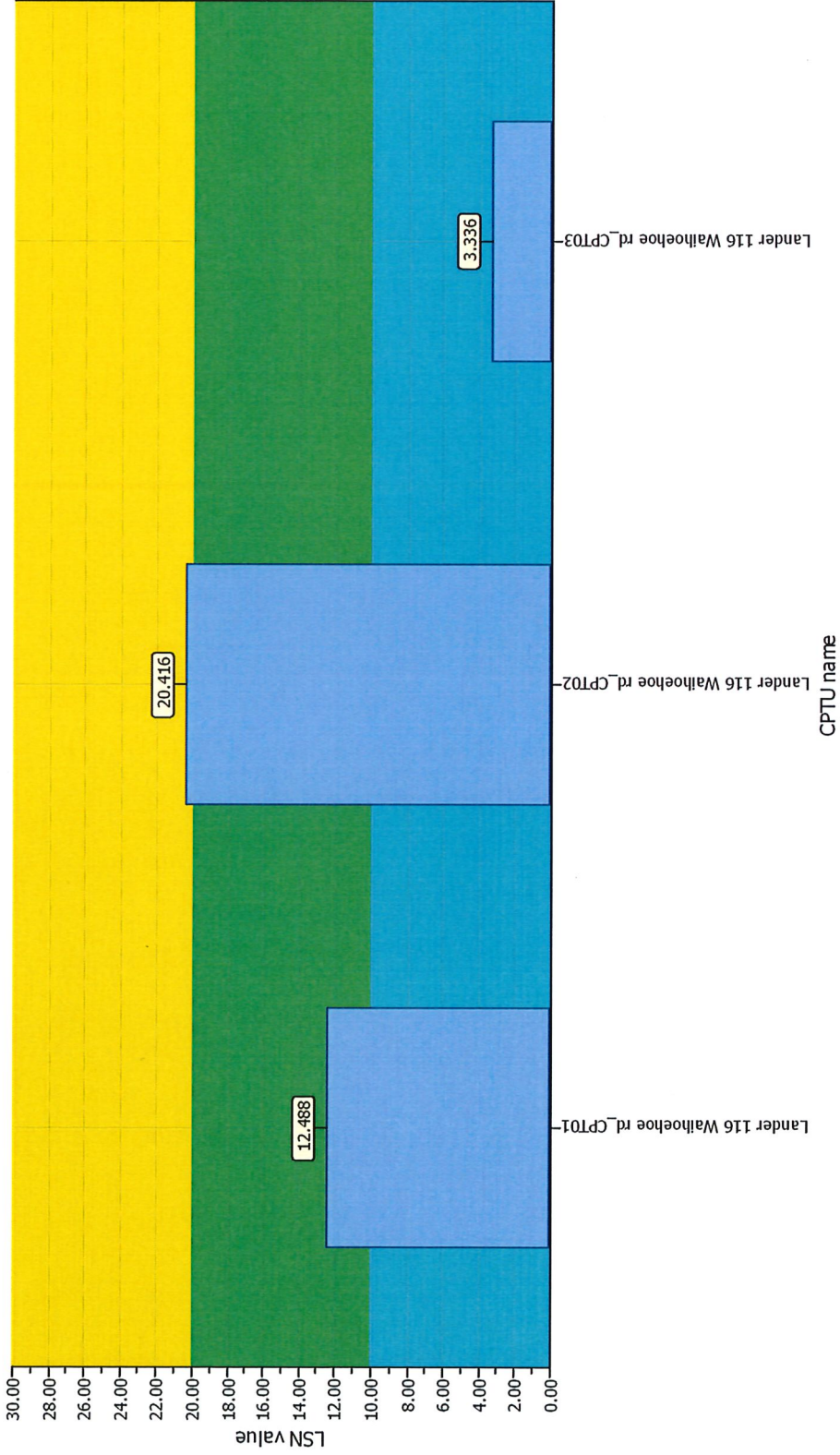


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 www.landergeotechnical.co.nz

Project title : ULS(1/500)

Location : 116 Waihoehoe Road, Drury

Overall Liquefaction Severity Number report



LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

Basic statistics

Total CPT number: 3
 33.33% little liquefaction
 33.33% minor liquefaction
 33.33% moderate liquefaction
 0.00% moderate to major liquefaction
 0.00% major liquefaction
 0.00% severe liquefaction

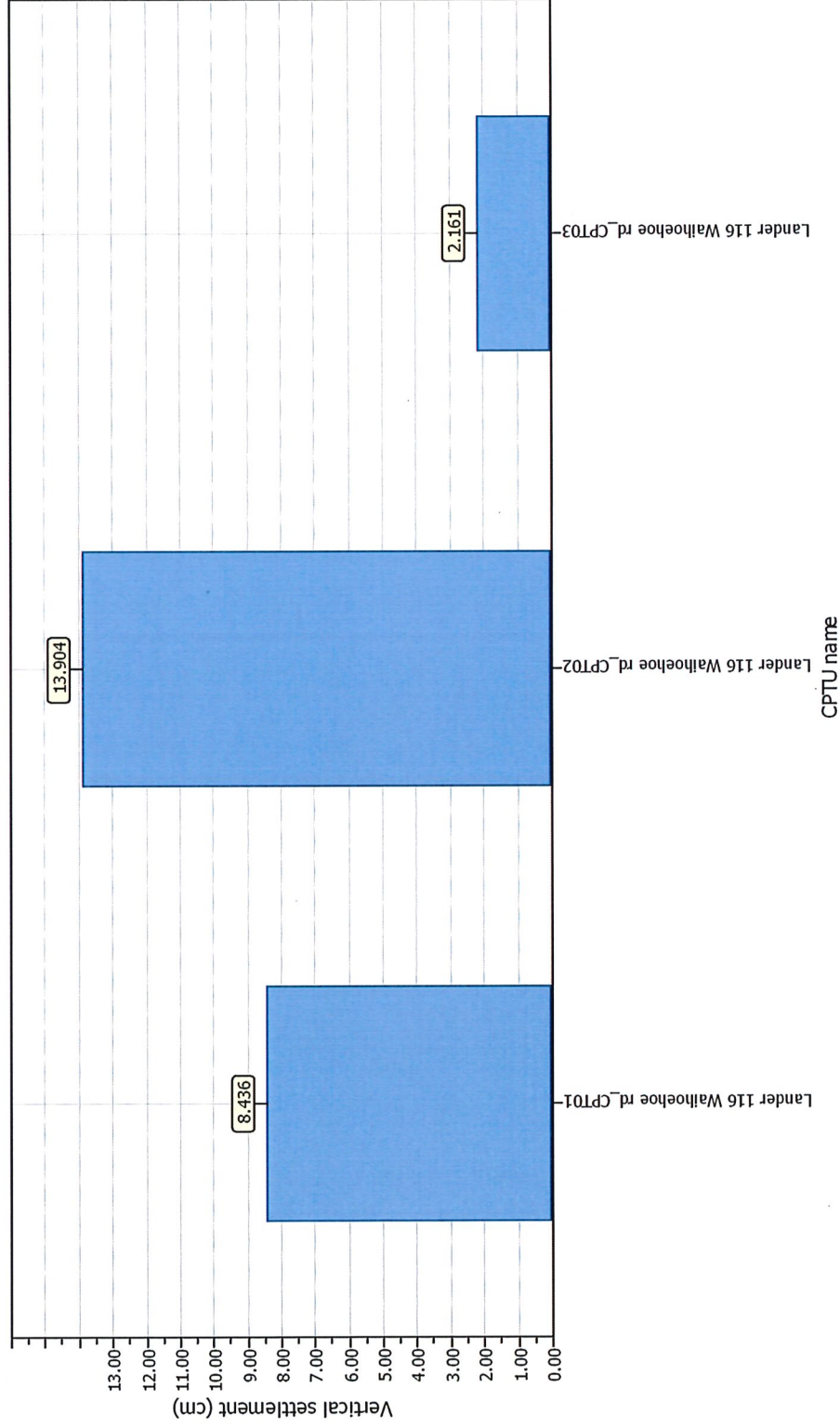


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Project title : ULS(1/500)

Location : 116 Waihoehoe Road, Drury

Overall vertical settlements report





Our Ref: 1009479.1000.0.0/REP01

Customer Ref: J00784

4 February 2019

Lander Geotechnical
 Level 3, 3 Osterley Way
 P O Box 97 385
 Manukau, Auckland 2241

Attention: Shane Lander

Dear Shane

116 Waihoehoe Road, Drury

Laboratory Test Report

Samples from the above mentioned site have been tested as received according to your instructions. Test results are included in this report.

Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Descriptions are enclosed for your information, but are not covered under the IANZ endorsement of this report.

Please reproduce this report in full when transmitting to others or including in internal reports.

If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report prepared by:

Corey Papu-Gread
 Christchurch Manager
 Approved Signatory

Authorised for Geotechnics by:

Paul Burton
 I have reviewed this
 document
 2019.02.04 11:17:11 +13'00'

Paul Burton
 Project Director

Report checked by:

Jack Singh
 Laboratory Technician



All tests reported
 herein have been
 performed in accordance
 with the laboratory's
 scope of accreditation

4-Feb-19

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 01.docx



Determination of Water Content - NZS 4402:1986 Test 2.1

| TEST DETAILS | | | |
|--------------------------|--|--|--|
| Location ID | 116 Waihoehoe Road, Drury | 116 Waihoehoe Road, Drury | |
| Location Description | 116 Waihoehoe Road, Drury | 116 Waihoehoe Road, Drury | |
| Location Data - Easting | N/A | N/A | |
| Location Data - Northing | N/A | N/A | |
| Location Data - Level | N/A | N/A | |
| Location Data - Chainage | N/A | N/A | |
| Location Data - Offset | N/A | N/A | |
| Geotechnics Sample ID | 003/19-1 | 003/19-2 | |
| Sample Reference | HA100 S1 | HA110 S1 | |
| Sample Depth | 0.5-1.0 | 0.5-1.0 | |
| Sample Description | Silty CLAY with trace sand and trace organics, orange brown mottled yellow brown and grey. Moist, extremely high plasticity. | Sandy silty CLAY, yellow brown mottled grey and orange brown. Moist, high plasticity. | |
| Specimen Reference | N/A | N/A | |
| Specimen Depth | N/A | N/A | |
| Specimen Description | N/A | N/A | |
| TEST RESULT | | | |
| Natural Water Content | 56.4% | 30.9% | |
| TEST REMARKS | | | |
| | <ul style="list-style-type: none"> The material used for testing was natural. | <ul style="list-style-type: none"> The material used for testing was natural. | |
| Approved By | IANZ Accredited CXPG | IANZ Accredited CXPG | |
| Date | 1/02/2019 | 1/02/2019 | |



GEOTECHNICS

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New Zealand
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Geotechnics Project ID 1009479.1000.0.0
Customer Project ID J00784

Determination of Liquid & Plastic Limit, Plasticity Index - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

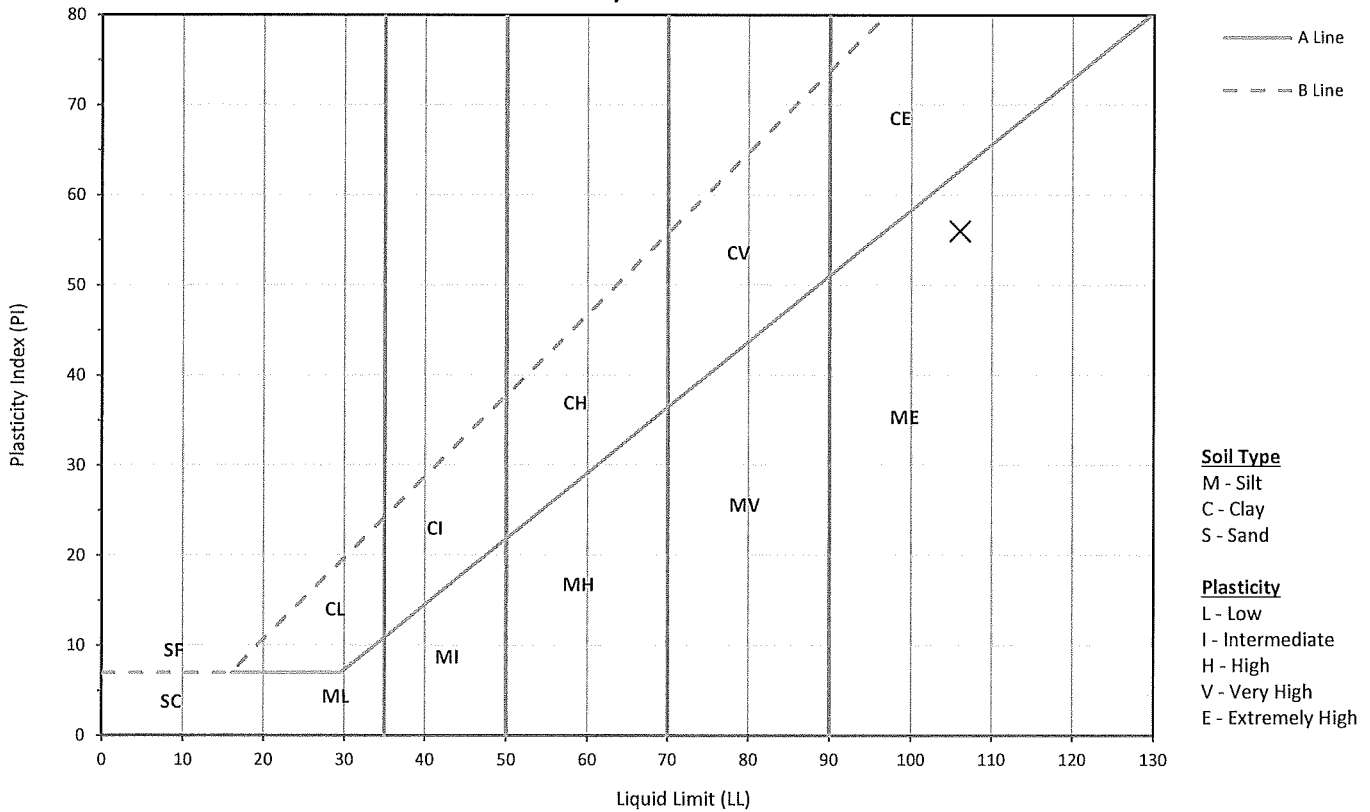
TEST DETAILS

| | | | | |
|----------|----------------|--|-------|---------|
| LOCATION | ID | 116 Waihoehoe Road, Drury | | |
| | Description | 116 Waihoehoe Road, Drury | | |
| | Data | N/A | | |
| SAMPLE | Geotechnics ID | 003/19-1 | | |
| | Reference | HA100 S1 | Depth | 0.5-1.0 |
| | Description | Silty CLAY with trace sand and trace organics, orange brown mottled yellow brown and grey. Moist, extremely high plasticity. | | |
| SPECIMEN | Reference | N/A | Depth | N/A |
| | Description | N/A | | |

TEST RESULTS

Liquid Limit 106
Plastic Limit 50
Plasticity Index 56

Plasticity Chart - BS 5930:1999



The plasticity chart is provided for your inference only and is not covered under our scope of IANZ accreditation. Due to the nature of classifications it is possible to have discrepancies between observational behaviour descriptions and measured parameters

TEST REMARKS

- The material used for testing was natural, fraction passing a 425um sieve.

This test result is IANZ accredited.

Approved By CXPG Date 4/02/2019



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Geotechnics Project ID 1009479.1000.0.0
Customer Project ID J00784

Determination of Linear Shrinkage - Determination of the Linear Shrinkage - NZS 4402:1986 Test 2.6

| TEST DETAILS | | | |
|--|----------------|--|---------------|
| LOCATION | ID | 116 Waihoehoe Road, Drury | |
| | Description | 116 Waihoehoe Road, Drury | |
| | Data | N/A | |
| SAMPLE | Geotechnics ID | 003/19-1 | |
| | Reference | HA100 S1 | Depth 0.5-1.0 |
| | Description | Silty CLAY with trace sand and trace organics, orange brown mottled yellow brown and grey. Moist, extremely high plasticity. | |
| SPECIMEN | Reference | N/A | Depth N/A |
| | Description | N/A | |
| TEST RESULT | | | |
| Linear Shrinkage | 25% | | |
| TEST REMARKS | | | |
| <ul style="list-style-type: none"> The material used for testing was natural, fraction passing a 425um sieve. | | | |
| This test result is IANZ accredited. | | | |
| Approved By | CXPG | Date | 31/01/2019 |



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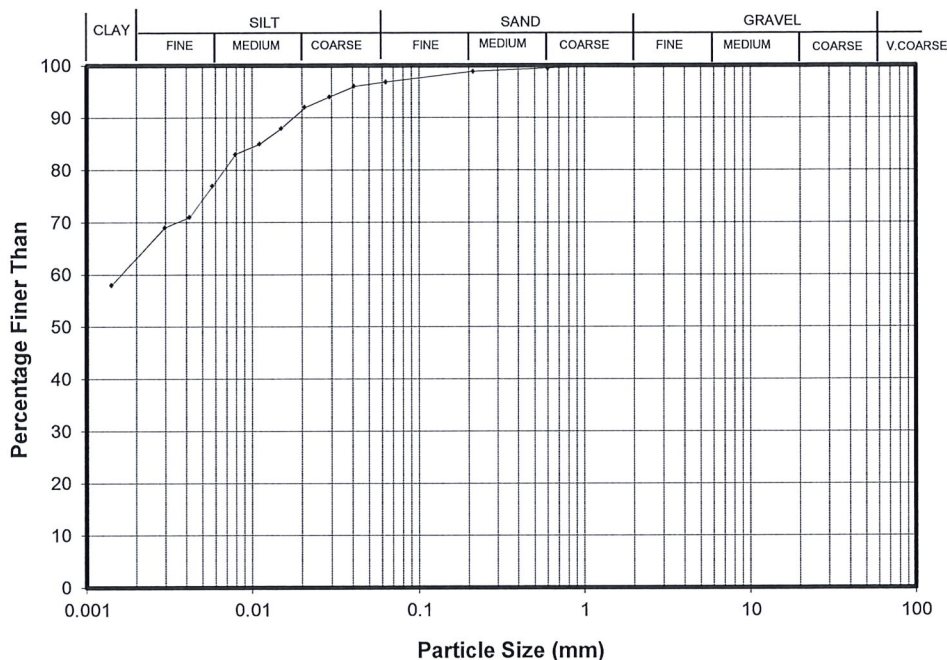
P 64 03 361 0300

www.geotechnics.co.nz

Site: 116 Waihoehoe Road, Drury
 BH No.: HA100S1 Sample ID.: 003/19-1
 Test Method Used : NZS 4402:1986 Test 2.8.4 Hydrometer

Your Job No.: J00784
 Our Job No.: 1009479.1000.0.0
 Depth: 0.5-1.0m

PARTICLE SIZE ANALYSIS



| Sieve (mm) | Total % Passing | Sieve (mm) | Total % Passing |
|------------|-----------------|------------|-----------------|
| 4.75 | - | | |
| 3.35 | - | | |
| 2.00 | 100 | | |
| 0.600 | 99 | | |
| 0.212 | 99 | | |
| 0.063 | 97 | | |

| Equivalent Particle Diameter D (mm) | % of Particles Finer than D |
|-------------------------------------|-----------------------------|
| 0.0406 | 96 |
| 0.0290 | 94 |
| 0.0207 | 92 |
| 0.0150 | 88 |
| 0.0110 | 85 |
| 0.0079 | 83 |
| 0.0057 | 77 |
| 0.0041 | 71 |
| 0.0030 | 69 |
| 0.0014 | 58 |

Sample history : Natural, whole soil

Description: Silty CLAY with trace sand and trace organics, orange brown mottled yellow brown and grey. Moist, extremely high plasticity.

Solid Density (Assumed) : 2.70t/m³

Remarks : A sub sample was split from the original sample for hydrometer analysis. This sample was soaked with a dispersing agent (~2 hrs), then the mechanical shaker was used, until the material was brought into suspension, before proceeding with the test.

Suspension pH 8.0.

The classification of sand-silt-clay components were described on the basis of particle size analysis. Use of assumed values in calculations is at the customers discretion and risk.

Sample description is not IANZ accredited.

Entered by : CXPG

Date : 31/01/2019

Checked by :

CFK

Date : 31/01/2019



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Christchurch 8042
New Zealand
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Geotechnics Project ID 1009479.1000.0.0
Customer Project ID J00784

GEOTECHNICS

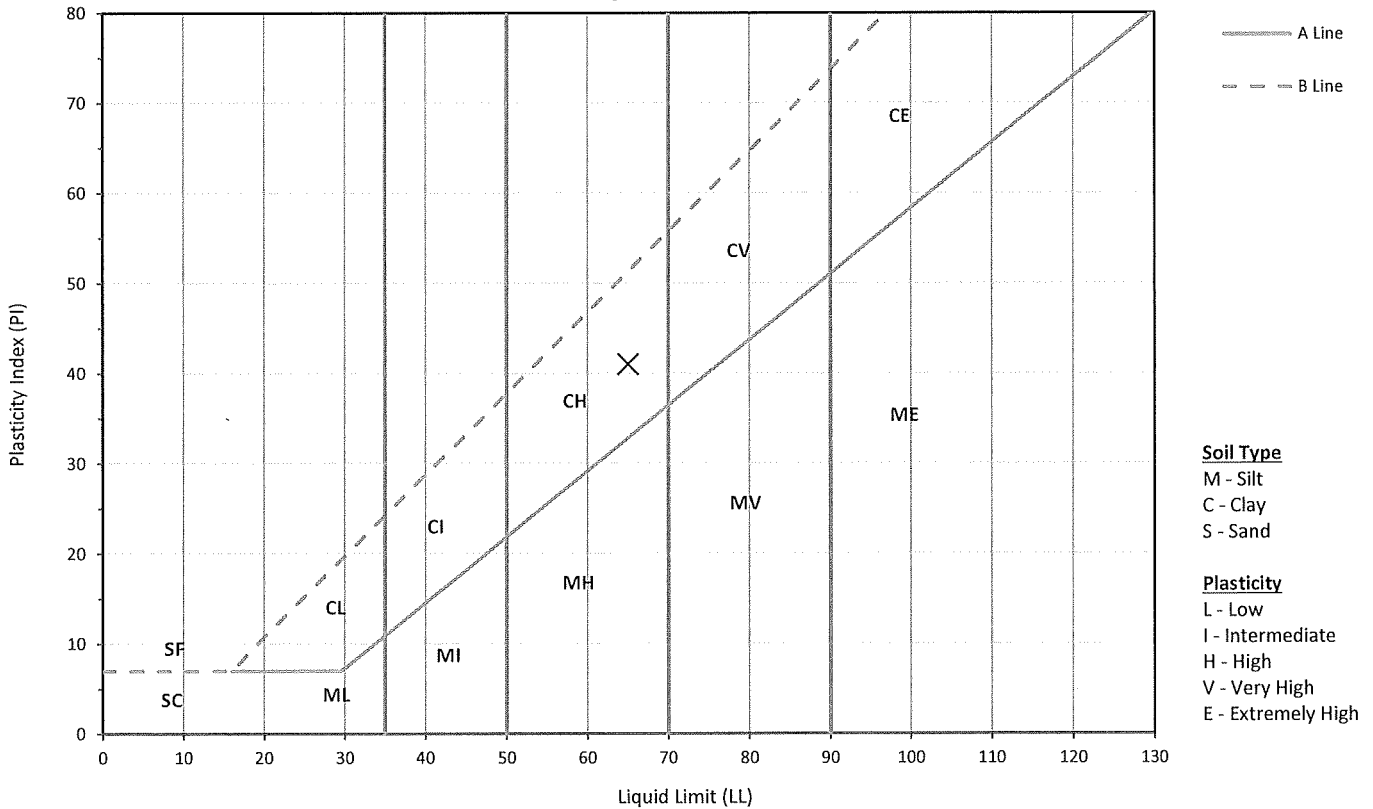
Determination of Liquid & Plastic Limit, Plasticity Index - NZS 4402: 1986 Tests 2.2 (4 Point), 2.3 & 2.4

| TEST DETAILS | | | |
|--------------|----------------|---|---------------|
| LOCATION | ID | 116 Waihoehoe Road, Drury | |
| | Description | 116 Waihoehoe Road, Drury | |
| | Data | N/A | |
| SAMPLE | Geotechnics ID | 003/19-2 | |
| | Reference | HA110 S1 | Depth 0.5-1.0 |
| | Description | Sandy silty CLAY, yellow brown mottled grey and orange brown. Moist, high plasticity. | |
| | | | |
| SPECIMEN | Reference | N/A | Depth N/A |
| | Description | N/A | |

TEST RESULTS

Liquid Limit **65**
Plastic Limit **24**
Plasticity Index **41**

Plasticity Chart - BS 5930:1999



The plasticity chart is provided for your inference only and is not covered under our scope of IANZ accreditation. Due to the nature of classifications it is possible to have discrepancies between observational behaviour descriptions and measured parameters

TEST REMARKS

- The material used for testing was natural, fraction passing a 425um sieve.

This test result is IANZ accredited.

Approved By **CXPG** Date **4/02/2019**



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Wigram
Christchurch
New Zealand
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Geotechnics Project ID

1009479.1000.0.0

Customer Project ID

J00784

Determination of Linear Shrinkage - Determination of the Linear Shrinkage - NZS 4402:1986 Test 2.6

TEST DETAILS

| | | | | |
|----------|----------------|---|-------|---------|
| LOCATION | ID | 116 Waihoehoe Road, Drury | | |
| | Description | 116 Waihoehoe Road, Drury | | |
| | Data | N/A | | |
| SAMPLE | Geotechnics ID | 003/19-2 | | |
| | Reference | HA110 S1 | Depth | 0.5-1.0 |
| | Description | Sandy silty CLAY, yellow brown mottled grey and orange brown. Moist, high plasticity. | | |
| SPECIMEN | Reference | N/A | Depth | N/A |
| | Description | N/A | | |

TEST RESULT

Linear Shrinkage 17%

TEST REMARKS

- The material used for testing was natural, fraction passing a 425um sieve.

This test result is IANZ accredited.

| | | | |
|-------------|------|------|------------|
| Approved By | CXPG | Date | 31/01/2019 |
|-------------|------|------|------------|



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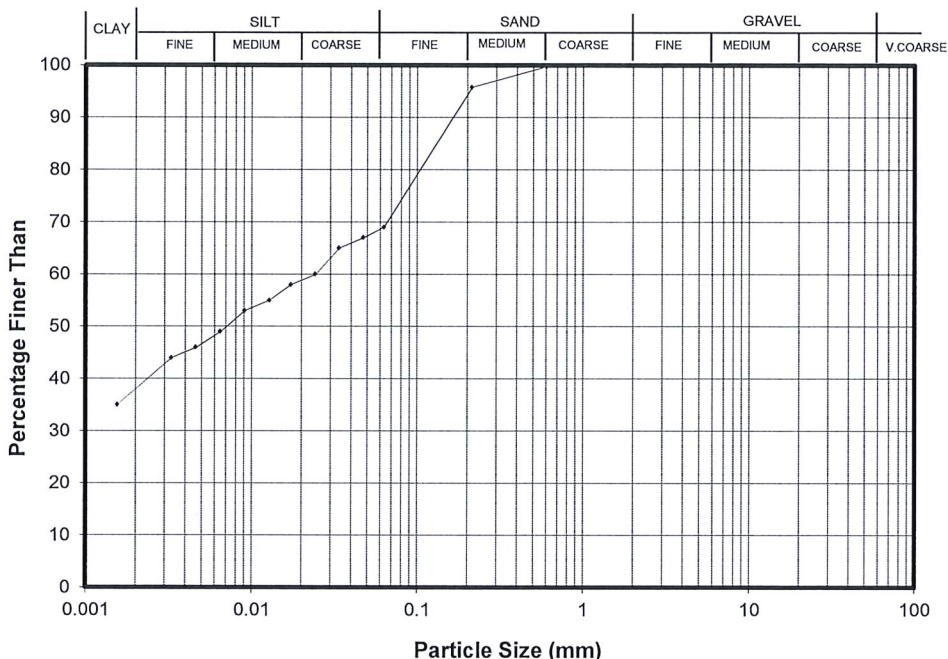
P 64 03 361 0300

www.geotechnics.co.nz

Site: 116 Waihoehoe Road, Drury
 BH No.: HA110S1 Sample ID.: 003/19-2
 Test Method Used : NZS 4402:1986 Test 2.8.4 Hydrometer

Your Job No.: J00784
 Our Job No.: 1009479.1000.0.0
 Depth: 0.5-1.0m

PARTICLE SIZE ANALYSIS



| Sieve (mm) | Total % Passing | Sieve (mm) | Total % Passing | Equivalent Particle Diameter D (mm) | % of Particles Finer than D |
|------------|-----------------|------------|-----------------|-------------------------------------|-----------------------------|
| 4.75 | - | | | 0.0473 | 67 |
| 3.35 | - | | | 0.0337 | 65 |
| 2.00 | 100 | | | 0.0242 | 60 |
| 0.600 | 100 | | | 0.0172 | 58 |
| 0.212 | 96 | | | 0.0127 | 55 |
| 0.063 | 69 | | | 0.0090 | 53 |
| | | | | 0.0065 | 49 |
| | | | | 0.0046 | 46 |
| | | | | 0.0033 | 44 |
| | | | | 0.0015 | 35 |

Sample history : Natural, whole soil

Description: Sandy silty CLAY, yellow brown mottled grey and orange brown. Moist, high plasticity.

Solid Density (Assumed) : 2.70t/m³

Remarks : A sub sample was split from the original sample for hydrometer analysis. This sample was soaked with a dispersing agent (~2 hrs), then the mechanical shaker was used, until the material was brought into suspension, before proceeding with the test.

Suspension pH 8.0.

The classification of sand-silt-clay components were described on the basis of particle size analysis. Use of assumed values in calculations is at the customers discretion and risk.

Sample description is not IANZ accredited.

Entered by : CXPG

Date : 31/01/2019

Checked by :

CFK

Date : 31/01/2019