

20 March 2026

Awanui Links Development

28 Telephone Road, Puketaha

PRELIMINARY GEOTECHNICAL DESKTOP REPORT

Maven Waikato Ltd

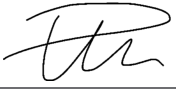
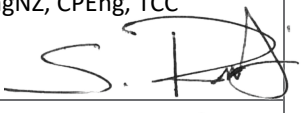
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Version Control

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Review and Update History

Revision	Date	Comments
A	04 March 2026	Initial draft for internal review
0	11 March 2026	Report issue
1	19 March 2026	Updated masterplan



CONTENTS

1.0	INTRODUCTION	4
1.1	Scope.....	4
2.0	SITE DESCRIPTION	4
2.1	Site Location.....	4
2.2	Landform.....	4
2.3	Proposed Development	5
3.0	CONCEPTUAL GROUND MODEL.....	5
3.1	Geology	5
3.2	Nearby Geotechnical Data	6
3.3	Groundwater.....	6
4.0	DESKTOP FINDINGS	7
4.1	Historical Photos	7
4.2	Regional Hazards.....	7
4.3	Fault Rupture	7
4.4	Liquefaction and Lateral Spread	7
4.5	Slope Stability.....	8
4.6	Load Induced Settlement.....	8
4.7	Earthworks, Civil Works and Road Subgrades	9
4.8	Acid sulphate soils.....	9
4.9	Seismic Site Subsoil Category.....	10
4.10	Foundation	10
	4.10.1 Bearing Capacity	10
	4.10.2 Preliminary Foundation Options	10
5.0	FURTHER WORK	10
6.0	CLOSURE	11

Appendices

APPENDIX A	NZGD Logs and WRC Bores
APPENDIX B	Historical Photographs
APPENDIX C	Waikato Regional Council Hazards Portal
APPENDIX D	Preliminary Liquefaction Results
APPENDIX E	Preliminary Load Induced Settlement Results
APPENDIX F	Natural Hazards Risk Assessment

1.0 INTRODUCTION

1.1 Scope

CMW Geosciences (CMW) was engaged by Maven Waikato Ltd to carry out a geotechnical desktop of a site located at 28 Telephone Road, Puketaha, for the proposed Awanui Links development to support a fast-track referral application.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal letter referenced HAM2025-0123AA, Rev 0 dated 3 November 2025.

This report has been prepared to summarise the expected ground conditions and provide preliminary recommendations for possible geohazards, foundations and site-specific geotechnical testing.

2.0 SITE DESCRIPTION

2.1 Site Location

The site is located at 28 Telephone Road, Puketaha, as shown in Figure 1. The site is approximately 96ha and is currently being used for agricultural purposes.

The site is bordered by Holland Rd and the East Coast Main Trunk (ECMT) railway to the south and Telephone Road (SH1B) to the west. Farmland borders the northern and eastern site boundaries.



Figure 1: Site Location Plan (Source: Google Earth Pro).

2.2 Landform

The landform is essentially near level with existing levels ranging from RL 42m to RL 43m across site. A depression is located close to Telephone Rd and ranged from RL 42m to RL 40m. A hill is also identified near the southern boundary which ranges from RL 44m to RL 46m. These features have been shown in **Appendix A**.

Two council open roadside drains run along Telephone and Holland Rd. These drains have very flat gradient with flow towards the north and ultimately feed into a gully system which feeds into the Kormakorau Stream, approximately 4km north of the proposed development. The drain locations are shown in **Appendix A**.

2.3 Proposed Development

The proposed Awanui Links is a mixed-use development as shown in Figure 2. It includes rural residential lots, light industrial lots, a retirement village with a care centre, a solar farm and an 18-hole international golf course with visitor accommodation, an event centre and wellness centre.



Figure 2: Awanui Links Masterplan (Source: Maven)

3.0 CONCEPTUAL GROUND MODEL

3.1 Geology

Published geological maps¹ for the area depict the regional geology as Holocene swamp deposits comprising of soft organic peat and mud with lenses of sand and silt. This is illustrated in Figure 3 below.

The Holocene swamp deposits are forming a surficial layer that commonly overlies late-Pleistocene age Hinuera Formation alluvial sand, silt and gravel with occasional peat interbeds.

¹ GNS Geological Map 1:250,000 scale Geological Map No 4 'Waikato'. SW Edbrooke et al.

A small area of late-Pliocene to Pleistocene age Walton Subgroup non-welded ignimbrite with associated alluvium and volcanic ashes is exposed 1.5km northwest of the site. This older geology underlies the more recent Holocene swamp deposits and Hinuera Formation alluvium.

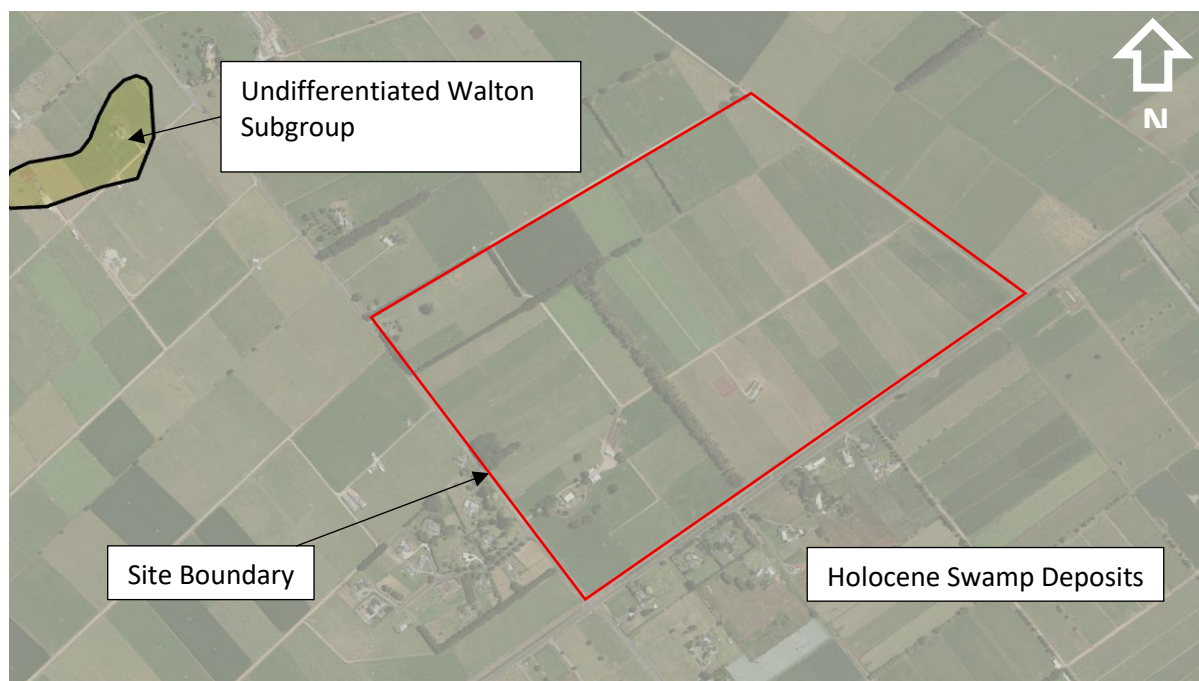


Figure 3: Regional Geology (Source: GNS Geology Map).¹

3.2 Nearby Geotechnical Data

A review of nearby geotechnical logs from the New Zealand Geotechnical Database (NZGD) confirms the geology present in the published geological maps. Relevant plans and engineering logs are presented in **Appendix A**.

Several bores are also located within or near the site. Three of these have a recorded lithology which has been included in **Appendix A**.

Table 1: Summary of Strata encountered in Publicly Available Logs

Unit	Depth to Base of Unit (m)		Assessed Thickness (m)
	Min	Max	
Topsoil	0.1	0.2	0.2
PEAT (Swamp Deposits)	0.5	2.7	0.8
Interbedded Stiff SILT/loose to dense silty SAND and organic SILT and CLAY (Hinuera Formation) *	>20		-
Note: *Base of unit not encountered in limited available investigation logs.			

3.3 Groundwater

Nearby NZGD test results indicate groundwater between 0.4m and 2.5m below ground level (bgl). Observations on the 26 February 2026, showed that there was water within the open drains along Telephone Road and Holland Road approximately 1.5m below ground level. This water level may represent groundwater level.

4.0 DESKTOP FINDINGS

4.1 Historical Photos

Historical photographs dating back to 1952 have been reviewed and are attached in **Appendix B**. The historical photographs show that the site has been used for agriculture prior to and since this time. In 1952, there are several structures present next to Telephone Road and more had been built in 1962. In 1991, the old buildings from 1952 have been removed and a tree had been planted. The depression next to Telephone Road also appears during this time. In an image from 2013, a pond is constructed in the southern part of site next to the silage pit.

4.2 Regional Hazards

A review of the Waikato Regional Council Natural Hazard Portal² was undertaken. The hazard portal addresses potential flooding, coastal hazards, volcanic and seismic hazards. Hazard maps have presented in **Appendix C**.

No river flooding risk had been identified. However, the site is part of the Waikato Central Drainage Scheme and there are Waikato Regional Council drains along Telephone and Holland Rd to remove water after a rainfall event. This demonstrates that the site is potentially prone to flooding after a heavy rainfall event. This will be addressed and resolved through the substantive application process.

The nearest active volcano is Ruapehu, which is approximately 170km away.

4.3 Fault Rupture

This site is not considered to be at risk of fault rupture on the basis that there are no mapped faults in the area. The GNS Active Fault Database³ indicates the nearest active fault is the Kerepehi Fault with is approximately 50km to the east of the site and has a recurrence interval of 2,000 to 3,500 years.

4.4 Liquefaction and Lateral Spread

Liquefaction occurs in loose saturated cohesionless soils that are subject to cyclic shear loading during an earthquake. This process leads to pore pressure build-up, soil grains moving into suspension and temporary loss of strength causing vertical and lateral ground deformation. A liquefaction hazard map from the Waikato Regional Council is presented in **Appendix C** which classes the liquefaction risk at the site as “possible”.

The Peak Ground Acceleration (PGA) for both Ultimate Limit State (ULS) and Serviceability Limit State (SLS) was calculated based on a 50-year design life in accordance with the PGA from MBIE guidance module 1 and return period from NZS 1170.0 and importance level (IL) 2 structures. The PGA for the SLS and ULS earthquake scenarios is as follows:

Table 2: Design Peak Ground Acceleration (PGA) for Various Limit States

Limit State	AEP	PGA(g)	Magnitude _{eff}
SLS	1/25	0.06	5.9
ULS	1/500	0.25	5.9
Note: AEP = annual exceedance probability.			

² Waikato Regional Council. Waikato Regional Hazards Portal. <https://experience.arcgis.com/experience/0eced30c44eb43a2b6fcb1ce8727c9db/>

³ GNS. New Zealand Active Fault Datasets. <https://data.gns.cri.nz/af/index.html>

The liquefaction susceptibility of the soils at this site was assessed using the existing CPT's at 545 Holland Road, approximately 300m from the site.

Liquefaction analyses were undertaken using the software package CLiq using the Boulanger and Idriss (2014) method. The cyclic stress ratio (CSR), being a function of the earthquake magnitude for the design return period event, was compared to the cyclic resistance ratio (CRR), being a function of the CPT cone resistance (q_c) and friction ratio (F_r). Results of this analysis has been presented in **Appendix D** and are summarised in the table below.

Table 3: Preliminary liquefaction analysis – 545 Holland Road.

CPT No.	SLS Settlements (mm)	ULS Settlements (mm)	Depth to liquefied layer (m bgl)
CPT_194534	<5	140	1.9
CPT_194537	<5	145	1.8
Note: ULS and SLS settlements are based on the full depth of the CPT trace with a weighing factor applied.			

The calculations indicate that in ULS cases, there is a potentially a high risk of liquefaction-induced settlement occurring at the site. Further investigations will need to take place to assess the site-specific liquefaction risk, however this can be managed through specifically designed foundations.

The fine-grained alluvium, while not liquefiable due to its high plasticity, may be susceptible to some strength loss, referred to as cyclic softening, during a ULS seismic event.

Following the onset of liquefaction, the liquefied soils behave as a very weak undrained material, which can give rise to lateral spreading where a free face is present within the vicinity of the site or where proposed cut and fill batters are proposed over or within liquefied soils. For example, lateral spread risk into stormwater retention swales or basins excavated below groundwater table will require slope stability analysis and lateral stretch assessment for adjacent buildings and infrastructure.

4.5 Slope Stability

Based on the general flat site topography, it is considered that the site is not generally considered to be at risk of slope instability. Slumping or subsidence has not been observed in the historical photographs.

The inclusion of fill with batters or cuts to form stormwater retention swales / basins will need an assessment of slope stability as part of the design process.

4.6 Load Induced Settlement

Given the site geology is predominantly swamp deposits over alluvial soils, there is a high risk of soft and compressible soils. In this instance, significant primary consolidation and long-term secondary creep settlements may occur as a response to the placement of fill and building loads.

Preliminary calculations were undertaken on the two CPT's located at 545 Holland Road and are presented in **Appendix E**. The calculations assume loading for light weight single story structures, as appropriate for the proposed luxury villas, retirement village and rural-residential buildings. A summary of results is presented Table 4 below. No Fill load was assumed when conducting these calculations.

Table 4: Preliminary load induced settlement results – 545 Holland Road

CPT No.	Primary Settlement (mm)	Total Settlement (mm)
CPT_194534	50	85
CPT_134537	45	75

CPT No.	Primary Settlement (mm)	Total Settlement (mm)
Note: - Settlement calculations are based on an applied load of 10kPa, with a footing width of 20m and an embedment depth of 0.5m. - Total settlement includes primary settlement and secondary settlement over a 50 year design life.		

New Zealand Building Code, Clause C.2.1.2 of B1/VM2 provides the following differential settlement criteria for design of shallow foundations:

“Foundation design should limit the probable maximum differential settlement over a horizontal distance of 6m to no more than 25mm under serviceability limit state load combinations of AS/NZS 1170 Part 0, unless the structure is specifically designed to prevent damage under a greater settlement.”

There is no site specific testing to enable an assessment of differential settlement, however these can typically be achieved through foundation and (if required) ground improvement design.

Settlement across site is expected to be variable. Further testing is required to establish site specific settlement results.

4.7 Earthworks, Civil Works and Road Subgrades

Due to the relatively flat landform, bulk earthworks involving cuts and fills are likely to be minor.

Excavations to form stormwater attenuation swales and ponds, service trenches and form road subgrades will encounter soft organic soils near the ground surface. The underlying silts / clays can be sensitive and may lose strength when they are disturbed or allowed to get wet.

Geotechnical site investigation and future reporting will provide advice on how to manage and treat soft soils. This may include removal and replacement or ground improvement methods, such as preloading.

Groundwater may be encountered at shallow depth. Future reporting will assess the need for groundwater mitigation measures, which may include the installation of underfill subsoil drains or granular drainage blanket layers as mitigation measures.

Temporary support of services trenches and excavations for buried infrastructure such as pump stations by benching along with use of trench shields and with temporary construction dewatering is anticipated.

Low CBR values for road subgrades should be expected with mitigation in the form of Subgrade Improvement Layers (SIL's).

If temporary or long-term groundwater levels are affected by any site development, then an assessment of groundwater drawdown effects such as settlement of surrounding properties may be required. If this is a significant risk then monitoring plans are typically required.

4.8 Acid sulphate soils

Acid sulphates can be found in waterlogged soils and can cause damage to water ways and infrastructure when exposed to oxygen through excavation or drainage. The Waikato Regional Council has assessed that there is a high probability of acid sulphate soils in this area, as shown on **Appendix C**. From recent experience in the Waikato region organic/peat soils present a potential higher risk of having acid sulphate conditions. Inorganic soils are typically low risk.

Testing and sampling will be required during the geotechnical investigation to assess the level of risk for the site. If mitigation is required, this can typically be done through the addition of Ag-Lime.

4.9 Seismic Site Subsoil Category

Based on those ground conditions and specific geophysical data gathered by the University of Waikato and Auckland University, the typical site period for the site is expected to be about 3 seconds where the seismic site subsoil category is assessed as being Class D (deep soil site) in accordance with NZS1170.5.

4.10 Foundation

4.10.1 Bearing Capacity

Further investigations will advise on anticipated foundation design parameters and any restrictions that require further engineering investigation and/or design on individual lots to address any remaining natural hazards as described in Section 71(3) of the Building Act, i.e. erosion, falling debris, subsidence, slippage, and inundation. The certification for residential lots is based on compliance with the “good ground” definition of NZS 3604 at finished ground levels.

There may be areas where localised variations in shear strength within the natural cut ground occur. Further confirmation of available bearing pressures will be addressed at the time of the geotechnical investigation.

4.10.2 Preliminary Foundation Options

Depending on the assessed magnitude of liquefaction-induced and static (load induced) settlement, engineered foundation solutions may be required. This may include foundation options such as TC2 or TC3 type raft foundations. Deep pile foundations/ deep ground improvement may also be required for larger loads expected in commercial / light industrial buildings.

Settlement magnitudes can be estimated once the required geotechnical investigation data is available and the proposed earthworks design, finished ground levels, and building loads are known. Depending on the nature of the proposed development and the finished ground levels, ground improvement of some kind may be required to manage static load induced settlement.

Ground improvement options that could be considered include:

- Undercut and rework of soft ground (to address static settlement only);
- Temporary surcharge fills (to address static settlement only);
- Deep soil mixing and/or vibro-stone columns (to mitigate both liquefaction and static settlement).

Confirmation of the most suitable approach will require detailed geotechnical investigation and design and will vary for different building typologies and locations.

5.0 FURTHER WORK

Based on the assessment presented in this report, there are no unusual features or geotechnical constraints observed for this site that would prevent a mixed use development as indicated on the Maven masterplan from proceeding.

We have identified the following additional scope of work that is considered necessary to further assess the risk profile for the scheme and to support a substantive consent application. This additional scope of work is typical for mixed use development of this scale, and includes the following:

- Geotechnical investigation to inform ground model development, detailed geohazard assessment, selection of geotechnical design parameters, and design and construction recommendations.

- Geotechnical analysis and reporting, suitable to support future project stages including resource consent application, detailed design, and building consent applications (as required).
- Design of ground improvement (if necessary) to mitigate load or liquefaction induced settlement, or lateral spread.
- Geotechnical completion reporting following subdivision earthworks.

6.0 CLOSURE

This report has been prepared for use by Maven Waikato Ltd in relation to the Awanui Links, 28 Telephone Road, Puketaha project in accordance with the scope, proposed uses and limitations described in the report. Should you have further questions relating to the use of your report please do not hesitate to contact us.

Where a party other than Maven Waikato Ltd seeks to rely upon or otherwise use this report, the consent of CMW should be sought prior to any such use. CMW can then advise whether the report and its contents are suitable for the intended use by the other party.

USING YOUR CMW GEOTECHNICAL REPORT

Geotechnical reporting relies on interpretation of facts and collected information using experience, professional judgement, and opinion. As such it generally has a level of uncertainty attached to it, which is often far less exact than other engineering design disciplines. The notes below provide general advice on what can be reasonably expected from your report and the inherent limitations of a geotechnical report.

Preparation of your report

Your geotechnical report has been written for your use on your project. The contents of your report may not meet the needs of others who may have different objectives or requirements. The report has been prepared using generally accepted Geotechnical Engineering and Engineering Geology practices and procedures. The opinions and conclusions reached in your report are made in accordance with these accepted principles. Specific items of geotechnical or geological importance are highlighted in the report.

In producing your report, we have relied on the information which is referenced or summarised in the report. If further information becomes available or the nature of your project changes, then the findings in this report may no longer be appropriate. In such cases the report must be reviewed, and any necessary changes must be made by us.

Your geotechnical report is based on your project's requirements

Your geotechnical report has been developed based on your specific project requirements and only applies to the site in this report. Project requirements could include the type of works being undertaken; project locality, size and configuration; the location of any structures on or around the site; the presence of underground utilities; proposed design methodology; the duration or design life of the works; and construction method and/or sequencing.

The information or advice in your geotechnical report should not be applied to any other project given the intrinsic differences between different projects and site locations. Similarly geotechnical information, data and conclusions from other sites and projects may not be relevant or appropriate for your project.

Interpretation of geotechnical data

Site investigations identify subsurface conditions at discrete locations. Additional geotechnical information (e.g. literature and external data source review, laboratory testing etc) are interpreted by Geologists or Engineers to provide an opinion about a site specific ground models, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist due to the variability of geological environments. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. Interpretation of factual data can be influenced by design and/or construction methods. Where these methods change review of the interpretation in the report may be required.

Subsurface conditions can change

Subsurface conditions are created by natural processes and then can be altered anthropically or over time. For example, groundwater levels can vary with time or activities adjacent to your site, fill may be placed on a site, or the consistency of near surface conditions might be susceptible to seasonal changes. The report is based on conditions which existed at the time of investigation. It is important to confirm whether conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation and use by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. To help avoid misinterpretations, it is important to retain the assistance of CMW to work with other project design professionals who are affected by the contents of your report. CMW staff can explain the report implications to design professionals and then review design plans and specifications to see that they have correctly incorporated the findings of this report.

Your report's recommendations require confirmation during construction

Your report is based on site conditions as revealed through selective point sampling. Engineering judgement is then applied to assess how indicative of actual conditions throughout an area the point sampling might be. Any assumptions made cannot be substantiated until construction is complete. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances from previous assumption, conduct additional tests if required and recommend solutions to problems encountered on site.

A Geotechnical Engineer, who is fully familiar with the site and the background information, can assess whether the report's recommendations remain valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Environmental matters are not covered

Unless specifically discussed in your report environmental matters are not covered by a CMW Geotechnical Report. Environmental matters might include the level of contaminants present of the site covered by this report, potential uses or treatment of contaminated materials or the disposal of contaminated materials. These matters can be complex and are often governed by specific legislation.

The personnel, equipment, and techniques used to perform an environmental study can differ significantly from those used in this report. For that reason, our report does not provide environmental recommendations. Unanticipated subsurface environmental problems can have large consequences for your site. If you have not obtained your own environmental information about the project site, ask your CMW contact about how to find environmental risk-management guidance.

APPENDIX A

NZGD Logs and WRC Bores



LEGEND:

- SITE BOUNDARY
- HAXX NZGD HAND AUGER (HA) LOCATION
- NZGD TEST PIT (TP) LOCATION
- NZGD CPT LOCATION
- WRC BORE LOCATION

- NOTES:
- 1. SITE BOUNDARY SHOWN INDICATIVELY.
 - 2. BASE PLAN COURTESY OF GOOGLE EARTH.
 - 3. TEST LOCATIONS SHOWN INDICATIVELY ONLY.

 Great People Practical Solutions	CLIENT:	MAVEN WAIKATO LTD	DRAWN:	PM	PROJECT:	HAM2025-0123
	PROJECT:	AWANUI LINKS	CHECKED:	KL	DRAWING:	01
			REVISION:	0	SCALE:	NTS
	TITLE:	EXISITING SITE INVESTIGATION PLAN	DATE:	2/07/2025	SHEET:	A3

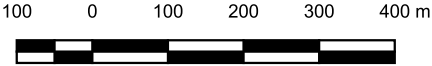


LEGEND:

- SITE BOUNDARY
- - - ROADSIDE DRAINS
- DEPRESSION
- HILL

NOTES:

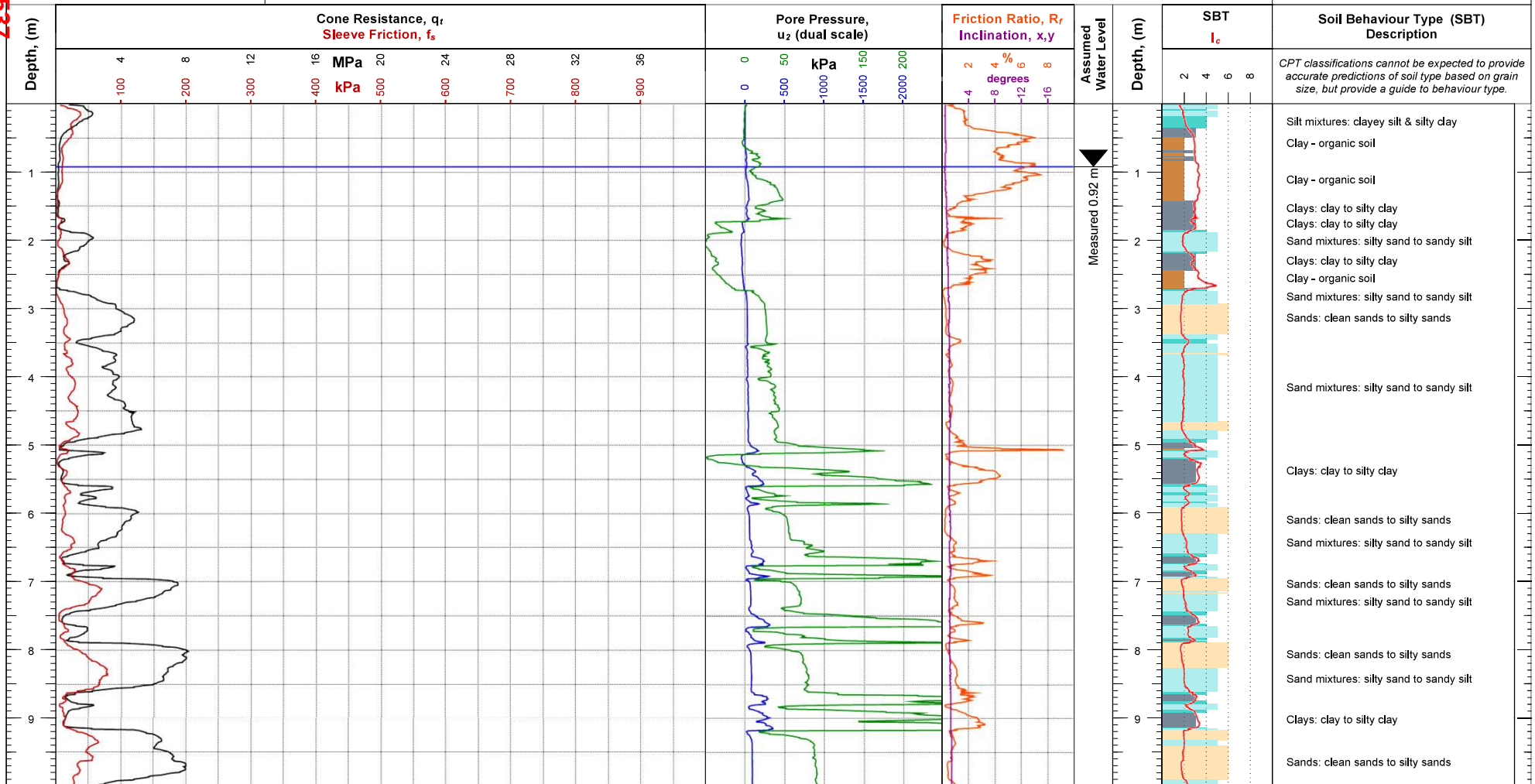
1. SITE BOUNDARY SHOWN INDICATIVELY.
2. BASE PLAN COURTESY OF GOOGLE EARTH.



CLIENT:	Maven Waikato Ltd	DRAWN:	PM	PROJECT:	HAM2025-0123
PROJECT:	Awanui Links	CHECKED:	KL	DRAWING:	02
TITLE:	Site Features	REVISION:	0	SCALE:	1:10,000
		DATE:	01/01/2025	SHEET:	A3L



CONE PENETRATION TEST (CPT) LOG



Client: Geoconsult

Project: 454 Holland Road

Location: Eureka, Hamilton

Engineer: Mark McDonald

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

Operator: Carlos Prieto

Cone Ref: MKJ167

Cone Type: 10 cm² Compression

Area Ratio: 0.8

Filter Type: u2

NZTM2000 N,E (m): 5820192.03, 1809172.98

WGS84, (deg): -37.741681, 175.373977

Location Method: Handheld GPS

Surveyor: N/A

Termination Reason: Limit of reaction force

Elevation (m): Unknown

Date of Test: 18/01/2019

Depth (m): 19.90

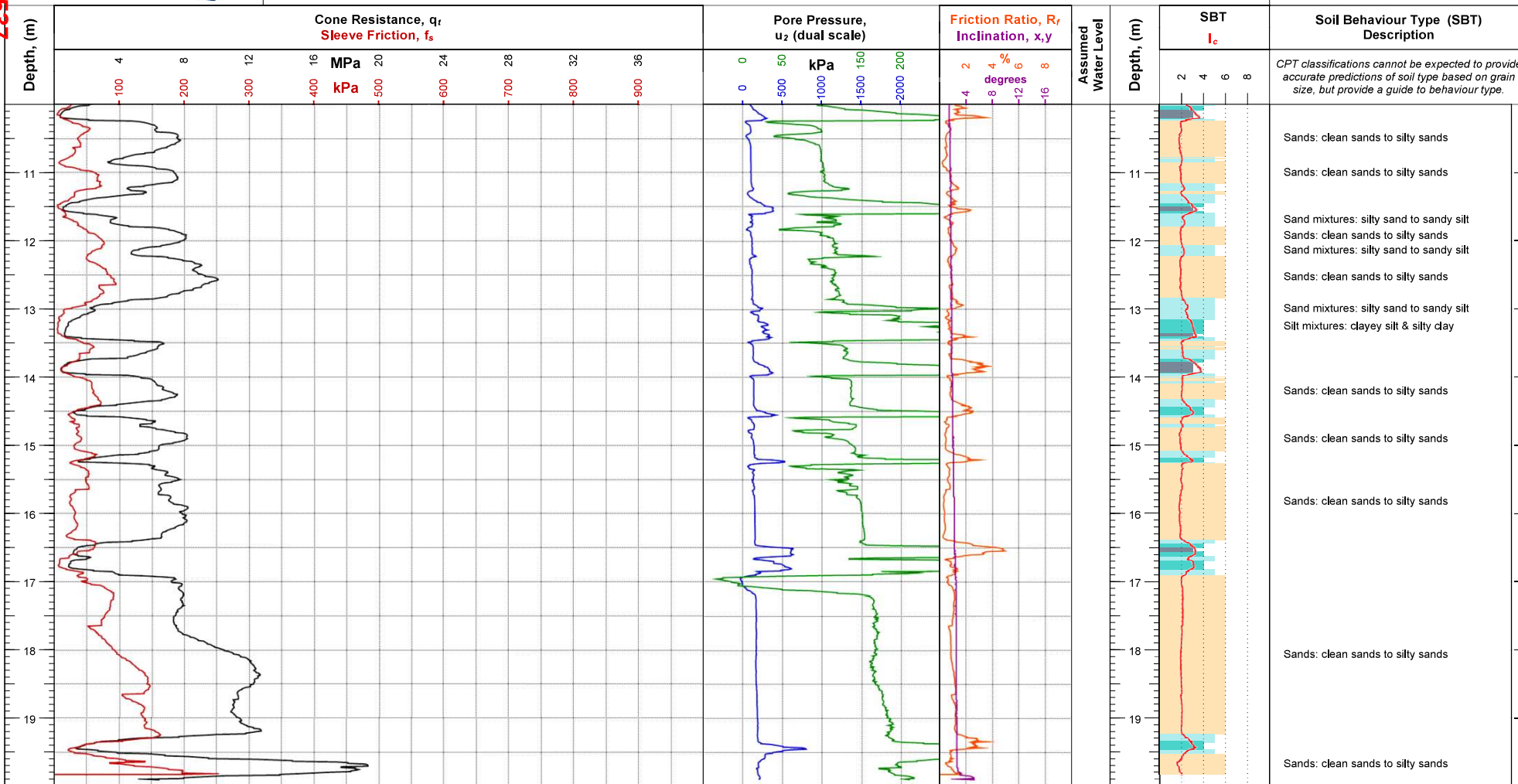
Pre-Drill (m): N/A

Client Job Ref:

CPT
Number: **CPT-02**G.I. Job Ref: **19-026**

Remarks:

CONE PENETRATION TEST (CPT) LOG



Client: Geoconsult
 Project: 454 Holland Road
 Location: Eureka, Hamilton
 Engineer: Mark McDonald
 Contractor: Ground Investigation Ltd.

www.g-i.co.nz

Operator: Carlos Prieto
 Cone Ref: MKJ167
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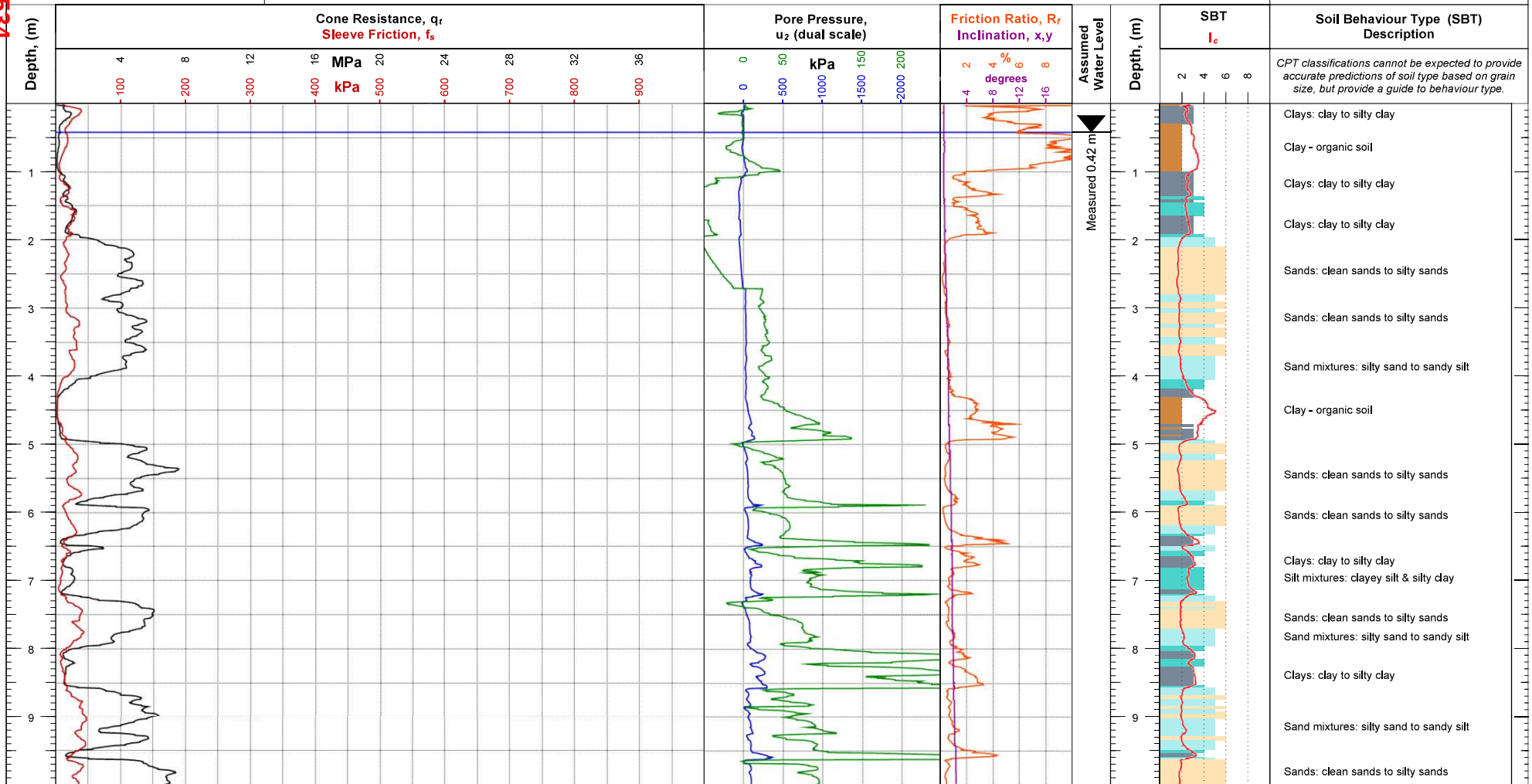
NZTM2000 N,E (m): 5820192.03, 1809172.98
 WGS84, (deg): -37.741681, 175.373977
 Location Method: Handheld GPS
 Surveyor: N/A
 Termination Reason: Limit of reaction force

Elevation (m): Unknown
 Date of Test: 18/01/2019
 Depth (m): 19.90
 Pre-Drill (m): N/A

Client Job Ref:
 CPT Number: **CPT-02**
 G.I. Job Ref: **19-026**

Remarks:

CONE PENETRATION TEST (CPT) LOG



Client: Geoconsult

Project: 454 Holland Road

Location: Eureka, Hamilton

Engineer: Mark McDonald

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

Operator: Carlos Prieto

Cone Ref: MKJ167

Cone Type: 10 cm² Compression

Area Ratio: 0.8

Filter Type: u2

NZTM2000 N,E (m): 5820225.48, 1809185.2

WGS84, (deg): -37.741377, 175.374106

Location Method: Handheld GPS

Surveyor: N/A

Termination Reason: Limit of reaction force

Elevation (m): Unknown

Date of Test: 18/01/2019

Depth (m): 19.84

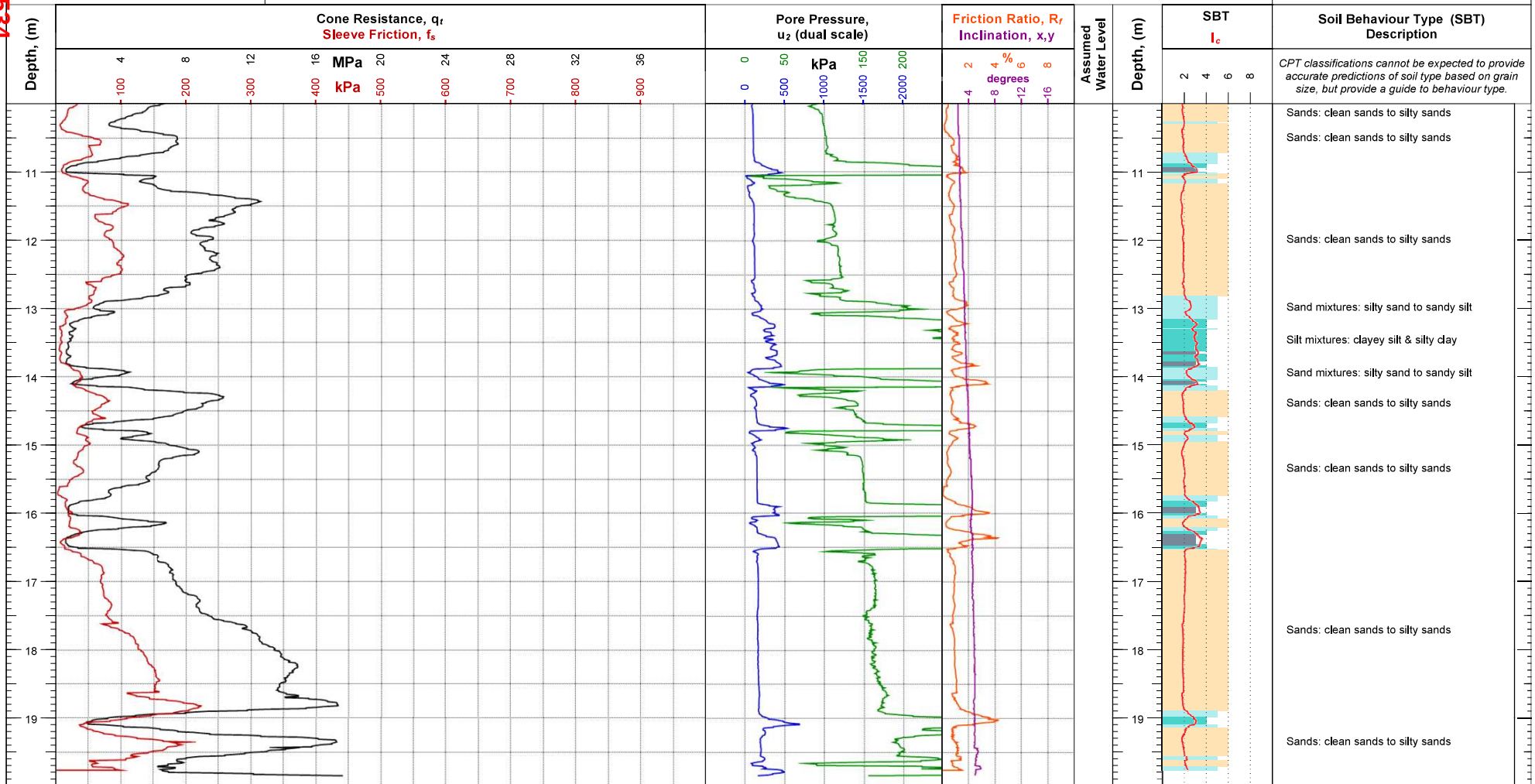
Pre-Drill (m): N/A

Client Job Ref:

CPT
Number: CPT-01
G.I. Job Ref: **19-026**

Remarks:

CONE PENETRATION TEST (CPT) LOG



Client: Geoconsult Project: 454 Holland Road Location: Eureka, Hamilton Engineer: Mark McDonald Contractor: Ground Investigation Ltd. www.g-i.co.nz	Operator: Carlos Prieto Cone Ref: MKJ167 Cone Type: 10 cm² Compression Area Ratio: 0.8 Filter Type: u2	NZTM2000 N,E (m): 5820225.48, 1809185.2	Elevation (m): Unknown	Client Job Ref:	
		WGS84, (deg): -37.741377, 175.374106	Date of Test: 18/01/2019	CPT Number: CPT-01	
		Location Method: Handheld GPS Surveyor: N/A	Depth (m): 19.84 Pre-Drill (m): N/A		
		Termination Reason: Limit of reaction force		G.I. Job Ref:	19-026

Remarks:

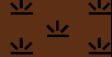
HA1

Address: 200 Holland Road

Date: 29/04/2022

Testers: PetaM

Project №: 13592

Water Table:	Depth (mm):	Geology:	Graphic Log:	Material Description:	Blows /100mm:			Shear Strength (kPa):		
					5	10	15	Undrained:	Remoulded:	Sensitivity:
	100	Undefined		Topsoil						
	200	Holocene Swamp Deposits		Dark brown and black, organics, Wood pieces present						
	300									
	400									
	500									
	600									
	700									
	800									
	900			SILT, light brownish grey, low plasticity, moist to wet, stiff				151	32	4.8
	1000									
	1100									
	1200							127	40	3.2
	1300									
	1400									
	1500			Sandy SILT, dark brownish grey, low plasticity, moist to wet, very stiff				162	48	3.4
	1600									
	1700									
	1800									
	1900									
	2000			SILT with some sand, dark greyish blue and brown, low plasticity, wet, stiff				103	44	2.3
	2100									
	2200									
	2300									
	2400									
	2500									
	2600			SILT with some sand, dark greyish blue and brown, low plasticity, saturated, stiff				127	48	2.7
	2700									
	2800			Borehole terminated due to non-retrieval @2700mm						

HA2

Address:200 Holland Road

Date:29/04/2022

Testers:PetaM

Project №:13592

Water Table:	Depth (mm):	Geology:	Graphic Log:	Material Description:	Blows /100mm:			Shear Strength (kPa):		
					5	10	15	Undrained:	Remoulded:	Sensitivity:
Not Found	100	Undefined		Topsoil						
	200									
	300	Holocene Swamp Deposits		Dark brown and black, moist, organics, Wood pieces present						
	400									
	500									
	600									
	700									
	800									
	900			SILT, light brownish grey, low plasticity, moist, stiff				143	32	4.5
	1000									
	1100			Sandy SILT, dark greyish brown, low plasticity, moist to wet, stiff				119	44	2.7
	1200									
	1300									
	1400									
	1500							87	16	5.5
	1600									
	1700									
	1800									
	1900			Sandy SILT, dark grey, low plasticity, wet, stiff				127	48	2.7
	2000									
	2100			End of Borehole @2000mm						

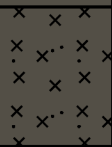
HA3

Address: 200 Holland Road

Date: 29/04/2022

Testers: PetaM

Project No: 13592

Water Table:	Depth (mm):	Geology:	Graphic Log:	Material Description:	Blows /100mm:			Shear Strength (kPa):		
					5	10	15	Undrained:	Remoulded:	Sensitivity:
	100	Undefined		Topsoil						
	200									
	300	Holocene Swamp Deposits		Dark brown and black, moist, organics						
	400									
	500									
	600									
	700									
	800									
	900			SILT, light brownish grey, low plasticity, moist, very stiff				187	41	4.5
	1000									
	1100			SILT, brownish grey mottled yellow, low plasticity, moist, very stiff				222	40	5.6
	1200									
	1300									
	1400									
	1500									
	1600			SILT, brownish grey, low plasticity, moist to wet, stiff				127	48	2.7
	1700									
	1800			SILT with some sand, dark greyish blue and brown, low plasticity, wet, stiff to very stiff				159	49	3.2
	1900									
	2000									
	2100							95	36	2.6
	2200									
	2300									
	2400			SILT with some sand, dark greyish brown and blue, low plasticity, saturated, stiff				125	48	2.6
	2500									
	2600			Borehole terminated due to non-retrieval @2500mm						

HA4

Address: 200 Holland Road

Date: 29/04/2022

Testers: PetaM

Project No: 13592

Water Table:	Depth (mm):	Geology:	Graphic Log:	Material Description:	Blows /100mm:			Shear Strength (kPa):		
					5	10	15	Undrained:	Remoulded:	Sensitivity:
Not Found	100	Undefined		Topsoil						
	200									
	300	Holocene Swamp Deposits		Dark brown and black, moist, organics						
	400									
	500									
	600									
	700									
	800									
	900									
	1000			SILT, light brownish grey, low plasticity, moist to wet, stiff				111	55	2
	1100									
	1200			Sandy SILT, light brownish grey, low plasticity, moist to wet, stiff				127	40	3.2
	1300									
	1400									
	1500									
	1600			SILT with some sand, dark greyish blue and brown, low plasticity, moist to wet, stiff to very stiff				222	48	4.7
	1700									
	1800									
	1900									
	2000							95	55	1.7
	2100			End of Borehole @2000mm						

Soil Description			Field Test Data																
Log Identification: HA03			Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)	Vane Shear Strength (NZGS) kPa Peak / Residual	Scala Penetrometer (blows per 100mm drop)										Groundwater Level
HAND AUGER	Depth (meters)								Blow count	Plot of Scala results								Groundwater encountered at 1.8m bgl.	
										Very loose	Loose	Medium Dense	Dense						
		TOPSOIL; dark brown. Moist.	T/S		3	3	3	3											
		PEAT (peat is amorphous); dark blackish brown. Moist to wet.	PEAT		2	2	2	3											
0.5				0.5	1	1													
		SILT with trace fine sand; brown. Stiff, moist to wet, slightly plastic.	SWAMP DEPOSITS		0.5	1													
		Sandy SILT with trace medium to coarse sand; brown. Stiff*, wet, slightly plastic.			0.5	1													
1.0				1.0	0.5	1													
		Silty medium to coarse SAND; brown. Loose to dense, wet.			2	2	2												
		- colour becoming light brownish grey.			2	2	2												
		- becoming wet to saturated.			3	3	3	3											
1.5				1.5	3	3	3	3											
					4	4	4	4	4										
					4	4	4	4	4										
					2	2	2												
2.0		- becoming saturated.		2.0	2	2	2												
					4	4	4	4	4										
				5	5	5	5	5											
				4	4	4	4	4											
				6	6	6	6	6	6										
				8	8	8	8	8	8	8	8								
2.5			2.5	7	7	7	7	7	7	7	7								
				9	9	9	9	9	9	9	9	9							
				7	7	7	7	7	7	7	7								
				7	7	7	7	7	7	7	7								
				6	6	6	6	6	6	6	6								
3.0		End of hand auger at 2.8m - No sample retained.		3.0															
		* consistency based on diagnostic features																	
3.5			3.5																
4.0			4.0																
4.5			4.5																
5.0			5.0																
5.5			5.5																
Notes: 1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual. 2. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005 3. Undrained shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "Guideline for Hand Held Shear Vane Test", August 2001. 4. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.																			
 Consulting Engineers and Planners HAMILTON 240 Tairāwhiti St, Hamilton +67 859 9137 NEW PLYMOUTH 11 East 24th Brangahua St, New Plymouth +67 757 5651				Job name: 369A Marshmeadow Road Site location: Newstead				Job Number: 18-1143 Shear Vane ID: 2206 Logged By: L.H.				Date of investigation: 10-01-2019							

Soil Description								Field Test Data													
Log Identification: HA04																					
Investigation method	Depth (meters)	Field Description				Geological Unit	Depth (meters)	Vane Shear Strength (NZGS) kPa Peak / Residual	Scala Penetrometer (blows per 100mm drop)										Groundwater Level		
HAND AUGER		TOPSOIL; dark brown. Moist.				T/S		72/34	Blow count	Plot of Scala results										Groundwater encountered at 1.8m bgl.	
		PEAT (peat is amorphous); dark blackish brown. Moist to wet.				PEAT			Very loose	Loose	Medium Dense				Dense						
	0.5					0.5 <td></td> <th>0 1 2 3 4 5 6 7 8 9 10</th> <th colspan="10"></th>			0 1 2 3 4 5 6 7 8 9 10												
		SILT with trace fine sand; brown. Stiff, moist to wet, slightly plastic. Note: Rootlets (dia < 10mm) observed at 0.6m.				SWAMP DEPOSITS			1	1											
		Sandy SILT; light brownish grey. Stiff*, wet, slightly plastic.					1.0		1	1											
	1.0	Silty medium to coarse SAND; light brownish grey. Loose to medium dense, wet to saturated.							1	1											
									1	1											
	1.5						1.5		1	1											
									2	2											
	2.0	- becoming saturated.					2.0		3	3	3										
							3	3	3												
2.5					2.5	3	3	3													
						2	2														
						3	3	3													
						4	4	4	4												
						3	3	3													
						3	3	3													
						2	2														
						3	3	3													
						4	4	4	4												
						5	5	5	5												
						7	7	7	7	7	7										
	End of hand auger at 2.7m - No sample retained.					3.0															
						3.5															
						4.0															
						4.5															
						5.0															
						5.5															
														</							

Soil Description					Field Test Data													
Log Identification: HA05																		
Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)	Vane Shear Strength (NZGS) kPa	Peak / Residual	Blow count	Scala Penetrometer (blows per 100mm drop)										Groundwater Level
HAND AUGER		TOPSOIL; dark brown. Moist.	T/S					Plot of Scala results										Groundwater not encountered during testing
		PEAT (peat is amorphous); dark blackish brown. Moist to wet.	PEAT															
	0.5	SILT; brown. Moist to wet, slightly plastic.		0.5														
		- with trace fine sand	SWAMP DEPOSITS															
	1.0	Sandy SILT; light greyish brown. Wet, slightly plastic.		1.0														
		End of hand auger at 1.0m - Target depth.																
	1.5			1.5														
	2.0			2.0														
	2.5			2.5														
	3.0			3.0														
	3.5			3.5														
	4.0			4.0														
	4.5			4.5														
	5.0			5.0														
	5.5			5.5														

Notes:

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005
- Undrained shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "Guideline for Hand Held Shear Vane Test", August 2001.
- Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.



Consulting Engineers and Planners

NEW PLYMOUTH | Level 3/53 Roughan St, New Plymouth | 06 757 5051

Job name: 369A Marshmeadow Road

Site location: Newstead

Job Number: 18-1143

Shear Vane ID: N/A

Logged By: L.H.

Date of investigation: 10-01-2019

Soil Description					Field Test Data												
Log Identification: HA06																	
Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)	Vane Shear Strength (NZGS) kPa Peak / Residual	Scala Penetrometer (blows per 100mm drop)										Groundwater Level	
HAND AUGER	0.5	TOPSOIL; dark brown. Moist.	T/S	PEAT	SWAMP DEPOSITS	Blow count	Plot of Scala results										
							Very loose	Loose	Medium Dense		Dense	Groundwater not encountered during testing.					
	1.0	PEAT (peat is amorphous); dark blackish brown. Moist to wet. <td></td> <td>0.5</td> <td></td> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td>		0.5			1	2	3	4	5		6	7	8	9	10
	1.5	SILT; brown. Moist to wet, slightly plastic. <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>															
	2.0	- with trace fine sand. Colour becoming light greyish brown. <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>															
	2.5	Sandy SILT; light greyish brown. Wet, slightly plastic. <td></td> <td>1.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>		1.0													
	3.0	End of hand auger at 1.0m - Target depth. <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>															
	3.5																
	4.0																
	4.5																
	5.0																
	5.5																

Soil Description						Field Test Data																
Log Identification: HA01																						
Investigation method	Depth (meters)	Field Description				Geological Unit	Depth (meters)	Vane Shear Strength (NZGS)		Scala Penetrometer (blows per 100mm drop)										Groundwater Level		
							kPa	Peak / Residual	Blow count	Plot of Scala results												
										Very loose	Loose	Medium Dense		Dense								
										0	1	2	3	4	5	6	7	8	9	10		
HAND AUGER		TOPSOIL; dark brown. Moist.				T/S			2	2	2											
		PEAT (peat is amorphous); dark blackish brown. Moist to wet.				PEAT			2	2												
	0.5								1													
									2	2												
								2	2													
	1.0	SILT with trace fine to medium sand; brown. Stiff, moist to wet, slightly plastic.				SWAMP DEPOSITS			1													
		- with trace of clay. Sand increasing to minor. Colour becoming light brownish grey. Becoming wet.							1													
		Sandy SILT; light brownish grey. Stiff, wet to saturated, slightly plastic.							1													
	1.5								2	2												
									5	5	5	5	5	5								
	SILT with trace fine to medium sand; light brownish grey. Stiff*, wet to saturated, slightly plastic.						5	5	5	5	5	5										
2.0							4	4	4	4	4											
							3	3	3													
							2	2	2													
							1	1														
							1	1														
							2	2	2													
							4	4	4	4	4											
							5	5	5	5	5	5										
							4	4	4	4	4											
							3	3	3													
							3	3	3													
							3	3	3													

Soil Description			Field Test Data																	
Log Identification: HA02			Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)	Vane Shear Strength (NZGS) kPa Peak / Residual	Scala Penetrometer (blows per 100mm drop)										Groundwater Level	
HAND AUGER	Depth (meters)								Blow count	Plot of Scala results								Groundwater Level		
										Very loose	Loose	Medium Dense	Dense							
																				0
		TOPSOIL; dark brown. Moist.				T/S			2	2	2									
		PEAT; dark blacking brown. Moist to wet.				PEAT			4	4	4	4	4							
	0.5						0.5		1	1										
									1	1										
									1.5	2	2									
									1.5	2	2									
									1	1										
	1.0	SILT with trace fine sand; brown. Stiff, moist to wet, slightly plastic.					1.0		2	2	2									
		- sand increasing to some. Colour becoming light brownish grey.							2	2	2									
		Silty medium to coarse SAND; light brownish grey. Loose to medium dense, moist to wet.							2	2	2									
		- becoming wet to saturated.							2	2	2									
	1.5						1.5		4	4	4	4	4							
									3	3	3									
									4	4	4	4	4							
									3	3	3									
									3	3	3									
									2	2	2									
									3	3	3									
									3	3	3									
	2.0	SILT, minor medium sand; greyish brown. Stiff, wet to saturated.					2.0	57/43	3	3	3									
		Silty medium to coarse SAND; greyish brown. Loose to medium dense, saturated.							3	3	3									
									5	5	5	5	5	5						
									4	4	4	4	4							
									4	4	4	4	4							
	2.5						2.5		4	4	4	4	4							
									5	5	5	5	5	5						
									6	6	6	6	6	6	6					
									4	4	4	4								
									6	6	6	6	6	6	6					
									5	5	5	5	5	5						
	3.0	End of hand auger at 2.8m - No sample retained.					3.0													
	3.5						3.5													
	4.0						4.0													
	4.5						4.5													
	5.0						5.0													
	5.5						5.5													
									</											

Log Key Sheet

WATER



Water level on date shown

METHOD (shows drilling method)

OB	open barrel
Wash	wash boring
TT	triple tube
UT	thin walled undisturbed tube
SPT	standard penetration test – open nose sampler
Nc	standard penetration test – solid nose sampler
MA	machine auger
PS	piston sample
PCT	percussion – top drive
PCB	percussion – bottom drive
Conc	concentrics
Sonic	sonic
HA	hand auger
VE	vacuum excavation

SAMPLES

Dx	Disturbed sample, number x
Bx	Bulk sample, number x
Ux(d)	Undisturbed sample, number x, tube diameter d in mm
Wx	Water sample, number x

MOISTURE

Dry, looks and feels dry
 Moist, no free water on hand when remoulding
 Wet, free water on hand when remoulding
 Saturated, soil below water table

SOIL AND ROCK DESCRIPTIONS

CONSISTENCY

Cohesive Soils	Undrained Shear Strength (kPa)
Very soft	<12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	>200

Soil and Rock Descriptions are generally as described in the NZ Geotechnical Society "Field Description of Soil and Rock – Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", dated December 2005.

Vane Shear Strength measurements in accordance with the NZ Geotechnical Society "Guideline for hand held shear vane test" dated August 2001.

IN SITU TESTS

SV	= 40/10	In situ shear strength and remoulded shear strength respectively, as measured by Geotechnics/ Pilcon Shear Vane
τ	= 50/12	Vane shear strength and remoulded vane shear strength respectively, corrected to BS1377
UTP	=	Unable To Penetrate with Shear Vane
N	= 15	SPT uncorrected blow count for 300mm penetration
N _c	= 50+	SPT uncorrected blow count for 300 mm penetration using solid nose sampler

★

AL	Atterberg limits
UU	Unconsolidated undrained triaxial
PSD	Particle size
CU	Consolidated undrained triaxial
CONS	Consolidation
COMP	Compaction
UCS	Unconfined compression

WEATHERING

CW	Completely weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
UW	Unweathered

Non-cohesive Soils	SPT – Uncorrected
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	>50

GRAPHIC LOG (1 or a combination of the following)



Fill



Silt



Cobbles



Sandstone



Fine igneous



Core loss



Sand



Boulders



Limestone



Coarse igneous



Organics



Shells



Mudstone



Schist



Clay



Gravel



Siltstone



Basalt

ORGANIC SOILS

Von Post Degree of Humification

H1	Completely unconverted and mud-free peat, when pressed gives clear water and plant structure is visible.
H2	Practically unconverted and mud-free peat, when pressed gives almost clear water and plant structure is visible.
H3	Very slightly decomposed or very slightly muddy peat, when pressed gives marked muddy water, no peat substance passes through the fingers and plant structure is less visible.
H4	Slightly decomposed or slightly muddy peat, when pressed gives marked muddy water and plant structure is less visible.
H5	Moderately decomposed or very muddy peat with growth structure evident but slightly obliterated.
H6	Moderately decomposed or very muddy peat with indistinct growth structure.
H7	Fairly well decomposed or very muddy peat but the growth structure can just be seen.
H8	Well decomposed or very muddy peat with very indistinct growth structure.
H9	Practically decomposed or mud-like peat in which almost no growth structure is evident.
H10	Completely decomposed or mud peat where no growth structure can be seen, entire substance passes through the fingers when pressed.

Log Key Sheet

WATER



Water level on date shown

METHOD (shows drilling method)

OB	open barrel
Wash	wash boring
TT	triple tube
UT	thin walled undisturbed tube
SPT	standard penetration test – open nose sampler
Nc	standard penetration test – solid nose sampler
MA	machine auger
PS	piston sample
PCT	percussion – top drive
PCB	percussion – bottom drive
Conc	concentrics
Sonic	sonic
HA	hand auger
VE	vacuum excavation

SAMPLES

Dx	Disturbed sample, number x
Bx	Bulk sample, number x
Ux(d)	Undisturbed sample, number x, tube diameter d in mm
Wx	Water sample, number x

MOISTURE

Dry, looks and feels dry
 Moist, no free water on hand when remoulding
 Wet, free water on hand when remoulding
 Saturated, soil below water table

SOIL AND ROCK DESCRIPTIONS

CONSISTENCY

Cohesive Soils	Undrained Shear Strength (kPa)
Very soft	<12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	>200

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Vane Shear Strength measurements in accordance with the NZ Geotechnical Society "Guideline for hand held shear vane test" dated August 2001.

IN SITU TESTS

SV	= 40/10	In situ shear strength and remoulded shear strength respectively, as measured by Geotechnics/ Pilcon Shear Vane
τ	= 50/12	Vane shear strength and remoulded vane shear strength respectively, corrected to BS1377
UTP	=	Unable To Penetrate with Shear Vane
N	= 15	SPT uncorrected blow count for 300mm penetration
N _c	= 50+	SPT uncorrected blow count for 300 mm penetration using solid nose sampler

★

AL	Atterberg limits
UU	Unconsolidated undrained triaxial
PSD	Particle size
CU	Consolidated undrained triaxial
CONS	Consolidation
COMP	Compaction
UCS	Unconfined compression

WEATHERING

CW	Completely weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
UW	Unweathered

Non-cohesive Soils	SPT – Uncorrected
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	>50

GRAPHIC LOG (1 or a combination of the following)



Fill



Silt



Cobbles



Sandstone



Fine igneous



Core loss



Sand



Boulders



Limestone



Coarse igneous



Organics



Shells



Mudstone



Schist



Clay



Gravel



Siltstone



Basalt

ORGANIC SOILS

Von Post Degree of Humification

H1	Completely unconverted and mud-free peat, when pressed gives clear water and plant structure is visible.
H2	Practically unconverted and mud-free peat, when pressed gives almost clear water and plant structure is visible.
H3	Very slightly decomposed or very slightly muddy peat, when pressed gives marked muddy water, no peat substance passes through the fingers and plant structure is less visible.
H4	Slightly decomposed or slightly muddy peat, when pressed gives marked muddy water and plant structure is less visible.
H5	Moderately decomposed or very muddy peat with growth structure evident but slightly obliterated.
H6	Moderately decomposed or very muddy peat with indistinct growth structure.
H7	Fairly well decomposed or very muddy peat but the growth structure can just be seen.
H8	Well decomposed or very muddy peat with very indistinct growth structure.
H9	Practically decomposed or mud-like peat in which almost no growth structure is evident.
H10	Completely decomposed or mud peat where no growth structure can be seen, entire substance passes through the fingers when pressed.

TEST PIT LOG

SHEET 1 of 1

PROJECT: SRA Level Crossing Programme			JOB NUMBER: 3413241		
SITE LOCATION: SH1B Telephone Road, Eureka			CLIENT: Safe Roads Alliance		
CIRCUIT: NZTM 2000		TEST PIT LOCATION: 30m from road edge and 1m from rail track			
COORDINATES: N 5,819,883 m E 1,808,648 m		R L: 44 m		COORDINATE ORIGIN: MAP	
		DATUM: Auckland 1946 (MSL)		ACCURACY: ±5m	

DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scale (Blows/100mm)	SV	γ (kPa)	WATER LEVEL	R L (m)
0.5			Loosely packed, fine to coarse sandy fine to coarse GRAVEL, minor cobbles, trace organics; greyish brown; moist, non plastic. Gravel: angular to subangular, slightly weathered, greywacke. Organics: rootlets.	Ballast					43.5
			Loosely packed, medium to coarse gravelly medium to coarse SAND; dark grey; moist, non plastic. Gravel: angular to subangular, slightly weathered, greywacke.	Sub-Ballast					
1.0			Loosely packed, fine to coarse SAND, minor fine gravel, trace coarse gravel; brownish yellow; moist, non plastic.	Holocene Alluvium					
1.0			END OF LOG @ 1 m		2				43.0
1.5					1				
					0				
					0				
					1				
					0				42.5
					0				
					1				
					0				
2.0					2				42.0
					2				
					2				
					1				
					3				
2.5									41.5
3.0									41.0
3.5									40.5

DATE EXCAVATED: 21/6/18	CONTRACTOR: Abernethy	COMMENTS: - Test Pit terminated at target depth. - Coordinates estimated from WRC LocalMaps (accuracy +/- 5m). - RL estimated from survey plan 3413241-SUR-0001 (accuracy +/- 1m). - Water table not encountered. - Test Pit backfilled and compacted in 300mm layers with excavator.
LOGGED BY: LZ	EQUIPMENT: 1.7t Excavator	
SHEAR VANE No:	METHOD: E	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Rev A

Log Key Sheet

WATER



Water level on date shown

METHOD (shows drilling method)

OB	open barrel
Wash	wash boring
TT	triple tube
UT	thin walled undisturbed tube
SPT	standard penetration test – open nose sampler
Nc	standard penetration test – solid nose sampler
MA	machine auger
PS	piston sample
PCT	percussion – top drive
PCB	percussion – bottom drive
Conc	concentrics
Sonic	sonic
HA	hand auger
VE	vacuum excavation

SAMPLES

Dx	Disturbed sample, number x
Bx	Bulk sample, number x
Ux(d)	Undisturbed sample, number x, tube diameter d in mm
Wx	Water sample, number x

MOISTURE

Dry, looks and feels dry
 Moist, no free water on hand when remoulding
 Wet, free water on hand when remoulding
 Saturated, soil below water table

SOIL AND ROCK DESCRIPTIONS

CONSISTENCY

Cohesive Soils	Undrained Shear Strength (kPa)
Very soft	<12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	>200

Soil and Rock Descriptions are generally as described in the NZ Geotechnical Society "Field Description of Soil and Rock – Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", dated December 2005.

Vane Shear Strength measurements in accordance with the NZ Geotechnical Society "Guideline for hand held shear vane test" dated August 2001.

IN SITU TESTS

SV	= 40/10	In situ shear strength and remoulded shear strength respectively, as measured by Geotechnics/ Pilcon Shear Vane
τ	= 50/12	Vane shear strength and remoulded vane shear strength respectively, corrected to BS1377
UTP	=	Unable To Penetrate with Shear Vane
N	= 15	SPT uncorrected blow count for 300mm penetration
N _c	= 50+	SPT uncorrected blow count for 300 mm penetration using solid nose sampler

★

AL	Atterberg limits
UU	Unconsolidated undrained triaxial
PSD	Particle size
CU	Consolidated undrained triaxial
CONS	Consolidation
COMP	Compaction
UCS	Unconfined compression

WEATHERING

CW	Completely weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
UW	Unweathered

Non-cohesive Soils	SPT – Uncorrected
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	>50

GRAPHIC LOG (1 or a combination of the following)



Fill



Silt



Cobbles



Sandstone



Fine igneous



Core loss



Sand



Boulders



Limestone



Coarse igneous



Organics



Shells



Mudstone



Schist



Clay



Gravel



Siltstone



Basalt

ORGANIC SOILS

Von Post Degree of Humification

H1	Completely unconverted and mud-free peat, when pressed gives clear water and plant structure is visible.
H2	Practically unconverted and mud-free peat, when pressed gives almost clear water and plant structure is visible.
H3	Very slightly decomposed or very slightly muddy peat, when pressed gives marked muddy water, no peat substance passes through the fingers and plant structure is less visible.
H4	Slightly decomposed or slightly muddy peat, when pressed gives marked muddy water and plant structure is less visible.
H5	Moderately decomposed or very muddy peat with growth structure evident but slightly obliterated.
H6	Moderately decomposed or very muddy peat with indistinct growth structure.
H7	Fairly well decomposed or very muddy peat but the growth structure can just be seen.
H8	Well decomposed or very muddy peat with very indistinct growth structure.
H9	Practically decomposed or mud-like peat in which almost no growth structure is evident.
H10	Completely decomposed or mud peat where no growth structure can be seen, entire substance passes through the fingers when pressed.

TEST PIT LOG

SHEET 1 of 1

PROJECT: SRA Level Crossing Programme			JOB NUMBER: 3413241		
SITE LOCATION: SH1B Telephone Road, Eureka			CLIENT: Safe Roads Alliance		
CIRCUIT: NZTM 2000		TEST PIT LOCATION: 10m from road edge and 1m from rail track			
COORDINATES: N 5,819,871 m		R L: 44 m		COORDINATE ORIGIN: MAP	
E 1,808,631 m		DATUM: Auckland 1946 (MSL)		ACCURACY: ±5m	

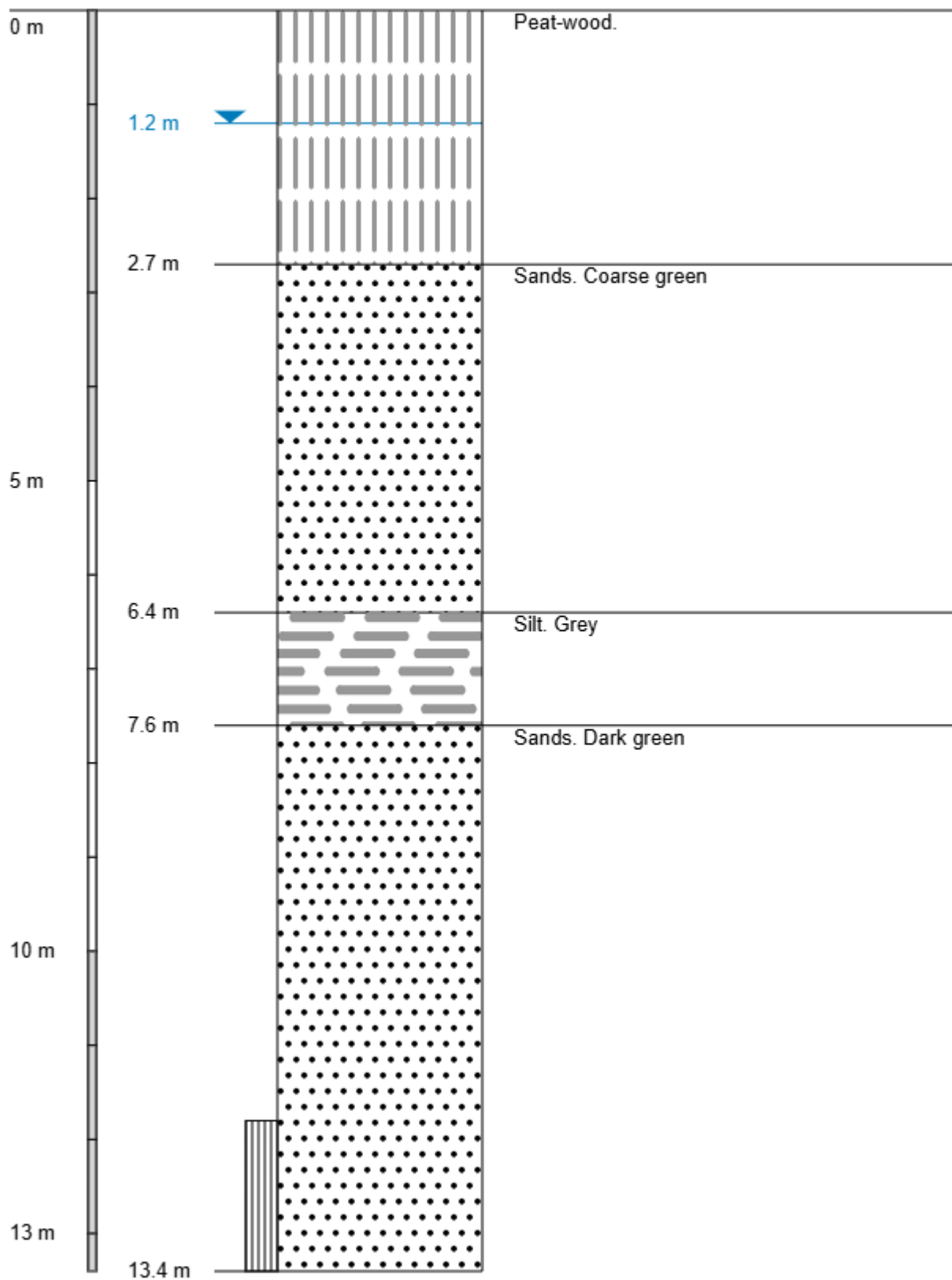
DEPTH (m)	SAMPLES	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scale (Blows/100mm)	SV	γ (kPa)	WATER LEVEL	R L (m)
0.5			Loosely packed, fine to coarse sandy fine to coarse GRAVEL, minor cobbles, trace organics; greyish brown; moist, non plastic. Gravel: angular to subangular, slightly weathered, greywacke. Organics: rootlets.	Ballast					43.5
			Loosely packed, medium to coarse gravelly medium to coarse SAND; brownish black; moist, non plastic. Gravel: angular to subangular, slightly weathered, greywacke.	Sub-ballast					
			Loosely packed, fine to coarse SAND, minor fine gravel, trace coarse gravel; brownish yellow; moist, non plastic.	Holocene Alluvium					
			'Firm', organic SILT; black; moist, non plastic. Organics: rootlets.						
1.0			END OF LOG @ 1 m		1				43.0
1.5					0				
2.0					0				
2.5					1				
3.0					1				
3.5					2				
					2				
					3				
					4				
					2				
					8				
					3				
					4				
					5				
									42.5
									42.0
									41.5
									41.0
									40.5

DATE EXCAVATED: 21/6/18	CONTRACTOR: Abernethy	COMMENTS: - Test Pit terminated at target depth. - Coordinates estimated from WRC LocalMaps (accuracy +/- 5m). - RL estimated from survey plan 3413241-SUR-0001 (accuracy +/- 1m). - Water table not encountered. - Test Pit backfilled and compacted in 300mm layers with excavator.
LOGGED BY: LZ	EQUIPMENT: 1.7t Excavator	
SHEAR VANE No:	METHOD: E	

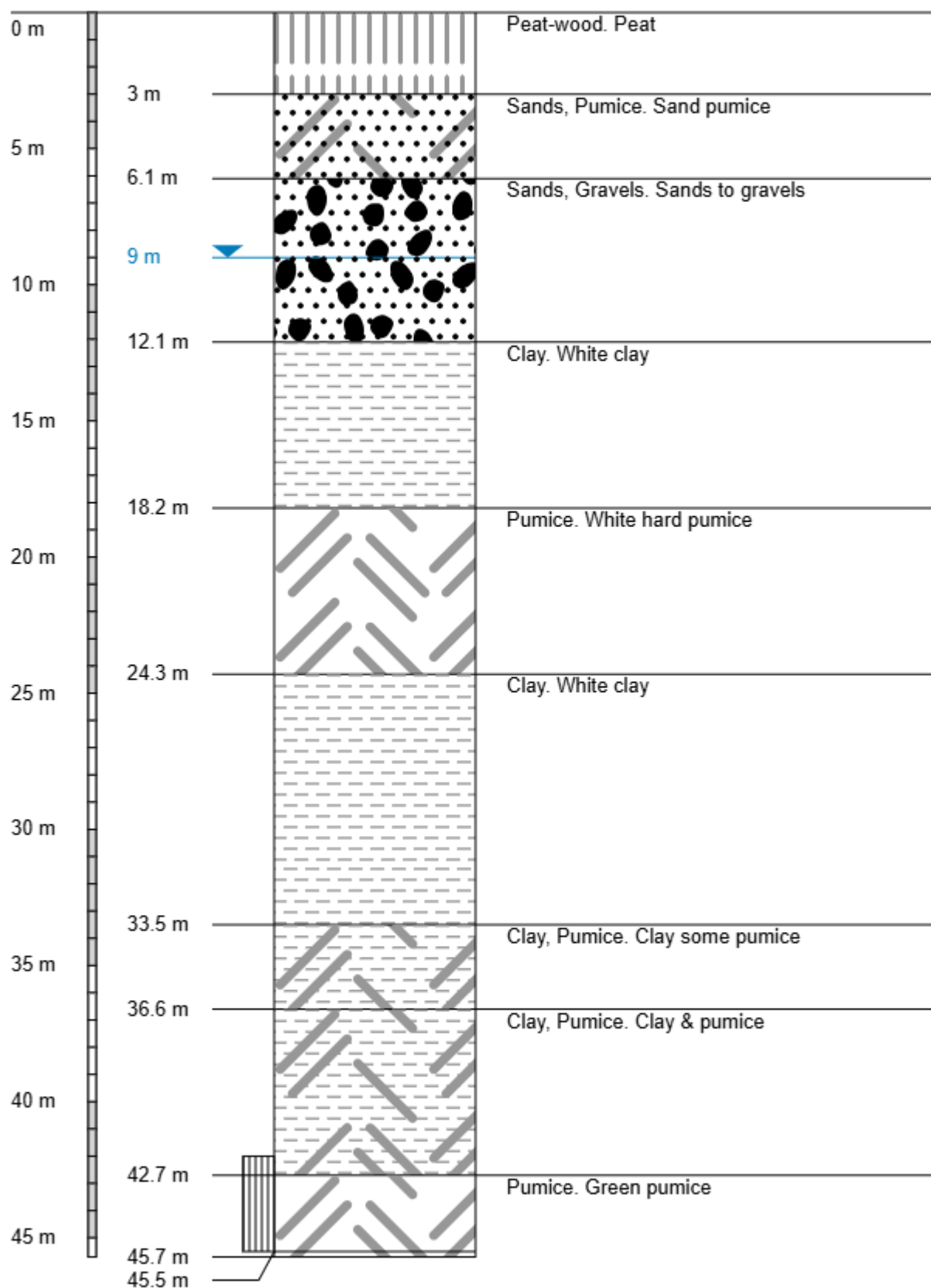
FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Rev A

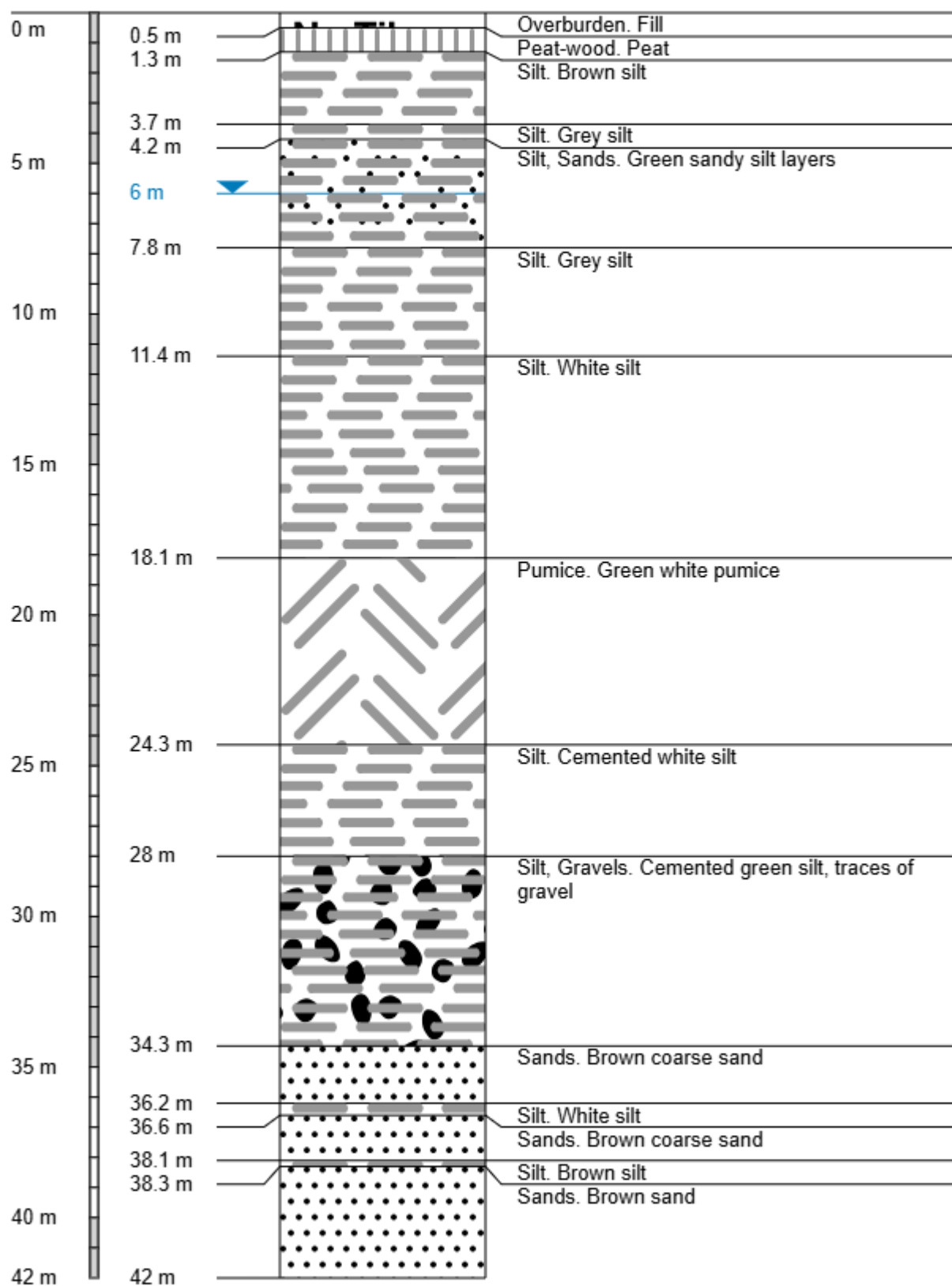
Council well number : 69_933
Well name : Bore 69 - Station 933
Drilling company : Benton & Son Limited
Drilling date : 12/05/1992
Drilling method : -
Locality : -
Total depth drilled : 13.4m
NZTM : 1808851 : 5819785



Council well number : 72_2804
Well name : Bore 72 - Station 2804
Drilling company : Geo Hutchinson (1984) Limited
Drilling date : 20/11/2005
Drilling method : -
Locality : -
Total depth drilled : 45.5m
NZTM : 1810050 : 5820987



Council well number : 72_4357
Well name : Bore 72 - Station 4357
Drilling company : Benton & Son Limited
Drilling date : 05/06/2008
Drilling method : -
Locality : -
Total depth drilled : 42m
NZTM : 1808663 : 5820242



APPENDIX B

Histocial Photographs

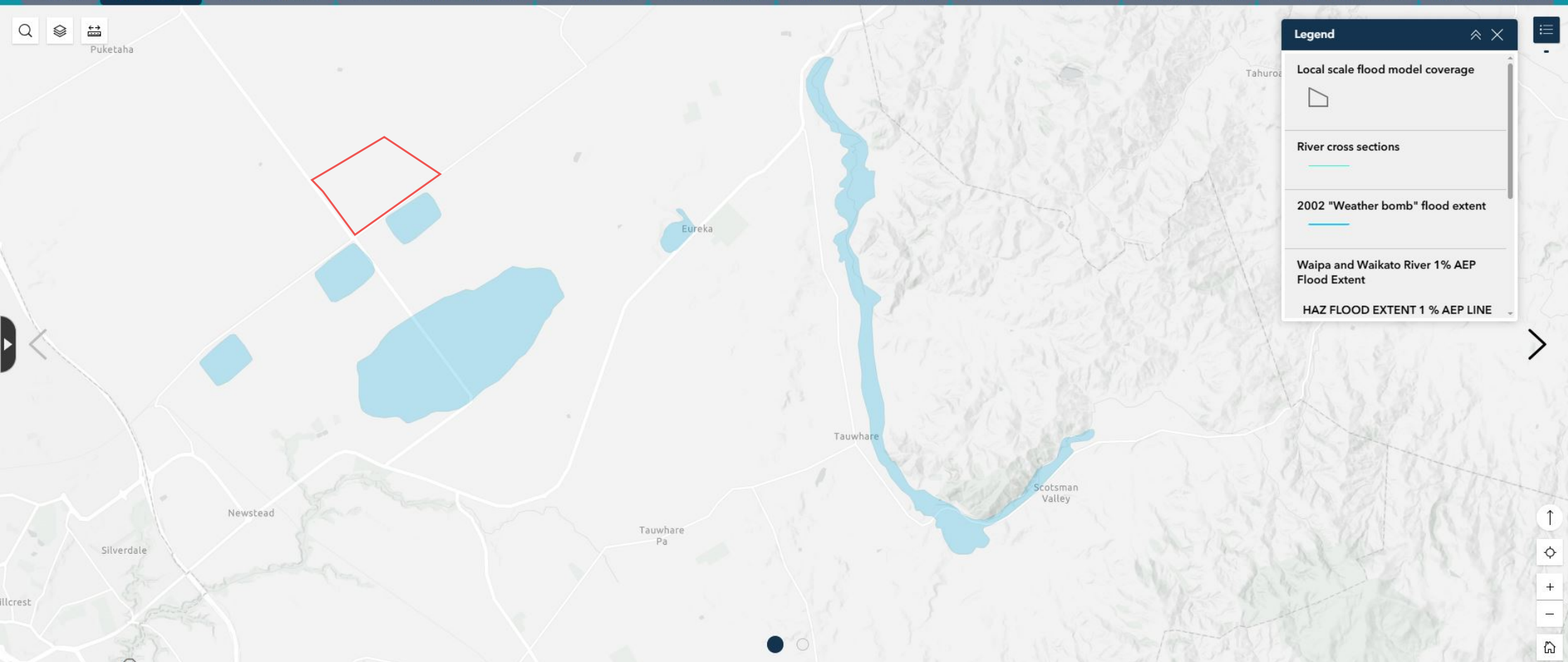
Date and source	Key Features
1962 Retrolens	 • building structures (circled in blue) • Potentially swampy areas (outlined in yellow)

Date and source	Key Features
1991 Retrolens	 • Depression next to Telephone road appears (circled in blue) • Additional paddocks have been created. Farm drains could run between them.

Date and source	Key Features
2013 Google Earth	 Image © 2025 Maxar Technologies • Effluent pond being constructed next to silage pad (circled in blue).

APPENDIX C

Waikato Regional Council Hazrads Portal

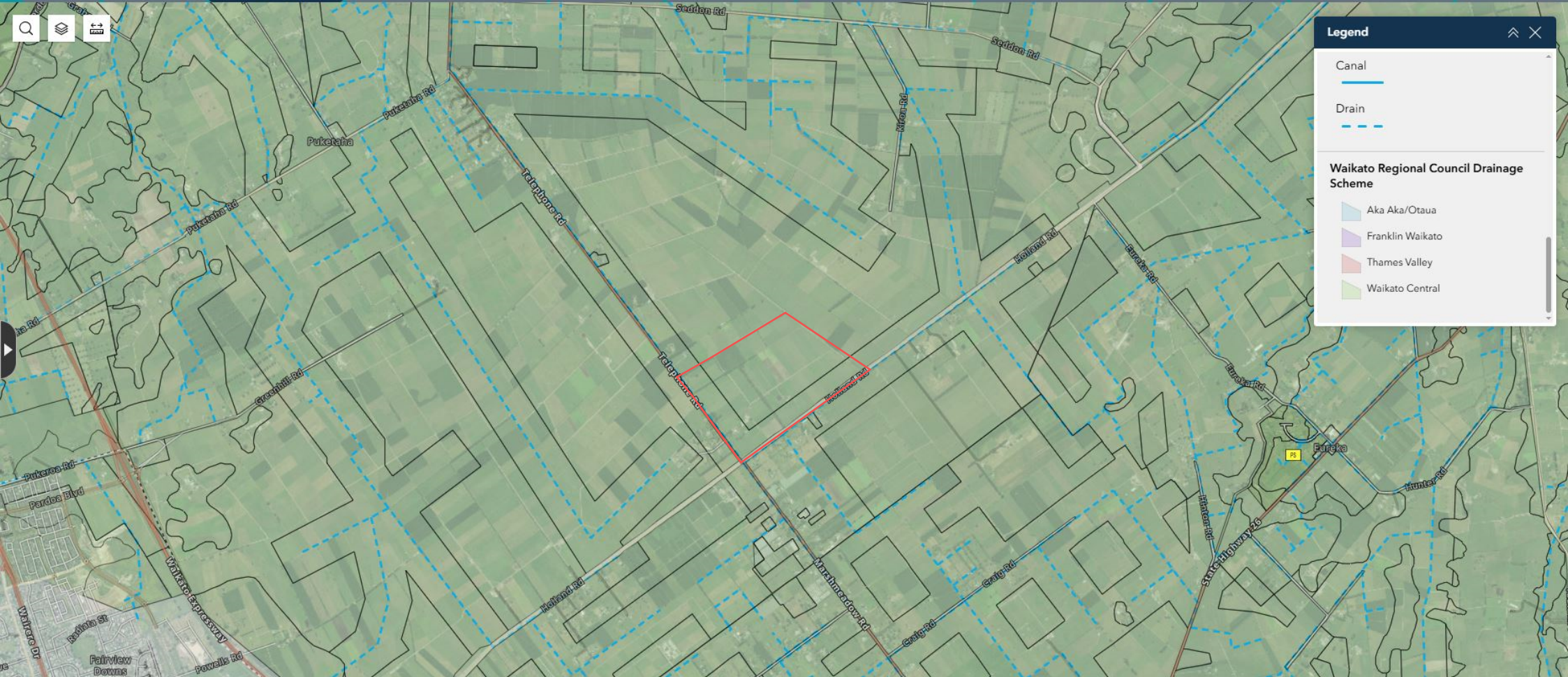


Waikato Regional Hazards Portal

Visit our regional hazards and emergency management page



[Overview](#) [River flooding](#) [Flood Management](#) [Waikato District Defended areas](#) [Coastal Hazards](#) [Coastal Inundation](#) [Earthquakes and landslides](#) [Volcanoes and Geothermal](#) [Karāpiro Dam Break](#) [Emergency Management](#) [Waikato Regional](#)



Legend

Canal

Drain

Waikato Regional Council Drainage Scheme

- Aka Aka/Otaua
- Franklin Waikato
- Thames Valley
- Waikato Central

Waikato Regional Hazards Portal

Visit our regional hazards and emergency management page



Overview

River flooding

Flood Management

Waikato District Defended areas

Coastal Hazards

Coastal Inundation

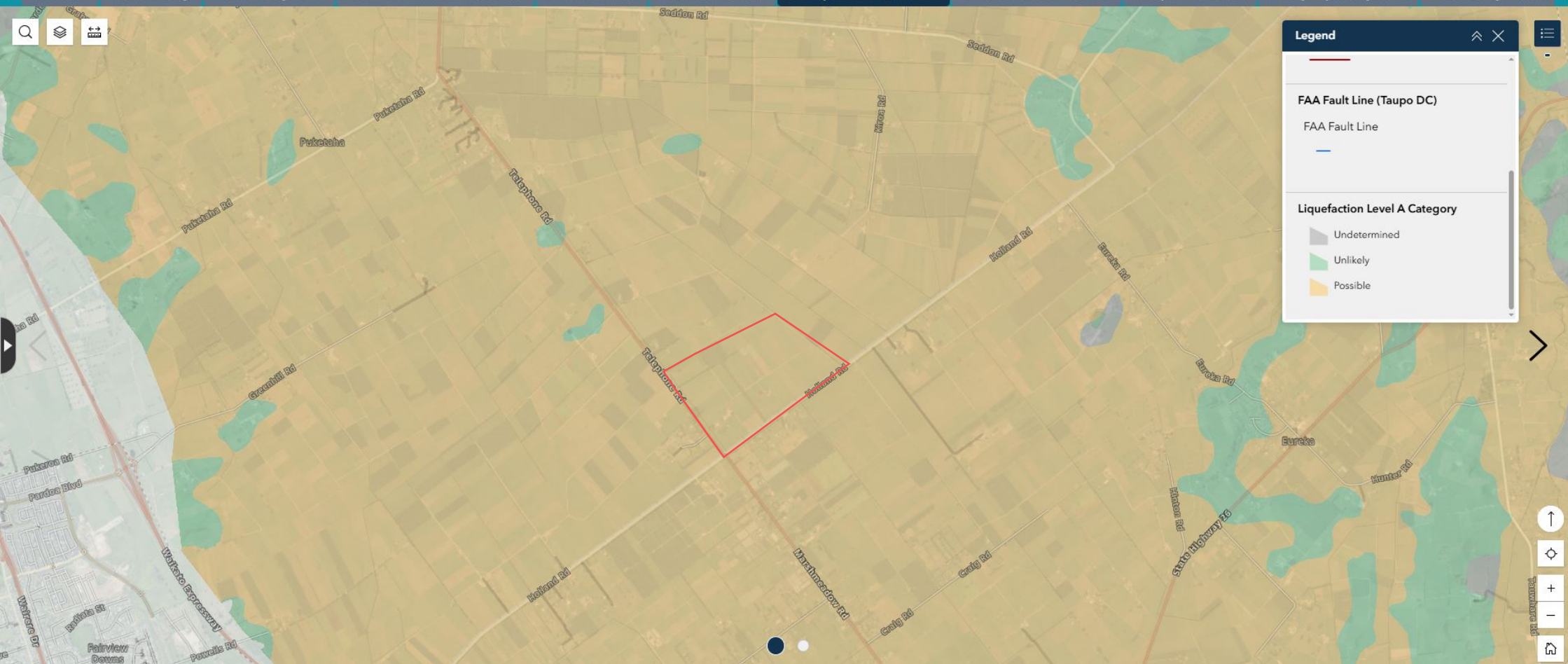
Earthquakes and landslides

Volcanoes and Geothermal

Karāpiro Dam Break

Emergency Management

Waikato Regional Cour



Legend

FAA Fault Line (Taupo DC)

FAA Fault Line

Liquefaction Level A Category

Undetermined

Unlikely

Possible





Flood protection and land drainage assets



Search for an address, place



Legend

Acid Sulfate Soil Probability

Acid Sulfate Soil Probability

-  Negligible Probability
-  Low Probability
-  Moderate Probability
-  High Probability

Base Layers

Biosecc Clam Risk Areas

Clam Red Risk



Clam Orange Risk



Clam Yellow Risk



0.4km
1,807,888.279 5,822,222.571 Meters

Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors | See individual layers' ...

POWERED BY
esri

APPENDIX D

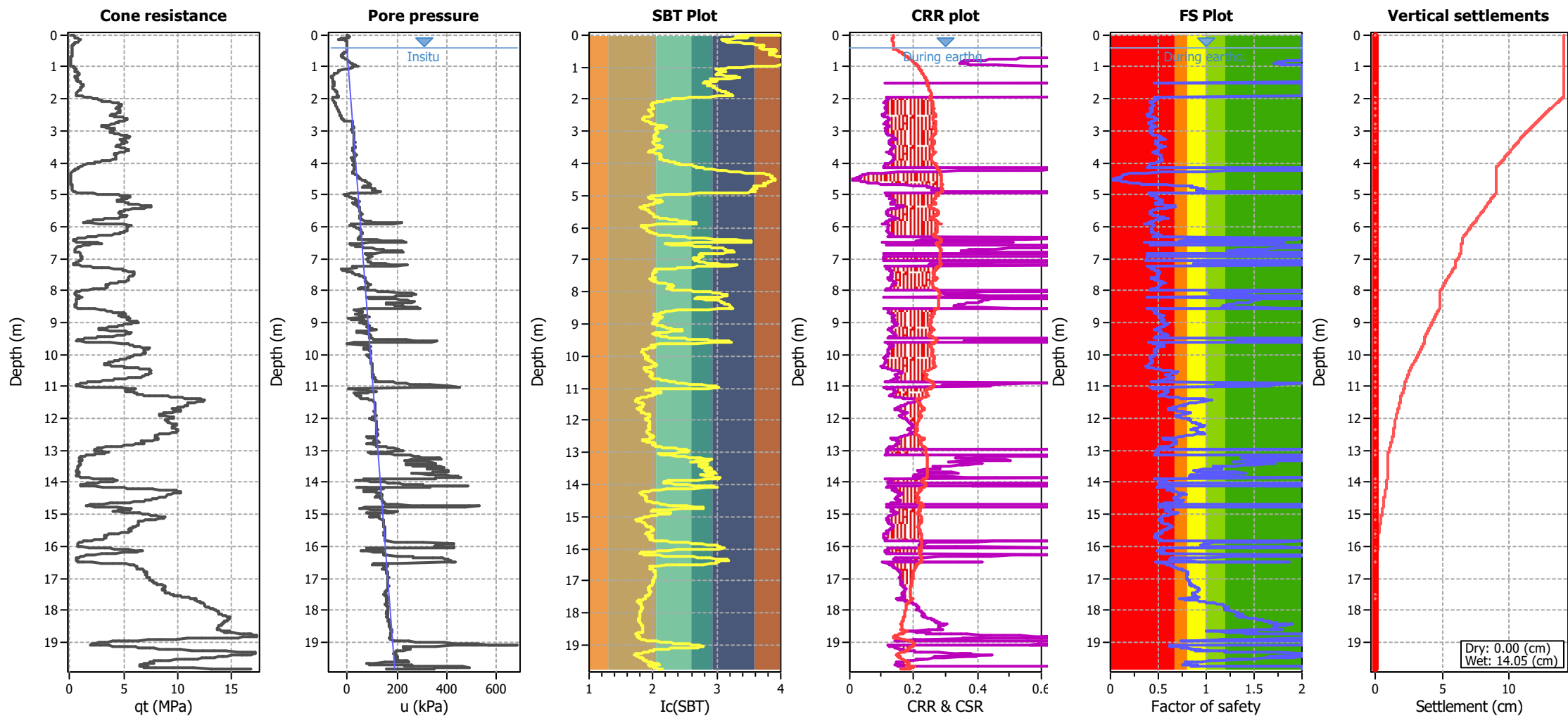
Preliminary Liquefaction Results

Project:

Location:

CPT: CPT_194534

Total depth: 19.84 m



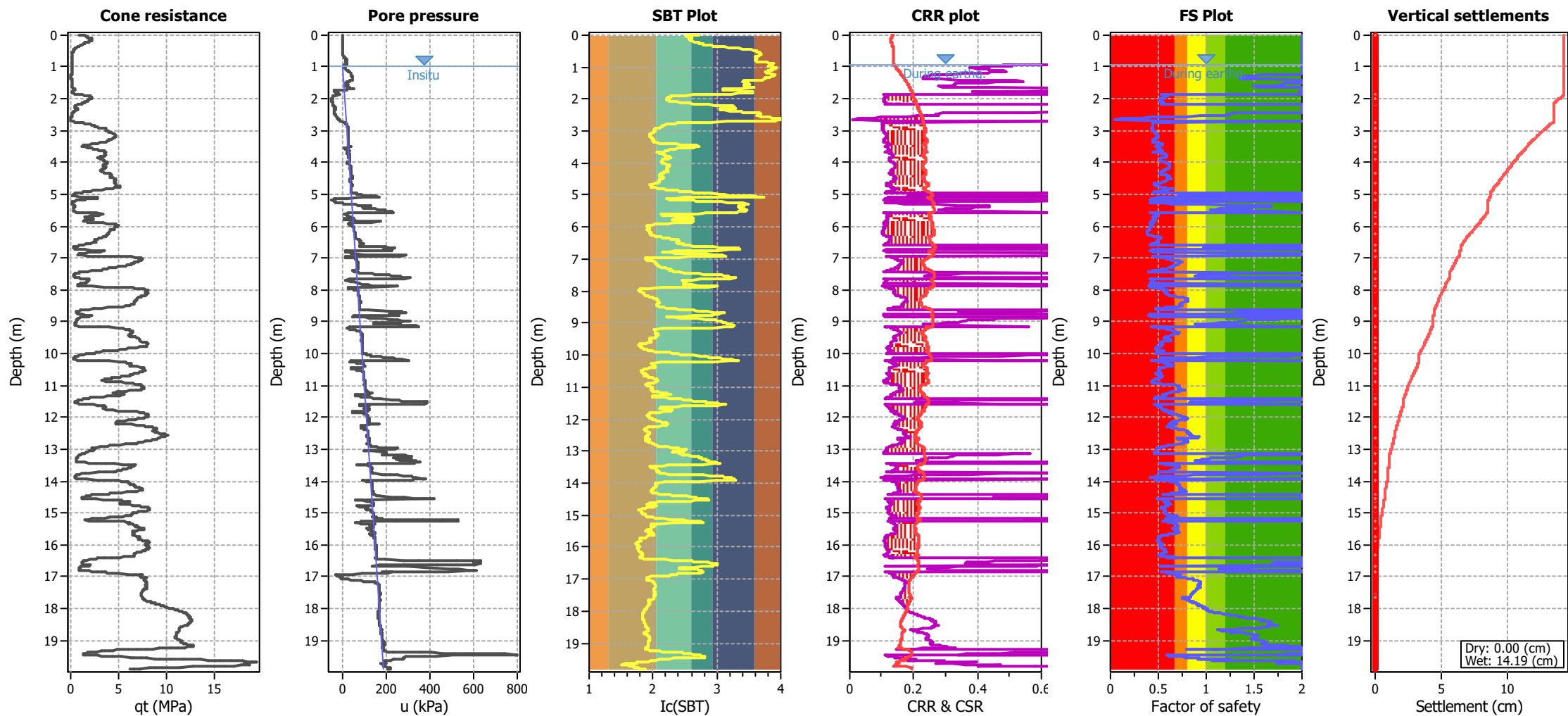
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.42 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.42 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT_194537

Total depth: 19.90 m



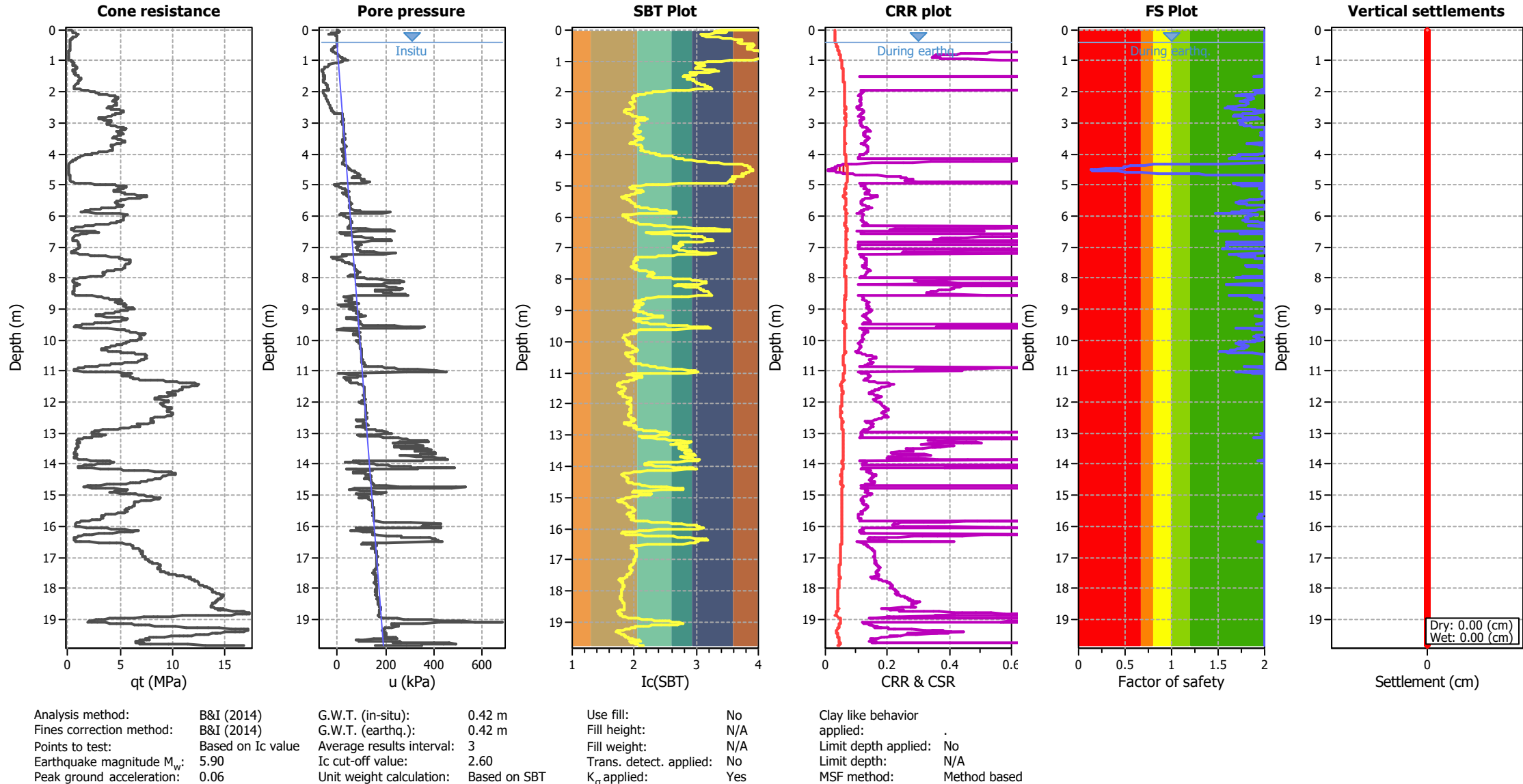
Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.92 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT_194534

Total depth: 19.84 m

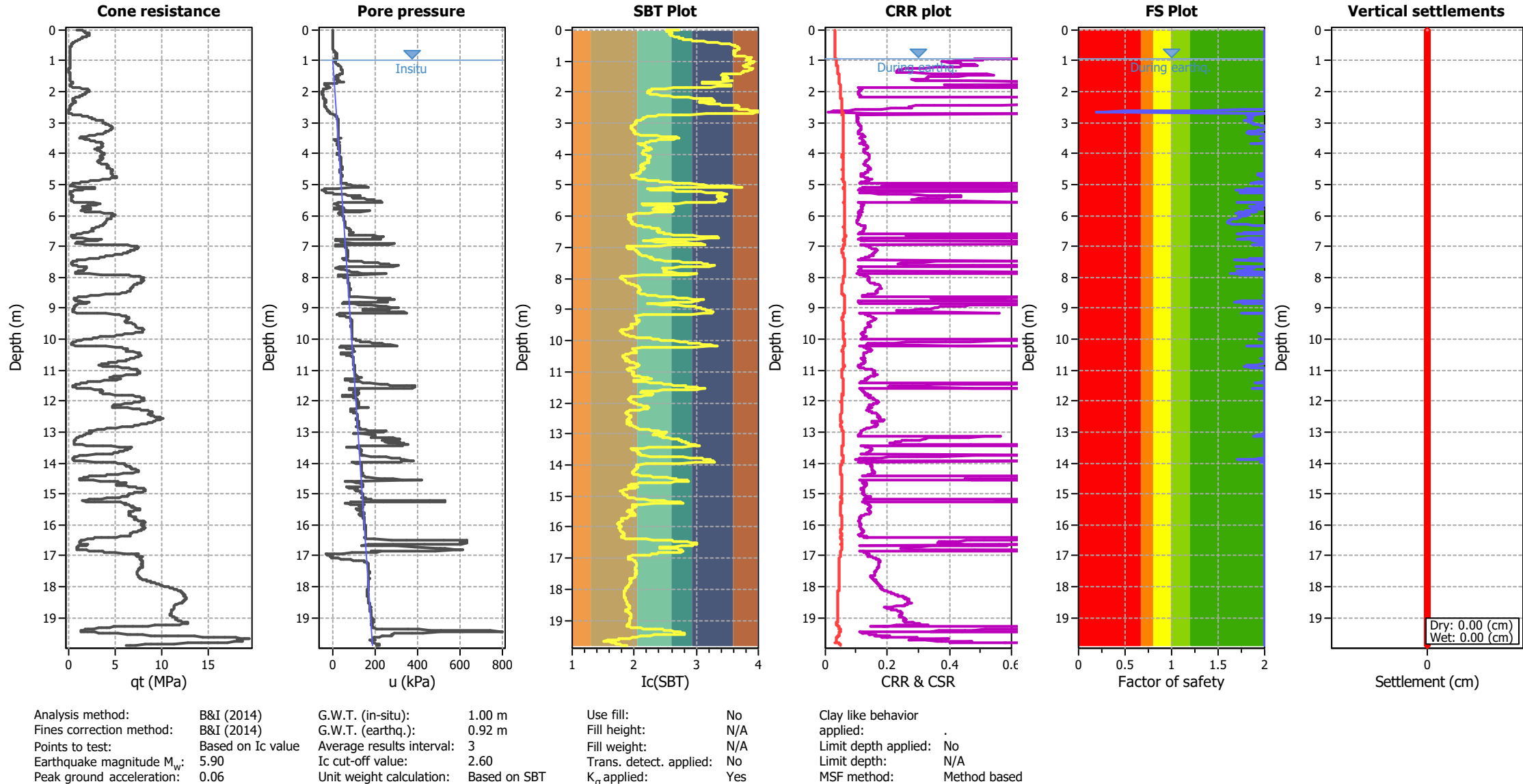


Project:

Location:

CPT: CPT_194537

Total depth: 19.90 m



APPENDIX E

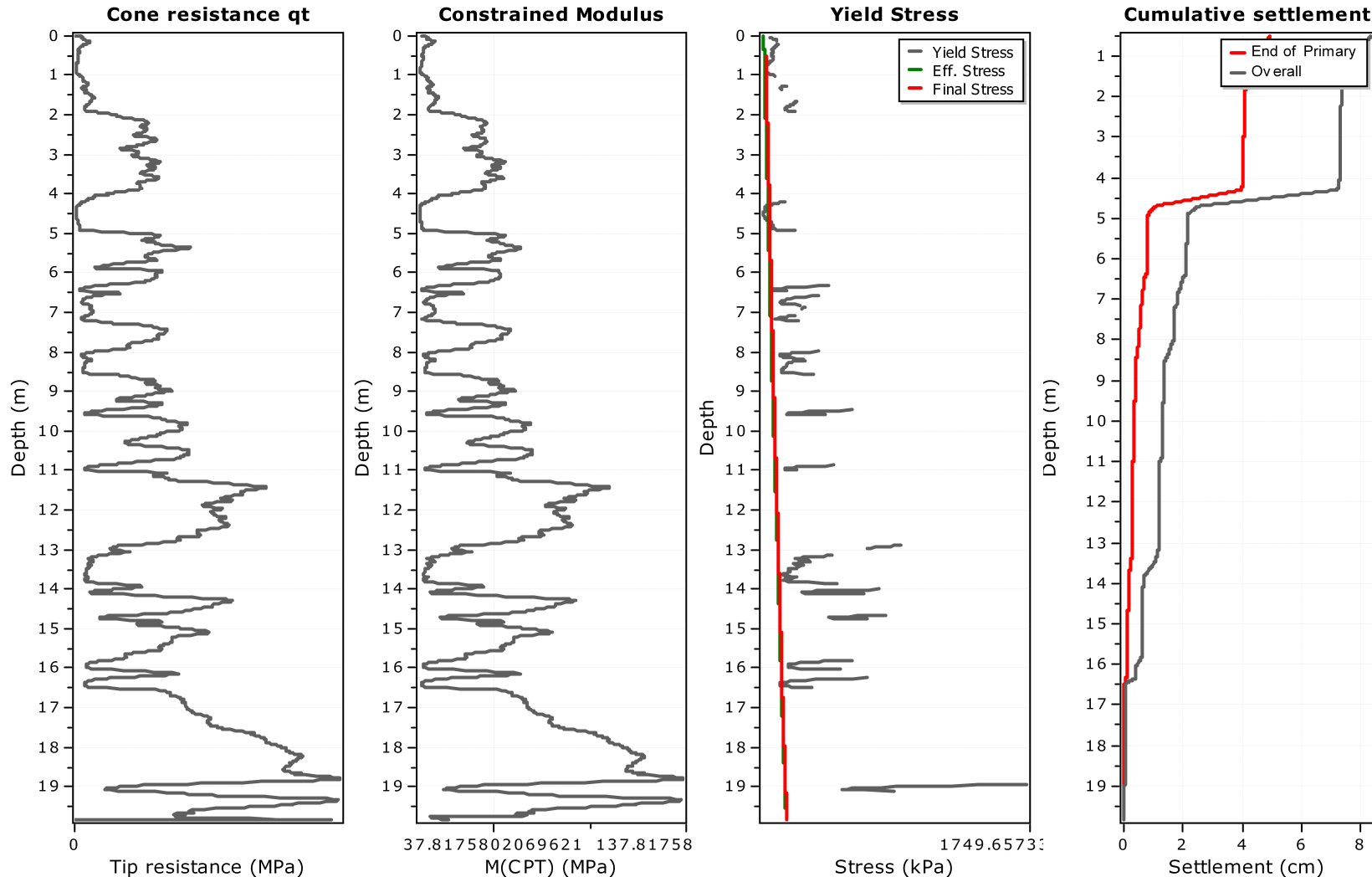
Preliminary Load Induced Settlement Results

Project:
Location:

CPT: CPT_194534

Total depth: 19.84 m, Date: 3/03/2026
Surface Elevation: 0.00 m, Est. GWL: 0.42 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 20.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 10 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

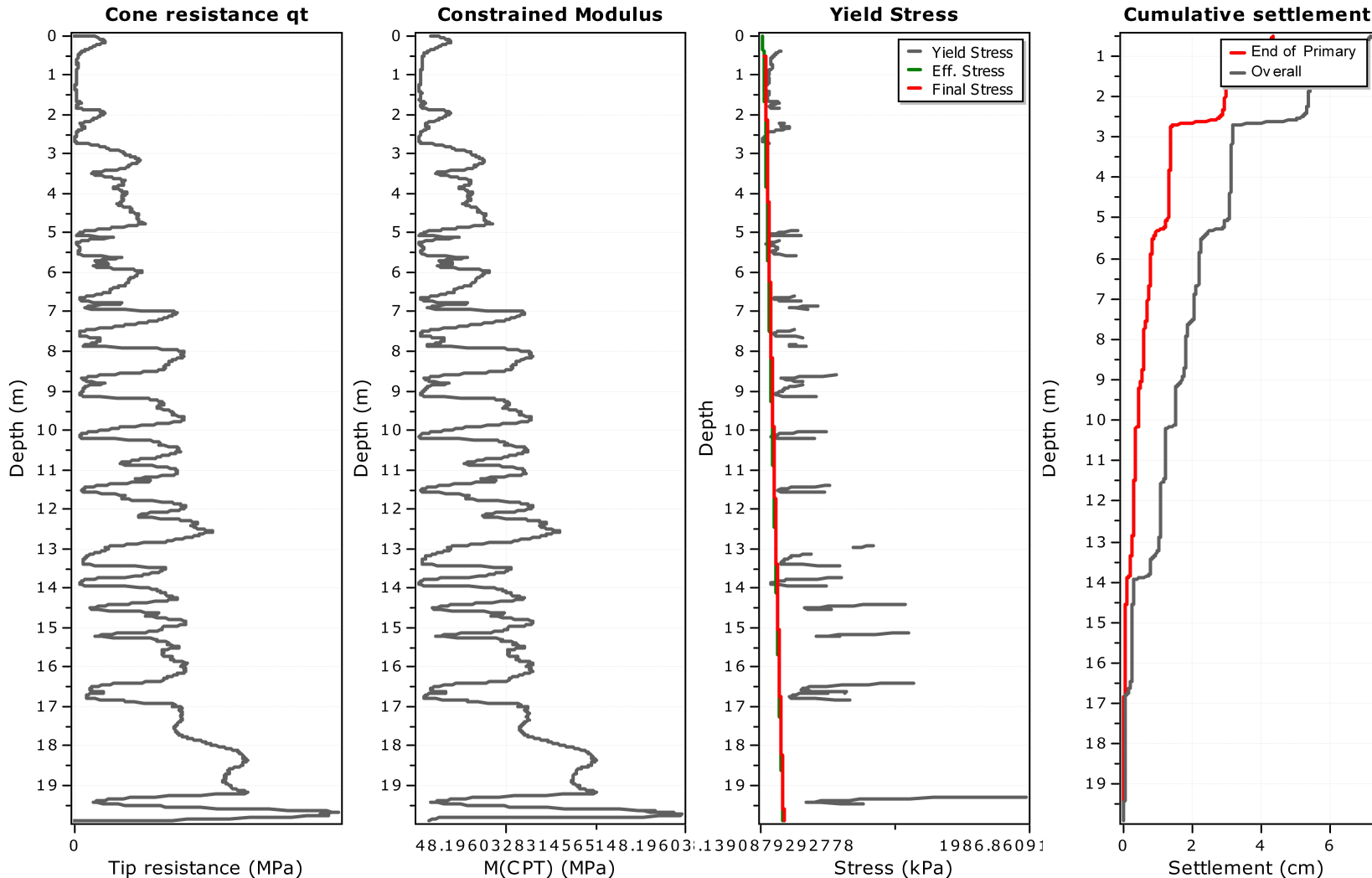
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S_{secondary} = S_{primary} \left(1 - e^{-\frac{t}{t_p}} \right)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 20.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.50 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 10 months
Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S_{\text{secondary}} = S_{\text{primary}} \left(1 - \exp \left(- \frac{t}{t_p} \right) \right)$$

where t_p is the duration of primary consolidation

APPENDIX F

Natural Hazards Risk Assessment

NATURAL HAZARDS RISK ASSESSMENT FOR LANDUSE CHANGE

PROPOSED DEVELOPEMENT, AWANUI LINKS, 28 TELEPHONE ROAD

1 CONTEXT

This appendix to CMW report reference HAM2025-0123AB Rev 0 sets out the criteria for and presents the results of an assessment of the geotechnical-related natural hazards associated with this proposed development.

Section 106 of the Resource Management Act (RMA) requires an assessment of the risk from natural hazards to be carried out when considering the granting of a subdivision consent. S106 RMA specifically states that the assessment must consider the combined effect of the natural hazard likelihood and material damage to land, other land, or structures (consequence).

Section 2 of the RMA defines natural hazards as any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.

The National Policy Statement for Natural Hazards 2025 (NPS-NH) provides direction under the Resource Management Act 1991 for assessing the risk associated with natural hazards for subdivision, use and development.

2 BASIS OF ASSESSMENT

2.1 Risk Classification

The occurrence of natural hazards and their potential impacts on the proposed subdivision development is assessed in terms of risk significance, which is based on likelihood and consequence factors. A risk matrix is used to assess the likelihood and consequence factors, the form of which used by CMW for this project is presented in Table B1 which is derived from Appendix 1 of the NPS-NH.

Table B1: Risk Matrix

	Almost certain Up to 10 AEP 10% or more	Very Likely 10-20 10% to 5%	Likely 20 – 50 5% to 2%	Possible 50 – 100 2% to 1%	Unlikely 100 – 500 1% to 0.2%	Rare 500 – 5000 0.2% to 0.02%	Very rare >5000 <0.02%
Catastrophic	Very High	Very High	Very High	High	Medium	Medium	Medium
Major	Very High	Very High	High	High	Medium	Medium	Medium
Moderate	High	High	High	Medium	Medium	Low	Low
Minor	Medium	Medium	Medium	Medium	Low	Low	Low
Negligible	Low	Low	Low	Low	Low	Low	Low

2.2 Likelihood

With respect to assessing the likelihood or chance of the risk occurring, the qualitative definitions used by CMW for this project are provided in Table B2 for each likelihood classification, which is derived from Appendix 1 of the NPS-NH.

Table B2: Likelihood Classification (extract from NPS-NH)

Likelihood level	Annual exceedance probability (AEP)	Average recurrence interval (ARI) or 'return period'
Almost certain	10% or more	Up to and including 10 years
Very likely	10% to 5%	Over 10 and up to and including 20 years
Likely	5% to 2%	Over 20 and up to and including 50 years
Possible	2% to 1%	Over 50 and up to and including 100 years
Unlikely	1% to 0.2%	Over 100 and up to and including 500 years
Rare	0.2% to 0.02%	Over 500 and up to and including 5,000 years
Very rare	Less than 0.02%	More than 5,000 years

2.3 Consequence

In terms of determining the consequence or severity of the natural hazard occurring, the qualitative definitions used by CMW for this project are provided in Table B3 for each consequence classification, which is derived from Appendix 1 of the NPS-NH.

Table B3: Consequence Table (extract from NPS-NH)

Consequence Level	Damage to Property	Potential for Injury or Fatalities
Catastrophic	Severe damage to land and building(s), potential for collapse or total destruction of structures. Building(s) need to be demolished, rebuilt or relocated.	High threat to life safety, with probable fatalities and/or critical injuries.
Major	Major damage to land and building(s), including structural damage. Loss of use and substantial repair required.	Unsafe for people, with potential for many injuries, or critical injuries and/or fatalities.
Moderate	Some damage to land and non-structural damage to building(s). Limited loss of use, repairs required.	Unsafe for people, with potential for injuries, although expected to be minor.
Minor	Minor damage to land and building(s). No loss of use, minimal repairs required.	Isolated minor injuries possible.
Negligible	No loss of use, no building repairs required.	No injuries.

2.4 Proportionate Management of Natural Hazard Risk

It is recognised that the natural hazard risk assessment provided herein is qualitative and, due to the wide range of possible geohazards that could occur, is somewhat subjective. Decision-makers must consider the scale and detail of information necessary to assess the risk by having regard to the anticipated level of risk.

Other methods are available to quantitatively assess an acceptable level of geotechnical related natural hazard risk, such as defining an acceptable factor of safety with respect to slope stability or acceptable differential ground settlements with respect to recommended building code limits.

When managing natural hazard risk associated with subdivision, use and development, decision-makers must apply mitigation measures, including location and design, for the purposes of ensuring that:

- (a) very high natural hazard risk is avoided;
- (b) high or medium natural hazard risk is avoided or mitigated proportionate to the level of risk; and
- (c) any creation of, or increase in, significant natural hazard risk on other sites is avoided or mitigated proportionate to the level of natural hazard risk.

3 RISK ASSESSMENT

The natural hazards relevant to this proposed subdivision development and adjacent, potentially affected land have been assessed with respect to the criteria outlined above.

Assessment is based on proposed post development ground conditions with and without any geotechnical controls. The latent risk was first assessed with the site in its proposed developed state to consider the risks to the development and surrounding land, including assessment of land modifications from the pre-existing natural state, without any implemented geotechnical controls. The specific geotechnical mitigation measures and engineering design solutions outlined in the table below and CMW report, where relevant, were then considered to determine the natural hazard residual risk remaining after the proposed controls have been implemented.

Results of this assessment are presented in Table C1 below.

Table C1: Natural Hazard Risk Assessment Results								
NPHS Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Earthquake	Fault Rupture	Rare	Major	Low	Approximately 50km from the Kerepehi Fault. Recurrence interval of 2,000 to 3,500 years, no control required.	Rare	Major	Low
	Liquefaction Subsidence	Possible	Major	Medium	Shallow foundations. TC2/TC3 foundation may be required.	Rare	Moderate	Low
	Lateral Spread	Possible	Major	Low	Shallow Groundwater table. Drains along the road present as a free face, may require a setback.	Rare	Moderate	Low
Volcanic Activity	Ash & Pyroclastic Falls	Very Rare	Moderate	Low	No geotechnical controls warranted	Very Rare	Moderate	Low
	Lava flows & Lahars	Very Rare	Moderate	Low	No geotechnical controls warranted	Very Rare	Moderate	Low
Geothermal Activity	Formation of geysers, hot springs,	Very Rare	Moderate	Low	Low risk due to distance from closest known geothermal area	Very Rare	Minor	Low

Table C1: Natural Hazard Risk Assessment Results

NPHS Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
	fumaroles, mud pools							
Erosion	Cut and Fill Batters	Almost Certain	Minor	Medium	Slope batters to be designed by geotechnical engineer	Possible	Minor	Medium
Landslip	Global Slope Instability	Possible	Moderate	Medium	Landform near level. Cut batters to be assessed by engineer	Unlikely	Minor	Medium
	Soil Creep	Rare	Negligible	Low	No geotechnical control warranted	Rare	Negligible	Low
	Bearing Capacity Failure	Possible	Major	High	Bearing Capacity to be assessed by a Geotechnical Engineer, and foundations designed to suit	Unlikely	Major	Low
	Cut & Fill Batter Instability	Possible	Major	High	Slope batters are to be designed by a geotechnical engineer	Unlikely	Moderate	Low
Subsidence	Soft soils leading to foundation subsidence	Likely	Major	High	Undercut and remove any surficial soft soils, existing fill and replace with engineered fill. Preloading of building platforms. Geotechnical engineer to observe building preparation works during construction.	Unlikely	Major	Medium
	Sinkholes	Rare	Moderate	Low	Site Investigation and geomorphic mapping will determine the risk	Very Rare	Moderate	Low
Sedimentation	Debris Inundation	Possible	Major	High	The site is near level in many areas.	Very Rare	Major	Medium

Table C1: Natural Hazard Risk Assessment Results

NPHS Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Coastal Erosion & Coastal Inundation	Erosion and Inundation	Very Rare	Negligible	Low	Site is >15km away from coast	Very Rare	Negligible	Low
Tsunami	Tsunami	Very Rare	Negligible	Low	Site is >15km away from coast.	Very Rare	Negligible	Low
Flooding from Rainfall	Inundation	Possible	Moderate	Medium	No flooding shown on council hazard maps. Stormwater disposal design for concentrated flows from roads and roof areas.	Possible	Minor	Low

Notes:

- Assessments include the impact of the proposed subdivision works on adjacent properties.
- The following reference(s) contain information on the hazards contained in this assessment and the non-geotechnical hazards that have not been included:
 - Waikato**
<https://waikatoregion.maps.arcgis.com/apps/MapSeries/index.html?appid=f2b48398f93146e8a5cf0aa3fddce92c>



Hamilton

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