Private Plan Change Request – Hughes Developments Limited
Appendix B – Geotechnical Investigations

ENGEO

Expect Excellence

Geotechnical Investigation

1066 West Coast Road

West Melton

Canterbury

Submitted to:

Hughes Development Ltd

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20.07.2018
15184.000.000_01

ACENZ

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ENGEO Document Control:

Report Title	Geotechnical Investigation - 1066 West Coast Road, West Melton			
Project No.	15184.000.000	Doc ID	01	
Client	Hughes Development Ltd	Client Contact	Kelvin Back	
Distribution (PDF)	Kelvin Back – kelvin@hughesdevelopments.co.nz			
Date	Revision Details/Status	WP	Author	Reviewer
20/07/2018	Final	BK	HB	DB

1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a geotechnical investigation for the proposed subdivision at 1066 West Coast Road in West Melton, as outlined in our variation proposal (ref. P2018.001.093, dated 28 June 2018).

The purpose of this investigation was to determine a geological model of the site; assess the likely future land performance; comment on the suitability of the site for residential subdivision; address the requirements of Section 106 of the Resource Management Act (RMA); and provide recommendations for subdivision works and foundations for typical timber framed residential dwellings.

Our scope of works included the following:

- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases.
- Undertake a geotechnical site walkover.
- Undertake 17 hand auger boreholes with associated Scala penetrometer tests to assess the near surface material types and strength characteristics.
- Organise and technically supervise the excavation of 15 test pits, including geotechnical logging of the exposed soils.
- Preparation of this report outlining our findings on the ground conditions and the suitability of the site for residential subdivision. This includes the provision of geotechnical advice on the likely foundation Technical Category, conceptual foundation recommendations for typical timber framed residential dwellings, and assess likely geohazards as required by Section 106 of the RMA.

2 Site Description

The site covers a total area of 12.36 ha, and has the legal description of Lot 1 DP 34902 (Selwyn District Council). It is understood that the site is proposed to be subdivided into residential lots.

The site is located approximately 800 m east of West Melton town centre, and is bound to the south by West Coast Road (State Highway 73), to the north by Halkett Road and by rural properties on all remaining sides (Figure 1).

Figure 1: Site Location Plan

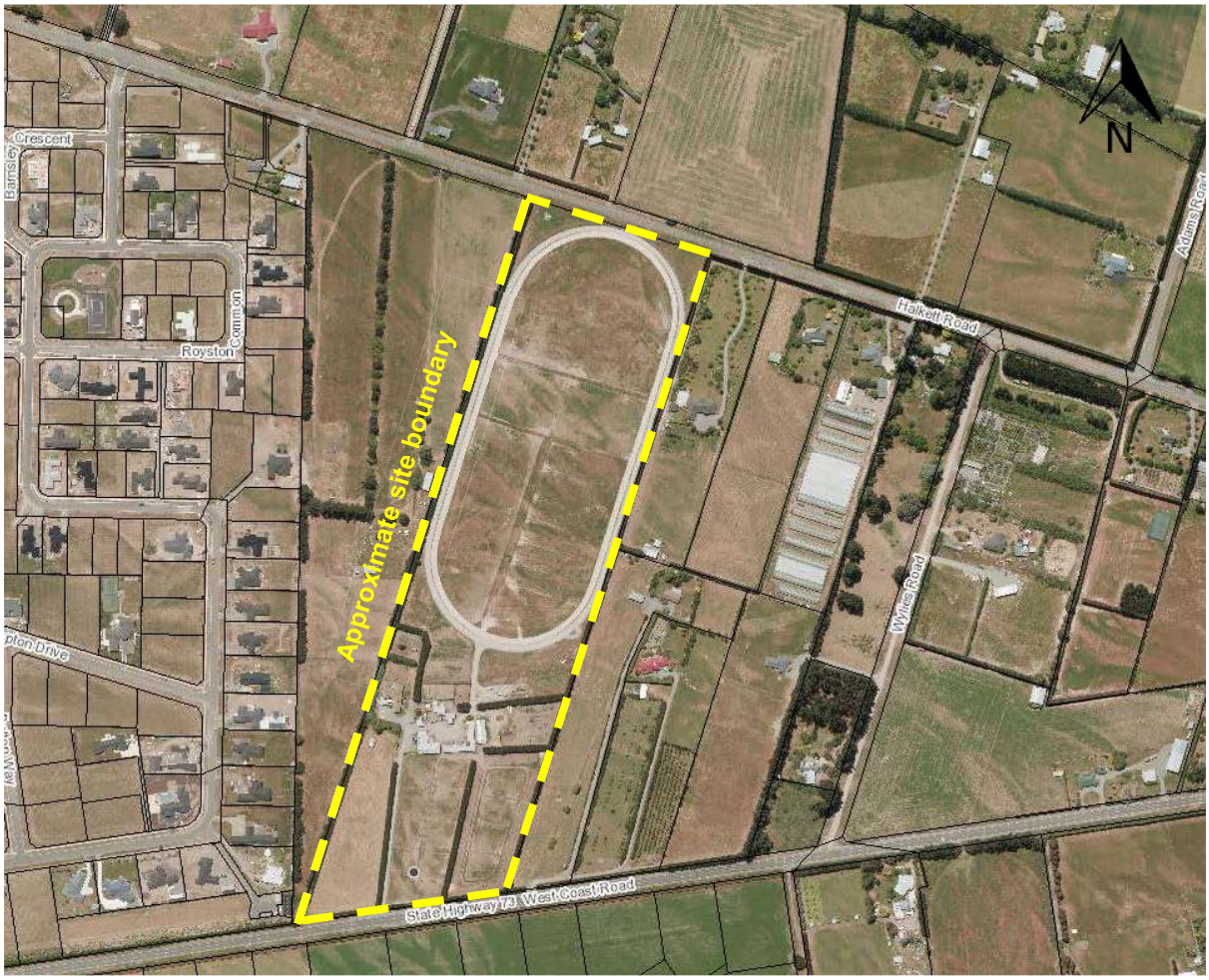

Image sourced from Canterbury Maps, not to scale.

The site is currently used for raising and training horses, with a race track covering the northern two thirds of the property. The southern third of the site has stables and pasture, with a two storey dwelling located toward the centre of the site. It is predominantly flat, with undulations representing old stream channels.

The Canterbury Earthquake Recovery Authority (CERA, now disestablished) has categorised the site as 'N/A Rural & Unmapped', meaning future development can proceed following normal consenting processes.

3 Geological Model

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by beach sand or river sand dunes.

3.2 ECan Boreholes

A review of four deep ECan borehole logs located to the east (M35/9443 and M35/5159), west (M35/10751) and northwest (M35/10753) of the site was conducted. The locations of these boreholes are presented in Figure 2.

Figure 2: Nearby ECan Borehole Locations

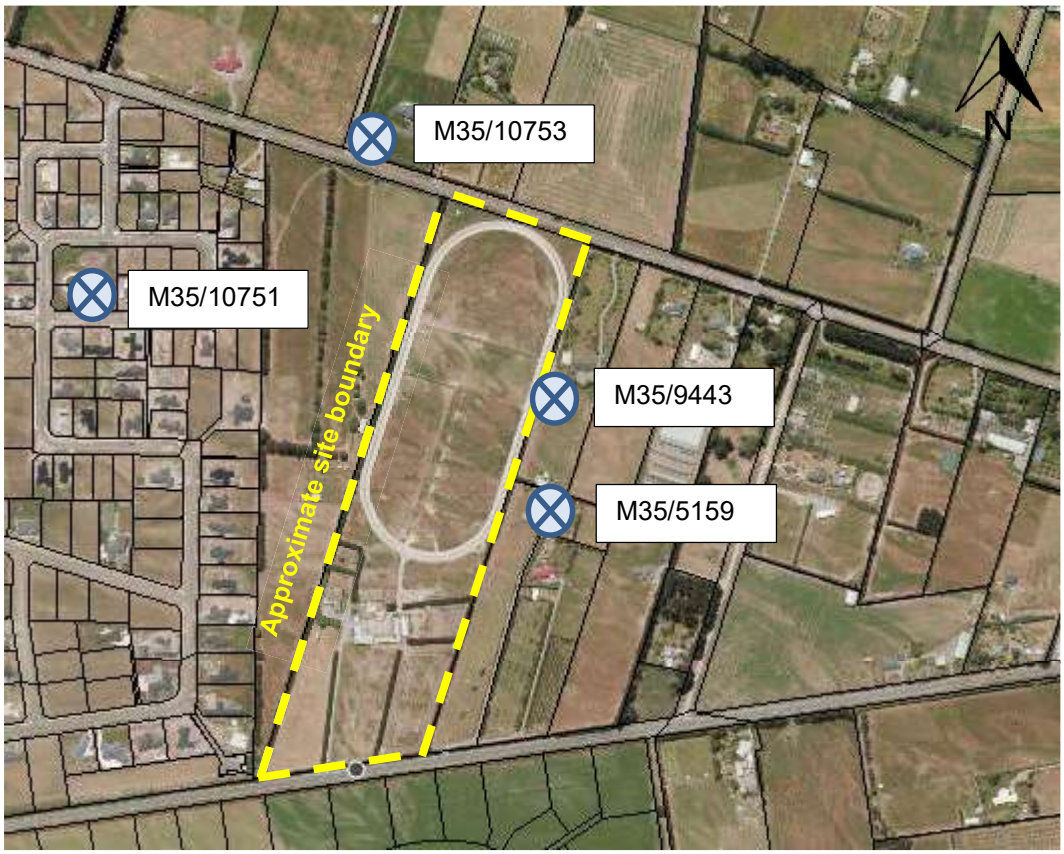

Image sourced from Canterbury Maps, not to scale.

The borehole logs indicate interbedded sandy gravel and clay-bound gravel from the surface through to the maximum depth of 78 m.

3.3 Groundwater

Groundwater is recorded within the ECan boreholes discussed above, at depths between 21 m and 24 m below ground level

3.4 Geomorphology

As evident on aerial imagery (Canterbury Maps) and observed during our site walkover conducted on 10 July 2018, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast trend. Based on observations, silt and sand deposits with variable thickness (up to 1.8 m) are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).

3.5 Geohazards

3.5.1 Seismicity

There are no known or mapped faults in the immediate area of the site, however the site may be at risk of ground shaking induced by movement of proximal or distal faults.

The site is located north of two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 6 km south of the site and trends roughly east-west with a surface rupture of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture at the surface. Movement on the Port Hills Fault is believed to have occurred at a depth of 1 km to 2 km below ground surface.

Large regional areas of faulting (GNS, 2015) namely the Ashley Fault, Porters Pass-Amberley Fault Zone, and the Hope and Alpine Faults, are further afield but present a high seismic hazard to the Christchurch area due to the anticipated size of earthquakes generated. The largest of these faults is the Alpine Fault, which has a return period of 250-300 years and is expected to produce a M8 earthquake. The last rupture on the Alpine Fault is believed to have occurred in 1717 (Pettinga et al., 2001).

3.5.2 Liquefaction and Lateral Spreading

The site is located within an area mapped as 'damaging liquefaction unlikely' (NZGD Map CGD5140, 2012).

4 Site Investigation

4.1 Subsurface Investigations

ENGEO undertook site investigations to assess the shallow subsurface material types and strength characteristics on 10 June and 11 June 2018. The investigations comprised 17 hand auger boreholes with associated Scala Penetrometer tests, and 15 test pit excavations.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 1.

Table 1: Generalised Summary of Subsurface Conditions

Soil Type	Depth to Top of Layer (m)	Layer Thickness (m)	Consistency / Density	Comment
Silt and Sand [Topsoil]	0	0.1 to 0.4	Soft to Firm	-
Silt and Sand	0.1 to 0.4	0.1 to 1.8	Soft to Very Stiff / Loose to Medium Dense	Not present in all test locations
Gravel	0.2 to 1.8	>1.8	Medium Dense to Dense	-

Review of the ECan well borehole logs indicated that the gravel continues to at least 78 m below ground level.

“Good ground” (as defined in NZS 3604:2010) under static conditions was typically encountered below 0.6 m depth.

Test locations are shown on the site plan presented in Appendix 1. Hand auger borehole and test pit logs are presented in Appendices 2 and 3.

4.2 Site Seismic Class

In accordance with NZS 1170.5:2004, Class D applies to this particular site, defining it as a ‘deep soft soil site’.

4.3 Additional Observations

During our site walk over on 10 July, ENGEO observed an excavation roughly 4 m wide by 4 m long by 3 m deep on the eastern side of the property, in the pasture area within the race track. Through conversation with the property owner, we understand that this was excavated as a drainage pit approximately 30 years ago (Figure 3). From the fence line surrounding the excavation, we observed collapsed topsoil and vegetation in the base of the excavation. The extent of this pit should be further investigated during construction and be appropriately remediated.

An area of saturated soil was observed to the southwest of the drainage excavation, near the southern most end of the horse track. Running water could be clearly heard beneath the surface in this location, though no source was visible. Through discussion with the home owner, we understand that an irrigation pipe had broken in this area. We performed a hand auger borehole (HA07) in this location, and inferred that sandy gravels could be found approximately 0.3 m below ground level. We advise this area be investigated during the construction phase and appropriately remediated.

Approximate locations of both the drainage excavation and the area of saturated ground are outlined in Figure 4.

Figure 3: Drainage Excavation

Figure 4: Saturated Ground and Drainage Excavation

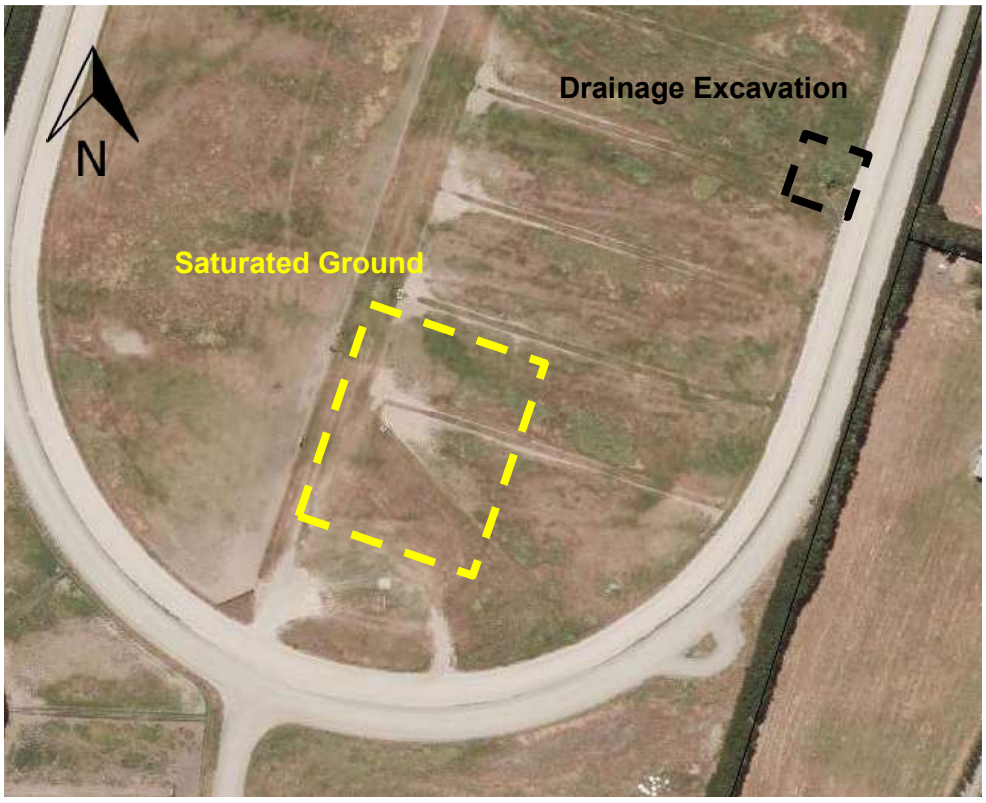

Image sourced from Canterbury Maps, not to scale.

5 Liquefaction Assessment

Based on our site investigation, subsurface conditions encountered in our explorations and documented in the ECan logs, and owing to the nature of the subsurface materials and depth to groundwater at the site, we consider the potential for liquefaction and lateral spreading on the site to be very low.

We therefore consider the site of the proposed subdivision to have Technical Category 1 (TC1) future land performance whereby future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.

6 RMA Section 106 Requirements and Suitability to Subdivide

Section 106 of the Resource Management Act 1991 states a consent authority may refuse to grant a subdivision consent, or may grant a consent subject to specific consent conditions if the land is likely to be subject to the following:

- Erosion, including surface and subsurface erosion, associated with water and wind.
- Falling debris, including rockfall that could impact the site from upslope sources.
- Subsidence, which involves the removal of underlying support by natural or artificial means.
- Slippage, which is defined as the downslope transfer of materials by sliding and / or flowage.
- Inundation, which may be sourced from streams, coastal processes or excess precipitation.

Based on our observations and the nature of the site, its performance during the CES, and the site's distance from the nearest significant watercourse, we consider it is unlikely for the site to be subject to any of the above hazards and, as such, the site is considered suitable for subdivision from a geotechnical perspective, subject to the following geotechnical recommendations.

7 Geotechnical Recommendations

7.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for Earthfilling for Residential Development. In particular, any areas to receive fill should be stripped of any vegetation, topsoil, non-engineered fill, soft or organic soils prior to fill placement.

Fill may comprise clean native sandy gravel or silty soils, or clean imported soils and / or granular fill, compacted to achieve no less than 95% of maximum dry density. Fill faces steeper than 2:1(H:V) and higher than 600 mm should be retained and referred back to ENGEO. Although unlikely, where any springs or groundwater seeps are encountered they should be intercepted with suitable drainage and discharged to a Council approved outlet.

All unretained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination of 1V:3H, with protection schemes in place to control erosion of the formed batters within the waterways.

A comprehensive earthworks specification should be provided to the earthworks contractor prior to starting excavations and a geotechnical observation / testing regime agreed, along with a robust erosion and sediment control plan.

7.2 Subdivision Roading

Vegetation, any organic or deleterious material, topsoil and non-engineered fill should be removed from the site under pavement areas prior to aggregate placement. Based on our observations during testing, we consider the native ground below the topsoil at the site should provide an adequate subgrade for the proposed pavement areas. Prior to placement of any fill to achieve finished roadway grades, the exposed native subgrade should be proof-rolled with heavy equipment and any soft, yielding areas compacted or over-excavated and replaced with compacted engineered fill to provide a smooth non-yielding surface for the roadway subgrade.

7.3 Stormwater Control

Concentrated stormwater flows from all impermeable areas must be collected and carried in sealed pipes to the Council system or an alternative disposal point subject to approval from Council. Uncontrolled stormwater must not be allowed to saturate the ground as this will potentially affect future foundation performance both statically and during future seismic activity.

7.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise pad, strip or slab foundations designed in accordance with the provisions of NZS 3604 Timber Framed Buildings.

Site specific testing will be required for Building Consent, to confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 200 kPa may be assumed for foundations bearing on native soils or engineered fill, below any topsoil. We anticipate this to be typically below 0.3 m depth based on our subsurface investigations. Greater capacity may be available across many Lots and will be confirmed during building consent testing. Alternatively, a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for bearing on the underlying medium dense sand and gravels, or stiff silt typically encountered below 0.6 m depth.

8 Additional Works

Future geotechnical work at the site will include a detailed subsurface exploration to support design of all earthwork and development concepts, including specific foundation recommendations appropriate for the proposed structures. Subject to the proposed development concept and timeline, this exploration can be tailored to inform the earthworks design, and to support building consent applications to the Selwyn District Council.

9 References

Canterbury Earthquake Recovery Authority. My Property. Retrieved July 2018, from http://cera.govt.nz/my-property.

Canterbury Maps, Groundwater. Retrieved July 2018, from http://canterburymaps.govt.nz/Viewer.

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Forsyth, P., Barrell, D. J., & Jongens, R. (2008). Sheet 16 - Geology of the Christchurch Area 1:250,000. Lower Hutt: Institute of Geological and Nuclear Sciences.

GNS Science (2015). New Zealand Active Faults Database. Retrieved January 2017, from http://data.gns.cri.nz /af.

Pettinga J.R., Yetton M.D., Van Dissen R.J., & Downes G. (2001). Earthquake Source Identification and Characterisation for the Canterbury Region, South Island, New Zealand. Bulletin of the New Zealand Society for Earthquake Engineering, Vol 34, No. 4, pp 282-317.

Selwyn District Council, Property Search, retrieved June 2017 from https://www.selwyn.govt.nz/my-property/rates/search-properties.

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Standards Association of New Zealand (2010). NZS 3604:2010. Timber Framed Buildings.

Standards Association of New Zealand (2010). NZS 4404:2010. Land Development and Subdivision Infrastructure.

The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved June 2017, from https://www.nzgd.org.nz

10 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Development Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

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

iv. This Limitation should be read in conjunction with the Engineers NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by

Hugh Brenstrum

Engineering Geologist

Report reviewed by

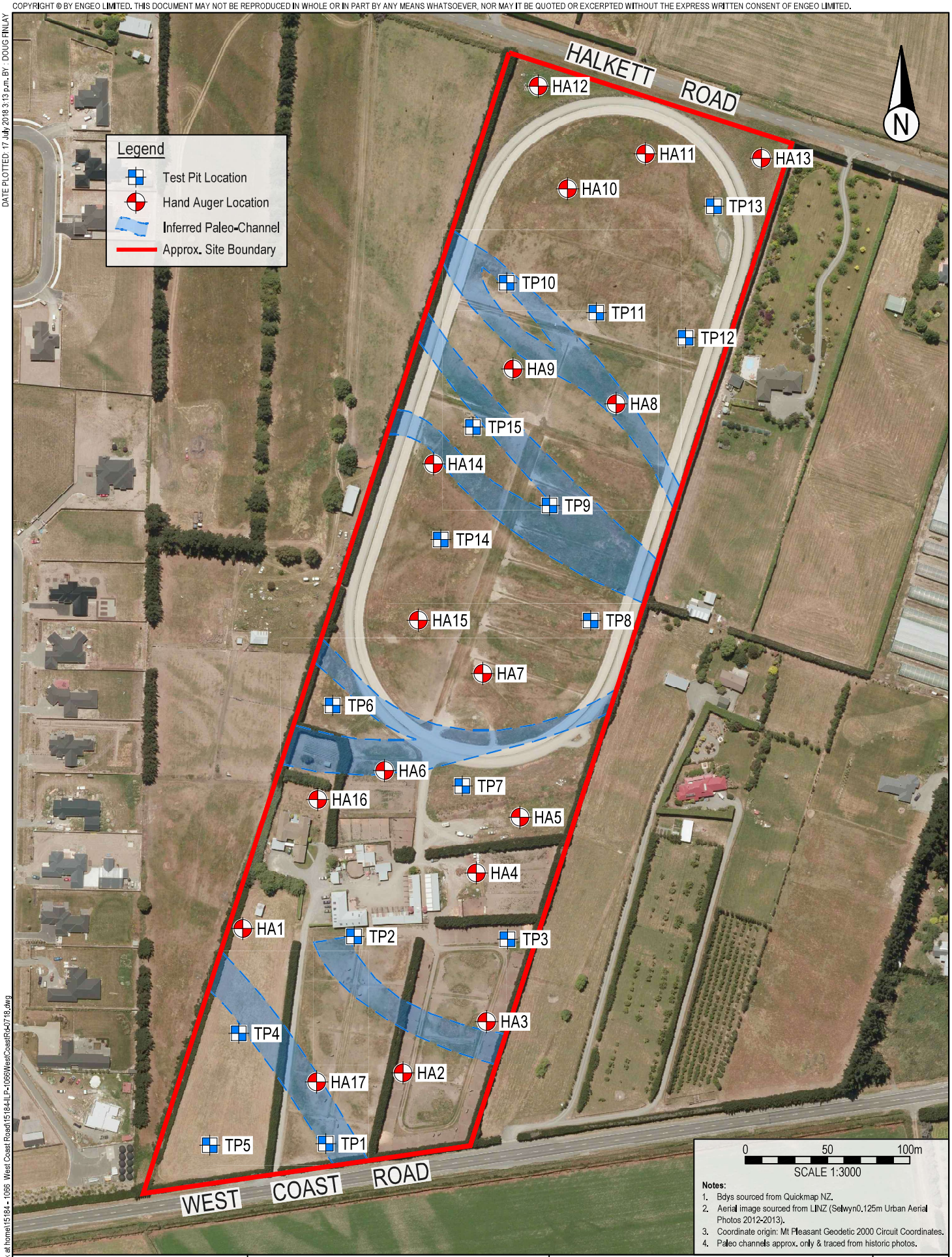
Don Bruggers, CMEngNZ (CPEng)

Principal Engineer

APPENDIX 1:

Site Location Plan and Paleo Channels

DATE PLOTTED: 17 July 2018 3:13 p.m. BY: DOUG FINLAY



Notes:

1. Bdys sourced from Quickmap NZ.
2. Aerial image sourced from LINZ (Selwyn0.125m Urban Aerial Photos 2012-2013).
3. Coordinate origin: Mt Pleasant Geodetic 2000 Circuit Coordinates.
4. Paleo channels approx. only & traced from historic photos.

XREFs: selwyn-0125m-urban-aerial-photos-2012-13
CAD File: C:\ENGEO CAD\Engeo work at home\15184 - 1066 West Coast Road\15184-LLP-1066WestCoastRd-0718.dwg

ENGEO
Expect Excellence

Christchurch Office
124 Montreal Street, Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title: PALEO CHANNELS & TEST LOCATIONS

Client: HUGHES DEVELOPMENTS			Appendix No: 1
Project: 1066 WEST COAST ROAD WEST MELTON SELWYN DISTRICT	Designed: HB		
	Drawn: DF		
	Checked: -		
	Date: 17.7.18		Size: A4
Proj No: 15184.000.000	Scale: 1:3000		Revision: -

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 2:

Hand Auger Logs

LOG OF AUGER HA01

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.8 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.521674
Longitude : 172.379102

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets; brown. Poorly graded [TOPSOIL].				L	
0.5	ALLUVIUM	ML	Sandy SILT; grey brown. Low plasticity. Sand, fine to medium.			M	St	
		SP	Fine to medium SAND with minor silt; grey brown. Poorly graded.				MD	
1.0			End of Hole Depth: 0.8 m Termination Condition: Practical refusal					

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

Hand auger met practical refusal at 0.8 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA02

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.522504
Longitude : 172.38031

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL	ML	Sandy SILT with trace rootlets; brown. Low plasticity. Sand, fine to medium [TOPSOIL].				F		
	ALLUVIUM	SP	Fine to medium SAND with trace silt; grey brown. Poorly graded.			M	MD		
0.5			End of Hole Depth: 0.6 m Termination Condition: Practical refusal						
1.0									

Scala Penetrometer: Blows per 100mm — 2, 4, 6, 8, 10, 12; >>

Hand auger met practical refusal at 0.6 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA03

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.522215
Longitude : 172.380943

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	Sandy SILT with trace rootlets; brown. Low plasticity. Sand, fine to medium [TOPSOIL].				F	
	ALLUVIUM	ML	Sandy SILT; grey brown. Low plasticity. Sand, fine to medium.			M	St - VSt	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal					
1.0								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

Hand auger met practical refusal at 0.5 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA04

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 1 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.521416
Longitude : 172.380798

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.0	TS	SM	Silty fine to medium SAND with trace rootlets; brown. Poorly graded [TOPSOIL].				L	
	ALLUVIUM	SP	Fine to medium SAND; grey brown. Poorly graded.			M	MD	
1.0			End of Hole Depth: 1 m Termination Condition: Target depth					
2.0								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met target depth at 1 m.

Standing groundwater was not encountered
TS = TOPSOIL

LOG OF AUGER HA05

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 1 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.521049
Longitude : 172.381268

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.0	TOPSOIL	ML	Sandy SILT with trace rootlets; brown. Low plasticity [TOPSOIL].				F	
0.5	ALLUVIUM	SM	Silty fine to medium SAND; grey brown. Poorly graded.			M	MD	
		SP	Fine to medium SAND with trace silt; grey brown. Poorly graded.				MD - D	
1.0			End of Hole Depth: 1 m Termination Condition: Target depth					
1.5								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

Hand auger met target depth at 1 m.
Scala Penetrometer met practical refusal at 1.1 m depth.

Standing groundwater was not encountered

LOG OF AUGER HA06

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.520748
Longitude : 172.380166

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	TOPSOIL	ML	Sandy SILT with trace rootlets; brown. Low plasticity [TOPSOIL].			M	F		
	ALLUVIUM	SM	Sandy SILT; grey brown. Low plasticity. Sand, fine to medium.				MD		
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal						
1.0									

Scala Penetrometer: Blows per 100mm — 2, 4, 6, 8, 10, 12; >>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA07

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.520302
Longitude : 172.381069

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL	ML	Sandy SILT with trace rootlets; brown. Low plasticity. Sand, fine to medium [TOPSOIL]		▼	S	S		
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12; >> at 0.3 m

Hand auger met practical refusal at 0.3 m depth on inferred gravel.

Dip test showed standing water at 0.1 m depth.
Broken pipe saturating surrounding soil

LOG OF AUGER HA08

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.518795
Longitude : 172.381937

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	Sandy SILT with trace rootlets; brown. Low plasticity. Sand, fine to medium [TOPSOIL].			M	S	
	ALLUVIUM	ML	SILT with some fine sand; grey brown.				S	
0.5			End of Hole Depth: 0.3 m Termination Condition: Practical refusal					

Scala Penetrometer
Blows per 100mm
2 4 6 8 10 12
>>

Hand auger met practical refusal at 0.3 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA09

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.9 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.518559
Longitude : 172.381015

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	TOPSOIL	SP	Silty fine to medium SAND with trace rootlets; brown. Poorly graded [TOPSOIL].				S		
0.5	ALLUVIUM	SP	Fine to medium SAND; greyish brown. Poorly graded.			M	MD		
1.0			End of Hole Depth: 0.9 m Termination Condition: Practical refusal						

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Hand auger met practical refusal at 0.9 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA10

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.517812
Longitude : 172.381431

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	SP	Sandy SILT with trace rootlets; brown. Low plasticity [TOPSOIL].				F	
	ALLUVIUM	ML	SILT with some SAND; greyish brown. Low plasticity. Sand, fine to medium.			M	F - St	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal					
1.0								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA11

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.517393
Longitude : 172.382153

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0	TOPSOIL	ML	SILT with some SAND; brown. Low plasticity. Sand, fine to medium [TOPSOIL].			M	F		
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						
0.5									
1.0									

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 >>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA12

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.517157
Longitude : 172.381358

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.0	TOPSOIL	ML	SILT with some SAND; brown. Low plasticity. Sand, fine to medium [TOPSOIL].				S	
	ALLUVIUM	ML	Sandy SILT; greyish brown. Low plasticity. Sand, fine to medium.			M	F	
0.5		SP	Fine to medium SAND with minor silt; grey brown. Poorly graded.				MD	
			End of Hole Depth: 0.6 m Termination Condition: Practical refusal					
1.0								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.6 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA13

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.517445
Longitude : 172.382894

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0	TOPSOIL	ML	SILT with some SAND; brown. Low plasticity. Sand, fine to medium [TOPSOIL].			M	S		2 4 6 8 10 12
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						>>
0.5									
1.0									

Hand auger met practical refusal at 0.2 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA14

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.519018
Longitude : 172.380563

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor fine sand; brown. Low plasticity [TOPSOIL].			M	F	
	ALLUVIUM	ML	SILT with some fine sand and trace gravel, grey brown. Low plasticity.				F	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal					
1.0								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA15

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.520197
Longitude : 172.380455

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with trace fine sand; brown. Low plasticity [TOPSOIL].				S	
	ALLUVIUM	ML	SILT with some fine sand; grey brown. Low plasticity.			M	F	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal					
1.0								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.

Standing groundwater was not encountered

GEOSCIENCE HAND AUGER HAND AUGER LOGS - 1066 WEST COAST.GPJ NZ DATA TEMPLATE 2.GDT 20/7/18

LOG OF AUGER HA16

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

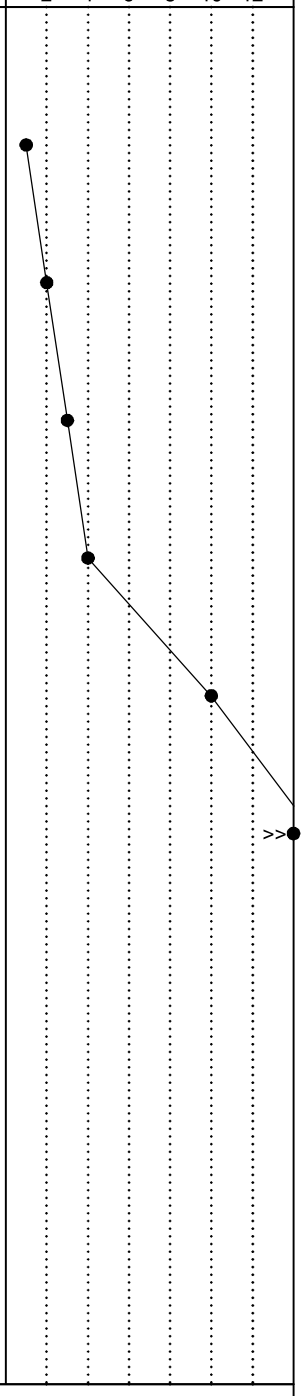
Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.520997
Longitude : 172.37966

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets; brown. Poorly graded [TOPSOIL].			M	S	
	ALLUVIUM	SM	Silty fine to medium SAND; greyish brown. Poorly graded.				L - MD	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal					

Scala Penetrometer

Blows per 100mm



Hand auger met practical refusal at 0.3 m depth on inferred gravel.

Standing groundwater was not encountered

LOG OF AUGER HA17

Geotechnical Investigation
1066 West Coast Road
West Melton, Canterbury
15184.000.000

Client : Hughes Developments
Client Ref. : 1066 West Coast Road
Date : 10/07/2018
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : NA
Logged By : HB
Reviewed By :
Latitude : -43.522504
Longitude : 172.379696

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets; brown. Poorly graded [TOPSOIL].				S	
	ALLUVIUM	SM	Silty fine to medium SAND; greyish brown. Poorly graded.			M	L - MD	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal					
1.0								

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.

Standing groundwater was not encountered

APPENDIX 3:

Test Pit Logs

LOG OF TEST PIT TP01

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.522792
Bucket Type/Size	: 500 mm	**Longitude**	: 172.379732

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TOPSOIL		ML	SILT with minor fine sand, trace gravel and rootlets; brown. Low plasticity [TOPSOIL].				St		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL some cobbles and trace boulders; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to coarse.			M	MD - D		>>
1.0										
1.5										
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						

Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP02

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.521704
Bucket Type/Size	: 500 mm	**Longitude**	: 172.379949

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	Silty fine to medium SAND; brown. Poorly graded [TOPSOIL].				St		
0.5	ALLUVIUM		SP	Fine to medium SAND; greyish brown. Poorly graded.				MD		
1.0			GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to coarse.			M	D		
1.5										
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 0.8 m depth.
Standing groundwater was not encountered

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP03

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.521757
Bucket Type/Size	: 500 mm	**Longitude**	: 172.381124

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		SM	Silty fine to medium SAND; brown. Poorly graded [TOPSOIL].				St		
0.5	ALLUVIUM		SM	Silty fine to medium SAND; greyish brown. Poorly graded.				MD		
1.0			GW	Sandy fine to coarse GRAVEL some cobbles; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to coarse.			M	D - VD		
1.5										
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 0.9 m depth.
Standing groundwater was not encountered

TS = TOPSOIL

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP04

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.522058
Bucket Type/Size	: 500 mm	**Longitude**	: 172.379121

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	T		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				S		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, sub-angular to sub-rounded. Sand, fine to coarse, poorly graded.			M	D		
1.0				Encountered minor boulders from 1.1 m depth.						
1.5										
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						

Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered

T=TOPSOIL

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP05

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.522817
Bucket Type/Size	: 500 mm	**Longitude**	: 172.378891

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				VS		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles and trace boulders; brownish grey. Well graded, sub-angular to sub-rounded. Sand, fine to coarse, poorly graded.				D		
1.0			SP	Fine to medium SAND; greyish brown. Poorly graded.			M	D		
1.5			GW	Sandy fine to coarse GRAVEL with minor cobbles and trace boulders; brownish grey. Well graded, sub-angular to sub-rounded. Sand, fine to coarse, poorly graded.				D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						

Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

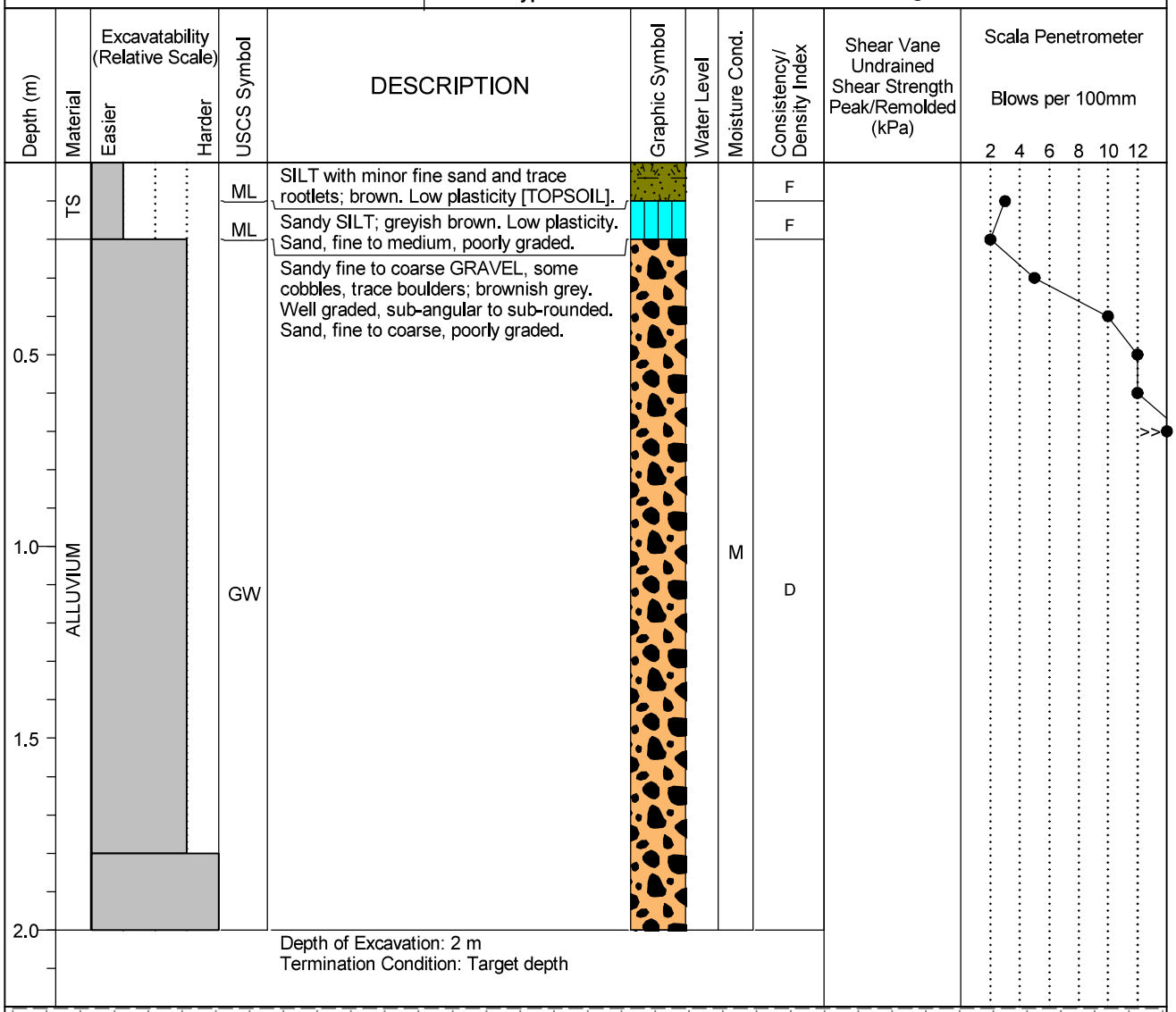
GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP06

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.520483
Bucket Type/Size	: 500 mm	**Longitude**	: 172.379771



Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered

TS = TOPSOIL

LOG OF TEST PIT TP07

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 1.9 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.520882
Bucket Type/Size	: 500 mm	**Longitude**	: 172.380726

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		SM	Silty fine to medium SAND; brown. Poorly graded [TOPSOIL].				S		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL some cobbles; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to coarse.			M	MD - D		
1.0										
1.5										
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth						

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Excavator met taget depth. at 1.9 m.
Scala Penetrometer met practical refusal at 0.8 m depth.
Standing groundwater was not encountered

TS = TOPSOIL

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP08

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.520093
Bucket Type/Size	: 500 mm	**Longitude**	: 172.381704

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	T		SM	Silty fine to medium SAND; brown. Poorly graded [TOPSOIL].				F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL some cobbles; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to coarse. Encountered fine to medium gravel lens from 0.6 m to 0.7 m depth.			M	D		
1.0										
1.5										
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						

Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

T = TOPSOIL

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP09

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 1.9 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.519197
Bucket Type/Size	: 500 mm	**Longitude**	: 172.381435

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				F		
	ALLUVIUM		ML	SILT with minor fine sand, greyish brown. Low plasticity.				St		
0.5				Sandy fine to coarse GRAVEL; brownish grey. Well graded, sub-angular to sub-rounded. Sand, fine to coarse, poorly graded.						
1.0			GW	Encountered trace boulders from 1.0 m depth.			M	MD - D		
1.5										
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth						

Excavator met taget depth. at 1.9 m.
Scala Penetrometer met practical refusal at 0.8 m depth.
Standing groundwater was not encountered

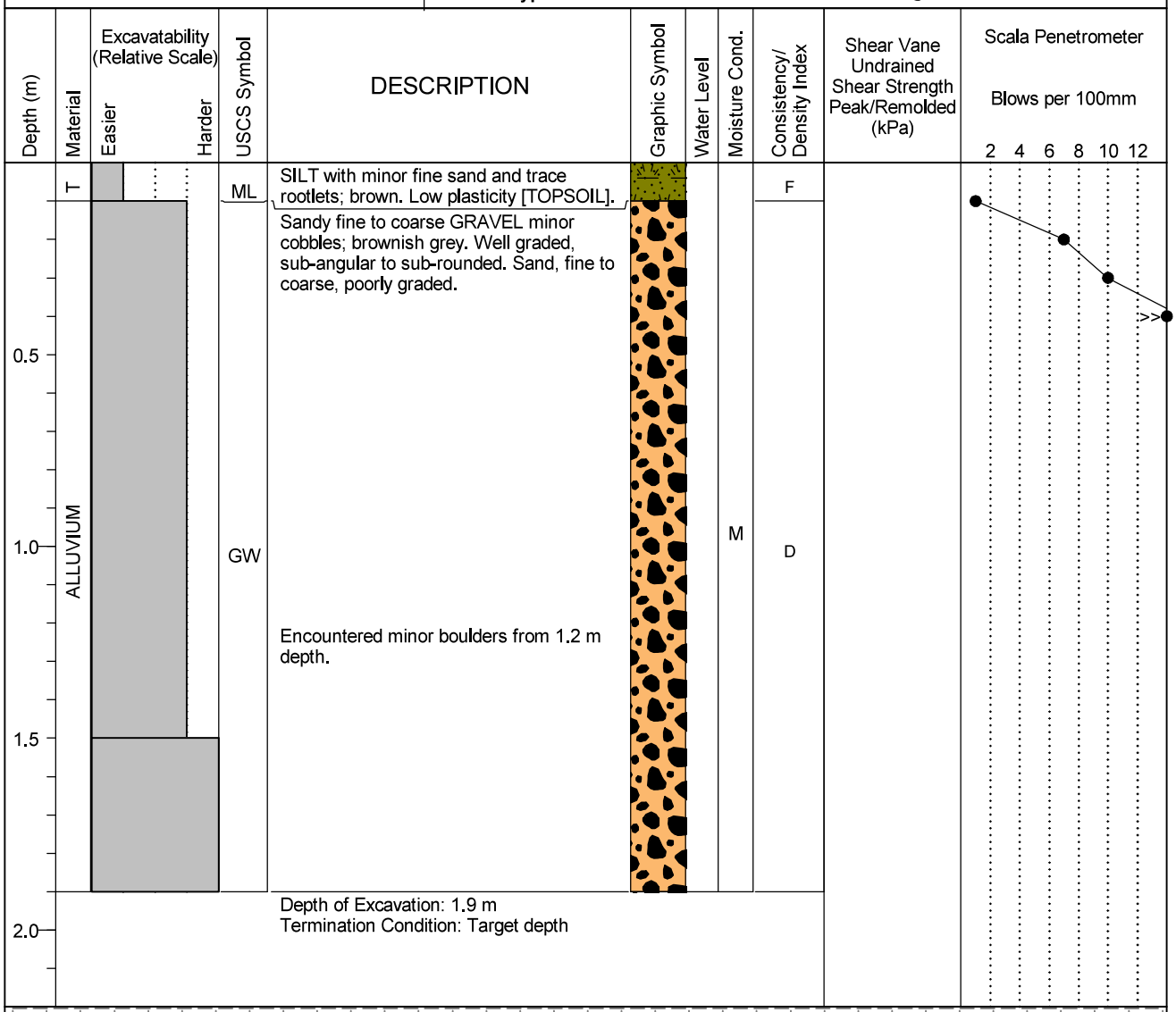
GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP10

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 1.9 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.518183
Bucket Type/Size	: 500 mm	**Longitude**	: 172.380984



Excavator met taget depth. at 1.9 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

T=TOPSOIL

LOG OF TEST PIT TP11

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.518294
Bucket Type/Size	: 500 mm	**Longitude**	: 172.381683

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		SP	Silty fine to medium SAND; brown. Poorly graded [TOPSOIL].				F		
0.5	ALLUVIUM		SP	Fine to medium SAND; greyish brown. Poorly graded.				L - MD		
1.0							M			
1.5			GW	Sandy fine to coarse GRAVEL some cobbles; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to coarse. Encountered trace boulders from 1.5 m depth.				D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12

Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 1.3 m depth.
Standing groundwater was not encountered

TS = TOPSOIL

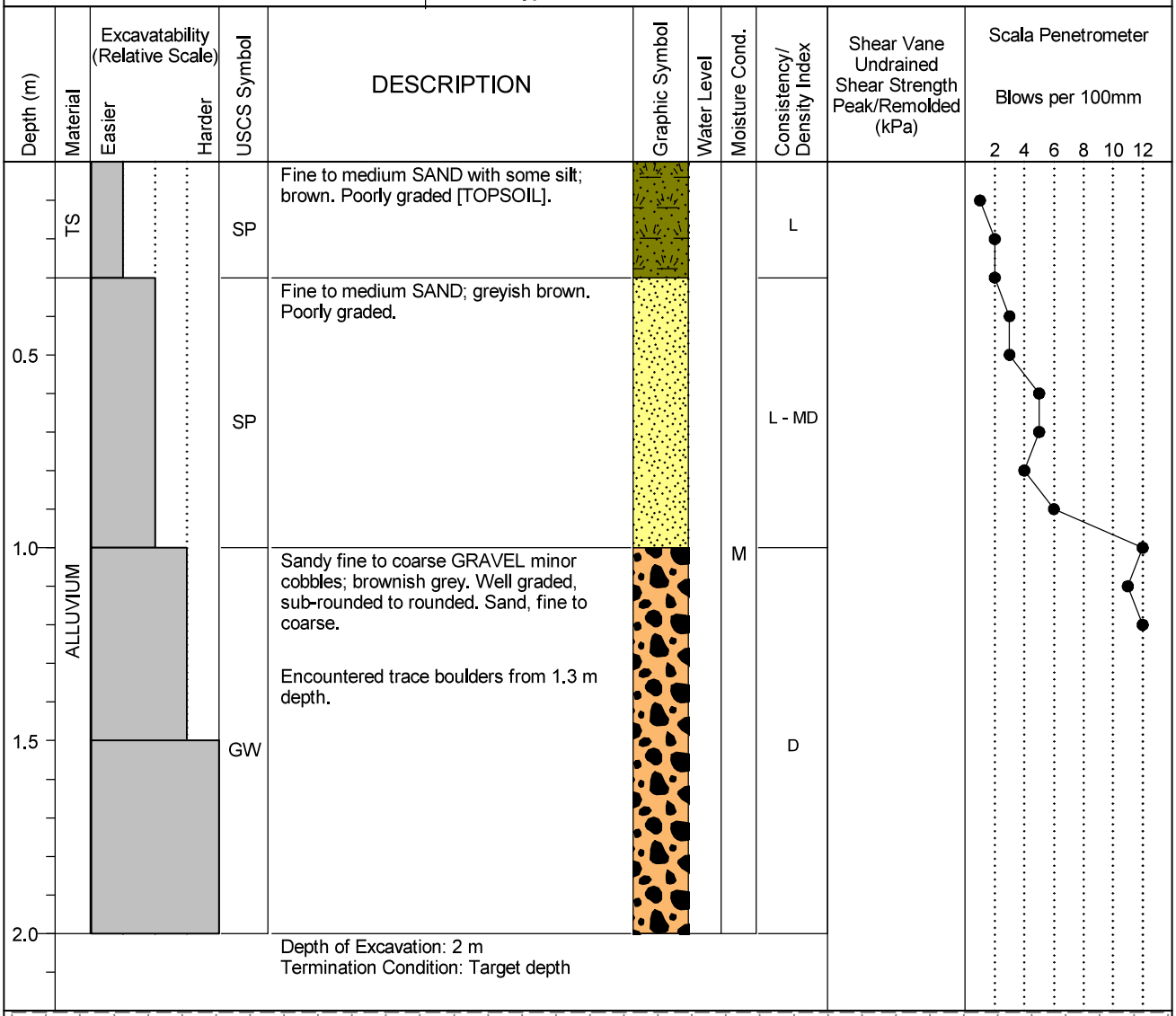
GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP12

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 2 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.518441
Bucket Type/Size	: 500 mm	**Longitude**	: 172.382411



Excavator met taget depth. at 2 m.
Scala Penetrometer met practical refusal at 1.2 m depth.
Standing groundwater was not encountered

TS = TOPSOIL

LOG OF TEST PIT TP13

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 1.9 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.517745
Bucket Type/Size	: 500 mm	**Longitude**	: 172.382679

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	SILT with trace fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				S		
0.5	ALLUVIUM		ML	SILT with minor fine sand; grey brown. Low plasticity.				St		
1.0			GW	Sandy fine to coarse GRAVEL with minor cobbles and trace boulders; brownish grey. Well graded, sub-angular to sub-rounded. Sand, fine to coarse, poorly graded.			M	D		
1.5										
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth						

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

Excavator met taget depth. at 1.9 m.
Scala Penetrometer met practical refusal at 0.9 m depth.
Standing groundwater was not encountered

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP14

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 1.8 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.519745
Bucket Type/Size	: 500 mm	**Longitude**	: 172.380612

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				S		
	ALLUVIUM		ML	SILT with some fine sand; grey brown. Low plasticity.				F		
0.5			GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, sub-angular to sub-rounded. Sand, fine to coarse, poorly graded.			M	D - VD		>>
1.0										
1.5										
2.0				Depth of Excavation: 1.8 m Termination Condition: Target depth						

Excavator met taget depth. at 1.8 m.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered

TS = TOPSOIL

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18

LOG OF TEST PIT TP15

Geotechnical Investigation

1066 West Coast Road
West Melton
15184.000.000

Client	: Hughes Developements Ltd.	**Shear Vane No**	: NA
Date	: 20/4/18	**Logged By**	: HB
Max Test Pit Depth	: 1.9 m	**Reviewed By**	:
Digger Type/Size	: Bucket Excavator	**Latitude**	: -43.518982
Bucket Type/Size	: 500 mm	**Longitude**	: 172.380712

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				S		
	ALLUVIUM		ML	SILT with some fine sand; grey brown. Low plasticity.				F		
0.5			GW	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey. Well graded, sub-angular to sub-rounded. Sand, fine to coarse, poorly graded.			M	D		>>
1.0										
1.5										
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth						

Excavator met taget depth. at 1.9 m.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered

TS = TOPSOIL

GEOSCIENCE TEST PIT LOG - PHOTOS TEST PIT LOGS - 1066 WEST COAST.GPJ NZ MASTER DATA TEMPLATE.GDT 18/7/18