

Geotechnical Investigation Report Stirling Park Subdivision, 734 Springs Road, Prebbleton, Selwyn District

Suburban Estates Ltd

Document Number: 18258-RPTGEO-001-A

Date: 2 August 2018

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1. Introduction

CGW Consulting Engineers have been engaged by the client (Suburban Estates Ltd) to undertake a Geotechnical Investigation Report and Statement of Professional Opinion on the Suitability of Land for Subdivision of the final stage of the Stirling Park Subdivision located at 734 Springs Road, Prebbleton. We understand it is proposed to subdivide Lot 2 DP 492814 at 734 Springs Road into 21 lots.

A Geotechnical Interpretive Report was produced by Elliot Sinclair, dated 4th April 2014, for Stage 2 of the Sterling Park Subdivision located towards the north western and northern extent of the final stage of the subdivision.

This geotechnical investigation report is intended to provide the required information to assist the consenting process for the final stage of the proposed subdivision. We will provide specific comment on the hazards raised by Section 106 of the RMA (1991), and provide a Statement of Professional Opinion on the Suitability of Land for Subdivision (as per IDS – Part 4 – Appendix 1 – with regard to land development).

Our geotechnical limitations are attached in Appendix A.

2. Scope of Works

Our scope of works is as follows.

- A site walk-over to assess site conditions;
- Review of the New Zealand Geotechnical Database (NZGD), and other available relevant geological or geotechnical information;
- Supervise the excavation of 5 Test Pits to a target depth of 3.5 m below ground level (bgl);
- Undertake 5 Dynamic Cone Penetrometer (DCP) Tests alongside excavated Test Pits.
- Geotechnical assessment of the site including specific comment on the hazards outlined in Section 106 of the RMA;
- Preparation of this Geotechnical Investigation Report detailing all of the above, including a statement of suitability for subdivision and preliminary recommendations for new residential building foundations.

3. Site Information

3.1. Site Description

The subject site, located at 734 Springs Road, Prebbleton is approximately 1.4 km southwest of Central Prebbleton and is legally described as Lot 2 DP 492814 covering a total area of 18,430 m².



The site was previously developed with a number of small sheds and one two storey building which were used as part of the Jarvis F & D Carnbrae Carnations Plant Nursery. The site is typically flat to gently undulating with a stockpiled area of soil to the northern extent of the site. Contamination of the site has been undertaken by Malloch Environmental Limited.

A site layout plan is presented in Figure 1.



Figure 1: Site Location Plan

4. New Zealand Geotechnical Database Review

4.1. MBIE Technical Category Zoning

The site is located within a classified Ministry of Business Innovation and Employment (MBIE) Technical Category N/A Rural & Unmapped. According to the Canterbury Earthquake Recovery Authority (CERA), normal consenting procedures will apply in these areas.

4.2. Liquefaction Hazard

Based on a review of the Selwyn District Council 'Potentially Liquefiable Ground Zone' map, the site is not located within the potentially and known liquefaction areas of the Selwyn area. As such, the site can be considered to be consistent with a low liquefaction risk.



4.3. Flood Hazard

Ground levels have changed across Christchurch as a result of the Canterbury earthquakes. According to the Canterbury Map Viewer provided by Selwyn District Council (SDC), 734 Springs Road is not within a flood hazard management area and we do not expect this to be a risk for the site, however, Selwyn District Council should be contacted directly to provide further information.

4.4. EQC Observed Land Damage

Aspects of the ground damage across Christchurch and parts of Canterbury have been recorded and this information is published on the New Zealand Geotechnical Database (NZGD). According to the New Zealand Geotechnical Database no relevant earthquake information has been recorded for the site which includes liquefaction and land damage, vertical settlements, horizontal movements and event specific groundwater recordings.

4.5. Scaled Conditional Peak Ground Accelerations

Conditional Peak Ground Acceleration (PGA) values, developed by Bradley Seismic Ltd and the University of Canterbury, are available on the NZGD. These values have been scaled (Table 1) to match a design earthquake moment magnitude (Mw) of 7.5 in accordance with Idriss/Boulanger (2008/2014), as recommended by Bradley and Hughes (2012).

Table 1: Scale	Table 1: Scaled Conditional PGA Values for the Site														
Earthquake Event	Moment Magnitude (M _w)	Average PGA (g)	Standard Deviation σ	PGA M=7.5 (g)	10th Percentile PGA M=7.5 (g)	Sufficiently Tested									
4 th September 2010	7.1	0.37	0.40	0.33	0.20	Yes									
22 nd February 2011	6.2	0.23	0.45	0.16	0.09	No									
13 th June 2011	6.0	0.10	0.45	0.07	0.04	No									
23 rd December 2011	5.9	0.10	0.45	0.07	0.04	No									

4.6. Site Performance

Using guidance from the MBIE and Bradley & Hughes (2012) 'Conditional Peak Ground Accelerations in the Canterbury Earthquakes for Conventional Liquefaction Assessment', we consider the site was "sufficiently tested" to a Serviceability Limit



State SLS level of earthquake demand during the 4th September 2010 earthquake events of the CES.

5. Geological Model

5.1. Published Geology

The soils across the Canterbury Plains comprise interbedded alluvial formations deposited by eastward flowing rivers emanating from the Southern Alps and draining towards the coast along Pegasus Bay. These alluvial soils, interlayered with marine deposits associated with previous fluctuations of sea level, comprise variable gravels, sand, silts and occasional peat, and can change markedly over relatively short distances, both horizontally and vertically. The sandy and silty soil types are considered susceptible to liquefaction, dependent upon grain size distribution, saturation, and in-situ density.

The 1:25,000 scale geological map 'Geology of the Christchurch Urban Area' (Brown and Weeber, 1992), indicates the near surface geology at the site is the Springston Formation. The Springston Formation is described as typically up to 20 m thick, less than 14,000 years in age, and comprises gravel, sand and silt of historic river flood channels. These deposits can also contain layers of organic material and gravels.

In this area the Springston Formation is likely to be underlain by the Riccarton Gravel. The Riccarton Gravel is described as typically up to 20 m thick, between 14,000 and 70,000 years in age, and comprises alluvial gravels with sand and silt deposited by rivers on outwash fans during the most recent glacial period. This formation is the uppermost confined gravel aquifer in Canterbury.

5.2. Site Specific Investigation

Following an initial site walkover and services locate, the field investigations comprised:

- Five machine excavated Test Pits and five Dynamic Cone Penetrometer Tests adjacent to the Test Pits undertaken from the surface;
- A visual-tactile field classification of the subsoils encountered during Test Pit excavations was carried out in accordance with 'Guidelines for the Field Classification and Description of Soil and Rock for Engineering Purposes' (NZGS, 2005) and Dynamic Cone Penetrometer testing was carried out in accordance with NZS 4402:1988, Test 6.5.2, 'Dynamic Cone Penetrometer'.

Investigation details are provided in Table 2. The tests were positioned in areas as to provide the most effective coverage of the site considering site access and the existing structures on the site. Test locations were recorded by handheld GPS or approximated from site measurements and reduced levels interpolated from LiDAR and are therefore approximate.



Existing deep geotechnical testing data is available on the NZGD and has also been reviewed for use as part of our assessment. The most relevant data is summarised in Table 2 and the test information can be found in Appendix D.

As these investigations were not undertaken/supervised by CGW Consultants, accuracy of the deep test data obtained cannot be guaranteed. Reduced levels have been interpolated from LiDAR.

Table 2: Summary of Site Specific and Nearby Investigation Information											
Test ID	Elevation RL	Termination Depth (bgl)	Further Information (Groundwater, piezometer, etc.)								
TP01	21.0 m	3.60 m	No Groundwater Encountered								
TP02	21.0 m	3.50 m	No Groundwater Encountered								
TP03	21.0 m	3.20 m	No Groundwater Encountered								
TP04	21.0 m	3.40 m	No Groundwater Encountered								
TP05	21.0 m	3.30 m	No Groundwater Encountered								
DCP01	21.0 m	0.90 m	No Groundwater Recorded								
DCP02	21.0 m	0.90 m	No Groundwater Recorded								
DCP03	21.0 m	1.00 m	No Groundwater Recorded								
DCP04	21.0 m	0.70 m	No Groundwater Recorded								
DCP05	21.0 m	1.00 m	No Groundwater Recorded								
MBH_77967	N/A	15.13 m	No Groundwater Recorded								

All test locations are presented on drawing 18258/1 in Appendix B with Test Pit and Dynamic Cone Penetrometer results showing detailed soil descriptions and blows per 100 mm penetration presented in Appendix C.

5.3. Site Subsurface Conditions

Subsurface conditions based on those encountered within the Test Pits are summarised in Table 3 below.



Table 3: Site Ground Model											
Soil Type	Depth to bottom of Layer (m)	Layer Thickness (m)	DCP Reading (Blows/100mm)	Relative Density / Consistency							
GRAVEL* (Fill)	0.3	0.3	5 – 8	Loose to Medium Dense							
SILT (Topsoil)	0.2 – 0.3	0.2 – 0.3	1 – 3	Soft							
Interbedded SILT, Sandy SILT and Silty SAND	0.6 – 1.0	0.3 – 0.8	2 – 12	Soft to Firm Silt. Loose to Dense Sand.							
Sandy GRAVEL and GRAVEL with cobbles	>3.6	>3.0	10 – 20+	Dense							

* - FILL only encountered within Test Pit TP05 that was carried out on gravel driveway entrance.

5.4. Groundwater

Groundwater was not recorded within any of our Test Pits on the day of our investigation. According to the Elliot Sinclair 'Geotechnical Interpretive Report' a number of borehole wells within 500 m of the site indicate groundwater table recordings from approximately 4.3 m below ground level (bgl) to 9.12 m bgl. Also, groundwater was also noted at the base of the neighbouring gravel pit indicating a depth of between 5m and 6m depth.

6. Resource Management Act (RMA) Section 106

The site has been assessed against Section 106 of the Resource Management Act (RMA) which states:

..." a consent authority may refuse to grant subdivision consent, or may grant a 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; or
- *c)* sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision."

The ground surface of the site is near-level with minor undulations and it is not within 100 m of any free edge or body of water. The groundwater is expected to be



between 4.0 m and 9.0 m below ground level across the site. Consequently we do not consider the site to be at risk from erosion.

No raised land is located in proximity of the proposed subdivision site; therefore, we consider there to be no risk to the site from falling debris, rockfall or land slippage.

A flood level assessment to determine the likelihood of inundation from bodies of water has not been carried out as part of our investigation. Selwyn District Council does not currently present information related to the flood hazard at this site. Based on the site location we consider the likelihood of flooding to be low.

Due to the level nature of the site and surrounding area we consider the site is not at risk of slope instability.

6.1. Geotechnical Ultimate Bearing Capacity

With reference to Dynamic Cone Penetrometer results, in accordance with NZS 3604:2011 and the MBIE Guidance, an Ultimate Bearing Capacity (UBC) of 200 kPa is available within the natural soil at a depth of 0.7 m bgl and an Ultimate Bearing Capacity (UBC) of 300 kPa is available within the natural soil at a depth of 0.9 m bgl. In accordance with the principles of AS/NZS1170.0:2002 Section 3.2, a Strength Reduction Factor of $\Phi = 0.5$, as per B1/VM4 Section 3.5, should be applied to the Ultimate Bearing Capacity, which should then equal or exceed the factored Ultimate Limit State design actions.

7. Recommendations

Based on the information provided and the requirements of the Resource Management Act Section 106 we consider the site has a low risk from any of the geotechnical conditions outlined. We consider, based on nearby borehole data and the Selwyn District Council 'Potentially Liquefiable Ground Zone' map, that the site will not be susceptible to liquefaction induced ground damage in future design level earthquakes.

Based on our investigations and assessment residential foundations at the site, we consider a current MBIE Technical Category TC1 foundation system such as an NZS3604 foundation system is applicable. All residential development will require site specific geotechnical investigations prior to construction in order to confirm the founding depths and subsoils for each allotment.

Based on our investigations and assessment, we consider this site to be suitable for subdivision. Our 'Statement of suitability for subdivision' documentation is presented in Appendix E.



8. References

- 1. Bradley and Hughes, 2012a. Conditional Peak Ground Accelerations in the Canterbury Earthquakes for Conventional Liquefaction Assessment, Technical Report for the Ministry of Business, Innovation and Employment.
- 2. Bradley and Hughes, 2012b. Conditional Peak Ground Accelerations in the Canterbury Earthquakes for Conventional Liquefaction Assessment: Part 2, Technical Report for the Ministry of Business, Innovation and Employment.
- 3. BS 1377: Part 9:1990. Methods for test for soils for civil engineering purposes, In-situ tests.
- Canterbury Earthquake Recovery Authority (CERA), 2015. New Zealand Geotechnical Database (NZGDGD), Available at https://canterburygeotechnicaldatabase.projectorbit.com (accessed 23/07/2018)
- 5. Forsyth, P.J.; Barrell, D.J.A.; Jongens, R. (compilers) 2008. Geology of the Christchurch Area, Scale 1:250,000, GNS Science, Institute of Geological & Nuclear Sciences, Lower Hutt. Geological Map 16.
- Ministry of Business, Innovation and Employment, 2014a. Acceptable Solutions and Verification Methods for New Zealand Building Code Clause B1 Structure, Verification Method B1/VM4, Foundations, New Zealand.
- 7. NZGS, 2005. Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes, NZ Geotechnical Society Inc, Wellington, New Zealand.
- 8. Selwyn District Council Potentially Liquefiable Ground Zone Map dated 31 July 2018.



Appendix A Limitations

CGW CONSULTING ENGINEERS - LIMITATIONS

The professional services and this document provided by CGW Consulting Engineers Ltd ("CGW") are subject to the following limitations:

Reliance: This document has been prepared solely for the benefit of our client, as per our brief and an agreed consultancy agreement. The document is confidential and reliance by any other parties on the information or opinions contained in this document shall, without our prior agreement in writing, be at such parties' sole risk. CGW accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this document.

Our Brief: This document has been prepared solely to address the issues raised in our brief, and shall not be relied on for any other purpose. The scope and the period of CGW's services are as described in CGW's proposal, and are subject to restrictions and limitations. CGW did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by CGW in regards to it.

Unforeseen Ground Conditions: The conclusions and recommendations contained within this document are based on the ground conditions indicated from published sources, site inspections and subsurface investigations described in this document based on accepted normal methods of site investigation. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this document does not purport to completely describe all the site characteristics and properties. The nature and continuity of ground and groundwater conditions are inferred using experience and judgement and it must be appreciated that actual conditions could vary considerably from the assumed model. Defects and unforeseen ground conditions may remain undetected which might adversely affect the stability of the site and the recommendations made herein.

Third Party Data: In the event that external third party investigation data has been utilised or provided to us, the client acknowledges that we have placed reliance on this information to produce our document and CGW will accept no liability resulting from any errors or defect in the external third party data.

Ground Investigation Data: The Client grants permission to CGW to upload any factual data collected during the works to the National Geotechnical Database (or other similar database) as appropriate.

Warranty: Any assessments made in this document are based on the conditions indicated from published sources and the investigations described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this document.

Time: In addition, it is recognised that the passage of time affects the information and assessment provided in this document. CGW's opinions are based upon information that existed at the time of the production of the document. It is understood that the services provided allowed CGW to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality or features of the site, or its surroundings, or any laws or guidance or regulations.

Construction Issues: It is common that not all site issues will necessarily be dealt with at site assessment stage. As the project progresses through design towards construction, if issues arise, allow CGW to develop alternative solutions to problems, that will be of benefit both in time and cost. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. Contractors should perform any additional tests as necessary for their own purposes.

Geoenvironmental: Unless specifically stated the document will not relate any findings, conclusions or recommendations about the potential for hazardous or contaminated materials existing at the site. Specialist equipment, techniques, laboratory testing and personnel are required to perform geoenvironmental (ie. HAIL) assessments.

Sub-Contractors and Staff: CGW may have retained sub-consultants or sub-contractors to provide services for the benefit of CGW. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, CGW's sub-consultant or sub-contractor companies, and CGW's employees, officers and directors.

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Intellectual Property Rights: All intellectual property (IP), designs and documents created or provided by CGW in the provision of the services shall remain the property of CGW. Subject to the Client complying with its obligations under the agreed consultancy agreement, the Client shall upon payment own all deliverables provided to it in the provision of the Services, and CGW grants to the Client a nonexclusive, non-transferable license to use the IP for the purposes described in the Proposal. The Client shall not use, or make copies of, the deliverables in connection with any work not included in the Proposal without prior written consent from CGW. If the Client is in breach of any obligation to make a payment to CGW, then CGW may revoke the license to use the IP and the Client shall return to CGW all originals of deliverables provided under the services and any copies thereof.

Assignment: Neither party and their respective successors may assign, transfer, or sublet any obligation under this Agreement without the prior written consent of the other party. Unless stated in writing to the contrary, no assignment, transfer, novation or sublet shall release the assignor from any obligation under this Agreement.

Standard Terms: These Limitations should be read in conjunction with the IPENZ/ACENZ Standard Terms of Engagement as per our proposal and agreed consultancy agreement.



Appendix B Test Location Plan



Notes:

 CGW Consulting Engineers Test Location Plan adapted from Ecan or Google maps.
It should be borne in mind that locations of features are approximate only.
Original plan size A4.

	Civil Structural Environmental	tructural Environmental DATE: July 2018 Test Location Plan		Test Location Plan	DRAWING NO:
	Geotechnical	DRAWN:	JF	Stirling Park Subdivision	10250/1
	Nelson Ph: 548 - 8259	SCALE:	NTS	734 Springs Road	16236/1
Consulting Engineers	Christchurch Ph: 348 - 1000	CAD REF:	18258	Prebbleton	SHEET 1 OF 1



Appendix C Test Pits & Scala Logs

				Project	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	TP01	
C	GV	V		Project	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1	
Consu	ulting Engin	ieers		GL (m	AOD): 2	1.00		N Coord: -43.589403	E Coord: 172.502075	
Date: 19/07/20	18			Metho	d: Digge	er		Logged By: JF	Scale: 1:30	
Depth (m)	Туре	Blows 0 5	s per 1 10	00mm 15 20	Level	Legend	Depth (m)	Description	Water	
					20.70 20.20 20.00 19.00		0.30 0.80 1.00 2.00 3.00	SILT, some fine to medium sat coarse, sub rounded gravels; o plasticity (TOPSOIL). Sandy SILT, trace fine to coa orange-brown. Soft, moist, no Sandy GRAVEL with minor cob to dense; moist; well graded. S to coarse, sub rounded.	nd, trace rootlets and fine to dark brown. Soft, moist, low rse gravels; brown mottled in plastic. bbles; brown. Medium Dense and is coarse. Gravel is fine les. Dense.	
KEY D - Disturbed S B - Bulk Samp W - Water San V - Hand Shea	Sample Ile mple ar Vane	kPa	⊻ ▼	- Grou - Grou	ndwater ndwater	Strike Level	AGS	REMARKS No Groundwater Encountered End of Hole at 3.6m. Hole Collapsi	ng.	

				Pı	roject	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	TP02	
	GV	V		Pı	roject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1	
Consu	ulting Engin	ieers		G	L (mA	AOD): 2	1.00		N Coord: -43.590287	E Coord: 172.501034	
Date: 19/07/20	18			М	ethoo	l: Digge	er		Logged By: JF Scale: 1:30		
Depth (m)	Туре	Blov 0 t	vspe 51	r 100 0 1)mm 5 20	Level	Legend	Depth (m)	Description		Water
				20.70 - 20.40 - 20.00 - - - - - - - - - - - - - - - - - - -		0.30 0.60 1.00 2.00 3.00	SILT, trace rootlets, fine san rounded gravels; dark brown. (TOPSOIL). SILT, some fine sand, trace fin gravels; light brown. Soft, moi Sandy GRAVEL with trace cobt to dense; moist; well graded. Sa is fine to coarse, sub rounded. 1.10 Becomes with some cobbl End Of Hole At 3.50 m	d and fine to coarse, sub Soft, moist, low plasticity ne to coarse, sub rounded <u>st, low plasticity.</u> oles; brown. Medium Dense and is fine to coarse. Gravel es.			
KEY D - Disturbed 3 B - Bulk Samp W - Water Sar V - Hand Shea	Sample ble mple ar Vane	kPa	Ž	Z - (Z - (Grour Grour	ndwater ndwater	Strike Level	AGS	REMARKS No Groundwater Encountered End of Hole at 3.5m. Hole Collapsir	ng.	

				Project	Title: S	itirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	TP03	
	GV	V		Project	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1	
Consi	ulting Engin	ieers		GL (m/	AOD): 2	1.00		N Coord: -43.589908	E Coord: 172.502545	
Date: 19/07/20)18			Method	l: Digge	er		Logged By: JF Scale: 1:30		
Depth (m)	Туре	Blows	s per 1 10	100mm 15 20	Level	Legend	Depth (m)	Description		Water
KEY					20.80		0.20	SILT, trace rootlets and fine to Soft, moist, low plasticity (TOF Sandy SILT; light brown. Soft, if fine to medium. 0.80 Becomes with trace fir gravels. Sandy GRAVEL with trace cob to dense; moist; well graded. S is fine to coarse, sub rounded. 1.80 Becomes with some cobb	ne to coarse, sub rounded bles; brown. Medium Dense and is fine to coarse. Gravel les. Dense.	
D - Disturbed B - Bulk Samp W - Water Sar V - Hand Shea	Sample ble mple ar Vane	kPa	⊻ ▼	- Grour - Grour	ndwater ndwater	Strike Level	AGS	No Groundwater Encountered End of Hole at 3.2m. Hole Collapsi	ng.	

			Р	roject	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	TP04	
C	GV	V	Р	roject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1	
Consu	ulting Engin	leers	G	iL (mA	AOD): 2	1.00		N Coord: -43.590029	E Coord: 172.501671	
Date: 19/07/20	18		N	lethod	l: Digge	er		Logged By: JF	Scale: 1:30	
Depth (m)	Туре	Blows pe 0 5 1	er 100	0mm 15 20	Level	Legend	Depth (m)	Description		Water
					20.80 20.20 20.00 19.00 119.00		0.20	SILT, minor fine sand, trace roc rounded gravels; dark brown. (TOPSOIL). Silty SAND with trace fine to co- light brown. Loose to medium; r medium to coarse. Sandy GRAVEL with minor cob to dense; moist; well graded. So is fine to coarse, sub rounded. 1.40 Becomes with some cobb End Of Hole At 3.40 m	etlets and fine to coarse, sub . Soft, moist, low plasticity oarse, sub rounded gravels; noist; poorly graded. Sand is bles; brown. Medium Dense and is fine to coarse. Gravel les.	
KEY D - Disturbed S B - Bulk Samp W - Water Sar V - Hand Shea	Sample le nple ar Vane	kPa	∠ - ▼ -	Grour Grour	ndwater ndwater	Strike Level	AGS	REMARKS No Groundwater Encountered End of Hole at 3.4m. Hole Collapsin	ng.	

				Pro	ject	Title: S	itirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	TP05	
C	GV	V		Pro	ject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1	
Consu	ulting Engin	ieers		GL	(mA	OD): 2	1.00		N Coord: -43.590407	E Coord: 172.502266	
Date: 19/07/20	18			Met	thod	: Digge	er		Logged By: JF	Scale: 1:30	
Depth (m)	Туре	Blows 0 5	s per 1 1 <u>0</u>	100m 1 <u>5</u>	nm 20	Level	Legend	Depth (m)	Description Wa		
KEY						20.90 20.70 20.20 20.00 19.00 19.00 17.70		_ 0.10 _ 0.30 _ 0.80 _ 1.00 _ 1.00 _ 2.00 _ 3.00 _ 3.30	Sandy GRAVEL; grey. Loose graded. Sand is fine to coar rounded (Made-Ground). GRAVEL with some medium to Dense; moist; well graded. Ge rounded gravels; light brown plasticity. Sandy GRAVEL with trace cob to dense; moist; well graded. Sa is fine to coarse, sub rounded. 1.40 Becomes with some cobble Cobbly GRAVEL with some find Dense; moist; well graded. Ge rounded. End Of Hole At 3.30 m	e to Dense; moist; poorly se. Gravel is coarse, sub o coarse sand; light brown. ravel is fine to coarse, sub h. Soft to firm, moist, low bles; brown. Medium dense and is fine to coarse. Gravel es. ne to coarse sand; brown. ravel is fine to coarse, sub	
D - Disturbed S B - Bulk Samp W - Water Sar V - Hand Shea	Sample ble mple ar Vane	kPa	⊻ ▼	- Gı - Gı	roun roun	dwater dwater	Strike Level	AGS	No Groundwater Encountered End of Hole at 3.3m. Hole Collapsin	ng.	

				Pr	oject	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	DCP01		
C	GV	V		Pr	oject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1		
Consu	ılting Engir	ieers		GI	L (mA	AOD): 2	1.00		N Coord: -43.589403	E Coord: 172.502075		
Date: 19/07/20	18			M	ethoc	I: DCP			Logged By: JF	Scale: 1:20		
Depth (m)	Туре	Blov 0 ±	vs per 5 1.0	100 0 1	mm 5 20	Level	Legend	Depth (m)	Description		Water	
				20.00		- 1.00 - 1.00 	End Of Hole At 0.9 m					
KEY D - Disturbed S B - Bulk Samp W - Water Sar V - Hand Shea	Sample le nple ar Vane	kPa		Z - 0 Z - 0	Grour	ndwater ndwater	Strike Level	AGS	REMARKS End of Hole at 0.9m. Scala Refusa	I. No Groundwater Recorded.	L	

				Pr	oject	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	DCP02		
C	GV	V		Pr	oject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1		
Consu	ulting Engin	ieers		GI	_ (mA	OD): 2	1.00		N Coord: -43.590287	E Coord: 172.501034		
Date: 19/07/20	18			Me	ethod	I: DCP			Logged By: JF	Scale: 1:20		
Depth (m)	Туре	Blov 0 t	vs per 5 1(100 0 1	mm 5 20	Level	Legend	Depth (m)	Description		Water	
								-			-	
						-		-			-	
						-		-			-	
						-		-			-	
						-		-			-	
						20.00_		_ 1.00	End Of Hole At 0.9 m		-	
						-		-			-	
						-		-			-	
						-		-			-	
						-		-			-	
						19.00_		_ 2.00			-	
						-		-			-	
						-		-			-	
KEY									REMARKS			
D - Disturbed S B - Bulk Samp W - Water Sar V - Hand Shea	Sample Ile mple ar Vane	kPa	Z	Z - 0 Z - 0	Grour Grour	ndwater ndwater	Strike Level	AGS	End of Hole at 0.9m. Scala Refusa	I. No Groundwater Recorded.		

				Pr	oject	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	DCP03					
C	GV	V		Pr	oject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1					
Consu	lting Engin	eers		GL	_ (mA	OD): 2	1.00		N Coord: -43.589908	E Coord: 172.502545					
Date: 19/07/20	18			Me	ethod	I: DCP			Logged By: JF	Scale: 1:20					
Depth (m)	Туре	Blov 0 5	vs per 5 10	· 100	mm 5 20	Level	Legend	Depth (m)	Description		Water				
KEY						20.00 - - - - - - - - - - - - - - - - - -		- 1.00 - 2.00	End Of Hole At 1 m						
D - Disturbed S B - Bulk Samp W - Water San V - Hand Shea	Sample le nple Ir Vane	kPa	Z	Z - G Z - G	Groun Groun	ndwater ndwater	Strike Level	AGS	End of Hole at 1.0m. Scala Refusa	I. No Groundwater Recorded.					

				Pr	oject	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	DCP04						
C	GV	V		Pr	oject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1						
Consi	ulting Engir	neers		GI	L (mA	OD): 2	1.00		N Coord: -43.590029	E Coord: 172.501671						
Date: 19/07/20	18			M	ethod	: DCP			Logged By: JF	Scale: 1:20						
Depth (m)	Туре	Blov 0 {	vs per 5 10	100) 1	mm 5 20	Level	Legend	Depth (m)	Description	•	Water					
						- - - - - - - - - - - - - - - - - - -		- 1.00 	End Of Hole At 0.7 m							
KEY D - Disturbed 3 B - Bulk Samp W - Water Sar V - Hand Shea Printed By GeoLogs	Sample Ile nple ar Vane	kPa	Som)	Z - (Z - (Grour	dwater dwater	Strike Level	AGS	REMARKS End of Hole at 0.7m. Scala Refusa	I. No Groundwater Recorded.						

				Pr	oject	Title: S	tirling Pa	ark Subdivis	ion, Hamptons Road, Prebbleton	DCP05					
C	GV	V		Pr	oject	Numbe	r: 18258		Client: Suburban Estates Ltd	Sheet 1 Of 1					
Consu	ılting Engin	neers		GI	_ (mA	OD): 2	1.00		N Coord: -43.590407	E Coord: 172.502266					
Date: 19/07/20	18			Me	ethod	: DCP			Logged By: JF	Scale: 1:20					
Depth (m)	Туре	Blow: 0 5	s per 1 _, 0	100 1	mm 5 20	Level	Legend	Depth (m)	Description		Water				
						20.00 - - - - - - - - - - - - - - - - - -			End Of Hole At 1 m						
KEY D - Disturbed 3 B - Bulk Samp W - Water Sar V - Hand Shea Printed By GeoLogs	KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa						Strike Level	AGS	REMARKS End of Hole at 1.0m. Scala Refusal	. No Groundwater Recorded.					



Appendix D Nearby Geotechnical Investigation Information



BOREHOLE LOG

BOREHOLE No: BH2 Hole Location: Refer to site plan

SHEET 1 OF 4

PROJECT: TONC	H-PR	EB	BLE	ETC	DN-I	INV					LOC	CATIO	N: Bla	kes/Sp	oring	js R	d, Pre	ebł	oleto	on, CHCH JOB No: 680393
CO-ORDINATES											DRI	LL TY	PE: U	DR60	C				HC	DLE STARTED: 13/10/11
D.											DRI	LL ME	THO	: HQ	TT/	HQ	Wasł	n	HC	DLE FINISHED: 13/10/11
DATUM	III										DRI	LL FL	UID: I	Лud					LO	GGED BY: DLM CHECKED:
GEOLOGICAL													0.2.			EN	GINE	EF		G DESCRIPTION
GEOLOGICAL UNIT,													Ŋ		E				פ	SOIL DESCRIPTION
GENERIC NAME,				(%								MBO	HERI	~	RENG		SSIVE GTH) ACIN	Soil type, minor components, plasticity or particle size, colour.
MINERAL COMPOSITION.				ERY (9			TEOTO					N S NC	WEAT	NSIT ON	R STF	(кРа	IPRE: (MPa	LO FO	1 1	
		ss		COVE			TESTS			Ê	LOG	CATIC	ų Z	'HVDE CATIC	HEAF		ST	L		Substance: Rock type, particle size, colour,
		ID LO	Ш	KE RE	DOH.	DNG		IPLES	Ē	TH (n	DHIC	SSIFI	STUR	ENG	0)				-	Defects: Type, inclination, thickness,
		FLU	WAJ	COF	MET	CAS		SAN	R.L	DEP	GR	CLA	MOI	STR CLA	- 1 50 50	898	39222	067 -	1220000	roughness, filling.
							***			-	× <u>//</u>	ML	M	S						TOPSOIL. SILT, dark brown. Moist, low
							NB:SPT			-	I× ^̂	WIL	м	F						SILT, dark brown. Moist, low plasticity.
							was not carried out			-	××									Contains rootlets.
							to NZS4402			-	××									
							N value is			0.5-	ĺ, ×									0.5-
					н		estimated			-	××									
				80	4QT		by driffer.			-	× Ľ									0.75m- becoming medium brown. Contains
					ш					-	× Č		X 17							trace fine gravel, subrounded to subangular.
										1.0-	ĺ× ^́		W							0.9m- becoming wet. 0.95m- becoming SILT with some gravel. 1.0 ⁻
										-		ML	М	VL.						Becoming mottled brown/ orangish brown.
										_	××	SP	М	VL						SILT with minor sand and trace gravel.
										-	×	1								mottled brown/ orangish brown. Very loose,
										-	×									moist, low plasticity. Sand is fine. Gravel is fine subrounded to subangular.
							3//2/2/3/3 N=10			1.5-	×		W							Silty, fine SAND, mottled brown/ orangish
										-	×	•								brown. Very loose, moist.
										-	×	1								1.5m- becoming britte with miller site.
										-	××	-								
										2.0-]* ×									2.0-
										-	××	-								2.05-2.17m- sandy SILT bed.
				00	5TT					-	l [×] ×]								
				[Ĥ					-	l^ ×									
										2 5	××	1								2.5-
										2.5	×									2.5
										-	×									
										-	* *									
										-	×	-								
							*** N⊳50			3.0-		GW	М	VD						Fine to coarse GRAVEL, grey. Very dense, 3.0
							N~30			-	00									moist, subrounded to subangular. Fines
										-	0 -									washed away nom anning process.
										-										
										3.5-	00	1								3.5-
										-	°0 =									
				0	E					-										
				=	H					-	00	1								3.75m- contains some cobbles. Becoming
										-	°0 =	2								
										4.0-	00									4.0-
										-	0	1								
										-	00									· · ·
										-	00									
							50//-			4.5-										HO wash drill No recovery 4.5
							for 65mm N>50			-	<u>}</u> //									The wash and. I've recovery.
							11- 50			-	ŧΥ									.
										-	1/1									
										5 -	1/ \	l								



BOREHOLE LOG

BOREHOLE No: BH2 Hole Location: Refer to site plan

SHEET 2 OF 4

PROJECT: TONC	JECT: TONCH-PREBBLETON-INV L												LOCATION: Blakes/Springs Rd, Prebbleton, CHCH JOB No: 680393										
CO-ORDINATES											DRI	LL TY	PE: U	DR60	0					HC	LE STARTED: 13/10/11		
											DRI	LL ME	THOE	: HQ	TT/	' HC	2 Wa	ash		HC	DLE FINISHED: 13/10/11		
R.L.	m										ווסח			Aud						DR			
GEOLOGICAL											DRI		י טוע. וו	/luu		FI	NGIN		=R		DESCRIPTION		
													Q		т				[<u>,</u>			
GENERIC NAME,				~								ABOL	TERIA		NGT		SIVE		ACINO		Soil type, minor components, plasticity or		
ORIGIN, MINERAL COMPOSITION				۲Y (%								N SYN	ÆATH	ISITY ⊿	STRE	kPa)	RES:	MPa)	T SP/		particle size, colour.		
		s		OVEF			TESTS				90	ATIO	5	4DEN ATIO	HEAR	Ŭ	COMF	0	EFEC		ROCK DESCRIPTION Substance: Rock type, particle size, colour,		
		S LOS	н	E REC	ПОР	ŊĊ		LES	Ê	(m) H	HICI	SIFIC	TURE	SIFIC	Ś					נ	minor components.		
		FLUI	WATE	COR	METH	CASI		SAMF	R.L.	DEP1	GRAF	CLAS	MOIS	STRE	- 10	200 500 500		520	- 50	500 500 1 220 1 220	roughness, filling.		
										_									T		HQ wash drill. No recovery.		
					₹					-													
					M/					-											-		
					Н					-											-		
										5.5-											5.5-		
										-											-		
										_											-		
										-													
							***			60-											6.0-		
							N=48			-													
										-											-		
										-											-		
										-											-		
										6.5-											6.5-		
					ASH					-													
					ζW					-											-		
					ЭH					_													
										7.0-											7.0-		
										-													
										-											-		
										-													
							***			7.5-											7.5–		
							N=38			_													
										-													
										-											-		
										8.0-											8.0-		
					₹					-													
					M/					-											-		
					Н					-											-		
										8.5-											8.5-		
										-											-		
										-													
										-											-		
							11//8/11/12	,		9.0-											9.0		
							N=37			9.0 -											9.0		
þþ										-						$\ \ $							
DT a										-											-		
D.E.										-													
PLA										9.5-						$\ \ $					9.5-		
LEM					HS					-						$\ \ $					-		
ATA					WA					-						$\ \ $							
T D					Η					-						$\ \ $							
÷										10 -											BORELOG PREBBLETON BH1 TP1-10 GP1 19/10/11		



BOREHOLE LOG

BOREHOLE No: BH2 Hole Location: Refer to site plan

SHEET 3 OF 4

PROJECT: TONC	H-PRE	EBB	LET	ON-	INV					LOC	ATIO	N: Blal	kes/Sp	oring	js F	Rd, F	Pre	bble	eto	n, CHCH JOB No: 680393
CO-ORDINATES										DRI	L TY	PE: U	DR60	0				ŀ	ю	LE STARTED: 13/10/11
										DRII	L ME	THOD	: HQ	TT/	HQ	Wa	ish	F	-10 סר	LE FINISHED: 13/10/11
	111									DRII	L FLU	JID: N	/lud					L	_0	GGED BY: DLM CHECKED:
GEOLOGICAL															E١	IGIN	NEE	RII	NG	DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		UID LOSS	DRF RECOVERY (%)	ETHOD	SING	TESTS	MPLES	г (m)	EPTH (m)	APHIC LOG	ASSIFICATION SYMBOL		RENGTH/DENSITY ASSIFICATION	SHEAR STRENGTH	0 (kPa)	COMPRESSIVE STRENGTH	0 (MPa)	DEFECT SPACING	00 (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness filling.
		4 3		WE	CA		SA	R.I	DE	5	C	Σ ŭ	ST CL	233	;28, 	- 282	3≘£	250	28 	HO wash drill. No recovery
				HQ WASH SPT	-	13//7/7/7 N=28			10.5	0.0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0	GW	W	MD							Sandy, silty, fine to coarse GRAVEL, dark greyish brown. Medium dense, wet. Gravel is subangular to angular. Sand is fine to coarse. HQ wash drill. No recovery. 11.0- 11.5-
				SPT	_	*** N=38			12.0	0.0.0. 0.0.0.0. 0.0.0.0.	GW	W	MD							Sandy, silty, fine to coarse GRAVEL, dark greyish brown. Dense, wet. Gravel is subangular to angular. Sand is fine to coarse. HQ wash drill. No recovery. 12.5-
				HQ WASH	,				13.0											- 13.0-
T DATATEMPLATE.GDT abb				HQ WASH		*** N>50			13.5											13.5- 14.0- 14.5-



BOREHOLE LOG

BOREHOLE No: BH2 Hole Location: Refer to site plan

SHEET 4 OF 4

PROJECT: TONCH-PREBBLETON-INV										LOCATION: Blakes/Springs Rd, Prebbleton, CHCH JOB No: 680393														
CO-ORDINATES										DRI	LL TY	PE: U	DR600)	-	-	_	-	НС	DLE STARTED: 13/10/11				
										DRI	LL ME	THOD	: HQ1	FT/	HQ	W	asł	n	HOLE FINISHED: 13/10/11					
R.L.	A.L. m DATUM									וסח			Aud						DF					
	GEOLOGICAL												/iuu		FN	IGII	NF	FR		G DESCRIPTION	_			
SEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS 50//- for 130mm	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE WEATHERING	STRENGTH/DENSITY CLASSIFICATION	25 26 50 50 25 50 25 50 25 25 25 25 25 25 25 25 25 25 25 25 25	200 (kPa)	20 COMPRESSIVE	100 (MPa)	- 50 DEEECT SPACING	250 CL CC C 2000	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.				
									15.5 16.0 16.5 17.0 17.5 18.0 19.0 19.5												(.5) (.5) (.5) (.5) (.5) (.5) (.5) (.5)			



Appendix E Statement for Subdivision Suitability

Statement of Professional Opinion on the Suitability of Land for Subdivision

(Appendix I to the Infrastructure Design Standard)

Issued by: *CGW Consulting Engineers* (Geotechnical engineering firm or suitably qualified engineer)

To: Suburban Estates Limited (Owner/Developer)

To be supplied to: Selwyn District Council (Territorial authority)

In respect of: Proposed Residential Subdivision (Description of proposed infrastructure/land development)

At: 734 Springs Road, Prebbleton, Selwyn District (Address)

l (Geotechnical engineer) Ferry Haryono on behalf of (Geotechnical engineering firm) CGW Consulting Engineers

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. My/the geotechnical assessment report, dated 2 August 2018 has been carried out in accordance with the Department of Building and Housing Guidelines for geotechnical investigation and assessment of subdivisions and includes:
 - (i) Details of and the results of my/the site investigations.
 - (ii) A liquefaction 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, I consider that Council is justified in granting consent incorporating the following conditions:

The original ground is suitable for the construction of a development/subdivision and are not subject to erosion, subsidence or slippage provided that the recommendations made in the CGW Consulting Engineers Geotechnical Investigation Report; Stirling Park Subdivsion, 734 Springs Road, Prebbleton, Selwyn District; Suburban Estates Ltd; dated 2 August 2018 are followed.

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 \$ 1 million dollars (Minimum amount of insurance shall be commensurate with the current amounts recommended by IPENZ, ACENZ, TNZ, INGENIUM.)

..... (Signature of Engineer)

Date: 2/08/2018

Qualifications and experience: CPEng, CMEngNZ, IntPE(NZ)