INITIA

GEOTECHNICAL SPECIALISTS

JASON WOODYARD AND STEPHEN SMITH

301 & 303 BUCKLAND RD

GEOTECHNICAL REPORT – FOR LAND USE CHANGE

INITIA REF P-000925-1 REV 0

SEPTEMBER 2021

Contents

1. Introduction

1.1 General

This Geotechnical Interpretative Report (GIR) has been prepared to provide geotechnical advice and recommendations to support the change in land use of 301 & 303 Buckland Road, Pukekohe. This report identifies any geohazards present at the site.

It is understood that the site is proposed to be re-zoned from Future Urban Zone to Business – General Business Zone (BGBZ). This geotechnical report is intended to support the Private Plan Change Request (PPR). It provides a preliminary assessment of the ground conditions and the key geotechnical considerations that could affect likely future development based on the rezoning and anticipated development types. Further investigation and analyses will be required to support detailed design of future buildings and infrastructure on the site.

1.2 Site Description

The proposed PPR is for two neighbouring properties, located at No. 301 and 303 Buckland Rd, Buckland. The site is presented in Figure 1-1 below and on Figure 925-1-001 in Appendix A. Both sites are currently used as pastoral land and have an approximate combined area of 7.86 HA. Each property has single storey dwellings with associated sheds and garages. Topography at the site slopes gently to moderately (~5-10°) toward the northeast from up to RL 86m at the western and southern boundaries down to RL 62m along Buckland Road in the east. There is a small gully situated near the centre of 301 Buckland Road. At the back of 303 Buckland Road, to the south, the topography drops away steeply.

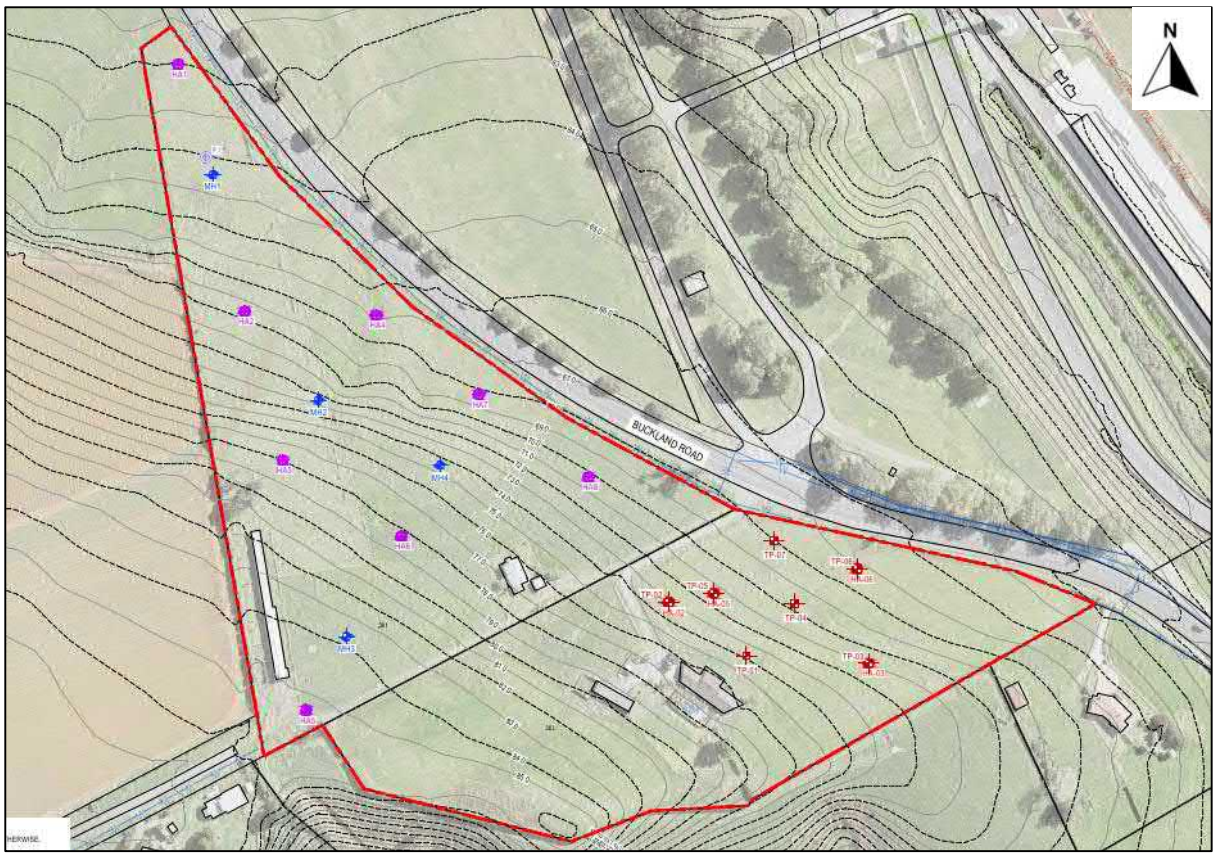

Figure 1-1: 301 – 303 Buckland Road, Pukekohe.

1.3 Proposed Development

We have not been provided any details of any future proposed development plans at the site, however we expect any new development will comprise light industrial and/or commercial buildings, similar to those located ~200m north on Manakau Road.

2. Published Geology

Based on a preliminary review of the published geological maps (see below) for the area, historical geotechnical investigation data from the New Zealand Geotechnical Database (NZGD), the sites are underlain by fine grained and coarse grained basalt and basanite rock associated with the Kerikeri Volcanic Group of the South Auckland Volcanic Field (SAVF) (Red in Figure 2-1 below). Based on the investigation data available for the sites and our knowledge of the local geology, the rock is overlain by a thick mantle of weathered ash / tuff and gravelly soils also from the AVF (light pink). Holocene river deposits (off white) are located directly north-east of the site.

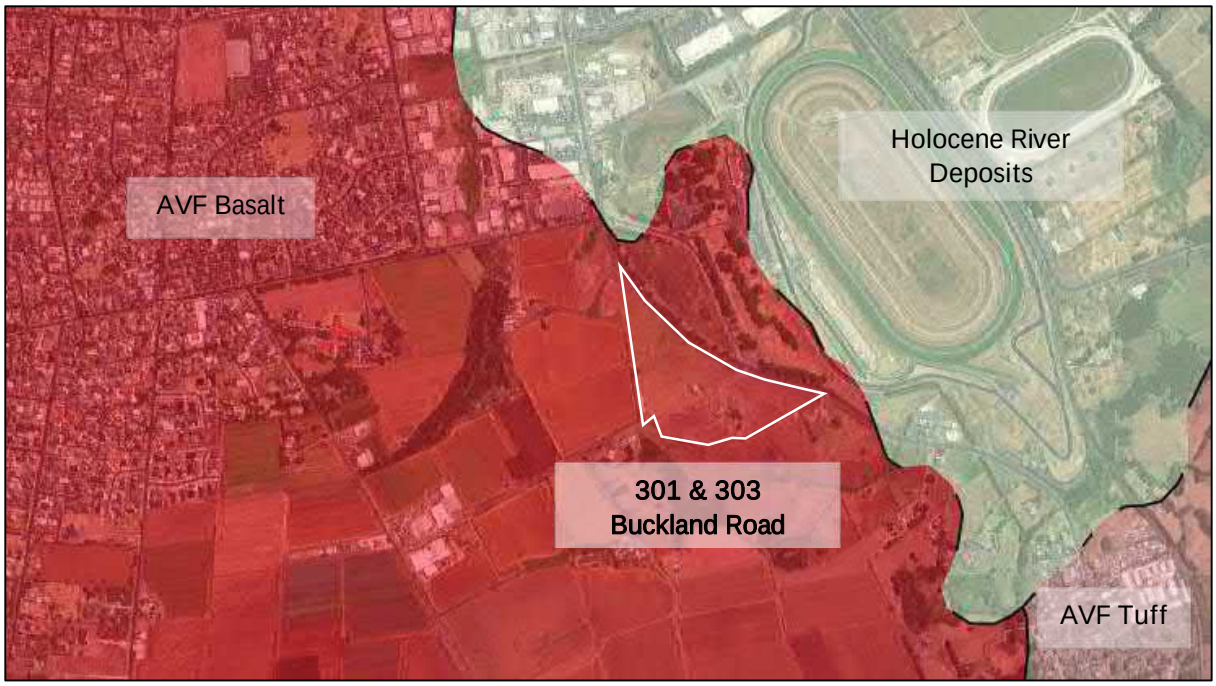

Figure 2-1: Geology of the Buckland area[1]

[1] GNS Science. New Zealand Geology Web Map. 1:250K. https://data.gns.cri.nz/geology/

3. Geotechnical Investigations

3.1 Historical Investigations

A historical investigation has been carried out at each of the properties and referenced as part of this report. The first by Lander Geotechnical at 301 Buckland Road in January 2018 comprising:

- 9 Hand Auger Boreholes (HA) to depths up to 5.0m;
- 4 Machine Boreholes (MH) to a depth of 10.5m; and
- 1 Falling Head Percolation Test to 2.5m.

The results of this investigation are outlined in the Lander Geotechnical Investigation Report dated 23 July 2018[2].

Subsequently, an investigation was carried out by Initia at 303 Buckland Road on 16 and 23 October 2020. The investigation consisted of 7 No. Test Pits and 4 No. Hand Auger Boreholes to depths of between 2 m to 5 m. The results of this investigation are outlined in the Initia Geotechnical Assessment dated December 2020[3].

A summary of the investigations is presented in Table 3-1 and Table 3-2 below. All investigation locations are presented on Figure 925-1-001 in Appendix A, and investigation logs are presented in Appendix B and Appendix C.

Table 3-1 - Summary of Lander Investigations

Investigation ID	Investigation Type	Coordinates (NZTM)[1]		Ground Surface Elevation[2] (m RL)	Termination Depth (m BGL)
		Easting (mE)	Northing (mN)		
HA01	Hand Auger Borehole	1769638	5879390	62.0	5.0
HA02	Hand Auger Borehole	1769669	5879265	69.8	5.0
HA03	Hand Auger Borehole	1769687	5879189	78.0	5.0
HA04	Hand Auger Borehole	1769736	5879261	67.0	0.5
HA05	Hand Auger Borehole	1769697	5879061	85.3	5.0
HA06	Hand Auger Borehole	1769747	5879149	78.2	5.0
HA07	Hand Auger Borehole	1769788	5879220	68.3	5.0
HA08	Hand Auger Borehole	1769843	5879177	70.3	5.0
P1	Falling Head Percolation Test	1769651	5879343	64.1	2.5
MH01	Machine Borehole	1769654	5879334	64.5	10.5
MH02	Machine Borehole	1769706	5879218	72.5	10.5
MH03	Machine Borehole	1769718	5879099	83.7	10.5
MH04	Machine Borehole	1769767	5879185	74.5	10.5

Note 1: Co-ordinate system – NZTM 2000. Test location coordinates are determined via hand-held GPS Survey, accuracy +/- 0.5m).
Note 2: Datum – AUCKHT 1946. Ground surface elevations are based on interpretation from Auckland Council Contours and are expected to be accurate + or – 0.5m.

[2] Lander Geotechnical. Geotechnical Investigation Report. 301 Buckland Road, Pukekohe. Ref: J00858. Dated 23 July 2018.
[3] Initia. Geotechnical Assessment. Proposed Industrial Yard Development – 303 Buckland Road, Pukekohe. Ref: P-000925 Rev 2. Dated December 2020.

Table 3-2 - Summary of Initia Investigations

Investigation ID	Investigation Type	Coordinates (NZTM)[1]		Ground Surface Elevation[2] (m RL)	Termination Depth (m BGL)
		Easting (mE)	Northing (mN)		
TP-01	Test Pit	1769921	5879085	74.0	2.6
TP-02	Test Pit	1769882	5879113	73.0	2.0
TP-03	Test Pit	1769983	5879080	71.0	5.0
TP-04	Test Pit	1769946	5879111	69.5	5.0
TP-05	Test Pit	1769905	5879117	71.5	5.0
TP-06	Test Pit	1769978	5879128	67.0	2.0
TP-07	Test Pit	1769936	5879143	68.0	2.0
HA-02	Hand Auger Borehole	1769882	5879113	73.0	4.0
HA-03	Hand Auger Borehole	1769983	5879080	71.0	5.0
HA-05	Hand Auger Borehole	1769905	5879117	71.5	5.0
HA-06	Hand Auger Borehole	1769978	5879128	67.0	4.0

Note 1: Co-ordinate system – NZTM 2000. Test location coordinates are determined via hand-held GPS Survey, accuracy +/- 0.5m).
Note 2: Datum – AUCKHT 1946. Ground surface elevations are based on interpretation from Auckland Council Contours and are expected to be accurate + or – 0.5m.

3.2 Laboratory Testing

The Lander investigation carried out laboratory testing on two samples taken from HA01 and HA05. Initia testing comprised bulk soil samples taken from TP-03, TP-04 and TP-05.

Table 3-3 and Table 3-4 below summarises the results from the laboratory testing undertaken at the site, test results are attached in Appendix D and Appendix E.

Table 3-3: Lander Geotechnical Laboratory Testing Summary

Sample Location	Depth interval (mBGL)	Liquid Limit	Plastic limit	Linear Shrinkage	Liquidity Index	Plasticity Index	Moisture Content (%)
HA01	1.5 – 2.0	104	74	21	0.2	30	79.1
HA05	1.5 – 2.1	114	80	24	-0.2	34	72.2

Table 3-4: Initia Laboratory Testing Summary

Sample Location	Depth interval (mBGL)	Allophane Content	Max Dry Density (t/m3)	Natural water content (%)	Optimum water content (%)	Liquid Limit	Plastic limit	Plasticity Index
TP-05	0.0 – 0.5	<5%		44.9				
TP-05	1.0 – 1.5	<5%	0.99	64.5	60.0			
TP-03	3.0 – 4.0		1.16	65.3	45.0			
TP-04	3.5 - 4.5			84.1		111	82	29
TP-05	3.5 – 4.5			79.9		93	70	23

4. Subsurface Conditions

4.1 General

The interpreted geotechnical model for the site is outlined below. The geotechnical investigations undertaken, and our understanding of the site geology, forms the basis of the recommendations and opinions presented within this report. The nature and continuity of the subsoils away from the investigation locations are inferred and it must be appreciated that the actual conditions may vary from the assumed model.

4.2 Soil Units

Based on a review of available geotechnical information the underlying geological conditions generally comprise:

- Topsoil;
- Non engineered fill;
- South Auckland Volcanic Field Ash

A summary of the geotechnical units identified beneath the site is presented in Table 4-1 below.

4.2.1 Topsoil

Topsoil was encountered at all investigation locations, with a thickness between 100 mm and 500 mm

4.2.2 Fill

Localised areas of fill were encountered at the 301 Buckland Road property in HA05, HA06, HA07 and P1 during the Lander investigation. The fill was typically a brown and orange/brown clayey silt, very stiff and moist, with a low plasticity. The fill was typically between 100mm and 600mm thick.

The fill is likely reworked ground from historical horticultural activities at the site.

4.2.3 South Auckland Volcanic Field

Weathered ash deposits from the South Auckland Volcanic Field were encountered in all the investigations. This typically comprised an orange/brown, yellow/brown or red/brown clayey silt, with low to high plasticity. Shear strengths ranged between 80 and 205+ kPa indicating stiff to hard soil, and SPT 'N' values were typically around 5 but ranged between 1 and 19.

Localised areas of firm and sensitive soils were encountered, typically between 4.5m and 9.0m within the machine boreholes. These shear strength readings and sensitivity observations may have been affected by drilling processes, therefore may be conservative.

Lab testing of the upper soils (TP-05, 0.0 – 1.5 m bgl) resulted in an allophane contents of less than 5%, however, testing of the deeper soils (TP-04 & TP-05, 3.5 – 4.5 m bgl) gave high liquid and plastic limits, indicating the potential for high allophane content.

Table 4-1: Summary of Geological Units.

Geological Unit	Soil Type	Depth to Top of Unit (m, BEGL)	Typical Layer Thickness (m)	In Situ Test Strength Parameters range [typical value]	
				Undrained Shear Strength, Su (kPa);	SPT – N Values [Blows/300]
Topsoil	SILT, dark brown, firm, non-plastic, moist.	0.0	0.1 -0.5	N/A	-
Fill	Clayey SILT, brown mottled orange/brown. Very stiff, moist, low plasticity.	0.1	0.1 – 0.5	120	-
South Auckland Volcanic Field (Ash)	Clayey SILT, orange/brown, yellow/brown & red/brown, stiff to hard, low to high plasticity, moist.	0.2 - 0.6	2.3 – 4.9+	97-205+ [130]	1 – 19 [5]

4.3 Groundwater

Standing groundwater levels of between 2.5m and 4.2m were recorded in the hand auger boreholes during the Lander fieldwork at 301 Buckland Road. Water levels were recorded in the machine drilled boreholes eight days following the completion of the drilling programme The following table summarises the results.

Groundwater observed is likely to be perched and is unlikely to affect any construction activities.

BH No.	Date	Depth (BEGL)
MH01	1/2/18	3.65
MH02	1/2/18	3.0
MH03	1/2/18	4.73
MH04	1/2/18	Standpipe damaged
HA01	22/1/18	3.7
HA02	22/1/18	4.2
HA03	22/1/18	4.1
HA04	22/1/18	Groundwater not encountered
HA05	22/1/18	Groundwater not encountered
HA06	22/1/18	Groundwater not encountered
HA07	22/1/18	2.5
HA08	22/1/18	Groundwater not encountered

Groundwater was not encountered during the Initia investigation at 303 Buckland Road, which extended to depths of up to 5.0 m below existing ground level. We expect groundwater levels to vary seasonally with rainfall.

5. Geotechnical Considerations

The following geotechnical considerations are considered pertinent to the proposed re-zoning of the land and any subsequent development plans at the site. The geotechnical assessment below is a high level assessment of identified potential geotechnical constraints to the suitability of a land use change at the site from Future Urban to Business – General Business Zone (BGBZ), with the anticipated development types as discussed in Section 1.3 above. As mentioned earlier in this report, additional ground investigations and analysis will be required to support the detailed design and consenting stages of any future development at the site. The nature and continuity of the subsoils away from the site investigation locations is inferred bit it must be appreciated that actual conditions could vary from the assumed model.

The below principal Geotechnical considerations for the site are addressed in more detail in the below Section:

- Site seismicity/site subsoil class;
- Slope stability;
- Long term static settlement;
- Soil expansivity (shrink/swell);
- Foundation types for likely buildings; and
- Earthworks

5.1 Site Seismicity and Site Subsoil Class

5.1.1 Site Subsoil Class

The depth to engineering rock was not confirmed during the investigations carried out at the site, nor is there any deep geotechnical information available to confirm rock on any neighbouring sites.

In absence of a detailed site-specific seismic study, the site subsoil class has been assessed in accordance with NZS 1770.5:2004, Clause 3.1.3. The consistency of the soils beneath the site comprises stiff to hard cohesive South Auckland Volcanic Field volcanic ash. Based on boreholes approximately 800m away sourced from the New Zealand Geotechnical Database, the site is expected to be underlain by soils to at least 60m depth. On this basis, the site has been assessed as having a **site subsoil class of D – Deep soil**.

5.1.2 Design Seismic Parameters

Design peak ground acceleration and associated magnitude M_w for serviceability (SLS) and ultimate limit state (ULS) seismic design have been estimated in accordance with the MBIE Geotechnical guidelines and NZTA Bridge Manual, 3rd Edition, 3rd Amendment, using the following design assumptions:

- Design life of 50 years
- Importance Level IL2 (normal structures and structures not in other importance levels)
- Site Subsoil Class D –Deep Soil
- Annual probability of exceedance for ULS of 1 in 500 years
- Annual probability of exceedance for SLS of 1 in 25 years.

The derived design earthquake parameters to be adopted for geotechnical design and liquefaction assessment are presented in Table 5-1.

Table 5-1: Summary of design peak ground acceleration (PGA) and associated magnitude M_w

Design Seismic Parameters	Serviceability Limit State	Ultimate Limit State
$C_{0,1000}$	0.22	
Return Period Factor	0.25	1.0
Peak ground acceleration (PGA)	0.04	0.19 (1)
Effective Earthquake Magnitude M_w	5.9	6.5 (1)

Note 1: As a lower bound, the ultimate limit state effects to be designed for shall not be taken to be less than those due to a 6.5 magnitude earthquake at 20 km distance, for which a PGA coefficient of 0.19 g is derived in accordance with Bridge Manual, Table 6.3 minimum design requirements.

5.1.3 Liquefaction susceptibility

The soils underlying the site are fine grained and cohesive, comprising stiff to hard volcanic soils, and are therefore considered to have a negligible risk of liquefaction during both serviceability limit state (SLS) and ultimate limit state (ULS) seismic events. No specific design or detailing is required to address liquefaction effects.

5.2 Slope stability

Topography at the site slopes gently to moderately toward the northeast from RL 86.0m down to RL 62.0m along Buckland Road. A review of historic aerial photographs did not identify signs of deep-seated, global instability at the sites. No obvious signs of instability were noted as part of a site walkover of 303 Buckland Road by Initia in 2020. Similarly, Lander reported no obvious signs of instability at 301 Buckland Road on site during the time of their investigation in 2018. Given the gentle slopes, subsurface ground conditions and geomorphology of the site, instability of natural slopes is not considered to be a significant constraint for future development across the site generally. It is noted however, that, as discussed in Section 1.2 above, the neighbouring site to the south slopes relatively steeply down from the site boundary. These slopes appear to have some signs of instability based on a review of aerial photography. Accordingly for development immediately adjacent to the southern boundary a specific assessment of the stability of these slopes may be required, however it is not generally expected to constrain development on the subject site.

Notwithstanding, once development plans have been formalised, slope stability analyses may be required to support building consent applications where earthworks are proposed to form accessways and building platforms. Analyses will need to demonstrate that generally accepted factors of safety (e.g. those stipulated in Auckland Council Code of Practice for Land development and subdivision) can be achieved.

Given the strengths of the subsoils it is expected that required factors of safety could be demonstrated through the use of appropriate batter angles (likely to be in the order of 1 V : 2.5 H) and/or specifically designed retention or stabilisation measures.

5.3 Long term consolidation settlement

Based on the nature and strengths of the subsoils beneath the site, consolidation settlement is unlikely to constrain development on this site.

Further specific site investigation and analyses should be carried out to support building consent applications once loadings due to fill placement and/or building surcharges are known. Mitigation measures if required, could comprise:

- Specifically detailed foundations;
- Preload; or
- Specifically designed ground improvement.

5.4 Expansive soils

The site is underlain by fine grained cohesive South Auckland Volcanic Field ash. Two samples of ash tested by Lander at 301 Buckland Road[2] resulted in linear shrinkages of 21 to 24, and liquid limits between 104 and 114, indicating a high shrink/swell potential. The shrinking and swelling of surficial soils can result in foundation movement, which can distort the superstructure. If this movement occurs it typically manifests as cracking damage to foundations, rigid cladding systems and to the internal linings (ceilings and walls). Due to the nature of the damage mechanism, i.e. wetting and drying of the soils, thus tends to occur seasonally and effect only near surface soils which are subject to moisture change.

This risk of shrink/swell can be mitigated through foundation embedment and/or specific foundation detailing. Alternatively, ground improvement could be undertaken.

5.5 Foundations

The site is considered suitable for the support of typical light industrial and commercial buildings on shallow foundations embedded in AVF soils or engineered fill. A suitable foundation system would be conventional isolated strip and pad footings.

Foundations should be designed to accommodate the shrinking and swelling cycles mentioned above in Section 5.4.

5.6 Earthworks

Based on the test pits and laboratory testing as outlined in Section 3 above, we expect the soils below the topsoil layer will be suitable for reuse as engineered fill, however, they are generally wet of optimum water with the soils becoming wetter and more sensitive at depth. Some of the soils may require additional conditioning (drying) to achieve suitable water contents for earthworks compaction. It is noted however that the soils are expected to be allophanic. Allophanic soils require careful handling to allow effective compaction for earthworks. This is not considered to be a constraint on cut to fill earthworks on site but will need to be managed by the earthworks contractor for any future development.

Any significant earthworks proposed for the site should be assessed and designed by a geotechnical and civil engineer. Appropriate design details, such as subsoil drainage, benching of fill and control of surface water, will be required.

6. Further Work

Further investigations will likely be required to support the design of any future developments at the site. The volume and scope of investigations should be as appropriate for the scale and details of any proposed development.

7. Conclusions

The following conclusions are made in relation to land use change at 301 – 303 Buckland Road, Pukekohe:

1. The site is underlain by weathered ash deposits from the South Auckland Volcanic Field, with overlying topsoil up to 500mm thick, and localised areas of fill at 301 Buckland Road up to 600mm thick.
2. Perched groundwater levels of between 2.5m and 4.2m were recorded in the hand auger boreholes. Groundwater is not likely to affect construction activities.
3. The site has been assessed as having a site subsoil class of D – Deep soil.
4. There is negligible risk of liquefaction at the site and no specific design or detailing is required to address liquefaction effects.
5. Instability of the natural slopes on the site is not generally expected to be a constraint for future development. Development immediately in the vicinity of the southern boundary may need to consider the stability of the relatively steep slopes in the neighbouring property. Slope stability assessments will likely be required for specific development proposals particularly where significant earthworks are proposed. However stability considerations are expected to be able to be adequately managed by the used of appropriate batter slopes, or the design of specific retention measures.
6. Consolidation settlement is not expected to constrain typically expected development of the site based on the natural and strengths of the subsoils. Specific settlement assessment will be required for future developments however in accordance with good engineering practice.
7. The subsoils are likely to be susceptible to volume expansivity (shrink/swell). However the effects can be mitigated through foundation embedment or specifically detailed reinforcement.
8. The site is considered suitable for the support of typical light industrial and commercial buildings on shallow foundations embedded in AVF soils or engineered fill. A suitable foundation system would be conventional isolated strip and pad footings.
9. In general, the soils below the topsoil layer will be suitable for reuse as engineered fill, however, they are generally wet of optimum with the soils becoming wetter and more sensitive at depth.
10. Based on our understanding of the local ground conditions and our experience with typical retail and commercial developments, i.e. lightly to moderately loaded buildings, we do not expect any significant geotechnical constraints to BGBZ development at the site. Provided that geotechnical considerations are addressed, along with specific investigations and assessment for any future development at the site, we expect the competent nature of the ground at the site to support a variety of development types and options.

8. Applicability

This report has been prepared for our client, Jason Woodyard and Stephen Smith, with respect to the brief provided to us. The advice and recommendations presented in this report should not be applied to any other project or used in any other context without prior written approval from Initia Limited.

This report is considered suitable to support a re-zoning application, however, further investigations and analyses will be required to support detailed design.

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Document control record

Report Title		301 & 303 Buckland Rd Geotechnical Report – For Land Use Change			
Initia Project Reference		P-000925-1			
Client		Jason Woodyard and Stephen Smith			
Revision	Date	Revision detail	Author	Reviewer	Approved by
-	07-09-21	First Issue	A. Klahn	N. Hickman	M. Wansbone
Current Revision		0			

Appendix A Figures

LEGEND

HISTORICAL INVESTIGATIONS

- HA-02 — HAND AUGER (INITIA - OCT 2020)
- TP-01 — TEST PIT (INITIA - OCT 2020)
- MH1 — MACHINE BOREHOLE (LANDER - JAN 2018)
- HA1 — HAND AUGER (LANDER - JAN 2018)
- P1 — FALLING HEAD PERCOLATION TEST (LANDER - JAN 2018)
- SITE BOUNDARY
- 0.5 — EXISTING GROUND CONTOUR (0.5m INTEVAL)

BUCKLAND ROAD

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: MOUNT EDEN 2000
3. AERIAL IMAGE, PROPERTY BOUNDARY, LIDAR CONTOUR AND EXISTING SERVICES TAKEN FROM AUCKLAND COUNCIL DATE 2017.

SCALE A1 1:1000
SCALE A3 1:2000

0 10 20 30 40 50 60 70 80 90 100m

FOR INFORMATION

Rev	Revision Description	Designed	Drawn	Checked
A	INVESTIGATION LOCATION (03/08/2021)		GG	

NOT FOR CONSTRUCTION
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

APPROVED:

DATE:

Scale AS SHOWN | Original Size A3

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301 & 303 BUCKLAND RD - LAND USE CHANGE

GEOTECHNICAL INVESTIGATION LOCATION PLAN

Initia Project ref: P000925-1

Figure Number 925-1-001

Revision A

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Appendix B Lander Investigation Logs

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Auger Borehole No. HA01

Sheet 1 of 9

Vane Head:	Logged By:	Processor :	Date:
1900	LJ	LJ	22.01.18

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL, with minor rootlet inclusions					
clayey SILT, mottled orange/brown and yellow/brown. Very stiff, moist, low plasticity, moderately sensitive, with minor limonite [ASH]	0.5		188/54	3.5	Sample 1 Disturbed 0.5-1.0m
becoming yellow/brown, without limonite	1.0		154/65	2.4	
becoming moist to wet					
	1.5		127/38	3.3	Sample 2 Disturbed 1.5-2.0m
becoming light grey/white and yellow/brown mottled red/pink, intermixed with light grey/white, high plasticity silty clay					
becoming yellow/brown, hard, without silty clay	2.0		204/84	2.4	
becoming soft to firm, wet, with minor fine to medium sand sized white clast inclusions					
becoming slightly clayey SILT, mottled red/pink, yellow/brown and grey, hard, no to low plasticity, intermixed with minor grey, high plasticity silty clay	2.5		239+		Sample 3 Disturbed 2.5-3.0m
becoming brown, loose to medium dense, no plasticity	3.0	▽	UTP		
becoming clayey SILT, yellow/brown, stiff, saturated, low plasticity, insensitive	3.5		89/47	1.9	
becoming slightly clayey SILT, brown, hard, no to low plasticity	4.0		UTP		
with minor manganese oxidation	4.5		239+		
EOB at 5.0m. Target Depth.	5.0		239+		
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater encountered 3.4m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: KM

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

Client :	PETEREX LIMITED	**Auger Borehole No.**	HA02
Project Location :	1700 BUCKLAND ROAD, PUKEKOHE		Sheet 2 of 9
Job Number:	J00858	Vane Head: 1900 / Logged By: LJ / Processor : LJ / Date: 22.01.18	

Borehole Location: mN | mE | Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL, with minor rootlet inclusions				
clayey SILT, light grey and pink/red mottled orange/brown. Very stiff, moist, low plasticity, moderately sensitive, with minor limonite, with minor organic staining [ASH]				
becoming red/brown mottled orange/brown, without organic staining	0.5	120/54	2.2	
becoming slightly clayey SILT, light grey mottled orange/brown and red/brown, hard, no to low plasticity, sensitive, with minor light grey, high plasticity silty clay	1.0	222/56	4.0	
becoming brown, without silty clay				
becoming grey/brown				
becoming moderately sensitive	1.5	213/65	3.3	
becoming brown, moist to wet				
becoming clayey SILT, very stiff, low plasticity, with trace to minor manganese oxidation	2.0	158/75	2.1	
becoming yellow/brown, wet, low to medium plasticity, without manganese oxidation				
becoming stiff	2.5	84/40	2.1	
becoming slightly clayey SILT, brown, moist, no to low plasticity				
becoming orange/brown, hard, wet, no plasticity	3.0	239+		
	3.5	UTP		
becoming clayey SILT, yellow/brown, very stiff, wet to saturated, low to medium plasticity, moderately sensitive				
	4.0	116/47	2.5	
becoming slightly clayey SILT, brown, saturated, no to low plasticity, with minor manganese oxidation				
becoming hard	4.5	239+		
EOB at 5.0m. Target Depth.	5.0	239+		
	5.5			
	6.0			

Standing Water Level: ▽ at 4.0

LANDER geotechnical

Comments:
Groundwater encountered 3.8m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm
Checked: KM

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

Client :	PETEREX LIMITED	**Auger Borehole No.**	HA03
Project Location :	1700 BUCKLAND ROAD, PUKEKOHE		Sheet 3 of 9
Job Number:	J00858	Vane Head: 1900 / Logged By: LJ / Processor : LJ / Date: 23.01.18	

Borehole Location: mN | mE | Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION	Legend	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL, with minor rootlets						
clayey SILT, orange/brown. Hard, moist, low plasticity, sensitive, with minor manganese oxidation [ASH]						
at 0.5m, without manganese oxidation		0.5		232/40	5.8	
becoming brown		1.0		239+		
becoming red/brown						
becoming very stiff, moderately sensitive		1.5		193/88	2.2	
		2.0		186/80	2.3	
		2.5		195/81	2.4	
becoming wet		3.0		195/88	2.2	
becoming stiff		3.5		97/34	2.9	
becoming very stiff		4.0	▽	127/56	2.3	
becoming saturated, sensitive		4.5		135/29	4.7	
becoming slightly clayey SILT, black mottled red/pink, no to low plasticity, with minor manganese oxidation						
at 5.0m, becoming stiff, insensitive		5.0		83/47	1.8	
EOB at 5.0m. Target Depth.		5.5				
		6.0				

LANDER geotechnical

Comments:
Groundwater encountered 4.5m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm
Checked: KM

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

Client :	PETEREX LIMITED	**Auger Borehole No.**	HA04
Project Location :	1700 BUCKLAND ROAD, PUKEKOHE		Sheet 4 of 9
Job Number:	J00858	Vane Head: 1900 / Logged By: LJ / Processor : LJ / Date: 23.01.18	

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION

Depth (m)	Legend	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
0.0	TOPSOIL				Scala Penetrometer Test (blows/100mm)
	slightly clayey SILT, yellow/brown. Loose to medium dense, moist, no plasticity, with some fine to medium gravel [TUFF]				
0.5	EOB at 0.5m. Too dense to auger further. Scala penetrometer test commenced. Unable to overcore		UTP		6
					17
					3
					3
1.0					4
					2
					2
1.5					2
					5
					18
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: Km

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

Client : PETEREX

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Auger Borehole No. HA05

Sheet 5 of 9

Vane Head:	Logged By:	Processor :	Date:
946	KM	RG	22.01.18

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL				
clayey SILT with trace fine to medium sand, light brown, mottled orange/brown. Very stiff moist, low plasticity [FILL]				
silty CLAY, orange/brown. Hard, moist, medium plasticity [ASH]	0.5	186+		Sample 1 Disturbed 0.5-1.2m
clayey SILT, orange/brown. Hard, moist, low plasticity	1.0	186+		
	1.5	186+		Sample 2 Disturbed 1.5-2.1m
becoming very stiff, wet, sensitive	2.0	111/22	5.0	
becoming slightly clayey SILT, orange/brown and red/brown, hard, wet	2.5	UTP		Sample 3 Disturbed 2.5-3.0m
becoming clayey SILT, orange/brown, very stiff				
becoming moderatley sensitive	3.0	168/67	2.5	
becoming red/brown	3.5	124/57	2.2	
becoming mottled black with some ash streaks	4.0	186+		
becoming stiff, without black mottling, insensitive	4.5	81/43	1.9	
at 5.0m, becoming very stiff, moderately sensitive	5.0	124/57	2.2	
EOB at 5.0m. Target Depth.	5.5			
	6.0			

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: KM

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

Client :	PETEREX LIMITED	**Auger Borehole No.**	HA06
Project Location :	1700 BUCKLAND ROAD, PUKEKOHE		Sheet 6 of 9
Job Number:	J00858	Vane Head: 946 / Logged By: KM / Processor : RG / Date: 22.01.18	

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT, brown mottled orange/brown. Very stiff, moist, low plasticity [TUFF/FILL?]					
silty CLAY, orange/brown. Hard, moist, low plasticity [ASH]	0.5		186+		
clayey SILT with trace fine sand, orange/brown. Hard, moist, low plasticity	1.0		186+		
becoming very stiff, moderately sensitive becoming wet	1.5		184/73	2.5	
	2.0		184/92	2.0	
becoming orange/brown mottled red/brown					
becoming slightly clayey SILT, orange/brown, hard	2.5		UTP		
becoming clayey SILT, very stiff					
	3.0		126/57	2.2	
becoming red/brown, hard					
	3.5		186+		
becoming very stiff					
	4.0		168/61	2.8	
becoming red/brown mottled orange/brown, insensitive	4.5		122/70	1.7	
at 5.0, becoming moderately sensitive					
EOB at 5m. Target Depth.	5.0		100/38	2.6	
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: km

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

Client :	PETEREX LIMITED	**Auger Borehole No.**	HA07
Project Location :	1700 BUCKLAND ROAD, PUKEKOHE		Sheet 7 of 9
Job Number:	J00858	Vane Head: 946 / Logged By: KM / Processor : LJ / Date: 22.01.18	

Borehole Location: mN | mE | Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT, brown mottled orange/brown. Very stiff, moist, low plasticity, sensitive, with trace fine gravel [FILL]					
at 0.3m, with occasional black and red mottles	0.5		120/28	4.3	
clayey SILT, light brown/grey streaked orange/brown. Very stiff, wet, low plasticity, sensitive [ASH]					
at 0.8m, becoming grey	1.0		183/39	4.7	
becoming wet					
becoming grey streaked orange, moderately sensitive	1.5		113/43	2.6	
	2.0		130/49	2.7	
becoming stiff	2.5	▽	70/27	2.6	
becomng hard, with trace fine to medium sand and fine pumiceous gravel			186+		
becoming slightly clayey SILT, orange/brown, no to low plasticity, without sand and gravel					
becoming orange/brown mottled red/brown, low plasticity	3.0		186+		
becoming stiff, poor sample recovery to 3.9m due to groundwater suction	3.5		57/23	2.5	
becoming red/brown, with normal sample recovery					
becoming hard	4.0		UTP		
becoming very stiff	4.5		171/62	2.8	
at 5.0m, becoming hard					
EOB at 5.0m. Target Depth.	5.0		186+		
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater encountered 2.7m.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm
Checked: KM

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

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Auger Borehole No. HA08

Sheet 8 of 9

Vane Head:	Logged By:	Processor :	Date:
1900	LJ	LJ	23.01.18

Borehole Location: mN | mE | Ground R.L.

Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Standing Water Level	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL					
clayey SILT, orange/brown. Hard, moist, low plasticity [ASH]	0.5		239+		
	1.0		239+		
becoming moderately sensitive	1.5		204/100	2.0	
becoming wet, with minor fine to coarse sand sized white clast inclusions					
becoming slightly clayey SILT, no to low plasticity, extra sensitive	2.0		204/24	8.5	
	2.5		UTP		
becoming clayey SILT, very stiff, wet, low to medium plasticity					
becoming moderately sensitive becoming brown, moist, low plasticity	3.0		170/73	2.3	
becoming hard	3.5		230/89	2.6	
intermixed with moderately thin bed of light grey, high plasticity silty clay	4.0		213/94	2.3	
becoming very stiff	4.5		158/69	2.3	
becoming orange/brown, with minor limonite silt clast inclusions					
EOB at 5.0m. Target Depth.	5.0		177/86	2.1	
	5.5				
	6.0				

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: KM

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

Client :	PETEREX LIMITED	**Auger Borehole No.**	P1
Project Location :	1700 BUCKLAND ROAD, PUKEKOHE		Sheet 9 of 9
Job Number:	J00858	Vane Head: 1900 / Logged By: LJ / Processor : LJ / Date: 22.01.18	

Borehole Location: mN | mE | Ground R.L.
Description: Refer to site plan

SOIL DESCRIPTION	Depth (m)	Vane Shear(kPa) peak / residual	Soil Sensitivity	Sample and Laboratory / Other Test Details
TOPSOIL				
clayey SILT, brown/grey streaked black. Very stiff, moist, low plasticity, with trace fine gravel [TUFF/FILL?]				
silty CLAY, orange/brown. Very stiff, moist, medium plasticity, moderately sensitive [ASH]				
with occasional manganese oxidation	0.5	177/49	3.6	
clayey SILT, orange/brown. Very stiff, moist, low plasticity, moderately sensitive	1.0	158/54	2.9	
with minor manganese oxidation	1.5	195/84	2.3	
becoming yellow/brown and light grey mottled red/pink, insensitive, intermixed with light grey, high plasticity silty clay, without manganese oxidation	2.0	154/86	1.8	
at 2.5m, becoming moderately sensitive	2.5	177/69	2.6	
EOB at 2.5m. Target Depth.	3.0			
	3.5			
	4.0			
	4.5			
	5.0			
	5.5			
	6.0			

LANDER geotechnical

Comments:
Groundwater not encountered.
UTP = unable to penetrate.
EOB = end of borehole.

Borehole Diameter: 50mm

Checked: KM

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

Client :	PETEREX LIMITED	**Machine Borehole No.**	MH01
Project Location :	1700 BUCKLAND ROAD, PUKEKOHE		Sheet 1 of 2
Job Number:	J00858	Vane Head: 307 / Logged By: AB / Processor : AB	Start Date: 24.01.18 Finish Date: 24.01.18

Borehole Location: mN ____ mE ____ Ground R.L. ____
Description: Refer to site plan Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Ash	TOPSOIL		0.0							
	clayey SILT, dark orange/ brown. Hard, moist, low to medium plasticity		0.5	Bentonite		OPEN BARREL	60			UTP
	at 0.7m, becoming orange mottled orange/ brown, low plasticity, with some limonite inclusions and staining									
	becoming brown, very stiff, medium plasticity, insensitive		1.0				100			158/82 - 1.9
			1.5				100			112/66 - 1.7
							SPT			SPT at 1.5-1.95m 3/4/4 N=8
			2.0	Piezometer screened from 1.5-6m						
	becoming orange/ brown		2.5				76			
	becoming dark orange/ brown, modrately sensitive		3.0				SPT			161/49 - 3.3
										SPT at 3.0-3.45m 6/8/11 N=19
			3.5	Groundwater Level as measured on 1.02.18: 3.65m						
	becoming yellow/ brown		4.0				95			
	becoming dark orange/ brown, hard		4.5				SPT			UTP
										SPT at 4.5-4.95m 4/2/4 N=6
			5.0				100			
			5.5							
	becoming slightly clayey SILT, very stiff, low plasticity, insensitive, with occasional manganese oxide inclusions		6.0				SPT			156/92 - 1.7
										SPT at 6.0-6.45m 2/2/3 N=5
			6.5				86			
			7.0							
	becoming stiff, quick		7.5				SPT			92/4 - 23.0
										SPT at 7.5-7.95m 1/2/5 N=7
			8.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: KM

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

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Machine Borehole No. MH01

Sheet 2 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
307	AB	AB	24.01.18	24.01.18

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Ash	slightly clayey SILT, pink/ red mottled orange/ brown. Firm, moist, low to no plasticity, with occasional manganese oxide inclusions		8.5			OPEN BARREL	62			
			9.0				SPT			46/8 - 5.8 SPT at 9.0-9.45m 1/1/1 N=2
			9.5				62			
	at 10.5m, becoming brown, stiff		10.0							
	EOB at 10.5m. Target Depth.		10.5				SPT			92/19 - 4.8 SPT at 10.5-10.95m 2/4/5 N=9
			11.0							
			11.5							
			12.0							
			12.5							
			13.0							
			13.5							
			14.0							
			14.5							
			15.0							
			15.5							
			16.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: km

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

LANDER geotechnical	client:	PETEREX LIMITED	project no:	figure no:
	project:	1700 BUCKLAND ROAD	J 00858	Figure MH01
		PUKEKOHE	compiled:	date:
	title:	MH01 CORE PHOTOS	AB	25.01.18

Client : PETEREX LIMITED

Project Location : 1700 BUCKLANDS ROAD, PUKEKOHE

Job Number: J00858

Machine Borehole No. MH02

Sheet 1 of 2

Vane Head:	Logged By:	Processor :	Start Date: 24.01.18
307	AB	RG	Finish Date: 24.01.18

Borehole Location: mN mE Ground R.L.

Description: Refer to site plan Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	TOPSOIL		0.0	Bentonite		OPEN BARREL	60			
	clayey SILT, dark orange and brown. Hard, moist, low plastic									UTP
	becoming orange/brown mottled red/brown, with occasional limonite inclusions and staining		0.5				96			
	becoming very stiff, moderately sensitive		1.0							174/82 - 2.1
	becoming insensitive		1.5	Piezometer screened from 1.0m to 6.0m			92			148/94 - 1.5 SPT at 1.5-1.95m 2/3/4 N=7
Ash			2.0				SPT			
	becoming stiff		2.5				43			
			3.0	Groundwater Level as measured on 1.02.18: 3.0m						92/52 - 1.8 SPT at 3.0-3.45m 2/2/2 N=4
			3.5				SPT			
			4.0				44			
	becoming brown speckled red/orange		4.5							52/29 - 1.8 SPT at 4.5-4.95m 1/1/1 N=2
	becoming pink/red mottled with red/orange		5.0				SPT			
			5.5				100			
	becoming slightly clayey SILT, streaked red/orange and brown, quick		6.0							69/4 - 17.6 SPT at 6.0-6.45m 1/1/1 N=2
			6.5				SPT			
			7.0				86			
	becoming firm, sensitive		7.5							49/12 - 4.2 SPT at 7.5-7.95m 0/1/2 N=3
			8.0				SPT			

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: KCK

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

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Machine Borehole No. MH02

Sheet 2 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
307	AB	RG	24.01.18	24.01.18

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Ash	becoming brown, loose,		8.5				85			
	becoming very loose, extra sensitive		9.0				SPT			49/12 - 11.8 SPT at 9.0-9.45m 1/1/2 N=3
	becoming clayey SILT, stiff, low to moderate plasticity, with trace fine sand		9.5				81			
	with trace fine sand in a very thin limonite bed		10.0							
	at 10.4m, becoming orange/brown, with some limonite silt clast inclusions		10.5							42/4 - 10.8 SPT at 10.5-10.95m 1/1/2 N=3
	EOB at 10.5m. Target Depth		11.0							
			11.5							
			12.0							
			12.5							
			13.0							
			13.5							
			14.0							
			14.5							
			15.0							
			15.5							
			16.0							

LANDER geotechnical

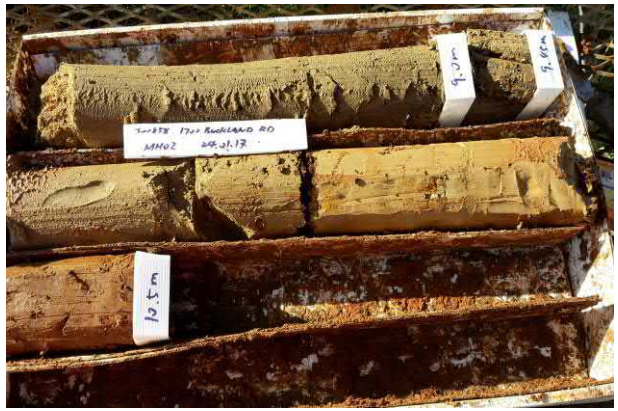
Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: Km

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



LANDER geotechnical	client:	PETEREX LIMITED	project no:	figure no:
	project:	1700 BUCKLAND ROAD	J 00858	Figure MH02
		PUKEKOHE	compiled:	date:
	title:	MH02 CORE PHOTOS	AB	25.01.18

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Machine Borehole No. MH03

Sheet 1 of 2

Vane Head:	Logged By:	Processor :	Start Date: 23.01.18
307	AB	AB	Finish Date: 23.01.18

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Ash	TOPSOIL clayey SILT, dark orange/ brown. Very stiff, moist to dry, low plasticity, moderately sensitive		0.0			OPEN BARREL	64			
	becoming orange/ brown		0.5	Bentonite			100			174/69 - 2.5
	becoming hard		1.0				100			UTP
	becoming slightly clayey SILT, red/ orange, low to no plasticity		1.5	Piezometer screened from 1.5m to 6.0m			SPT			211/49 - 4.3 SPT at 1.5-1.95m 3/4/6 N=10
			2.0				100			
			2.5							
	becoming stiff, insensitive		3.0				SPT			86/66 - 1.3 SPT at 3.0-3.45m 2/1/2 N=3
			3.5				81			
			4.0							
	becoming moderately sensitive, with some manganese oxide inclusions		4.5	Groundwater Level as measured on 1.02.18: 4.73m			SPT			79/34 - 2.3 SPT at 4.5-4.95m 1/1/1 N=2
			5.0				95			
			5.5							
	becoming mottled brown and red/ orange, extra sensitive		6.0				SPT			82/8 - 10.3 SPT at 6.0-6.45m 1/0/1 N=1
			6.5				100			
			7.0							
	becoming slightly clayey SILT, mottled red/ pink and yellow/ brown, low to no plasticity		7.5				SPT			66/8 - 8.3 SPT at 7.5-7.95m 1/0/2 N=2
			8.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: KM

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

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Machine Borehole No. MH03

Sheet 2 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
307	AB	AB	23.01.18	23.01.18

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	becoming firm		8.5 – 9.0			OPEN BARREL	71			35/4 - 8.8 SPT at 9.0-9.45m 1/1/2 N=3
	becoming brown, with some fine to medium sand sized clast inclusions at 10.5m, becoming moderately sensitive		9.5 – 10.0				SPT 65			
	EOB at 10.5m. Target Depth.		10.5 – 16.0				SPT			46/15 - 3.1 SPT at 10.5-10.95m 1/1/3 N=4

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: KM

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

LANDER geotechnical	client:	PETEREX LIMITED	project no:	figure no:
	project:	1700 BUCKLAND ROAD	J 00858	Figure MH03
		PUKEKOHE	compiled:	date:
	title:	MH03 CORE PHOTOS	AB	25.01.18

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Machine Borehole No. MH04

Sheet 1 of 2

Vane Head:	Logged By:	Processor :	Start Date: 23.01.18
307	AB	RG	Finish Date: 23.01.18

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	TOPSOIL		0.0							
Ash	clayey SILT, dark orange/brown mottled orange/brown. Hard, dry, low plasticity			Bentonite			88			UTP
	at 0.5m, becoming orange and brown		0.5				76			
			1.0							UTP
			1.5	Piezometer screened from 1.0-6.0m			83			UTP
			2.0				SPT			SPT at 1.5-1.95m 4/4/4 N=8
	becoming red/orange		2.5				100			
	becoming very stiff, insensitive, with occasional limonite inclusions and staining		3.0				SPT			149/82 - 1.8 SPT at 3.0-3.45m 2/2/4 N=6
			3.5				86			
			4.0							
	becoming firm, extra sensitive		4.5				SPT			49/4 - 12.25 SPT at 4.5-4.95m 1/0/1 N=1
	with occasional manganese oxidation		5.0				86			
			5.5							
	becoming sensitive		6.0				SPT			49/8 - 6.1 SPT at 6.0-6.45m 1/1/2 N=3
			6.5							
			7.0				76			
	becoming mottled red/brown and brown		7.5				SPT			49/19 - 2.8 SPT at 7.5-7.95m 1/0/2 N=2
			8.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: km

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

Client : PETEREX LIMITED

Project Location : 1700 BUCKLAND ROAD, PUKEKOHE

Job Number: J00858

Machine Borehole No. MH04

Sheet 2 of 2

Vane Head:	Logged By:	Processor :	Start Date:	Finish Date:
307	AB	RG	23/01/18	23/01/18

Borehole Location: mN mE

Description: Refer to site plan

Ground R.L.

Orientation: vertical

Stratigraphy	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
Ash			8.5				90			
	slightly clayey SILT, red and brown with brown streaks. Stiff, moist, low to no plasticity, sensitive, with occasional sand sized silt clast inclusions									
Tuff	becoming brown, medium dense, sensitive		9.0				SPT			66/19 - 3.5 SPT at 9.0-9.45m 2/2/2 N=4
			9.5							
			10.0				59			
	EOB at 10.5m. Target Depth		10.5				SPT			49/19 - 2.6 SPT at 10.5-10.95m 2/2/2 N=4
			11.0							
			11.5							
			12.0							
			12.5							
			13.0							
			13.5							
			14.0							
			14.5							
			15.0							
			15.5							
			16.0							

LANDER geotechnical

Comments:

Driller: Pro-Drill Rig: Tractor

Drilling Fluid: water

Checked: KM

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

LANDER geotechnical	client:	PETEREX LIMITED	project no:	figure no:
	project:	1700 BUCKLAND ROAD	J 00858	Figure MH04
		PUKEKOHE	compiled:	date:
	title:	MH04 CORE PHOTOS	AB	25.01.18

STORMWATER PERCOLATION TEST

Client:	PETEREX LIMITED	Job No:	J00858
Location:	1700 BUCKLAND ROAD	Date:	23.01.18
	PUKEKOHE	Page	1 of 2
Hole No:	P1	Diameter:	0.1 (m)
Location:	refer to site plan	Depth:	2.45 (m)
Weather conditions preceding test:	dry		
Details of presoaking:	16 hours		

Time of Test (hr.min)	Time Interval (min)	Depth Reading (m)	Water Depth (m)	Cum Time (min)
9:03	-	0.30	2.15	0
9:04	1	0.36	2.09	1
9:06	2	0.45	2.00	3
9:08	2	0.53	1.92	5
9:10	2	0.57	1.88	7
9:15	5	0.70	1.75	12
9:20	5	0.75	1.70	17
9:40	20	0.87	1.58	37
10:00	20	0.97	1.48	57
10:20	20	1.03	1.42	77
10:40	20	1.12	1.33	97
11:00	20	1.15	1.30	117
11:20	20	1.20	1.25	137
11:40	20	1.23	1.22	157
12:00	20	1.25	1.20	177
12:20	20	1.28	1.17	197
12:40	20	1.30	1.15	217
13:00	20	1.35	1.10	237

Test	P1	
Gradient	0.001	m/min
Percolation	0.02	L/m^2/min

Lander Geotechnical Consultants Limited
P O Box 97 385, Manukau, Auckland 2241
Phone: 027 488 6882
Email: shane@landergeotechnical.co.nz

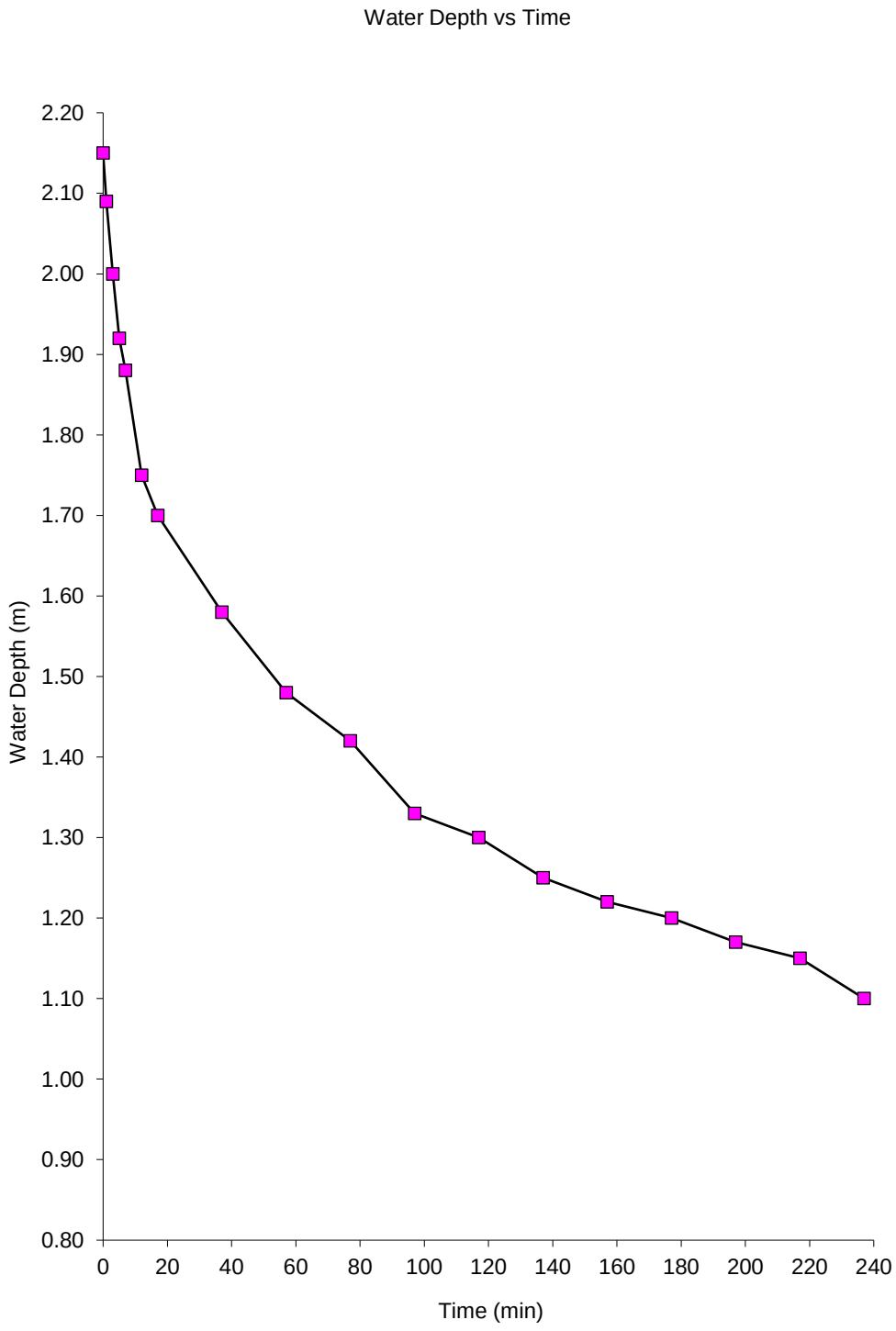
Operator: KM

Checked: SL

STORMWATER PERCOLATION TEST

Client:	PETEREX LIMITED	Job No:	J00858
Location:	1700 BUCKLAND ROAD	Date:	23.01.18
	PUKEKOHE	Page	2 of 2

Hole No:	P1	Diameter:	0.1	(m)
Location:	refer to site plan	Depth:	2.5	(m)



Lander Geotechnical Consultants Limited
P O Box 97 385, Manukau, Auckland 2241
Phone: 027 488 6882
Email: shane@landergeotechnical.co.nz

Operator:	KM
Checked:	SL

Appendix C Initia Investigation Logs

TEST PIT LOG

HOLE NO.: TP-01

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769921mE, 5879085mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 74m
Datum: AUCKHT1946
Level method: CONTOUR
CONTRACTOR: Local Contractor
MACHINE: Excavator
OPERATOR: Eugene
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
Topsoil SILT; dark brown. Firm; non-plastic; dry.		0.0 – 0.2	TS			
South Auckland Volcanic Field Clayey SILT; orange brown. Very stiff; high plasticity; moist.		0.2 – 0.6			131 / 61	
Clayey SILT; brown with light brown mottles. Very stiff; high plasticity; moist.		0.6 – 2.0			161 / 99 175 / 91	Groundwater Not Encountered
EOH: 2.60m		2.6				

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- ☐ Hand Auger
- ☑ Test Pit

Checked By: MDH

TEST PIT LOG

HOLE NO.: TP-02

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769882mE, 5879113mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 73m
Datum: AUCKHT1946
Level method: CONTOUR
CONTRACTOR: Local Contractor
MACHINE: Excavator
OPERATOR: Eugene
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	Values	WATER
Top soil: SILT; dark brown. Firm; non-plastic; dry.		0.2	TS	2 4 6 8 10 12 14 16 18	50 100 150 200		
South Auckland Volcanic Field: Clayey SILT; orange brown. Very stiff; high plasticity; moist.		0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8				124 66	
Clayey SILT; yellowish brown. Hard; high plasticity; moist.		2.0				204.54+ -	Groundwater Not Encountered
1.8m: Grading to very stiff		2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8 5.0 5.2 5.4 5.6 5.8				190 61	
EOH: 2.00m							

REMARKS

Continued as hand auger. Refer to HA-02

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

Checked By: MDH

TEST PIT LOG

HOLE NO.: TP-03

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769983mE, 5879080mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 71m
Datum: AUCKHT1946
Level method: CONTOUR
CONTRACTOR: Local Contractor
MACHINE: Excavator
OPERATOR: Eugene
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
Topsoil SILT; dark brown. Firm; non-plastic; dry.		0.2	TS			
Clayey silty; orange brown. Very stiff; high plasticity; moist.	B	0.4 0.6 0.8			178 53	
Clayey SILT; brown with some grey mottles. Hard; high plasticity; moist.		1.0 1.2 1.4			204.54+ -	
Clayey SILT; reddish brown. Hard; high plasticity; moist.	B	1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8 5.0			204.54+ -	
EOH: 5.00m		5.2 5.4 5.6 5.8				

Scala penetrometer axis: 2 4 6 8 10 12 14 16 18
Vane shear strength axis: 50 100 150 200 Values

South Auckland Volcanic Field

Groundwater Not Encountered

REMARKS

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- [ ] Hand Auger
- [x] Test Pit

Ver 2. Generated with CORE-GS by Geroc - Test Pit_Initia - 20/10/2020 1:10:30 pm

Checked By: MDH

TEST PIT LOG

HOLE NO.: TP-04

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769946mE, 5879111mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 69.5m
Datum: AUCKHT1946
Level method: CONTOUR
CONTRACTOR: Local Contractor
MACHINE: Excavator
OPERATOR: Eugene
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	Values	WATER
Topsoil SILT, with some gravel; dark brown. Firm; non-plastic; dry; gravel, fine to coarse.		0.2	TS	2 4 6 8 10 12 14 16 18	50 100 150 200		
Clayey SILT; orange brown. Very stiff; high plasticity; moist.	B	0.4 – 1.4				155 41 123 56	
Clayey SILT; yellow brown with some black mottles. Hard; high plasticity; moist.	B	1.6 – 3.8				204.54+ - 204.54+ - 204.54+ -	
EOH: 5.00m		4.0 – 5.8					

South Auckland Volcanic Field

Groundwater Not Encountered

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- ☐ Hand Auger
- ☑ Test Pit

Ver 2. Generated with CORE-GS by Geroc - Test Pit_Initia - 20/10/2020 1:10:32 pm

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TEST PIT LOG

HOLE NO.: TP-05

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769905mE, 5879117mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 71.5m
Datum: AUCKHT1946
Level method: CONTOUR
CONTRACTOR: Local Contractor
MACHINE: Excavator
OPERATOR: Eugene
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	Values	WATER
Topsoil SILT; dark brown. Firm; non-plastic; dry.		0.2	TS				
Clayey SILT; orange brown with some grey mottles. Very stiff; high plasticity; moist.	B	0.4, 0.6, 0.8, 1.0				143 38 178 76	
Clayey SILT; brown with grey mottles. Very stiff to hard; high plasticity; moist.	B	1.2, 1.4				204.54+ -	
Clayey SILT; reddish brown. Hard; high plasticity; moist. EOH: 5.00m	B	1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.2, 3.4, 3.6, 3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5.0, 5.2, 5.4, 5.6, 5.8				204.54+ -	

South Auckland Volcanic Field

Groundwater Not Encountered

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- ☐ Hand Auger
- ☑ Test Pit

Checked By: MDH

TEST PIT LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: TP-06

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769978mE, 5879128mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 67m
Datum: AUCKHT1946
Level method: CONTOUR
CONTRACTOR: Local Contractor
MACHINE: Excavator
OPERATOR: Eugene
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
Topsoil SILT; dark brown. Firm; non-plastic; dry.		0.0 – 0.2	TS			
South Auckland Volcanic Field Clayey SILT; orange brown. Very stiff; high plasticity; moist.		0.2 – 1.0			120 50	
Clayey SILT; reddish brown. Very stiff; high plasticity; moist. - INTERBEDDED WITH - Silty CLAY; grey. Stiff; high plasticity; moist.		1.0 – 1.6			175 79	
Clayey SILT; light brown. Very stiff; high plasticity; moist.		1.6 – 2.0			178 99	
EOH: 2.00m		2.0			161 47	Groundwater Not Encountered

REMARKS

Continued as hand auger. Refer to HA-01

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

TEST PIT LOG

HOLE NO.: TP-07

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769936mE, 5879143mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 68m
Datum: AUCKHT1946
Level method: CONTOUR
CONTRACTOR: Local Contractor
MACHINE: Excavator
OPERATOR: Eugene
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
Topsoil SILT; dark brown. Firm; non-plastic; dry.		0.0 – 0.2	TS			
Auckland Volcanic Field Clayey SILT; orange brown. Very stiff; high plasticity; moist.		0.2 – 1.0			117 / 44 167 / 64	Groundwater Not Encountered
Clayey SILT; reddish brown. Hard; high plasticity; moist.		1.0 – 1.4			204.54+ -	
Clayey SILT; light brown. Hard; high plasticity; moist.		1.4 – 2.0			204.54+ -	
EOH: 2.00m		2.0				

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- ☐ Hand Auger
- ☑ Test Pit

HAND AUGER LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: HA-02

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769936mE, 5879128mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 73m
Datum: AUCKHT1946
Level method: CONTOUR
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
	Test Pit 0.0 to 2.0 m (refer to TP-02)		0.0 to 2.0				
South Auckland Volcanic Field	Clayey SILT; light brown. Very stiff; high plasticity; moist.		2.0 to 3.6			126 / 58 146 / 66 131 / 73 161 / 80 153 / 76	Groundwater Not Encountered
	3.6m: Grades to hard						
	SILT, with some clay; orange brown. Hard; low plasticity; moist.		3.6 to 4.0			205+ / - 205+ / -	
	EOH: 4.00m						

Scala Penetrometer (Blows / 0mm): 2, 4, 6, 8, 10, 12, 14, 16, 18

Vane Shear Strength (kPa) Vane: 2503: 50, 100, 150, 200

Values: 126 / 58; 146 / 66; 131 / 73; 161 / 80; 153 / 76; 205+ / -; 205+ / -

REMARKS

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- [x] Hand Auger
- [ ] Test Pit

Ver 2. Generated with CORE-GS by Geroc - Hand Auger_Initia - 20/10/2020 1:10:38 pm

Checked By: MDH

HAND AUGER LOG

INITIA
GEOTECHNICAL SPECIALISTS

HOLE NO.: HA-03

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769983mE, 5879080mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 71m
Datum: AUCKHT1946
Level method: CONTOUR
START DATE: 23/10/2020
END DATE: 23/10/2020
LOGGED BY: QS
CHECKED BY: MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2689	Values	WATER
Topsoil	SILT; dark brown. Firm; non-plastic; dry.		0.0	TS				
South Auckland Volcanic Field	Clayey SILT; orange brown. Very stiff to hard; high plasticity; moist.		0.6				200+ -	
	Clayey SILT; brown with some grey mottles. Hard; high plasticity; moist.		1.2				200+ -	
	Clayey SILT; reddish brown. Very stiff; high plasticity; moist.		1.8				186 86	
	2.6m: Grades to stiff		2.6				200+ -	
	3.3m: Grades to very stiff		3.3				200+ -	
	EOH: 5.00m		5.0				122 72	Groundwater Not Encountered
			5.8				107 60	
							97 64	
							97 64	
							122 74	
							100 66	
							100 63	
							114 50	
							136 100	
							172 100	

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

Checked By: MDH

HAND AUGER LOG

HOLE NO.: HA-05

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769905mE, 5879117mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 71.5m
Datum: AUCKHT1946
Level method: CONTOUR
START DATE: 23/10/2020
END DATE: 23/10/2020
LOGGED BY: QS
CHECKED BY: MDH

INITIA
GEOTECHNICAL SPECIALISTS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2689	Values	WATER
Topsoil	SILT; dark brown. Firm; non-plastic; dry.		0.2	TS	2 4 6 8 10 12 14 16 18	50 100 150 200	200+ -	Groundwater Not Encountered
South Auckland Volcanic Field	Clayey SILT; orange brown. Very stiff to hard; high plasticity; moist.		0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8				129 60 200+ - 200+ - 200+ - 200+ - 172 79	
	Clayey SILT; brown with grey mottles. Hard; high plasticity; moist.		2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8 5.0 5.2 5.4 5.6 5.8				200+ - 122 64 143 74 200+ - 200+ - 200+ - 200+ - 200+ - 114 37 200+ -	
	Clayey SILT; brownish. Very stiff; high plasticity.							
	2.1m: Grades to hard							
	2.4m: Grades to very stiff							
	3.0m: Grades to hard							
	4.5m: Grades to very stiff							
	4.8m: Grades to hard							
	EOH: 5.00m							

REMARKS

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- [x] Hand Auger
- [ ] Test Pit

Checked By: MDH

HAND AUGER LOG

HOLE NO.: HA-06

CLIENT: Jason Woodyard
PROJECT: 303 Buckland Road
SITE LOCATION: 303 Buckland Road, Pukekohe
Project Ref.: P-000925

CO-ORDINATES: 1769882mE, 5879113mN
Co-ordinate system: NZTM
Location method: GPSH
ELEVATION: 67m
Datum: AUCKHT1946
Level method: CONTOUR
START DATE: 16/10/2020
END DATE: 16/10/2020
LOGGED BY: QS
CHECKED BY: MDH

INITIA
GEOTECHNICAL SPECIALISTS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	Values	WATER
	Test Pit 0.0 to 2.0 m (refer to TP-06)		0.2 – 2.0		2 4 6 8 10 12 14 16 18	50 100 150 200		Groundwater Not Encountered
South Auckland Volcanic Field	Clayey SILT; light brown. Very stiff; high plasticity; moist.		2.2 – 3.0				161 47 124 69 161 82	
	SILT, with some clay; brown. Hard; low plasticity; moist. EOH: 4.00m		3.2 – 4.0				205+ -	
			4.2 – 5.8					

REMARKS

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- [x] Hand Auger
- [ ] Test Pit

Checked By: MDH

Appendix D Lander Lab Testing Results

East Tamaki Laboratory

Coffey Services (NZ) Limited

144A Cryers Road, East Tamaki NZ 2013
PO Box 58877, Botany, Manukau NZ 2163

Phone: +64 9 272 3375
Fax: +64 9 272 3378

Report No: ETAM18S-00533-1
Issue No: 1

Material Test Report

Client:	Lander Geotechnical Consultants Limited PO Box 97385 Manukau City 2241
Principal:	Kyle Meffan
Project No.:	773-ETAM00588AA
Project Name:	J00858 - 1700 Buckland Road, Pukekohe
Lot No.:	- **TRN:** -

Tests indicated as not accredited are outside the scope of the laboratory's accreditation.
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

Approved Signatory: James McKelvey
(Senior Technician)
IANZ Accredited Laboratory Number:105
Date of Issue: 2/02/2018

Sample Details

Sample ID:	ETAM18S-00533
Client Sample:	S2
Date Sampled:	22/01/2018
Source:	Unknown (Sampled by Client)
Material:	Disturbed Soil
Specification:	NZ Grading Full
Sampling Method:	Unknown (Not IANZ Endorsed)
Project Location:	1700 Buckland Road, Pukekohe
Sample Location:	HA1 1.5 - 2.0 m

Test Results

Description	Method	Result	Limits
Allophane Content	NZS 4402:1986 Test 3.4	5 - 7 %	
Date Tested		1/02/2018	

Comments

Work Order: ETAM18W00227
Tested By: CT

East Tamaki Laboratory

Coffey Services (NZ) Limited

144A Cryers Road, East Tamaki NZ 2013
PO Box 58877, Botany, Manukau NZ 2163

Phone: +64 9 272 3375
Fax: +64 9 272 3378

Report No: ETAM18S-00534-1
Issue No: 1

Material Test Report

Client:	Lander Geotechnical Consultants Limited PO Box 97385 Manukau City 2241
Principal:	Kyle Meffan
Project No.:	773-ETAM00588AA
Project Name:	J00858 - 1700 Buckland Road, Pukekohe
Lot No.:	- **TRN:** -

Tests indicated as not accredited are outside the scope of the laboratory's accreditation.
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

Approved Signatory: James McKelvey
(Senior Technician)
IANZ Accredited Laboratory Number:105
Date of Issue: 2/02/2018

Sample Details

Sample ID:	ETAM18S-00534
Client Sample:	S2
Date Sampled:	22/01/2018
Source:	Unknown (Sampled by Client)
Material:	Disturbed Soil
Specification:	NZ Grading Full
Sampling Method:	Unknown (Not IANZ Endorsed)
Project Location:	1700 Buckland Road, Pukekohe
Sample Location:	HA5
	1.5 - 2.1 m

Test Results

Description	Method	Result	Limits
Allophane Content	NZS 4402:1986 Test 3.4	5 - 7 %	
Date Tested		1/02/2018	

Comments

Work Order: ETAM18W0027
Tested By: CT

East Tamaki Laboratory

Coffey Services (NZ) Limited

144A Cryers Road, East Tamaki NZ 2013
PO Box 58877, Botany, Manukau NZ 2163
Phone: +64 9 272 3375
Fax: +64 9 272 3378

Report No: CLAS:ETAM18S-00533
Issue No:1
This report replaces all previous issues of Report No. CLAS:ETAM18S-00533

Atterberg Classification Test Report

Client:	Lander Geotechnical Consultants Limited PO Box 97385 Manukau City 2241
Principal:	Kyle Meffan
Project No.:	773-ETAM00588AA
Project Name:	J00858 - 1700 Buckland Road, Pukekohe

Tests indicated as not accredited are outside the scope of the laboratory's accreditation.

{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

Approved Signatory: James McKelvey
Senior Technician
IANZ Accredited Laboratory Number: 105
Date of Issue: 02/02/2018

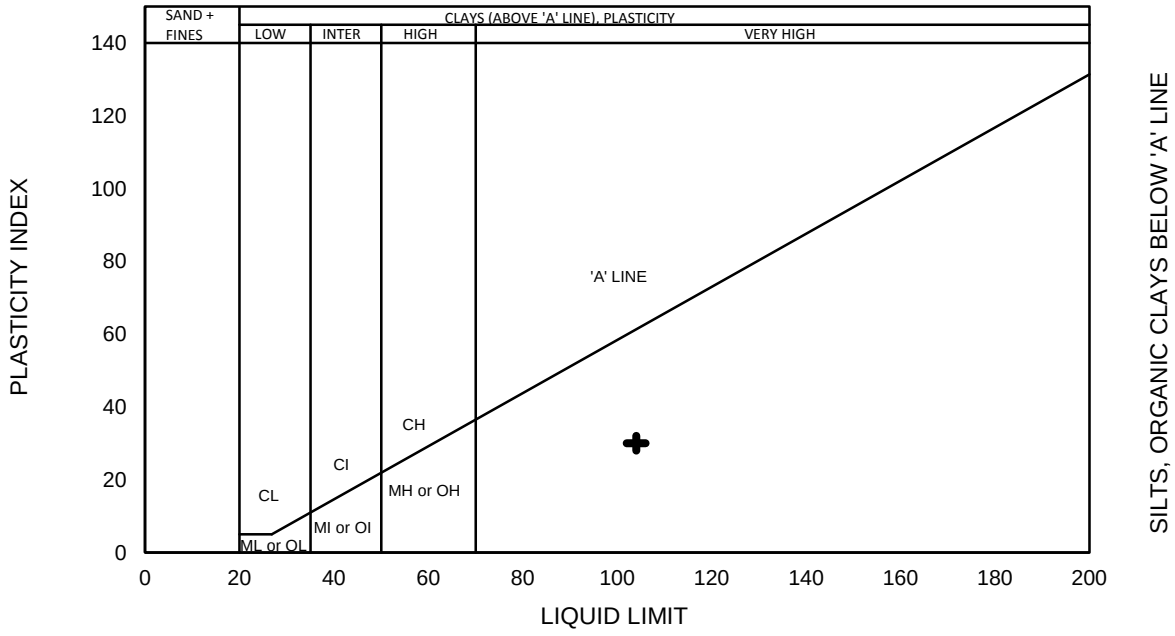
Sample Details

Sample Number:	ETAM18S-00533	**Date Sampled:**	22/01/2018
Project Location:	1700 Buckland Road, Pukekohe	**Date Tested:**	31/01/2018
Sample Location:	HA1, 1.5 - 2.0 m	**Tested by:**	Nara Yoon
Laboratory test Procedures:	*Atterberg Limits [NZS 4402 Test 2.2, 2.3, 2.4, 2.6], Moisture Content [NZS 4402:1986 Test 2.1]*		
Sampling Method:	*Unknown (Not IANZ Endorsed)*		

Laboratory Data

Liquid Limit	**104**	**Sample History:**	Natural state
Plastic Limit:	**74**	**Fraction Tested:**	Passing 425µm sieve
Plasticity Index:	**30**	**Material Description:**	Disturbed Soil
Linear Shrinkage:	**21**		
#Liquidity Index (w-PL)/PI	**0.2**	**Moisture Content (%)**	79.1

CASAGRANDE PLASTICITY CHART



Comments:

Form Number: R027A Issue Date: 19/09/2017

East Tamaki Laboratory

Coffey Services (NZ) Limited

144A Cryers Road, East Tamaki NZ 2013
PO Box 58877, Botany, Manukau NZ 2163
Phone: +64 9 272 3375
Fax: +64 9 272 3378

Report No: CLAS:ETAM18S-00534
Issue No:1
This report replaces all previous issues of Report No. CLAS:ETAM18S-00534

Atterberg Classification Test Report

Client:	Lander Geotechnical Consultants Limited PO Box 97385 Manukau City 2241
Principal:	Kyle Meffan
Project No.:	773-ETAM00588AA
Project Name:	J00858 - 1700 Buckland Road, Pukekohe

Tests indicated as not accredited are outside the scope of the laboratory's accreditation.

{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

Approved Signatory: James McKelvey
Senior Technician
IANZ Accredited Laboratory Number: 105
Date of Issue: 02/02/2018

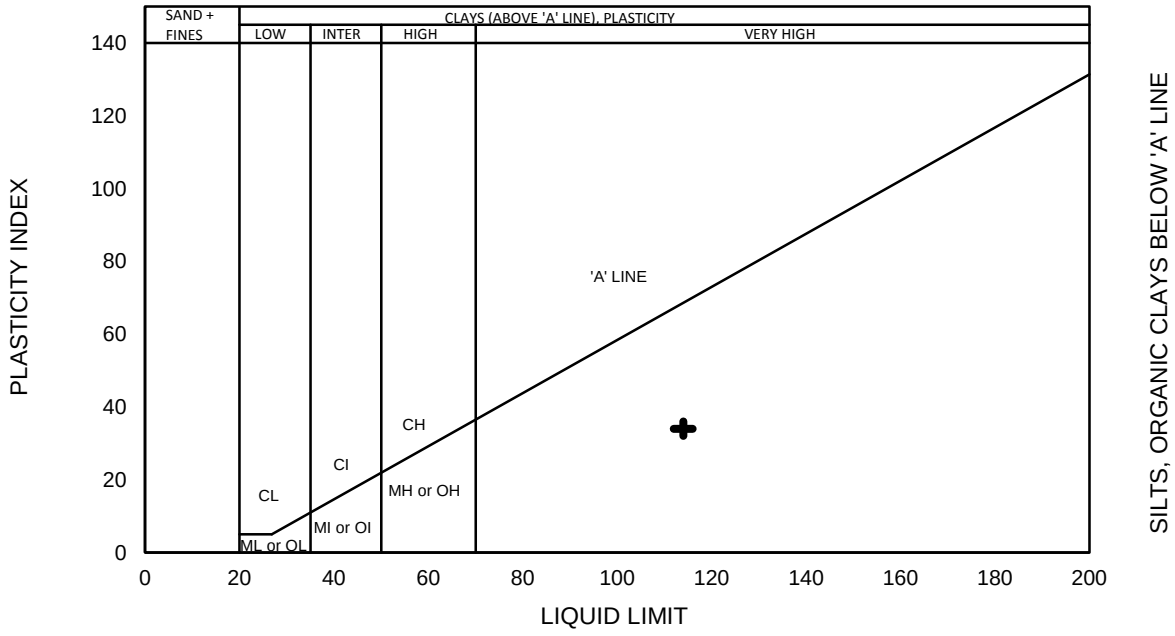
Sample Details

Sample Number:	ETAM18S-00534	**Date Sampled:**	22/01/2018
Project Location:	1700 Buckland Road, Pukekohe	**Date Tested:**	31/01/2018
Sample Location:	HA5, 1.5 - 2.1 m	**Tested by:**	Nara Yoon
Laboratory test Procedures:	*Atterberg Limits [NZS 4402 Test 2.2, 2.3, 2.4, 2.6], Moisture Content [NZS 4402:1986 Test 2.1]*		
Sampling Method:	*Unknown (Not IANZ Endorsed)*		

Laboratory Data

Liquid Limit	**114**	**Sample History:**	Natural state
Plastic Limit:	**80**	**Fraction Tested:**	Passing 425µm sieve
Plasticity Index:	**34**	**Material Description:**	Disturbed Soil
Linear Shrinkage:	**24**		
#Liquidity Index (w-PL)/PI	**-0.2**	**Moisture Content (%)**	72.2

CASAGRANDE PLASTICITY CHART



Comments:

Form Number: R027A Issue Date: 19/09/2017

PARTICLE SIZE DISTRIBUTION

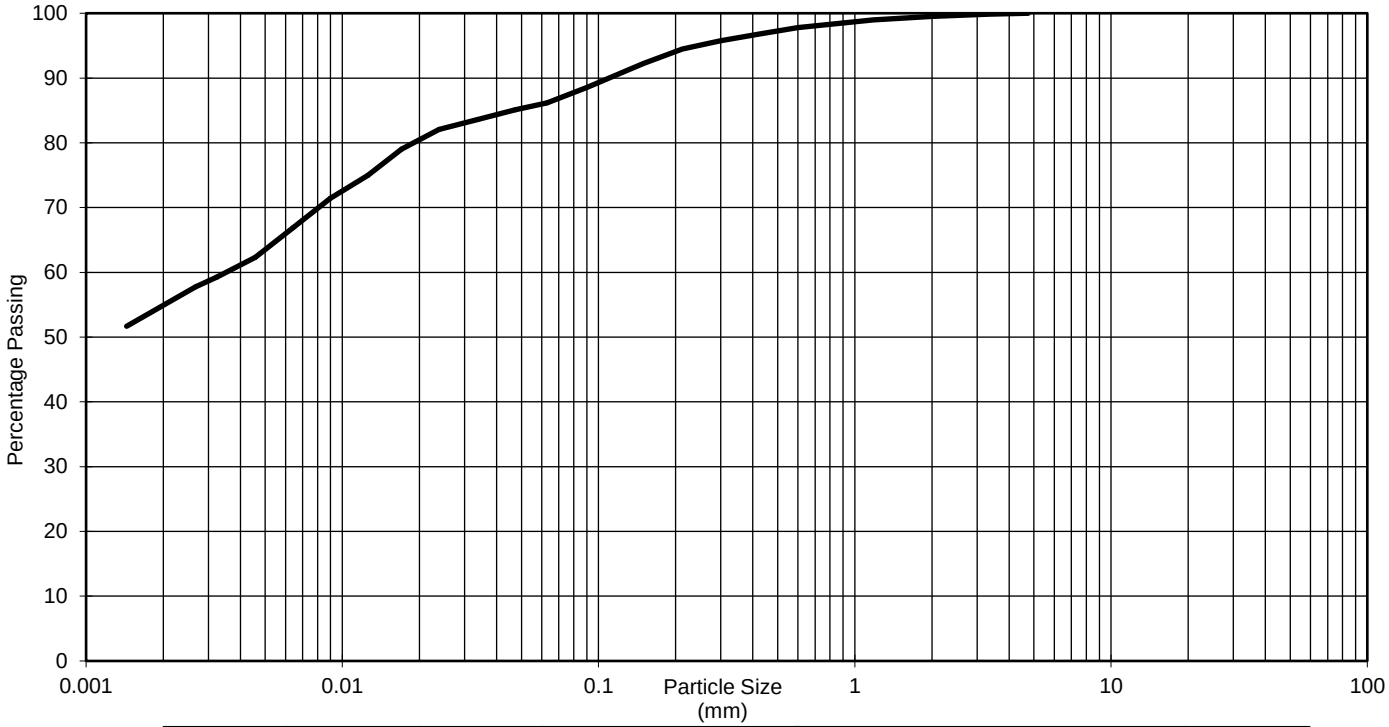
HYDROMETER NZS 4402:1986 TEST 2.8.4

IANZ ACCREDITED LABORATORY

Tests / comments indicated * are outside the scope of the laboratory's accreditation

J. McKelvey Approved Signatory

JOB NO	773-ETAM00588AA
PROJECT	J00858 - 1700 Buckland Road, Pukekohe
CLIENT	Lander Geotechnical Consultants Limited
BOREHOLE NO	HA1
CLIENT REF	S2
DEPTH	1.5 - 2.0 m
LAB SAMPLE ID	ETAM18S-00533



	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
CLAY	SILT			SAND			GRAVEL		

Tested from 'As received natural' state without pretreatment pH 8.5 Solid Density 2.75 Assumed

'As received' natural water content 79.1 % Percentage passing obtained by difference

SIZE	FRACTION	RANGE mm	%	*Size parameters diam % passing	mm
COBBLES		> 60		d_{85}	0.046
GRAVEL	Coarse	60 - 20		d_{60}	0.0035
	Medium	20 - 6		d_{50}	-
	Fine	6 - 2		d_{30}	-
SAND	Coarse	2 - 0.6	2	d_{15}	-
	Medium	0.6 - 0.2	4	d_{10}	-
	Fine	0.2 - 0.06	8	d_5	-
SILT	Coarse	0.06-0.02	6	*Uniformity Coefficient	
	Medium	0.02-0.006	14	C_u	-
	Fine	0.006-0.002	12	*Curvature Coefficient	
CLAY		<0.002	54	C_c	-

coffey A TETRA TECH COMPANY

Coffey Services (NZ) Limited (Lab - East Tamaki)
144A Cryers Road, East Tamaki, Auckland NZ 2013
PO Box 58877, Botany, Auckland NZ 2163
Phone: +64 9 272 3375, Fax: +64 9 272 3378
www.coffey.com

DATE 2.02.18

CHECKED JM

PARTICLE SIZE DISTRIBUTION

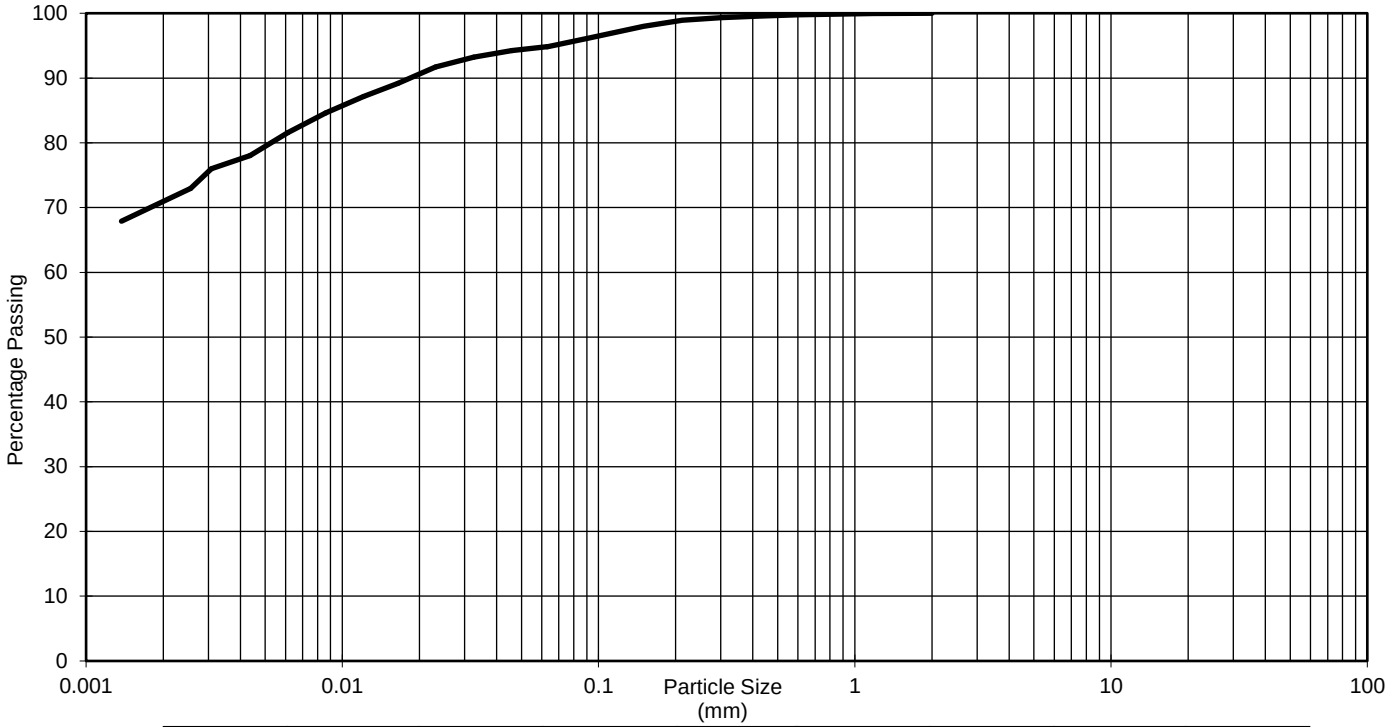
HYDROMETER NZS 4402:1986 TEST 2.8.4

IANZ ACCREDITED LABORATORY

Tests / comments indicated * are outside the scope of the laboratory's accreditation

J. McKelvey Approved Signatory

JOB NO	773-ETAM00588AA
PROJECT	J00858 - 1700 Buckland Road, Pukekohe
CLIENT	Lander Geotechnical Consultants Limited
BOREHOLE NO	HA5
CLIENT REF	S2
DEPTH	1.5 - 2.1 m
LAB SAMPLE ID	ETAM18S-00534



	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
CLAY	SILT			SAND			GRAVEL		

Tested from 'As received natural' state without pretreatment pH 8.0 Solid Density 2.75 Assumed

'As received' natural water content 72.2 % Percentage passing obtained by difference

SIZE	FRACTION	RANGE mm	%	*Size parameters diam % passing	mm
COBBLES		> 60		d_{85}	0.0091
GRAVEL	Coarse	60 - 20		d_{60}	-
	Medium	20 - 6		d_{50}	-
	Fine	6 - 2		d_{30}	-
SAND	Coarse	2 - 0.6		d_{15}	-
	Medium	0.6 - 0.2	1	d_{10}	-
	Fine	0.2 - 0.06	4	d_5	-
SILT	Coarse	0.06-0.02	4	*Uniformity Coefficient	
	Medium	0.02-0.006	10	C_u	-
	Fine	0.006-0.002	10	*Curvature Coefficient	
CLAY		<0.002	71	C_c	-

coffey A TETRA TECH COMPANY

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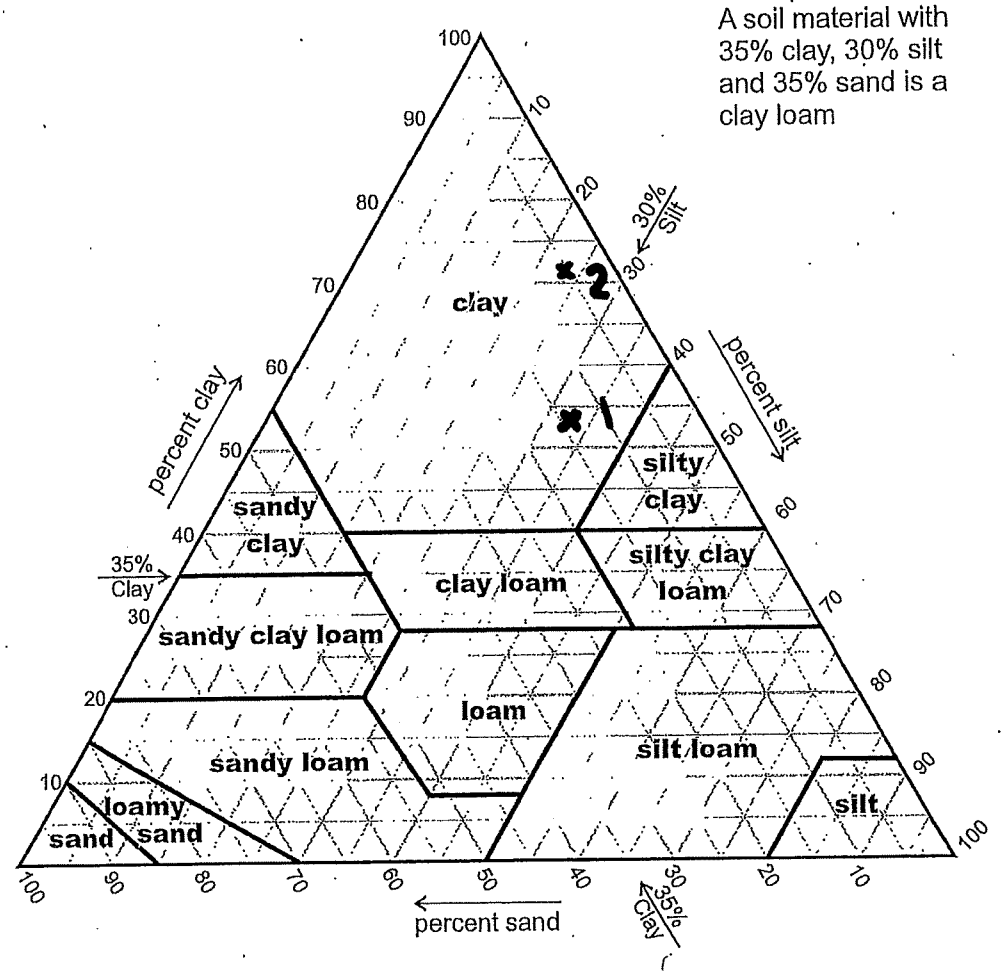
PO Box 58877, Botany, Auckland NZ 2163
Phone: +64 9 272 3375, Fax: +64 9 272 3378
www.coffey.com

DATE 2.02.18

CHECKED JM

Figure D1: US Department of Agriculture Textural Classification for Soils



1= HA1, 1.5-2.0m

2= HA5, 1.5-2.1m

Source: US Department of Agriculture, Textural Classification for Soils

Appendix E Initia Lab Testing Results

STEVENSON AGGREGATES LIMITED
Drury Quarry
Corner Quarry / Fitzgerald Roads, Drury
Auckland
www.stevenson.co.nz

Test Number: *203061* Report Number: *36953T*

Date of Issue: *2nd November 2020*

FINAL REPORT FOR *INITIA LTD*

Clients Address:	*PO Box 47647* *Ponsonby* *AUCKLAND 1144*
Attention:	*Kent Dalziel*
Reference:	*P-000925*
Subject:	***SOIL TESTING***
Clients Instructions:	*Conduct the tests as detailed below on the soil sample received*
Test Methods:	*1. NZS4402: 1986: Test* *2.1: Determination of the Water Content* *4.1.1: Determination of the Dry Density/Water Content Relationship - NZ Standard Compaction Test* *3.4: Detection of the Presence of Allophane in Soils* *2. NZ Geotechnical Society, Guideline - 2001 Determining the Shear Strength of a Cohesive Soil using a Hand Held Shear Vane*
Date Sampled:	*16th October 2020*
Date Received:	*23rd October 2020*
Date of Tests:	*October 2020*
Description of Sample:	***Clayey Silt, (Ash)***
Location:	***TP-05-02, 1.0-1.5m***
Project Name:	*303 Buckland Road*

Notes: *i. Field sample received in its natural state.*
ii. Sampling of soil is not covered by this report.

for STEVENSON AGGREGATES LTD

T A WHITMORE
IANZ APPROVED SIGNATORY

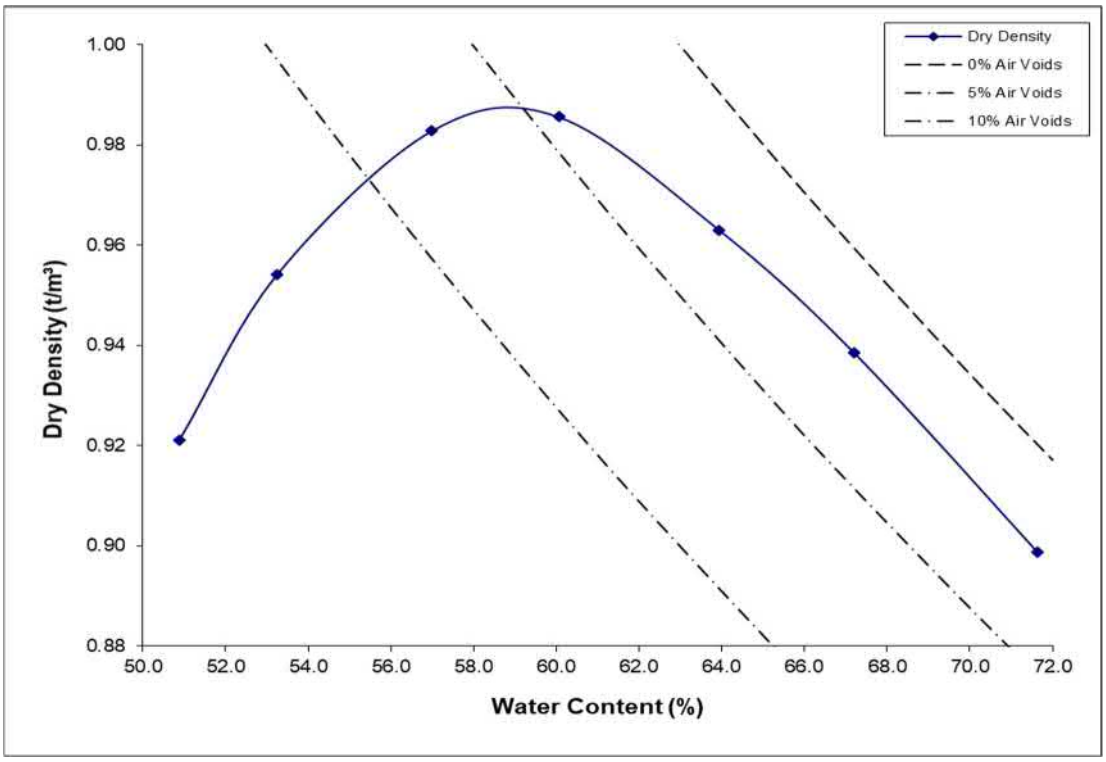
ACCREDITED IANZ TESTING LABORATORY Nº 17

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

TEST RESULTS

Material:	***Clayey Silt, (ASH)***	Test No:	***203061***
Location:	***TP-05-02, 1.0-1.5m***		
Project Name:	*303 Buckland Road*	Reference No.:	*P-000925*

NZ STANDARD COMPACTION



Maximum Dry Density (t/m³)	Optimum Water Content (%)	Solid Density Assumed t/m³	Natural Water Content %
0.99	*60.0*	*2.70*	*64.5*

Water Content (%)	*50.9*	*53.3*	*57.0*	*60.1*	*63.9*	*67.2*	*71.6*
Dry Density (t/m³)	*0.92*	*0.95*	*0.98*	*0.99*	*0.96*	*0.94*	*0.90*
Shear Strength (kPa)	*UTP*	*UTP*	*UTP*	*185*	*142*	*88*	*46*
Remould Shear Strength (kPa)	-	-	-	-	*62*	*32*	*8*

Note: *i.* *UTP = Unable to Penetrate.*
ii. *Test performed on material passing the 19.0mm sieve (97%)*

ALLOPHANE TEST RESULTS

Sample	Allophane Content %
TP-05-02, 1.0-1.5m	*< 5%*

STEVENSON AGGREGATES LIMITED
Drury Quarry
Corner Quarry / Fitzgerald Roads, Drury
Auckland
www.stevenson.co.nz

Test Number: *203060* Report Number: *36942T*

Date of Issue: *2nd November 2020*

FINAL REPORT FOR *INITIA LTD*

Clients Address: *PO Box 47647*
Ponsonby
AUCKLAND 1144

Attention: *Kent Dalziel*

Reference: *P-000925*

Subject: ***AGGREGATE TESTING***

Clients Instructions: *Conduct the tests as detailed below on the soil sample received.*

Test Methods: *1. NZS4402: 1986: Tests*
2.1: Determination of the Water Content
2.2: Determination of Liquid Limit
2.3: Determination of Plastic Limit
2.4: Determination of Plasticity Index

Date Sampled: *16th October 2020*

Date Received: *23rd October 2020*

Date of Test: *October 2020*

Description of Sample: ***Clayey Silt, (ASH)***

Location: ***TP-05-03, 3.5-4.5m***

Project Name: *303 Buckland Road*

TEST METHOD	RESULT	SPECIFICATION
Natural Water Content (%)	***79.9***	
Liquid Limit	***93***	-
Plastic Limit	***70***	-
Plasticity Index	***23***	-

Notes: *i. Field sample received in its natural state.*
ii. Sampling of soil is not covered by this report.
iii. Plasticity Index Test performed on material passing 0.425mm sieve.

for STEVENSON AGGREGATES LTD

T A WHITMORE
IANZ APPROVED SIGNATORY

ACCREDITED IANZ TESTING LABORATORY Nº 17

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

STEVENSON AGGREGATES LIMITED
Drury Quarry
Corner Quarry / Fitzgerald Roads, Drury
Auckland
www.stevenson.co.nz

Test Number: *203059* Report Number: *36943T*

Date of Issue: *2nd November 2020*

FINAL REPORT FOR *INITIA LTD*

Clients Address: *PO Box 47647*
Ponsonby
AUCKLAND 1144

Attention: *Kent Dalziel*

Reference: *P-000925*

Subject: ***AGGREGATE TESTING***

Clients Instructions: *Conduct the tests as detailed below on the soil sample received.*

Test Methods: *1. NZS4402: 1986: Tests*
2.1: Determination of the Water Content
2.2: Determination of Liquid Limit
2.3: Determination of Plastic Limit
2.4: Determination of Plasticity Index

Date Sampled: *16th October 2020*

Date Received: *23rd October 2020*

Date of Test: *October 2020*

Description of Sample: ***Clayey Silt, (ASH)***

Location: ***TP-04-02, 3.5-4.5m***

Project Name: *303 Buckland Road*

TEST METHOD	RESULT	SPECIFICATION
Natural Water Content (%)	***84.1***	-
Liquid Limit	***111***	-
Plastic Limit	***82***	-
Plasticity Index	***29***	-

Notes: *i. Field sample received in its natural state.*
ii. Sampling of soil is not covered by this report.
iii. Plasticity Index Test performed on material passing 0.425mm sieve.

for STEVENSON AGGREGATES LTD

T A WHITMORE
IANZ APPROVED SIGNATORY

ACCREDITED IANZ TESTING LABORATORY Nº 17
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

STEVENSON AGGREGATES LIMITED
Drury Quarry
Corner Quarry / Fitzgerald Roads, Drury
Auckland
www.stevenson.co.nz

Test Number: *203062* Report Number: *36944T*

Date of Issue: *2nd November 2020*

FINAL REPORT FOR *INITIA LTD*

Clients Address: *PO Box 47647*
Ponsonby
AUCKLAND 1144

Attention: *Kent Dalziel*

Reference: *TP-05-01*

Subject: ***AGGREGATE TESTING***

Clients Instructions: *Conduct the tests as detailed below on the soil sample received.*

Test Methods:
1. *NZS4402: 1986: Test*
   - *2.1: Determination of the Water Content*
   - *3.4: Detection of the Presence of Allophane in Soils*

Date Sampled: *16th October 2020*

Date Received: *23rd October 2020*

Date of Test: *October 2020*

Description of Sample: ***Clayey Silt, (ASH)***

Location: ***P-000925, 0.0 – 0.5m***

Project Name: *303 Buckland Road*

TEST RESULTS

Sample	Natural Water Content %	Allophane Content %
Source TP-05-01	*44.9*	*< 5%*

Notes:
i. *Field sample received in its natural state.*
ii. *Sampling of soil is not covered by this report.*

for STEVENSON AGGREGATES LTD

T A WHITMORE
IANZ APPROVED SIGNATORY

ACCREDITED IANZ TESTING LABORATORY Nº 17

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

STEVENSON AGGREGATES LIMITED
Drury Quarry
Corner Quarry / Fitzgerald Roads, Drury
Auckland
www.stevenson.co.nz

Test Number: *203058* Report Number: *36952T*

Date of Issue: *2nd November 2020*

FINAL REPORT FOR *INITIA LTD*

Clients Address:	*PO Box 47647* *Ponsonby* *AUCKLAND 1144*
Attention:	*Kent Dalziel*
Reference:	*P-000925*
Subject:	***SOIL TESTING***
Clients Instructions:	*Conduct the tests as detailed below on the soil sample received*
Test Methods:	*1. NZS4402: 1986: Test* *2.1: Determination of the Water Content* *4.1.1: Determination of the Dry Density/Water Content Relationship - NZ Standard Compaction Test* *2. NZ Geotechnical Society, Guideline - 2001 Determining the Shear Strength of a Cohesive Soil using a Hand Held Shear Vane*
Date Sampled:	*16th October 2020*
Date Received:	*23rd October 2020*
Date of Tests:	*October 2020*
Description of Sample:	***Clayey Silt, (Ash)***
Location:	***TP-03-02, 3.0-4.0m***
Project Name:	*303 Buckland Road*

Notes:
i. Field sample received in its natural state.
ii. Sampling of soil is not covered by this report.

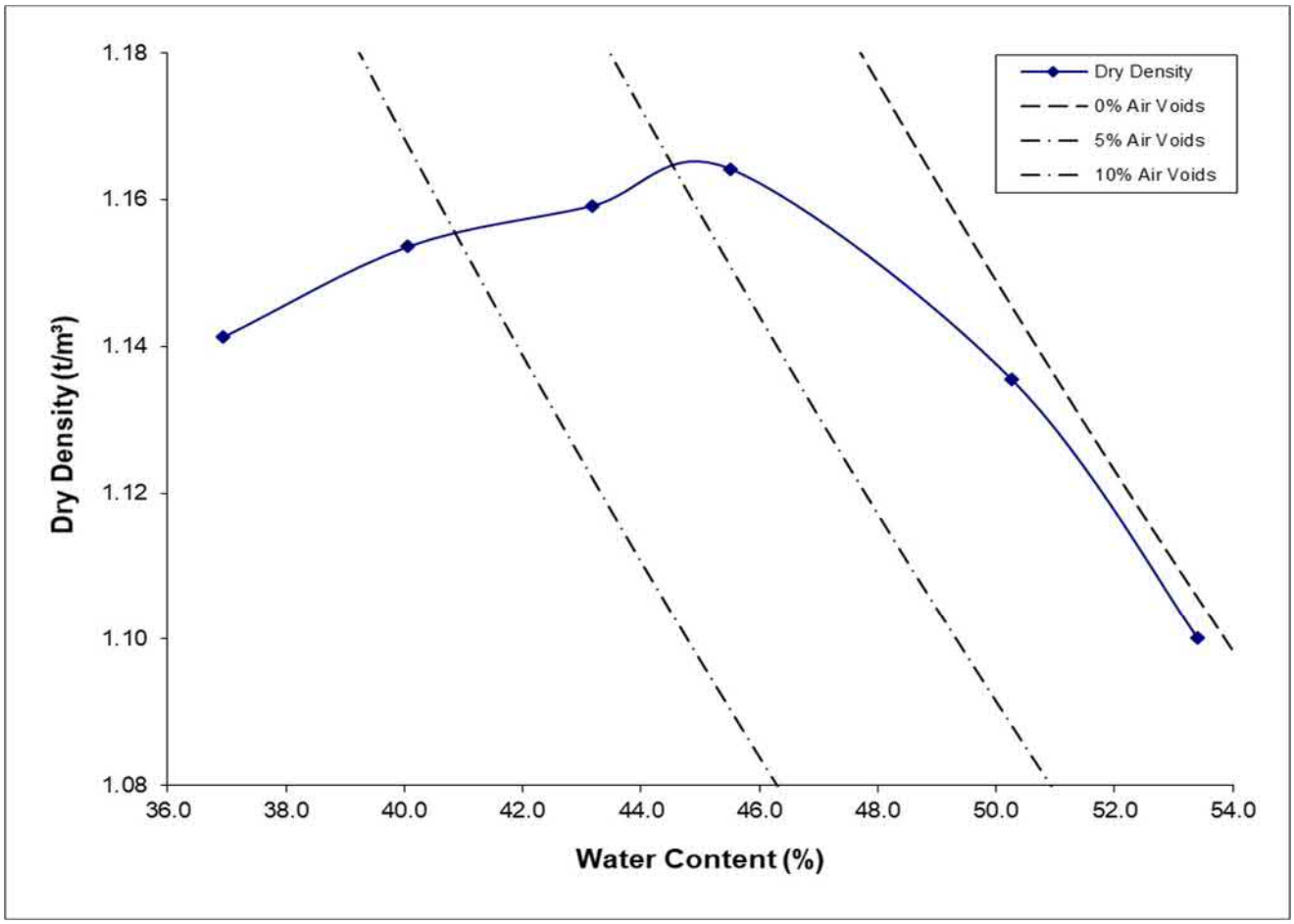
for STEVENSON AGGREGATES LTD

T A WHITMORE
IANZ APPROVED SIGNATORY

TEST RESULTS

Material:	***Clayey Silt, (ASH)***	Test No:	***203058***
Location:	***TP-03-02, 3.0-4.0m***		
Project Name:	*303 Buckland Road*	Reference No.:	*P-000925*

NZ STANDARD COMPACTION



Maximum Dry Density (t/m³)	Optimum Water Content (%)	Solid Density Assumed t/m³	Natural Water Content %
1.16	*45.0*	*2.70*	*65.3*

Water Content (%)	*36.9*	*40.1*	*43.2*	*45.5*	*50.3*	*53.4*
Dry Density (t/m³)	*1.14*	*1.15*	*1.16*	*1.16*	*1.16*	*1.14*
Shear Strength (kPa)	*UTP*	*UTP*	*UTP*	*185*	*131*	*86*
Remould Shear Strength (kPa)	-	-	-	*48*	*24*	*24*

Note: *i.* *UTP = Unable to Penetrate.*
ii. *Test performed on material passing the 19.0mm sieve (97%)*