Annexure Eight: Geotechnical Report



COLES PROPERTY PARK
LANE: ROLLESTON

GEOTECHNICAL
ASSESSMENT FOR
SUBDIVISION PLAN CHANGE
AND RESOURCE CONSENT

**Engineers and Geologists** 



# COLES PROPERTY PARK LANE: ROLLESTON GEOTECHNICAL ASSESSMENT FOR SUBDIVISION RESOURCE CONSENT AND PLAN CHANGE

Report prepared for:

Nimbus Group

Report prepared by:

Report reviewed by:

Emma Turner, Civil Engineer

Don Tate, Director, CPEng

**Report Reference:** 

12891-A

Date:

18 December 2012

Copies to:

Client

2 copies

Riley Consultants Ltd

1 сору

Revision:	Details:	Date:
1.0	Geotechnical Assessment	18 December 2012

# Contents

1.0	Introduction	1
2.0	Regional Geology	
3.0	Site Seismicity	
3.1	Recorded Peak Ground Accelerations (2010/2011)	2
3.2	Seismic Design Parameters	
4.0	Council Requirements	2
5.0	Subsurface Investigations	3
6.0	Suitability of Ground for Development	4
6.1	Bearing Capacity	
6.2	Ground Movement/Liquefaction	4
7.0	Foundation Development Options	5
7.1	Further Development Considerations	6
8.0	RMA Considerations	6
9.0	Conclusions	7
10.0	Limitation	7
11.0	References	7

# **Appendices**

Appendix A Appendix B Site Plan

Test Pit Logs Scala Penetrometer Logs Appendix C



# COLES PROPERTY LAKE PARK: ROLLESTON GEOTECHNICAL ASSESSMENT FOR SUBDIVISION PLAN CHANGE AND RESOURCE CONSENT

## 1.0 Introduction

Riley Consultants Ltd (RILEY) has been engaged to undertake a geotechnical investigation at Coles Subdivision, Rolleston, Lots 3 and 4 of DP74253, as outlined in the initial desktop study and proposal dated 2 November 2012 (RILEY ref: R18468-A).

This report details our geotechnical investigations and outlines the level of geotechnical hazard at the site in accordance with "Guidelines for the Geotechnical Investigation and Assessment of Subdivisions in the Canterbury Region" released by the Ministry of Business, Innovation and Employment (MoBIE) September 2012.

This report will be used in support of application for a Resource Consent for Lot 3 and a plan change and subsequent Resource Consent for Lot 4 by the Selwyn District Council (SDC). We understand Lot 3 is to be divided into approximately 170 residential lots and Lot 4 is to be changed to rural residential with 36 lots of approximately 5,000 m<sup>2</sup>.

# 2.0 Regional Geology

The published geological map of the area, (Geology of the Christchurch Area 1:250,000, Brown and Weeber, 1992) indicates that the site is underlain by grey river alluvium.

A review of the Environmental Canterbury (ECan) Wells database showed multiple wells located within 1 km of the proposed subdivision. Material logs available for two of these wells located with the two lots indicates that subsurface materials comprise layers of surficial topsoil and clay to 1.8 m depth underlain by gravel dominated material to at least 30 m depth.

Groundwater information provided in the well logs indicates that groundwater level in the area varies between 10 m and 85 m depth.

A Preliminary Site Investigation Report for the adjacent Park Lane Subdivision (west) was undertaken by E2 Environmental in December 2011. The purpose of this report was to estimate the ground soakage potential of the soils underlying the site. In order to undertake the soakage testing E2 Environmental dug four test pits on the site, two towards the north and two towards the south. The depth of these test pits ranged from 2.2 m to 4.75 m depth, the logs of which were included in the appendices. In summary these test pits encountered 0.2-0.4 m of topsoil overlying sandy silt to 1.9 to 2.0 m depth. Sandy gravel was then present to 2.3 to 2.4 m depth overlying gravel and cobbles to the maximum depth of the test pits.

The recommendation that soil characterisation be carried out to 15 m depth recognises that generally liquefaction will not occur below this depth, or if it does is unlikely to be observable at the ground surface. The soil investigation therefore seeks to quantify the liquefaction hazard of the upper 15 m of the soil profile. For this site, this quantification is made largely on the basis of site geology and available borehole data in the area and confirmatory investigations of soil composition via test pits. Available borehole logs in the area indicate dense granular alluvial soils to at least 15 m depth.

# 5.0 Subsurface Investigations

Subsurface geotechnical investigations were undertaken by RILEY staff (with the assistance of an excavator provided by the Nimbus Group) on 20 November 2012 and comprised:

- Nine test pits (TP1 to TP9) to a maximum depth of 5.2 m
- 15 Scala Penetrometer tests undertaken adjacent to the testpits and at consistent spacing over Lots 3 and 4

The testpits were logged in accordance with the NZGS guidelines (December 2005) and the location of the geotechnical investigations is shown in Appendix A.

The material encountered in the test pit investigations comprised between 200 and 600 mm organic sands (topsoil) underlain by sandy silts and silty sands to a depth of between 0.75 to 2.2 m. Gravels were located below the sand and silt layers to the extent of testing (a maximum of 5.2 m in TP5).



Photo 1: Sandy silt underlain by sandy gravel with cobbles and boulders to 2.0 m depth (TP3)

Groundwater was not encountered in any of the test pits during our investigations. Based on ECAN well logs, groundwater varies between 10 and 85 m depth.

A total of nine Scala penetrometer tests were undertaken at or near existing ground level adjacent to each of the testpits, with an additional six Scala tests undertaken at varied locations across site, to confirm consistency of soil strength.

Soft to firm soils were encountered in the natural soils over the site to approximately 1.8 m depth. Dense to very dense gravels were encountered below this depth to the extent of testing.

The presence of silts and sands in the upper 2.2 m of soil strata underlain by dense gravels is consistent with the geological data for this area and confirmed the expected ground conditions. Regional geological maps indicate the presence of predominantly gravelly soils such as those encountered in the test pits to at least 30 m depth.

# 6.0 Suitability of Ground for Development

It is desirable for new subdivisions on flat or gently sloping ground to provide building platforms that meet the NZS3604:2011 definition of "good ground", as such building platforms do not require specific engineering design of foundations for residential development. NZS3604:2011 defines the criteria for "good ground" as that which has an ultimate bearing capacity of 300 kPa, and excludes:

- Potentially compressible ground
- Expansive soils
- Ground which could foreseeably experience movement of 25 mm or greater for any reason.

In recent months the Department of Building and Housing (DBH) have included liquefiable soils in the ground conditions for which NZS3604 is not applicable.

On the basis of regional geology, and testpit investigations, the soils on site are considered unlikely to be expansive or compressible. The other criteria for good ground are considered in the following paragraphs.

## 6.1 Bearing Capacity

NZS3604:2011 provides a Scala penetrometer test criteria whereby if a certain blow count over a measured depth is met, an ultimate bearing capacity of 300 kPa may be assumed (5 blows per 100 mm).

Scala penetrometer (SP) results indicate that moderate to high strength soils exist beneath the topsoil to the extent of testing. The materials have a geotechnical ultimate bearing capacity of above 200 kPa immediately below the topsoil. A geotechnical ultimate bearing capacity of 300 kPa is available at and below approximately 1.8 m consistently across site.

The sands and silts above 1.8 m across site do not meet the bearing capacity criteria for "good ground" according to NZS3604:2011.

### 6.2 Ground Movement/Liquefaction

The key consideration for ground movement is the potential for seismically induced liquefaction resulting in settlement or lateral movement. Liquefaction may occur in loose silts and sands beneath groundwater level. The susceptibility of such soils to liquefy depends on their density and particle size distribution.

Dense granular soils are not liquefiable (Youd et al, 1996 & 1998), and the density of the granular soils (below the sandy silt layer) within the test pits has been confirmed to be high via Scala penetrometer testing. Similar soils in Canterbury have generally performed well under recent seismic loading. No land damage is observable, and no ejected sands or lateral spreading was reported across the site as a result of the recent Christchurch earthquakes.

A deeper groundwater profile of 10 to 85 m was indicated by the regional well logs, therefore at least a 10 m thick non-liquefiable cap exists over any potentially liquefiable sand or silt strata, and therefore these shallow layers are not considered a significant risk to the development. Furthermore, if liquefiable lenses exist below this depth, it is unlikely that any evidence of liquefaction induced densification of the lenses would be observed at ground surface.

The Department of Building and Housing (DBH) has provided a guidance document whereby land is placed into one of three technical categories with the following liquefaction deformation limits. These limits are reproduced in Table 2.

Table 2: Liquefaction Deformation Limits and House Foundation Implications

Technical	Liquefac	tion Deform	nation Limi	ts	Likely Implications for House
Category	Vertical		Lateral S	pread	Foundations (subject to individual
	SLS	ULS	SLS	ULS	assessment)
TC1	15 mm	25 mm	Nil	Nil	Standard 3604-like foundations with tied slabs <sup>2</sup>
TC2	50 mm	100 mm	50 mm	100 mm	DBH enhanced foundation solutions (Section 5.2)
TC3	>50 mm	>100 mm	>50 mm	>100 mm	Site specific measures – piles or ground improvement

1. Provided the shallow investigation determines the site is 'good ground' (As defined by NZS 3604:2011)

Based on the 1.0 m non-liquefiable cap, site geology and past ECAN boreholes in the area the risk of surface manifestation of liquefaction in a SLS event is considered to be low.

In terms of the DBH guidelines, we consider that the subject site is likely to be similar to those sites that fall into the technical category TC1.

# 7.0 Foundation Development Options

The subsurface data obtained at the site to date indicates that the subsoils do not meet the bearing capacity requirements for 'good ground', (as defined by NZS 3604:2011). Therefore any proposed houses developed at this site will require specifically designed foundations as part of the building consent, once the subdivision is formed.

In terms of the DBH guidelines, where the ultimate bearing capacity meets the 200 kPa requirement either enhanced slab TC2 solutions or other specific engineering design is applicable. At a conceptual level, enhanced house foundation solutions could comprise the following:

- A concrete slab foundation built over a compacted granular fill raft;
- Shallow driven timber piles;
- A thickened slab foundation over the existing site soils.

<sup>2.</sup> Note that certain foundation details included in NZS 3604 are precluded from use in Canterbury (refer to: <a href="http://www.dbh.govt.nz/information-sheet-seismicity-changes">http://www.dbh.govt.nz/information-sheet-seismicity-changes</a>)

Further investigations will be required at the time of individual building development as outlined in the DBH guidelines. It is noted that test pits create weaker areas in the ground and foundations should be located clear of test zones or should take this into consideration during design.

Alternatively, wide scale soil improvement of the upper soil profile (subject to design) could be undertaken to allow for the construction of standard foundations in accordance with NZS 3604:2011, (with the modifications outlined in Building Code Acceptable Solutions B1/VM1, B1/AS1 and B1/AS3).

## 7.1 Further Development Considerations

#### **Roads**

Roads are not subject to the same design criteria as foundations; however subgrade layers are required to provide appropriate strength and stiffness for pavement design. Following removal of the topsoil (200 - 600 mm), the representative CBR value for the silty soils encountered on site (derived from Scala penetrometer testing) is 2.0.

## **Earthworks**

During development of the site, RILEY recommends that appropriate stormwater and erosion controls be implemented. These are likely to involve the use of silt fences, hay bales and similar devices to intercept soil runoff and improve the quality of the stormwater discharged. Any exposed surfaces shall be topsoiled and grassed as soon as practicable to limit soil erosion.

#### 8.0 RMA Considerations

Section 106 of the RMA states that 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.

No evidence of erosion, falling debris, or slippage was observed during our site visit walkover for this site based on its relatively flat topography. Due to the uniform nature of the soils encountered in our testpit excavations, and the absence of any noticeable surface expressions, subsidence is not considered to be a geotechnical risk. Based on the topographical setting, the lack of evidence of overland flows and the dry soils encountered, the site is unlikely to be subject to inundation.

Any future development of this site will likely involve the removal of the surface vegetation and topsoil for extended periods of time. Exposure of the stripped ground surface to rainfall will potentially cause erosion and rilling of the site soils. Damage can be minimised by staging the earthworks (to retain vegetated areas) and the use of appropriate mitigation measures as described in section 7.1.

Access to the site is presently off Main South Road (SH 1) and is likely to be enhanced with the development of adjacent subdivisions.

#### 9.0 Conclusions

- 1. Geotechnical investigations have been completed and a typical soil profile for the site identified, which corresponds well to the regional geological setting from published data.
- Ground conditions in the test locations do not meet the minimum requirements of NZS3604:2011 for standard shallow foundations and therefore house foundations require specific investigation and design. Indications based on investigations to date are that enhanced slab TC2 solutions or other specific design is applicable.
- 3. The potential for seismically induced liquefaction has been assessed from the test pit investigations.
  - Liquefaction is a negligible risk in soils to 10.0 m depth above the water table.
  - Liquefaction in soils below 10 m depth may potentially occur within saturated sand or silt lenses that may be present over this depth. However, it is unlikely that liquefaction of these lenses will cause any surface disruption or observable settlement and therefore they are not considered a significant risk to the development.
- 4. In terms of the DBH guidelines, we consider that the subject site is likely to be similar to those sites that fall into the technical category, TC1.
- 5. The proposed development will generally comply with the intent of section 106 of the RMA provided that appropriate engineering measures are undertaken to protect the existing site soils during subdivision development.
- 6. Inspections of ground conditions during the construction phase should be undertaken in accordance with accepted practice. RILEY shall be informed if there are any changes from the conditions described in this report.

### 10.0 Limitation

This report has been prepared solely for the benefit of the Nimbus Group as our client with respect to the brief, and the Selwyn District Council in processing the subdivision consent for the land area. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Recommendations and opinions in this report are based on data from limited test positions. The nature and continuity of subsoil conditions away from the test positions are inferred, and it must be appreciated that actual conditions could vary considerably from the assumed model.

## 11.0 References

Youd, T.L. et al, 1996 and 1998, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction resistance of soils. Journal of Geotechnical and Geoenvironmental Engineering, October 2001.

APPENDIX A

Site Plan



APPENDIX B

**Test Pit Logs** 

2	RII CONSI	LE JLTANT	rs :	395 Mad Christho Tel: +64	Cons ras Stre urch 801 13 37944 43 3794	et 3 102	ts L	imited	i									T	ES	Т	PI	T LOC	à
Proje		erty - P				10.20	T	Loca	tion:	Car	nterbi	urv						osition:				١	lo.:
Job N			an c	Sta	rt Da			1-12		_	d Lev		LINZ)	: Co	-Ordi	_		TM2000				Т	P1
Clien	t: mbus (	Group		1								Dept	h:									Sheet:	of 1
Elevation (m LINZ)	Depth (m)	(	refer to	separa	ogical ite Geo sheet fo	technic	al an		gical		Legend	FS CW TWW Weathering	Field Soil	l Stren	٠	(t	ype, orie hness, p	Descriptic entation, space ersistence ap filling etc)	ing.	Groundwater	Samples	I No. 1	Tests
+49,75	0.25	Fine to rootlets.					t, darl	k brown	wilh tra	ace	×											1, 1, 2, 1, 1, 1, 2, 1, 1,	
.40.45	1	Fine to I greyish and loca medium with pal	brown s al clay-r dense	SILT wi ich len: ; moist;	ith some ses, ligi clay ric	e sand ht yello ch lens	at 0 6 wish I es ligi	5 m., tra prown. I nt greyis	ace rool Loose to	s o n	x x											1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	
+48.15	1,85 2	cobbles and boulders at depth, brown. Very den Gravel, subangular to subrounded, strong, slight greywacke sandstone. (Q1a ALLUVIUM)									×0000000000000000000000000000000000000											V	
+45.80	-4 4.20 EOH @ 4.20 m										0000												
SKE	TCH:	 		- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1			-   -   -     -		-						- + - +  - + - +	 		MAP					, s
													- + -		- <del> </del>								20 mil
Shori Stabil	A U100 Undisk  Permeability Clegg Hamm India Vane S P=Peak, R=F UTP=Unable										ample Samp st repe Streng ual, enetrate	le etitions gth (kPa	(IV) [ a)	S R PIT TE	JNDW low Si lapid I ERMIN arget tefusa	eep (inflow NATEI depth	depth (dept	) h )		a		Remar nd level and co mate and subje ation.	ordinates are
All d		Soolo Ponotrom											Rig/F Mach				14 to	inne)				Logged by 39	Checked by AvD

2	RI CONS Engineers	LEY ULTANTS and Geologists	Riley 395 Mad Christhou Tel: +64 Fax: +64	ras Street urch 8013 3 379440	2	ts Li	mited										TES	ST	PI	T LOG	i
Proje		erty - Park l	ane				Locat Rolle	ion: ston, (	Cante	erbu	ırv						sition: site plan			N	0.:
Job N			Sta	rt Date	e: 2	0-1	1-12				el (m l	INZ):	Co-C	Ordina	ites (N	ZTM	12000):			TI	P2
Clien			1					1			Depth									Sheet:	of 1
Elevation (m LINZ)	Depth (m)	(refer to Info	Geolo separa rmation :	te Geote	chnica	al and	Geolog	gical )		Legend	RS Cow Livy Weathering		Strengti   Rocl		(lype, c	rientati	scription on, spacing, stence aperture, etc)	Groundwater	Samples		ests
+49.70	0.30	Fine to mediu	m silty S ose; mois	AND, da	rk brov SOIL)	wn wi	lh trace	rootlets												No. 1 1, 1, 1, 1, 1, 1, 1, 1, 1,	
+48.45	1.55	Fine to medium with trace root dense; moist.	ts, light y	ellowish	brown	ly SIL	T thinly se to m	bedded edium	×											1, 2, 2, 2, 1, 1, 1, 1, 1, 1, 2, 2, 2, 1, 1, 3, 4, 2, 2, 1, 1, 1, 2, 4, 7, 15	
+47.80	2 2.20	Fine to coarse boulders at de subangular to greywacke sa	epth, brow subroun	wn: Very	dense	e; moi ightly	ist; grav	el.	0	0000										٧	
	-3	EOH @ 2 20 r																			
	4																				
	5																				
SKET	ГСН:		 			[		- <del> </del>				1 - 1 -		<u></u>			MAP				
  -  -  -		-   -   -     -   -   -   -   -		- <del> </del> -				- <del> </del>		- <del> </del>   -	-       -     -		 	<u> </u>							
				- <del> </del>   -   -   -   -   -   -   -   -		-     	    	-		- <del> </del>				 							01
-	1						-	+-				+-	+ -	+-				7 344			20± 1:1,0
Shorir Stabil	ing/Support: None    Small District Large District									nple ample repel rengi l, etrate	titions (I th (kPa)	v) [	Rap PIT TEP X Tar	w See oid Infl	p (deptow (dep	pth ) UE T	X None O: ollapse	1		Remark and level and coo mate and subject ation.	ordinates are
All di		ons in metr le 1:50	es C	Contra							Rig/F	Plant U	sed:	or (14			_		Logged by:	Checked b	

Service   Property - Park   Lane   Bolloston, Carterbury   Park   Lane   Bolloston   TP3	2	RI CONS Engineers	ULTA and Geo	NTS logists	395 Chri Tel:	Madra: sthcurc +643	ONSI Street h 8013 379440 37944	1 3	its L	imite	d											TES	T	PI	T LO	à
State   Date: 20-11-12   Ground Level (m INZ);   Co-Ordinates (NZTM2000);   TP3	Proje		ertv -	Park	Lan	e							nterb	urv											ľ	No.:
Sheet: 1 of 1  Geological Description Peter to require descent of and Geological Peter of the reformation of	_	lo.:			1	Start				1-12	T		d Lev	vel (m	ı LIÎ	NZ):	Co	-Ord	linate		_				1	Ъ3
Geological Description (refer to separate Geological collection and and Geological Information investments of the first formation of the first formation investments of the first formation of	Clien Nir	t:		p		11110	., 50		-0 1	1 12	-		Hole	Dept	th:										190	of 1
Fine to modulum ally SAID, dark brown with trace roots and local stay incinices, light yellower brown. Lose to modulum arendy SILT thinly bodded with trace roots and local stay incinices, light yellower brown. Lose to modulum arendy. SILT thinly bodded with trace roots and local stay incinices, light yellower brown. Lose to modulum arendy. GRAVEL with frace coboles and stay of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace coarse sandy. GRAVEL with frace coboles and a case of the coarse sandy. GRAVEL with frace co	© (m LINZ)	Depth (m)		(refer	to ser	parate	Geote	echnic	al an	d Geol	ogica on)		Legend	Weathering	W.			_			orieni	tation, spacing, rsistence aperture,	Groundwater	Samples		Tests
Fire to medium across, model, (Cls ALLIVIUM) brown, Looke to be modelum decrees, model, (Cls ALLIVIUM) thrown, Looke to be modelum decrees, model, (Cls ALLIVIUM) thrown, Looke to be modelum decrees, model, (Cls ALLIVIUM) to the modelum decrees, modelum decree	49.80	0.20	Fine Loos	to medi e; mois	um sil t-(TOF	ty SAN	ND, da	ark bro	wn w	ith trac	e roo	llets.	4 4		N=10	*****	a.c.es								1, 1, 1, 2, 1, 1, 1, 2, 2,	
FICH:    Small Deturbed Sample   Large Disturbed Sample   Large Disturb		-1	and I	ocal cla	y-rich	lense	s, ligh	t yello	wish I	with to	race r Loos	oots e to	×	*											3, 2, 3, 2, 1, 1, 2, 2, 3, 1, 1, 2, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3,	
## Small Disturbed Sample   United Disturbed	18.00		bould	ders at o g, sligh	depth, tly wea	brown	i. Grav	vel. su	bana	ular to	subro	ounaea.	000	2											*	
ETCH:    MAP   MAP		3	EOH @ 2.00 m																							
Dring/Support: None bility:  Sall Disturbed Sample Large Disturbed Sample Large Disturbed Sample Large Disturbed Sample Large Disturbed Sample U100 Undisturbed Sample Permeability Test Clegg Hammer; test repetitions (IV) Insitu Vane Shear Strength (IPa) P=Peak, R-Residual, UTP=Unable to penetrate Set of Pearmeability Test Vollegg Hammer; test repetitions (IV) Insitu Vane Shear Strength (IPa) P=Peak, R-Residual, UTP=Unable to penetrate Set of Pearmeability Test Vollegg Hammer; test repetitions (IV) PIT TERMINATED DUE TO: X Target depth Collapse		4																								
Small Disturbed Sample Large Disturbed Sample Unto Undisturbed Sample Permeability Test Clegg Hammer; test repetitions (IV) Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate P=Peak Residual, UTP=Unable to penetrate Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate Strength (kPa) PT TERMINATED DUE TO: X Target depth Collapse		- 5																								
bility:  Large Disturbed Sample U100 Undisturbed Sample Permeability Test Clegg Hammer; test repetitions (IV) Institu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate Slow Seep (depth ) Rapid Inflow (depth ) PIT TERMINATED DUE TO: X Target depth Collapse	KE	r¢H:		1	1	-	L _		L	10.4			1	 				:-!				MAP				
bility:  Large Disturbed Sample U100 Undisturbed Sample Permeability Test Clegg Hammer; test repetitions (IV) Institu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate Slow Seep (depth ) Rapid Inflow (depth ) PIT TERMINATED DUE TO: X Target depth Collapse	1	-	- <del> </del> -	- <del> </del> - - <del> </del> - - <del> </del> -	-	<u> </u> -		 			- <del> </del>	   	  -  -  -	-     -     -     + -				- <del> </del> - + +	-   -   -	    	- 7					
bility:  Large Disturbed Sample U100 Undisturbed Sample Permeability Test Clegg Hammer; test repetitions (IV) Institu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate Slow Seep (depth ) Rapid Inflow (depth ) PIT TERMINATED DUE TO: X Target depth Collapse		+-1		- <del> </del>				    			<del> </del>	-  -  -  -	  -  -  -  -					- <del> </del> - + - + - + - + - + - + - + - + - + -								
bility:  Large Disturbed Sample U100 Undisturbed Sample Permeability Test Clegg Hammer; test repetitions (IV) Institu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate Slow Seep (depth ) Rapid Inflow (depth ) PIT TERMINATED DUE TO: X Target depth Collapse	1	+-1	-	+-	-	<u> </u>	ļ	-	  - 				-	+-				- +			-					1:1
A coera i enerometei - nowayonini I   Retrissi   I Machine limit   II		ty:    Large Dis   U100 Un     Permeat     Clegg Ha     Insitu Va     B 1.0     Pereak     UTP=Un     UTP=Un									e Dist Und eabil Har Van eak, F =Una	turbed Sisturbed ity Test nmer; to e Shear R=Resid ble to p	Sample I Samp est reposition Streng Iual, enetral	ole etitions gth (kP	a)		S R IT TI	low S apid ERMI arget	Seep Inflov INAT dept	(deț w (de ED [	epth DUE	) TO: Collapse	6	pprox	und level and c imate and subj	oordinates are
C Total Indiana	MI 4:	menei										en ome	ei - Di	JWS/50	_	l L	_					Macnine limit	_][_		Logged by	/: Checked

2	RII CONS Engineers	LE ULTANT	<b>У</b> 3 S т	95 Mad hristho. el: +64	Cons ras Stree arch 801: 3 37944 13 37944	ol 3 02	ts Li	mited	1										TES	T	PΙ	ΓLOG	
Proje		erty - P		0.120			1	Loca		Car	atorhi	ID.							sition: o site plan			N	o.:
Job N	lo.:		air Le	Sta	rt Dal			1-12			d Lev	rel (m	LINZ)	: C	o-Orc	dinat			M2000):			TI	<b>9</b> 4
Clien	128 nt:	391		Fini	sh Da	ate: 2	20-1	1-12	1	-1		.00 Depth	1:								-	Sheet:	
Nii	mbus (	Group									5.00									1 - 1		1 (	of 1
Elevation (m LINZ)	Depth (m)	(1	refer to s	separa	ogical te Geot sheet fo	echnic	al and	d Geolo	gical		Legend	RS CW HW HW WW WW WW WW	Field Soil	d Stre	٠ ا	ro		orient	escription ation, spacing, sistence aperture, ng etc)	Groundwater	Samples		ests
+49.80	0.20	Fine to r Loose; r	nedium noist. (T	silty S OPSC	AND, d	ark bro	wn w	th trace	e rootle	ets,	×											No. 1 1, 2, 1, 2, 1, 2, 1, 1, 1,	
	-1	Fine to r and loca medium	al clay-ri	ch lens	ses, ligh	it yello	wish b	with tra	ice roo Loose	ots to	× × ×											2, 2, 4, 3, 3, 2, 2, 3, 3, 3, 2, 2, 1, 1, 1, 1, 2, 2, 2, 3, 2, 1, 1, 1,	
+48.35	1.65										×		ŀ									1, 2, 2, 3, 3, 6, 15	
+48.00	2 2.00	Fine to de boulders strong, s	s al dep slightly v	th, bro	wn. Gra	vel, su	bang	ular to s	subrou	nded,	00											•	
	3																						
	4																						
	5																						
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	EOH@	5.00 m																				
SKE	тсн:			1	1	1	1		I	T	1_	1 -1	+	L			(1)		MAP				
	+ - -			<del> </del> - - <del> </del> - - <del> </del> -	- <del> </del> - - <del> </del> - - <del> </del> -				- + ·	- - - - -	  -  -  -	+ -  -  -  -  -	- <del> </del> - - <del> </del> - - <del> </del> -	 									A
	· +	- <del> </del>	+	- + - 	- <del> -</del> -		  -     -	  -	- <del> </del>		- - - -	+ - -	<del> </del> - - <del> </del> -	- <del> </del> -	1 1		 	_					0 m
	+-1					<u>i</u>	-		_ ‡ .	_  -  -  -		+ - -		+-	-								10 m -
			- -   -			-			_	-  - -  -	- - - - -	 		  -  -  -									1:1,000
Shori Stabil	5.0 U100 Undis A Permeabilit Clegg Ham Insitu Vane B 1.0 P=Peak, Rt UTP=Unab										st repe Strene Strene ual,	etitions gth (kPa	1)	PIT	PUND\ Slow S Rapid FERM Targe Refus	Seep Inflo IINAT It dep	der w (der	epth DUE	)	1	I. Grou approxi confirm	Remark and level and coc imate and subject ation.	(S
All d		Scala Penetro													t Use Exca		or (14	tor	ine)			Logged by: 39	Checked by AvD

2	RII CONS Engineers	LEY ULTANTS	395 Mac Christho Tel: +64	Consultras Street urch 8013 13 379440 43 379440	2	s Liı	mited										TE	S1	ГР	17	ΓLOG	
Proje		erty - Park L	ane		20		_ocati	on: ston, C	anter	bur	,				Hole Refe		ion: site plar	1			N	0.:
Job N	lo.:	391	Sta	rt Date		0-11	-12	_	und Le		(m L	.INZ):	Co-C	Ordina	tes (NZ						TI	P5
Clien	t:		1	1311 154		-	12	4	Hol	e D	epth:									1	Sheet:	
	mbus (	Group							1.4	45 n	_			1					7	_	1 (	of 1
÷ Elevation ⊗ (m LINZ)	Depth (m)	(refer to	separa	ogical ate Geote sheet for	chnica	l and	Geolog		Legend	200	W Weathering	Field Soil	Strengt   Roc		Defect (type, or oughness, i		n, spacing, nce aperlure	е,	Groundwater	Samples		ests
+49 60	0.40	Fine to medium Loose; maist			rk brov	vn wit	th trace	rootlets	×												No. 1 1, 1, 2, 2, 2, 3, 2, 2, 2, 3, 2, 3,	
+49.25	0.75	Fine to mediur and local clay- lenses light gre to medium der 0.45 m Grades	rich len syish br ise; mo	ses, light own with ist. (Q1a	yellow pale o ALLU\	vish bi orange	rown. C spottir	Clay rich	0000	0000											3, 5, 3, 2, 2, 2, 2, 1, 2, 2, 4, 3, 3, 3, 2, 1, 3, 15	
	2	Fine to coarse cobbles and be subrounded, s sandstone. (Q	oulders trong, s	at depth lightly we	brown	. Gra	vel, sub	angular	000	2.											٧	
									000	0.00												
	3								000	0000000000												
+44.80	- 5 5.20	EOH @ 1,45 n	1						0	0 0												
SKE	г <b>сн:</b>		-   -   -   -   -   -   -   -   -   -		1 - +  			-		-+	1	 		+		M	AP					A3
			- +							-+	+											10 m 20 m
Shorii Stabil		oort: None						Disturbed Disturbed				G	ROUN	IDWAT	ER		X No	ne			Remark	
D		- 5.0 ——— A	В	1.0		Ī V V	U100 U Permei Clegg I Insitu V P=Peal	Jndisturb ability Te Hammer 'ane She k, R=Re Inable to	ed San est ; test re ear Stre sidual,	nple petiti ngth		P	Rap	oid Inflo	depth w (depth ED DU oth	oth ) JE TO	: llapse		арр	roxir	nd level and coo mate and subject ation	
		С		<u> </u>				Penetron			/50mr		Ref	usal	Ē	Ma	chine lin	nit				
All di		ons in metre le 1:50	es	Contra	ctor:							Rig/Pi Machi			or (14 t	tonne	)				Logged by: 39	Checked by AvD

2	RI	LE Y	395 Mad Christho Tel: +64	Consulars Street urch 8013 13 3794402 43 3794402		imited								TES	T	Pl <sup>-</sup>	T LOG	ì
Proje		erty - Park L	ane			Locat	ion: ston, Ca	anterb	urv					sition: o site plan			N	0,;
Job N	vo.:	891	Sta	rt Date		11-12		nd Lev	rel (m l	_INZ):	Co-Ord	_		M2000):			Т	P6
Clier									Depth								Sheet:	of 1
Elevation (m LINZ)	Depth (m)	(refer to	separa	ogical [ ate Geotec sheet for	chnical ar	nd Geolo	gical )	Legend	PS CW TW TW TW WW TW TW TW		Strength   Rock	(h	/pe, orient	escription ation, spacing, sistence aperture, ng etc)	Groundwater	Samples		ests
+49.70	0.30	Fine to mediur roollets Loose				rk brown	with trace	×									No. 1 1, 1, 2, 1, 2, 1, 1, 1, 1,	
+47.80	1 <b>2</b> 2.20	Fine to mediur yellowish brow pale orange sp ALLUVIUM)	n. Clay	rich lense	es light gr	eyish bro	wn with	x x x x x x									1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1	
M5 00	-3	Fine to coarse cobbles and bi subrounded, s sandstone, (Q	oulders	at depth.	brown. G	ravel, sul	pangular to	000000000000000000000000000000000000000										
+45.00	5 5.00	EOH @ 5.00 n	1															
Ske						Large U100 l Perme	l l l l l l l l l l l l l l l l l l l	Sample d Samp t	le	E	=	WATER Seep (c	lepth )	MAP  X None	1 a		Remarking level and commate and subjectation.	ordinates are
D		С		1.0		Insitu \ P=Pea UTP=U	/ane Sheak, R=Resi Jnable to perentions	r Streng dual, penetrat	gth (kPa) e ws/50mr	P []	T TERM X Targe Refus	et depth		TO: Collapse Machine limit			Logged by:	Checked by
All di		ons in metre le 1:50	5								ne Exca		14 ton	ne)			39	AvD

		ULTANTS	Riley Consultants 395 Madras Street Christhourch 8013 Tel: +643 3794402 Fax: +643 3794403	Limitod								TES	T	PI <sup>-</sup>	T LOC	à
Proje		erty - Park L	ane	Location	on: ston, Ca	ınterbi	ırv				le positio				1	No.;
lob N	lo.:	891	Start Date: 20 Finish Date: 20	-11-12		nd Lev	el (m l	_INZ):	Co-Ord		NZTM200				Т	<b>P7</b>
Clien	t:		T Illian Bate. 20	11 12		Hole	Depth	:							Sheet:	
	-	Group				4.50			-				<u>ā</u>			of 1
00 (m LINZ)	Depth (m)	(refer to	Geological Description of the separate Geotechnical relation sheet for further	and Geologi	cal	Legend	Weathering		Strength   Rock ====================================		ect Descrip e, orientation, sp ess, persistence infilling etc)		Groundwater	Samples	No. 1	Tests
9.40	0.60	subrounded gr (TOPSOIL)	n silty SAND, dark browr ravel, roollets and roots.	n with trace r Loose; mois	medium it.	× ×									1, 2, 1, 1, 1, 1, 1, 1, 2, 2, 1, 2	
	1	brown, Deepe	n SAND with minor sitt a r at North end of pit, loca um dense; moist. (Q1a A	I gravel lens	ts, light at 1.1 m.	× × ×									2, 3, 1, 2, 2, 2, 2, 2, 3, 6, 3, 7, 12, 5, 7, 15	
7.90	<sup>2</sup> 2.10	Gravel, suban greywacke sai	sandy GRAVEL with mingular to subrounded, str dotslone. Contains obvoil lenses. (Q1a ALLUVIUM	ong, slightly ous layering a	weathered	000000000000000000000000000000000000000										
	4					000000000000000000000000000000000000000										
5.00	5 <sup>5.00</sup>	EOH @ 4.50 r	n			00.										
KET	ген:			L				<u> </u>	1	_ Ll	MAR	0				
1-	+		_ + - + -   - + -		+ -			 								1:1
horir tabili		port: None  - 6.0  A	B 1.0	Large D U100 U Permea Clegg H ✓ Insitu Va P=Peak UTP=Ua	isturbed & isturbed & isturbed & isturbed & isturbed & isturbed is	Sample d Sampl est repe r Streng dual, enetrate	titions (I th (kPa)	v) [	Rapid I	eep (de nflow (d NATED depth	pth ) depth ) DUE TO:		a	. Grou pproxi onfirm	Remaind level and comate and subjection,	ordinates are
	mer-	C ons in metre		Scala P	enetrome	rei - 010,			Refusa ant Used		Mach	ine limit		-	Logged by	: Checked

2	RII CONSI	LEY ULTANTS	Riley Consulta 395 Madras Street Christhourch 8013 Tel: +643 3794402 Fax: +643 3794403	ants Limite	d							TES	ST	PI	T LOG	ì
Proje		erty - Park L			ition: eston, Ca	nterb	urv				ole pos	ition: site plan			N	lo.:
Job N	lo.:	891	Start Date: Finish Date:	20-11-12	Groun	nd Lev	/el (m l	LINZ):	Co-Orc	dinates (					Т	P8
Clien Nir			T IIIION Bato	. 20 11 12			Depth	:							Sheet:	of 1
Elevation (m LINZ)	Depth (m)	(refer to	Geological De separate Geotechr mation sheet for fur	nical and Geol	ogical on)	Legend	Sw www. Weathering		Strength   Rock	(Lype	fect Desi e, orientation ess, persist infilling	on, spacing, ence aperture,	Groundwater	Samples	1	ests
+49.75	0.25	Fine to medium and roots, Loo	n silty SAND, dark t se; moist. (TOPSO)	prown with trac L)	e roollets	×									No. 1 2, 2, 3, 3, 2, 2, 1, 4, 6,	
+49.00	-1.00 -2 -3	Fine to coarse Gravel, subang greywacke sar sand lenses. L	n SAND with minor to medium dense; n sandy GRAVEL wil jular to subrounded distone. Contains o oose; moist. (Q1a A	noist (Q1a AL th minor cobble f, strong, slight byoius layerin	LUVIUM) es, brown. ly weathered	× × 0 200 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0									8.4.5.4.4.5 16.5.6.5.16	
		EOH @ 5.00 n	1													
Shorir		oort: None		Large	Disturbed S	Sample			ROUNDV			X None	1	. Grou	Remar and fevel and co	ordinates are
D		5.5 — A	B 1.0	▼ Perm ▼ Clegg ∨ Insitu P=Pe UTP= ▼ Scala	Undisturbed eability Test Hammer; to Vane Sheat ak, R=Resid Unable to p Penetrome	est repe Streng lual, enetrate	etitions (I pth (kPa)	P P	Rapid T TERMI Target Refusa	depth	depth ) DUE TO	ollapse achine limit	a	pproxi	mate and subject	ct to survey
All di		ons in metre e 1:50	Contracto	1.					ant Used ne Exca		4 tonne	e)			Logged by: 39	Checked b AvD

2	RII CONS Engineers	LE'	rs	Riley 395 Ma Christh Tel: +1 Fax +	adras s curch 643 37	Street 8013 94402		ts Li	mite	d												-	ΓES	<b>S</b> 1	ΓΙ	PI	ΓL	OG	
Proje Cole:		erty - P			*****	200			Loca	esto	on, C											osition to site							0.:
Job N	lo.: 128	391							1-12 1-12		Gro	und	Lev 50.		n Ll	NZ):	Co	-Oro	dinat	es (	NZT	TM200	0):					TI	<b>-</b> 9
Clien Nii	it: mbus (	Group											ole 1.70		th:												Shee		of 1
Elevation (m LINZ)	Depth (m)	(	refer to	Geo sepa matio	rate G	eoteo	chnica	al and	Geol	ogica on)	ı		Legend	PS CW Weathering	MS AN	Field Soil		.	ſſ		a, orier	Descripti ntation, spa rsistence a lling etc)			Groundwater	Samples			ests
+49.80	0.20	Fine to and roo	mediur ts. Loo	n silty se; mo	SANI oist. (	D, dar FOPS	k brov OIL)	wn w	th trac	ce roc	ollets	- 14	× .														No 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2	2, 3, 2, 3, 2, 3, 2, 3, 2, 2,	
	1	Fine to Loose t	mediur o medi	n silty um de	SANI nse; r	O silt a	and Ir (Q1a	ace r	oots, I UVIUM	ight b	rown.		× ,														2, 2, 2, 2, 2, 2,	2, 2, 2, 1, 2, 1, 3, 1, 2, 2, 2, 10	
+48.40 +48.20	1.60 1.80	Fine to Gravel, greywa	cke sar	sandy gular t ndston	/ GRA o sub ie. Lo	VEL round	with rided, so	ninor trong lium d	cobbl , sligh lense;	es, bi tly we ; mois	rown. eather st. (Q1	ed	0 0									_					*		
		EOH @ 1,70 m										_1																	
	3																												
	-4												1																
	- 5																												
SKE	г¢н:				_ L		-									1				1	-1	MAP	)						
-   -	-     -     -     -		       	   - +	- L		- <del> </del>	·				 	   — :   — :	 		, 		   		  									i
	\frac{1}{1} = \frac{1}{1} \\ \frac{1} = \frac{1}{1} \\ \frac{1}{1} = \frac{1}{1} \\ \frac{1}{1} = \frac	-   - -   -   -   -	-     -     + -     -	- <u> </u>   -   -	-   -   -		- <del> </del>   -   -   -   -   -   -   -   -   -						! — : ! — :	  -  -  -  -	-	<u> </u>		 			_ +								On 10in
	+	- <u> </u> -	 	<del> </del> +	- <del> </del>		_ <u> </u> _ <del> </del>	_	(5' -4				! — ·		-				! _ !   - !										20 m 1:1,00
Shorii Stabil	A  U100 Undis Permeability Clegg Hamr Insitu Vane P=Peak, R= UTP=Unabl										turber disturb lity Te mmer de She R=Re dble to	d Sar ed S est ; test ear S sidua pen	mple sample repe treng al, etrate	tition  th (kl	Pa)	) [		Slow : Rapid ERM	WATI Seep Inflo IINAT	(de w (de ED	depth	) 1)			a		nd level mate ar		
All di		UTP=Unable													Ti	Rig/P Machi	lant	Use	d:	ır (1	4 to			14	<u> </u>			ed by:	Checked b

APPENDIX C

Scala Penetrometer Logs

Explanations:  Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, residually weathered  Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense  Small Disturbed Sample  U100 Undisturbed Sample  Water Rise (1st, 2nd)  Scala Penetrometer: blows/50mm  Permeability Test Clegg Hammer: impact value (test repetitions) Insitu Vane Shear Strength (kPa) Pereak, R=Residual, UTP=Unable to penetrate Water Strike (1st, 2nd) Water Rise (1st, 2nd) Water Rise (1st, 2nd) Water Rise (1st, 2nd) Water Rise (1st, 2nd)  Target depth X Refusal	2	RI CONS Engineers	LE ULTAN and Greek		Riley 395 Ma Christh Tel: +6 Fax: +	dras St curch 8 543 379	treet 3013 34402	ants	s Lir	nited	d														S	CA	<b>\</b> L	A	LOG		
Test Depth:   1.60 m   Test Depth:   1.60 m			erty -	Park	Lane								ante	erbu	ıry											า			1	10.:	
Septimention:   Septimention	Job N	No.: 12	891								ľ	Grou	nd			n LI	NZ):	С	o-Oı	rdina	ates	(N	ZTI	M200	00):				S	P1	
SKETCH:    Sket TCH:			Group													th:														of 1	
SKETCH:    Sket TCH:											)		T	pueße	Weathering				-		Sc.	ala f blow	en s / !	etrom 50 mn	eter	id & Water		amples			Instrument/ Backfill
Explanations:  Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, moderately weathered, slightly weathered, moderately weathered, slightly weathered, explain the state of completely weathered, resultant was old Strength - very softwey loose, soft/loose, firm/medium dense, stiffdense, very stifftyry dense  Small Disturbed Sample Large Disturbed Sample U100 Undisturbed Sample U100 Undisturbed Sample U100 Undisturbed Sample	+50.00	-1													25 Z	表	2文章 景	STATE OF THE STATE	<u> </u>	0 9 9 4 4 4 9 1 9 1 9 1 9 1	シンファンファーナン								2, 2, 2 2, 2, 1, 2, 1, 1, 2, 1, 1, 2, 1, 1, 1, 1, 2,		
Explanations: Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, moderately weathered Relative soil Strength - very soft/very loose, soft/loose, firm/medium dense, stiff/dense, very stiff/very dense  Small Disturbed Sample Large Disturbed Sample U100 Undisturbed Sample  Scala Penetrometer: blows/50mm Permeability Test Clegg Hammer: impact value (test repetitions) Insitu Vane Shear Strength (kPa) P=Peak, R=Residual, UTP=Unable to penetrate Water Strike (1st, 2nd) & Rise Time (min's.)  Water Rise (1st, 2nd) & Refusal		TČH:	SH:																		MAF							O m			
All dimensions in metres Contractor: Rig/Plant Used: Logged by: Checket	Exp Rock weath comp Relat firm/n	Mass Wiletely we live soil Sinedium of Small Distance Dis	eathering oderately athered itrength dense, st sturbed S sturbed S disturbed	y wealh , residu - very s :iff/dens Sample Sample d Samp	ered, h ally we oft/very e, very	ighly wathered	veathe d , soft/l ery der	oose nse	▼ ~	Perm Clegg Insitu P=Pe pene	neabi g Hai u Van eak, I etrate er Stri	ility Te mmer ne She R=Re ike (1:	est : impa ear St sidua st, 2n	act va rengt I, UTI d)	alue (1 lh (kP P=Un	test ro a) able Time	to (min	'S <sub>1</sub> )	НО	No Ro LE T	one ods v	wet l	belo ATE	ED DI			app	oroxin dirma	nd level and co	ordinatect to su	1:1,000 es are urvey

SKETCH:   MAP	2	CONS	ULTANTS and Geologists	395 Madras Street Christhourch 8013 Tol: +643 3794402 Fax: +643 3794403								S	CA	LA	LOG	
Count   Finish Date: 20-11-12   So.00   Test Depth:   T.70 m   Test Depth:   Test			erty - Park L	ane			anterb	ury							No.:	
Client: Nimbus Group  Dosorbière Strength Term (valerred from in allu penahration test)  Dosorbière strength Term (valerred from in allu penahration test)  Self Solid Floods  SERSEL SOLID Floods  SERSEL SOLID Flood Strength  Tests  Solid Floods  SERSEL SOLID Floods  Tests  T	lob N	lo.: 12	891			Groun			LINZ):	Co-Ord	inates (Na	ZTM2000):			SP2	
Descriptive Strength Term (referred from in-altu pervainalism test)  Descriptive Strength Term (referred from in-altu pervainalism test)  Descriptive Strength Term (referred from in-altu pervainalism test)  Descriptive Strength (referred from in-altu pervainalism test)  Descriptive Strength (referred from in-altu pervainalism test)  Tests  Soil of Rock  Soil of Ro			Group													
Explanations:  Explan	% (m LINZ)	Depth (m)	(in				Legend	N. Weathering		-	(blow:	s / 50 mm)	Fluid & Water	Samples	Tests	Instrument
Explanations: Rock Mass Weathering - unweathered, slightly weathered, moderately weathered, highly weathered, moderately weathered, highly weathered.  Scala Penetrometer: blows/50mm Permeability Test Clean Hammer: impact value (test repetitions)  None  1. Ground level and coordinates are approximate and subject to survey.												•			1, 1, 1, 2, 3, 3, 1, 1, 2, 2, 1, 1, 2, 1, 2	
completely weathered, residually weathered  Insitu Vane Shear Strength (kPa)  Relative soil Strength - very soft/very loose, soft/loose,  P-Pook R-Residual LTP-I leable to	Expl Rock weath	anatio Mass Wiered, moletely we	eathering - unwe oderately weathe eathered, residua	ered, highly weathered, ally weathered	Perme Clegg	ability Tes Hammer:	st impact v	/alue (tes		ns) X	None			approxi	nd level and coordinates mate and subject to surv	1 2 1:1

2	RI CONS Engineers	LEY ULTANTS and Geologists	Riley Consultants 395 Madras Street Christhcurch 8013 Tel: +643 3794402 Fax: +643 3794403	Limited								S	CA	LA	LOG	
Proje Cole:		erty - Park l	_ane	Location	on: ston, Ca	ınterb	ury					osition: to site plan			No.:	
Job N	lo.:	891	Start Date: 20 Finish Date: 20	)-11-12		nd Lev		LINZ):	Co-Or	rdinate		ГМ2000):			SP	3
Clien			1				Depth								Sheet:	1
		Стопр				T							ıter	s	1 01	
5 Elevation (m LINZ)	Depth (m)	(in	Descriptive Strength			Legend	ow Iww Weathering		Strength   Rock		cala Per (blows /	netrometer /50 mm) 9 12 15	Fluid & Water	Samples	Tests	Instrument/ Backfill
	-1														No. 1 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 3, 4, 8, 15	
Rock weath compl Relati	anatic Mass W. Wered, moletely we ve soil S	eathering - unwe oderately weathe athered, residua Irength - very so	oft/very loose, soft/loose,	Perme	Penetroma ability Tes Hammer: I/ vane Shea k, R=Resi	t impact v ır Streng	alue (tes gth (kPa)	st repetitio	[X			MAP	- 11	1. Grou approxi	Remarks and level and coordinate and subject to allion.	1 km 1:1,00
firm/m	medium d Small Dis arge Dis J100 Und		e, very stiff/very dense	penetra Water		, 2nd	)	me (min's	ant Use	Targe	t depth	ED DUE TO	- 11		Logged by: Ch	necked by

2	RI CONS Engineers	LEY ULTANTS and Geologists	Riley Consultant 395 Madras Street Christhourch 8013 Tel: +643 3794402 Fax: +643 3794403	s Limited								S	CA	LA	LOG	
Proje		erty - Park I	ane	Location	on: ston, Ca	interb	urv					osition: to site plar	1		N	0.:
Job N	lo.:	391	Start Date: 26	0-11-12		nd Lev	/el (m	LINZ):	Co-O	rdinate		TM2000):			SI	P4
Clier			Tillish Date. 25	J-11-12			.00 Depth 5 m	:							Sheet:	of 1
Elevation (m LINZ)	Depth (m)	(ir	Descriptive Strength			Legend	Weathering		Strength   Rock	1 -	cala Per (blows a	netrometer / 50 mm) 9 12 15	Fluid & Water	Samples	Tes	or Instrument/ Backfill
	_1										•	•			No. 1 1, 1, 1, 2, 2, 2, 1, 1, 1, 2, 2, 2, 1, 1, 1, 1, 1, 1, 1, 2, 12, 5	
Rock weath comp Relati	anatio Mass Wieered, mo letely we soil S	eathering - unwe oderately weathe athered, residua Irength - very so	pathered, slightly ered, highly weathered, slly weathered offivery loose, soft/loose s, very sliff/yery dense	Perme  ▼ Clegg  ∨ Insilu \ P=Pea	k, R=Resi	t impact v ar Streng	alue (tes jth (kPa)	t repetitio	Ιx			MAP	- 11	1. Grou	Remark and level and coo imate and subject action.	rdinates are
□ L	Small Dis arge Dis J100 Und	turbed Sample turbed Sample disturbed Sample ons in metro	е		ate Strike (1st Rise (1st,			Rig/PI	ant Use	Targe	t depth	TED DUE TO	- 11		Logged by:	Checked by AvD

2	CONS	ULTANTS and Gradupists	Riley Consultants 395 Madras Street Christhourch 8013 Tel: +643 3794402 Fax: +643 3794403									S	CA	LA	LOG	
Projec		erty - Park I	ane	Location	n: ton, Ca	ınterb	ury					osition: to site plan			No.:	
Job N	lo.:	391	Start Date: 20 Finish Date: 20	-11-12		nd Lev		_INZ):	Co-Or	rdinate		ΓM2000):			SP5	
Clien			4				Depth								Sheet: 1 of 1	
			Descriptive Strength	Term		9	ering	Field !	Strength		cala Poi	netrometer	Vater	les		ĮL.
e (m LINZ)	Depth (m)	(in	iferred from in-situ penet	ration test)		Legend	ks cw tw tw Weathering		Rock		(blows	9 12 15	Fluid & Water	Samples	Tests	Instrument
										?					No. 1 1, 2, 1, 2, 2, 3, 2, 2, 2, 3, 2, 2,	
										}	•				11 224	
İ										3	1				1, 1, 1, 2, 2, 2, 3, 3, 2, 3, 12, 15	
										ļ ,ī						
										İ						
	-1															
										1						
															*	
ŀ									9							
ł	-2															
, idea	rbu l				1 1	_						r				
KEI	CH:		-1-1-1-1			+		1-1		-	1-1	MAP				
-	+-					-		-			-					N
1-	1-1		1 1 1		+	1		1-1		! ! ! !	1					
1	1 - 1 T - 1	1-1-		- <del> </del>		+	1-1-	1-1								0 m
1-	+					-	1 1	1-1			+					1 Km
1-	1 1	1-1-			11	1				 	1					2km
	anatio			▼ Scala P	enetrome	eter: blo	ws/50mm		Gro	oundw	ater:	F			Remarks	1:1,0
weath compl	ered, mo etely we	derately weath alhered, residua			bility Tes lammer: i ane Shea	impact v		t repetitio	ons) X	None	wet be	low	118	Grou     approxi     confirm	ind level and coordinate mate and subject to sui ation.	es are vey
firm/m	edium d	ense, stiff/dense	oft/very loose, soft/loose, e, very stiff/very dense	P=Peak	k, R=Resi ite	dual, U	FP=Unab	le to		1.003						
L	arge Dis	lurbed Sample turbed Sample disturbed Sampl	e		Strike (1st Rise (1st,			ne (min's	) HOI			ED DUE TO				
All di		ons in metro	es Contractor:						ant Use							cked <b>b</b> AvD

2	RII CONS Engineers	LEY ULTANTS and Geologists	Riley Consultants 395 Madras Street Christhcurch 8013 Tei: +643 3794402 Fax: +643 3794403	Limited							S	CAI	LA	LOG	
Proje Cole		erty - Park I	Lane	Locati	on: ston, Ca	anterb	ury				position: er to site plan			No.:	
Job I	No.:	891	Start Date: 20 Finish Date: 20	-11-12		nd Lev	el (m l	LINZ):	Co-Ord		ZTM2000):			SP6	
Clie	nt: imbus (	Group			-		Depth	:						Sheet: 1 of 1	
	-	Спопр	Descriptive Strength	Torm		1						ater	S	1 011	Ţ
Elevation (m LINZ)	Depth (m)	(ir	nferred from in-situ penetr			Legend	Sw. Weathering	Field S	Flock		enetrometer s / 50 mm) 9 12 15	Fluid & Water	Samples	Tests	Instrument/ Rackfill
	-1										•			1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1	
Exp Rock weath comp Relai	hered, mo bletely we tive soil S medium d	eathering - unwo derately weath athered, residua trength - very so	eathered, slightly ered, highly weathered, ally weathered off/very loose, soft/loose, e, very stiff/very dense	Perme Clegg Insitu P=Pea	Vane Shea k, R=Res	st impact v ar Streng idual, UT	alue (les jth (kPa) 「P=Unab	t repetition	(s)	indwater: None Rods wet b			1. Grou approxix	Remarks and level and coordinates mate and subject to surv ation.	0 mm 1 km 2 km 1:1,00
	Large Dis U100 Und	turbed Sample turbed Sample disturbed Sample ons in metr	12					me (min's.)	· I —	arget dept	ATED DUE TO:			Logged by: Chec	L. II

Proje Cole	ct:	ty - Park La	ane	Loca	tion: eston, Ca	anterbi	urv					oosition: to site plan			No.:	
Job N			Start Date:	20-11-12		nd Lev	el (m L	.INZ):	Co-Or	dinate		TM2000):			SP7	
Clier					1		Depth:								Sheet: 1 of 1	
6 Elevation 8 (m LINZ)	Depth (m)	(infe	Descriplive Streng		)	Legend	RS CW WW. Weathering SW DW		Strength   Rock			enetrometer /50 mm) 9 12 15	Fluid & Water	Samples	Tests	Instrument
	1											•			No. 1 1, 1, 1, 2, 2, 3, 3, 3, 2, 3, 3, 3, 2, 3, 3, 3, 2, 2, 2, 1, 1, 1, 1, 2, 1, 1, 1, 3, 6, 15	
SKE	TCH:				_ L _ L _ L _ L	1-		1 1				MAP				
																0 1 k 2 ku 1:1,
Rock		thering - unwea	athered, slightly	T Pern	a Penetrom		ws/50mm		_	undw				1 Grow	Remarks	
comp	letely weatl ive soil Stre	nered, residuall ngth - very soft	ed, highly weathered ly weathered t/very loose, soft/loos very stiff/very dense	a, ▼ Cleg ∨ Insitu se, P=P	ig Hammer: u Vane She eak, R=Res	impact v ar Strenç	gth (kPa)		ins) X	Rods	e s wet be	elow	- 11	Grout     approxit     confirms	nd level and coordinate: mate and subject to sun ation.	s are vey
			, , , , , , , , , , , , , , , , , , , ,	1 perie	etrate er Strike (1s								- 11			

2	RI CONS Engineers	LEY ULTANTS	Riley Consultants 395 Midras Street Christhourch 8013 Tel: +643 3794402 Fax: +643 3794403	s Limited							S	CA	LA	LOG	
Proje		erty - Park L		Location	on: iton, Ca	interb	ury				osition: to site plai	1		No	.:
Job N	lo.:	891	Start Date: 20 Finish Date: 20	0-11-12		nd Lev	rel (m l	_INZ):	Co-Or	dinate	TM2000):			SP	8
Clien Nir	t:	Group					Depth:	,						Sheet:	1
			Descriptive Strength	Term		1		Field 6	Strength	-		ater	S		
© (m LINZ)	Depth (m)	(in	ferred from in-silu pene			Legend	W. Weathering		Strength   Rock		netrometer / 50 mm) 9 12 15	Fluid & Water	Samples	No. 1	Instrument
	-1										•			1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1	
Rock I weath compl Relation	anatio Mass W. Wered, moletely we ve soil S	eathering - unwe oderately weathe athered, residua trength - very so	athered, slightly ared, highly weathered, Illy weathered (fivery loose, soft/loose, , very stiff/very dense	Permer Clegg   Insitu	k, R=Resi	il impact v ar Streng	alue (les gth (kPa)	t repetilio	[X]	bundw	MAP	- 11	1. Grou approxi confirm	Remarks und level and coord imate and subject lation.	finates are
S	arge Dis	turbed Sample sturbed Sample disturbed Sample ons in metre			ate Strike (1st Rise (1st,				ant Use	Targe	TED DUE TO	- 11		Logged by: (	Checked

2	RII	JLTANTS	Riley Consultants 195 Madras Street Christhcurch 8013 Fel: +643 3794402 Fax: +643 3794403	Limited							S	CAI	LA	LOG	
Proje Cole:		erty - Park L	ane	Location	on: ton, Ca	interb	urv				Hole position: Refer to site plan			N	0.:
Job N	_		Start Date: 20 Finish Date: 20	-11-12		nd Lev	/el (m l	LINZ):	Co-Oı	rdinate	es (NZTM2000):			S	P9
Clien							Depth:							Sheet:	of 1
_			Descriptive Strength	Torm		T		1				ater	g		
g Elevation (m LINZ)	Depth (m)	(info	erred from in-situ peneti			Legend	Sw. Weathering		Strength   Rock \$\$≥\$∞%£	_	cala Penetrometer (blows / 50 mm)	Fluid & Water	Samples	Tes	Instrument/
	-1													No. 1 1. 1. 0, 1. 2, 1, 2, 11, 1, 1. 1, 1, 1, 1. 1, 1, 1, 1. 2, 1, 2, 2, 1. 2, 2, 2, 3, 5, 4, 4, 3, 3, 4, 5	
Rock weath compl Relati firm/m	anatio Mass We lered, mo detely we ve soil Si edium di Small Dislarge Dis-	eathering - unwer derately weather athered, residual trength - very sof ense, stiff/dense, urbed Sample turbed Sample	ed, highly weathered,	Permer Clegg I Insitu \ P=Pea penetra Water:	k, R=Resi	it impact v ar Strenç idual, U <sup>1</sup> t, 2nd;	value (tes gth (kPa) FP=Unab	st repetitio	ons) X	Rods			1. Grou approxi confirm	Remark and level and coo mate and subject ation.	ordinates are
	mensi	isturbed Sample  ons in metre e 1:20	S Contractor:	<del>*</del>					ant Use	ed:				Logged by:	Checked by AvD

2	Engineers	ULTANTS	Riley Consultants 395 Madras Street Christhourch 8013 Tel: +643 3794402 Fax: +643 3794403	1						Holop	S(	CAI	LA	LOG	
-	s Prop	erty - Park L		_	ton, Ca		_		2 0 "	Refer	to site plan			No.:	
Job N	No.: 128	391	Start Date: 20 Finish Date: 20	-11-12 -11-12	Grour	50	el (m l		Co-Ordin	ates (NZ	M2000):			SP10	
Clier Ni	nt: mbus (	Group				Test 0.55	Depth: m							Sheet: 1 of 1	
Elevation (m LINZ)	Depth (m)	(in	Descriptive Strength ferred from in-situ penet		.,	Legend	Weathering	Field Str	- 1	(blows	netrometer ( 50 mm)	Fluid & Water	Samples	Tests	Instrument/ Backfill
+50.00	-1						2833a		2423 0	3 6	9 12 15			No. 1 1, 0, 1, 2, 2, 2, 3, 7, 15	
Exp Rock weat com Rela firm/i	hered, modetely we tive soil S medium of Small Dis	eathering - unwe oderately weathe athered, residua strength - very so lense, stiff/dense sturbed Sample	eathered, slightly ered, highly weathered, tilly weathered off/very loose, soft/loose a, very stiff/very dense	Perme Clegg Insitu P=Pea penetr Water	/ane Shea k, R=Resi ate Strike (1s	impact v ar Streni idual, U	/alue (les gth (kPa) ΓP≐Unat	st repetitions	X N	idwater:	MAP			Remarks and level and coordinates a mate and subject to survey	
	U100 Un	eturbed Sample disturbed Sample ————————————————————————————————————	10	¶ Water	Hise (1st,	2nd) ł	& Rise Ti	Rig/Pla		arget depth	X Refusal			Logged by: Checke	

2	RI CONS Engineers	LEY ULTANTS	Riley Consultants 995 Madras Street Christhourch 8013 Tel: +643 3794402 Fax: +643 3794403	Limited							S	CAI	LA	LOG	
Proj	ect:	erty - Park L		Location	on: ston, Ca	ınterbi	urv				ole position: efer to site plan			No.:	
Job	No.:	391	Start Date: 20- Finish Date: 20	-11-12		nd Lev	rel (m l .00	_INZ):	Co-Or		(NZTM2000):			SP1	1
Clie	nt: imbus (	Graup					Depth:							Sheet:	1
		агоир	Descriptive Strength 1	Torm.		T						ater	SS	1 01	
Elevation (m LINZ)	Depth (m)	(inf	erred from in-situ penetr			Legend	w. Weathering		Strength   Rock \$\$≥\$∞\$8	(h	a Penetrometer lows / 50 mm)	Fluid & Water	Samples	Tests	Instrument/ Backfill
	-1													1. 0. 1. 1. 2. 2. 1. 1. 1. 2. 2. 1. 1. 1. 2. 2. 1. 1. 1. 2. 1. 2. 1. 2. 2. 2. 2. 3. 4. 10. 15	
Ext Rocard Relations (Control of the Control of the	hered, modelely we tive soil S medium o	eathering - unwe oderately weathe athered, residua trength - very so	red, highly weathered,	Perme Clegg Insitu	k, R=Res	st impact v ar Streng idual, U	/alue (tes glh (kPa) TP=Unab	st repetitio	nns) X		et below		1. Grou approxi	Remarks and level and coordi mate and subject to ation.	1 km 1:1,000 nates are survey
	Large Dis U100 Un	sturbed Sample sturbed Sample disturbed Sample cons in metre	10		Strike (1s Rise (1st,			Rig/Pl		Target o	finated due to lepth Refusal	- 11		Logged by: C	hecked by AvD

2	RI	LEY SULTANTS and Geologists	Riley Consult. 395 Madras Street Christhourch 6013 Tel: +643 3794402 Fax: +643 3794403	ants L	imited							S	CAI	_A	LOG	
Proje Cole		erty - Park I	_ane		Location	on: ston, Ca	ınterb	ury				osition: to site plan			N	0.:
Job N	lo.: 12	891	Start Date: Finish Date	20-1	1-12 1-12	Groui		/el (m .00	LINZ): C	o-Ordin	ates (NZ	TM2000):			SF	P12
Clier		Group	,				Test 1.45	Depth 5 m	:						Sheet:	of 1
_			Descriptive Stre	nalh Ter	rm		T		5.110				ater	SS.		
5 Elevation 8 (m LINZ)	Depth (m)	(ir	ferred from in-situ	-			Legend	Es Dw Weathering	Field Stre	- 1		netrometer / 50 mm) 9 12 15	Fluid & Water	Samples	Tes	Instrument/ Backfill
	-1														No. 1 1, 2, 1 2, 2, 2 2, 2, 2, 2 2, 1, 2, 2 1, 1, 2, 2 1, 1, 1 2, 2, 1, 1 3, 2, 2 10, 15	
	-2															
SKE	TCH:											MAP				0 m 1 km 2 lum
	lanatio		agthored slightly	1	*	Penetrome		ws/50mm	n	Ground	dwater:				Remark	
weath comp Relat firm/n	nered, m letely we live soil S nedium o Small Dis arge Dis	oderately weath eathered, residua strength - very so dense, stiff/dense sturbed Sample sturbed Sample	off/very loose, soft/fo e, very stiff/very der	oose,	Clegg I Insitu V P=Pea penetra Water	/ane Shea k, R=Resi ate Strike (1si	impact var Streng dual, Ul	glh (kPa) TP=Unab		HOLE 1		TED DUE TO:	C		und level and coo imate and subject ation.	
	J100 Un	disturbed Sampl	10	or.	<u> </u>				Rig/Plan		rget depth	X Refusal			Logged buil	Checked by
All d		ions in metro le 1:20	es   Commacil	, i					Scala Pe		eter				Logged by: 39	AvD

2	RI CONS Engineers	LEY ULTANTS	Riley Consulta 895 Madras Street Christhcurch 8013 Tel: +643 3794402 Fax: +643 3794403	nts Limited	SCALA LOG												
Project: Location: Coles Property - Park Lane Rolleston						ınterb	ury			ŀ	Hole po	sition: o site plar		No.:			
Job N	lo.;	891	Start Date: Finish Date:	20-11-12		nd Lev		LINZ):	Co-Or			M2000):		SI	213		
Client: Nimbus Group							Depth 0 m	:							Sheet:	of 1	
			Descriptive Streng	oth Torre		T		ľ					afer	S		- 1	
Elevation (m LINZ)	Depth (m)	(inf	Descriptive Streng			Legend	OW I'M Weathering Sw		Strength   Rock  }   Rock		(blows / !	etrometer 50 mm) 9 12 15	Fluid & Water	Samples	Tes	sts	Instrument/ Backfill
	-1														No. 1 1, 0, 1 1, 1, 1 1, 1, 1 1, 1, 1 2, 1, 2 2, 2, 3 3, 3 4, 5 6		
Rock I weath compl	anatio Mass Weered, moetely we	eathering - unwea deralely weather athered, residual	ed, highly weathere y weathered	d, ▼ Permo	a Penetrome eability Tes y Hammer: i Vane Shea	t mpact v	alue (tes	st repetition	X	undwa None Rods	ater:	MAP	ll:	1. Grou	Remari nd level and co mate and subjer ation.	1: ks ordinates are	0 m
Relativ	ve soil S ledium d mall Dis arge Dis 1100 Und	trength - very sof	/very loose, soft/loo very sliff/very dense	P=Pe penet Water	ak, R=Resi	dual, U1	P=Unab	nle to me (min's	1	.E TER Target	MINATE	ED DUE TO	:		Logged by:	Charles	4

2	CONS Engineers	ULTANTS and Geologists	Riley Co 395 Madras 8 Christhcurch Tel: +643 37 Fax: +643 3	Street 6013 '94402										S	CA	LA	LOG	
Project: Location: Coles Property - Park Lane Rolleston, Ca							anterb	ury		(-,			position: r to site plan		No.:			
Job No.: Start Date: 20-11-12 Groun 12891 Finish Date: 20-11-12								vel (m ).00	LINZ)	: Co-	Ordina	ates (NZ	TM2000):			SF	P14	
Client: Nimbus Group								Test	Depth 5 m	1:							Sheet:	of 1
Elevation (m LINZ)	Depth (m)	(in	Descripti	ve Strength		est)		Legend	Sw Sw Sw Sw Weathering		I Streng			enetrometer s / 50 mm) 9 12 15	Fluid & Water	Samples	Tes	to programment
	-1 -2													•			1, 0, 1, 2, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 2, 2, 1, 1, 1, 2, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,	
SKET														MAP				2 ton 1:1,0
Rock i weath complete Relative firm/m	ered, mo etely we ve soil S edium d mall Dis arge Dis	ns: hathering - unwe derately weathe athered, residua rength - very so ense, stiff/dense urbed Sample turbed Sample isturbed Sample	red, highly of lly weathere ft/very loose , very stiff/ve	wealhered, ed e, soft/loose	Pi V C V In Pi W	ermeat legg Hi situ Va =Peak, enetrat	oility Testammer: ammer: ane Shea R=Resta e trike (1st	impact impact ar Stren idual, U	glh (kPa TP=Una )	st repeti	ions)	X No	ds wet b	elow TED DUE TO I X Refusal			Remark and level and coc mate and subject ation.	rdinates are

2	RI	LEY ULTANTS and Geologisis	39 Ch Te	iley C 5 Madra rristhcur H: +643 x: +643	s Stree ch 8013 379440	l 3 02	ts L	imited	t											S	CA	LA	L	OG		
Project: Location: Coles Property - Park Lane Rolleston, Car							ınterb	ury							ositio to site			No.:								
Job No.: Start Date: 20-11-12 Groun 12891 Finish Date: 20-11-12								nd Level (m LINZ): Co-Ordinat 50.00							(NZ	TM200	00):				SF	P15				
	Nimbus Group									Test Depth: 2.00 m												She		of 1		
Elevation (m LINZ)	Descriptive Streng (Inferred from in-situ per				_						Whering	Field Str				Scala Penetrometer (blows / 50 mm)			Fluid & Water	uid & Water Samples				Instrument/ Backfill		
+50.00	<u>∆</u>										Legend	y8=\$;	1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S. 1. S.	ARAMA MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MAR MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS MARKAS	ተመ መጀመር መመር መመር መመር መመር መመር መመር መመር መመር መ	0	3	6	9 1;	2 15		S	3 3 4 5 4	10. 1 2. 2. 3 . 4 . 3 . 4 . 4 . 4		Su!
SKET	CH: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			1												1			MAF	•						O m
Rock I weath compl Relati	ered, mo etely we ve soil S	eathering - u oderately we eathered, resi strength - ven lense, stiff/de	athere idually y soft/\	d, high weath very loc	ly wea ered ose, so	lhered		Perm Clego Insitu	ieabil g Han i Vand eak, F	ity Tes nmer: i e Shea	t impact v ar Streng	ws/50m /alue (te gth (kPa TP=Una	st repe	etitions	X	No		er:	elow		- 11	1. Grot approx confirm	und lev	Remark el and coo and subjec	KS ordinates a of to surve	2 km 1:1,00
O L	arge Dis 100 Und mensi	sturbed Samp sturbed Samp disturbed Samp disturbed Samp disturbed Samp die 1:20	ole mple	Co	ontra	ctor:	Ž				, 2nd 2nd) (	) & Rise 1	Rig	/Plar	-	Tar	get d	IINAT lepth	TED DI	JE TC efusal	- 11			ged by:	Check Av	

#### AUCKLAND

Riley Consultants Limited 4 Fred Thomas Drive, Takapuna PO Box 100 253, NSMC, Auckland, New Zealand elephone 64 9 489 7872, Facsimile 64 9 489 7873 riley@riley.co.nz

www.riley.co.nz

Riley Consultants Limited Ground Floor, 395 Madras Street PO Box 4355, Christchurch, New Zealand

elephone 64 3 379 4402, Facsimile 64 3 379 4403

rileychch@riley.co.nz

www.riley.co.nz



