23 July 2024

Ray Pickett
13 Hammond Street,
Hamilton 3204

Attention: Ray Pickett
Email: ray@pplgroup.co.nz

SITE INVESTIGATION AND ASSESSMENT OF POSSIBLE BUILDING SETTLEMENT AT NO. 13 HAMMOND STREET, HAMILTON – J5545.1

1. SCOPE OF WORK

In accordance with your request, we have carried out a site investigation and assessment of the above-referenced property. The purpose of our investigation and assessment was to determine and evaluate the subsurface conditions within the property and carry out an assessment of the likely cause of reported building subsidence.

This report is based on site conditions as observed during a geotechnical investigation carried out by our staff on 21 June and 8 July 2024.

2. SITE DESCRIPTION

The locally elevated, near level site is located on the eastern side of Hammond Street which is approximately 1.15km south of Hamilton Central, approximately halfway between Hamilton Lake and the meandering Waikato River.

A two-storey dwelling is located in the centre of the sections and is surrounded by standalone garage, several mature trees and lawn. The area of interest is located off the south-western corner of the dwelling, the lawn in that area exhibits a hummocky appearance with several depressions visible, refer Figure 1 and Figure 2 below.

The results of our geotechnical assessment, and observations are as follows:

Auckland
Ground Floor Oceanbridge House
25 Anzac Street
Takapuna Auckland 0622
PO Box 32 311 Devonport Auckland 0624
+64 9 445 8338

Waiheke Island
Waitai Business Hub
4 Waitai Road Ostend
Waiheke Island Auckland 1081
+64 9 445 8338

Hamilton
1150 Victoria Street
Whitiora Hamilton 3200
PO Box 9123 Hamilton 3240
+64 7 838 3119

Tauranga
PO Box 13384
Tauranga Central
Tauranga 3141
+64 272 769 699

enquiries@gwe.co.nz | gwe.co.nz

Figure 1. Figure 1. View to the northeast through the subject area of interest showing depressions in the lawn area circled in red.

Figure 2. View to the south-west through the subject area of interest showing depressions in the lawn area circled in red.

3. SITE CONDITIONS & HISTORY

3.1 General Historical Appreciation

The existing dwelling located onsite is acknowledged by Hamilton City Council as a historic Build known as 'A Ebberts's Residence (Ebbert Motors) home 1930-1950 'H217' as is a B-ranked heritage item under Schedule 8A.

Do we know when subsidence was first noticed to put a time scale on things ? maybe not

3.2 Site History

A review of historical aerial imagery has been carried out using 'Google Earth'. Figure 3 below shows a large tree in close proximity to the southwestern corner of the dwelling and that tree was removed between the time period of March 2015 and March 2016.

Additionally, several other depressions in the lawn, as shown in Figures 1 and 2, were likely as a result of other trees having been removed. Historic street view images from 'Google Maps depicted in Figure 4 show the difference in vegetation within the lawn area from 2010 to 2014.

Figure 3. No. 13 Hammond Street 'Google Earth' Aerial Imagery from March 2015 and March 2016 depicting the removal of a large mature tree circled in red.

Figure 4. 2010 vs 2014 Street View from Google Maps showing vegetation removal over time.

4. SITE GEOLOGY AND GEOMORPHOLOGY

Published geological information, S.W. Edbrooke, 2005; Geology of the Waikato Area, indicates that the site is primarily located over former floodplain (late Pleistocene - alluvial deposits) with a thin cover of low-strength slack water deposits (Recent Alluvium) overlying the denser alluvial deposits (Hinuera Formation) below.

The *Hinuera Formation* is reported as covering much of the Waipa Basin lowlands and was originally deposited by the braided river systems of the former Waikato River between 17,000 to 22,000 years ago. The deposits generally include interbedded layers of pumiceous and siliceous, cross-bedded Clays, Silts, Sands and Gravels together with occasional slack water deposits including organic Silts and Peats.

Because of the non-uniform way, the alluvial soils were deposited and the continually changing river channel alignments, variations in soil grain size, density and shear strength may occur within relatively short distances.

5. FIELD INVESTIGATION AND SUBSURFACE CONDITIONS

5.1 General

Based on our site observations the existing dwelling is founded on conventional timber piles with a concrete perimeter footing. The founding depth of the piles is unknown.

5.2 Field Investigations

The subsurface conditions at the site were investigated by drilling two hand auger borings and a single continuous flight machine auger boring together with associated *in-situ* shear vane and Scala penetrometer tests at the locations shown on the Site Plan J5545-01.

The Bore Holes are designated Nos. 1 to 3 with the Bore Hole Logs and associated test results presented in Fig. A-1 and A-2.

The purpose of the borings and associated testing was to provide guidance as to the general subsurface soil profile, variability, and relative density of soils within the proposed building area. Actual conditions may vary across the site and may differ slightly from those described below.

5.3 Subsurface Conditions

The bore hole testing revealed 100 to 200mm of re-spread TOPSOIL overlying low strength uncontrolled FILLING comprised of a mixture of Clay, Silt, Gravels and Sand to 0.5m below existing ground level.

The Filling is underlain by stiff to very stiff, silty CLAY to 0.9 and 1.1m depth overlying layers of loose to medium dense, silty, fine to medium grained SAND and very soft to firm, silty CLAY to at least the base of 1.6m and 3.0m deep Bore Hole Nos. 2 and 3 respectively. A 200mm thick layer of stiff, organic SILT is present between 1.1 and 1.3m in Bore Hole No. 1 only.

The soft to stiff, silty CLAY in Bore Hole No. 1 extends to 5.5m and overlies medium dense SAND to 5.7m and very stiff CLAY to at least the base of the 6.0m deep borehole.

5.4 Groundwater

Perched groundwater was encountered between 1.6m and 2.0m below existing ground level in Bore Hole Nos. 2 and 3 only. No groundwater was encountered in the 6.0m deep Bore Hole No. 1 during our mid-winter site investigation.

The site is relatively elevated at approximately RL - 39.0m approximately 2.0m above the Waikato River. We expect the regional groundwater table to be located in respect of the Waikato River level located at an approximate RL of 12 – 14m.

6. REVIEW OF SOIL CONDITIONS AND POSSIBLE CAUSE OF SETTLEMENT

The results of the testing indicate that the soils in the upper 2m of the site comprise of low to moderate strength silty Clay soils which in the location of Bore Hole No. 2 are less than what we would typically consider to be 'Good Ground' in terms of NZS3604:2011 the NZ for Timber framed buildings. Furthermore, organic material was encountered in BH01 at a depth of 1.1 to 1.3m.

Our review of the available aerial imagery indicates several large trees were located in the affected corner of the building which may explain the settlement and possibly the zone of very low strength soils encountered between 1 and 1.7m depth in Bore Hole No. 2.

Should the building be repaired then the area of foundations affected will require underpinning or re-piling. This will require a pile to be installed at a depth where the soils strengths achieve 300kPa. The bore holes indicate that this is in the order of 2-3m depth.

It should be noted that our assessment is based on information provided by the client. We have not carried out an assessment of the structure and understand that is being carried out by a structural engineer.

7. LIMITATIONS

This report has been prepared for the sole benefit of **Ray Pickett** as our Client, and their appointed representatives, according to their instructions, for the specific objectives described herein. This report is qualified in its entirety and should be considered in the light of our Terms of Engagement with the Client and the following:

a. Data or opinions contained within the report may not be used in other contexts or for any other purpose without our prior review and written agreement. Any reliance will be at the parties' sole risk.

b. No responsibility is assumed for inaccuracies in reporting by the information providers. In no event, regardless of whether GWE 's consent has been provided, does GWE accept any liability, whether directly or indirectly, for any liability or loss suffered or incurred by any third party to whom this report is disclosed placing any reliance on this report, in part or in full.

c. GWE has relied on information provided by the Client and by third parties to produce this document and arrive at its conclusions. GWE has not verified information provided (unless specifically noted otherwise) and we assume no responsibility and make no representations with respect to the adequacy, accuracy, or completeness of such information. No responsibility is assumed for inaccuracies in reporting by the information providers.

d. Only a finite amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. Due to the inherent variability in natural soils and subsurface conditions, it is unlikely that the results, assumptions, and conclusions set out in this report represent the extremes of conditions at any location removed in time and/or place from the specific points of sampling. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it must be appreciated that actual conditions could vary from the assumed model.

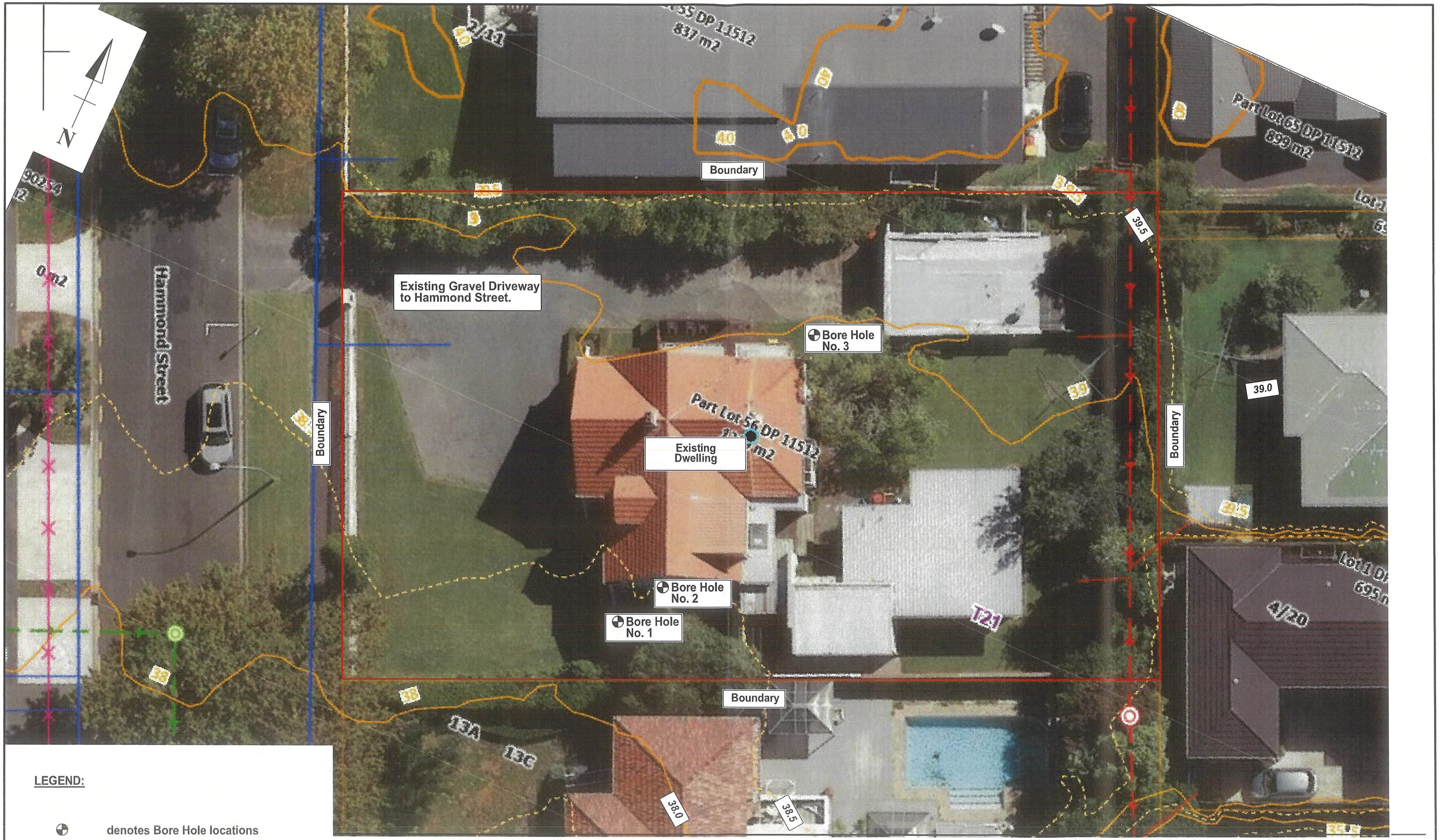
e. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

f. Subsurface conditions, such as groundwater levels, can change over time. This should be borne in mind, particularly if the report is used after a protracted delay.

Sincerely
GWE Consulting Engineers

Prepared by:	**Reviewed by:**	**Approved by:**
Olivia Hooker	Geraint Walters	Doug Harbutt
Engineering Geologist - BSc	General Manager	Senior Geotechnical Engineer

APPENDIX A -SITE PLAN



LEGEND:

● denotes Bore Hole locations

55.0 " contour RL (m)

SCALE 1:200

0 4 8 12 16 20 metres

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RAY PICKETT

Site Investigation & Assessment of Possible Building Subsidence
No. 13 Hammond Street, Hamilton

SITE PLAN

DRAWING No. J5545-01

DATE: July 2024

ISSUE DATE: 23.07.2024

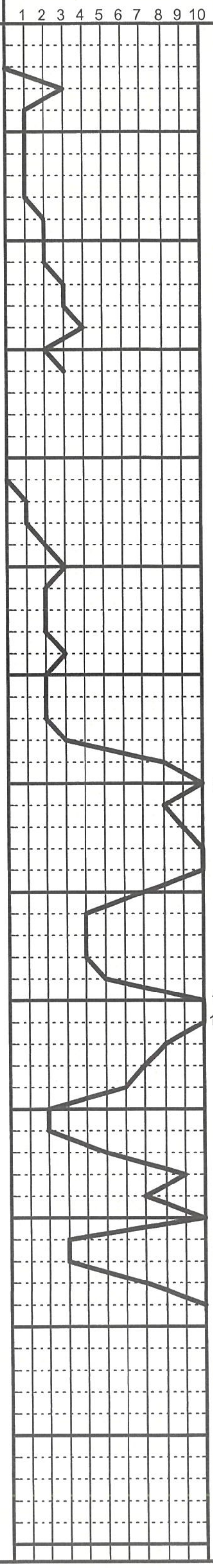
APPENDIX B -BORE HOLE LOGS

BORE HOLE LOG No. 1

GRAPHIC LOG	SOIL DESCRIPTION	DEPTH (metres)	GEOLOGICAL FORMATION	UNDRAINED SHEAR STRENGTH - kPa (In-situ/Remoulded)	PIEZOMETER / WATER LEVEL
	TOPSOIL.		TS		
	FILLING: Mixture of Clay, Silt, Gravels & Sand. Uucontrolled, variable strength, moist, mixed brown, grey and orangey brown.		Fill		
	silty CLAY. Stiff to very stiff, moist, moderately plastic, brown. Becoming light brown @ 0.4 metres. " yellowish brown @ 1.4 metres.	1	Recent Alluvium	117/23 119/23 88/23	
	organic SILT. Stiff, wet, low plasticity, heavily manganese stained, dark black to bluish black.			71/23 85/23	
	silty CLAY. Soft to very stiff, moist, moderately plastic, pumiceous, trace manganese stained nodules, dilatant, bluish grey to grey. Containing several tree rootlets from 1.5m.	2 3		117/61	No Groundwater
	silty CLAY. Stiff to very stiff, moist, moderately plastic, pumiceous, trace manganese stained nodules, dilatant, bluish grey to grey.	4 5	Hinuera Formation		
	fine to medium SAND with trace fine to coarse gravels. Medium dense, moist, siliceous, moderately graded, greenish grey to bluish grey.				
	CLAY. Very stiff, moist, moderately plastic, trace iron stained, pale grey.	6			

Bottom of Bore Hole completed 08/07/2024

SCALA PENETROMETER (blows/100mm)



NOTES
- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are Undrained Shear Strength, which was determined from Geotechnics Vane 1432 with a calibration factor of 1.53 applied to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

JOB NAME: RAY PICKET
JOB LOCATION: No. 13 Hammond Street, Hamilton
JOB NUMBER: J5545

DRILL METHOD: Machine Auger
RIG: Hilux
DRILLER: RS

LOGGED: OH
PLOTTED: OH
DATE LOGGED: 08/07/2024
CHECKED: SW

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BORE HOLE LOG

BORE HOLE No. 1
LOCATION: Refer Site Plan
RL (m):
SHEET: 1 OF 1
Fig. No. A-1

BORE HOLE LOG No. 2

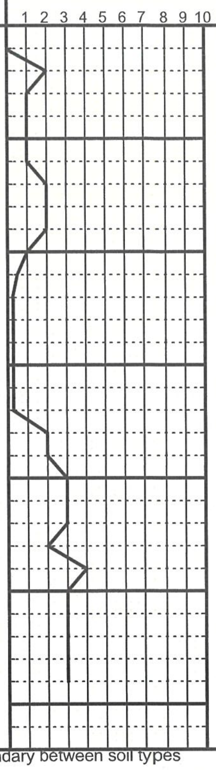
GRAPHIC LOG	SOIL DESCRIPTION	GEOLOGICAL FORMATION
▨	TOPSOIL.	TS
▦	FILLING: Mixture of Topsoil, Clay, Silt, Gravels & Sand. Uncontrolled , low strength, Moist, mixed dark brown to black.	Fill
	silty CLAY. Stiff to very stiff, moist, moderately plastic, pumiceous, trace iron stained, mottled grey to orangey bown.	Recent Alluvium
	silty CLAY. Very soft, moist, low plasticity, pumiceous, contains some manganese stained nodules, dilatant, bluish grey to grey. Becoming very soft @ 1.0m. Unable to retrieve full sample from 1.2m.	
	Bottom of Bore Hole completed 21/06/24	

DEPTH (metres): 1, 2, 3

UNDRAINED SHEAR STRENGTH - kPa (In-situ/Remoulded):

131/23
131/49
78/49
91/49
110/49
232+/46
232+/56
232+

SCALA PENETROMETER (blows/100mm)



PIEZOMETER / WATER LEVEL: After Drilling

BORE HOLE LOG No. 3

NOTES

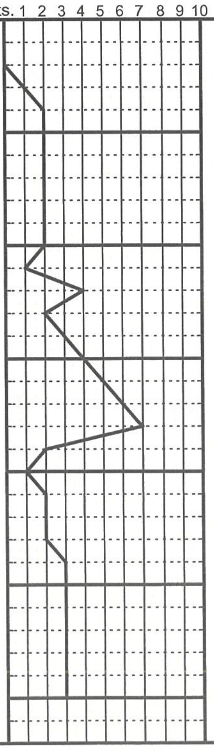
- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are Undrained Shear Strength, which was determined from Geotechnics Vane 1432 with a calibration factor of 1.53 applied to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	SOIL DESCRIPTION	GEOLOGICAL FORMATION
▨	TOPSOIL.	TS
▦	FILLING: Mixture of Clay, Silt, Gravels & Sand. Uncontrolled, low strength, Moist, mixed brown, grey and orangey brown.	Fill
	silty CLAY. Stiff to very stiff, moist, moderately plastic, brown. Becoming light brown @ 0.4 metres. " yellowish brown @ 1.4 metres.	Recent Alluvium
	fine to medium silty SAND with some clay. Loose to medium dense, wet, siliceous, greyish brown.	Hinuera Formation
	clayey SILT with trace fine sand. Stiff, wet, siliceous, dilatant, grey to brown.	
	fine sandy SILT with trace clay. Stiff, wet, low plasticity, pumiceous, trace iron stained, dilatant, pale grey to orangey brown. Becoming soft to firm @ 1.8m. " heavily iron stained (possible iron pan) at 2.0m. " saturated and unable to retrieve full sample from 2.1m. " firm to stiff @ 2.3m.	
	Bottom of Bore Hole completed 21/06/24	

DEPTH (metres): 1, 2, 3

UNDRAINED SHEAR STRENGTH - kPa (In-situ/Remoulded):

117/23
119/23
88/23
71/23
117/61



PIEZOMETER / WATER LEVEL: After Drilling

JOB NAME: RAY PICKETT
JOB LOCATION: No. 13 Hammond Street, Hamilton
JOB NUMBER: J5545

DRILL METHOD: Hand Auger
RIG:
DRILLER: OH

LOGGED: OH PLOTTED: OH
DATE LOGGED: 21/06/2024
CHECKED: SW

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BORE HOLE LOG

BORE HOLE Nos. 2 & 3
LOCATION: refer Site Plan **RL (m):**
SHEET: 1 OF 1 **Fig. No.** A-2