



Geotechnical Investigation Report

Hornby Quadrant Stage 5

Calder Stewart Land Holdings Limited

Document Number: 220748-RPT-G-001-A

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1. Executive Summary

Table 1: Report Summary

Project	Site		Multiple properties along Main South Road (SH1) and Marshs Road, Hornby, Christchurch
	CGW Project Number		220748
Site Assessment	Geotechnical Hazard Assessment	MBIE Land Classification and Land Performance	N/A Rural and Unmapped
		Liquefaction	Qualitatively assessed as Low
		Flooding	Site is not located within a mapped flood zone
		Soil Contamination	Not listed on the LLUR
		Groundwater Level	>3.3 m bgl
		Site Subsoil Classification	Class D
	Site Suitability for Rezoning		The site is suitable for rezoning based on ground conditions encountered
Ground Conditions	Summary of site geology encountered		Alluvial deposits consisting predominantly of interbedded Silts, Sands and Gravels
	Depth where 200kPa available		0.25 m – 0.8 m below the topsoil layer
Assessment	Recommendations		Further deep testing to accurately determine the liquefaction risk and earthworks specifications will be required for anticipated geotechnical requirements supporting a subsequent subdivision consent

2. Introduction

CGW Consulting Engineers have been engaged by Calder Stewart Land Holdings Limited (Client) to undertake a geotechnical investigation and report for their proposed Hornby Quadrant Stage 5 development. It is understood that the client is proposing to rezone multiple rural and residential properties along Marshs Road and Main South Road (SH1) to industrial land use.

The purpose of this investigation and report is to assess the ground conditions across the site and provide a geotechnical report suitable to support a Plan Change application to Christchurch City Council (CCC). Our geotechnical report will provide confirmation of preliminary site wide bearing capacity, confirmation of shallow ground conditions and a qualitative assessment of the liquefaction risk for the site. Our geotechnical limitations are attached in Appendix A.

3. Scope of Works

Our scope of works, as per the short form agreement (SFA) dated 10 October 2022, is as follows:

- Site walkover assessment.
- Desktop review of relevant geological and geotechnical information.
- Eighteen machine excavated test pits including associated shear vane testing and dynamic cone penetrometer tests to a target depth of 3.0 m.
- A geotechnical report suitable to support a plan change consent.

4. Site and Development Information

The subject site is located approximately 12 km west of Christchurch City and consists of multiple residential and rural zoned properties along Marshs Road and Main South Road (SH1), Hornby. It is understood that the site is proposed to be developed as Stage 5 of the larger Hornby Quadrant development. The existing site layout is shown in Figure 1 below.

Topographically the site is generally flat with minor local undulations. The majority of the site is currently being used as farmland which is sporadically planted with medium to large trees. Existing residential properties are located along the northern and north-western margins of site. Islington Reserve is located towards the northern corner of site.

To the north of the site is Main South Road (SH1), with Marshs Road located to the west of site, and farmland located to the east and south of site. It is understood that an area zoned as commercial land, located at the north-western corner of site

(corner of Main South Road and Marshs Road), is not part of the proposed rezone site area.



Figure 1: The existing site layout, with approximate boundaries shown in red. Image taken from Canterbury Maps, accessed 18/10/22.

5. Desktop Study

5.1 MBIE Technical Category Zoning

The site is located within an area classified as MBIE N/A Rural and Unmapped. The nearest area mapped as MBIE Technical Category TC1 is located approximately 800 m to the west of site, and the nearest area mapped as MBIE Technical Category TC2 is located approximately 3.9 km southeast of site.

5.2 Flood Hazard

Ground levels have changed across Canterbury as a result of the Canterbury earthquakes. According to the Christchurch City Council (CCC) online flood risk map

no properties that exist within the proposed site boundaries lie within a "Flood Management Area" (FMA).

5.1 Hazardous Activities and Industries List (HAIL)

Based on a review of the Listed Land Use Register (LLUR), no properties that exist within the proposed site boundaries are registered as a HAIL site. As described by Environment Canterbury (ECan), this does not mean that an activity with the potential to cause contamination has never occurred or is currently occurring at the site and as such will need to be assessed during the site walkover assessment and site investigations.

Our site walkover and investigations did not encounter any obvious evidence of site contamination or hazardous activities.

5.2 Nearby Existing Geotechnical Data

Existing geotechnical data available on the NZGD website has been reviewed as part of our assessment. The review was limited to deep geotechnical testing within 100 m of the site, and nearby testing has been summarised in Table 2 below and presented in Appendix B.

Table 2 - Site Specific Investigation Information			
Test ID	Elevation (R.L)	Test Location	Termination Depth (m)
CPT_22326	34.41	53 Marshs Road	19.78 m
CPT_93492	n/a	693 Main South Road	3.0 m
CPT_93491	n/a	693 Main South Road	3.0 m

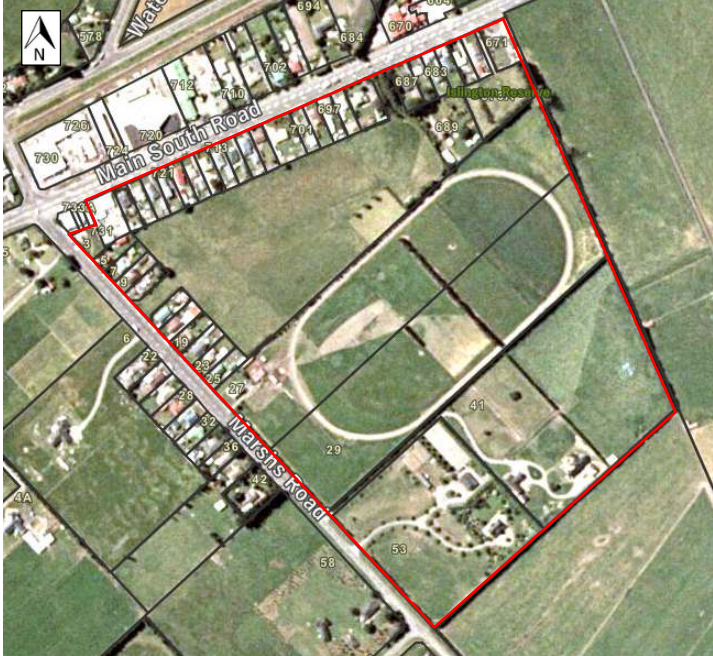
5.3 Historic Aerial Photography Review

A review of historic aerial photography sourced from Canterbury Maps was undertaken. Aerial photography images and descriptions are summarised below in Table 3.

Table 3: Aerial Photography Review

Aerial Photograph	Description
	Canterbury Maps 1955-1959. The majority of site is farmland. Some residential properties on Marshs Road and Main South Road have been constructed. A shallow and dry tributary feature can be seen within the eastern margin of site.
	Canterbury Maps 1970 - 1974. The majority of residential dwellings along Marshs Road and Main South Road have been constructed. The tributary feature appears to be less prominent on the landscape.

Table 3: Aerial Photography Review

Aerial Photograph	Description
	Canterbury Maps 2000 - 2004. The generally site resembles the present-day layout and configuration. The only exception is the dwelling at 29 Marshs Road has not been constructed. The horse racetrack has been formed, and 41 and 53 Marshs Road has been developed. The tributary feature appears to have been infilled or levelled.

6. Geological Model

6.1 Published Geology

The soils across the Canterbury Plains comprise interbedded alluvial formations deposited by eastward flowing rivers emanating from the Southern Alps and draining towards the coast along Pegasus Bay. These alluvial soils, interlayered with marine deposits associated with previous fluctuations of sea level, comprise variable gravels, sand, silts and occasional peat, and can change markedly over relatively short distances, both horizontally and vertically. The sandy and silty soil types are considered susceptible to liquefaction, dependent upon grain size distribution, saturation and in-situ density.

The 1992 geology of the Christchurch urban area indicates the site is underlain by Holocene aged Springston Formation described as 'dominantly alluvial sand and silt overbank deposits'. It should be noted that older Holocene aged Springston Formation deposits, described as 'older alluvial gravel, sand, and silt', are mapped approximately 750 m to the northeast of site.

According to the GNS New Zealand Active Faults database the closest mapped active fault is the Greendale Fault, with a recurrence interval of 10,000 to 20,000 years, located approximately 9.2 km southwest of site.

6.2 Site Subsoil Classification

We consider that the site subsoil category in terms of NZS 1170.5 Clause 3.1.3 is Class D (deep or soft soil sites) based on the following:

- Forsyth et al (2008) indicates that rock in this area of Christchurch is likely to be in the order of several hundred metres.
- Investigations undertaken within 100 m of the site indicate approximately 20 m of interbedded silt, sand, gravel, and clay, which is likely overlying predominately gravels to at least 200 m depth.
- Clause 3.1.3 and Table 3.2 of NZS 1170.5:2004.

6.3 Site Walkover

A site walkover was conducted during the geotechnical investigation on the 13th and 14th of October 2022. Relevant observations are listed below:

- Topographically, the site is generally flat.
- No boggy or saturated ground was observed underfoot.
- The property owner at 41 Marshs Road indicated a deep groundwater borehole was located on his property, and that groundwater was not noted at shallow depths.

6.4 Site Specific Investigation

Following an initial site walkover and services locate, the field investigations comprised of:

- Sixteen machine excavated Test Pits with associated Dynamic Cone Penetrometer tests to target depths of 3.0 m bgl.

A visual-tactile field classification of the subsoils encountered during test pit excavations was carried out in accordance with 'Guidelines for the Field Classification and Description of Soil and Rock for Engineering Purposes' (NZGS, 2005) and Dynamic Cone Penetrometer testing was carried out in accordance with NZS 4402.1988, Test 6.5.2, 'Dynamic Cone Penetrometer'. Test R.L data has been interpolated from available surface LiDAR data.

Investigation details are provided in Table 4. All test locations are presented in Appendix C. Test Pit logs and Dynamic Cone Penetrometer test results showing detailed soil descriptions and blows per 100 mm penetration presented in Appendix D.

Table 4 - Site Specific Investigation Information			
Test ID	Elevation (R.L)	Termination Depth (m bgl)	Further Information (Groundwater, piezometer, etc)
TP/DCP01	34.54	TP: 3.0 DCP: 1.1	No groundwater encountered. DCP terminated on gravel.
TP/DCP02	34.84	TP: 2.9 DCP: 1.8	No groundwater encountered. DCP terminated on gravel.
TP/DCP03	35.11	TP: 3.0 DCP: 1.8	No groundwater encountered. DCP terminated on gravel.
TP/DCP04	34.82	TP: 2.9 DCP: 2.2	No groundwater encountered. DCP terminated on gravel.
TP/DCP05	35.37	TP: 3.0 DCP: 1.9	No groundwater encountered. DCP terminated on gravel.
TP/DCP06	34.83	TP: 2.9 DCP: 1.8	No groundwater encountered. DCP terminated on gravel.
TP/DCP07	35.58	TP: 3.0 DCP: 1.4	No groundwater encountered. DCP terminated on gravel.
TP/DCP08	35.61	TP: 2.9 DCP: 2.2	No groundwater encountered. DCP terminated on gravel.
TP/DCP09	35.71	TP: 3.0 DCP: 1.7	No groundwater encountered. DCP terminated on gravel.

Table 4 - Site Specific Investigation Information			
Test ID	Elevation (R.L)	Termination Depth (m bgl)	Further Information (Groundwater, piezometer, etc)
TP/DCP10	35.59	TP: 3.0 DCP: 2.2	No groundwater encountered. DCP terminated on gravel.
TP/DCP11	35.62	TP: 3.3 DCP: 3.0	No groundwater encountered. No gravel encountered in TP, maximum reach of excavator.
TP/DCP12	35.75	TP: 3.0 DCP: 1.3	No groundwater encountered. DCP terminated on gravel.
TP/DCP13	36.28	TP: 3.0 DCP: 1.5	No groundwater encountered. DCP terminated on gravel.
TP/DCP14	36.28	TP: 3.0 DCP: 1.0	No groundwater encountered. DCP terminated on gravel.
TP/DCP15	35.86	TP: 3.0 DCP: 0.8	No groundwater encountered. DCP terminated on gravel.
TP/DCP16	35.47	TP: 3.0 DCP: 2.3	No groundwater encountered. DCP terminated on gravel.

7. Ground Model

7.1 Site Subsurface Conditions

Subsurface conditions based on those encountered within the machine excavated test pits are summarised in Table 5.

Table 5 - Site Ground Model				
Soil Type	Depth to bottom of Layer (m)	Layer Thickness (m)	DCP (Blows/100 mm)	Relative Density / Consistency
Sandy SILT, SILT (TOPSOIL)	0.25 – 0.4	0.25 – 0.4	2 - 7	Firm to stiff
SILT, sandy SILT, silty SAND, SAND (ALLUVIUM)	0.8 – >3.3	0.5 – >3.0	2 - 17	Firm to stiff Loose to very dense
Gravelly SAND, sandy GRAVEL, silty GRAVEL, Gravelly SILT, GRAVEL, COBBLES (ALLUVIUM)	>3.0	Not determined	7 - 25+	Medium dense to very dense

7.2 Groundwater

Groundwater was not encountered within the machine excavated test pits. The maximum Test Pit investigation depth achieved was 3.3 m in TP/DCP11, and soil moisture conditions at the base of the excavations were generally described as 'moist to wet'.

The property owner at 41 Marshs Road indicated that there is a deep groundwater borehole located on his property and that groundwater was not present at shallow depths. We consider groundwater is to be below 3.3 m bgl. It should be noted that groundwater levels may fluctuate due to seasonal variations or heavy rainfall events.

8. Geotechnical Assessment

8.1 Qualitative Liquefaction Assessment

The soils encountered within the geotechnical testing were qualitatively assessed for liquefaction potential. Based on our desktop review of the site geology and our experience with similar soils in the area, we consider soils prone to liquefaction are typically saturated silts and sands located below the groundwater table.

The geotechnical testing generally encountered dry to wet, stiff silts and medium dense to dense sand, gravel, and cobbles to depths of 3.3 m bgl. These soils are likely to be underlain by gravels/ cobbles to depths of 10 m bgl. Groundwater was not encountered within the geotechnical testing at depths down to 3.3 m bgl.

Based on the site investigation testing, and the sites MBIE classification and liquefaction mapping of the surrounding area presented in Section 5.1, we consider the liquefaction risk to be low and we consider likely consistent with a TC1 technical classification. Further testing is required to accurately determine the liquefaction risk of the site.

8.2 Geotechnical Ultimate Bearing Capacity

With reference to the Dynamic Cone Penetrometer results and Shear Vane results, in accordance with NZS3604:2011 and the MBIE Guidance, an Ultimate Bearing Capacity (UBC) of 200 kPa is available beneath the topsoil within the natural alluvial soils at a depth ranging between 0.25 m and 0.8 m bgl.

In accordance with the principles of AS/NZS1170.0:2002 Section 3.2, a Strength Reduction Factor of $\Phi = 0.5$, as per B1/VM4 Section 3.5, should be applied to the Ultimate Bearing Capacity, which should then equal or exceed the factored Ultimate Limit State design actions.

9. Assessment Against RMA Section 106

9.1 Criteria

In accordance with the Resource Management Act 1991 (RMA), the site has been assessed in accordance with Section 106 for natural hazards. Section 106 states:

- *There is significant risk from natural hazards; or*
- *Sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision.*

For the purpose of subsections 1a, an assessment of the risk from natural hazards requires a combined assessment of:

- *The likelihood of natural hazards occurring;*
- *The material damage to land in respect of which consent is sought, other land or structures that would results from natural hazards;*
- *Any likely subsequent use of land in respect of which the consent is sought that would accelerate, worsen or result in material damage of the kind referred to in paragraph b.*

9.2 Assessment

The site has been assessed, based on site mapping, site investigations and research of local information, for the following natural hazards:

- Fault Rupture – the site is not located within an identified active fault hazard zone and geological mapping indicates there are no mapped active faults within 9 km of the site.
- Slope Stability – The site and surrounding areas are generally flat and low lying. Consequently, slope instability risk can be discounted.
- Inundations (soil, rock debris) – the site is not located at the base of a major slope and debris inundation can be discounted.
- Inundations (flooding) – the site is not mapped within a Flood Management Area.

However, we consider the site may be subject to the following hazards, which will need to be mitigated as part of the development design:

- Liquefaction induced settlement – Our qualitative liquefaction assessment of the site and surrounding area indicates there is a risk of minor liquefaction induced ground damage consistent with TC1 technical category classification. We consider the risk from liquefaction induced settlement and ground subsidence to be low, and further testing is required to accurately determine the liquefaction risk on site.

In our opinion, under Section 106 of the RMA, there are no geotechnical reasons preventing the proposed land change rezone and subsequent development, provided the developer takes the appropriate measures as recommended in this report and follows appropriate industry standards for erosion control.

10. Site Suitability

Based on the ground conditions encountered during the geotechnical investigation, CGW considers the site suitable for the proposed rezoning of residential and rural land to industrial. A statement of professional opinion to support the suitability of the site for the proposed rezoning is presented in Appendix E.

10.1 Recommendations

10.1.1 Further Geotechnical Testing

For the further geotechnical testing required to support a subsequent subdivision suitability consent, it is recommended that geotechnical site-specific deep testing is undertaken to accurately determine the liquefaction risk. CGW recommends Cone Penetrometer Testing and/ or Dynamic Probe Super Heavy tests (CPT/ DPSH) to be undertaken on site.

Any proposed cut and fill earthworks will need to be specifically sampled and laboratory tested during subdivision consenting stage geotechnical investigations

to provide suitable fill compaction reference information during earthworks. Any cut and fill earthworks will require a site specific earthworks specification document by a geotechnical engineer.

10.1.2 Earthworks

Any earthworks undertaken across the site during development should be undertaken in accordance with NZS4431:2022.

For any excavations required to form foundation subgrades, any topsoil, organic matter and deleterious material underlying any proposed foundations should be stripped and removed from site.

Site preparation should generally include the following procedures:

- Remove vegetation, topsoil and soil containing significant amounts of organic material from beneath building footprints, foundations and proposed fill areas;
- Excavate where required to the foundation levels;
- Proof roll and compact the exposed subgrade materials using a heavy roller to reveal soft or loose areas and to densify the subgrade soils, where required. Soft or loose areas which do not improve with compaction should be over excavated and replaced with compacted engineered fill; and
- If fill is required, backfill where required to the design foundation levels with compacted engineered fill.

Fill should be placed in layers not exceeding 200 mm loose thickness and compacted to the recommended level prior to placing the next layer.

The recommended compaction level is a density ratio of at least 95% Standard Compaction MDD (Maximum Dry Density) as specified by NZS4431. If required, additional imported fill materials will need to be tested for geotechnical suitability/compaction criteria and be approved by CGW prior to use.

Earthworks should be supervised by a suitably qualified person and compaction levels checked and certified by field density (Nuclear Density – ND) testing or Clegg hammer testing, at appropriate spacings and lift intervals.

11. References

1. GNS, New Zealand Geology Web Map (online), available at GNS Science - Geology Web Map Client (accessed 18/10/22).
2. GNS, New Zealand Active Faults Database (online), available at <http://maps.gns.cri.nz/website/af/> (accessed 18/10/2022).
3. Ministry of Business, Innovation and Employment, 2012. Repairing and rebuilding house affected by the Canterbury earthquake sequence, Christchurch, New Zealand.

4. Ministry of Business, Innovation and Employment, 2014a. Acceptable Solutions and Verification Methods for New Zealand Building Code Clause B1 Structure, Verification Method B1/VM4, Foundations, New Zealand.
5. Ministry of Business, Innovation and Employment, 2014b. Clarifications and updates to the Guidance 'Repairing and rebuilding houses affected by the Canterbury earthquakes', Issue 7, October 2014.
6. New Zealand Geotechnical Database (NZGD) online map viewer (accessed 18/10/22).
7. NZGS, 2005. Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes, NZ Geotechnical Society Inc, Wellington, New Zealand.

Appendix A: Limitations

This report has been prepared solely for the benefit of our client, Calder Stewart Land Holdings Limited, as per our brief and an agreed consultancy agreement. The reliance by any other parties on the information or opinions contained in this report shall, without our prior agreement in writing, be at such parties' sole risk.

The conclusions and recommendations contained within this report are based on the investigations as described in detail above. The nature and continuity of subsoil conditions are inferred and it must be appreciated that actual conditions could vary considerably. Defects and unforeseen ground conditions may remain undetected which might adversely affect the stability of the site and the recommendation made herein.

This report has been prepared solely to address the issues raised in our brief, and shall not be relied on for any other purpose.

Where we have provided comments on aesthetic issues these need to be confirmed by an architect or other expert in the field.

In the event the third party investigation data has been provided to us, the client acknowledges that we have placed reliance on this information to produce our report and CGW will accept no liability resulting from any errors or defect in the third party data provided to us.

Appendix B: Nearby Geotechnical Data



REPORT OF PIEZO-CONE PROBE:

GA_SCP_8003

SHEET: 1 OF 2

CONTRACTOR: PRO-DRILL

RIG:

CONE NO.: 4439

RECORDED: Chris DATE: 15/05/2012

CHECKED: GOLDER DATE: -

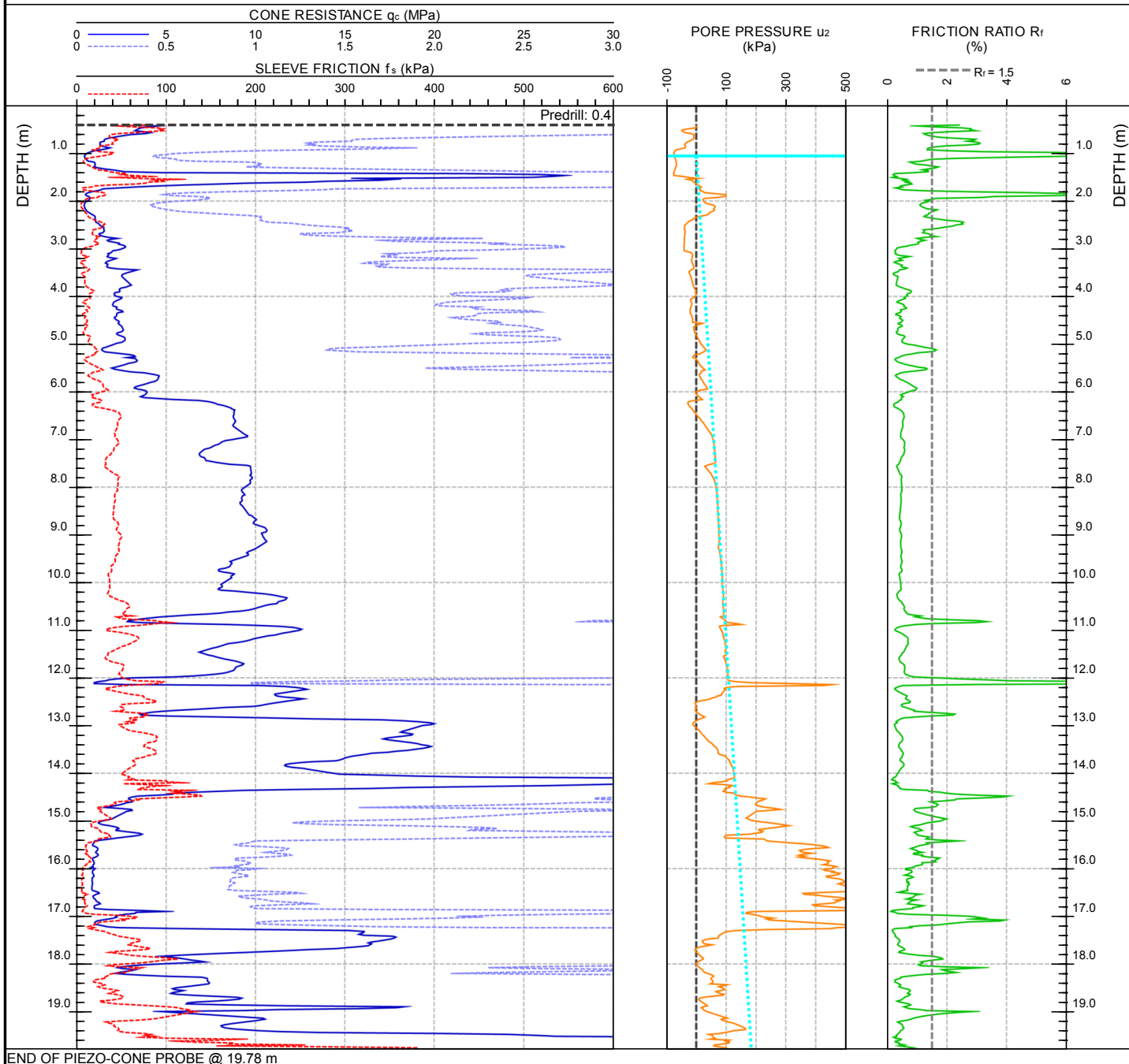
LOCATION: 5 Cholmondeley Ave, Opawa, Christchurch

COORDS: 1559009 mE 5177574 mN

SURFACE RL: 34.41 m DATUM: MSL

WATER LEVEL: 1.05 m

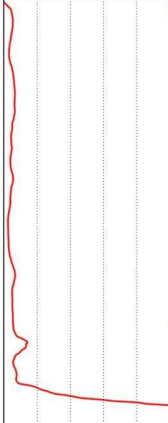
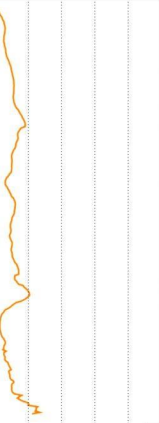
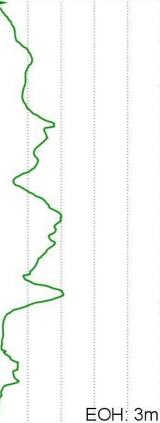
HOLE DEPTH: 19.78 m



COMMENT:



This report of piezo-cone probe must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination.

LandTest subsurface ground investigation		CPT & DPSH TEST LOG		CGW Consulting Engineers	
		Client: Cameron Gibson Wells Project: 693 Main South Road			
Site Location: 693 Main South Road, Islington Test Date: 30/03/2017 Coordinates: -43.54931, 172.49130 (WGS84) Supervisor: Robert Smith				Operator: Logan Allan Piezocone (Rig): MKJ364 (P001245) Hole Depth: 3m EOH Reason: DPSH Refusal	
Tip Resistance (MPa) 10 20 30 40	Sleeve Friction (kPa) 100 200 300 400	Pore Pressure (kPa) 0 200 400 600 800	Friction Ratio (%) 2 4 6 8	Depth (m) 1 2 3	Dynamic Probe Super Heavy (DPSH-B) (Blows / 200mm) 4 8 12 16 20 24 28 32 36
				EOH: 3m	
Remarks CPTu testing carried out to ASTM Standard D5778-12 10cm-sq piezocone used for each CPTu test CPTu refusal at 50MPa on the tip, 500kPa on the friction sleeve or at 2500kPa pore pressure DPSH-B refusal at two consecutive increments of 40 blows or over Average Energy Transfer Ratio for the DPSH-B hammer on each rig: P 001245: 95% P 001249: 90% Calibration performed on 4th November 2014					
300 Cashel St, Christchurch Central, Christchurch 8011, New Zealand 0800 TESTER (837837) www.landtest.co.nz					Hole Depth: 3m Page 1 of 1

 subsurface ground investigation		CPT & DPSH TEST LOG		 Consulting Engineers			
		Client: Cameron Gibson Wells Project: 693 Main South Road					
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> Site Location: 693 Main South Road, Islington Test Date: 30/03/2017 Coordinates: -43.54935, 172.49100 (WGS84) Supervisor: Robert Smith </td> <td style="width: 50%; border: none;"> Operator: Logan Allan Piezococone (Rig): MKJ364 (P001245) Hole Depth: 3m EOH Reason: DPSH Refusal </td> </tr> </table>						Site Location: 693 Main South Road, Islington Test Date: 30/03/2017 Coordinates: -43.54935, 172.49100 (WGS84) Supervisor: Robert Smith	Operator: Logan Allan Piezococone (Rig): MKJ364 (P001245) Hole Depth: 3m EOH Reason: DPSH Refusal
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Tip Resistance (MPa)	Sleeve Friction (kPa)	Pore Pressure (kPa)	Friction Ratio (%)	Depth (m)	Dynamic Probe Super Heavy (DPSH-B) (Blows / 200mm)		
10 20 30 40	100 200 300 400	0 200 400 600 800	2 4 6 8		4 8 12 16 20 24 28 32 36		
EOH: 3m					40		
Remarks CPTu testing carried out to ASTM Standard D5778-12 10cm-sq piezocone used for each CPTu test CPTu refusal at 50MPa on the tip, 500kPa on the friction sleeve or at 2500kPa pore pressure DPSH-B refusal at two consecutive increments of 40 blows or over Average Energy Transfer Ratio for the DPSH-B hammer on each rig: P 001245: 95% P 001249: 90% Calibration performed on 4th November 2014							
300 Cashel St, Christchurch Central, Christchurch 8011, New Zealand 0800 TESTER (837837) www.landtest.co.nz					Hole Depth: 3m Page 1 of 1		

Appendix C: Test Location Plan



Legend:

TP/DCP Location 

Notes:

1. CGW Consulting Engineers Test Location Plan adapted from Canterbury Maps.
2. It should be borne in mind that locations of features are approximate only.
3. Original plan size A4.



Civil Structural Environmental
Geotechnical

Nelson Ph: 548 - 8259
Christchurch Ph: 348 - 1000

DATE: October 2022

DRAWN: TVD

SCALE: NTS

CAD REF:

Test Location Plan

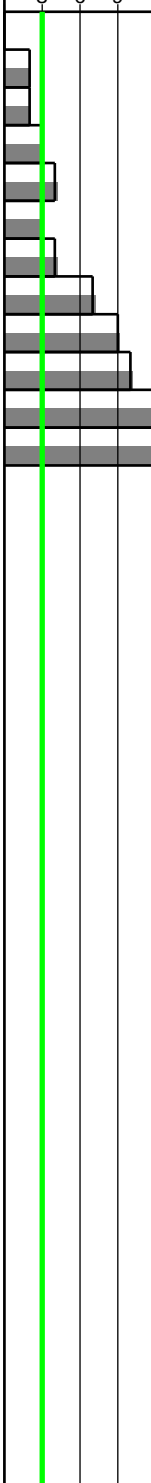
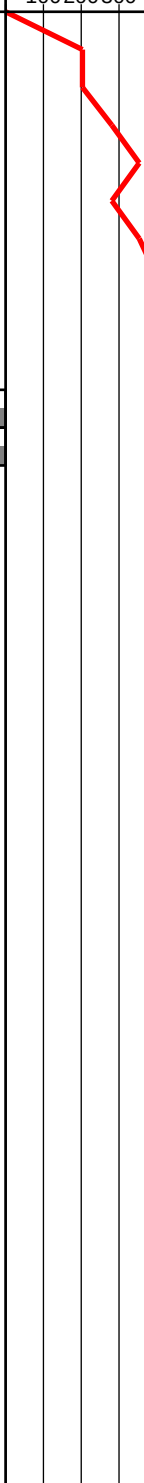
220748 - Hornby Quadrant Stage 5

DRAWING NO:

220748

SHEET 1 OF 1

Appendix D: Test Pit Logs and Dynamic Cone Penetrometer Tests

		Project Title: Hornby Quadrant Stage 5				TP/DCP01		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 34.54		N Coord: 0		E Coord: 0		
Date: 13/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 369 		UBC (kPa) (Stockwell) 100200300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
			0.5 V-114-40			34.24 0.30	SILT, some fine sand, dark brown. Stiff, dry, non-plastic, some rootlets. (TOPSOIL)	
						33.94 0.60	SILT, trace fine sand, light brown. Very stiff, dry to moist, slightly plastic. (ALLUVIAL DEPOSITS)	
						33.64 0.90	Silty fine SAND, trace organics, light brown streaked brown. Medium dense, moist, non-plastic. (ALLUVIAL DEPOSITS)	
		1 V-UTP				33.54 1.00	Fine to coarse gravelly cobbly (6 cmØ max.) SILT, trace fine sand, light brown. Dense, moist, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
						33.24 1.30		
						32.54 2.00	Fine sandy fine to coarse GRAVEL & COBBLES (12 cmØ max.), light brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
						31.54 3.00		
							End Of Hole At 3.00 m	
KEY					REMARKS			
D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa					No Groundwater Encountered Terminated at target depth			
 - Groundwater Strike  - Groundwater Level								

GEOTECHNICAL SITE INVESTIGATION

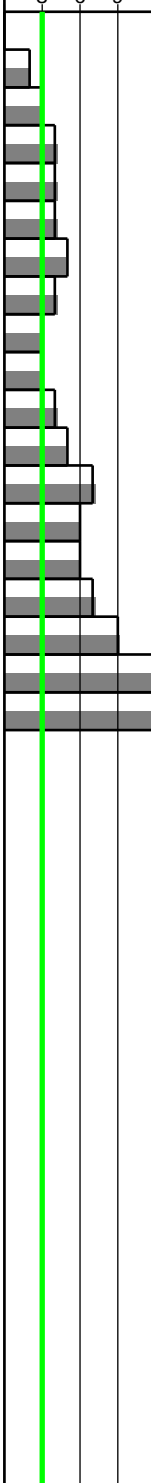
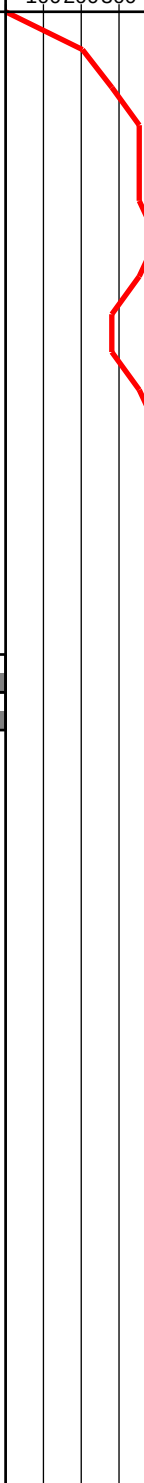
TP/DCP01 PHOTOGRAPHS



Figure 1: Test Pit 01 Pit



Figure 2: Test Pit 01 Materials

		Project Title: Hornby Quadrant Stage 5			TP/DCP02		
		Project Number: 220748	Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 34.84	N Coord: 0	E Coord: 0			
Date: 13/10/2022		Method: Test Pit-Scala	Logged By: TVD	Scale: 1:20 Sheet 1 Of 1			
Blows (per 100mm) 3 6 9	UBC (kPa) (Stockwell) 100 200 300	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
		0.5 V-120-44	34.49		0.35	SILT, trace fine sand, dark brown. Stiff, dry, non-plastic, some rootlets. (TOPSOIL)	
			34.24		0.60	Fine SAND, trace silt, brownish grey. Medium dense, dry to moist, non-plastic. (ALLUVIAL DEPOSITS)	
		1 V-126-45	33.84		1.00	Fine sandy SILT, light brownish grey streaked orange. Very stiff, moist to wet, slightly plastic. (ALLUVIAL DEPOSITS)	
		1.5 V-UTP	33.34		1.50		
			33.04		1.80	Fine to coarse gravelly silty fine SAND, light brown, Dense, wet, non-plastic Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
			32.84		2.00	Fine to medium sandy fine to coarse GRAVEL & COBBLES (15 cmØ max.), light brown. Dense to very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS) 1.80 Becomes very dense.	
			31.94		2.90		
			31.84		3.00	End Of Hole At 2.90 m	

GEOTECHNICAL SITE INVESTIGATION

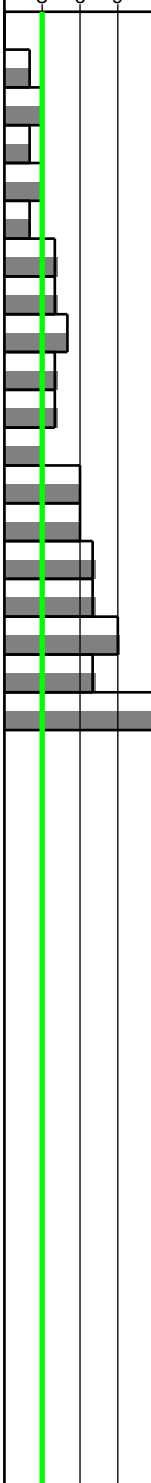
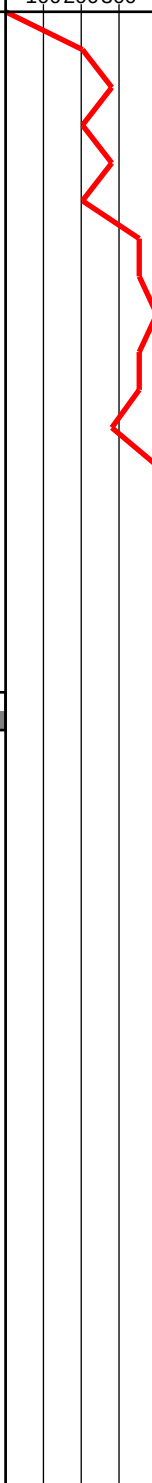
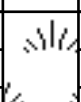
TP/DCP02 PHOTOGRAPHS



Figure 3: Test Pit 02 Pit



Figure 4: Test Pit 02 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP03		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 35.11		N Coord: 0		E Coord: 0		
Date: 13/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 369 		UBC (kPa) (Stockwell) 100200300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
			0.5 V-120-50	34.86		0.25	SILT, trace fine sand, brown. Stiff, dry, non-plastic, some rootlets. (TOPSOIL)	
			1 V-103-31	34.11		1.00	SILT, some fine sand, light greyish brown. Very stiff, moist, slightly plastic. (ALLUVIAL DEPOSITS) 0.50 Trace fine sand. 1.20 Becomes moist to wet.	
			1.5 V-91-32	33.51		1.60	Fine to coarse gravelly cobbly (10 cmØ max.) SILT, some fine sand, light brown. Stiff, moist to wet, slightly plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
				33.11		2.00	Fine sandy fine to coarse GRAVEL & COBBLES (15 cmØ max.), some silt, light brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
				33.01		2.10		
				32.11		3.00		
							End Of Hole At 3.00 m	
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level						REMARKS No Groundwater Encountered Terminated at target depth		

GEOTECHNICAL SITE INVESTIGATION

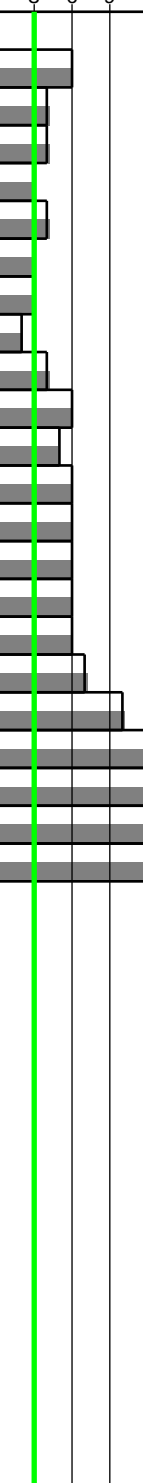
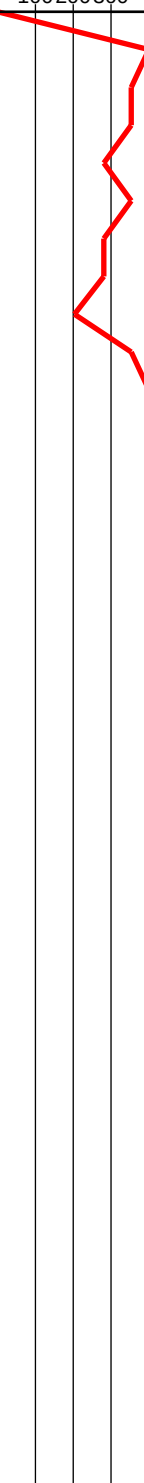
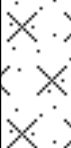
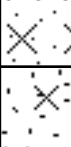
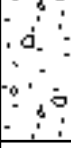
TP/DCP03 PHOTOGRAPHS



Figure 5: Test Pit 03 Pit



Figure 6: Test Pit 03 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP04										
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited												
		GL (mAOD): 34.82		N Coord: 0		E Coord: 0										
Date: 13/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1										
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 		Samples / Testing		Level mAHD		Legend		Depth (m)		Description		Water		
				0.5 V-123-47		34.52				0.30		SILT, trace fine sand, dark brown. Stiff, dry, non-plastic, some rootlets. (TOPSOIL)				
				1 V-114-38		33.82				1.00		Fine sandy SILT, light greysih brown. Very stiff, moist, non-plastic. (ALLUVIAL DEPOSITS)				
				1.5 V-135-47		33.22				1.60		1.00 Becomes moist to wet, slightly plastic.				
				2 V-120-45		32.82				2.00		Silty fine SAND, light greyish brown streaked orange. Medium dense, moist to wet, non-plastic. (ALLUVIAL DEPOSITS)				
						32.52				2.30		Fine to coarse gravelly cobbly (10 cmØ max.) fine SAND, light brown. Very dense, wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)				
						31.92				2.90						
						31.82				3.00		End Of Hole At 2.90 m				
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level																REMARKS No Groundwater Encountered Terminated at target depth

GEOTECHNICAL SITE INVESTIGATION

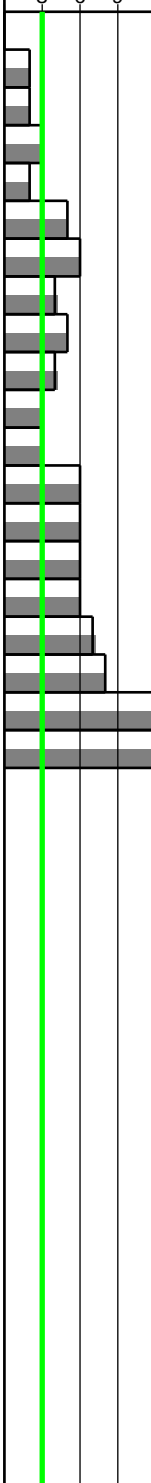
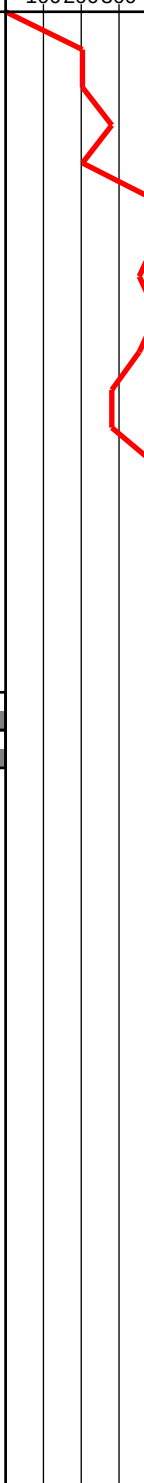
TP/DCP04 PHOTOGRAPHS



Figure 7: Test Pit 04 Pit



Figure 8: Test Pit 04 Materials

		Project Title: Hornby Quadrant Stage 5			TP/DCP05		
		Project Number: 220748	Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 35.37	N Coord: 0	E Coord: 0			
Date: 13/10/2022		Method: Test Pit-Scala	Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 3 6 9	UBC (kPa) (Stockwell) 100 200 300	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
		0.5 V-97-48	35.02		0.35	Fine sandy SILT, dark brown. Stiff, dry, non-plastic, some rootlets. (TOPSOIL)	
						Silty fine SAND, brown. Medium dense, moist, non-plastic. (ALLUVIAL DEPOSITS)	
		1 V-UTP	34.47 34.37		0.90 1.00	SILT, some fine sand, light brown. Stiff, moist to wet, slightly plastic. (ALLUVIAL DEPOSITS) 1.10 Becomes light greyish brown.	
		1.5 V-114-41				1.80 Trace fine sand, wet, moderately plastic.	
		2 V-172-37	33.37 33.27		2.00 2.10	Fine to medium sandy fine to coarse GRAVEL & COBBLES (12 cmØ max.), light brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
			32.37		3.00	End Of Hole At 3.00 m	
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level				REMARKS No Groundwater Encountered Terminated at target depth			

GEOTECHNICAL SITE INVESTIGATION

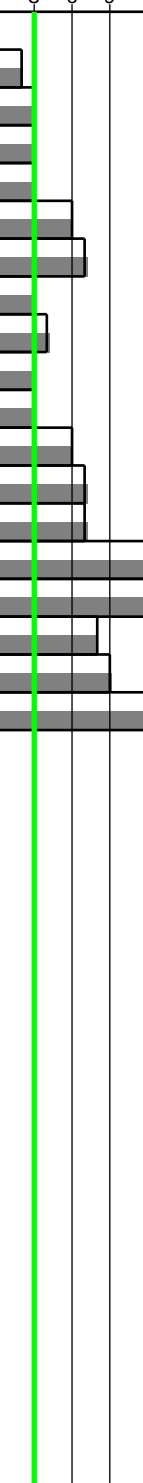
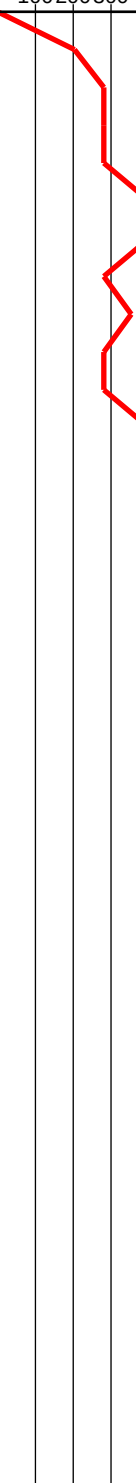
TP/DCP05 PHOTOGRAPHS



Figure 9: Test Pit 05 Pit



Figure 10: Test Pit 05 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP06		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 34.83		N Coord: 0		E Coord: 0		
Date: 13/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100200300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
							SILT, trace fine sand, brown. Stiff, dry, non-plastic. (TOPSOIL)	
			0.5 V-176-47	34.48	                     	0.35	SILT, trace fine sand, light greyish brown. Very stiff, moist, non-plastic. Occasional subrounded cobbles (6-10 cmØ). (ALLUVIAL DEPOSITS) 0.80 Streaked orange and trace iron staining.	
			1 V-120-43	33.83	                   	1.00		
			1.5 V-UTP	33.53	                   	1.30	Fine SAND, trace silt, light brownish grey streaked orange. Medium dense, moist, non-plastic. (ALLUVIAL DEPOSITS)	
				33.23	                   	1.60	Fine to coarse gravelly cobbly (10 cmØ max.) SILT, trace fine sand, light brown mottled orange. Hard, moist to wet. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
				32.93	                   	1.90	Fine sandy fine to coarse GRAVEL, some cobbles (10 cmØ max.), light brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
				32.83	                   	2.00		
				31.93	                   	2.90	2.70 Trace cobbles (15 cmØ max.).	
				31.83	                   	3.00	End Of Hole At 2.90 m	
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa		 - Groundwater Strike  - Groundwater Level				REMARKS No Groundwater Encountered Terminated at target depth		

GEOTECHNICAL SITE INVESTIGATION

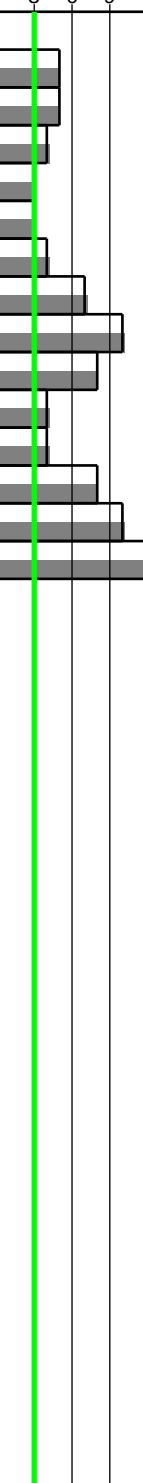
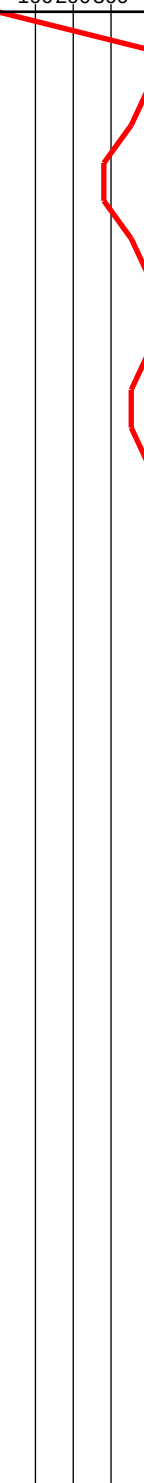
TP/DCP06 PHOTOGRAPHS



Figure 11: Test Pit 06 Pit



Figure 12: Test Pit 06 Materials

		Project Title: Hornby Quadrant Stage 5			TP/DCP07		
		Project Number: 220748	Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 35.58	N Coord: 0	E Coord: 0			
Date: 14/10/2022		Method: Test Pit-Scala	Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 3 6 9	UBC (kPa) (Stockwell) 100 200 300	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
		0.5 V-173-51	35.28		0.30	SILT, trace fine sand, dark brown. Stiff, dry, non-plastic, some rootlets. (TOPSOIL)	
						SILT, some fine sand, light greyish brown. Very stiff, dry to moist, slightly plastic. (ALLUVIAL DEPOSITS)	
			34.58		1.00	0.80 Silty fine SAND, non-plastic.	
						Fine sandy fine to coarse GRAVEL & COBBLES (10 cmØ max.). Medium dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
						1.40 Becomes very dense.	
							
							
							
							
						2.50 Occasional larger cobbles (15 cmØ max.).	
						2.70 Becomes wet.	
			32.58		3.00	End Of Hole At 3.00 m	

GEOTECHNICAL SITE INVESTIGATION

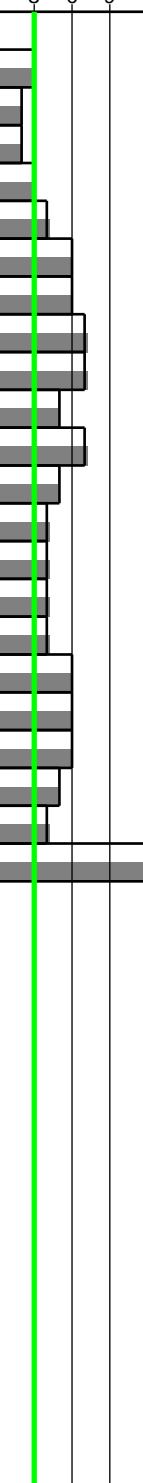
TP/DCP07 PHOTOGRAPHS



Figure 13: Test Pit 07 Pit



Figure 14: Test Pit 07 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP08		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 35.61		N Coord: 0		E Coord: 0		
Date: 13/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
			0.5 V-177-51	35.31		0.30	SILT, trace fine sand, dark brown. Stiff, dry, non-plastic. (TOPSOIL)	
			1 V-100-40	34.61 34.51	                                    	1.00 1.10	SILT, some fine sand, light greyish brown. Very stiff, moist, non-plastic. (ALLUVIAL DEPOSITS) 0.50 Trace fine sand.	
			1.5 V-139-37	33.71 33.61 33.41	                                     	1.90 2.00 2.20	Fine SAND, trace silt, light brownish grey. Medium dense, moist to wet, non-plastic. (ALLUVIAL DEPOSITS) Fine to coarse gravelly SILT, trace fine sand. Light brown. Very stiff, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
				32.71 32.61	                                     	2.90 3.00	Fine sandy fine to coarse GRAVEL, some cobbles (10 cmØ max.), light brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS) End Of Hole At 2.90 m	
KEY		REMARKS						
D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa		No Groundwater Encountered Terminated at target depth						
		 - Groundwater Strike  - Groundwater Level						

GEOTECHNICAL SITE INVESTIGATION

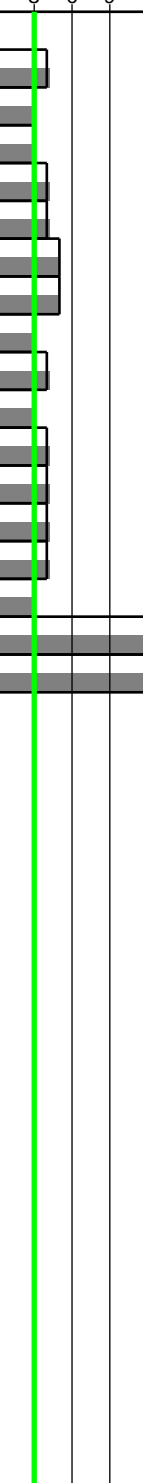
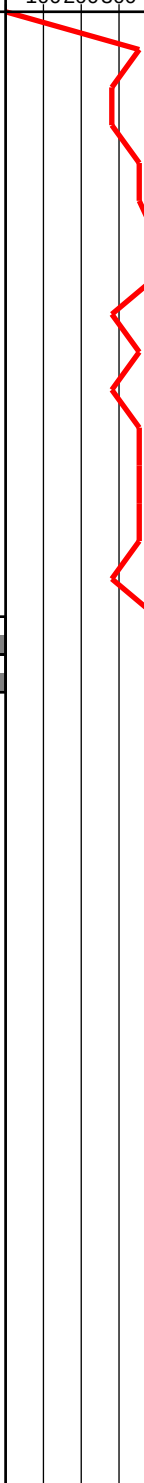
TP/DCP08 PHOTOGRAPHS



Figure 15: Test Pit 08 Pit



Figure 16: Test Pit 08 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP09		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 35.71		N Coord: 0		E Coord: 0		
Date: 13/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
			0.5 V-UTP	35.46		0.25	SILT, some fine sand, dark brown. Stiff, dry, slightly plastic, some rootlets. (TOPSOIL)	
							SILT, some fine sand, light brown. Very stiff, dry to moist, slightly plastic. (ALLUVIAL DEPOSITS)	
							0.50 Becomes hard.	
							0.70 Fine sandy SILT, moist.	
			1 V-128-34	34.71		1.00		
							1.30 Minor fine sand, light brown. Moist to wet, slightly plastic.	
			1.5 V-158-40					
				34.01		1.70		
				33.71		2.00	Fine to coarse gravelly cobbly (7 cmØ max.) SILT, light brown. Hard, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
				33.51		2.20		
							Fine to medium sandy fine to coarse GRAVEL & COBBLES (10 cmØ max.), light brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
							2.60 Trace cobbles (10 - 20 cmØ).	
				32.71		3.00		
							End Of Hole At 3.00 m	

GEOTECHNICAL SITE INVESTIGATION

TP/DCP09 PHOTOGRAPHS



Figure 17: Test Pit 09 Pit

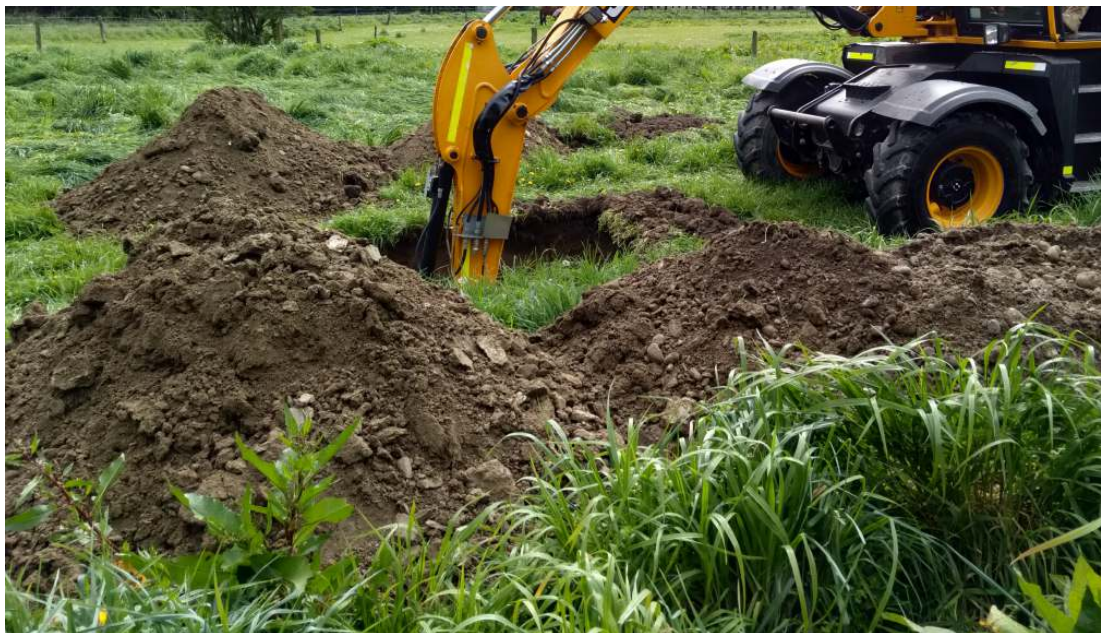
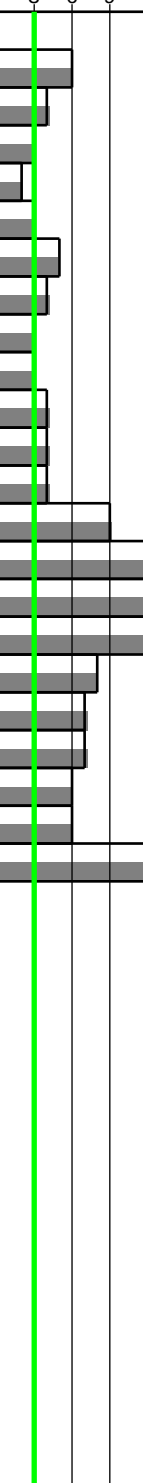
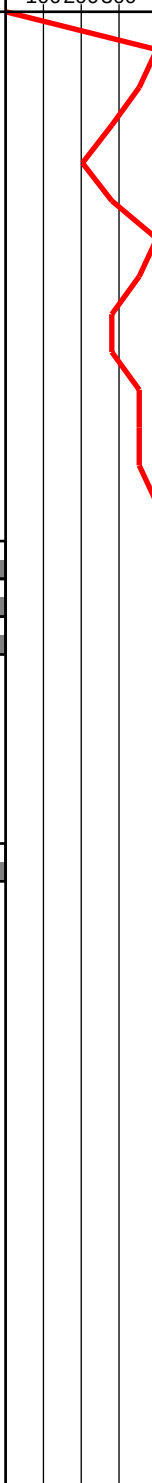


Figure 18: Test Pit 09 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP10		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 35.59		N Coord: 0		E Coord: 0		
Date: 14/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
							Fine sandy SILT, dark brown. Stiff, dry to moist, non-plastic, some rootlets. (TOPSOIL)	
			0.5 V-132-43	35.34		0.25	SILT, some fine sand, light greyish brown. Very stiff, dry to moist, non-plastic. (ALLUVIAL DEPOSITS)	
							0.60 Trace fine sand, slightly plastic.	
			1 V-182-47	34.59		1.00		
				34.29		1.30		
			1.5 V-114-54				Silty fine SAND, light greyish brown. Medium dense, moist to wet, non-plastic. (ALLUVIAL DEPOSITS)	
				33.69		1.90		
				33.59		2.00	Fine sandy fine to coarse GRAVEL & COBBLES (12 cmØ max.), greyish brown. Medium dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
							2.20 Becomes very dense.	
				32.59		3.00		
							End Of Hole At 3.00 m	
KEY						REMARKS		
D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa						No Groundwater Encountered Terminated at target depth		
 - Groundwater Strike  - Groundwater Level								

GEOTECHNICAL SITE INVESTIGATION

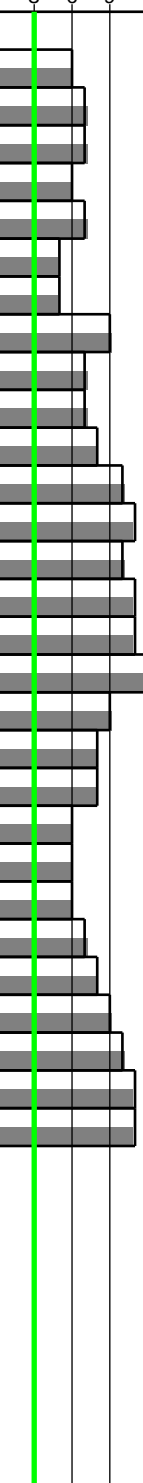
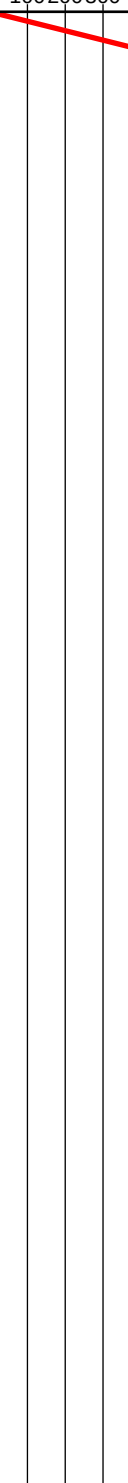
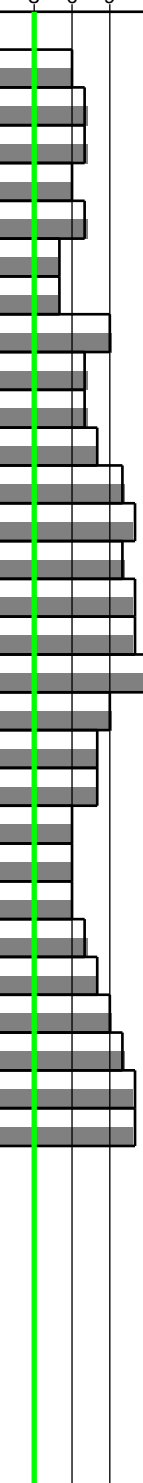
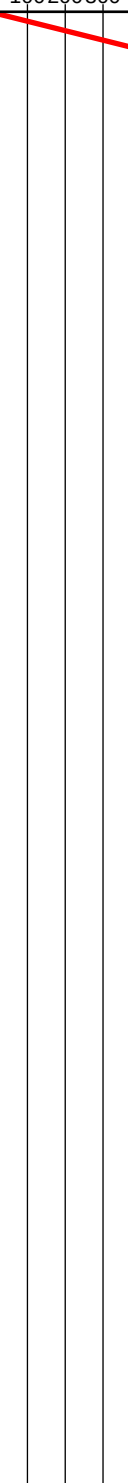
TP/DCP10 PHOTOGRAPHS



Figure 19: Test Pit 10 Pit



Figure 20: Test Pit 10 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP11									
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited											
		GL (mAOD): 35.62		N Coord: 0		E Coord: 0									
Date: 14/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1									
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 		Samples / Testing		Level mAHD		Legend		Depth (m)		Description		Water	
				0.5 V-70-32		35.32				0.30		SILT, some fine sand, dark brown. Stiff, dry, non-plastic, trace rootlets and trace larger wood roots. (TOPSOIL)			
										Fine SAND, some silt, greyish brown. Medium dense, dry, non-plastic. (ALLUVIAL DEPOSITS)					
										0.60 Occasional large wood roots.					
				1 V-UTP		34.62				1.00		1.20 Trace silt, dense.			
				1.5 V-UTP											
						33.82				1.80					
				2 V-UTP		33.62				2.00		SILT, trace fine sand, brownish grey and iron staining. Hard, dry, slightly plastic. (ALLUVIAL DEPOSITS)			
				2.5 V-UTP								2.50 Iron staining, dry.			
				3 V-UTP		32.62				3.00					
						32.32				3.30		End Of Hole At 3.30 m			

GEOTECHNICAL SITE INVESTIGATION

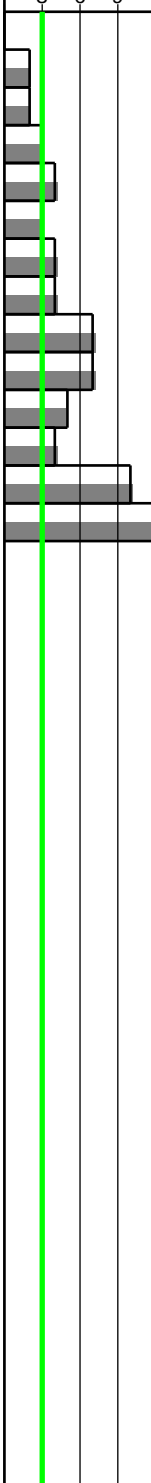
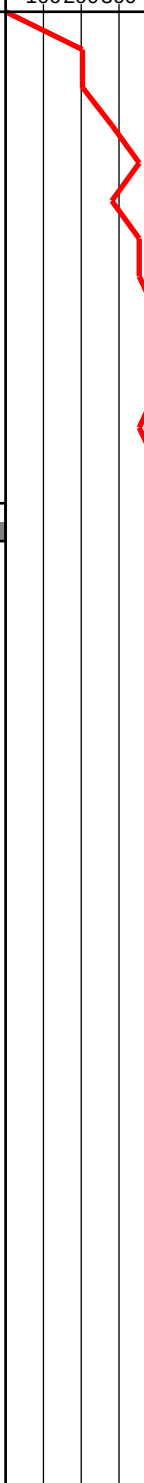
TP/DCP11 PHOTOGRAPHS



Figure 21: Test Pit 11 Pit



Figure 22: Test Pit 11 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP12		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 35.75		N Coord: 0		E Coord: 0		
Date: 14/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 369 		UBC (kPa) (Stockwell) 100200300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
			0.5 V-114-41	35.45		0.30	SILT, trace fine sand, dark brown. Stiff, moist, slightly plastic. (TOPSOIL)	
							Fine sandy SILT, light brownish grey. Very stiff, moist, non-plastic. (ALLUVIAL DEPOSITS)	
							0.50 Trace fine sand, brownish grey, slightly plastic.	
			1 V-129-38	34.75		1.00	0.90 Fine sandy SILT, moist to wet, moderately plastic.	
								
				34.35		1.40		
			1.5 V-78-57	34.25		1.50	Fine SAND, trace silt, brownish grey. Very dense, moist to wet, non-plastic. (ALLUVIAL DEPOSITS)	
							Fine sandy fine to coarse GRAVEL & COBBLES (8 cmØ max.), brownish grey. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)	
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								

GEOTECHNICAL SITE INVESTIGATION

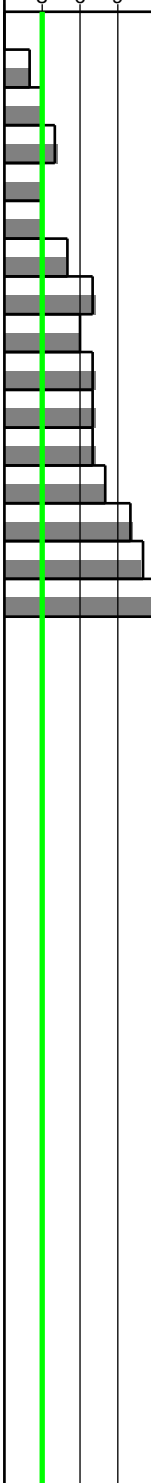
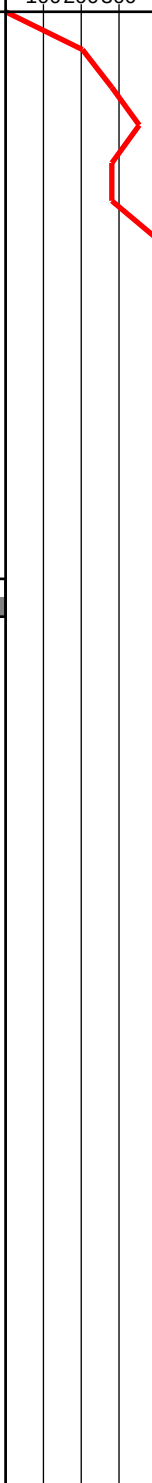
TP/DCP12 PHOTOGRAPHS



Figure 23: Test Pit 12 Pit



Figure 24: Test Pit 12 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP13									
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited											
		GL (mAOD): 36.28		N Coord: 0		E Coord: 0									
Date: 14/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1									
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 		Samples / Testing		Level mAHD		Legend		Depth (m)		Description		Water	
				0.5 V-188-41		36.03				0.25		SILT, trace fine sand, dark brown. Stiff, dry to moist, non-plastic, trace rootlets. (TOPSOIL)			
				1 V-135-47		35.28				1.00		0.90 Some fine sand, moist to wet.			
				1.5 V-106-40		34.68				1.60		Fine sandy fine to coarse GRAVEL & COBBLES (20 cmØ max.), trace silt, light greyish brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)			
						34.28				2.00					
						33.28				3.00		End Of Hole At 3.00 m			
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level														REMARKS No Groundwater Encountered Terminated at target depth	

GEOTECHNICAL SITE INVESTIGATION

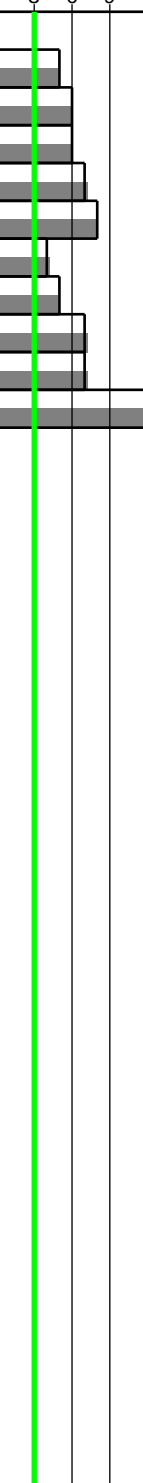
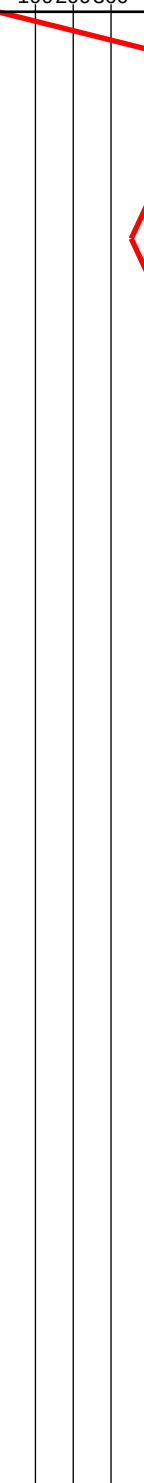
TP/DCP13 PHOTOGRAPHS



Figure 25: Test Pit 13 Pit



Figure 26: Test Pit 13 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP14		
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited				
		GL (mAOD): 36.28		N Coord: 0		E Coord: 0		
Date: 14/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1		
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 	Samples / Testing	Level mAHD	Legend	Depth (m)	Description	Water
			0.5 V-161-45				SILT, trace fine sand, brown. Stiff, dry, non-plastic, some rootlets. (TOPSOIL)	
				35.98		0.30	Fine sandy SILT, light brown. Very stiff, moist, slightly plastic. (ALLUVIAL DEPOSITS)	
				35.48		0.80		
				35.28		1.00	Fine to coarse gravelly cobbly (8 cmØ max.) fine SAND, light greyish brown. Medium dense, moist, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS) 1.00 Becomes very dense.	
				34.88		1.40		
			34.28		2.00	Fine sandy fine to coarse GRAVEL & COBBLES (10 cmØ max.), light greyish brown. Very dense, moist, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)		
							2.50 Occasional cobbles (20 cmØ max.).	
				33.28		3.00		
							End Of Hole At 3.00 m	

GEOTECHNICAL SITE INVESTIGATION

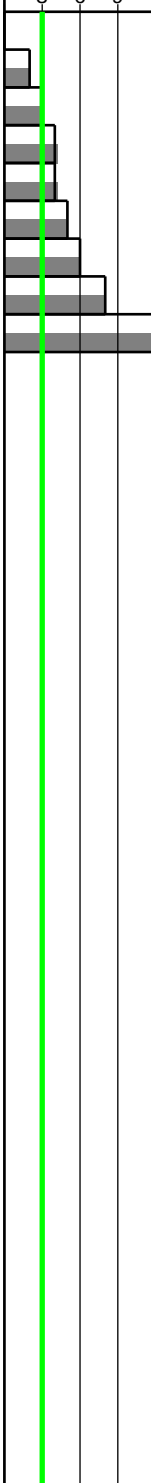
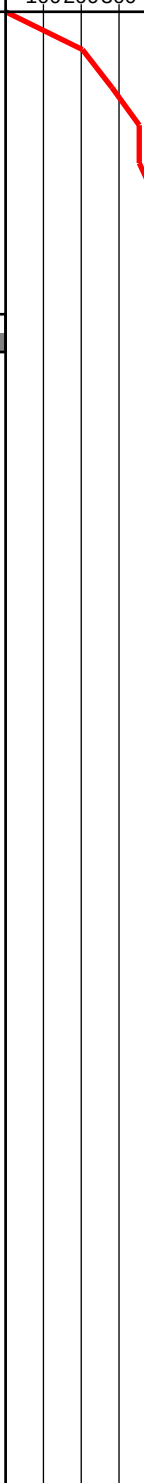
TP/DCP14 PHOTOGRAPHS



Figure 27: Test Pit 14 Pit



Figure 28: Test Pit 14 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP15											
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited													
		GL (mAOD): 35.86		N Coord: 0		E Coord: 0											
Date: 14/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1											
Blows (per 100mm) 3 6 9 		UBC (kPa) (Stockwell) 100 200 300 		Samples / Testing		Level mAHD		Legend		Depth (m)		Description		Water			
				0.5 V-67-26		35.51				0.35		SILT, trace fine sand, dark brown. Stiff, dry to moist, non-plastic, trace rootlets. (TOPSOIL)					
												Fine sandy SILT, light greyish brown. Stiff, moist, slightly plastic. (ALLUVIAL DEPOSITS)					
				1 V-84-32		34.86				1.00		0.90 Some fine sand, light brown streaked orange. 1.00 Trace iron staining.					
						34.56				1.30		Fine sandy fine to coarse GRAVEL & COBBLES (10 cmØ max.), trace silt, light brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)					
						33.86				2.00		2.20 Trace cobbles (15-20 cmØ).					
						32.86				3.00		End Of Hole At 3.00 m					
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level																REMARKS No Groundwater Encountered Terminated at target depth	

GEOTECHNICAL SITE INVESTIGATION

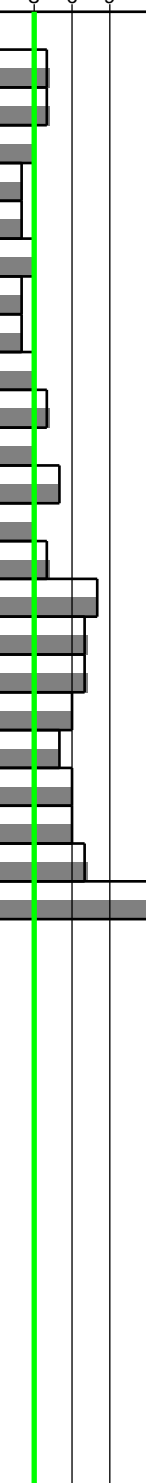
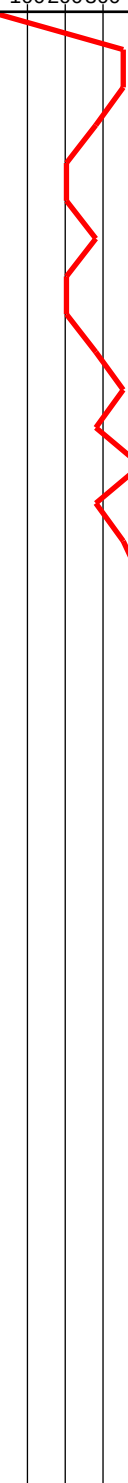
TP/DCP15 PHOTOGRAPHS



Figure 29: Test Pit 15 Pit



Figure 30: Test Pit 15 Materials

		Project Title: Hornby Quadrant Stage 5				TP/DCP16									
		Project Number: 220748		Client: Calder Stewart Land Holdings Limited											
		GL (mAOD): 35.47		N Coord: 0		E Coord: 0									
Date: 14/10/2022		Method: Test Pit-Scala		Logged By: TVD		Scale: 1:20 Sheet 1 Of 1									
Blows (per 100mm) 369 		UBC (kPa) (Stockwell) 100200300 		Samples / Testing		Level mAHD		Legend		Depth (m)		Description		Water	
0.5 V-141-47		1 V-51-22		35.07		0.40				SILT, some fine sand, dark brown. Stiff, dry to moist, non-plastic, trace rootlets, trace larger wood roots. (TOPSOIL)					
				34.67		0.80				Fine SAND, trace silt, light brownish grey. Medium dense, moist, non-plastic. (ALLUVIAL DEPOSITS)					
		34.47		1.00				Fine sandy SILT, light greyish brown. Very stiff, moist, slightly plastic, trace wooden roots (2 mmØ). (ALLUVIAL DEPOSITS) 1.00 Become stiff.							
		34.07		1.40				Silty fine SAND, light greyish brown. Medium dense, moist, non-plastic. (ALLUVIAL DEPOSITS)							
		33.47		2.00				2.00 Becomes moist to wet.							
		33.17		2.30				Fine sandy fine to coarse GRAVEL & COBBLES (8 cmØ max.), trace silt, light greyish brown. Very dense, moist to wet, non-plastic. Gravel: SW, subrounded. (ALLUVIAL DEPOSITS)							
		32.47		3.00				End Of Hole At 3.00 m							
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level														REMARKS No Groundwater Encountered Terminated at target depth	

GEOTECHNICAL SITE INVESTIGATION

TP/DCP16 PHOTOGRAPHS



Figure 31: Test Pit 16 Pit



Figure 32: Test Pit 16 Materials

Appendix E: Statement of Professional Opinion

APPENDIX I

Statement of Professional Opinion on the Suitability of Land for Subdivision

ISSUED BY: CGW Consulting Engineers
(Geotechnical engineering firm or suitably qualified Geoprofessional)

TO: Christchurch City Council
(Territorial authority)

TO BE SUPPLIED TO: Calder Stewart Land Holdings Limited
(Owner/Developer)

IN RESPECT OF: Proposed Commercial Subdivision
(Description of infrastructure/land development)

AT: 29, 41, 53 Marshs Road & 689 Main South Road

Robert Bruce Smith
(Address)
I Robert Bruce Smith on behalf of
(Geoprofessional)
CGW Consulting Engineers
(Geotechnical engineering firm)

hereby confirm:

1. I am a suitably qualified and experienced Geoprofessional employed by CGW Consulting Engineers and the geotechnical firm named above was retained by the owner/developer as the Geoprofessional on the above proposed development.

2. The geotechnical assessment report, dated 21/10/2022 has been carried out in accordance with the Ministry of Business, Innovation and Employment *Part D - Guidelines for the geotechnical investigation and assessment of subdivisions in the Canterbury region* and the Christchurch City Council *Infrastructure Design Standard – Part 4: Geotechnical Requirements* and includes:

- (i) Details of and the results of my/the site investigations.
- (ii) A liquefaction and lateral spread assessment.
- (iii) An assessment of rockfall and slippage, including hazards resulting from seismic activity.
- (iv) An assessment of the slope stability and ground bearing capacity confirming the location and appropriateness of building sites.
- (v) Recommendations proposing measures to avoid, remedy or mitigate any potential hazards on the land subject to the application, in accordance with the provisions of Section 106 of the Resource Management Act 1991.

3. In my professional opinion, not to be construed as a guarantee, I consider that Council is justified in granting consent incorporating the following conditions:

(i) ___The recommendations of our geotechnical report Ref. 220748 are followed

4. This professional opinion is furnished to the territorial authority and the owner/developer for their purposes alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building. It is limited to those items referred to in clause 2 only.

5. This statement shall be read in conjunction with the geotechnical report referred to in clause 2 above, and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

6. Liability under this statement accrues to the geotechnical firm only and no liability shall accrue to the individual completing this statement.

7. The geotechnical engineering firm issuing this statement holds a current policy of professional indemnity insurance of no less than \$1,000,000_____

(Minimum amount of insurance shall be commensurate with the current amounts recommended by ENGINEERING NEW ZEALAND, ACENZ, NZTA, INGENIUM.)

R. Smith Date: 21-10-22

(Signature of engineer, for and on behalf of CGW Consulting Engineers)

Qualifications and experience

_____CMEngNZ CPEng IntPE(NZ) / APEC Engineer

This form is to accompany Form 9 – Resource Management Act 1991 (Application for a Resource Consent (Subdivision))