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126 LEHMANS ROAD, RANGIORA.

Natural Hazard Assessment Report for Rezoning Submission.

Miranda Hale

Revision: B

Date:
04 March 2024

DOCUMENT CONTROL

Project Reference	23235	
Project Name	126 LEHMANS ROAD, RANGIORA.	
Revision	B	
Prepared For	Miranda Hale	
Prepared By		Steven Roberts CPEng (Geotechnical), CMEngNZ, IntPE(NZ)
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Report Distribution:		
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1 Introduction

Tetrad Consulting Ltd was engaged by Miranda Hale to undertake a geotechnical investigation and natural hazards assessment at 126 Lehmans Rd, Rangiora for:

- Rezoning proposal application for a 5.57-hectare block of rural land from LLRO to MRZ in accordance with the Waimakariri's Proposed District Plan (PDP).

This report addresses the risk of natural hazards as they relate to the rezoning application under Section 106 of the Resource Management Act (RMA), 1991.

The scope of this geotechnical report does not include commentary on site-specific environmental issues, which is beyond the scope of our geotechnical engagement.

2 Reporting Requirements

The scope of this report is governed by a need to address the relevant requirements of the following documents:

- Resource Management Act, 1991; Section 106 – Natural Hazards
- Ministry for the Environment (MfE) Resource Legislation Amendments 2017 – Fact Sheet 10 regarding natural hazards[1]
- Ministry of Business, Innovation and Employment (MBIE),2012: Repairing and Rebuilding Houses Affected by the Canterbury Earthquakes – Part D: Subdivisions.
- Waimakakiri District Council/B3.1 Natural Hazards[2]

3 Site Description

The setting is a flat parcel of land comprising 5.57 hectares of legal title - Pt RS 937 1275 BLK VI.

The site boundaries are defined by Johns Road to the south, Lehmans Road to the west and continuation of flat pastoral land beyond the east boundary. The north end of the site is partitioned from the remaining site area by an established hedge located along the south and east side of an existing dwelling, and by a row of established trees extending to the west boundary.

4 Geology

Published geology[3] indicates the site comprises late Pleistocene river deposits comprising gravels, sand and silt capped by a thin veneer of loess. The alluvial fan thickness varies due to the underlying topography and accumulation of alluvial outwash from the flood plains.

5 Aerial Photograph Review

We have reviewed available historical aerial photographs from the 1940's and 1980's on the Retro Lens websites. The aerial imagery returned no obvious evidence of remnant geotechnical hazards specific to the site.

[1] Mfe https://www.mfe.govt.nz/publications/rma/resource-legislation-amendments-2017-fact-sheet-series
[2] https://waimakariki.govt.nz/council/plans-policies-reports/district-plan
[3] GNS Science – New Zealand Geology Web Map, September 2023

6 Ground Investigation

6.1 Geotechnical Investigation

Shallow geotechnical testing was undertaken on 31st August 2023 and comprised five shallow test pile holes excavated with a 6-tonne digger. The test pit holes were excavated to a target depth of 2.9 m. Practical refusal of the Scala test was encountered at 1.4 – 2.2 m bgl in dense gravel with resistance values exceeding 12 blows/100 mm. The test pit and Scala penetrometer test locations and results are shown in Appendix A and summarized in Table 1 below.

Table 1: Summary of hand auger and Scala penetrometer investigation

Test type	Depth of test (m)	Comments
TP1/SP1	2.9 m, 2.2 m (SP)	Target depth achieved
TP2/SP2	2.6 m, 2.0 m (SP)	Shallow refusal in dense gravel
TP3/SP3	2.5 m, 1.4 m (SP)	Shallow refusal in dense gravel
TP4/SP4	2.9 m, 2.1 m (SP)	Target depth achieved
TP5/SP5	2.9 m, 2.0 m (SP)	Target depth achieved

6.2 Subsurface Conditions

The machine dug test pit holes returned the following simplified soil profile:

Table 2: Summary of Test Pit Soil Profiles

Test Pit Location	Top of Soil Unit (m bgl)	Description	Density
TP1 – TP5	0.0	Organic SILT	Firm
	0.2 – 0.3	Sandy SILT	Firm
	1.4 – 2.3	Sandy GRAVEL	Very dense

Scala penetrometer results returned blow counts ranging from 1 - 5 blows/100 mm penetration to 1.2 m depth, thereafter, transitioning to higher resistance values (6 - 12+ blows/100mm) in stiff silt and dense sandy gravel.

7 Natural Hazards Assessment

7.1 Introduction

Council can refuse subdivision consent if there is a significant risk due to natural hazards. To determine whether there is a significant risk due to natural hazards, decision-makers are guided by the matters set out in the RMA Section 106 (1A). A suitability assessment of the site for subdivision has been carried out in accordance with Section 106 of the Resource Management Act (RMA).

Section 106 the RMA states *inter alia*

1. …" a consent authority may refuse subdivision consent, or may grant subdivision consent subject to conditions, if it considers that:

(a) *the land in respect of which a consent is sought, or any structure on the land, is or is likely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; or*

(b) *any subsequent use that is likely to be made of the land is likely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source*.

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

7.2 Site-specific risk assessment

7.2.1 Overview

The following sections identify natural hazards that require discussion on a 'lot-specific' basis except for seismicity hazard which is the same for each lot. Other hazards have also been considered including drought, fire, geothermal activity, and volcanic activity. These hazards are assessed as unlikely.

7.2.2 Seismicity

The GNS (2023) website image in Figure 3 shows the closest active fault- the Ashley Fault- located about 4 km due north of the site. The Ashley Fault Zone is the most active fault in the Waimakariri District. The fault has an expected recurrence interval (RI) of about 5,140 years corresponding to RI Class IV, based on average recurrence interval assessment techniques and work carried out by Dawson et al (2008), and Nicol et al (2012) on average recurrence intervals.

Figure 3: Site Location in relation to known active faults – from GNS (2023) geology web map. The dotted line represents part of the concealed Cust fault trace.

7.2.3 Risk Assessment for Buildings

The Active Fault guidelines (Kerr et al. 2003) provide a framework and methodology to assist in avoiding or mitigating the risks associated with development of land on or close to active faults. Risk assessment is based on fault recurrence interval, fault complexity and Building Importance Category (BIC).

The Ashley fault has an inferred fault recurrence interval (RI) Class IV assessment, translating to an average fault recurrence interval of surface rupture between 5,000 – 10,000 years.

The current proposal is for a rezoning change to the subject site (Pt RS 9371275 BLK VI) from LLRO to MZR on which residential dwellings can be built.

The building importance category for normal occupancy dwellings is IL2. The Active Fault guidelines further subdivide the normal IL2 category into 2a and 2b as shown in Table 3.

For the proposed subdivision, the Building importance category shall be limited to 'BIC' 1,2a, 2b and 3 for RI Class V. Table 3 below describes the various Importance categories and building type/s suitable for the green field site.

Table 3: Building Importance Category (from Active Fault Guidelines)

Importance Category	Description	Examples
1	Utility structures of low risk to life	Structures with a total floor area of less than 30m^2. Farm buildings, isolated structures, and in-ground swimming pools.
2a	Residential timber framed construction	Timber framed single-storey dwellings
2b	Normal structures and structures not in other categories	Timber framed houses of plan area >300m^2. Houses outside the scope of NZS 3604 "Timber Framed Buildings"

For a Recurrence Interval Class - IV, Importance Category 2b and Level A– *Well defined* deformation – fault complexity, Table 11.1 of Kerr et al recommends a ***permitted Activity*** consent status (Figure 4) below.

Importance Category buildings 1 – 3 are permitted activities for Recurrence Interval Class IV. This applies to sites within a fault awareness zone, which is set out below to allow for the uncertainty in fault location and extent of ground deformation in a future earthquake.

Table 11.1: Resource consent activity status for greenfield sites

Building importance category	1	2a	2b	3	4
Fault complexity	**Activity status**				
Fault recurrence interval class I less than or equal to 2000 years					
A – Well defined	Permitted	*Non-complying*	*Non-complying*	*Non-complying*	Prohibited
B – Distributed	Permitted	*Discretionary*	*Non-complying*	*Non-complying*	Non-complying
C – Uncertain[†]	Permitted	*Discretionary*	*Non-complying*	*Non-complying*	Non-complying
Fault recurrence interval class II greater than 2000 but less than or equal to 3500 years					
A – Well defined	Permitted	*Non-complying*	*Non-complying*	*Non-complying*	Prohibited
B – Distributed	Permitted	*Discretionary*	*Non-complying*	*Non-complying*	Non-complying
C – Uncertain[†]	Permitted	*Discretionary*	*Non-complying*	*Non-complying*	Non-complying
Fault recurrence interval class III greater than 3500 to but less than or equal to 5000 years					
A – Well defined	Permitted	Permitted*	*Non-complying*	*Non-complying*	Non-complying
B – Distributed	Permitted	Permitted	*Discretionary*	*Discretionary*	Non-complying
C – Uncertain[†]	Permitted	Permitted	*Discretionary*	*Discretionary*	Non-complying
Fault recurrence interval class IV greater than 5000 but less than or equal to 10,000 years					
A – Well defined	Permitted	Permitted*	Permitted*	*Non-complying*	Non-complying
B – Distributed	Permitted	Permitted	Permitted	*Discretionary*	Non-complying
C – Uncertain[†]	Permitted	Permitted	Permitted	*Discretionary*	Non-complying
Fault recurrence interval class V greater than 10,000 but less than or equal to 20,000 years					
A – Well defined	Permitted	Permitted*	Permitted*	Permitted*	Non-complying
B – Distributed	Permitted	Permitted	Permitted	Permitted	Non-complying
C – Uncertain[†]	Permitted	Permitted	Permitted	Permitted	Non-complying
Fault recurrence interval class VI greater than 20,000 but less than or equal to 125,000 years					
A – Well defined	Permitted	Permitted*	Permitted*	Permitted*	Permitted*
B – Distributed	Permitted	Permitted	Permitted	Permitted	Permitted**
C – Uncertain[†]	Permitted	Permitted	Permitted	Permitted	Permitted**

Figure 4: Extract from Active Fault Guidelines.

For the Ashley Fault Zone location discussed above, fault awareness zones have not been imposed on the subject property and therefore, location of future dwellings on the site is not restricted by such fault zones.

7.2.4 Seismic Category

The relatively thin layer of flood plain fan deposits overlying the site underlain by deep alluvial soils defines the site as Class D, 'deep alluvial soil sites', in terms of the seismic design requirements of NZS 1170.5.

7.3 Flood Inundation

Waimakariri Councils' GIS OpenMP system identified flood inundation hazard for a 1 in 200-year event with as shown in Figure 4. The site's micro topography indicates flood hazard towards the middle of the site (highlighted in blue) may experience up to 200 mm of surface flooding.

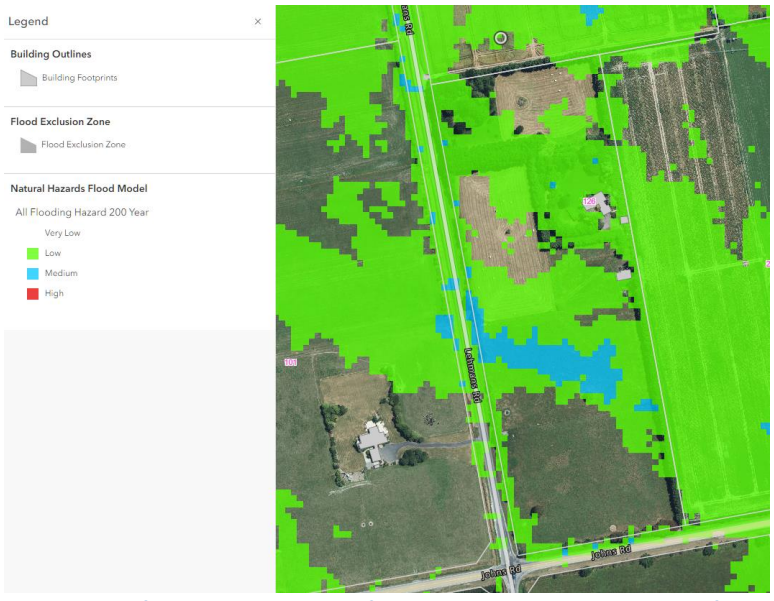

Figure 4: Surface Flooding model for 1 in 200-year event, source: from Waimakariri District Council Flood Map.

Surface water ponding within the affected area can be controlled by locally raising the ground level to redirect surface water runoff to either a swale feature or a reticulated stormwater collection system.

Alternatively, future development of the affected area can be achieved by imposing raised floor levels and foundation systems that do not restrict surface water runoff during periods of sustained rainfall.

7.4 Rockfall Hazard

The site is located on expansive flat Canterbury Plains, as such, rockfall hazard is negligible.

7.5 Slope Instability and Slippage Hazard

The site is located on expansive flat Canterbury Plains, as such, slope instability and/or surficial soil slippage hazard is negligible.

7.6 Erosion and Sedimentation Hazard

Our walkover inspection confirmed no major erosion apart from localised areas of dirt tracks where exposed soils showed signs of minor dispersion from uncontrolled surface water runoff. Erosion and Sedimentation hazard would not prevent subdivision of the site.

7.7 Liquefaction Hazard

The dense near-surface gravels and deep ground water table translate to negligible liquefaction hazard at the site.

7.8 Volcanic Hazard

Volcanic hazard is negligible at this site and would not prevent subdivision of the site.

7.9 Tsunami Hazard

Tsunami hazard is negligible at this site and would not prevent subdivision of the site.

7.10 Meteorological Hazard

No higher risk than other location in the Waimakariri District; therefore, would not prevent subdivision of the site.

8 Foundation Considerations for proposed Subdivision

The proposed rezoning change is not affected by a fault awareness zone, accordingly, there is no restriction on location of a dwelling except in accordance with current district plan rules for minimum building setback from common boundaries.

On the limited testing carried out, it can be assumed that the soils are consistent with the definition of “good ground” as defined in NZS3604:2011. Soil testing will be required at building consent stage at the selected house location to confirm this assumption.

Specific design of foundation is recommended for the dwelling in accordance with MBIE guidelines for TC1 rated land. If local surface flooding is predicted at this site (Figure 7 above), then a raised timber floor on a timber subfloor structure would be the preferred foundation option for either a Category 2A or 2B building. The interim flood floor level (if any) should be discussed with the Waimakariri District Council and assessed for a 1 in 200-year flood to district plan rules.

9 Conclusions

Based on the above discussion, we conclude there is no risk from falling debris, slippage, erosion, subsidence, or inundation.

It is our opinion that a rezoning application to MRZ of the site in accordance with Waimakariri District Council district plan will not result in the acceleration or worsening of these hazards.

Section 106 1(c) is not relevant to a geotechnical appraisal and therefore has not been considered in this report.

The interim flood floor level (if any) should be discussed with the Waimakariri District Council and assessed for a 1 in 200-year flood to district plan rules.

10 Limitations

Comments made in this report are based on information on the NZGD, WDC GIS, GNS's Active Faults Database, our inspection of the site, shallow geotechnical testing and the Ministry of Business, Innovation and Employment's (MBIE) December 2012 guidelines.

This report has been prepared for the benefit of Miranda Hale and the Waimakariri District Council. This report is specifically prepared for the proposed rezoning change to Lot 1 (Pt RS 937 1275 BLK V) and should not be used to support any future consent application without prior review and approval in writing.

No liability is accepted by this company or any employee of this company with respect to the use of this report by any other party or for any other purpose other than what is stated in our scope of work.

The geotechnical investigation was confined to geotechnical aspects of the site only and did not involve the assessment for environmental contaminants.

Appendix A

- Site Investigation Plan
- Scala penetrometer and Test Pit Profiles

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LEGEND

TP1 TEST PIT & SCALA PENETROMETER

PROJECT	REZONING CHANGE FOR LOT 1 (Pt RS 937 1275 BLK VI)
ADDRESS	126 LEHMANS ROAD, RANGIORA
CLIENT	MIRANDA HALE
TITLE	Test Location Plan
JOB NO.	23235

Drawing not to scale - Do not scale of drawing

DRAWING NO. G1.0

REV. 1

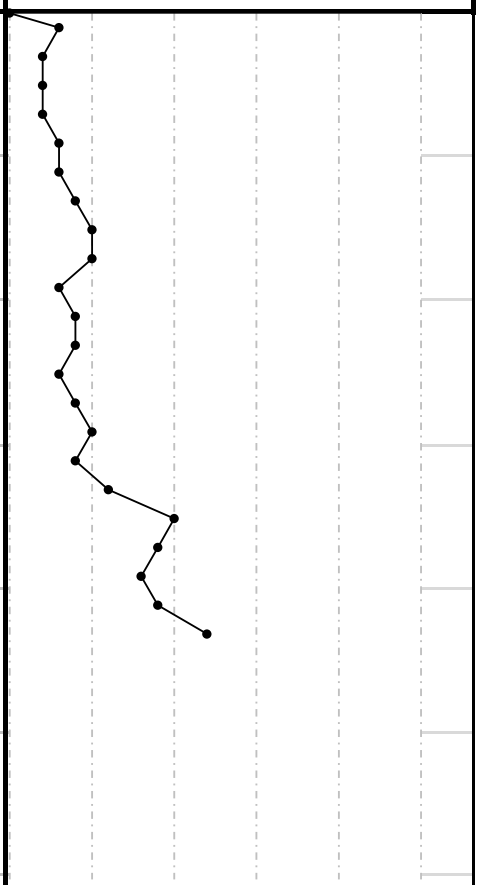
Tetrad.	Test Number	TP1/SP1

Project No:	23235	**Drill Type:**	6 tonne digger/ Scala penetrometer
Client:	Survus Consultants Ltd	**Drilled By:**	Callum
Site Address:	126 Lehmans Road	**Drilling Date:**	31/08/2023
City:	Christchurch	**Log Date:**	15/09/2023

Stratigraphy	Depth (m)	Graphic Log	Soil Description	USCS	Groundwater depth(m
	0.0		**SILT**; dark brown (TOPSOIL), soft, damp.		
	0.5		sandy **SILT**,fine sand; grey mottled orange staining; soft, to firm; damp; moderate plasticity.		
	1.0				
	1.5				
	2.0				
	2.5		sandy **GRAVEL**; well graded, dense		
	3.0		E.O.H at 2.9 m		
	3.5				
	4.0				

Dynamic Cone (Scala) Penetrometer

Depth (m)	Blow Count
0.0	3
	2
	2
	2
0.5	3
	3
	4
	5
	5
1.0	3
	4
	4
	3
	4
1.5	5
	4
	6
	10
	9
2.0	8
	9
	12
2.5	
3.0	
3.5	
4.0	



Note: Scala Penetrometer and hand auger log tests give an indication of the ground condition at the test location only.While they are representative of typical conditions across the site, they do not indentify variations in the ground away from the test location.

Tetrad Consulting Ltd: 71 Peterborough Street,Christchurch Central City, 8013 Phone:(03) 365 0726 Email: info@tetrad.co.nz

Tetrad.

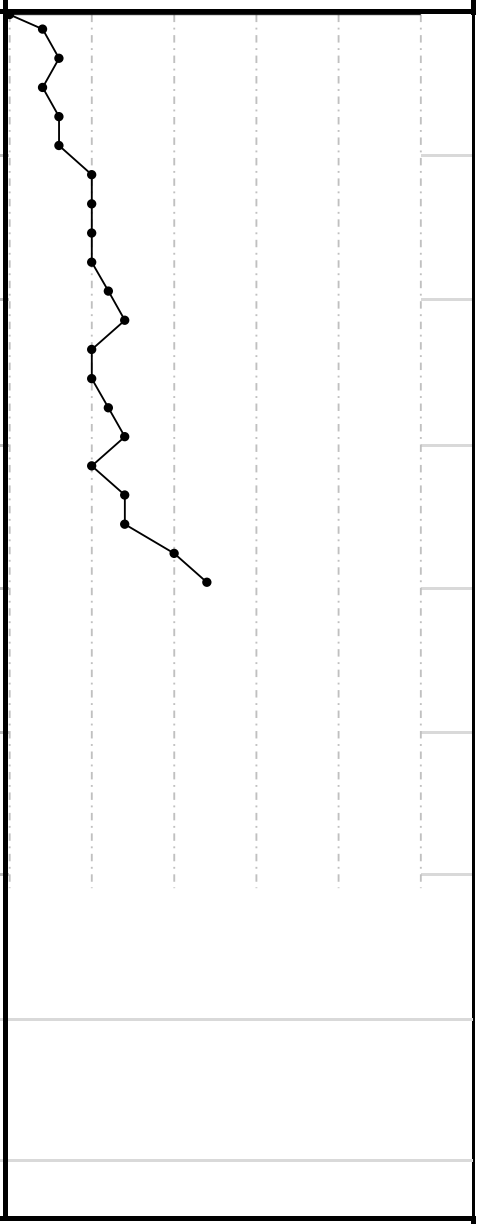
Test Number	TP2/SP2

Project No:	23235	**Drill Type:**	6 tonne digger/ Scala penetrometer
Client:	Survus Consultants Ltd	**Drilled By:**	Callum
Site Address:	126 Lehmans Road	**Drilling Date:**	31/08/2023
City:	Christchurch	**Log Date:**	15/09/2023

Stratigraphy	Depth (m)	Graphic Log	Soil Description	USCS	Groundwater depth(m
	0.0		**SILT**; dark brown (TOPSOIL), soft, damp.		
	0.5		sandy **SILT**,fine sand; grey/orange; firm to stiff; dry; moderate plasticity.		
	1.0				
	1.5				
	2.0		sandy **GRAVEL**; well graded, dense		
	2.5				
	3.0		E.O.H in GRAVELS at 2.6 m		
	3.5				
	4.0				

Dynamic Cone (Scala) Penetrometer

Depth (m)	Blow Count
0.0	2
	3
	2
	3
0.5	3
	5
	5
	5
	5
1.0	6
	7
	5
	5
	6
1.5	7
	5
	7
	7
	10
2.0	12
2.5	
3.0	
3.5	
4.0	



Note: Scala Penetrometer and hand auger log tests give an indication of the ground condition at the test location only.While they are representative of typical conditions across the site, they do not indentify variations in the ground away from the test location.

Tetrad Consulting Ltd: 71 Peterborough Street,Christchurch Central City, 8013 Phone:(03) 365 0726 Email: info@tetrad.co.nz

Tetrad.

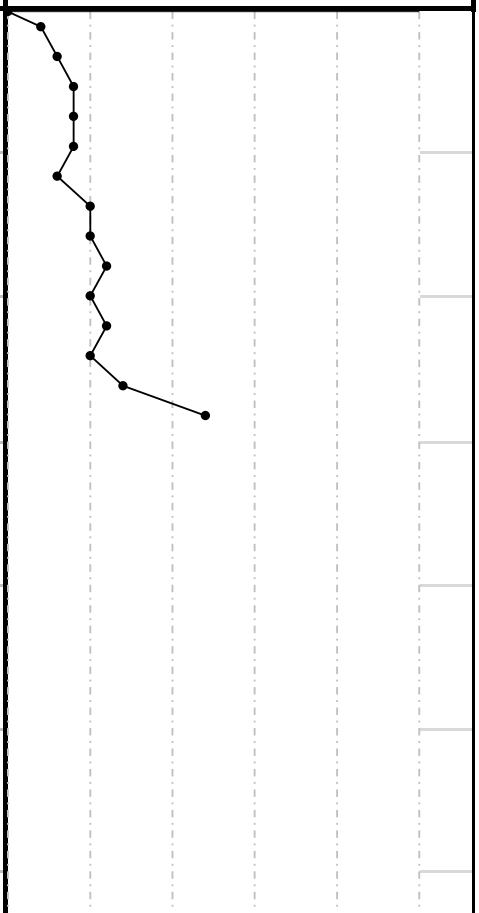
Test Number	TP3/SP3

Project No:	23235	**Drill Type:**	6 tonne digger/ Scala penetrometer
Client:	Survus Consultants Ltd	**Drilled By:**	Callum
Site Address:	126 Lehmans Road	**Drilling Date:**	31/08/2023
City:	Christchurch	**Log Date:**	15/09/2023

Stratigraphy	Depth (m)	Graphic Log	Soil Description	USCS	Groundwater depth(m
	0.5		**SILT**; dark brown (TOPSOIL), soft, damp. Sandy loess **SILT,** orange/grey; firm to stiff; dry; moderate plasticity.		
	1.0				
	1.5		**GRAVEL** with some sand; well graded, dense		
	2.0				
	2.5		E.O.H at 2.5 m depth		
	3.0				
	3.5				
	4.0				

Dynamic Cone (Scala) Penetrometer

Depth (m)	Blow Count
0.5	2 3 4 4 4
1.0	3 5 5 6 5
1.5	6 5 7 12
2.0	
2.5	
3.0	
3.5	
4.0	



Note: Scala Penetrometer and hand auger log tests give an indication of the ground condition at the test location only.While they are representative of typical conditions across the site, they do not indentify variations in the ground away from the test location.

Tetrad Consulting Ltd: 71 Peterborough Street,Christchurch Central City, 8013 Phone:(03) 365 0726 Email: info@tetrad.co.nz

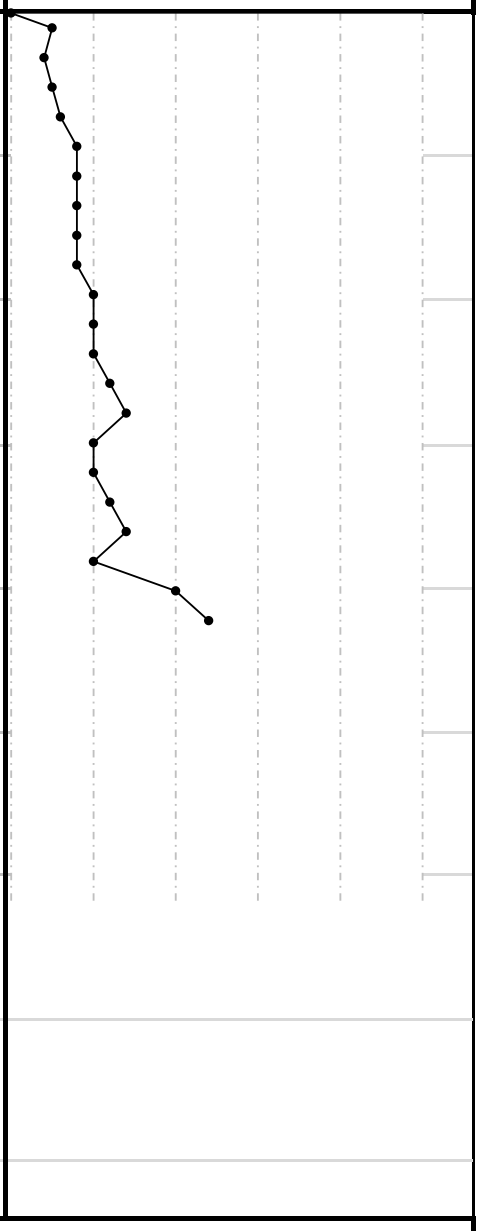
Tetrad.	Test Number	TP4/SP4

Project No:	23235	**Drill Type:**	6 tonne digger/ Scala penetrometer
Client:	Survus Consultants Ltd	**Drilled By:**	Callum
Site Address:	126 Lehmans Road	**Drilling Date:**	31/08/2023
City:	Christchurch	**Log Date:**	15/09/2023

Stratigraphy	Depth (m)	Graphic Log	Soil Description	USCS	Groundwater depth(m
	0.0		**SILT**; dark brown (TOPSOIL), soft, damp.		
	0.5		sandy **SILT**,fine sand; grey/orange; soft - firm; damp; moderate plasticity.		
	1.0				
	1.5				
	2.0				
	2.5		sandy **GRAVEL**; well graded, dense		
					WT ▼
	3.0		E.O.H at 2.9 m depth		
	3.5				
	4.0				

Dynamic Cone (Scala) Penetrometer

Depth (m)	Blow Count
0.0	2.5
	2
	2.5
	3
0.5	4
	4
	4
	4
	4
1.0	5
	5
	5
	6
	7
1.5	5
	5
	6
	7
	5
2.0	10
	12
2.5	
3.0	
3.5	
4.0	



Note: Scala Penetrometer and hand auger log tests give an indication of the ground condition at the test location only.While they are representative of typical conditions across the site, they do not indentify variations in the ground away from the test location.

Tetrad Consulting Ltd: 71 Peterborough Street,Christchurch Central City, 8013 Phone:(03) 365 0726 Email: info@tetrad.co.nz

Tetrad.

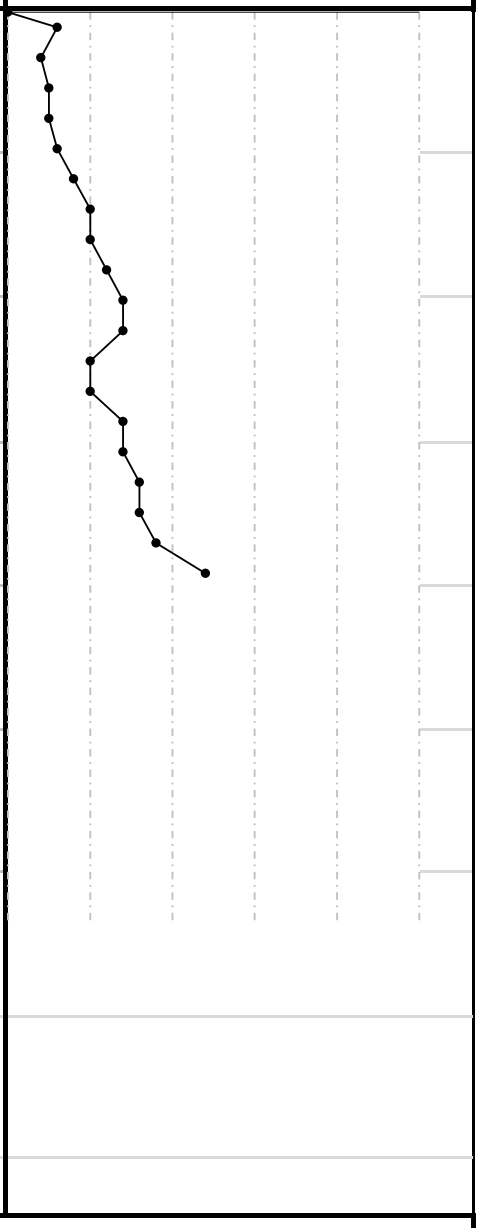
Test Number	TP5/SP5

Project No:	23235	**Drill Type:**	6 tonne digger/ Scala penetrometer
Client:	Survus Consultants Ltd	**Drilled By:**	Callum
Site Address:	126 Lehmans Road	**Drilling Date:**	31/08/2023
City:	Christchurch	**Log Date:**	15/09/2023

Stratigraphy	Depth (m)	Graphic Log	Soil Description	USCS	Groundwater depth(m
	0.0		**SILT**; dark brown (TOPSOIL), soft, damp.		
	0.5		sandy **SILT**,fine sand; grey/orange; soft - firm; damp; moderate plasticity.		
	1.0				
	1.5				
	2.0				
	2.5		sandy **GRAVEL**; well graded, dense		
	3.0		E.O.H at 2.9 m depth		WT ▼
	3.5				
	4.0				

Dynamic Cone (Scala) Penetrometer

Depth (m)	Blow Count
0.0	3
	2
	2.5
	2.5
0.5	3
	4
	5
	5
1.0	6
	7
	7
	5
	5
1.5	7
	7
	8
	8
	9
2.0	12
2.5	
3.0	
3.5	
4.0	



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Statement of Professional Opinion on the Suitability of Land for Subdivision

(Appendix I to the Infrastructure Design Standard)

Issued by: **Tetrad Consulting Ltd**.....
(Geotechnical engineering firm or suitably qualified engineer)

To: **Miranda Hale**.....
(Owner/~~Developer)~~

To be supplied to: **Waimakariri District Council**.....
(Territorial authority)

In respect of: **Rezoning Submission**.....
(Description of proposed ~~infrastructure~~/land development)

At: **126 Lehmans Road, Rangiroa**.....
(Address)

I **Steven Roberts**..... on behalf of: **Tetrad Consulting Ltd.**.....
(Geotechnical engineer) *(Geotechnical engineering firm)*

hereby confirm:

1. I am a suitably qualified and experienced geotechnical engineer and was retained by the owner/~~developer~~ as the geotechnical engineer on the above proposed development.

2. Tetrad's geotechnical assessment report dated: **4th March 2024**.... has been carried out in accordance with the Ministry of Business, Innovation and Employment's *Guidelines for geotechnical investigation and assessment of subdivisions* and includes:

   (i) A liquefaction assessment.
   (ii) An assessment of rockfall and slippage, including hazards resulting from seismic activity.
   (iii) An assessment of the slope stability and ground bearing capacity
   (iv) 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, I consider that Council is justified in granting consent incorporating the following conditions:
   .....
   No geotechnical constraints have been identified on the site for the purpose of rezoning submission.
   .....

   .....

   .....

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.

5. This certificate shall be read in conjunction with my/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 $200,000
   (Minimum amount of insurance shall be commensurate with the current amounts recommended by EngNZ, ACENZ, TNZ, INGENIUM.)

..... Date: 4th March 2024.....

(Signature of Engineer)

Qualifications and experience:

CPEng (Geotechnical), CMEngNZ, Int PE(NZ).....

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