4 Loader Lane and 2 Ararat Lane, Clifton, Christchurch

Geotechnical Report for Resource Consent

Prepared for: Gethvillas Limited

CC: Stuart Grant

Project 51274 - Rev 0 - 02/08/2023

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Revision	Date	Engineer	Description
0	02/08/2023	DP	FINAL

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Limitations of Report

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Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report, in regard to its accuracy or completeness.

Our opinions and recommendations are based on our comprehension of the current regulatory standards and must not be considered legal opinions. For legal advice, please consult your solicitor. This opinion is not intended to be advice that is covered by the Financial Advisors Act 2010.

The recommendations and opinions contained in this report are based on our visual reconnaissance of the site, information from geological maps and upon data from the field investigation as well as the results of in situ testing of soil. Inferences are made about the nature and continuity of subsoils away from and beyond the exploratory holes which cannot be guaranteed. The descriptions detailed on the exploratory hole logs are based on the field descriptions of the soils encountered.

Any advice provided in connection with a site in Class II or III zones of the Port Hills Mass Movement area has been provided with reference to the current guidance available from the Ministry of Business, Innovation and Employment at the time of preparing this report. No responsibility is accepted for any consequences resulting from any future alterations to these guidelines, general practices or the law concerning development in Class II or III zones. A degree of resilience and repairability is required for a building in these areas where future ground movement resulting in building damage is still possible.

This report includes Appendices. These appendices should be read in conjunction with the main part of the report and this report should not be considered complete without them.

CONTENTS

1.0 INTRODUCTION

1.1 Terms of Reference

Engineering Design Consultants Ltd (EDC) was commissioned by Gethvillas Limited on 30/05/2023 to provide a geotechnical assessment suitable for Resource Content for a proposed 13 lot subdivision at 4 Loader Lane and 2 Ararat Lane, Clifton, Christchurch.

1.2 Proposed Development/Works

It is proposed to divide Lot 16 (defined in this report as Area 1 – Figure 1), into 7 separate lots, and Lot 15 (defined in this report as Area 2 – Figure 2) into 5 lots (referred to below as Lots 1 to 15). Proposed subdivision plans, provided Elrick & Co form Appendix A.

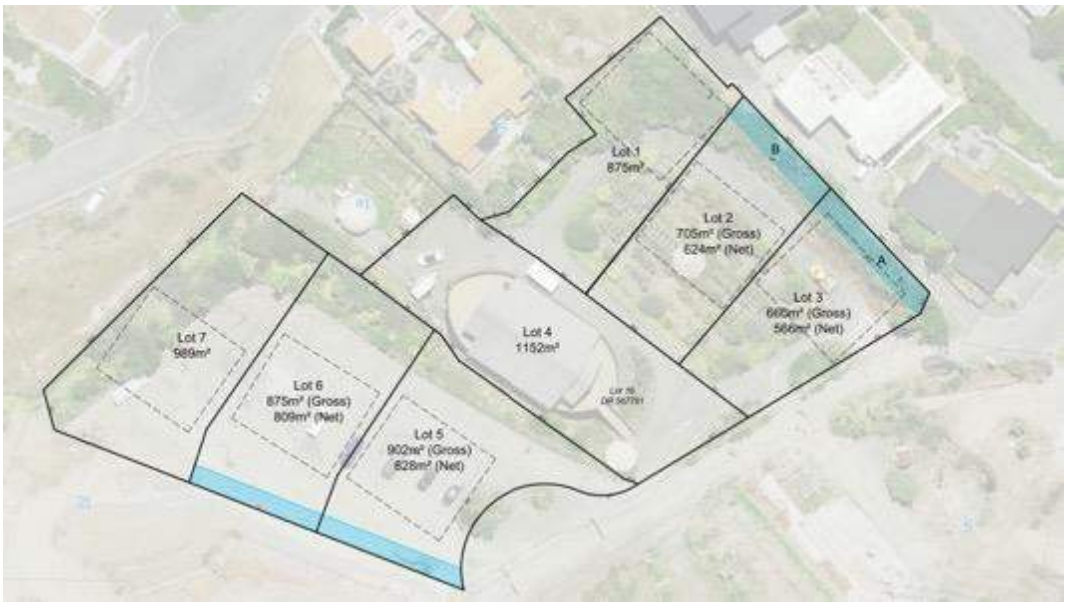

Figure 1: Proposed Development Plan of Area 1 (Lot 16)

Figure 2: Proposed Development Plan of Area 2 (Lot 15)

1.3 Objective/Scope

The objective of this report is to assess the geotechnical hazards on the site with respect to the proposed subdivision. In order to achieve the outlined objectives this geotechnical investigation comprised the following scope:

- A geotechnical desktop study to review geological mapping and geotechnical information resources.
- A review of freely available historical aerial photographs.
- A site walkover.
- A shallow intrusive investigation comprising hand auger boreholes and Scala Penetrometer tests.
- A Resource Management Act Section 106 assessment and provision of a Geotechnical Statement of Professional Opinion.
- An interpretive report summarising the above and assessing the suitability for subdividing the site for Resource Consent, with preliminary foundation recommendations.

2.0 EXISTING GEOTECHNCIAL REPORT

EDC has been supplied with a geotechnical report by BLE, for an earlier subdivision of the larger area (to the west of Area 1). This investigation consisted of 6 x shallow test pits to a depth of 0.7 – 1.5m below existing ground level (bgl) - 7 x shallow Dynamic Cone Penetration (DCP) tests using the Scala penetrometer to practical refusal. The test pits generally encountered an organic-rich silty topsoil between 0.3m and 0.4m thick, which was underlain by yellowish brown clayey silt. Rock/refusal was at depths ranging between 0.7m and 1.9m. Non-engineered fill was present locally where past earthworks have been undertaken for Gethsemane Gardens.

The results of the BLE shallow investigation logs are attached as Appendix B.

3.0 SITE DESCRIPTION

3.1 Site Location

The site is irregular in shape and covers a total area of approximately 0.61ha (Lot 16) and 1.02ha (Lot 15). The Google Earth coordinates of the approximate centre of the site are: 43°34'25.59"S, 172°44'34.69"E (Lot 16/Area 1) and 43°34'30.83"S, 172°44' 32.49"E (Lot 15/Area 2).

Figure 3: Site Aerial Photo showing the location of the site within the larger area in red (Courtesy of Canterbury Maps)

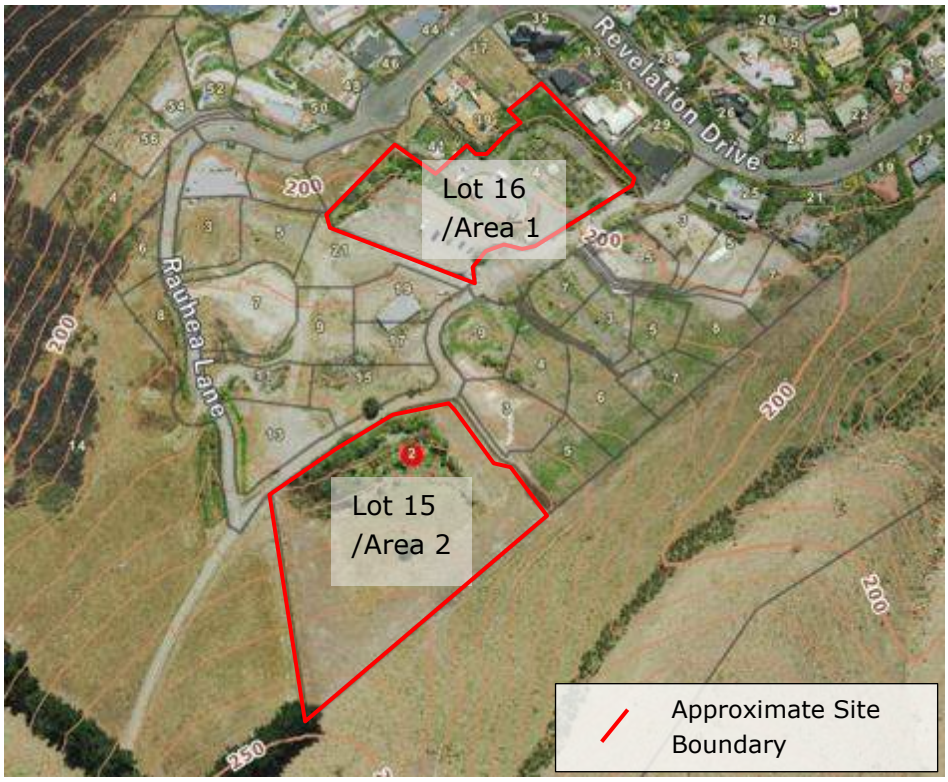

Figure 4: Site Aerial Photo (Courtesy of Canterbury Maps)

3.2 Site Walkover

3.2.1 Area 1

Area 1 is split into three portions, the northern area that has previously been a garden area, the area of the current building and the car park area above. The following are key features of each of the areas:

- The garden area is gently sloping to the northeast, with a mass wall retaining structure (~1-2m high) along the northern boundary, supporting a driveway.
- Proposed Lot 4 contains an existing dwelling with the land generally sloping to the northeast. This area is largely covered in asphalt with a large mass wall retaining structure (3-4m high) to the west. The structure on Lot 4 and the mass wall are planned to remain as part of this subdivision, with no development works proposed as part of this project.
- The car parking area is sloping gently down to the northeast. An approximately 3.5m high retaining wall in located on the adjacent site, along the north western boundary of Lot 7. Above this wall, the ground slopes up at ~20 – 25° to the gravel fill surfaced car park.
- No ground damage or erosion features were noted at the time of EDC's visit (16/06/2023).

Figures 5 to 12 show the key features of area 2, taken during EDC's site walkover:

Figure 5: View of the garden area of Area 1, looking west.

Figure 6: View of the garden area of Area 1, looking southeast towards Lots 1-3

Figure 7: View of Lot 4 with the existing dwelling on the right, looking south

Figure 8: Example of the mass wall between Lot 4 (Lower elevation) and Lot 5 (higher elevation), looking west (Area 1)

Figure 9: View of the car park area (Lots 5 – 7), looking northwest (Area 1)

Figure 10: View of the car park area (Lots 5 – 7), looking southeast (Area 1)

Figure 11: View of the retaining wall west of Lot 7, looking northeast (Area 1)

Figure 12: View of the retaining wall below Lot 7, looking northeast (Area 1)

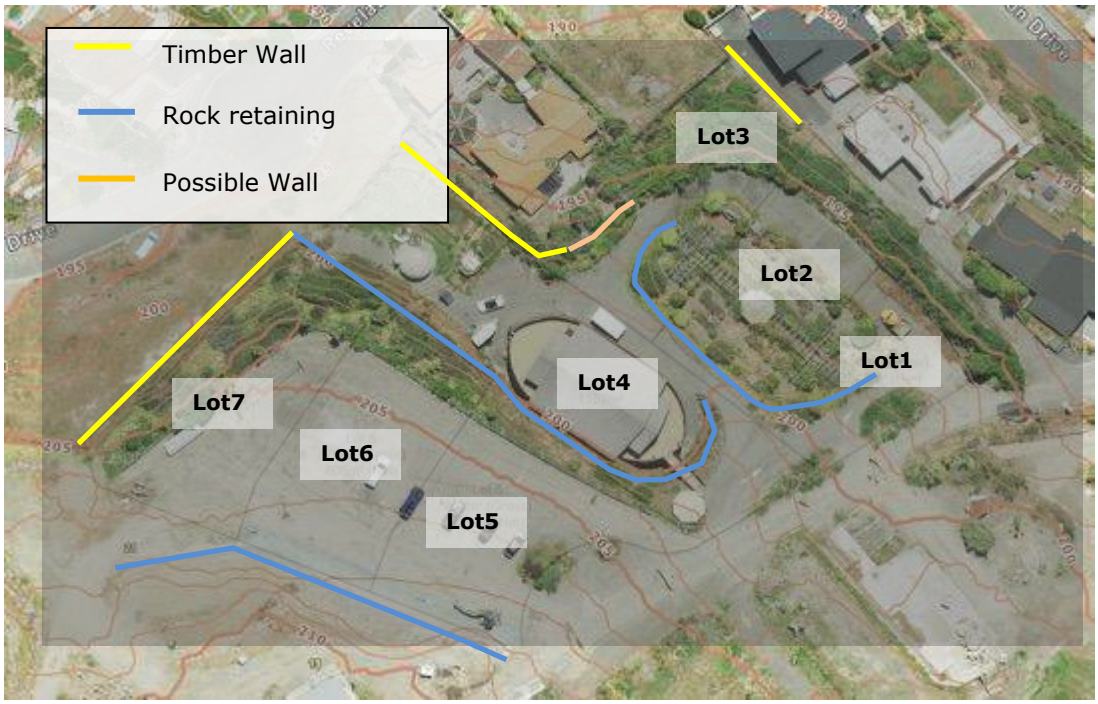

Figure 13: Location of retaining wall structures

3.2.2 Area 2

Area 2 is accessed via a right of way off Ararat Lane, the area forms a ridge that is generally sloping to the northwest, with the land to the south sloping to the southeast. The grounds are vegetated, with tall grasses and mature trees along the northern boundary. Along the northern and eastern boundary, the site slopes approximately 20-25° (Figure 19). No retaining walls were observed.

No ground damage or erosion features were noted at the time of EDC's visit (16/06/2023).

Figures 14 to 19 show the key features of Area 2, taken during EDC's site walkover:

Figure 14: View of the entrance to Area 2, looking north (Lot 10)

Figure 15: View of area two, looking northwest towards Lot 9

Figure 16: Looking west towards Lot 13

Figure 17: View from Lot 13, looking west towards Lots 11 and 12

Figure 18: View of Area 2 from Lot 13, looking northeast

Figure 19: View from Ascott Road, looking towards Lots 9 and 11 (Area 2)

Figure 20: View of the valley to the southeast of the site.

4.0 SITE HISTORY

4.1 Historical Aerial Mapping

Historical aerial photographs available on Environment Canterbury's (ECan) GIS database (Environment Canterbury, 2016) have been reviewed by EDC for the years 1929 through to 2019. This review indicated that:

- In 1929, the site was undeveloped. A line of trees were present crossing northeast and southwest of Area 1 in the approximate location of the large rock retaining wall.
- By 1969, a structure was built in the car park area (Lot 7) and was removed by 1974.
- By 1994, Area 1 is part of the larger Gethsemane Garden grounds, with the car park present and garden areas present. In Area 2 pine tree shelterbelts are present around the boundary and the middle of the site.
- By 2004, the building within Lot 4 is present, with the pine trees along the mass rock wall removed. It is possible that the lower elevation was cut, with the mass walls steepened/created.
- By 2022, the mature trees in Area 2 have mostly been removed. A figure showing where mature pine trees in Area 2 once stood can be found in Figure 21.

The removal of mature trees, commercial activities (the gardens) across the two areas and earthworks during the construction of the dwelling and retaining walls may have resulted in the placement of non-engineered fill on site to create flat platforms, especially behind retaining walls which may pose a geotechnical constraint to development of the site.

Figure 21: Aerial image showing where mature trees were present in red

4.2 Historical Land Use

The ECan Listed Land Use Register (LLUR) holds information regarding sites that have been or currently are used for activities which have the potential to cause contamination.

The LLUR indicates that HAIL activity A10 (Persistent Pesticide Bulk Storage or Use)' may have occurred on the site, characterised by 'Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds' and was based on aerial images. Area 1 is considered partially investigated due to an investigation having occurred on the adjacent subdivision to the east (Previously 27 Revelation Drive, Clifton)

The adjacent subdivision (Previously 27 Revelation Drive, Clifton) was investigated by Geoscience Limited in 2014, which found soils to be below residential standards for heavy metals and organochlorine pesticides.

Although no investigation has been undertaken on Area 1 or 2, the above HAIL activity is not anticipated to have a geotechnical impact on the proposed development.

The LLUR response forms Appendix C.

5.0 GEOLOGICAL DESK-BASED INFORMATION

5.1 Geological Mapping

According to the GNS Geological Unit QMap, available on the New Zealand Geotechnical Database (Earthquake Commission / Ministry of Business, Innovation & Employment, 2016), the site is underlain by Neogene (9.7 Ma – 11 Ma) igneous rocks (Figure 22), comprising *'Basaltic (hawaiite) to trachytic lava flows interbedded with tuff and breccia (including lahars), many dikes & minor lava domes'* (Mvl).

Loess soils 'mQe' may sit locally on top of the rock and are Quaternary (12k – 524k) in age and described as '*yellow-brown windblown silt deposits, locally with fine sand or clay'.*

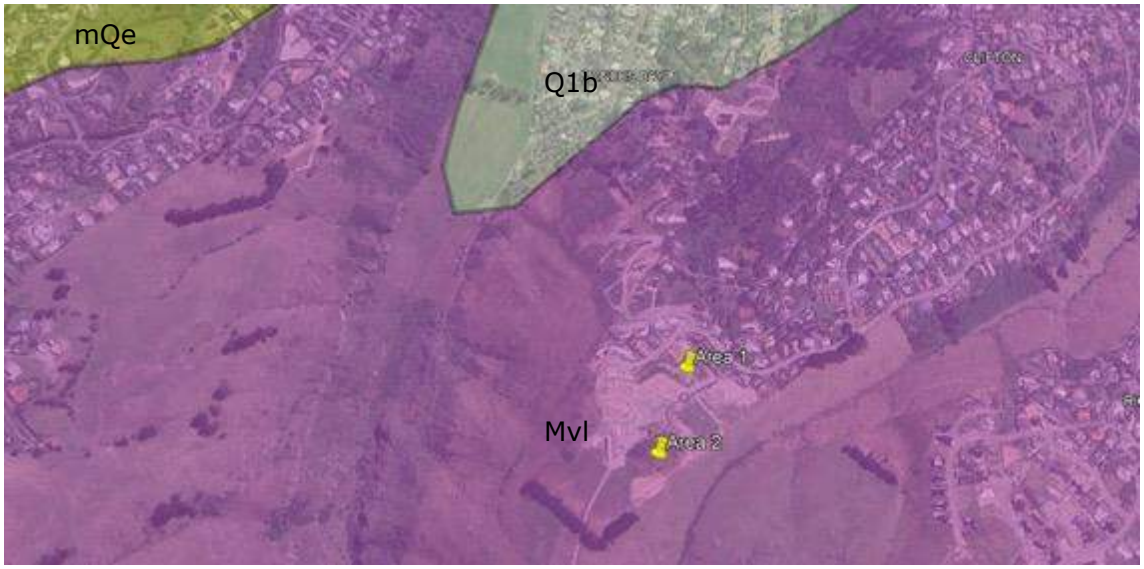

Figure 22: GNS Qmap units

5.2 Geological Investigation Data

Table 1 below is a summary of information obtained from the New Zealand Geotechnical Database (NZGD) and the ECan GIS Database, from previous investigation holes within the local area:

Hole Reference	Location	Depth	Summary
HA-DCP_ 175384 (DCP1+HA)	~25m N (from Lot 15) 27B Revelation Drive	3.0m	FILL to 0.3m TOPSOIL to 0.8m SILT, stiff to hard to 3.0m End of hand auger at 3.0m (Target Depth), groundwater not encountered
HA-DCP_ 175400 (DCP01+HA)	~49m S (from Lot 16) Lot 11, Loader Lane	3.0m	TOPSOIL to 0.2m SILT, stiff to very hard to 1.0m, then becoming very stiff to hard to 3.0m End of hand auger at 3.0m (Target Depth), groundwater not encountered
BH_32803 (BH101)	~65m N (from Lot 16)	15.2m	FILL to 0.3m Sandy SILT, stiff to very stiff to 1.5m

	Galilee Lane		GRAVEL, medium dense to 3.0m BASALT and SCORIA to 4.8m GRAVEL to 6.3m BASALT, weak to moderately strong to 15.2m End of borehole at 15.20m, groundwater not encountered
TP1 + DCP1	~ 20m E Lot 1, 27 Revelation Dr	0.65m	TOPSOIL to 0.3m SILT (Loess), firm 0.65m End of test pit at 0.65m, Groundwater not encountered
TP3 + DCP3	~ 20m E Lot 1, 27 Revelation Dr	1.3m	TOPSOIL to 0.4m Clayey / sandy SILT, dense to 1.3m End of test pit at 1.3m, Groundwater not encountered Scala continued to 1.9m before refusing

Table 1: Nearby Geological Investigation Summary

5.3 Ground Water Data

The Canterbury Geotechnical Database GNS groundwater maps do not indicate groundwater depths in the area of the site due to the site's hillside location. Groundwater is not anticipated based on NZGD/nearby Investigations. Perched water on top of rock was found in nearby investigations.

5.4 Nearby Springs

The Canterbury Maps website does not show any springs present within close proximity to the site.

5.5 Seismic Site Subsoil Classification

EDC considers that a seismic site subsoil classification Class B – Rock, as defined in NZS:1170.5 is appropriate.

5.6 Technical Classification

Canterbury Maps indicates the site is located in a zone labelled 'Green Zone – N/A Port Hills & Banks Peninsula'.

Christchurch Liquefaction Information vulnerability map considers the site to be 'Liquefaction Damage Is Unlikely.'

5.7 Rockfall and Slope Stability

5.7.1 GNS Geomorphological Mapping for Rockfall Risk Assessment

The site is included on map C12 of the Port Hills GNS Geomorphological Mapping for Rockfall Risk Assessment (Townsend & Rosser, 2012). This map indicates that the site is underlain by rock at or near the surface with a small portion of Area 2 to the northwest corner being underlain by colluvium. A cliff is marked at the top of the northern slope of Area 2 with a rounded concave break in slope running northwest to

northeast and a rounded ridgeline running east to south of Area 2. No ephemeral drains are present on the site.

Figure 23: GNS Geomorphological Mapping for Rockfall Risk Assessment

5.7.2 GNS Rockfall Risk

The site can be found on Map C10 of the GNS study for life safety from rockfall risk (Carey, et al., 2013), it is noted that the site is not indicated to be in an area with an annual risk of fatality from rockfall.

5.7.3 GNS Cliff Collapse

The GNS study for life safety from cliff collapse (McSaveney, Massey, & Heron, 2013) does not include the subject site.

5.7.4 CCC Earthquake Rockfall Maps

Rock fall maps titled 'Location of fallen and in-situ boulders and bluffs', are provided on the Christchurch City Council (CCC) website.

Map 38 includes the subject site and does not indicate any fallen boulders, in situ boulders or collapsed bluffs located above or within the vicinity of the site. It should be noted these maps were last updated in May 2013.

5.7.5 GNS Mass Movement

The site has not been identified in the GNS study of Mass Movement Areas Report (Massey, et al., 2013) for the Port Hills.

5.7.6 GNS strong motion

The nearest GNS seismic station is located at Heathcote Valley Primary School, located 2.5km southwest of the site. This motion sensor recorded horizontal displaces equivalent to 1.4g during the 22 Feb 2011. Is it assumed that the subject site received a similar if not greater PGA's due to the magnification effect of the site's

ridgeline topography. Post the Christchurch Earthquake Sequence, including the Feb 2022 earthquake no ground damage was recorded on-site.

5.8 Geological Fault-lines

The GNS Active Fault maps, available on the NZGD indicate that there are no active faults within 10km radius of the site.

5.9 Flooding

The site is located on a hillside. Provided surface water is controlled, flooding is not anticipated to be an issue.

Consultation with CCC is recommended to establish any restrictions / Resource Consent requirements.

6.0 SITE INVESTIGATION

6.1 Rationale

To achieve the outlined objectives, shallow hand testing involving hand auger boreholes (HA's) and Scala Penetrometer tests (SC's) was considered sufficient to determine ground conditions for the proposed works, in accordance with the MBIE guidance.

6.2 Intrusive Investigation Summary

6.2.1 Shallow Hand Testing

EDC visited the site on 16 June 2023 to undertake a shallow geotechnical investigation in order to determine the subsoil conditions.

We undertook a total of nine hand augered exploratory holes and nine Scala Penetrometer tests (HASC 101-109). Soils have been described generally in accordance with NZGS: Field Description of Soil and Rock. The results of these investigations are shown on the HA Log sheets attached in Appendix D.

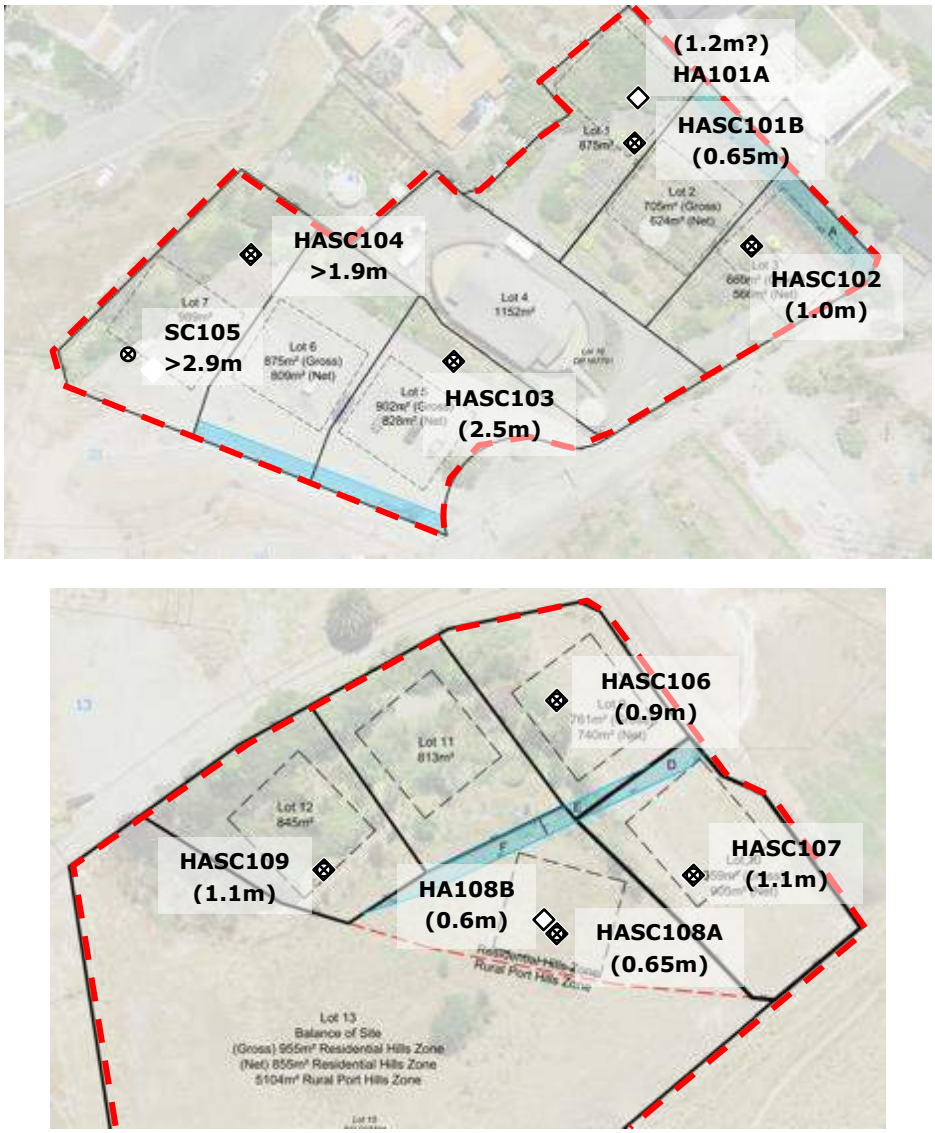

Figure 24: Intrusive Investigation Approximate Locations. The depth to rock is given in brackets

Within Area 1, hand augers generally refused within shallow hardfill between 0.1m and 0.6m, with Scala Penetrometers in the garden area (Lots 1-3) reaching refusal on assumed rock at depths ranging between 0.65 and 1.1m. Upslope, in the car park area, rock was encountered at 2.5m in the Scala Penetrometer of HASC103. Scala Penetrometers at HASC104 and SC105 reached between 1.9m and 2.9m without encountering rock.

Within Area 2, shallow testing reached between 0.6m and 1.1m, refusing on the shallow rock.

The depth to rock is in line with the nearby BGL shallow investigations and the outcropping of rock within the larger subdivision and the nearby road cuttings.

The approximate investigation locations are indicated in Figure 24, above.

6.3 Summary of Ground Conditions

6.3.1 Area 1

The depth of fill soils varies through the proposed subdivision. Within the garden area (Lots 1-3), this was found to be within the upper 0.65 to 1.2m, with rock below.

Fill is anticipated to be present in the car park area (Lots 5 – 7), being its thickest along the north eastern and north western edges of the gravel surfaced carpark. Rock was encountered as shallow as 2.5m in SC103 (Lot 5), but was not encountered in SC104 & 105 (Lot 7). Rock exposures in the vicinity indicate a bedrock depth of 3m - 7m below ground level in Lot 7.

Groundwater was encountered in HA101B at 0.5m, assumed to be perched on rock.

6.3.1 Area 2

Topsoil was generally encountered to 0.3m depth, with natural very stiff loess soils below. Shallow hand tested refused between 0.6m and 1.1m on shallow rock.

Fill soils were encountered in HA's 108A and 108B to 0.6m, before refusing on rock. The fill soils in Area 2 and anticipated to be associated with the mature pine trees that once stood in the middle of Area 2 from 1995 to 2004. Fill soils associated with the removal of trees may also be present on the eastern side half of Lots 9 and 10.

7.0 GEOTECHNICAL ASSESSMENT

7.1 Static Ultimate Bearing Capacity Assessment

The Scala Penetrometer results have been assessed using a correlation between Scala blow count and allowable bearing capacity by Stockwell (Stockwell, 1977). Using this correlation, the Scala Penetrometer results indicate the following geotechnical ultimate bearing capacities (UBC's).

It is anticipated that a geotechnical UBC of 300kPa will be available in the natural inorganic soils and rock encountered between 0.3m and 1.2m (but may locally be deeper due to natural variability/presence of fill). This will require confirmation at the Building Consent stage.

A copy of the Scala Penetrometer Ultimate Bearing Capacity Graph for both areas forms Appendix E.

All bearing capacities will need to be confirmed at Building Consent Stage. Any topsoil/fill, very soft, organic or otherwise unsuitable materials encountered are not considered a suitable bearing stratum and will require removal beneath the building platform.

7.2 Ground Settlement Under Static Conditions

The natural soils and rock are not prone to static settlement, however static settlement should be considered on a lot-by-lot basis at building consent when considering the proposed building plans.

Should earthworks consist of raising the ground more than 600mm above the current ground level, EDC should be contacted.

7.3 Qualitative Liquefaction Comment

For liquefaction to occur there needs to be three preconditions:

- Young (Holocene or less than 10,000 years old) sediments;
- The soils include fine-grained and non-cohesive (silts and sands);
- The soils are saturated (below the water table).

The natural loess soils on site are expected to be Quaternary in age (At least 12,000 years old), with shallow rock present. Groundwater is not anticipated in the area due to the elevation; however localised perched groundwater may be present. In view of the above, and considering the low susceptibility of the loess and shallow rock to liquefaction we consider that:

- Future land performance of the site is likely to be within the limits of MBIE land classification Technical Category 1 (TC1).
- Vulnerability to liquefaction classification of 'Liquefaction Damage Is Unlikely', which is in line with the Christchurch Liquefaction Information
- Deep (>15m) drilling and quantitative liquefaction analysis is not warranted.

7.4 Slope Stability Comment

As shown in Figure 25 below, there are several retaining wall structures in Area 1, with the main constraint being the retaining structures downslope of Lots 5 to 7, with a smaller slope associated with Lots 1-3.

7.4.1 Lots 1-3

The proposed building platform on Lot 3 encroaches a slope that slopes at approximately 20-25° to the north and west which is partially retained. Provided that foundations are designed not to load these walls/slopes, the stability of these slopes are considered to be suitable. A building limitation line (BLL)* 3.0m from the boundaries (Figure 25) is recommended to ensure walls are not loaded without further specific design and investigation.

Alternatively, EDC can be contacted for advice regarding retaining of these platforms at the building consent stage. This BLL will impact lot the proposed building platform of Lot 3.

*A Building Limitation Line (BLL) is defined as the edge of a zone which is the closest that a building should be located towards a slope or significant feature. Building above (i.e. on the side away from the slope) the BLL will have no specific design limitations due to stability issues.

7.4.2 Lots 5-7

A 2-3m high retaining wall supports lot 7 along its north western boundary. The retaining wall is located on the adjacent property with a 2-3m high surcharge at 20-25° above the wall.

The depth of fill behind this wall is assumed to be 1.0m – 1.5m, with rock anticipated to be present at the base of the wall (~RL 200m – 202m), which is consistent with rock exposure on adjacent properties.

In order to avoid loading the existing retaining walls on lots 5 – 7, a Building Limitation Line (BLL) has been set based on the greater of two requirements: 10m from the top of the retaining wall (such that the angle of repose is 30 degrees or less) or 3m from the crest. This BLL primarily impacts the building platform of Lot 7, with the proposed building platforms of Lots 5 and 6 being outside of the BLL.

Building below from the BLL will require SED and further investigation.

7.4.3 Lot 4

Given the sites performance in terms of slope stability post the Christchurch Earthquake Sequence and with a nearby a motion sensor recording ground displacements of 1.3g post the 22 Feb 2011 earthquake event having no recorded damage, EDC considers the walls on Lot 4 to be at low risk of failure. To prevent loading of these walls, BLL's have been placed on Lots 5 - 7 as discussed in section 7.4.2.

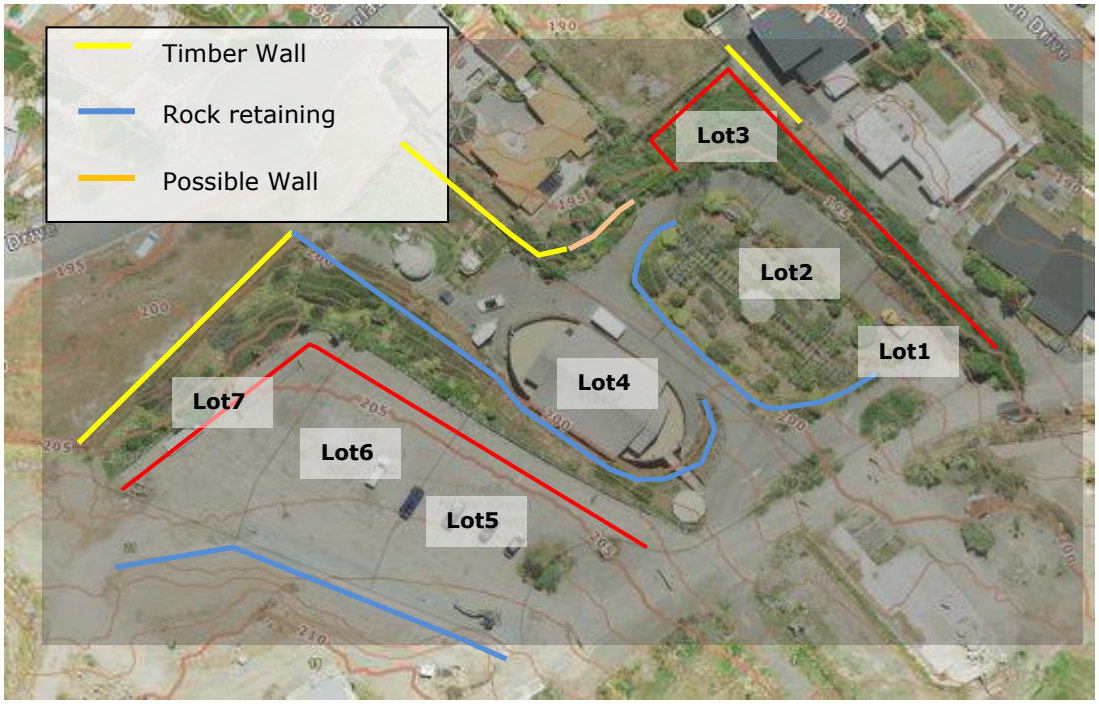

Figure 25: Existing retaining wall structures, with contours. The approximate location of the Building Limitation Line is in red

7.4.4 Area 2

Slopes near the northern and eastern boundaries of Lots 9, 10, 11, and 12 are sloping at approximately 25-30°. The natural loess soils are very stiff. Shallow rock is present and there is no evidence of shallow slips or erosion. Provided that foundations and access ways are designed appropriately there are no inherent slope stability risks.

If bulk earthworks are intended to fill any areas of the site, EDC should be contacted to ensure the above slope stability recommendations remain suitable, as shallow rock may prevent the use of cantilever wooden pole walls in some areas.

8.0 RESOURCE MANAGEMENT ACT ASSESSMENT

Section 106 (1) of the Resource Management Act (RMA) states:

'A consent authority may refuse to grant a subdivision consent, or may grant a subdivision consent subject to conditions, if it considers that:

(a) there is a significant risk from natural hazards; or

(b) section repealed.

(c) sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision'

RMA 106 1A indicates that '*for the purpose of subsection (1)(a), an assessment of the risk from natural hazards requires a combined assessment of:*

(a) the likelihood of natural hazards occurring (whether individually or in combination); and

(b) the material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and

(c) any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b)'.

Table 2 provides our assessment of parts (a) of the above. Section 106 1(b) was repealed and 106 (c) is not relevant to a geotechnical assessment:

Hazard	**Potential Susceptibility**	
	Current (part a)	**Post Development (part b)**
Erosion	While no signs of erosion were observed during the site walkover, the site has steep slopes in places and the natural loess soils are susceptible to erosion.	It is not anticipated that the proposed development will accelerate or worsen the erosion rates provided appropriate stormwater collection and disposal methods are implemented. Slopes and open spaces should be vegetated/grassed post-construction.
Falling Debris	GNS has not indicated an elevated risk of falling debris.	Several retaining walls are present around the perimeter of the subdivision, Specifically Engineered Design and BLL's (Section 7.4) are recommended such that foundations do not load these structures.
Slippage	There are currently no signs of slippage. Further comment on the slopes of concern is outlined in section 7.4.	Provided slopes are retained and/or foundations designed not to load the current slopes/retaining walls as described in section 7.4, the site risk of slippage will not be worsened.

Hazard	Potential Susceptibility	
	Current (part a)	Post Development (part b)
Subsidence	Based on the general strength and non-organic nature of the natural soils the risk of static subsidence is considered low. The site is classified by MBIE as Green Zone – N/A Port Hills & Banks Peninsula, with the liquefaction vulnerability classified as 'Liquefaction Damage Is Unlikely'.	Provided that foundations are located on a suitable bearing stratum, and to an engineered design, the risk of subsidence is unlikely to be worsened. It is recommended that further assessment of static settlement risk is undertaken if the ground is raised by more than 600mm.
Inundation - Flooding	Flooding has not been identified as an issue due to the elevation of the site.	Localised control of surface water is recommended to provide prevent erosion and mitigate the risk of localised ponding.

Table 2: RMA Section 106 (1) Assessment

It is considered, under Section 106 (1) of the RMA, that there are no reasons from a geotechnical perspective that the site is considered unsuitable for development, provided any development is undertaken with appropriate engineering design measures including providing adequate retaining of slopes, compliance with the BLL (Section 7.4) and or specifically engineered design foundations.

Our Geotechnical Statement of Professional Opinion forms Appendix F.

9.0 CONCLUSIONS / RECOMMENDATIONS

9.1 Ground Description

Shallow hand augers within Area 1 generally refused within hardfill, with Scala Penetrometers indicating varying depths of rock (as shallow as 0.6m to >2.9m). Within Area 2, very stiff loess soils are encountered from 0.3m below the existing ground level, with rock encountered between 0.6m and 1.1m below the existing ground level. Localised fill was found to be 0.6m thick was identified overlying rock within the proposed building platform of Lot 13, and is anticipated to be associated with the removal of trees and may be present on the eastern half of proposed building platforms 9 and 10, but were not encountered in our shallow investigation.

Saturated soils were encountered in HA101B, being perched on rock but were not present to 1.2m in HA101A. The absence of shallow groundwater is in line with the adjacent BLE investigation, which did not encounter groundwater with the exception of one test pit, which found saturated soils perched above the rock. The presence or absence of shallow groundwater and the depth to natural soils should be further investigated on a lot-by-lot basis at the Building Consent Stage.

9.2 Slope Stability Comment

9.2.1 Area 1

The slopes are generally considered stable within the building limitation lines specified in section 7.4. Building elements that are proposed beyond the BLL will require site specific retaining walls, quantitative slope stability analysis and/or engineered foundations at the building consent stage.

9.2.2 Area 2

Within Area 2, the natural loess soils are stiff with shallow rock present and no evidence of shallow slips or erosion. Provided that foundations and access ways are designed appropriately there are no elevated risks of slope instability.

9.2.3 General comment

If it is intended to fill any areas of the site, EDC should be contacted ensure the above slope stability recommendations remain suitable.

9.3 Proposed Additional Works

It is recommended that a site-specific geotechnical investigation is undertaken on each proposed lot at the building consent stage, based on the proposed dwelling design. Should building elements be proposed beyond the BLL's outlined in Section 7.4, a slope stability analysis or engineered design will be required.

9.4 Potential Foundation Types

Based on the ground assessment, the following preliminary foundation recommendations are considered appropriate to the ground conditions for dwellings located behind the BLL

outlined in Section 7.4. However, they should be confirmed at the building consent stage using lot-specific information including bearing capacities and founding depth/material.

- A shallow piled foundation is considered to be suitable to the site's conditions. These are likely to require specific engineering design due to the sloping nature of the site and localised presence of fill.

- A waffle or slab-on-grade foundation must be suitability retained with fill soils removed below the building footprint. Such foundations must be constructed to avoid loading adjacent slopes or retaining walls. The feasibility of this approach will need to be confirmed at Building Consent Stage, when considering the proposed buildings and depths of fill beneath the building footprint.

Fill soils associated with the removal of trees were identified on Lot 13 within the proposed building platform to 0.65m, and may also be present locally within the building platform of Lots 9 and 10.

9.5 Erosion Control

The silt encountered on-site (Loess) is susceptible to riling and tunnel erosion. As such:

- Stormwater from land runoff, roofs and hard paved areas should drain into a piped network. Uncontrolled discharge to land and the use of soakaways should be avoided.
- A stormwater flow path should be designed to ensure water is diverted appropriately and to minimise the risk of tunnel/gully erosion.
- Service trenches should be backfilled with low permeability materials to avoid preferential pathways for water to enter the ground.
- If the natural silt is to be used as backfill, it should be treated with lime/cement. Advice from a suitably qualified geotechnical engineer should be sought if this is to be pursued.
- The advice of a competent engineer should be sought if any erosion features are encountered during construction.
- It is vital that a good level of vegetation is maintained across the site during and post-development.

9.6 General

If gravel hardfill is required, it should be compacted in accordance with NZS 4431:2022 Engineered fill construction for lightweight structure and MBIE Module 5A: Specification of ground improvement for residential properties in the Canterbury region (MBIE & NZGS, 2021). Validation testing of the compacted gravel should be undertaken and signed off by a suitably experienced Geotechnical Engineer.

According to the New Zealand Building Code, Ultimate Bearing Capacities should be multiplied by a reduction factor based on the design scenario. The MBIE Earthquake geotechnical engineering practice Module 4 'Earthquake resistant foundation design', suggests 0.45 – 0.60 (EDC recommends 0.60) for all Ultimate Limit State load combinations and the NZBC recommends 0.40 – 0.55 (EDC recommends 0.50) for all other load combinations.

It is the structural engineer or designer's responsibility to ensure that the recommendations of this report are correctly understood and applied. We are happy to discuss the project with the structural engineer or designer and recommend that we review the final design documentation prior to construction.

Any topsoil/fill, very soft, organic or otherwise unsuitable materials encountered are not considered a suitable bearing stratum for new foundations and will require removal beneath the building platform.

Advice from a geotechnical engineer should be sought if ground conditions different to those encountered in the intrusive investigation are observed during foundation construction works.

9.7 Health and Safety

We recommend that 'Safety in Design' principles are included during the design of the proposed structure/development. It should be noted that all parties involved in construction, including the client have responsibilities under the current 'Health and Safety at Work Act 2015'. This includes ensuring that the chosen contractor is both competent and suitably qualified/experienced to undertake the commissioned works.

EDC would be happy to provide geotechnical/geoenvironmental advice in relation to these issues at any workshops or design meetings for this project. In addition, our Structural and Fire Safety Design Engineers can provide advice as appropriate.

1.0 REFERENCES

Bowles, J. (1997). *Foundation Analysis and Design, 5th Edition.* Peoria, Illinois: McGraw-Hill.

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APPENDIX A

PROPOSED SUBDIVISION PLANS

CONSULTANT PROJECT No.

CONSULTANT DRAWING No.

REF. DRAWING No.	REFERENCE DRAWINGS	REV.	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APP'D	CLIENT

Elrick & CO PLANNING & SURVEYING

SURVEYED:	J. Elrick	DATE:	8/11/2022
DRAWN:	J. Elrick	DATE:	8/11/2022
CHECKED:		DATE:	
APPROVED:		DATE:	
SCALE:	1:250 @ A3		
STATUS:	DRAFT		

DRAWING TITLE:
Proposed Lots 1 to 13 Being a Subdivision of
Lots 15 and 16 DP 567781
The Hills

SHEET SIZE A3 | DRAWING No. 5910-001-The Hills | REVISION

C:\Users\JeremyElrick\Elrick & Co\Main site - Documents\2.0 Projects\5900 - 5999\5910 - The Arc Subdivision\3.0 Survey and Design\3.5 Drawings and CAD\3.5.1 CAD\5910-001.dwg Feb 15, 2023 - 8:24am

APPENDIX B

BLE SHALLOW INVESTIGATION LOGS

INVESTIGATION LOG

No.: TP1 + DCP1
Job No.: BGL1939
Sheet: 1 of 1

Client:	Coordinates:	Ground Level:	Date:
Stuart Grant	E 1,579,200.00 N 5,175,265.00	241	08/08/19

Project:	Location:
Lot 1, 27 Revelation Drive	Clifton, Christchurch

Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)	Legend	Scala Penetrometer (blows / 100mm)	Hand Shear Vane (Corrected)	Water
Organic SILT, some rootlets, trace gravel; dark brown; moist [TOPSOIL].	0.2	TS T TS	(200kPa)* (300kPa)* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19		Groundwater Not Encountered
SILT, minor sand, minor gravel, trace clay, trace cobbles; yellowish brown; moist [LOESS COLLUVIUM].	0.4				
Slightly weathered to moderately weathered; black; porphyritic; BASALT; strong [BEDROCK].	0.6				
EOH: 0.70m	0.8				
	1.0				
	1.2				
	1.4				
	1.6				
	1.8				
	2.0				
	2.2				
	2.4				
	2.6				
	2.8				

Legend

- TP1
- DCP1

Remarks

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [ ] Hand Auger
- [x] Test Pit

Contractor:	Rig/Plant Used:	Logged By:	Checked By:	Hole Depth:
Bob McGiffin		Tom Garden	David Bell	0.70 m

Produced with Core-GS

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INVESTIGATION LOG

No.: TP2 + DCP2
Job No.: BGL1939
Sheet: 1 of 1

Client:	Coordinates:	Ground Level:	Date:
Stuart Grant	E 1,579,273.00 N 5,175,313.00	224	08/08/19

Project:	Location:
Lot 1, 27 Revelation Drive	Clifton, Christchurch

Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)	Legend	Scala Penetrometer (blows / 100mm)	Hand Shear Vane (Corrected)	Water
Organic SILT, some clay, some rootlets; dark brown; soft; moist; low plasticity [TOPSOIL].	0.2	TS T TS T	(200kPa)* (300kPa)* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19		Groundwater Not Encountered
Clayey SILT, minor rootlets; yellowish brown; firm; moist; low plasticity [LOESS COLLUVIUM].	0.4 0.6 0.8				
EOH: 0.90m	1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8				

Legend

- TP2
- DCP2

Remarks

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [ ] Hand Auger
- [x] Test Pit

Contractor:	Rig/Plant Used:	Logged By:	Checked By:	Hole Depth:
Bob McGiffin		Marcel Langton	David Bell	0.90 m

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INVESTIGATION LOG

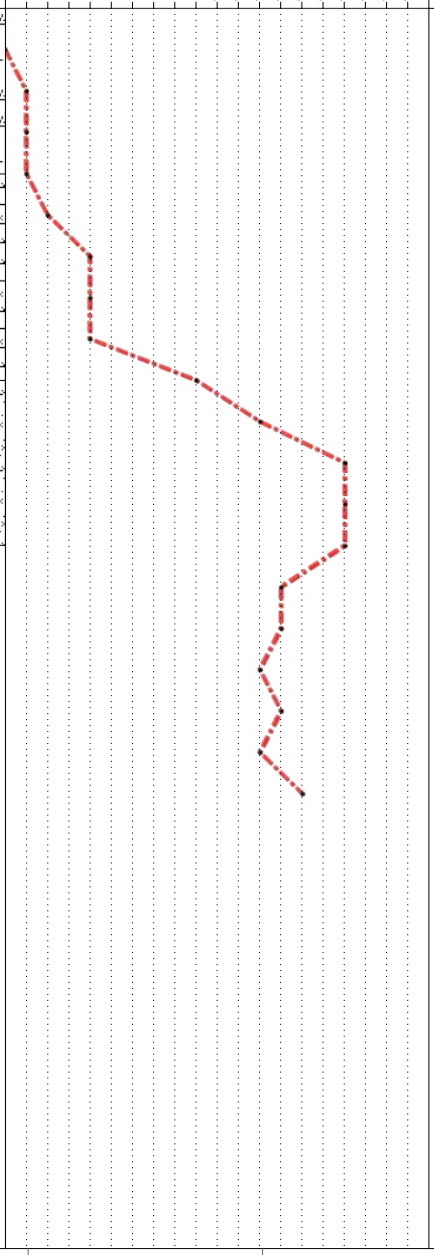
No.: TP3 + DCP3
Job No.: BGL1939
Sheet: 1 of 1

Client:	Coordinates:	Ground Level:	Date:
Stuart Grant	E 1,579,257.00 N 5,175,352.00	215	08/08/19

Project:	Location:
Lot 1, 27 Revelation Drive	Clifton, Christchurch

Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Organic SILT, minor rootlets, minor clay; dark brown; moist; low plasticity [TOPSOIL]. @0.25m: becoming saturated	0.2
Clayey SILT, minor sand; yellowish brown; saturated; moderate plasticity [LOESS COLLUVIUM]. @0.7m: becoming moist to wet.	0.4 0.6 0.8
Sandy SILT; yellowish brown; dense; dry [AIRFALL LOESS]. EOH: 1.30m	1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8

Legend: TS, T



Hand Shear Vane (Corrected)

Water

08/08/2019

Legend

- TP3
- DCP3

Remarks

Near base of topsoil a void filled with water was intercepted. No continuous flow of water once the void was drained.

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [ ] Hand Auger
- [x] Test Pit

Contractor:	Rig/Plant Used:	Logged By:	Checked By:	Hole Depth:
Bob McGiffin		Tom Garden	David Bell	1.30 m

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INVESTIGATION LOG

No.: TP4 + DCP4	
Job No.: BGL1939	
Sheet: 1 of 1	

Client:	**Coordinates:**	**Ground Level:**	**Date:**
Stuart Grant	E 1,579,326.00 N 5,175,366.00	207	08/08/19

Project:	**Location:**
Lot 1, 27 Revelation Drive	Clifton, Christchurch

Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)	Legend	Scala Penetrometer (blows / 100mm)	Hand Shear Vane (Corrected)	Water
Organic SILT, minor clay; dark brown; moist; low plasticity [TOPSOIL].	0.2	TS T TS	1 2 (200kPa)* 3 (300kPa)* 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19		Groundwater Not Encountered
Clayey SILT; greyish light brown; soft; wet; moderate plasticity [LOESS COLLUVIUM].	0.4				
Clayey SILT; yellowish light brown; stiff; moist; low plasticity [LOESS COLLUVIUM].	0.6				
EOH: 0.95m	0.8				
	1.0				
	1.2				
	1.4				
	1.6				
	1.8				
	2.0				
	2.2				
	2.4				
	2.6				
	2.8				

Legend

- TP4
- DCP4

Remarks

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- ☐ Hand Auger
- ☑ Test Pit

Contractor:	**Rig/Plant Used:**	**Logged By:**	**Checked By:**	**Hole Depth:**
Bob McGiffin		Marcel Langton	David Bell	0.95 m

Produced with Core-GS

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INVESTIGATION LOG

No.: TP5 + DCP5
Job No.: BGL1939
Sheet: 1 of 1

Client:	Coordinates:	Ground Level:	Date:
Stuart Grant	E 1,579,331.00 N 5,175,400.00	194	08/08/19

Project: Lot 1, 27 Revelation Drive
Location: Clifton, Christchurch

Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)	Legend	Scala Penetrometer (blows / 100mm)	Hand Shear Vane (Corrected)	Water
GRAVEL; grey; moist [FILL]. Gravels are medium grained and angular.	0.2	TS			Groundwater Not Encountered
Organic SILT, minor clay, trace gravel; dark brown; moist [BURIED TOPSOIL].	0.4				
SILT, some clay; yellowish brown, mottled orange brown; firm; moist; moderate plasticity [LOESS COLLUVIUM].	0.6				
	0.8				
EOH: 0.90m	1.0				
	1.2				
	1.4				
	1.6				
	1.8				
	2.0				
	2.2				
	2.4				
	2.6				
	2.8				

Scala Penetrometer: 1 2 (200kPa)* 3 (300kPa)* 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Legend

- TP5
- DCP5

Remarks

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [ ] Hand Auger
- [x] Test Pit

Contractor:	Rig/Plant Used:	Logged By:	Checked By:	Hole Depth:
Bob McGiffin		Tom Garden	David Bell	0.90 m

Produced with Core-GS

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INVESTIGATION LOG

No.: TP6 + DCP6	
Job No.: BGL1939	
Sheet: 1 of 1	

Client:	**Coordinates:**	**Ground Level:**	**Date:**
Stuart Grant	E 1,579,300.00 N 5,175,353.00	206	08/08/19

Project:	**Location:**
Lot 1, 27 Revelation Drive	Clifton, Christchurch

Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)	Legend	Scala Penetrometer (blows / 100mm)	Hand Shear Vane (Corrected)	Water
Silty sandy GRAVEL; grey; dense; moist [FILL]. Gravels are subrounded.	0.2, 0.4				Groundwater Not Encountered
Bouldery COBBLES, some silt; greyish brown; dense; moist [FILL].	0.6, 0.8				
Organic SILT, some rootlets; dark brown; 'medium dense'; moist [BURIED TOPSOIL/FILL].	1.0, 1.2				
Clayey SILT; yellowish brown; firm; moist; low plasticity [LOESS COLLUVIUM].	1.4				
EOH: 1.50m	1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8				

Scala Penetrometer: (200kPa)* (300kPa)* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Legend

- TP6
- DCP6

Remarks

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [ ] Hand Auger
- [x] Test Pit

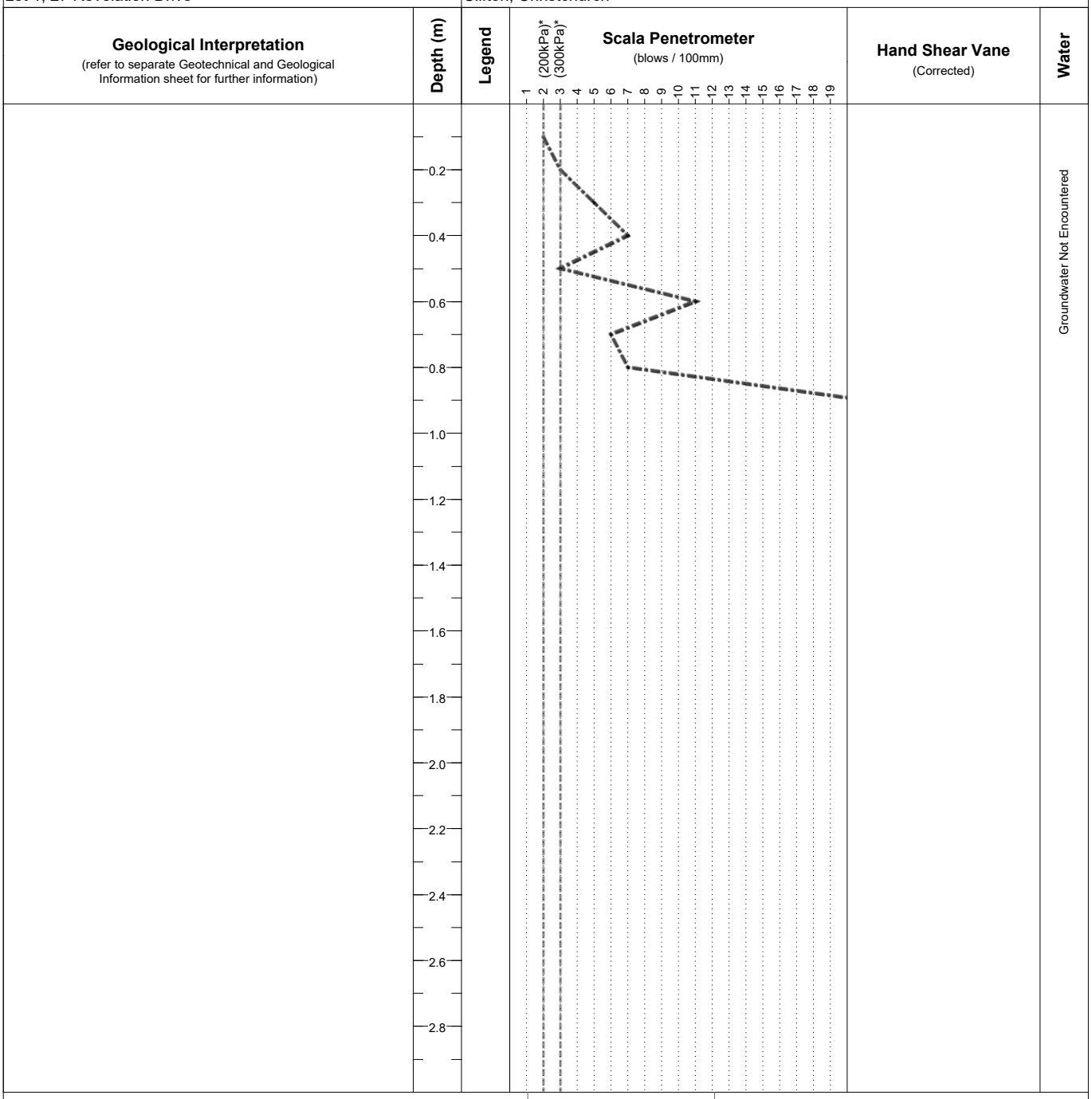
Contractor:	**Rig/Plant Used:**	**Logged By:**	**Checked By:**	**Hole Depth:**
Bob McGiffin		Marcel Langton	David Bell	1.50 m

INVESTIGATION LOG

No.: DCP7
Job No.: BGL1939
Sheet: 1 of 1

Client:	Coordinates:	Ground Level:	Date:
Stuart Grant	E 1,579,286.00 N 5,175,382.00	205	08/08/19

Project:	Location:
Lot 1, 27 Revelation Drive	Clifton, Christchurch



Legend

DCP7

Remarks

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- Hand Auger
- Test Pit

Contractor:	Rig/Plant Used:	Logged By:	Checked By:	Hole Depth:
Bob McGiffin		Marcel Langton	David Bell	0.90 m

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APPENDIX C

LLUR RESPONSE

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

Dear Sir/Madam

Thank you for submitting your property enquiry from our Listed Land Use Register (LLUR). The LLUR holds information about sites that have been used or are currently used for activities which have the potential to cause contamination.

The LLUR statement shows the land parcel(s) you enquired about and provides information regarding any potential LLUR sites within a specified radius.

Please note that if a property is not currently registered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR database is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; additional relevant information may be held in other files (for example consent and enforcement files).

Please contact Environment Canterbury if you wish to discuss the contents of this property statement.

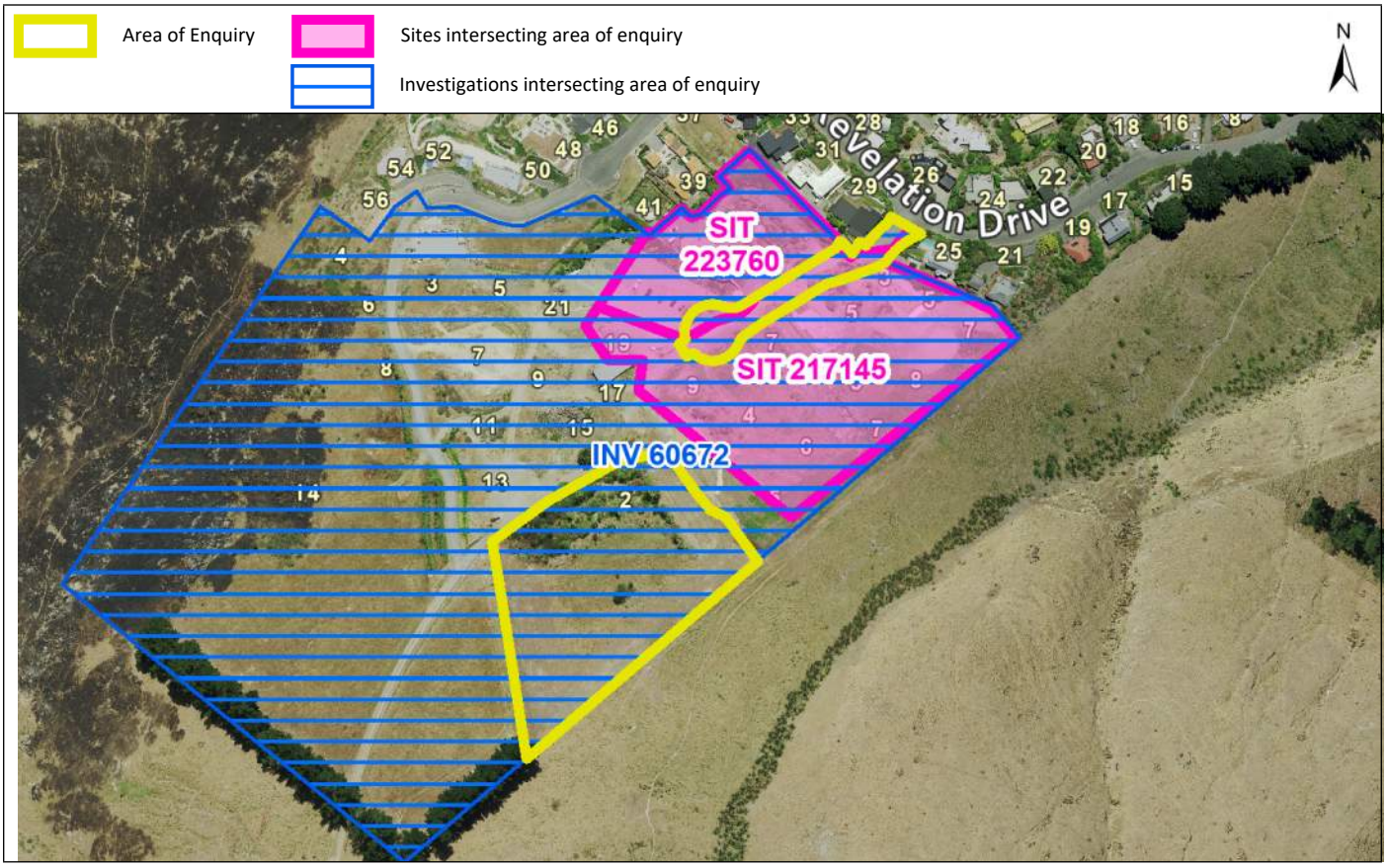
Yours sincerely

Contaminated Sites Team

Property Statement
from the Listed Land Use Register

Visit ecan.govt.nz/HAIL for more information or
contact Customer Services at ecan.govt.nz/contact/ and quote ENQ346193

Date generated: 05 June 2023
Land parcels: Lot 15 DP 567781
Lot 17 DP 567781



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Sites at a glance

Sites within enquiry area

Site number	Name	Location	HAIL activity(s)	Category
217145	27 Revelation Drive, Clifton	27 Revelation Drive, Clifton	A10 - Persistent pesticide bulk storage or use;	Below guideline values - Residential
223760	27A Revelation Drive, Clifton	27A Revelation Drive, Clifton	A10 - Persistent pesticide bulk storage or use;	Partially Investigated

More detail about the sites

Site 217145: 27 Revelation Drive, Clifton (Intersects enquiry area.)

Category: Below guideline values - Residential
Definition: Investigation results demonstrate that hazardous substances present at the site, but below applicable

guidelines. - Residential

Location: 27 Revelation Drive, Clifton
Legal description(s): Lot 1 DP 508120,Lot 2 DP 508120

HAIL activity(s):

Period from	Period to	HAIL activity
Pre-1955	Pre-1994	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

Investigations:

INV 60672 **Preliminary and Detailed Environmental Site Investigation - 27 Revelation Drive. Clifton**
Geoscience Consulting Ltd - Detailed Site Investigation
31 Jul 2014

Summary of investigation(s):

Site History: Aerial photographs indicate that horticultural land use occurred at 27 Revelation Drive, Clifton (the site) from pre-1955 until around 1980 when the site was developed. Following this the site was used for ornamental gardening with residential land use until present.

INV60672 - Preliminary & Detailed Site investigation - 27 Revelation Drive, Clifton - Geoscience 2014

Geoscience were engaged to complete a combined preliminary and detailed site investigation (PSI and DSI respectively) at the site to support redevelopment of the site and subdivision. The site was to be separated into three lots. No change of land use was proposed for Lots 1 (on the north of the site) and 3 (on the west of the site) and it was proposed to develop Lot 2 (on the east of the site) for residential land use.

The PSI involved review of regional and district council information, interviews with site owners, a site inspection and review of aerial photographs. Horticultural activities (market gardening) were identified on the proposed Lots 1 and 2. Sixteen soil samples were collected from across the area of horticultural activity on the proposed Lot 2 and were composited to form four composite soil samples consisting of four sub-samples. One of the sub-samples was collected from outside a cupboard used to store pesticides and fertilisers and this sub-sample was mixed with three other sub-samples from the general cropping area. This composite sampling is not in accordance with the Ministry for the Environment Contaminated Land Management Guideline (CLMG) No. 5 as the sub-samples had not come from the same historical land use. No soil samples were collected from the proposed Lot 1 as no change of land use was proposed for this area. Composite soil samples were analysed for heavy metals (arsenic, copper, cadmium, chromium, lead, nickel, zinc and mercury) and organochlorine pesticides. Results were compared with National Environmental Standard (NES) Soil Contaminant Standards for residential land use which had been adjusted for the number of sub-samples in the composite soil samples.

Results: Soil sample results were below adjusted residential standards for heavy metals and organochlorine pesticides.

Conclusion: The area of the investigation (SN217145) has been categorised as 'Below Guideline Values - Residential' and the area of Lot 1 (SN223760) has been categorised as 'Partially Investigated'.

Justification: Horticultural activity on the proposed Lot 1 has not been investigated to date. A soil sample from outside a chemical storage area was composited with samples from areas of broad scale horticulture which is not in accordance with CLMG No. 5. However, concentrations of contaminants in soil in areas investigated were generally low with minor exceedances for background concentrations. Therefore, these areas are considered to be sufficiently investigated to show they are suitable for residential land use. If further investigation of the proposed Lot 1 is completed, the site category will be updated accordingly.

Site 223760: 27A Revelation Drive, Clifton (Intersects enquiry area.)

Category: Partially Investigated
Definition: Verified HAIL has been partially investigated.

Location: 27A Revelation Drive, Clifton
Legal description(s): Lot 3 DP 508120

HAIL activity(s):

Period from	Period to	HAIL activity
Pre-1955	Pre-1994	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

Investigations:

There are no investigations associated with this site.

Disclaimer

The enclosed information is derived from Environment Canterbury’s Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987.

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1] The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

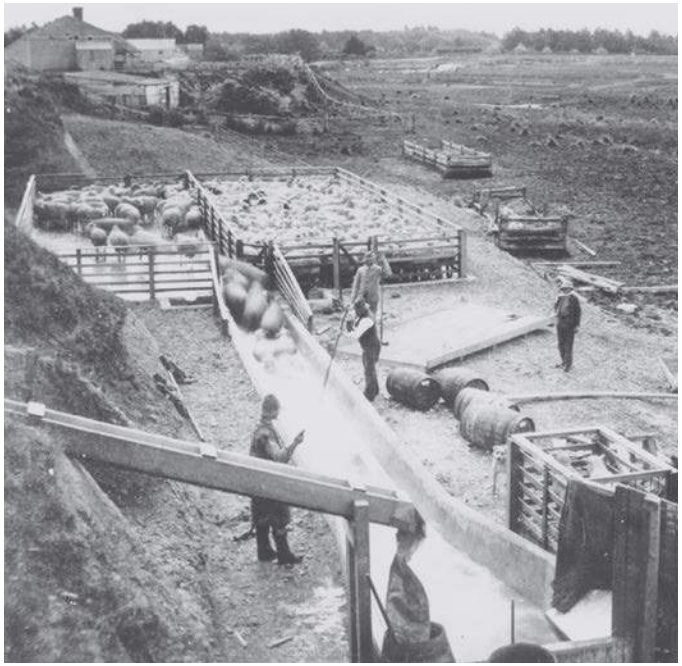
The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.

IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.

If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

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Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

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E13/102

APPENDIX D

EDC HA LOG SHEET

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DRILLED: 16/06/2023 **FILE: 51274**

HAND AUGER NO.:
HASC101A

SHEET 1 OF 1

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

LOGGED	PROCESSED	CHECKED
DP	CE	DP

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION — Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm) 5 10 15
	FILL: Firm, brown SILT, moist			
0.2				
0.4				
0.6				
0.8	with trace rounded medium gravel, wet			
1.0				
	End of hand auger at 1.2m (Terminated due to pipe/possible rock).	EOH @ 1.20 m		

NOTES:
Groundwater not encountered. No Scala.

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CHRISTCHURCH

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FAX (09) 415 1280

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ALBANY, AUCKLAND

PH (09) 451 9044

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DRILLED: 16/06/2023 **FILE: 51274**

HAND AUGER NO.:
HASC101B

SHEET 1 OF 1

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

LOGGED	PROCESSED	CHECKED
DP	CE	DP

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION	Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0.2	FILL: Medium dense, light grey silty fine to coarse GRAVEL, moist				
0.4	becoming saturated				
0.6	End of hand auger at 0.5m (Unable to penetrate gravel hardfill).				

EOH @ 0.65 m

NOTES:
Groundwater not encountered. Scala reached 0.65m, terminated due to scala bouncing.

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DRILLED: 16/06/2023 **FILE: 51274**

HAND AUGER NO.:

HASC102

SHEET 1 OF 1

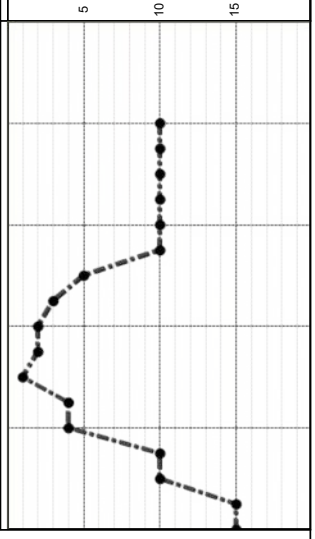
PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

LOGGED	PROCESSED	CHECKED
DP	CE	DP

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION [Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments]	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0.2	FILL: Medium dense to dense, light grey sandy fine to coarse GRAVEL			
0.4	becoming hard SILT with some gravel			
0.6	End of hand auger at 0.5m (Unable to penetrate gravel hardfill).			
0.8				



EOH @ 1.00 m

NOTES:

Groundwater not encountered. Scala reached 0.9m, terminated due to scala bouncing.

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DRILLED: 16/06/2023 **FILE: 51274**

HAND AUGER NO.:
HASC103

SHEET 1 OF 1

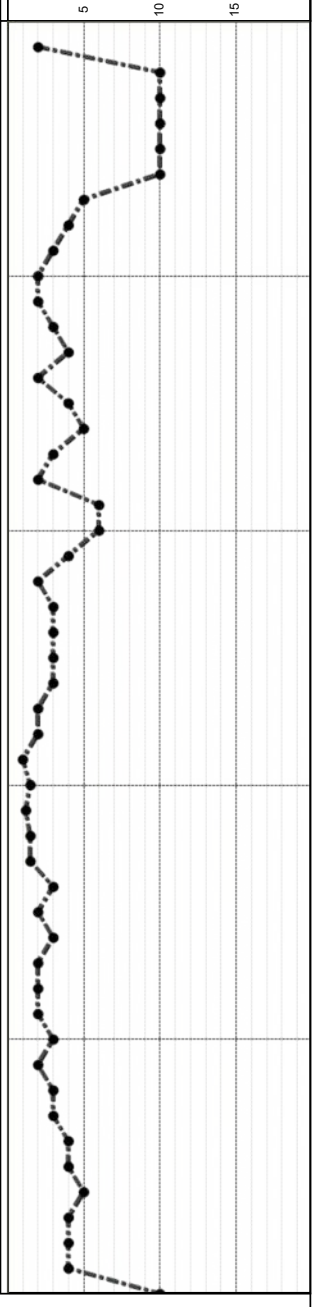
PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

LOGGED	PROCESSED	CHECKED
CE	CE	DP

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION [Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments]	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0.0	PLACED TOPSOIL: Soft, dark brown organic SILT with trace gravel, moist. Gravel is fine.			
	End of hand auger at 0.1m (Unable to penetrate gravel hardfill).			
0.2				
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				



EOH @ 2.50 m

NOTES:
Groundwater not encountered. Scala reached 2.5m, terminated due to scala bouncing.

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HAND AUGER NO.:
HASC104

SHEET 1 OF 1

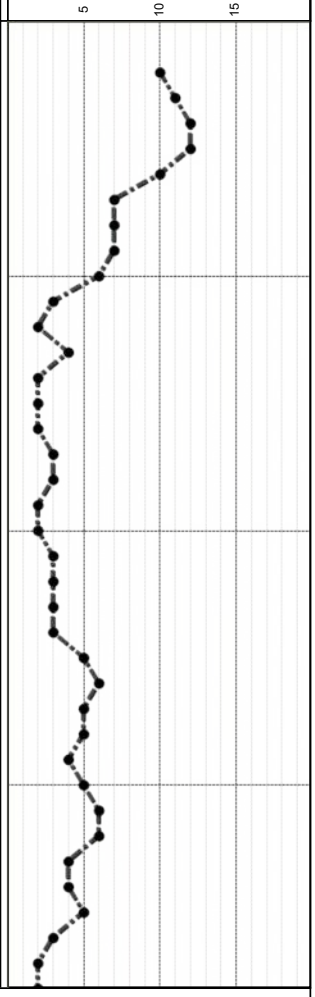
PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

LOGGED	PROCESSED	CHECKED
CE	CE	DP

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION [Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments]	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0.0	PLACED TOPSOIL: Soft, dark brown organic SILT, moist			
0.2	FILL: Dense to very dense, light brown coarse angular GRAVEL, dry			
0.3	End of hand auger at 0.3m (Unable to penetrate gravel hardfill).			
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				



EOH @ 1.90 m

NOTES:
Groundwater not encountered. Scala reached 1.9m.

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HAND AUGER NO.:
HASC105

SHEET 1 OF 1

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

LOGGED	PROCESSED	CHECKED
DP+CE	CE	DP

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION	Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0	No hand auger.				
0.2					
0.4					
0.6					
0.8					
1.0					
1.2					
1.4					
1.6					
1.8					
2.0					
2.2					
2.4					
2.6					
2.8					

SCALA BLOWS (PER 50 mm): 5, 10, 15

EOH @ 2.90 m

NOTES:
Scala only. Scala reached 2.9m.

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HAND AUGER NO.:

HASC106

SHEET 1 OF 1

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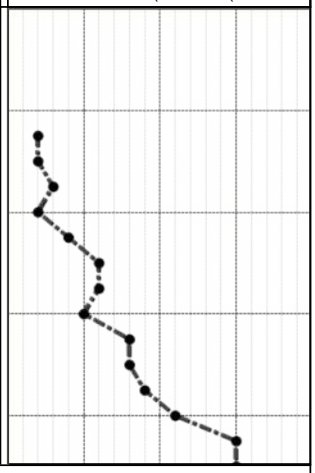
CE	CE	DP

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION	Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0.0	TOPSOIL: Soft, dark brown organic gravelly SILT, moist. Gravel is medium to coarse and angular.		TS		
0.2	Stiff, light brown SILT, moist				
0.4					
0.6	End of hand auger at 0.6m (Refusal on hard SILT).				
0.8					



EOH @ 0.90 m

NOTES:

Groundwater not encountered. Scala reached 0.9m.

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HAND AUGER NO.:

HASC107

SHEET 1 OF 1

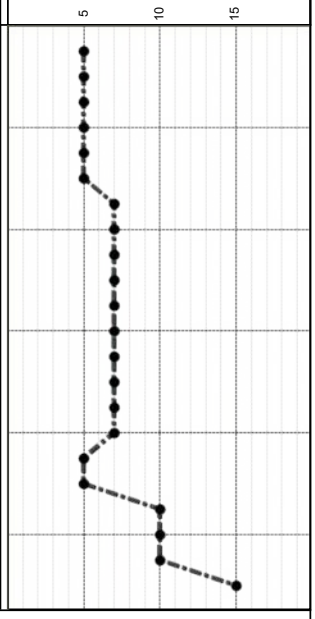
LOGGED	PROCESSED	CHECKED
DP	CE	DP

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION	Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0.0	TOPSOIL: Dark brown organic SILT		TS		
0.2	Very stiff to hard, light orange SILT, dry (Loess)				
0.4	End of hand auger at 0.5m (Refusal on hard SILT).				
0.6					
0.8					
1.0					



EOH @ 1.15 m

NOTES:

Groundwater not encountered. Scala reached 1.1m, terminated due to scala bouncing.

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DRILLED: 16/06/2023 **FILE: 51274**

HAND AUGER NO.:

HASC108A

SHEET 1 OF 1

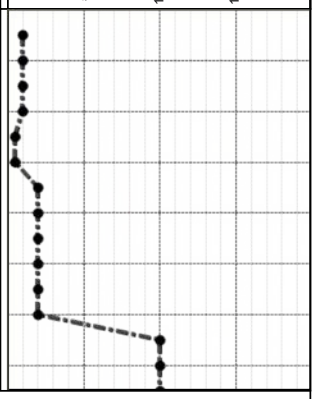
LOGGED	PROCESSED	CHECKED
DP	CE	DP

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION (Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments)	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
	FILL: Firm, brown Organic SILT, dry			
0.2				
	Firm, brown SILT with trace fine gravel, moist			
0.4				
0.6				
	End of hand auger at 0.7m. No recovery (Refusal on rock).			



EOH @ 0.75 m

NOTES:

Groundwater not encountered. Scala reached 0.75m, terminated due to scala bouncing.

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DRILLED: 16/06/2023 **FILE: 51274**

HAND AUGER NO.:
HASC108B

SHEET 1 OF 1

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

LOGGED	PROCESSED	CHECKED
DP	CE	DP

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION [Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments]	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm) 5 10 15
	FILL: Dark brown gravelly SILT with some bricks			
0.2	becoming brown mottled orange and white SILT			
0.4				
	End of hand auger at 0.6m (Refusal on rock).	EOH @ 0.60 m		

NOTES:
Groundwater not encountered. No Scala.

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DRILLED: 16/06/2023 **FILE: 51274**

HAND AUGER NO.:

HASC109

SHEET 1 OF 1

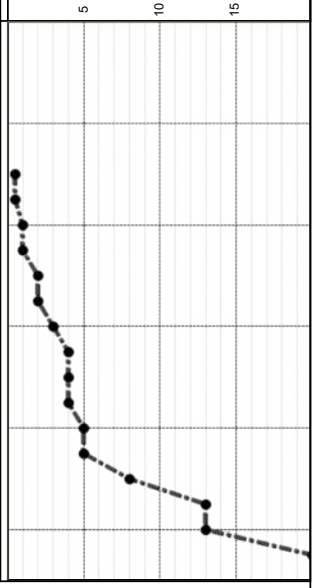
LOGGED	PROCESSED	CHECKED
CE	CE	DP

PROJECT: Geotechnical Investigation **CLIENT: Gethvillas Limited**

ADDRESS: 4 Loader Ln and 2 Ararat Ln, Clifton, Christchurch

BH LOCATION: COORDS: RL GROUND:

DEPTH (m) GL	SOIL DESCRIPTION	Strength/density, colour, structure, minor, MAJOR, plasticity, moisture content, other comments	LEGEND	GROUND WATER	SCALA BLOWS (PER 50 mm)
0.2	TOPSOIL: Soft, dark brown organic SILT with some gravels, dry. Gravel is medium to coarse		TS T TS T		
0.4	Firm to stiff, light brown SILT moist				
0.6					
0.8	with trace fine sand				
1.0					
	End of hand auger at 1.1m (Refusal on inferred rock).		EOH @ 1.10 m		



NOTES:

Groundwater not encountered. Scala reached 1.1m, terminated due to scala bouncing.

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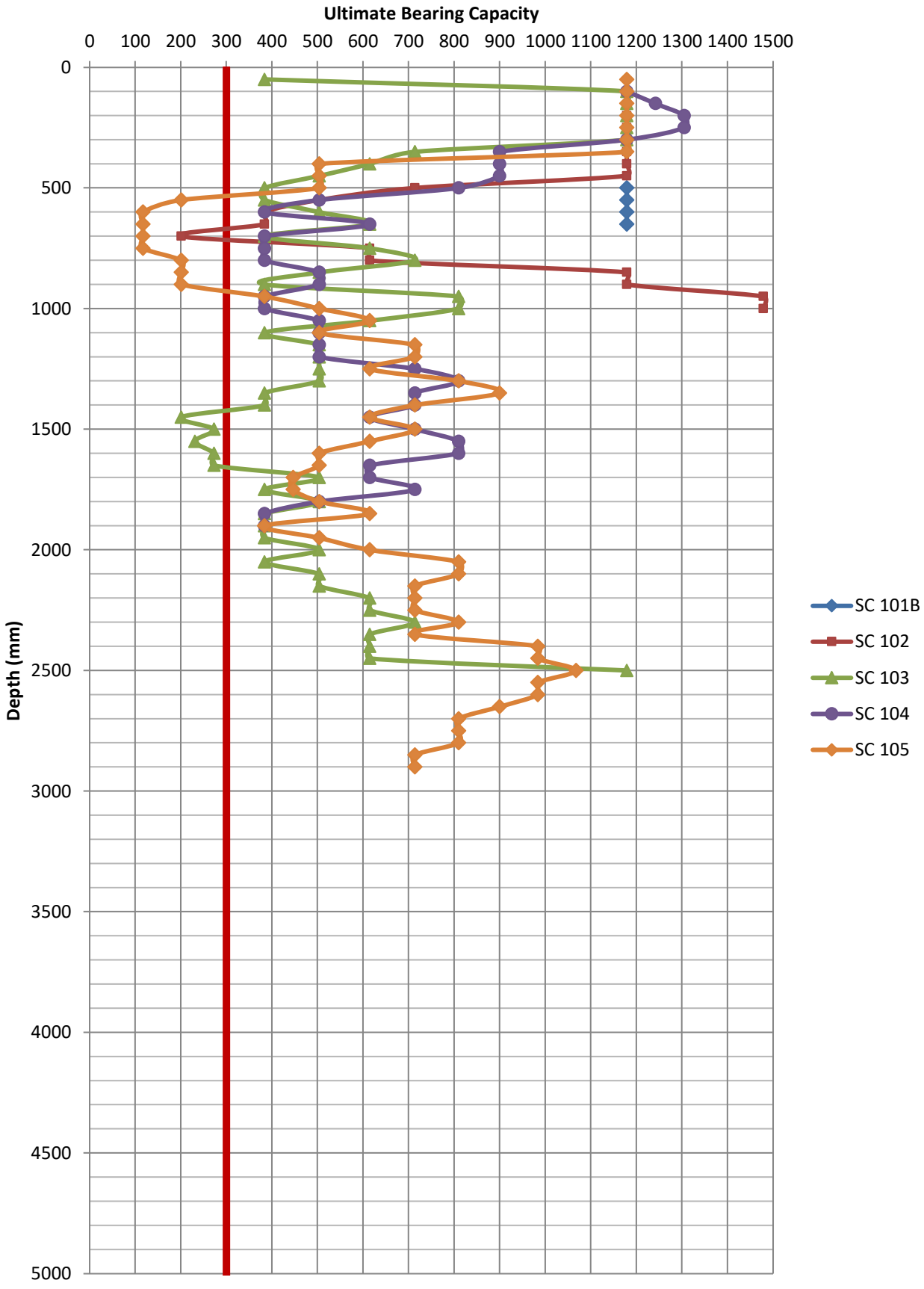
APPENDIX E

UBC GRAPH

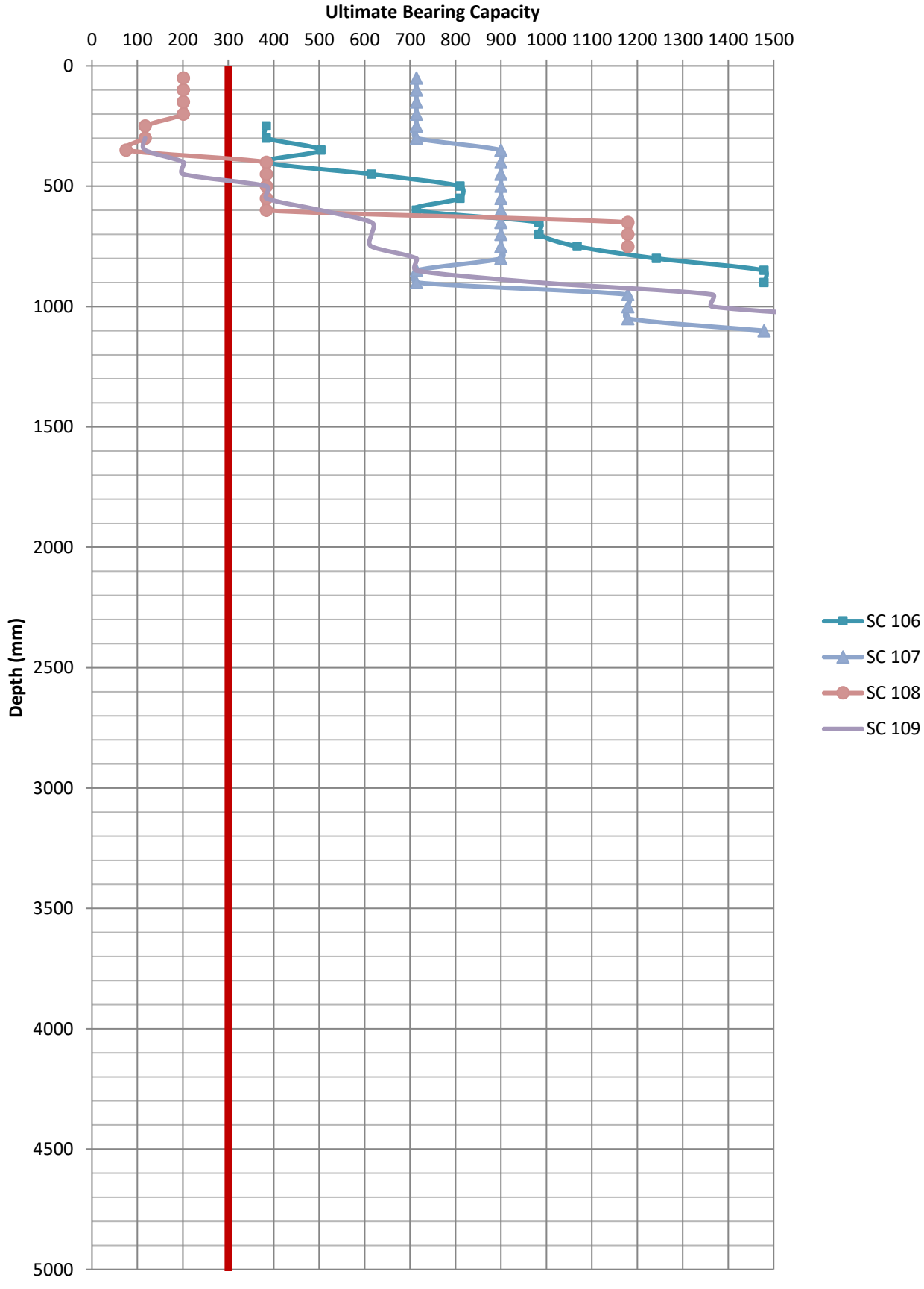
Summary of Ultimate Bearing Capacity vs Depth



NOTES

1. Based on Stockwell, M.J., 1977: Determination of allowable bearing pressure under small structures. New Zealand Engineering (32:6), dated 15 June 1977, using a factor of safety of three to back calculate the UBC.

Summary of Ultimate Bearing Capacity vs Depth



NOTES

1. Based on Stockwell, M.J., 1977: Determination of allowable bearing pressure under small structures. New Zealand Engineering (32:6), dated 15 June 1977, using a factor of safety of three to back calculate the UBC.

APPENDIX F

GEOTECHNICAL STATEMENT OF PROFESSIONAL OPINION

APPENDIX I

Statement of Professional Opinion on the Suitability of Land for Subdivision

ISSUED BY: Engineering Design Consultants Ltd. (EDC Ltd.)
(Geotechnical engineering firm or suitably qualified engineer)

TO: Christchurch City Council
(Territorial authority)

TO BE SUPPLIED TO: Gethvillas Limited
(Owner/Developer)

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

AT: 4 Loader Lane and 2 Ararat Lane, Clifton

(Address)

I Gareth B. Williams on behalf of
(Geoprofessional)

Engineering Design Consultants Ltd. (EDC Ltd.)
(Geotechnical engineering firm)

hereby confirm:

1. I am a suitably qualified and experienced geoprofessional employed by EDC Ltd. and the geotechnical firm named above was retained by the owner/developer as the geoprofessional on the above proposed development.

2. The geotechnical assessment report, dated 02/08/2023 has been carried out in accordance with the Ministry of Business, Innovation and Employment *Guidelines for geotechnical investigation and assessment of subdivisions* and the Christchurch City Council *Infrastructure Design Standard – Part 4: Geotechnical Requirements* and includes:

(i) Details of and the results of my/the site investigations.

(ii) A liquefaction and lateral spread assessment.

(iii) An assessment of rockfall and slippage, including hazards resulting from seismic activity.

(iv) An assessment of the slope stability and ground bearing capacity confirming the location and appropriateness of building sites.

(v) Recommendations proposing measures to avoid, remedy or mitigate any potential hazards on the land subject to the application, in accordance with the provisions of Section 106 of the Resource Management Act 1991.

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

(i) No further conditions to those outlined in the Geotechnical report (EDC: 51274)

(ii) _____

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

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

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

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

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

_____ Date: 02/08/2023

(Signature of engineer, for and on behalf of Engineering Design Consultants Ltd.)

Qualifications and experience

CP Eng, IntPE(NZ), MIPENZ, MAusIMM, MIoD,Director, Snr Geotechnical Engineer

_____

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