DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

GEOTECHNICAL REPORT FOR SUBDIVISION

37211 / 2 AUCKLAND STREET, ASHLEY / ALISTAIR CAMERON

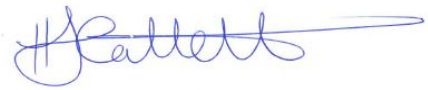
0800 999 333
hello@do.nz

Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
www.do.nz

Davis Ogilvie & Partners Ltd

QUALITY ASSURANCE

Title:	Geotechnical Report for Subdivision: 2 Auckland Street, Ashley
Client:	Alistair Cameron
File Location:	\\chsvr\JobData\projects\37s\37211 - 2 Auckland Street, Ashley\Geotech\003 Report\240130.hc.2AucklandStreet_Geotech Rev 2 FINAL.docx
Version:	2
Date:	09 February 2024
Project No.:	37211

Prepared By:	**Hamish Cattell** Engineering Geologist PhD, MEngNZ	**Signature:** 
Reviewed By:	**Andrew Bunce** Engineering Geologist MSci Geology (Hons)	**Signature:** 
Authorised By:	**Elliot Duke** **DIRECTOR** Chartered Professional Engineer BE Nat Res (hons), CMEngNZ CPEng IntPE(NZ) / APEC Engineer	**Signature:** 

DISCLAIMER

This report has been prepared at the specific instructions of Alistair Cameron, and concerns 2 Auckland Street, Ashley, Waimakariri. The site is legally described as Lot 1 DP 394101 (Title 376526). This report provides a geotechnical assessment of the land underlying the site and a review of geotechnical information.

Davis Ogilvie did not perform a complete assessment of all possible conditions or circumstances that may exist at the site. Conditions may exist which were undetectable given the limited investigation of the site. Variations in conditions may occur between test locations, and there may be conditions onsite which have not been revealed by the investigation, which have not been taken into account in the report.

Davis Ogilvie's opinions are based upon information that existed at the time of the production of the document. Assessments made in this report are based on the conditions found onsite and published sources detailing the recommended investigation methodologies described. No warranty is included; either expressed or implied that the actual conditions will conform to the assessments contained in this report.

Information herein was created from maps and / or data from the New Zealand Geotechnical Database (https://www.nzgd.org.nz) which were prepared and / or compiled for the Earthquake Commission (EQC) to assist in assessing insurance claims made under the Earthquake Commission Act 1993. The source maps and data were not intended for any other purpose. EQC and its engineers, Tonkin & Taylor, have no liability for any use of the maps and data or for the consequences of any person relying on them in any way.

Only Alistair Cameron and the Local and Regional Territorial Authorities are entitled to rely upon this engineering report. Davis Ogilvie & Partners Ltd. accepts no liability to anyone other than Alistair Cameron in any way in relation to this report and the content of it and any direct or indirect effect this engineering report may have. Davis Ogilvie & Partners Ltd. does not contemplate anyone else relying on this report or that it will be used for any other purpose.

Should anyone wish to discuss the content of this report with Davis Ogilvie & Partners Ltd, they are welcome to contact us on (03) 366 1653 or at Level 1, 24 Moorhouse Ave, Addington, Christchurch.

EXECUTIVE SUMMARY

Davis Ogilvie & Partners Ltd. was engaged by Alistair Cameron to undertake a geotechnical investigation of the site at 2 Auckland Street, Ashley. The purpose of the geotechnical investigation was to investigate the underlying ground conditions, assess natural hazards, and provide recommendations regarding residential foundations and civil infrastructure to support a subdivision consent application for 94 proposed residential lots.

Across the 8.0 ha site, Davis Ogilvie oversaw the excavation of 22 Test Pits and 26 Dynamic Cone Penetrometers. The shallow soil profile generally consisted of a surficial topsoil layer overlying a unit of silt, which ranged from 1.1 to 3.7 m thick, then dense silty and sandy gravel. Groundwater was encountered at between 2.4 – 5.4 m below existing ground level (EGL). Observations of the soil and groundwater conditions indicate liquefaction-induced settlement is unlikely and a liquefaction vulnerability risk of 'very low' to 'low' is considered appropriate.

Based on the in-situ DCP testing, a static Ultimate Bearing Capacity (UBC) of 300 kPa was achieved at depths ranging from 0.5 – 2.4 m below EGL. The maximum depth to which 'good ground' has been assigned at the site is 0.6 m, above which standard (NZS 3604:2011) foundation options are considered suitable. Recommended foundation options where 'good ground' has been achieved include NZS 3604 concrete slab or piles for suspended floors founded at a depth where 300 kPa has been confirmed. In areas where the depth to 300 kPa UBC exceeds 0.6 m below EGL, an UBC of 200 kPa is recommended with Specific Engineering Design for foundations.

An extract from the Davis Ogilvie Flooding Assessment report summarises *"Given the protection provided by the Ashley / Rakahuri River Control Scheme stopbanks the overall flood hazard risk for 2 Auckland Street, Ashley, is considered very low and no specific flood hazard mitigation measures are likely to be required when constructing dwellings on or servicing the property."*

For pavement design, it is recommended that a subgrade Californian Bearing Ratio of 4 be adopted. Stormwater management is to a stormwater management area at the south of the site on proposed Lot 94. Falling Head Infiltration testing in the underlying gravelly soils returned average initial rates of between 1.8 – 3.0 m/hr, and ultimate rates ranged between 0.3 – 0.6 m/hr.

The site is considered suitable for residential development under Section 106 of the Resource Management Act (1991) in regards to natural hazards, subject to the following conditions:

- Site-specific geotechnical investigation at building consent stage will be required to determine the depth to an appropriate bearing capacity at the location of each dwelling;

- Finished floor levels are confirmed during the consenting process by Waimakariri District Council and / or Environment Canterbury;
- Specific engineering design, observation and certification will be required on proposed Lots 39 – 48 and Lot 94 to address the reduced bearing capacity and possible low liquefaction risk identified in this area.

TABLE OF CONTENTS

1.0 INTRODUCTION

Davis Ogilvie & Partners Ltd. (DO) was engaged by Alistair Cameron (the client), to carry out a geotechnical investigation at 2 Auckland Street, Ashley, Waimakariri District, legally known as Lot 1 DP 394101, held under title 376526. The purpose of the geotechnical investigation was to investigate the underlying ground conditions, assess natural hazards, and provide recommendations regarding residential foundations and civil infrastructure to support your subdivision consent application for 94 proposed residential lots.

1.1 Site Description

The site is located in the North Canterbury town of Ashley, approximately 6.6 km west of State Highway 1 (Main North Road), and 3.0 km northeast of Rangiora town centre (Figure 1). The land parcel is zoned 'Rural'[1] and is bounded by Canterbury Street to the north, Auckland Street to the west, Lower Sefton Road to the south, and developed rural-residential land to the east.

The 400 m wide Ashley River channel is 320 m south of the site, and is separated from the site by a raised flood bank and Lower Sefton Road. A narrow waterway, Saltwater Creek, flows through adjacent farmland, 135 m east of the site. In the north-eastern corner of the site, the original channel (that can be observed in historical aerial photographs[20]) has been diverted into a man-made drainage channel which runs along the north boundary and northern half of the eastern boundary. Bunds formed from excavation of the channel remain in this area. The channel contained still to low-flow water at the time of the site walkover. An overgrown drainage swale containing still water also runs along the western boundary, parallel to Auckland Street.

The site comprises an approximately semi-rectangular area of 8.0 hectares (80,000 m^2), and is largely undeveloped grassed farmland. Existing developed residential land parcels (Lots 1 DP 5992 and Pt RS 1294) located immediately north of the subject land area are not within the subject site; however, a recently relocated dwelling (located within proposed Lot 9) and temporary storage yard and stockpile area are included in the north of the site, as seen in Figure 2. In the south of the site and along the western boundary, the land area has also been used to stockpile topsoil and gravel. The resulting land surface is irregular and is overgrown by vegetation.

The land is generally flat to undulating, with a gentle overall slope towards the Ashley River in the south to southeast. According to an existing topographical survey of the site[2], there is an overall elevation differential of approximately 5.0 m between the northwest and southeast boundaries of the property. A recent oblique aerial photo of the site is shown in Figure 2.

[1] Waimakariri District Council – District Plan accessed via https://waimakariri.isoplan.co.nz/eplan/#/Property/15548, accessed August 2020.
[2] Survey plan provided by the client: Topography Survey of Lot 2 DP 71999 (Base Plot) - 1:1,000. Details of surveyor and date of approval are not legible in the copy provided. Based on features in the survey, it is understood to have been undertaken mid-1990s.

Figure 1: Topo50 map[3] showing the site location (red arrow) relative to nearby features. Grid size is equal to 1 km².

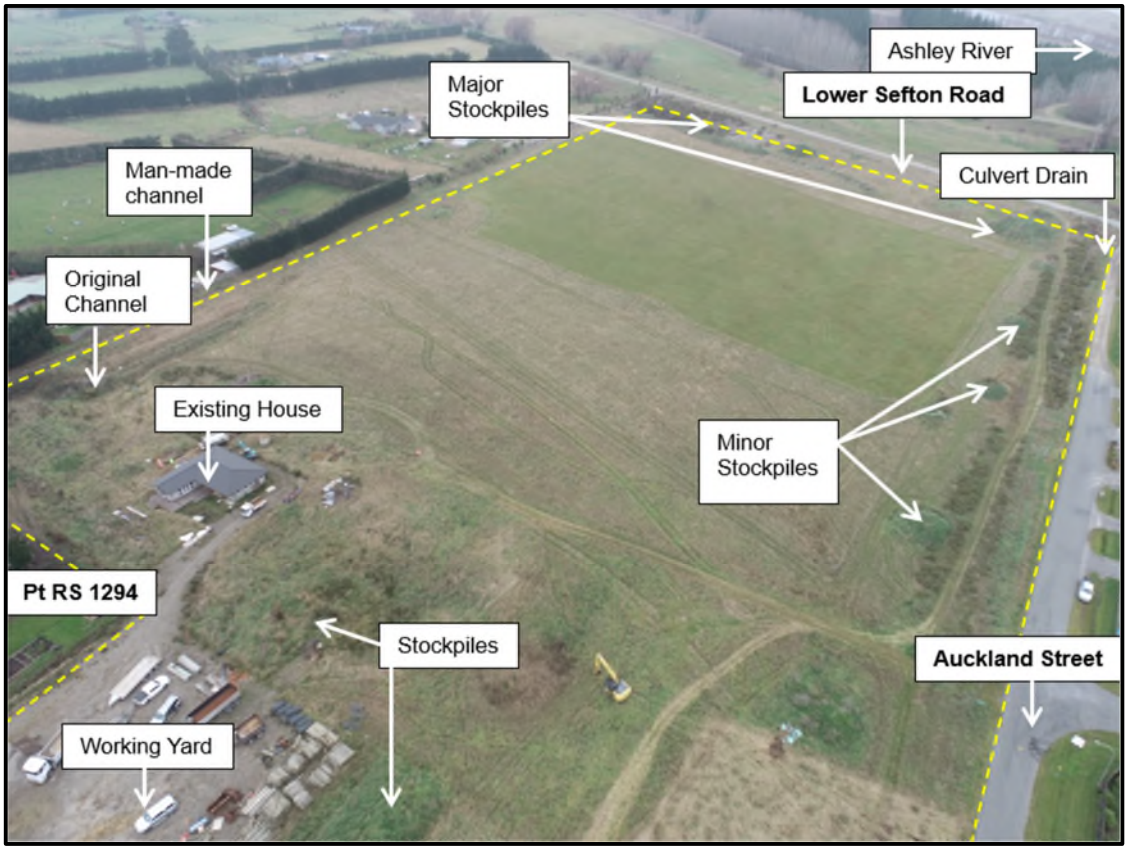


Figure 2: Oblique aerial photograph of the site (yellow dash line is approximate boundary), orientated south-east. Photo dated 24 June 2020.

[3] Topo50 Maps accessed from https://data.linz.govt.nz/layer/50767-nz-topo50-maps/

1.2 Proposed Development

Based on the scheme plan for the site, the proposed development is to include subdividing the 8.0 ha site into approximately 93 residential lots plus a stormwater disposal area in the south (Lot 94) and access road (Lot 95), as shown in Figure 3[4]. The lots are to be served by an internal roading network with two egresses from Auckland Street and one from Lower Sefton Road. The proposed residential lots are typically 600 m^2 but range from 600 m^2 up to 860 m^2. Lot 94, the stormwater management area, will be 5600 m^2,

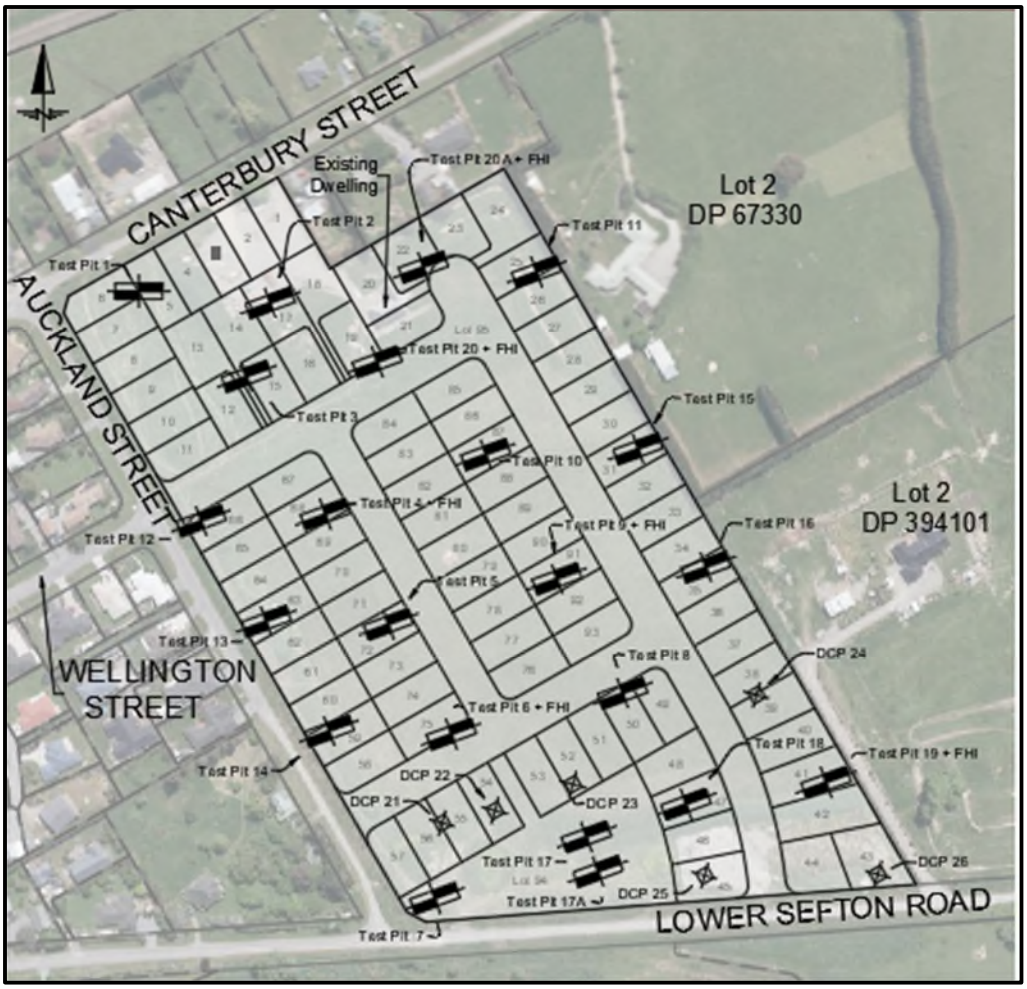


Figure 3: Proposed scheme plan showing test pit and DCP locations and recent aerial image[5]

[4] Davis Ogilvie – GM37211 – Proposed Subdivision of Lot 1 DP394101, DWG 101-A, 2 pages,
[5] Canterbury Maps Viewer – Imagery Basemaps: Latest Imagery, accessed via https://mapviewer.canterburymaps.govt.nz/

2.0 REVIEW OF PUBLISHED INFORMATION

A detailed review of published information regarding the site is provided in following sections.

2.1 Site Geology

The published geology of the site is identified as *"Grey to grey-brown river alluvium of undifferentiated Late Quaternary age (lQa)"* covering most of the site[6]. A mapped geological boundary is located approximately 90 m north of the southern boundary of the site, striking northeast / southwest where the geology changes to modern river (Holocene) floodplain deposits of *"Grey river alluvium beneath plains or low-level terraces (Q1a)."* A further geological boundary is mapped 40 m south of the site where the geology changes to active floodplain deposits of *"Grey river alluvium, comprising gravel, sand and silt, in active floodplains (Q1a_af)"*, as shown in Figure 4.

Geomorphic mapping of the area[7] inidcates that the site is largely covered by the Okuku aggradation surface (15 – 25 Ka), with the Ashley Fan alluvial surface (<2.4 Ka) and an area of *"riverbed reclaimed by stopbanks"* narrowly present in the south of the site.

The only geotechnical test information available on the New Zealand Geotechnical Database (NZGD) in the immediate vicinity of the site is that which was uploaded by Davis Ogilvie in 2020 upon completion of this ground investigation. Boreholes drilled near the Ashley River Bridge[8], 1.6 km west of the site, shows the deep underlying soil profile consisting of sandy gravel with several ~1.0 m thick beds of gravelly clay or gravelly silt encountered to the termaination depth at 25 m.

[6] Forsyth, P.J.; Barrell, D.J.A.; Jongens, R. (compilers) 2008. Geology of the Christchurch area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 16. 1 sheet + 67 p. Lower Hutt, New Zealand. GNS Science.
[7] Environment Canterbury (2002) *Map 4.3 Ashley River Floodplain Management Plan: Floodplain Geomorphology*. Major Revision by McPherson & Cameron Associates, Geological Field Services, Christchurch, March 2002. Drafting by Ryan Elley, GIS Section of Environment Canterbury, March 2002.
[8] NZGD boreholes BH_31944 and BH_31945 (Opus Job 6-DHLHB.00) drilled July 2013.

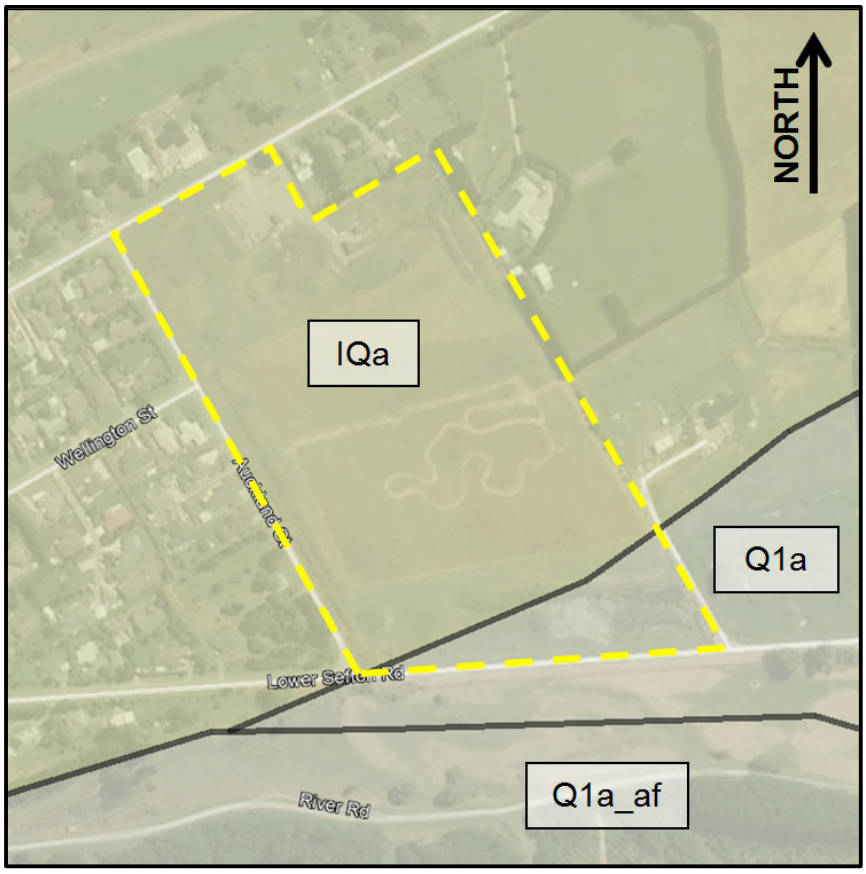


Figure 4: Mapped Geological boundaries in the area of 2 Auckland Street with labelled geological units[6]. The approximate outline of the site is shown by the yellow dashed line.

2.2 Groundwater

The closest existing groundwater wells publically available via Environment Canterbury (ECan)[9] are 160 – 410 m west of the site (M35/0001, M35/7335 and M35/7558). The wells all show a calculated (minimum 80%) depth to groundwater of approximately 3.7 m below ground level.

Groundwater depths in well M34/0208, 480 m west of the site near the intersection of Fawcetts and Boundary Roads, were recorded during a 23-year period between 1963 and 1986. The results are presented in Figure 5 and show a median depth to groundwater during this period of 5.9 m below ground level, and a minimum depth of 5.3 m at this location.

[9] ECan Well Search accessed from https://www.ecan.govt.nz/data/well-search/

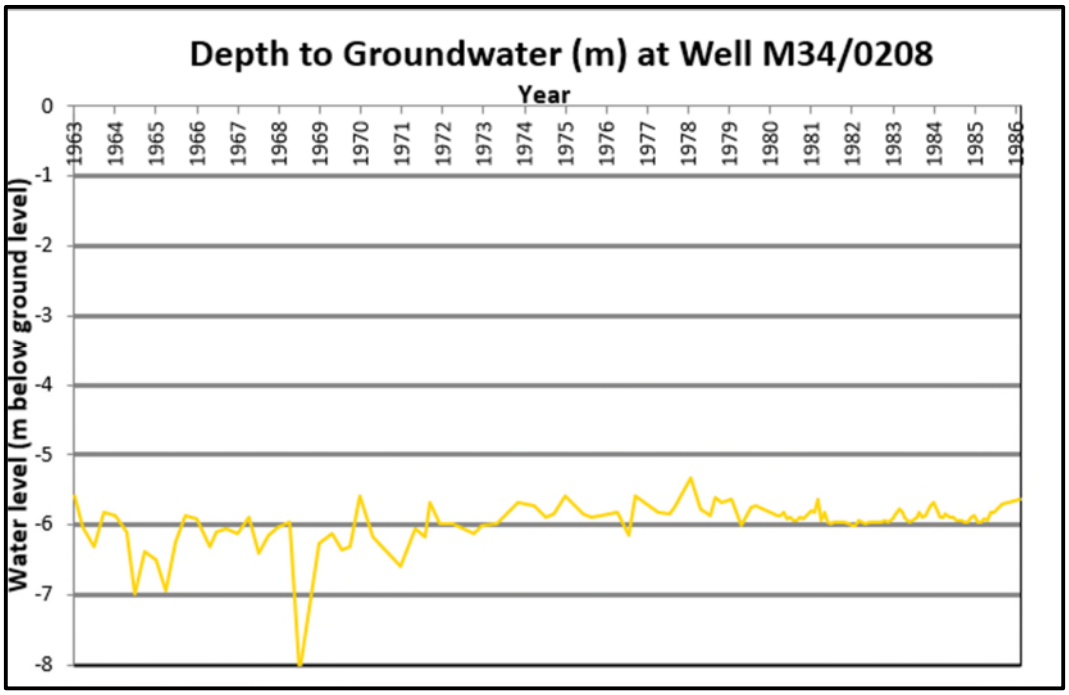


Figure 5: Groundwater monitoring data from well M34/0208 (480 m from the site) showing measured depths to groundwater below ground level (in meters) between 1963 to 1986 (generally 3 to 4 measurements recorded annually).

2.3 Seismicity and Liquefaction Hazard

The nearest known major active faults listed in the NZS 1170.5:2004 are the Alpine (100 km northwest of the site), Kakapo (70 km, north-northwest), Hope (80 km, north and northwest) and the Kelly Fault (88 km northwest).

According to the GNS Active Fault Database[10], faults below the Canterbury planes nearest to the site include the east-west trending Loburn Fault (1.3 km, northwest and north of the site) and Ashley Fault (4.0 km, west of the site). These faults are within a 'hybrid zone' of fault relative movement below a zone of dominantly thrust faulting to the north and dominantly strike-slip faulting to the south[11,12]. The site is not presently mapped by the WDC as being in a Fault Avoidance Zone[13,14].

[10] GNS Active Fault Database available at http://data.gns.cri.nz/af/
[11] R Sisson, J Campbell, J Pettinga, D Milner – Paleoseismicity of the Ashley & Loburn Faults, North Canterbury, New Zealand – Natural Hazards Research Centre, Department of Geological Sciences, University of Canterbury (EQC funded project 97/237)
[12] Pettinga, J.R., Chamberlain, C.G., Yetton, M.D., Van Dissen, R.J. and Downes, G. (1998). Earthquake Hazard and Risk Assessment Study (Stage 1 – Part A); Earthquake Source Identification and Characterisation. Canterbury Regional Council Publication U98/10.
[13] Waimakariri District Plan Hazards Map from: https://waimakariri.maps.arcgis.com/apps/webappviewer/index.html?id=a1508164fb474825bd34c34eebfadc46
[14] Canterbury Maps - Earthquake Faults Map from: https://canterburymaps.govt.nz/map?webmap=f716b840dc434c009e8f74f644a271d6

The site is mapped by the Ministry of Business of Innovation, Business and Employment (MBIE) As *"N/A – Rural and Unmapped"*[15]. According to the ECan Liquefaction Assessment Area map[16], the site is zoned within a broad area classified as *"damaging liquefaction unlikely."* The zone defined as *"liquefaction assessment needed"* occurs from 560 m east of the site and continues towards the coast. The nearest mapped area of *"possible flooding by sediment, possibly related to liquefaction"* by ECan is 50 m north of the site[17] following the 2010/2011 Christchurch Earthquake Sequence. The corresponding area of *"probable observed liquefaction at the surface"* is some 650 m west of the site, north of Ashley River Bridge[17].

In summary, the site is not presently mapped in any areas of concern with respect to the seismic hazard.

2.4 Flood Management Finished Floor Levels

Flood management is addressed in a standalone Flooding Assessment Memorandum[18] prepared by Davis Ogilvie and included as **Appendix A**. An extract from the summary is provide below.

> *"Numerous flood investigations have been undertaken for the Ashley / Rakahuri River floodplain and there is a good understanding of the flood risk. Given the protection provided by the Ashley / Rakahuri River Control Scheme stopbanks the overall flood hazard risk for 2 Auckland Street, Ashley, is considered very low and no specific flood hazard mitigation measures are likely to be required when constructing dwellings on or servicing the property.*
>
> *Current expectation is that finished floor level for any dwellings constructed on 2 Auckland Street, Ashley will need to be at least 400 mm above undisturbed ground around the dwelling footprint. It is recommended that finished floor level requirements are confirmed with Environment Canterbury and Waimakariri District Council during detailed design of the subdivision."*

2.5 Environment Canterbury Listed Land Use Register

The property is not included on the ECan Listed Land Use Register (LLUR). Please note, this does not confirm that the site is not contaminated. This is discussed further in a standalone environmental report by Davis Ogilvie.

[15] New Zealand Geotechnical Database - MBIE Residential Foundation Technical Categories - Map CGD5020.
[16] Environment Canterbury "Liquefaction assessment area map for the eastern Canterbury project area" released in January 2013. New Zealand Geotechnical Database Map CGD5140 - 19 Feb 2013.
[17] Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts. Environment Canterbury Report R12/83. December 2012. #
[18] Flooding Assessment – 2 Auckland Street, Ashley V1 02/02/2014, Davis Ogilve 37211

2.6 Aerial Imagery

A summary of the observations made from publically available aerial imagery is provided below[19,20,21]:

- The earliest aerial imagery of the site from 1941 shows the site as mostly undeveloped agricultural land with 5 to 6 buildings on the northern half of the site. These appear to be farm buildings / sheds with a probable dwelling and auxiliary buildings central to the north of the site (proposed Lot 19 area).
- A clear channel depression crosses the northeast corner of the site (near the original dwelling), and connects to a water race in the west near Saltwater Creek.
- A silo structure appears in the 1970 photo between one of the auxiliary buildings and the dwelling. Imagery from 1994 shows all farm buildings removed, apart from the dwelling and sheds directly next to the dwelling. By 2000, the dwelling (in proposed Lot 19) was also removed.
- Ground disturbance along the north-east property boundary can be seen in the 2000 photo. The dwelling has been removed from the site by 2004 but two shed-sized buildings remain.
- The gravel work platform and soil storage area off Canterbury Street was constructed by mid-2016.
- The dwelling in the area of proposed Lots 20 / 21 (central north of site) was relocated on site and the surrounding ground was prepared in early-2017.
- Following this, no significant change at the site can be observed to the present day.

3.0 GEOTECHNICAL INVESTIGATION AND RESULTS

Davis Ogilvie conducted geotechnical testing on the site between 24 June and 10 July 2020. The testing comprised 22 machine-excavated Test Pits (TP) with 26 Dynamic Cone Penetrometer (DCP) testing.

TPs were excavated to between 1.6 to 5.4 m below Existing Ground Level (EGL). DCPs were advanced to between 1.1 and 3.9 m below EGL, terminating at practical refusal or at a target depth. Falling Head Infiltration (FHI) tests were also conducted on 5 of the TPs to assist with civil stormwater design.

A geotechnical site plan showing the test locations is provided in **Appendix B**.

[19] Google Earth – historical imagery.
[20] Canterbury Maps – Imagery Base Maps, available at: https://mapviewer.canterburymaps.govt.nz/
[21] RetroLens historical image resource, available at: http://retrolens.nz/

3.1 Shallow Testing

Testing revealed a generally uniform soil profile across the site consisting of topsoil underlain by silt (with lesser sand) that generally showed an increase in consistency / density with depth and then gravel. In the far north of the site, the depth to gravel (overlain by silt) was relatively shallow (i.e., 1.5 – 2.5 m below EGL) compared to the far south of the site where gravel was measured at greater depth (i.e., 3.0 – 4.6 m below EGL).

Typical soil profiles revealed by the TPs are shown in Figure 6 and DCP profiles are presented in Figure 7. This figure shows the variation between blow counts with depth over most of the site compared to those in the south. A summary of the soil profiles encountered at each test location is provided in Table 1A-C and full logs are included in **Appendix C**. The depth to gravel encountered across the site is presented on a site plan in Figure 8.

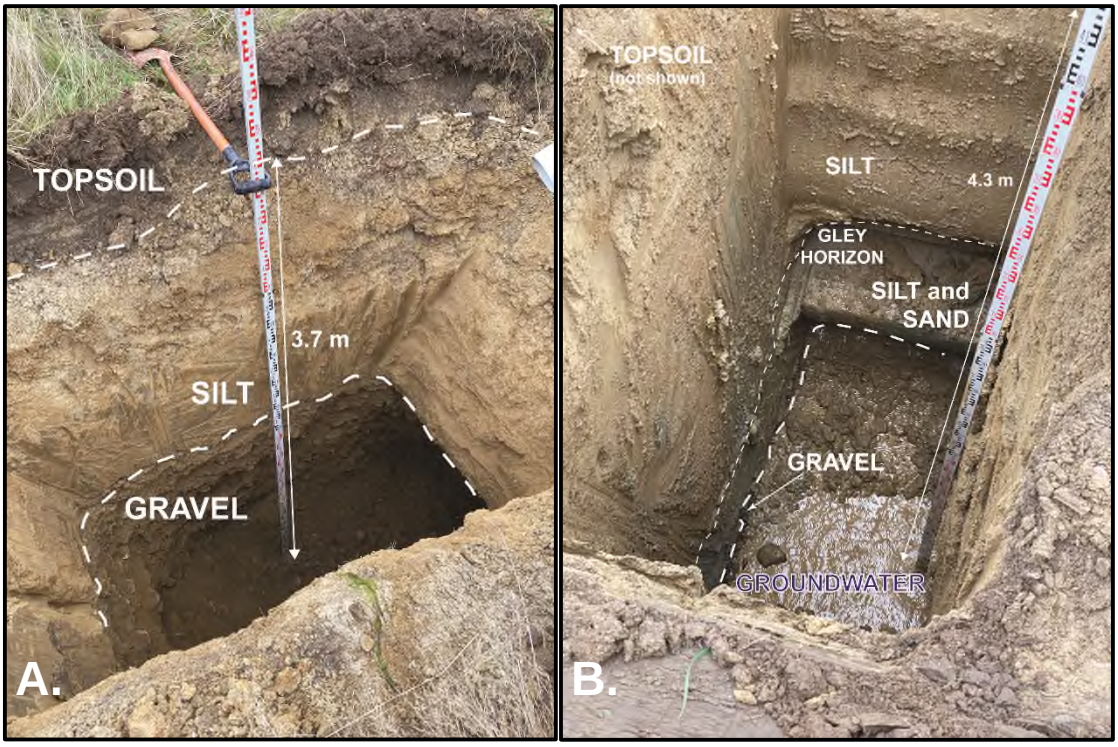


Figure 6: Examples of the soil profile encountered in the north of the site:
A) TP20a, where gravel was encountered at relatively shallow depths; and south of the site:
B) TP7 where gravel was encountered at greater depths beneath a saturated gley horizon.

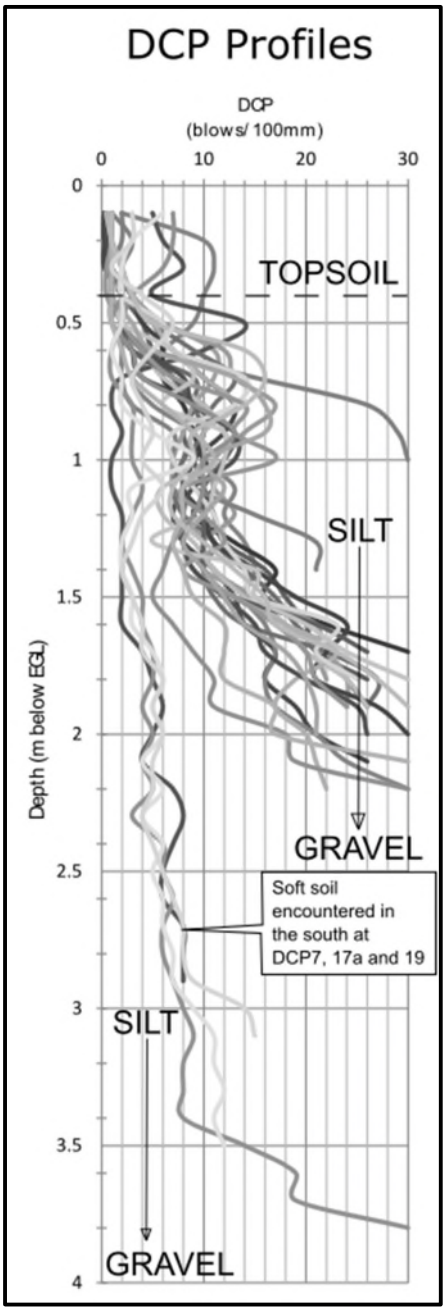


Figure 7: DCP profiles through topsoil and silt (overlying gravel, not reached by DCPs). Results show a consistent trend, except for DCP 7, 17a and 19 in the south of the site where soft, wet silt was encountered at deep.

Table 1A: Summarised Soil Profile for DCP 1 – 6

Summary of Soil Type	DCP (blows / 100 mm)	Relative Density / Consistency	Depth Below EGL (m)**					
			DCP1 +TP	DCP2 +TP	DCP3 +TP	DCP4 +TP	DCP5 +TP	DCP6 +TP
TOPSOIL / FILL	0 – 11	*	0.0 – 0.4	0.0 – 0.5	0.0 – 0.5	0.0 – 0.3	0.0 – 0.4	0.0 – 0.4
SILT	<1 – 7	Soft to stiff	0.4 – 0.7	0.5 – 0.8	0.5 – 0.7	0.3 – 0.8	0.4 – 0.7	0.4 – 0.6
	7 – 30 +	Very stiff to hard	0.7 – 2.2	0.8 – 2.5	0.7 – 3.0	0.8 – 2.5	0.7 – 2.2	0.6 – 2.3
Sandy or silty GRAVEL	NE	Dense to very dense***	2.2 – 2.8+	2.5 – 2.8+	3.0 – 5.4+	2.5 – 3.9+	2.2 – 3.1+	2.3 – 3.0+
Groundwater depth (m below EGL)			NE	NE	5.4	NE	NE	NE

Table 1B: Summarised Soil Profile for DCP 7 – 13

Summary of Soil Type	DCP (blows / 100 mm)	Relative Density / Consistency	Depth Below EGL (m)**						
			DCP7 +TP	DCP8 +TP	DCP9 +TP	DCP10 +TP	DCP11 +TP	DCP12 +TP	DCP13 +TP
TOPSOIL / FILL	0 – 11	*	0.0 – 0.3	0.0 – 0.3	0.0 – 0.3	0.0 – 0.4	0.0 – 0.4	0.0 – 0.3	0.0 – 0.3
SILT	<1 – 7	Soft to stiff	0.3 – 2.7	0.3 – 0.6	0.3 – 0.6	0.4 – 0.7	0.4 – 0.9	0.3 – 1.3	0.3 – 0.7
	7 – 30 +	Very stiff to hard	2.7 – 4.0	0.6 – 2.8	0.6 – 3.4	0.7 – 3.6	0.9 – 1.5	1.3 – 2.6	0.7 – 2.3
Sandy or silty GRAVEL	NE	Dense to very dense****	4.0 – 4.3+	2.8– 3.8+	3.4 – 4.0 +	3.6 – 5.3+	1.5 – 1.6+	2.6 – 3.3+	2.3 – 4.2+
Groundwater depth (m below EGL)			3.2***	3.7	NE	5.3	NE	NE	4.2

Table 1C: Summarised Soil Profile for DCP 14 – 20

Summary of Soil Type	DCP (blows / 100 mm)	Relative Density / Consistency	Depth Below EGL (m)**						
			DCP14 +TP	DCP15 +TP	DCP16 +TP	DCP17A +TP	DCP18 +TP	DCP19 +TP	DCP20 +TP
TOPSOIL / FILL	0 – 11	*	0.0 – 0.3	0.0 – 0.3	0.0 – 0.3	0.0 – 0.4	0.0 – 0.3	0.0 – 0.3	0.0 – 0.4
SILT	<1 – 7	Soft to stiff	0.3 – 0.6	0.3 – 0.7	0.3 – 0.7	0.4 – 2.9	0.3 – 0.6	0.3 – 0.7	0.4 – 0.9
	7 – 30 +	Very stiff to hard	0.6 – 2.7	0.7 – 2.9	0.7 – 3.0	2.9 – 4.0	0.6 – 3.7	0.7 – 2.5	0.9 – 2.3
Sandy or silty GRAVEL	NE	Dense to very dense****	2.7 – 3.1+	2.9 – 3.7+	3.0 – 3.1+	4.0 – 4.1+	3.7 – 3.9+	2.5 – 3.0+	2.3 – 2.9+
Groundwater depth (m below EGL)			NE	NE	NE	3.7	3.2	2.4***	NE

* Relative density not assigned to topsoil or non-engineered fill due to the propensity for settlement.

** Depths rounded to the nearest 0.1 m, and may vary across the site from the test locations. Depths are not corrected for variations in topographic elevation between test locations. DCP blows per depth interval generalised to show general consistency.

*** Possible shallow seepage which may not represent groundwater level.

**** Gravel density inferred from test pit excavations only.

NE = Not Encountered.

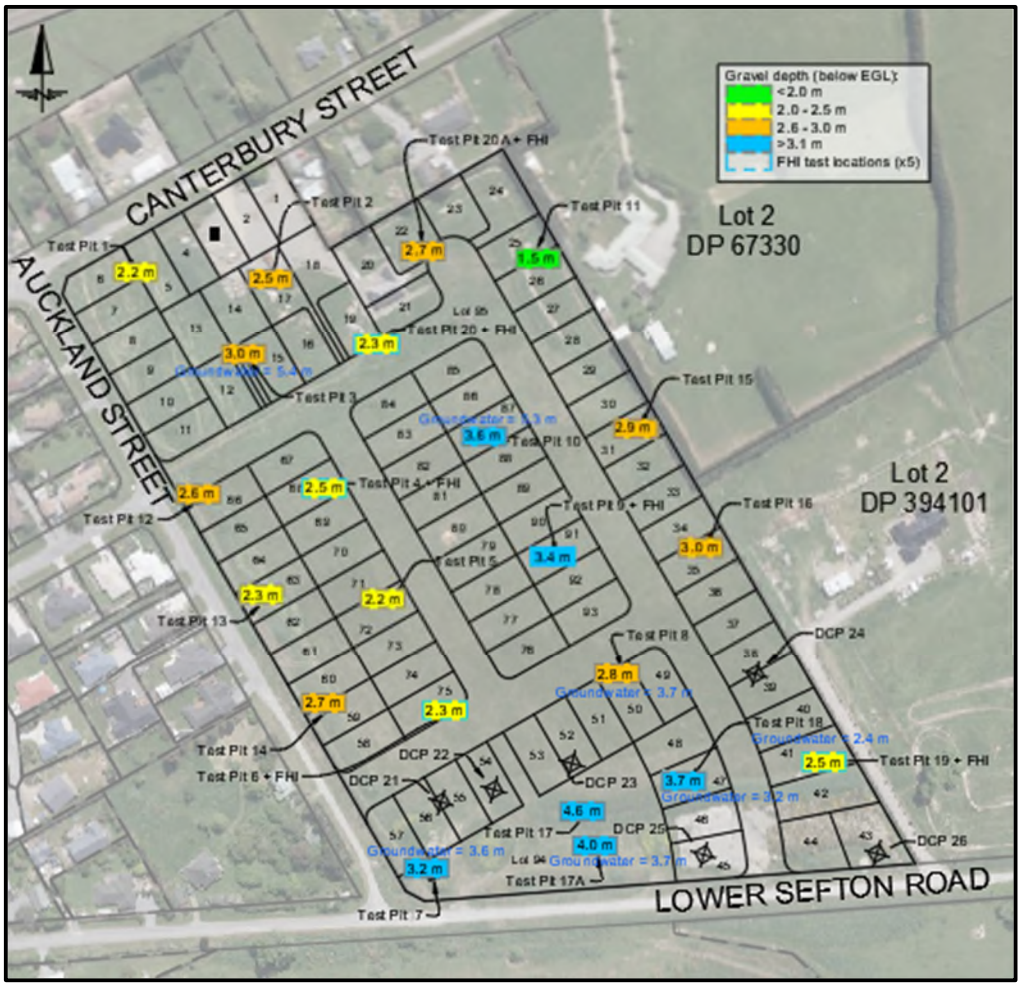


Figure 8: Proposed scheme plan annotated to show the approximate depth to gravel and groundwater (m below EGL) measured in test pit excavations during the site investigation. *Possible seepage encountered at 2.4m depth in TP19.

3.2 Groundwater

As shown in Figure 8, groundwater was encountered in some of the TP excavations at between 2.4 – 5.4 m below EGL, with the median depth being 3.7 m below EGL. Groundwater was encountered at a shallower depth in the south of the site (2.4 – 3.7 m below EGL) compared with measurement in the north (up to 5.4 m below EGL). This is, albeit broadly, consistent with groundwater wells in the area as discussed in Section 2.2. Due to the varied ground level across the site, the depth to water measured below relative ground level broadly reflected changes in topography.

TPs encountered groundwater within the gravel unit. In the south of the site, where the depth to gravel was greater, the initial level of the water strike gradually rose to the lower levels of the overlying silt (and interbedded sand) unit. This is consistent with the observed presence of a gleysol horizon overlying the gravel indicating long-term saturation of the silt.

4.0 INFILTRATION TESTING

Davis Ogilvie conducted falling-head infiltration (FHI) tests at six test pit locations across the site (TP20a, TP4, TP6, TP9 and TP19 & TP20).

FHI tests were conducted by discharging water in the test pit excavated down to the gravel unit. Tests were generally repeated 2 to 3 times to ensure full saturation during testing. The field results of all tests are included in **Appendix D**. Using Horton's empirical equation, FHI parameters derived from the selected field results are summarised in Table 2. These selected results, returned average initial rates of between 1.8 – 3.1 m/hr, and ultimate rates ranged between 0.3 – 0.6 m/hr. It should be noted that given the high infiltration capacity of the gravelly soils, an ultimate plateau rate was not always reached.

TP4, TP19 & TP20 did not show an appreciable drop in water level or did not return sufficient data; these results are not included in Table 2, but the raw data is included in **Appendix D**.

Table 2: Summarised Horton's Equation Infiltration Parameters for TP6, 9 & 20a

	TP6	TP9	TP20a
Test depth (below EGL)	2.7 m	1.7 m	3.7 m
Initial infiltration rate, f_0 (m/hr)	2.4 – 3.6 (mean 3.0)	1.2 – 2.4 (mean 1.8)	1.9 – 5.2 (mean 3.1)
Ultimate infiltration rate, f_c (m/hr)	<0.1 – 0.6** (mean 0.3)	0.1 –0 .5* (mean 0.3)	0.2 – 1.0** (mean 0.6)
Decay Coefficient, k (/hr)	3 – 5** (mean 4)	1 – 4** (mean 3)	1 – 17** (mean 9)

* Figures stated are averages taken from the three infiltration tests undertaken at each TP location.
** Ultimate infiltration rate often not reached due to high infiltration capacity of gravel soils.

5.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

5.1 Design Criteria

In accordance with NZS 1170.5 a site soil class of D (deep or soft soils) shall apply to the site, due to the expected significant depth to bedrock.

5.2 Liquefaction Hazard

Currently the underlying liquefaction hazard at the site is unclassified based on regional hazard map, as discussed in Section 2.3. No deep testing or quantitative liquefaction hazard assessments have been undertaken at the site to date. The following classifications apply to the possible damage as a result of both seismically-induced vertical settlement and lateral spreading.

Observations of the soil materials and groundwater profile at the site based on test pit excavations suggest that northern areas of the site (proposed Lots 1 – 38 and 49 – 93) are considered consistent with a 'Very Low' Liquefaction Vulnerability Category (i.e., liquefaction damage is unlikely)[22], as shown in Figure 9. Observations in the north showed groundwater as generally being confined to the dense underlying gravel unit which is overlain by 2.0 – 3.0 m of stiff silt (excluding topsoil thickness). The saturated gravel is assumed to be sufficiently dense and consistent to resist liquefying under seismic conditions.

TPs 7, 17/17a and 18 within ~50 m of the southern boundary (proposed Lots 39 – 48 and Lot 94) identified gravel at greater depth overlain by soft and wet silts. The soft soils included a ~1.0 m thick silt and sand gley horizon, approximately 3.0 m below EGL. This material indicates groundwater is present at a shallower depth, and the saturated soils overlying gravel are potentially liquefiable.

Based on observations of liquefaction occurrence in Canterbury during the CES[23], a 'crust' thickness greater than 3.5 – 4.0 m overlying a liquefiable unit was found sufficient to prevent liquefaction-induced damage. Measurements in the south of the site show that there may not be a sufficiently thick non-liquefiable cap available in the south of the site to eliminate the risk of liquefaction damage. However, given the thinness of the potentially liquefiable layer and proximity to dense gravels with a 3.0 m thick cap / crust of unsaturated material above, we consider proposed Lots 39 – 48 and Lot 94 in the south to be consistent with a 'Low' Liquefaction Vulnerability Category (i.e., liquefaction damage is unlikely but none to minor ground damage could occur)[22]. This could be confirmed by Cone Penetration Testing (CPT. It is anticipated that Lot 94 will be used for stormwater disposal and for Lots 39 – 48 a suitable building platform and site-specific foundation can be established through Lot specific geotechnical testing.

[22] Ministry of Business, Innovation and Employment (MBIE). Planning and engineering guidance for potentially liquefaction-prone land. Rev 0.1. Dated September 2017.
[23] Bowen, H. J. & Jacka, M. E. (2013) Liquefaction induced ground damage in the Canterbury earthquakes: predictions vs. reality *in* Proceedings 19th NZGS Geotechnical Symposium. Ed. CY Chin, Queenstown.

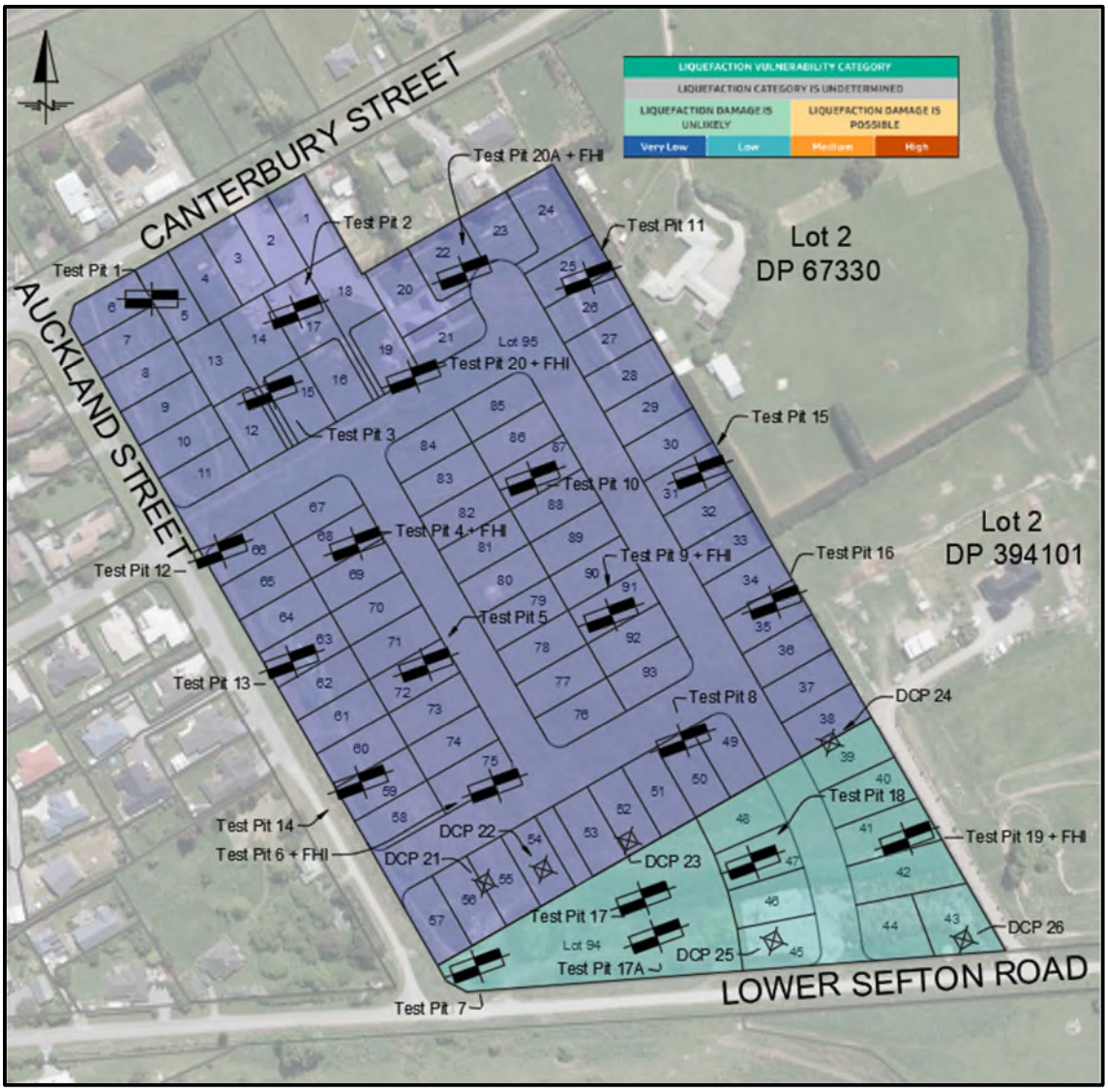


Figure 9: Expected liquefaction vulnerability categories at the site based on subsurface observations. Category extents defined by proposed lot boundaries. Categories based on MBIE (2017)[22].

5.3 Soil Static Ultimate Bearing Capacities and Foundation Recommendations

"Good Ground" is defined by NZS 3604:2011 *(Timber-Framed Buildings*) as any soil or rock capable of permanently withstanding an ultimate bearing capacity (UBC) of 300 kPa, but excludes compressible ground, expansive soils and ground that could foreseeably experience movement, including liquefaction-induced ground movement.

Based on the in-situ DCP testing, a static UBC of 300 kPa is achieved at depths ranging from 0.5 – 2.4 m below EGL, as shown on the map in Figure 10. The maximum depth at which “good ground” has been assigned at the site is ≤0.6 m relative to EGL. This is considered a maximum practical depth where standard (NZS 3604:2011) foundation options are considered suitable. In addition, NZS 3604 states that *"Specific Engineer Design (SED) foundations are required if filling is in excess of 600 mm."* Where the depth to 300 kPa UBC exceeds a depth of 0.6 m below EGL (i.e., below normal foundation depths), an UBC of 200 kPa is recommended with SED for concrete slab foundations. Table 3 summarises the depth to 300 kPa and 200 kPa UBC encountered at the location of the DCP testing. We note, however, that the testing was undertaken during winter and the prevailing weather conditions could have increased the moisture content and softened the near-surface soils. Testing during drier seasons may encounter different results.

Due to the presence of soft near-surface soils, any future development at Lots 39 – 48 is expected to require specific engineering design, observation, and certification for development.

Site-specific geotechnical investigation at building consent stage will be required to determine the depth to UBC at the location of each dwelling. For a building to comply with NZS 3604:2011, all topsoil, organic material, or any other unsuitable material, including non-engineered fill, should be stripped from beneath the building footprint prior to any foundation construction onsite. Recommended foundation options where ‘good ground’ has been achieved include NZS 3604 concrete slab founded on appropriate competent natural soil or engineered fill, or piles founded to a depth where 300 kPa has been achieved for suspended floors.

Should the developer wish to construct gravel pads to be used for construction of house foundation on each lot, testing will be required at the location of the pad to determine the required depth. Any engineered fill placed onsite must be in accordance with NZS 4431:2022.

It should also be noted that although testing revealed relatively consistent subsurface soil conditions, a low density of geotechnical testing has been undertaken (i.e., not lot-specific). The level of testing is considered suitable for general recommendations to assist with the initial consenting phase of the development, however, following earthworks and prior to building consent, site-specific shallow investigation in accordance with NZS 3604:2011 should be undertaken for each lot.

Table 3: Summary of bearing capacities encountered at the site

TP / DCP	Depth to 300 kPa UBC* (below EGL)	'Good Ground' Achieved? (within 0.6 m below EGL)	Depth to 200 kPa UBC** (below EGL)
1	0.6 m	Yes	0.4 m
2	0.7 m	No	0.5 m
3	0.6 m	Yes	0.5 m
4	0.5 m	Yes	0.4 m
5	0.7 m	No	0.5 m
6	0.5 m	Yes	0.4 m
7	1.8 m	No	1.2 m
8	0.5 m	Yes	0.4 m
9	0.5 m	Yes	0.4 m
10	0.6 m	Yes	0.4 m
11	0.9 m	No	0.4 m
12	0.7 m	No	0.6 m
13	0.7 m	No	0.5 m
14	0.5 m	Yes	0.3 m
15	0.6 m	Yes	0.4 m
16	0.7 m	No	0.5 m
17a	2.4 m	No	0.8 m
18	0.5 m	Yes	0.3 m
19	0.6 m	Yes	0.5 m
20	0.6 m	Yes	0.4 m
21***	0.6 m	Yes	0.5 m
22***	0.8 m	No	0.6 m
23***	0.8 m	No	0.6 m
24***	0.5 m	Yes	~0.5 m
25***	1.9 m	No	0.7 m
26***	1.8 m	No	~0.4 m

* 300 kPa UBC based on the definition by NZS 3604 as a minimum of 5 blows/100 mm using the DCP to a depth of twice the foundation width (assumed to be 0.6 m), followed by a minimum of 3 blows/100 mm thereafter.

** 200 kPa UBC based on MBIE Guidance (2012) as a minimum of 2 blows/100 mm.

*** Depth to suitable bearing capacity inferred from DCP only (no test pit excavation confirming appropriate materials).

Figure 10: Map of the proposed development showing the depth 300 kPa (UBC) below EGL encountered across the site.

5.4 Indicative Soil Properties

Estimated soil properties for structural design purposes are provided in Table 4.

Table 4: Estimated Shallow Soil Properties

Soil Description	Unit Weight[24] (γ)	Internal Angle of Friction[25] (ϕ)	Cohesion (c)[24]	Elastic Modulus (E_s)[25]	Modulus of Subgrade Reaction (k_s)[26]
SILT*	16 – 18 kN/m^3	26 – 28°	3 – 5 kPa	8 – 10 MPa	35 – 60 kPa/mm

*Assuming stiff (>3 blows per 100 mm) consistency.

[24] Look, B.G. (2007) Handbook of Geotechnical Investigation and Design Tables, Taylor & Francis Group, London, UK.
[25] Bowles, J.E. (2001) Foundation Analysis and Design, McGraw-Hill International Editions – 5th Edition, Table 2-6 pp108.
[26] Figure 3.1 in NZS 4404:2010

5.5 Civil Infrastructure Recommendations

5.5.1 Preliminary Pavement Design

Based on DCP test of the shallow subgrade soils (silt), and correlations provided in NZS 4404:2010[27], a California Bearing Ratio (CBR) of 4 is recommended for preliminary pavement design.

It must be noted that the silty subgrade soils will be sensitive to moisture variations and all vehicle wheel loads. Excessive moisture or vehicles tracking over the subgrade will have an adverse impact on the subgrade conditions and must be carefully managed during the earthworks phase.

5.5.2 Stormwater Management

It is understood the proposed stormwater management design is to convey stormwater to a stormwater management area on proposed Lot 94.

5.5.3 Wastewater

It is understood wastewater will be piped via a gravity reticulation system to a wastewater pump station on Lot 94.

5.5.4 Earthworks

It is understood that no significant earthworks (cut and fill) are proposed for the site. Earthworks are limited to the removal of existing stockpiles on the site, construction of proposed stormwater ponds and road excavations, individual building pads and buried services / infrastructure.

All engineered filling must be carried out in accordance with the NZS 4431:2022[28].

Important aspects of the fill operation include but are not limited to the following:

- The area on which the fill is to be placed is to be stripped of all vegetation, topsoil, soft, organic, or otherwise unsuitable soils. Topsoil onsite is approximately 0.3 - 0.5 m thick. All stripped subgrade areas are to be inspected by a suitably experienced Geo-professional prior to placing of any fill.
- The engineer is to be notified of all weak soils, soft or organic material, uncontrolled or historic fill.

[27] NZS 4404:2010 Land development and subdivision infrastructure.
[28] NZS 4431:2022 Engineered fill construction for lightweight structures.

- The subgrade surface must be adequately surveyed by the contractor (under the supervision of a Registered Professional Surveyor), and the information provided to Davis Ogilvie.
- The subgrade should be protected from water ponding and from rutting or weaving as a result of vehicle or machine loadings.
- Material to be used as engineered fills must be approved by the Engineer prior to use.
- Target engineered fill Maximum Dry Density (MDD) values (1 per 4,000 m^3 of fill) must be obtained prior to placement of fill and shall be retested in accordance with NZS 4431, or as directed at any stage by the engineer. Fill shall be placed in layers no thicker than 230 mm (un-compacted) and is to be compacted to 95% of its MDD.
- Nuclear Density (ND) testing shall be carried out on every 230 mm layer of filling at max 20 m x 20 m spacing, 400 m^2 to confirm sufficient compaction, or unless otherwise specified by the Engineer. The site location and subject lift of ND tests must be appropriately recorded (e.g., GPS surveyed), and is to be provided along with the test results to Davis Ogilvie.
- The Engineer may undertake additional DCP testing on the compacted engineered fill, as to achieve a minimum 5 blows / 100 mm before the placement of any subsequent lifts of topsoil.
- All filling records are to be provided to the engineer for review and to support the fill certificate and as-built completion report.

6.0 SECTION 106 RESOURCE MANAGEMENT ACT (1991) ASSESSMENT

Section 106 of the Resource Management Act (RMA 1991) requires that the site of a subdivision be assed for potential material damage due to a range of natural hazards. The natural hazards, as defined by the RMA, considered relevant to this site aspects are addressed in Table 5.

Table 5: Resource Management Act Considerations

Natural Hazard	Potential Effects on Developed Site
Erosion	Erosion is not considered a significant risk to the subdivision due to its low level of topographic variation and distance of the site to the active channel of the Ashley River (which is separated from the site by a flood bank). All surface water on the site should be managed to minimise potential erosion and suitable landscaping and stormwater management systems are required to ensure overland flows are controlled to prevent erosion and scouring of surface soils.
Falling Debris	Due to the relatively flat topography of the subdivision and surrounding area, it is considered there is no risk of falling debris impacting the site.

Subsidence	Based on the observed soil types and groundwater profiles across the site, damaging effects on the land as a result of seismically-induced liquefaction (both seismically-induced vertical settlement and lateral spreading) are considered 'Very Low' risk across the area of proposed Lots 1 – 38 and 49 - 93 , and 'Low' risk across the area of proposed Lots 39 - 48 and 94. A risk of static settlement due to bearing capacity failure exists where tests in the shallow soils indicated low ultimate bearing capacity. This risk can be managed by an appropriate level of geotechnical investigation and foundation design on a lot-specific basis. All earthworks filling undertaken across the site is to be carried out in accordance with NZS 4431:2022 to ensure that any settlements are within the SLS limits specified in Appendix B1 of Clause B1 of the Building Code and in Table C1 of NZS 1170.0.
Slippage	Due to the relatively flat topography of the subdivision site, ground slippage (or slope instability) is not anticipated.
Inundation	Reference is made to the Flooding Assessment Memorandum [18]. Numerous flood investigations have been undertaken for the Ashley / Rakahuri River floodplain and there is a good understanding of the flood risk. Given the protection provided by the Ashley / Rakahuri River Control Scheme stopbanks the overall flood hazard risk for 2 Auckland Street, Ashley, is considered very low and no specific flood hazard mitigation measures are likely to be required when constructing dwellings on or servicing the property. Current expectation is that finished floor level for any dwellings constructed on 2 Auckland Street, Ashley will need to be at least 400 mm above undisturbed ground around the dwelling footprint. It is recommended that finished floor level requirements are confirmed with Environment Canterbury and Waimakariri District Council during detailed design of the subdivision

6.1 Section 106 Summary

As indicated in Table 5, the southern section of the site is at risk of subsidence from static settlement due to low bearing pressures to significant depth and at a low risk of liquefaction induced settlement. However, it is determined that the site is suitable for subdivision into 93 residential lots under Section 106 of the RMA because the risk of subsidence to Lots 39 to 48 can be mitigated or managed to an acceptable level (with Lot 94 vested as a stormwater reserve). This will involve specific engineering design, observation and certification, should any structures be planned for those lots in future. We note that site-specific geotechnical investigation will be required on each lot to determine the depth to suitable bearing and enable appropriate foundation design at building consent stage.

A Statement of Professional Opinion on the Suitability of Land for Building Construction is included in **Appendix E**. The subdivision into 93 residential lots (plus two roads and one stormwater reserve in Lot 94) may proceed subject to the following conditions:

- Site-specific geotechnical investigation at building consent stage will be required to determine the depth to an appropriate bearing capacity at the location of each dwelling;

- Finished floor levels are confirmed during the consenting process by WDC and / or ECan;
- Specific engineering design, observation and certification will be required on proposed Lots 39 – 48 to address the reduced bearing capacity and possible low liquefaction risk identified in this area. This also applies to Lot 94 should the use change from stormwater reserve to residential development.

7.0 CONCLUSIONS

A geotechnical investigation was undertaken to investigate the underlying ground conditions, assess natural hazards, and provide recommendations regarding residential foundations and civil infrastructure to support a subdivision consent application for 93 proposed residential lots.

Davis Ogilvie oversaw the excavation of 22 Test Pits and 26 Dynamic Cone Penetrometers. The shallow soil profile generally consisted of a 0.3 – 0.5 m topsoil layer over a unit of soft to hard silt which ranged from 1.1 to 3.7 m thick, then dense silty and sandy gravel. Groundwater was encountered at between 2.4 – 5.4 m below EGL. Observation of the soil and groundwater conditions indicates that vertical settlement as a result of liquefaction is unlikely, and a liquefaction vulnerability risk of 'very low' to 'low' is considered appropriate.

Based on the in-situ DCP testing, a static UBC of 300 kPa was achieved at depths ranging from 0.5 – 2.4 m below EGL. The maximum depth at which "good ground" has been assigned at the site is ≤0.6 m above which standard (NZS 3604:2011) foundation options are considered suitable. Recommended foundation options where "good ground" has been achieved include NZS 3604 concrete slab founded on appropriate competent natural soil or engineered fill, or piles founded to a depth where 300 kPa has been achieved for suspended floors. Where the depth to 300 kPa UBC exceeds 0.6 m below EGL, an UBC of 200 kPa is recommended with SED for concrete slab foundations.

A flood hazard assessment recently prepared by Environment Canterbury for 2 Auckland Street stated the following:

"Environment Canterbury Rivers engineering staff have reviewed the Ashley / Rakahuri River control scheme at this location. This included consideration of overtopping and lateral erosion failures for events with an ARI of up to 500 years, including increases to flow from climate change. Based on currently available information, stopbank breaches which would affect the proposed development are possible, but have a less than 10% chance of occurring during 200 and 500 year ARI flood events."

All earth filling must be carried out in accordance with NZS 4431:2022, and will require engineering certification prior to residential construction. Road pavement design may adopt a preliminary subgrade CBR value of 4, which will require conformation testing on site during the earthworks phase. Falling Head Infiltration testing in the underlying gravelly soils returned average initial rate between 1.8 – 3.1 m/hr, and ultimate rates ranged between 0.3 – 0.6 m/hr.

The site is considered suitable for residential development under Section 106 of the Resource Management Act (1991) in regards to natural hazards, subject to the following conditions:

- Site-specific geotechnical investigation at building consent stage will be required to determine the depth to an appropriate bearing capacity at the location of each dwelling;
- Finished floor levels are confirmed during the consenting process by Waimakariri District Council and/or Environment Canterbury;
- Specific engineering design, observation and certification will be required on proposed Lots 39 – 48 and 94 to address the reduced bearing capacity and possible low liquefaction risk identified in this area.

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

MEMORANDUM

Project:	2 Auckland Street, Ashley	**Author:**	Ian Lloyd
Job No.:	37211	**Date:**	V1 – 02/02/2024
Subject:	Flooding Assessment - 2 Auckland Street, Ashley		
Issued To:	Peter Glasson (Davis Ogilvie Ltd.)		
Copies To:	Alistair Cameron (property owner), Samatha Webb and Clem Maloney (Davis Ogilvie Ltd.)		

1.0 BACKGROUND

Mr Alistair Cameron owns an approximately semi-rectangular 8 ha property at 2 Auckland Street, Ashley, Legal Description: Lot 1 DP 394101. The property is largely undeveloped grassland and contains a relocated dwelling, a storage yard and various stockpiles of gravel and soil material. Mr Cameron wishes to develop the property into a residential subdivision. The property is within the Waimakariri District and is currently zoned Rural under the operative Waimakariri District Plan, but is zoned Rural Lifestyle Zone (RLZ) under the Proposed Waimakariri District Plan (PWDP). In his submission on the PWDP Mr Cameron seeks to change the proposed zoning from Rural Lifestyle Zone (RLZ) to Settlement Zone ("SETZ") which would allow a higher density of residential development.

The purpose of this memorandum is to provide a preliminary flood assessment for the property to support the rezoning request by Mr Cameron in his submission on the PWDP.

2.0 THE PROPERTY AND THE HYDROLOGICAL SETTING

The property (2 Auckland Street, Ashley) is located on the floodplain of the Ashley / Rakahuri River on the true left bank at the downstream (eastern) edge of the Ashley township (Figure 1). The active channel of the Ashley / Rakahuri River is approximately 320 m south of the site, and is separated from the site by a stopbank which is part of Environment Canterbury's Ashley / Rakahuri River Control Scheme and Lower Sefton Road. The property is generally flat to undulating, with a gentle overall slope towards the southeast. The site predominantly drains to Saltwater Creek with two unnamed tributaries / drains of Saltwater Creek present on the site (Figure 2). The northern of these two unnamed tributaries / drains has been diverted around the boundary of the property although some drainage still occurs via the old channel. A small area in the south-western corner of the site drains to an unnamed tributary / drain of the Ashley / Rakahuri River which flows via a culvert fitted with a flap gate, under the Ashley River stopbank (Figure 2).

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

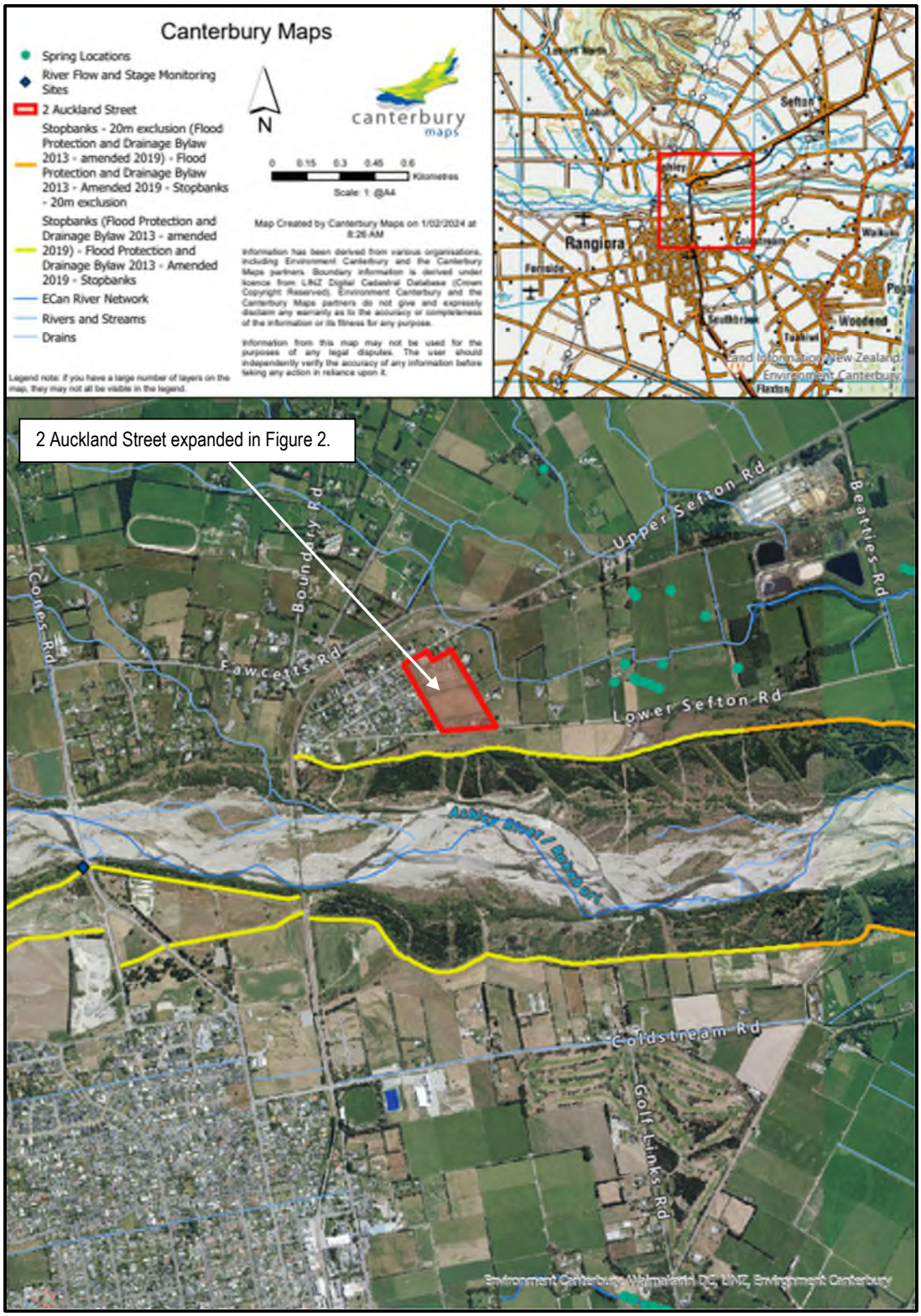


Figure 1: 2 Auckland Street, Ashley – location map showing key hydrological features.

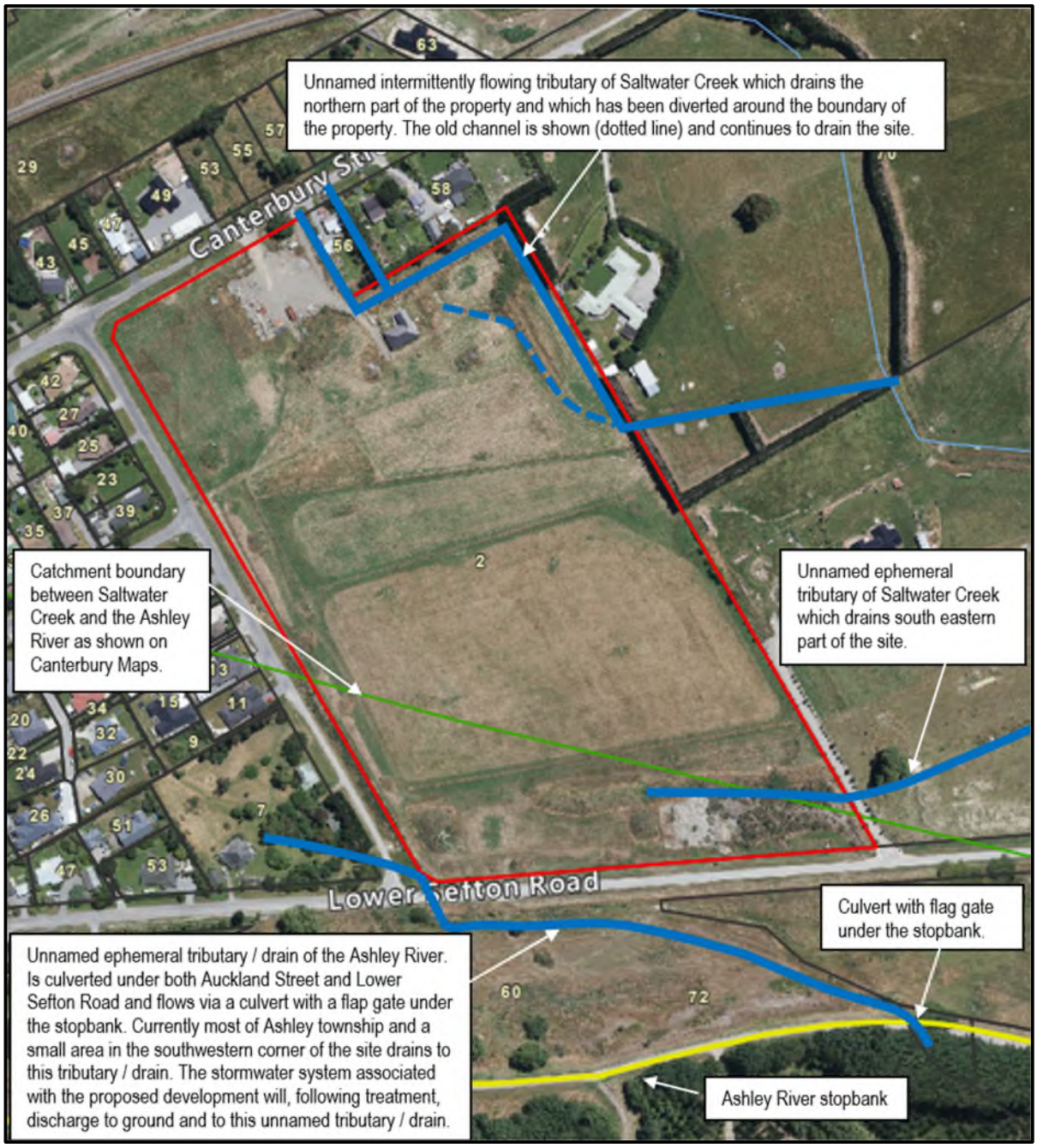


Figure 2: 2 Auckland Street, Ashley – onsite hydrological features.

3.0 FLOODING ASSESSMENT

When assessing flooding risk at 2 Auckland Street, Ashley there is need to assess both the potential for flooding from the Ashley / Rakahuri River and local flooding associated with the unnamed tributaries / drains that cross or border the site. Both of which are discussed in turn below.

3.1 Ashley / Rakahuri River flooding

Environment Canterbury operates the Ashley / Rakahuri River Control Scheme which includes stopbanks which run along both banks of the river in the vicinity of the site and are designed to protect Rangiora to the south and Ashley to the north from flooding from the Ashley / Rakahuri River. Numerous flood investigations have been undertaken for the Ashley / Rakahuri River floodplain the most recent of which was undertaken in 2016[1] and updated earlier work[2].

A flood hazard assessment recently prepared by Environment Canterbury for 2 Auckland Street (copy in **Attachment A**) stated the following:

Environment Canterbury Rivers engineering staff have reviewed the Ashley / Rakahuri River control scheme at this location. This included consideration of overtopping and lateral erosion failures for events with an ARI of up to 500 years, including increases to flow from climate change. Based on currently available information, stopbank breaches which would affect the proposed development are possible, but have a less than 10% chance of occurring during 200 and 500 year ARI flood events.

The Environment Canterbury's flood hazard assessment concluded that:

Given the assessed standard of protection offered by the river control scheme at this location, the proposed development is not considered a high (flood) *hazard area.*

Waimakariri District Council (WDC) have completed flood modelling[3] for all the district other than Lees Valley and the resulting flood and hazard maps are available at WDC's website https://waimakariri.maps.arcgis.com/apps/instant/portfolio/index.html?appid=c6bc05f87d4f47ecae975e5241657913. The map for flood depths during a 1:200 Year (0.5% AEP) Ashley Breakout scenario (Figure 3) indicates that the river is not expected to breach the stopbanks which protect Ashley township in the vicinity of the site. The modelling investigations indicated that breakouts through the stopbanks are more likely to occur to the south (towards Rangiora) or closer to the coast.

[1] Environment Canterbury, 2026. *Ashley River Floodplain investigation – 2016 update*. Environment Canterbury report number R16/36 prepared by T Oliver and M Wild, dated July 2016.
[2] Earlier work includes the following key investigations.
- Environment Canterbury, 2008. *Ashley Floodplain Hazard Risk Assessment*. Environment Canterbury report number R08/1 prepared by T Boyle and M Surman, dated January 2008.
- Environment Canterbury, 2008. *Waimakariri District flood hazard management strategy – Ashley River floodplain.* Environment Canterbury report number R08/23 prepared by T Oliver, dated June 2008.
- Griffiths, G; Pearson, C; McKerchar, A. 2009: *Review of Ashley River flood frequency at Rangiora Traffic Bridge*. NIWA Client report CHC2009-103, prepared for Environment Canterbury, dated July 2009.

[3] Waimakariri District Council (WDC) 2015: *Localised flood hazard assessment 2015*. Project Delivery Unit (PDU) Project Number PD000362. Published July 2015. Document Number 150410056887.

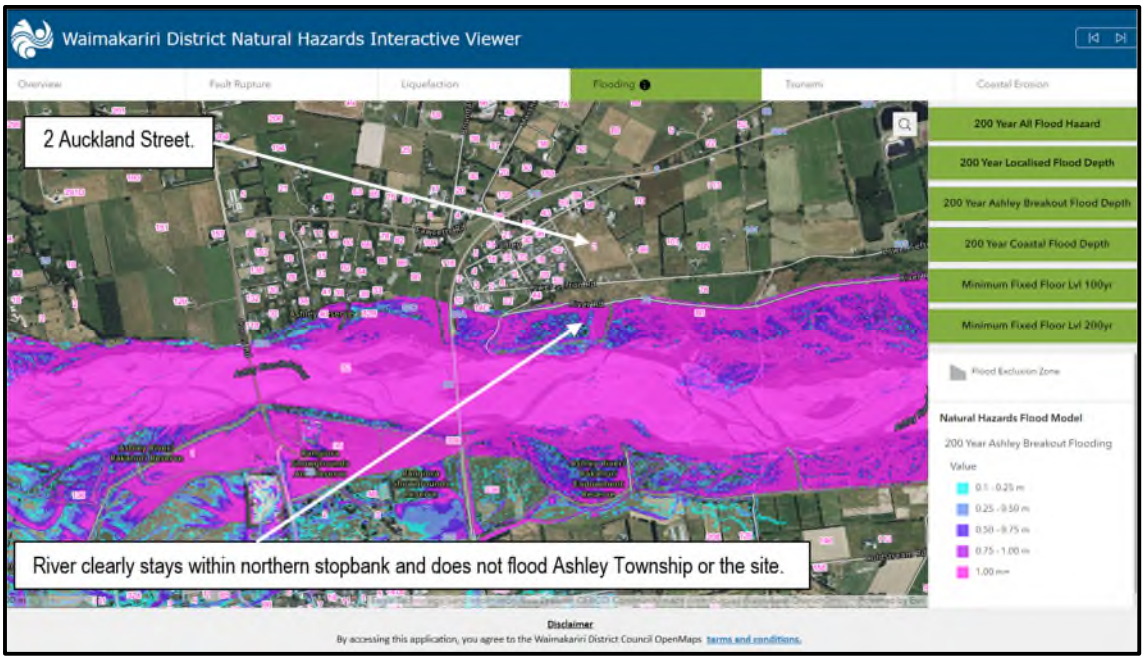


Figure 3: Waimakariri District Flood Map showing flood depth for a 1:200 Year Ashley Breakout scenario. (Base figure from WDC's website sourced 1 February 2024.)

3.2 Local flooding from unnamed watercourses

As outlined above, three small tributaries / drains cross or border the site. Two drain to Saltwater Creek while the other drains to the Ashley River via a culvert under the stopbank. The stopbank culvert is fitted with a flap gate which will prevent flood waters in the Ashley / Rakahuri River from backing up through the culvert. When the flap gate is closed due to floods in the Ashley / Rakahuri River, local runoff will pond on the upgradient side of the culvert and stopbank. The area upstream of the stopbank culvert between it and Lower Sefton Road is undeveloped grazing land, the lower reaches of which are known to occasionally become inundated. LiDAR data[4] indicates that from where the unnamed tributary / drain crosses Lower Sefton Road it falls approximately 1.3 m to the stopbank over a length of approximately 260 m.

Mr Cameron who has owned the property since 12 October 1995 (approximately 28 years) indicated that he was not aware of any flooding events or issues that have affected the site.

WDC's 1:200 Year (0.5% AEP) Localised Flood Depth map which excludes a breakout from the Ashley / Rakahuri River indicates that the site is expected to experience limited flooding during a 1:200-year event with flooding expected to be limited to topographically low points across the site (Figure 4). Similarly, WDC's 1:200 Year (0.5% AEP) All Flood Hazard map indicates that the majority of the site has a very low flood hazard with only a few small areas identified as having a low flood hazard (Figure 5).

[4] Scaled off LIDAR Map supplied by Environment Canterbury and contained in **Attachment A**. Also checked using the elevation tool available on Canterbury Maps.

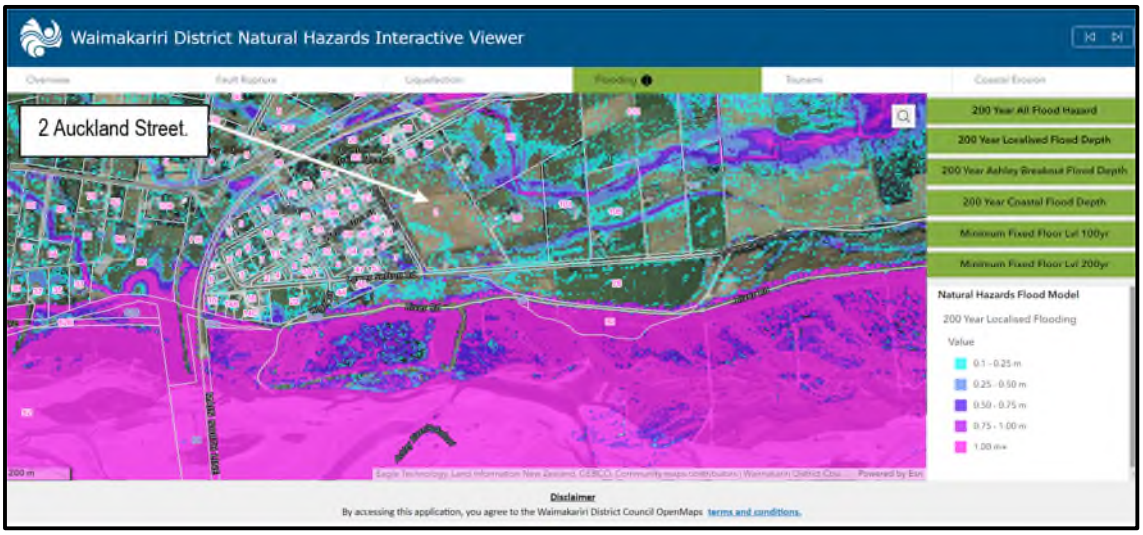


Figure 4: Waimakariri District Flood Map showing flood depth for a 1:200 Year Localised Flooding scenario. (Base figure from WDC's website sourced 1 February 2024.)

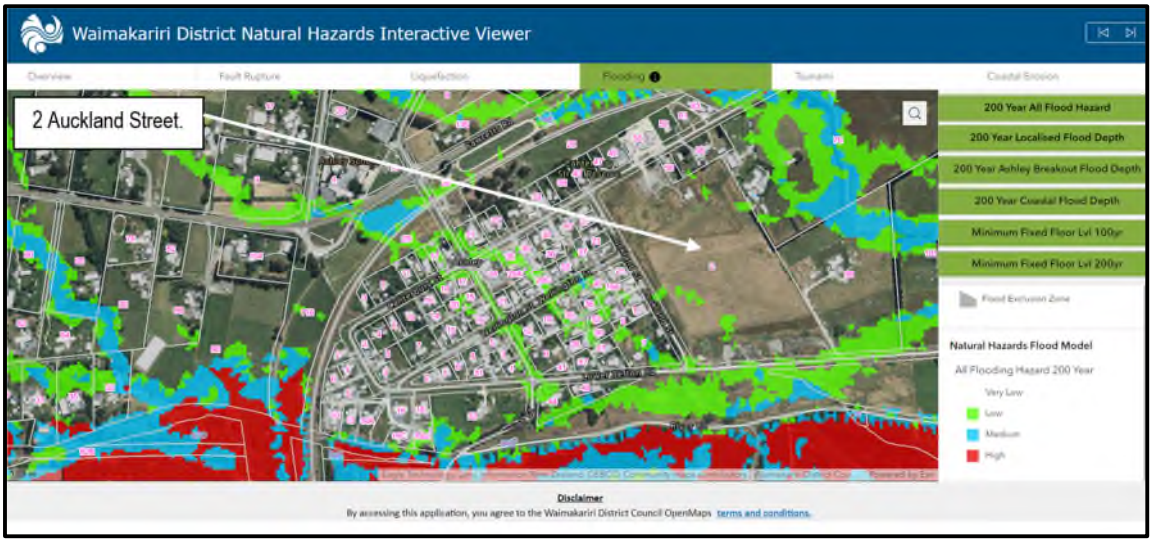


Figure 5: Waimakariri District Flood Hazard Map showing the 1:200 Year all Flood Hazard. (Base figure from WDC's website sourced 1 February 2024.)

3.3 Floor Levels

During communications with WDC staff in July 2020 regarding floor level requirements for 2 Auckland Street, WDC staff indicated the following:

The minimum Finished Floor Level (FFL) for a proposed dwelling site at 2 Auckland Ashley (Lot 1 DP 394101) is to be set no lower than 400mm above undisturbed ground at any point intersecting the building footprint and outside Councils mapped 0.5 % AEP (1 in 200 year) Flood Hazard Areas.

Full communications with WDC are also included in **Attachment B.**

4.0 SUMMARY AND RECOMMENDATIONS

Ashley township including 2 Auckland Street lies on the floodplain of the Ashley / Rakahuri River. When assessing flooding risk at the site there is need to assess both the potential for flooding from the Ashley / Rakahuri River and local flooding associated with the unnamed tributaries / drains that cross or border the site.

Numerous flood investigations have been undertaken for the Ashley / Rakahuri River floodplain and there is a good understanding of the flood risk. Given the protection provided by the Ashley / Rakahuri River Control Scheme stopbanks the overall flood hazard risk for 2 Auckland Street, Ashley, is considered very low and no specific flood hazard mitigation measures are likely to be required when constructing dwellings on or servicing the property.

Current expectation is that finished floor level for any dwellings constructed on 2 Auckland Street, Ashley will need to be at least 400 mm above undisturbed ground around the dwelling footprint. It is recommended that finished floor level requirements are confirmed with Environment Canterbury and Waimakariri District Council during detailed design of the subdivision.

5.0 CONCLUDING COMMENT

We trust the above comments provide a suitable flood hazard assessment for 2 Auckland Street, Ashley. If you have any queries, please do not hesitate to contact the undersigned.

Yours faithfully,

DAVIS OGILVIE & PARTNERS LTD.

IAN LLOYD
Principal Water Engineer
MSc (Environmental Science), BE (Civil), BSc (Geology)

Email: ian@do.nz

ATTACHMENT A - Environment Canterbury's Flood Hazard Assessment letter for 2 Auckland Street, Ashley, dated 21 December 2023

ATTACHMENT B - Waimakariri District Council Email Communications regarding finished floor levels at 2 Auckland Street, Ashley, dated 30 July 2020

ATTACHMENT A

Environment Canterbury's Flood Hazard Assessment letter for 2 Auckland Street, Ashley, dated 21 December 2023

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140
P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz
www.ecan.govt.nz

21st December 2023

Peter Glasson
peterg@do.nz

Dear Peter

LOT 1 DP 394101 – 2 AUCKLAND STREET, ASHLEY

Flood Hazard

The proposed development is on the floodplain of the Ashley River / Rakahuri and may also be susceptible to flooding from local rainfall runoff.

Enclosed is a LiDAR map showing ground levels across the property. LiDAR is an airborne laser system that surveys ground topography. When compared to known survey points, the data has an accuracy of ± 150 mm or better. The ground levels, surveyed in 2019, are presented in meters – NZVD2016.

Waimakariri District Council has completed rain-on-grid flood modelling for the majority of the district. This modelling includes 100, 200, and 500 year average recurrence interval (ARI) events. Results of this modelling shows some limited rainfall runoff flooding across the property. Mapped results of this modelling are available here:

https://apps.canterburymaps.govt.nz/FloodModelResults/?extent=1566815.9098%2C5208014.1824%2C1569109.0207%2C5209054.4426%2C2193

Environment Canterbury Rivers engineering staff have reviewed the Ashley / Rakahuri River control scheme at this location. This included consideration of overtopping and lateral erosion failures for events with an ARI of up to 500 years, including increases to flow from climate change. Based on currently available information, stopbank breaches which would affect the proposed development are possible, but have a less than 10% chance of occurring during 200 and 500 year ARI flood events.

Chapter 11 of the Canterbury Regional Policy Statement (CRPS) provides a framework for managing natural hazard risk in Canterbury. Policy 11.3.1 of this document seeks to avoid new subdivision, use, and development in 'High Hazard' areas. These are defined as areas where the water depth is greater than 1 m (or where the water depth (m) x velocity (m/sec) is greater than 1) in a 500 year ARI flood event. The primary aim of this policy is to minimise the risk to life associated with deep and/or fast moving floodwaters. Given the assessed standard of protection offered by the river control scheme at this location, the proposed development is not considered a high hazard area.

Policy 11.3.2. of the Canterbury Regional Policy Statement states that development should be avoided in areas subject to inundation in a 200 year ARI flood event unless a range of conditions are met. These include the requirement for new buildings to have floor levels above the 200 year ARI design flood level. While no onsite mitigation of river breakouts is necessary to meet the CRPS requirements, rainfall runoff and stormwater will still need to be considered. A combination of stormwater design, earthworks, and possibly raised floor levels will allow the CRPS requirements to be met.

When using the information provided in this letter, it is important that the following points are understood:

- The information is limited to what Environment Canterbury currently has available. The District Council or local residents may have further information about flooding at the property.
- Environment Canterbury's understanding of flooding at the property may change in the future as further investigations are carried out and new information becomes available.
- It is assumed that flood protection works will be maintained to at least their current standard in the future.
- Stopbank failure can occur at flows less than the design standard, and the location of bank failure/overtopping may affect flood depths/levels at the property.
- Flood flow paths and depths/levels can be affected by changes on the floodplain such as:
  - Earthworks, road alterations, and irrigation structures
  - Property development including buildings, fencing, and hedges
  - Blockages in culverts, drains, and bridges
  - Seasonal vegetation growth
  - Antecedent soil conditions

The prediction of flood depths/levels requires many assumptions and is not an exact science.

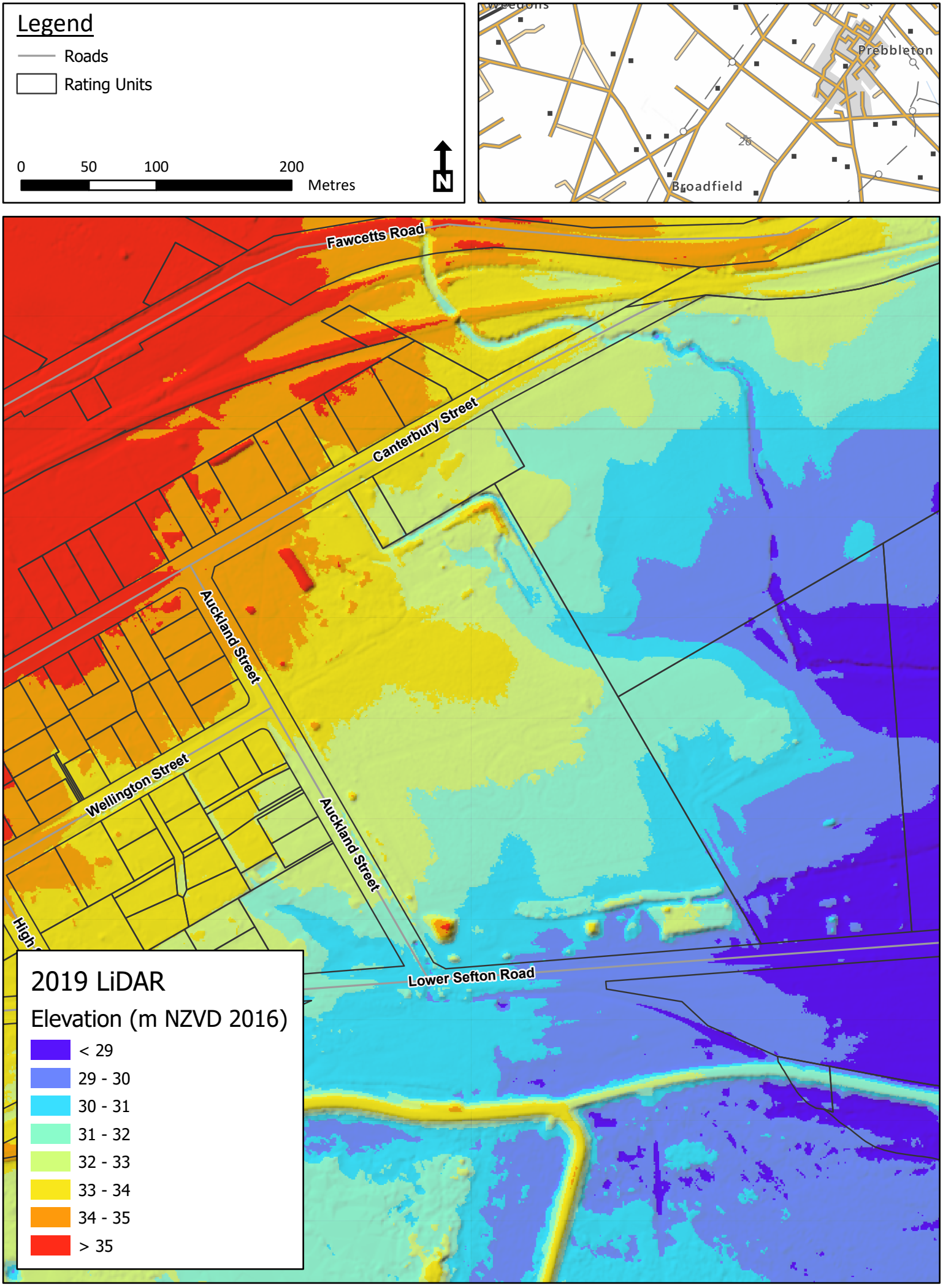
Yours sincerely

Callum Margetts

Scientist (Natural Hazards)

Encl. 2019 LiDAR Map

2 Auckland Street, Ashley - LiDAR Map



ATTACHMENT B

Waimakariri District Council Email Communications regarding finished floor levels at 2 Auckland Street, Ashley, dated 30 July 2020

From: Subdivision Eng <subdivisioneng@wmk.govt.nz>
Sent: Thursday, 30 July 2020 9:23 a.m.
To: Hamish Cattell
Subject: RE: SUBDIVENG 2 Auckland Street, Ashley (Lot 1 DP 394101) - Finished floor level requirements

Hi Hamish

Green = Low risk of inundation
Blue = Medium risk of inundation
Red = High risk of inundation

As a general rule of thumb, we work to 400mm above undisturbed ground in a "clear" area, 600mm above undisturbed ground in a green area, 900mm above undisturbed ground in a blue area, and we don't really like people building in red area.

In reality – once we learn the location of a potential dwelling, we can work out the max flood depth and then, 400mm above max flood depth in Green areas and 500 above max flood depth in blue areas, although Council preference would be to avoid these areas if at all practicable.

If an area is identified as being subject to Ashley Breakout – we ask that the applicant gets a FFL from Ecan in the first instance, and we will work to either their level or Council level whichever is the greater.

Kind regards

Debbie Wilson | **Land Development Officer**
Project Delivery Unit
Phone: 0800 965 468 (0800 WMK GOV)
Mobile: 027 322 2338

From: Hamish Cattell <hamishc@do.nz>
Sent: Thursday, 30 July 2020 9:01 AM
To: Subdivision Eng <subdivisioneng@wmk.govt.nz>
Subject: RE: SUBDIVENG 2 Auckland Street, Ashley (Lot 1 DP 394101) - Finished floor level requirements

Thank you.

Can you please confirm the hazard levels of the map colour contours (green, blue and red).

Thank you.

Hamish

HAMISH CATTELL / Engineering Geologist / hamishc@do.nz /

DAVIS OGILVIE & PARTNERS LTD
ENGINEERS / SURVEYORS / PLANNERS

03 366 1653 / 0800 999 333 / www.do.nz
Level 1, 24 Moorhouse Ave, Addington / P O Box 589, Christchurch 8140

Offices in Christchurch, Nelson, Greymouth and Timaru

From: Subdivision Eng [mailto:subdivisioneng@wmk.govt.nz]
Sent: Thursday, 30 July 2020 8:25 a.m.
To: Hamish Cattell
Cc: Subdivision Eng
Subject: SUBDIVENG 2 Auckland Street, Ashley (Lot 1 DP 394101) - Finished floor level requirements

Good Morning Hamish

Apologies for the delay in replying.

Please find attached the 1 in 200 year flood hazard mapping for 2 Auckland Street, Ashley.

Council Draft Technical Practice note requires the following as a guide to FFL.

The minimum Finished Floor Level (FFL) for a proposed dwelling site at 2 Auckland Street, Ashley (Lot 1 DP 394101) is to be set no lower than 400mm above undisturbed ground at any point intersecting the building footprint and outside Councils mapped 0.5& AEP (1 in 200 year) Flood Hazard Areas.

Hope this helps

Kind regards

Debbie Wilson | **Land Development Officer**
Project Delivery Unit
Phone: 0800 965 468 (0800 WMK GOV)
Mobile: 027 322 2338

From: Hamish Cattell <hamishc@do.nz>
Sent: Thursday, 30 July 2020 8:04 AM
To: Subdivision Eng <subdivisioneng@wmk.govt.nz>
Subject: FW: 37211 - 2 Auckland Street, Ashley - Finished floor level requirements

Good morning,

Can you please provide me with the latest flood hazard information (and any finished floor level requirements) for 2 Auckland Street, Ashley.

Thank you.
Hamish

HAMISH CATTELL / Engineering Geologist / hamishc@do.nz /

DAVIS OGILVIE & PARTNERS LTD
ENGINEERS / SURVEYORS / PLANNERS

03 366 1653 / 0800 999 333 / www.do.nz
Level 1, 24 Moorhouse Ave, Addington / P O Box 589, Christchurch 8140

Offices in Christchurch, Nelson, Greymouth and Timaru

Davis Ogilvie is proud to be carboNZero certified. Please don't print unless necessary.

APPENDIX B

Geotechnical Site Plan

Test locations are approximate (scaled and aligned using aerial imagery).
Aerial image obtained from Canterbury Maps
Boundaries are taken from Quickmap and are indicative only.
Proposed lots taken from DO drawing GM37095 101A dated 09/2020.

0m 50m 100m 150m 200m 250m

Scale 1:2500

A	08/20	Geotechnical Report Diagram	HC
/ issue	/ date	/ reason	/ approved

CAD ref: 37905.200617.Geotechnical Site Plan G01A

DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

Davis Ogilvie & Partners Ltd - Ph. 0800 999 333

Geotechnical Site Plan
Auckland Street Subdivision
Lot 1 DP 394101

/ design	/ drawn	/ QA check	/ dwg
AB+HC	KL	HC	G01
/ scale @ A4	/ date	/ file	/ issue
1:2500	08/20	37211	A

APPENDIX C

Test Pit and Dynamic Cone Penetrometer Logs

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 01

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

Test Pit at DCP 01

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

DEPTH (m)	STRATA DESCRIPTION	USCS
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.40m]	TS
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [1.80m] 0.5m: SV: 66/22 0.6m: SV: 102/25 0.8m: SV: 196+ 1.3m: Colour change to orangey brown. Soil becomes hard and wet with an increase in sand content.	ML
2.3	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.60m]	GW
2.8	Test Pit terminated at 2.80m - Target depth achieved.	

Graphic Log

Water Table: Groundwater Not Encountered

BLOWS / 100 mm

DCP 01

DEPTH (m)	Blows / 100 mm
0.0	1
0.1	1
0.2	2
0.3	3
0.4	4
0.5	5
0.6	6
0.7	7
0.8	8
0.9	9
1.0	9
1.1	9
1.2	9
1.3	9
1.4	9
1.5	> 11
1.6	> 13
1.7	> 14
1.8	> 17
1.9	> 16
2.0	> 19
2.1	> 21
2.2	> 26

Logged By:	AB+HC	**Notes:**	Shear vane (SV): peak/remoulded (kPa)
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 02

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

DEPTH (m)	STRATA DESCRIPTION Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005 **Test Pit at DCP 02**	USCS	Graphic Log	Water Table	BLOWS / 100 mm DCP 02	DEPTH (m)
0.0	Sandy GRAVEL; dark grey. Wet, well graded (FILL). [0.20m]	FILL		Groundwater Not Encountered		0.0
	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (BURIED TOPSOIL). [0.30m]	TS			11	
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [2.00m]	ML				0.5
1.0	1.0m: Becomes hard.				13	1.0
					12	
	1.3m: Colour change to orangey brown. Becomes wet with an increase in sand content.				14	
1.5					15	1.5
					14	
					16	
2.0					17	2.0
					21	
					24	
2.5	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.30m]	GW			30	2.5
	Test Pit terminated at 2.80m - Target depth achieved.					
3.0						3.0
3.5						3.5
4.0						4.0
4.5						4.5
5.0						5.0

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KL		
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № / **37211**
Test № / **DCP 03**

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 03

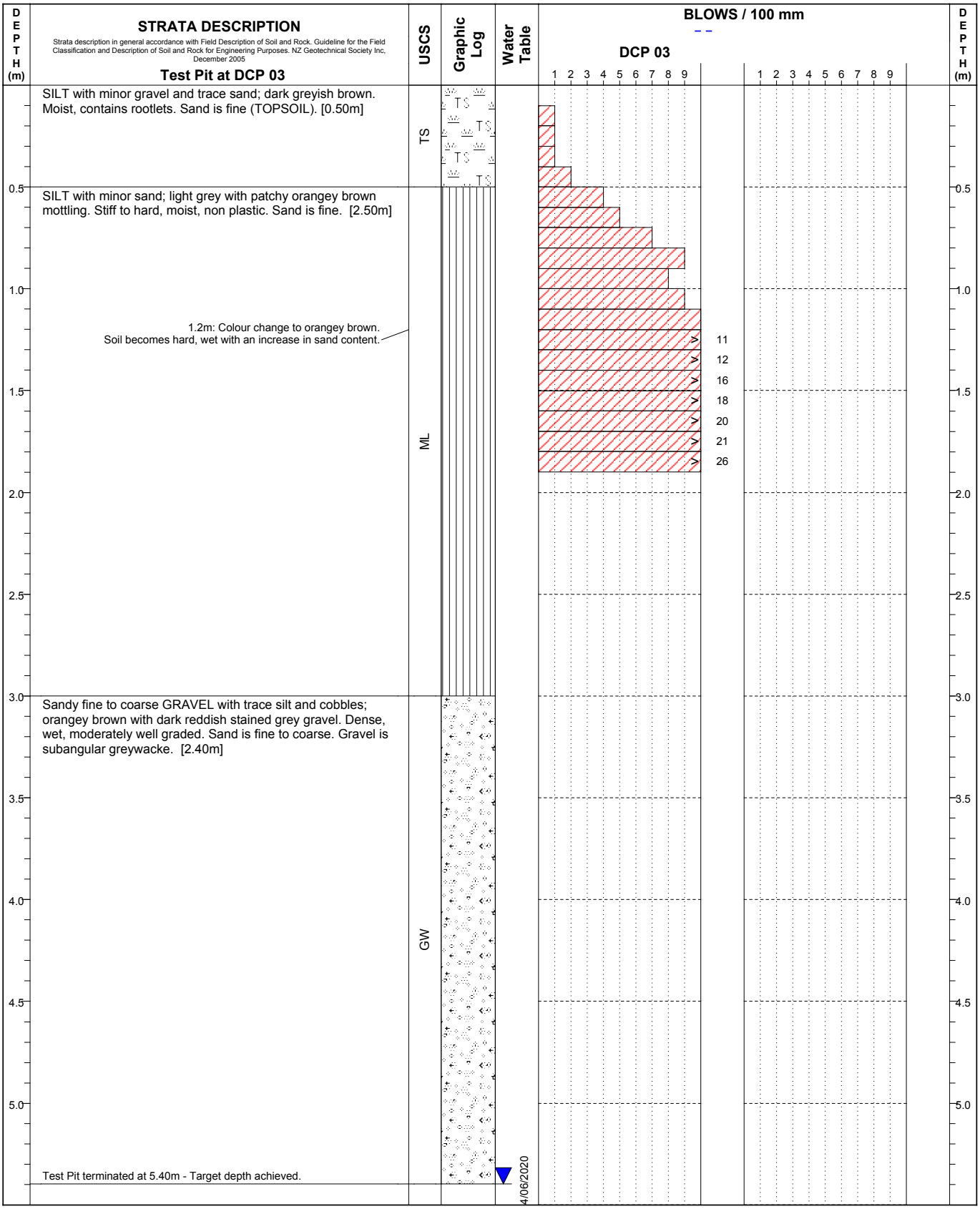
SILT with minor gravel and trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.50m]

SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [2.50m]

1.2m: Colour change to orangey brown. Soil becomes hard, wet with an increase in sand content.

Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [2.40m]

Test Pit terminated at 5.40m - Target depth achieved.



Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.
Plotted By:	KL		Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 04

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 04

SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m] — TS

SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [2.20m] — ML

0.5m: SV: 107/21
0.6m: SV: 157/39
0.7m: SV: UTP

1.0m: Colour change to orangey brown. Becomes wet with an increase in sand content.

1.3m: Becomes hard.

Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [1.40m] — GW

Test Pit terminated at 3.90m - Target depth achieved.

Groundwater Not Encountered

DCP 04

BLOWS / 100 mm

Depth (m)	Blows / 100 mm
0.5	11
1.0	13
1.5	17
2.0	16
2.5	22
3.0	30

Logged By:	AB+HC	**Notes:**	Shear vane (SV): peak/remoulded (kPa) Unable to penetrate with SV (UTP) IT3 = TP4
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № / **37211**
Test № / **DCP 05**

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 05

DEPTH (m)	Strata Description	USCS	Graphic Log
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.35m]	TS	
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Soft to hard, moist, non plastic. Sand is fine. [1.85m]	ML	
1.0	1.3m: Colour change to orangey brown. Soil becomes hard and wet with an increase in sand content.		
1.5	1.7m: Becomes very stiff.		
2.0			
2.5	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.90m]	GW	
3.0	Test Pit terminated at 3.10m - Target depth achieved.		
3.5			
4.0			
4.5			
5.0			

Water Table: Groundwater Not Encountered

BLOWS / 100 mm

DCP 05

DEPTH (m)	Blows / 100 mm
0.0	1
0.1	2
0.2	3
0.3	4
0.4	5
0.5	6
0.6	7
0.7	8
0.8	9
0.9	> 11
1.0	> 14
1.1	> 17
1.2	> 19
1.3	> 22
1.4	> 24
1.5	> 26

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KL		
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № / **37211**
Test № / **DCP 06**

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	10/07/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 06

DEPTH (m)	Strata Description	USCS	Graphic Log
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.40m]	TS	
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [1.90m]	ML	
	0.6m: Becomes very stiff.		
1.0	1.0m: Colour change to orangey brown. Soil becomes wet with an increase in sand content.		
1.5	1.5m: Becomes hard.		
2.0			
2.5	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.70m]	GW	
3.0	Test Pit terminated at 3.00m - Target depth achieved.		
3.5			
4.0			
4.5			
5.0			

Water Table: Groundwater Not Encountered

BLOWS / 100 mm

DCP 06

DEPTH (m)	Blows / 100 mm
0.0	
0.5	11
	11
1.0	
1.5	15
	18
2.0	22
	24
2.5	24
3.0	
3.5	
4.0	
4.5	
5.0	

Logged By: AB+HC

Plotted By: KL

Checked By:

Notes:

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job Nº / **37211**
Test Nº / **DCP 07**

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

DEPTH (m)	STRATA DESCRIPTION Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005 **Test Pit at DCP 07**	USCS	Graphic Log	Water Table
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]	TS		
0.5	Interbedded Sandy SILT and silty fine SAND; orangey brown. soft to hard (to loose to dense), wet. [2.90m] 0.6m: SV: 196+ 0.7m: UTP 0.8m: Becomes soft.	ML		
1.5	1.7m: Becomes stiff.			
2.0	2.2m: Becomes very stiff to dense.			
3.5	SILT with minor sand and trace clay; bluish grey. Very soft, saturated, low plasticity. Interbedded with fine sand beds. Unit has wet 'puggy' appearance and consistency. [0.80m]	ML		24/06/2020
4.0	Fine to coarse GRAVEL with some sand; grey. Dense, saturated, poorly graded. Sand is fine to coarse. [0.30m]	GP		
4.3	Test Pit terminated at 4.30m - Target depth achieved.			

BLOWS / 100 mm

DCP 07

1 2 3 4 5 6 7 8 9 | 1 2 3 4 5 6 7 8 9

14

Logged By:	AB+HC	**Notes:**	Shear vane (SV): peak/remoulded (kPa) Unable to penetrate with SV (UTP)
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 08

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 08

Depth (m)	Strata Description	USCS
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]	TS
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [2.50m]	ML
	0.6m: Becomes very stiff to hard.	
	0.8m: Colour change to orangey brown. Becomes wet with an increase in sand content.	
1.5	1.5m: Becomes hard.	
3.0	Interbedded gravelly fine to coarse SAND with some silt to sandy fine to coarse GRAVEL with some silt; orangey brown with dark stained gravel. Dense, wet. Gravel is subangular greywacke. [1.00m]	GW
3.5	Test Pit terminated at 3.80m - Target depth achieved.	

Water Table: 24/06/2020

BLOWS / 100 mm

DCP 08

Depth (m)	1	2	3	4	5	6	7	8	9
0.0									
0.5									
1.0									
1.5									
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

Depth (m)	Blows / 100 mm
0.0	12
0.5	13
1.0	17
1.5	14
2.0	11
2.5	11
3.0	13
3.5	11
4.0	15
4.5	21
5.0	21
	22

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KL		
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 09

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

Test Pit at DCP 09

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	USCS	Graphic Log	Water Table	BLOWS / 100 mm — DCP 09
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]	TS	TS	Groundwater Not Encountered	
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Soft to hard, moist, non plastic. Sand is fine. [3.10m] 0.6m: SV: 134/53 Becomes very stiff. 0.8m: SV: UTP	ML			13 11
1.0					
1.5	1.3m: Colour change to orangey brown. Becomes wet with an increase in sand content. 1.6m: Becomes hard.				11 11 14 22 27 26
2.0					
2.5					
3.0					
3.5	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.55m] 3.7m: Trace to no silt content below. Test Pit terminated at 3.95m - Target depth achieved.	GW			
4.0					
4.5					
5.0					

Logged By:	AB+HC	**Notes:**	Shear vane (SV): peak/remoulded (kPa) Unable to penetrate with SV (UTP)
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 10

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 10

SILT with trace sand dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.35m] — USCS: TS

SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [3.25m] — USCS: ML

- 0.4m - 0.8m: Mottled reddish orange and greyish white.
- 0.5m: SV: 70/13
- 0.7m: SV: 154/22
- 0.8m: Colour change to orangey brown. Soil becomes very stiff and wet with an increase in sand content.
- 0.9m: SV: UTP
- 1.4m: Becomes hard.

Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [1.70m] — USCS: GW

Test Pit terminated at 5.30m - Target depth achieved.

Water Table: 24/06/2020

BLOWS / 100 mm

DCP 10

Depth (m)	Blows / 100 mm
0.5	13
1.0	12
1.5	11
2.0	15
2.5	19
3.0	24
3.5	22
4.0	21
4.5	27
5.0	30

Logged By:	AB+HC	**Notes:**	Shear vane (SV): peak/remoulded (kPa) Unable to penetrate with SV (UTP)
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 11

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

DEPTH (m)	STRATA DESCRIPTION Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005 **Test Pit at DCP 11**	USCS	Graphic Log	Water Table	BLOWS / 100 mm DCP 11	DEPTH (m)
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.40m]	TS	TS	Groundwater Not Encountered		0.0
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Firm to hard, moist, non plastic. Sand is fine. [1.10m] 0.9m: Becomes very stiff. 1.2m: Becomes hard.	ML			15 21 21	0.5
1.0						1.0
1.5	Silty, fine to coarse GRAVEL with some sand and trace cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is medium. Gravel is subangular greywacke. Gap graded. [0.10m]	GM				1.5
2.0	Test Pit terminated at 1.60m - Target unit encountered.					2.0
2.5						2.5
3.0						3.0
3.5						3.5
4.0						4.0
4.5						4.5
5.0						5.0

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KL		
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 12

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 12

DEPTH (m)	Strata Description	USCS	Graphic Log
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]	TS	
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [2.30m]	ML	
	0.6m: Becomes stiff to very stiff.		
1.0			
	1.3m: Colour change to orangey brown. Becomes wet with an increase in sand content.		
1.5	1.5m: Becomes hard.		
2.0			
2.5	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.70m]	GW	
3.0	Test Pit terminated at 3.30m - Target depth achieved.		
3.5			
4.0			
4.5			
5.0			

Water Table: Groundwater Not Encountered

BLOWS / 100 mm

DCP 12

DEPTH (m)	1	2	3	4	5	6	7	8	9
0.0									
0.5									
1.0									
1.5									
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

DEPTH (m)	Blows / 100 mm
0.0	
0.5	
1.0	12
	12
1.5	11
	14
	18
2.0	20
	24
2.5	26
3.0	
3.5	
4.0	
4.5	
5.0	

Logged By:	AB+HC
Plotted By:	KL
Checked By:	HC

Notes:

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 13

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

DEPTH (m)	STRATA DESCRIPTION Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005 Test Pit at DCP 13	USCS	Graphic Log	Water Table	BLOWS / 100 mm DCP 13	DEPTH (m)
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]	TS				0.0
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Soft to hard, moist, non plastic. Sand is fine. [2.00m]	ML				0.5
1.0	0.8m: Colour change to orangey brown. Soil becomes soft to hard and wet with an increase in sand content.				> 13 > 12	1.0
1.5					> 13 > 21 > 21 > 26	1.5
2.0						2.0
2.5	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [1.90m]	GW				2.5
3.0						3.0
3.5						3.5
4.0	Test Pit terminated at 4.20m - Target depth achieved.			25/06/2020		4.0
4.5						4.5
5.0						5.0

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KL		
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 14

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

Test Pit at DCP 14

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

DEPTH (m)	STRATA DESCRIPTION	USCS	Graphic Log	Water Table
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]	TS		
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Firm to hard, moist, non plastic. Sand is fine. [2.40m] 0.4m: Becomes stiff to very stiff. 0.9m: Colour change to orangey brown. Becomes wet with an increase in sand content. 1.5m: Becomes hard.	ML		Groundwater Not Encountered
3.0	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.40m]	GW		
	Test Pit terminated at 3.10m - Target depth achieved.			

BLOWS / 100 mm

DCP 14

DEPTH (m)	1 2 3 4 5 6 7 8 9
0.5	> 13
1.0	
1.5	> 13
2.0	> 18
	> 18
	> 23
	> 19
	> 17
	> 20
	> 21
2.5	> 22
3.0	
3.5	
4.0	
4.5	
5.0	

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KL		
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job Nº /37211
Test Nº / DCP 15

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 15

DEPTH (m)	USCS	Graphic Log	Water Table
0.0	TS		Groundwater Not Encountered
0.30	ML		
2.60	GW		
3.70			

SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]

SILT with minor sand; orangey brown. Firm to hard, moist, non plastic. Sand is fine. [2.60m]

0.7m: Becomes hard.

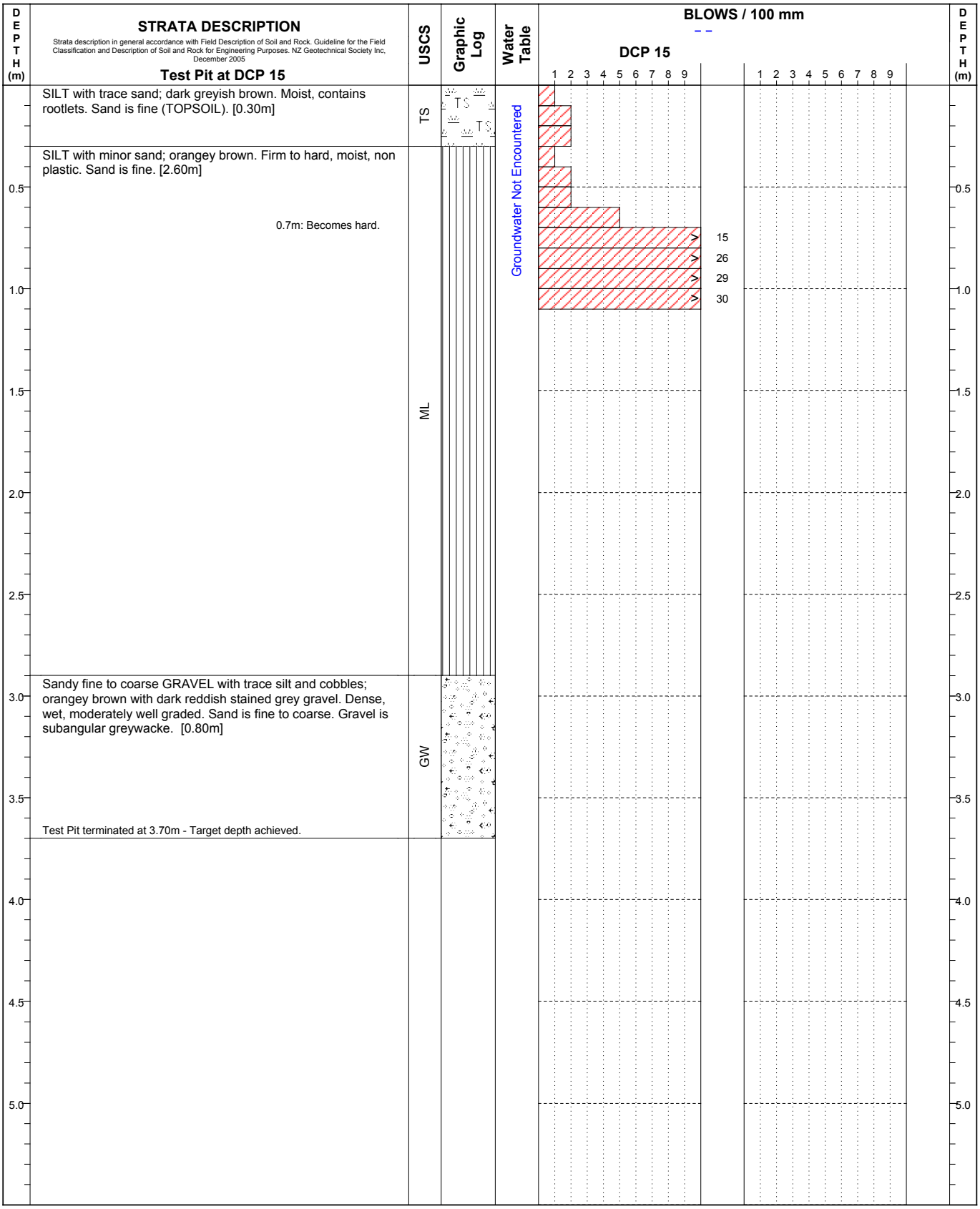
Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.80m]

Test Pit terminated at 3.70m - Target depth achieved.

BLOWS / 100 mm

DCP 15

Depth (m)	Blows / 100 mm
0.7	15
1.0	26
1.5	29
2.0	30



Logged By:	AB+HC	**Notes:**	Shear vane (SV): peak/remoulded (kPa) Unable to penetrate with SV (UTP)
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 16

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 16

DEPTH (m)	USCS	Graphic Log	Water Table	BLOWS / 100 mm — DCP 16
0.0	TS		Groundwater Not Encountered	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]
0.5	ML			SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [2.70m]
1.0				1.0m: Colour change to orangey brown. Becomes wet with an increase in sand content. — 13, 13
1.5				12, 15, 16, 20, 25, 26
2.0				
2.5				
3.0	GM			Silty, fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, poorly graded (uppermost unit). Sand is fine to coarse. Gravel is subangular greywacke. [0.10m]
3.5				Test Pit terminated at 3.10m - Target depth achieved.
4.0				
4.5				
5.0				

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Plotted By:	KL		
Checked By:	HC		

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 17A

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 17A

DEPTH (m)	Strata Description	USCS	Graphic Log
0.0	SILT with minor sand and gravel; dark brown. Moist, contains rootlets. Gravel is medium to coarse, subrounded greywacke (TOPSOIL/FILL) [0.40m]	TS	TS
0.5	SILT with minor sand; orangey brown. Soft to very stiff, wet. Sand is fine. [2.90m]	ML	
	0.8m: Becomes stiff.		
1.0			
1.5			
2.0			
2.5	2.5m: Groundwater seepage encountered.		
3.0	3.0m: Beomes very stiff.		
3.5	Sandy SILT; bluish grey with localised orangey mottling. Very soft*, saturated. Sand is fine. Unit has wet 'puggy' appearance and consistency. [0.70m]	ML	
4.0	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.05m]	GW	
	Test Pit terminated at 4.05m - Target depth achieved.		
4.5			
5.0			

Water Table: 25/06/2020, 24/06/2020

BLOWS / 100 mm

DCP 17A

DEPTH (m)	Blows / 100 mm
3.5	14
	19
	19
	30

Logged By:	AB+HC	**Notes:**	IT2a = TP17a * Silt was very soft upon excavation, but DCP results indicate dense which may be attributed to high DCP rod friction at depth.
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 18

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 18

DEPTH (m)	Strata Description	USCS	Graphic Log
0.0	SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]	TS	
0.5	SILT with minor sand; light grey with patchy orangey brown mottling. Firm to hard, moist, non plastic. Sand is fine. [3.40m]	ML	
	0.6m: SV: 164/11		
	0.8m: SV: 159/21		
1.0	1.0m: SV: UTP		
	1.3m: Colour change to orangey brown. Soil becomes hard and wet with an increase in sand content.		
1.5			
2.0			
2.5			
3.0	3.0m - 3.4m: Bed of silty GRAVEL; orangey brown.		
3.5			
3.4	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.20m]	GW	
4.0	Test Pit terminated at 3.90m - Target depth achieved.		
4.5			
5.0			

Water Table: 24/06/2020

BLOWS / 100 mm

DCP 18

DEPTH (m)	Blows / 100 mm
0.0	
0.5	14
	13
1.0	
	11
1.5	12
	14
	15
2.0	23
	21
2.5	25
3.0	
3.5	
4.0	
4.5	
5.0	

Logged By:	AB+HC	**Notes:**	Shear vane (SV): peak/remoulded (kPa) Unable to penetrate with SV (UTP)
Plotted By:	KL		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 19

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 19

DEPTH (m)	USCS	Graphic Log	Water Table	BLOWS / 100 mm — DCP 19
0.0	TS			SILT with trace sand; dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL). [0.30m]
0.5	ML			SILT with minor sand; light grey with patchy orangey brown mottling. Stiff to hard, moist, non plastic. Sand is fine. [2.20m]
1.0	ML			0.7m: Colour change to orangey brown. Soil becomes very stiff to hard and wet with an increase in sand content. — 14, 13, 17
1.5	ML			1.5m: Becomes hard. — 12, 13, 17, 20, 21, 24
2.0	ML		24/06/2020	
2.5	GP		28/07/2020	Fine to coarse GRAVEL with some sand; grey. Dense, saturated, poorly graded (fine possibly washed out). Gravel is subangular greywacke. Sand is coarse. [0.50m]
3.0	GP			2.8m: Groundwater inflow. Test Pit terminated at 3.00m - Target depth achieved.
3.5				
4.0				
4.5				
5.0				

Logged By:	AB+HC	**Notes:**	Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.
Plotted By:	KL		Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)
Checked By:	HC		

Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 **Email** hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /**37211**
Test № / **DCP 20**

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	25/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at DCP 20

DEPTH (m)	USCS	Graphic Log	Water Table	BLOWS / 100 mm — DCP 20
0.0	TS	TS	Groundwater Not Encountered	SILT with some sand; dark grey. Moist, rootlets. Sand is fine. (TOPSOIL) [0.40m]
0.5	ML			SILT with some sand; light orangey brown/grey with orange mottles. Very stiff to hard, moist, trace rootlets. [1.90m] 0.5m: SV: 129/46 0.6m: Becomes stiff. 0.8m: SV: 196+ 0.9m: SV: 168/59 1.3m: Becomes hard.
2.5	GP			Medium to coarse GRAVEL with some sand and trace cobbles; orangey brown. Dense, moist. Gravel is subangular to well rounded greywacke, iron staining on outside of gravel/cobbles. Sand is coarse. [0.60m] Test Pit terminated at 2.90m - Target depth achieved.

DCP 20 blows per 100 mm (1 2 3 4 5 6 7 8 9):

Depth (m)	Blows
0.4	1
0.5	2
0.6	3
0.7	4
0.8	5
0.9	6
1.0	>12
1.1	>12
1.2	>11
1.3	7
1.4	>15
1.5	>15
1.6	>15
1.7	>20
1.8	>24
1.9	>30

Logged By:	JLP	**Notes:**	IT1a = TP20
Plotted By:	KL		
Checked By:			

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 21

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	10/07/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	DCP

DEPTH (m)	STRATA DESCRIPTION Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005 No Associated Log	USCS	Graphic Log	Water Table	BLOWS / 100 mm DCP 21	DEPTH (m)
0.5	0.5m: Becomes stiff.			Groundwater Not Encountered		0.5
	0.7m: Becomes very stiff to hard.				> 13 > 16 > 16	
1.0					> 12	1.0
1.5	1.5m: Becomes hard.				> 12 > 14 > 18 > 20 > 21 > 21	1.5
2.0						2.0
2.5						2.5
3.0						3.0
3.5						3.5
4.0						4.0
4.5						4.5
5.0						5.0

Logged By: AB+HC
Plotted By: HC
Checked By: HC

Notes: No test pit undertaken at DCP 21.

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job Nº / **37211**
Test Nº / **DCP 22**

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	10/07/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

No Associated Log

USCS | **Graphic Log** | **Water Table**

Groundwater Not Encountered

BLOWS / 100 mm

DCP 22

0.6m: Becomes stiff to very stiff.

2.0m: Becomes hard.

Depth (m)	Blows / 100 mm
1.0	> 13
2.0	> 11
2.0	> 11
2.0	> 18
2.0	> 19
2.0	> 30

Logged By: AB+HC

Plotted By: HC

Checked By: HC

Notes: No test pit undertaken at DCP 22.

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 23

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	10/07/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	DCP

DEPTH (m)	STRATA DESCRIPTION Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005	USCS	Graphic Log	Water Table	BLOWS / 100 mm DCP 23	DEPTH (m)
	No Associated Log			Groundwater Not Encountered	1 2 3 4 5 6 7 8 9	
0.5	0.8m: Becomes stiff to very stiff.					0.5
1.0					> 11	1.0
1.5	1.6m: Becomes hard.				> 12	1.5
					> 12	
					> 12	
					> 17	
2.0					> 17	2.0
					> 30	
2.5						2.5
3.0						3.0
3.5						3.5
4.0						4.0
4.5						4.5
5.0						5.0

Logged By:	AB+HC	**Notes:**	No test pit undertaken at DCP 23.
Plotted By:	HC		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / DCP 24

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	10/07/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

No Associated Log

0.5m: Becomes stiff to hard.

1.4m: Becomes hard.

Groundwater Not Encountered

BLOWS / 100 mm

DCP 24

Depth (m)	Blows / 100 mm
0.5	14
1.0	16
1.5	14
2.0	13
2.5	16
3.0	17
3.5	23
4.0	27
4.5	30
5.0	

Logged By:	AB+HC	**Notes:**	No test pit undertaken at DCP 24.
Plotted By:	HC		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № / 37211
Test № / DCP 25

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	10/07/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

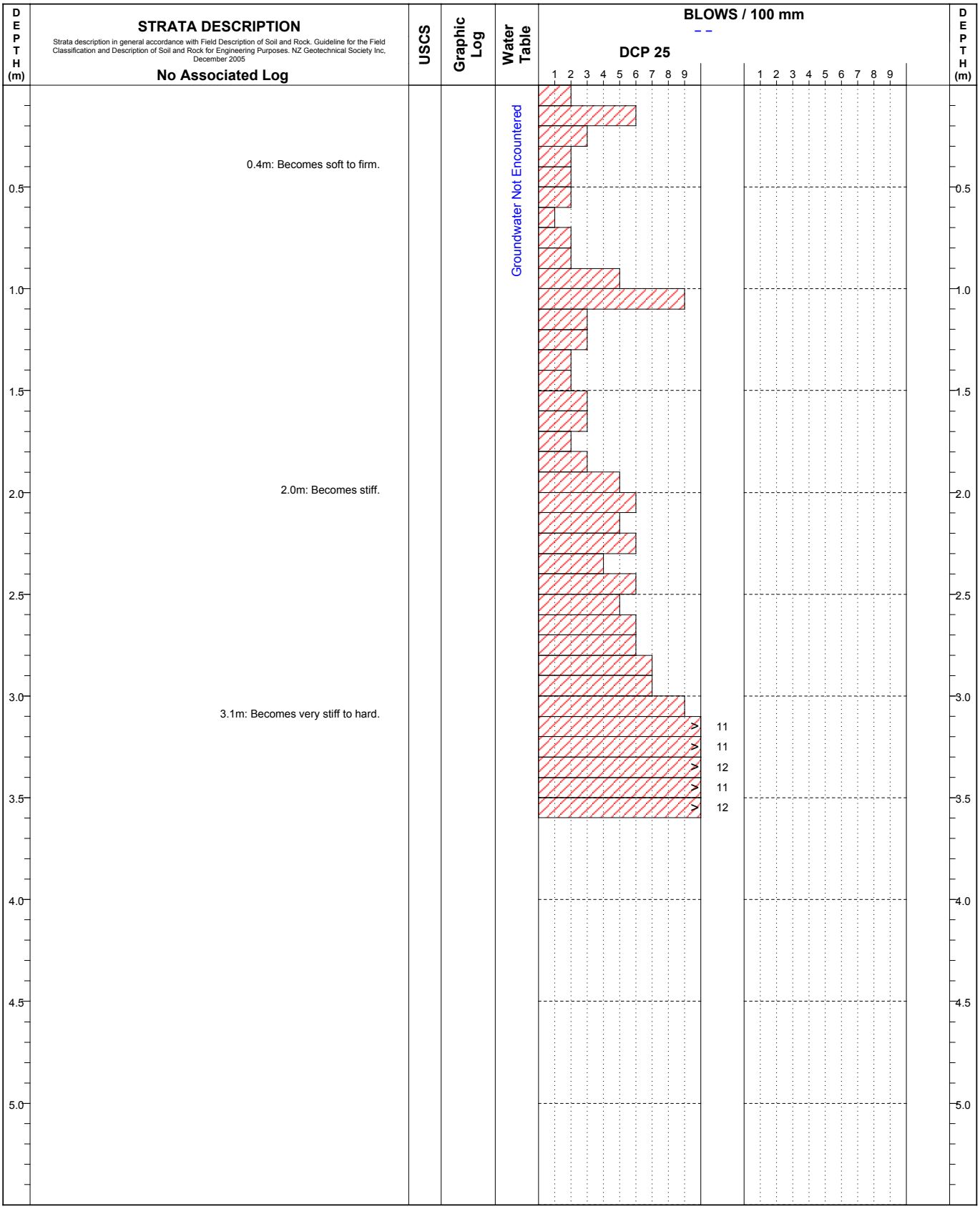
No Associated Log

0.4m: Becomes soft to firm.

2.0m: Becomes stiff.

3.1m: Becomes very stiff to hard.

Groundwater Not Encountered



Logged By:	AB+HC	**Notes:**	No test pit undertaken at DCP 25. Fill inferred to ~0.3 m.
Plotted By:	HC		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job Nº /37211
Test Nº / DCP 26

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	10/07/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

No Associated Log

USCS | **Graphic Log** | **Water Table**

Groundwater Not Encountered

BLOWS / 100 mm

DCP 26

1 2 3 4 5 6 7 8 9 | 1 2 3 4 5 6 7 8 9

DEPTH (m)

0.7m: Firm.

1.6m: Becomes stiff.

2.5m: DCP rod wet

2.6m: Becomes very stiff.

3.0m: Becomes hard.

14
15

0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0

Logged By:	AB+HC	**Notes:**	No test pit undertaken at DCP 26. Fill interred to ~0.5 m.
Plotted By:	HC		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № /37211
Test № / TP 17

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	13T Ex+DCP

STRATA DESCRIPTION

Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005

Test Pit at TP 17

DEPTH (m)	Strata Description	USCS	Graphic Log	Water Table
0.0	SILT with trace sand dark greyish brown. Moist, contains rootlets. Sand is fine (TOPSOIL/FILL). [1.00m]	TS		
1.0	Sandy fine to coarse GRAVEL with minor cobbles; grey. Dense, dry, contains rootlets. Gravel is subrounded to subangular greywacke (POSSIBLE FILL/PITRUN) [1.50m]	SW		
2.5	2.5m: Deposit of iron precipitate beneath perched water inflow.			25/06/2020
2.5	Sandy SILT with trace clay; bluish grey. Very soft, puggy, saturated, low plasticity. Sand is fine. Unit has wet 'puggy' appearance and consistency. [2.10m]	ML		24/06/2020
4.6	Sandy fine to coarse GRAVEL with trace silt and cobbles; orangey brown with dark reddish stained grey gravel. Dense, wet, moderately well graded. Sand is fine to coarse. Gravel is subangular greywacke. [0.05m]	GW		
4.65	Test Pit terminated at 4.65m - Target depth achieved.			

BLOWS / 100 mm

TP 17

1 2 3 4 5 6 7 8 9 | 1 2 3 4 5 6 7 8 9

DEPTH (m)

Logged By:	AB+HC	
Plotted By:	KL	
Checked By:	HC	

Notes: No DCP at TP17 due to surfiial unit of gravel (pit run fill?) - see adjacent DCP 17A.

IT2 = TP17

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

DAVIS OGILVIE
Davis Ogilvie & Partners Limited
Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140
Office 0800 999 333 Email hello@do.nz
www.do.nz

SHALLOW INVESTIGATION RESULTS

Job № 37211
Test № TP 20A + HA

Project:	2 Auckland Street, Ashley (Lot 1 DP 394101)	**Date:**	24/06/20
Client:	A J Cameron	**Time:**	10:00 a.m.
Test Location:	Refer to attached Geotechnical Site Plan (G01A).	**Excavation Method:**	DCP

DEPTH (m)	STRATA DESCRIPTION Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005 **Auger at TP 20A**	USCS	Graphic Log	Water Table
0	SILT with some sand; dark grey. Moist, rootlets. Sand is fine. (TOPSOIL) [0.30m]	TS		Groundwater Not Encountered
0.5	SILT with some sand; light orangey brown/grey with orange mottles. Stiff to hard, moist. [1.30m]	ML		
1.0				
1.5	Silty medium to coarse GRAVEL with some sand and trace cobbles; orangey brown. Dense, dry. [1.10m]	GM		
2.0				
2.5	Medium to coarse GRAVEL with some sand and trace cobbles; orangey brown. Dense, moist. Gravel is subangluar to well rounded greywacke, iron staining on outside of gravel/cobbles. Sand is coarse. [1.00m]	GP		
3.0				
3.5	Auger terminated at 3.70m - Target depth achieved.			
4.0				
4.5				
5.0				

BLOWS / 100 mm
TP 20A
1 2 3 4 5 6 7 8 9 | 1 2 3 4 5 6 7 8 9

Logged By:	JLP	**Notes:**	No DCP at TP20A - see nearby DCP 20.
Plotted By:	HC		
Checked By:	HC		

Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

APPENDIX D

Falling Head Infiltration (FHI) Test Results

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

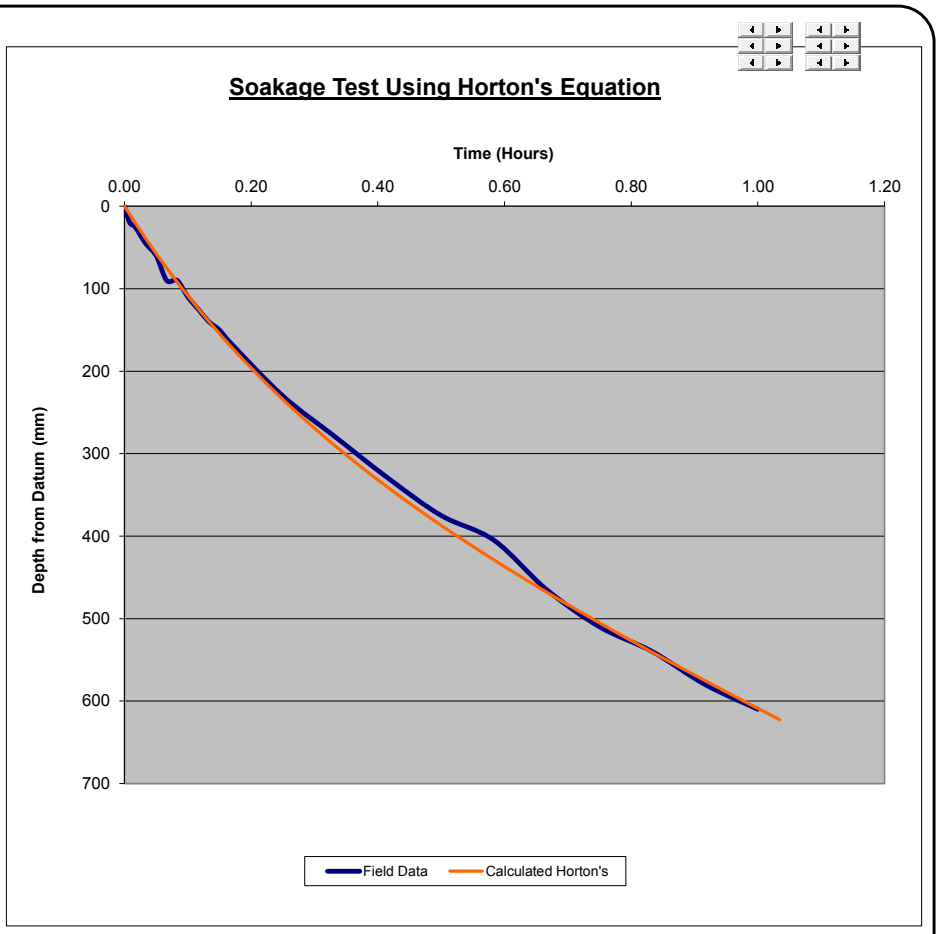
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	**File**				
Date:	**24 June 2020**	Job name:	**2 Auckland Street, Ashley**	Test Pit:	**FHI1**
Time:		Job no:	**37441**		
People/equipment/materials on site:	**HC AB JLP**				
Weather/ground conditions:	**Wet**				
Test/photographs taken:	**Falling head infiltration test**				
Location Information:					
Pit size:	**2500 x 1000 x 2800 (L x W x D)**				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	20
2	1.00	25
3	2.00	45
4	3.00	60
5	4.00	90
6	5.00	90
7	6.00	110
8	7.00	125
9	8.00	140
10	9.00	150
11	10.00	165
12	15.00	230
13	20.00	280
14	25.00	330
15	30.00	375
16	35.00	405
17	40.00	465
18	45.00	510
19	50.00	540
20	55.00	580
21	60.00	610
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**1214.00**	**mm per hour**
Ultimate Infiltration Rate:	**372.00**	**mm per hour**
Horton's Decay Coefficient:	**3.44**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. www.do.nz

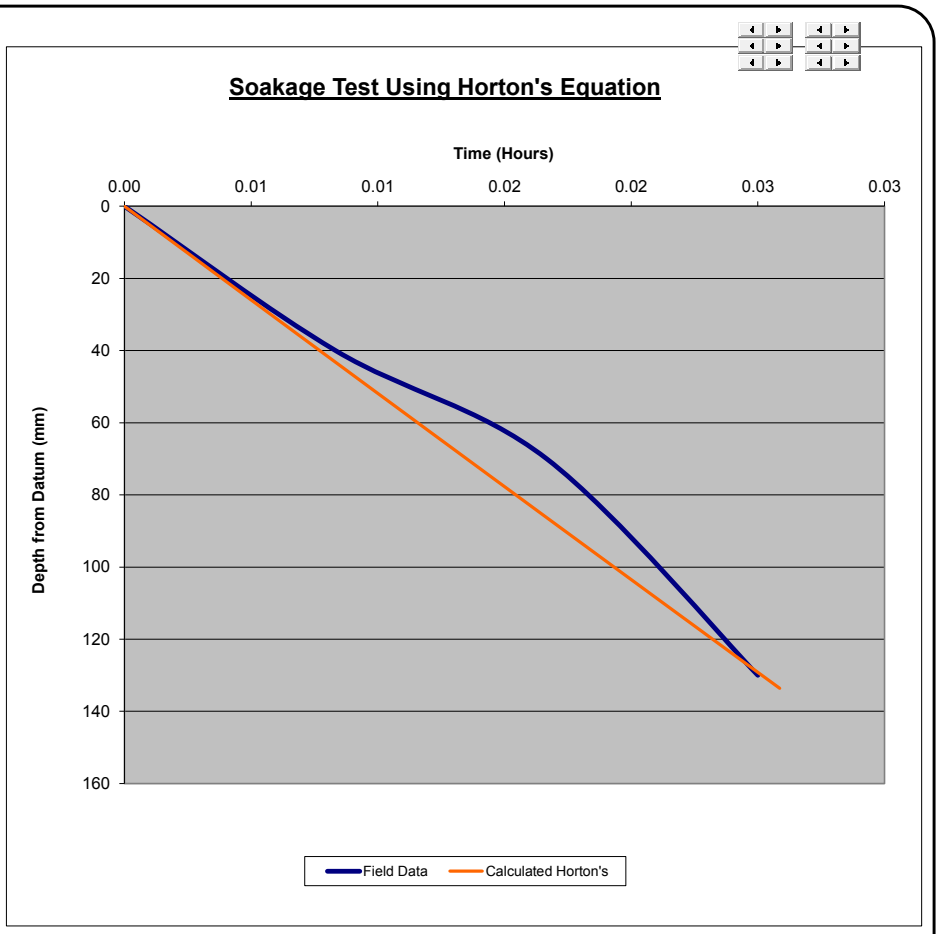
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	File				
Date:	24 June 2020	Job name:	2 Auckland Street, Ashley	Test Pit:	FHI-1A-1
Time:		Job no:	37441		
People/equipment/materials on site:	HC AB JLP				
Weather/ground conditions:	Wet				
Test/photographs taken:	Falling head infiltration test				
Location Information:					
Pit size:	1100 x 1500 x 3700 (L x W x D)				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	40
2	1.00	70
3	1.50	130
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**5200.00**	**mm per hour**
Ultimate Infiltration Rate:	**255.00**	**mm per hour**
Horton's Decay Coefficient:	**0.53**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. www.do.nz

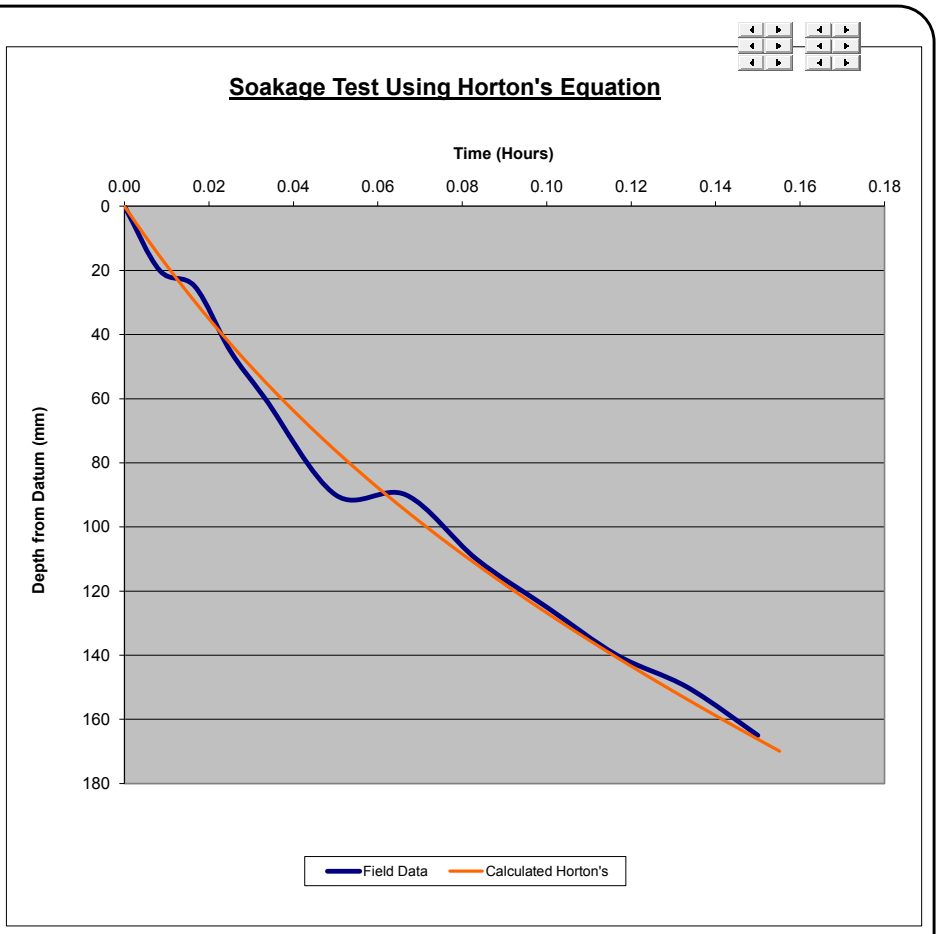
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	File				
Date:	24 June 2020	Job name:	2 Auckland Street, Ashley	Test Pit:	FHI1A-2
Time:		Job no:	37441		
People/equipment/materials on site:	HC AB				
Weather/ground conditions:	Wet				
Test/photographs taken:	Falling head infiltration test				
Location Information:					
Pit size:	2500 x 1000 x 2800 (L x W x D)				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	20
2	1.00	25
3	1.50	45
4	2.00	60
5	3.00	90
6	4.00	90
7	5.00	110
8	6.00	125
9	7.00	140
10	8.00	150
11	9.00	165
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**1953.00**	**mm per hour**
Ultimate Infiltration Rate:	**616.00**	**mm per hour**
Horton's Decay Coefficient:	**16.62**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

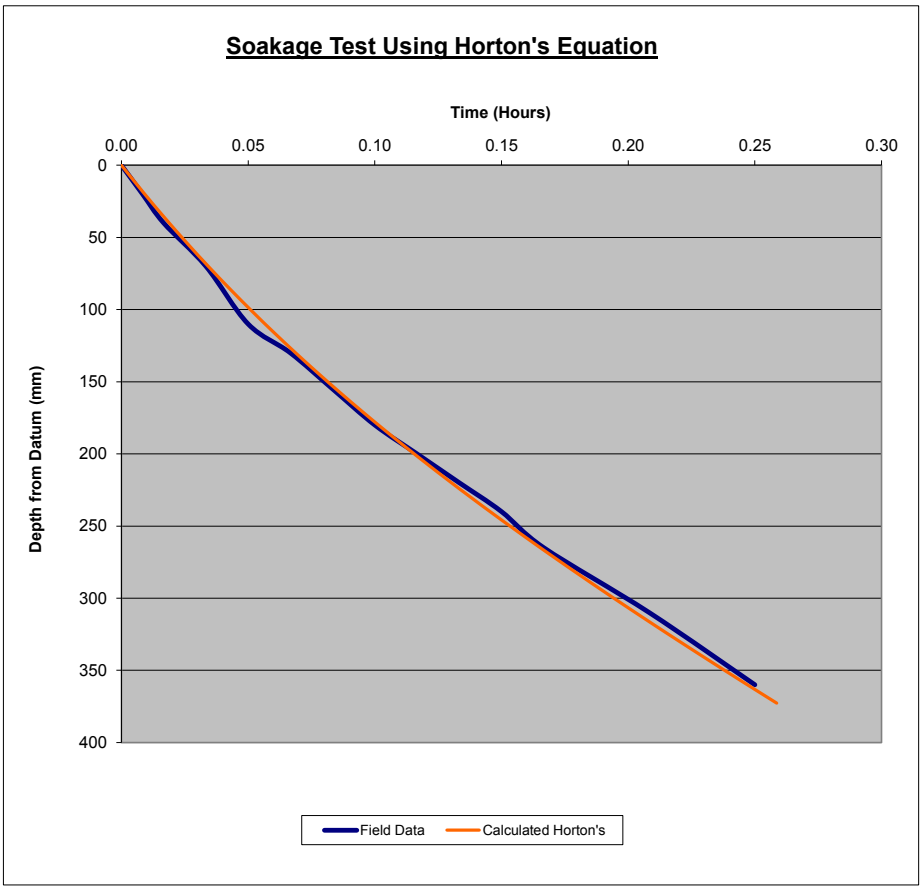
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	**File**				
Date:	**24 June 2020**	Job name:	**2 Auckland Street, Ashley**	Test Pit:	**FHI1A-3**
Time:		Job no:	**37441**		
People/equipment/materials on site:	**HC AB**				
Weather/ground conditions:	**Wet**				
Test/photographs taken:	**Falling head infiltration test**				
Location Information:					
Pit size:	**2500 x 1000 x 2800 (L x W x D)**				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	20
2	1.00	40
3	2.00	70
4	3.00	110
5	4.00	130
6	5.00	155
7	6.00	180
8	7.00	200
9	8.00	220
10	9.00	240
11	10.00	265
12	12.50	310
13	15.00	360
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate: **2232.00** **mm per hour**

Ultimate Infiltration Rate: **1001.00** **mm per hour**

Horton's Decay Coefficient: **10.00** **per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. www.do.nz

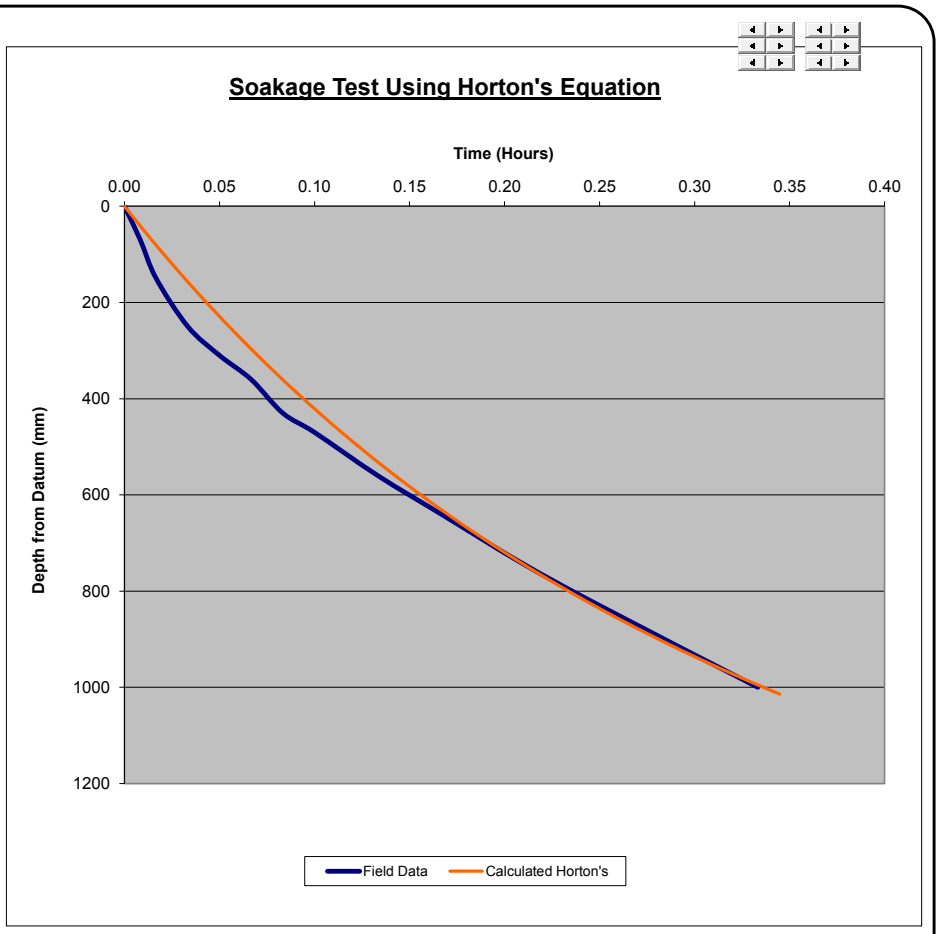
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	File				
Date:	24 June 2020	Job name:	2 Auckland Street, Ashley	Test Pit:	TP4-1
Time:		Job no:	37441		
People/equipment/materials on site:	HC AB TR				
Weather/ground conditions:	Wet				
Test/photographs taken:	Falling head infiltration test				
Location Information:					
Pit size:	2500 x 1000 x 2800 (L x W x D)				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	70
2	1.00	150
3	2.00	250
4	3.00	310
5	4.00	360
6	5.00	430
7	6.00	470
8	8.00	560
9	10.00	640
10	12.50	740
11	15.00	830
12	20.00	1000
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**5000.00**	**mm per hour**
Ultimate Infiltration Rate:	**500.00**	**mm per hour**
Horton's Decay Coefficient:	**4.00**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

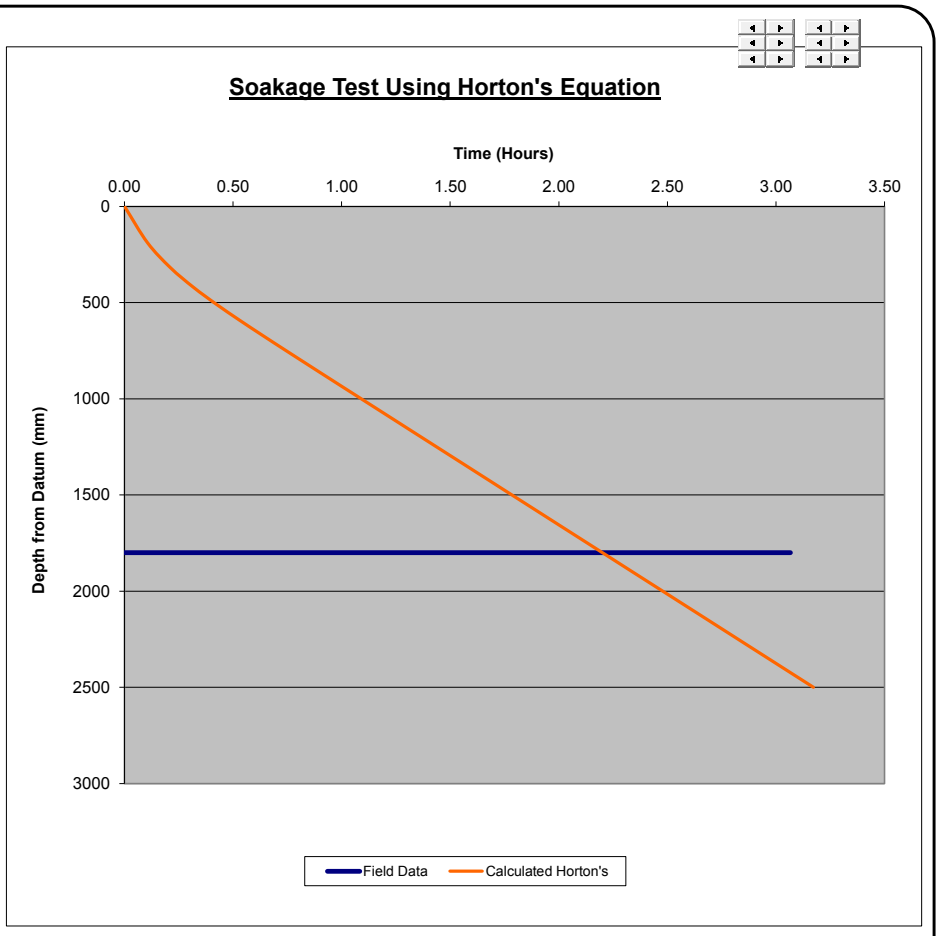
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	**File**				
Date:	**24 June 2020**	Job name:	**2 Auckland Street, Ashley**	Test Pit:	**FHI19**
Time:		Job no:	**37441**		
People/equipment/materials on site:	**HC AB TR**				
Weather/ground conditions:	**Wet**				
Test/photographs taken:	**Falling head infiltration test**				
Location Information:					
Pit size:	**2300 x 1100 x 1600 (L x W x D)**				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	1800
1	33.00	1800
2	110.00	1800
3	184.00	1800
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Cannot model 'no change' in field data water level

Initial Infiltration Rate: **2228.00** **mm per hour**

Ultimate Infiltration Rate: **720.00** **mm per hour**

Horton's Decay Coefficient: **7.00** **per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. www.do.nz

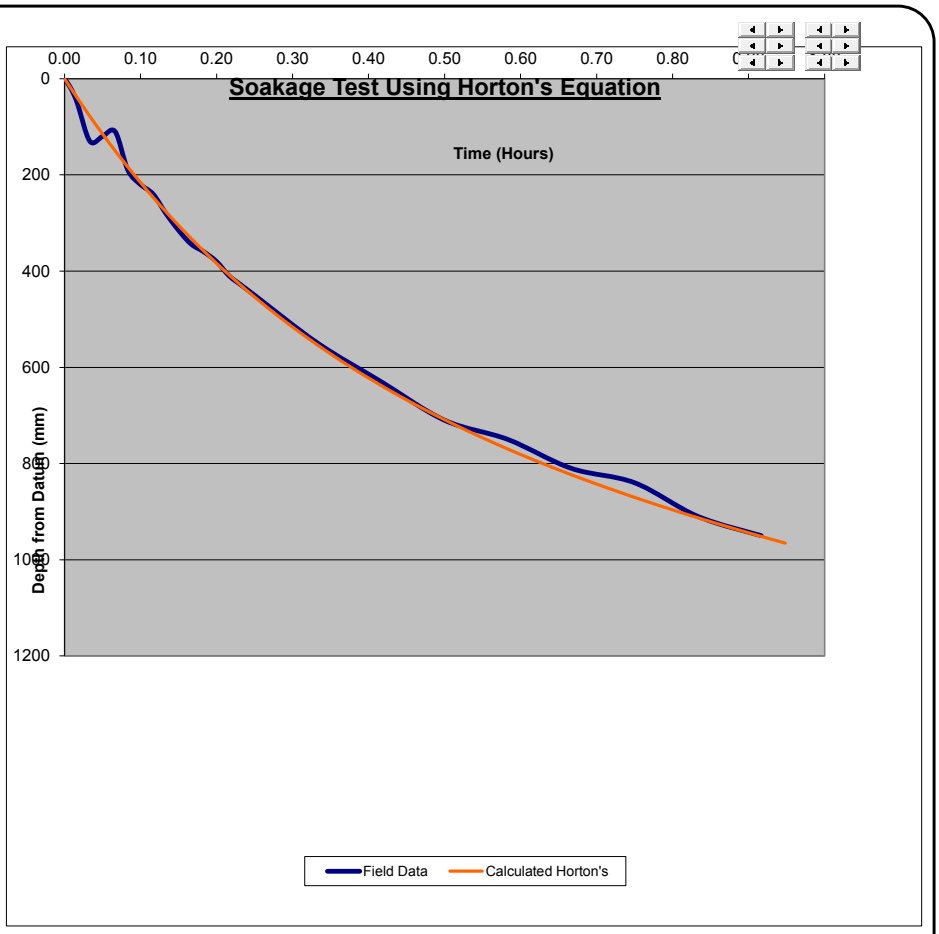
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	File				
Date:	24 June 2020	Job name:	2 Auckland Street, Ashley	Test Pit:	TP 9-1
Time:		Job no:	37441		
People/equipment/materials on site:	HC AB TR				
Weather/ground conditions:	Wet				
Test/photographs taken:	Falling head infiltration test				
Location Information:					
Pit size:	3900 x 1100 x 2600 (L x W x D)				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	20
2	1.00	50
3	2.00	130
4	3.00	120
5	4.00	110
6	5.00	190
7	6.00	220
8	7.00	240
9	8.00	280
10	9.00	315
11	10.00	344
12	11.00	360
13	12.00	380
14	13.00	410
15	14.00	430
16	15.00	450
17	20.00	550
18	25.00	630
19	30.00	710
20	35.00	750
21	40.00	810
22	45.00	840
23	50.00	910
24	55.00	950
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**2449.00**	**mm per hour**
Ultimate Infiltration Rate:	**310.00**	**mm per hour**
Horton's Decay Coefficient:	**3.00**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. www.do.nz

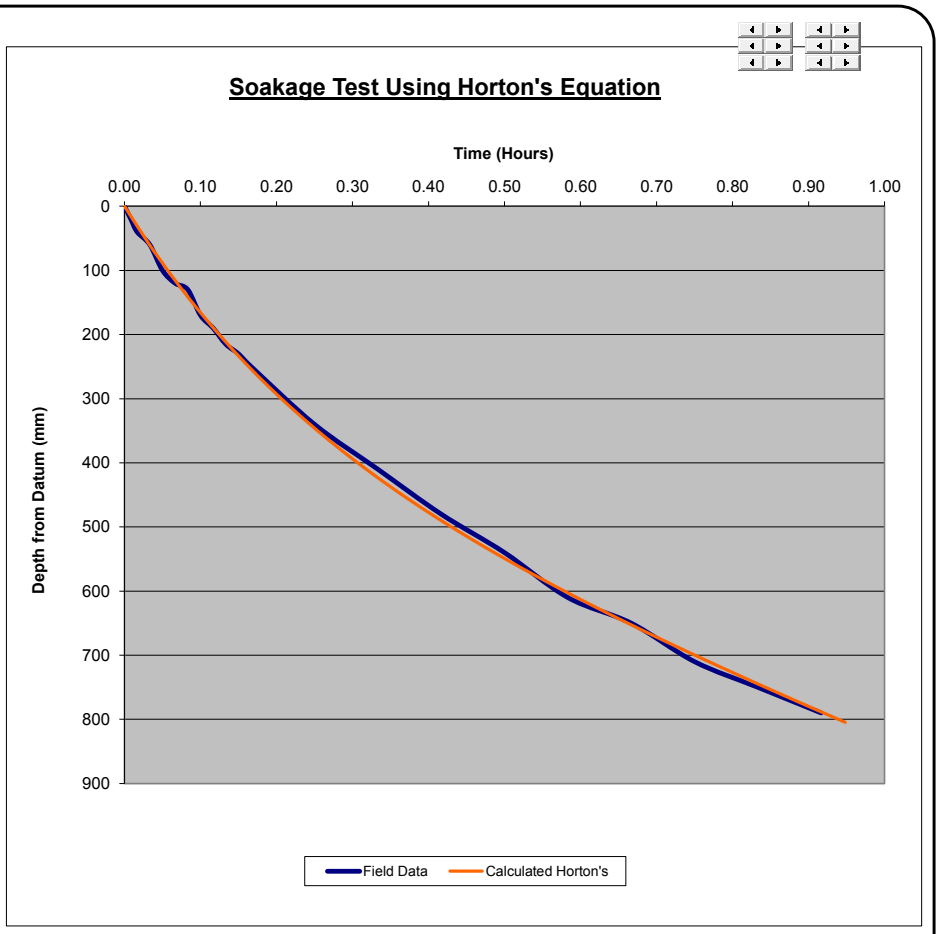
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	File				
Date:	24 June 2020	Job name:	2 Auckland Street, Ashley	Test Pit:	TP 9-2
Time:		Job no:	37441		
People/equipment/materials on site:	HC AB TR				
Weather/ground conditions:	Wet				
Test/photographs taken:	Falling head infiltration test				
Location Information:					
Pit size:	3900 x 1100 x 2600 (L x W x D)				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	20
2	1.00	40
3	2.00	60
4	3.00	100
5	4.00	120
6	5.00	130
7	6.00	170
8	7.00	190
9	8.00	215
10	9.00	230
11	10.00	250
12	15.00	340
13	20.00	410
14	25.00	480
15	30.00	540
16	35.00	610
17	40.00	650
18	45.00	710
19	50.00	750
20	55.00	790
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**1910.00**	**mm per hour**
Ultimate Infiltration Rate:	**480.00**	**mm per hour**
Horton's Decay Coefficient:	**4.00**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. www.do.nz

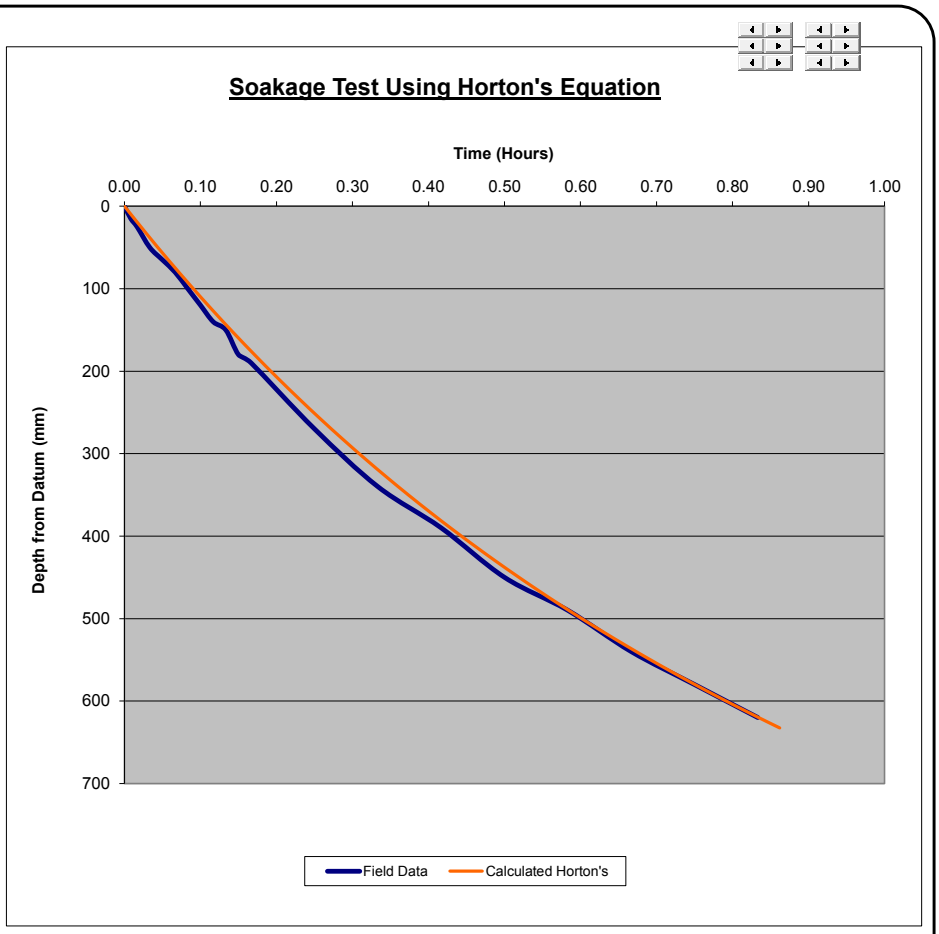
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	File				
Date:	24 June 2020	Job name:	2 Auckland Street, Ashley	Test Pit:	TP 9-3
Time:		Job no:	37441		
People/equipment/materials on site:	HC AB TR				
Weather/ground conditions:	Wet				
Test/photographs taken:	Falling head infiltration test				
Location Information:					
Pit size:	3900 x 1100 x 2600 (L x W x D)				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	15
2	1.00	25
3	2.00	50
4	3.00	65
5	4.00	80
6	5.00	100
7	6.00	120
8	7.00	140
9	8.00	150
10	9.00	180
11	10.00	190
12	15.00	270
13	20.00	340
14	25.00	390
15	30.00	450
16	35.00	490
17	40.00	540
18	45.00	580
19	50.00	620
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**1168.00**	**mm per hour**
Ultimate Infiltration Rate:	**161.00**	**mm per hour**
Horton's Decay Coefficient:	**1.46**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

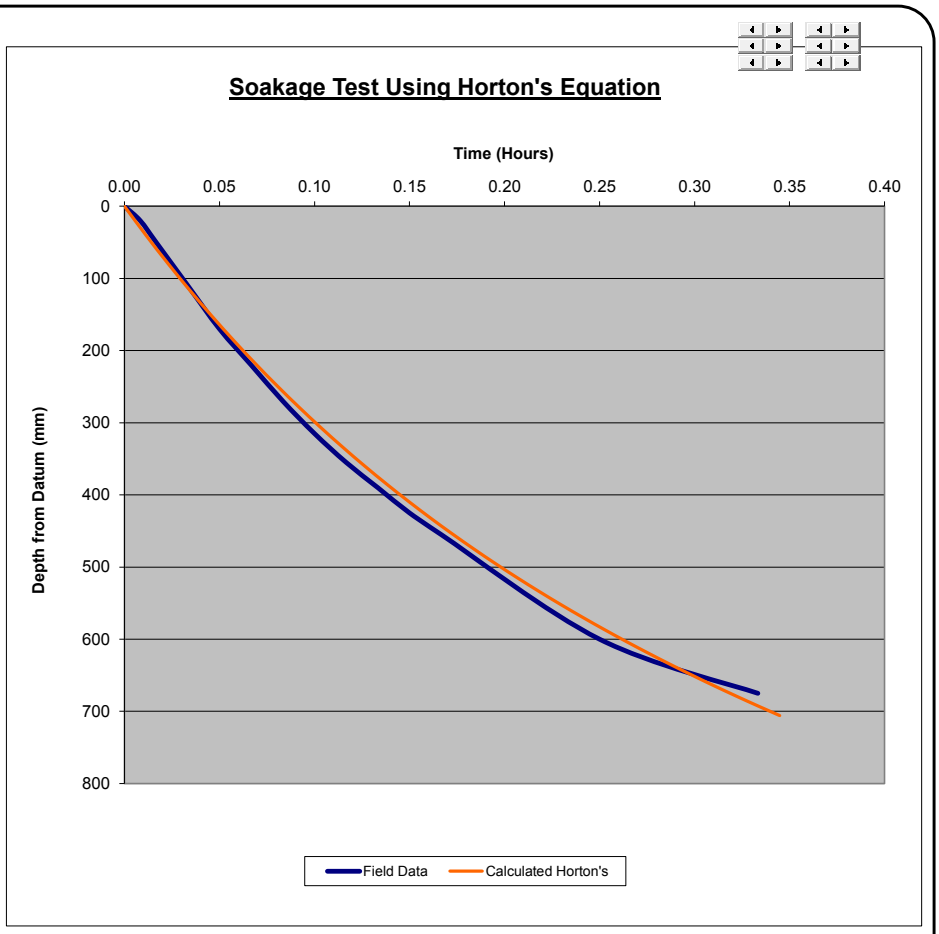
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	**File**				
Date:	**24 June 2020**	Job name:	**2 Auckland Street, Ashley**	Test Pit:	**TP 6-1**
Time:		Job no:	**37441**		
People/equipment/materials on site:	**HC AB TR**				
Weather/ground conditions:	**Wet**				
Test/photographs taken:	**Falling head infiltration test**				
Location Information:					
Pit size:	**2500 x 1100 x 2700 (L x W x D)**				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	20
2	1.00	50
3	2.00	110
4	3.00	170
5	4.00	220
6	5.00	270
7	6.00	315
8	7.00	355
9	8.00	390
10	9.00	425
11	10.00	455
12	15.00	600
13	20.00	675
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**3633.00**	**mm per hour**
Ultimate Infiltration Rate:	**613.00**	**mm per hour**
Horton's Decay Coefficient:	**5.03**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

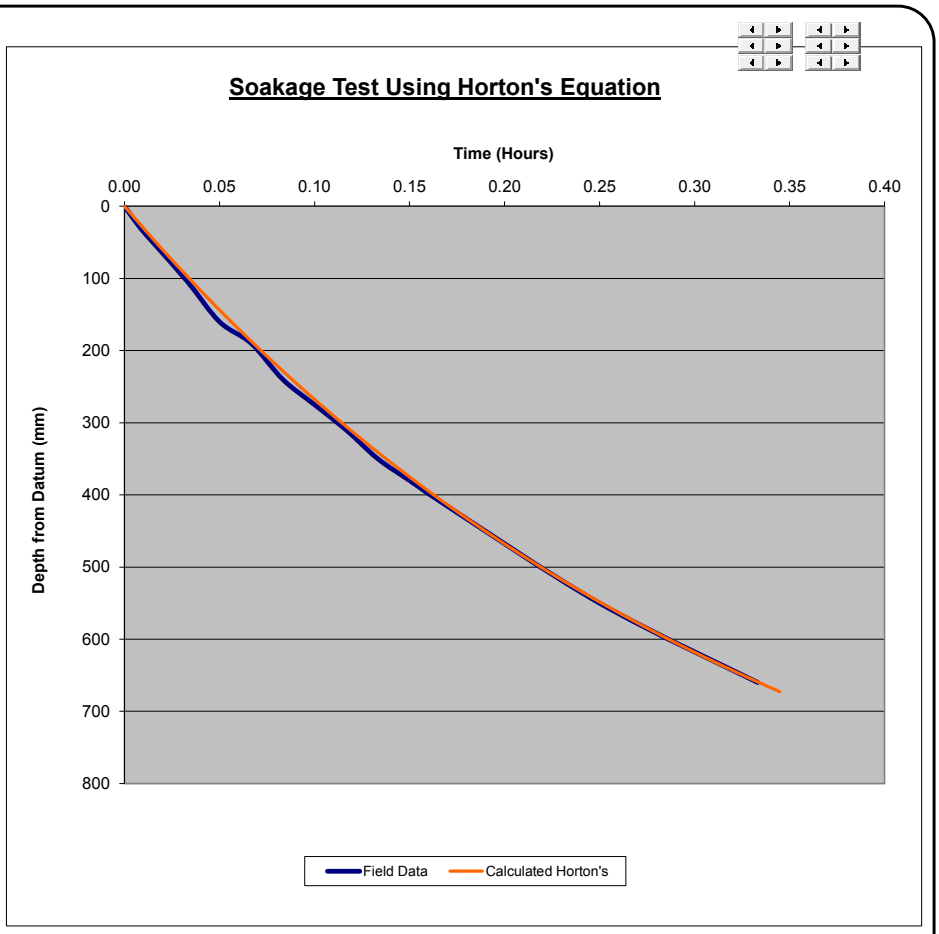
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	**File**				
Date:	**24 June 2020**	Job name:	**2 Auckland Street, Ashley**	Test Pit:	**TP 6-2**
Time:		Job no:	**37441**		
People/equipment/materials on site:	**HC AB TR**				
Weather/ground conditions:	**Wet**				
Test/photographs taken:	**Falling head infiltration test**				
Location Information:					
Pit size:	**2500 x 1100 x 2700 (L x W x D)**				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	30
2	1.00	55
3	2.00	105
4	3.00	160
5	4.00	190
6	5.00	240
7	6.00	275
8	7.00	310
9	8.00	350
10	9.00	380
11	10.00	410
12	15.00	550
13	20.00	660
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**3088.00**	**mm per hour**
Ultimate Infiltration Rate:	**71.00**	**mm per hour**
Horton's Decay Coefficient:	**3.00**	**per hour**

DAVIS OGILVIE & PARTNERS LIMITED
Level 1, 24 Moorhouse Avenue, Addington
PO Box 589, Christchurch 8140
0800 999 333 / 03 366 1653 / hello@do.nz
Offices in Christchurch, Timaru, Nelson & Greymouth. **www.do.nz**

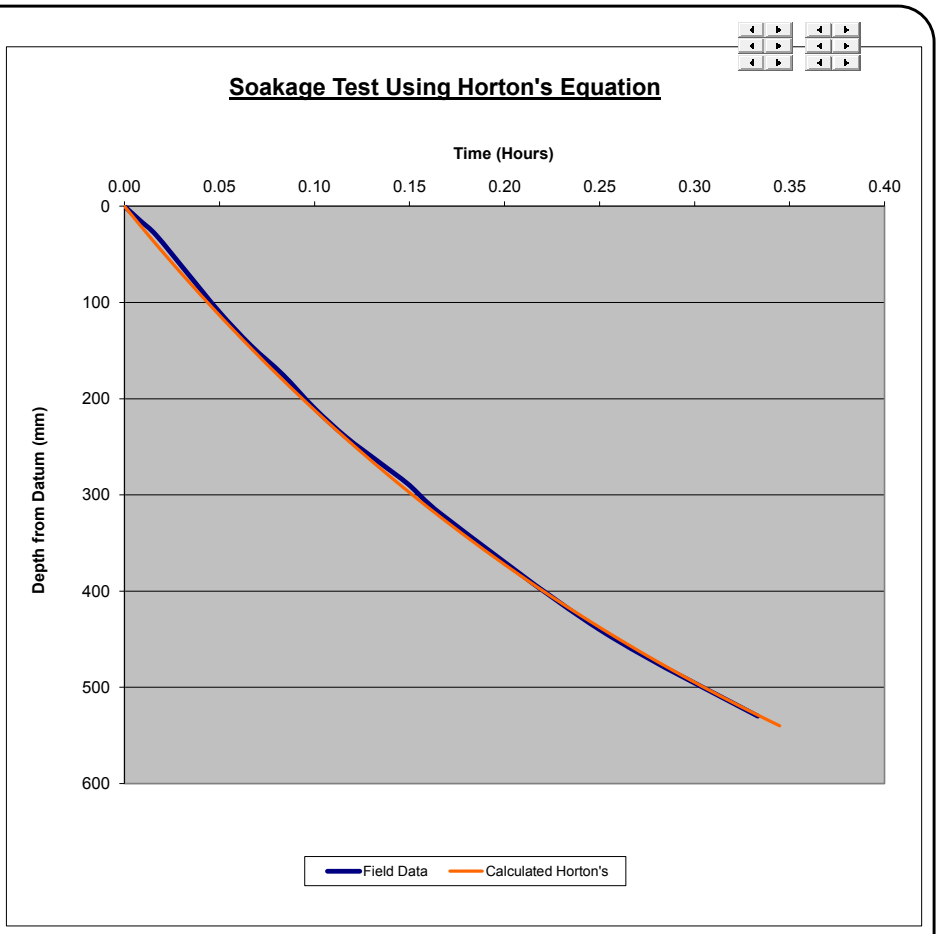
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

INFILTRATION TEST RESULTS

CONSTRUCTION VERIFICATION

Issued to:	**File**				
Date:	**24 June 2020**	Job name:	**2 Auckland Street, Ashley**	Test Pit:	**TP 6-3**
Time:		Job no:	**37441**		
People/equipment/materials on site:	**HC AB TR**				
Weather/ground conditions:	**Wet**				
Test/photographs taken:	**Falling head infiltration test**				
Location Information:					
Pit size:	**2500 x 1100 x 2700 (L x W x D)**				

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	0.50	15
2	1.00	30
3	2.00	70
4	3.00	110
5	4.00	145
6	5.00	175
7	6.00	210
8	7.00	240
9	8.00	265
10	9.00	290
11	10.00	320
12	15.00	440
13	20.00	530
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		



Initial Infiltration Rate:	**2430.00**	**mm per hour**
Ultimate Infiltration Rate:	**138.00**	**mm per hour**
Horton's Decay Coefficient:	**3.00**	**per hour**

STATEMENT OF PROFESSIONAL OPINION ON THE SUITABILITY OF LAND FOR SUBDIVISION

Issued by:	Davis Ogilvie & Partners Ltd. *(Geotechnical engineering firm or suitably qualified engineer)*
To:	Alistair Cameron *(Owner/Developer)*
To be supplied to:	Waimakariri District Council *(Territorial authority)*
In respect of:	94 Lot Subdivision (93 Residential Lots) *(Description of proposed infrastructure/land development)*
At:	2 Auckland Street, Ashley - Lot 1 DP 394101 (Title 376526) *(Address)*

I, Elliot Duke *(Geo-professional)* on behalf of Davis Ogilvie and Partners Limited *(Geotechnical Engineering Firm*) hereby confirm:

1. I am a suitably qualified and experienced geotechnical engineer/engineering geologist, employed by Davis Ogilvie and the geotechnical firm named above was retained by the owner/developer as the geotechnical engineer/engineering geologist on the above proposed development.

2. This geotechnical assessment report titled “Geotechnical Report For Subdivision: 2 Auckland Street, Ashley” dated 09 February 2024 has been carried out in accordance with the Ministry of Business, Innovation and Employment (MBIE) *Part D – Guidelines for geotechnical investigation and assessment of subdivisions in the Canterbury region* and the Waimakariri District Council *Engineering Code of Practice* – Part 4: Geotechnical Requirements, and includes:

   (i) Site walkover and shallow testing (26 test points) results;
   (ii) Review of data available on the New Zealand Geotechnical Database (NZGD) and previous geotechnical reports;
   (iii) A visual assessment of rockfall and slippage, including potential hazards associated with seismic activity;
   (iv) A visual assessment of the slope stability and discussion on the appropriateness of building sites;
   (v) Recommendations including 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. Site-specific geotechnical investigation at building consent stage will be required to determine the depth to an appropriate bearing capacity at the location of each dwelling;
   ii. Finished floor levels are confirmed during the consenting process by Waimakariri District Council and/or Environment Canterbury;
   iii. Specific engineering design, observation and certification will be required on proposed Lots 39 – 48 and 94 to address the reduced bearing capacity and possible low liquefaction risk identified in this area.

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 appropriate geotechnical investigation and the normal inspection of foundations and ground conditions at the time of construction of any building.

5. This certificate 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. The geotechnical engineering firm issuing this statement holds a current policy of professional indemnity insurance of no less than $ 2,000,000.00 (Minimum amount of insurance shall be commensurate with the current amounts recommended by EngNZ, ACENZ, TNZ, INGENIUM.)

Elliot Duke

……
(Signature of Engineer)
For and on behalf of Davis Ogilvie & Partners Ltd.

Date: 09 February 2024

Qualifications and experience:
BE Nat Res (Hons), CMEngNZ
CPEng IntPE(NZ) / APEC Engineer