19 September 2018 AKL2017-0167AC Rev 0

Neil Construction Limited
PO Box 8751
Symonds Street
Auckland 1150

Attention: Neil Pye

Dear Neil,

RE: GEOTECHNICAL INVESTIGATION REPORT FOR KAURI ROAD RESIDENTIAL DEVELOPMENT, HOBSONVILLE

1 INTRODUCTION

CMW Geosciences has been engaged by Neil Construction Limited to undertake a geotechnical investigation at Kauri Road Development in Hobsonville. Our investigation has been undertaken together with a review of the preliminary development plans provided by Neil Construction Limited in June 2018.

We understand that this report will form part of the documentation required to support a Resource Consent application with Auckland Council for the proposed subdivision.

2 SITE DESCRIPTION

The subject site, legally described as Lots 4, 5 and 6 DP 64526 is a roughly rectangular 14 hectare parcel of land currently in pasture, located just west of the Hobsonville township. Four residential dwellings with associated agricultural buildings are located in the eastern portions of the site.

The site is bound by rural lifestyle blocks to the north, Kauri Road to the east, Brigham Creek Road to the south and the Whenuapai Air Force Base to the west. It is accessed via residential driveways on Kauri Road.

The site generally slopes from north to south with an average fall of approximately 1(V):25(H), which steepens in the southern and western portions of the site with slopes of approximately 1(V):13(H) and 1(V):7(H) down towards Brigham Creek Road and Kauri Road respectively. The northern portion of the site is generally flat.

There is evidence of previous earthworks to form a small pond located in the western portion of the site. This pond is located within an existing gully with reeds and wetland vegetation within the base of the gully.

Two smaller gully features are located along the eastern boundary of the site.

CMW understand that a number of offal pits from previous agricultural works are present and these have been have been located and surveyed across the site by others.

3 DEVELOPMENT PROPOSALS

The Neil Construction Limited drawings provided to CMW, (attached in Appendix A) depict formation of a residential subdivision comprising:

- 264 residential lots, generally 200m^2 to 500m^2;
- 7 roads;
- 5 Jointly Owned Access Lots;
- 2 Drainage Reserves, within the existing gully features.

Access is proposed via both Kauri Road and Brigham Creek Road. Some roads are proposed to terminate on the western and northern boundaries which could provide future access to the subdivision from neighbouring land parcels.

Earthworks to form the development will comprise cuts and fills of up to 3m and 2m respectively.

In general, the proposed earthworks aim to ease and smooth the topography by filling in depressions and cutting ridges. Filling will be concentrated in the gully areas in the south-western and north-eastern portions of the site, and across the lower lying area in the southern portion of the site.

No retaining walls or other such structures are shown on the plans.

4 GEOLOGY

Published geology[1] indicates the site is underlain by Late Pliocene to Middle Pleistocene sediments of the Puketoka Formation. These alluvial deposits include pumiceous mud, sand and gravel with muddy peat and lignite, rhyolitic pumice (including non-welded ignimbrite, tephra and alluvial pumice deposits) and massive micaceous sand beds.

The younger alluvial deposits mapped in published geological records are generally underlain by strata of the Waitemata Group sedimentary formation typically comprising interbedded muddy sandstones and siltstones with variable volcaniclastic coarse sands and fine gravels. In some cases, the parent sedimentary rock has weathered in the upper mantle to form sandy clays and silts.

The main geotechnical hazards within these strata are low bearing capacity and settlement.

5 SITE INVESTIGATION AND FINDINGS

5.1 Fieldwork

Fieldwork was carried out between 7th August and 22nd August 2018. All fieldwork was carried out under the direction of CMW Geosciences in general accordance with NZGS Ground Investigation Specification Volume 0 – 2 and soils logged in general accordance NZGS Soil and Rock Logging Guidelines (appended). The scope of the fieldwork carried out was as follows:

- 8 Cone Penetrometer Tests (CPTs), denoted CPT01-18 to CPT08-18, were carried out to depths of up to 15.5m to help us define the deeper soil profile. Results of the CPT's, presented as traces of tip resistance (qc), friction resistance (fs) and friction ratio are presented in Appendix C;
- 16 hand augured boreholes, denoted as HA01-18 to HA16-18, were carried out to depths of up to 5m or refusal. Full borehole records are presented in Appendix C.

[1] Edbrooke, S.W. (compiler) 2001. Geology of the Auckland Area. Institute of Geological and Nuclear Sciences 1:250000

Shear strength tests were conducted using hand held shear vanes at regular intervals throughout the hand augurs to assess the strength and consistency of the materials.

Dynamic Cone Penetrometer (DCP) testing was conducted if hand auger boreholes were terminated above the target depth of 5m. Due to recent inclement weather resulting in a wet site, in addition to a high groundwater table, some of the hand augers were terminated early due to the borehole sides collapsing or the samples being unable to be retained.

Four samples were taken for laboratory testing to help determine the soil Atterberg limits and site soil expansive classification. The results of this testing are presented in Appendix C.

Auger and CPT locations were measured using a hand held GPS and are shown on the site plan attached in Appendix B.

5.2 Laboratory Testing

Four sets of samples were recovered for the determination of liquid limit, plastic limit, plasticity index and linear shrinkage, to help assess the earthworks suitability of the site won materials. All testing was carried out in accordance with NZS4402:1986: Methods for testing soils for civil engineering purposes. All testing was scheduled by CMW and carried out by Road Test Laboratory, Auckland, an IANZ registered Testing Authority. The test results are appended.

5.3 Soils Encountered

5.3.1 Topsoil

Topsoil was encountered in all exploratory hole locations except HA04-18, with depths ranging from 200 to 400mm. At the time of our investigation the topsoil was saturated due to recent inclement weather.

5.3.2 Fill Material

Existing fill material was encountered to a total depth of 2.6m in HA04-18 in the southern embankment of the existing pond. This fill overlies a 200mm thick deposit of buried topsoil. The fill materials consisted of highly plastic stiff to very stiff silty clays with trace gravel inclusions

5.3.3 Recent Alluvial Soils

Alluvial soils, consisting of soft to stiff, saturated organic clays were encountered in HA07-18 in the western gully to a depth of 1.6m. We anticipate that these materials extend up the western gully and underneath the existing pond.

Similar materials were encountered HA11-18 and HA16-18 and were observed in CPT05-18 and CPT06-18 in the northern gullies beneath a thin, stiffer crust material. The CPT results indicate that these materials extend to an approximate total depth of 10m.

5.3.4 Puketoka Formation Alluvial Soils

Interbedded firm to very stiff, highly plastic silty clays and silts with trace amounts of sand of the Puketoka Formation were encountered in all exploratory hole locations and made up the majority of the soils observed onsite.

Moisture ranges were typically moist to wet with soils being saturated below the groundwater level and in lower lying areas of the site.

5.3.5 Residual Waitemata Group Soils

Very stiff to hard, plastic, dark grey clays of the Waitemata Group were encountered beneath the overlying Puketoka Formation soils at depths ranging from 2.0m to 4.4m in HA02-18, HA03-18 and HA04-18 within the western gully areas, and in HA05-18 in the north west of the site.

5.4 Groundwater

Groundwater levels recorded in a number of the boreholes indicate a groundwater table ranging from 1.2m to 4.0m deep, with levels rising to the surface in the gully areas.

6 PROJECT RECOMMENDATIONS

6.1 General

On the basis of our desktop studies, investigation findings and modelling we are satisfied that the land is generally suitable for the proposed subdivision depicted on the appended Neil Construction Limited plans, and free from the land stability hazards listed in Section 71(3) of the Building Act, subject to the comments in the sections below.

6.2 Earthworks

6.2.1 Preparation

Prior to the placement of any fill it will be necessary to undercut all surface topsoil and any soft deposits immediately underneath it to be stockpiled for later use.

In preparation for filling in the gully areas, the existing unconsolidated alluvial soils will need to be removed and the gully areas well benched prior to drainage placement and filling.

Organic materials from the gully areas should be separated from inorganic alluvium and the organic materials respread as reserve landscaping fill or removed from site.

Generally the alluvial soils appear to be less than 2m thick apart from within the western drainage reserve which appears to be between 3 and 4m deep.

The deep soft alluvial soils encountered in the northern gully are likely to be too deep to undercut and backfill as part of a typical earthworks operation.

We recommend that further specific investigation is undertaken during earthworks to define the extent and depth of these materials.

No organic or otherwise unsuitable materials should be used in the proposed fill. All earthworks should be carried out to certifiable standards.

6.2.2 Use of Site Won Material

Cut to fill operations are expected to be relatively straightforward with the predominantly highly plastic clay soils on site.

However, the available materials are expected to be wet of optimum moisture content for compaction and will likely require some conditioning through harrowing/disking on drying pads or by chemical drying through the use of lime.

No sands are expected to be encountered as part of the earthworks, however if these are encountered they should be blended with other site won suitable material.

6.2.3 Compaction Specification

The following compaction control specification should be adopted for all engineered fills on the site:

- Air voids percentage average value* less than 10%
- Air voids percentage maximum value 12%

- Undrained shear strength average value* not less than 140kPa
- Undrained shear strength minimum single value 100kPa

*The average value is determined over ten consecutive tests.

This compaction specification may be further refined as part of the initial earthworks once further standard compaction tests are undertaken.

Vane shear strength, water contents and in-situ density tests are to be carried out on all areas of the engineered fill to at least the frequency recommended by NZS 4431.

6.2.4 Land Drainage

Underfill drains will need to be installed beneath new fills in all gully areas proposed to have filling, once the surface deposits have been stripped.

As a minimum, these drains should comprise a 600mm deep by 450mm wide trench excavation into the gully base containing two highway grade, punched drain coils surrounded in a free draining aggregate (e.g. drainage 20/40) and fully wrapped in a needle punched geotextile complying with TNZ F/7 Strength Class B and Filtration Class 1, e.g. Bidim A19 or an approved similar material. Alternatively, the drain may remain unwrapped if specific drainage aggregate that provides self-filtering and segregation properties, such as SAP50, TNZ F/2, or similar material, is approved by the Geotechnical Engineer prior to use. A layer of geotextile cloth would still be required across the top of any drainage material to prevent contamination by the placed fill.

Additional subsoil drains may also be required at the discretion of the Geotechnical Engineer to tap any identified seepages during construction inspections.

These subsoil drains should be considered private drainage formed as part of the earthworks to control groundwater during construction. While we recommend they remain in following subdivision development, they do not require ongoing maintenance by Council or homeowners and they do not need to be vested to Council as public drainage works.

6.2.5 Offal Pits

The known offal pits and any further offal pits uncovered during earthworks will need to be remediated prior to being benched and backfilled with engineered fill. The material excavated from the offal pits is likely to be unsuitable for reuse on site and will be required to be removed from site.

6.3 Settlement and Liquefaction

Based on the materials observed in our boreholes and CPT data, and the relatively minor amounts of fill being placed across the site, settlement and liquefaction are not considered to pose a hazard on the site. It is recommended that any soft materials in the gully and lower-lying area uncovered as part of the earthworks operation, are undercut and replaced with compacted engineered fill.

6.4 Slope Stability

The proposed earthworks generally work to ease gradients across the site by cutting down the higher areas and filling in the lower-lying areas. Subsequently with the proposed contours shown on the appended Neil Construction Limited drawings, slope stability is not considered to pose a hazard on the site.

However any batters in areas of fill should be limited to a maximum gradient of 1(V):2.5(H), and batters in areas of cut should be limited to a maximum gradient of 1(V):3(H) unless specifically designed by a Chartered Professional Engineer.

6.5 Civil Works

6.5.1 Service Installation

High groundwater levels were encountered during our investigations, which were undertaken during the winter months. If these levels remain constant through the drier summer months, or if services are installed during the winter months, this may result in greater than normal trench instability and groundwater seepages into the trench. This is likely to be exacerbated within the areas of deeper cut. Contractors should be made aware of this potential issue for planning their operations accordingly.

If these circumstances arise, we recommend installing a 110mm diameter punched draincoil within the bedding of each stormwater line installed within natural ground. This draincoil should outlet into the downstream manholes to assist in controlling localised groundwater levels in the long term.

The backfill of all services trenches will need to be compacted to the same standard as the bulk filling to prevent water ingress and localised settlement.

6.5.2 Stormwater and Sanitary Sewer

We anticipate that stormwater and sanitary sewer for the subdivision will be reticulated.

While we recognise that on site stormwater infiltration is a desired approach under Auckland Council's Unitary Plan there is currently no standardised construction guidelines for these devices. Road construction adjacent to infiltration devices such as rain gardens needs to be carefully considered so as to maintain the design lifespan of the pavement without promoting subgrade softening. Soils exposed to seasonal wetting and drying effects also have a tendency to lose their peak strength and are prone to creep and erosion over time.

In addition, soakage to ground is unlikely to be particularly effective on this site due to the above-noted high groundwater levels.

Raingarden design incorporating precast concrete surrounds help to mitigate seasonal wetting and drying of the soils cut near vertical faces within the road reserve.

6.5.3 Road Subgrades

Road subgrades are proposed to comprise a combination of cut and fill materials. The available CBR for pavement design is best confirmed as they are cut to grade. However, the investigation data does not suggest any widespread unusual materials are present with regards to pavement design, provided any soft alluvial materials are removed and reworked as part of the earthworks operations.

The soils found during our investigations generally comprise clays which typically respond well to lime stabilisation methods. We recommend post stabilisation testing of subgrade soil is undertaken at least 7 days following application to ensure bonding/curing of the lime has occurred.

6.6 Foundations

6.6.1 Residential Building Platforms

On the basis of our findings and our recommendations below, we anticipate that a geotechnical ultimate bearing capacity of 300kPa will be available for the design of shallow strip or pad footings on all lots following completion of the earthworks.

Based on the laboratory testing (appended) and visual-tactile assessment of the soils we anticipate expansive soil site Classes of between M (moderate) and H1 (high) are likely for foundation design.

This will be confirmed as part of further testing at the time of preparation of the Geotechnical Completion Report and appropriate recommendations to help land owners, designers and building contractors will be contained within that report.

6.6.2 Building Restriction Zones

As part of the works to prepare the Geotechnical Completion Report, it will be necessary to establish the extents of areas on each lot that are not appropriate for NZS 3064 type shallow foundations or for earthworks undertaken without the input of a Chartered Professional Engineer via implementation of Specific Design Zones.

These areas will include land on or adjacent to steep batters, or within the 45 degree zone of influence of any stormwater or sewer line.

7 ASBUILT INFORMATION REQUIREMENTS

In order to provide a Geotechnical Completion Report for the subdivision works, the following as-built information will need to be provided to CMW. The survey of these items should therefore be a hold point in the construction sequence:

- The location and invert of all subsoil drainage and associated outlets;
- The depth of filling placed including all benching works, undercuts, and temporary silt control excavations;
- The crest and toes of any batter slopes;
- The extent of all specific design zones and building restriction zones including restriction adjacent to service lines and slopes.

8 LIMITATION

This report has been prepared for use by our client Neil Construction Limited, their consultants and Auckland Council. Liability for its use is limited to these parties and to the scope of work for which it was prepared as it may not contain sufficient information for other parties or for other purposes.

It should be noted that factual data for this report has been obtained from discrete locations using normal geotechnical investigation techniques. As such investigation methods by their very nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site which have not be disclosed by the investigation and which have not been taken into account in the report. If variation in the subsoils occurs from those described or assumed to exist then the matter should be referred back to CMW immediately.

9 CLOSURE

We trust this report meets your current requirements.

Should you require any further information of clarification regarding our investigation report, please do not hesitate to contact the undersigned.

For and on behalf of CMW Geosciences

Prepared by:

Jack Mynett – Johnson

Project Engineering Geologist

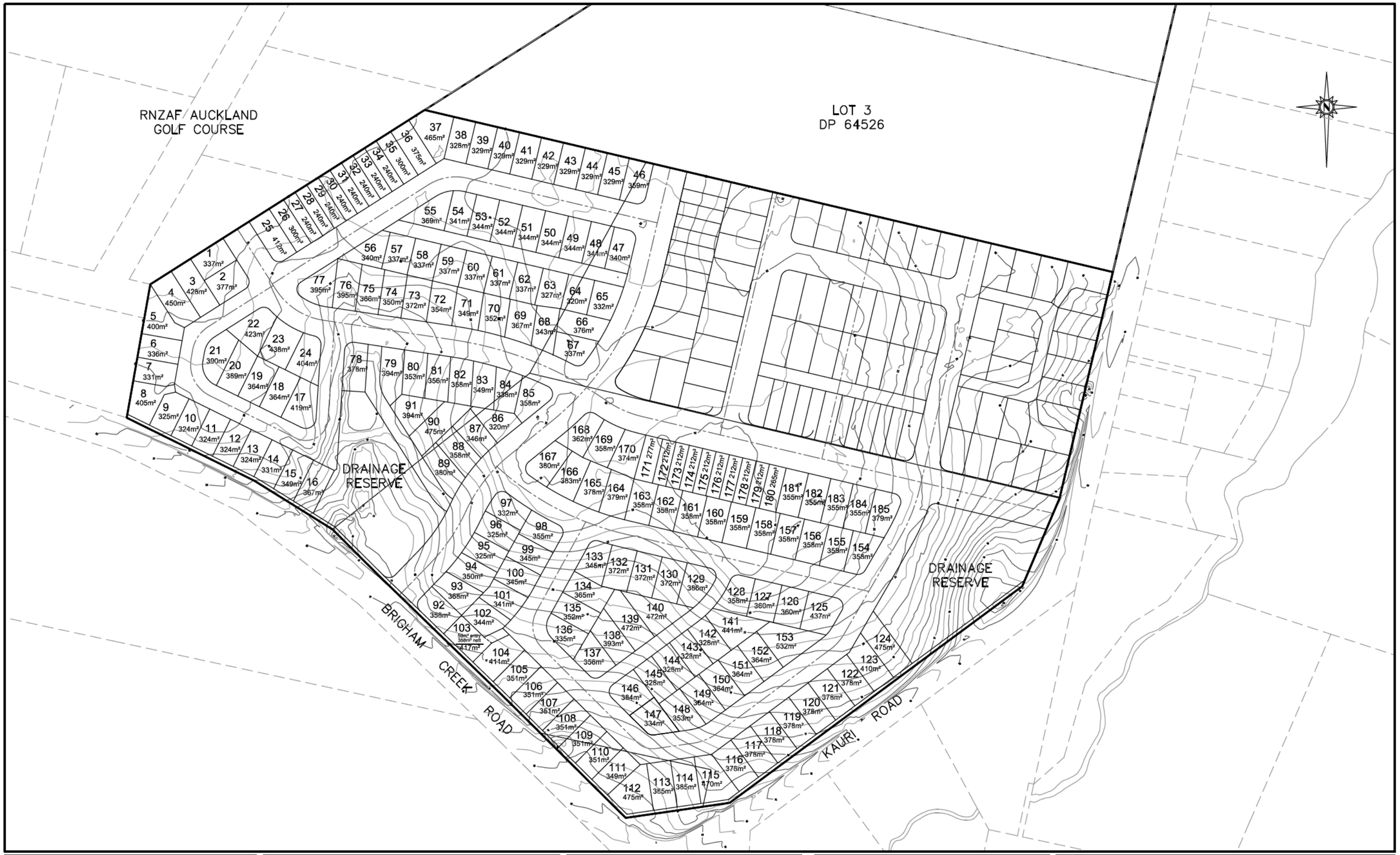
Reviewed and Approved by:

Andrew Linton

Principal Geotechnical Engineer

Distr bution:	1 copy to Client (electronic)	Original held by CMW Geosciences
Appendices	Neil Construction Limited Plans	
	CMW Site Investigation Plan	
	CMW Site Investigation Borehole Records	
	CMW Ground Models	

Appendix A
(Neil Construction Limited Plans)



Rev	Description	By	Date
E	ROADING PATTERN AMENDED	JWL	08/17

THE NEIL GROUP

LAND AND PROPERTY DEVELOPERS

NEIL CONSTRUCTION LIMITED – NEIL PROPERTIES LIMITED

The Neil Group Limited
Level 3, Building B
8 Nugent Street, Grafton, Auckland

PO Box 8751, Symonds Street
Auckland, New Zealand

Telephone: +64 9 918 6565
Facsimile: +64 9 918 6567
Web: www.neilgroup.co.nz

Job Title

KAURI ROAD
WHENUAPAI

Drawing Title

POSSIBLE SUBDIVISION OF
LOTS 4, 5 & 6 DP 64526 & ALLOT 481
& 525 PARISH OF WAIPAREIRA

	By	Date	Scale	Job No.	
Surveyed:			1:1000@A1 1:2000@A3	Drawing No.	Rev
Designed:				432–00–SP–01	F
Drawn:	06/17				
Approved:					
CAD FILE	F:_PROJECTS\KAURI ROAD\DWG\432–00–SP–01 RevF.dwg				

RNZAF AUCKLAND
GOLF COURSE

LOT 3
DP 64526

AREA EXCLUDED FROM
CURRENT EARTH WORKS
CONSENT APPLICATION

BRIGHAM CREEK ROAD

KAURI ROAD

LEGEND

- PROPOSED CONTOUR MINOR (1m)
- PROPOSED CONTOUR MAJOR (5m)
- EXISTING CONTOUR

EARTHWORKS

STAGE	AREA (ha)	CUT (m3)	FILL (m3)	BALANCE (m3)
1	14.5	66,700	58,000	8,700

NOTE: BALANCE MATERIAL – POSSIBLE EXCESS TOPSOIL AND UNSUITABLE MATERIAL

Rev	Description	By	Date
1	FOR REVIEW	S.F.	07/18

THE NEIL GROUP
NEIL CONSTRUCTION LIMITED
LAND DEVELOPERS
THE NEIL GROUP LIMITED
LEVEL 3, BUILDING B
8 NUGENT STREET
GRAFTON
PO BOX 8751, SYMONDS STREET
AUCKLAND, NEW ZEALAND
TELEPHONE +64 9 918 6565
FACSIMILE +64 9 918 6567
WEB www.neilgroup.co.nz

Job Title
KAURI ROAD
WHENUAPAI

Drawing Title
EARTHWORKS PLAN
DESIGN CONTOURS

	By	Date	Scale	Job No.
Surveyed:			1:2000 A3	Drawing No. 432–1–EW–201 Rev 1
Designed:	S.F.			
Drawn:	S.F.	06/07/18		
Approved:				
CAD FILE	F:_PROJECTS\KAURI ROAD\DWG\432–1–EW–201–210.dwg			

RNZAF AUCKLAND
GOLF COURSE

LOT 3
DP 64526

AREA EXCLUDED FROM
CURRENT EARTH WORKS
CONSENT APPLICAITON

BRIGHAM CREEK ROAD

KAURI ROAD

LEGEND

1.0	FILL CONTOUR (1.0m INTERVALS)
-1.0	CUT CONTOUR (1.0m INTERVALS)
	ZERO CONTOUR

Rev	Description	By	Date
1	FOR REVIEW	S.F.	07/18

THE NEIL GROUP

NEIL CONSTRUCTION LIMITED
LAND DEVELOPERS

THE NEIL GROUP LIMITED
LEVEL 3, BUILDING B
8 NUGENT STREET
GRAFTON

PO BOX 8751, SYMONDS STREET
AUCKLAND, NEW ZEALAND

TELEPHONE +64 9 918 8588
FACSIMILE +64 9 918 8587
WEB www.neilgroup.co.nz

Job Title
KAURI ROAD
WHENUAPAI

Drawing Title
EARTHWORKS PLAN
CUT/FILL CONTOURS

	By	Date	Scale	Job No.	
Surveyed:			1:2000 A3	Drawing No.	Rev
Designed:	S.F.			432-1-EW-202	1
Drawn:	S.F.	06/07/18			
Approved:					

CAD FILE F:_PROJECTS\KAURI ROAD\DWG\432-1-EW-201-210.dwg

Appendix B
(CMW Investigation Site Plan)

LEGEND:

HA01-18	HAND AUGER (HA) LOCATION
CPT01-18	CONE PENETRATION TEST (CPT) LOCATION
	SITE BOUNDARY
	EXIST NG CONTOURS

NOTES:

1. BASE PLAN ADAPTED FROM: AUCKLAND COUNCIL GIS MAP

1:2500 0 25 50 75 100 125 m

CMW Geosciences

CLIENT: THE NEIL GROUP		DRAWN: FMS	PROJECT No: AKL2017-0167
PROJECT: CORNER BRIGHAM CREEK ROAD & KAURI ROAD, WHENUAPAI		CHECKED: JMJ	FIGURE: 01
		REVISION: 0	SCALE: 1:2500
TITLE: SITE INVESTIGATION PLAN		DATE: 13/09/2018	SHEET: A3

C:\USERS\FALIQS\DOCUMENTS\AKL2017-0167\AKL2017-0167-SITE PLAN_REV B.DWG

Appendix C
(CMW Site Investigation Records and Ground Models)

BOREHOLE LOG - HA01-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 16/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745476.0m N.5926469.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
							OL: TOPSO L:					5 10 15	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		0.4	Peak = 149kPa Residual = 78kPa				CH: Silty CLAY : greyish orange. High plasticity. (Puketoka Formation)						
							... at 0.50m, becoming grey with orange streaks.						
		0.8	Peak = 161kPa Residual = 86kPa										
					1			M	VSt				
		1.2	Peak = 146kPa Residual = 75kPa										
		1.6	Peak = 126kPa Residual = 72kPa										
	▼	2.0	Peak = 92kPa Residual = 69kPa		2		CH: Silty CLAY with minor fine sand: light grey. High plasticity. (Puketoka Formation)						
		2.4	Peak = 95kPa Residual = 52kPa								HA		
		2.8	Peak = 98kPa Residual = 55kPa				... at 2.80m, becoming greyish orange.	W	St				
					3								
		3.2	Peak = 98kPa Residual = 63kPa										
		3.6	Peak = 132kPa Residual = 37kPa				CH: CLAY with minor fine sand : dark bluish grey with orange veining. High plasticity. (Puketoka Formation)						
		4.0	Peak = 129kPa Residual = 40kPa		4								
		4.4	Peak = 152kPa Residual = 43kPa					M	VSt				
		4.8	Peak = 201+										
					5		Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 2.0m

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

BOREHOLE LOG - HA02-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 07/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: MCC | Position: E.1745569.0m N.5926547.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.4	Peak = 75kPa Residual = 56kPa		0		TOPSOIL.					5 10 15	
	▼	0.8	Peak = 69kPa Residual = 61kPa				CH: CLAY: greyish brown. High plasticity. (Puketoka Formation)		St				
		1.2	Peak = 75kPa Residual = 64kPa		1								
		1.6	Peak = 107kPa Residual = 56kPa					M			HA		
		2.0	Peak = 109kPa Residual = 61kPa		2		CH: CLAY: blueish grey. High plasticity. (Waitemata Group)		VSt				
		2.4	Peak = 128kPa Residual = 64kPa										
		2.8	Peak = UTP		3				VSt to H				
		3.2	Peak = UTP				*... at 3.10m, becoming hard. Unable to retain sample due to water pressure.* Borehole terminated at 3.2 m						
					4								
					5								

Termination reason: Unable To Retain Sample

Remarks: Groundwater sitting at top of hole during hand auger

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

BOREHOLE LOG - HA03-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 07/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: MCC | Position: E.1745566.0m N.5926509.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.4	Peak = 83kPa Residual = 64kPa		1		TOPSOIL.					5 10 15	
		0.8	Peak = 109kPa Residual = 77kPa				CH: CLAY with minor silt: greyish white. High plasticity. (Puketoka Formation)		St				
	▼	1.2	Peak = 120kPa Residual = 83kPa				CH: Silty CLAY with minor fine sand: greyish white. High plasticity. (Puketoka Formation)						
		1.6	Peak = 136kPa Residual = 93kPa		2			M	VSt		HA		
		2.0	Peak = 147kPa Residual = 101kPa										
		2.4	Peak = UTP		3		CL: Silty CLAY: blueish grey. Low plasticity. (Waitemata Group)		VSt to H				
		2.8	Peak = UTP										
		3.2	Peak = UTP				*... at 3.20m, becoming hard.*						
					4		Borehole terminated at 3.4 m						
					5								

Termination reason: Unable To Retain Sample

Remarks: Groundwater encountered at 1.2m

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

BOREHOLE LOG - HA04-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 16/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745568.0m N.5926445.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.4	Peak = 201+		1		CH: Silty CLAY : brown with orange and grey mottles. High plasticity. (Fill)	M	VSt				
		0.8	Peak = 123kPa Residual = 60kPa										
		1.2	Peak = 115kPa Residual = 57kPa										
		1.6	Peak = 80kPa Residual = 57kPa				CH: Silty CLAY with trace medium gravel: greyish yellow with dark grey and brown mottles. High plasticity. (Fill)						
	▼	2.0	Peak = 75kPa Residual = 55kPa		2						HA		
		2.4	Peak = 95kPa Residual = 57kPa						St				
							OL: TOPSO L:						
		2.8	Peak = 106kPa Residual = 75kPa				CH: Silty CLAY : light grey. High plasticity. (Puketoka Formation)	W					
		3.2	Peak = 103kPa Residual = 72kPa		3		*... at 3.20m, with minor decomposing wood fragments.*		VSt				
							... at 3.40m, with bluish grey streaks.						
		3.6	Peak = UTP				CH: Silty CLAY with some fine sand: bluish grey. High plasticity. (Waitemata Group)	M	H				
		3.9	Peak = UTP				Borehole terminated at 3.9 m					18	
					4							20	
					5								

Termination reason: Unable to penetrate further

Remarks: Groundwater encountered at 2.0m.

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

BOREHOLE LOG - HA05-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 01/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745676.0m N.5926586.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
							TOPSOIL.					5 10 15	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		0.4	Peak = 149kPa Residual = 72kPa				CH: CLAY : yellowish orange. High plasticity. (Puketoka Formation)						
		0.8	Peak = 128kPa Residual = 60kPa										
					1		*... at 0.90m, becoming yellowish grey with light orange mottles and dark orange streaks.*		VSt				
		1.2	Peak = 129kPa Residual = 72kPa					M					
							CH: Silty CLAY: light grey with orange streaks. High plasticity. (Puketoka Formation)						
		1.6	Peak = 106kPa Residual = 57kPa										
		2.0	Peak = 95kPa Residual = 63kPa		2				St				
	▼	2.4	Peak = 78kPa Residual = 43kPa				*... at 2.40m, becoming moist to wet.*	M to W			HA		
		2.8	Peak = 69kPa Residual = 52kPa										
					3		*... at 3.00m, becoming wet.*	W					
		3.2	Peak = 69kPa Residual = 43kPa				*... at 3.30m, becoming light grey with light orange mottles.*						
							CH: CLAY with some silt: light grey with orange mottles. High plasticity. (Puketoka Formation)						
		3.6	Peak = 106kPa Residual = 55kPa										
							... at 3.80m, becoming light orange.	M					
		4.0	Peak = 103kPa Residual = 55kPa		4				VSt				
		4.4	Peak = 201+				CH: CLAY: dark grey. High plasticity. (Waitemata Group)						
		4.8	Peak = UTP					D to M	VSt to H				
					5		Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 2.4m

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

BOREHOLE LOG - HA06-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 01/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745716.0m N.5926465.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Depth	Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
				TOPSOIL.						
0.4	Peak = 106kPa Residual = 55kPa			CH: Silty CLAY: light grey. High plasticity. (Puketoka Formation)						
0.8	Peak = 118kPa Residual = 57kPa			*... at 0.80m, with occasional orange streaks and minor fine rootlets.*		VSt				
1.2	Peak = 101kPa Residual = 57kPa		1		M					
1.6	Peak = 92kPa Residual = 55kPa					St				
2.0	Peak = 126kPa Residual = 66kPa		2	CH: Silty CLAY with minor sand: grey. High plasticity. (Puketoka Formation)						
2.4	Peak = 109kPa Residual = 34kPa							HA		
2.8	Peak = 106kPa Residual = 37kPa			ML: Clayey SILT with some fine sand: light grey. High plasticity. (Puketoka Formation)						
3.2	Peak = 109kPa Residual = 46kPa		3	*... at 3.30m, with purplish blue streaks.*		VSt				
3.6	Peak = 126kPa Residual = 43kPa				W					
4.0 ▼	Peak = 106kPa Residual = 46kPa		4							
4.4	Peak = 158kPa Residual = 40kPa									
4.8	Peak = 201+					VSt to H				
			5	Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 4.0m

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

BOREHOLE LOG - HA07-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 16/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745558.0m N.5926389.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Depth	Type & Results	Material Description	Moisture Condition	Consistency/ Relative Density	Drilling Method/ Support
		OL: TOPSO L:			
0.4	Peak = 63kPa Residual = 29kPa	CH: Sandy organic CLAY: dark brown. High plasticity. Sand is coarse grained. Strong organic smell. (Alluvium)			
0.8	Peak = 23kPa Residual = 11kPa	CH: Organic CLAY : dark brown. High plasticity. With some organic fragments. Strong organic smell. (Alluvium)		S	
1.2	Peak = 26kPa Residual = 14kPa				
1.6	Peak = 49kPa Residual = 34kPa	CH: Silty CLAY with some fine sand : yellowish grey. High plasticity. (Puketoka Formation)	S	F	HA
2.0	Peak = 52kPa Residual = 40kPa			St	
2.4	Peak = 55kPa Residual = 34kPa			F	
2.8	Peak = 43kPa Residual = 29kPa				
3.0	Peak = 49kPa Residual = 37kPa	Borehole terminated at 3.0 m			

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

4 4 4 3 3 3 4 6 10 10 12 16 16 20

Structure & Other Observations: Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination reason: Unable to penetrate further. Hole collapsing.

Remarks: Groundwater encountered at 0.0m

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

BOREHOLE LOG - HA08-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 01/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745675.0m N.5926370.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm) 5 10 15	Structure & Other Observations
							TOPSOIL.	D to M					
		0.4	Peak = UTP				CH: Silty CLAY: grey with orange streaks. High plasticity. (Puketoka Formation)						
							... at 0.40m, becoming moist.						
		0.8	Peak = 201+										
					1								
		1.2	Peak = 149kPa Residual = 89kPa					M					
		1.6	Peak = 141kPa Residual = 72kPa										
		2.0	Peak = 138kPa Residual = 63kPa		2								
		2.4	Peak = 144kPa Residual = 78kPa				ML: Clayey SILT: whitish grey. High plasticity. (Puketoka Formation)		VSt		HA		
		2.8	Peak = 109kPa Residual = 55kPa										
					3								
	▼	3.2	Peak = 103kPa Residual = 57kPa										
		3.6	Peak = 101kPa Residual = 49kPa				*... at 3.60m, with some fine sand*	M to W					
		4.0	Peak = 106kPa Residual = 49kPa		4								
		4.4	Peak = 88kPa Residual = 32kPa										
		4.8	Peak = 129kPa Residual = 57kPa										
					5		Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 3.2m

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

BOREHOLE LOG - HA09-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 15/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: MMC | Position: E.1745849.0m N.5926528.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
							OL: TOPSO L:						
		0.4	Peak = 93kPa Residual = 43kPa				CH: Silty CLAY : dark brown. High plasticity. (Puketoka Formation)	M					
		0.8	Peak = 107kPa Residual = 29kPa				MH: Clayey SILT with trace fine sand: orangish brown with mottled greyish brown. High plasticity . (Puketoka Formation) *... at 0.80m, becoming wet* *... at 0.90m, becoming dark brown with mottled orange.*	W					
	▼	1.2	Peak = 104kPa Residual = 40kPa		1		*... at 1.10m, becoming saturated*						
		1.6	Peak = 160kPa Residual = 123kPa				CH: CLAY with minor silt and trace fine sand: brownish grey. High plasticity. (Puketoka Formation) *... at 1.80m, with reddish brown mottles*		VSt				
		2.0	Peak = 139kPa Residual = 96kPa		2								
		2.4	Peak = 147kPa Residual = 136kPa								HA		
		2.8	Peak = 93kPa Residual = 69kPa						St				
		3.2	Peak = 101kPa Residual = 75kPa		3		CH: Silty CLAY with minor fine sand: yellowish orange. High plasticity. (Puketoka Formation)	S					
		3.6	Peak = 109kPa Residual = 91kPa						VSt				
		4.0	Peak = 115kPa Residual = 77kPa		4		CH: Sandy silty CLAY : grey. High plasticity. Sand is fine grained. (Puketoka Formation)						
		4.4	Peak = 83kPa Residual = 64kPa				CH: Silty CLAY : purpleish grey. High plasticity. (Puketoka Formation)		St				
		4.8	Peak = 85kPa Residual = 67kPa										
					5		Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 1.2m

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

BOREHOLE LOG - HA10-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 15/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: JW | Position: E.1745896.0m N.5926444.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.4	Peak = 203+		0		OL: TOPSO L:						
							CH: CLAY : orangish brown with brown streaks. High plasticity. With trace rootlets. (Puketoka Formation)	M					
	▼	0.8	Peak = 203+				*... at 0.80m, becoming saturated.*						
							... at 0.90m, becoming grey with orange streaks and rootlets ending.						
		1.2	Peak = 203+		1								
		1.6	Peak = 203+										
									VSt		HA		
		2.0	Peak = 203+		2		*... at 2.10m, with yellow streaks*						
		2.4	Peak = 174kPa Residual = 73kPa					S					
		2.8	Peak = 105kPa Residual = 61kPa		3		CH: Organic stained CLAY : dark grey and black. High plasticity. (Puketoka Formation)						
		3.2	Peak = 160kPa Residual = 41kPa										
							CH: Organic stained CLAY : brown. High plasticity. With some minor organic inclusions. (Puketoka Formation)						
					4		Borehole terminated at 3.7 m					12	
												11	
												3	
												2	
												2	
												3	
												3	
												8	
												20	
					5								

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

Structure & Other Observations: Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination reason: Obstructed by power lines

Remarks: Groundwater encountered at 2.7m

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

BOREHOLE LOG - HA11-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 16/08/2018
Borehole Location: Referr to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: MO | Position: E.1745986.0m N.5926475.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.4	Peak = 186+		0		OL: TOPSO L:						
		0.8	Peak = 160kPa Residual = 101kPa				CH: CLAY with minor silt : orange with yellowish white mottles. High plasticity, (Puketoka Formation)		VSt				
		1.2	Peak = 109kPa Residual = 83kPa		1		CH: CLAY with minor silt: greyish brown with purple veins. High plasticity. (Puketoka Formation)	M					
		1.6	Peak = 93kPa Residual = 77kPa				*... at 1.70m, becoming brownish grey with orange mottles.*				HA		
		2.0	Peak = 96kPa Residual = 56kPa		2				St				
	▼	2.4	Peak = 32kPa Residual = 53kPa				MH: Clayey SILT : whitish grey. High plasticity. (Puketoka Formation)	S	F				
							CH: Organic stained CLAY : dark brown. high plasticity (Puketoka Formation)						
					3		Borehole terminated at 3.0 m					2 4 4 5 6 6 7 5 8 9 10 7 10 12 18 12 20 20 20	
					4								
					5								

Termination reason: Unable to penetrate further. Hole collapsing.

Remarks: Groundwater encountered at 2.4m

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

BOREHOLE LOG - HA12-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 15/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: MMC | Position: E.1745939.0m N.5926359.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
	▼	0.4	Peak = 80kPa Residual = 64kPa		1		OL: TOPSO L:	S	VSt		HA	6	
		0.8	Peak = 120kPa Residual = 96kPa				CH: Silty CLAY : orangish brown. High plasticity. (Puketoka Formation)					6	
		1.2	Peak = 101kPa Residual = 67kPa									6	
		1.6	Peak = 93kPa Residual = 75kPa		2		CH: Organic stained CLAY : grey and black. High plasticity. (Puketoka Formation)		St			5	
		2.0	Peak = 53kPa Residual = 43kPa						F			7	
					3		Borehole terminated at 2.7 m					6	
												6	
												9	
												8	
												8	
												8	
												10	
					4							13	
												11	
												10	
												14	
												15	
												17	
												20	
												20	
												20	
												20	
					5							20	

Termination reason: Unable to penetrate further. Hole collapsing

Remarks: Groundwater at surface.

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

BOREHOLE LOG - HA13-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 16/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: MMC | Position: E.1745808.0m N.5926331.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
							OL: TOPSO L:					5 10 15	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		0.4	Peak = 160kPa Residual = 96kPa				CL: Silty CLAY : yellowish brown. Low plasticity. (Puketoka Formation)						
		0.8	Peak = 186+				CH: Silty CLAY : yellowish orange. High plasticity. (Puketoka Formation)						
		1.2	Peak = 186+		1			M					
		1.6	Peak = 186+				CH: CLAY with minor silt: whitish yellow with mottled orange. High plasticity. (Puketoka Formation)		VSt				
		2.0	Peak = 160kPa Residual = 104kPa		2								
	▼	2.4	Peak = 120kPa Residual = 69kPa				CH: Silty CLAY : greyish brown with light orange mottles. High plasticity. (Puketoka Formation)				HA		
		2.8	Peak = 104kPa Residual = 80kPa		3								
		3.2	Peak = 91kPa Residual = 69kPa				CH: CLAY : white with mottled orange. High plasticity. (Puketoka Formation)		St				
		3.6	Peak = 80kPa Residual = 56kPa					S					
		4.0	Peak = 43kPa Residual = 35kPa		4				F				
		4.4	Peak = 40kPa Residual = 35kPa				ML: SILT : light grey. Low plasticity. (Puketoka Formation)		St				
		4.8	Peak = 93kPa Residual = 75kPa										
					5		Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 2.4m

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

BOREHOLE LOG - HA14-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 01/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745759.0m N.5926306.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Depth	Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm) 5 10 15	Structure & Other Observations
				TOPSOIL.						
				CH: CLAY: orange. High plasticity. (Puketoka Formation)	D					
0.4	Peak = UTP			CH: Silty CLAY: orange. High plasticity. (Puketoka Formation)		VSt to H				
0.8	Peak = 149kPa Residual = 72kPa		1							
1.2	Peak = 132kPa Residual = 83kPa			... at 1.20m, with grey mottles.						
				... at 1.40m, becoming light grey with orange mottles.						
1.6	Peak = 164kPa Residual = 86kPa									
2.0	Peak = 184kPa Residual = 89kPa		2	CH: CLAY with some silt: grey with mottled white and orange. High plasticity. (Puketoka Formation)						
2.4	Peak = 149kPa Residual = 86kPa			... at 2.30m, white mottles ending.	M			HA		
2.8	Peak = 161kPa Residual = 75kPa					VSt				
3.2	Peak = 144kPa Residual = 98kPa		3							
				CH: Silty CLAY: light grey with orange streaks. High plasticity. (Puketoka Formation)						
3.6	Peak = 103kPa Residual = 63kPa									
4.0	Peak = 103kPa Residual = 72kPa		4							
4.4	Peak = 109kPa Residual = 55kPa			ML: Clayey SILT with some fine sand: light grey with orange streaks. High plasticity. (Puketoka Formation)	M to W					
4.8	Peak = 106kPa Residual = 43kPa									
			5	Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 4m

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

BOREHOLE LOG - HA15-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 01/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

Logged by: CC | Position: E.1745706.0m N.5926266.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		0.4	Peak = 149kPa Residual = 69kPa		0		TOPSOIL.					5 10 15	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		0.8	Peak = 152kPa Residual = 72kPa				CH: Silty CLAY: grey with orange streaks. High plasticity. (Puketoka Formation)		VSt				
		1.2	Peak = 161kPa Residual = 78kPa		1								
		1.6	Peak = 98kPa Residual = 49kPa				CH: Silty CLAY with some fine sand: light grey. High plasticity. (Puketoka Formation)	M					
		2.0	Peak = 86kPa Residual = 46kPa		2				St				
		2.4	Peak = 83kPa Residual = 43kPa								HA		
	▼	2.8	Peak = 89kPa Residual = 46kPa										
		3.2	Peak = 106kPa Residual = 37kPa		3		ML: Clayey SILT with minor fine sand: grey. High plasticity. (Puketoka Formation)						
		3.6	Peak = 126kPa Residual = 43kPa						VSt				
		4.0	Peak = 115kPa Residual = 34kPa		4			M to W					
		4.4	Peak = 106kPa Residual = 52kPa										
		4.8	Peak = 126kPa Residual = 34kPa										
					5		Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached

Remarks: Groundwater encountered at 2.8m

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

BOREHOLE LOG - HA16-18

Client: The Neil Group
Project: Kauri Road
Site Location: Whenuapai
Project No.: AKL2017-0167
Date: 16/08/2018
Borehole Location: Refer to site plan

CMW Geosciences

1:25 Sheet 1 of 1

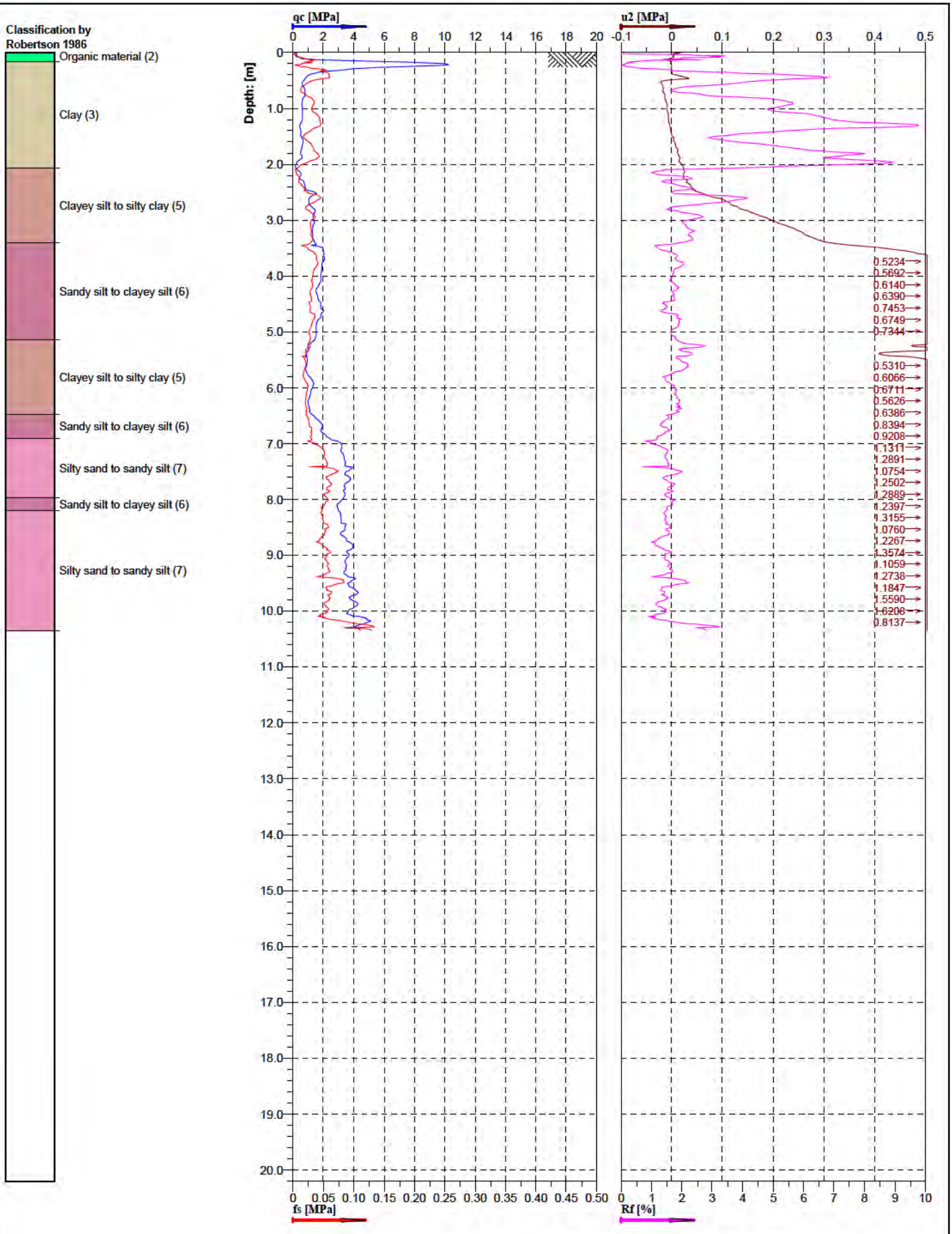
Logged by: MMC | Position: E.1745989.0m N.5926463.0m | Elevation: | Hole Diameter: 50mm
Checked by: JMJ | Survey Source: Hand Held GPS | Datum: NZTM | Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
	▼	0.4	Peak = 152kPa Residual = 120kPa		0		OL: TOPSO L:					5 10 15	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		0.8	Peak = 107kPa Residual = 35kPa		1		CH: CLAY with minor silt and minor fine sand : greyish brown. High plasticity. (Alluvium)	S	VSt F		HA	1 1 1 1 1 2 3 5	
		1.2	Peak = 40kPa Residual = 29kPa				Borehole terminated at 1.2 m					11 12 12 13 11 10 9 7 9 16 13 10 12 11 8 12 10 10 18 19 16 17 18 20 18 19 20 20	
					2								
					3								
					4								
					5								

Termination reason: Unable to penetrate further. Hole collapsing.

Remarks: Groundwater encountered at 0.0m

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

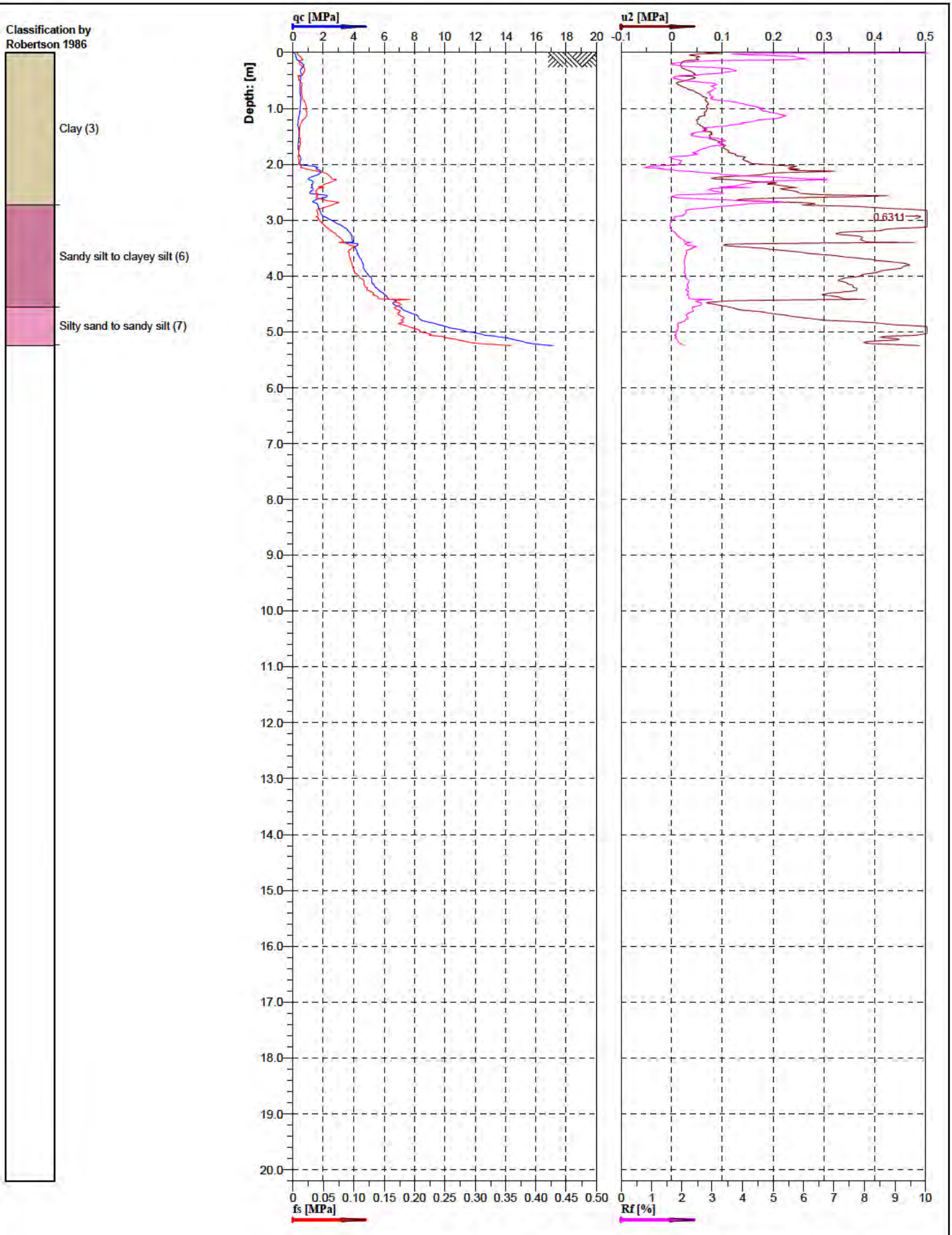


PRO-DRILL

u2

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT01
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT01.GEF	

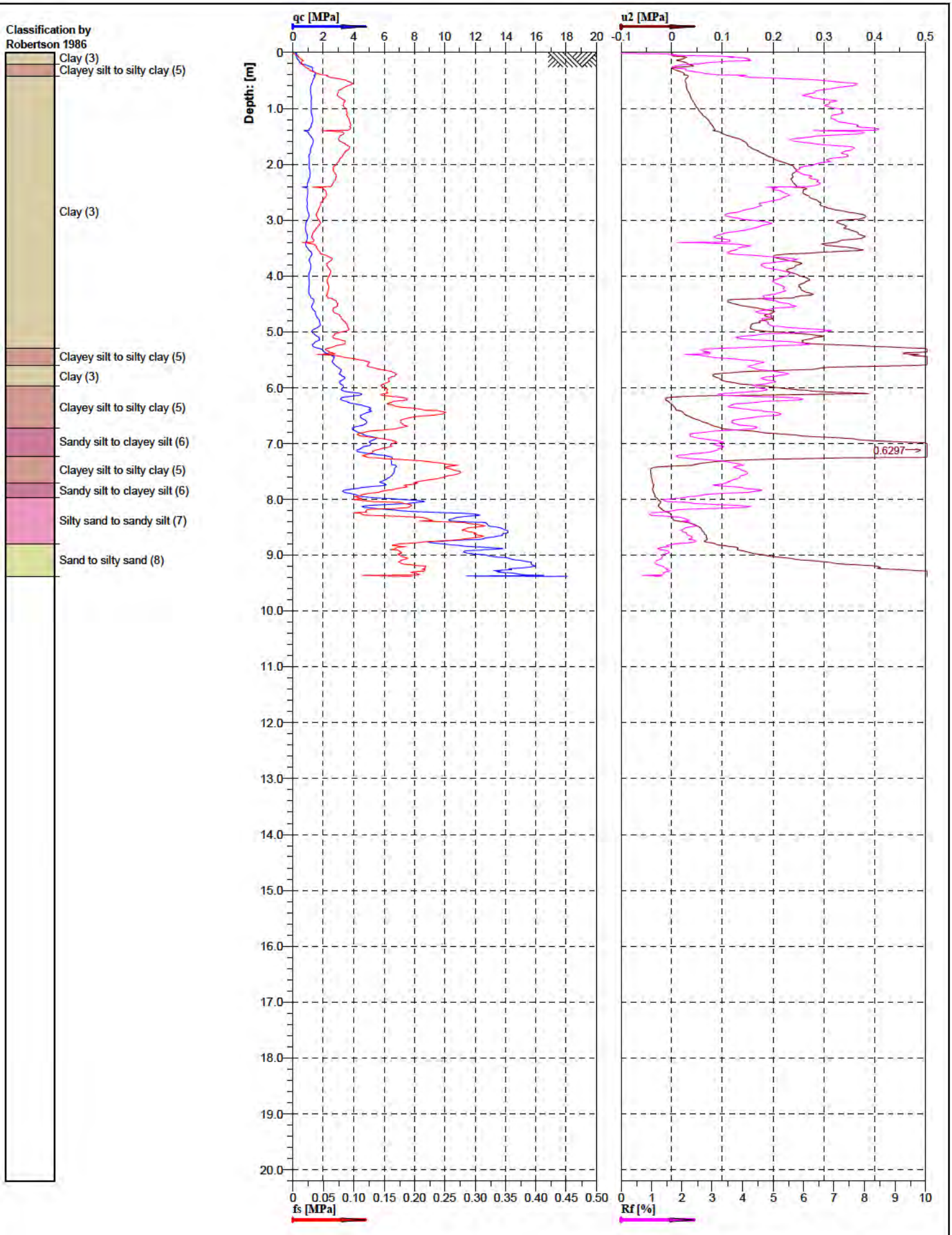


PRO-DRILL

u2

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

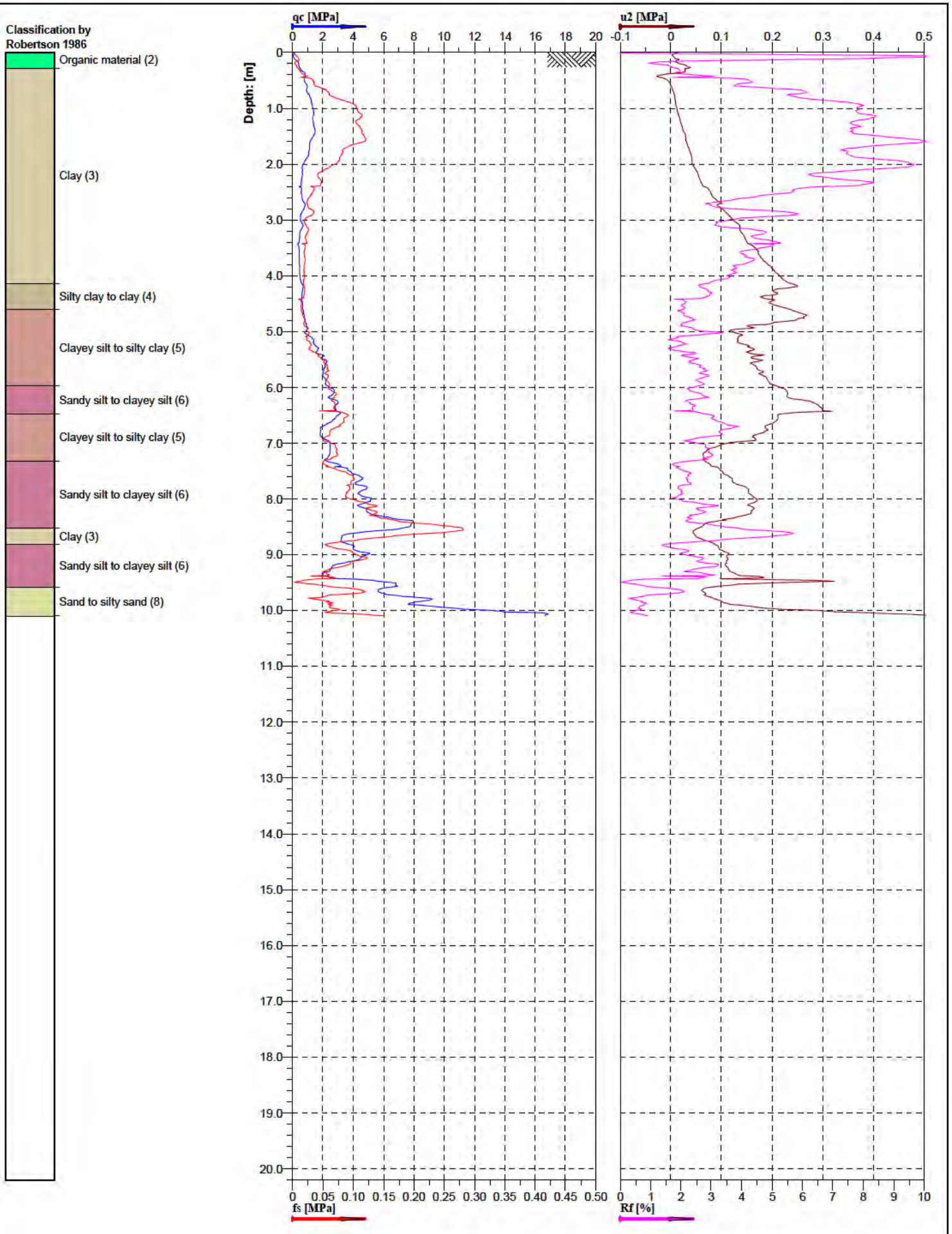
Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT02
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT02.GEF	



PRO-DRILL

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

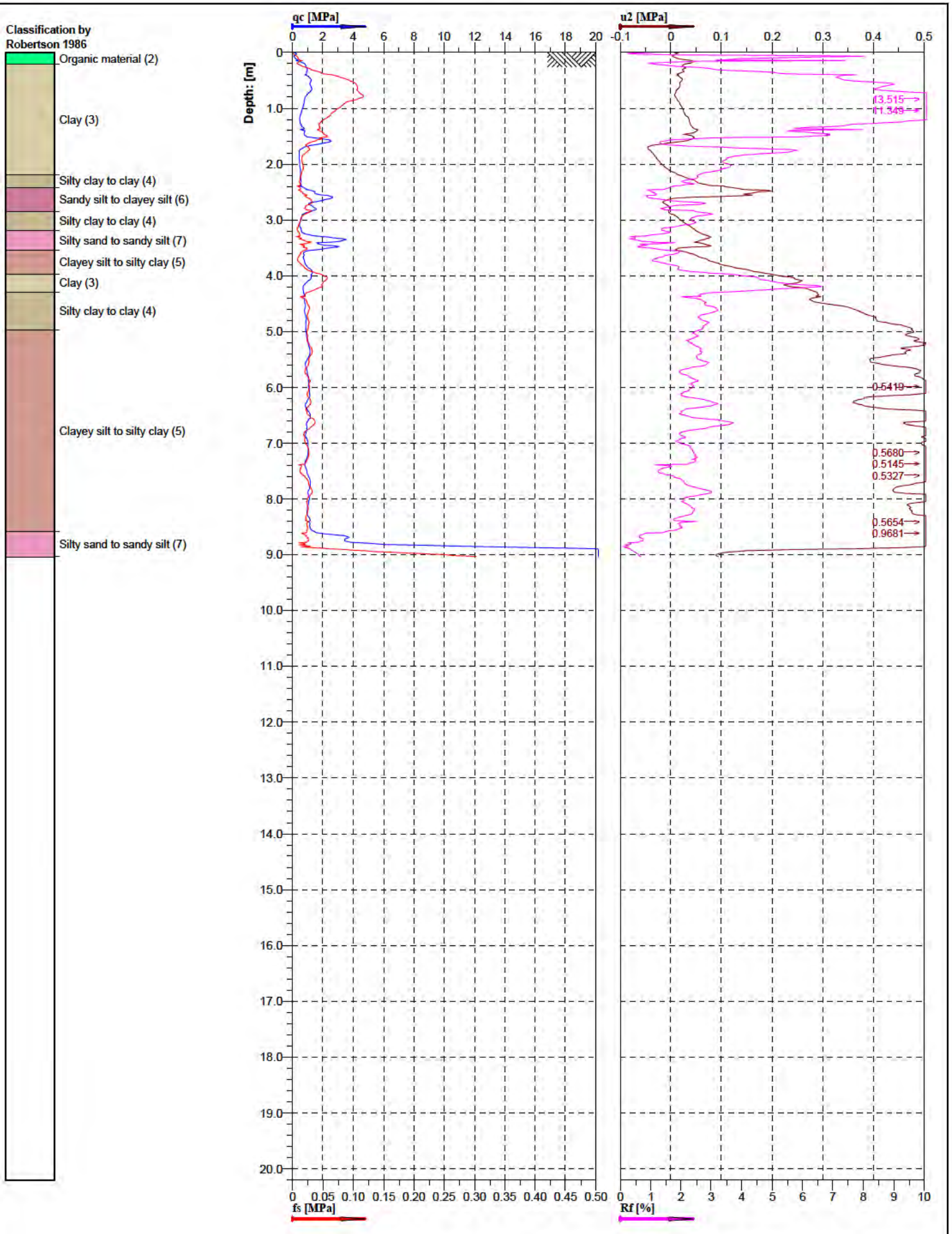
Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT03
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT03.GEF	



PRO-DRILL

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

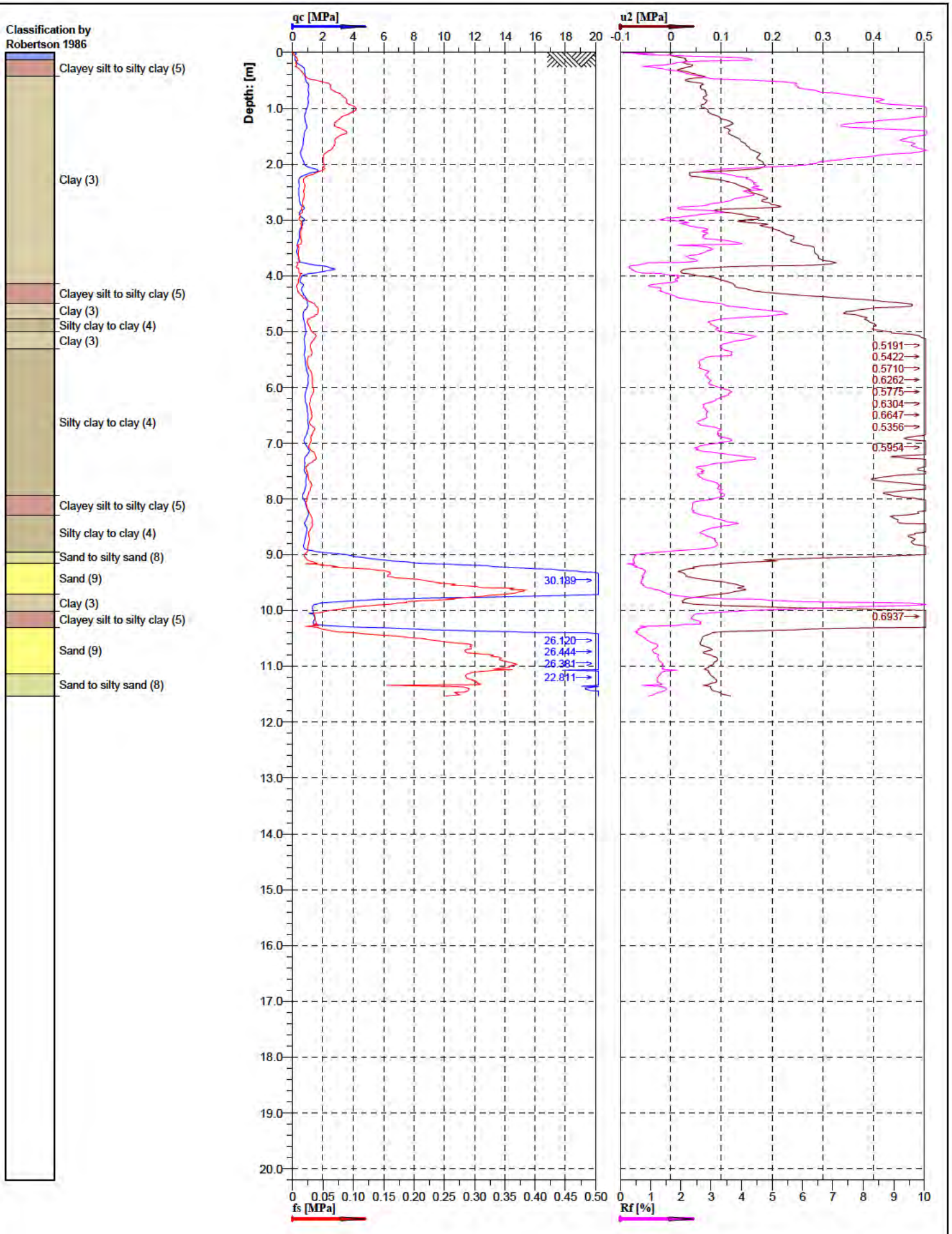
Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT04
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT04.GEF	



PRO-DRILL

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

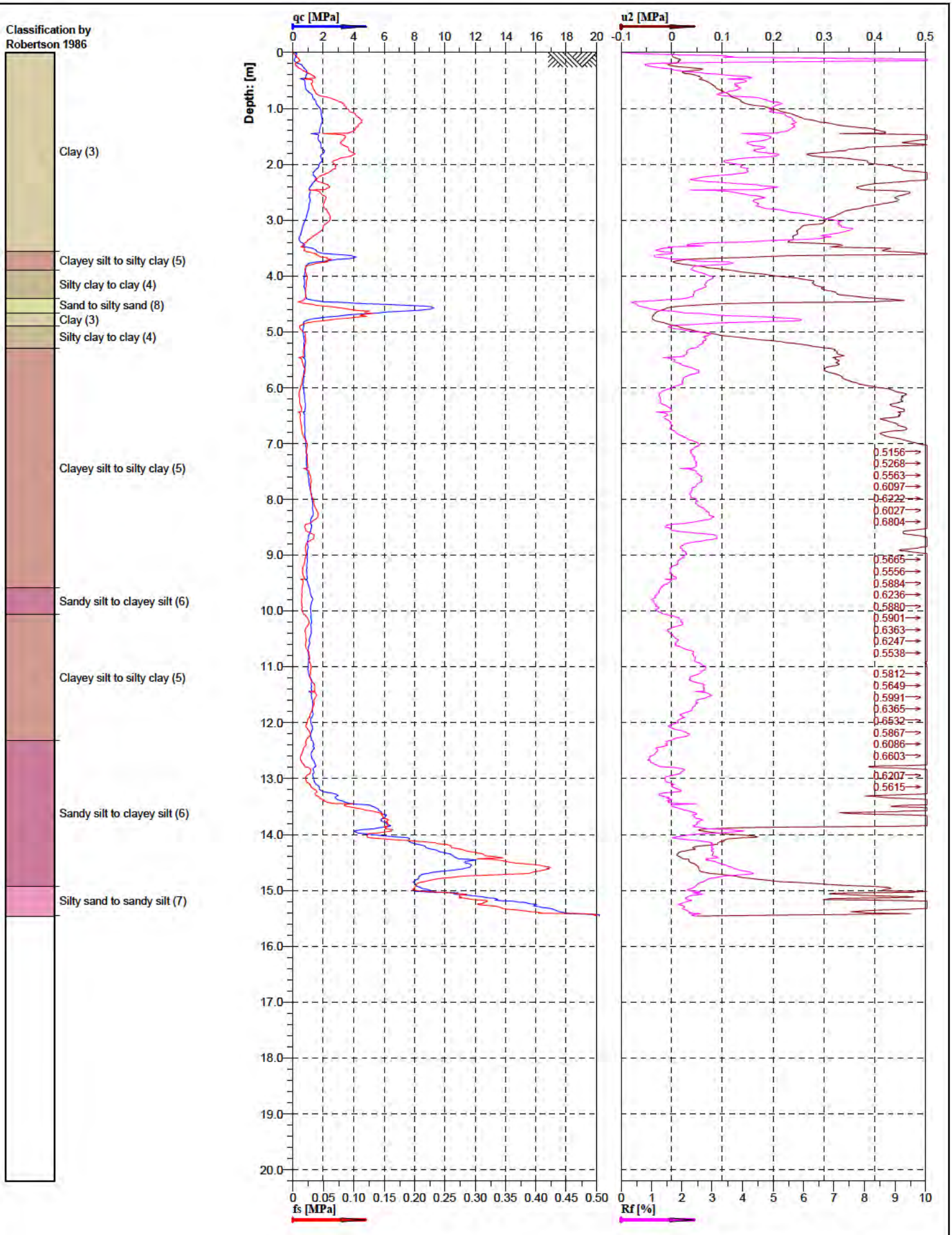
Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT05
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT05.GEF	



PRO-DRILL

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

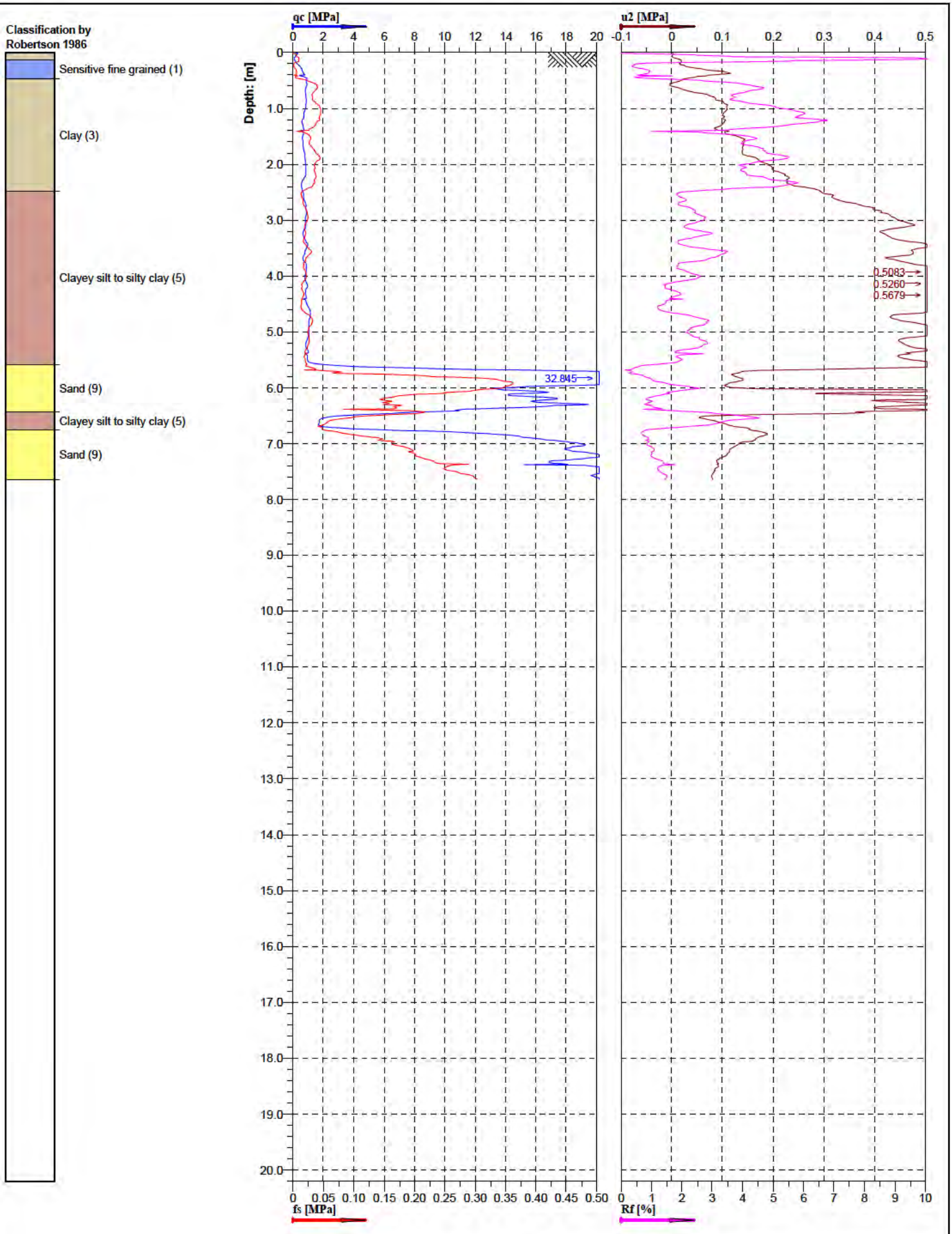
Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT06
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT06.GEF	



PRO-DRILL

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT07
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT07.GEF	



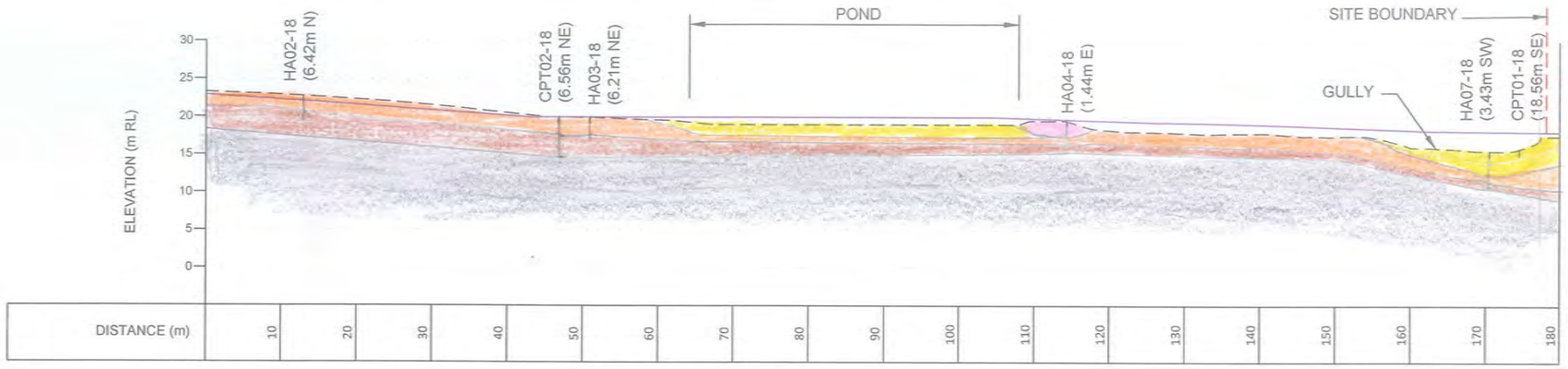
PRO-DRILL

Cone No: S10CFI P.S12141
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Kauri Rd Whenuapai	Position: X: 0 m, Y: 0 m	Ground level: 0.000	Test No.: CPT08
Project ID: CMWAKL2017-0157	Client: CMW	Date: 22/08/2018	Scale: 1 : 87
Project: CMWAKL2017-0157		Page: 1/1	Fig.:
		File: CMWAKL2017-0157_CPT08.GEF	

Soils Legend

- Existing Fill
- Recent Alluvials
- Puketoka Formation Soils
- Waitemata Group Residual Soils
- Waitemata Group Rock



SECTION A
SCALE 1:750

LEGEND:

- EXISTING PROFILE
- DESIGN PROFILE

NOTES:

1. DESIGN PROFILE PROVIDED BY 'THE NEIL GROUP.

1:750 0 7.5 15 22.5 30 37.5 m

CMW Geosciences

CLIENT: THE NEIL GROUP		DRAWN: FMS	PROJECT No: AKL2017-0167
PROJECT: CORNER BRIGHAM CREEK ROAD & KAURI ROAD, WHENUAPAI		CHECKED: JMJ	FIGURE: 02
		REVISION: A	SCALE: 1:750
TITLE: CROSS-SECTION A		DATE: 30/08/2018	SHEET: A3

C:\USERS\FALIQS\DOCUMENTS\AKL2017-0167\AKL2017-0167-SITE PLAN_REV B.DWG

ROADTEST LTD

Revision: 1

DETERMINATION OF THE LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX & LINEAR SHRINKAGE TEST METHOD NZS 4402 : 1986 TEST 2.2, 2.3, 2.4 & 2.6

Project Name :	**Kauri Road**		
		Project No :	18 0240 00
Client :	CMW Geosciences Ltd	Page :	1 of 1
Address :	PO Box 300206 Albany, Auckland 0754	Date of Order :	10.08.18
		Sample Method :	Hand Auger
Attention :	Jack Mynett-Johnson	Sample Date :	01 & 02.08.18
		Sampled By :	CMW Geosciences Ltd

Test Details :

Test performed on :	Whole Sample
History :	Natural

Sample No.	Location	Depth (m)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Linear Shrinkage (LS)	Natural Water Content (%)
053H	HA13-18	3.0 to 3.4	97	34	63	20	40.3
054H	HA05-18	0.4 to 0.8	75	40	35	17	39.4
055H	HA14-18	0.4 to 0.8	40	21	19	10	26.7
056H	HA01-18	0.4 to 0.8	81	43	38	18	60.0

Comments :

Tested By:	SN & MW	Date :	16 to 21.08.18
Calculated By :	SN	Date :	22.08.18
Checked By :	ZH	Date :	22.08.18