MOTT MACDONALD

Milldale Development Infrastructure Project 1 - Argent Lane Extension

Geotechnical Interpretive Report

30 September 2020

Mott MacDonald
Mason Bros. Building
Level 2, 139 Pakenham
Street West
Wynyard Quarter
Auckland
1010
PO Box 37525
Parnell 1151
New Zealand

T +64 (0)9 375 2400
mottmac.com

Auckland Transport
20 Viaduct Harbour Avenue
Westhaven
Auckland 1010

Milldale Development Infrastructure Project 1 - Argent Lane Extension

Geotechnical Interpretive Report

30 September 2020

Mott MacDonald New Zealand Limited
Registered in New Zealand no. 3338812

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
01	20/02/20	Jared Jiang	Vick Kumaran	Andrew Campbell	Draft for client's comments
02	30/09/20 20	Jared Jiang	Vick Kumaran	Andrew Campbell	Addressed comments from BG

Document reference: 402828-MMD-XX-XX-RP-GE-006

Information class: Standard

Contents

Tables

Figures

Executive summary

This geotechnical interpretive report documents the ground investigation results and subsurface geological interpretation for the proposed roading realignment of Pine Valley Road and widening of existing pavement of Pine Valley Road and Dairy Flat Highway. The works comprise a total of 1.17km of roading to the west of Silverdale, northern Auckland.

The purpose of this document is to support a preliminary design submission for resource consent lodgement to Auckland Council.

The specific ground investigation was carried out between the 9th September and 16th September 2019. The investigation involved two parts: a preliminary site walkover and intrusive investigation as below;

- The site walkover assessed potential engineering constraints associated with the proposed development. Total project alignment was broken down into 4 main areas and discussed in detail in terms of the landforms.
- The intrusive investigation comprised eleven (11) hand-auger boreholes, three (3) cone penetration tests and one (1) seismic flat dilatometer test along the proposed project alignments, and laboratory testing on recovered soil samples.

Soils encountered during the investigation are typical of the region with residual, alluvial and colluvial soils, described as firm to hard, moderately to extra sensitive, intermediate to extremely high plastic sandy SILTs and CLAYs overlying the highly weathered to completely weathered Northland Allochthon – Hukerenui Mudstone throughout the project alignment. Perched groundwater table varies between 0.2 and 3.3m bgl.

This report provides the geotechnical design parameters for the proposed development. Preliminary assessment was carried out and we note the following;

- Based on the site soils encountered during the investigation, a site subsoil class of C for seismic design purposes;
- NZGS guidance and laboratory testing data of the underlying soils suggest the risk of liquefaction is very low;
- Soil settlement assessment was carried out for the decommissioning and backfilling of the existing pond on 36 Old Pine Valley Road. Primary settlement is expected to be between 100mm and 200mm. Secondary and long-term creep are expected and should be assessed during detailed design stage. Ground improvement of the backfill may be required to reduce consolidation settlement prior to pavement construction.
- A subgrade California Bearing Ratio (CBR) of 1.5% should be adopted for preliminary design of pavements on residual Northland Allochthon soil across the site. Undercutting is required where alluvial/colluvial soils are encountered. In-situ CBR values will need to be confirmed on subgrade formed on fill ground during earthworks prior to pavement construction.
- Specific stability analyses and checks need to be carried out on the cross-sections at detailed design stage.
- Any designs involving soakage and retention through infiltration within the site should be avoided.
- Specific analysis and design are required for future retaining walls in the case that sufficient land uptake is not possible to form a stable batter slope.

1 Introduction

1.1 General

Fulton Hogan Land Development Limited has engaged Mott MacDonald to prepare a geotechnical interpretive report on the ground investigation of the proposed roading realignment of Pine Valley Road and upgrading/widening existing sections of Pine Valley Road and Dairy Flat Highway, on the western side of the Northbound Exit Ramp of the Silverdale interchange on State Highway 1, north of Auckland.

This report will support a preliminary design submission for resource consent lodgement to Auckland Council.

1.2 Project Scope

The proposed project undertaken by Mott is limited to the southern extremity of the overall roading extension of Argent Lane. This extension begins from south of Wainui Road through the current under-construction Milldale subdivisional works and connecting with the existing Pine Valley Road in the south.

Mott MacDonald's project scope overview is summarised below;

- Shown in green in Figure 1.1, the construction of a single carriageway to realign the part of the Pine Valley Road through 10 and 36 Old Pine Valley Road;
- The existing road section up to Old Pine Valley Road (indicated in yellow in Figure 1.1) will be decommissioned after the realignment;
- Widening part of Pine Valley Road leading up to Dairy Flat Highway intersection;
- Widening part of Dairy Flat Highway on either side of the intersection.
- The current indictive Earthworks for Pine Valley Road and Dairy Flat Highway project during the Interim stage are as follows:
  - Volume of Cut = 19,500 m^3 (approximate)
  - Volume of Fill = 29,000 m^3 (approximate)

Figure 1.1: Proposed Development Extent.

Source: Google Earth and Auckland Council Geomap

The current design indicates there will be minimal changes to the levels and gradients of the existing roads. There will be land uptakes from neighbouring properties to accommodate the proposed new road and widening at this stage of the design.

1.3 Proposed Development

The current design has been divided into interim and ultimate stages. The geotechnical investigations have been extended to cover the area of works for both stages. All design layouts and key elements for these two stages are summarised below and shown on Figure 1.2 and Figure 1.3.

Figure 1.2: Interim Design Elements

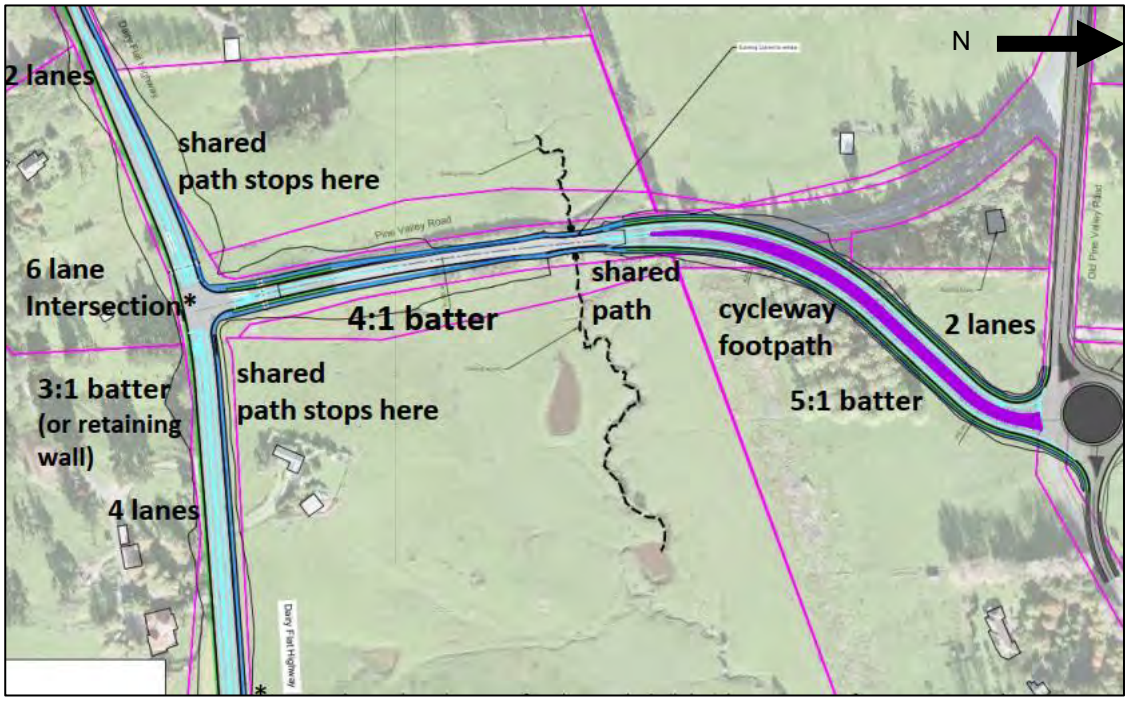
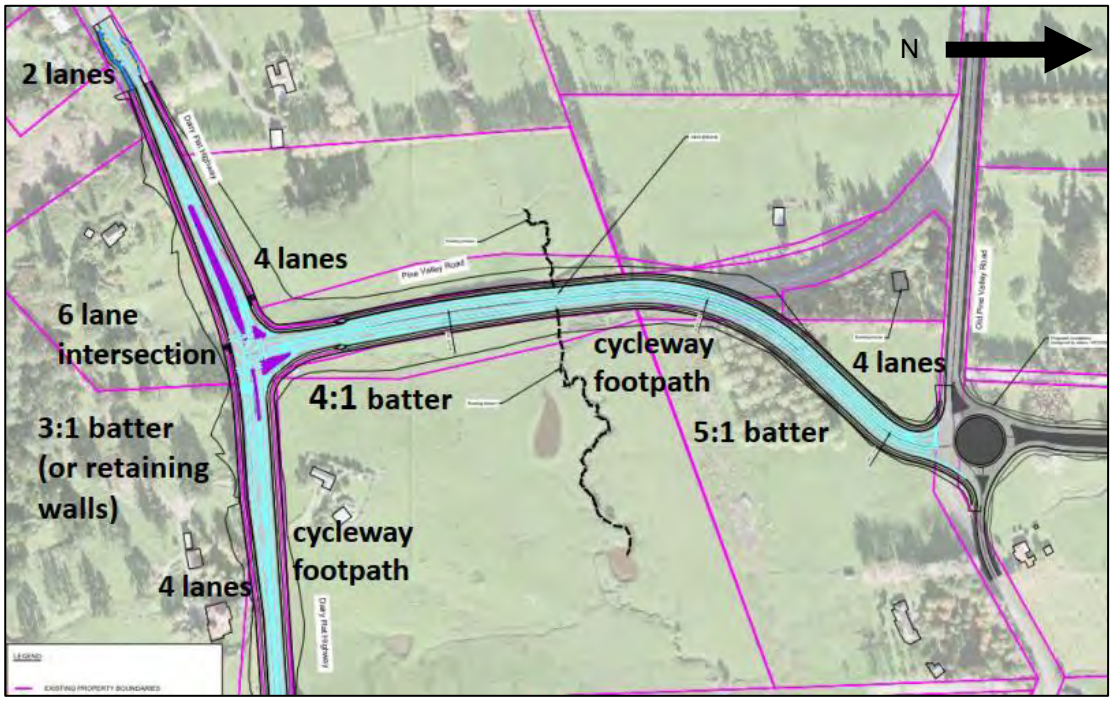


Figure 1.3: Ultimate Design Elements



Source: <Insert Notes or Source>

The ultimate stage comprises design elements from the interim stage, including an additional cycleway and footpath along both Dairy Flat Highway and Pine Valley Road.

Detailed comparisons are summarised in Table 1.1.

Table 1.1: Summary of design elements of interim and ultimate design options

Locations	Key Features	
	Interim Design	Ultimate Design
Dairy Flat Highway	• Pavement widening with a six-lane intersection (*subject to change); • Shared path adjacent to the intersection; • Options for 3H:1V batter or retaining wall below the shoulder on the southern side; • Four-lanes from the intersection towards Silverdale off-ramp; • Direction towards Albany remains two-lanes;	• Pavement widening with a six-lane intersection; • Separated paths for cycle and foot traffic between the intersection and Silverdale interchange; • Options for 3H:1V batter or retaining wall below the shoulder on the southern side; • Four-lanes from the intersection towards Silverdale off-ramp; • Direction towards Albany remains two-lanes;
Pine Valley Road	• Pavement widening with a six-lane intersection (*subject to change); • Shared path; • 4H:1V batter below shoulder; • Generally two-lanes and four-lanes towards the intersection;	• Pavement widening with a six-lane intersection; • Separated paths for cycle and foot traffic between the intersection and roundabout; • 4H:1V batter below shoulder; • Four-lanes;

Locations		Key Features	
Pine Valley Road Realignment	• Construction of the new road; • Cycleway and footpath; • 5H:1V batter below shoulder; • Four-lanes onto the roundabout to the north;	• Construction of the new road; • Separated cycleway and footpath; • 5H:1V batter below shoulder; • Four-lanes towards the roundabout in the north;	

2 Site Appraisal

2.1 Site Description

The project site is located on the western side of State Highway 1 (SH1) on the fringe of the Silverdale town centre, approximately 25km north of Auckland CBD, as shown in Figure 1.1.

The Dairy Flat Highway trends northeast - southwest near the Silverdale off-ramp. Pine Valley Road trends in a northwest-southeast perpendicular to Dairy Flat Highway and takes an almost 90˚ bend at the intersection with Old Pine Valley Road.

The wider area around the project site has been identified as Future Urban Zone in the Silverdale West Dairy Flat Structure Plan document by Auckland Council. The current land usage in the area is predominantly rural residential (life-style blocks) and dairy farming.

2.2 Site Reconnaissance

The site walkover was carried out by Mott MacDonald staff between the 9th September and 16th September 2019. The purpose of the site walkover was recording site observations in relation to the proposed development. The walkover looked at the overall geomorphology of the area along the proposed development route, slope stability and potential engineering constraints. The following sections summarise the observations made and categorised by areas of interest during the walkover.

2.2.1 Dairy Flat Highway

The proposed upgrade for Dairy Flat Highway (DFH) is limited to the section of the road southwest from the SH1 off-ramp, west of Silverdale, as shown in red in Figure 2.1 below.

Figure 2.1: Approximate Extent of the Pavement Widening Works along Dairy Flat Highway

Source: Auckland Coucil Geomap

This section of the DFH is generally a two-lane, single carriageway road. Near the eastern end of the DFH, adjacent the motorway off-ramp, the verge is up to 10 metres wide and grassed (Image 1 and Image 2 in Table 2.1), with up to 2m of paved shoulder, including a parking bay between the current road kerb and neighbouring property boundaries (1731 and 1732 Dairy Flat Highway), and with slopes up to 1V:3H on either side of the road between 70m and 170m from the off-ramp.

This part of the road was likely cut into the surrounding land to match the gradient towards the roundabout at top of the off-ramp during the construction of the current road. The road then gently rises away from the roundabout towards Pine Valley Road intersection.

In general, the surrounding land along DFH gently falls away from the road with slopes to 1V:3H in places. Shallow open swale drains were observed at places below shoulders of the road, as shown in Table 2.1. The highest point within the scope of works is at the southern extent of the proposed development.

Table 2.1: Dairy Flat Highway - Proposed Pavement Widening

Google Earth Image

Image 1. DFH widening works looking east

Image 2. DFH widening works looking west

Image 3. Parking bay along side of Dairy Flat Highway.

Image 4. Slope beyond the shoulder is 1V:3H into neighbouring property

Source: Google Earth Street View

2.2.2 Pine Valley Road Widening

The approximate 400m long proposed pavement widening along Pine Valley Road (PVR) is between the tree block (indicated in cyan) and intersection with Dairy Flat Highway, see Figure 2.2. This section of Pine Valley Road dips down moderately (1V:10H) away from the intersection with Dairy Flat Highway and passes over the existing stream and then gently rises towards the intersection with Old Pine Valley Road.

The existing pavement is likely constructed over fill ground. Slopes up to 1V:2H were observed near the Dairy Flat Intersection and 1V:5H in most places along either side of the existing road pavement as shown in Table 2.2: Site Photos along either side of Pine Valley Road. Land stabilisation is likely required beyond the shoulder of the road for the widening as shown in Table 2.2. No signs of deep-seated movement were observed on the slope immediately below the Dairy Flat Highway.

Figure 2.2: Pine Valley Road - Widening of Existing Pavement.

Source: Auckland Council GeoMap

Table 2.2: Site Photos along either side of Pine Valley Road.

Images	Comments

- Western shoulder of PVR, looking south
- General slope gradient of 1V:10H from
- Pavement constructed over fill ground

- Slopes up to 1V:2H below the existing pavement were observed near the Dairy Flat Intersection
- 1V:5H slope in most places along either side of the existing road

- Eastern shoulder of PVR, looking north
- Pavement constructed over fill ground

2.2.3 Culvert

The culvert is located beneath the embankment at the lowest section along the Pine Valley Road to accommodate the stream below as shown in Figure 2.3: Culvert below Pine Valley Road. It is a bolted steel plate structure approximately 2.4m in diameter, with a 0.5m wide concrete headwall ring beam as shown in Figure 2.4.

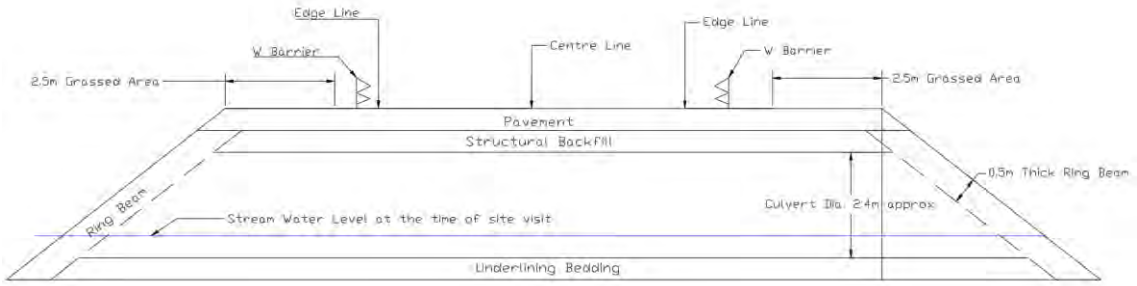
Figure 2.3: Culvert below Pine Valley Road

Source: Auckland Council GeoMap. Stream flow direction is shown in blue (arrow).

A grassed batter spans 10m along either side of the culvert, up to 3m wide between the road shoulder and the headwall of the culvert as shown in Table 2.3. Below the shallow batter is a less than 1V:2H batter leading down to the base of the stream on either side of the road as shown in Table 2.3.

The stream below is approximately 2.5m wide at the culvert. The direction of flow is from south-west to north-east as shown in Figure 2.3.

Figure 2.4: Cross-section of Culvert.



Source

Table 2.3: Existing Culvert Beneath Pine Valley Road - along Proposed Widening

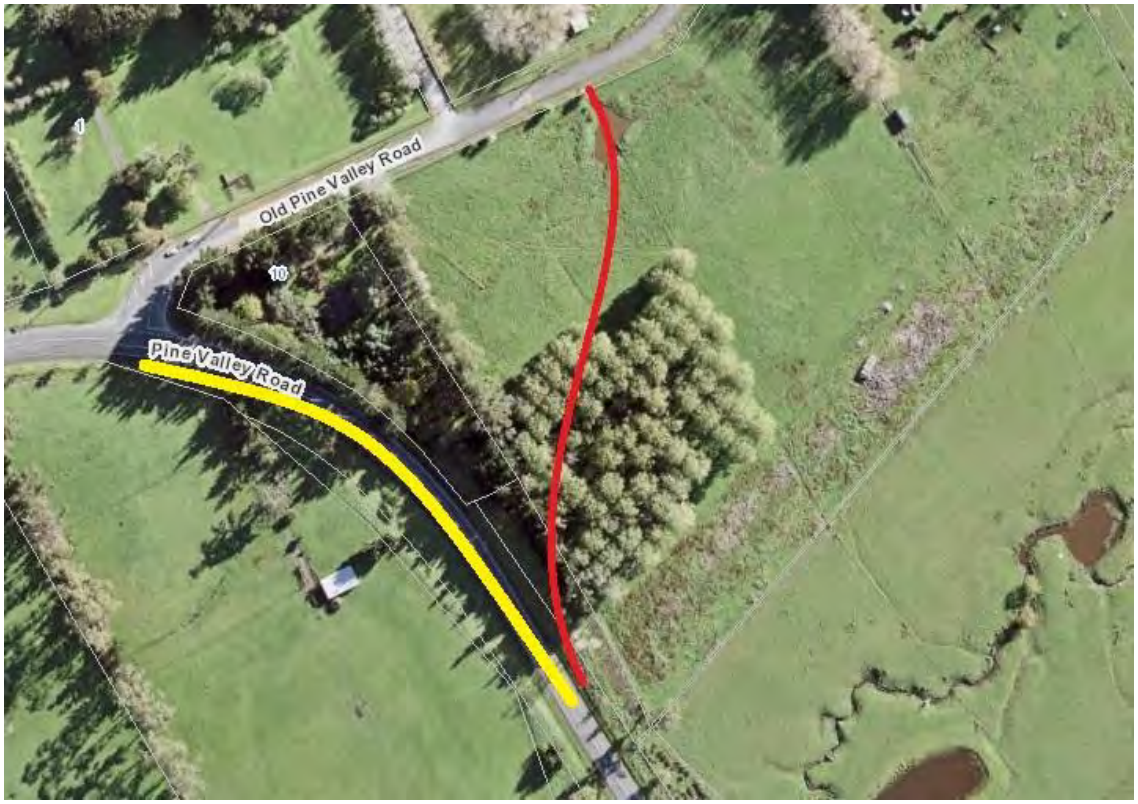
Images	Comments
	• Eastern shoulder of Pine Valley Road above the culvert
	
	• Western shoulder of Pine Valley Road above the culvert

Culvert internal

2.2.4 Pine Valley Road Realignment

The existing section of Pine Valley Road, shown in yellow in Figure 2.5, will be realigned (in red) through the green fields and a block of trees on 36 Old Pine Valley Road. The current section of Pine Valley Road (in yellow) will be decommissioned once the new alignment is constructed.

Figure 2.5: Pine Valley Road Realignment - Through 36 Old Pine Valley Road.



Source: Auckland Council GeoMap

The greenfield land gently undulates. Trees cover approximately half of the section. The proposed road will follow the current topography of the land.

A pond is located near the northern boundary of 36 Old Pine Valley Road and is directly under the proposed alignment. It is currently used to detain the surface run-off from the neighbouring lot and for watering stock on the property as shown in Table 2.4.

Removal of some of the large poplar trees will be required to accommodate the proposed road corridor.

Table 2.4: Through the green field, along the Proposed Realignment.






Note: Images from north to south.

3 Geological Overview

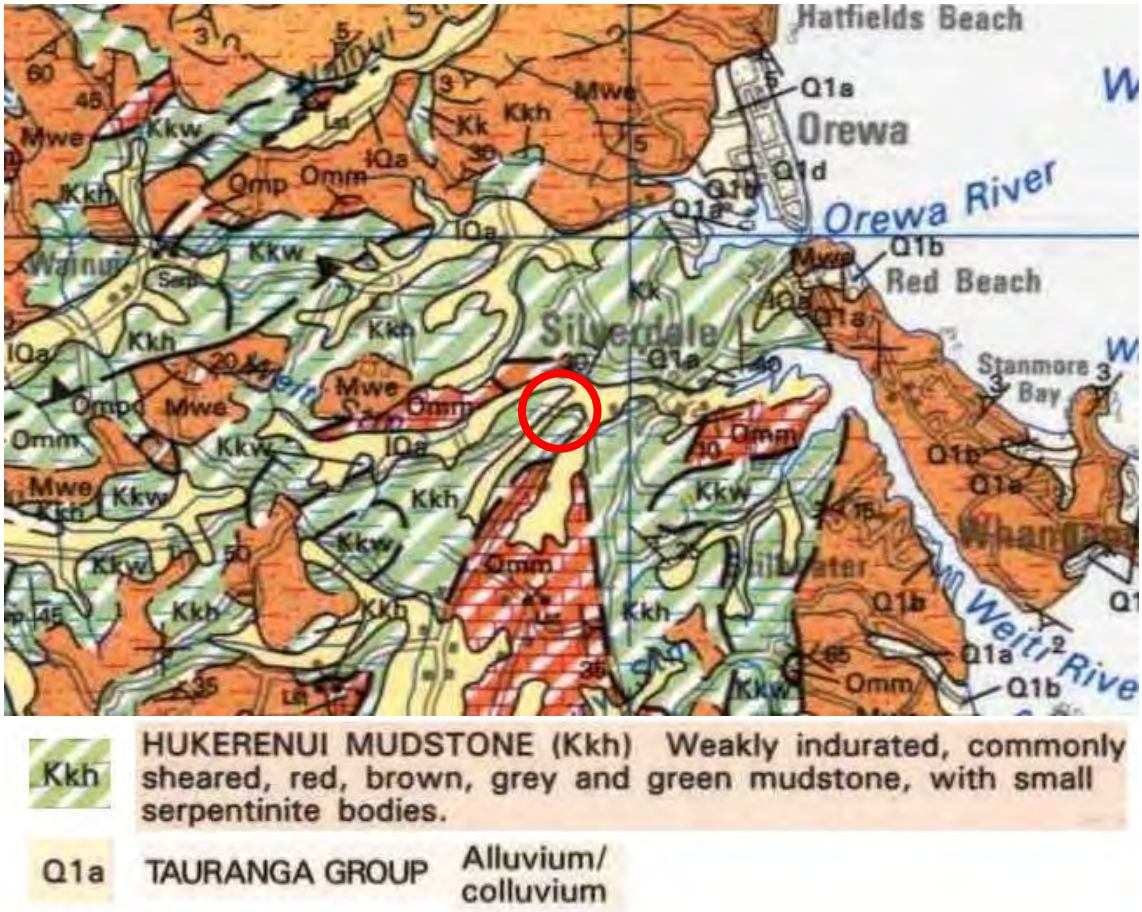
3.1 Local Geology

An extract of the published geological map of the area is presented in Figure 3.1 This indicates that the underlying geology of the site is predominantly Hukerenui Mudstone of Mangakahia Complex, part of the Northland Allochthon, with recent alluvial soils present in the flood plains and colluvial soils associated with existing hill slopes and stream networks.

Hukerenui Mudstone (Kkh) has been described by Heron 2014 as a non-calcareous, clay-rich and highly sheared mudstone bearing lithology. Morphologically this formation is commonly associated with shallow slope instability (e.g. surface creep and slumping) in the region.

The alluvial and colluvial soils (1Qa) are predominantly pumiceous sand, silts, mud and clay with interbedded gravel and peat, and are age equivalent of the mid– to late-Pleistocene Tauranga Group (Heron 2014).

Figure 3.1: Regional Geological Map



Source: GNS - 1:250,000 Geological Map 3. Project site is indiccated in red circle.

3.2 Geomorphology

Shallow slumping and creep are common geomorphic features associated with the highly sheared and weak nature of the Northland Allochthon rocks in the field. The shallow gradient of the slopes is generally related to the underlying lithology. In particular, the non-calcareous mudstones and melange units such as the Hukerenui mudstone commonly exhibit lowest gradients at <12°, reflecting the low residual shear strength of the soil and rock transition. Unlike the widespread evidence of slumping and creep in the landscape, evidence of deep-seated landslides can be difficult to recognise due to rapid regression of head and lateral scarps within the residual soil (Gordon 2015).

The presence of the recent alluvial and colluvial soils are generally associated with the regional topography, specifically the low-lying land and incised streams in the area.

3.3 Hydrogeology

Northland Allochthon soils and rock mass are naturally erosive, with limited soakage and infiltration capability throughout the region. Northland Allochthon rock mass has typically low infiltration potential with rates of permeability ranging between 10^{-7}m/s and 10^{-11} m/s.

Available data from Auckland Council indicates that the groundwater level is relatively low (deeper depth to groundwater) in Silverdale West area, with water likely to be present at depths of 3m or more below ground level. Groundwater flow across the Silverdale west area is typically from elevated areas towards streams and creeks, resulting in groundwater levels being near to the surface within low-lying areas and gullies. Groundwater is expected to be perched within residual and alluvial soils in the area depending on soil thickness and proximity to the streams and creeks.

4 Geotechnical Investigation

4.1 Investigation Scope Overview

The intrusive investigation works were carried out in two stages:

- Hand-auger drilling carried out by Geotechnics between 9th and 11th September 2019, involving the drilling of eleven hand-auger boreholes (HA01 to HA11) with Scala Penetrometer Testing to depths of up to 5.2 metres below the existing ground levels in the position indicated in Sheet1; and
- Cone penetrometer tests and seismic dilatometer tests carried out by Ground Investigation Limited between 13th and 16th September 2019; involving three CPTs and one sDMT at locations also indicated in Sheet1.

4.2 Fieldwork and Testing

4.2.1 Hand-augers

The purpose of the hand-auger boreholes is to examine the subsurface soil profile and build a ground model along the proposed project alignment.

Table 4.1: Investigation Locations along the Proposed Development.

Proposed works	Hand-auger locations
Dairy Flat Highway Widening	HA01, HA02, HA03, HA04, HA05 and HA06
Pine Valley Road Widening	HA03, HA04, HA07, HA08 and HA09
Pine Valley Road Realignment	HA09, HA10 and HA11

Source: Insert Notes or Source

Field description of the soils has been carried out in accordance with NZGS guideline – 2005. Vane shear strength readings were undertaken within the hand-augers at 0.3m centres. Results are summarised in Table 4.2 and Figure 4.1.

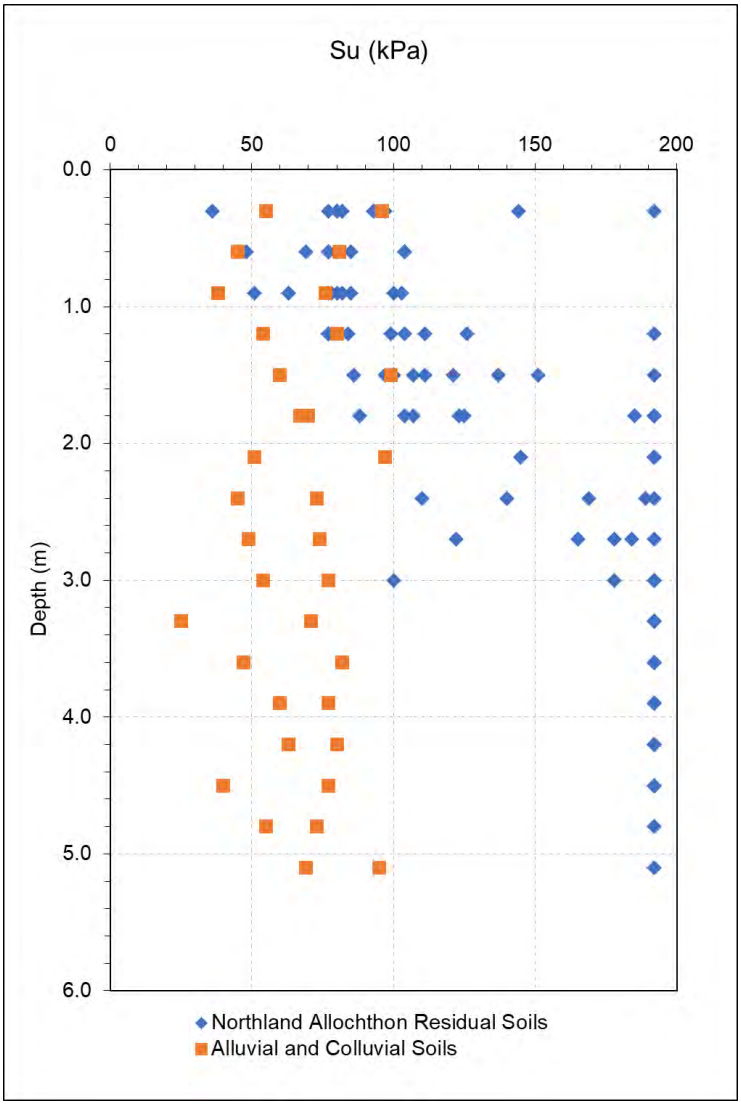
Strength of the soil encountered varied between firm to hard, with peak vane shear reading ranging from 25kPa to over 192kPa. The majority (98%) of the vane shear readings with remould strength indicates the soil sensitivity in the project area is moderately to extra sensitive. Only two samples recovered from 0.3m bgl within HA06 and 3.9m bgl within HA11 are described as quick and insensitive, respectively.

Table 4.2: Summary of Field Vane Shear Readings.

Stratum	Peak Shear Strength Range (kPa)	Residual Shear Strength Range (kPa)	Shear Strength Ratio (Peak/Residual)	Sensitivity Descriptions (NZGS 2005)
Northland Allochthon Residual	36 - > 192	0 – 80	2 – 27	Majority moderately to extra sensitive
Alluvial/Colluvial	25 – 99	6 – 58	1 – 16	

Note: Not including UTP Readings;

Figure 4.1: Field Peak Vane Shear Strength vs Deth Plot.



4.2.2 Scala Penetrometer (DCP)

Scala penetrometer (DCP) test was carried out in hand-auger boreholes and from the surface to the base to obtain soil density/CBR data for pavement design. Data from Scala penetrometer testing within the top 1.5m bgl is summarised in Figure 4.2 and Table 4.3.

Table 4.3: Summary of DCP and Apparent CBR Data.

Testing Item	Number of Test	Min – Max (average)	Apparent CBR Range (%)
DCP Blow Count Per 100mm within 1.5m bgl	In Residual Northland Allochthon soil	0 – 24 (5)	0 – 63
	In Alluvial/Colluvial	0 – 13 (4)	0 – 31

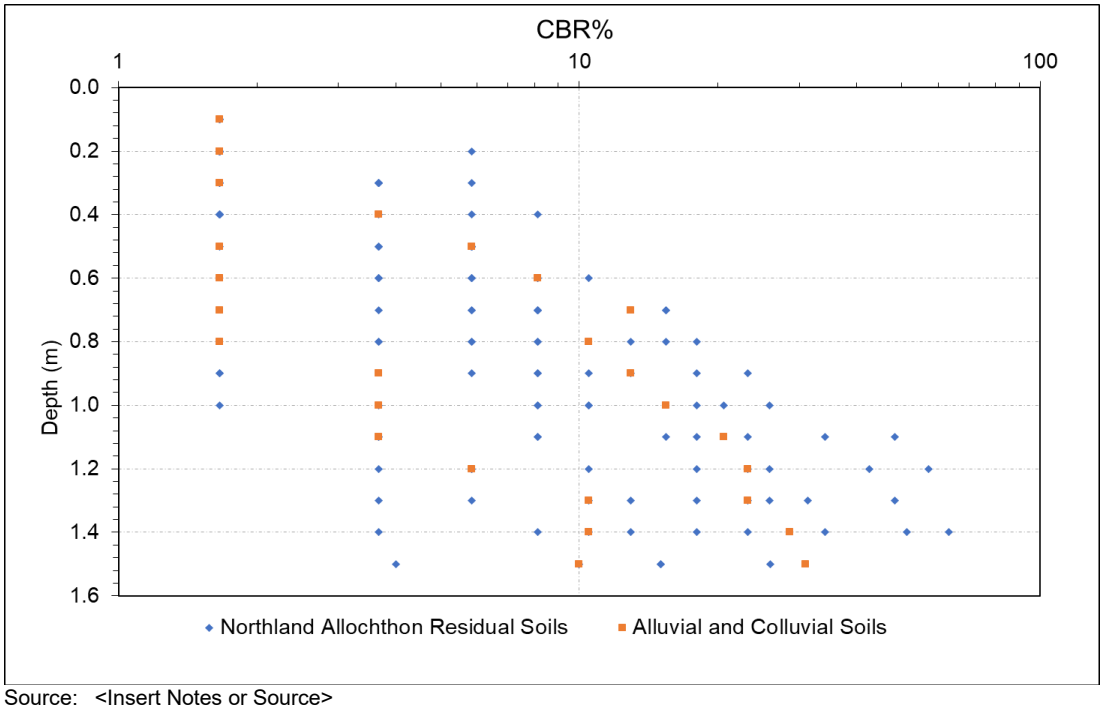
Source: Insert Notes or Source

Apparent field CBR % within the top 1.0m of the DCP testing was estimated from the equation shown below provided in AUST Roads Pavement Design Manual April 2014.

Equation:

$$Apprent\ CBR = 324.51 \times \left(\frac{Finish\ Depth - Start\ Depth}{no.of\ blows}\right)^{-1.1457}$$

Figure 4.2: Apparent CBR (%) v Depth Plot.



Source: <Insert Notes or Source>

4.2.3 Cone Penetration Test and Seismic Dilatometer Test

Four (4) CPTs were carried out in three locations as shown in Sheet 1, to refusal depths between 9.7 and 14.7 metres bgl as summarised in Table 4.4. Data is presented in Appendix B.

One (1) sDMT was carried out to a depth of 14.0 metres bgl on the northern extent of the Pine Valley Road realignment. Data is presented in Appendix B.

Table 4.4: Summary of Cone Penetration Test and Seismic Flat Dialatometer Test

Locations	Total Depth (m bgl)
CPT01	9.7
CPT01A	12.2
CPT02	14.7
CPT03	14.0
sDMT	14.0

Source: Insert Notes or Source

4.2.4 Groundwater

Groundwater levels encountered varied across the hand-auger boreholes, between 0.2m and 3.3m bgl at the end of drilling, otherwise the gorund was dry/groundwater was not encountered. Results are summarised in Table 4.5 below. Logs of the hand-auger boreholes and in-situ soil testing data are presented in Appendix B.

Table 4.5: Summary of Groundwater Levels Encountered at the end of Drilling.

Hand-auger Borehole ID	Groundwater levels (m bgl)
HA01	dry
HA02	dry
HA03	0.50
HA04	1.00
HA05	1.80
HA06	dry
HA07	dry
HA08	3.30
HA09	2.00
HA10	dry
HA11	0.20

Source: Insert Notes or Source

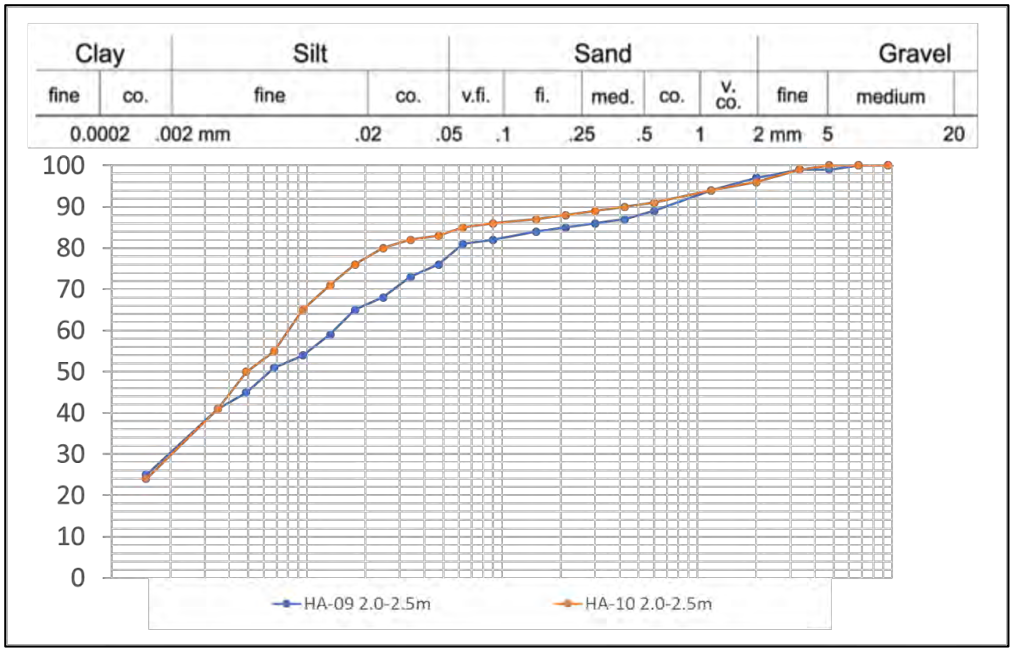
4.3 Laboratory Testing

Specific geotechnical laboratory testing was carried out on soil samples recovered from the hand-auger drilling, and the data is presented in Appendix C. The following sections summarise the results of all the laboratory testing.

4.3.1 Particle Size Distribution

Particle Size Distribution (PSD) tests were undertaken on two samples obtained from HA09 and HA10 at depths of 2.0m bgl. The results indicate that the stratum comprises mainly of gravelly, sandy and clayey SILT. The percentage of fines content (material passing 63-micron sieve) varied from 81% to 85%.

Figure 4.3: Plot of PSD and Hydrometer Curves



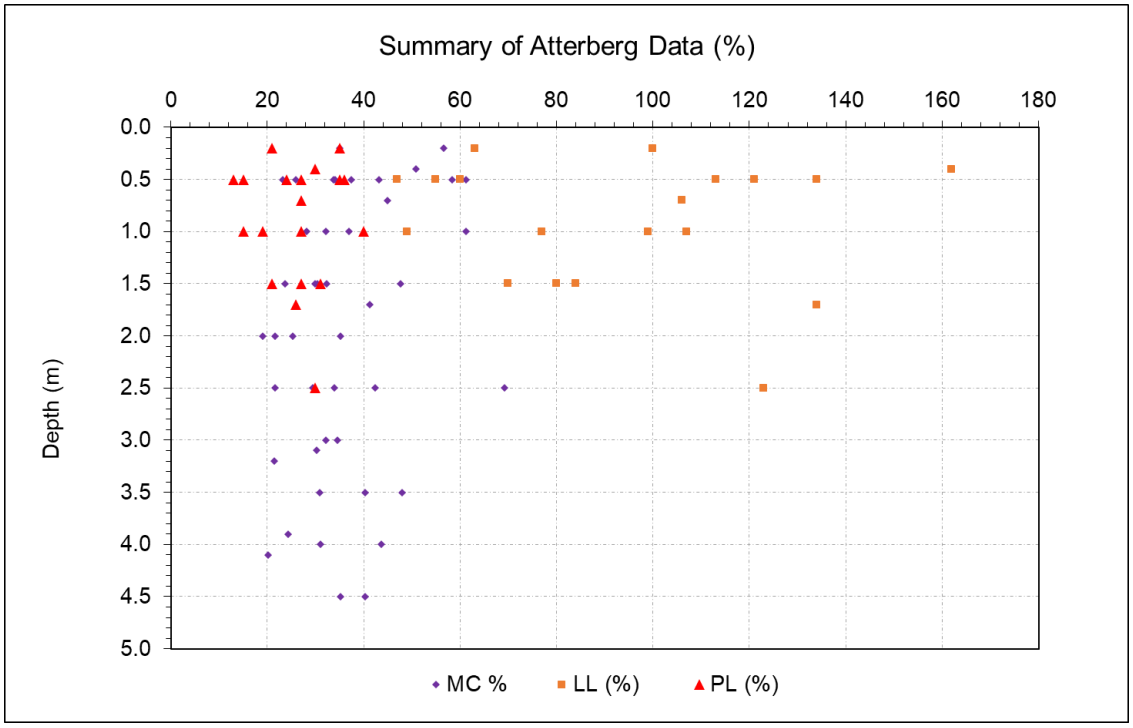
Source: <Insert Notes or Source>

4.3.2 Atterberg Limits and Moisture Content

Nineteen (19) Atterberg Limit tests were undertaken on samples from eleven boreholes. The Liquid Limit of the samples varied from 47% to 162%. The results of the Plastic Limit varied between 13% and 40%. Results of Atterberg Limits are summarised in Figure 4.4.

Moisture Content tests were undertaken on forty-four (44) soil samples recovered from the hand-auger boreholes. The tests yielded moisture content values of 19% to 69% with an average of 36%. Results are summarised in Figure 4.4.

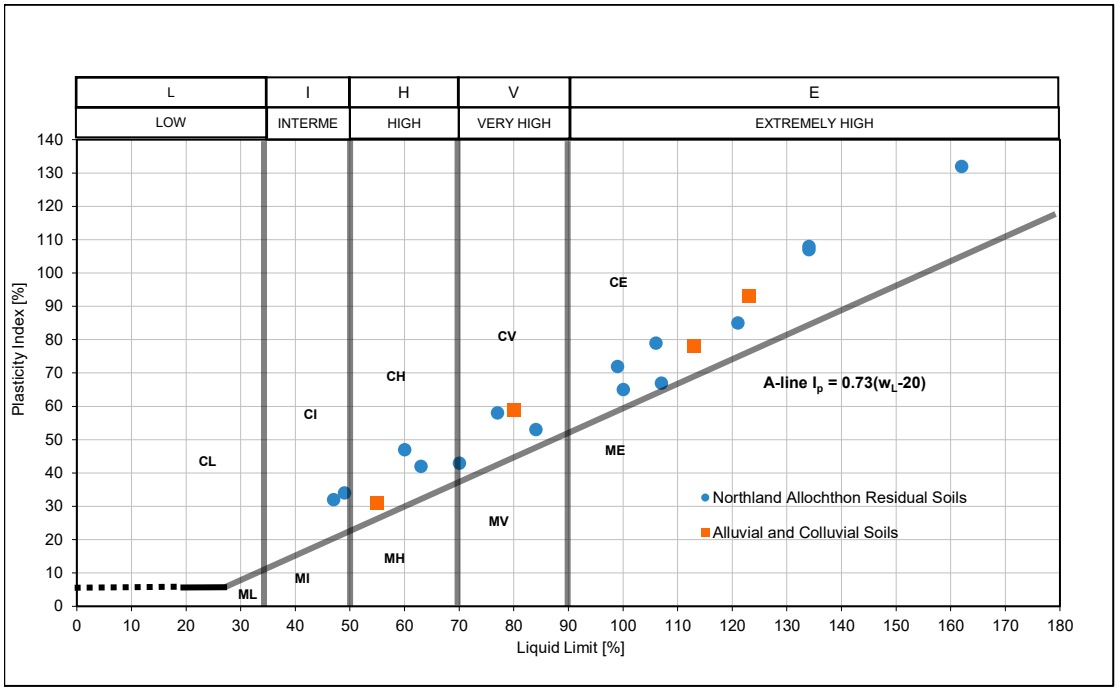
Figure 4.4: Summary of Atterberg Limit Data



Source: <Insert Notes or Source>

Plasticity Index results varied between 31% and 132%. Plastic Index data is plotted against Liquid Limit on a Casagrande Chart to classify the soil plasticity as shown in Figure 4.5. Soil samples tested are between intermediately plastic to extremely plastic silty CLAYs.

Figure 4.5: Summary of Liquid Limit vs Plastic Index.



Source: <Insert Notes or Source>

4.3.3 Shrink - Swell Tests

Shrink-Swell Testing was carried out on 5 sets of soil samples from HA01, HA06, HA 09, HA10 and HA11 at depth between 0.4m and 1.1m bgl. The tests were carried out with an applied pressure of 25 kPa. The results are summarised in Table 4.6 below.

Table 4.6: Summary of Shrink and Swell Test

Item		Results range
Swell Test	Initial Water Content (%)	22 – 52
	Bulk Density (t/m³)	1.64 – 1.93
	Dry Density (t/m³)	1.08 – 1.58
	Final Water Content (%)	23 – 53
	Swelling Strain (%)	0.04 – 0.33
Shrinkage Test	Initial Water Content (%)	22 – 48
	Shrinkage Strain (%)	0.8 – 10
	Inert Material Estimate in the Soil Specimen (%)	0
	Soil Crumbling During Shrinkage	No crumbling during shrinkage
	Cracking of the Shrinkage Specimen	Minor to major
	Shrink – Swell Index (%)	0.5 – 5.7

4.4 Soil Classification

Based on the NZGS soil and rock classification for fine grained soil, and plotted laboratory and field data, the soils encountered during this investigation are firm to hard, moderately to extra sensitive, intermediate to extremely high plastic sandy SILTs and CLAYs.

5 Subsurface Conditions

5.1 Ground Model

5.1.1 General

The ground conditions encountered during the site investigation are typical of the region. The dominant geological unit encountered with these hand-auger boreholes is residual soil from the Hukerenui Mudstone of the Northland Allochthon. Alluvial and colluvial silts and clays of Tauranga Group were encountered around the low-lying valley area on either side of the stream and in the vicinity of the pond area.

The 2D ground profiles (Sheet 2 and Sheet 3) generated from available field investigation data are attached in Appendix A. The general stratigraphy at the site revealed by the hand-auger boreholes is discussed in the following sections.

5.1.2 Topsoil

Topsoil depth typically ranged from 0.1 to 0.4 metres. A thicker deposit of topsoil at 0.5 metres bgl was encountered in HA11 adjacent the pond on 36 Old Pine Valley Road.

5.1.3 Tauranga Group Alluvial and Colluvial Soil

Tauranga alluvial and colluvial soils were encountered in HA08 as mapped out by the published GNS Geological Map Series. Soils with lower residual shear strength were also encountered in the vicinity of the existing pond, HA11 on 36 Old Pine Valley Road, but those soils were not differentiated from the underlying Hukerenui mudstone on the published GNS geological map.

These materials typically comprised clays and silts, with stiffness ranges from firm to stiff, and non-plastic to high plasticity. The base of the materials was not encountered in these hand-auger boreholes. Typical in-situ vane shear reading within the alluvial and colluvial soils is below 40 and 70kPa.

The thickness of the alluvial and colluvial soils were picked up by the CPT and sDMT probes and extent to depths between 8m and 9m bgl.

5.1.4 Residual Hukerenui Mudstone (Kkh)

Residual Northland Allochthon soils were encountered in all the hand-auger boreholes, except HA08 and HA11, to depths between 1.6m and 2.0m bgl. These residual soils were described as firm to hard, non-plastic to highly plastic, clayey and gravelly SILT. Typical in-situ vane shear reading ranges between 50 and 100kPa.

5.1.5 Highly Weathered Hukerenui Mudstone (Kkh)

The highly weathered Hukerenui mudstone was encountered within most of the hand-auger boreholes, except HA08 and HA11, immediately below the residual soil. It is described as light grey to brown, non-plastic to low plasticity, gravelly and clayey SILT. These soil-like materials have typical vane shear readings above 100kPa. This unit is commonly known as the transition zone above the less weathered mudstone.

5.2 Groundwater Conditions

Groundwater was encountered between 0.2 and 3.3 metres below the existing ground level in six out of eleven of the hand-auger boreholes at the time of the investigation. Due to the impermeable nature of the underlying mudstone, the groundwater encountered during the investigation is likely representing the phreatic surface of the underlying soil.

Groundwater level encountered along both Dairy Flat Highway and Pine Valley Road alignments are summarised in Table 5.1.

Table 5.1: Summary of Groundwater Levels.

Locations	Groundwater Level Range (m bgl)
Dairy Flat Highway	From no ground water encountered to 1.8m bgl
Pine Valley Road Widening	0.5 – 3.3
Pine Valley Road Realignment	From no groundwater encountered to 2.0m bgl

6 Geotechnical Assessment

6.1 General

This section presents key recommendations and considerations with regard to the proposed development.

6.1.1 Elastic Parameters for Alluvial and Colluvial Soils

The minimum Young's Modulus values for alluvial soils mapped on either side of the stream and in the vicinity of the pond area are derived from estimated constrained modulus values from CPT and sDMT data.

At areas adjacent to the culvert, the CPT data as shown in Figure 6.1 and Figure 6.2 indicates a desiccated crust approximately 1m thick over lower strength alluvial and colluvial soils to between 4 – 8m bgl. The estimated soil modulus values vary between 1.5MPa and 9Mpa from 2m bgl to 4m bgl. Larger variance is observed between <1MPa and 290MPa in Young's modulus values within 4m to 8.5m bgl before increasing to between typically 100MPa and 550MPa below 8.5m, which is interpreted to be the surface of the residual soil over the Hukerenui Mudstone.

Figure 6.1: Summary of E' from Constrained Modulus vs Depth Plot in Log Scale.

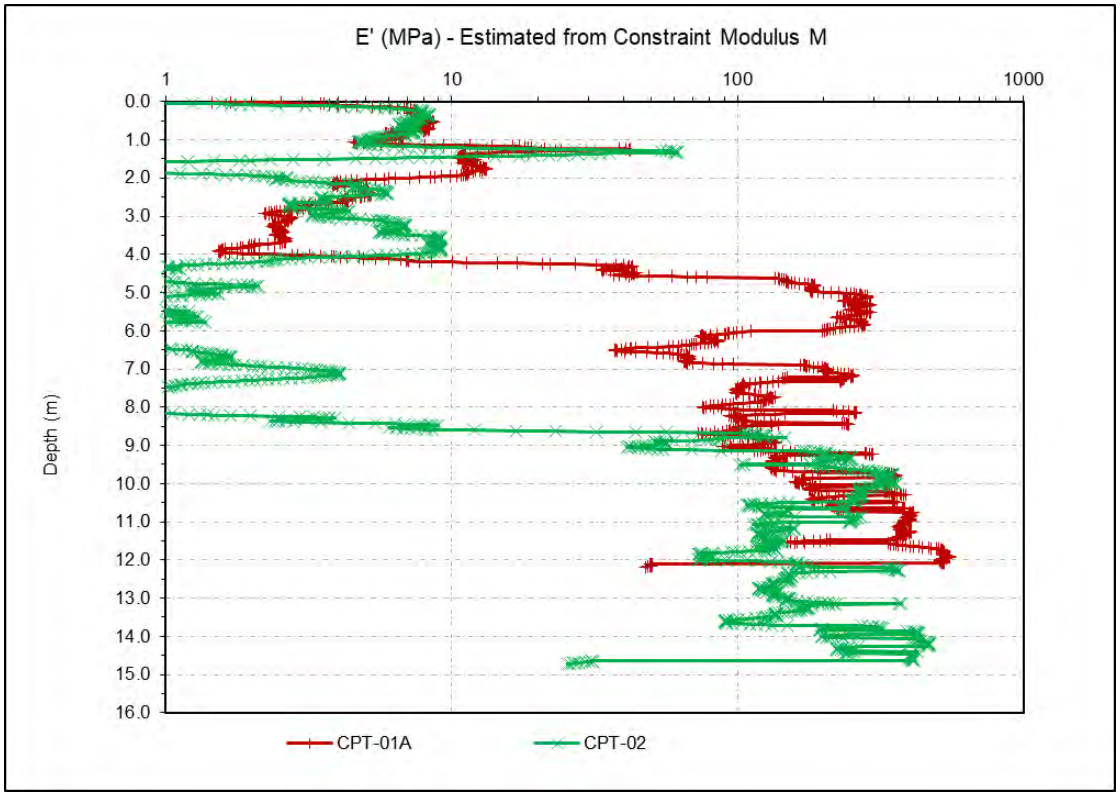


Figure 6.2: Summary of E' from Constrained Modulus vs Depth Plot in Linear Scale.

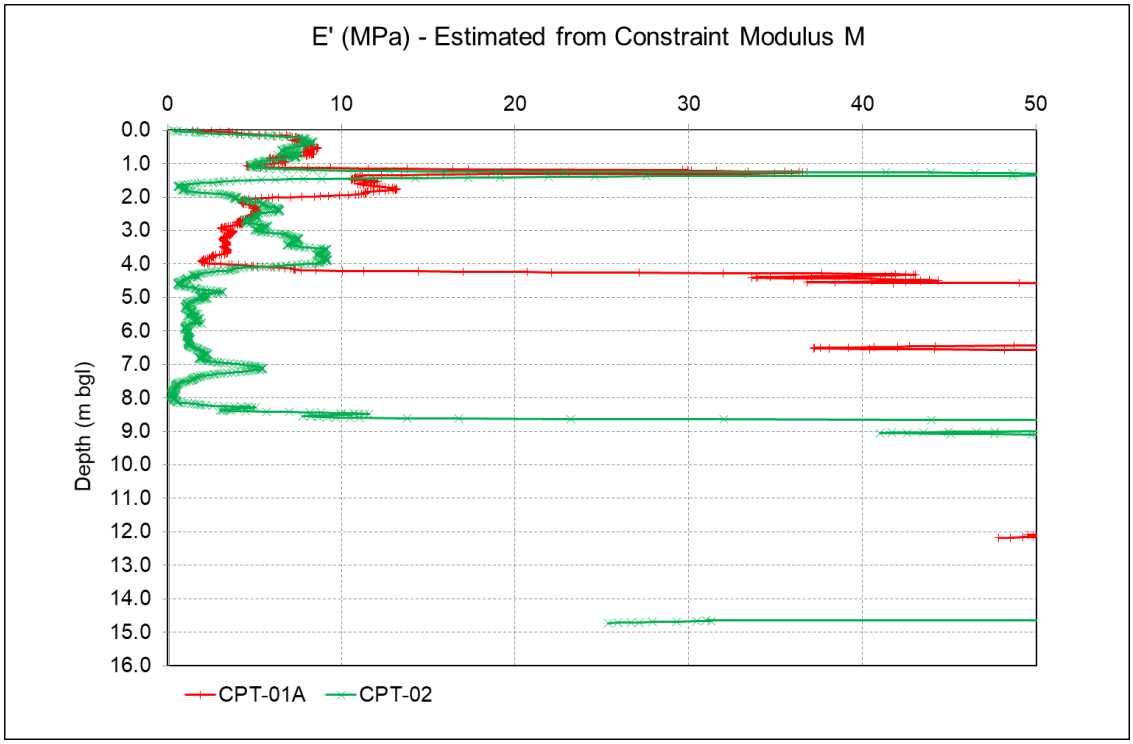


Figure 6.3 and Figure 6.4 show the Young's Modulus values estimated from constrained modulus from both CPT and sDMT data in the vicinity of the existing pond. The data indicates that the site is underlain by a desiccated crust 2m thick over softer alluvial and colluvial soils to approximately 7m.

Figure 6.3: Summary E' from Constrained Modulus vs Depth Plot with Log Scale.

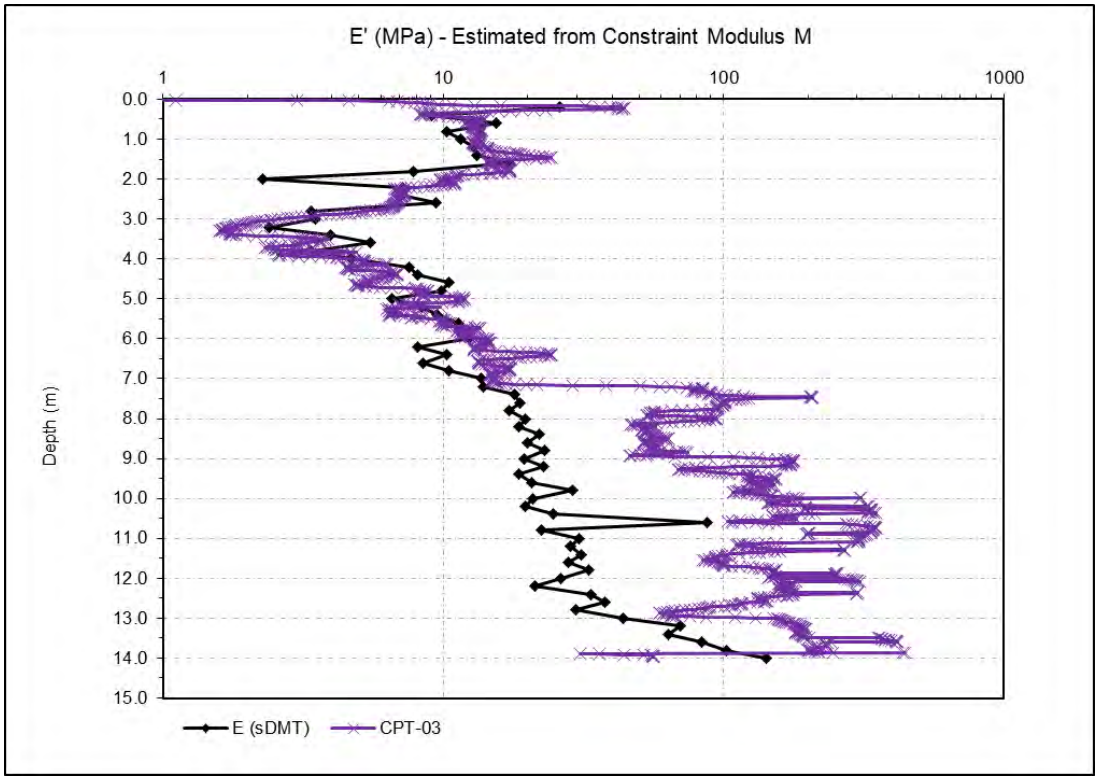
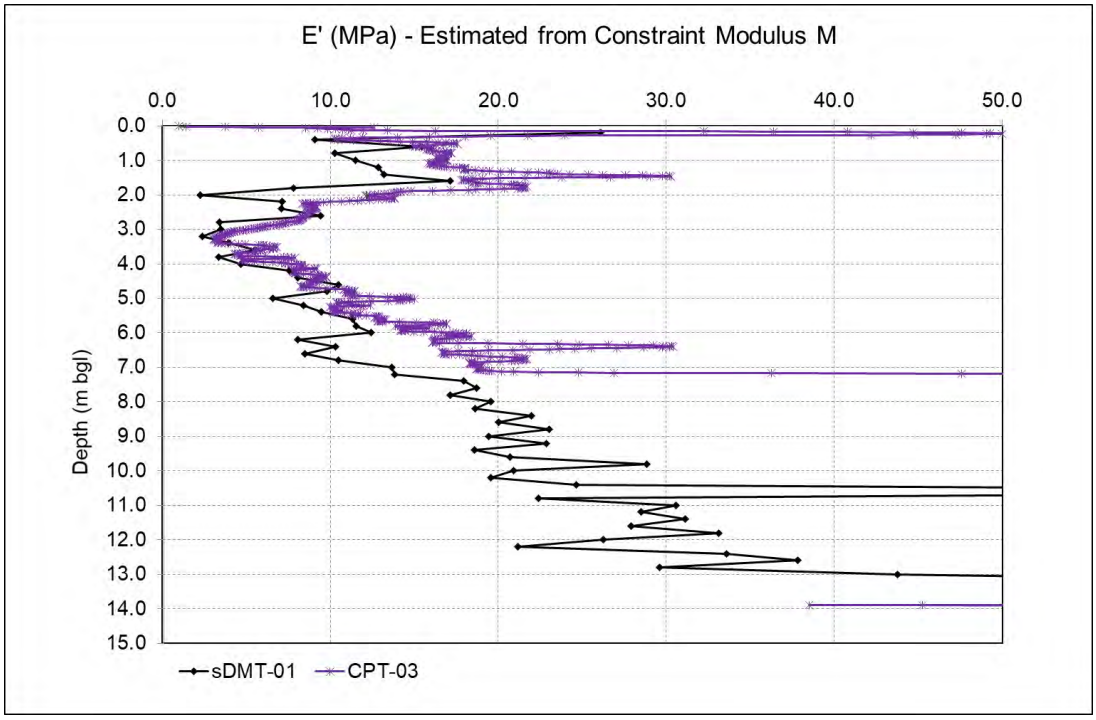


Figure 6.4: Summary E' from Constrained Modulus vs Depth Plot with Linear Scale.



6.1.2 Summary of Geotechnical Design Parameters

The proposed geotechnical parameters required for the final design work are summarised in Table 6.1. These values were derived from the results of in-situ field testing, soil classification and laboratory testing on recovered soil samples.

Table 6.1: Geotechnical Design Parameters for Pavement Widening along DFH and PVR.

Parameters	Existing Fill	Alluvial and Colluvial Area	Residual Hukerenui Mudstone		Transition Zone Hukerenui Mudstone
Depth Range (m bgl)	0.0 – 0.5	0.0 – 1.0	0.0 – 1.0	1.0 – 1.5	Below 1.5
Bulk Unit Weight ɣ (kN/m^3)	18	18	19		19
Dry Weight ɣ (kN/m^3)	15	15	16		16
Angle of Internal Friction φ' (º)	28	25	28		15
Cohesion c' (kPa)	5	5	5		2
Design Apparent CBR value	5	-	1.5	4	6
Ultimate Unfactored Undrained Shear Strength S_u kPa	80	40	50	75	85
Poisson's Ratio, υ	0.3	0.3	0.3		0.3
Elastic Modulus, E (MPa)	-	5	15	30	100

6.2 Seismic Considerations

Based on the soil stratigraphy and published geological information, a site subsoil class of C (shallow soil site) for seismic design purposes has been assessed with methodology adopted in accordance with Section 3.1.3 in NZS 1170.5:2004, Structural Design Actions – Part 5: Earthquake Actions.

6.3 Liquefaction

In accordance with NZGS guidance (Earthquake Geotechnical Engineering Practice, Module 3) the liquefaction susceptibility of the soils at this site has been considered with respect to geological age, soil fabric and soil consistency / density.

The majority of the underlying geology along the project alignment is of early-Miocene age or older. Also, a review of the plasticity index (PI ranges from 31 to 132) of the soils was also carried out to assess liquefaction susceptibility as recommended in Section 5.2 of NZGS Earthquake Geotechnical Engineering Practice Module 3. The PI criteria set out in that publication is summarised below:

- PI < 7: Susceptible to Liquefaction
- 7≤ PI ≤ 12: Potentially Susceptible to Liquefaction
- PI ≥ 12: Not Susceptible to Liquefaction

Based on the soil types encountered within the top 5m during the investigation, the risk of liquefaction is very low.

6.4 Settlement in Soils

6.4.1 Alluvial and Colluvial Soils

Tauranga Group alluvial soils are highly compressible and likely to be encountered in areas mapped in the geological map in Figure 3.1, and settlement may be significant. Previous not mapped soft soils were encountered within HA-11 and during in-situ testing of CPTs and sDMT, near the northern end of the proposed Pine Valley Road realignment.

Settlement associated with these soft soils has been calculated using a coefficient of volume compressibility (m_v) derived from M_{DMT} from the in-situ CPT and sDMT tests. Settlement parameters with depth are given in Table 6.2.

Table 6.2: Summary of Settlement Parameters within Tauranga Group Alluvial Soils

Depth Range (m bgl)	Minimum Constrained Modulus (M, MPa)	Calculated Coefficient of Volume Compressibility (Mv)
0 – 1.6	11.3	0.0883
1.6 – 4	2.8	0.3571
4 – 7	8.2	0.1219
Below 7	21.4	0.0467

The decommissioning of the existing pond on 36 Old Pine Valley Road will require removal of soft sediments from the base of the pond and backfill with engineered fill. It likely requires ground improvement of the backfill prior to pavement construction to reduce consolidation settlement.

The actual depth of the pond and the conditions of soil at its base are not known at the time of writing this report. However, for preliminary assessment of the primary settlement, the pond depth is assumed to be 1m deep, with a maximum undercut of 1m of soft soil at the base of the pond and thickness of the embankment up to 1m. With these assumptions, the primary settlement is expected to be in the order of 100 – 200mm. Secondary settlement and long-term creep are expected for a longer period of time, which need to be assessed during the detailed design stage.

Undercutting of soft ground can be carried to minimise secondary settlement and long-term creep where alluvium/colluvium is limited to shallow depth of 2m to 3m at the base of the pond/stream. Any soft ground encountered during the earthwork stage can be undercut to achieve minimum undrained shear strength typically between 40kPa and 80kPa prior to engineered fill placement. This must be verified by a Geotechnical engineer/geologist at the time of construction.

6.4.2 Northland Allochthon Soil

Details of embankments through the Pine Valley Road realignment section were not available at the time of writing this report. However, settlement in Northland Allochthon soil should be expected if thickness of the embankment fill is greater than 0.5m. Detailed settlement assessment needs to be carried out during the detailed design stage.

6.5 Road Subgrade

Subgrade CBR values encountered during the investigation are variable. A subgrade CBR of 1.5% should be adopted for preliminary design of pavements on residual Northland Allochthon soil across site. Undercutting is required where alluvial/colluvial soils are encountered. In-situ CBR values will need to be confirmed on subgrade formed on fill ground during earthworks prior to pavement construction.

6.6 Slope Stability

Slope Instability is a significant risk in Northland Allochthon settings. Due to limited information available regarding the earthworks filling and forming of embankments, specific stability analyses and checks need to be carried out on the cross-sections at detailed design stage. Stability criteria and methods applicable to land development published and recommended by the New Zealand Geotechnical Society and Auckland Council should be adopted for this project. We should be given the opportunity to review the development plans if changes are made to them.

6.7 Stormwater

Due to the impermeable nature of the underlying geology, and limited soakage and infiltration capacity of the local soil, any designs involving soakage and retention through infiltration within such geology should be avoided.

6.8 Retaining Wall

The development plans provided do not show any retaining walls proposed. Specific analysis and design are required for future retaining walls.

7 Summary

- This report presents the findings of the geotechnical investigation works carried out between 9th and 16th September 2019. The investigation involved a preliminary site walkover, 11 hand-auger boreholes, 3 CPT and 1 sDMT, and suit of laboratory testing.
- The purpose of the site walkover was to summarise the potential engineering constrains across the proposed project alignment. The total project alignment was broken down into areas and discussed in detail.
- Preliminary assessment was carried out for the ground conditions for the proposed roading development. The results of the field investigation indicate that the underlying soils are mostly residual from Hukerenui Mudstone of Northland Allochthon, and Tauranga Group alluvial and colluvial soils in some places along the project alignment.
- This report provided geotechnical design parameters for road subgrade and soils along the project alignment.
- This report provides design recommendations, including undercutting of soft ground, soil settlement, liquefaction potential and site soil class.
- Further studies are recommended during the detailed design stage on secondary settlement and long-term creep of backfilling and retaining wall designs.
- Soakage and disposal through infiltration should be avoided for any proposed stormwater retention systems.

8 Limitations

This report has been prepared solely for the use of our client, Fulton Hogan Land Development Limited, their professional advisor and relevant Territorial Authorities in relation to the specific project described herein. It must not be relied upon in any other context or recreated for any other purpose. The scope of this report is limited to the reporting and interpreting of the subsurface condition for the design and execution of the proposed roading works.

All the information provided in this report, including the ground conditions and design parameters are based on factual evidence obtained from hand-auger boreholes, CPT and sDMT which by their nature only provide information about a relatively small volume of subsoils. There may be special conditions pertaining to this site which have not yet been disclosed by this investigation and which have not been taken into account in this report.

In the event that there are any changes to the nature, design or location of the development planned, the conclusions and recommendations contained in this report must be reviewed to confirm that they remain valid.

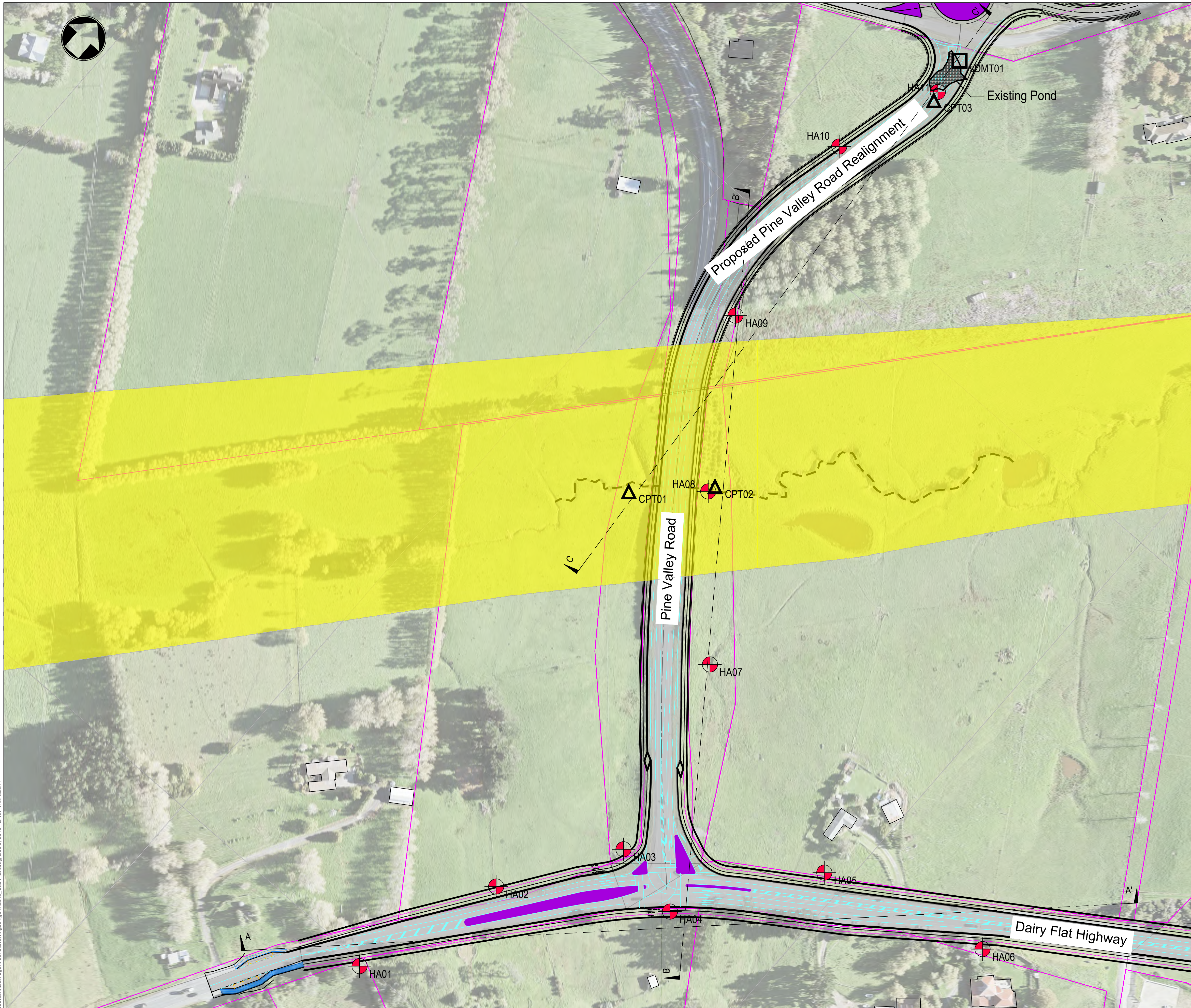
9 References

Edbrooke 2001 Geology of Auckland Area, Institute of Geological and Nuclear Sciences 1: 250,000 Geological Map 3

NZGS 2005: Field description of soil and rock.

Appendices

A. Drawings



Key:

HA01	Approximate Hand Auger locations, 09 to 11-Sept-19
CPT01	Approximate Cone Penetration Test locations, 13 & 16-Sept-19
sDMT01	Approximate Seismic Dilatometer Test locations, 16-Sept-19
A A'	Approximate cross-section locations
	Legal Property boundary
	Building Footprint
	GNS Mapped Tauranga Group Alluvial and Colluvial

Notes:

1. Locations of features approximate only.
2. Locations of all buried services to be verified prior to construction.
3. Site Plan adapted from Preliminary Design Drawings
4. Topographical contours sourced from Woods survey plan
5. Hand-auger, CPT and sDMT locations were confirmed by hand-held GPS with minimum accuracy of +/- 3m

DRAFT - FOR DISCUSSION ONLY

P:\Auckland\NZL\01 Projects_Geotechnical\Argent Lane\Drawings\Argent Lane_Site Plan.dwg Dec 9, 2019 - 2:16PM JIA89311

REV	DESCRIPTION	DATE
A	DRAFT - FOR DISCUSSION ONLY	21/10/2019
B		

DRAWING Q.A.
DRAWN VK
CHECKED AC
APPROVED

DO NOT SCALE OFF THIS DRAWING. VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK.

CONSULTANT PROJECT NO.
MOTT MACDONALD : 402828

CONSULTANT
Mason Bros. Building
L2, 139 Pakenham St West
Auckland 1010
T +64 (0) 9 375 2400
MOTT MACDONALD

CLIENT
MILLDALE

ROAD CONTROLLING AUTHORITY
Auckland Transport

PROJECT
MILLDALE DEVELOPMENT
INFRASTRUCTURE PROJECTS

PROJECT TYPE: NEW CONSTRUCTION
PROJECT PHASE: PRELIMINARY DESIGN
CONSULTANT PROJECT NO.: 410600

DRAWING
Milldale Development, Argent Lane - Dairy Flat Highway
GEOTECHNICAL INVESTIGATION LOCATION PLAN

DRAWING NO.: Sheet 1 of 3
REVISION: Draft
CONSULTATION
SCALE (A1) N.T.S

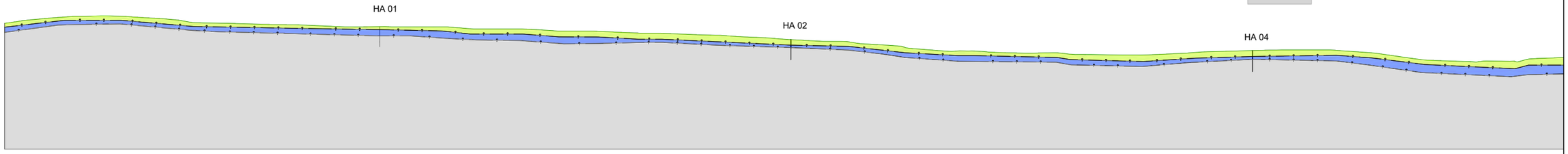
Tauranga Group Alluvial and Colluvial

Residual Hukerenui Mudstone

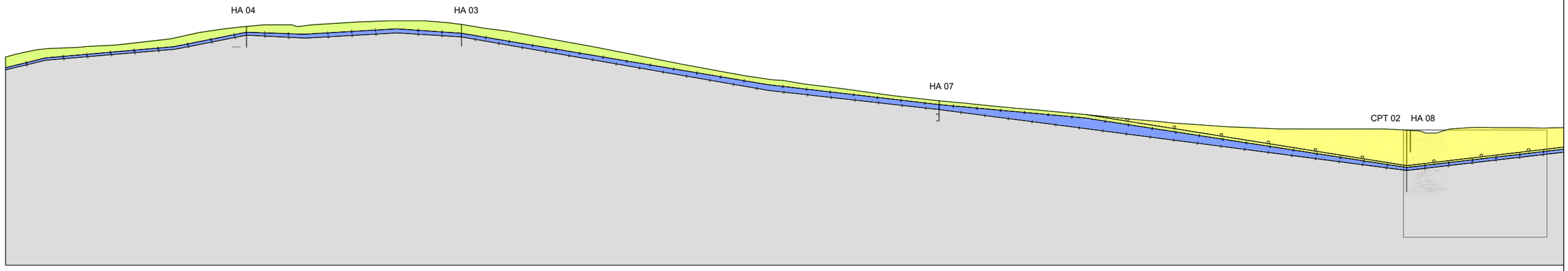
Highly Weathered Hukerenui Mudstone

Moderately to Slightly Weaterhed Hukerenui Mudstone

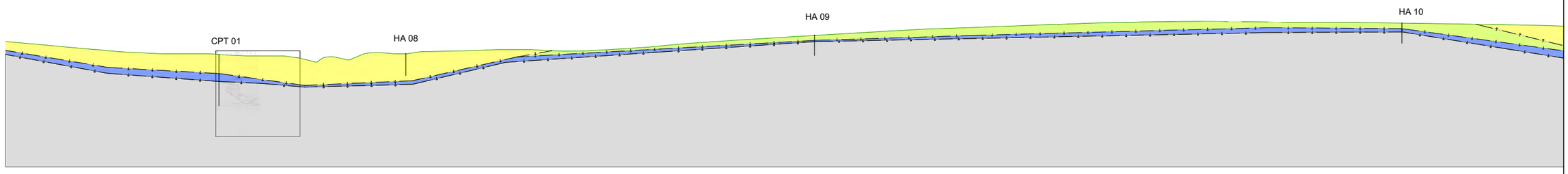
A



B



C



DRAFT - FOR DISCUSSION ONLY

REV	DESCRIPTION	DATE
A	DRAFT - FOR DISCUSSION ONLY	25/10/2019
B		

DRAWING Q.A.

DRAWN JJ

CHECKED AC

APPROVED

DO NOT SCALE OFF THIS DRAWING. VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK.

CONSULTANT PROJECT NO.

MOTT MACDONALD : 402828

CONSULTANT

Mason Bros. Building
Level 3, 160 Lambton Quay West
Auckland 1010
T +64 (0) 9 375 2400

MOTT MACDONALD

CLIENT

MILLDALE

ROAD CONTROLLING AUTHORITY

Auckland Transport

PROJECT

MILLDALE DEVELOPMENT
INFRASTRUCTURE PROJECTS

PROJECT TYPE: NEW CONSTRUCTION

PROJECT PHASE: PRELIMINARY DESIGN

CONSULTANT PROJECT NO.: 410600

DRAWING

Milldale Development, Argent Lane - Dairy Flat Highway
Cross-Sections Page 1 of 2

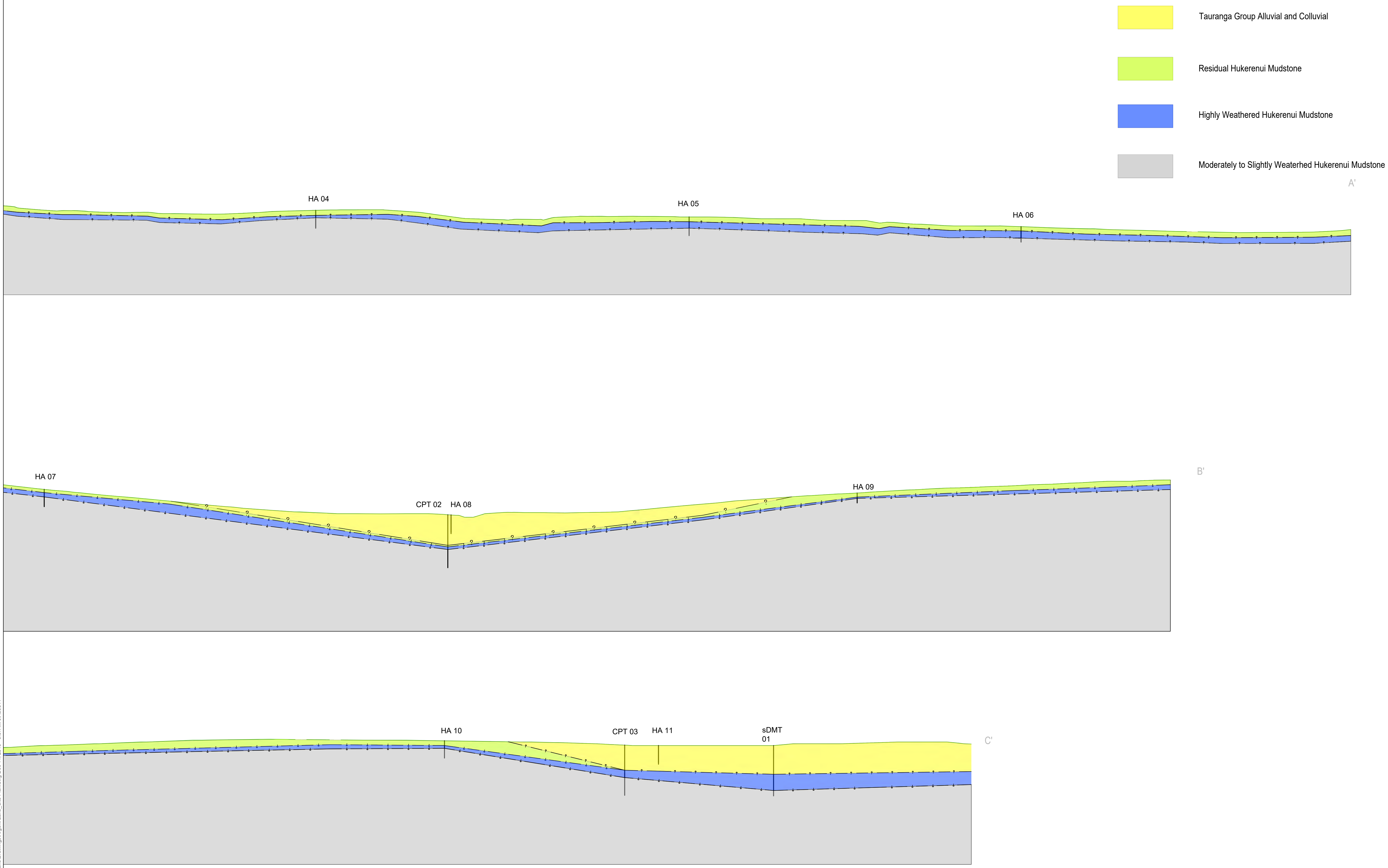
DRAWING NO.: Sheet 2 of 3

REVISION: Draft

CONSULTATION

SCALE (A1): N.T.S

P:\Auckland\NZL\01 Projects_Geotechnical\Argent Lane\Drawings\Argent Lane_Site Plan.dwg Dec 9, 2019 - 2:20PM JIA89311



DRAFT - FOR DISCUSSION ONLY

REV	DESCRIPTION	DATE
A	DRAFT - FOR DISCUSSION ONLY	25/10/2019
B		

DRAWING Q.A.
DRAWN JJ
CHECKED AC
APPROVED

DO NOT SCALE OFF THIS DRAWING. VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK.

CONSULTANT PROJECT NO.
MOTT MACDONALD : 402828

CONSULTANT
Mason Bros. Building
L2, 139 Pakenham St West
Auckland 1010
T +64 (0) 9 375 2400
MOTT MACDONALD

CLIENT
MILLDALE

ROAD CONTROLLING AUTHORITY
Auckland Transport

PROJECT
MILLDALE DEVELOPMENT
INFRASTRUCTURE PROJECTS

PROJECT TYPE: NEW CONSTRUCTION
PROJECT PHASE: PRELIMINARY DESIGN
CONSULTANT PROJECT NO. 410600

DRAWING
Milldale Development, Argent Lane - Dairy Flat Highway
Cross-Sections Page 2 of 2

DRAWING NO. Sheet 3 of 3
REVISION Draft
CONSULTATION
SCALE (A1) N.T.S

B. Borehole Logs and field-testing data

Our Ref: 1012056A
30 September 2019

Mott MacDonald Ltd
PO Box 37525
Parnell
Auckland 1151

Attention: Jared Jiang

Dear Jared

Argent Lane, Milldale Development
(Hand Augers, Pine Valley Rd-Dairy Flat Highway, Silverdale)
Site Report – Amended

Amendment

The report supersedes the report issued on the 26th of September 2019, which contained an error in the R.L reported on the logs.

Customer's Instructions

We were instructed to: Complete eleven hand augers to 5m or refusal, with shear vane readings every 0.5m minimum, Scala from surface to refusal alongside each hole: and to provide samples from these holes for laboratory testing, including several representative undisturbed samples for shrink swell testing as required.

Laboratory results will be reported separately.

Specifications

None issued.

Dates of Procedures

Testing was carried out on 9-11 September 2019

Locations

Test locations were set out as per co-ordinates supplied by the client, using a hand held GPS. HA6 was moved several metres to avoid an enclosed fenced garden, and new coordinates are provided for this location.

The attached plan provides indicative locations only and is not to scale.

Coordinates are provided in the bore logs.

a Method used to determine locations: GPS\GNSS (Handheld)

b Method used to determine RL: Estimated from contours

c Expected accuracy for location: +/-3 m

d Expected accuracy for elevation: +/-3 m

Samples

Samples were taken of all materials recovered below top soil, for laboratory testing as selected by the client, and delivered to our laboratory in Newmarket.

Methods

NZS 4402:1988 Test 6.5.2 - Determination of the penetration resistance of a soil (Hand method using a dynamic cone penetrometer) - Scala

NZGS 8:2001 - Test method for determining the vane shear strength of a cohesive soil using a hand held shear vane.

Material Description

Material descriptions are provided in the attached results.

Results

The following are attached: Logs of hand augers, and site plan

A list of samples available for testing was sent by e-mail on 11 September 2019. Photographs of the borehole material were sent on 12 September 2019.

Test Remarks

Hand augers were completed to target depth or to practical refusal. Where refusal was encountered prior to target depth, base of hole was proved with Scala. All holes were dipped for ground water level on completion, or at the end of each day, prior to capping/ back filling of the holes.

Material Logging

Material logging and descriptions in the field are in general accordance with the New Zealand Geotechnical Society Inc. in 'Guideline for the Field Classification of Soil and Rock for Engineering Purposes' (December 2005), excluding geological information and are based on the observational behaviour of the recovered material.

The logs represent our best assessment of the sub-surface conditions, but due to the subjective nature of material logging, we take no responsibility for any inaccuracies or misinterpretations.

Scala

Our standard test procedure is to over-drill Scala penetrometer tests every 1 m. As requested by you, we have not over-drilled these tests. This variation to the standard test method may increase friction with depth due to skin friction and the protrusion of the rod connectors. The results >1 m deep may therefore not be accurate and are provided for your own interpretation and inference.

For ease of reference, Scala results have been included in the borehole logs even though they were performed adjacent to the boreholes.

Shear Vane

Shear Vane tests are potentially unsuitable for material described in the borehole logs as 'non-plastic', 'sandy SILT' or 'silty SAND'. Tests in these materials may not be compliant with the stated test method. Results are provided for your own interpretation and inference.

General Remarks

This report has been prepared for the benefit of Mott MacDonald Ltd, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement. The inherent uncertainties of site investigation work, mean the nature and continuity of subsoil away from the test location could vary from the data logged.

We provide the results and logs for your interpretation and inference.

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

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 the letterhead page.

GEOTECHNICS LTD

Report prepared by:

.....
Roger Evans
Field Technician

Authorised for Geotechnics by:

.....
Steven Anderson
Project Director

Report checked by:

.....
William Roads
Geoscience Specialist

30-Sep-19

\\ttgroup.local\corporate\geotechnicsgroup\projects\1012056\workingmaterial\pine valley rd-dairy flat highway 20190930.docx

LOCATION PLAN

Field Investigation, Pine Valley Rd/Dairy Flat Highway, September 2019

Locations are indicative only

GEOTECHNICS

23 Morgan Street
Newmarket
Auckland 1023

Site	Pine Valley Rd/Dairy Flat Hwy.	Our Ref	1012056	Drawn	RBE	Date	18/9/2019
Location	Silverdale	Your Ref		Checked	SJA	Date	19/9/2019
Project	Argent Lane, Milldale Development	Lab Ref		Scale	Not to Scale		

N

Aerial photograph sourced from TT Map Viewer(Copyright 2019)

HOLE Id: **HA01**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945000.00 mN 1748131.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 11/09/2019 HOLE FINISHED: 11/09/2019
R.L.:	49.50m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	Description and Additional Observations
				1 2 3 4 5 6 7 8 9					TS	M	VSt		SILT; dark brown. Moist, non-plastic.
											VSt-H		SILT; yellowish brown. Very stiff to hard, moist, non-plastic.
				1									0.0m: Scala from surface alongside hole (blows per 100mm): 1,3,2,3,3,2,3,3,3,4 4,3,5,5,5,7,6,5,6,4 5,6,7,8,10,11,8,8,8,8 9,13,17,17,20,18,21,28
				3									
				2									
				3									
				3	● 144/33 kPa S/swl 1 @ 0.4m								
				2			49						
				3	● 104/33 kPa								
				3									
				3									
				4	● 103/41 kPa								
				4				1					0.9m: trace clay
				3									
				5	● 111/41 kPa								
				5									
				5									
				7	● 111/33 kPa		48						
				6									
				5									
				6	● 123/38 kPa								
				4									
				5				2					2.0m: friable, bands of rusty oxides
				6	● >192 kPa								
				7									
				8									
				10	● 189/48 kPa								
				11 >>			47						
				8									
				8	● 184/80 kPa								
				8									
				8									2.8m: trace clay; light brown
				9	● UTP			3					
				13 >>									
				17 >>							H		SILT; brown and blackish brown. Hard, moist, non-plastic; (very weathered siltstone).
				17 >>	● UTP								
				20 >>									
				18 >>			46						
				21 >>	● UTP								
				28 >>									
					● UTP			4					
					● UTP								SILT; blackish brown. Hard, moist to dry, non-plastic; (weathered siltstone).
					● UTP		45						4.5m: dry
	DRY: 11/09/2019 on completion			24 >>									Scala only: 24 for 100mm, bouncing
													4.8m: Refusal
								5					
							44						

COMMENTS

Hole Depth 4.8m

Scale 1:30

Rev.: A

HOLE Id: **HA02**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945101.00 mN 1748171.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 11/09/2019
		DRILL METHOD: HA	HOLE FINISHED: 11/09/2019
R.L.:	44.00m		DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 2 4 6 8 10 12 14 46 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
	DRY: 11/09/2019 on completion			1 1 1 3 5 7 8 10 8 10 11 11 20 23 >> 18 24 >>	● 80/34 kPa ● 45/29 kPa ● 51/30 kPa ● 77/32 kPa ● 107/30 kPa ● UTP		43 42	1 2	TS T	M-W M D-M	St F-St St-VSt H		SILT; dark brown. Stiff, moist to wet, non-plastic; cased off to prevent water inflow. Clayey SILT; greyish brown. Stiff, moist; medium plasticity. Silty CLAY; yellowish brown mottled light grey. Firm to stiff, moist; medium to high plasticity. Clayey SILT; yellowish brown mottled light grey. Stiff to very stiff, moist; medium plasticity. 0.0m: Scala from surface beside hole (blows/100mm): 1.3m: fragments of weathered limestone Gravelly SILT; light grey mottled white. Hard, dry to moist, non-plastic; (weathered argillaceous limestone). 1.8m: change to 50mm auger scala only (blows per 100mm): 18,24 2.2m: Refusal
							41 40 39	3 4 5					

COMMENTS

Hole Depth 2.2m

Scale 1:30

Rev.: A

HOLE Id: **HA03**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945182.00 mN 1748213.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 11/09/2019 HOLE FINISHED: 11/09/2019
R.L.:	41.00m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 2 4 6 8 10 12 14 46 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
	11/09/2019 W/L on comple				80/32 kPa s/swl 3 @ 0.5m 80/33 kPa 63/22 kPa 77/41 kPa 86/16 kPa 88/8 kPa 145/0 kPa 110/22 kPa 178/27 kPa >192 kPa UTP >192 kPa UTP >192 kPa >192 kPa UTP UTP		40 39 38 37 36	1 2 3 4 5	TS T	W-S M	St St-VSt VSt-H		SILT; dark brown. Stiff, wet to saturated, non-plastic; Cased off to prevent surface inflow. Silty CLAY; yellowish brown. Stiff, moist; medium plasticity. Clayey SILT; yellowish brown. Stiff, moist, low plasticity. 0.0m: Scala from surface alongside auger (blows per 100mm): 1,1,1,1,1,2,7,2,1,1 2,2,2,2,2,3,3,4,3,2 3,5,5,6,6,7,10,11,13,10 11,11,13,14,22,17,12,12,13,12 12,12,12,15,19,20 Clayey SILT; yellowish brown. Stiff to very stiff, moist; medium plasticity. 0.5m: Water inflow Clayey SILT; grey and brown. Very stiff to hard, moist, low plasticity. 3.0m: change to 50mm hand auger (weathered mudstone) Scala only (blows per100mm): 8,8 5.2m: Target depth

COMMENTS

Hole Depth 5.2m

Scale 1:30

Rev.: A

GEOTECHNICS

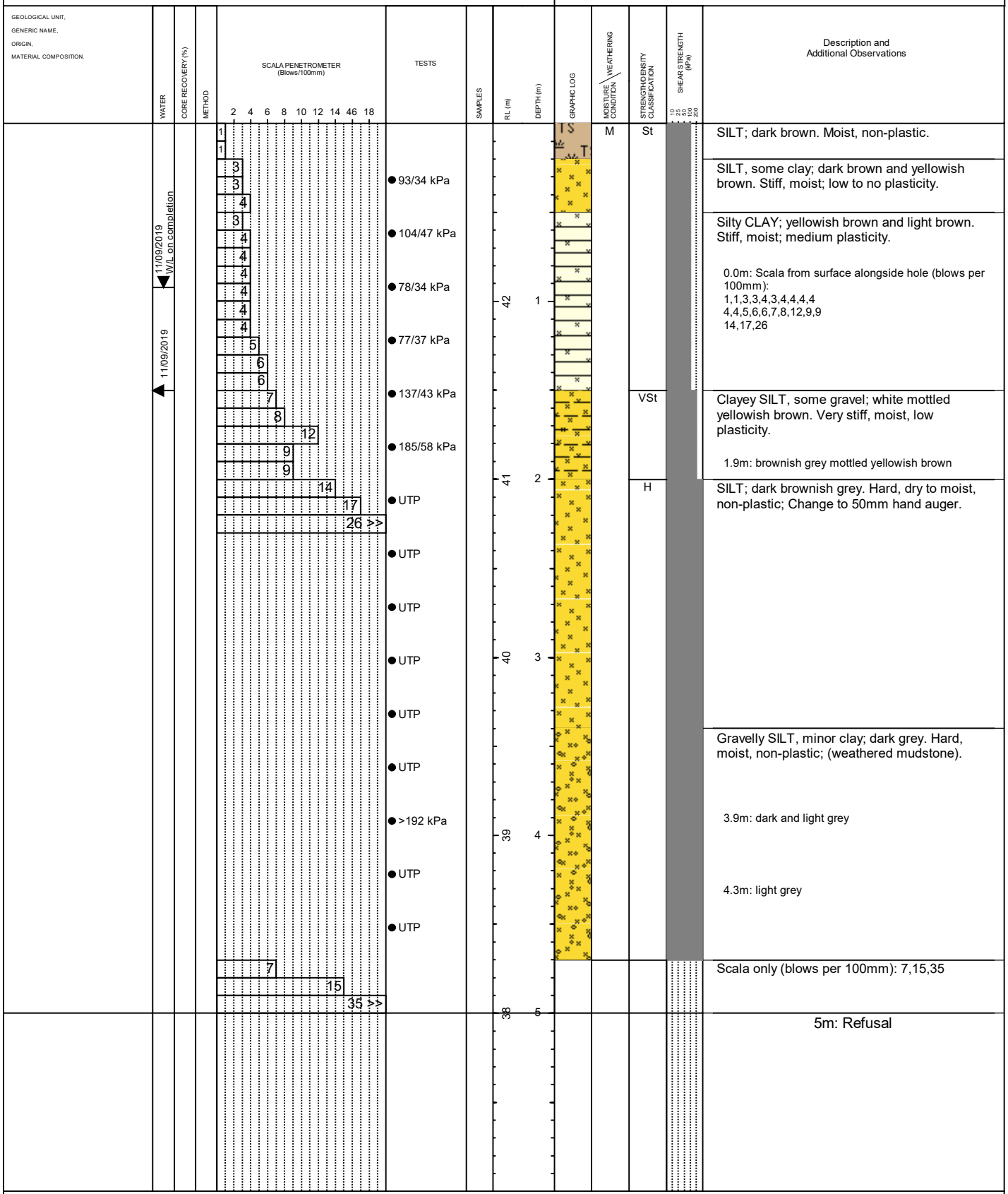
HAND AUGER LOG

HOLE Id: **HA04**

SHEET: 1 OF 1

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945158.00 mN 1748269.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 11/09/2019
			HOLE FINISHED: 11/09/2019
R.L.:	43.00m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION



COMMENTS

Hole Depth 5m

Scale 1:30

Rev.: A

HOLE Id: **HA05**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945247.00 mN 1748328.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 10/09/2019
			HOLE FINISHED: 10/09/2019
R.L.:	43.00m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 2 4 6 8 10 12 14 46 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
	10/09/2019 Inflow at 1.8m Water level on completion			1 1 2 1 2 2 2 1 2 2 3 3 4 5 6 6 5 5 5 6 7 8 13 10 10 8 8 10 12 14 25 >> 7 6 6 8	● 97/47 kPa S/Sw5 @ 0.4m ● 77/41 kPa ● 82/32 kPa ● 104/41 kPa ● 100/38 kPa ● 104/11 kPa ● UTP ● 169/74 kPa ● 122/63 kPa ● 100/49 kPa ● UTP ● UTP ● UTP ● UTP ● UTP		42 41 40 39 38	1 2 3 4 5		W M	St St-VSt VSt H		SILT; dark brown. Stiff, wet, non-plastic; Cased off to prevent water ingress. Clayey SILT; brown and yellowish brown. Stiff, moist, low plasticity. Clayey SILT; light brown and yellowish brown. Stiff, moist; medium plasticity. Clayey SILT; yellowish brown mottled light greyish white. Stiff to very stiff, moist; medium plasticity. 0.0m: Scala from surface alongside hole (blows per 100mm): 1,1,2,1,2,2,2,2,1,2 2,3,3,4,5,6,6,5,5,5 6,7,8,13,10,10,8,8,10,12 14,25,22 for 50mm 1.5m: low plasticity 1.8m: low to no plasticity, yellowish brown and SILT, minor clay; dark brown. Very stiff, moist. Clayey SILT; dark brown. Very stiff, moist, low plasticity. Clayey SILT. Hard, moist, low plasticity; . Change to 50mm auger (weathered mudstone). 4.5m: becoming slightly gravelly Scala only (blows per 100mm): 7,6,6,8 5.2m: Target depth

COMMENTS

Hole Depth 5.2m

Scale 1:30

Rev.: A

HOLE Id: **HA06**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945270.00 mN 1748427.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 10/09/2019
		DRILL METHOD: HA	HOLE FINISHED: 10/09/2019
R.L.:	40.50m		DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 2 4 6 8 10 12 14 46 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
	DRY: 10/09/2019 on completion			1,1,2,1,2,3,4,7,8,11,14,17,19,24 >>	● 82/23 kPa s/sw6 @ 0.5m ● 85/49 kPa ● 85/47 kPa ● 126/59 kPa ● 121/37 kPa ● 125/38 kPa ● UTP ● 140/62 kPa ● 165/51 kPa ● 178/55 kPa ● UTP ● UTP		40 39 38 37	1 2 3	TS T				SILT; dark brown. Moist, non-plastic; Minor gravel (adjoins driveway). Clayey SILT; brown. Stiff, moist, low plasticity. Silty CLAY; yellowish brown and light greyish white. Stiff, moist; medium plasticity. Clayey SILT; yellowish brown and grey. Very stiff, moist; low to medium plasticity. SILT, some clay; light greyish white and light brown. Very stiff, moist; low to no plasticity. Clayey SILT; grey and greenish grey. Moist, low plasticity; minor inclusions of limestone. Change to 50mm hand auger. 0.0m: Scala from surface alongside hole (blows per 100mm): 1,1,2,1,2,3,4,7,8,11, 14,17,19,24 SILT, some clay and gravel. Dry to moist; gravel is white. 3.5m: friable, dry, grey (weathered mudstone)
				15,15,22 >>				4					Scala only (blows per 100mm): 15,15,22
							36 35	5					4.3m: Refusal

COMMENTS

Hole Depth 4.3m

Scale 1:30

Rev.: A

HOLE Id: **HA07**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development | LOCATION: Pine Valley Rd/Dairy Flat Hwy | JOB No.: 1012056.0000

CO-ORDINATES: (NZTM2000) 5945300.00 mN 1748182.00 mE

R.L.: 25.00m

DATUM AUCKHT1946

DRILL TYPE: 75 and 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 10/09/2019

HOLE FINISHED: 10/09/2019

DRILLED BY: GEOTECHNICS

LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	Description and Additional Observations
				1					TS	W-S	F		SILT; dark brown. Firm, wet to saturated, non -plastic; Cased off to prevent water ingress.
				2									
				2	● 36/15 kPa								
				3						M	F-St		Clayey SILT; light grey mottled yellowish brown. Moist, low plasticity.
				3	● 48/19 kPa								0.0m: Scala from surface alongside hole (blows/100mm): 0,1,2,2,3,3,4,4,4,5 7,8,8,8,7,14,23,29
				4									0.6m: light whitish grey
				4									
				4	● 100/44 kPa		24	1					1.0m: low to medium plasticity
				5									
				7									
				8									
				8	● 84/22 kPa								1.4m: yellowish brown mottled light greyish white, low plasticity
				8									
				7									
				14	● 97/22 kPa								
	DRY: 10/09/2019 on completion			23 >>						D-M	H		Gravelly SILT; light greyish white. Hard, dry to moist, non-plastic; (weathered argillaceous limestone).
				28 >>									2.0m: change to 50mm auger
					● UTP		23	2					Scala only: 28 for 100mm
													2.2m: Refusal
							22	3					
							21	4					
							20	5					

COMMENTS

Hole Depth 2.2m

Scale 1:30

Rev.: A

HOLE Id: **HA08**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945389.00 mN 1748112.00 mE	DRILL TYPE: 75mm hand auger	HOLE STARTED: 10/09/2019 HOLE FINISHED: 10/09/2019
R.L.:	18.00m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 2 4 6 8 10 12 14 46 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
				1 1	● 55/6 kPa				TS	W	St		SILT; dark brown. Stiff, wet, non-plastic.
				1 1 1 1	● 45/16 kPa					M	F-St		Clayey SILT; light greyish white mottled yellowish brown. Firm to stiff, moist, low plasticity.
	10/09/2019 trace			2 2 2	● 38/14 kPa		17	1					0.0m: Hole cased to 0.25m to prevent water ingress Scala from surface alongside hole (blows/100mm): 0,1,1,0,1,1,1,1,2,2 2,3,5,5,5,6,8,9,10,8, 8,9,10,9,10,14,14,16,12,15 15,16,19,20,23 0.6m: light brown
				3 5 5 5 6 8 9 10	● 54/19 kPa ● 60/25 kPa ● 67/25 kPa								Sandy SILT; light brownish white. Firm to stiff, moist, non-plastic.
				8 8 9 10 9 10 14 14 16 12 15 15 16 19 20 23 >>	● 51/23 kPa ● 73/22 kPa ● 74/22 kPa ● 77/36 kPa ● 71/47 kPa		16 15	2 3					Silty CLAY; brown. Firm to stiff, moist, low plasticity. 1.1m: light greyish white mottled yellowish brown 2.0m: bluish grey
	10/09/2019 W/L after 5hrs				● 82/36 kPa ● 77/41 kPa ● 63/38 kPa ● 40/21 kPa ● 55/21 kPa ● 69/30 kPa		14 13	4 5					
													5.2m: Target depth

COMMENTS

Hole Depth 5.2m

Scale 1:30

Rev.: A

HOLE Id: **HA09**

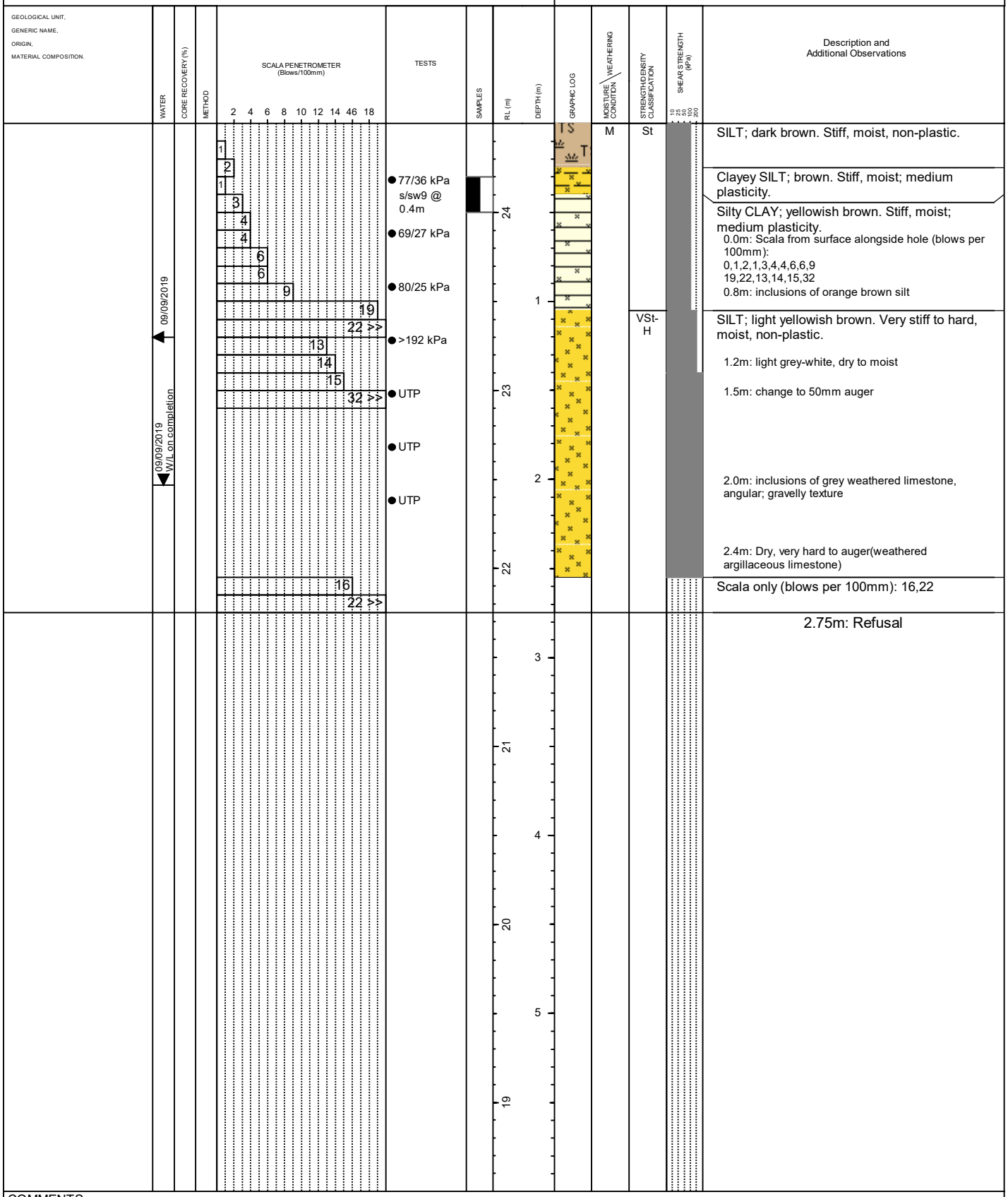
SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945483.00 mN 1748051.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 09/09/2019
		DRILL METHOD: HA	HOLE FINISHED: 09/09/2019
R.L.:	24.50m		DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION



COMMENTS

Hole Depth 2.75m

Scale 1:30

Rev.: A

HOLE Id: **HA10**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945622.00 mN 1748031.00 mE	DRILL TYPE: 75 and 50mm hand auger	HOLE STARTED: 09/09/2019
		DRILL METHOD: HA	HOLE FINISHED: 09/09/2019
R.L.:	26.50m		DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 2 4 6 8 10 12 14 46 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
				1 1 1 2 3 3 3 5 5 8 10 10 10 11 9 10 10 10 9 11 16 17 20 20	● UTP s/sw10 @ 0.4m ● 77/37 kPa ● 77/36 kPa ● 99/44 kPa ● 151/47 kPa ● 107/38 kPa ● UTP		26 25 24	0 1 2	TS T	W-S M D-M	St VSt H		SILT; dark brown. Stiff, wet to saturated, non -plastic; Cased off to prevent water ingress. Clayey SILT; light grey mottled yellowish brown. Stiff, moist, low plasticity. 0.0m: Scala from surface adjacent to hole (blows per 100mm): 0,1,1,1,2,3,3,3,5,5, 8,10,10,1,011,9,10,10,10,9 11,16,17, then 14 for 50mm 1.0m: minor fine sand, low to no plasticity Sandy SILT; light grey mottled yellowish brown. Very stiff, moist, non-plastic; sand, fine. Clayey SILT; light brown mottled orange brown. Very stiff, moist; medium plasticity; fragments of weathered limestone near base. SILT; light brown mottled orange brown. Hard, moist, non-plastic; Chg. to 50mm. 2.0m: Gas emission (odourless) from hole and from scala at about 2m Gravelly SILT; light grey. Hard, dry to moist; (weathered argillaceous limestone). Scala only (blows per 100mm): 20,20
DRY: 25/09/2019 on completion							24 23 22 21	3 4 5					2.7m: Refusal

COMMENTS

Hole Depth 2.7m

Scale 1:30

Rev.: A

HOLE Id: **HA11**

SHEET: 1 OF 1

GEOTECHNICS

HAND AUGER LOG

PROJECT: Argent Lane, Milldale Development		LOCATION: Pine Valley Rd/Dairy Flat Hwy	JOB No.: 1012056.0000
CO-ORDINATES: (NZTM2000)	5945683.00 mN 1748054.00 mE	DRILL TYPE: 75mm hand auger	HOLE STARTED: 09/09/2019
		DRILL METHOD: HA	HOLE FINISHED: 09/09/2019
R.L.:	26.00m		DRILLED BY: GEOTECHNICS
DATUM	AUCKHT1946		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 2 4 6 8 10 12 14 46 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
	09/20 OK			1,1,2,3,4,6,5,6,7,9,10,10,12,13,11,10,8,11,11,13,13,13,15,16,15,12,12,33 >>,12,14,12,13,11,12,12,14,16,21 >>,15,14,15,18,20,24 >>	96/6 kPa 81/7 kPa 67/11 kPa s/sw11 @ 0.9m 80/19 kPa 99/30 kPa 70/22 kPa 97/19 kPa 45/19 kPa 49/18 kPa 54/18 kPa 25/16 kPa 47/16 kPa 60/34 kPa 80/47 kPa 77/48 kPa 73/43 kPa 95/58 kPa		25 24 23 22 21	1 2 3 4 5	TS T TS T	W-S M	St F-St		SILT; dark brown. Stiff, moist to saturated, non-plastic; Water inflow from -0.3m, water slowly filled hole after completion. SILT, some clay; dark brown. Stiff, moist; low to no plasticity. Clayey SILT; brown. Stiff, moist; medium plasticity. Clayey SILT; light grey. Stiff, moist, low plasticity. 0.0m: Scala from surface alongside hole (blows per 100mm): 1,1,0,2,3,4,6,5,6,7 9,10,10,12,13,11,10,8,11,11 13,13,13,15,16,15,12,12,33,12 14,12,13,11,12,12,14,16,21,15 14,15,18,20,24 1.4m: medium plasticity 1.8m: low plasticity, light grey mottled yellowish Silty CLAY; greenish grey. Firm to stiff, moist; medium plasticity. 3.0m: light grey 4.0m: isolated fragments of weathered limestone 5.2m: Target depth

COMMENTS

Hole Depth 5.2m

Scale 1:30

Rev.: A

MOTT MACDONALD

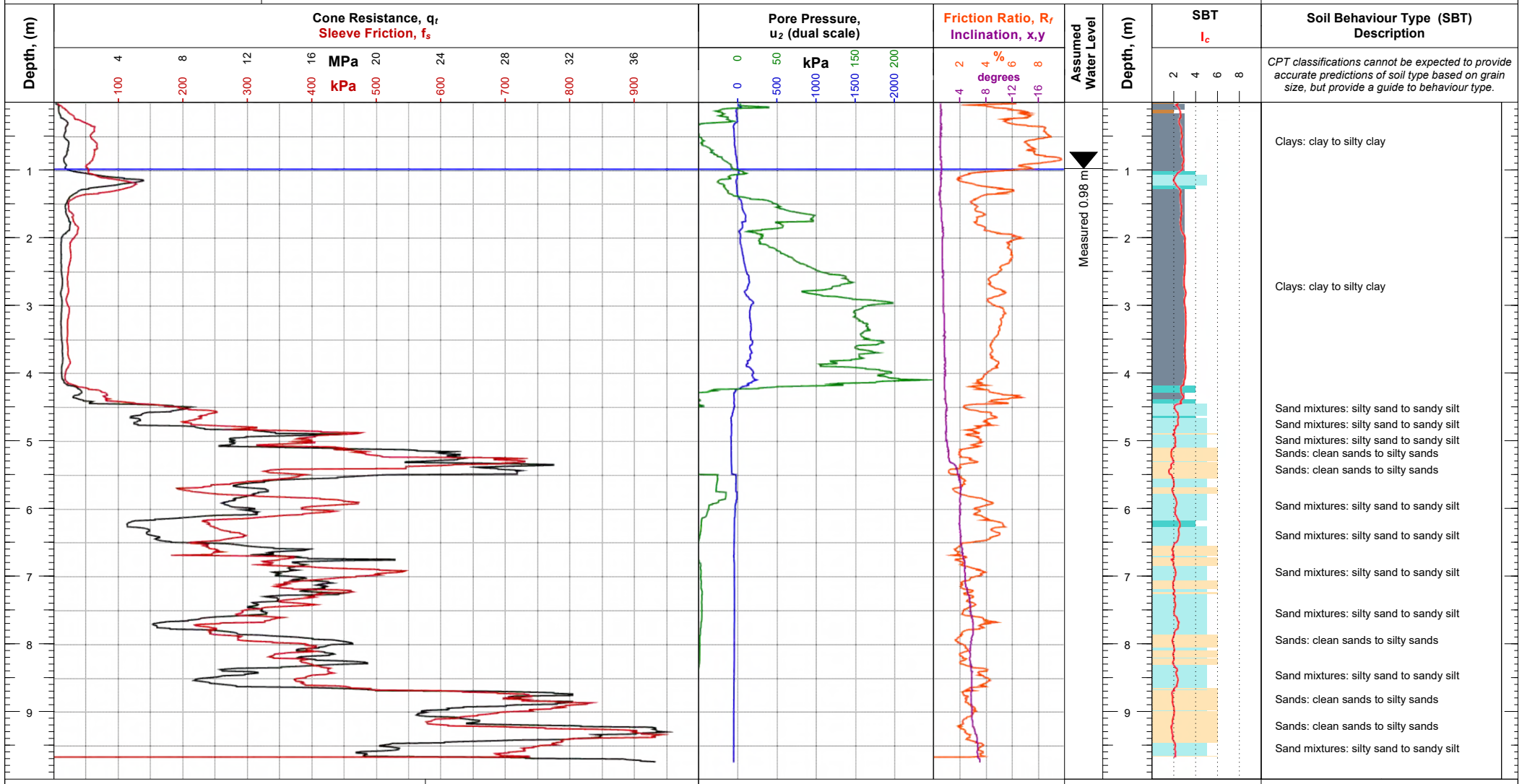
GROUND INVESTIGATION

CONE PENETRATION TEST (CPT) LOGS

CONE PENETRATION TEST (CPT) LOG

MOTT MACDONALD

GROUND INVESTIGATION



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Cone Ref: MKJ167
Cone Type: 10 cm² Compression
Area Ratio: 0.8
Filter Type: u2

NZTM2000 N,E (m): 5945341.88, 1748076.89
WGS84, (deg): -36.625969, 174.656089
Location Method: Handheld GPS
Surveyor: N/A
Termination Reason: Limit of reaction force

Elevation (m): Unknown
Date of Test: 13/09/2019
Depth (m): 9.74
Pre-Drill (m): N/A

Client Job Ref:

CPT Number: CPT-01

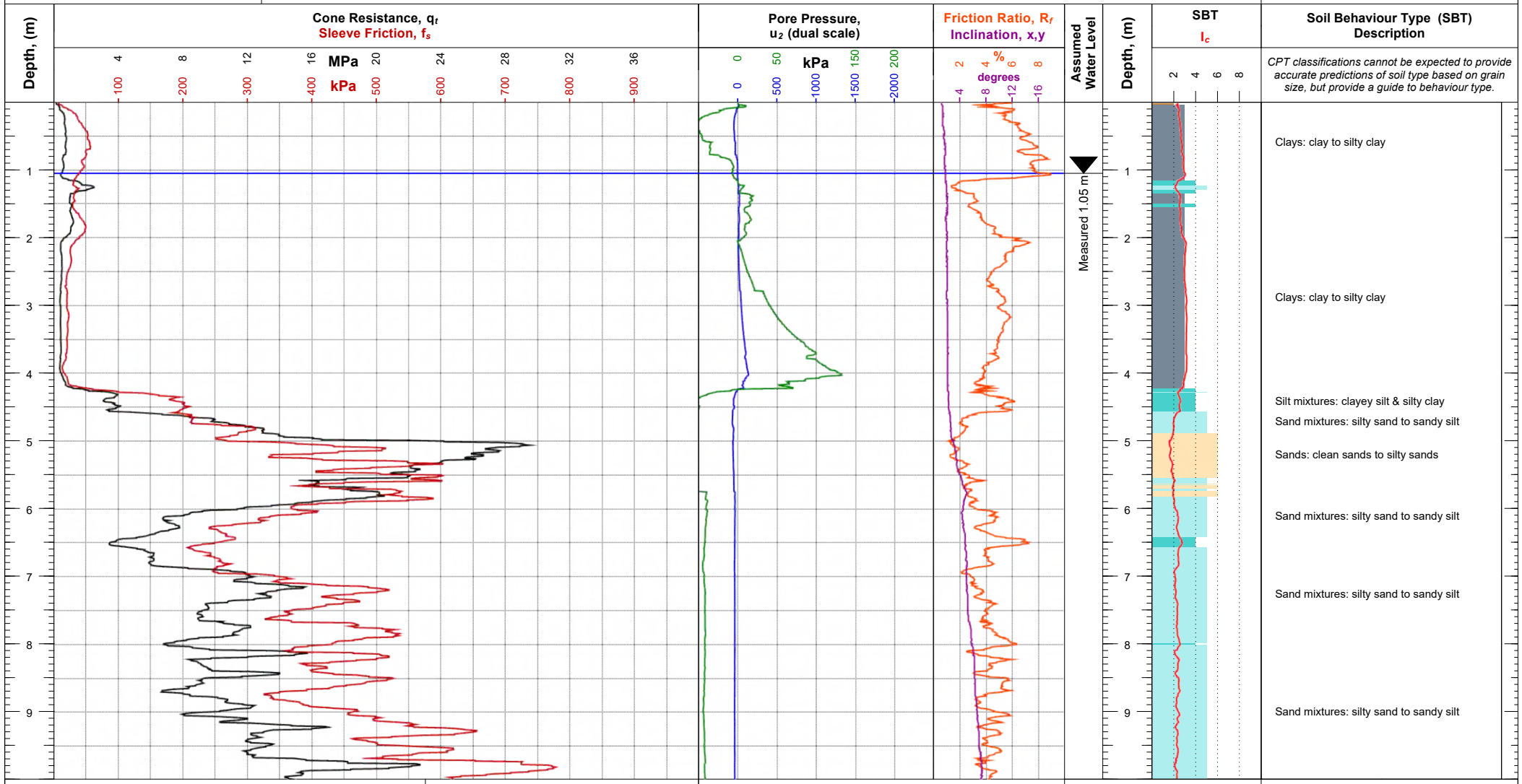
G.I. Job Ref: 190560

Remarks:

MOTT MACDONALD

CONE PENETRATION TEST (CPT) LOG

GROUND INVESTIGATION



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Cone Ref: MKJ167
Cone Type: 10 cm² Compression
Area Ratio: 0.8
Filter Type: u2

NZTM2000 N,E (m): 5945341.88, 1748076.89
WGS84, (deg): -36.625969, 174.656089
Location Method: Handheld GPS
Surveyor: N/A
Termination Reason: High total load

Elevation (m): Unknown
Date of Test: 13/09/2019
Depth (m): 12.18
Pre-Drill (m): N/A

Client Job Ref:

CPT Number: CPT-01A

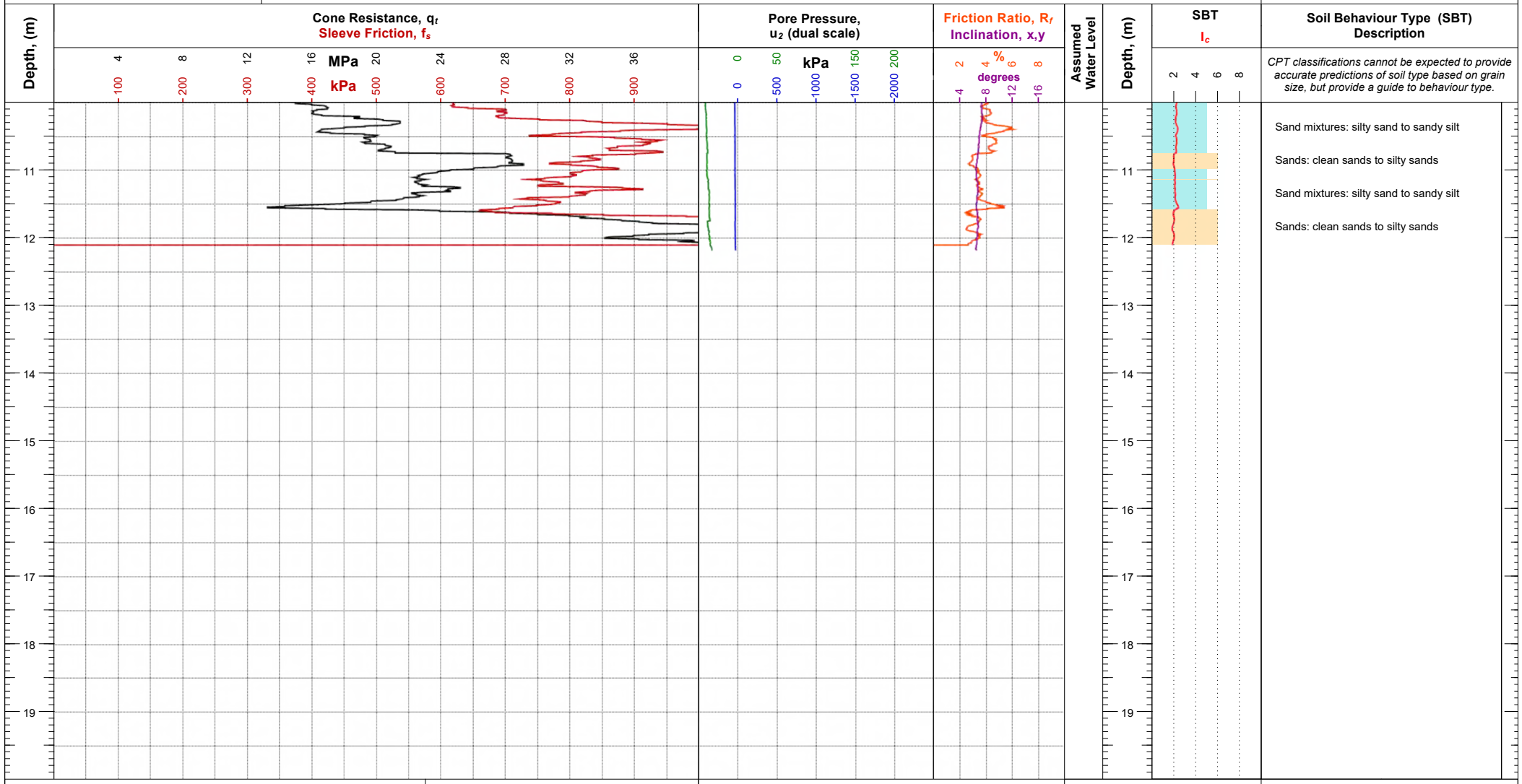
G.I. Job Ref: 190560

Remarks: Retest of CPT-01 in an attempt to get deeper.

CONE PENETRATION TEST (CPT) LOG

MOTT MACDONALD

GROUND INVESTIGATION



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Cone Ref: MKJ167
Cone Type: 10 cm² Compression
Area Ratio: 0.8
Filter Type: u2

NZTM2000 N,E (m): 5945341.88, 1748076.89
WGS84, (deg): -36.625969, 174.656089
Location Method: Handheld GPS
Surveyor: N/A
Termination Reason: High total load

Elevation (m): Unknown
Date of Test: 13/09/2019
Depth (m): 12.18
Pre-Drill (m): N/A

Client Job Ref:

CPT Number: CPT-01A

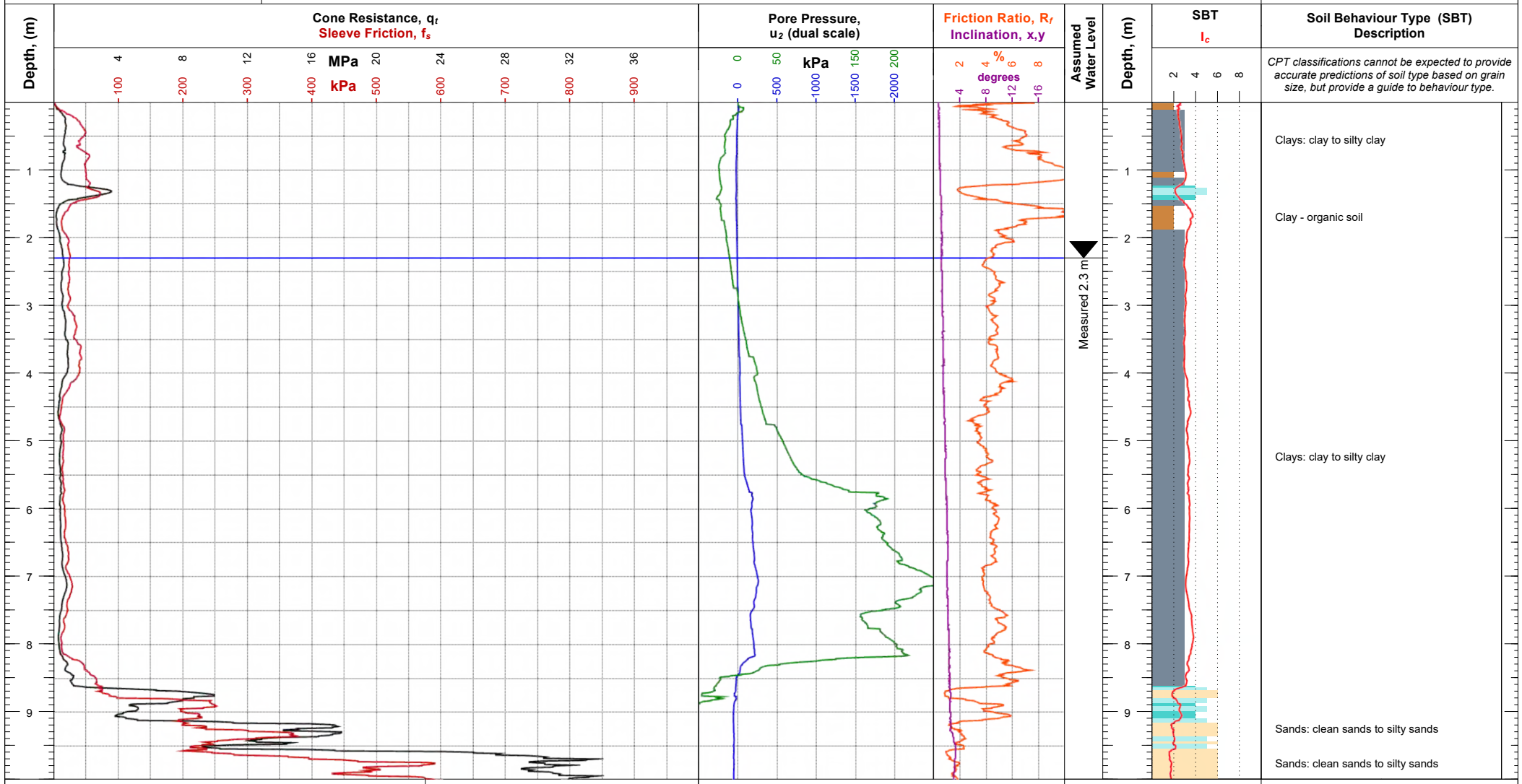
G.I. Job Ref: 190560

Remarks: Retest of CPT-01 in an attempt to get deeper.

MOTT MACDONALD

CONE PENETRATION TEST (CPT) LOG

GROUND INVESTIGATION



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Cone Ref: MKJ167
Cone Type: 10 cm² Compression
Area Ratio: 0.8
Filter Type: u2

NZTM2000 N,E (m): 5945399.97, 1748131.74
WGS84, (deg): -36.625437, 174.656691
Location Method: Handheld GPS
Surveyor: N/A

Elevation (m): Unknown
Date of Test: 13/09/2019
Depth (m): 14.73
Pre-Drill (m): N/A

Client Job Ref:

CPT Number: CPT-02

Termination Reason: Inclination high or rapid increase

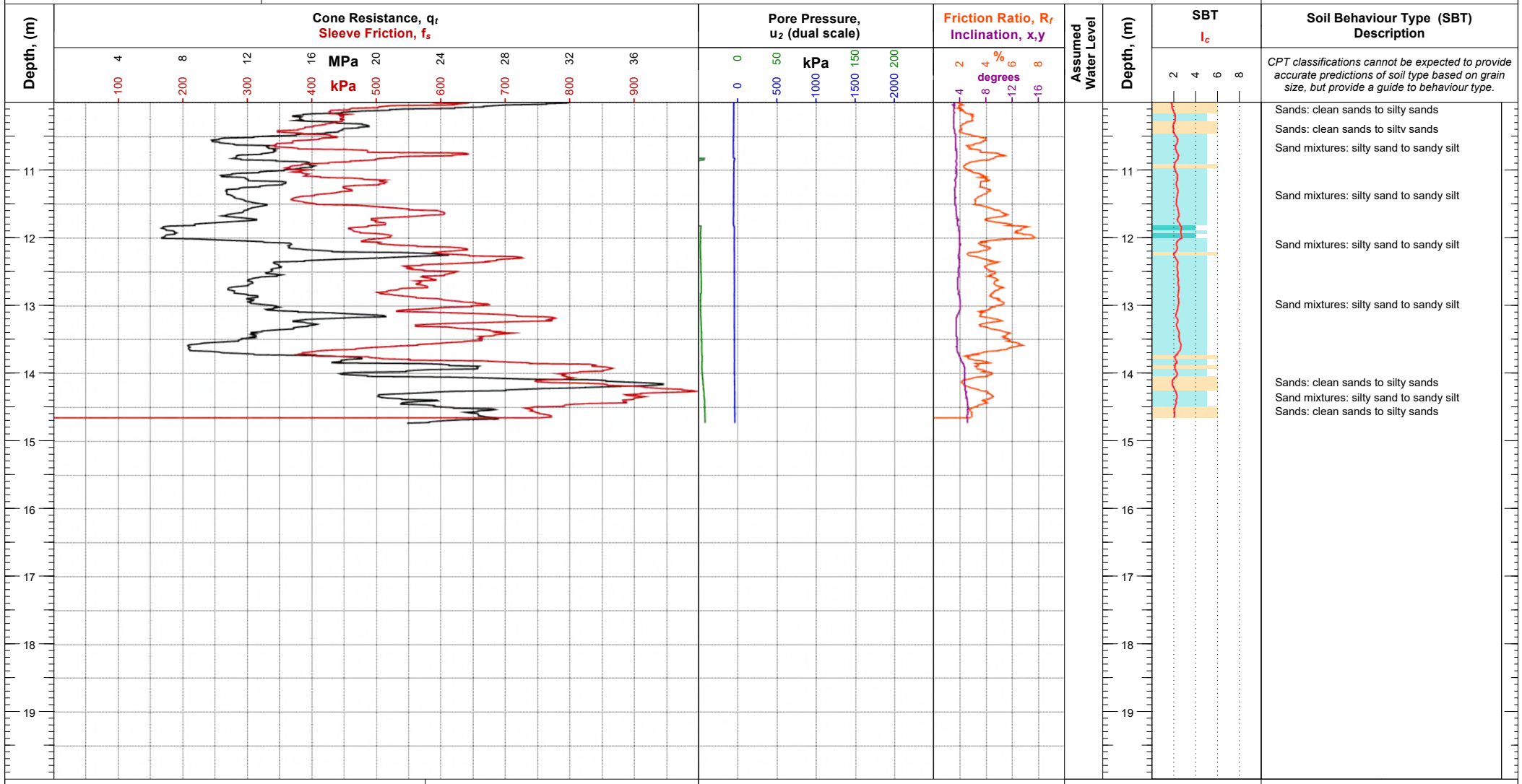
G.I. Job Ref: 190560

Remarks:

MOTT MACDONALD

CONE PENETRATION TEST (CPT) LOG

GROUND INVESTIGATION



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Cone Ref: MKJ167
Cone Type: 10 cm² Compression
Area Ratio: 0.8
Filter Type: u2

NZTM2000 N,E (m): 5945399.97, 1748131.74
WGS84, (deg): -36.625437, 174.656691
Location Method: Handheld GPS
Surveyor: N/A
Termination Reason: Inclination high or rapid increase

Elevation (m): Unknown
Date of Test: 13/09/2019
Depth (m): 14.73
Pre-Drill (m): N/A

Client Job Ref:

CPT Number: CPT-02

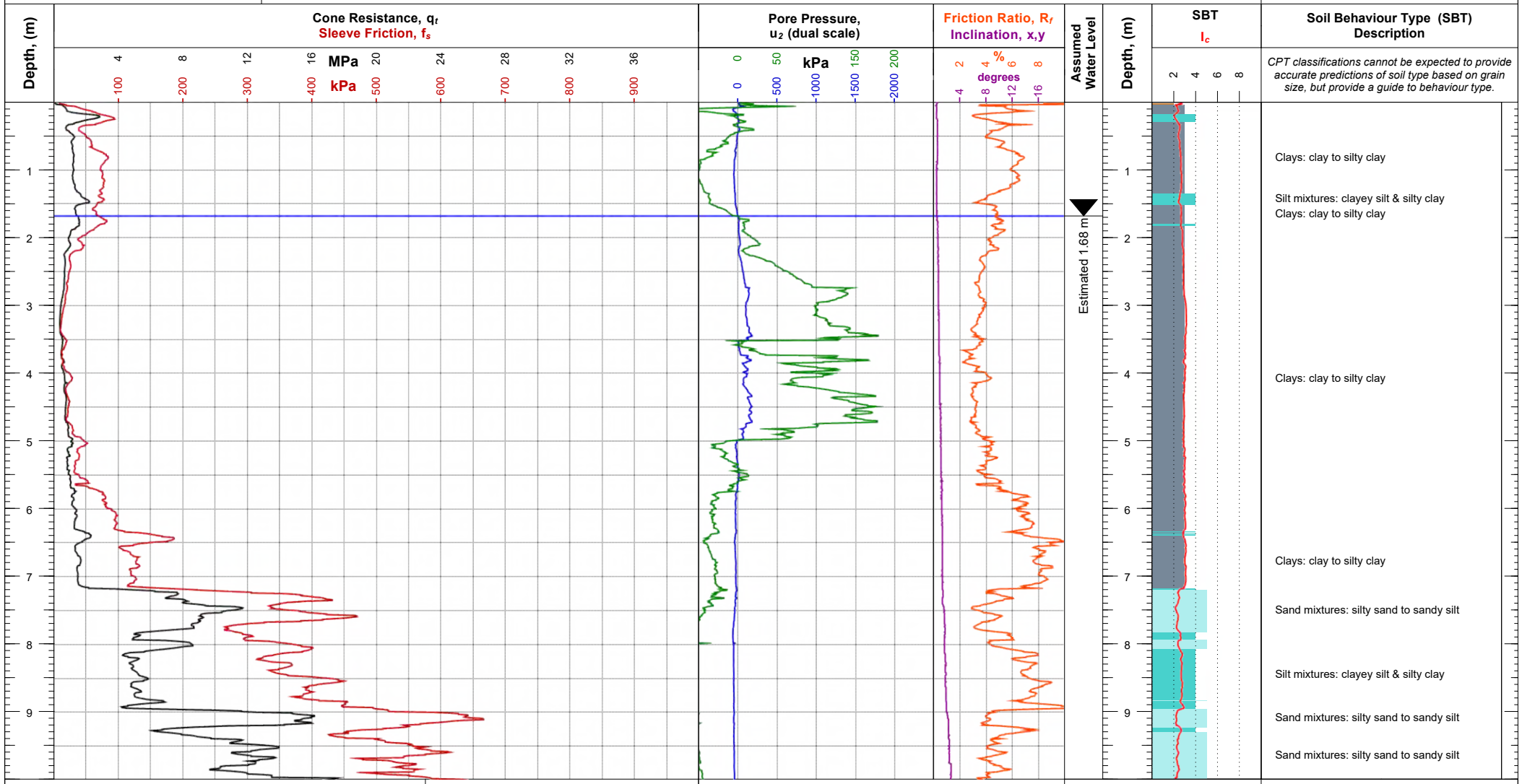
G.I. Job Ref: 190560

Remarks:

MOTT MACDONALD

CONE PENETRATION TEST (CPT) LOG

GROUND INVESTIGATION



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Kemp Hugo
Cone Ref: MKJ167
Cone Type: 10 cm² Compression
Area Ratio: 0.8
Filter Type: u2

NZTM2000 N,E (m): 5945674.14, 1748063.21
WGS84, (deg): -36.622977, 174.655872
Location Method: Handheld GPS
Surveyor: N/A
Termination Reason: High total load

Elevation (m): Unknown
Date of Test: 16/09/2019
Depth (m): 13.97
Pre-Drill (m): N/A

Client Job Ref:

CPT Number: **CPT-03**

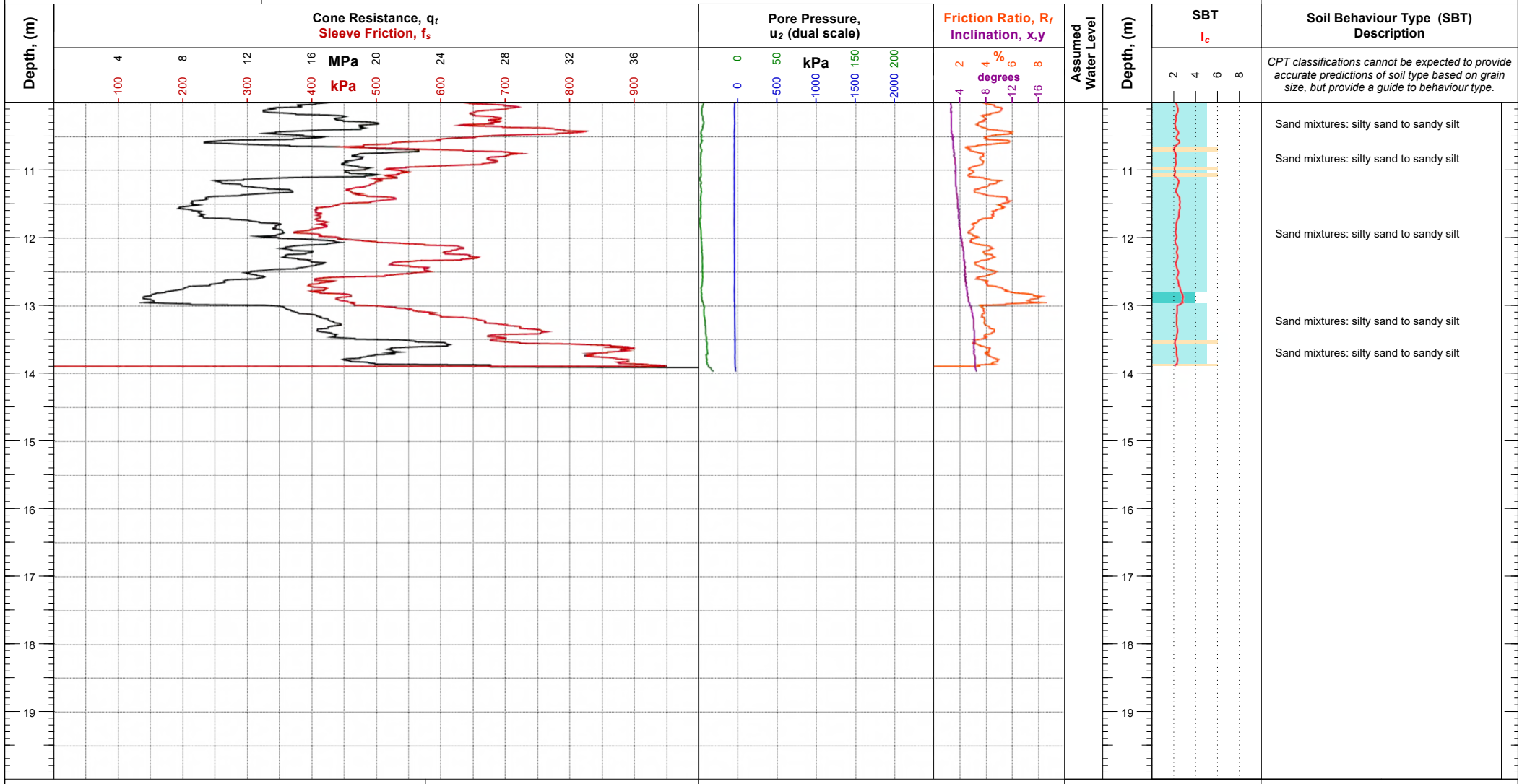
G.I. Job Ref: **190560**

Remarks:

CONE PENETRATION TEST (CPT) LOG

MOTT MACDONALD

GROUND INVESTIGATION



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Kemp Hugo

Cone Ref: MKJ167

Cone Type: 10 cm² Compression

Area Ratio: 0.8

Filter Type: u2

NZTM2000 N,E (m): 5945674.14, 1748063.21

WGS84, (deg): -36.622977, 174.655872

Location Method: Handheld GPS

Surveyor: N/A

Termination Reason: High total load

Elevation (m): Unknown

Date of Test: 16/09/2019

Depth (m): 13.97

Pre-Drill (m): N/A

Client Job Ref:

CPT Number: CPT-03

G.I. Job Ref: 190560

Remarks:

MOTT MACDONALD

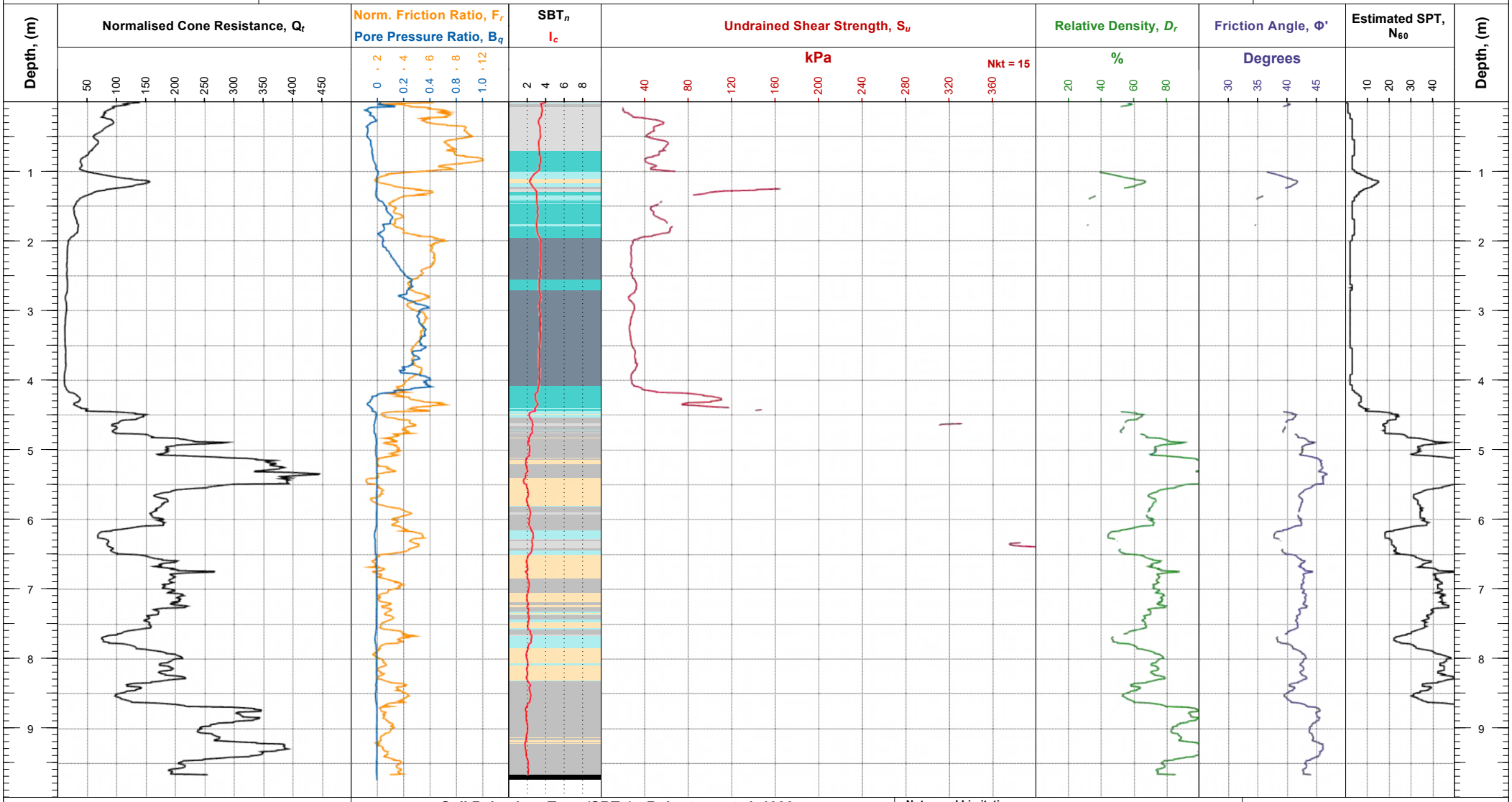
GROUND INVESTIGATION

CONE PENETRATION TEST (CPT) PARAMETER LOGS

CONE PENETRATION TEST (CPT) PARAMETER LOG

MOTT MACDONALD

GROUND INVESTIGATION



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd.

Soil Behaviour Type (SBTn) - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes and Limitations:
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Job Ref:

CPT Number: CPT-01

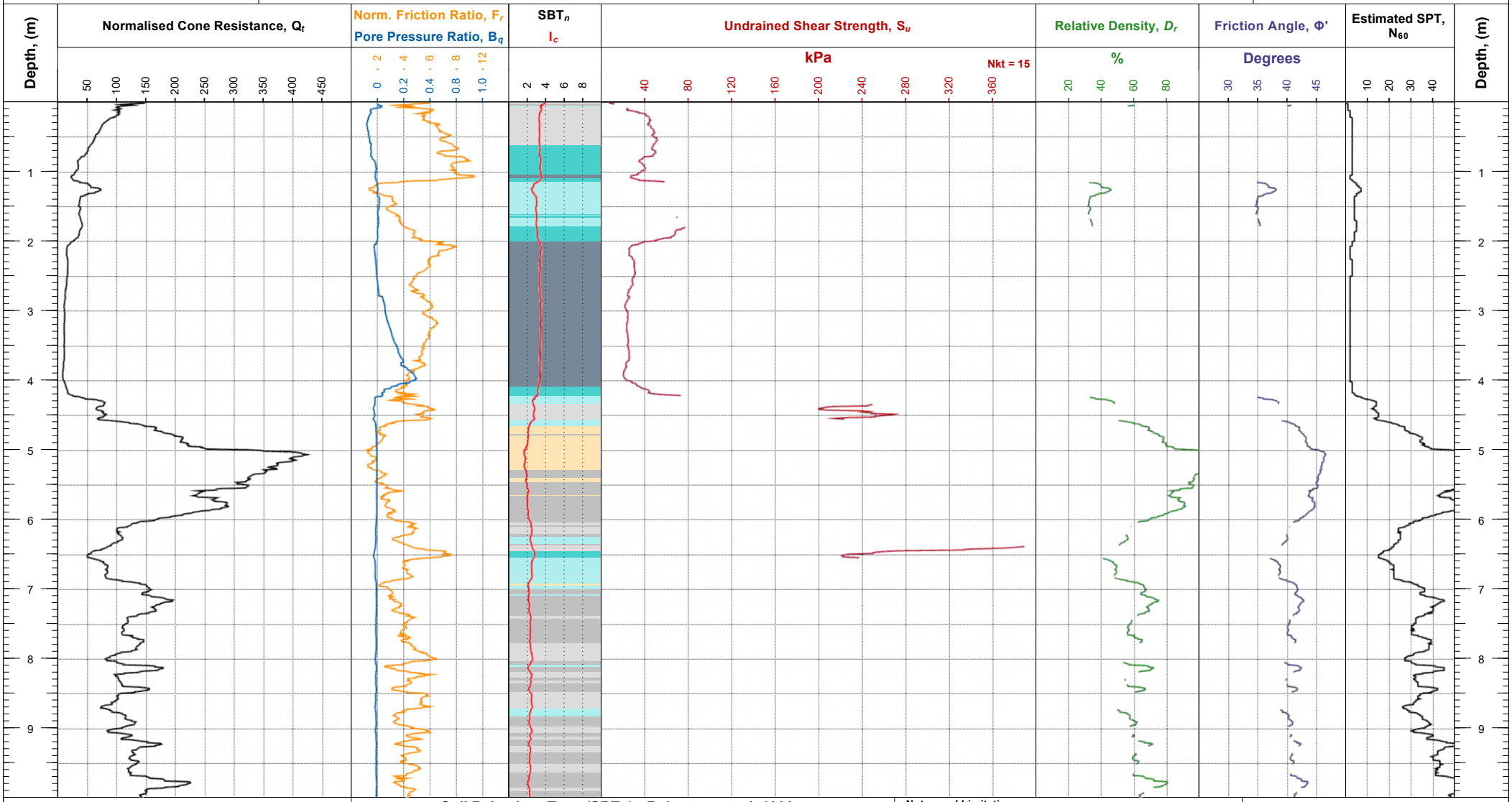
G.I. Job Ref: 190560

Test Date: 16/09/2019

MOTT MACDONALD

CONE PENETRATION TEST (CPT) PARAMETER LOG

GROUND INVESTIGATION



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd.

Soil Behaviour Type (SBTn) - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes and Limitations:
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

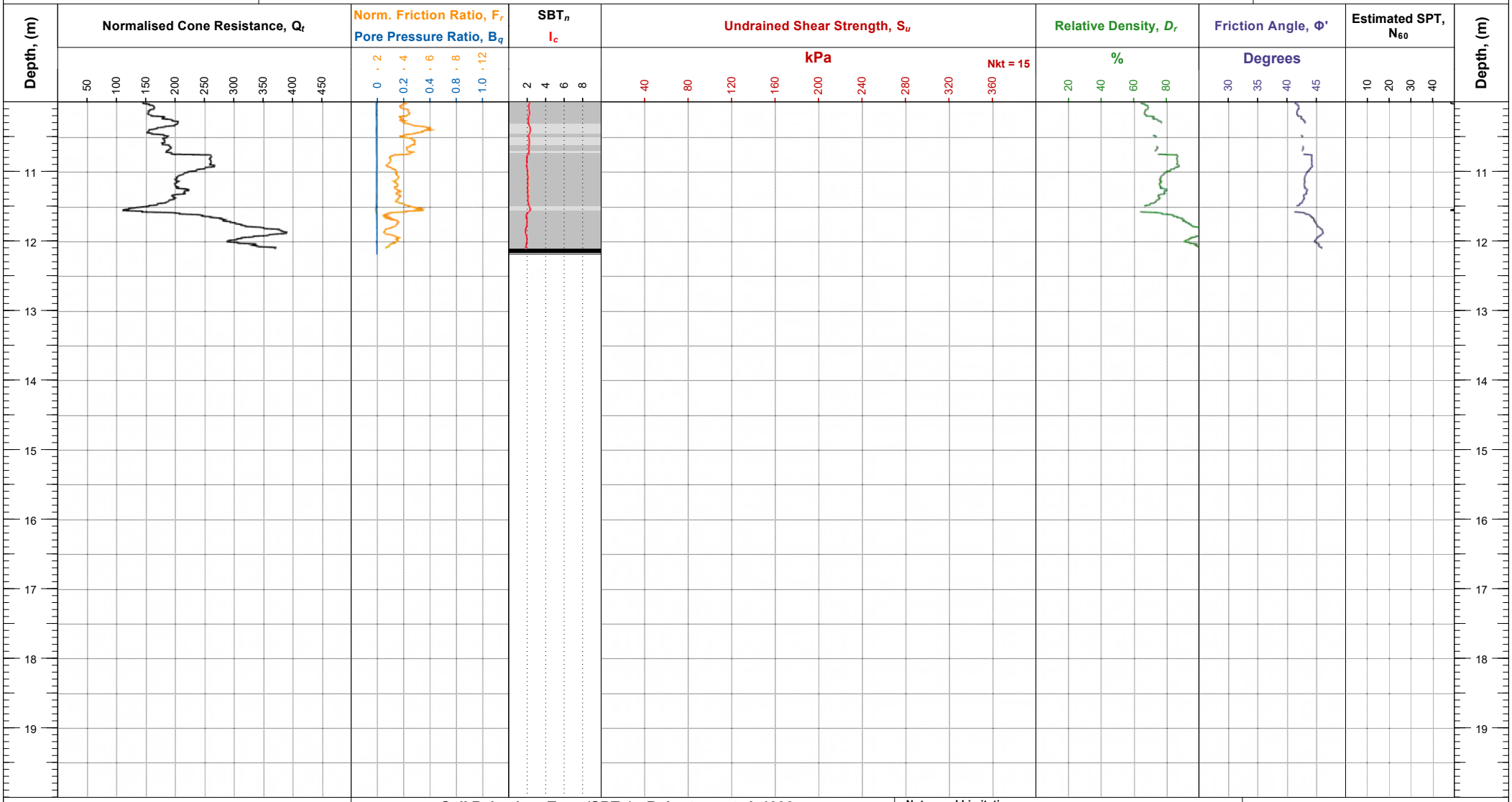
Client Job Ref:

CPT Number: CPT-01A

G.I. Job Ref: 190560

Test Date: 16/09/2019

CONE PENETRATION TEST (CPT) PARAMETER LOG



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd.

Soil Behaviour Type (SBTn) - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes and Limitations:
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Job Ref:

CPT Number: CPT-01A

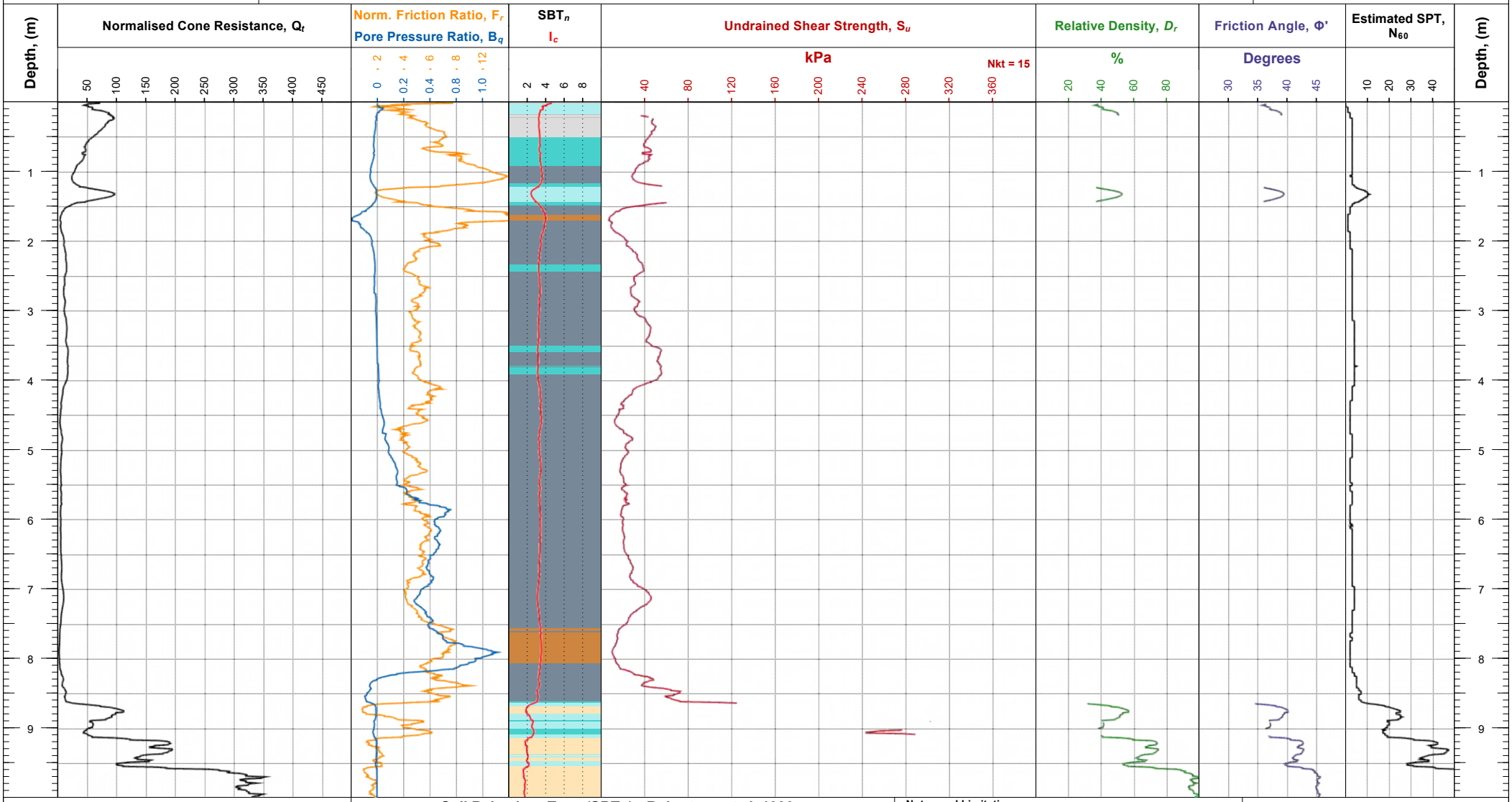
G.I. Job Ref: 190560

Test Date: 16/09/2019

MOTT MACDONALD

CONE PENETRATION TEST (CPT) PARAMETER LOG

GROUND INVESTIGATION



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd.

Soil Behaviour Type (SBTn) - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

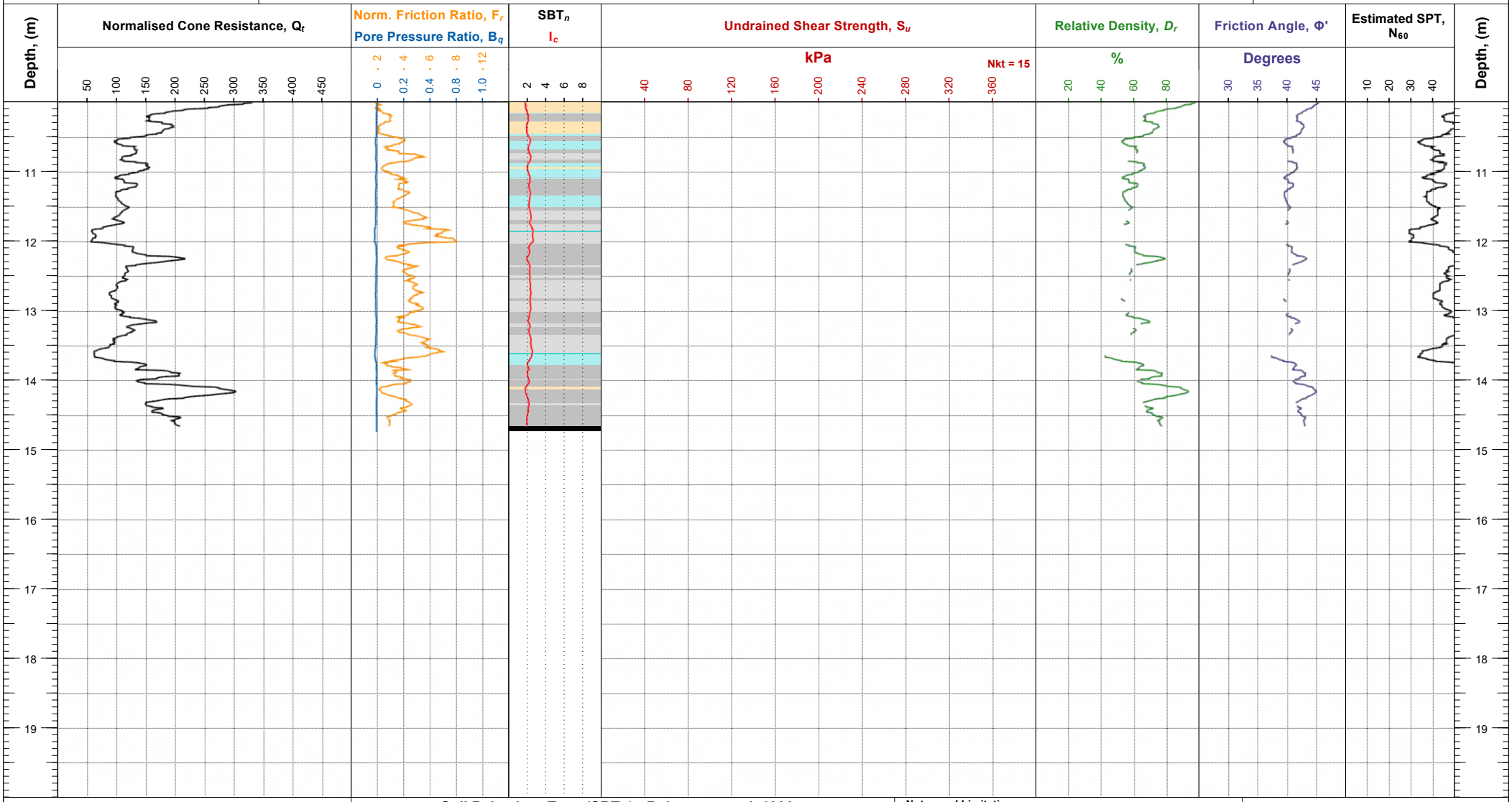
Notes and Limitations:
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Job Ref:	
CPT Number:	**CPT-02**
G.I. Job Ref:	**190560**
Test Date:	**16/09/2019**

MOTT MACDONALD

CONE PENETRATION TEST (CPT) PARAMETER LOG

GROUND INVESTIGATION



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd.

Soil Behaviour Type (SBTn) - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes and Limitations:
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

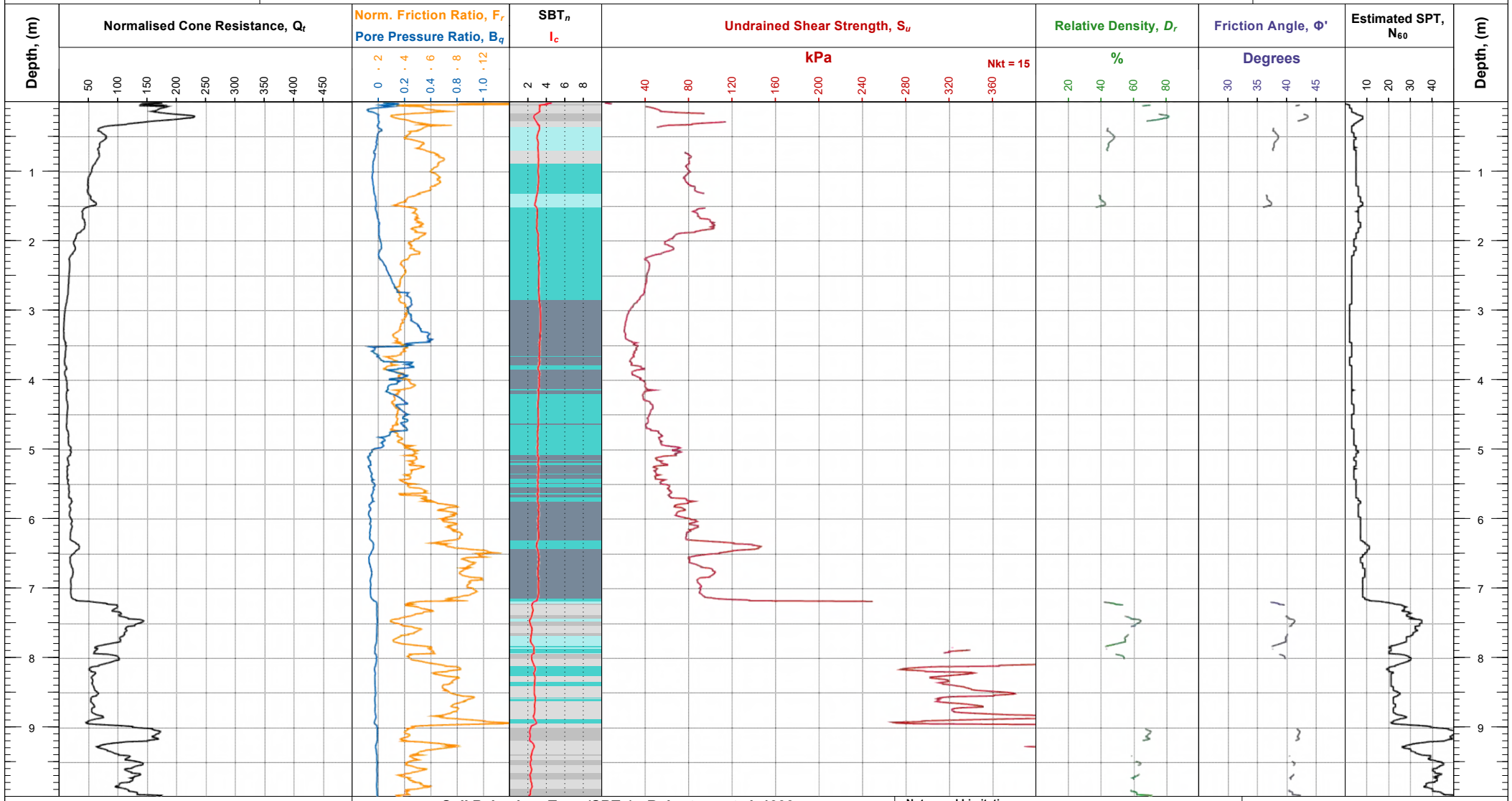
Client Job Ref:

CPT Number: CPT-02

G.I. Job Ref: 190560

Test Date: 16/09/2019

CONE PENETRATION TEST (CPT) PARAMETER LOG



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd.

Soil Behaviour Type (SBTn) - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes and Limitations:
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

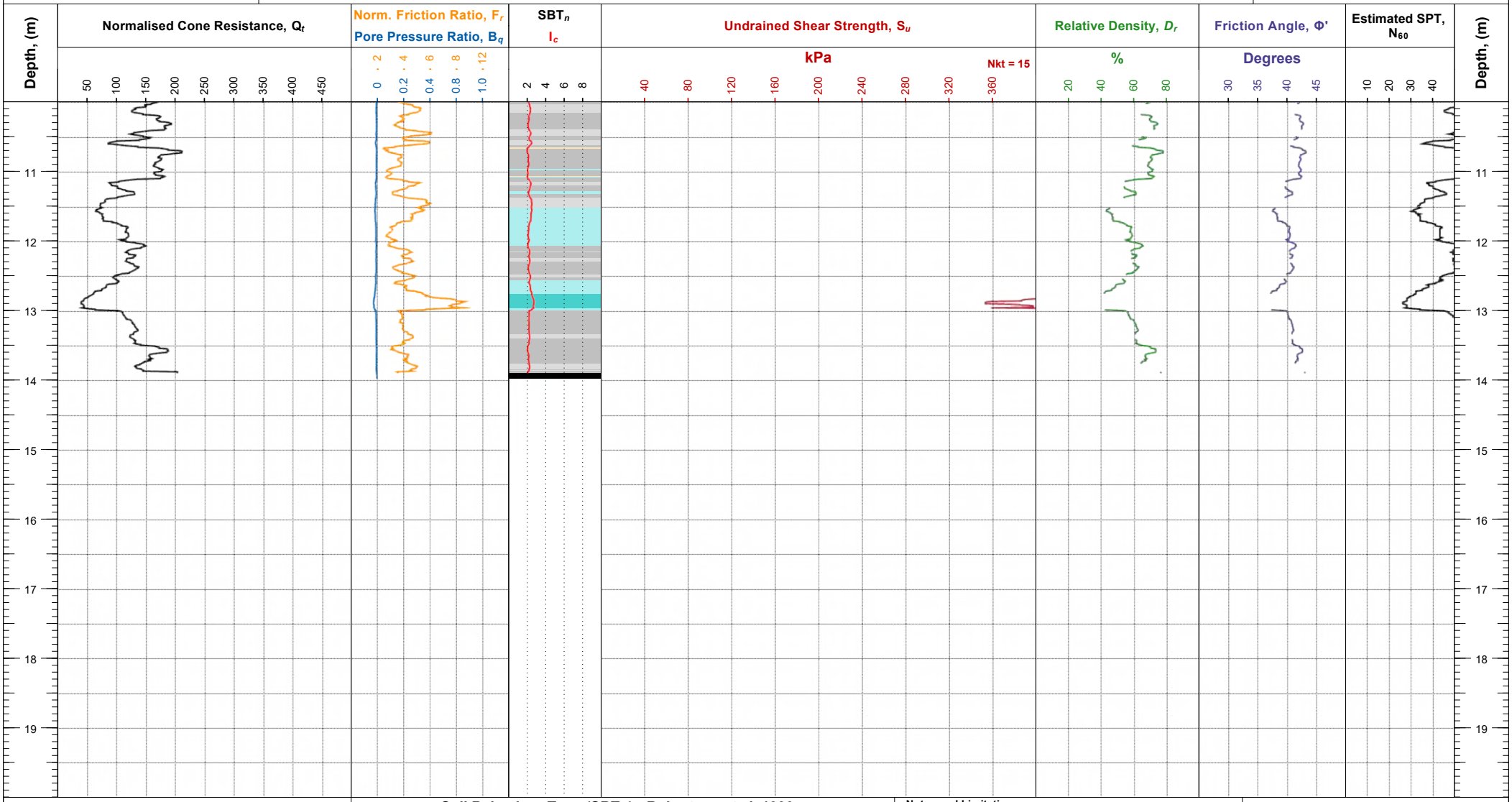
Client Job Ref:

CPT Number: CPT-03

G.I. Job Ref: 190560

Test Date: 16/09/2019

CONE PENETRATION TEST (CPT) PARAMETER LOG



Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

Contractor: Ground Investigation Ltd.

Soil Behaviour Type (SBTn) - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine-grained	6	Sands: clean sands to silty sands
2	Clay - organic soil	7	Dense sand to gravelly sand
3	Clays: clay to silty clay	8	Stiff sand to clayey sand
4	Silt mixtures: clayey silt & silty clay	9	Stiff fine-grained

Notes and Limitations:
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Job Ref:

CPT Number: CPT-03

G.I. Job Ref: 190560

Test Date: 16/09/2019

CPT ZEROS AND DRIFT RESULTS

MOTT MACDONALD

CPT ZEROS AND DRIFT

Argent Lane to Dairy Flat Highway Pine Valley Road

GROUND INVESTIGATION

G.I. Ref: 190560

Cone Reference	CPT Name	Push Number	Tip Resistance			Local Friction			Pore Pressure		
			Initial (MPa)	Final (MPa)	Difference (%)	Initial (MPa)	Final (MPa)	Difference (%)	Initial (MPa)	Final (MPa)	Difference (%)
MKJ167	CPT-01	1	8.837	8.837	0.00	0.129	0.132	-0.18	1.489	1.487	0.08
MKJ167	CPT-01A	1	8.910	8.801	0.22	0.131	0.132	-0.07	1.487	1.472	0.61
MKJ167	CPT-02	1	8.936	8.822	0.23	0.131	0.134	-0.19	1.487	1.486	0.06
MKJ167	CPT-03	1	8.754	8.848	-0.19	0.132	0.131	0.06	1.491	1.489	0.07

Client: Mott MacDonald

Project: Argent Lane to Dairy Flat Highway Pine Valley Road

Location: Silverdale, Auckland

Engineer: Jared Jiang

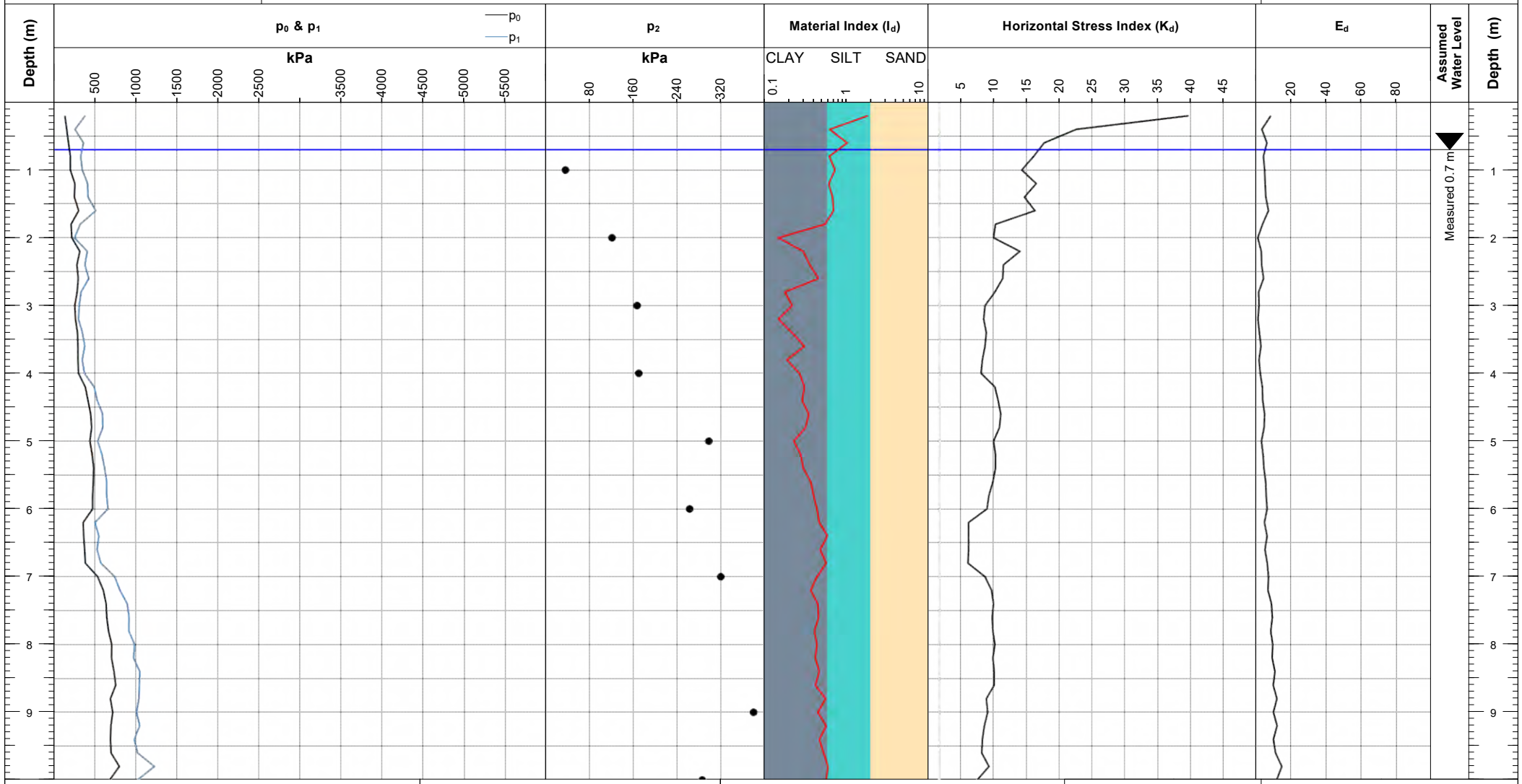
NOTE: Percentage Zero Difference calculated following ASTM D5778-12. Green indicates a difference between -1% and 1%; yellow shows either -1% to -2% or 1% to 2%; red shows below -2% or over 2%

MOTT MACDONALD

GROUND INVESTIGATION

FLAT DILATOMETER TEST (DMT) LOG

FLAT DILATOMETER TEST (DMT) LOG



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Blade Reference: N/A
Diaphragm Thickness: 0.25 mm
A-Reading Calibration: 29 kPa
B-Reading Calibration: 6 kPa

NZTM2000 N,E (m): 5945714.97, 1748050.94
WGS84, (deg): -36.622611, 174.655727
Location Method: Handheld GPS
Surveyor: N/A

Elevation (m): Unknown
Date of Test: 16/09/2019
Depth (m): 14.00
Pre-Drill (m): 0.00

Termination Reason: Maximum Nominal Pressure

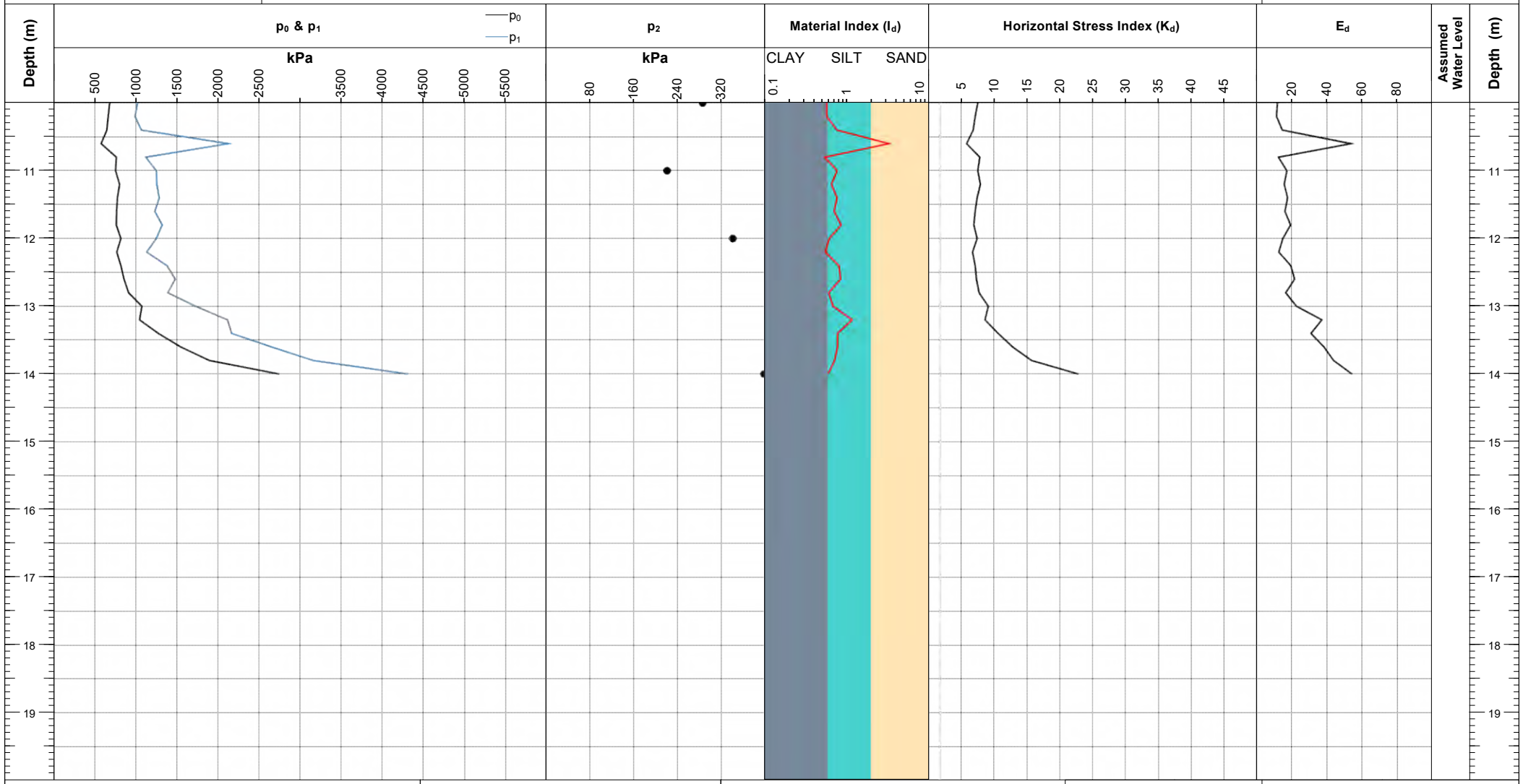
Client Job Ref:

DPSH Number: SDMT-01

G.I. Job Ref: 190560

Remarks:

FLAT DILATOMETER TEST (DMT) LOG



Client: Mott MacDonald	**Operator:** Carlos Prieto	**NZTM2000 N,E (m):** 5945714.97, 1748050.94	**Elevation (m):** Unknown	**Client Job Ref:**
Project: Argent Lane to Dairy Flat Highway Pine Valley Road	**Blade Reference:** N/A	**WGS84, (deg):** -36.622611, 174.655727	**Date of Test:** 16/09/2019	**DPSH Number:** SDMT-01
Location: Silverdale, Auckland	**Diaphragm Thickness:** 0.25 mm	**Location Method:** Handheld GPS	**Depth (m):** 14.00	
Engineer: Jared Jiang	**A-Reading Calibration:** 29 kPa	**Surveyor:** N/A	**Pre-Drill (m):** 0.00	
Contractor: Ground Investigation Ltd. www.g-i.co.nz	**B-Reading Calibration:** 6 kPa	**Termination Reason:** Maximum Nominal Pressure		**G.I. Job Ref:** 190560

Remarks:

FLAT DILATOMETER TEST (DMT) PARAMETER LOG

FLAT DILATOMETER TEST (DMT) PARAMETER LOG

Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Blade Reference: N/A
Diaphragm Thickness: 0.25 mm
A-Reading Calibration: 29 kPa
B-Reading Calibration: 6 kPa

NZTM2000 N,E (m): 5945714.97, 1748050.94
WGS84, (deg): -36.622611, 174.655727
Location Method: Handheld GPS
Surveyor: N/A

Elevation (m): Unknown
Date of Test: 16/09/2019
Depth (m): 14.00
Pre-Drill (m): 0.00

Termination Reason: Maximum Nominal Pressure

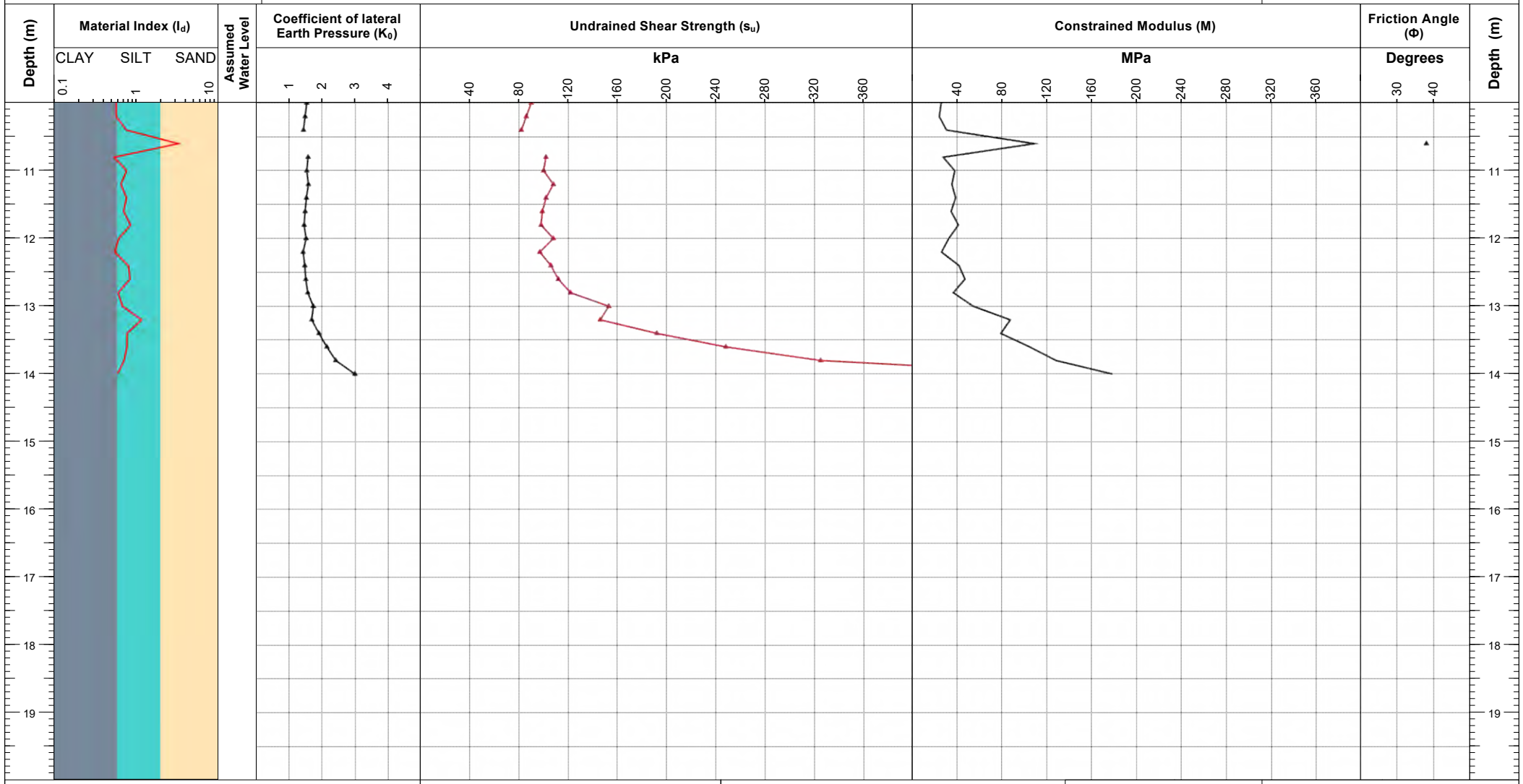
Client Job Ref:

DPSH Number: SDMT-01

G.I. Job Ref: 190560

Remarks:

FLAT DILATOMETER TEST (DMT) PARAMETER LOG



Client: Mott MacDonald
Project: Argent Lane to Dairy Flat Highway Pine Valley Road
Location: Silverdale, Auckland
Engineer: Jared Jiang
Contractor: Ground Investigation Ltd. www.g-i.co.nz

Operator: Carlos Prieto
Blade Reference: N/A
Diaphragm Thickness: 0.25 mm
A-Reading Calibration: 29 kPa
B-Reading Calibration: 6 kPa

NZTM2000 N,E (m): 5945714.97, 1748050.94
WGS84, (deg): -36.622611, 174.655727
Location Method: Handheld GPS
Surveyor: N/A

Elevation (m): Unknown
Date of Test: 16/09/2019
Depth (m): 14.00
Pre-Drill (m): 0.00

Termination Reason: Maximum Nominal Pressure

Client Job Ref:

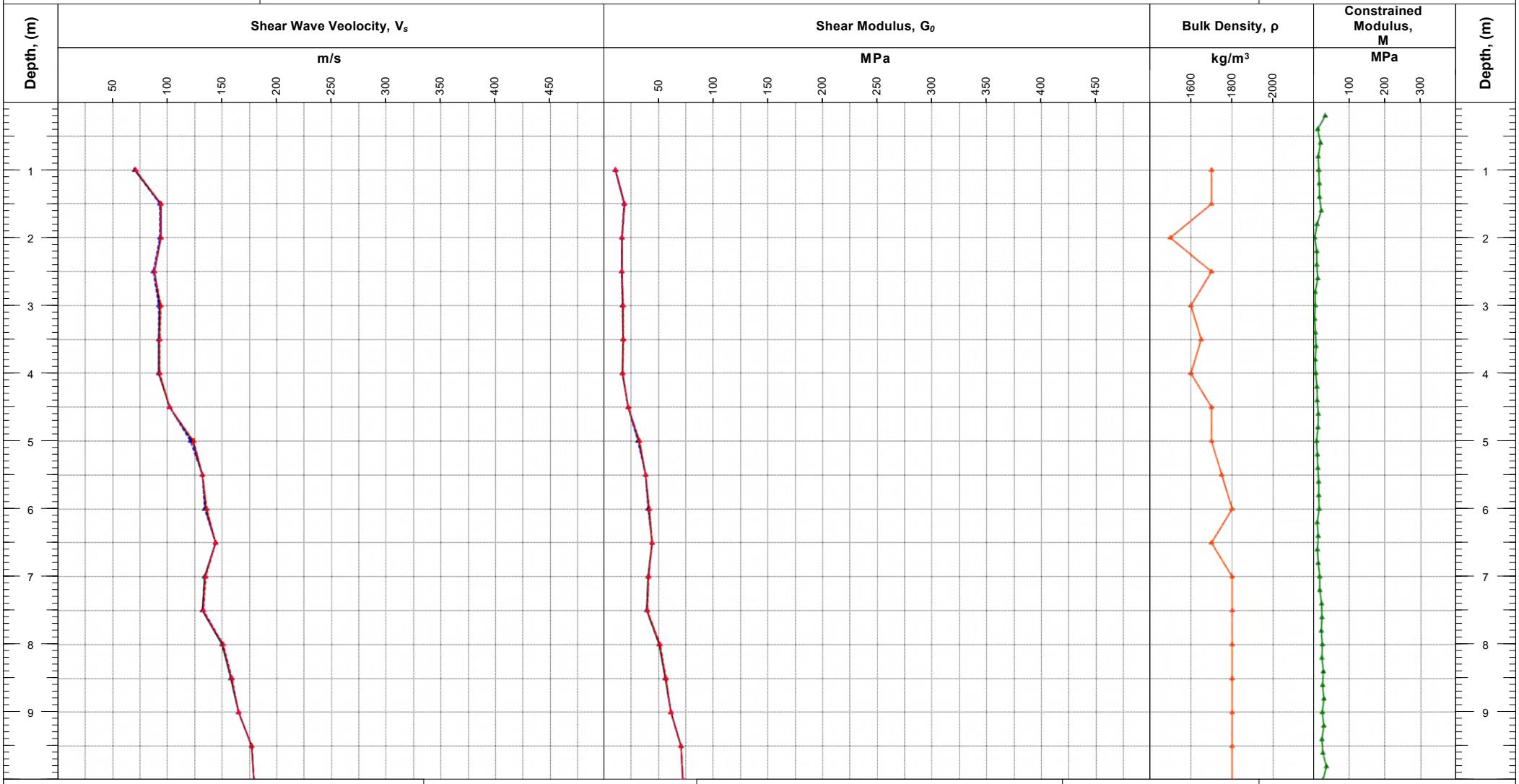
DPSH Number: SDMT-01

G.I. Job Ref: 190560

Remarks:

FLAT DILATOMETER TEST (DMT) SEISMIC LOG

FLAT DILATOMETER TEST (DMT) SEISMIC LOG



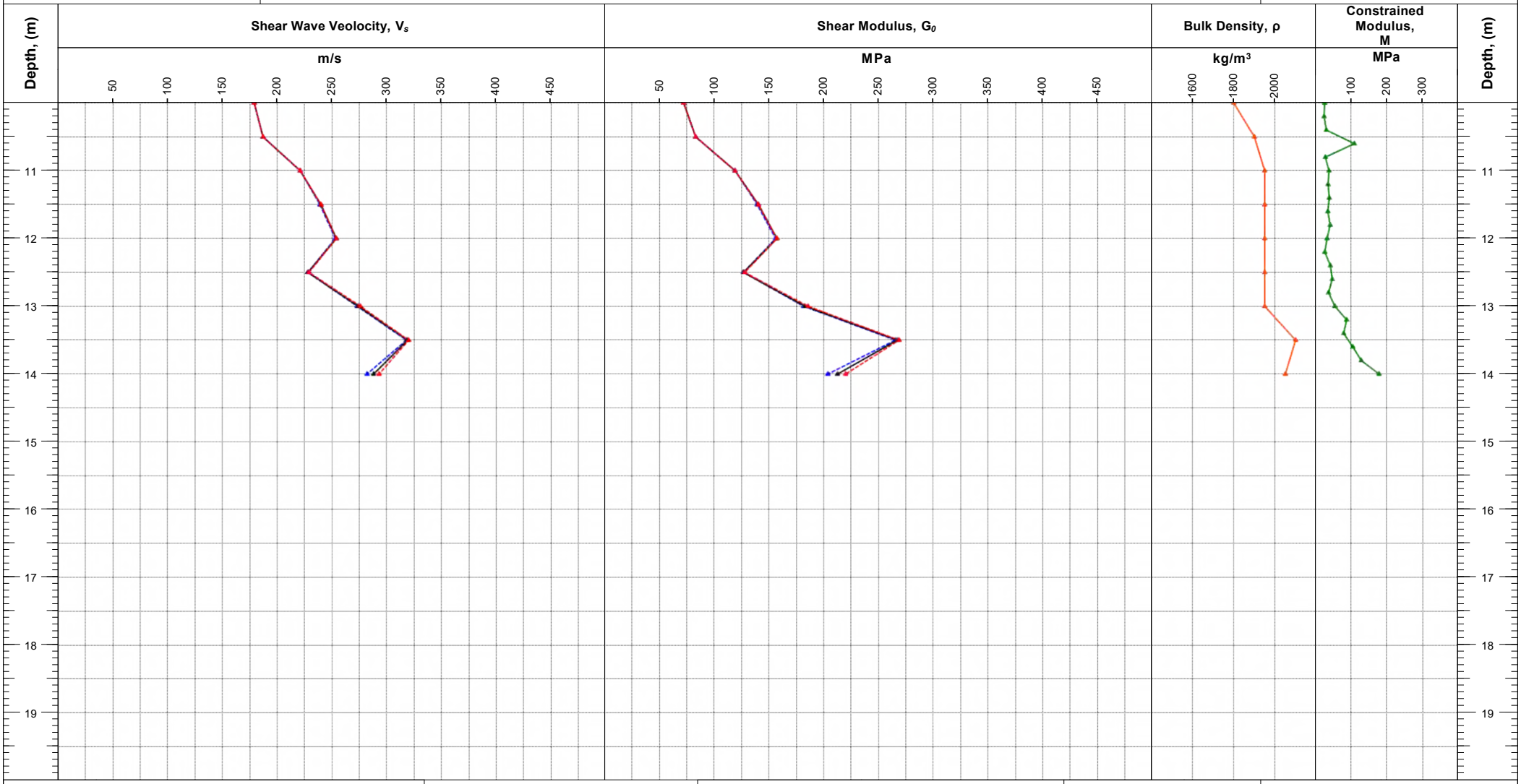
Client: Mott MacDonald	Estimated from DMT	**NZTM2000 N,E (m):** 5945714.97, 1748050.94	**Elevation (m):** Unknown	**Client Job Ref:**
Project: Argent Lane to Dairy Flat Highway Pine Valley Road	Measured Lower Bound	**WGS84, (deg):** 174.655727, -36.622611	**Date of Test:** 16/09/2019	**Test Number:** SDMT-01
Location: Silverdale, Auckland	Measured Average Value	**Location Method:** Handheld GPS	**Depth (m):** 14.00	
Engineer: Jared Jiang	Measured Upper Bound	**Source Type:** Wooden Block	**Offset (m):** 1.40	
Contractor: Ground Investigation Ltd. www.g-i.co.nz	ρ for G_0 Calculation	**Termination Reason:** Maximum Nominal Pressure		**G.I. Job Ref:** 190560

Remarks:

MOTT MACDONALD

FLAT DILATOMETER TEST (DMT) SEISMIC LOG

GROUND INVESTIGATION



Client: Mott MacDonald	Estimated from DMT	**NZTM2000 N,E (m):** 5945714.97, 1748050.94	**Elevation (m):** Unknown	**Client Job Ref:**
Project: Argent Lane to Dairy Flat Highway Pine Valley Road	Measured Lower Bound	**WGS84, (deg):** 174.655727, -36.622611	**Date of Test:** 16/09/2019	**Test Number:** SDMT-01
Location: Silverdale, Auckland	Measured Average Value	**Location Method:** Handheld GPS	**Depth (m):** 14.00	
Engineer: Jared Jiang	Measured Upper Bound	**Source Type:** Wooden Block	**Offset (m):** 1.40	
Contractor: Ground Investigation Ltd. www.g-i.co.nz	ρ for G_0 Calculation	**Termination Reason:** Maximum Nominal Pressure		**G.I. Job Ref:** 190560

Remarks:

C. Lab results

Our Ref: 1100211.0.0.0/ Rep 1
Customer Ref: ---
14 October 2019

Mott MacDonald Ltd
PO Box 37525, Parnell,
Auckland 1151

Attention: Mr Jared Jiang

Dear Jared

Argent Lane, Milldale Development

Test Results

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

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:

.....
Sim Tirunahari
Soils Laboratory Manager
Approved Signatory

Authorised for Geotechnics by:

.....
Steven Anderson
Project Director

Report checked by:

.....
James Kimiangatau
Laboratory Technician
This document consists of 30 pages

14-Oct-19
t:\geotechnicsgroup\projects\1100211\issueddocuments\20191014.argent lane_milldale development.st.final.rep1.docx

GEOTECHNICS

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000296
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000296
Sample Reference	HA01
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		34.1	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000297
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000297
Sample Reference	HA01
Sample Depth	1.0m
Bottom Depth	1.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		32.9	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000298
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000298
Sample Reference	HA01
Sample Depth	2.0m
Bottom Depth	2.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		25.3	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000299
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000299
Sample Reference	HA01
Sample Depth	3.2m
Bottom Depth	4.1m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		21.4	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

GEOTECHNICS

Material Test Report

Report No: MAT:S19AK000300
Issue No: 2
This report replaces all previous issues of report no 'MAT:S19AK000300'.

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000300
Sample Reference	HA01
Sample Depth	4.1m
Bottom Depth	4.7m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		20.2	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000303
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000303
Sample Reference	HA03
Sample Depth	2.5m
Bottom Depth	3.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		42.4	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000304
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000304
Sample Reference	HA03
Sample Depth	3.0m
Bottom Depth	4.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		34.6	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000305
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000305
Sample Reference	HA03
Sample Depth	4.0m
Bottom Depth	5.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		31.0	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000306
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000306
Sample Reference	HA04
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		43.2	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000307
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000307
Sample Reference	HA04
Sample Depth	2.0m
Bottom Depth	3.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		35.2	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Our Ref: 1100211.0.0.0/Rep 1

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000308
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000308
Sample Reference	HA04
Sample Depth	3.0m
Bottom Depth	4.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		32.1	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Our Ref: 1100211.0.0.0/Rep 1

GEOTECHNICS

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000309
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000309
Sample Reference	HA04
Sample Depth	4.0m
Bottom Depth	4.7m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		43.7	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000310
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000310
Sample Reference	HA05
Sample Depth	2.5m
Bottom Depth	3.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		29.4	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000311
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000311
Sample Reference	HA05
Sample Depth	3.1m
Bottom Depth	3.9m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		30.2	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Our Ref: 1100211.0.0.0/Rep 1

GEOTECHNICS

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000312
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000312
Sample Reference	HA05
Sample Depth	3.9m
Bottom Depth	4.8m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		24.4	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000313
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000313
Sample Reference	HA06
Sample Depth	2.5m
Bottom Depth	3.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		21.6	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000314
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000314
Sample Reference	HA06
Sample Depth	3.5m
Bottom Depth	4.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		30.9	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000315
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000315
Sample Reference	HA08
Sample Depth	2.5m
Bottom Depth	3.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		34.0	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000316
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000316
Sample Reference	HA08
Sample Depth	3.5m
Bottom Depth	4.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		40.3	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000317
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000317
Sample Reference	HA08
Sample Depth	4.5m
Bottom Depth	5.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		40.3	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000318
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000318
Sample Reference	HA09
Sample Depth	1.5m
Bottom Depth	2.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		23.7	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000319
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000319
Sample Reference	HA11
Sample Depth	1.5m
Bottom Depth	2.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		32.4	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000320
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000320
Sample Reference	HA11
Sample Depth	3.5m
Bottom Depth	4.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		48.0	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Auckland
19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand

p: + 64 9 356 3510

Report No: MAT:S19AK000321
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.0000
Customer Reference No.: ---
Report Authorised By : Sim Tirunahari

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Sim Tirunahari
(Soils Laboratory Manager)
Date of Issue: 14/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19AK000321
Sample Reference	HA11
Sample Depth	4.5m
Bottom Depth	5.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		35.2	
Date Tested		14/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100211.0000**
QESTLab Work Order ID	**W19AK-0070**
Customer Project ID	---

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000291	**HA No**	01
	Reference		**Top Depth**	0.4m
	Sampled By	Others, Tested As Received	**Bottom Depth**	0.6m
	Description	clayey SILT with trace of sand, few rootlets, stiff, light yellowish brown, mottled orange-red, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	33.5
	Bulk Density	(t/m³)	1.79
	Dry Density	(t/m³)	1.34
	Final Water Content	(%)	35.0
	Swelling Strain	(%)	0.24
SHRINKAGE TEST	Initial Water Content	(%)	35.2
	Shrinkage Strain	(%)	5.4
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	3.1

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 14/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100211.0000**
QESTLab Work Order ID	**W19AK-0070**
Customer Project ID	---

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000292	**HA No**	06
	Reference		**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	0.7m
	Description	clayey SILT with trace of sand, firm to stiff, light bluish grey mixed with orange brown, mottled red-black, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	41.7
	Bulk Density	(t/m³)	1.71
	Dry Density	(t/m³)	1.21
	Final Water Content	(%)	43.8
	Swelling Strain	(%)	0.33
SHRINKAGE TEST	Initial Water Content	(%)	47.9
	Shrinkage Strain	(%)	9.5
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Minor
SHRINK - SWELL INDEX		(%)	5.4

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 14/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100211.0000**
QESTLab Work Order ID	**W19AK-0070**
Customer Project ID	---

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000293	**HA No**	09
	Reference		**Top Depth**	0.4m
	Sampled By	Others, Tested As Received	**Bottom Depth**	0.6m
	Description	clayey SILT with trace of sand, firm to stiff, light bluish grey mixed with orange brown, mottled red-black, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	51.5
	Bulk Density	(t/m³)	1.64
	Dry Density	(t/m³)	1.08
	Final Water Content	(%)	53.4
	Swelling Strain	(%)	0.24
SHRINKAGE TEST	Initial Water Content	(%)	41.3
	Shrinkage Strain	(%)	10
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	5.7

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 14/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100211.0000**
QESTLab Work Order ID	**W19AK-0070**
Customer Project ID	---

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000294	**HA No**	10
	Reference		**Top Depth**	0.4m
	Sampled By	Others, Tested As Received	**Bottom Depth**	0.6m
	Description	clayey SILT with trace of sand, firm to stiff, light bluish grey mixed with orange brown, mottled red-black, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	22.1
	Bulk Density	(t/m³)	1.92
	Dry Density	(t/m³)	1.57
	Final Water Content	(%)	23.5
	Swelling Strain	(%)	0.04
SHRINKAGE TEST	Initial Water Content	(%)	22.1
	Shrinkage Strain	(%)	0.81
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	0.5

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 14/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100211.0000**
QESTLab Work Order ID	**W19AK-0070**
Customer Project ID	---

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000295	**HA No**	11
	Reference		**Top Depth**	0.9m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.1m
	Description	clayey SILT with trace of sand, few rootlets, stiff, grey, mottled black, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	22.5
	Bulk Density	(t/m³)	1.93
	Dry Density	(t/m³)	1.58
	Final Water Content	(%)	23.3
	Swelling Strain	(%)	0.09
SHRINKAGE TEST	Initial Water Content	(%)	24.2
	Shrinkage Strain	(%)	1.6
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Minor
SHRINK - SWELL INDEX		(%)	0.9

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 14/10/2019

IANZ ACCREDITED LABORATORY

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

Our Ref: 1100211.1000.0.0/rep1
16 October 2019

Mott MacDonald Ltd
PO Box 37525, Parnell
Auckland - 1151

Attention: Jared Jiang

Dear Jared

Argent Lane, Milldale Development

Test Results

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

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:

.....
Jack Singh
Laboratory Technician

Authorised for Geotechnics by:

.....
Paul Burton
Project Director

Report checked by:

.....
Corey Papu-Gread
Christchurch Manager
Approved Signatory

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

16-Oct-19
\\ttgroup.local\corporate\geotechnicsgroup\projects\1100211\1100211.1000\workingmaterial\20191015.jasi.1100211.1000.0.0.rep1.docx

GEOTECHNICS

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000246
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000246
Sample Reference	HA02
Sample Description	SILT with minor to some clay and trace sand, brown, mottled orange. Moist, high plasticity.
Sample Depth	0.2m
Bottom Depth	0.7m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		35.3	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000247
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000247
Sample Reference	HA02
Sample Description	clayey SILT and trace sand, light brown, mottled dark brown. Moist, extremely high plasticity.
Sample Depth	0.7m
Bottom Depth	1.1m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		45.8	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000248
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000248
Sample Reference	HA03
Sample Description	SILT with minor to some clay and trace sand, light brown, mottled dark brown and orange. Moist, extremely high plasticity.
Sample Depth	0.2m
Bottom Depth	0.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		56.6	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000249
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000249
Sample Reference	HA03
Sample Description	clayey SILT with trace sand and trace rootlets, light brown mixed with orange, mottled grey. Moist, extremely high plasticity.
Sample Depth	1.0m
Bottom Depth	1.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		61.2	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000250
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000250
Sample Reference	HA04
Sample Description	SILT with some clay and trace sand, greyish brown. Moist, high plasticity.
Sample Depth	1.5m
Bottom Depth	2.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		30.4	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000251
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000251
Sample Reference	HA05
Sample Description	clayey SILT with trace sand, light brown, mottled orange and grey. Moist, extremely high plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		58.3	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000252
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000252
Sample Reference	HA05
Sample Description	clayey SILT with trace sand, light greyish brown. Moist, very high plasticity.
Sample Depth	1.5m
Bottom Depth	2.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		47.6	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000253
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000253
Sample Reference	HA06
Sample Description	clayey SILT with trace sand, brown, mottled dark brown. Moist, extremely high plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		37.5	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000254
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000254
Sample Reference	HA06
Sample Description	SILT with some clay and trace sand, brownish grey. Moist, high plasticity.
Sample Depth	1.0m
Bottom Depth	1.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		28.1	
Date Tested		23/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000255
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000255
Sample Reference	HA07
Sample Description	SILT with minor clay and minor sand and trace rootlets, grey. Moist, medium plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		26.0	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000256
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000256
Sample Reference	HA07
Sample Description	SILT with minor clay and minor sand, grey, mottled orange and brown. Moist, high plasticity.
Sample Depth	1.0m
Bottom Depth	1.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		37.0	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000257
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000257
Sample Reference	HA08
Sample Description	clayey SILT with trace sand, brown. Moist, extremely high plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		61.2	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000258
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000258
Sample Reference	HA08
Sample Description	SILT with some clay and trace sand, brownish grey. Moist. very high plasticity.
Sample Depth	1.5m
Bottom Depth	2.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		30.0	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000259
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000259
Sample Reference	HA09
Sample Description	clayey SILT with trace sand and few rootlets, grey mixed with orange and mottled black. Moist, extremely high plasticity.
Sample Depth	0.4m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		50.8	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000260
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000260
Sample Reference	HA10
Sample Description	SILT with minor clay and trace sand, grey, mottled white. Dry to moist, high plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		23.2	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000261
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000261
Sample Reference	HA10
Sample Description	clayey SILT with trace sand, greenish grey, mottled black. Moist. extremely high plasticity.
Sample Depth	1.7m
Bottom Depth	2.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		41.2	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000262
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000262
Sample Reference	HA11
Sample Description	SILT with minor clay and trace sand, dark brown. Moist, high plasticity.
Sample Depth	0.5m
Bottom Depth	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		33.7	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000263
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 15/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000263
Sample Reference	HA11
Sample Description	clayey SILT with trace sand, light bluish grey. Moist to wet, extremely high plasticity.
Sample Depth	2.5m
Bottom Depth	3.0m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		69.3	
Date Tested		24/09/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000278
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 16/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000278
Sample Reference	HA10
Sample Description	clayey SILT with minor sand and trace gravel, grey, mottled brown. Moist. Sand fine to coarse.
Sample Depth	2.0m
Bottom Depth	2.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		21.7	
Date Tested		4/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

Christchurch
45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand

p: +64 3 361 0300

Report No: MAT:S19CH000279
Issue No: 1

Material Test Report

Customer: Mott MacDonald Ltd
Address: PO Box 37525
Parnell, Auckland 1151
Project: Argent Lane, Milldale Development
Project No.: 1100211.1000.0.0
Customer Reference No.:
Report Authorised By : Corey Papu-Gread

IANZ ACCREDITED LABORATORY

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

Approved Signatory:
Corey Papu-Gread
(Christchurch Manager)
Date of Issue: 16/10/2019

Sample Details

Location	Argent Lane, Milldale Development
Geotechnics ID	S19CH000279
Sample Description	clayey SILT with some sand and trace gravel, grey,
Sample Ref: HA09	mottled white. Moist, Sand fine to coarse.
Sample Depth	2.0m
Bottom Depth	2.5m

Test Results

Description	Method	Result	Limits
Moisture Content [NZS 4402:1986 Test 2.1]			
Moisture Content (%)		19.0	
Date Tested		4/10/2019	

Comments

Results apply only to sample tested. This report may be reproduced only in full. Sampling and sample description are not covered under our scope of IANZ accreditation.

If samples have been taken, and were not destroyed during testing, they will be retained for one month from the date of this report before being discarded.

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000246		
	Reference	HA02	**Top Depth**	0.2m
	Sampled By	Others, Tested As Received	**Bottom Depth**	0.7m
	Description	SILT with minor to some clay and trace sand, brown, mottled orange. Moist, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**63**
Plastic Limit	**21**
Plasticity Index	**42**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000247		
	Reference	HA02	**Top Depth**	0.7m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.1m
	Description	clayey SILT and trace sand, light brown, mottled dark brown. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**106**
Plastic Limit	**27**
Plasticity Index	**79**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000248		
	Reference	HA03	**Top Depth**	0.2m
	Sampled By	Others, Tested As Received	**Bottom Depth**	0.5m
	Description	SILT with minor to some clay and trace sand, light brown, mottled dark brown and orange. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**100**
Plastic Limit	**35**
Plasticity Index	**65**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000249		
	Reference	HA03	**Top Depth**	1.0m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.5m
	Description	clayey SILT and trace sand and trace rootlets, light brown mixed with orange, mottled grey. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**107**
Plastic Limit	**40**
Plasticity Index	**67**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000250		
	Reference	HA04	**Top Depth**	1.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	2.0m
	Description	SILT with some clay and trace sand, greyish brown. Moist, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**70**
Plastic Limit	**27**
Plasticity Index	**43**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000251		
	Reference	HA05	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	clayey SILT with trace sand, light brown, mottled orange and grey. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**121**
Plastic Limit	**36**
Plasticity Index	**85**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000252		
	Reference	HA05	**Top Depth**	1.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	2.0m
	Description	clayey SILT with trace sand, light greyish brown. Moist, very high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**84**
Plastic Limit	**31**
Plasticity Index	**53**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000253		
	Reference	HA06	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	clayey SILT with trace sand, brown, mottled dark brown. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**134**
Plastic Limit	**27**
Plasticity Index	**107**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000254		
	Reference	HA06	**Top Depth**	1.0m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.5m
	Description	SILT with some clay and trace sand, brownish grey. Moist, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**77**
Plastic Limit	**19**
Plasticity Index	**58**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000255		
	Reference	HA07	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	SILT with minor clay and minor sand and trace rootlets, grey. Moist, medium plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**47**
Plastic Limit	**15**
Plasticity Index	**32**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000256		
	Reference	HA07	**Top Depth**	1.0m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.5m
	Description	SILT with minor clay and minor sand, grey, mottled orange and brown. Moist, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**49**
Plastic Limit	**15**
Plasticity Index	**34**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000257		
	Reference	HA08	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	clayey SILT with trace sand, brown. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**113**
Plastic Limit	**35**
Plasticity Index	**78**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000258		
	Reference	HA08	**Top Depth**	1.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	2.0m
	Description	SILT with some clay and trace sand, brownish grey. Moist. very high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**80**
Plastic Limit	**21**
Plasticity Index	**59**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000259		
	Reference	HA09	**Top Depth**	0.4m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	clayey SILT with trace sand and few rootlets, grey mixed with orange and mottled black. Moist, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**162**
Plastic Limit	**30**
Plasticity Index	**132**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000260		
	Reference	HA10	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	SILT with minor clay and trace sand, grey, mottled white. Dry to moist, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**60**
Plastic Limit	**13**
Plasticity Index	**47**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000261		
	Reference	HA10	**Top Depth**	1.7m
	Sampled By	Others, Tested As Received	**Bottom Depth**	2.0m
	Description	clayey SILT with trace sand, greenish grey, mottled black. Moist. extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**134**
Plastic Limit	**26**
Plasticity Index	**108**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000262		
	Reference	HA11	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.0m
	Description	SILT with minor clay and trace sand, dark brown. Moist, high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**55**
Plastic Limit	**24**
Plasticity Index	**31**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000263		
	Reference	HA11	**Top Depth**	2.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	3.0m
	Description	clayey SILT with trace sand, light bluish grey. Moist to wet, extremely high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**123**
Plastic Limit	**30**
Plasticity Index	**93**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

45A Parkhouse Road
Wigram
Christchurch 8042
New Zealand
p: +64 3 361 0300

Geotechnics Project Number	1100211.1000.0.0
QESTLab Work Order ID	W19CH-0032
Customer Project ID	

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

TEST DETAILS

LOCATION	**Description**	Argent Lane, Milldale Development		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19CH000264		
	Reference	HA04	**Top Depth**	1.0m
	Sampled By	Others, Tested As Received	**Bottom Depth**	1.5m
	Description	clayey SILT with trace sand, greyish brown, mottled orange. Moist, very high plasticity.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

Liquid Limit	**99**
Plastic Limit	**27**
Plasticity Index	**72**

TEST REMARKS

• The material used for testing was natural, fraction passing a 425um sieve. • Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory	Corey Papu-Gread
Date	15/10/2019

IANZ ACCREDITED LABORATORY

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

GEOTECHNICS

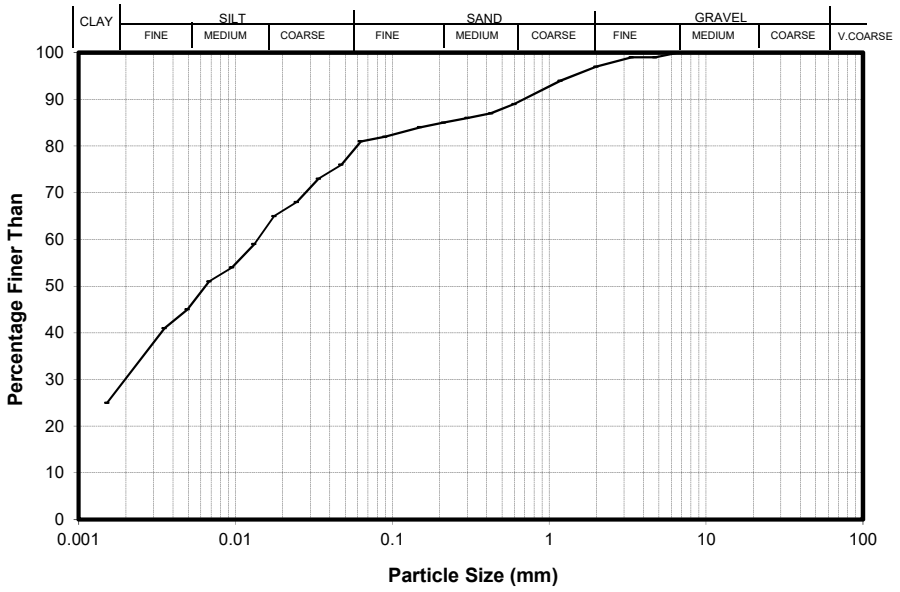
45a Parkhouse Road
Wigram
Christchurch 8042
p. +64 3 361 0300

Page 1 of 1

Your Job No.:
Our Job No.: 1100211.1000.0.0

Site : Argent Lane, Milldale Development
BH No.: HA9 Sample No.: S19CH00279 Depth (m):2.0m - 2.5m
Test Method Used : NZS 4402:1986 Test 2.8.1 Wet Sieve Test 2.8.4 Hydrometer

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing	Sieve (mm)	Total % Passing
37.5	-	0.600	89
26.5	-	0.425	87
19.0	-	0.300	86
13.2	-	0.212	85
9.50	-	0.150	84
6.70	100	0.090	82
4.75	99	0.063	81
3.35	99		
2.00	97		
1.18	94		

Equivalent Particle Diameter D (mm)	% of Particles Finer than D
0.0473	76
0.0340	73
0.0246	68
0.0176	65
0.0132	59
0.0095	54
0.0068	51
0.0049	45
0.0035	41
0.0015	25

Sample history : Natural, whole soil
Solid Density: (assumed) 2.65t/m^3
Description : clayey SILT with some sand and trace gravel, grey, mottled white. Moist, Sand fine to coarse.

Remarks : A representative sub sample was split from the original sample for wet sieve and hydrometer analysis. Material was washed over the 0.063mm sieve, wash water was collected and oven dried for hydrometer analysis. Material retained on the 0.063mm sieve was oven dried and dry sieved. The sieve data was combined with the hydrometer analysis to give a continous curve. Suspension pH 8. The classification of gravel- sand-silt-clay components are 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 : JASI Date :04/10/2019 Checked by : CXPG Date : 16/10/2019

GEOTECHNICS

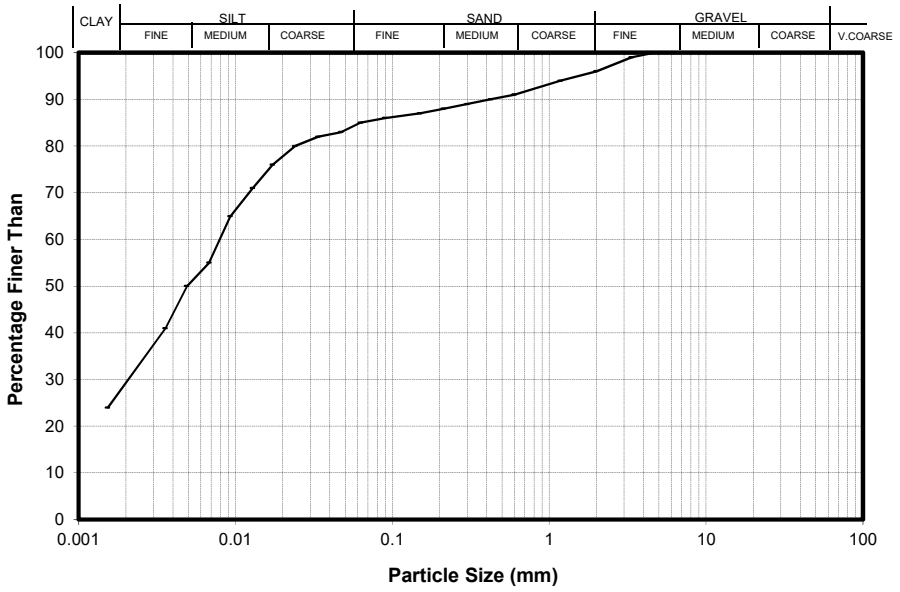
45a Parkhouse Road
Wigram
Christchurch 8042
p. +64 3 361 0300

Page 1 of 1

Your Job No.:
Our Job No.: 1100211.1000.0.0

Site : Argent Lane, Milldale Development
BH No.: HA10 Sample No.: S19CH00278 Depth (m):2.0m - 2.5m
Test Method Used : NZS 4402:1986 Test 2.8.1 Wet Sieve Test 2.8.4 Hydrometer

PARTICLE SIZE ANALYSIS



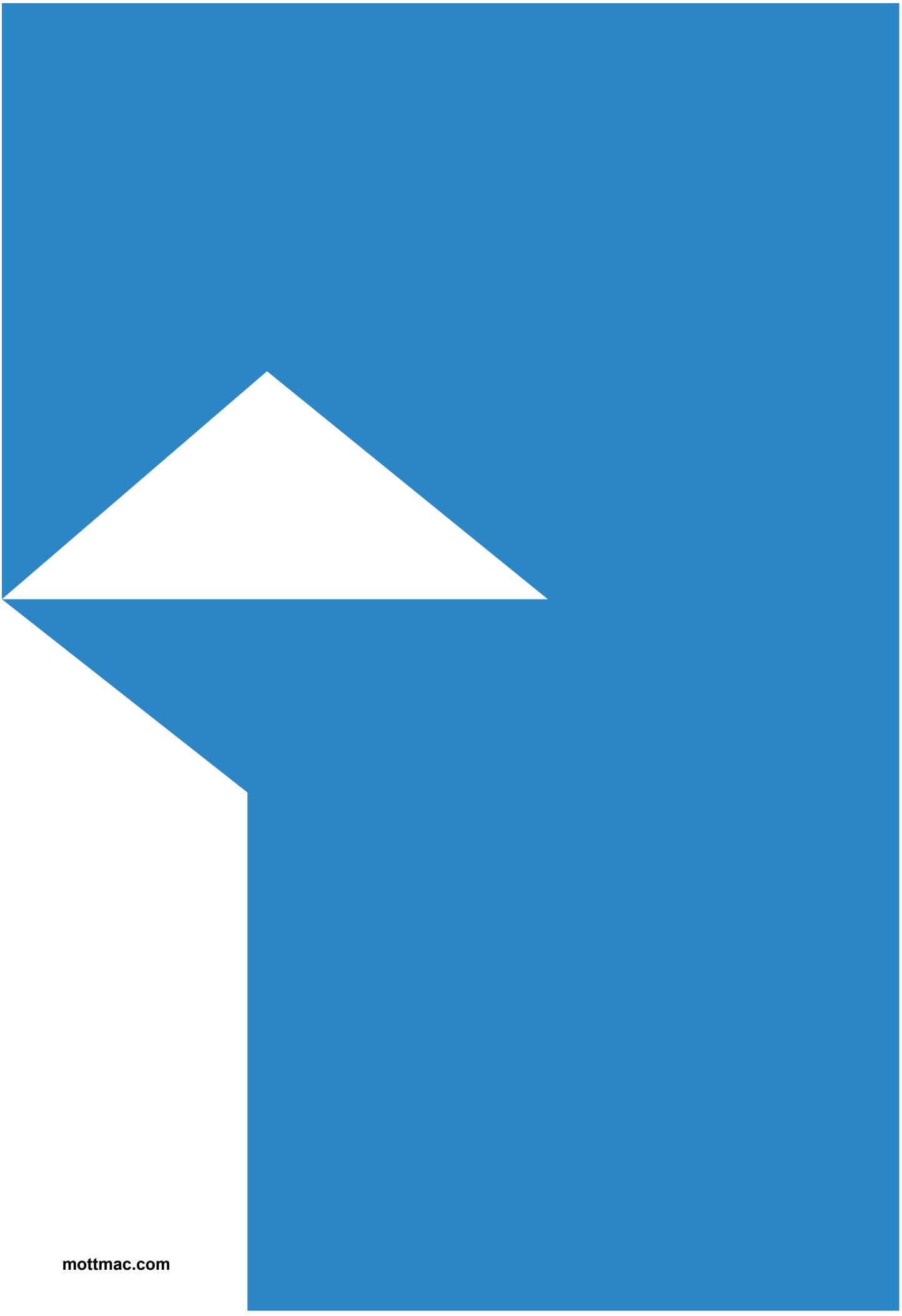
Sieve (mm)	Total % Passing	Sieve (mm)	Total % Passing
37.5	-	0.600	91
26.5	-	0.425	90
19.0	-	0.300	89
13.2	-	0.212	88
9.50	-	0.150	87
6.70	-	0.090	86
4.75	100	0.063	85
3.35	99		
2.00	96		
1.18	94		

Equivalent Particle Diameter D (mm)	% of Particles Finer than D
0.0473	83
0.0337	82
0.0240	80
0.0172	76
0.0129	71
0.0093	65
0.0068	55
0.0049	50
0.0036	41
0.0015	24

Sample history : Natural, whole soil
Solid Density: (assumed) 2.65t/m^3
Description : clayey SILT with minor sand and trace gravel, grey, mottled brown. Moist. Sand fine to coarse.

Remarks : A representative sub sample was split from the original sample for wet sieve and hydrometer analysis. Material was washed over the 0.063mm sieve, wash water was collected and oven dried for hydrometer analysis. Material retained on the 0.063mm sieve was oven dried and dry sieved. The sieve data was combined with the hydrometer analysis to give a continous curve. Suspension pH 8. The classification of gravel- sand-silt-clay components are 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 : JASI Date :04/10/2019 Checked by : CXPG Date : 16/10/2019



mottmac.com