17 December 2024

WHENUAPAI GREEN

98-102 TOTARA ROAD, WHENUAPAI

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

Neil Construction Limited

AKL2018-0085AG Rev 2

AKL2018-0085AG		
Date	**Revision**	**Comments**
11 March 2024	A	Initial draft for internal review
12 March 2023	0	Issue to Support Plan Change Application
26 August 2024	1	Update following council review
17 December 2024	2	Update to include Clause 23 responses

	Name	**Signature**	**Position**
Prepared by	Chris Ritchie		Principal Engineering Geologist CMEngNZ, PEngGeol
Reviewed and Authorised by	Richard Knowles		Principal Geotechnical Engineer CMEngNZ, CPEng

EXECUTIVE SUMMARY

This report presents the results of a geotechnical investigation and geohazards assessment to support of a Private Plan Change request ('PPC') to make changes to the Auckland Unitary Plan – Operative in Part ('AUP') to enable the rezoning of 98-100 and 102 Totara Road, collectively referred to as Whenuapai Green ('WG') or the 'PPC land'. WG comprises an approximate land area of 16.36 ha over two properties. The zone change request seeks to rezone the PPC land from Future Urban Zone ('**FUZ**') to Residential – Mixed Housing Urban ('**MHU**') zone.

The site comprises two individual lot parcels (LOT 2 DP 81411 and LOT 1 DP 53062) with a collective land area of approximately 16.4 hectares. Ground contours grade gently from approximately mRL 25.0 at the southern boundary to mRL 15.0 across the bulk of the site.

Based on the investigation results, the site is underlain by Puketoka Formation alluvial deposits, with Waitemata Group deposits encountered beneath the alluvium. Groundwater was encountered across the site between 0.7m and 4.0m depth below existing ground level.

A geotechnical assessment of the site in respect of the proposed development is summarised as follows:

- The site is located in a low seismicity region with the nearest active fault (Wairoa North Fault) located approximately 42 kilometres south-east of the site. The risk of fault rupture induced damage is considered 'low'.
- Due to the geological age and soil fabric of the soils encountered, liquefaction is low risk for the proposed works.
- The Puketoka Formation soils underlying the site are generally of a stiff to very stiff consistency and unlikely to undergo large static settlements when subject to typical residential development loads Notwithstanding this, any localised soft spots and/ or isolated pockets of weak alluvial deposits that may be encountered during earthworks can be over excavated and replaced with engineered fill or reworked to minimise the risk of potential differential settlements and reduced bearing capacities.
- With reference to AS2870 and BRANZ Report SR120A, the preliminary expansive site class for this development has been assessed as M (moderately reactive soils).
- Generally the site is near flat with discrete areas of sloping ground near stream banks. As such global stability has been classified as low risk.
- With reference to NZS1170.5:2004, the subject site has been assessed as Class C – Shallow Soils.
- The subsoils encountered beneath the site are considered suitable to be able to support up to 300kPa geotechnical ultimate bearing pressures from conventional NZS 3604 type structures.

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Appendices

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1 INTRODUCTION

1.1 Project Brief

CMW Geosciences (CMW) was engaged by Neil Construction Limited to carry out a geotechnical investigation of a site located at 98-102 Totara Road, Whenuapai to support a Private Plan Change application to Auckland Council. The request seeks to rezone the PPC land from Future Urban Zone ('**FUZ**') to Residential – Mixed Housing Urban ('**MHU**') zone.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal letter referenced 2018-0085AF, Rev.0 dated 3 June 2022.

1.2 Scope of Work

As detailed in our proposal letter (referenced above), the agreed scope of work to be conducted by CMW was defined as follows:

- Desk top study of available information relevant to the proposed development.
- Arrange and execute a geotechnical site investigation (SI).
- Evaluate and develop an appropriate geological and geotechnical model, including seasonal groundwater variations.
- Identify any geohazards to the proposed development, including liquefaction, static settlements, sensitive soils, groundwater issues.
- Compile all of the above detail into a concise geotechnical investigation report, incorporating relevant plans, field investigation data, laboratory test data to support a private plan change application.

2 SITE DESCRIPTION

2.1 Site Location

The site is located at 98-102 Totara Road, Whenuapai, and consists of two individual lot parcels (Lot2 2 DP 81411 and Lot 1 DP 53062) with a collective land area of approximately 16.4 hectares. The overall site location is shown on Figure 1 below.

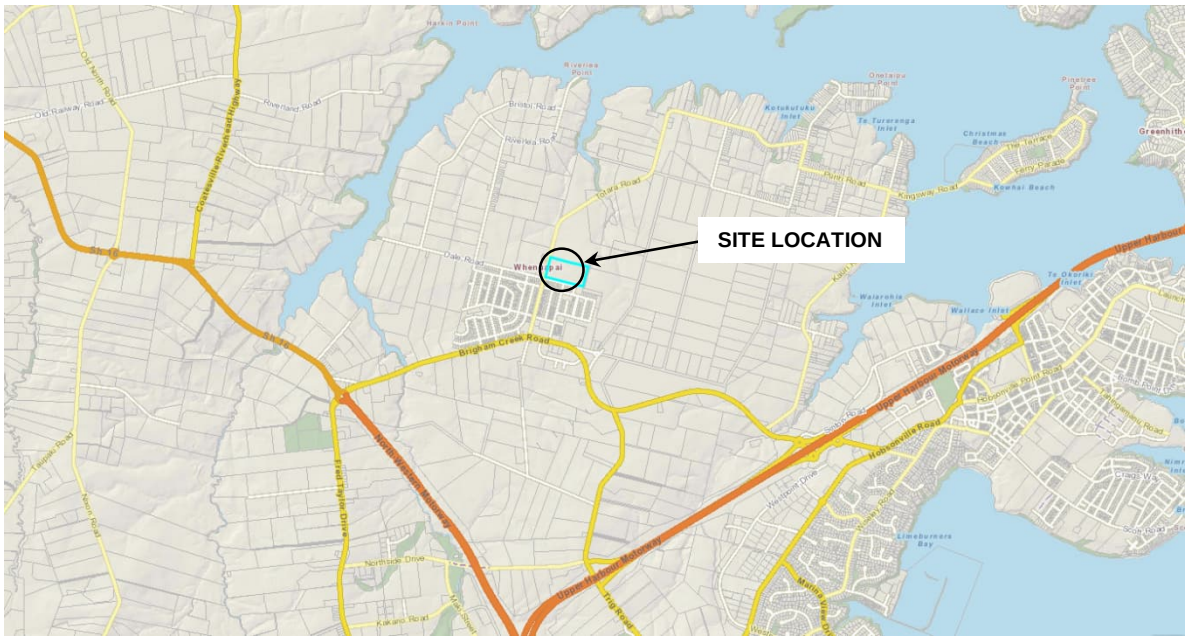


Figure 1: Site Location Plan (Source: Auckland council Geomaps)

2.2 Landform

The current general landform, together with associated features located within and adjacent to the site is presented on Geotechnical Site Plan, attached (***Drawing 01***).

The ground contours grade gently from approximately mRL 25.0 at the southern boundary to mRL 15.0 across the bulk of the site.

A south to north flowing tributary with approximately 2m deep invert is located in the eastern part of 98-100 Totara Road and collects the stormwater runoffs from the site and adjacent properties to the south. This tributary discharges north of the site boundary, into a permanent stream which flows from southeast to northwest and crosses the site at the north-eastern corner.

Part way up the western boundary there appears to be a field drain feeding a shallow over land flow path with flowing water. No signs of the drain could be found anywhere else. We presume that it is shallowly buried and only a short distance from where it is seen to discharge.

The site is bound to the north and west by Totara Road, to the south by McCaw Avenue and to the east by Whenuapai Airforce Base. Currently there are three dwellings (and associated ancillary structures) located on site. A single dwelling with a detached garage is located in the northern tip with access off Totara Road and two dwellings (102 and 102A Totara Road) with detached sheds are located in the south-western corner. Both these dwellings are accessed off Totara Road near the intersection with Dale Road and McCaw Avenue. The remainder of the site exists in pasture.

Historic aerial photography viewed on the Auckland GIS viewer and from the Retrolens website indicates the current dwelling located near the northern tip of 98-100 Totara Road was constructed between 1988 and 1996. The two dwellings located adjacent to the south western and southern boundaries of 102 Totara Road were constructed circa 1968 and 1996, respectively.

The historic photos show an area in the east of the site was used to grow a plantation of trees from around 1950 to around 1980. Other large single trees are visible in the historic photos over time that are no longer present.

Our review of the publicly available historic aerial photos found no signs of major slope instability.

3 INVESTIGATION SCOPE

3.1 Desktop Study

As part of this geotechnical assessment, CMW completed a desktop review of available geotechnical information pertaining to this site. The following information was reviewed as part of our desktop study:

- Published geological map[1]
- New Zealand Geotechnical Database;
- Topographical information available from Auckland Council GIS database;
- Aerial imagery (current and historic) available from Auckland Council GIS database;
- Currently proposed scheme plans provided by Neil Construction Ltd;
- Preliminary geotechnical Investigation Reports for 98-100 Totara Road (Ref: AKL2018-0085AB Rev. 0, dated 18 May 2018), and 102 Totara Road (Ref: AKL2019-0136AB Rev. 0) prepared by CMW Geosciences.

3.2 Field Investigation

Recent field investigations were carried out between 14 October 2022 and 15 October 2022. All fieldwork was carried out under the direction of CMW Geosciences in general accordance with the NZGS specifications[2] and logged in accordance with NZGS guidance[3]. The scope of fieldwork completed was as follows:

- Undertook a walkover survey of the site to assess the general landform and site conditions;
- Twenty-five hand auger boreholes, denoted HA01-22 to HA25-22, were drilled using a 50mm diameter auger to target depths of between 4.0m and 5.0m below existing ground levels to visually observe the near surface soil profile and to facilitate in-situ permeability / vane shear strength testing. HA09-22, HA11-22, HA13-22, HA19-22, HA20-22, HA21-22, and HA25-22 were terminated between 1.5m and 3.7m depth due to refusal. Engineering logs of the hand auger boreholes, together with peak and remoulded vane shear strengths are presented in ***Appendix B.***
- Dynamic cone (Scala) penetrometer (DCP) tests were carried out within auger boreholes that were refused early to a maximum depth of 2m below the base of the borehole to provide soil density profiles and investigate interface with rock material. Graphical results of the DCP testing are presented on respective borehole logs in ***Appendix B.***

The approximate locations of the respective investigation sites referred to above are shown on the Site Plan (***Drawing 01***). Test locations were measured using a hand-held GPS device.

3.3 Laboratory Testing

Laboratory testing was carried out generally in accordance with the requirements of NZS4402[4] (where applicable). Two soil samples were taken from site (HA04-18 and HA11-18) during our 2018 investigation. Both these samples were collected near ground surface (between 0.4m and 0.8m depth) and sent to a IANZ accredited soil testing laboratory to determine the expansiveness of the soils (test 2.2 and 2.6).

[1] Edbrooke, S. W. (compiler) 2001: Geology of the Auckland area. Institute of Geological & Nuclear Sciences 1:250 000 geological map 3. 1 sheet +74 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences.

[2] NZ Geotechnical Society (2017) NZ Ground Investigation Specification, Volume 1 – Master Specification

[3] NZ Geotechnical Society (2005), Field Description of Soil and Rock, Guideline for the field classification and description of soil and rock for engineering purposes.

[4] New Zealand Standard NZS4402 (1986), Methods of testing soils for civil engineering purposes.

Results from the expansive soil testing are appended (***Appendix C***) and discussed below. Further expansive soil testing will be carried out on site following site development earthworks to assist with geotechnical completion reporting (GCR).

4 GROUND MODEL

4.1 Published Geology

Published geological maps[5] for the area depict the regional geology as comprising Late Pliocene to Mid Pleistocene alluvial deposits of the Puketoka Formation as illustrated in below.

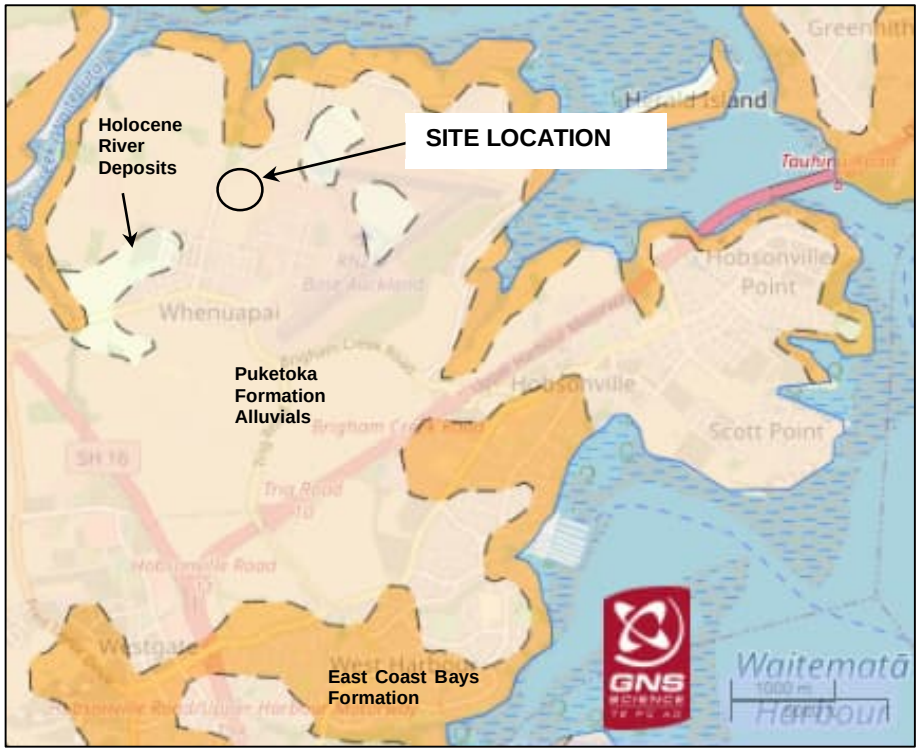


Figure 2: Regional Geology (GNS Science – Geology Web Map 1:250 000)

These alluvial deposits predominantly consist of inorganic clays and silts with occasional inclusions of sand and gravel with muddy peat and lignite, rhyolitic pumice (including non-welded ignimbrite, tephra and alluvial pumice deposits) and massive micaceous sand beds. Below these upper soil layers, the deeper geological formation is reported to comprise, interbedded muddy sandstones and siltstones of the East Cast Bays Formation within the Waitemata Group.

The main geotechnical hazards likely to be encountered within Puketoka Formation are low bearing capacity and settlement of soft/organic soils.

4.2 Stratigraphic Units

The ground conditions encountered and inferred from the investigation were considered to be generally consistent with the published geology for the area and our previous site investigations. These can be generalised according to the following subsurface sequences.

The distribution of the various units encountered is presented in the appended Geological Sections on ***Drawings 02 and 03***.

[5] Edbrooke, S. W. (compiler) 2001: Geology of the Auckland area. Institute of Geological & Nuclear Sciences 1:250 000 geological map 3. 1 sheet +74 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences.

4.2.1 Topsoil / Fill

Topsoil generally consisting of dark brown silt was encountered in the majority of the hand augers up to 400mm depth.

Isolated lenses of uncontrolled fill were encountered in HA04-22, HA05-22, and HA19-22 to a depth of up to 600mm below ground level.

4.2.2 Puketoka Formation

Residually weathered Puketoka Formation soils were encountered underlying the topsoil and fill in all boreholes across the site and comprised brown to grey streaked orange, stiff to very stiff clays, from 0.2m up to approximately 4.8m depth, overlying grey stiff to hard silt and silty to sandy clays from 0.9m to 5.0m depth.

Thin lenses of organic silt were found to be embedded within these soils in discrete locations across the site.

4.2.3 Recent Alluvium

Recent alluvial deposits comprising, brown and grey, low plasticity silt with minor organic inclusions were encountered in HA11-22 to 1.2m depth below ground surface.

4.2.4 Waitemata Group Transition Zone

Transitional Waitemata Group materials were encountered in several hand augers at depths from approximately 3m to 5m below ground surface, and typically comprised completely to highly weathered ECBF sandstone and mudstone deposits. These deposits were generally recovered as hard and saturated soils.

4.3 Groundwater

Standing groundwater was encountered in several hand auger boreholes drilled during the past and most recent site investigations. Groundwater levels were generally recorded between 0.7m and 4.0m depth below the existing ground level. A summary of the groundwater levels encountered across the site during our most recent site investigation undertaken on 14 October 2022 is presented in Table 1 below.

Table 1: Summary of Groundwater Levels across site

Borehole ID	Groundwater Depth (m bgl)	Borehole ID	Groundwater Depth (m bgl)
HA01-22	4.0	HA15-22	2.9
HA02-22	3.5	HA16-22	1.5
HA03-22	2.5	HA17-22	0.9
HA04-22	3.3	HA18-22	3.2
HA05-22	2.5	HA19-22	1.6
HA07-22	2.9	HA20-22	1.4
HA08-22	2.0	HA21-22	1.5
HA10-22	1.6	HA22-22	2.2
HA11-22	0.7	HA23-22	3.9

HA12-22	2.1	HA24-22	2.8
HA14-22	1.1		

It should be appreciated that the groundwater levels measured during the site investigations may not be representative of the worst-case groundwater conditions given the time of the year these investigations were undertaken. The actual worst-case groundwater levels may be higher following times of heavy or prolonged rainfall and/ or wetter winter conditions.

5 GEOHAZARDS ASSESSMENT

5.1 Context

Section 106 of the Resource Management Act[6] (RMA) requires an assessment of the risk from natural hazards to be carried out when considering the granting of a subdivision consent. S106 RMA specifically states that the assessment must consider the combined effect of the natural hazard likelihood and material damage to land or structures (consequence).

The following sections of this report provide an preliminary assessment of the geohazards relevant to this site and provide the basis for the Natural Hazards Risk Assessment presented in ***Appendix D*** to support a Private Plan Change Application.

5.2 Seismicity

A seismic assessment has been carried out in general accordance with NZGS guidance[7] to calculate the peak horizontal ground acceleration or PGA (a_{max}) as follows:

$$a_{max} = C_{0,1000} \frac{R}{1.3} x\ f\ x\ g$$

Where: $C_{0,1000}$ = unweighted PGA coefficient (for subsoil class C)

R = return period factor given in NZS1170.5, Table 3.5 (for importance level IL2)

f = site response factor subject to subsoil class (for subsoil class C)

g = acceleration due to gravity

The ULS PGA was calculated based on a 50-year design life in accordance with the New Zealand Building Code[8] and importance level (IL) 2 structures. The PGA for the serviceability limit state (SLS) and ultimate limit state (ULS) earthquake scenarios is as follows:

Table 2: Design Peak Ground Acceleration (PGA) for Various Limit States

Limit State	AEP	R	PGA(g)	$Magnitude_{eff}$
SLS	1/25	0.25	0.04	5.9
ULS	1/500	1.0	0.19	6.5
ACCOPS	1/150	0.58	0.10	5.75

Note: SLS = serviceability limit state; ULS = ultimate limit state; ACCOPS = Auckland Council seismic stability case[9], AEP = annual exceedance probability

5.3 Fault Rupture

The site is located in a low seismicity region with the nearest active fault (Wairoa North Fault) located approximately 42 kilometres south-east of the site. The updated National Seismic Hazard Model (NZSM) estimates up to 4% chance of damage resulting from fault rupture to sites in Auckland located up to a distance of 40 kilometres from the source. We therefore consider fault rupture to be low risk.

[6] Resource Management Act (1991), as at 29 October 2019

[7] NZ Geotechnical Society publication "Earthquake geotechnical engineering practice, Module 1: Overview of the standards", (March 2016)

[8] Ministry of Business, Innovation and Employment (1992) NZ Building Code Handbook, Third Edition, Amendment 13 (effective from 14 February 2014)

[9] Auckland Council Code of Practice for Land Development and Subdivision, version 1.6, 24 September 2013, Table 2.C.1

5.4 Liquefaction and Lateral Spreading

In accordance with NZGS guidance[10] the liquefaction susceptibility of the soils at this site has been considered with respect to geological age, soil fabric and soil consistency / density. The vast majority of case history data compiled in empirical charts for liquefaction evaluation come from Holocene deposits or man-made fills[11,12]. Pleistocene aged alluvium (>12,000 years) is also considered to have a very low to low risk of liquefaction[11]. Soils are also classified with respect to their grain size and plasticity to assess liquefaction susceptibility. Based on more recent case histories, there is general agreement that sands, non-plastic silts, gravels and their mixtures form soils that are susceptible to liquefaction. Clays, although they may significantly soften under cyclic loading, do not exhibit liquefaction features, and therefore are not considered liquefiable. Given the majority of soils across the site are >12,000 years old and are plastic, we consider the liquefaction (and lateral spreading) susceptibility to be low.

In addition to this, in accordance with a Level B assessment, we have now reviewed nearby CPTs (deep investigation) on NZGD, these are located some 300m south of the site within the geology. These CPTs show similar soils to the subject site, with residual ECBF soils present to 30m depth. It is noted that some sand mixtures are encountered around 3-4m depth. These are dense and likely to be of Pleistocene age.

Based on the above assessment we have assessed the liquefaction vulnerability as low.

5.5 Slope Stability

The landform is generally near flat with discrete areas of steep slopes near watercourses. As such, the site is considered at low risk of slope instability.

5.6 Load Induced Settlement

The residual Puketoka soils encountered on site generally conform to the definition of ‘good ground’ provided in NZS 3604, with the exception of expansive soils as noted in Section 5.8 below and should be able to sufficiently withstand up to 300kPa ultimate bearing pressures from shallow foundations and roads without undergoing settlement. Notwithstanding this, the presence of localised soft spots and pockets of compressible alluvial soils embedded within the residual soils can affect the overall mechanics of the bearing soils and introduce the risk of differential settlement within structures. The presence of such materials should be confirmed during construction and where possible excavated and replaced with engineered fill. Alternatively, where proposed roads and structures are expected to span over these materials (located at depth), remediation in the form of specifically designed foundation systems and/ or ground improvement techniques (e.g., lime stabilisation of surface soils) may be utilised.

5.7 Pumice Soil Exposure

Trace pumiceous silts were observed in some boreholes and can be commonly associated with other soft and sensitive soils.

Depending on the final development plans, undercutting portions of soft and sensitive soils may be required. The majority of this undercut material can generally be suitable for use as engineered fill once conditioned and blended with more plastic soils (clays).

[10] Earthquake Geotechnical Engineering Practice, Module 3: Identification, assessment and mitigation of liquefaction hazards”, (May 2016)

[11] Seed, H.B. and Idriss, I.M. (1971) *A simplified procedure for evaluating soil liquefaction potential*, Earthquake Engineering Research Centre, Report No. EERC 70-9, University of California

[12] Youd, T.L. and Perkins, D.M. (1978) Mapping liquefaction-induced ground failure potential, *Journal of the Geotechnical Engineering Division,* ASCE, Vol. 104, No. GT4, Proc Paper 13659, p. 433-446

5.8 Expansive Soils

Seasonal shrinking and swelling results in vertical surface ground movement which can cause significant cracking of floor slabs and walls. There have been instances of concrete floors and/ or foundations that have been poured on dry, desiccated subgrades in summer months on expansive soils and have undergone heaving and cracking requiring extensive repairs or re-building once the soil moisture contents have returned to higher levels. This hazard is addressed by a combination of careful foundation design and site preparation.

NZS 3604:2011[13] excludes from the definition of 'good ground', soils with a liquid limit of more than 50% and a linear shrinkage of more than 15% due to their potential to shrink and swell as a result of seasonal fluctuations in water content. For soils exceeding these limits, NZS 3604 references AS 2870[14]. for foundation design advice. However, the November 2019 update of Acceptable Solution B1/AS1[15] provides amendments to NZS 3604 that define a method for testing and classifying the soils and provides foundation designs for specific, simple house configurations across the range of expansive soil conditions.

Nevertheless, there is evidence[16] indicating that the use of the B1/AS1 method of assessment of expansiveness may be inaccurate. Accordingly, our assessments herein have been made in line with our experience, BRANZ Report SR120A[17] and AS2870.

The soil samples collected from the site were tested in a laboratory for linear shrinkage, natural water content, and cone penetration limit (the latter two tests can be correlated to the liquid limit of the soil) and have been used for the classification of the expansive soil class in addition to the visual-tactile method. The laboratory test results are attached in ***Appendix C***, and classification of expansive site class is provided in Section 8**.**

[13] Standards New Zealand (2011) Timber-framed buildings, NZS 3604:2011, NZ Standard

[14] Standards Australia Limited (2011) *Residential slabs and footings*, AS 2870-2011, Australian Standard, NSW

[15] Ministry of Business, Innovation and Employment (2019) *Acceptable Solutions and Verification Methods for NZ Building Code Clause B1 Structure,* B1/AS1, Amendment 19

[16] Rogers, N., McDougall, N., Twose, G., Teal, J. & Smith, T. (2020) The Shrink Swell Test: A Critical Analysis, *NZ Geomechanics News,* Issue 99, pages 66-80.

[17] Fraser Thomas Limited (2008) - Addendum Study Report (BRANZ SR120A), Soil Expansivity in the Auckland Region – Final Report

6 CONCLUSION

Based on our hazard assessment, we consider that the land is suitable for future urban development including infrastructure, having acceptable levels of post-development residual risk from natural hazards.

Any proposed earthworks are to be undertaken in accordance with all relevant standards and documents. The engineering controls required to control existing, latent risks are commonplace works in this terrain that are consistent with those being adopted on adjacent land. Further site investigation and design will need to be undertaken to quantify the geotechnical controls prior to resource consent application and the commencement of any works.

7 CLOSURE

Additional important information regarding the use of your CMW report is provided in the '*Using your CMW Report*' document attached to this report.

This report has been prepared for use by Neil Construction Limited in relation to the Whenuapai Green 98-102 Totara Road, Whenuapai project in accordance with the scope, proposed uses and limitations described in the report. Should you have further questions relating to the use of your report please do not hesitate to contact us.

Where a party other than Neil Construction Limited seeks to rely upon or otherwise use this report, the consent of CMW should be sought prior to any such use. CMW can then advise whether the report and its contents are suitable for the intended use by the other party.

USING YOUR CMW GEOTECHNICAL REPORT

Geotechnical reporting relies on interpretation of facts and collected information using experience, professional judgement, and opinion. As such it generally has a level of uncertainty attached to it, which is often far less exact than other engineering design disciplines. The notes below provide general advice on what can be reasonably expected from your report and the inherent limitations of a geotechnical report.

Preparation of your report

Your geotechnical report has been written for your use on your project. The contents of your report may not meet the needs of others who may have different objectives or requirements. The report has been prepared using generally accepted Geotechnical Engineering and Engineering Geology practices and procedures. The opinions and conclusions reached in your report are made in accordance with these accepted principles. Specific items of geotechnical or geological importance are highlighted in the report.

In producing your report, we have relied on the information which is referenced or summarised in the report. If further information becomes available or the nature of your project changes, then the findings in this report may no longer be appropriate. In such cases the report must be reviewed, and any necessary changes must be made by us.

Your geotechnical report is based on your project's requirements

Your geotechnical report has been developed based on your specific project requirements and only applies to the site in this report. Project requirements could include the type of works being undertaken; project locality, size and configuration; the location of any structures on or around the site; the presence of underground utilities; proposed design methodology; the duration or design life of the works; and construction method and/or sequencing.

The information or advice in your geotechnical report should not be applied to any other project given the intrinsic differences between different projects and site locations. Similarly geotechnical information, data and conclusions from other sites and projects may not be relevant or appropriate for your project.

Interpretation of geotechnical data

Site investigations identify subsurface conditions at discrete locations. Additional geotechnical information (e.g. literature and external data source review, laboratory testing etc) are interpreted by Geologists or Engineers to provide an opinion about a site specific ground models, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist due to the variability of geological environments. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. Interpretation of factual data can be influenced by design and/or construction methods. Where these methods change review of the interpretation in the report may be required.

Subsurface conditions can change

Subsurface conditions are created by natural processes and then can be altered anthropically or over time. For example, groundwater levels can vary with time or activities adjacent to your site, fill may be placed on a site, or the consistency of near surface conditions might be susceptible to seasonal changes. The report is based on conditions which existed at the time of investigation. It is important to confirm whether conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation and use by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. To help avoid misinterpretations, it is important to retain the assistance of CMW to work with other project design professionals who are affected by the contents of your report. CMW staff can explain the report implications to design professionals and then review design plans and specifications to see that they have correctly incorporated the findings of this report.

Your report's recommendations require confirmation during construction

Your report is based on site conditions as revealed through selective point sampling. Engineering judgement is then applied to assess how indicative of actual conditions throughout an area the point sampling might be. Any assumptions made cannot be substantiated until construction is complete. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances from previous assumption, conduct additional tests if required and recommend solutions to problems encountered on site.

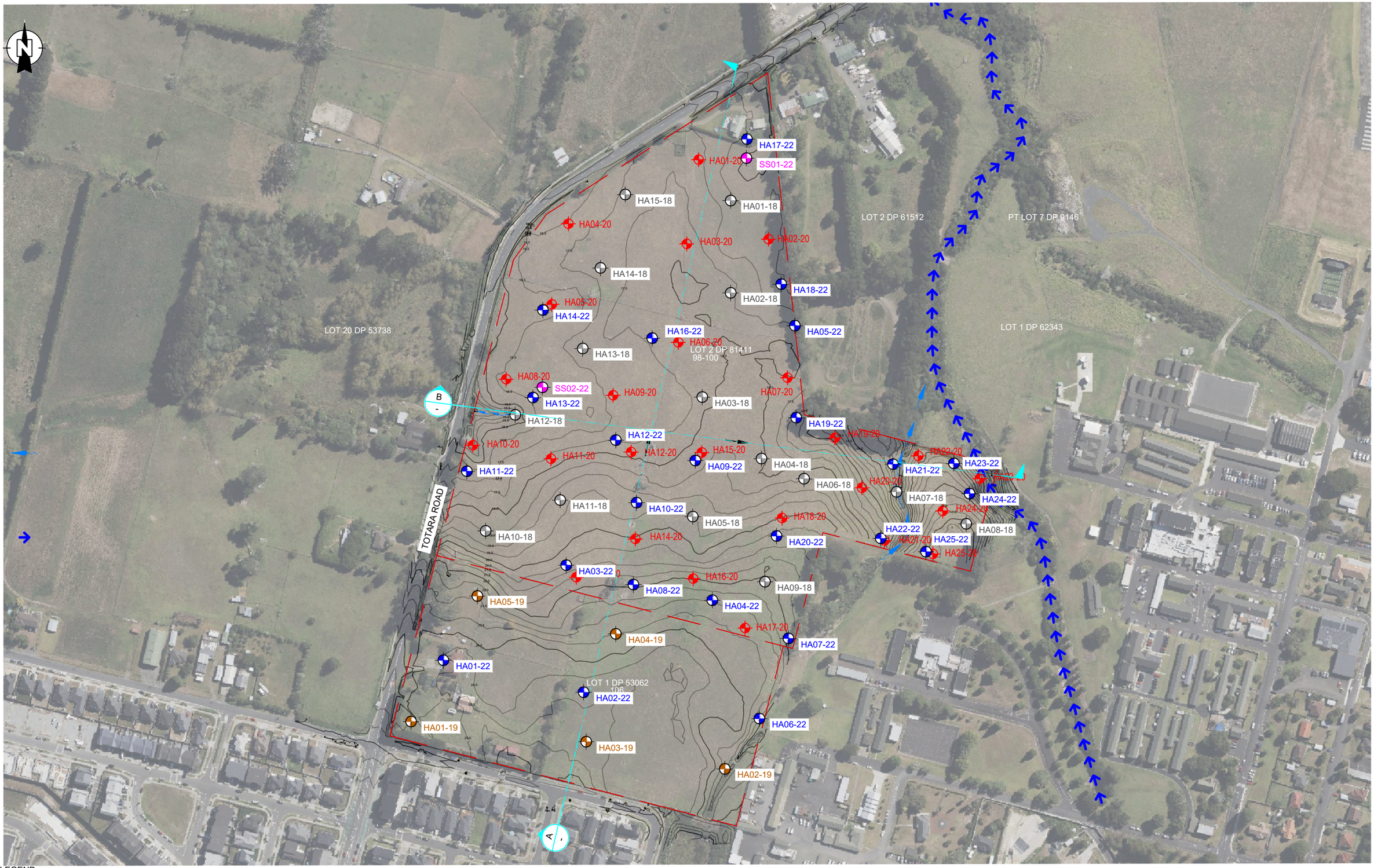
A Geotechnical Engineer, who is fully familiar with the site and the background information, can assess whether the report's recommendations remain valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Environmental Matters Are Not Covered

Unless specifically discussed in your report environmental matters are not covered by a CMW Geotechnical Report. Environmental matters might include the level of contaminants present of the site covered by this report, potential uses or treatment of contaminated materials or the disposal of contaminated materials. These matters can be complex and are often governed by specific legislation.

The personnel, equipment, and techniques used to perform an environmental study can differ significantly from those used in this report. For that reason, our report does not provide environmental recommendations. Unanticipated subsurface environmental problems can have large consequences for your site. If you have not obtained your own environmental information about the project site, ask your CMW contact about how to find environmental risk-management guidance.

Appendix A: Drawings



LEGEND:

HA01-22	HAND AUGER (HA) LOCATION
HA01-19	HAND AUGER (HA) LOCATION
HA01-18	HAND AUGER (HA) LOCATION
HA20-20	HAND AUGER (HA) LOCATION
SS01-22	SOAKAGE TEST LOCATION
	SITE BOUNDARY
	STREAM LINE
	OVERLAND FLOW

NOTES:

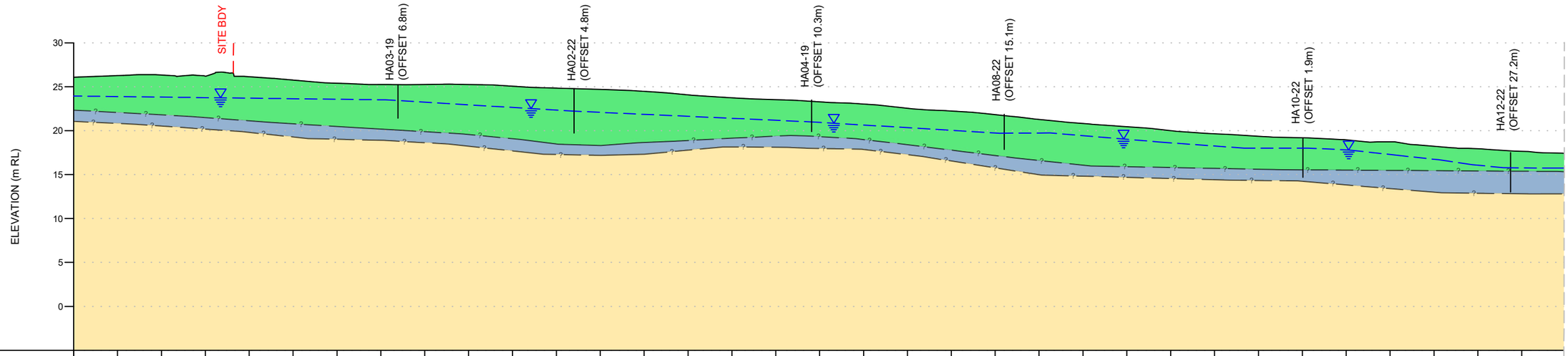
1. BASE PLAN ADAPTED FROM AUCKLAND COUNCIL'S GIS MAP.
2. EXISTING SURVEY DATA RECEIVED FROM NEIL CONSTRUCTION LIMITED.

1:3000 0 30 60 90 120 160 m

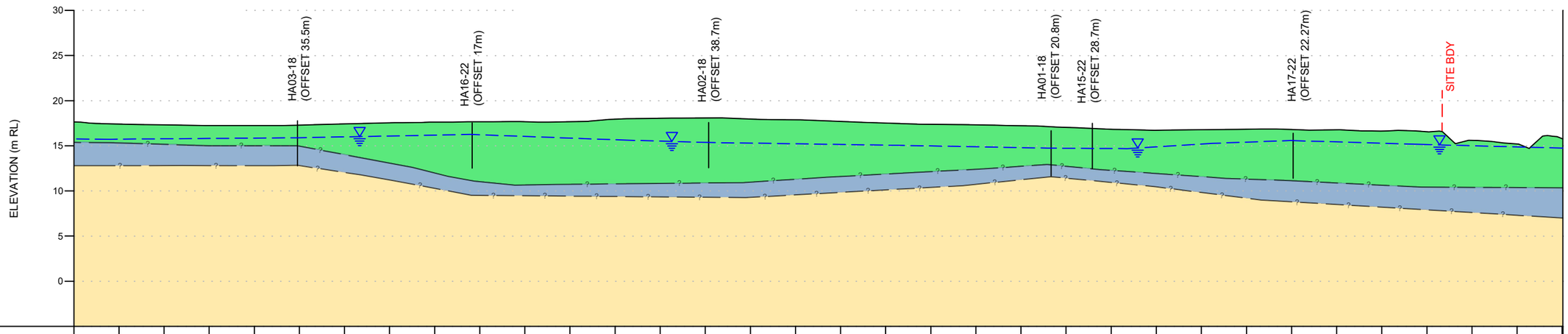
CMW Geosciences

CLIENT: NEIL CONSTRUCTION LIMITED		DRAWN: JS	PROJECT No: AKL2018-0085
PROJECT: 98-100 TOTARA ROAD, WHENUAPAI		CHECKED: HP	FIGURE: 01
		REVISION: 1	SCALE: 1:3000
TITLE: SITE INVESTIGATION PLAN		DATE: 11/03/2024	SHEET: A3

\\CMWGEOSCIENCES.SHAREPOINT.COM@SSL\DAVWWWROOT\SITES\AUCKLANDTEAM\SHARED DOCUMENTS\AUCKLAND PROJECT DOCUMENTS\2018\AKL2018-0085 98-100 TOTARA ROAD. WHENUAPAI\07 DRAWINGS\CAD\2022\AKL2018-0085-SITE INVESTIGATION PLAN.DWG



DISTANCE (m)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340
EXISTING GROUND (m RL)		26.32	26.20	26.13	25.76	25.40	25.25	25.25	25.25	25.05	24.84	24.69	24.47	24.08	23.74	23.53	23.28	23.03	22.56	22.23	21.83	21.28	20.81	20.44	20.00	19.64	19.36	19.20	18.96	18.74	18.23	17.94	17.64	17.42
DESIGN SURFACE (m RL)				26.67	26.70	26.60	24.70	24.70	24.51	24.33	23.70	23.70	22.74	22.74	21.99	22.00	22.00	20.66	20.57	20.40	20.40	20.22	20.31	20.30	19.13	18.89	19.30	19.40	19.38	19.39	19.02	19.00	19.00	19.00



DISTANCE (m)	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660
EXISTING GROUND (m RL)	17.42	17.33	17.25	17.25	17.30	17.42	17.55	17.63	17.66	17.67	17.68	17.95	18.05	18.08	17.97	17.88	17.70	17.52	17.39	17.33	17.23	17.05	16.84	16.73	16.80	16.84	16.82	16.78	16.64	16.57	15.61	15.21	
DESIGN SURFACE (m RL)	19.00	18.40	18.55	18.32	17.89	17.79	17.96	18.13	17.65	17.61	17.61	17.61	17.61	17.61	17.61	17.61	17.61	17.61	17.61	17.61	17.61	17.61	17.48	16.81	16.31	15.96	15.79	15.63	15.80	15.87	15.55	15.23	

LEGEND:

- EXISTING SURFACE
- STANDING GROUNDWATER LEVEL
- PUKETOKA FORMATION SOILS / ALLUVIUM
- WAITEMATA GROUP RESIDUAL SOILS
- WAITEMATA GROUP BEDROCK

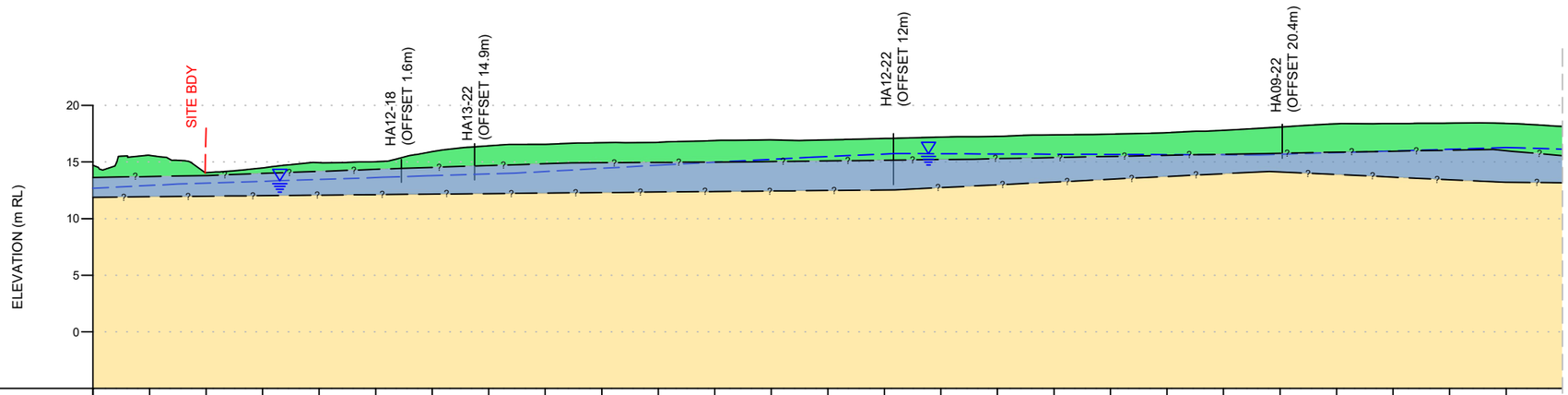
1:500 — 0 5 10 15 20 25 m

1:1000 — 0 10 20 30 40 50 m

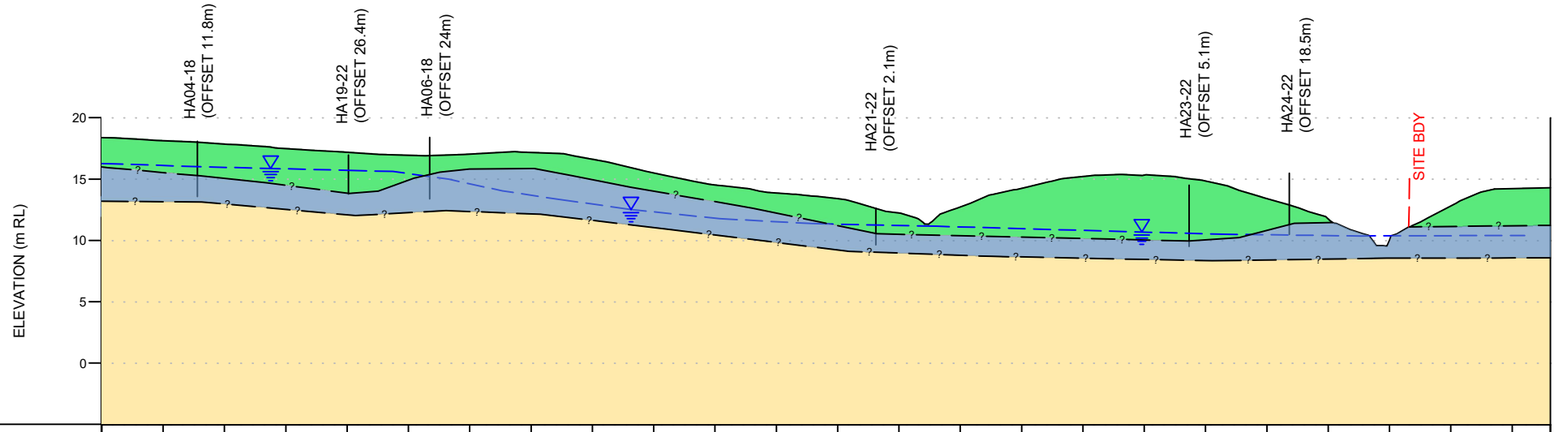
CMW Geosciences

CLIENT: NEIL CONSTRUCTION LIMITED	DRAWN: JS	PROJECT No: AKL2018-0085
PROJECT: 98-100 TOTARA ROAD, WHENUAPAI	CHECKED: HP	FIGURE: 02
	REVISION: 1	SCALE: H 1:1000 V 1:500
TITLE: GEOLOGICAL SECTION-A	DATE: 11/03/2024	SHEET: A3

\\CMWGEOSCIENCES.SHAREPOINT.COM@SSL\DAVWWWROOT\SITES\AUCKLANDTEAM\SHARED DOCUMENTS\AUCKLAND PROJECT DOCUMENTS\2018\AKL2018-0085 98-100 TOTARA ROAD. WHENUAPAI\07 DRAWINGS\CAD\2022\AKL2018-0085-SITE INVESTIGATION PLAN.DWG



DISTANCE (m)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260
EXISTING GROUND (m RL)	15.58	14.05	14.48	14.94	15.03	15.92	16.43	16.56	16.70	16.75	16.90	16.95	16.95	17.08	17.20	17.27	17.39	17.46	17.59	17.79	18.08	18.38	18.39	18.43	18.40	18.15
DESIGN SURFACE (m RL)	15.58	14.05	14.48	14.94	15.03	15.92	16.43	16.56	16.70	16.75	16.90	16.95	16.95	17.08	17.20	17.27	17.39	17.46	17.59	17.79	18.08	18.38	18.39	18.43	18.40	18.15



DISTANCE (m)	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	486
EXISTING GROUND (m RL)	18.15	17.87	17.50	17.20	16.95	17.04	17.19	16.64	15.51	14.53	13.88	13.43	12.25	12.74	14.26	15.22	15.35	14.86	13.42	11.77	10.02	12.83		
DESIGN SURFACE (m RL)	18.15	17.87	17.50	17.20	16.95	17.04	17.19	16.64	15.51	14.53	13.88	13.43	12.25	12.74	14.26	15.22	15.35	14.86	13.42	11.77	10.02	12.83		

LEGEND:

EXISTING SURFACE

STANDING GROUNDWATER LEVEL

PUKETOKA FORMATION SOILS / ALLUVIUM

WAITEMATA GROUP RESIDUAL SOILS

WAITEMATA GROUP BEDROCK

1:1000 0 10 20 30 40 50 m

1:500 0 5 10 15 20 25 m

CMW Geosciences

CLIENT: NEIL CONSTRUCTION LIMITED		DRAWN: JS	PROJECT No: AKL2018-0085
PROJECT: 98-100 TOTARA ROAD, WHENUAPAI		CHECKED: HP	FIGURE: 03
		REVISION: 0	SCALE: H 1:1000 V 1:500
TITLE: GEOLOGICAL SECTION-B		DATE: 11/03/2024	SHEET: A3

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Appendix B: Hand Auger Borehole Logs

HAND AUGER BOREHOLE LOG - HA01-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744061.4mE; 5927382.1mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT : dark brown. Low plasticity. (Topsoil)			
	0.3	Peak = 106kPa Residual = 20kPa				ML: Clayey SILT: orange brown mottled orange. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 176kPa Residual = 86kPa							
	1.0	Peak = 149kPa Residual = 133kPa		1		CH: Silty CLAY: brownish white mottled orange. High plasticity. (Puketoka Formation)			
	1.2	Peak = 156kPa Residual = 76kPa							
	1.6	Peak = 183kPa Residual = 96kPa							
						... at 1.70m, Becoming purpleish grey			
	2.0	Peak = 179kPa Residual = 116kPa		2					
	2.5	Peak = UTP				*... at 2.50m, Becoming light pinkish grey*		VSt	
	3.0	Peak = 123kPa Residual = 93kPa		3					
						... at 3.10m, Iron ataining			
	3.5	Peak = 106kPa Residual = 73kPa				ML: Clayey SILT: light pinkish grey. Low plasticity. (Puketoka Formation)			
13-10-2022	4.0	Peak = 66kPa Residual = 50kPa		4					
	4.5	Peak = 159kPa Residual = 56kPa							
	5.0	Peak = 140kPa Residual = 50kPa		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered 4.0m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA02-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744206.2mE; 5927367.7mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT : dark brown. Low plasticity. (Topsoil)			
	0.3	Peak = 199kPa Residual = 100kPa				ML: Clayey SILT: orange brown mottled orange. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 196kPa Residual = 103kPa							
	0.9	Peak = 199kPa Residual = 113kPa		1		CH: Silty CLAY: brownish white mottled orange. High plasticity. (Puketoka Formation)			
	1.2	Peak = UTP							
						ML: Clayey SILT: light brownish white mottled orange. Low plasticity. (Puketoka Formation)			
	1.6	Peak = 186kPa Residual = 120kPa							
	2.0	Peak = 219kPa Residual = 125kPa		2		CH: Silty CLAY: dark pinkish grey mottled orange. High plasticity. (Puketoka Formation)		VSt to H	
						... at 2.40m, Becoming white.			
	2.5	Peak = UTP							
	3.0	Peak = UTP		3					
13-10-2022	3.5	Peak = 189kPa Residual = 40kPa							
	4.0	Peak = 140kPa Residual = 43kPa		4				VSt	
	4.5	Peak = 149kPa Residual = 90kPa				ML: Clayey SILT: with some fine peat; bluish grey. Low plasticity. (Puketoka Formation)			
	5.0	Peak = 93kPa Residual = 66kPa		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered 3.5m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA03-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744323.5mE; 5927326.2mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: black. (Topsoil)			
	0.3	Peak = >189kPa				CL: Silty CLAY: light brown mottled orange. Low plasticity. (Puketoka Formation)	D to M		
	0.6	Peak = >189kPa							
	0.9	Peak = >189kPa				... at 0.80m, becoming light grey mottled orange.			
	1.2	Peak = >189kPa		1				VSt to H	
	1.6	Peak = 143kPa Residual = 78kPa					M		
	2.0	Peak = 97kPa Residual = 57kPa		2					
13-10-2022	2.4	Peak = 70kPa Residual = 35kPa				... at 2.40m, becoming light grey, orange mottling absent.			
	2.8	Peak = 62kPa Residual = 19kPa				... at 2.80m, contains some small rootlets and black organic silt.			
				3		ML: Sandy SILT: light greyish brown. Low plasticity; sand, fine grained. (Puketoka Formation)			
						... at 2.80m, contains some small rootlets and black organic silt.		St to VSt	
	3.2	Peak = 46kPa Residual = 27kPa					S		
						... at 3.40m, becoming light grey.			
	3.6	Peak = 95kPa Residual = 32kPa							
						... at 3.80m, becoming light bluish grey.			
	4.0	Peak = UTP		4				H	
						Borehole terminated at 4.2 m			3 3 3 4 1 2 4 4
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3239 DCP No: 22
Remarks: Groundwater encountered at 2.4m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA04-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744229.2mE; 5927449.3mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: black. (Topsoil)			
	0.3	Peak = 127kPa Residual = 35kPa				ML: SILT: brown. Non-plastic. (Fill)	D to M		
	0.6	Peak = >189kPa				CL: Silty CLAY: light yellowish brown. Low plasticity. (Puketoka Formation)			
	0.9	Peak = 135kPa Residual = 60kPa		1		... at 0.90m, becoming orange brown.			
	1.2	Peak = UTP							
						... at 1.40m, becoming grey mottled orange, contains some sand, fine to medium.		VSt to H	
	1.6	Peak = UTP				... at 1.60m, sand absent.	M		
	2.0	Peak = UTP		2		... at 2.10m, contains minor fine sand.			
	2.4	Peak = UTP							
	2.8	Peak = 141kPa Residual = 43kPa				ML: Sandy SILT: light grey mottled orange. Low plasticity; sand, fine to medium. (Puketoka Formation)			
14-10-2022				3		... from 2.90m to 3.00m, contains organic silt lens.	W	St to VSt	
	3.2	Peak = 95kPa Residual = 41kPa				... at 3.30m, becoming orange mottled grey.			
	3.6	Peak = 60kPa Residual = 30kPa				CL: Silty CLAY: light grey mottled orange. Low plasticity. (Puketoka Formation)			
						ML: Sandy SILT: light brownish grey. Low plasticity; sand, fine. (Puketoka Formation)			
	4.0	Peak = 46kPa Residual = 24kPa		4			S	F to St	
	4.4	Peak = 62kPa Residual = 27kPa							
	4.8	Peak = 60kPa Residual = 35kPa							
				5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 3239 DCP No:
Remarks: Groundwater encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA05-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744117.6mE; 5927450.8mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: black. (Topsoil)			
	0.3	Peak = 81kPa Residual = 14kPa				ML: SILT: brown. Non-plastic. (Fill)	D to M	St	
						... at 0.40m, becoming brown mottled orange, contains minor clay.			
	0.6	Peak = >189kPa				CL: Silty CLAY: light yellowish brown. Low plasticity. (Puketoka Formation)			
						... at 0.80m, becoming light orange-brown with some bluish grey streaks.			
	0.9	Peak = >189kPa		1					
	1.2	Peak = UTP				... at 1.20m, becoming light bluish grey with orange mottling.	M	H	
	1.6	Peak = UTP							
	2.0	Peak = >189kPa		2		... at 2.00m, contains some sand, fine to medium.			
						ML: Sandy SILT: light grey mottled orange. Low plasticity; sand, fine to medium. (Puketoka Formation)			
						... at 2.20m, contains fine black organic silt lens.			
▼ 14-10-2022	2.4	Peak = 135kPa Residual = 81kPa				... at 2.40m, contains minor clay, sand becoming fine, orange mottling absent.	M to W	St to VSt	
						... at 2.60m, becoming orange, sand is now fine to medium.			
	2.8	Peak = 87kPa Residual = 30kPa							
				3		... at 3.00m, becoming grey mottled orange, sand is fine.			
	3.2	Peak = UTP				CL: Silty CLAY: light bluish grey. Low plasticity. (Puketoka Formation)	S		
						... at 3.40m, becoming dark orange.			
						... at 3.50m, becoming dark purplish brown, contains fine black organic silt lens.			
	3.6	Peak = UTP				... at 3.60m, material is extremely difficult to pull out of auger head.		H	1
									1
									1
									2
				4		Borehole terminated at 4.0 m			2
									3
									4
									5
									9
									11
									11
									18
									16
				5					20

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3239 DCP No: 22
Remarks: Groundwater encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA06-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744358.2mE; 5927384.5mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
	0.3	Peak = 115kPa Residual = 29kPa				OL: Organic SILT: dark brown. Low plasticity. (Topsoil)			
	0.6	Peak = 208kPa Residual = 48kPa				CL: Silty CLAY: greyish brown mottled orange. Low plasticity. (Puketoka Formation)	D to M		
	0.9	Peak = 208kPa Residual = 83kPa		1					
	1.2	Peak = 208kPa Residual = 112kPa							
	1.5	Peak = 224kPa Residual = 109kPa				CL: Sandy SILT: light greyish white. Low plasticity. (Puketoka Formation)			
	1.8	Peak = 208kPa Residual = 112kPa							
	2.1	Peak = 183kPa Residual = 131kPa		2				VSt to H	
	2.4	Peak = 208kPa Residual = 112kPa							
	2.7	Peak = 160kPa Residual = 99kPa					M to W		
	3.0	Peak = 176kPa Residual = 102kPa		3					
	3.3	Peak = 160kPa Residual = 112kPa							
	3.6	Peak = 160kPa Residual = 144kPa							
	3.9	Peak = 130kPa Residual = 49kPa		4					
	4.5	Peak = 208kPa Residual = 160kPa				Borehole terminated at 4.5 m			
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3434 DCP No:
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA07-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744382.7mE; 5927452.2mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. (Topsoil)			
	0.3	Peak = 213kPa Residual = 93kPa				CL: Clayey SILT: brownish grey mottled orange. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 193kPa Residual = 100kPa				CL: Silty CLAY: light grey mottled orange. Low plasticity, moderately sensitive. (Puketoka Formation)			
	0.9	Peak = 216kPa Residual = 100kPa		1					
	1.2	Peak = UTP							
	1.6	Peak = 206kPa Residual = 130kPa				ML: Clayey SILT: with minor fine sand; light greyish brown mottled orange. Low plasticity, Iron stained. (Puketoka Formation)			
	2.0	Peak = 216kPa Residual = 106kPa		2				H	
	2.5	Peak = 203kPa Residual = 66kPa							
14-10-2022	3.0	Peak = >230kPa		3		CL: Gravelly SILT: dark pinkish grey light. Low plasticity. (Puketoka Formation) *... from 2.90m to 3.00m, Dark pinkish grey CLAY* *... from 3.30m to 3.40m, Organic/peat layer*			
	3.5	Peak = 133kPa Residual = 43kPa						VSt	
	4.0	Peak = 70kPa Residual = 47kPa		4		ML: Silty Fine to medium SAND: light grey mottled orange. Low plasticity, moderately sensitive. (Puketoka Formation)		St	
	4.5	Peak = UTP				*... at 4.50m, Becoming blueish grey.*		H	
	5.0	Peak = UTP		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered at 2.9m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA08-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744251.8mE; 5927497.6mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: black. (Topsoil)			
	0.3	Peak = 141kPa Residual = 54kPa				CL: Silty CLAY: light brown mottled dark orange. Low plasticity. (Puketoka Formation)			
	0.6	Peak = >189kPa				... at 0.60m, becoming light grey mottled orange.	M		
	0.9	Peak = >189kPa		1				VSt to H	
	1.2	Peak = UTP							
	1.6	Peak = 119kPa Residual = 68kPa				... at 1.60m, becoming light grey.	M to W		
13-10-2022						... at 1.80m, becoming light brown.			
	2.0	Peak = 100kPa Residual = 70kPa		2					
	2.4	Peak = 65kPa Residual = 30kPa							
	2.8	Peak = 41kPa Residual = 22kPa				... at 2.80m, contains fine black organic silt lens.		F to St	
				3		ML: Sandy SILT: light greyish brown. Low plasticity; sand, fine. (Puketoka Formation)	S		
	3.2	Peak = 60kPa Residual = 35kPa							
	3.6	Peak = 84kPa Residual = 32kPa				... at 3.50m, becoming light greyish brown, contains a fine black organic silt lens.			
						... at 3.80m, contains some small rootlets and a fine black organic silt lens.			
						... at 3.90m, becoming light bluish grey.		H	
	4.0	Peak = UTP		4		Borehole terminated at 4.0 m			1, 1, 2, 2, 2, 3, 4, 5, 6, 4
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3239 DCP No: 22
Remarks: Groundwater encountered at 2m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA09-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744304.2mE; 5927602.4mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. (Topsoil)			
	0.3	Peak = 224kPa Residual = 48kPa				CL: CLAY: brownish grey. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 176kPa Residual = 48kPa							
	0.9	Peak = 141kPa Residual = 48kPa		1					
	1.2	Peak = 176kPa Residual = 64kPa				CH: Silty CLAY: light greyish brown. High plasticity, moderately sensitive. (Puketoka Formation)			
	1.5	Peak = 163kPa Residual = 90kPa					M	VSt to H	
	1.8	Peak = 144kPa Residual = 61kPa							
	2.1	Peak = 160kPa Residual = 74kPa		2					
	2.4	Peak = UTP				ML: Sandy SILT: light grey. Low plasticity, moderately sensitive. (Puketoka Formation)			
	2.7	Peak = UTP							
	3.0	Peak = UTP		3		Borehole terminated at 3.0 m		D to VD	9, 13, 9, 7, 9, 10, 14, 17, 19, 20
				4					
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3434 DCP No: 22
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA10-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744254.5mE; 5927566.9mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. (Topsoil)			
	0.3	Peak = 150kPa Residual = 35kPa							
						CL: Silty CLAY: brownish grey. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 109kPa Residual = 32kPa							
	0.9	Peak = 150kPa Residual = 35kPa		1					
	1.2	Peak = 160kPa Residual = 64kPa					M to W		
13-10-2022	1.5	Peak = 141kPa Residual = 54kPa						VSt	
	1.8	Peak = 128kPa Residual = 42kPa							
	2.1	Peak = 112kPa Residual = 51kPa		2					
	2.4	Peak = 96kPa Residual = 51kPa				... at 2.40m, Poor recovery		St	
	2.7	Peak = 224kPa Residual = 48kPa							
	3.0	Peak = 141kPa Residual = 54kPa		3				VSt to H	
	3.3	Peak = 138kPa Residual = 64kPa					S		
	3.6	Peak = 144kPa Residual = 112kPa							
	3.9	Peak = 125kPa Residual = 80kPa		4					
	4.2	Peak = 224kPa Residual = 160kPa				ML: Sandy SILT: light grey. Low plasticity. (Puketoka Formation)			
	4.5					Borehole terminated at 4.5 m		D	9, 11, 13, 12, 17
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3434 DCP No: 22
Remarks: Groundwater encountered at 1.6m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA11-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744111.1mE; 5927593.4mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
13-10-2022 ▼						OL: Organic SILT: brownish black. (Topsoil)			
	0.3	Peak = 54kPa Residual = 14kPa				ML: SILT: with some clay; brown. Low plasticity. (Puketoka Formation)	M to W		
						... at 0.40m, becoming silty clay.			
	0.6	Peak = 41kPa Residual = 5kPa					W to S		
	0.9	Peak = 49kPa Residual = 5kPa		1				F to St	
	1.2	Peak = 97kPa Residual = 19kPa							
						... from 1.40m to 1.60m, contains some black organic silt.			
	1.6	Peak = UTP				... at 1.60m, becoming greyish brown with orange spots.	S		
						ML: Sandy SILT: bluish grey. Non-plastic; sand, fine. (Puketoka Formation)			
	2.0	Peak = UTP		2				H	
						... at 2.20m, contains small rootlets and green fibrous plant material.			
	2.4	Peak = UTP				... at 2.40m, low recovery.			
						Borehole terminated at 2.5 m			
				3					
				4					
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3239 DCP No:
Remarks: Groundwater encountered at 0.8m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA12-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744237.0mE; 5927619.6mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. (Topsoil)			
	0.3	Peak = 141kPa Residual = 19kPa							
						CL: CLAY: brownish grey. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 144kPa Residual = 64kPa							
	0.9	Peak = 141kPa Residual = 48kPa		1					
						CH: Silty CLAY: light greyish brown. High plasticity, moderately sensitive. (Puketoka Formation)	M		
	1.2	Peak = 125kPa Residual = 67kPa							
	1.5	Peak = 144kPa Residual = 48kPa							
	1.8	Peak = 138kPa Residual = 51kPa				CH: Sandy CLAY: light brown. High plasticity, moderately sensitive. (Puketoka Formation)			
13-10-2022	2.1	Peak = 176kPa Residual = 61kPa		2				VSt to H	
	2.4	Peak = UTP				ML: Sandy SILT: light grey. Low plasticity. (Puketoka Formation)			
	2.7	Peak = UTP							
	3.0	Peak = UTP		3					
	3.3	Peak = UTP					W		
	3.6	Peak = UTP							
	3.9	Peak = UTP							
	4.2	Peak = UTP		4					
	4.5	Peak = UTP				Borehole terminated at 4.5 m		D	11, 18, 15, 7, 15, 17
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3434 DCP No: 22
Remarks: Groundwater encountered at 2.1m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA13-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744167.0mE; 5927655.6mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. (Topsoil)			
	0.3	Peak = 115kPa Residual = 32kPa				CL: CLAY: brownish grey. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 128kPa Residual = 32kPa						VSt	
	0.9	Peak = 93kPa Residual = 29kPa		1					
	1.2	Peak = 96kPa Residual = 32kPa							
	1.5	Peak = 80kPa Residual = 35kPa					M to W	St	
	1.8	Peak = 80kPa Residual = 32kPa							
	2.1	Peak = UTP		2		ML: Sandy SILT: with minor siltstone; light grey. Low plasticity, moderately sensitive. (Puketoka Formation)			
	2.4	Peak = UTP							
	2.7	Peak = UTP						H	
	3.0	Peak = UTP		3					
						Borehole terminated at 3.2 m			3 4 4 6 8 7
								MD to D	10 10 11 12 13 20
				4					
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3434 DCP No: 906
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA14-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744176.4mE; 5927729.1mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
13-10-2022 ▼	0.3	Peak = 144kPa Residual = 45kPa		0		OL: Organic SILT: dark brown. (Topsoil)			
	0.6	Peak = 192kPa Residual = 77kPa				CL: Silty CLAY: light grey. Low plasticity, moderately sensitive. (Puketoka Formation)	M	VSt	
	0.9	Peak = 160kPa Residual = 74kPa		1					
	1.2	Peak = 102kPa Residual = 45kPa							
	1.5	Peak = 128kPa Residual = 48kPa							
	1.8	Peak = 99kPa Residual = 51kPa							
	2.1	Peak = 96kPa Residual = 32kPa		2		ML: Sandy SILT: light grey. Low plasticity, moderately sensitive. (Puketoka Formation)		St to VSt	
	2.4	Peak = 128kPa Residual = 51kPa							
	2.7	Peak = 157kPa Residual = 58kPa				*... from 2.70m to 3.00m, Poor recovery*			
	3.0	Peak = 192kPa Residual = 48kPa		3		CL: Silty CLAY: light grey mottled light brown. Low plasticity, moderately sensitive. (Puketoka Formation)	W		
	3.3	Peak = 205kPa Residual = 45kPa				ML: Sandy SILT: light grey. Low plasticity, moderately sensitive. (Puketoka Formation)			
	3.6	Peak = 224kPa Residual = 54kPa							
	3.9	Peak = 224kPa Residual = 48kPa		4				H	
	4.2	Peak = UTP							
	4.5	Peak = UTP							
	4.8	Peak = UTP							
				5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 3434 DCP No:
Remarks: Groundwater encountered at 1.1m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA15-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744287.9mE; 5927842.2mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT : dark brown. Low plasticity. (Topsoil)			
	0.3	Peak = 179kPa Residual = 76kPa				ML: Clayey SILT: orange brown mottled orange. Low plasticity. (Puketoka Formation)			
	0.6	Peak = >230kPa Residual = 90kPa				... at 0.70m, Becoming light yellowish brown.			
	0.9	Peak = 203kPa Residual = 106kPa		1		CH: Silty CLAY: brownish white mottled orange. High plasticity. (Puketoka Formation)			
	1.2	Peak = 169kPa Residual = 96kPa					M		
	1.6	Peak = 159kPa Residual = 66kPa							
	2.0	Peak = 159kPa Residual = 83kPa		2		... from 2.00m to 2.30m, Minor fine to coarse sand.			
	2.5	Peak = 130kPa Residual = 75kPa				... from 2.50m to 2.70m, Becoming orangeish brown.		VSt to H	
13-10-2022							M to W		
	3.0	Peak = 100kPa Residual = 53kPa		3					
	3.5	Peak = 146kPa Residual = 83kPa				... at 3.50m, Becoming grey.			
	4.0	Peak = 206kPa Residual = 33kPa		4			S		
						ML: Clayey SILT: grey. Low plasticity. (Puketoka Formation)			
	4.5	Peak = 226kPa Residual = 75kPa							
						ML: SILT: grey. Low plasticity. (Puketoka Formation)			
	5.0	Peak = UTP		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered at 2.9m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA16-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744267.7mE; 5927705.7mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT : dark brown. Low plasticity. (Topsoil)			
	0.3	Peak = >230kPa Residual = 63kPa				ML: SILT: brown orange. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 216kPa Residual = 96kPa				*... at 0.50m, Becoming greyish brown mottled orange.*		H	
	0.9	Peak = 153kPa Residual = 63kPa				ML: Clayey SILT: light greyish brown. Low plasticity. (Puketoka Formation)			
				1					
13-10-2022	1.2	Peak = 120kPa Residual = 28kPa						VSt	
						... at 1.50m, Becoming iron stained.			
	1.6	Peak = 66kPa Residual = 25kPa							
	2.0	Peak = 83kPa Residual = 43kPa		2					
	2.5	Peak = 100kPa				ML: Sandy SILT: light greyish brown. Low plasticity, Iron stained. (Puketoka Formation)			
	3.0	Peak = 133kPa Residual = 40kPa		3				St to VSt	
	3.5	Peak = 159kPa Residual = 76kPa				ML: SILT: grey. Low plasticity. (Puketoka Formation)			
	4.0	Peak = 183kPa Residual = 40kPa		4					
	4.5	Peak = UTP							
						... at 4.70m, Trace fine sand,		VSt to H	
	5.0	Peak = 174kPa		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered at 1.5m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA17-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744347.7mE; 5927873.9mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
14-10-2022						OL: Organic SILT: dark brown. Low plasticity. (Topsoil)			
	0.3	Peak = 160kPa Residual = 74kPa				CH: Silty CLAY: greyish brown mottled orange. High plasticity. (Puketoka Formation)	M to W	VSt	
	0.6	Peak = 176kPa Residual = 80kPa							
	0.9	Peak = 176kPa Residual = 29kPa		1					
	1.2	Peak = 160kPa Residual = 26kPa							
	1.5	Peak = 176kPa Residual = 80kPa							
	1.8	Peak = 160kPa Residual = 96kPa							
	2.1	Peak = 144kPa Residual = 99kPa		2					
	2.4	Peak = 128kPa Residual = 67kPa							
	2.7	Peak = 96kPa Residual = 61kPa						St	
	3.0	Peak = 112kPa Residual = 64kPa		3		ML: Sandy SILT: light greyish white. Low plasticity. (Puketoka Formation)	W		
	3.3	Peak = 125kPa Residual = 48kPa							
	3.6	Peak = 128kPa Residual = 67kPa							
	3.9	Peak = 144kPa Residual = 80kPa				ML: Sandy SILT: light grey. Low plasticity, Iron stained. (Puketoka Formation)		VSt to H	
	4.2	Peak = 160kPa Residual = 99kPa		4					
	4.5	Peak = 176kPa Residual = 131kPa							
	4.8	Peak = UTP							
				5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 3434 DCP No:
Remarks: Groundwater encountered at 0.9m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA18-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744376.6mE; 5927751.3mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. (Topsoil)	D to M		
	0.3	Peak = 60kPa Residual = 23kPa				CL: Clayey SILT: with trace fine to coarse sand; orange brown. Low plasticity. (Puketoka Formation)	M to W	St	
	0.6	Peak = 143kPa Residual = 13kPa							
	0.9	Peak = 146kPa Residual = 70kPa							
				1		CL: Silty CLAY: light brownish grey mottled orange. Low plasticity, moderately sensitive. (Puketoka Formation)			
	1.2	Peak = UTP				... at 1.30m, Becoming light brownish white mottled orange.			
	1.6	Peak = 163kPa Residual = 70kPa				ML: SILT: with some clay; light brownish white mottled orange. Low plasticity. (Puketoka Formation)			
	2.0	Peak = 209kPa Residual = 123kPa		2			W		
	2.5	Peak = 209kPa Residual = 116kPa				CL: CLAY: sandy silt; greyish brown mottled orange. Low plasticity, Some pink mottles. (Puketoka Formation)		VSt to H	
						ML: Clayey SILT: greyish brown. Low plasticity, Iron stained. (Puketoka Formation)			
14-10-2022	3.0	Peak = 189kPa Residual = 103kPa		3					
						ML: Sandy SILT: light grey mottled orange. Low plasticity, moderately sensitive. (Puketoka Formation)			
	3.5	Peak = 169kPa Residual = 90kPa							
	4.0	Peak = 169kPa Residual = 56kPa		4			S		
	4.5	Peak = 130kPa Residual = 83kPa				ML: Sandy SILT: bluish grey. Low plasticity. (Waitemata Group)			
	5.0	Peak = UTP		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered at 3.2

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA19-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744389.3mE; 5927638.6mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: black. (Topsoil)	D to M		
	0.3	Peak = UTP				ML: SILT: brown. Non-plastic. (Fill)		H	
						ML: SILT: with minor clay; orange brown. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 138kPa Residual = 54kPa				CL: Silty CLAY: orange brown. Low plasticity. (Puketoka Formation)			
	0.9	Peak = 92kPa Residual = 32kPa						VSt to St	
				1		... at 1.00m, becoming lighter yellow-orange brown.	M		
	1.2	Peak = >189kPa				... at 1.20m, becoming light greyish brown mottled orange.			
						... at 1.40m, contains some sand, fine.			
13-10-2022	1.6	Peak = >189kPa				ML: Sandy SILT: light greyish brown mottled orange. Low plasticity; sand, fine to medium. (Puketoka Formation)		H	
	2.0	Peak = UTP		2		... at 2.00m, still sandy silt, sand becoming fine to coarse.			
						... at 2.20m, contains minor siltstone fine.			
	2.4	Peak = 78kPa Residual = 14kPa					S		
	2.8	Peak = 154kPa Residual = 35kPa				ML: Sandy SILT: with minor fine gravel; light grey mottled orange. Low plasticity; sand, fine. (Puketoka Formation)		St to VSt	
				3		... at 3.00m, becoming grey with white mottling. Contains some fine to medium gravel.			
	3.2	Peak = UTP				Borehole terminated at 3.2 m			3
				4					4
									4
									4
									6
									7
									6
									6
									7
									9
									10
									10
									11
									10
									12
									16
				5					16

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3239 DCP No: 22
Remarks: Groundwater encountered at 1.6m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA20-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744372.8mE; 5927538.7mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: black. (Topsoil)			
	0.3	Peak = >189kPa				CL: Silty CLAY: with some fine sand; brown mottled orange. Low plasticity. (Puketoka Formation)			
						... at 0.40m, becoming light brownish grey mottled orange, sand absent.	M		
	0.6	Peak = >189kPa						H	
	0.9	Peak = 122kPa Residual = 43kPa				*... at 0.90m, becoming light grey mottled orange.*			
14-10-2022	1.2	Peak = UTP		1			W		
	1.6	Peak = 68kPa Residual = 22kPa							
	2.0	Peak = 106kPa Residual = 51kPa		2		ML: Sandy SILT: light grey mottled orange. Non-plastic, sand, fine. (Puketoka Formation)		St to VSt	
	2.4	Peak = UTP				*... at 2.40m, becoming light bluish grey mottled orange.*	S		
	2.8	Peak = >189kPa				CL: Silty CLAY: with minor fine sand; bluish grey mottled orange. Low plasticity. (Puketoka Formation)			
				3		*... at 3.00m, orange mottling absent.*		H	
	3.2	Peak = UTP				ML: Sandy SILT: bluish grey. Non-plastic, sand, fine. (Puketoka Formation)			
	3.6	Peak = UTP							
						Borehole terminated at 3.7 m			3
				4					5
									4
									5
									10
									11
									14
									15
									15
									15
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3239 DCP No: 22
Remarks: Groundwater encountered at 1.4m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA21-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: EM Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744471.0mE; 5927599.3mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
14-10-2022	0.3	Peak = >189kPa		0		OL: Organic SILT: black. (Topsoil)			
	0.6	Peak = >189kPa				CL: Silty CLAY: brown mottled orange. Low plasticity. (Puketoka Formation)	M		
	0.9	Peak = >189kPa				... at 0.80m, becoming grey mottled orange.			
	1.2	Peak = UTP		1					
	1.6	Peak = 116kPa Residual = 43kPa				ML: Sandy SILT: light grey mottled orange. Low plasticity; sand, fine. (Puketoka Formation)			
						CL: Silty CLAY: light bluish grey mottled orange. Low plasticity. (Puketoka Formation)			
	2.0	Peak = UTP		2		ML: Sandy SILT: light grey mottled orange. Low plasticity; sand, fine. (Puketoka Formation)			
						... at 2.20m, becoming bluish grey mottled orange.	S		
	2.4	Peak = UTP				CL: Silty CLAY: bluish grey mottled orange. Low plasticity. (Puketoka Formation)			
						ML: Sandy SILT: bluish grey mottled orange. Low plasticity; sand, fine. (Puketoka Formation)			
	2.8	Peak = UTP				... at 2.90m, becoming bluish grey, orange mottling absent.			3
				3		Borehole terminated at 3.0 m			6
									7
									6
									8
									9
									8
									12
									13
									16
				4					15
									15
				5					

Dynamic Cone Penetrometer (Blows/100mm): 5 10 15

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3239 DCP No: 22
Remarks: Groundwater encountered at 1.5

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA22-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 13/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744460.7mE; 5927536.6mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT : dark brown. Low plasticity. (Topsoil)			
	0.3	Peak = UTP				ML: Sandy SILT: orange brown orange. Low plasticity. (Puketoka Formation)			
	0.6	Peak = >230kPa Residual = 116kPa				*... at 0.50m, Becoming blueish grey, iron stained*			
	0.9	Peak = UTP		1				H	
						... at 1.10m, Becoming lighter grey.	M		
	1.6	Peak = 126kPa Residual = 66kPa							
13-10-2022	2.0	Peak = 126kPa Residual = 47kPa		2		ML: Clayey SILT: with minor fine sand; light greyish brown mottled orange. Low plasticity. (Waitemata Group)			
	2.5	Peak = 149kPa Residual = 83kPa							
	3.0	Peak = UTP		3		ML: Sandy SILT: grey. Low plasticity. (Waitemata Group)		VSt to H	
	3.5	Peak = UTP					S		
	4.0	Peak = UTP		4					
	4.5	Peak = UTP							
	5.0	Peak = UTP		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered at 2.2m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA23-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744522.6mE; 5927600.0mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. Low plasticity. (Topsoil)			
	0.3	Peak = 189kPa Residual = 48kPa				CL: CLAY: brown. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 224kPa Residual = 128kPa				ML: SILT: with some fine sand; grey. Low plasticity. (Puketoka Formation)			
	0.9	Peak = 192kPa Residual = 112kPa		1					
	1.2	Peak = 224kPa Residual = 128kPa							
	1.5	Peak = 224kPa Residual = 128kPa							
	1.8	Peak = 208kPa Residual = 80kPa					M to W		
	2.1	Peak = 176kPa Residual = 64kPa		2		ML: Sandy SILT: light greyish white. Low plasticity. (Puketoka Formation)			
	2.4	Peak = 192kPa Residual = 32kPa							
	2.7	Peak = 208kPa Residual = 61kPa						VSt to H	
	3.0	Peak = 208kPa Residual = 61kPa		3					
	3.3	Peak = 224kPa Residual = 80kPa							
	3.6	Peak = 224kPa Residual = 112kPa							
14-10-2022	3.9	Peak = 224kPa Residual = 96kPa		4					
	4.2	Peak = 224kPa Residual = 64kPa							
	4.5	Peak = UTP					W		
				5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 3434 DCP No:
Remarks: Groundwater encountered at 3.9m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA24-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: OP Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744535.8mE; 5927574.5mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Depth	Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. (Topsoil)	D to M		
	0.3	Peak = >230kPa				ML: Clayey SILT: with trace fine to coarse sand; orange brown. Low plasticity. (Puketoka Formation)			
	0.6	Peak = 153kPa Residual = 33kPa				CL: Silty CLAY: light brownish grey mottled orange. Low plasticity, moderately sensitive. (Puketoka Formation)		H	
	0.9	Peak = 176kPa Residual = 47kPa							
				1		CL: Clayey SILT: with minor fine sand; light brownish grey. Low plasticity, Iron staining between 1m and 1.5m. (Puketoka Formation)			
	1.2	Peak = 216kPa Residual = 73kPa							
	1.6	Peak = 216kPa Residual = 90kPa					M to W		
	2.0	Peak = 173kPa Residual = 66kPa		2					
						... at 2.20m, Becoming iron stained			
14-10-2022	2.5	Peak = 179kPa Residual = 53kPa						VSt to H	
	3.0	Peak = 166kPa Residual = 73kPa		3					
	3.5	Peak = 173kPa Residual = 63kPa				ML: Sandy SILT: light orange grey. Low plasticity. (Puketoka Formation)			
						ML: Clayey SILT: greyish brown. Low plasticity, Iron stained. (Puketoka Formation)	S		
	4.0	Peak = 209kPa		4		ML: Sandy SILT: bluish grey. Low plasticity. (Waitemata Group)			
	4.5	Peak = UTP							
	5.0	Peak = UTP		5		Borehole terminated at 5.0 m			

Termination Reason: Target depth
Shear Vane No: 2087 DCP No:
Remarks: Groundwater encountered 2.8m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA25-22

Client: Neil Construction Limited
Project: 98-100 Totara Road, Whenuapai
Site Location: Whenuapai
Project No.: AKL2018-0085
Date: 14/10/2022
Borehole Location: See site plan Logged by: PT Checked by: JW Scale: 1:25 Sheet 1 of 1

Position: 1744499.0mE; 5927525.5mN Projection: NZTM
Datum: AUCKHT1946 Survey Source: pLog Tablet

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
	0.3	Peak = 173kPa Residual = 48kPa				OL: Organic SILT: dark brown. Low plasticity. (Topsoil)			
	0.6	Peak = 192kPa Residual = 64kPa				CL: Silty CLAY: greyish brown mottled orange. Low plasticity. (Puketoka Formation)		VSt to H	
	0.9	Peak = 179kPa Residual = 61kPa		1					
	1.2	Peak = 192kPa Residual = 83kPa				ML: Sandy SILT: grey. Low plasticity. (Waitemata Group)			
	1.5	Peak = 224kPa Residual = 83kPa				Borehole terminated at 1.7 m		D to VD	6, 9, 9, 9, 11, 7, 9, 10, 11, 15, 12, 20
				2					
				3					
				4					
				5					

Termination Reason: Equipment refusal due to hard ground
Shear Vane No: 3434 DCP No: 22
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

Appendix C: Laboratory Test Results

ROADTEST LTD

Revision: 1

DETERMINATION OF THE LIQUID LIMIT & LINEAR SHRINKAGE
TEST METHOD NZS 4402 : 1986 TEST 2.2 & 2.6

Project Name : **98-100 Totara Ave**

Client : CMW Geosciences Ltd
Address : 9 Piermark Drive
Albany

Attention : J.Walden

Project No : 18 0160 00
Page : 1 of 1
Date of Order : 15/05/2018

Sample Method : Handauger
Sample Date : 14/05/2018
Sampled By : JW

Sample No.	Location	Depth (m)	Liquid Limit	Linear Shrinkage	Natural Water Content (%)
803G	HA04-18	0.4-0.8m	67	18	35.4
804G	HA11-18	0.4-0.8m	58	16	34.5

Comments :

Tested By:	SN	Date :	17.05.18
Calculated By :	EC	Date :	19.05.18
Checked By :	EC	Date :	21.05.18

Appendix D: Natural Hazards Risk Assessment

NATURAL HAZARDS RISK ASSESSMENT FOR LAND SUBDIVISION WHENUAPAI GREEN, 98-102 TOTARA ROAD, WHENUAPAI

A. CONTEXT

Section 106 of the Resource Management Act (RMA) requires an assessment of the risk from natural hazards to be carried out when considering the granting of a subdivision consent. S106 RMA specifically states that the assessment must consider the combined effect of the natural hazard likelihood and material damage to land, other land or structures (consequence).

Section 2 of the RMA defines natural hazards as any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.

This appendix to CMW report reference AKL2018-0085AF Rev 1 sets out the criteria for and presents the results of an assessment of the geotechnical-related natural hazards associated with this proposed subdivision development. The remaining hazards, i.e. tsunami, wind, drought, fire and flooding hazards are not covered by this assessment.

B. BASIS OF ASSESSMENT

B.1. Risk Classification

The occurrence of natural hazards and their potential impacts on the proposed subdivision development is assessed in terms of risk significance, which is based on likelihood and consequence factors. A risk table is used to help assess the likelihood and consequence factors, the form of which used by CMW for this project is presented in Table B1.

Table B1: Natural Hazard Risk Classification

Risk Matrix		Consequence				
		Insignificant 1	**Minor 2**	**Moderate 3**	**Major 4**	**Catastrophic 5**
Likelihood	**Almost Certain 5**	Medium 5	High 10	Very high 15	Extreme 20	Extreme 25
	Likely 4	Low 4	Medium 8	High 12	Very high 16	Extreme 20
	Moderate 3	Low 3	Medium 6	Medium 9	High 12	Very high 15
	Unlikely 2	Very low 2	Low 4	Medium 6	Medium 8	High 10
	Rare 1	Very low 1	Very low 2	Low 3	Low 4	Medium 5

B.2. Likelihood

With respect to assessing the likelihood or chance of the risk occurring, the qualitative definitions used by CMW for this project are provided in Table B2 for each likelihood classification.

Table B2: Qualitative Natural Hazard Likelihood Definitions		
1	Rare	The natural hazard is not expected to occur during the design life of the project
2	Unlikely	The natural hazard is unlikely, but may occur during the design life
3	Moderate	The natural hazard will probably occur at some time during the life of the project
4	Likely	The natural hazard is expected to occur during the design life of the project
5	Almost Certain	The natural hazard will almost definitely occur during the design life of the project

B.3. Consequence

In terms of determining the consequence or severity of the natural hazard occurring, the qualitative definitions used by CMW for this project are provided in Table B3 for each consequence classification.

Table B3: Qualitative Natural Hazard Consequence Definitions		
1	Insignificant	Very minor to no damage, not requiring any repair, no people at risk, no economic effect to landowners.
2	Minor	Minor damage to land only, any repairs can be considered normal property maintenance no people at risk, very minor economic effect.
3	Moderate	Some damage to land requiring repair to reinstate within few months, minor cosmetic damage to buildings being within relevant code tolerances, does not require immediate repair, no people at risk, minor economic effect.
4	Major	Significant damage to land requiring immediate repair, damage to buildings beyond serviceable limits requiring repair, no collapse of structures, perceptible effect to people, no risk to life, considerable economic effect.
5	Catastrophic	Major damage to land and buildings, possible structure collapse requiring replacement, risk to life, major economic effect, or possible site abandonment.

B.4. Risk Acceptance

It is recognised that the natural hazard risk assessment provided herein is qualitative and, due to the wide range of possible geohazards that could occur, is somewhat subjective. Other methods are available to quantitatively assess an acceptable level of geotechnical related natural hazard risk, such as defining an acceptable factor of safety with respect to slope stability or acceptable differential ground settlements with respect to recommended building code limits.

Therefore, to give this qualitative natural hazard risk assessment some relevance to more commonly adopted numerical or quantitative geotechnical assessment techniques, a residual risk rating of very low to medium (risk value = 1 to 9 inclusive) is considered an acceptable result for the proposed subdivision development.

A risk rating of high to extreme (risk value ≥ 10) is considered an unacceptable result for the proposed subdivision development.

C. RISK ASSESSMENT

The natural hazards relevant to this proposed subdivision development and adjacent, potentially affected land have been assessed with respect to the criteria outlined above.

Assessment is based on proposed post development ground conditions with and without any geotechnical controls. The latent risk was first assessed with the site in its proposed developed state to consider the risks to the development and surrounding land, including assessment of land modifications from the pre-existing natural state, without any implemented geotechnical controls. The specific geotechnical mitigation measures and engineering design solutions outlined in the table below and CMW report, where relevant, were then considered to determine the natural hazard residual risk remaining after the proposed controls have been implemented.

Results of this assessment are presented in Table C1 below.

Table C1: Natural Hazard Risk Assessment Results

RMA S2 Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Earthquake	Fault Rupture	1	5	Medium 5	Nearest active fault is approximately 80km away. Located in a low seismicity region	1	5	Medium 5
	Liquefaction Induced Flooding and/ or Subsidence	1	4	Low 4	Liquefaction risk assessed as not significant based on age and soil fabric criteria	1	4	Low 4
	Lateral Spread	1	4	Low 4	Risk of liquefaction induced lateral displacement is considered low due to absence of potentially liquifiable zone below ground surface	1	4	Low 4
Volcanic Activity	Ash & Pyroclastic Falls	1	5	Medium 5	No volcanoes in the area	1	5	Medium 5
	Lava flows & Lahars	1	5	Medium 5	No volcanoes in the area	1	5	Medium 5

Geothermal Activity	Formation of geysers, hot springs, fumaroles, mud pools	1	5	Medium 5	No geothermal activity in the area	1	5	Medium 5
Erosion	Cut Batters	5	2	High 10	Max 1V:3H gradient	2	2	Low 4
	Fill Batters	4	2	Medium 8	Appropriate drainage and stormwater flow, max gradient 1V:2.5H	2	2	Low 4
	Coastal (cliff top)	1	4	Low 4	No coastal cliffs located within the site	1	4	Low 4
Landslip	Global Slope Instability	5	4	Extreme 20	Appropriate drainage and control of groundwater levels, stability improvement works as recommended in the report	1	4	Low 4
	Soil Creep	5	4	Extreme 20	Appropriate design of footings, regrading of locally oversteepened slopes	1	4	Low 4
	Bearing Capacity Failure	2	4	Medium 8	Undercut and replace any unsuitable material, appropriate site gradients	1	4	Low 4
	Cut & Fill Batter Instability	4	4	Very High 16	Gradients of less than 1V:3H, engineered fill placed appropriately, use of specifically designed retaining walls with sufficient toe drainage	1	4	Low 4
Subsidence	Expansive Soils	5	3	Very High 15	Foundation design to account for expansive soils	1	3	Low 3
	Cut Batters	5	2	High 10	Max 1V:3H gradient	2	2	Low 4
	Fill Batters	4	2	Medium 8	Appropriate drainage and stormwater flow, max gradient 1V:2.5H	2	2	Low 4
	Effects of dewatering	2	4	Medium 8	Risk of dewatering induced ground settlement beyond site boundary is considered low due to adequate setback from proposed excavation	1	4	Low 4

Notes:

- Assessments include the impact of the proposed subdivision works on adjacent properties.

- The following reference(s) contain information on the hazards contained in this assessment and the non-geotechnical hazards that have not been included:
    - **Auckland**
      https://aucklandcouncil.maps.arcgis.com/apps/MapSeries/index.html?appid=81aa3de13b114be9b529018ee3c649c8