Geotechnical Investigation

130 Dunns Crossing Road

Rolleston

Submitted to:

Hughes Developments Ltd
8 Millbank Lane
Merivale
Christchurch 8014

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ENGEO Document Control:

Report Title	Geotechnical Investigation - 130 Dunns Crossing Road,			
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Client	Hughes Developments Ltd	Client Contact	Alan Grove	
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Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to undertake a geotechnical investigation of the property at 130 Dunns Crossing Road, Rolleston (herein referred to as 'the site'). This work has been carried out in accordance with our signed agreement dated 16 May 2021 (ENGEO Ref: P2021.001.305_01).

The purpose of this assessment was to conceptualise 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:

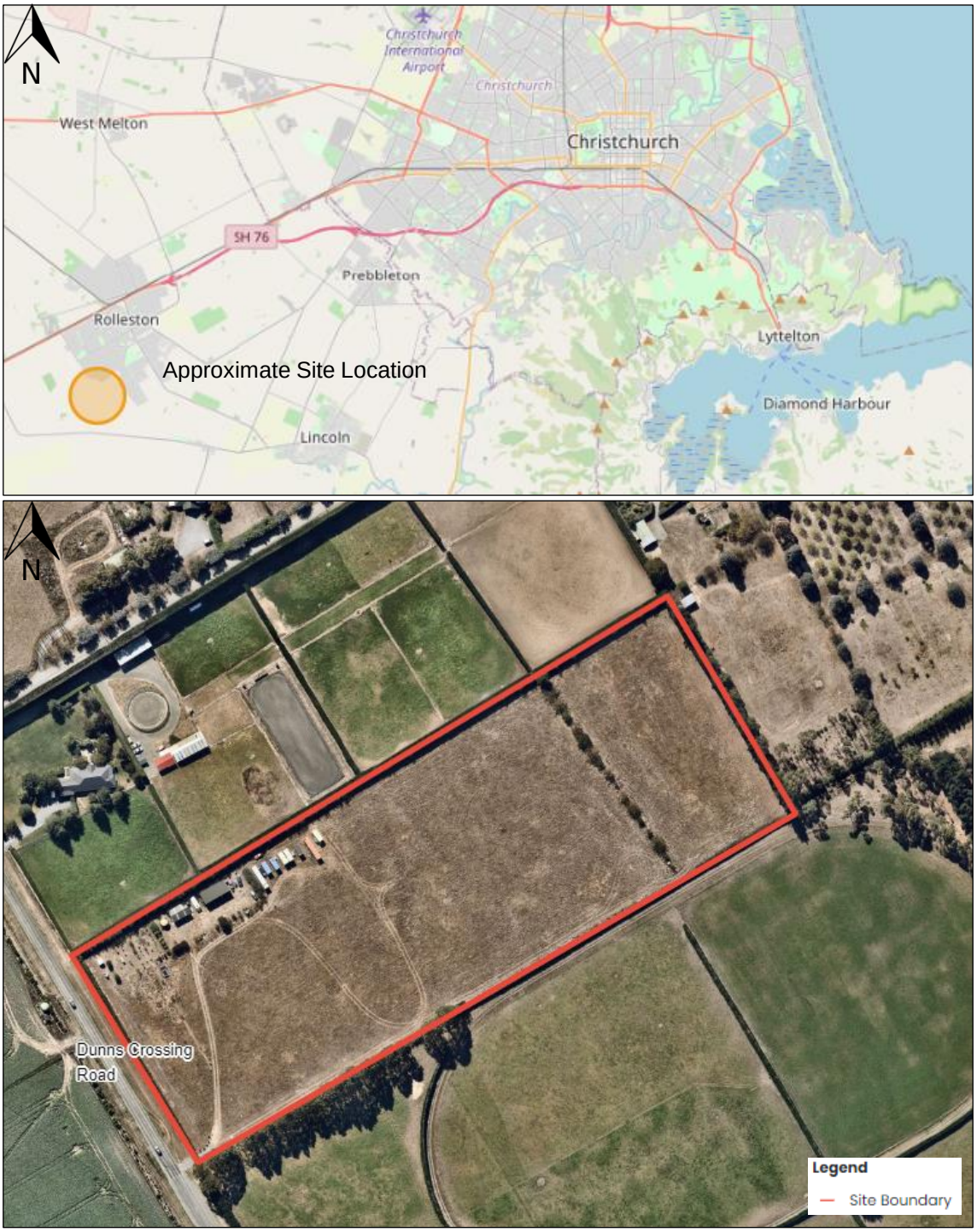
- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases;
- Undertake a geotechnical site walkover;
- Undertake five hand auger boreholes with associated Scala penetrometer tests to assess the near surface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

1 Site Description

The site at 130 Dunns Crossing Road comprises of a rural property approximately 3 km southwest of Rolleston town centre. It has an area of approximately 4.0 ha and a legal description of LOT 1 DP 70352 BLK III LEESTON SD. It is bound to the southwest by Dunns Crossing Road and by rural properties on all other sides.

The majority of the site is currently used as agricultural grazing land. A small orchard, barn, shed and several containers are observed at the road end of the north-western boundary.

Figure 1: Site Location Plan



Images sourced from OpenStreetMap and NearMaps. Not to scale.

2 Geological Model

2.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by brownish grey river alluvium (Q2a).

2.2 Geomorphology

The site comprises relatively flat ground, with gentle undulations and depressions in some areas. As evident on aerial imagery (Canterbury Maps, 2019) and observed during our site walkover conducted on 25 May 2021, undulating and depressed ground can be attributed to paleo-channels.

We have not mapped any paleo channels across the site as their location is not clear on aerial photography. However, we infer that several paleo channels extend across the site in a general northwest to southwest direction based on our knowledge of the area and aerial photography of neighbouring sites. Based on our observations, silt deposits with variable thickness (up to 0.5 m was observed in our investigations) are expected to have in-filled the paleo-channels where they have not remained as channel features.

Figure 2: Historical Aerial Photo – 1940 to 1944

Image sourced from Canterbury Maps. Not to scale.

2.3 Geohazards

2.3.1 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 between 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 north / northwest of the site and trends roughly east-west with a surface rupture length 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 extended to within 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).

2.3.2 Liquefaction and Lateral Spreading

The site is located in an area mapped where “damaging liquefaction is unlikely” (NZGD Map CGD5140, 2012), and a “zone of very low liquefaction potential” (GNS, 2006).

2.3.3 Flooding

The site is outside of any defined flood zones in the Selwyn District Council (SDC) Operative District Plan (SDC, 2015).

The Selwyn District Council have carried out computer-based flood modelling to predict the extent and depth of flooding that could happen during a one-in-200-year and a one-in-500-year flood. The flood mapping indicates that the site is potentially at risk from inundation following high rainfall events, although it is outside of the mapped flood plains of any major waterways. Based on this modelling, the water depth in localised lower lying areas of the site may be up to 0.5 m deep during both the one-200 and one-in-500 year events (Figure 3).

Figure 3: SDC Flooding Map

Image sourced from Selwyn District Council flooding map. Not to scale.

2.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on 25 May 2021. Six test pits and five hand auger investigations with associated Scala penetrometer tests were completed to a maximum depth of 2.7 m below ground level.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 1. The locations in which the tests were taken are presented in Appendix 1 of this report. Hand auger and test pit logs are attached as Appendix 2 of this report.

Table 1: Summary of Subsurface Conditions

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.2 – 0.3	-	Consistent across the site
SILT	0.1 – 0.3	0.2 – 0.3	Stiff to Very Stiff	Present in TP03, TP06 and HA01
Sandy GRAVEL	0.1 – 0.5	At least 2.5 m thick, total depth unknown	Medium Dense to Very Dense	Consistent across the site

2.5 ECan Boreholes

A review of four deep ECan borehole logs was conducted. The first (M36/5038), is located on-site, and appears to be the water well providing the properties domestic supply. The other boreholes are located to the northwest (M36/5040), northeast (M36/5041) and southeast (M36/4450) of the site.

Well logs from the four holes of interest are attached to this report as Appendix 3 and summarised in Table 2.

Table 2: Generalised Summary of ECan Boreholes

ECan Borehole	Total Depth (m)	Water Level Below Ground Level (m)	Generalised Borelog as Logged by Driller
M36/5038	32.0	6.3	Varying sandy and clayey gravel layers to 32.0 m.
M36/5040	35.0	5.0	Interbedded layers of sandy and siltbound gravel. A layer of silt is present between 28.2 and 30.4 m depth.
M36/5041	26.5	6.8	Varying sandy, claybound and clean gravels to 24 m depth. This is underlain with interbedded layers of clayey sand and clean gravel.
M36/4450	26.0	6.1	Gravel to 26 m with a layer of clayey gravel from 12 to 18 m, clay and sand from 22 to 24 m and 26 to 26.5 m.

Figure 4: Nearby ECan Borehole Locations

Aerial photograph sourced from Canterbury Maps. Not to scale.

2.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 5.0 m and 6.8 m depth.

Regional mapping of groundwater depths by Environment Canterbury indicates that groundwater levels at the site are slightly shallower than 10 m (Canterbury Maps, 1987).

2.7 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'.

3 Liquefaction Analysis

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 future land performance to be in line with Technical Category 1 (TC1), whereby future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.

4 Geotechnical Recommendations

4.1 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 Earth filling for Residential Development. In particular, any areas to receive fill should be stripped of all vegetation, topsoil, non-engineered fill, soft or organic soils prior to fill placement.

Fill may comprise clean natural 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 2V:1H and higher than 600 mm should be retained. Although unlikely, where any springs or groundwater seeps are encountered, they should be intercepted with suitable drainage and discharged to a Council approved outlet.

Unless specifically designed, all unretained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination no steeper than 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 an inspection / testing regime agreed, along with a robust erosion and sediment control plan.

4.2 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 natural ground below the topsoil at the site should provide an adequate subgrade for the proposed pavement areas.

4.3 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.

4.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise shallow 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 300 kPa may be assumed for foundations bearing on sandy gravel or engineered fill, below any topsoil. All topsoil shall be stripped from within building footprints, we anticipate this to be typically below 0.1 to 0.3 m depth based on our subsurface investigations.

5 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 it considers that:

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

An assessment of the risk from natural hazards as required by the RMA includes the following:

- The likelihood of natural hazards occurring (whether individually or in combination);
- The material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
- Any likely subsequent use of the 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).

We have assessed the risk of natural hazards at the site in accordance with Section 106 of the Resource Management Act (RMA) and considered the risk to the site from rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. 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 natural hazards such as rockfall, slope stability, subsidence, and tsunami. As discussed in section 4.3, we recommend that inundation hazard is considered during subdivision design. As such, the site is considered suitable for subdivision from a geotechnical perspective.

6 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 Developments 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 Engineering 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

Dai Kiddle

Geotechnical Engineer

Jed Watts

Engineering Geologist

Report reviewed by

Greg Martin, CMEngNZ (PEngGeol)

Principal Engineering Geologist

7 References

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APPENDIX 1:

Site Plan

Legend

- Proposed Hand Auger Locations
- Proposed Test Pit Locations
- Site Boundary

10m 0 10 20 30 40 50m

ENGEO

Produced by **Evalu8.earth**

Title: Site Investigation Plan		
Client: HUGHES DEVELOPMENT		Figure No: 1
Project: 130 Dunns Crossing Road	Drawn: RM	Size: A4
Date: 18-05-2021	Checked: RM	
Proj No: 12903.001.000	Scale: 1:2031	Version: draft

APPENDIX 2:

Site Investigation Logs

LOG OF AUGER HA01

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 25/05/2021
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : DKi/RM
Reviewed By : JRW
Latitude : -43.623059
Longitude : 172.370078

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].					N/A		
	ALLUVIUM	ML	SILT with minor fine to medium sand and trace rootlets; light brown. Low plasticity.				D	St - VSt		
							M			
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal							>>

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

Hand auger met practical refusal at 0.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 130 DUNNS CROSSING ROAD - HA.GPJ NZ DATA TEMPLATE 2.GDT 2/6/21

LOG OF AUGER HA02

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 25/05/2021
Hole Depth : 0.15 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : DKi/RM
Reviewed By : JRW
Latitude : -43.623294
Longitude : 172.371734

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	N/A	
			End of Hole Depth: 0.15 m Termination Condition: Practical refusal						
0.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.15 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.2 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 130 DUNNS CROSSING ROAD - HA.GPJ NZ DATA TEMPLATE 2.GDT 2/6/21

LOG OF AUGER HA03

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 25/05/2021
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : DKi/RM
Reviewed By : JRW
Latitude : -43.622821
Longitude : 172.371847

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	N/A		
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal							
0.5										

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

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA04

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 25/05/2021
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : DKi/RM
Reviewed By : JRW
Latitude : -43.62211
Longitude : 172.372151

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	N/A	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						
0.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 130 DUNNS CROSSING ROAD - HA.GPJ NZ DATA TEMPLATE 2.GDT 2/6/21

LOG OF AUGER HA05

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 25/05/2021
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : DKi/RM
Reviewed By : JRW
Latitude : -43.622359
Longitude : 172.373911

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	N/A	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						
0.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH HAND AUGER 130 DUNNS CROSSING ROAD - HA.GPJ NZ DATA TEMPLATE 2.GDT 2/6/21

LOG OF TEST PIT TP01

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd **Shear Vane No** :
Date : 25/05/2021 **Logged By** : DKI/RM
Max Test Pit Depth : 2.4 m **Reviewed By** : JRW
Digger Type/Size : Bucket Excavator **Latitude** : -43.623683662226
Bucket Type/Size : Digging Bucket **Longitude** : 172.3705747354

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	N/A		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor silt and trace rootlets; brown. Well graded. Gravel is sub-rounded to rounded. Sand is fine to coarse.				M	Tightly Packed		
1.0									Tightly Packed		
1.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; brownish grey. Well graded. Gravel is sub-angular to rounded. Sand is fine to coarse.				W	Moderately Packed		
2.0									Tightly Packed		
2.5				Depth of Excavation: 2.4 m Termination Condition: Target depth							
3.0											

Test pit met target depth at 2.4 m.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 130 DUNNS CROSSING ROAD - TP.GPJ NZ MASTER DATA TEMPLATE.GDT 2/6/21

LOG OF TEST PIT TP02

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd **Shear Vane No** :
Date : 25/05/2021 **Logged By** : DKI/RM
Max Test Pit Depth : 2.5 m **Reviewed By** : JRW
Digger Type/Size : Bucket Excavator **Latitude** : -43.623171563764
Bucket Type/Size : Digging Bucket **Longitude** : 172.37088219868

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TOPSOIL		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].					N/A		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; brownish grey. Well graded. Gravel is sub-angular to rounded. Sand is fine to coarse. Rootlets no longer encountered from 0.6 m depth.				D	Tightly Packed		
1.0								M			
1.5								W	Moderately Packed		
2.0											
2.5				Depth of Excavation: 2.5 m Termination Condition: Target depth							
3.0											

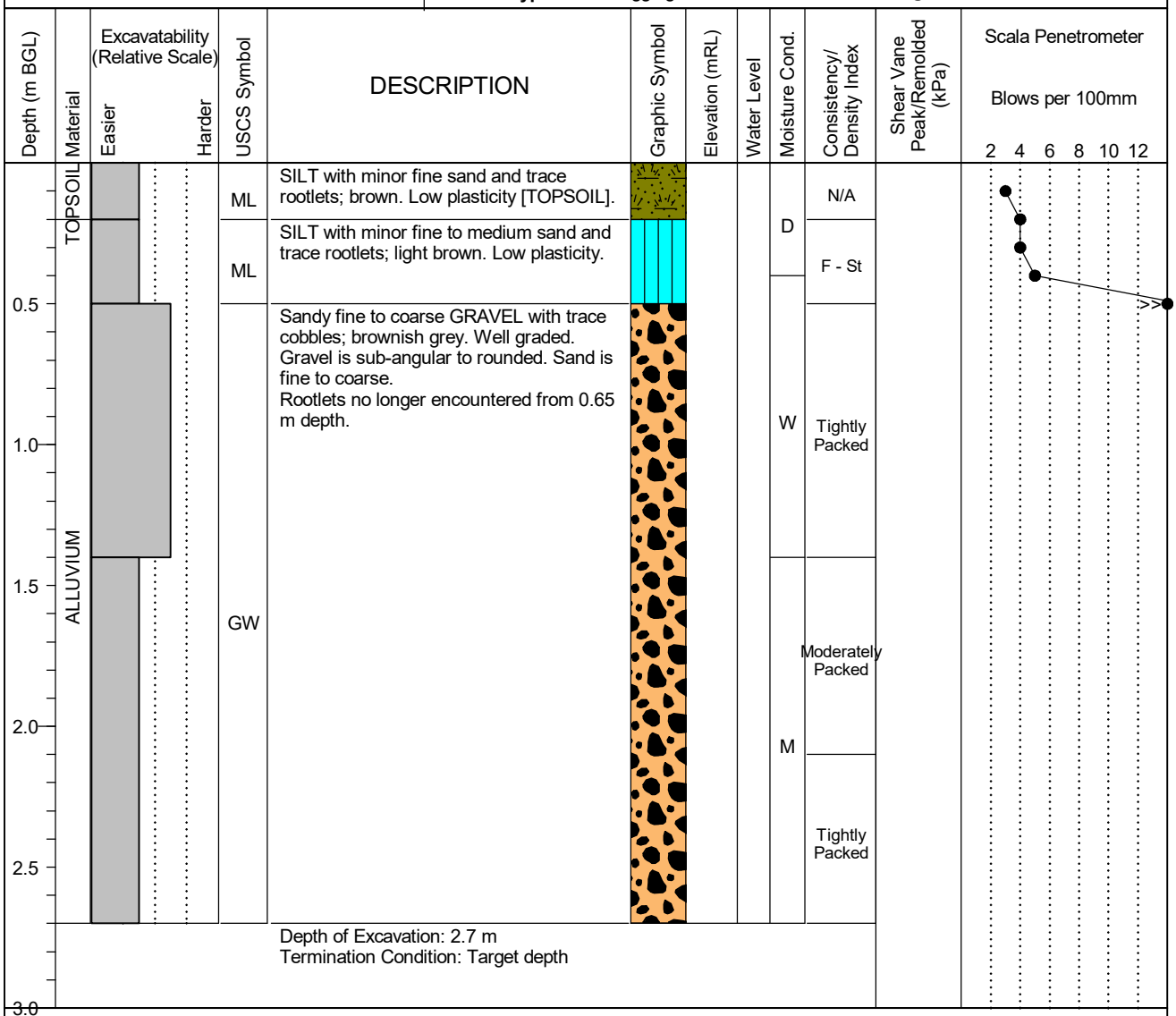
Test pit met target depth at 2.5 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 130 DUNNS CROSSING ROAD - TP.GPJ NZ MASTER DATA TEMPLATE.GDT 2/6/21

LOG OF TEST PIT TP03

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd **Shear Vane No** :
Date : 25/05/2021 **Logged By** : DKI/RM
Max Test Pit Depth : 2.7 m **Reviewed By** : JRW
Digger Type/Size : Bucket Excavator **Latitude** : -43.622662896926
Bucket Type/Size : Digging Bucket **Longitude** : 172.37116493408



Test pit met target depth at 2.7 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP04

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd **Shear Vane No** :
Date : 25/05/2021 **Logged By** : DKI/RM
Max Test Pit Depth : 2.7 m **Reviewed By** : JRW
Digger Type/Size : Bucket Excavator **Latitude** : -43.622772977861
Bucket Type/Size : Digging Bucket **Longitude** : 172.37271203999

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	N/A		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor silt and trace rootlets; brown. Well graded. Gravel is sub-rounded to rounded. Sand is fine to coarse. Rootlets no longer encountered from 0.5 m depth.					Tightly Packed		
1.0			GW	Sandy fine to coarse GRAVEL with trace cobbles; brownish grey. Well graded. Gravel is sub-angular to rounded. Sand is fine to coarse.				M	Tightly Packed		
2.0								W			
2.5				Depth of Excavation: 2.7 m Termination Condition: Target depth							
3.0											

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

Test pit met target depth at 2.7 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 130 DUNNS CROSSING ROAD - TP.GPJ NZ MASTER DATA TEMPLATE.GDT 2/6/21

LOG OF TEST PIT TP05

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd **Shear Vane No** :
Date : 25/05/2021 **Logged By** : DKI/RM
Max Test Pit Depth : 2.5 m **Reviewed By** : JRW
Digger Type/Size : Bucket Excavator **Latitude** : -43.622235852781
Bucket Type/Size : Digging Bucket **Longitude** : 172.37294463797

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				D	N/A		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor silt and trace rootlets; brown. Well graded. Gravel is sub-rounded to rounded. Sand is fine to coarse. Rootlets no longer encountered from 0.6 m depth. Lens of fine to medium gravel on one corner of the test pit at 0.8 m depth.				M	Tightly Packed		
1.0			GP	Sandy fine to medium GRAVEL; brownish grey. Poorly graded. Gravel is sub-rounded to rounded. Sand is fine to coarse.					Moderately Packed		
1.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; brownish grey. Well graded. Gravel is sub-angular to rounded. Sand is fine to coarse.				W	Moderately Packed		
2.0											
2.5				Depth of Excavation: 2.5 m Termination Condition: Target depth							
3.0											

Test pit met target depth at 2.5 m.
Scala Penetrometer met practical refusal at 0.3 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 130 DUNNS CROSSING ROAD - TP.GPJ NZ MASTER DATA TEMPLATE.GDT 2/6/21

LOG OF TEST PIT TP06

Geotechnical Investigation
130 Dunns Crossing Road
Farringdon, Rolleston
12903.000.011

Client : Hughes Developments Ltd **Shear Vane No** :
Date : 25/05/2021 **Logged By** : DKI/RM
Max Test Pit Depth : 2.1 m **Reviewed By** : JRW
Digger Type/Size : Bucket Excavator **Latitude** : -43.62162131904
Bucket Type/Size : Digging Bucket **Longitude** : 172.37327367089

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TOPSOIL		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].					N/A		
0.2			ML	SILT with minor fine to medium sand and trace rootlets; light brown. Low plasticity.					F - St		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace cobbles; brownish grey. Well graded. Gravel is sub-angular to rounded. Sand is fine to coarse. Rootlets no longer encountered from 0.7 m depth.				D	Tightly Packed		
1.0								M	Moderately Packed		
1.5								W	Tightly Packed		
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth							
2.5											
3.0											

Test pit met target depth at 2.1 m.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered

GEOTECH TEST PIT LOG 130 DUNNS CROSSING ROAD - TP.GPJ NZ MASTER DATA TEMPLATE.GDT 2/6/21

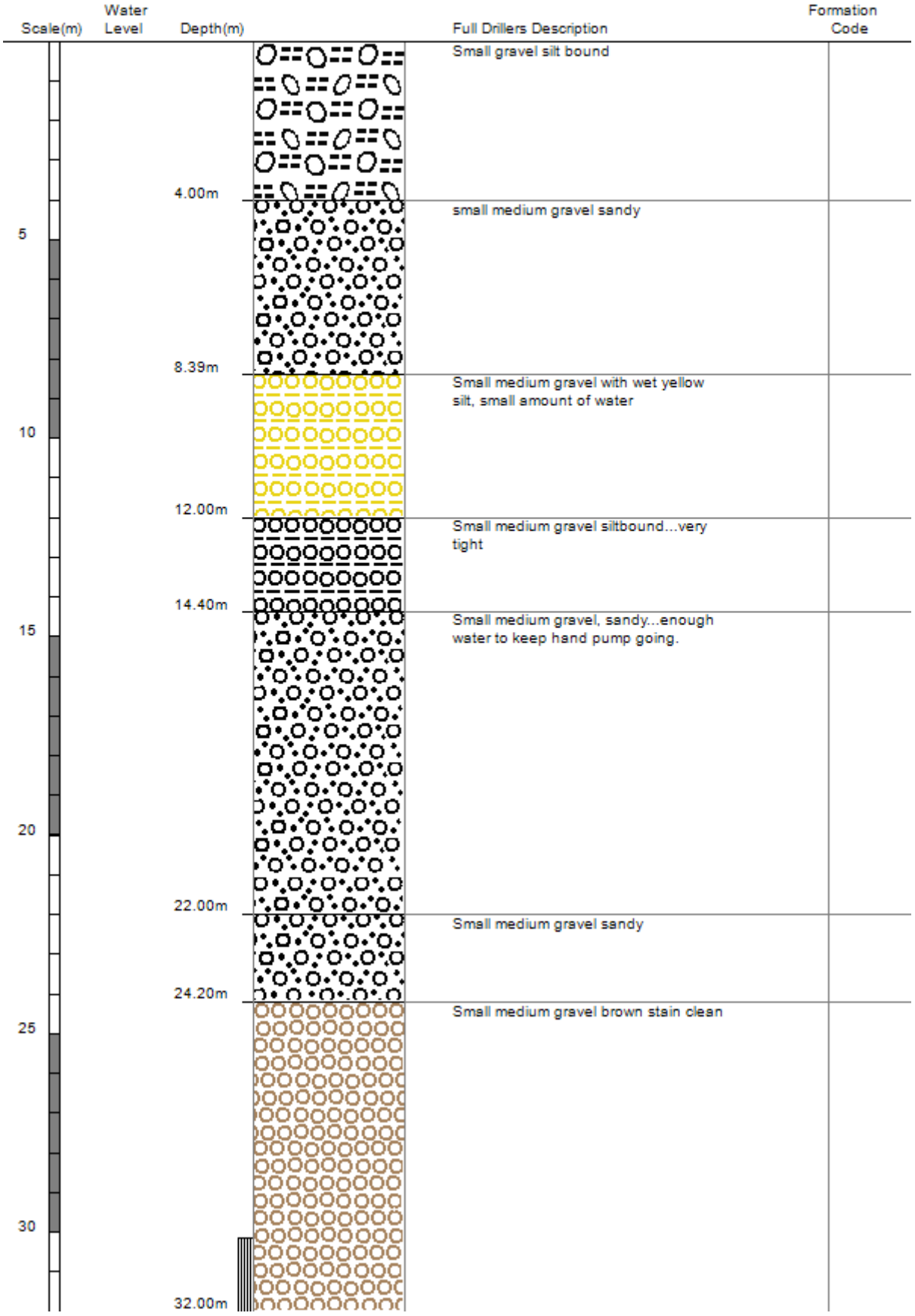
APPENDIX 3:

ECan Borelogs

Borelog for well M36/5038

Grid Reference (NZTM): 1549278 mE, 5169841 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.4 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 32.0 m Drill Date: 01-Nov-1996

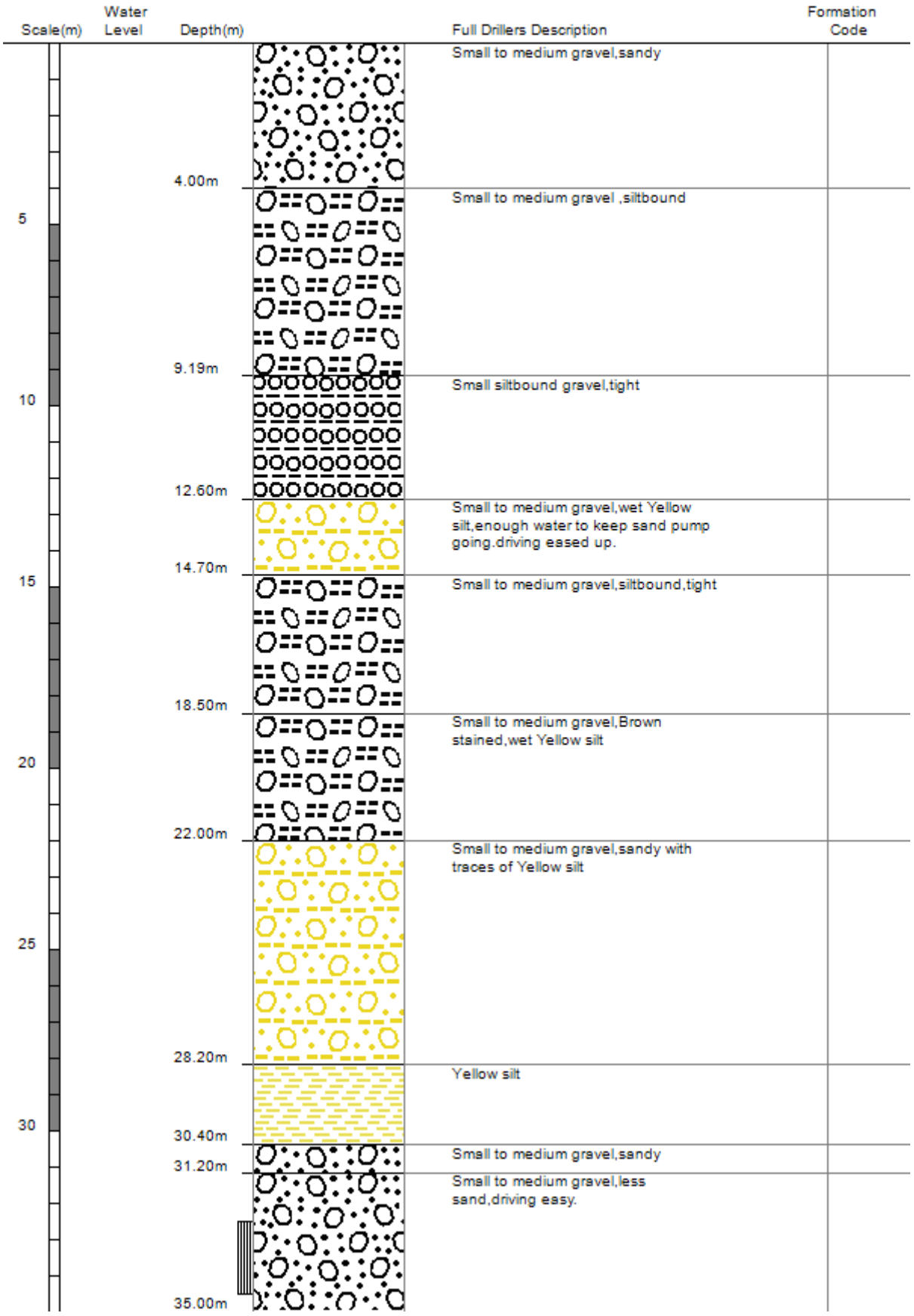
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/5040

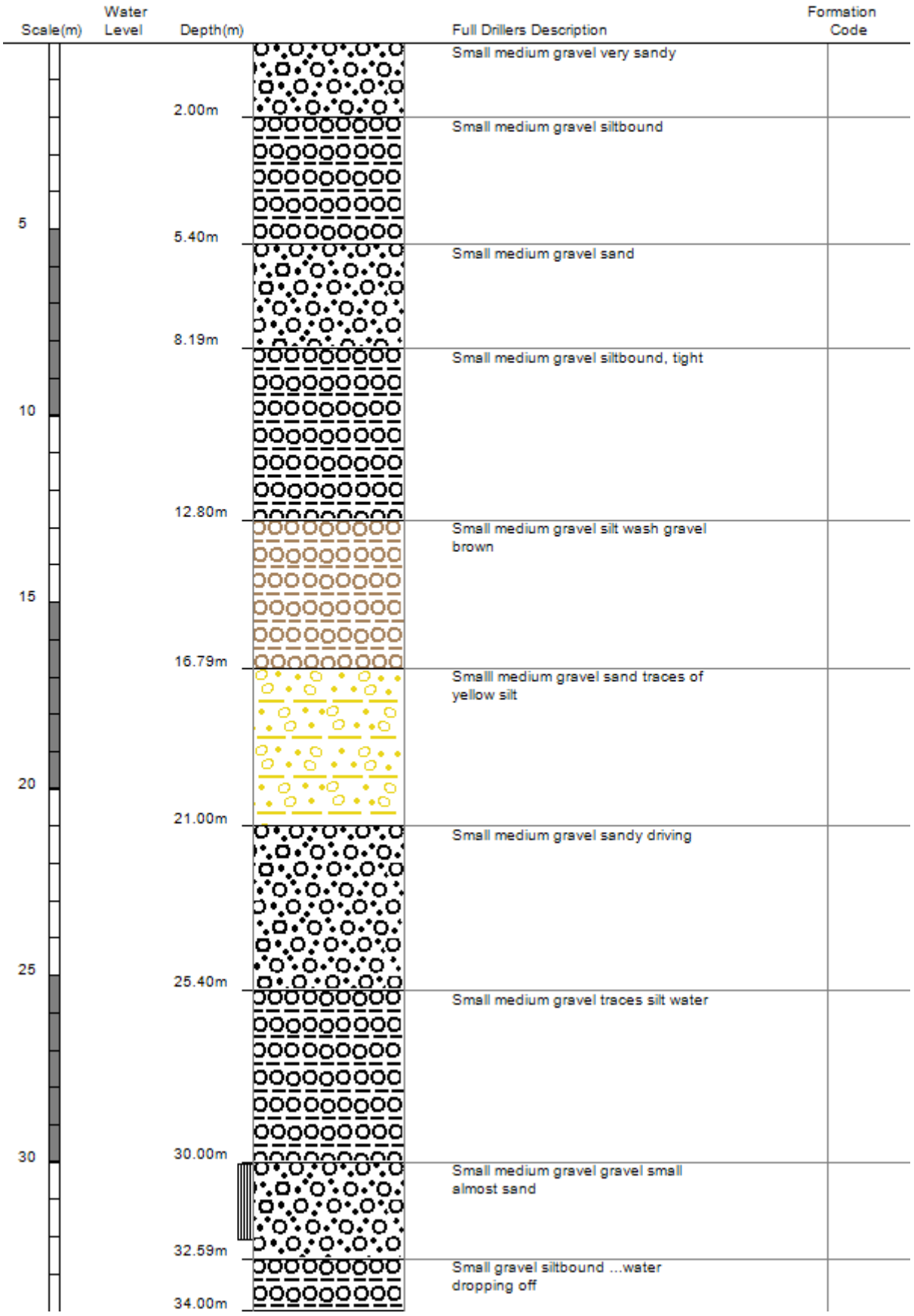
Grid Reference (NZTM): 1549168 mE, 5169891 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.9 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 35.0 m Drill Date: 01-Jul-1996

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/5041

Grid Reference (NZTM): 1549508 mE, 5169991 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.5 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 34.0 m Drill Date: 01-Feb-1997



Borelog for well M36/4450

Grid Reference (NZTM): 1549388 mE, 5169661 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.6 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 26.5 m Drill Date: 09-Apr-1992

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