

To:	Michael Li (Maven Associates)
From:	Kyle Meffan (LDE)
Copy:	Darren Ellis (Clevedon Properties)
Subject:	Liquefaction Susceptibility for Clevedon Meadows Subdivision, Clevedon
Date:	23/05/2025
Project Ref:	J00721
Document ID:	613654

1 INTRODUCTION

LDE have completed a liquefaction susceptibility assessment for the Clevedon Meadows Subdivision. This assessment has been completed in accordance with the requirements with the NZ Building Code Acceptable Solution B1/AS1. Specially, we refer to the most recent MBIE and NZGS guidance regarding liquefaction assessments. These documents are:

- “Planning and engineering guidance for potentially liquefaction-prone land: Resource Management Act and Building Act aspects”¹
- MBIE/NZGS Module 3: “Identification, assessment and mitigation of liquefaction hazards”².

2 LIQUEFACTION VULNERABILITY ASSESSMENT

2.1 Liquefaction Vulnerability Maps

We have reviewed the liquefaction vulnerability assessment as outlined in the Auckland Council Geomaps Viewer which provides the following categories:

- Level A (Basic Desktop Assessment): Liquefaction Damage is Unlikely to Possible
- Level B (Calibrated Desktop Assessment): Liquefaction Damage is Unlikely to Possible (refer section 2.2)

¹ Earthquake Commission (EQC), Ministry of Business Innovation & Employment (MBIE) and Ministry for the Environment (MfE). “Planning and engineering guidance for potentially liquefaction-prone land: Resource Management Act and Building Act aspects” Rev. 0.1, Issue Date September 2017.

² New Zealand Geotechnical Society (NZGS) and Ministry of Business Innovation & Employment (MBIE) guidelines for Earthquake Geotechnical Practice in New Zealand. “Module 3: Identification, assessment and mitigation of liquefaction hazards” Rev. 1, Issue Date November 2021.

2.2 Geology Maps

We have reviewed the published GNS digital geological QMaps³ within the vicinity of the subdivision which indicate the following geologies:

- **Engineered Fill**: Although not shown on the geological maps, some areas of the subdivision have been modified through recent bulk earthworks operations overseen by LDE. Fills of up to 4m have been placed to date (although generally less than 2m).
- **Tauranga Group (Holocene)**: Comprises organic rich alluvial and colluvial deposits, typically sand, silt and clay with local gravel and peat beds.
- **Tauranga Group (Middle to Late Pleistocene)**: Comprises predominantly pumiceous sand, silt, mud and clay, with interbedded gravel and peat.
- **Puketoka Formation (Late Pliocene to Middle Pleistocene)**: Comprises rock derived alluvial sedimentary soils. Generally includes inorganic silts and clay soils, although alluvial soils can be highly variable and lenses of organic soils, peats and pumiceous soils occasionally occur
- **Waipapa Group (Late Triassic to Middle Jurassic)**: The Waipapa Group forms the basement rock in Auckland and the surrounding areas. It comprises a partially metamorphosed, indurated, moderately strong sandstone and mudstone. These rocks completely weather to a residual clay and silt mantle.

The above units are shown in Figure 01 (attached), which indicates that both Holocene and Middle to Late Pleistocene Tauranga Groups are present below this development, as well as engineered fills across most parts of the subdivision.

2.3 Semi-Qualitative Screening

We have also completed a semi-quantitative screening criteria where liquefaction damage is considered unlikely based on the criteria of Table 4.3 from the liquefaction planning document¹. This table specifies that a liquefaction vulnerability category of "Liquefaction Damage is Unlikely" can be assigned if the PGA for a 500-year intensity of earthquake shaking is calculated as being less than 0.3g. We have therefore calculated the PGA for magnitude 7.5 earthquake using the magnitude scaling factor specified, assuming an ultimate limit state (ULS) PGA of 0.19g and earthquake magnitude of 6.5 as specified in Table 1A of MBIE Module 1⁴, as follows:

³ GNS Science. (2012) Geological Map of New Zealand [NZL_GNS_250K_seamless_qmap_geological_map.kml]. GNS Science. <https://doi.org/10.21420/QF82-7D42>

⁴ New Zealand Geotechnical Society (NZGS) and Ministry of Business Innovation & Employment (MBIE) guidelines for Earthquake Geotechnical Practice in New Zealand. "Module 1: Overview of the guidelines" Rev. 1, Issue Date November 2021.

$$MSF = \left[6.9e^{\frac{-6.5}{4}} - 0.058 \right] = 1.3$$

$$1.3 \times 0.19g = 0.25g$$

On this basis, we have determined that the scaled PGA is less than 0.3g and therefore the liquefaction vulnerability category of “**Liquefaction Damage is Unlikely**” applies. This is described in Table 4.4 of the MBIE planning document¹ as “there is a probability of more than 85% that liquefaction-induced ground damage will be none to minor for 500-year shaking”.

Table 4.4: Performance criteria for determining the liquefaction vulnerability category

LIQUEFACTION CATEGORY IS UNDETERMINED			
A liquefaction vulnerability category has not been assigned at this stage, either because a liquefaction assessment has not been undertaken for this area, or there is not enough information to determine the appropriate category with the required level of confidence.			
LIQUEFACTION DAMAGE IS UNLIKELY		LIQUEFACTION DAMAGE IS POSSIBLE	
There is a probability of more than 85 percent that liquefaction-induced ground damage will be None to Minor for 500-year shaking. At this stage there is not enough information to distinguish between Very Low and Low . More detailed assessment would be required to assign a more specific liquefaction category.		There is a probability of more than 15 percent that liquefaction-induced ground damage will be Minor to Moderate (or more) for 500-year shaking. At this stage there is not enough information to distinguish between Medium and High . More detailed assessment would be required to assign a more specific liquefaction category.	
Very Low Liquefaction Vulnerability	Low Liquefaction Vulnerability	Medium Liquefaction Vulnerability	High Liquefaction Vulnerability
There is a probability of more than 99 percent that liquefaction-induced ground damage will be None to Minor for 500-year shaking.	There is a probability of more than 85 percent that liquefaction-induced ground damage will be None to Minor for 500-year shaking.	There is a probability of more than 50 percent that liquefaction-induced ground damage will be: Minor to Moderate (or less) for 500-year shaking; and None to Minor for 100-year shaking.	There is a probability of more than 50 percent that liquefaction-induced ground damage will be: Moderate to Severe for 500-year shaking; and/or Minor to Moderate (or more) for 100-year shaking.

3 LEVEL B LIQUEFACTION SUSCEPTIBILITY ASSESSMENT

3.1 Level B Assessment Requirements

Table 3.7 of the MBIE planning document¹ specifies that a Level B assessment should be completed where Liquefaction Damage is Unlikely. Table 3.1 of this document then specifies that a Level B assessment may involve:

- Information from a small number of subsurface investigation points to provide high-level understanding of the nature and variability of the key geological units.
- Qualitative (or possibly quantitative) assessment of subsurface ground information to provide high-level understanding of the potential for liquefaction triggering to occur, and potential severity of the consequences.

3.2 Deep Investigation Summary

We have reviewed the available information from the New Zealand Geotechnical Database as well as geotechnical investigations completed by LDE, and have selected six deep investigation records within the vicinity of the Clevedon Meadows subdivision, located as shown in Figure 01, and are summarised in Table 1 below. Full investigation logs are attached.

Table 1. Summary of nearby investigation logs.

Borehole ID	Source	Geological Group	Depth	Summary of Ground Conditions
MH01	LDE Geotechnical Assessment Report (Ref. J00721 – Rev.E. Dated 3 August 2022.	Tauraga Group (Middle to Late Pleistocene)	19.5m	Generally inorganic silty clays and clayey silts. Occasional layers of amorphous to fibrous peat below 3m depth. Interbedded with sands and gravels below 12.5m depth.
80368	NZ Geotechnical Database	Tauraga Group (Holocene)	198m	Clays. Occasional silts and organics below 2.5m depth. Sands and pumiceous clays below 14.5m. Interbedded with cohesive soils to 194m.
80512	NZ Geotechnical Database	Tauraga Group (Middle to Late Pleistocene)	100m	Cohesive soils to 4m to 5m. Becomes interbedded with peat and sands / gravel to 100m.
81146	NZ Geotechnical Database	Tauraga Group (Holocene)	281m	Cohesive soils to 8m, becoming interbedded with silts, sands, gravels and occasional peats to 123m.
81460	NZ Geotechnical Database	Tauraga Group (Holocene)	90m	Clays to 11m, becoming interbedded with silts and sands to 90m.
82369	NZ Geotechnical Database	Tauraga Group (Middle to Late Pleistocene)	58m	Clays to 2m, becoming interbedded with peats to 21.5m. Generally interbedded sands and clays to 58m.

3.3 Investigation Data Review

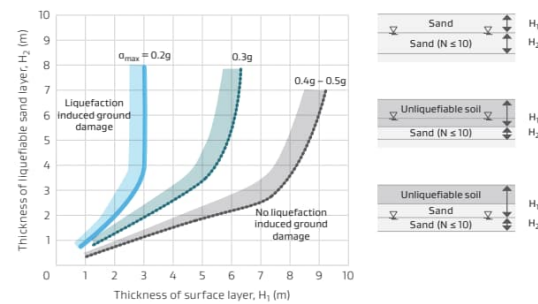
Our review of the boreholes indicates that the wider soils of the Tauranga Group across the wider subdivision and adjacent areas comprise stiff cohesive deposits over the upper 2m to 3m (or up to 11m in some cases), underlain by variable peats, silts and sands below these depths. MBIE Module 3² discusses that cohesive soils with a plasticity index (PI) >12% are not susceptible to liquefaction. It is our opinion the soils identified in both these boreholes exceed this criteria over at least the upper 3m (i.e. the material over these depths is cohesive). Expansive soils testing presented in the 2022 LDE report referenced in Table 1 above (see results in Table 3 below) indicate the cohesive soils at this site have a PI of greater than 39%, which is typical for Tauranga Group cohesive soils.

Table 3. Results of Laboratory Tests

Borehole No.	Avg. Depth (m)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Linear Shrinkage	Casagrande Classification
HA02	0.75	39.6	92	38	54	0.0	16	CH
HA11	0.75	51.0	114	49	65	0.0	17	MH
HA17	0.75	40.6	72	33	39	0.2	14	CH
HA22	0.75	54.5	119	49	70	0.1	18	MH

Further, MBIE also provides guidance around consideration of crust thickness where a crust thickness of 3m is generally deemed thick enough to suppress surface manifestation of deep liquefaction occurrence (refer inset Figure 5.3). Based on our review of the deep geotechnical borehole data, the non-liquefiable crust thickness is generally greater than 3m at this site (i.e. highly plastic cohesive soils), and in some areas that crust thickness has been modified with engineered fills of variable thicknesses. Similar observations have been made within our post-construction boreholes across the completed stages of the Clevedon Meadows subdivision as well as adjacent subdivisions.

Figure 5.3: Ishihara's chart for evaluation of effects of crust thickness on liquefaction-induced ground damage (Ishihara, 1985)



Research completed by Bowen & Jacka (2013)⁵ has compared this theory to the damage recorded in during the 2010 and 2011 Canterbury earthquake sequence which found that where the crust thickness of 3m or more is present (for a PGA of 0.2g, which is similar to the 0.19g ULS PGA for Clevedon Meadows), liquefaction was considered unlikely to occur as the crust thickness was considered too thick for the underlying liquefied soils to 'break through', for example in the case of sand boils. The research also suggests that the thickness of the underlying liquefied layer is a less important factor except in instances where a liquefied layer of between 0.5m and 2.0m were present within the upper 3m, which is not the case here.

4 CLOSURE

This memorandum provides a (high-level) qualitative assessment of liquefaction assessment for the Clevedon Meadows subdivision, for which multiple stages have undergone extensive geotechnical investigations prior to Resource Consent approval. Based on the Level B assessments outlined above, it is our opinion that the subdivision has **Low Liquefaction Vulnerability** and **Liquefaction Damage is Unlikely** (i.e. there is a probability of more than 85% that liquefaction induced ground damage will be none to minor for 500-year shaking).

For and on behalf of LDE Limited

K. Meffan

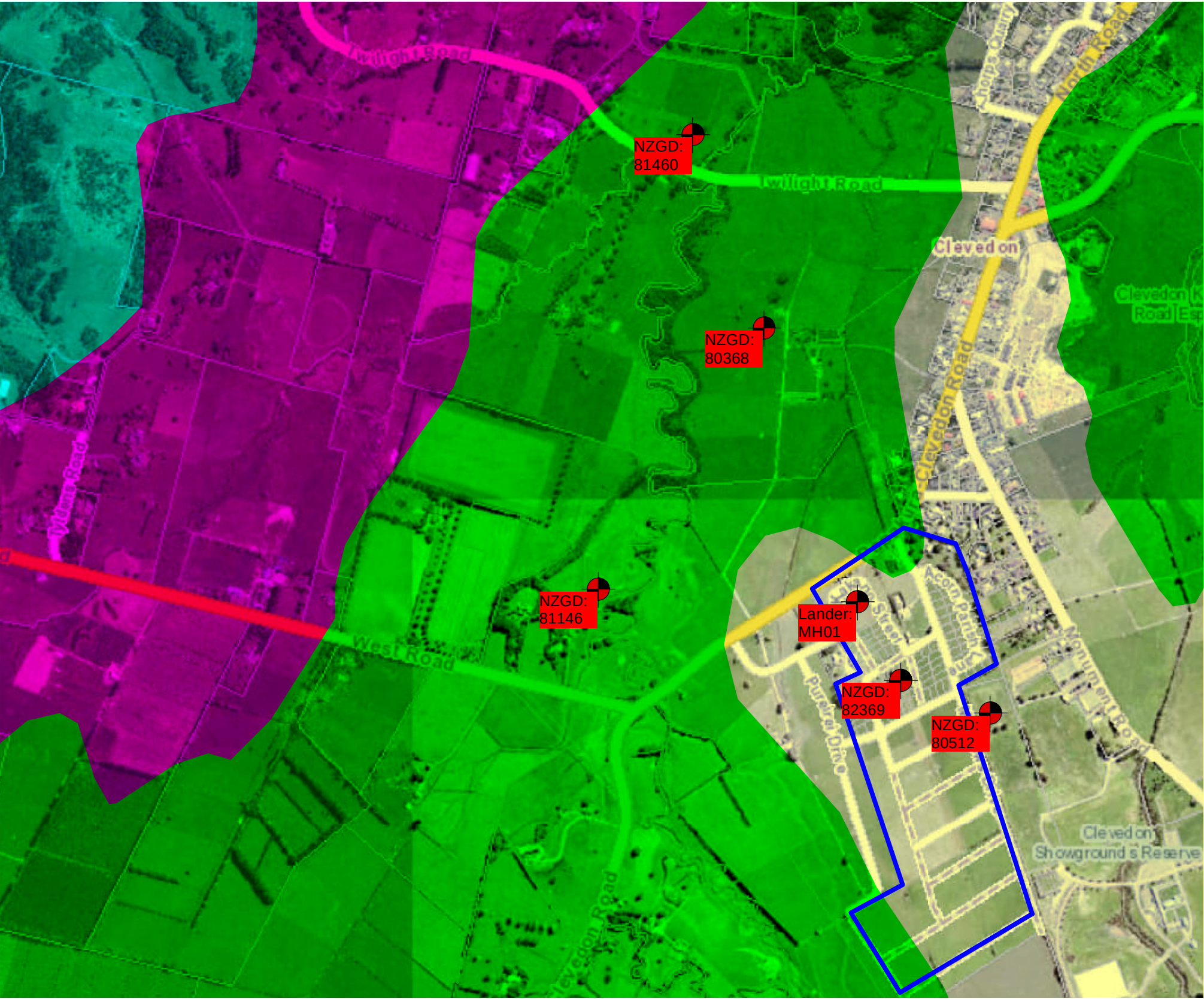
Kyle Meffan

Associate Engineering Geologist

CMEngNZ (PEngGeol)

Attachments: Figure 01 (Geological and Relevant Investigation Summary)
 Investigation Logs

⁵ Bowen, H. & Jacka, M. (2013) "Liquefaction induced ground damage in the Canterbury earthquakes: predictions vs reality" Proc. 19th NZGS Geotechnical Symposium.



Legend and/or Notes:

-  Lander / NZGD Borehole
-  Clevedon Meadows Subdivision Boundary
-  Tauranga Group (Holocene)
-  Tauranga Group (Middle to Late Pleistocene)
-  Puketoka Formation (Late Pliocene to Middle Pleistocene)
-  Waipapa Group (Late Triassic to Middle Jurassic)

BASE PLAN SOURCE: AUCKLAND COUNCIL GEOMAPS VIEWER. RETRIEVED 22/05/2025

revision	description	drawn	approved	date	0150.0300.0450.0600.0 Horizontal Scale (metres) 0150.0300.0450.0600.0 Vertical Scale (metres)	drawn	KM		client:	CLEVEDON PROPERTIES	
						approved	KM		project:	CLEVEDON MEADOWS SUBDIVISION CLEVEDON	
						date	23.05.25		title:	GEOLOGY AND LIQUEFACTION ASSESSMENTS	
						scale	1:10,000		project no:	J00721	figure no:
						original size	A3				01

Client : ACORN PARISH HOLDINGS LTD						Machine Borehole No. MH01						
Project Location : 62-78 PAPA KURA-CLEVEDON ROAD, CLEVEDON						Sheet 1 of 3						
Job Number: J00721						Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 18.07.17 Finish Date: 18.07.17			
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT	
	Description:	Refer to site plan		Orientation: vertical								
	CORE DESCRIPTION			Legend	Depth (m)	DEFECTS						
Alluvium	TOPSOIL			[Pattern]		Groundwater level as measured on 01.08.17: 0.35m						
	silty CLAY, orange mottled light grey. Very stiff, moist, high plasticity, moderately sensitive			[Pattern]	0.5						147/ 73	
	becoming mottled orange/ brown and light grey, with trace limonite staining			[Pattern]								
	becoming grey streaked orange, insensitive, with some limonite silt inclusions and staining			[Pattern]	1.0						137/ 77	
	becoming moderately sensitive			[Pattern]	1.5							
				[Pattern]	2.0							
				[Pattern]	2.5							
	becoming orange mottled green and grey, with minor to some black organic staining			[Pattern]								
	amorphous PEAT, black. Soft, wet, medium plasticity			[Pattern]	3.0						129/ 39 SPT at 3.0-3.45m 1/2/3 N=5	
	silty CLAY, green. Firm, wet, high plasticity			[Pattern]	3.5							
				[Pattern]	4.0							
	becoming stiff, sensitive			[Pattern]	4.5						82/ 15 SPT at 4.5-4.95m 2/1/2 N=3	
			[Pattern]	5.0								
			[Pattern]	5.5								
organic clayey SILT, dark brown/black. Soft, moist, low plasticity, with some decayed wood chip inclusions			[Pattern]	6.0								
fibrous PEAT, black. Soft, moist, no plasticity, with some organic fiber inclusions			[Pattern]	6.5						SPT at 6.0-6.45m 0/0/1 N=1		
			[Pattern]	7.0								
			[Pattern]	7.5								
organic CLAY, black streaked dark brown. Stiff, moist to wet, high plasticity, with some black organic inclusions and staining, with occasional fibrous wood inclusions			[Pattern]	8.0						60/ 1 SPT at 7.5-7.95m 1/1/0 N=1		
Comments:						Drilling Fluid: Topsoil Fill Clay Silt Sand Gravel Organic Pumice Sandstone Siltstone Limestone Volcanic Plutonic No Core						
Driller: Pro-Drill Rig: Tractor						Checked: T.T.						

Client : ACORN PARISH HOLDINGS LTD Project Location : 62-78 PAPAKURA-CLEVEDON ROAD, CLEVEDON Job Number: J00721					Machine Borehole No. MH01 Sheet 2 of 3								
					Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 18.07.17 Finish Date: 18.07.17					
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT		
	Description: Refer to site plan			Orientation: vertical									
	CORE DESCRIPTION			Legend	Depth (m)	DEFECTS							
Alluvium	fibrous PEAT, black. Stiff, moist, no plasticity, with some decayed wood and rootlet inclusions			[Pattern]	8.5			OPEN BARREL	84				
				[Pattern]	9.0								
				[Pattern]	9.5				SPT			SPT at 9.0-9.45m 1/1/2 N=3	
				[Pattern]	10.0				95				
				[Pattern]	10.5								
	CLAY, light blue/ green. Firm, moist, high plasticity			[Pattern]	11.0				SPT			SPT at 10.5-10.95m 5/3/3 N=6	
				[Pattern]	11.5				89				
				[Pattern]	12.0								
				[Pattern]	12.5				SPT			SPT at 12.0-12.45m 1/4/4 N=8	
	SAND, light blue/ green. Loose, moist, no plasticity			[Pattern]	13.0				84				
				[Pattern]	13.5								
				[Pattern]	14.0				SPT			SPT at 13.5-13.95m 4/4/5 N=9	
	pumiceous SILT, cream/ white. Loose, moist, no plasticity			[Pattern]	14.5				95				
	slightly silty CLAY, dark brown mottled green/ grey. Stiff, moist, high plasticity, with minor organic staining at 14.3m, without organic staining			[Pattern]	15.0								
	sandy fine to medium GRAVEL, grey. Loose, moist, no plasticity			[Pattern]	15.5				SPT			SPT at 15.0-15.45m 3/3/3 N=6	
			[Pattern]	16.0			76						
			Comments: Driller: Pro-Drill Rig: Tractor		Drilling Fluid:	Topsoil	[Pattern]	Sand	[Pattern]	Sandstone	[Pattern]	Plutonic	[Pattern]
					water	Fill	[Pattern]	Gravel	[Pattern]	Siltstone	[Pattern]	No Core	[Pattern]
					Checked:	Clay	[Pattern]	Organic	[Pattern]	Limestone	[Pattern]		
					77	Silt	[Pattern]	Pumice	[Pattern]	Volcanic	[Pattern]		

Client : ACORN PARISH HOLDINGS LTD					Machine Borehole No. MH01				
Project Location : 62-78 PAKURA-CLEVEDON ROAD, CLEVEDON					Sheet 3 of 3				
Job Number: J00721					Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 18.07.17 Finish Date: 18.07.17	

Stratigraphy	Borehole Location:	mN	mE	Ground R.L.	Depth (m)	DEFECTS	Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT	
	Description: Refer to site plan			Orientation: vertical									
	CORE DESCRIPTION			Legend									
Alluvium	with moderately thin layer of slightly silty CLAY				16.5			OPEN BARREL	76				SPT at 16.5-16.95m 4/5/6 N=11
	organic clayey SILT, dark brown/ black. Stiff, moist, low plasticity, with major organic inclusions and staining												
	becoming organic slightly clayey SILT, dark brown, low to no plasticity, with some decayed organic inclusions and staining				17.0								
	becoming dark brown mottled brown, with minor organic inclusions and staining				17.5				90				
					18.0								
					18.5								
	fibrous PEAT, black. Stiff, moist, no plasticity, with some fibrous organic inclusions				19.0				91				
					19.5								
	EOB at 19.5m. Target Depth.				20.0								
					20.5								
					21.0								
					21.5								
					22.0								
					22.5								
					23.0								
					23.5								
					24.0								

	Comments: Driller: Pro-Drill Rig: Tractor		Drilling Fluid:	Topsoil	Sand	Sandstone	Plutonic	
			water	Fill	Gravel	Siltstone	No Core	
	Checked:	Clay	Organic	Limestone				
		Silt	Pumice	Volcanic				

Version: 18 February 2002

Daily Log Sheet (General)

42533

Job Ref No.

BL	06	WW	092
Comp	Year	Div	#

Comp	Year	Div
------	------	-----

Permit No.

Date 11 12 06

day mth yr

Bore Hole No.

Bore Size | 100mm

or Grid ref

Mac

easting

nothing

Rig No. 48

Tender No. 52/132

2 Compressor No.

Purpose of Bore Water

Consultant

First

Surname

Accommodation/Meals - No. of Men

Signed

Kilometers Drill Rig | 3 km

Support Tender | 15km

6 x 6 Crane Tender |

Heavy Transporter

Utility Service | 26 km

Client representative

Drill crew Des

Driller C. Brown
ID: 00268

Time

Hours

Hours

Rig Working $(4\frac{1}{2})$

Start 12.45

Stand-by |

Finish LS, LS

Compressor |

Total 4 1/2

DH Hammer

Down Time

Contract Rate |

Travel | 3/4 hr

KIWI WELLDRIILLERS N.Z.

ISO 9002 CERTIFIED

KEVIN BROWN LTD.

MEMBER NZ. DRILLERS FED

PH. 0800 822 822

BRANCHES:

BAY OF ISLANDS
WARKWORTH
GLENBROOK



PO BOX 400 OREWA

FAX 09 425 0228

E-Mail

kevin@kiwiwelldrillers.co.nz

BORE LOG FORM

Client MANUKAU CITY COUNCIL
CLEVEDON SPORTS GROUNDS
Address 73 MONUMENT RD CLEVEDON
Grid Reference S11 2691930 6464690
Consent No. 300935 Bore I.D. 22355

Driller SAM KOREWHA
Drilling Method ROT.- MUD
Date of Finishing 24.6.2005
Purpose of Bore SPORTS GROUNDS
SITE: BY BOWLING CLUB PUMP SET

Consent Holder MANUKAU CITY COUNCIL
Bore Permit No. 300935
Bore ID 22355
Water Permit No.
Date Consents D-base Updated 25/11/05
Date Bore Log D-base Updated
Airline Result 75% of Test 216m³/day

BORE LOG

Depth from Surface Top	Bottom	Description of Ground Passed Through
0.0	0.2	TOP SOIL
0.2	5.0	MULTI COLOUR CLAY
5.0	5.5	PEAT
5.5	8.0	V. SOFT BLUE GREEN CLAY
8.0	8.6	PEAT
8.6	16.0	V. SOFTBLUE GREEN CLAY
16.0	16.9	PEAT TIMBER
16.9	31.5	V. SOFTBLUE GREEN MARL
31.5	33.7	TIMBER - GRAVELS
33.7	45.5	V. SOFT BLUE GREEN MARL
45.5	47.0	TIMBER GRAVELS GREYW/KE
47.0	70.0	V. SOFT BLUE GREEN MARL
70.0	72.0	GRAVELS - GREYWACKE CHIP
72.0	85.0	V. SOFT BLUE GREEN MARL
85.0	97.0	GRAVELS - GREYWACKE WITH TIMBER
97.0	100.0	V. SOFT BLUE GREEN MARL

WELL CONSTRUCTION

All measurements from the top of the casing
Depth of bore (M) 97.00
Depth of casing (M) 83.00
Diameter of Casing PVC 104 (mm)
Screens: 80mm PVC KIWI CUT - TOP 66m
From 85.00 m to 97.00 m
Slot size and type 4mm 250 mm APART
Grouting 14 Bags

Pump Tests:

Method of development AIR & SURFACE
Static water level 3.10 m
Duration of test 7 HOURS
Max 12000 ltrs p/hr
Test discharge (m³/hr) 12
Drawdown level 7.10 m

PUMP DEPTH 10.00 m FOOT SUCTION**PUMP VOLUME up to** 6000 ltrs p/hr

Type pump to suit construction of bore for client

SURFACE PUMP SET

AT 10.00 m. FOR 3000 lph

Water Quality Basic on site taste test

SMALL ODOUR & IRON CONTENT

REMARKS

TOP OF SCREEN AT 66m
5 % CIRCULATION LOSS AT 32.00m 5% @ 46.00m 5% @ 71.00m 10 % @ 90.00m.

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E-Mail

kevin@kiwiwelldrillers.co.nz

BORE LOG FORM

Client MANUKAU CITY COUNCIL
CLEVEDON SPORTS GROUNDS
Address 73 MONUMENT RD CLEVEDON
Grid Reference S11 2691695 6464670
Consent No. 30935 Bore I.D. 22366

Driller SAM KOREWHA
Drilling Method ROT.- MUD
Date of Finishing 28.6.2005
Purpose of Bore SPORTS GROUNDS
SITE: WEST SIDE OF SPORTS FIELD

BORE LOG

Depth from Surface Top	Bottom	Description of Ground Passed Through
0.0	0.3	TOP SOIL
0.3	4.0	MULTI COLOUR SOFT CLAY
4.0	6.0	PEAT
6.0	8.0	GREY SOFT CLAY
8.0	13.0	PEAT
13.0	28.0	GREY GREEN SOFT CLAY
28.0	39.5	GRAVELS
39.5	51.0	WHITE GREY SOFT CLAY
51.0	55.0	PEAT TIMBER
55.0	59.0	GRAVELS
59.0	68.0	MULTI COLOUR SOFT CLAY
68.0	70.0	GRAVELS
70.0	82.0	GREY SOFT CLAY
82.0	88.0	GRAVELS
88.0	92.0	GREY SOFT MUDSTONE
92.0	97.0	GRAVELS
97.0	102.0	GREY SOFT MUDSTONE

REMARKS

5 % CIRCULATION LOSS @ 82.00m

WELL CONSTRUCTION

All measurements from the top of the casing
Depth of bore (M) 88.40
Depth of casing (M) 72.90
Diameter of Casing PVC 104 (mm)
Screens: 80mm PVC KIWI CUT
From 80.00 m to 88.40 m
Slot size and type 4mm 250mm APART
Grouting 14 Bags

Pump Tests:

Method of development AIR INDUCTION
Static water level 2.00 m
Duration of test 3 HOURS
Max 9000 ltrs p/hr
Test discharge (m³/hr) 9.0

Drawdown level 7.40 m

PUMP DEPTH 10.00 m FOOT SUCTION**PUMP VOLUME up to** 7200 ltrs p/hr

Type pump to suit construction of bore for client

SURFACE PUMP SET

AT 10.00 m. FOR 3000 lph

Water Quality Basic on site taste test

VERY SMALL IRON CONTENT

Consent Holder MCC
Bore Permit No. 30935
Bore ID 22366
Water Permit No.
Date Consents D-base Updated 23/11/05
Date Bore Log D-base Updated
Airline Result (75% of Test) 16.2 m³/day

Drillwell Exploration NZ LTD

Daily Log Sheet (General)

Log No.

28538

9 Rawson Way, Takanini, Auckland

1st client David Smith (Argenz P.b. Ltd)

Job Ref No.

DE 99 WW 002

Day

Thursday

2nd client

BY:

Permit No.

C512-12-2315

Date

14 / 1 / 99

day mth yr

Location 24 West Road Clevedon

street address or locality

Bore Hole No.

1

Bore Size

100mm Test

Grid ref

511 908

northing

649

easting

Rig No.

15

Tender No.

27

Compressor No.

Purpose of Bore Water

S&D

Consultant

First

Surname

Work Details Arrived on site at 8:00amwaited for pit to be dug.Set up rig and levelledon blocks. Drilled 100mmtest hole from 0m to 139.46m.We mixed mud through outthe day to keep thehole conditioned. Pulled outrocks. Packed away all thetools etcSecured site etc.Secured site etc.Ceased work at 4:45pm.Consent Holder Argenz P.b. Ltd.Bore Permit No: C512-12-2315Bore ID 20461Water Permit No: /Date Consents D-base Updated 24/3/99Date Bore Log D-base Updated 24/3/99Airline Result (75% of Test) /

Bore Log

0-3m clays3m-8m Blue silts8m-18m Gravels/peat/Grey silts18m-24m Blue silts24m-34m Green Gravels/Sand34m-55m Grey/Brown silts/peat55m-98m Blue silts/peat/Brown silts98m-123m sticky Blue silts123m-276m waitanata mudstone276m-278m Sandstone/SandstoneLimestone v/Hard278m-279m Limestone v/Hard279m-280/4m Greywacky v/HardTest Bore Back Filled

WATER BOARD

COPY

Telephone 07 871 5897
 Mobile 025 925 036

Fax 07 871 6513

Date _____

 14959
 BORE INFORMATION

Bore Log:

Owners Name:

Mr. Cody Forsyth

Address:

Twilight Rd Clevedon

0h - 11 Brown clay

Permit No: 1733

11 - 15 Silts.

Date drilled: 12/31/96

Purpose of Bore: Water Bore

15 - 31 Brown clay

WELL CONSTRUCTION:

Bore Hole Depth:

90

m

31 - 48 Brown

Casing Depth:

39

m

rotten rock

Diameter of casing: 100

mm dia

Type of casing:

Steel

48 - 76 Brown clays

Screens:

Type:

P.V.C.

76 - 90 Brown rock

Depth Top:

38.5

m

layers

Depth Bottom:

90

m

+ clay

Cement grouted:

Yes.

m

STATIC WATER:

Static Water Level:

1m above ground

m

Flow Rate:

1.5

m3p/hr

S.D. Pumped with:

Compressor

WATER QUALITY:

Good.

GROUNDWATER A.R.W.B.

W.R. No.

NAME C. Forsyth

TECHNICAL FILES

CS12-12-1733

RES

ACTIONED

BORELOG

PUMP TEST

COMPUTER

WATER QUAL BL-3216

REMARKS:

ON GTGS

SU 913660

REDUCED LEVEL IN METRES above + below - m.s.l.	GRAPHIC LOG	DEPTH IN METRES Below ground surface	LITHOLOGY Reduced level of surface < = drillwater gain > = drill water loss	COLOUR	STATIC WATER LEVEL	CASING	SCREEN	Approximate yield (litres/min) m ³ /day	Specific capacity (litres/min/metre) m ³ /day
					(a) Related to ground surface				
	20		BROWN STICKY CLAYS		1.4m				
	45		PEAT & TIMBER.						
	65		GREEN SILTY CLAYS						
			PEAT & TIMBER						
	12								
			BLUE GREY SILTY CLAYS						
	16.5		PEAT & TIMBER.						
	21.5								
			GREEN GREY SANDY SILTS						
	30.5		GREYWACKE GRAVEL + SILT						
	31.7		BROWN SANDY SILTS						
	38.5								
			BLUE GREY MUDDY SILTS						
	41.7		GREYWACKE GRAVEL + SILT TRACES.						
	42.8		FINE SAND + SILT						
	43.5								
			PLIMICE + SAND & SMALL GRAVEL.						
	50.8		PLIMICE SAND + SILT						
	51.7								
			E.O.B.						