



INITIA

GEOTECHNICAL SPECIALISTS

GOODMAN NOMINEE (NZ) LTD

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VILLA MARIA

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GEOTECHNICAL FACTUAL REPORT

INITIA REF P-000982-2 REV 0

MAY 2022

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# 1. Introduction

A series of geotechnical investigations have been carried out to support the development of a 41 Hectare land parcel formerly known as Villa Maria, at 118 Montgomerie Road, Mangere, near Auckland Airport. This factual report summarises the investigation undertaken. Investigation locations are shown on Figure 982-2-001 in Appendix A.

Geotechnical considerations will be addressed in Initia Geotechnical Interpretive Report. Preliminary recommendations regarding four zones within the site are outlined in Initia Memo dated 27 May 2022.

This report includes the factual information presented in Initia Report<sup>1</sup> Ref 982 revision 2, dated March 2021, which was prepared to support the due diligence on the site.

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<sup>1</sup> Initia Ltd, Goodman Nominee (NZ) Ltd, Villa Maria – Geotechnical Assessment – Due Diligence, Ref 982 Rev 2, dated March 2021



## 2. Geotechnical Investigations

### 2.1 Historical Geotechnical Data

At least two stages of historical geotechnical investigations have been completed at the site, including investigations completed by Harrison Grierson (HG) between December 1999 and July 2000; and CMW Geoscience (CMW) between August 2019 and July 2020.

The investigations are summarised below.

#### 2.1.1 Harrison Grierson – December 1999 and July 2000

Harrison Grierson undertook 13 No. machine boreholes (MBs) across the southern area of the site. The ground investigations were terminated at depths between 5.0 m and 9.7 m below the existing ground level (begl). Table 2-1 below presents the borehole details. In situ strength testing comprising Standard Penetration Tests (SPTs) was undertaken at approximately 1.5m intervals within the boreholes, except for borehole MB11, MB12 and MB13 which were wash-drilled through peat until a stiffer material was encountered. Groundwater levels were measured following the completion of each borehole.

We note the coordinates have been inferred from Figure 12292-G01 in the HG report attached in Appendix D.

**Table 2-1: Harrison Grierson Boreholes Summary**

Investigation ID	Coordinates (NZTM) <sup>1</sup>		Termination Depth (m BEGL)	Measured GWL (mBEGL)
	Easting (mE)	Northing (mN)		
MB1	1757318	5905851	6.5	2.5
MB2	1757389	5905880	5.0	1.5
MB3	1757308	5906029	5.0	2.5
MB4	1757273	5905999	5.0	3.8
MB5	1757307	5905946	5.0	2.9
MB6	1757150	5905993	5.0	1.2
MB7	1757264	5905787	5.0	4.2
MB8	1757362	5905733	5.0	3.3
MB9	1757417	5905816	5.0	0.8
MB10	1757383	5905787	5.0	1.5
MB11	1757421	5905950	4.8	0.8
MB12	1757522	5905972	9.7	1.1
MB13	1757787	5906048	5.0	1.7

Note 1: The coordinates were estimated using Lidar and Auckland Council Contours, estimated accuracy  $\pm 5$  m, NZTM coordinates – Coordinate datum: Mt Eden 2000.

#### 2.1.2 CMW Geosciences

CMW undertook investigations for the site comprising Hand Auger boreholes (HAs) with Scala penetrometer tests (scala). The termination depths of the HAs ranged between 0.8 m and 5.4 m begl. Scalas were undertaken at the end of each HA or at 100 mm intervals within the cohesionless soil layers. In situ undrained shear strength were measured within the HA boreholes at approximately 0.4 m intervals using a hand held vane.

The HA details are summarised in Table 2-2 below.

**Table 2-2: CMW Geoscience Ground Investigation Details**

Investigation ID	Coordinates (NZTM) <sup>1</sup>		Ground Surface Elevation <sup>2</sup> (m RL)	Termination Depth (m BGL)	Termination Remarks
	Easting (mE)	Northing (mN)			
HA01-19	1757384	5906424	13.7	0.8	Encountered dense sands
HA02-19	1757470	5906468	10.3	1.2	Refusal on hard ground
HA03-19	1757462	5906382	8.0	3	Refusal on hard ground
HA04-19	1757506	5906429	8.2	0.8	Refusal on hard ground
HA05-19	1757435	5906309	7.6	2	Refusal on hard ground
HA06-19	1757781	5906090	7.5	0.9	Refusal on hard ground
HA07-19	1757862	5906174	7.3	1.5	Refusal on hard ground
HA08-19	1757890	5906074	7.1	1.4	Refusal on hard ground
HA09-19	1757912	5905986	8.3	5.4	Poor Returns and caving
HA10-19	1757945	5906071	13.2	4.4	Gravel collapse down hole
HA11-19	1757372	5906251	7.2	3.2	Too hard to auger
HA12-19	1757311	5906198	8.3	1.0	Refusal on hard ground
HA13-19	1757255	5906287	12.7	0.8	Refusal on hard ground
HA14-19	1757330	5906317	16.6	1.5	Refusal on hard ground
HA01-20	1757378	5906105	8.0	0.9	Hard to continue auger
HA02-20	1757416	5906054	7.5	3.6	Hard to continue auger
HA03-20	1757525	5906045	6.5	5.0	Target depth reached
HA04-20	1757677	5906060	6.5	3.6	Hard to continue auger
HA05-20	1757674	5905953	5.5	5.0	Target depth reached
HA06-20	1757547	5905891	6.5	5.0	Target depth reached
HA07-20	1757442	5905819	6.7	2.6	Hard to continue auger
HA08-20	1757517	5905748	9.0	2.0	Hard to continue auger
HA09-20	1757374	5905761	8.0	1.6	Hard to continue auger
HA10-20	1757062	5905893	15.4	2.0	Hard to continue auger
HA11-20	1757019	5905813	15.0	2.0	Hard to continue auger
HA12-20	1757106	5905773	17.0	2.2	Hard to continue auger

**Note 1:** The coordinates were taken using a **hand-held GPS**, estimated accuracy  $\pm 5$  m NZTM.

**Note 2:** The elevation was taken using a **hand-held GPS**, estimated accuracy  $\pm 5$  m using **AUCKHT 1946 datum**.

## 2.2 Initia Site Investigations

Supplementary investigations were undertaken by Initia in the following stages:

- December 2020 - February 2021: 5 No. Boreholes and 8 No. Cone penetration tests;
- November 2021: 8 No. CPTs; and
- December 2021 to March 2022: 44 No. CPTs and 12 No. BHs.

The locations of all investigations completed by Initia are presented on Figure 982-2-001 in Appendix GFR-A. The investigation test results are presented in Appendix GFR-B.



### 2.2.1 Machine Boreholes

18 No. machine boreholes were drilled by DCN Drilling and Geotech Drilling using a rotary coring technique. All boreholes were terminated at a depth instructed by Initia.

In situ strength testing comprising SPTs and undrained shear strengths were undertaken at approximately 1.5m intervals within the boreholes. Undrained shear strengths were measured within either the borehole or within the core barrel where cohesive material was encountered.

Materials encountered during the investigations were logged in general accordance with the New Zealand Geotechnical Society (NZGS) guidelines by an engineering geologist or geotechnical engineer from Initia.

Groundwater levels were measured at the completion of the BHs. Standpipe piezometers were installed in 5 No. BHs (BH102, BH106, BH108, BH110 and BH112). The groundwater level and Standpipe piezometers details will be discussed in Section 2.3 below.

Boreholes details are summarised in Table 2-3.

**Table 2-3: Initia Machine Boreholes Details**

Investigation ID	Coordinates <sup>1</sup>		Ground Surface Elevation <sup>2</sup> (mRL)	Termination Depth (m BEGL)
	Easting (mE)	Northing (mN)		
BH01	1757895	5906114	7.1	12.5
BH02	1757496	5905965	6.0	12.0
BH03	1757598	5905982	6.0	9.0
BH04	1757710	5905996	6.0	10.5
BH05	1757050	5905789	15.9	6.0
BH101	1757855	5906036	6.8	18.5
BH102	1757797	5906146	6.2	21.2
BH103	1757715	5906085	5.5	12.0
BH104	1757636	5906062	5.6	8.50
BH104A	1757586	5906061	5.7	10.5
BH105	1757605	5905932	6.0	10.0
BH106	1757478	5905881	5.7	15.5
BH107	1757491	5905999	5.9	10.5
BH108	1757369	5906014	6.0	18.0
BH109	1757376	5906132	6.7	15.0
BH110	1757365	5906227	6.9	12.0
BH111	1757030	5905893	12.7	11.0
BH112	1756972	5905788	12.8	11.0

**Note 1:** The coordinates were taken using a hand-held GPS, estimated accuracy  $\pm 5$  m. NZTM coordinates - Coordinate datum: Mt Eden 2000.

**Note 2:** The elevation was derived from Lidar and Auckland Council contours date 2017. Level Datum - New Zealand Vertical Datum 2016 (NZVD2016)

### 2.2.2 Static Cone Penetration Testing (CPTs)

A total of 52 no. CPTs were completed by Geotech Drilling using a combination of track and truck mounted CPT rigs with between 10 and 15 tonne pushing capacity. The CPTs were extended between 0.3 m and 20 m begl to effective refusal (tip resistance.  $Q_c$  greater than 20 MPa) or at a target depth directed by Initia. Table 2-4 below presents a summary of the CPTs details.



Table 2-4 - CPT Summary

Investigation ID	Coordinates NZTM <sup>1</sup>		Ground Surface Elevation <sup>2</sup> (m RL)	Termination depth (m BEGL)
	Easting (mE)	Northing (mN)		
CPT01	1757844	5906017	7.4	20
CPT02	1757604	5905903	6.8	2
CPT03	1757696	5905990	6.2	2.2
CPT04	1757554	5905969	6.0	5.8
CPT05	1757544	5906051	6.0	7.6
CPT06	1757416	5905966	5.8	7.6
CPT07	1757495	5905822	6.0	8
CPT08	1757875	5906041	5.5	3.6
CPT101	1757850	5906087	7.0	1
CPT102	1757778	5906143	6.7	1.6
CPT105	1757813	5906118	6.2	5
CPT106	1757762	5906110	6.4	1.2
CPT107	1757817	5906031	5.7	4.8
CPT108	1757795	5905985	6.3	2.1
CPT109	1757734	5906019	6.0	0.3
CPT110	1757743	5906056	5.8	4.6
CPT111A	1757694	5906076	5.6	4.5
CPT112	1757697	5906075	5.5	1.3
CPT112A	1757635	5906067	5.5	1.4
CPT113	1757656	5906006	5.5	7.8
CPT114	1757704	5905958	6.0	3.3
CPT115	1757624	5905948	5.6	4.3
CPT116	1757590	5906026	5.9	7.3
CPT117	1757554	5905922	5.9	8.3
CPT118	1757532	5905990	6.0	6.5
CPT119	1757492	5906052	6.0	9.3
CPT120	1757468	5906013	5.6	8.4
CPT121	1757498	5905906	5.9	9.6
CPT123	1757533	5905850	5.8	5.5
CPT124	1757469	5905871	5.5	5.4
CPT125	1757435	5905901	5.7	2.6
CPT126	1757416	5905835	5.9	1.4
CPT127	1757416	5905765	5.9	11.5
CPT128	1757358	5905804	6.2	13.2
CPT129	1757383	5905902	6.6	1.8
CPT130	1757361	5905963	6.2	3.0
CPT131	1757398	5906011	6.3	8.4
CPT132	1757355	5906031	6.0	5.4
CPT133	1757386	5906076	6.0	6.5
CPT134	1757432	5906056	5.9	6.0
CPT135	1757429	5906106	5.9	5.8
CPT136	1757341	5906120	5.6	9.4



Investigation ID	Coordinates NZTM <sup>1</sup>		Ground Surface Elevation <sup>2</sup> (m RL)	Termination depth (m BEGL)
	Easting (mE)	Northing (mN)		
CPT137	1757349	5906173	7.8	9.3
CPT138	1757338	5906232	7.4	8.6
CPT139	1757418	5906314	7.4	4.0
CPT142	1757089	5905927	7.7	4.6
CPT143	1756979	5905878	16.8	2.8
CPT144	1756958	5905821	11.2	6.8
CPT145	1756998	5905766	11.6	6.6
CPT146	1757041	5905827	13.9	3.7
CPT147	1757084	5905802	15.8	4.6
CPT148	1757844	5906017	17.3	4.8

**Note 1:** The coordinates were taken using a hand-held GPS, estimated accuracy  $\pm 5$  m. NZTM coordinates - Coordinate datum: Mt Eden 2000.

**Note 2:** The elevation was derived from Auckland Council/Lidar contours date 2017, Level Datum NZVD2016.

## 2.3 Groundwater

A summary of recorded groundwater levels from historical and recent ground investigations are presented in Table 2-6 were measured following the completion of geotechnical investigations. 3 No. standpipe piezometers were installed in Initia's Boreholes, which were undertaken in March 2022, to monitor groundwater levels. A summary of the piezometer installations is presented in Table 2-5 below.

**Table 2-5: Summary of Standpipe Piezometers**

Investigation ID	Installation Date	Solid Pipe Elevation (m RL)	Screen Depth (m begl)	Screen Elevation (m RL)	Geological Unit over Screen Depth
BH102	13/03/2022	6.2	5.0 to 7.0	-0.8 to 1.2	Unweathered Basalt and Sandy Gravel - dense
BH106	23/03/2022	5.7	4.0 to 6.0	-0.3 to 1.7	Sandy gravelly Cobbles - medium dense
BH108	16/03/2022	6.0	4.0 to 6.0	0.0 to 2.0	SILT - very soft
BH110	18/03/2022	6.9	4.0 to 6.0	0.9 to 2.9	Organic SILT, soft and SILT with some Clay - soft
BH112	25/03/2022	12.8	4.0 to 6.0	6.8 to 8.8	SAND with some Silt - medium dense

1 No. Electronic 'level-logger' was installed in BH106 at the completion of the borehole for continuous monitoring of groundwater levels. Manual groundwater measurements are being obtained infrequently from the standpipe piezometers installed in the boreholes using a handheld dip meter.

Table 2-6 presents the results of monitoring to date.



**Table 2-6: Groundwater Results to Date**

Investigation ID	Date of Measurement	Measured Groundwater Depth (m BGL)	Measured Groundwater Elevation (m RL)
BH102	13/03/2022	1.6*	4.6
	05/04/2022	1.7	5.1
BH106	23/03/2022	1.0*	4.7
	05/04/2022	0.8	4.9
BH108	16/03/2022	1.6*	4.4
	05/04/2022	0.7	5.1
BH110	-	-	-
	05/04/2022	0.41	5.2
BH112	25/03/2022	3.2*	9.6
	-	-	-

Note:

\*: Measured instantly on the completion of borehole.

## 2.4 Laboratory Testing

A series of lab tests were completed by Geotechnics Ltd and IANZ accredited WSP on selected samples retrieved from within the Initia boreholes. The laboratory tests have comprised the following:

- Geotechnics Ltd:
  - 2 No. of One-Dimensional Consolidation Test.
- IANZ accredited WSP Lab:
  - 6 No. of One-Dimensional Consolidation Test
  - 2 No. of Atterberg Limits;
  - 2 No. of Water Content; and
  - 2 No. of Organic Content.

Details of the laboratory tests are summarised in Table 2-7 and Table 2-8 below. Laboratory test results are attached in Appendix GFR-C.



**Table 2-7: Summary of laboratory samples on clayey silt (amorphous peat)**

Sample ID	Material description	Sample depth (m)	Laboratory test completed	Natural Water Content	Organic Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %
BH105-02	Clayey SILT	4.5	1D consolidation; Natural water content; Organic content	211%	9	294	86	208
BH110-02	Clayey SILT	4.5	1D consolidation; Natural water content; Organic content	265%	20	446	143	303
BH104A-02	Clayey SILT	3.25	1D consolidation			N/A		
BH106-01	Clayey SILT	1.5	1D consolidation					
BH108-01	Clayey SILT	3.4	1D consolidation					
BH3-2	Clayey SILT	4.75	1D consolidation					
BH4-1	Clayey SILT	3.3	1D consolidation					

**Table 2-8: Summary of laboratory samples completed on fibrous peat**

Sample ID and material description	Sample depth (m)	Laboratory test completed	Natural Water Content
BH104A-01 PEAT	1.5	1D consolidation	N/A
BH102-01 PEAT	1.5	Natural water content	210%
BH107-01 PEAT	1.5	Natural water content	734%

### 3. Applicability

This report has been prepared for our client, Goodman Nominee (NZ) Ltd, with respect to the brief provided to us.

Report prepared by:

Report reviewed by:

Tram Dinh  
**Geotechnical Engineer**

Nathan Hickman  
**Senior Geotechnical Engineer**

Report authorised for Initia Ltd by:

Andy Pomfret  
**Senior Geotechnical Engineer/Director**



## Document control record

Report Title		Villa Maria Geotechnical Factual Report			
Initia Project Reference		P-000982-2			
Client		Goodman Nominee (NZ) Ltd			
Revision	Date	Revision detail	Author	Reviewer	Approved by
0	May 22	Final	T.Dinh	N. Hickman	A. Pomfret
Current Revision		0			



## Appendix GFR-A: Figures

- Site Investigation Location Plan - Initia



**LEGEND**

INITIA INVESTIGATIONS (MAR 2022)

MACHINE BOREHOLE  
BH101

INITIA INVESTIGATIONS (OCT 2021)

CONE PENETRATION TEST  
CPT101

INITIA INVESTIGATIONS (DEC 2020 & FEB 2021)

CONE PENETRATION TEST  
CPT01  
 MACHINE BOREHOLE  
BH01

HISTORICAL INVESTIGATIONS

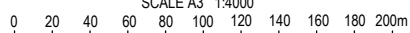
HAND AUGER (CMW - JULY 2019)  
HA01-19  
 HAND AUGER (CMW - JUNE 2020)  
HA01-20  
 MACHINE BOREHOLE (HG - JULY 2000)  
MB1

SITE BOUNDARY  
 EXISTING GROUND CONTOUR (0.5m INTERVAL)



- NOTES**
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
  2. COORDINATE DATUM: MOUNT EDEN 2000
  3. LEVEL DATUM: NEW ZEALAND VERTICAL DATUM 2016 (NZVD2016)
  4. AERIAL IMAGE, PROPERTY BOUNDARY, LIDAR CONTOUR AND EXISTING SERVICES TAKEN FROM AUCKLAND COUNCIL DATE 2017.

SCALE A1 1:2000  
SCALE A3 1:4000



**FOR INFORMATION**

**NOT FOR CONSTRUCTION**

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

APPROVED:

DATE:

Scale

AS SHOWN

Original Size

A3



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GOODMAN PROPERTY

**VILLA MARIA PROJECT - 118 MONTGOMERIE ROAD, MANGERE - STAGE 2**

**GEOTECHNICAL INVESTIGATION LOCATION PLAN**

Initia Project ref: P000982

Figure Number 982-2-001

Revision B

Rev	Revision Description	Designed	Drawn	Checked	Scale	AS SHOWN	Original Size	A3
B	ADDITIONAL INVESTIGATION (30/03/2022)	GG						
A	INVESTIGATION LOCATION (20/12/2021)	BS	GG	BS				

## Appendix GFR-B: Initia Investigation Results

- Machine Boreholes;
- Static Cone Penetration Tests;





# DRILLHOLE LOG

**HOLE NO.:**  
BH101

**Project Ref.:**  
P-000982-2

**START DATE:** 03/03/2022  
**END DATE:** 04/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757855.3mE, 5906036.9mN **ELEVATION:** 6.8m **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM **Datum:** AUCKHT1946 **RIG:** Tracked mounted rig

**Location method:** GPSH **Level method:** CONTOUR **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING						STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%)		RQD (%)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		
			DW	SW	HW	OW	EW	VW						W	MS			ES	DESCRIPTION	WATER
Topsoil	SILT, with minor organics; dark brown. Firm; non-plastic; moist.	[Symbol]											HQTT	25-50	50-75					
Auckland Volcanic Field	Gravelly SILT, with trace cobbles; brown with black speckles. Hard; non-plastic; moist; gravel, fine; cobbles, up to 60mm. 1.2m - 1.5m: Core loss	[Symbol]							1	6.0		HQTT	25-50	50-75						
	Gravelly SAND; dark grey with light brown speckles. Very dense; moist; sand, medium to coarse; gravel, fine to medium, Basalt.	[Symbol]							2	5.0		SPT	86	100	25	11, 24 / 18, 22, 10 for 20mm N=50+ for 170mm				
	GRAVEL, with some sand; grey. Medium dense; moist; gravel, fine to coarse, basalt; sand, fine to coarse.	[Symbol]							4	4.0		HQTT	100	100	25					
Alluvium	Sandy SILT, with minor gravel, with trace cobbles; dark grey. Very stiff; moist; sand, fine to medium; gravel, fine, basalt; cobbles, up to 60mm, basalt.	[Symbol]							3	3.0		SPT	55	85	25	2, 2 / 1, 2, 2, 2 N=7				
	Clayey SILT; greenish grey with light brown mottles. Firm; high plasticity; moist.	[Symbol]							4	3.0		HQTT	95	100	25					
	PEAT (PLASTIC); black. Firm; moist. 6.0m - 6.45m: Push tube (450mm recovery)	[Symbol]							5	2.0		SPT	66	100	25	0, 0 / 0, 0, 0, 0 N=0				
Puketokai Formation	Organic clayey SILT; dark grey. Soft; high plasticity; moist.	[Symbol]							6	1.0		DPT	100	100	25					
	PEAT (SPONGY); black. Soft; moist.	[Symbol]							7	0.0		HQTT	100	100	25					
	Organic clayey SILT; dark grey. Soft; high plasticity; moist.	[Symbol]							8	1.0		SPT	100	100	25	0, 1 / 1, 0, 2, 2 N=5				
	Sandy SILT, with some organics; dark grey. Very stiff; moist; sand, fine.	[Symbol]							9	2.0		HQTT	100	100	25	1, 0 / 0, 0, 1, 1 N=2				
	7.95m - 8.50m: Dilatant	[Symbol]							8	2.0		HQTT	100	100	25					
	9.00m: grades to stiff.	[Symbol]							9	2.0		SPT	100	100	25					
	9.45m - 10.5m: Core loss	[Symbol]							10	3.0		HQTT	100	100	25					

08/03/2022

Bentonite

Box 1, 0.0-4.0m

Box 2, 4.0-8.0m

Box 3, 8.0-12.6m

REMARKS:

Ver 3.0 - Generated with CORE-GS by Geroc - Drillhole\_Initia - 14/04/2022 2:28:59 PM





# DRILLHOLE LOG

**HOLE NO.:**  
BH101

**Project Ref.:**  
P-000982-2

**START DATE:** 03/03/2022  
**END DATE:** 04/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757855.3mE, 5906036.9mN    **ELEVATION:** 6.8m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

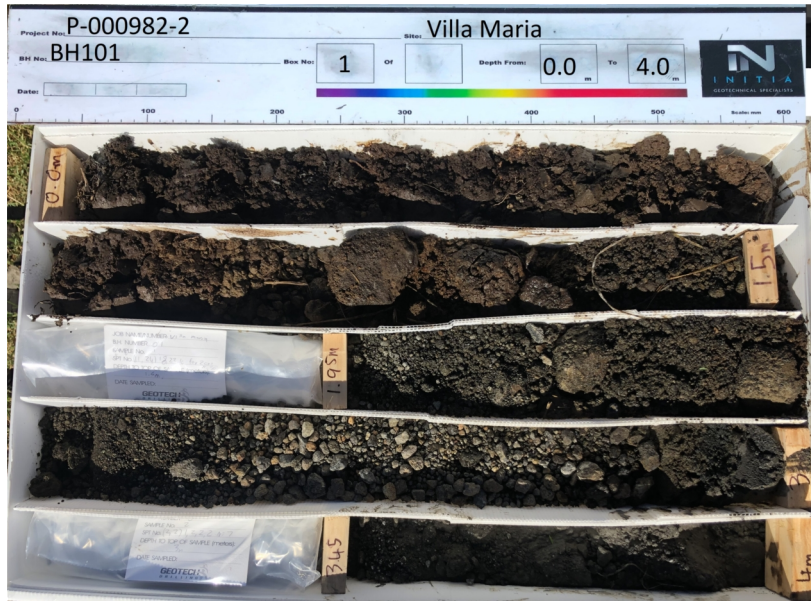
**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW EV VW WS VS ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES	
												DESCRIPTION					
	[Cont...] 9.45m - 10.5m: Core loss							HQTT	0	0							
	Organic clayey SILT; dark grey. Soft to firm; high plasticity; moist.					-4.0		SPT	100	100		0, 0 / 1, 0, 1, 0 N=2					
	Silty SAND; light grey. Dense; non-plastic; moist; sand, fine to medium.					-5.0		HQTT	100	100							
	Silty SAND; light grey. Dense; non-plastic; moist; sand, fine to medium.					-6.0		SPT	100	100		2, 5 / 10, 8, 7, 7 N=32					Box 3, 8.0-12.6m
	Silty SAND; grey. Medium dense; non-plastic; moist; sand, fine. - INTERBEDDED WITH - Clayey SILT; grey. Stiff, high plasticity; moist.					-7.0		HQTT	100	100							
	Silty SAND; grey. Medium dense; non-plastic; moist; sand, fine. - INTERBEDDED WITH - Clayey SILT; grey. Stiff, high plasticity; moist.					-8.0		SPT	77	77		1, 2 / 3, 3, 4, 7 N=17					
	SAND, with minor silt; grey. Medium dense; non-plastic; moist; sand, fine to medium.					-9.0		HQTT	76	76							
	SAND, with minor silt; grey. Medium dense; non-plastic; moist; sand, fine to medium.					-10.0		SPT	55	55		1, 4 / 4, 5, 8, 8 N=25					
	15.50m - 16.00m: wet					-11.0		HQTT	100	100							
	16.90m - 17.50m: Dilatant.					-12.0		SPT	100	100		3, 4 / 3, 11, 16, 16 N=46					Box 4, 12.6-16.4m
	EOH: 18.45m					-13.0		HQTT	100	100							
						-14.0		SPT	100	100		4, 3 / 4, 10, 15, 15 N=44					Box 5, 16.4-18.5m

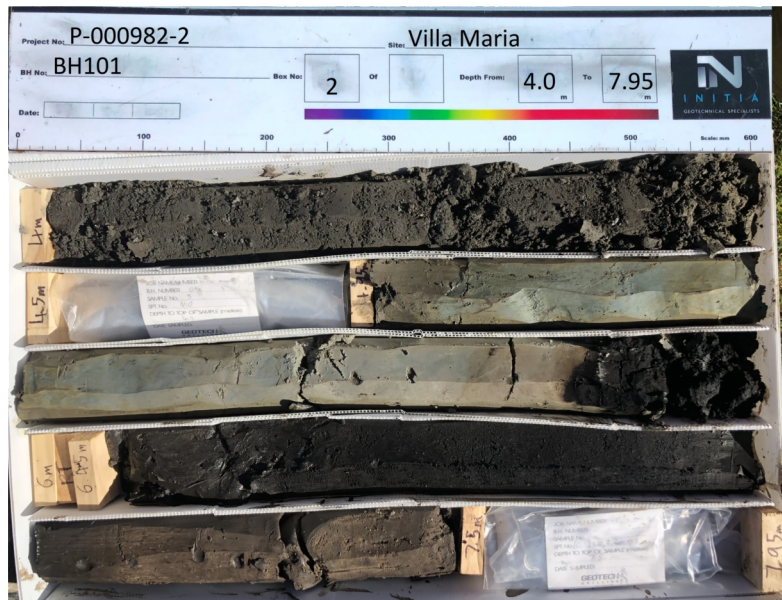
REMARKS:

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Box 1, 0.0-4.0m



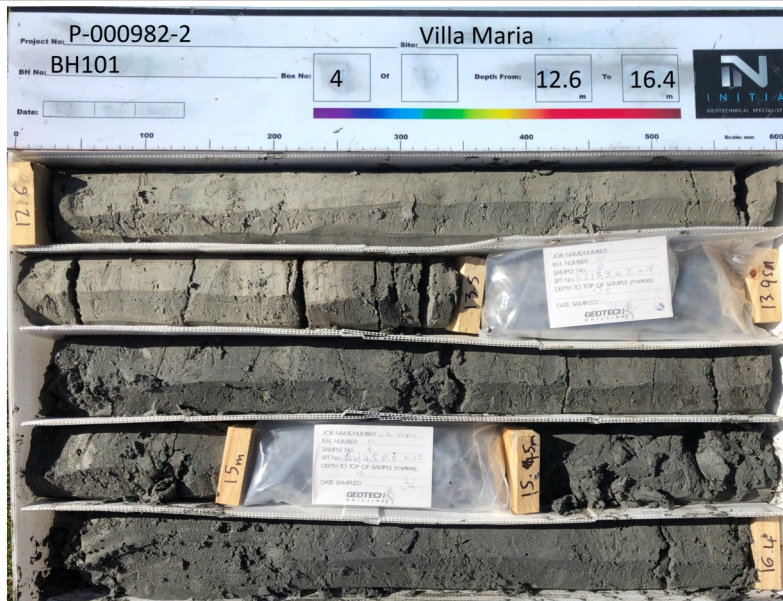
Box 2, 4.0-8.0m



Box 3, 8.0-12.6m



Box 4, 12.6-16.4m



Box 5, 16.4-18.5m





# DRILLHOLE LOG

**HOLE NO.:**  
BH102

**Project Ref.:**  
P-000982-2

**START DATE:** 07/03/2022  
**END DATE:** 09/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757797.9mE, 5906146.2mN    **ELEVATION:** 6.2m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>SW HW OW EW MW W WS WS ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES			
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Alluvium	SILT, with minor gravel and cobbles, with trace rootlets, wood fragments; brown. Stiff; moist; gravel, subangular, cobbles, subangular, up to 60mm.	[Symbol]			0.0 - 1.0	6.0		HQTT	73						
	1.1m - 1.5m: Core loss	[Symbol]			1.0 - 1.5	5.0		DPT	100						
	1.5m - 1.95m: Push Tube	[Symbol]			1.5 - 1.95	4.5									
	PEAT (FIBROUS); black. Soft; moist.	[Symbol]			1.95 - 2.5	4.0		HQTT	47						
	SILT, with minor clay; brownish grey. Firm; low plasticity; moist; sponged. 2.5m - 3.0m: Core loss	[Symbol]			2.5 - 3.0	3.0		DPT	100						
Auckland Volcanic Field	3.0m - 3.45m: Push Tube	[Symbol]			3.0 - 3.45	3.0		DPT	100						
	Clayey SILT; grey with brownish grey. Soft; high plasticity; moist.	[Symbol]			3.45 - 4.2	3.0		HQTT	76						
	Gravelly SILT; grey with brownish grey mottles. Firm; low plasticity; moist; gravel, fine.	[Symbol]			4.2 - 4.5	2.0		HQTT	76						
Auckland Volcanic Field	Sandy GRAVEL, with trace cobbles; grey. Moist; gravel, fine to coarse, basalt; sand, coarse; cobbles, basalt; loosely packed. 4.2m - 4.5m: Core loss	[Symbol]			4.2 - 4.5	2.0		SPT	100		10, 40 N=50+				
	Unweathered; grey; BASALT; strong; moderately vesicular.	[Symbol]	SW	S	4.5 - 5.0	1.0		HQTT	100	88					
Auckland Volcanic Field	Sandy GRAVEL, with trace cobbles; dark grey. Dense; moist; gravel, fine to coarse, basalt; cobbles, subangular, up to 60mm, basalt. 6.5m - 7.5m: Core loss	[Symbol]			6.5 - 7.5	0.0		HQTT	100						
	Clayey SILT, with trace sand; greenish grey with black speckles. Firm; high plasticity; moist; sand, fine.	[Symbol]			7.5 - 8.0	-1.0		SPT	0		0, 0 / 0, 0, 0, 0 N=0				
Pukekohe Formation	Clayey SILT, with minor organics; brownish grey with black mottles. Firm; high plasticity; moist. 9.0m - 9.45m: Push Tube	[Symbol]			9.0 - 9.45	-3.0		HQTT	100						
	Clayey SILT, with trace sand; greenish grey. Stiff; high plasticity; moist; sand, fine.	[Symbol]			9.45 - 9.9	-3.0		DPT	88						

REMARKS:

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INITIA

GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

HOLE NO.:  
BH102

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
P-000982-2

CO-ORDINATES: 1757797.9mE, 5906146.2mN ELEVATION: 6.2m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

START DATE: 07/03/2022  
END DATE: 09/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING DW SW HW OW EW VW W MS S ES	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) 25 50 75	RQD (%) 25 50 75	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES	
												DESCRIPTION					
Pukekohe Formation	[Cont...] Clayey SILT, with trace sand; greenish grey. Stiff; high plasticity; moist; sand, fine. Sandy SILT; greenish grey. Hard; low plasticity; moist; sand, fine. Clayey SILT, with minor sand; greenish grey. Hard; high plasticity; moist; sand, fine.	[Cross-hatched pattern]			4.0			HQTT				1, 1 / 2, 2, 3, 5 N=12					
	Clayey SILT, with minor organics; brownish grey with black mottles. Firm; high plasticity; moist.	[Cross-hatched pattern]			5.0			SPT				0, 0 / 0, 0, 0, 0 N=0					
		[Cross-hatched pattern]			6.0			HQTT				0, 0 / 0, 0, 0, 0 N=0					
		[Cross-hatched pattern]			7.0			SPT				0, 0 / 0, 0, 0, 0 N=0					
		[Cross-hatched pattern]			8.0			HQTT				0, 0 / 0, 0, 0, 0 N=0					
		[Cross-hatched pattern]			9.0			SPT				0, 0 / 0, 0, 0, 0 N=0					
		[Cross-hatched pattern]			10.0			HQTT				2, 3 / 4, 6, 7, 9 N=26					
		[Cross-hatched pattern]			11.0			SPT				1, 2 / 5, 6, 6, 7, 9 N=27					
		[Cross-hatched pattern]			12.0			HQTT				3, 6 / 12, 20, 18 for 70mm N=50+ for 220mm					
		[Cross-hatched pattern]			13.0			SPT									

REMARKS:

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INITIA

GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

HOLE NO.:  
BH102

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
P-000982-2

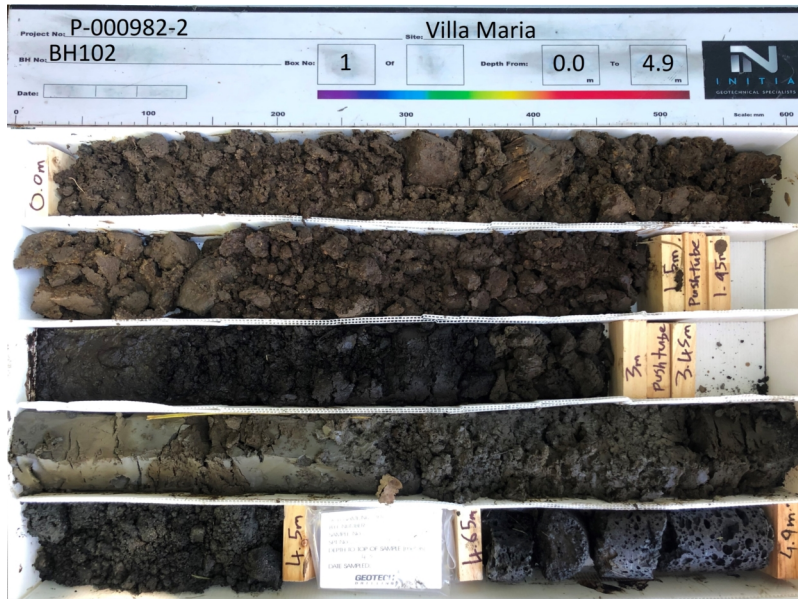
CO-ORDINATES: 1757797.9mE, 5906146.2mN ELEVATION: 6.2m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

START DATE: 07/03/2022  
END DATE: 09/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

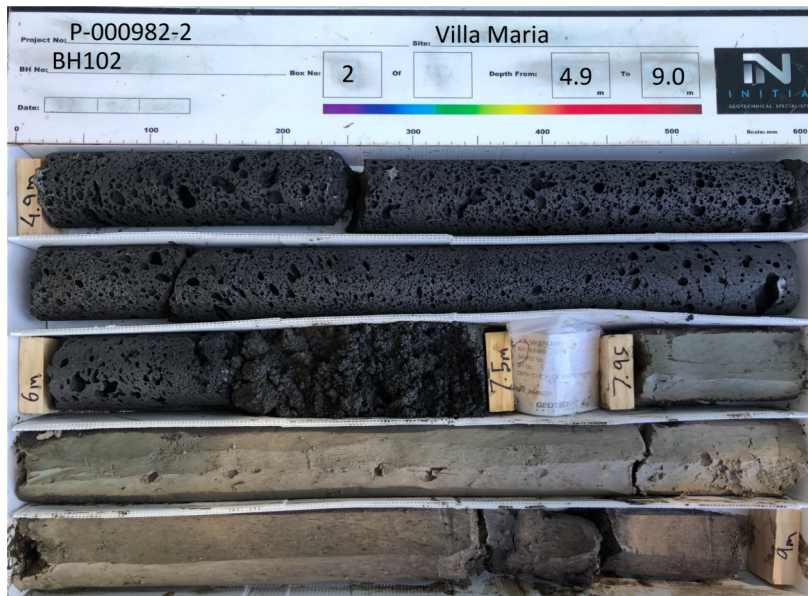
UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING DW SW HW OW EW VW W WS S ES	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) 25 50 75	RQD (%) 25 50 75	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES	
												DESCRIPTION					
Pukekohe Formation	[Cont...] Silty SAND, with trace organics; dark grey with black speckles. Very dense; moist; sand, fine to medium.				14.0												
	SAND, with minor silt; light grey. Very dense; moist; sand, fine to medium, pumice.				21.0			SPT	75		18, 32 N=50+				Bentonite 21.2m	Box 5, 18.0-21.2m	
	EOH: 21.20m				15.0												
					16.0												
					17.0												
					18.0												
					19.0												
					20.0												
					21.0												
					22.0												
					23.0												

REMARKS:

Box 1, 0.0-4.9m



Box 2, 4.9-9.0m



Box 3, 9.0-13.0m



Box 4, 13.0-18.0m



Box 5, 18.0-21.2m







# DRILLHOLE LOG

**HOLE NO.:**  
BH103

**Project Ref.:**  
P-000982-2

**START DATE:** 09/03/2022  
**END DATE:** 11/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757715.0mE, 5906085.9mN    **ELEVATION:** 5.5m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%)	RQD (%)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES			
												DESCRIPTION	WATER	INSTALLATION	
Topsoil	SILT, with minor rootlets; brown. Firm; non-plastic; moist.	[Symbol]	SW		0.0 - 0.5	5.5		HQTT	25-75						
Alluvium	SILT, with some organics; brown. Soft; non-plastic; moist. Organic SILT; black. Soft; non-plastic; moist. Slightly weathered; grey; BASALT; strong; Moderately vesicular.  1.2m - 1.5m: Core loss	[Symbol]	SW		0.5 - 5.8	5.0 - 1.2		HQTT	25-75		22 / 14 kPa				
	5.8m - 6.0m: Core loss	[Symbol]			6.0 - 6.8			HQTT	25-75		30, 20 for 25mm N=50+				
	Cobbly GRAVEL, with trace boulders. Medium dense; moderately weathered.  6.8m - 9.0m: Core loss	[Symbol]			6.8 - 9.0			HQTT	25-75						
	7.50m: grades to dense.	[Symbol]			7.5			HQTT	25-75						
	9.00m: grades to medium dense.	[Symbol]			9.0			HQTT	25-75						
		[Symbol]			9.0 - 10.0			HQTT	25-75						

**REMARKS:**

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# DRILLHOLE LOG

**HOLE NO.:**  
BH103

**Project Ref.:**  
P-000982-2

**START DATE:** 09/03/2022  
**END DATE:** 11/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757715.0mE, 5906085.9mN    **ELEVATION:** 5.5m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW VW W WS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES
												DESCRIPTION				
Auckland Volcanic Field	[Cont...] Cobbly GRAVEL, with trace boulders. Medium dense; moderately weathered.  EOH: 12.00m				5.0 11.0 6.0			HQTT	100	0				Bentonite		Box 3, 8.0-12.0m
					7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0											

REMARKS:

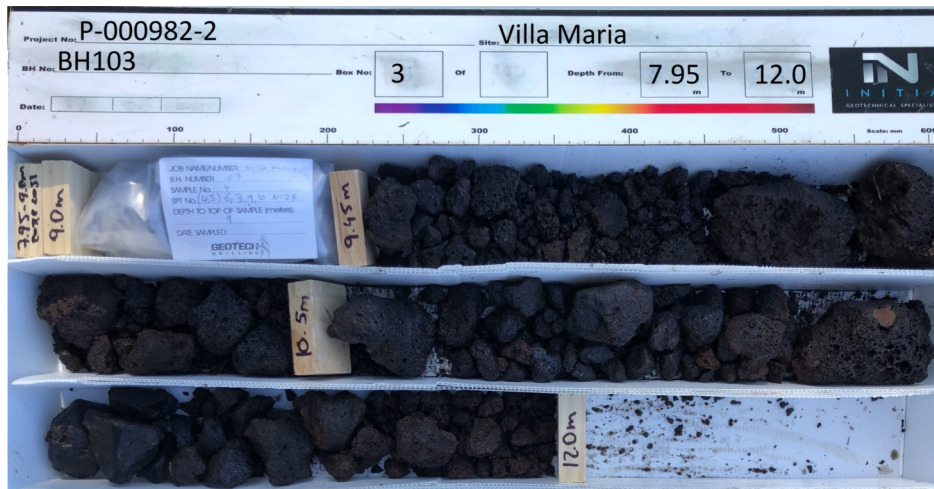
Box 1, 0.0-3.4m



Box 2, 3.4-8.0m



Box 3, 8.0-12.0m





# DRILLHOLE LOG

**HOLE NO.:**  
BH104A

**Project Ref.:**  
P-000982-2

**START DATE:** 25/03/2022  
**END DATE:** 25/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757586.0mE, 5906061.0mN    **ELEVATION:** 5.7m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DM SW HW OW EV VW WS VS ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		
												DESCRIPTION	WATER	INSTALLATION
Top soil	SILT, with some rootlets and peat; dark brown. Soft; non-plastic; moist to wet. 0.2m - 1.5m: Core loss	[Symbol]			0.2 - 1.5	5.0 - 1.5		HQTT			20 / 14 kPa			
	1.5m - 1.95m: Push Tube (450mm recovered)	[Symbol]			1.5 - 1.95	4.0 - 1.95		DPT	100		22 / 17 kPa			
	PEAT (FIBROUS); black. Soft; moist.	[Symbol]			2.0 - 3.0	3.0 - 2.0		HQTT	61		22 / 14 kPa			
	2.6m - 3.0m: Core loss	[Symbol]			2.6 - 3.0	3.0 - 2.6		HQTT	61		20 / 11 kPa			
	3.0m - 3.45m: Push Tube (450mm recovered)	[Symbol]			3.0 - 3.45	3.45 - 3.0		DPT	100		20 / 11 kPa			
	Organic SILT, with some clay; greyish brown. Soft; low plasticity; moist.	[Symbol]			3.9m - 4.5m: Core loss	4.5 - 3.9		HQTT	47		17 / 8 kPa			
Alluvium	4.5m - 4.95m: Push Tube (450mm recovered)	[Symbol]			4.5 - 4.95	4.95 - 4.5		DPT	100		17 / 8 kPa			
	5.7m - 6.0m: Core loss	[Symbol]			5.7 - 6.0	6.0 - 5.7		HQTT	66		17 / 6 kPa			
	6.0m - 6.45m: Push Tube (450mm recovered)	[Symbol]			6.0 - 6.45	6.45 - 6.0		DPT	100		17 / 6 kPa			
	Slightly weathered; grey; BASALT; strong; moderately vesicular.	[Symbol]	SW	S	7.0 - 8.0	8.0 - 7.0		SPT	33					
Auckland Volcanic Field		[Symbol]			8.0 - 9.0	9.0 - 8.0		HQTT	95	28				
		[Symbol]			9.0 - 10.5	10.5 - 9.0		HQTT	86	28				

25/03/2022

Bentonite

7.40m, 1No. 45°, JT, ST, RG

Box 1, 0.0-7.4m

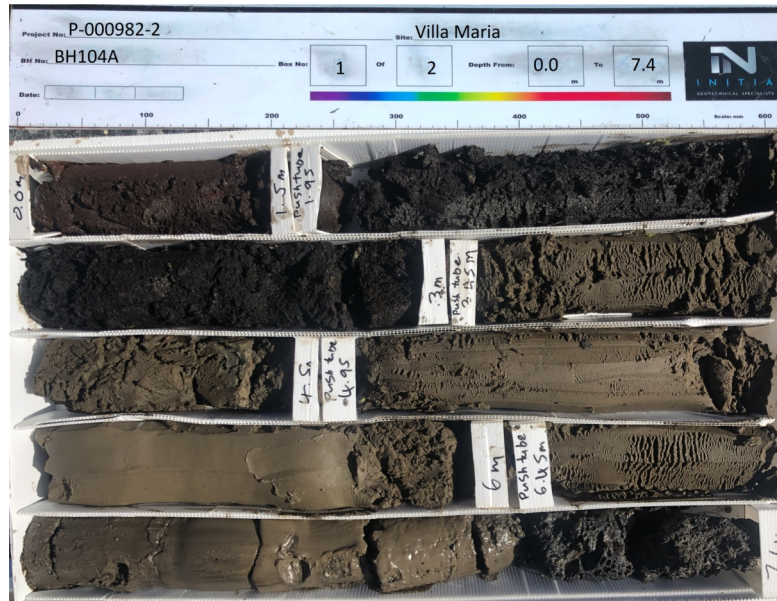
Box 2, 7.4-10.5m

REMARKS:

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Box 1, 0.0-7.4m

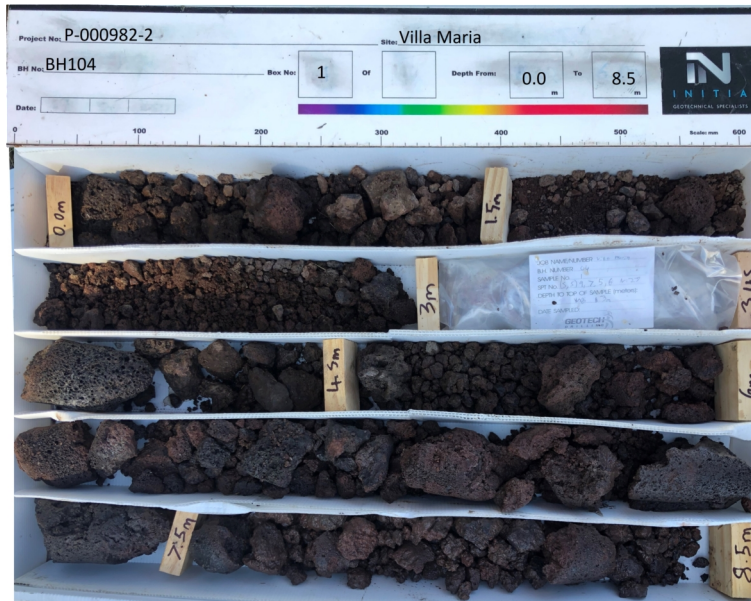


Box 2, 7.4-10.5m





Box 1, 0.0-8.5m







# DRILLHOLE LOG

**HOLE NO.:**  
BH105

**Project Ref.:**  
P-000982-2

**START DATE:** 15/03/2022  
**END DATE:** 15/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757605.6mE, 5905932.5mN **ELEVATION:** 6m **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM **Datum:** AUCKHT1946 **RIG:** Tracked mounted rig

**Location method:** GPSH **Level method:** CONTOUR **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>LOW SW, HIGH HW, LOW OW, EV, W, MS, S, ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25, 50, 75</small>	RQD (%) <small>25, 50, 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		
												DESCRIPTION	WATER	INSTALLATION
Alluvium	0.0m - 1.5m: Core loss	[Symbol]			1	5.0		HQTT			17 / 6 kPa	18/03/2022	Bentonite	Box 1, 0.0-7.5m
	WOOD FRAGMENTS AND PEAT (FIBROUS); black. Soft; moist.	[Symbol]			2	4.0		HQTT	46		22 / 8 kPa			
	2.2m - 3.0m: Core loss	[Symbol]									20 / 6 kPa			
	3.0m - 3.45m: Push Tube (450 recovered)	[Symbol]			3	3.0		DPT	100		14 / 6 kPa			
	Spongy SILT; grey. Soft; low plasticity; moist.	[Symbol]			4	2.0		HQTT	76					
	4.5m - 4.95m: Push Tube (400 recovered)	[Symbol]						DPT	100		17 / 8 kPa			
Auckland Volcanic Field	Gravelly SILT; brownish grey. Soft; moist to wet; gravel, fine to medium, basalt.	[Symbol]			5	1.0		HQTT	33					
	Gravelly SAND, with minor silt. Medium dense; moist; sand, fine to coarse; gravel, fine, basalt. 5.4m - 6.0m: Core loss	[Symbol]			6	0.0		SPT	100		7, 4 / 6, 6, 6, 7 N=25			
	Slightly weathered; grey; BASALT; strong; moderately vesicular.	[Symbol]			7	-1.0		HQTT	76			6.90m, 1No. 15°, JT, PL, RG		
Auckland Volcanic Field	7.3m - 7.5m: Core loss	[Symbol]			8	-2.0		HQTT	100			7.80m, 1No. 45°, JT, PL, RG		
		[Symbol]			9	-3.0		HQTT	60			8.20m, 1No. 30°, JT, PL, RG 8.40m, 1No. 60°, JT, ST, RG 8.60m, 1No. 80°, JT, UN, RG		
		[Symbol]						HQTT				9.20m, 1No. 45°, JT, CRV, RG		Box 2, 7.5-10.0m

REMARKS:

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# DRILLHOLE LOG

**HOLE NO.:**  
BH105

**Project Ref.:**  
P-000982-2

**START DATE:** 15/03/2022  
**END DATE:** 15/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757605.6mE, 5905932.5mN    **ELEVATION:** 6m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

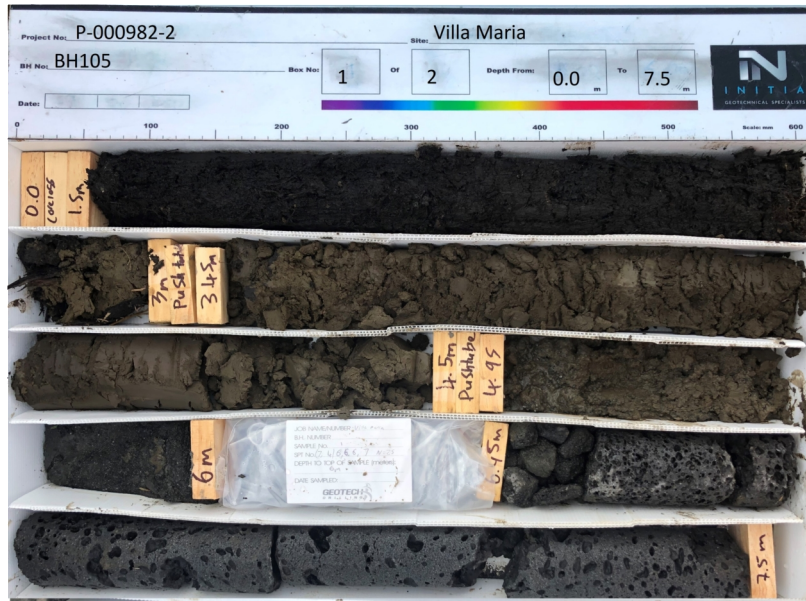
**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW EW VV WS NS ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES	WATER	INSTALLATION	CORE BOXES
												DESCRIPTION			

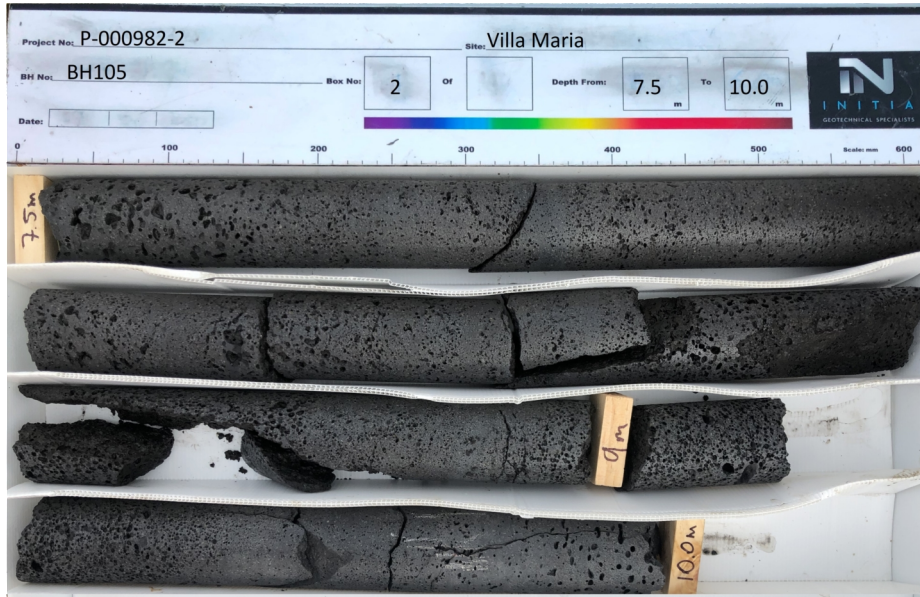
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**REMARKS:**

Box 1, 0.0-7.5m



Box 2, 7.5-10.0m





# DRILLHOLE LOG

**HOLE NO.:**  
BH106

**Project Ref.:**  
P-000982-2

**START DATE:** 22/03/2022  
**END DATE:** 23/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757478.2mE, 5905881.2mN    **ELEVATION:** 5.7m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DM SW HW OW EV W MS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES			
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Topsoil	SILT, with trace rootlets; brown. Firm; non-plastic; dry.	[Symbol]			0.0 - 0.5			HQTT			17 / 14 kPa				
Alluvium	PEAT (FIBROUS); black. Soft; moist. 0.6m - 1.5m: Core loss	[Symbol]			0.5 - 1.5			HQTT			20 / 14 kPa				
	1.5m - 1.95m: Push tube (400 recovery)	[Symbol]			1.5 - 1.95			DPT			20 / 14 kPa				
Auckland Volcanic Field	Organic clayey SILT; brownish grey. Soft; high plasticity; moist; spongy. 2.6m - 3.0m: Core loss	[Symbol]			2.6 - 3.0			HQTT							
	Sandy GRAVEL; grey. Medium dense; moist; gravel, fine to coarse, subangular, basalt; sand, fine to coarse. 4.2m - 6.45m: Core loss	[Symbol]			4.2 - 6.45			SPT			UTP 12, 11 / 11, 7, 9, 6 N=33				
	Sandy gravelly COBBLES. Medium dense; moist; cobbles, subangular, up to 60mm, basalt; sand, fine to coarse, gravel, fine to coarse, subangular, basalt. 4.2m - 6.45m: Core loss	[Symbol]			4.2 - 6.45			HQTT							
	Gravelly SAND, with minor silt; grey. Medium dense; non-plastic; moist; sand, fine to coarse, gravel, fine to coarse, subangular. 7.0m - 7.5m: Core loss	[Symbol]			7.0 - 7.5			SPT				0, 1 / 1, 2, 3, 4 N=10			
Auckland Volcanic Field	8.7m - 9.0m: Core loss	[Symbol]			8.7 - 9.0			HQTT			5, 6 / 4, 6, 5, 4 N=19				
	9.45m - 10.5m: Core loss	[Symbol]			9.45 - 10.5			SPT			2, 3 / 2, 4, 4, 5 N=15				
		[Symbol]						HQTT							

REMARKS:

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# DRILLHOLE LOG

**HOLE NO.:**  
BH106

**Project Ref.:**  
P-000982-2

**START DATE:** 22/03/2022  
**END DATE:** 23/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757478.2mE, 5905881.2mN    **ELEVATION:** 5.7m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DM SW HW OW EV WW WS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES			
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Volcanic Ejecta	[Cont...] 9.45m - 10.5m: Core loss	[Symbol]						HQTT	0	0					
	Clayey SILT, with minor organics, with trace sand; purplish grey. Hard; high plasticity; moist; sand, fine.	[Symbol]				-5.0		SPT	100	100	195+ kPa 1, 0 / 2, 3, 1, 2 N=8				
Pukekohe Formation	Clayey SILT, with trace sand; greenish grey. Hard; high plasticity; moist; sand, fine.	[Symbol]				-6.0		HQTT	100	100					
	Silty SAND; grey. Medium dense; non-plastic; moist; sand, fine.	[Symbol]				-12.0		SPT	100	100	2, 2 / 4, 5, 6, 7 N=22				
	Clayey SILT, with minor organics; dark grey. Very stiff; high plasticity; moist. - INTERBEDDED WITH - Silty SAND, with minor organics; dark grey. Medium dense; low plasticity; moist; sand, fine to medium.	[Symbol]					-7.0		HQTT	100	100				
	Silty SAND, with trace organics; grey. Dense; low plasticity; moist; sand, fine to medium.	[Symbol]					-8.0		SPT	86	100	1, 1 / 4, 5, 6, 7 N=22			
	EOH: 15.45m	[Symbol]					-9.0		HQTT	100	100				
						-10.0		SPT	100	100	4, 5 / 6, 9, 10, 11 N=36				

**REMARKS:**

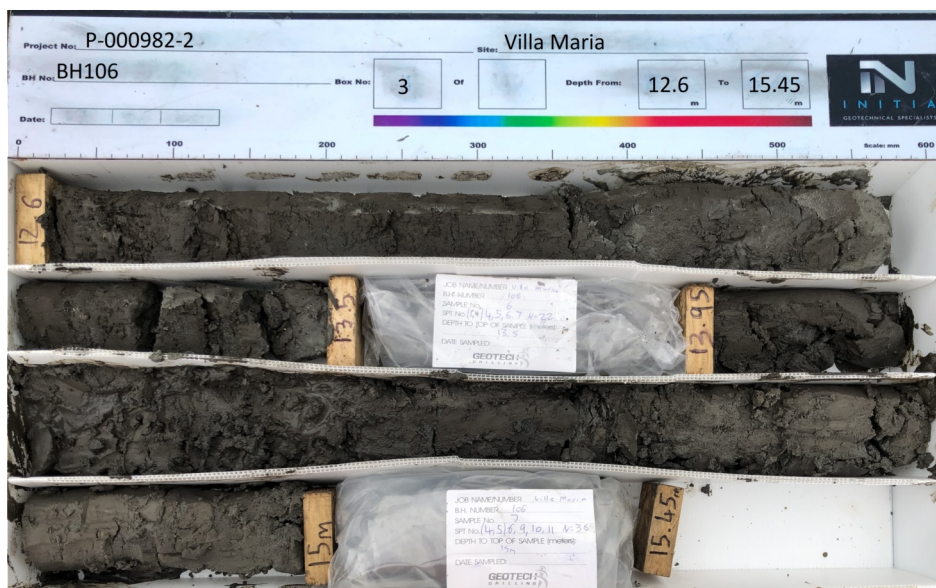
Box 1, 0.0-7.5m



Box 2, 7.5-12.0m



Box 3, 12.0-15.5m





# DRILLHOLE LOG

**HOLE NO.:**  
BH107

**Project Ref.:**  
P-000982-2

**START DATE:** 23/03/2022  
**END DATE:** 23/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757491.6mE, 5905999.8mN    **ELEVATION:** 5.9m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%)	RQD (%)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		
												DESCRIPTION	WATER	INSTALLATION
Topsoil	SILT, with minor rootlets; dark brown. Firm; non-plastic; moist. 0.3m - 1.5m: Core loss	TS	SW	VS	0.3 - 1.5	5.0 - 5.7		HQTT	25-50	25-75	25 / 14 kPa			
	1.5m - 1.95m: Push tube	CL	SW	VS	1.5 - 1.95	4.0 - 4.5		DPT	88		28 / 17 kPa			
	PEAT (FIBROUS). Firm; moist to wet; with highly decomposed wood fragments.	TS	SW	VS	2.0 - 2.8	3.0 - 3.8		HQTT	85		25 / 11 kPa			
	Organic SILT; brownish grey. Firm; low plasticity; moist. 2.8m - 3.0m: Core loss 3.0m - 3.45m: Push tube	CL	SW	VS	2.8 - 3.45	2.0 - 2.5		DPT	100		31 / 14 kPa			
Alluvium	4.0m - 4.5m: Core loss 4.5m - 4.95m: Push tube	CL	SW	VS	4.0 - 4.95	1.0 - 1.5		HQTT	57		28 / 17 kPa			
	SILT, with minor organics; brownish grey. Soft; high plasticity; moist.	CL	SW	VS	5.0 - 5.5	0.0 - 0.5		DPT	100					
	Organic SILT; brownish grey. Soft; low plasticity; moist.	CL	SW	VS	5.5 - 6.0	0.0 - 0.5		HQTT	100					
	Slightly weathered; grey; BASALT; strong; moderately vesicular.	SW	SW	VS	6.0 - 9.0	0.0 - 3.0		HQTT	100		20, 30 for 25mm N=50+			
												6.80m, 1No. 70°, JT, CRV, RG		
												6.90m, 1No. 45°, JT, PL, RG		
												7.40m, 1No. 85°, JT, ST, RG		
												7.80m, 1No. 60°, JT, ST, SL		
												8.50m, 1No. 30°, JT, ST, IR		
												9.30m, 1No. 45°, JT, CRV, RG		

REMARKS:

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# DRILLHOLE LOG

HOLE NO.:  
BH107

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
P-000982-2

CO-ORDINATES: 1757491.6mE, 5905999.8mN ELEVATION: 5.9m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

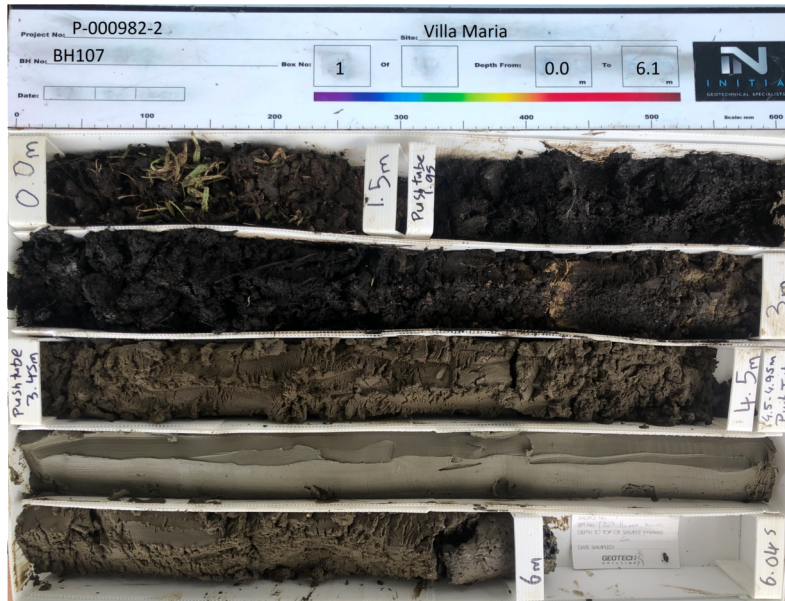
START DATE: 23/03/2022  
END DATE: 23/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING DW SW HW OV EW VW W MS S ES	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) 25 50 75 100	RQD (%) 25 50 75	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		
												DESCRIPTION	WATER	INSTALLATION
Proximal Volcanic Ejecta	[Cont...] Slightly weathered; grey; BASALT; strong; moderately vesicular.  EOH: 10.50m							HQTT				10.20m, 1No. 85° , JT ST , IR	Bentonite	Box 3, 9.0
					-5.0									
					-6.0									
					-7.0									
					-8.0									
					-9.0									
					-10.0									
					-11.0									
					-12.0									
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					-14.0									

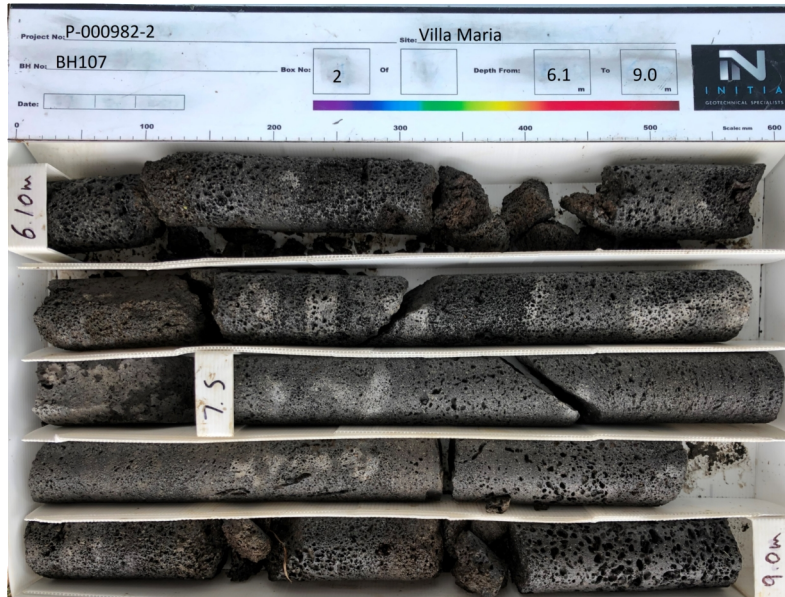
REMARKS:



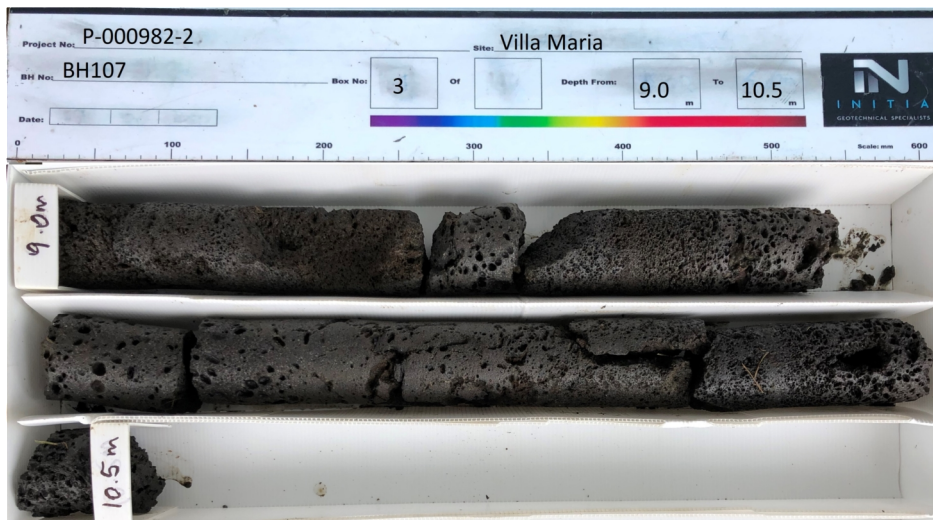
Box 1, 0.0-6.1m



Box 2, 6.1-9.0m



Box 3, 9.0-10.5m





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GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

HOLE NO.:  
**BH108**

CLIENT: Goodman Nominee (NZ) Ltd    SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
**P-000982-2**

CO-ORDINATES: 1757369.9mE, 5906014.5mN    ELEVATION: 6m    CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM    Datum: AUCKHT1946    RIG: Tracked mounted rig  
Location method: GPSH    Level method: CONTOUR    DRILLER: Ben + Cody  
ORIENTATION (°): Vertical    INCLINATION (°): 90

START DATE: 16/03/2022  
END DATE: 16/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING DW SW HW OV EW VV W WS S ES	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) 25 50 75	RQD (%) 25 50 75	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES				
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES	
Tops Oil	SILT, with minor rootlets, with trace sand and gravel; brown. Firm; low plasticity; moist; sand, fine. PEAT (FIBROUS). Firm; moist; with highly decomposed wood fragments.	[Symbol]			1.0m - 1.5m: Core loss 1.6m - 1.95m: Core loss	5.0 4.0		HQTT DPT	86 86		42 / 17 kPa 36 / 14 kPa 47 / 22 kPa					
Alluvium	SILT: greenish grey. Very soft; low plasticity; moist; spongy. 3.0m - 3.45m: Push Tube (450mm recovered)	[Symbol]			2.7m - 3.0m: Core loss 3.0m - 3.45m: Push Tube (450mm recovered)	3.0 2.0		HQTT DPT	86 100		11 / 6 kPa					
	4.1m - 4.5m: Core loss	[Symbol]			4.1m - 4.5m: Core loss	2.0 1.0		HQTT SPT	86 100		11 / 3 kPa 0, 0 / 0, 0, 0 N=0					
	GRAVEL: grey. Dense; gravel, medium to coarse, basalt.	[Symbol]				0.0		SPT	86		6, 9 / 9, 5, 10, 18 N=42					
Auckland Volcanic Field	Slightly weathered; grey; BASALT; strong; moderately weathered and fractured.	[Symbol]	SW S			-1.0 -2.0 -3.0		HQTT HQTT HQTT	90 100 100				6.70m, 1No. 60°, JT, ST, RG 6.90m, 1No. 60°, JT, ST, RG 7.40m, 1No. 85°, JT, UN, IR 7.70m, 1No. 60°, JT, PL, RG 8.00m, 1No. 45°, JT, PL, RG 8.10m, 1No. 85°, JT, PL, RG 8.20m, 1No. 60°, JT, PL, RG			

17/03/2022

Bentonite

4m

Sand

6m

Bentonite

Box 1, 0.0-5.2m

Box 2, 5.2-8.2m

Box 3, 8.2-12.3m

REMARKS:

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GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

HOLE NO.:  
**BH108**

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
**P-000982-2**

CO-ORDINATES: 1757369.9mE, 5906014.5mN ELEVATION: 6m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

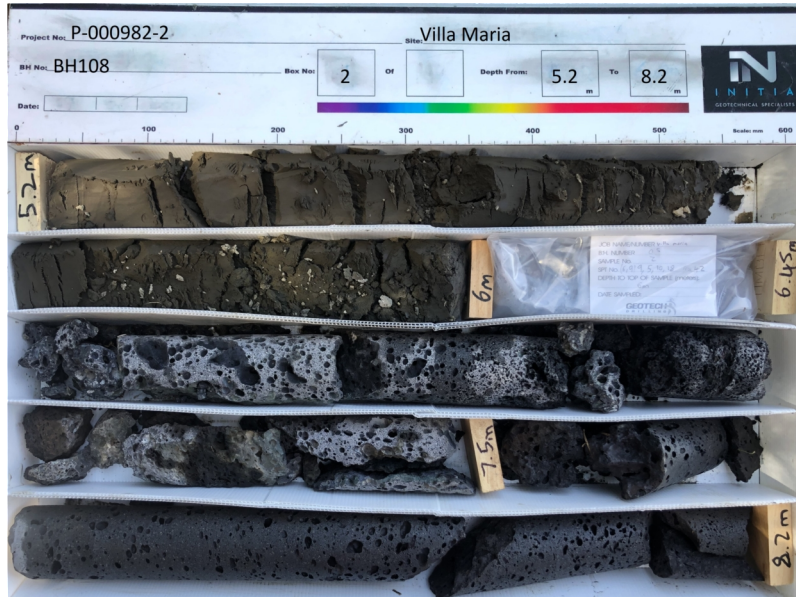
START DATE: 16/03/2022  
END DATE: 16/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW NW HW OW EV VW W WS S ES</small>	STRENGTH	DEPTH RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES
											DESCRIPTION				
	[Cont...] Slightly weathered; grey; BASALT; strong; moderately weathered and fractured.						HQTT	86	0						
	11.4m - 12.0m: Core loss				11 -5.0		HQTT	60				10.70m, 1No. 45° , JT . PL , RG			
					12 -6.0		HQTT	100				11.00m, 1No. 45° , JT . PL , RG			Box 3, 8.2-12.3m
			SW		13 -7.0		HQTT	100				12.20m, 1No. 30° , JT . PL , RG			
					14 -8.0		HQTT	100				14.10m, 1No. 45° , JT . PL , RG		Bentonite	
					15 -9.0		HQTT	86				14.40m, 1No. 30° , JT . PL , RG			Box 4, 12.3-15.1m
					16 -10.0		HQTT	86				14.90m, 1No. 30° , JT . ST , RG			
					17 -11.0		HQTT	86				15.10m, 1No. 80° , JT . ST , RG			
					18 -12.0		HQTT	86				15.40m, 1No. 80° , JT . ST , RG			
					19 -13.0		HQTT	86				16.40m, 1No. 75° , JT . ST , RG			
					20 -14.0		HQTT	86				16.80m, 1No. 60° , JT . ST , RG			
					21 -15.0		HQTT	86				17.00m, 1No. 45° , JT . PL , RG			Box 5, 15.1-18.0m
					22 -16.0		HQTT	86				17.90m, 1No. 60° , JT . PL , RG		18m	
REMARKS:															
EOH: 18.00m															

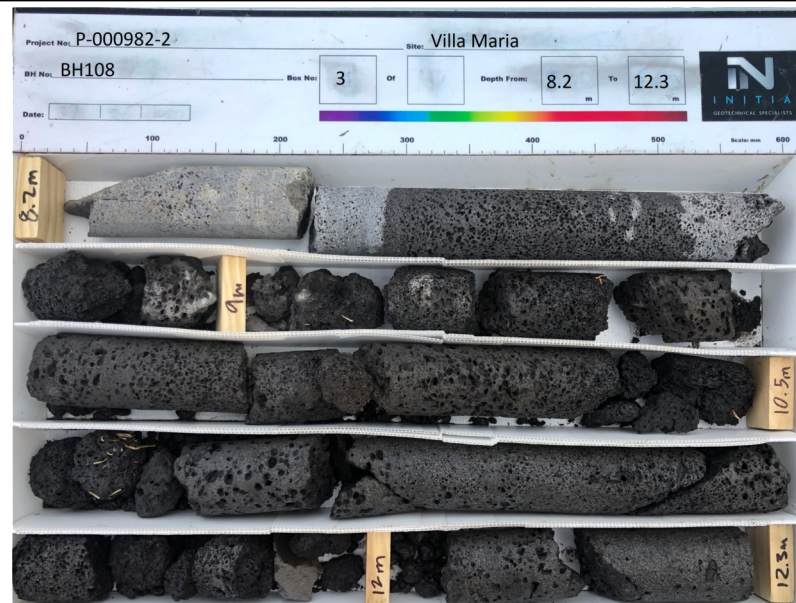
Box 1, 0.0-5.2m



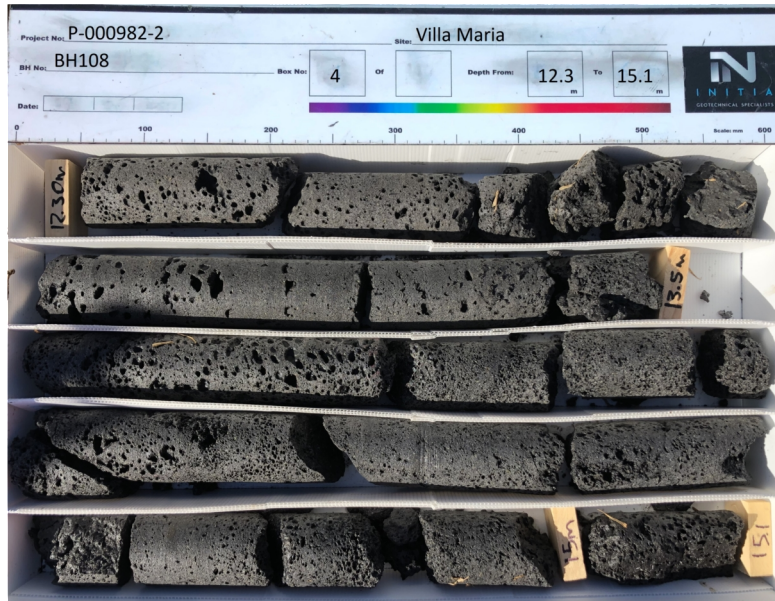
Box 2, 5.2-8.2m



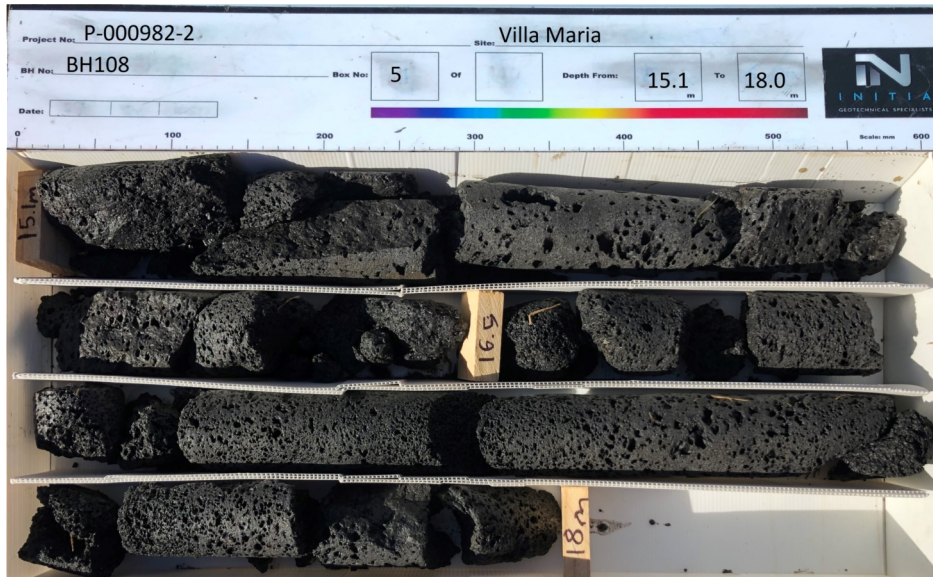
Box 3, 8.2-12.3m



Box 4, 12.3-15.1m



Box 5, 15.1-18.0m





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# DRILLHOLE LOG

HOLE NO.:  
BH109

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
P-000982-2

CO-ORDINATES: 1757376.5mE, 5906132.0mN ELEVATION: 6.7m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

START DATE: 21/03/2022  
END DATE: 22/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW OW EV VW W WS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		
												DESCRIPTION	WATER	INSTALLATION
Fill	SILT, with minor rootlets; brown. Firm; non-plastic; moist. Clayey SILT, with minor gravel, with trace sand and cobbles; brown with light brown mottles and orange brown speckles. Hard; high plasticity; moist; gravel, fine to coarse, basalt; cobbles, subangular, up to 60mm, basalt. 0.7m - 3.0m: Core loss							HQTT	46		UTP			
							SPT				8, 4 / 2, 1, 2, 3 N=8			
Alluvium	Organic SILT, with minor clay; brownish grey. Very soft; high plasticity; moist to wet. 3.45m - 4.5m: Core loss							SPT	100		11 / 11 kPa 0, 0 / 0, 0, 0, 0 N=0			
	4.5m - 4.95m: Push Tube (350mm recovery)							HQTT			8 / 3 kPa			
	6.0m - 6.45m: Push Tube (400 recovery)							DPT	88		8 / 3 kPa			
								HQTT	85					
Auckland Volcanic Field	Cobbly GRAVEL; grey. Medium dense; moist; gravel, coarse, basalt; cobbles, subangular, basalt. 8.4m - 9.0m: Core loss							HQTT	38		11 / 6 kPa 0, 0 / 0, 0, 0, 0 N=0			
								SPT			5, 7 / 5, 3, 2, 5 N=15			
	Slightly weathered; grey; BASALT; strong; moderately vesicular.		SW	S				HQTT	100					

22/03/2022

Bentonite

Box 1, 0.0-7.5m

Box 2, 7.5-11.7m

REMARKS:

9.60m, 1No. 30° , JT , CRV , RG

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# DRILLHOLE LOG

**HOLE NO.:**  
BH109

**Project Ref.:**  
P-000982-2

**START DATE:** 21/03/2022  
**END DATE:** 22/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757376.5mE, 5906132.0mN    **ELEVATION:** 6.7m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW EV VW WS MS ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES	WATER	INSTALLATION	CORE BOXES								
												DESCRIPTION											
Auckland Volcanic Field	[Cont...] Slightly weathered; grey; BASALT; strong; moderately vesicular. 9.90m - 10.20m: Slightly weathered; dark grey; BASALT; moderately strong; Highly vesicular.		SW	S	-4.0	-4.0		HQTT	100	0		10.10m, 1No. 75°, JT, ST, RG	Bentonite		Box 2, 7.5-11.7m								
					-5.0	-5.0		HQTT	100		10.30m, 1No. 30°, JT, PL, RG	10.50m, 1No. 45°, JT, PL, RG				10.60m, 2No. 80°, JT, ST, RG							
					-5.0	-5.0		HQTT	100		11.40m, 1No. 45°, JT, PL, RG	11.70m, 1No. 30°, JT, UN, IR											
					-6.0	-6.0		HQTT	100		12.20m, 1No. 75°, JT, ST, SL	12.30m, 1No. 30°, JT, PL, RG											
					-7.0	-7.0		HQTT	100		12.90m, 1No. 60°, JT, ST, RG	13.10m, 1No. 45°, JT, ST, RG											
					-7.0	-7.0		HQTT	100		13.70m, 1No. 20°, JT, PL, RG	13.90m, 2No. 30°, JT, PL, RG				14.00m, 2No. 20°, JT, PL, SM							
					-8.0	-8.0		HQTT	100		14.40m, 1No. 70°, JT, CRV, RG	14.60m, 1No. 85°, JT, ST, RG											
					-9.0	-9.0																	
					-10.0	-10.0																	
					-11.0	-11.0																	
					-12.0	-12.0																	
					-13.0	-13.0																	
						EOH: 15.00m																	

REMARKS:

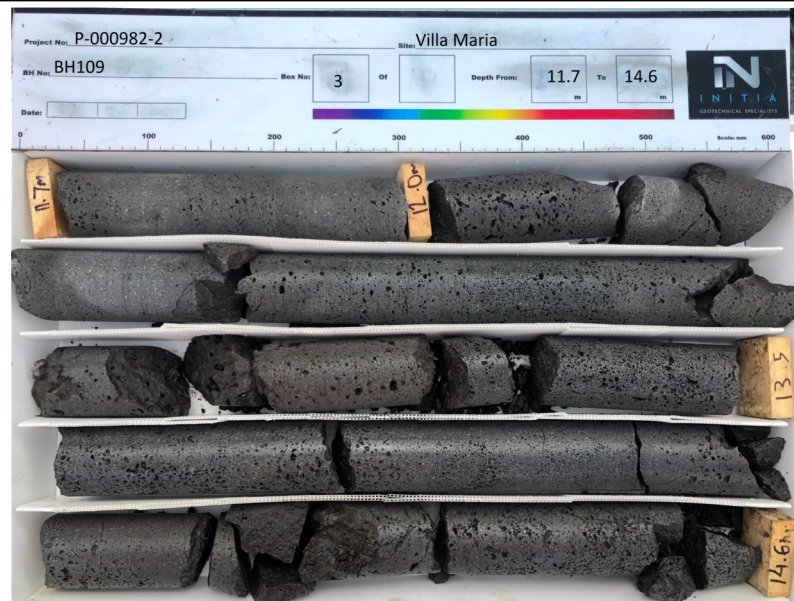
Box 1, 0.0-7.5m



Box 2, 7.5-11.7m

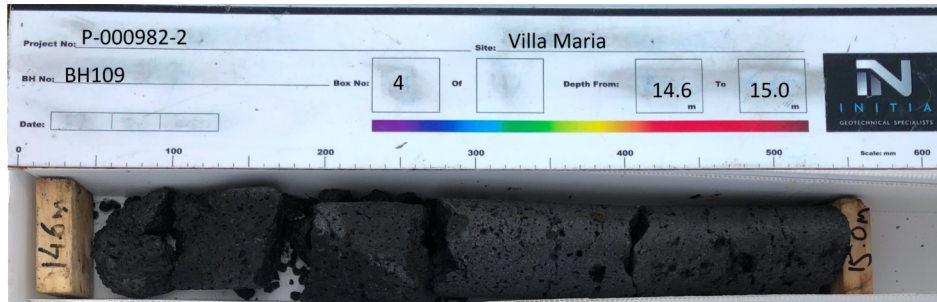


Box 3, 11.7-14.6m





Box 4, 14.6-15.0m





INITIA

GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

HOLE NO.: BH110

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.: P-000982-2

CO-ORDINATES: 1757365.8mE, 5906227.4mN ELEVATION: 6.9m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

START DATE: 17/03/2022  
END DATE: 18/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING DW SW HW OW EW VW W MS S ES	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) 25 50 75	RQD (%) 25 50 75	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES
												DESCRIPTION				
Top soil	SILT, with minor rootlets; brown. Firm; non-plastic; moist.	[Symbol]			0.0	6.0		HQTT	86		UTP					
Fill	Clayey SILT, with minor gravel, with trace sand and cobbles; brown with light brown mottles and orange brown speckles. Hard; high plasticity; moist; gravel, fine to coarse, basalt; cobbles, subangular, up to 60mm, basalt.	[Symbol]			1.0	5.0		HQTT	86		UTP					
	1.0m - 1.5m: Core loss	[Symbol]			2.0	4.0		SPT	100		UTP 2, 1 / 2, 2, 2, 3 N=9					
	2.4m - 3.0m: Core loss	[Symbol]			3.0	3.0		HQTT	33							
Alluvium	3.0m - 3.45m: Push Tube	[Symbol]			4.0	2.0		DPT	88							
	PEAT (FIBROUS). Soft; moist.	[Symbol]			4.5	1.0		HQTT	86							
	Organic SILT; brownish grey. Soft; low plasticity; moist.	[Symbol]			5.0	0.0		DPT	100		22 / 11 kPa					
	4.5m - 4.95m: Push Tube	[Symbol]			6.0	0.0		HQTT	100							
Auckland Volcanic Field	SILT, with some clay, with minor organics; grey. Firm; low plasticity; moist.	[Symbol]			7.0	-1.0		SPT	100		20 / 14 kPa 0, 0 / 0, 0, 0, 0 N=0					
	Organic SILT; brownish grey. Soft; low plasticity; moist.	[Symbol]			8.0	-2.0		HQTT	100							
	Slightly weathered; grey; BASALT; strong; moderately vesicular.	[Symbol]	SW	S	9.0	-3.0		HQTT	93							
	Moderately weathered; brownish grey; BASALT; moderately strong; oxidated.	[Symbol]	MW	MS				HQTT								

6.80m, 1No. 30°, JT, ST, RG  
7.00m, 2No. 30°, JT, ST, RG  
7.20m, 1No. 30°, JT, ST, RG

Bentonite

Sand

Bentonite

Box 1, 0.0-5.5m

Box 2, 5.5-8.5m

Box 3, 8.5-11.5m

REMARKS:

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GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

**HOLE NO.:**  
BH110

**CLIENT:** Goodman Nominee (NZ) Ltd **SITE LOCATION:** 118 Montgomerie Road, Mangere  
**PROJECT:** Villa Maria Estate

**Project Ref.:**  
P-000982-2

**CO-ORDINATES:** 1757365.8mE, 5906227.4mN **ELEVATION:** 6.9m **CONTRACTOR:** Geotech Drilling  
**Co-ordinate system:** NZTM **Datum:** AUCKHT1946 **RIG:** Tracked mounted rig  
**Location method:** GPSH **Level method:** CONTOUR **DRILLER:** Ben + Cody  
**ORIENTATION (°):** Vertical **INCLINATION (°):** 90

**START DATE:** 17/03/2022  
**END DATE:** 18/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

UNIT	MATERIAL DESCRIPTION <small>(See Classification &amp; Symbolology sheet for details)</small>	GRAPHIC	WEATHERING					STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%)	RQD (%)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES			
			DW	SW	MW	HW	OW									EW	W	MS	VS
Auckland Volcanic Field	Moderately weathered; brownish grey; BASALT; moderately strong; oxidated. Slightly weathered; grey; BASALT; strong; moderately vesicular.		MW								HQTT	25 50 75	25 50 75		10.70m, 1No. 75° , JT , CRV , RG  11.30m, 1No. 20° , JT , PL , RG  11.80m, 1No. 45° , JT , PL , RG		Bentonite	Box 3, 8.5-11.5m	
			SW									HQTT	25 50 75	25 50 75			12m	Box 4, 11.5-12.0m	

**REMARKS:**

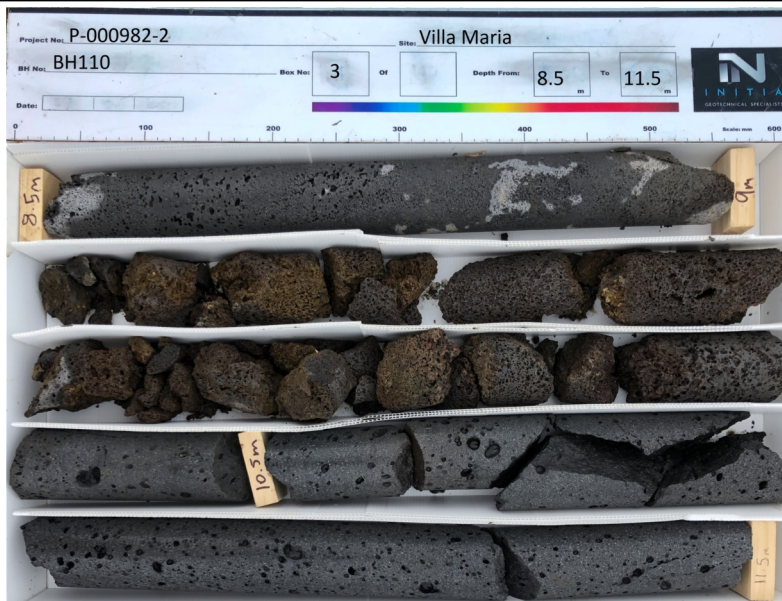
Box 1, 0.0-5.5m



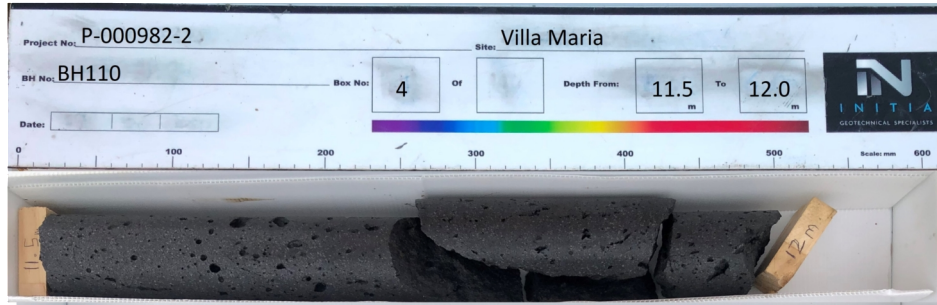
Box 2, 5.5-8.5m



Box 3, 8.5-11.5m



Box 4, 11.5-12.0m





INITIA

GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

HOLE NO.:  
BH111

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
P-000982-2

CO-ORDINATES: 1757030.8mE, 5905893.9mN ELEVATION: 12.7m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

START DATE: 24/03/2022  
END DATE: 24/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING DW SW HW OV EW	STRENGTH VV W MS S ES	DEPTH	RL	SAMPLES	METHOD	TCR (%) 25 50 75	RQD (%) 25 50 75	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES	
												DESCRIPTION					
Topsoil	Clayey SILT; dark brown. Stiff, high plasticity; moist.	[Symbol]			0.0	12.0		HQTT			126 / 50 kPa						
	Clayey SILT, with trace sand; orange brown. Very stiff, high plasticity; moist; sand, fine.	[Symbol]			1.0			HQTT			142 / 22 kPa						
	SILT, with minor sand; light brown with reddish brown mottles. Very stiff, low plasticity; moist; sand, fine.	[Symbol]			2.0			SPT	100		195+ kPa 1, 2 / 2, 2, 2, 4 N=10						
	Sandy SILT, with minor gravel; light brownish grey with reddish brown speckles. Hard; low plasticity; moist; sand, fine to coarse; gravel, fine.	[Symbol]			3.0			HQTT	57								
	Gravelly SILT, with minor sand; brownish grey. Hard; non-plastic; moist; gravel, fine to medium; sand, fine to coarse. 2.6m - 3.0m: Core loss	[Symbol]			4.0			SPT	100		1, 1 / 6, 7, 5, 5 N=23						
	3.45m - 3.60m: dilatant.	[Symbol]			5.0			HQTT	71								
	SILT, with some clay, with minor sand, with trace gravel; brownish grey. Hard; high plasticity; moist; sand, fine; gravel, fine. 4.2m - 4.5m: core loss	[Symbol]			6.0			SPT	66		4, 7 / 8, 8, 8, 6 N=30						
	4.95m - 6.0m: Core loss	[Symbol]			7.0			HQTT									
	Gravelly SAND; grey and black. Very dense; moist; sand, medium to coarse; gravel, fine.	[Symbol]			8.0			SPT	55		6, 11 / 12, 12, 14, 12 for 70mm N=50+ for 295mm						
	7.1m - 7.5m: Core loss	[Symbol]			9.0			HQTT	57								
	SAND, with minor silt and gravels; brownish grey. Very dense; non-plastic; moist; gravel, fine to medium; sand, fine to coarse.	[Symbol]			10.0			SPT	44		7, 10 / 10, 15, 15, 10 for 60mm N=50+ for 285mm						
	Gravelly SAND; grey and black. Very dense; moist; sand, medium to coarse; gravel, fine. 8.3m - 9.0m: Core loss	[Symbol]			11.0			HQTT	23								
	SAND, with minor silt; brown grey. Very dense; moist; sand, fine; with Sandy GRAVEL lenses; black.	[Symbol]			12.0			SPT	55		5, 8 / 10, 12, 13, 15 for 70mm N=50+ for 295mm						
		[Symbol]						HQTT	66								

REMARKS:

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# DRILLHOLE LOG

**HOLE NO.:**  
BH111

**Project Ref.:**  
P-000982-2

**START DATE:** 24/03/2022  
**END DATE:** 24/03/2022  
**LOGGED BY:** BSS  
**CHECKED BY:** APK

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757030.8mE, 5905893.9mN    **ELEVATION:** 12.7m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked mounted rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Ben + Cody

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW EV W WS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES						
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES			
Puketokā Formation	[Cont...] SAND, with minor silt; brown grey. Very dense; moist; sand, fine; with Sandy GRAVEL lenses; black. Gravel, fine; sand, coarse. 10.2m - 10.5m: Core loss  10.50m: grades to Dense.  EOH: 10.95m																	
												14, 20 / 14, 11, 12, 12 N=49				Bentonite 10.95m		Box 2, 3.8-11.0m

**REMARKS:**

Box 1, 0.0-3.8m



Box 2, 3.8-11.0m







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# DRILLHOLE LOG

HOLE NO.:  
BH112

CLIENT: Goodman Nominee (NZ) Ltd SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
P-000982-2

CO-ORDINATES: 1756972.9mE, 5905788.3mN ELEVATION: 12.8m CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM Datum: AUCKHT1946 RIG: Tracked mounted rig  
Location method: GPSH Level method: CONTOUR DRILLER: Ben + Cody  
ORIENTATION (°): Vertical INCLINATION (°): 90

START DATE: 24/03/2022  
END DATE: 25/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING DW SW HW OV EW VW W MS S ES	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) 25 50 75	RQD (%) 25 50 75	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES
												DESCRIPTION				
	Clayey SILT, with trace sand; orange brown. Very stiff; high plasticity; moist; sand, fine.				12.0			HQTT			170 / 56 kPa					
	Clayey SILT, with minor sand; light brown with dark brown speckles. Very stiff; high plasticity; moist; sand, fine.				1.0			HQTT			142 / 47 kPa					
	1.3m - 1.5m: Core loss				11.0			SPT			137 / 47 kPa 1, 0 / 3, 2, 2, 2 N=9					
	Sandy SILT; brownish grey. Hard; non-plastic; moist; sand, fine to medium. 2.5m - 3.0m: Core loss				10.0			HQTT			195+ kPa 2, 4 / 4, 4, 4, 4 N=16					
	SAND, with some silt; dark grey with greyish brown speckles. Medium dense; moist; sand, fine to coarse. 4.0m - 4.5m: Core loss				9.0			SPT			4, 9 / 7, 7, 10, 10 N=34					
	SAND; brownish grey. Dense; moist; sand, fine to medium. 5.4m - 6.0m: Core loss				8.0			HQTT			6, 7 / 12, 12, 14, 12 for 40mm N=50+ for 265mm					
	SAND, with minor silt; brownish grey with black speckles. Very dense; moist; sand, fine to coarse.				7.0			SPT			7, 10 / 15, 20, 15 for 10mm N=50+ for 160mm					
	8.6m - 9.0m: Core loss				6.0			HQTT			195+ kPa 8, 9 / 10, 6, 4, 5 N=25					
	Clayey SILT, with minor organics; dark grey. Hard; high plasticity; moist.				4.0			SPT								
					3.0			HQTT								

REMARKS:

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Checked By: APK



# DRILLHOLE LOG

HOLE NO.:  
**BH112**

CLIENT: Goodman Nominee (NZ) Ltd    SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
**P-000982-2**

CO-ORDINATES: 1756972.9mE, 5905788.3mN    ELEVATION: 12.8m    CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM    Datum: AUCKHT1946    RIG: Tracked mounted rig  
Location method: GPSH    Level method: CONTOUR    DRILLER: Ben + Cody  
ORIENTATION (°): Vertical    INCLINATION (°): 90

START DATE: 24/03/2022  
END DATE: 25/03/2022  
LOGGED BY: BSS  
CHECKED BY: APK

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW EV SW HW CW EV W MS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES
												DESCRIPTION				
Puketokā Formation	10.0m - 10.5m: Core loss  [Cont...] Clayey SILT, with minor organics; dark grey. Hard; high plasticity; moist.  EOH: 10.95m					2.0		HQTT SPT	47 100	0		195+ kPa 0, 0 / 2, 2, 2, 2 N=8		Bentonite 10.95m		Box 3, 9.5-11.0m

REMARKS:

Box 1, 0.0-4.5m



Box 2, 4.5-9.5m



Box 3, 9.5-11.0m





# DRILLHOLE LOG

**HOLE NO.:**  
BH-01

**Project Ref.:**  
P-000982

**START DATE:** 04/12/2020  
**END DATE:** 04/12/2020  
**LOGGED BY:** LBW  
**CHECKED BY:** BSS

**CLIENT:** Goodman Nominee (NZ) Ltd **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757897.0mE, 5906117.0mN **ELEVATION:** 7.1m **CONTRACTOR:** DCN Drilling

**Co-ordinate system:** NZTM **Datum:** AUCKHT1946 **RIG:** JD26

**Location method:** GPSH **Level method:** CONTOUR **DRILLER:** Kurt/ Cam

**ORIENTATION (°):** Vertical **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW EV VW W WS S ES</small>	STRENGTH <small>W MS S ES</small>	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES					
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES		
Auckland Volcanic Field	0.00m - 1.10m: Core Loss.	[Symbol]			0.00	7.0		HQTT									
	SILT, with some gravel; brown. Very stiff; low plasticity; moist; gravel, fine to coarse, angular, Basalt.	[Symbol]			1.10	6.0		SPT	100			5, 7 / 7, 9, 9, 10 N=35					
Alluvium	1.95m - 2.80m: Core Loss	[Symbol]			2.80	5.0		HQTT									
	SAND, with some gravel; grey. Dense; wet, sand, medium to coarse; gravel, fine to medium, Basalt.	[Symbol]			2.80	5.0		SPT	100			1, 1 / 2, 2, 2, 2 N=8					
Alluvium	3.45m - 4.10m: Core Loss	[Symbol]			4.10	4.0		HQTT									
	GRAVEL; brown and grey. Medium dense; moist; gravel, medium to coarse, angular, Basalt.	[Symbol]			4.10	4.0		SPT	100			0, 0 / 0, 0, 0, 0 N=0					
Alluvium	4.95m - 5.55m: Core Loss	[Symbol]			5.55	2.0		HQTT									
	Clayey SILT; brownish grey. Firm; high plasticity; moist.	[Symbol]			5.55	2.0		SPT	100			59 / 30 kPa					
Alluvium	6.00m - 6.60m: Push Tube (not recovered)	[Symbol]			6.60	1.0		DPT	100								
	6.6m - 7.0m: Core loss	[Symbol]			7.00	0.0		HQTT									
Puketokā Formation	PEAT (FIBROUS); black. Firm; moist; minor decomposed tree remains.	[Symbol]			7.00	1.0		SPT	100			0, 0 / 0, 0, 0, 0 N=0					
	Clayey SILT, with trace organics; light grey with dark grey and black mottles. Stiff, high plasticity; moist.	[Symbol]			7.00	1.0		HQTT									
Puketokā Formation	9.45m - 9.60m: Core Loss	[Symbol]			9.60	2.0		SPT	100			96 / 33 kPa 0, 0 / 0, 0, 0, 1 N=1					
	Clayey SILT; with minor organics, brownish grey with black speckles.	[Symbol]			9.60	2.0		HQTT	85								

REMARKS:

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# DRILLHOLE LOG

**HOLE NO.:**  
BH-01

**Project Ref.:**  
P-000982

**START DATE:** 04/12/2020  
**END DATE:** 04/12/2020  
**LOGGED BY:** LBW  
**CHECKED BY:** BSS

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757897.0mE, 5906117.0mN    **ELEVATION:** 7.1m    **CONTRACTOR:** DCN Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** JD26

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Kurt/ Cam

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>SW SH HW CW EW VW W MS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		WATER	INSTALLATION	CORE BOXES		
												DESCRIPTION						
Pukekohe Formation	[Cont...] Clayey SILT; with minor organics, brownish grey with black speckles. Stiff, high plasticity; moist.				3.0			HQTT	85	0							Box	
	Silty SAND; greyish brown. Medium dense; wet; sand, fine to medium.				11			SPT	100			1, 3 / 4, 4, 4, 3 N=15						
	11.00m - 11.15m: Sandy SILT; greyish brown. Medium dense; non-plastic; wet. 11.15m - 11.30m: SAND; brown. Medium dense; saturated; sand, fine to medium.		CW			12			HQTT	100								
	SAND; light grey. Medium dense; wet; sand, fine to medium.					12.45			SPT	100			1, 1 / 2, 4, 4, 4 N=14		Bentonite		Box 3, 10.2-12.5m	
EOH: 12.45m																		
					6.0													
					7.0													
					8.0													
					9.0													
					10.0													
					11.0													
					12.0													

**REMARKS:**

Box 1, 0.0-6.6m



Box 2, 6.6-10.2m



Box 3, 10.2-12.5m



# DRILLHOLE LOG

**HOLE NO.:**  
**BH-02**

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere  
**PROJECT:** Villa Maria Estate

**Project Ref.:**  
**P-000982**

**CO-ORDINATES:** 1757492.0mE, 5905971.0mN    **ELEVATION:** 6m    **CONTRACTOR:** DCN Drilling  
**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** JD26  
**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Kurt/ Cam  
**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

**START DATE:** 04/12/2020  
**END DATE:** 04/12/2020  
**LOGGED BY:** LBW  
**CHECKED BY:** BSS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%)	RQD (%)	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES		
												DESCRIPTION	WATER	INSTALLATION
	0.00m - 1.00m: Core Loss							HQTT	33					
Volcanic Field	Silty SAND, with minor gravel; reddish brown. Non-plastic; wet; sand, fine to medium; gravel, fine to coarse; Loosely packed. SILT, with minor clay, with trace sand; brown. Hard; high plasticity; moist. PEAT (FIBROUS); black. Firm; wet; organic odour.				1	-5.0		SPT	86		39 / 13 kPa 1, 0 / 0, 0, 0, 0 N=0			
	1.95m - 2.40m: Core Loss (Failed push tube sample)				2	-4.0		HQTT	57					
	Organic SILT, with trace clay; brown. Firm; high plasticity; wet; spongy.				3	-3.0		SPT	100		33 / 10 kPa 0, 0 / 0, 0, 0, 0 N=0			
Alluvium	PEAT (FIBROUS); black. Firm; wet; organic odour.				4	-2.0		HQTT	47					
	3.45m - 4.00m: Core Loss (Failed push tube sample)				5	-1.0		SPT	100		49 / 19 kPa 1, 0 / 0, 0, 0, 1 N=2			
	Organic SILT; brown. Firm; low plasticity; moist; spongy. 4.30m: Brownish grey. 4.50m: With some peat (fibrous).				6	-0.0		HQTT	40					
	5.50m - 5.80m: Core Loss				7	-1.0		HQTT	100					
Auckland Volcanic Field	Slightly weathered; dark grey; BASALT; strong; moderately vesicular. 6.00m - 6.40m: Dark reddish grey; scoriaceous.				8	-2.0		HQTT	80					
					9	-3.0		SPT	33					
								HQTT	83					

**REMARKS:**

04/12/2020

Bentonite

Box 1, 0.0-5.2m

Box 2, 5.2-8.9m

Box 3, 8.9-12.0m

6.70m, /90°, JT, UN, RG, MN

7.10m, /10°, JT, UN, RG, MW

8.40m, /75°, JT, UN, RG, N

8.45m, /5°, JT, UN, RG, N

8.55m, /0°, JT, UN, RG, MN

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# DRILLHOLE LOG

**HOLE NO.:**  
BH-02

**Project Ref.:**  
P-000982

**START DATE:** 04/12/2020  
**END DATE:** 04/12/2020  
**LOGGED BY:** LBW  
**CHECKED BY:** BSS

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757492.0mE, 5905971.0mN    **ELEVATION:** 6m    **CONTRACTOR:** DCN Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** JD26

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Kurt/ Cam

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW CW VW W MS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES			
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES
Auckland Volcanic Field	[CONT...] Slightly weathered; dark grey; BASALT; strong; moderately vesicular.  11.40m: Slightly vesicular.  EOH: 12.00m				11.00 11.50 12.00	-5.0 -6.0		HQTT	83	0		11.10m, /10°, JT, UN .RG, MN  11.40m, /10°, JT, UN .RG, N 11.50m, /45°, JT, UN .RG, N 11.75m, /25°, JT, UN .RG, MN 11.85m, /10°, JT, UN .RG, MN		Bentonite 12m	Box 3, 8.9-12.0m

**REMARKS:**



Box 1, 0.0-5.2m



Box 2, 5.2-8.9m



Box 3, 8.9-12.0m





# DRILLHOLE LOG

**HOLE NO.:**  
BH-03

**Project Ref.:**  
P-000982

**START DATE:** 18/02/2021

**END DATE:** 18/02/2021

**LOGGED BY:** BSS

**CHECKED BY:** MDH

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757598.5mE, 5905982.2mN    **ELEVATION:** 6m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked Mounted Rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Troy/Zack

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW OW EV VW W MS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES					
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES		
Topsoil	SILT, with minor clay, with trace rootlets; brown. Firm; non-plastic; moist.	TS			0.0 - 0.5	6.5		MSA	100	100							
Alluvium	Organic clayey SILT; black with dark grey and grey mottles. Soft; high plasticity; moist; sponged.	N/L			0.5 - 2.0	5.0		DPT	80	80							Box 1, 0.0-1.5m
	1.5m - 2.0m: Push Tube	N/L			2.0 - 3.0	4.0		DPT	80	80							Box 2, 1.5-3.0m
	3.0m - 3.5m: Push Tube (no recovery)	N/L			3.0 - 4.5	3.0		DPT	80	80							Box 2, 1.5-3.0m
	4.5m - 5.0m: Push Tube	N/L			4.5 - 5.0	2.0		MSA	100	100							Box 3, 3.0-4.5m
	Clayey SILT, with trace sand; grey. Stiff; high plasticity; moist; sand, fine.	N/L			5.0 - 5.6	1.0		DPT	70	70							Box 4, 4.5-5.8m
Auckland Volcanic Field	5.60m - 5.70m: Clayey gravelly SILT, with minor cobbles; grey. Cobbles, basalt.	CS			5.6 - 5.7	0.0		HQTT	100	100							
	Slightly weathered; grey; BASALT; moderately strong; moderately vesicular.	S			5.7 - 6.5	0.0		HQTT	93	93				6.50m, 1No. 60°, JT, UN, SL			
		S			6.5 - 7.0	-1.0		HQTT	86	86				6.70m, 1No. 20°, JT, UN, SL			
					7.0 - 7.3	-1.0							7.00m, 1No. 25°, JT, UN, SL				
					7.3 - 7.7	-1.0							7.30m, 1No. 15°, JT, UN, SL				
					7.7 - 9.0	-2.0							7.70m, 2No. 80°, JT, UN, IR				
	EOH: 9.00m				9.0	-3.0											Box 5, 5.8-9.0m

REMARKS:

Ver. 3.0 - Generated with CORE-GS by Geroc - Drillhole\_Initia - 14/04/2022 4:07:22 PM

Box 1, 0.0-1.5m



Box 2, 1.5-3.0m



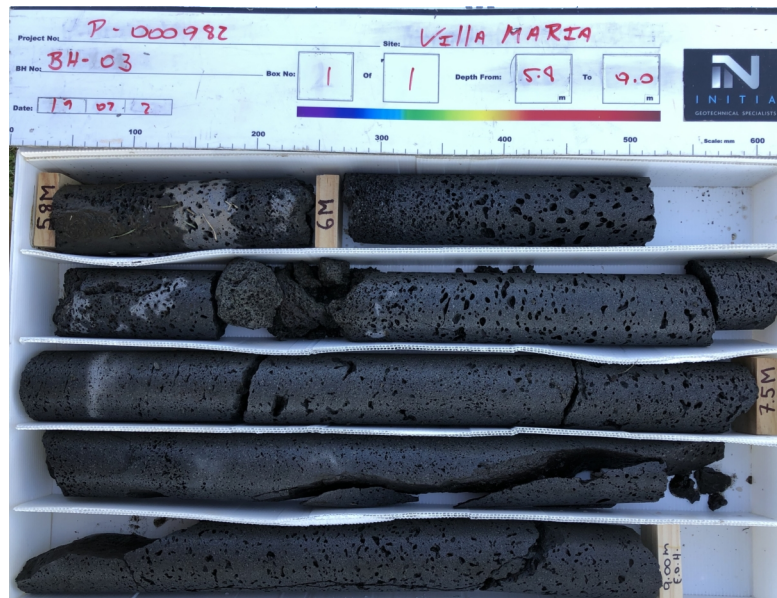
Box 3, 3.0-4.5m



Box 4, 4.5-5.8m



Box 5, 5.8-9.0m





# DRILLHOLE LOG

**HOLE NO.:**  
BH-04

**Project Ref.:**  
P-000982

**START DATE:** 18/02/2021

**END DATE:** 19/02/2021

**LOGGED BY:** BSS

**CHECKED BY:** MDH

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757710.3mE, 5905996.6mN    **ELEVATION:** 6m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked Mounted Rig

**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Troy/Zack

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>LOW SW HW OW EV HIGH MW VV VERY W MS WS ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES					
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES		
Top soil	SILT, with some rootlets and clay; brown. Firm; non-plastic; moist. 0.2m - 1.5m: Core loss	[Symbol]			0.2 - 1.5	5.0 - 5.2		HQTT									
Alluvium	Organic clayey SILT; dark grey. Soft; low plasticity; moist.	[Symbol]			1.5 - 2.0	4.0 - 4.2		DPT									
	2.7m - 3.0m: Core loss	[Symbol]			2.7 - 3.0	3.0 - 3.3		HQTT	70								
	Push Tube: 3.0m - 3.5m	[Symbol]			3.0 - 3.5	3.0 - 3.3		DPT	80								
	Clayey SILT, with some organics; grey. Soft; moist.	[Symbol]			3.5 - 4.3	2.0 - 2.2		HQTT	80								
Auckland Volcanic Field	BOULDERS; grey. Boulders, basalt. 4.3m - 6.0m: Core loss	[Symbol]			4.3 - 6.0	0.0 - 1.0		HQTT									
	Highly weathered; dark grey; BASALT; strong; Highly vesicular.	[Symbol]			6.0 - 7.0	-0.0 - -1.0		HQTT	100	40							
	Moderately weathered; grey; BASALT; strong; moderate vesicular.	[Symbol]			7.0 - 8.5	-1.0 - -2.0		HQTT	100	33							
	Slightly weathered; grey; BASALT; strong; slightly vesicular.	[Symbol]			8.5 - 9.7	-2.0 - -3.0		HQTT	100	86							
		[Symbol]			9.7 - 9.9	-3.0 - -3.1		HQTT									

6.80m, 1No. 45°, JT, UN, SL

7.00m, 2No. 45°, JT, UN, SL

7.50m, 1No. 60°, JT, UN, SL

8.50m, 1No. 85°, JT, UN, SL

9.60m, 1No. 45°, JT, UN, IR

9.70m, 1No. 20°, JT, UN, SL

Bentonite

Box 1, 0.0-7.0m

Box 2, 7.0-9.9m

REMARKS:



# DRILLHOLE LOG

**HOLE NO.:**  
BH-04

**Project Ref.:**  
P-000982

**START DATE:** 18/02/2021  
**END DATE:** 19/02/2021  
**LOGGED BY:** BSS  
**CHECKED BY:** MDH

**CLIENT:** Goodman Nominee (NZ) Ltd    **SITE LOCATION:** 118 Montgomerie Road, Mangere

**PROJECT:** Villa Maria Estate

**CO-ORDINATES:** 1757710.3mE, 5905996.6mN    **ELEVATION:** 6m    **CONTRACTOR:** Geotech Drilling

**Co-ordinate system:** NZTM    **Datum:** AUCKHT1946    **RIG:** Tracked Mounted Rig

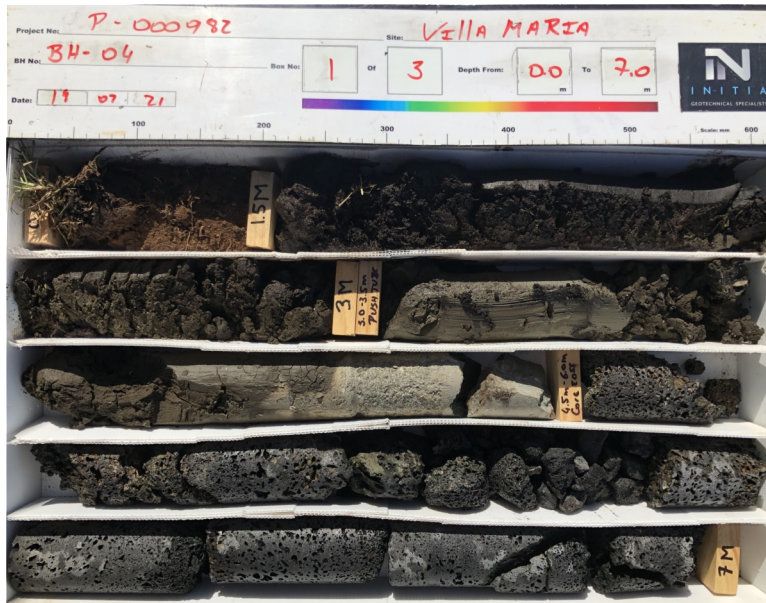
**Location method:** GPSH    **Level method:** CONTOUR    **DRILLER:** Troy/Zack

**ORIENTATION (°):** Vertical    **INCLINATION (°):** 90

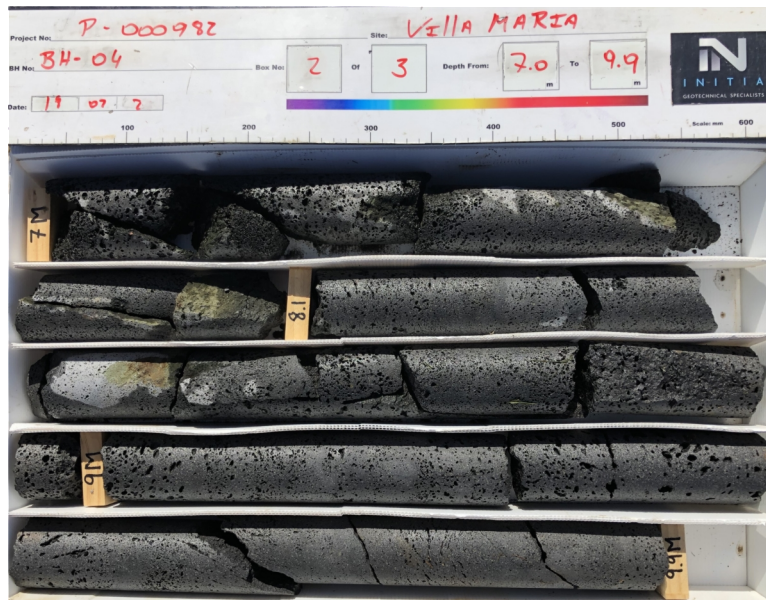
UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW SH HW CW EV</small>	STRENGTH <small>W VV W MS S ES</small>	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES	WATER	INSTALLATION	CORE BOXES
												DESCRIPTION			
Proterozoic Volcanic Ejecta	[Cont...] Slightly weathered; grey; BASALT; strong; slightly vesicular.  EOH: 10.50m							HQTT				9.80m, 1No. 30°, JT, UN, IR 10.00m, 1No. 30°, JT UN, SL		Bentonite	Box 3, 9.9-10.5m

**REMARKS:**

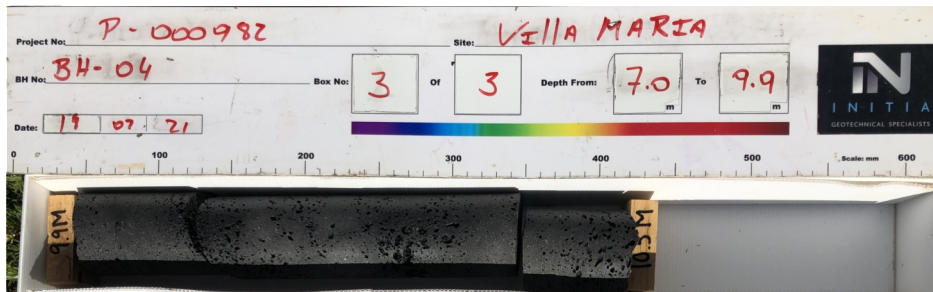
Box 1, 0.0-7.0m



Box 2, 7.0-9.9m



Box 3, 9.9-10.5m





**INITIA**  
GEOTECHNICAL SPECIALISTS

# DRILLHOLE LOG

HOLE NO.:  
**BH-05**

CLIENT: Goodman Nominee (NZ) Ltd    SITE LOCATION: 118 Montgomerie Road, Mangere  
PROJECT: Villa Maria Estate

Project Ref.:  
**P-000982**

CO-ORDINATES: 1757050.4mE, 5905789.6mN    ELEVATION: 15.9m    CONTRACTOR: Geotech Drilling  
Co-ordinate system: NZTM    Datum: AUCKHT1946    RIG: Tracked Mounted Rig  
Location method: GPSH    Level method: CONTOUR    DRILLER: Troy/Zack  
ORIENTATION (°): Vertical    INCLINATION (°): 90

START DATE: 19/02/2021  
END DATE: 19/02/2021  
LOGGED BY: BSS  
CHECKED BY: MDH

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	GRAPHIC	WEATHERING <small>DW SW HW DW EV VW WS S ES</small>	STRENGTH	DEPTH	RL	SAMPLES	METHOD	TCR (%) <small>25 50 75</small>	RQD (%) <small>25 50 75</small>	INSITU TESTING SPT 'N' Vane shear strength	DISCONTINUITIES					
												DESCRIPTION	WATER	INSTALLATION	CORE BOXES		
Top soil	SILT, with minor rootlets, with trace sand; brownish. Firm; low plasticity; moist; sand, fine. Clayey SILT; red brown. Stiff; high plasticity; moist.				0.0	15.0		HQTT	80								
Auckland Volcanic Field	Clayey SILT, with minor sand; brownish grey. Stiff, low plasticity; moist; sand, fine. 0.90m - 1.00m: GRAVEL; dark grey. 1.2m - 1.5m: Core loss Gravel, fine.				1	14.0		HQTT	40								
	1.80m - 2.25m: Core loss 1.60m - 1.70m: GRAVEL; dark grey. Gravel, fine.				2	13.0		HQTT	59								
	Clayey SILT, with minor sand and trace gravels; grey. Stiff, low plasticity; moist; sand, fine. 2.7m - 3.0m: Core loss				3	12.0		HQTT	46								
	Clayey SILT, with minor sand; grey. Stiff, low plasticity; moist; sand, fine. 3.00m - 3.10m: GRAVEL; dark grey. Gravel, fine.				4	11.0		HQTT	53								
	SAND; black. Moist; sand, coarse; loosely packed. 3.7m - 4.5m: Core loss				5	10.0		HQTT	46								
	SILT, with minor sand; grey. Stiff, low plasticity; moist; sand, fine. 4.9m - 5.25m: Core loss				6	9.0											
	5.6m - 6.0m: Core loss				7	8.0											
	EOH: 6.00m				8	7.0											
					9	6.0											

Bentonite

Box 1, 0.0-5.3m  
Box 2, 5.3-6.0m

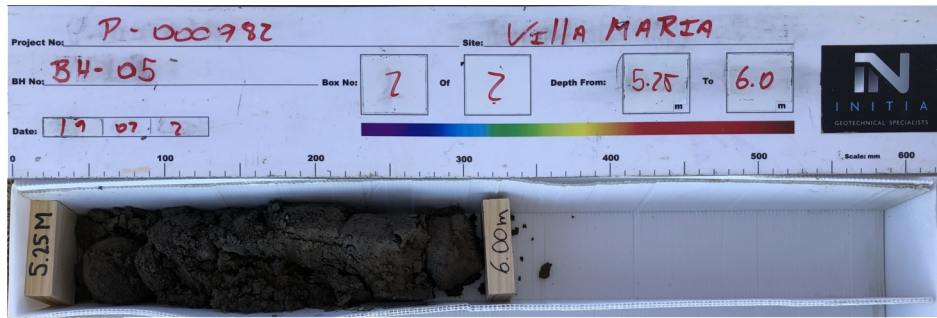
REMARKS:



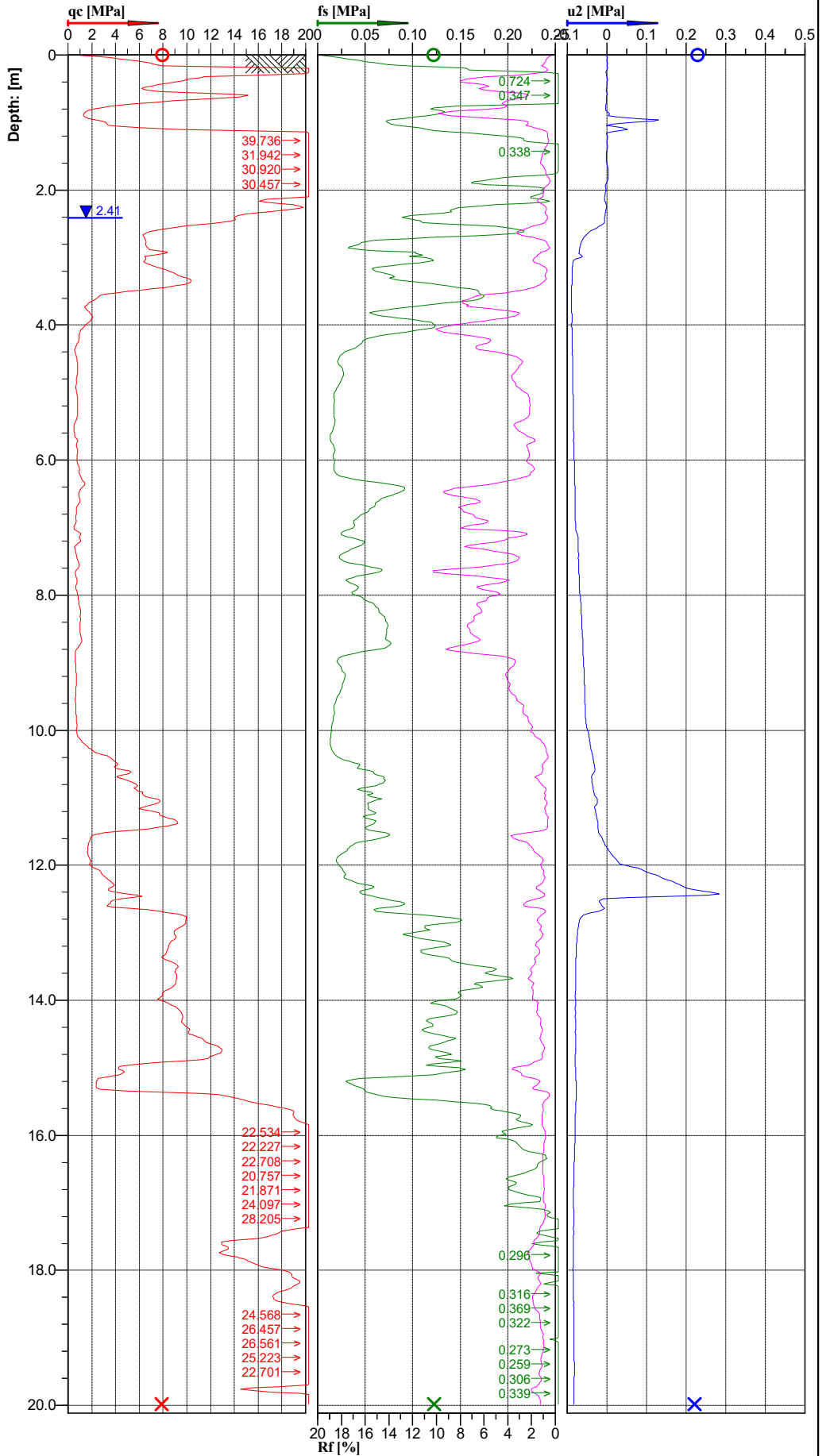
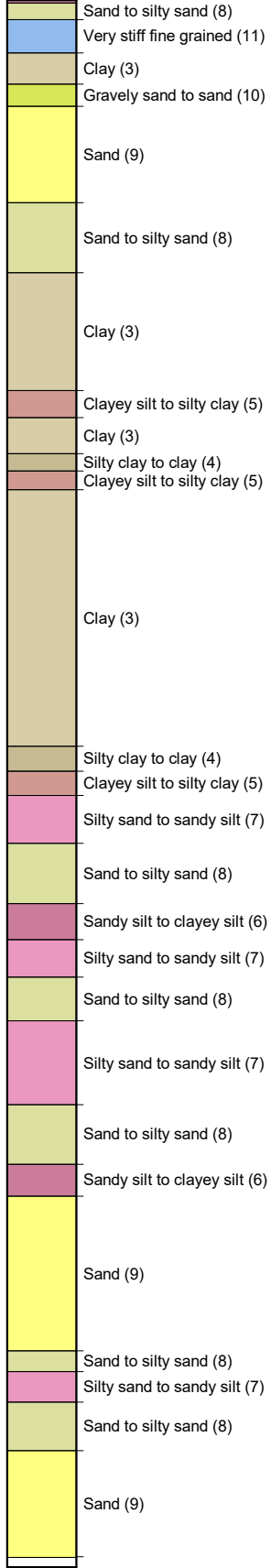
Box 1, 0.0-5.3m



Box 2, 5.3-6.0m



**Classification by  
Robertson 1986**

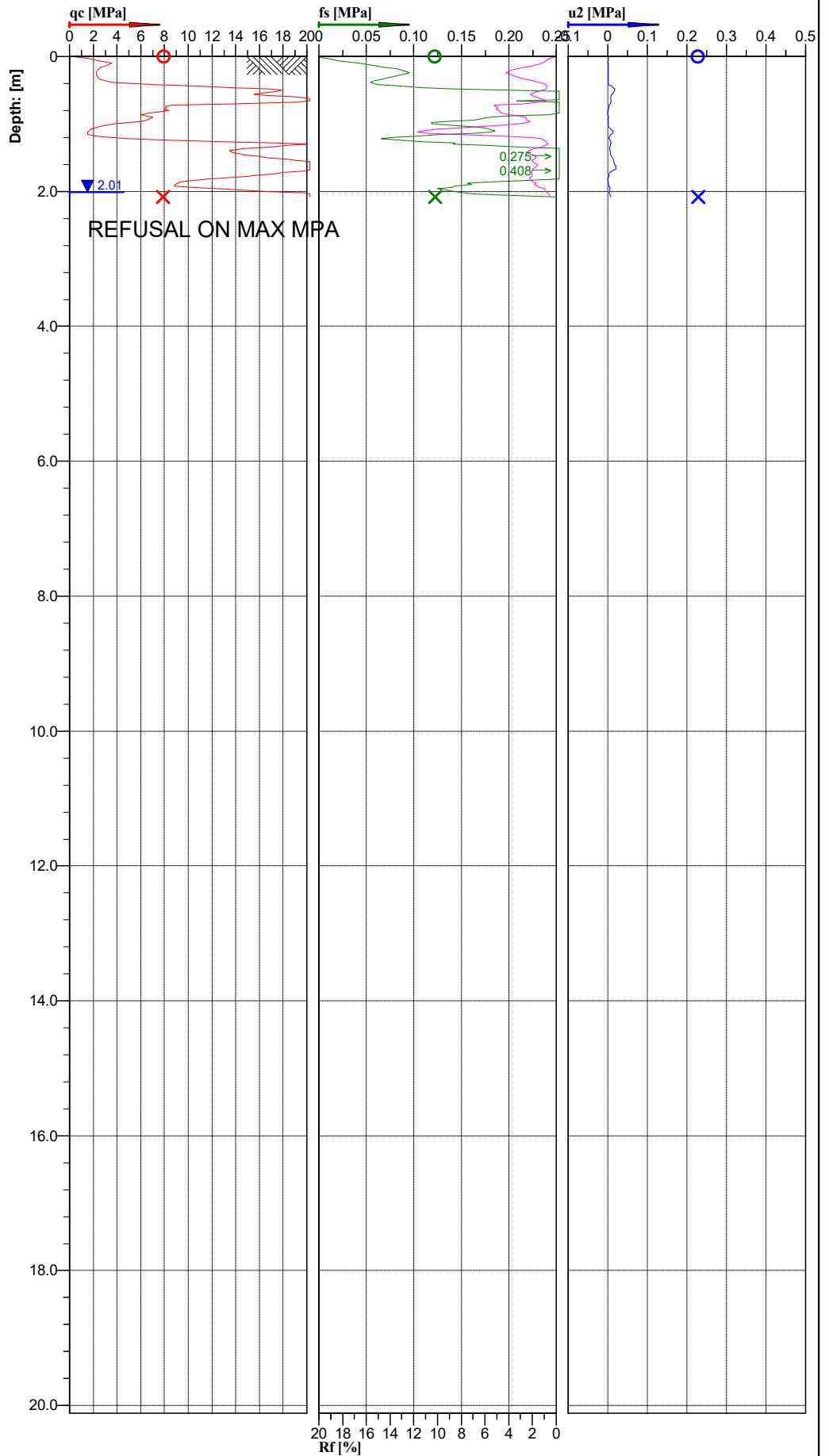


Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150

Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT01
Project ID:	Client: <b>INITIA</b>	Date: 7/12/2020	Scale: 1 : 89
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97780 E 174.77406		File: CPT01.cpt	

**Classification by  
Robertson 1986**

- Clayey silt to silty clay (5)
- Very stiff fine grained (11)
- Clay (3)
- Silty sand to sandy silt (7)



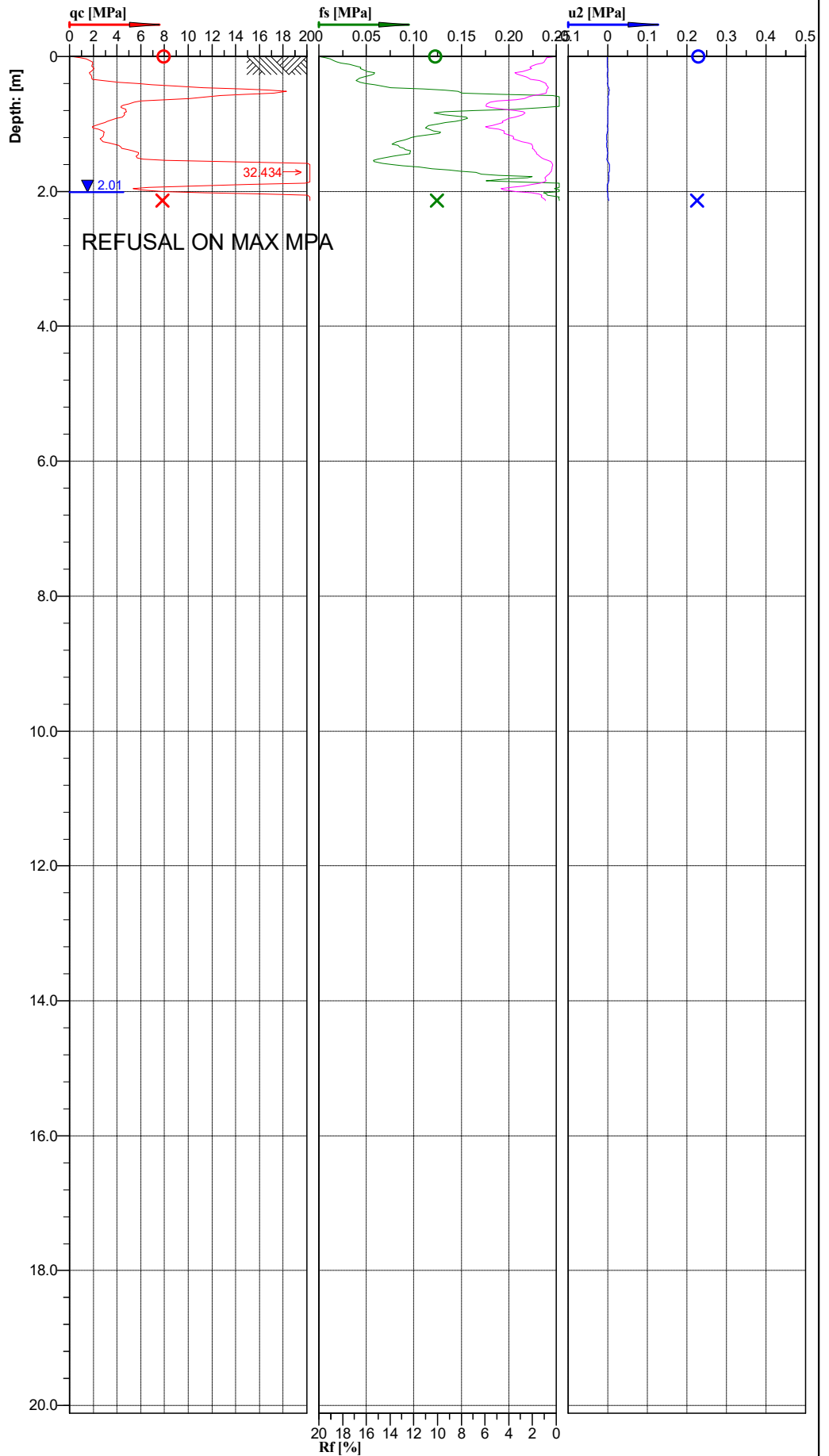
Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT02
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 89
Project:	VILLA MARIA			Page:	1/1	Fig.:	
S 36.97871 E 174.77342				File:	CPT02.cpt		

**Classification by  
Robertson 1986**

- Sandy silt to clayey silt (6)
- Sand (9)
- Clay (3)
- Sandy silt to clayey silt (6)
- Sand (9)

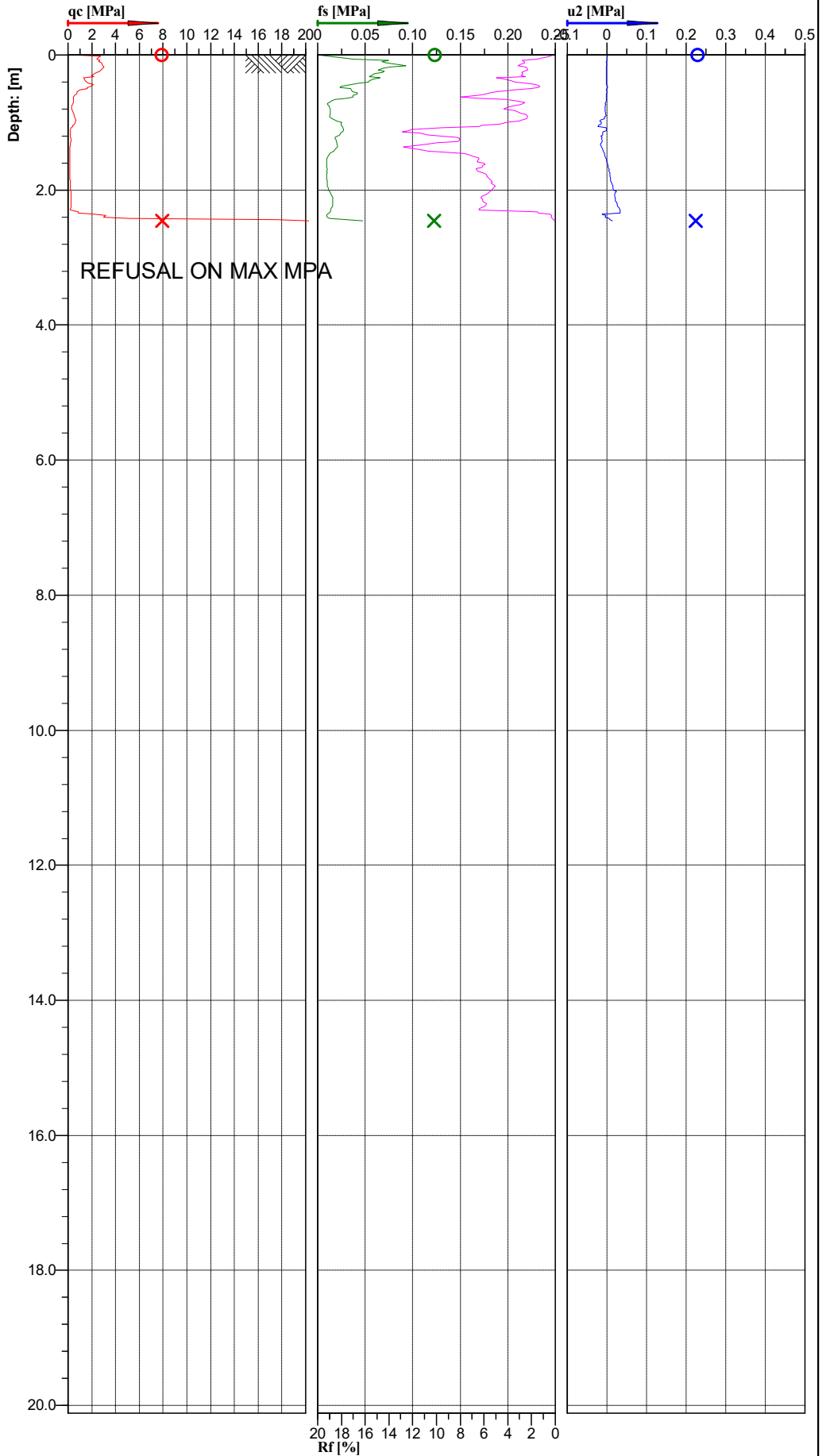
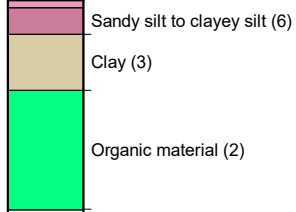


Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT02A
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 89
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97872 E 174.77343			File:	CPT02A.cpt		

**Classification by  
Robertson 1986**



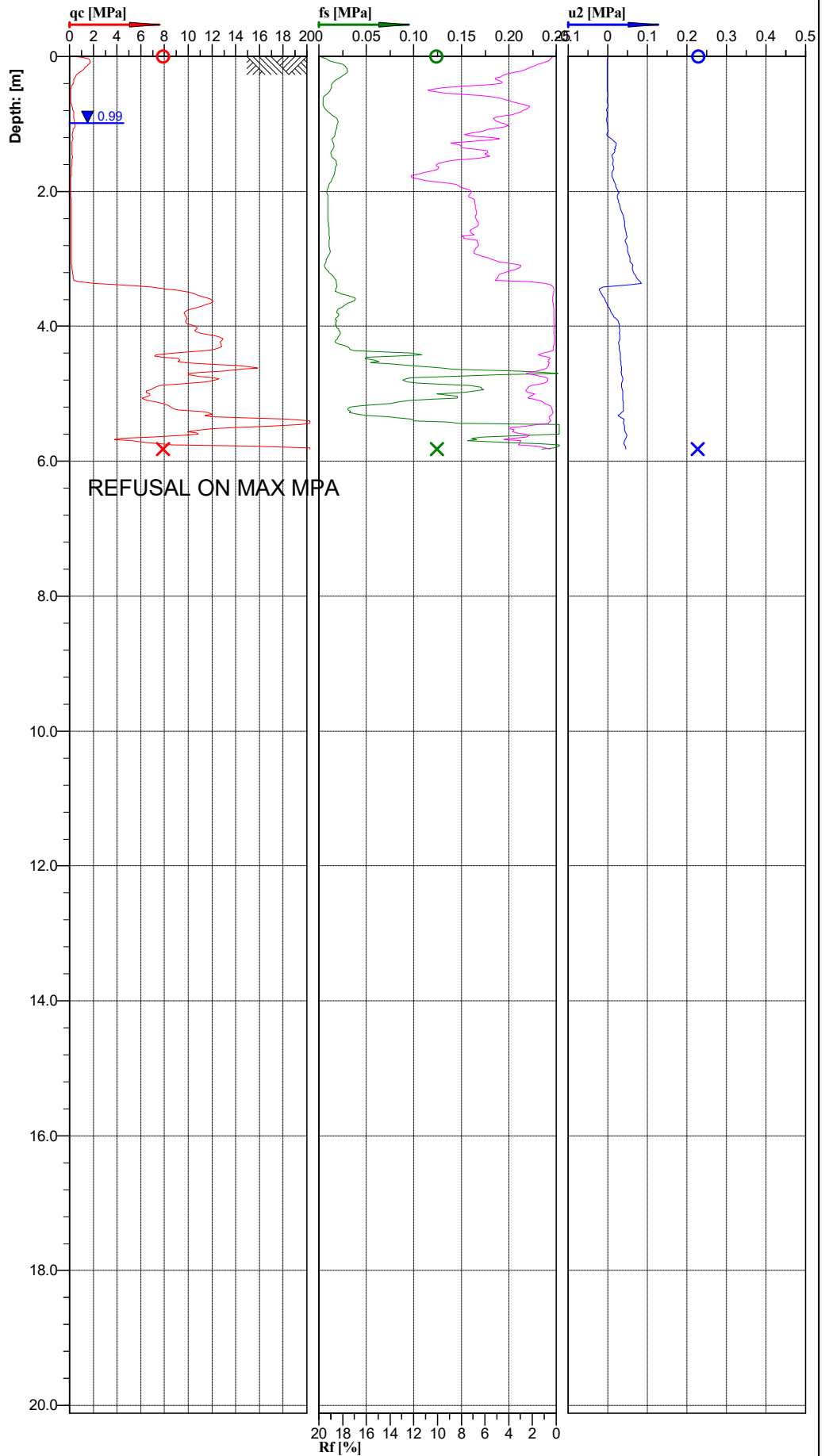
Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT03
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 89
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97985 E 174.77075			File:	CPT03.cpt		

**Classification by  
Robertson 1986**

- Sandy silt to clayey silt (6)
- Clay (3)
- Organic material (2)
- Clay (3)
- Organic material (2)
- Clay (3)
- Sand (9)
- Sand to silty sand (8)
- Sandy silt to clayey silt (6)
- Sand (9)
- Sandy silt to clayey silt (6)



REFUSAL ON MAX MPA

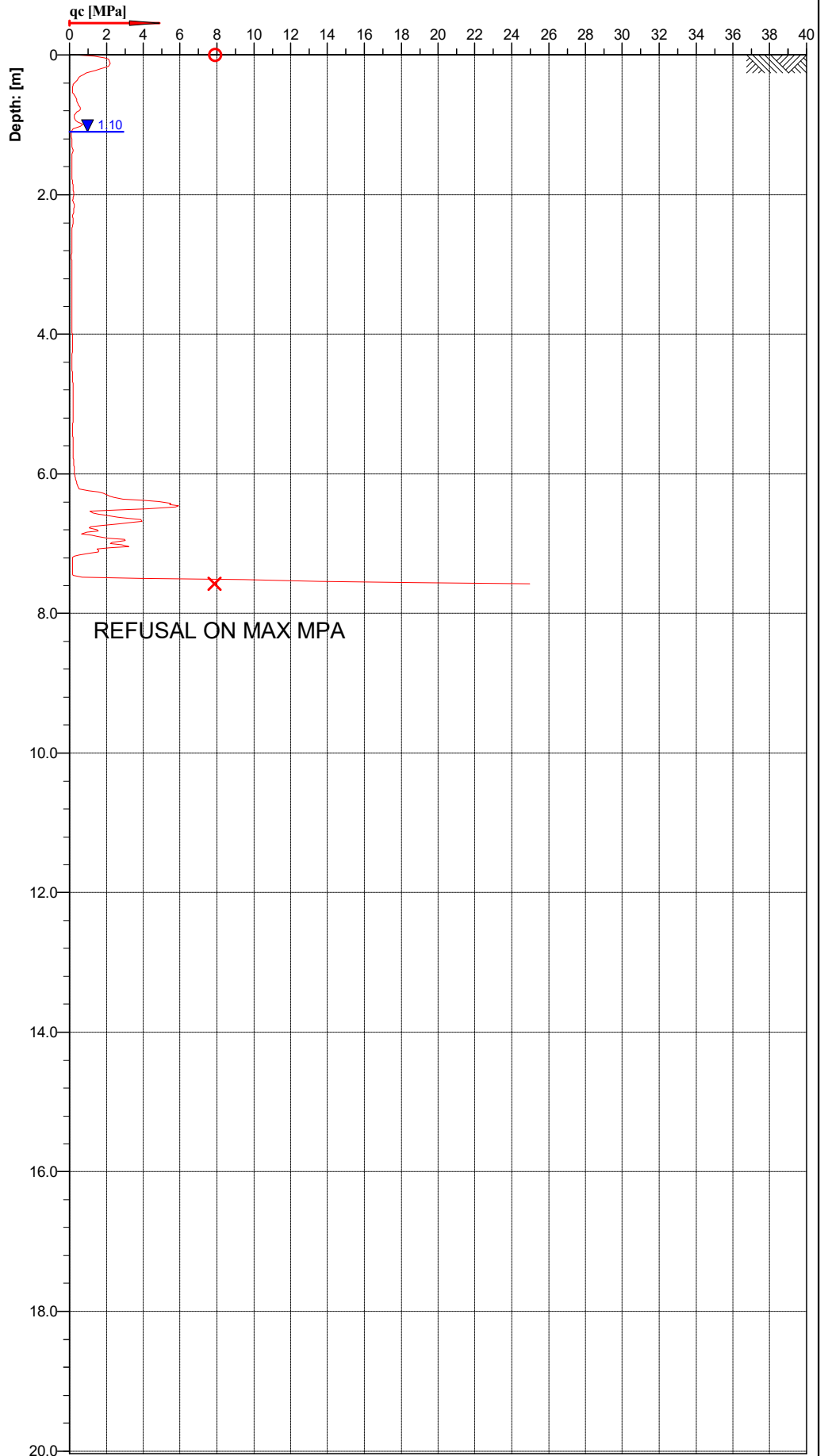
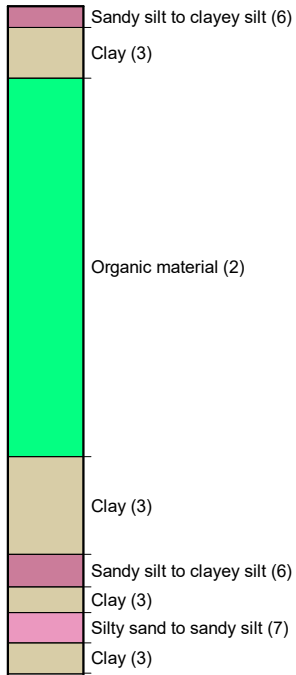


Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT04
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 89
Project:	VILLA MARIA			Page:	1/1	Fig.:	
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**Classification by  
Robertson 1986**

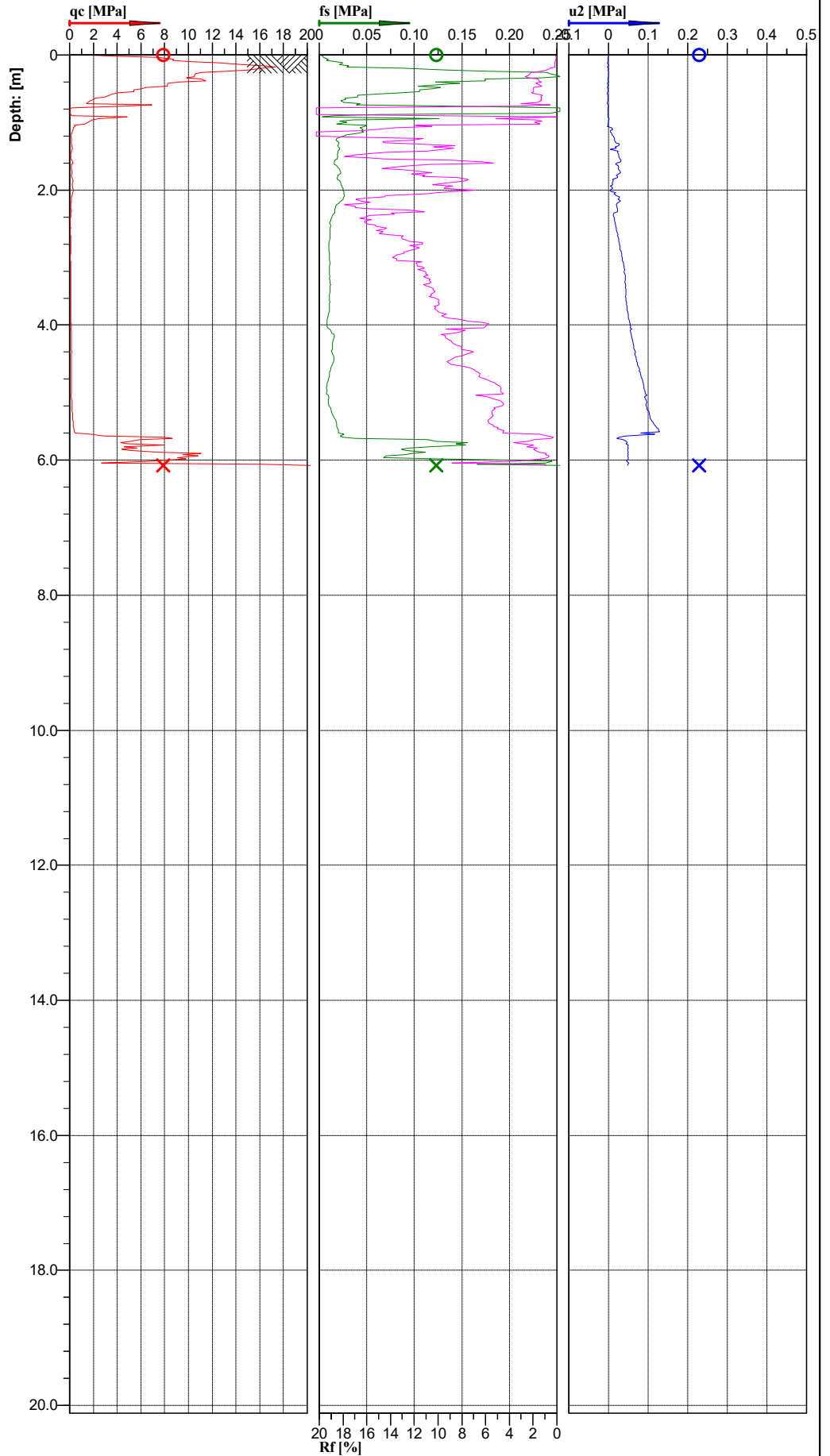
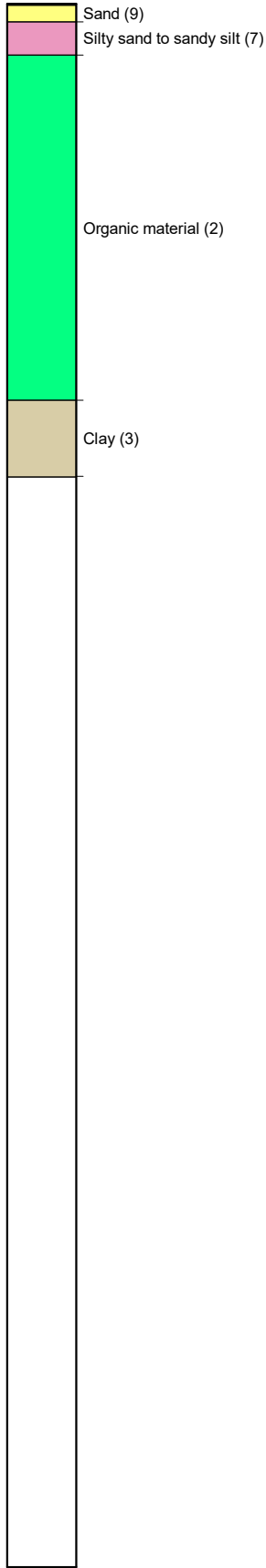


Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT05
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 86
Project:	VILLA MARIA			Page:	1/1	Fig.:	
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**Classification by  
Robertson 1986**



Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150

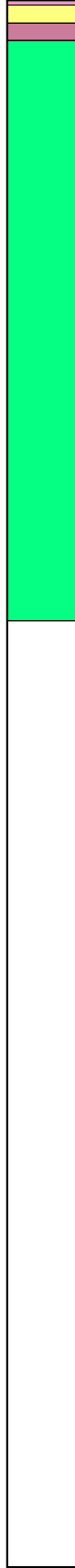


Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT06
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 89
Project:	VILLA MARIA			Page:	1/1	Fig.:	
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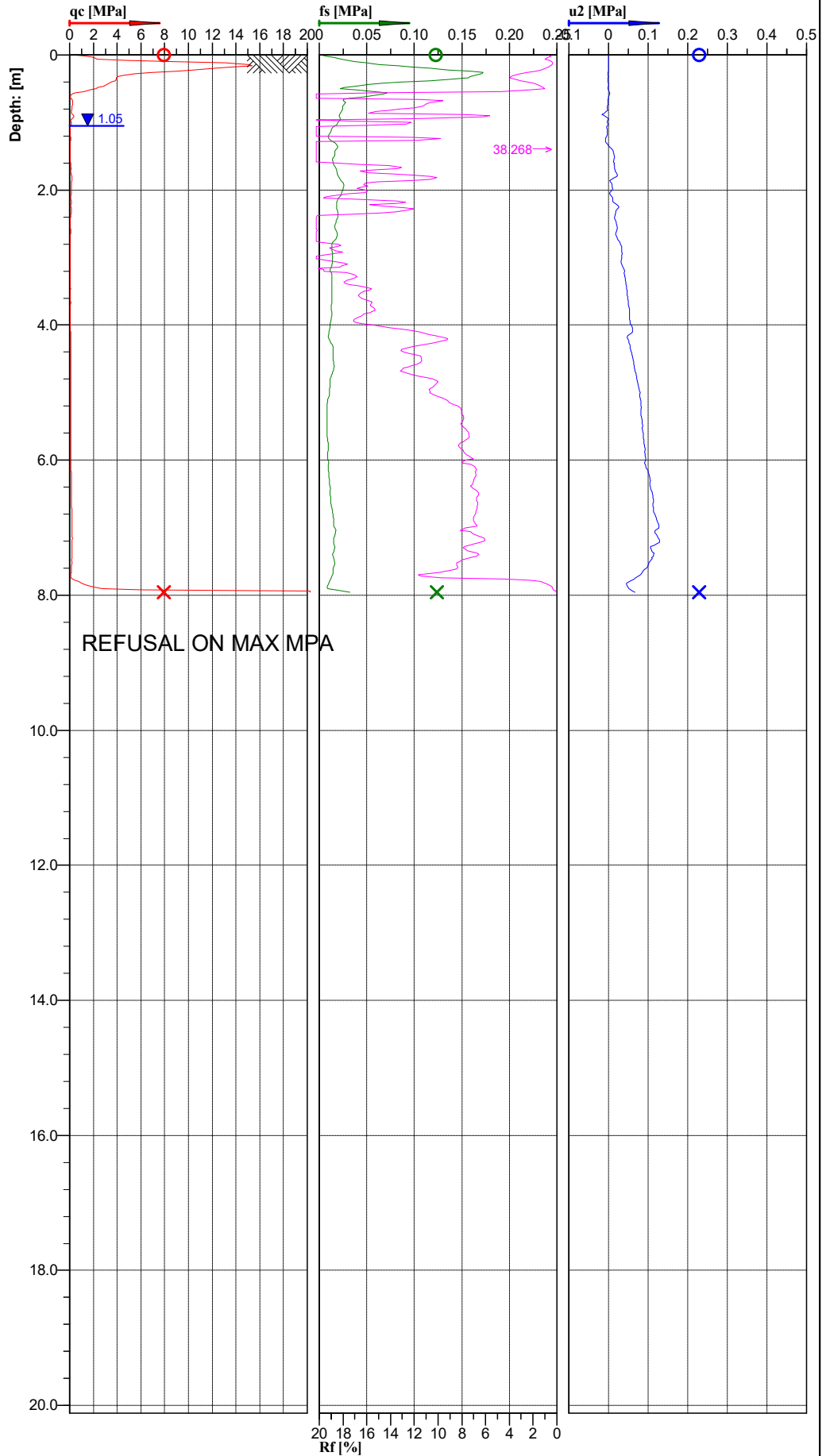


Classification by  
Robertson 1986

- Sand (9)
- Sandy silt to clayey silt (6)



Organic material (2)

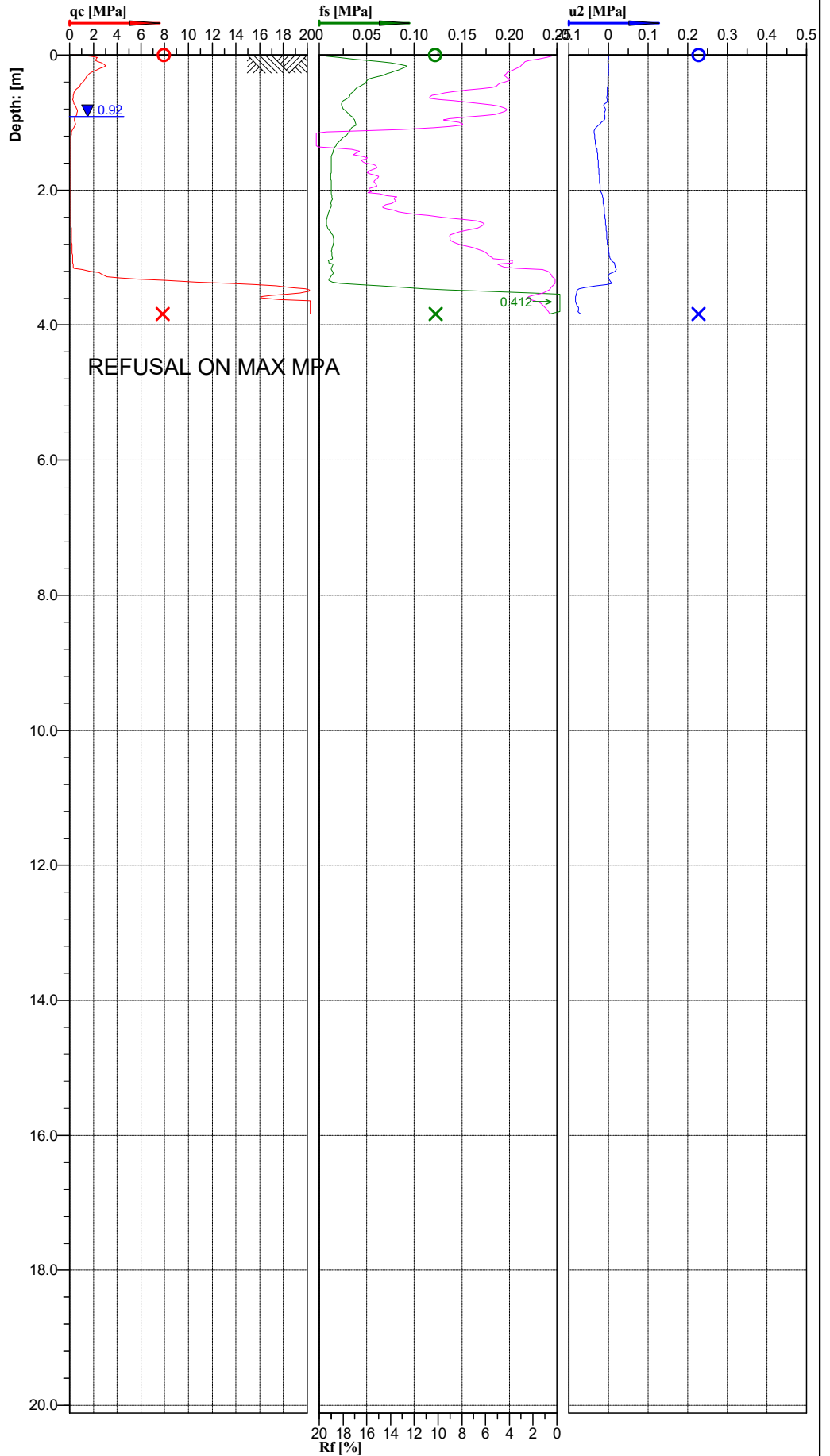
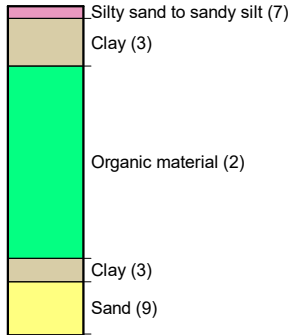


Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT07
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 89
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97930 E 174.76865			File:	CPT07.cpt		

**Classification by  
Robertson 1986**

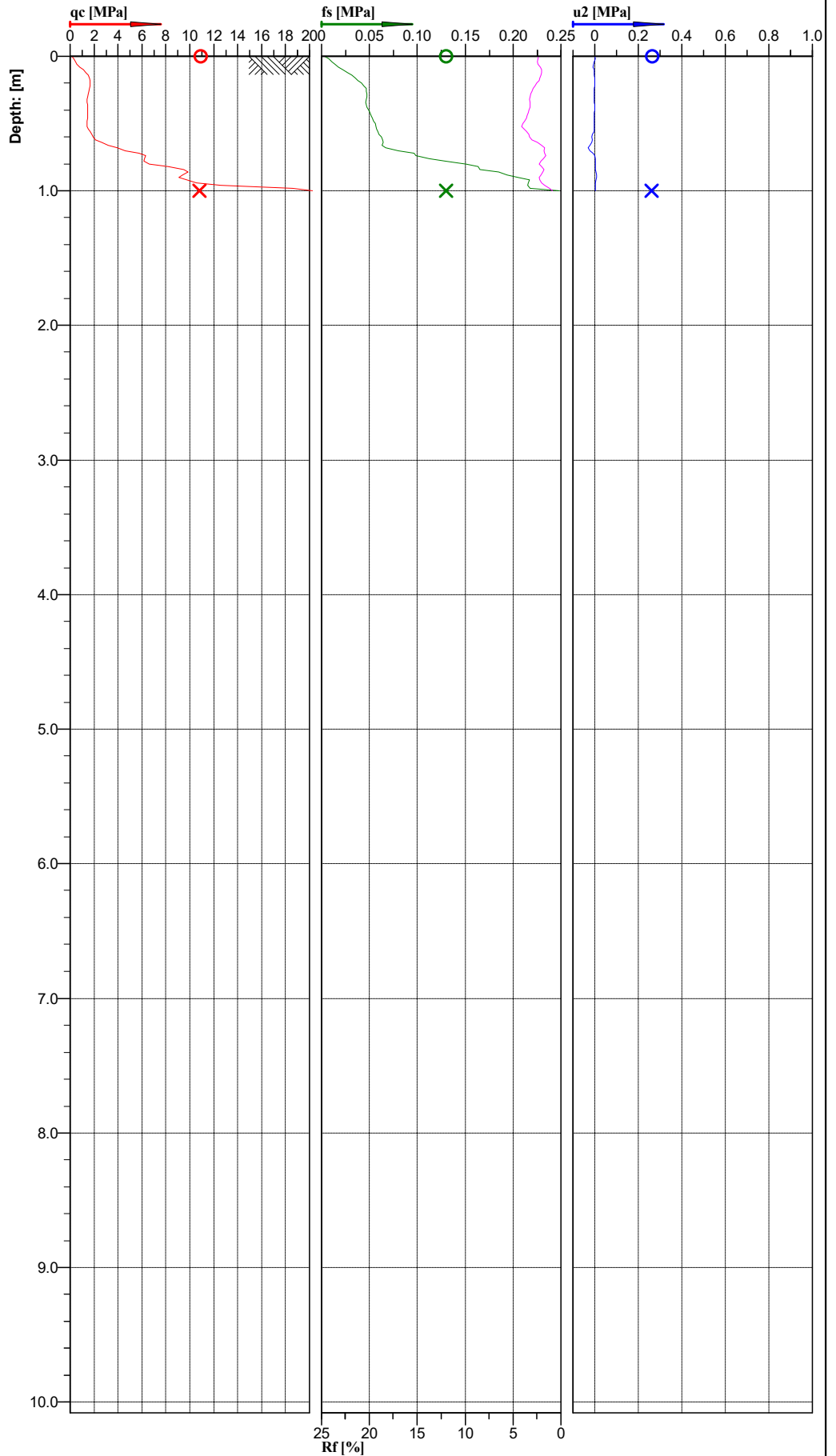


Cone No: 5332  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150

Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT08
Project ID:		Client:	INITIA	Date:	7/12/2020	Scale:	1 : 89
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.98054 E 174.76971			File:	CPT08.cpt		

Classification by  
Robertson 1986

- Clayey silt to silty clay (5)
- Silty clay to clay (4)
- Silty sand to sandy silt (7)



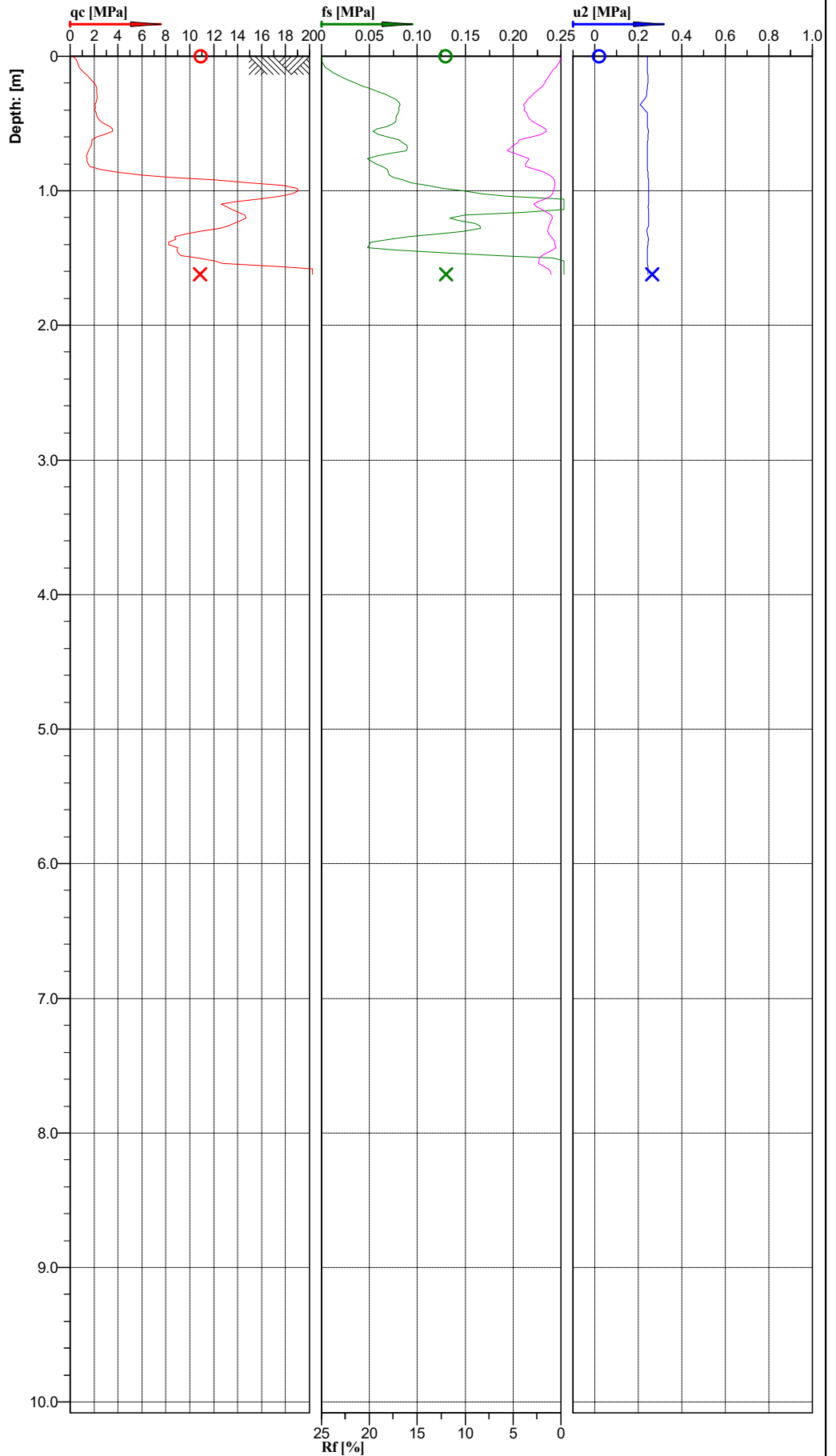
Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT01</b>
Project ID:	Client: <b>INITIA</b>	Date: 2/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97851, E 174.77377		File: CPT01.cpt	

**Classification by  
Robertson 1986**

- Sensitive fine grained (1)
- Sandy silt to clayey silt (6)
- Silty sand to sandy silt (7)
- Sand (9)
- Sand to silty sand (8)



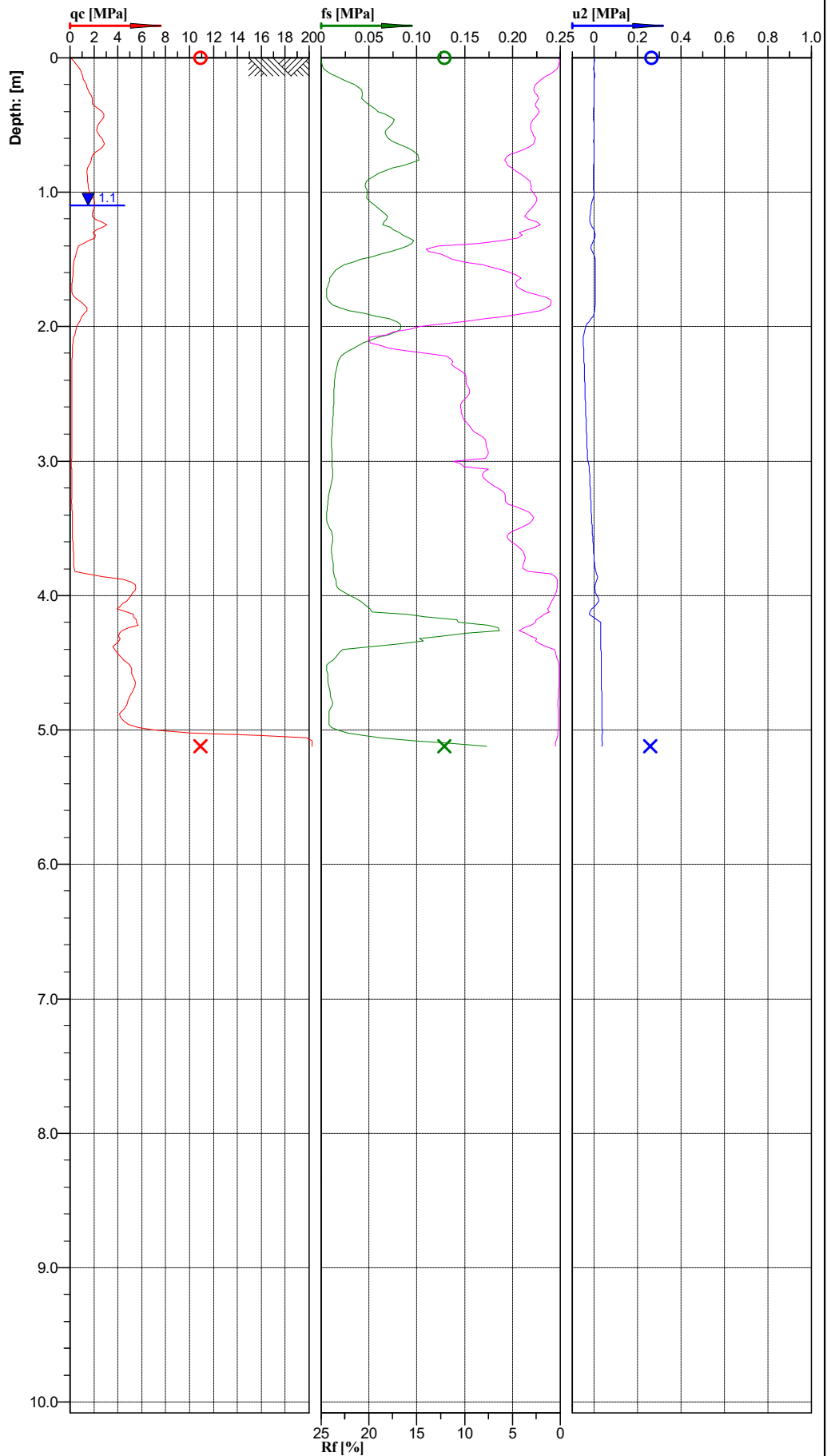
Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT02</b>
Project ID:	Client: <b>INITIA</b>	Date: 2/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97810, E 174.77348		File: CPT02.cpt	

**Classification by  
Robertson 1986**

- Sensitive fine grained (1)
- Clayey silt to silty clay (5)
- Clay (3)
- Clayey silt to silty clay (5)
- Organic material (2)
- Clay (3)
- Organic material (2)
- Clay (3)
- Silty sand to sandy silt (7)
- Sand to silty sand (8)



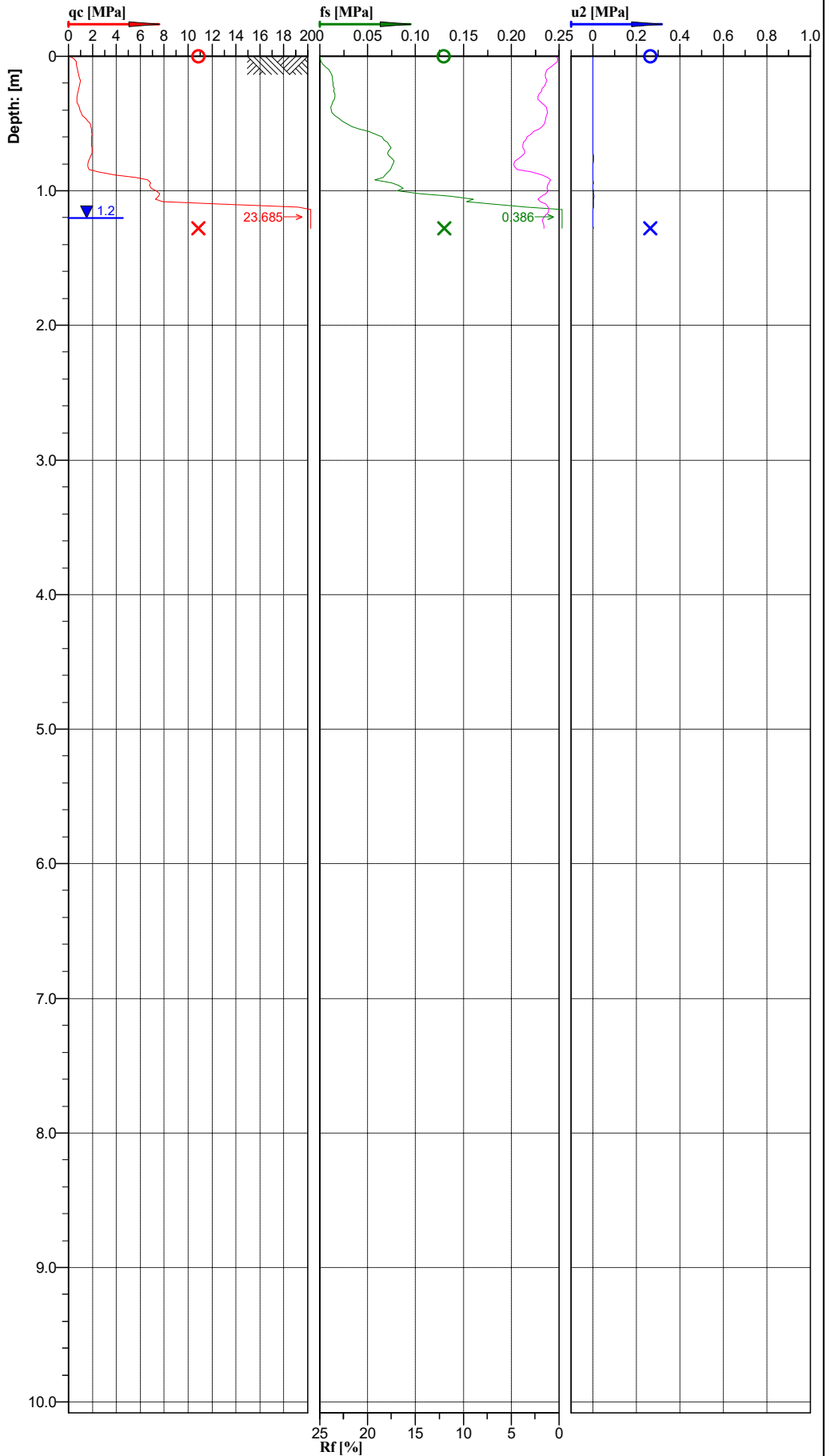
Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT05</b>
Project ID:	Client: <b>INITIA</b>	Date: 2/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97761, E 174.77266		File: <b>CPT05.cpt</b>	

**Classification by  
Robertson 1986**

- Sensitive fine grained (1)
- Clayey silt to silty clay (5)
- Silty clay to clay (4)
- Silty sand to sandy silt (7)

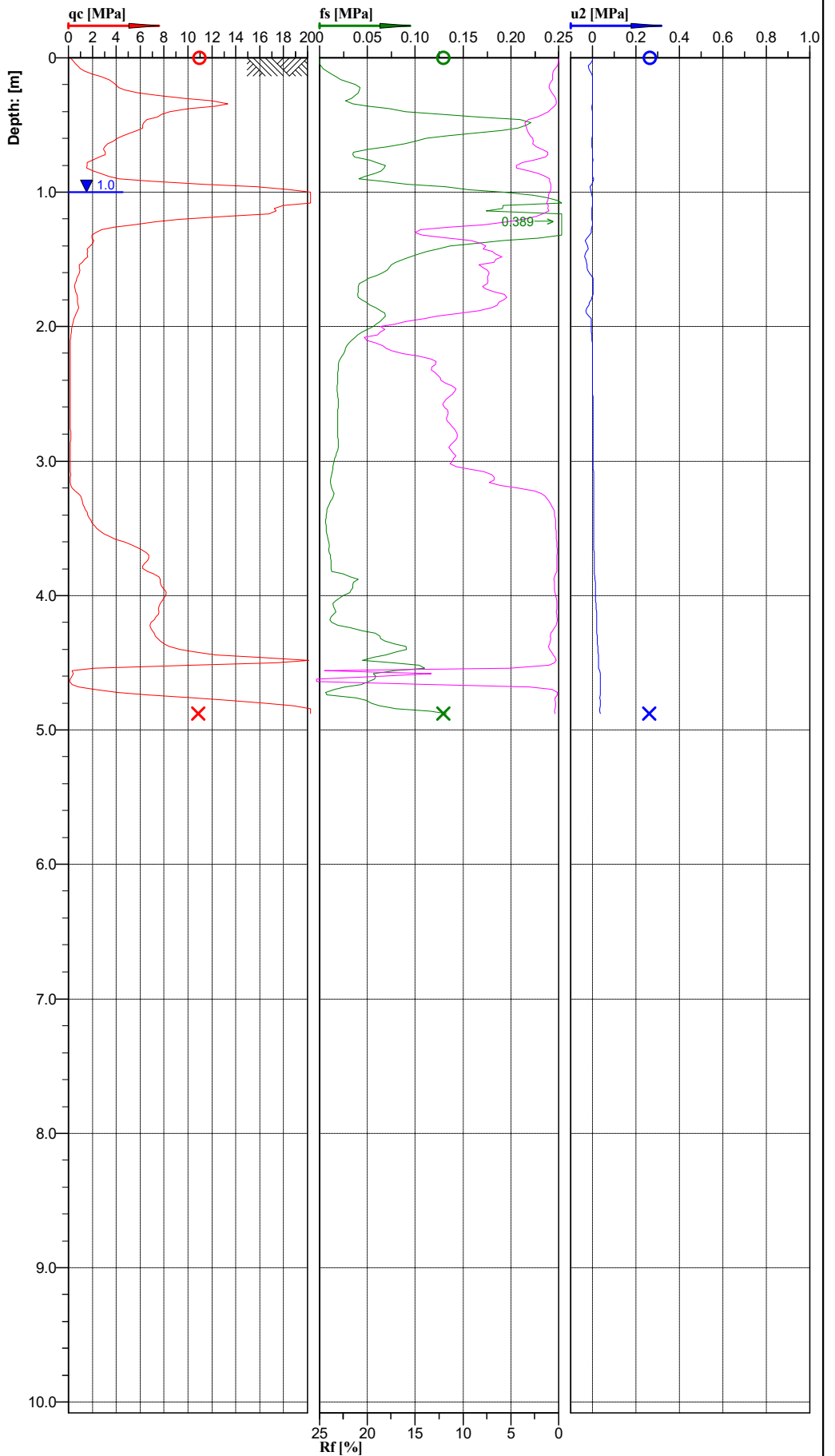
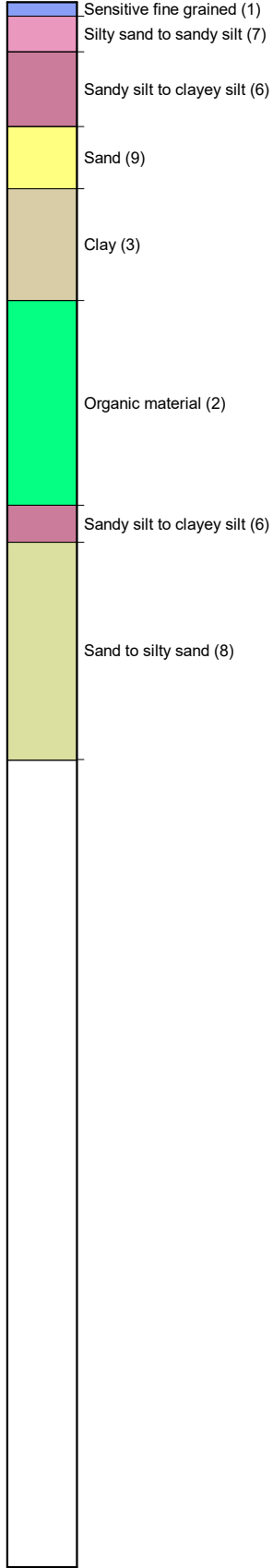


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT06</b>
Project ID:	Client: <b>INITIA</b>	Date: 2/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97783, E 174.77306		File: CPT06.cpt	

**Classification by Robertson 1986**



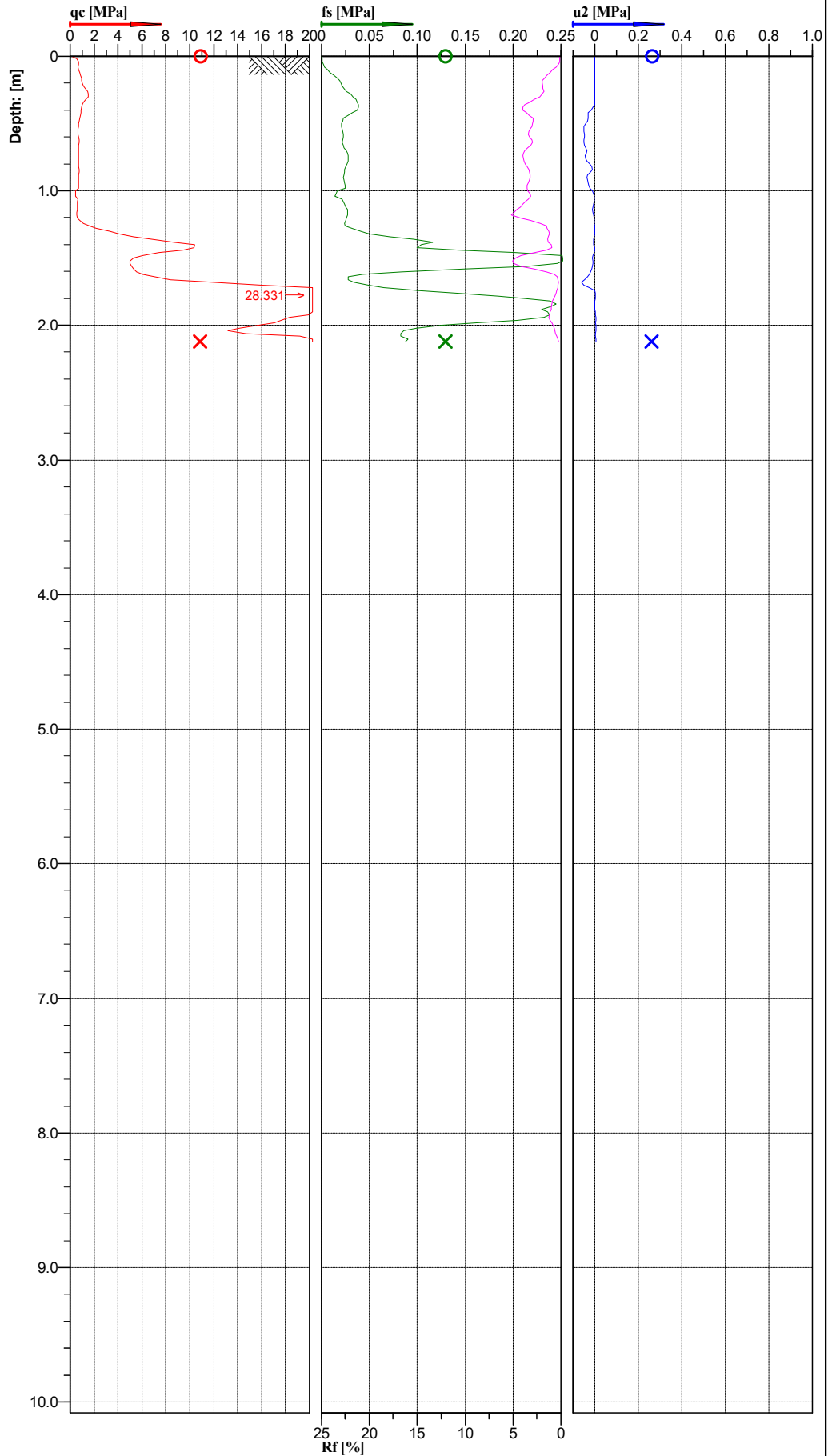
Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT07
Project ID:		Client:	INITIA	Date:	2/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
S 36.97791, E 174.77249				File:	CPT07.cpt		

**Classification by  
Robertson 1986**

- Sensitive fine grained (1)
- Clayey silt to silty clay (5)
- Clay (3)
- Silty sand to sandy silt (7)
- Sand (9)



Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150

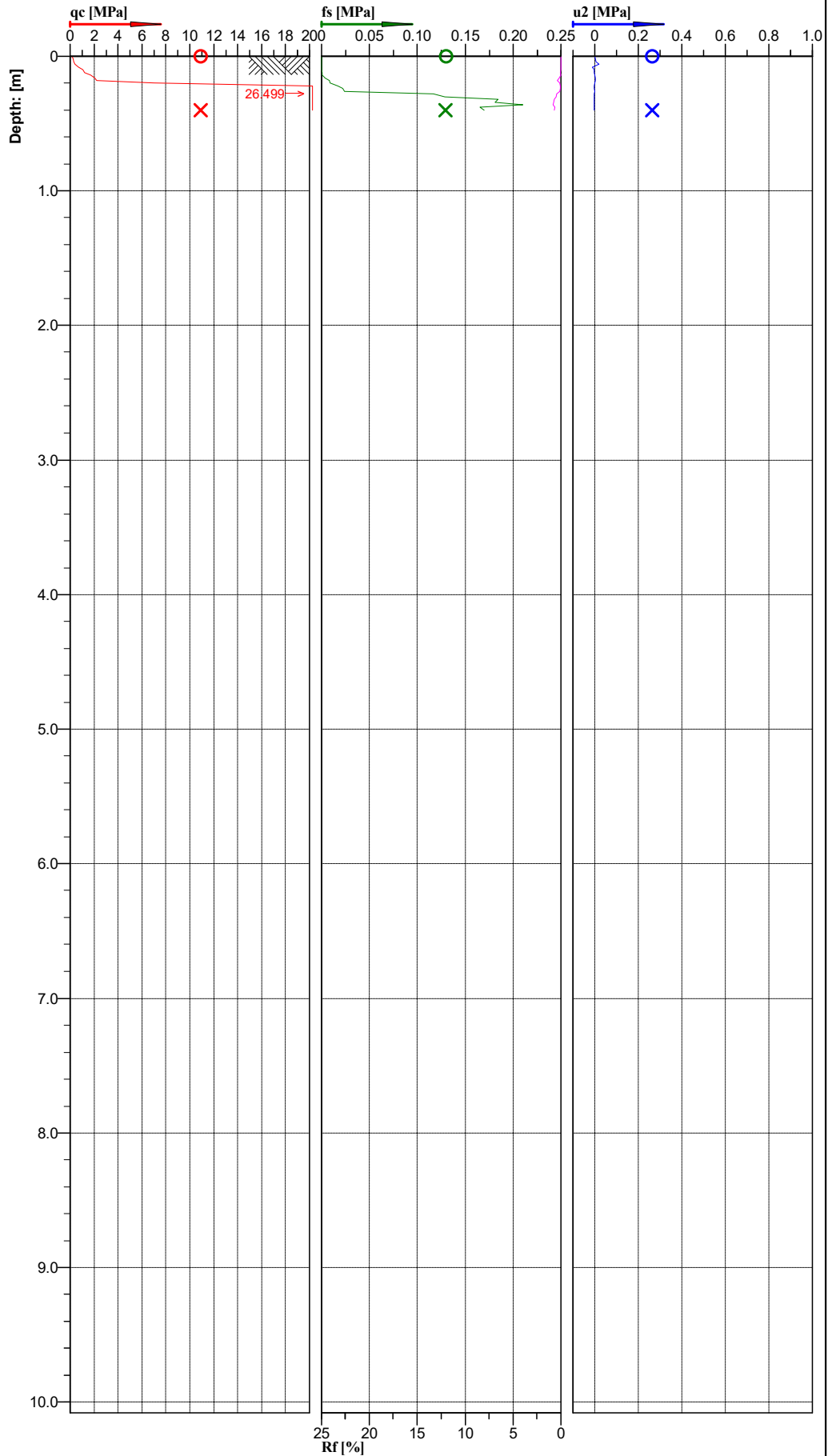


Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT108</b>
Project ID:	Client: <b>INITIA</b>	Date: 2/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97861, E 174.77312		File: <b>CPT108.cpt</b>	



Classification by  
Robertson 1986

- Sensitive fine grained (1)
- Gravely sand to sand (10)

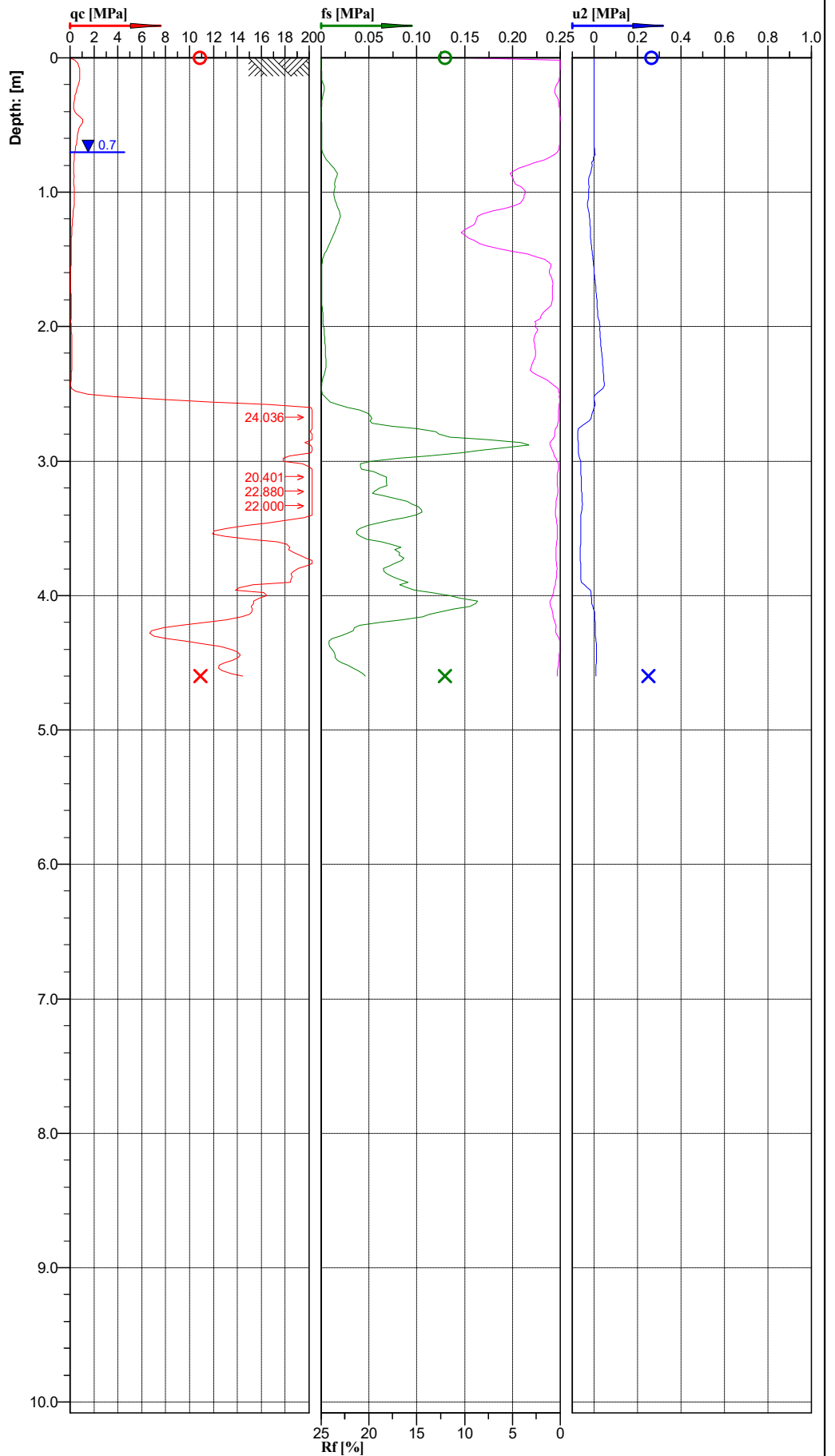
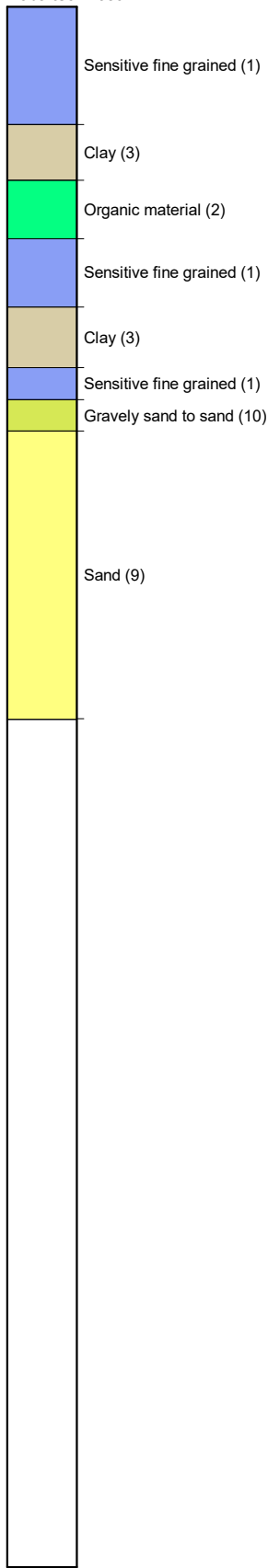


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT109
Project ID:		Client:	INITIA	Date:	2/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97903, E 174.77289			File:	CPT109.cpt		

Classification by  
Robertson 1986

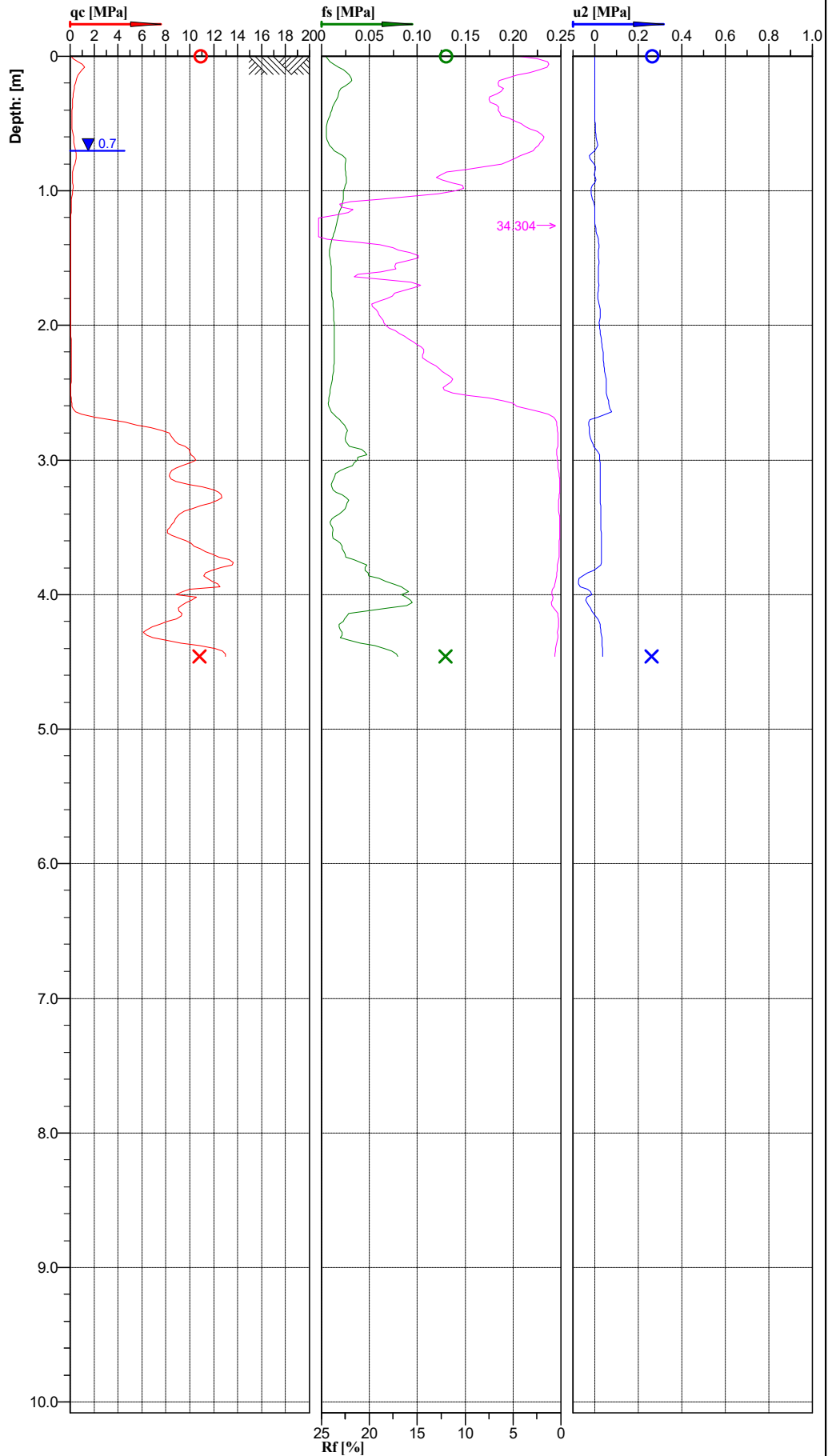
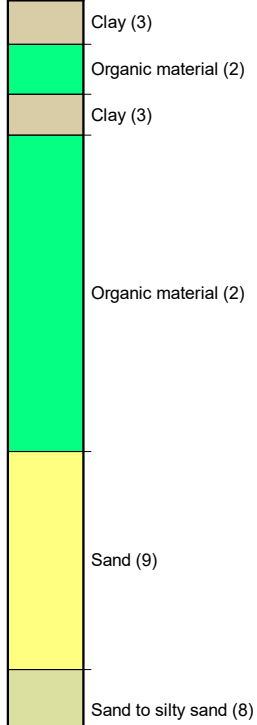


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT110
Project ID:		Client:	INITIA	Date:	2/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
S 36.97873, E 174.77219				File:	CPT110.cpt		

**Classification by  
Robertson 1986**



Rf [%]

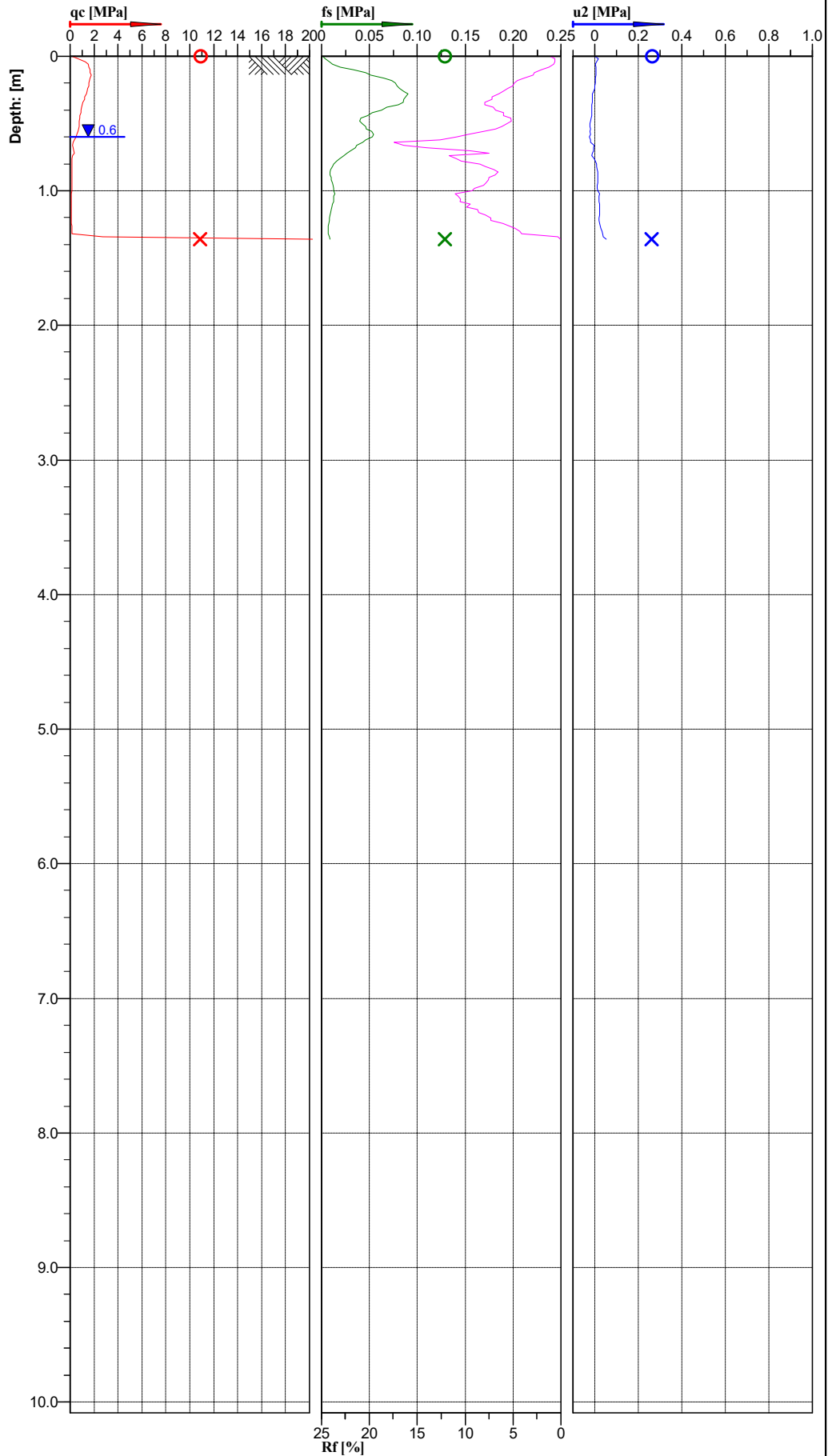
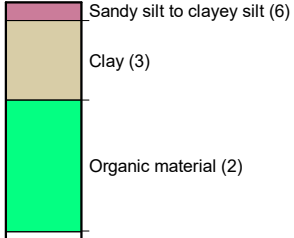


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT111A
Project ID:		Client:	INITIA	Date:	2/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97840, E 174.77229			File:	CPT111.cpt		

**Classification by  
Robertson 1986**

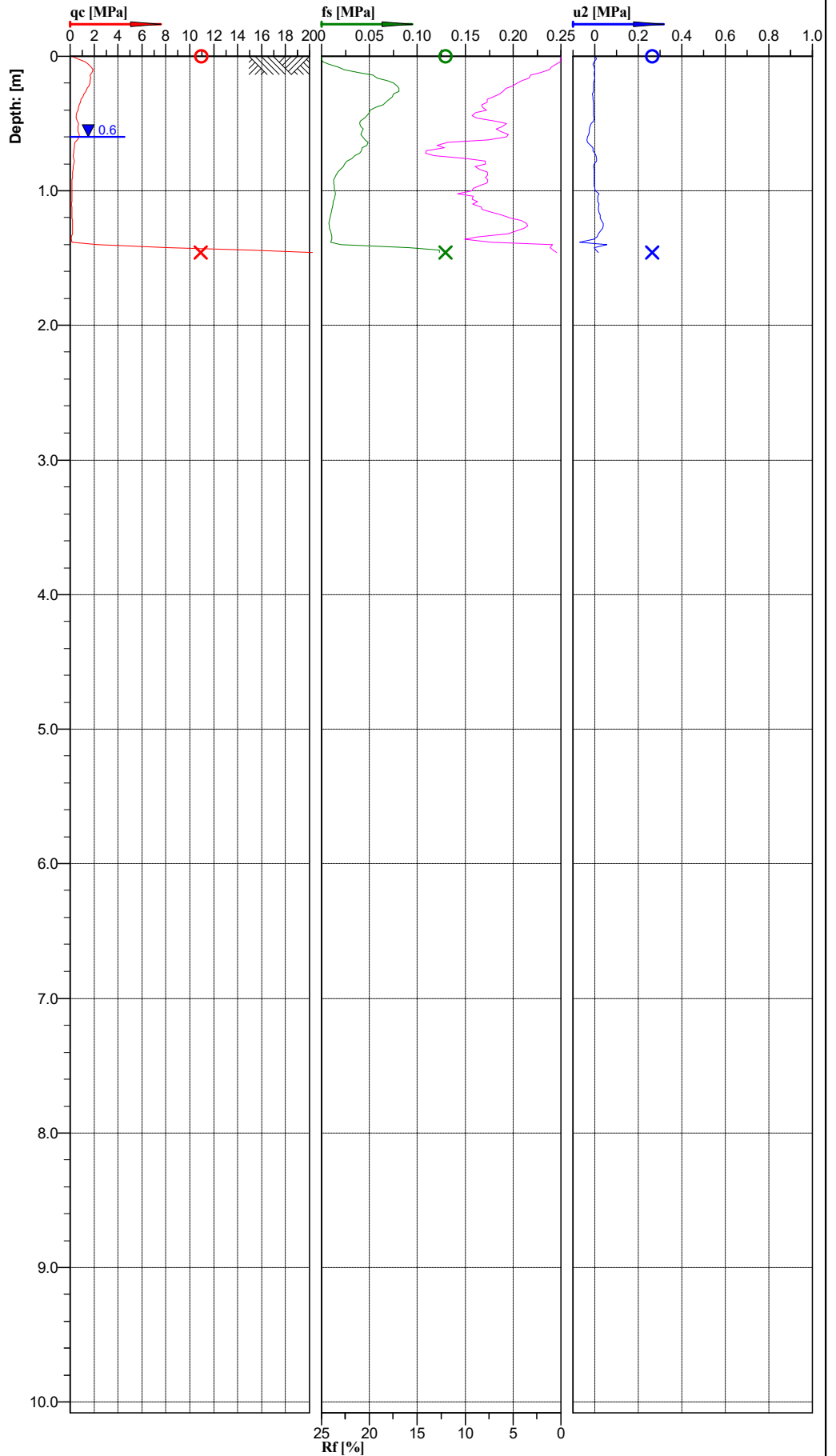
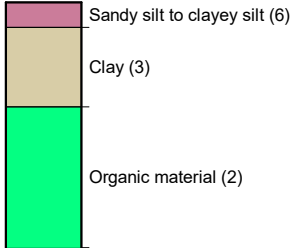


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT112
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97823, E 174.77174			File:	CPT112.cpt		

Classification by  
Robertson 1986

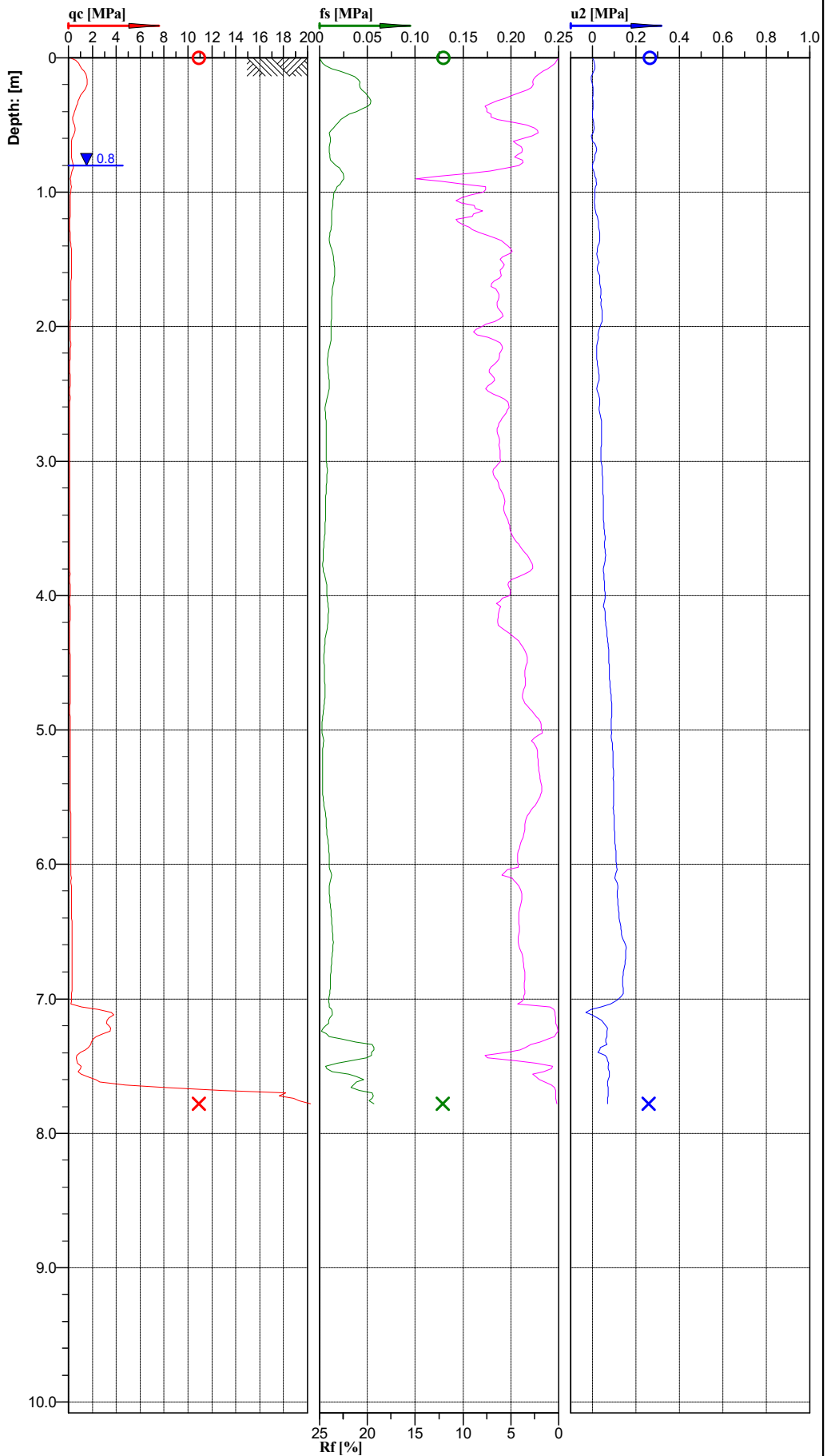
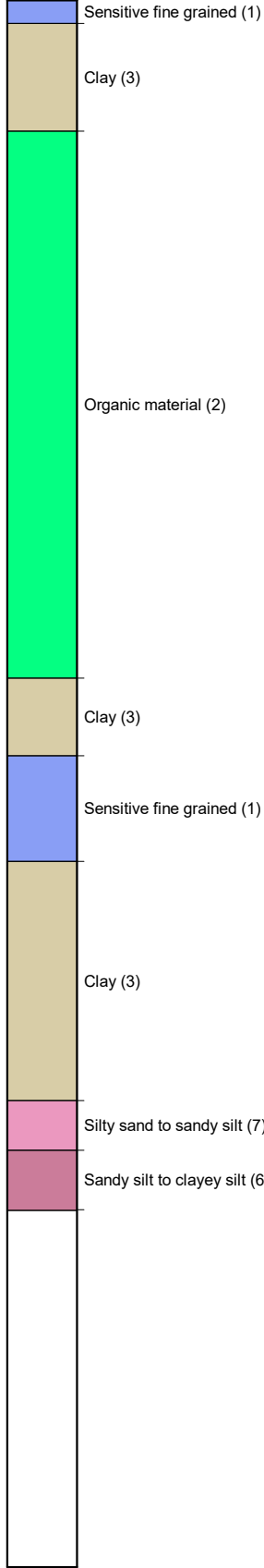


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT112A
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97824, E 174.77177			File:	CPT112A.cpt		

**Classification by  
Robertson 1986**



Rf [%]  
25 20 15 10 5 0

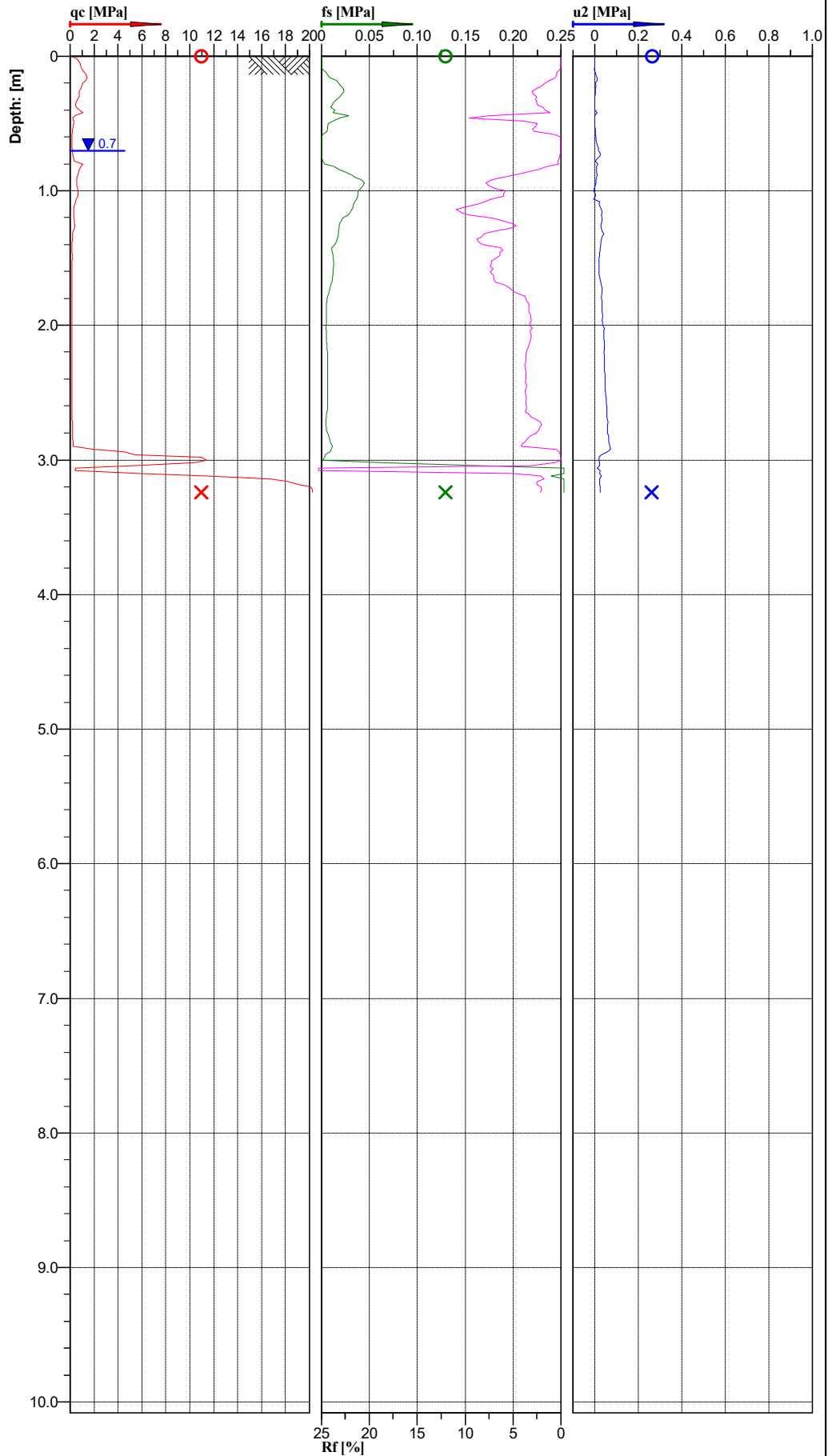
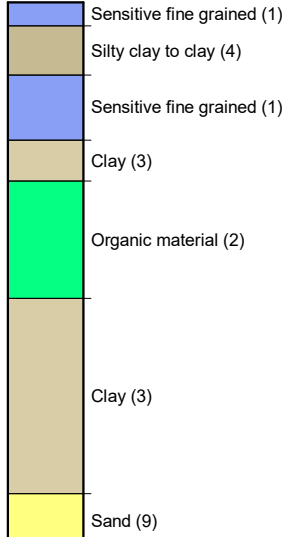


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT113
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
S 36.97831, E 174.77107				File:	CPT113.cpt		

**Classification by  
Robertson 1986**

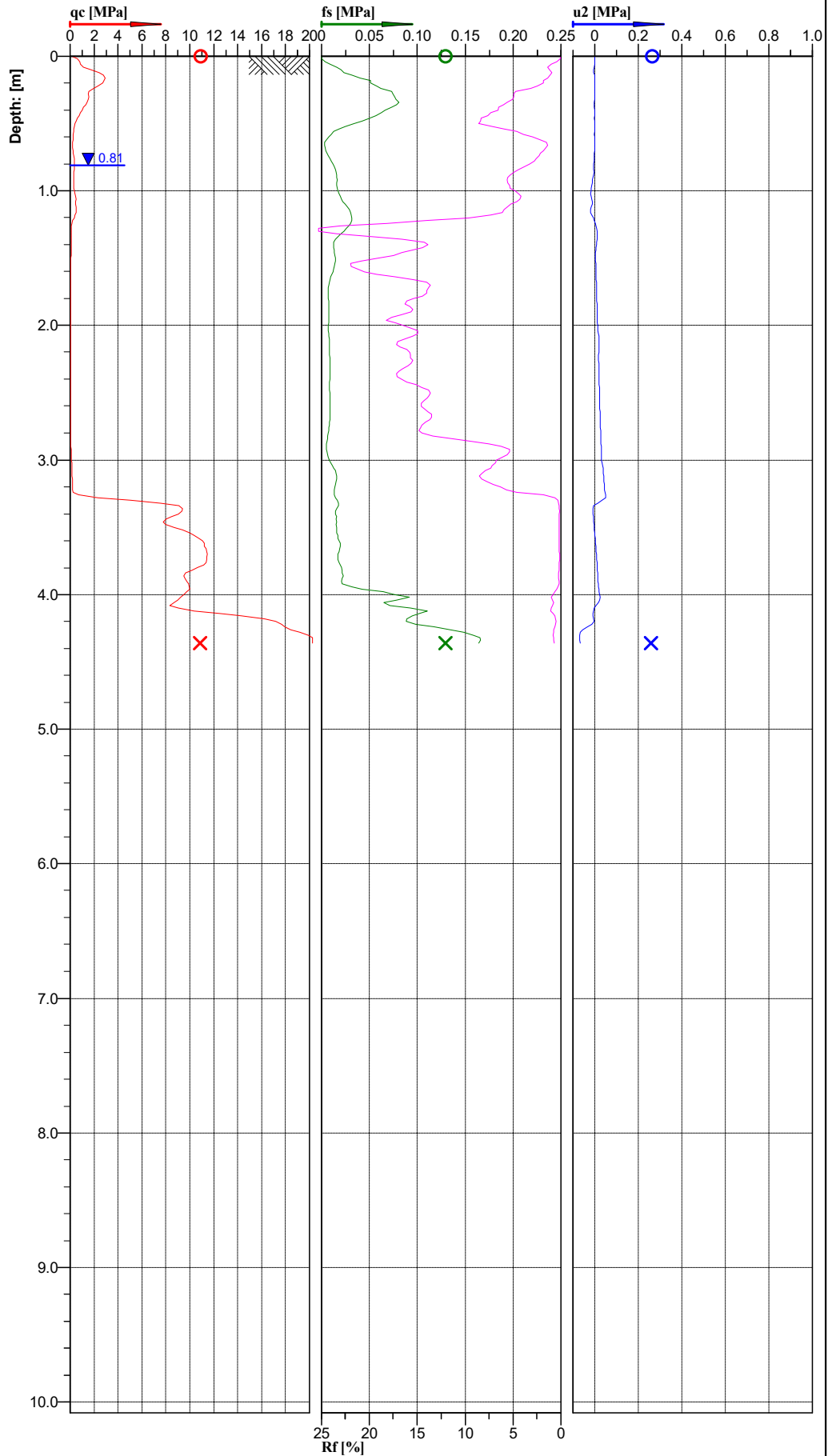
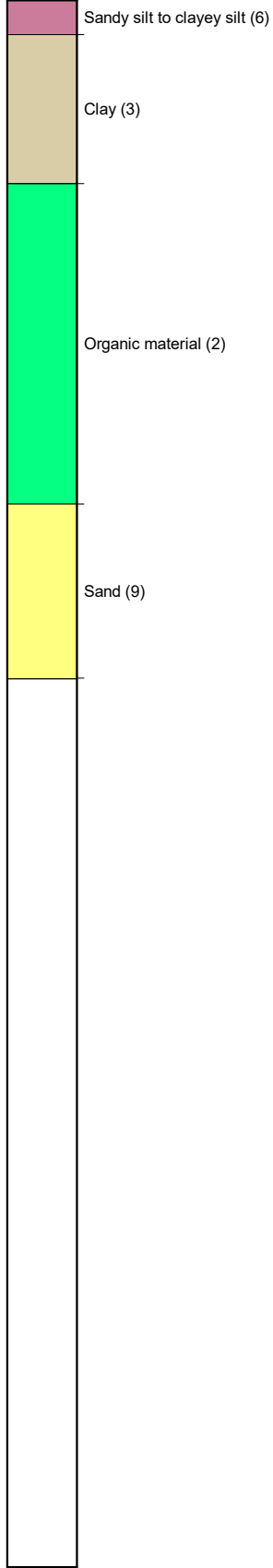


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT114</b>
Project ID:	Client: <b>INITIA</b>	Date: 3/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97887, E 174.77132		File: <b>CPT114.cpt</b>	

Classification by  
Robertson 1986



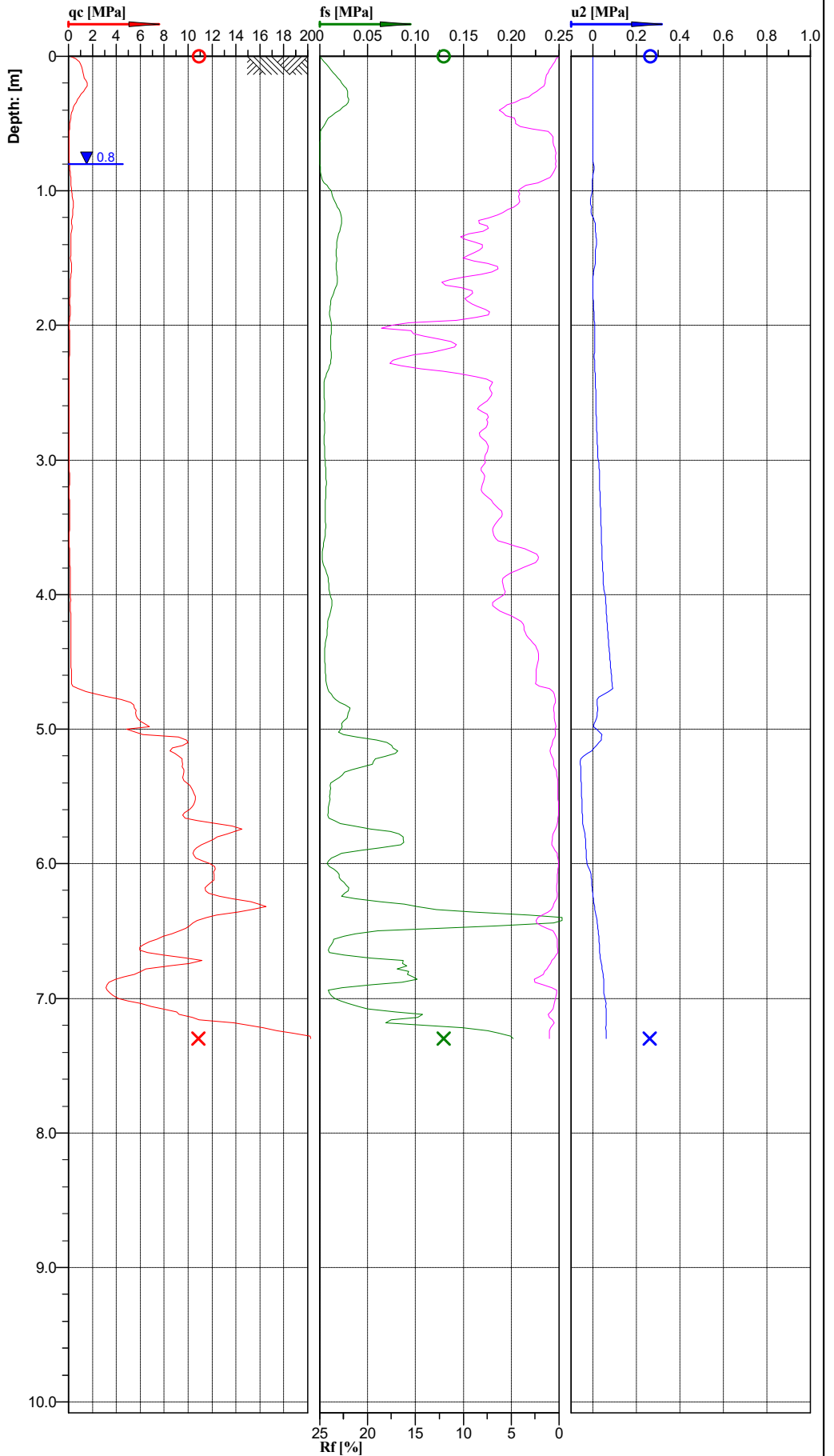
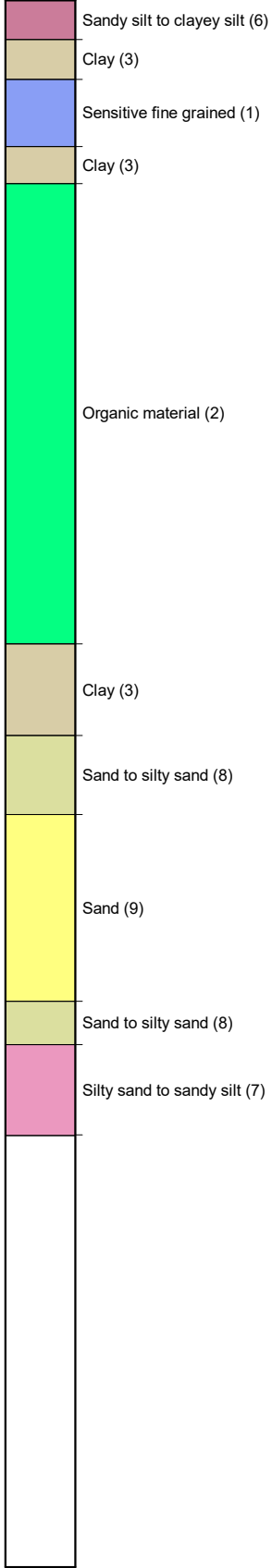
Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT115
Project ID:		Client:	INITIA	Date:	2/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97929, E 174.77187			File:	CPT115.cpt		



**Classification by Robertson 1986**



Rf [%]

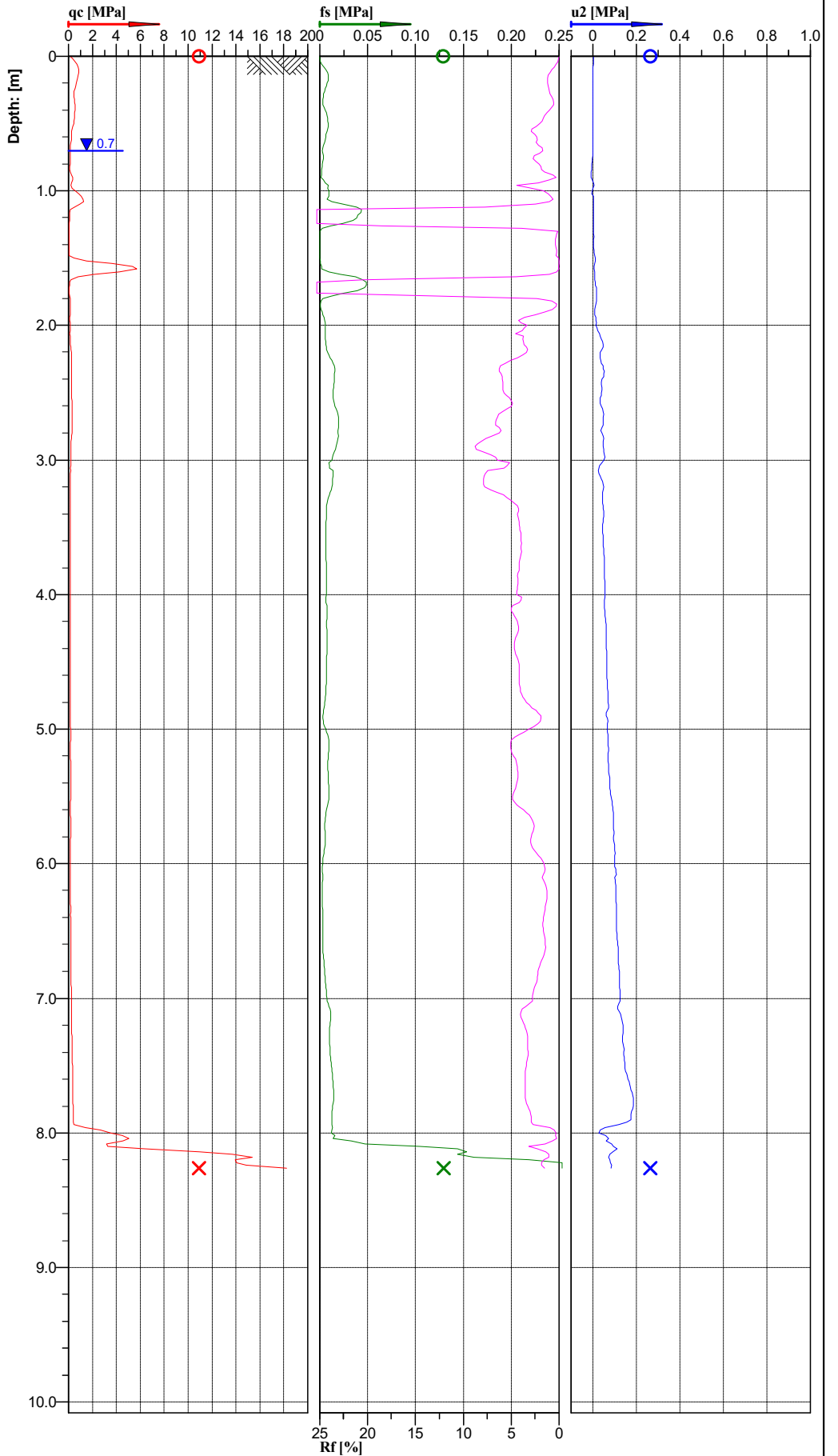
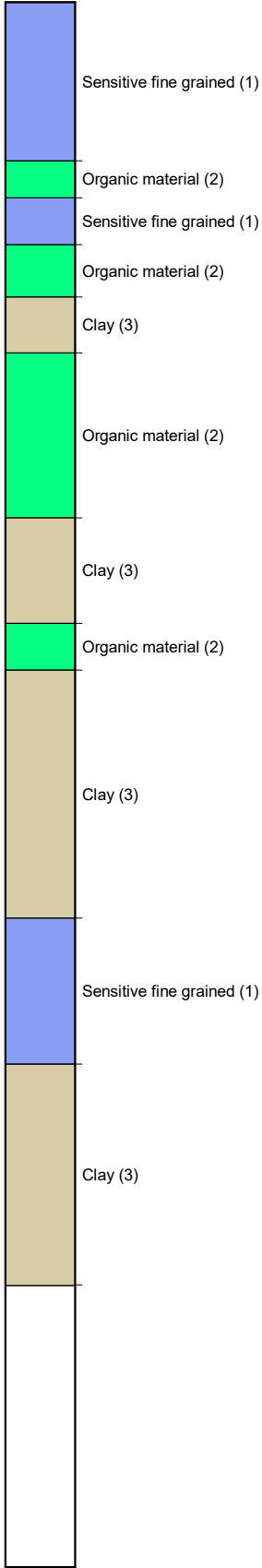


Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150



Location: AUCKLAND	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT116
Project ID:	Client: INITIA	Date: 2/11/2021	Scale: 1 : 45
Project: VILLA MARIA		Page: 1/1	Fig.:
S 36.97939, E 174.77098		File: CPT116.cpt	

Classification by  
Robertson 1986

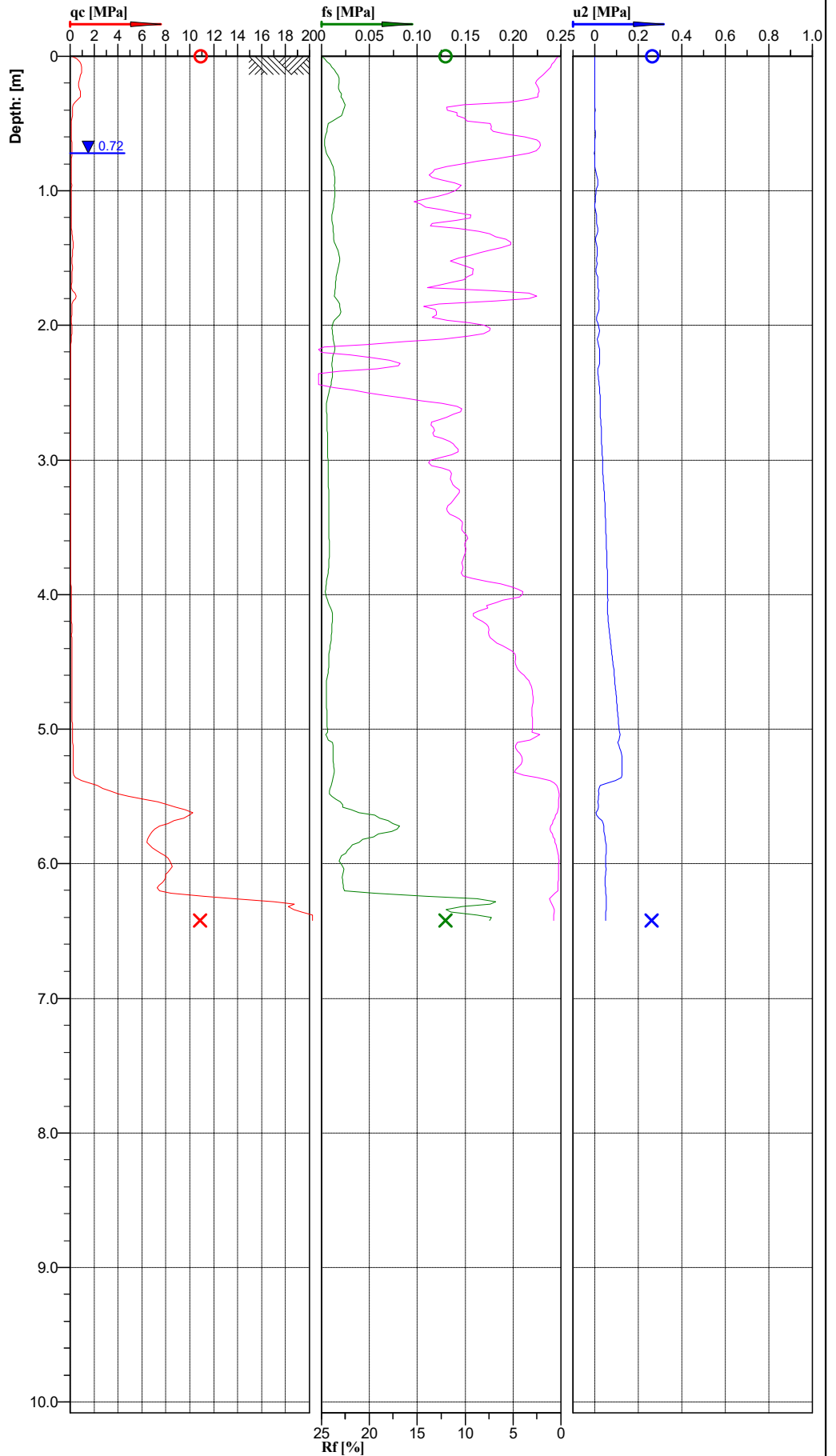
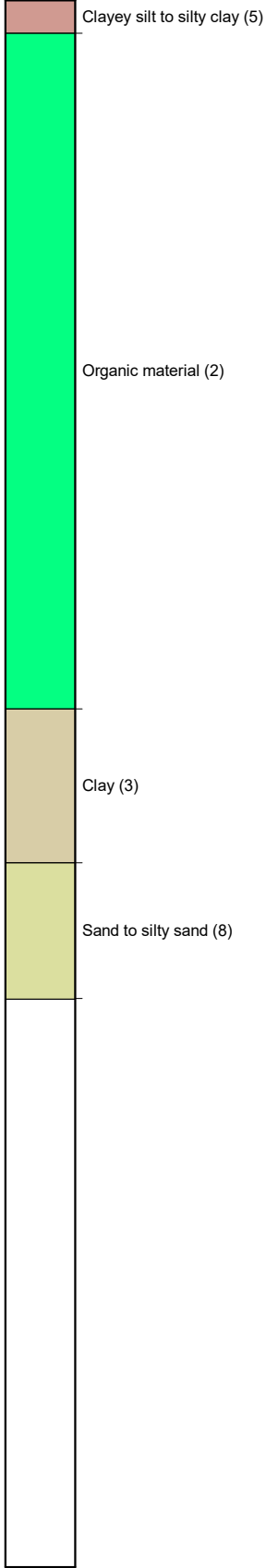


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT117
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97870, E 174.77058			File:	CPT117.cpt		

Classification by  
Robertson 1986

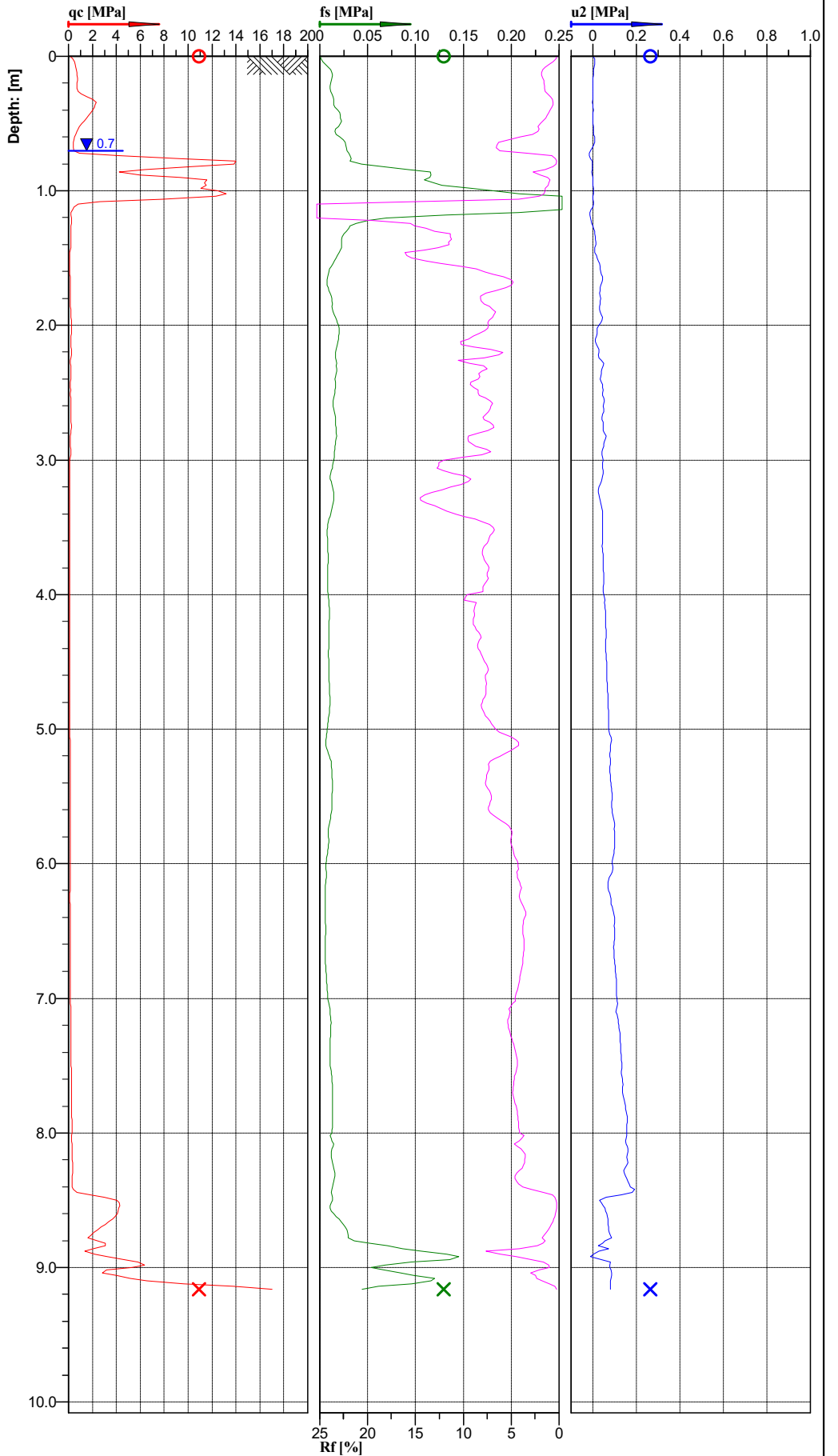
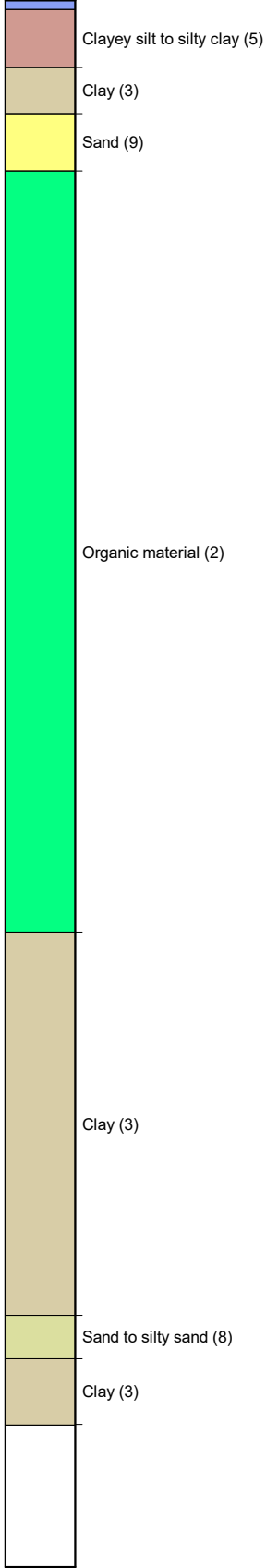


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT118
Project ID:		Client:	INITIA	Date:	2/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97964, E 174.77020			File:	CPT118.cpt		

**Classification by Robertson 1986**

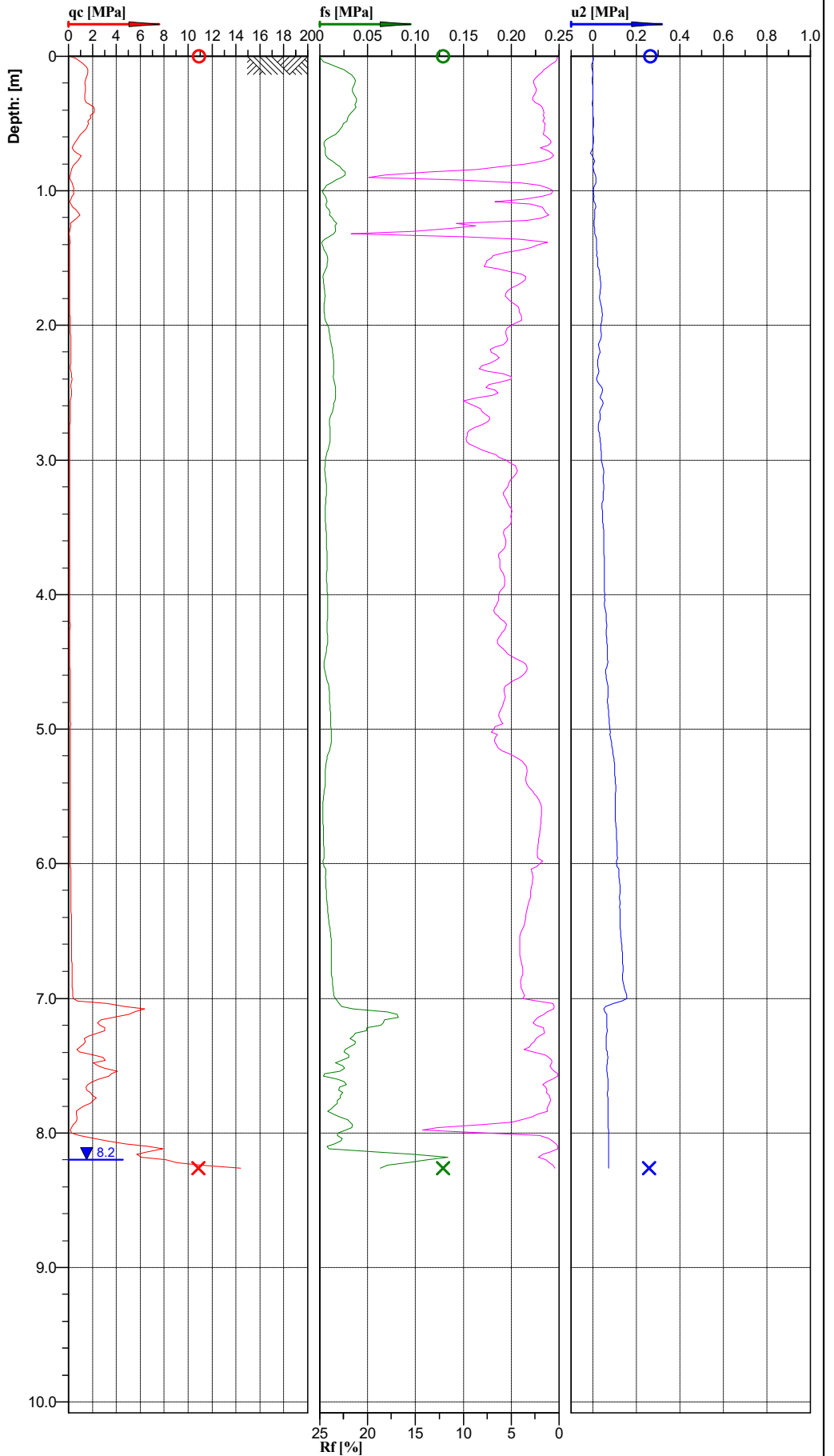
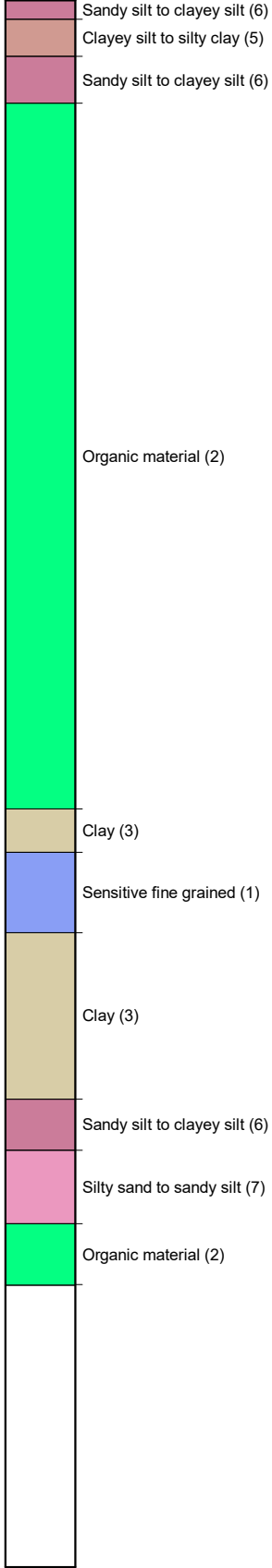


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: AUCKLAND	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT119
Project ID:	Client: INITIA	Date: 3/11/2021	Scale: 1 : 45
Project: VILLA MARIA		Page: 1/1	Fig.:
S 36.97903, E 174.76993		File: CPT119.cpt	

**Classification by  
Robertson 1986**



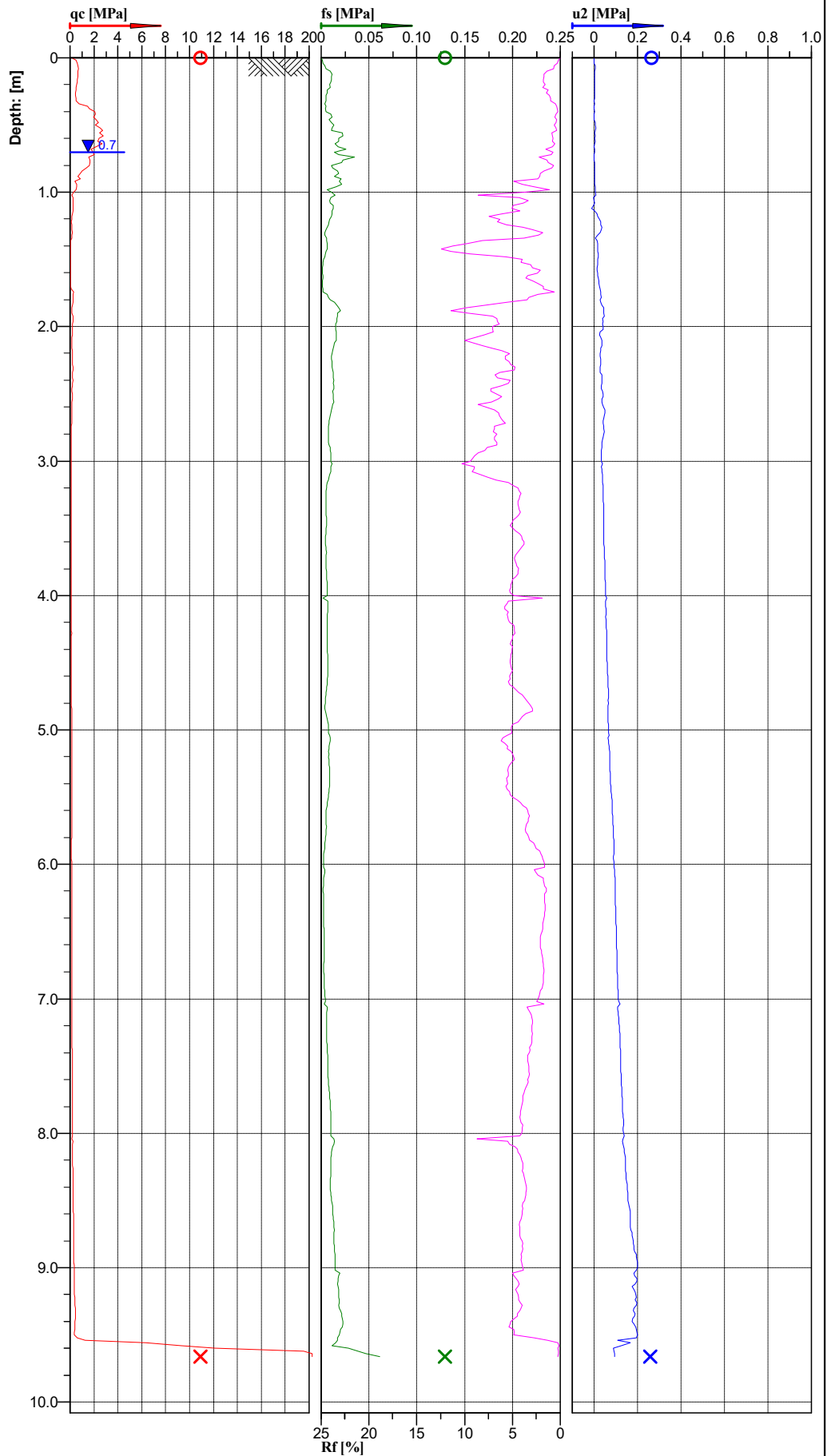
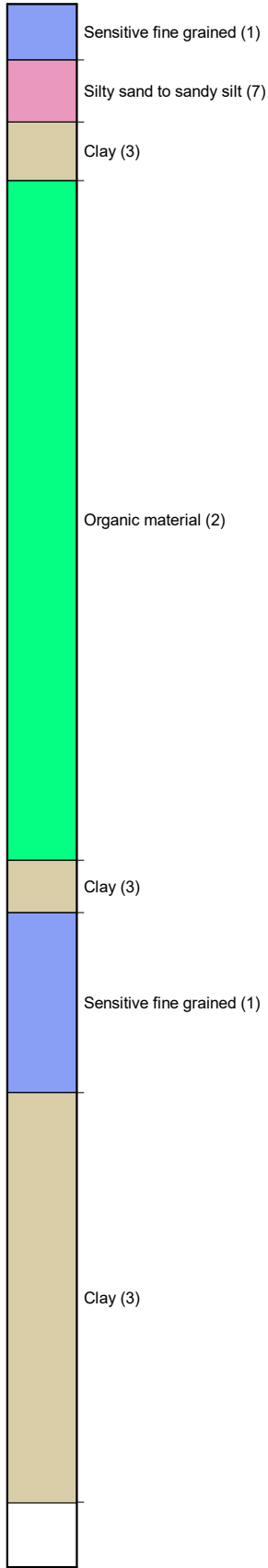
Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT120
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97848, E 174.76947			File:	CPT120.cpt		



Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150



**Classification by  
Robertson 1986**

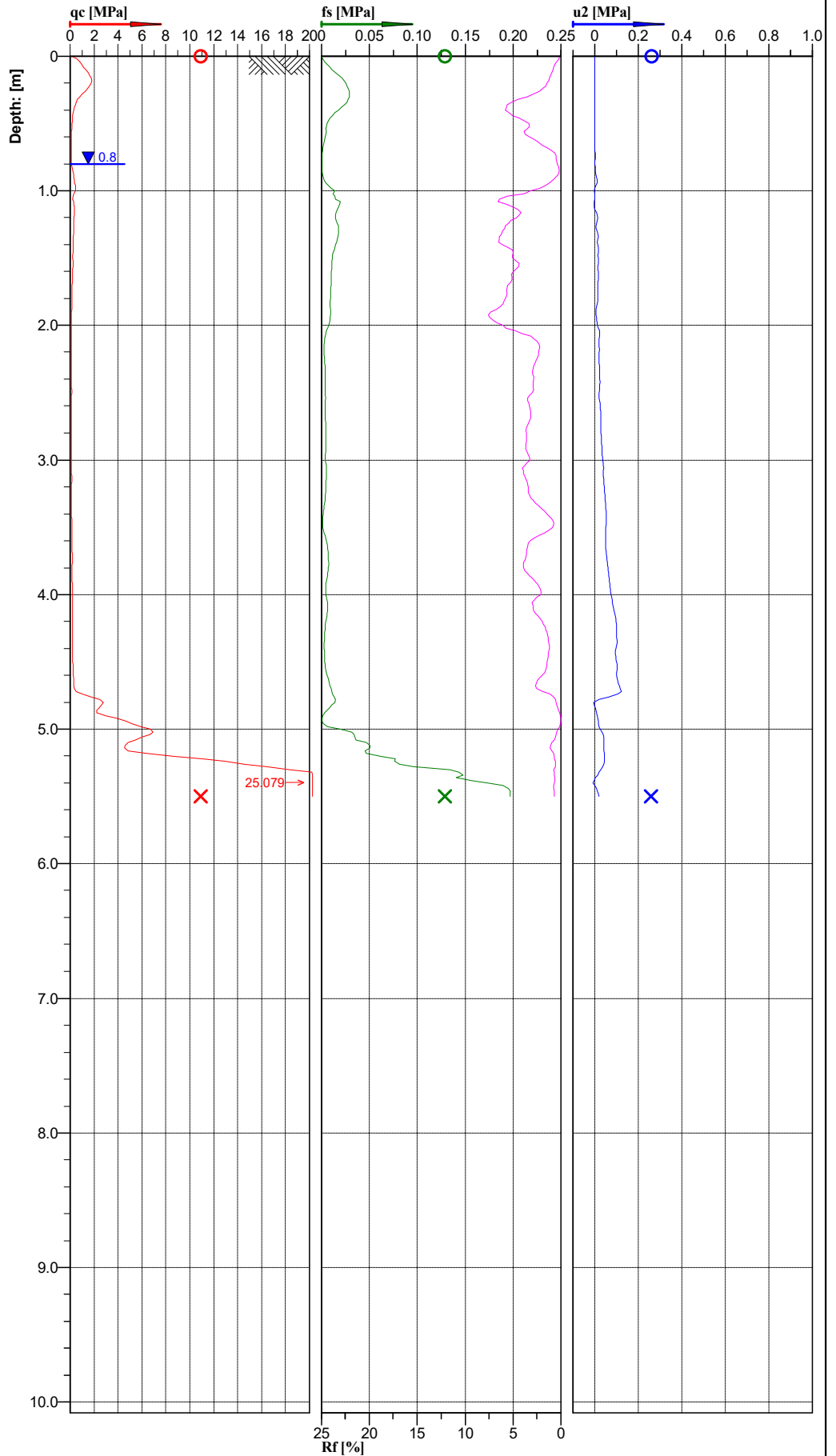
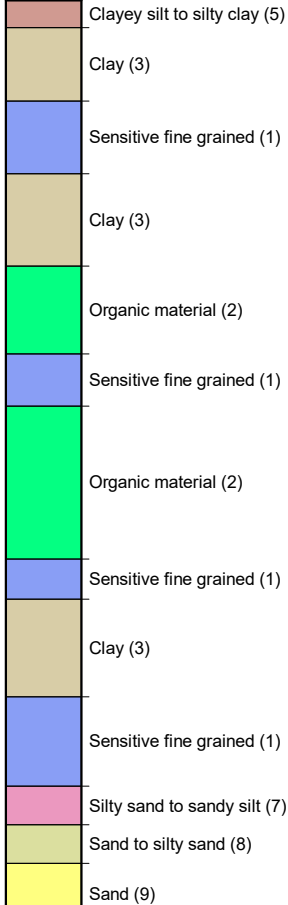


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT121
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97883, E 174.76921			File:	CPT121.cpt		

**Classification by  
Robertson 1986**

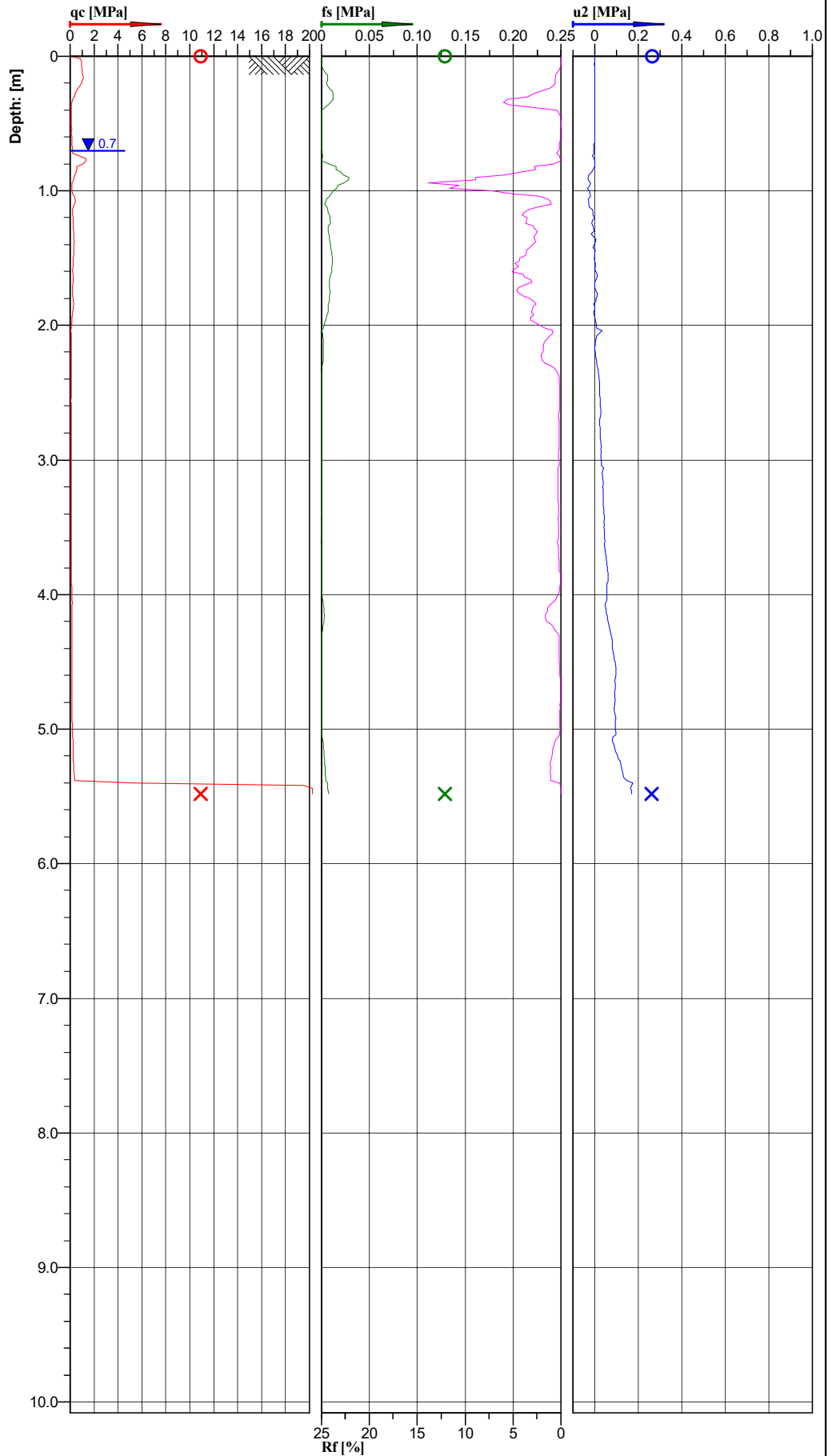
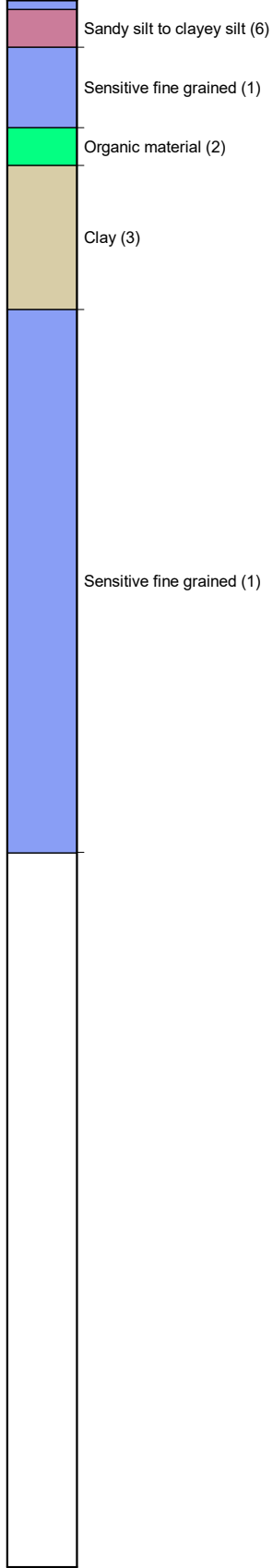


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT123</b>
Project ID:	Client: <b>INITIA</b>	Date: 3/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.98029, E 174.76997		File: <b>CPT123.cpt</b>	

**Classification by Robertson 1986**

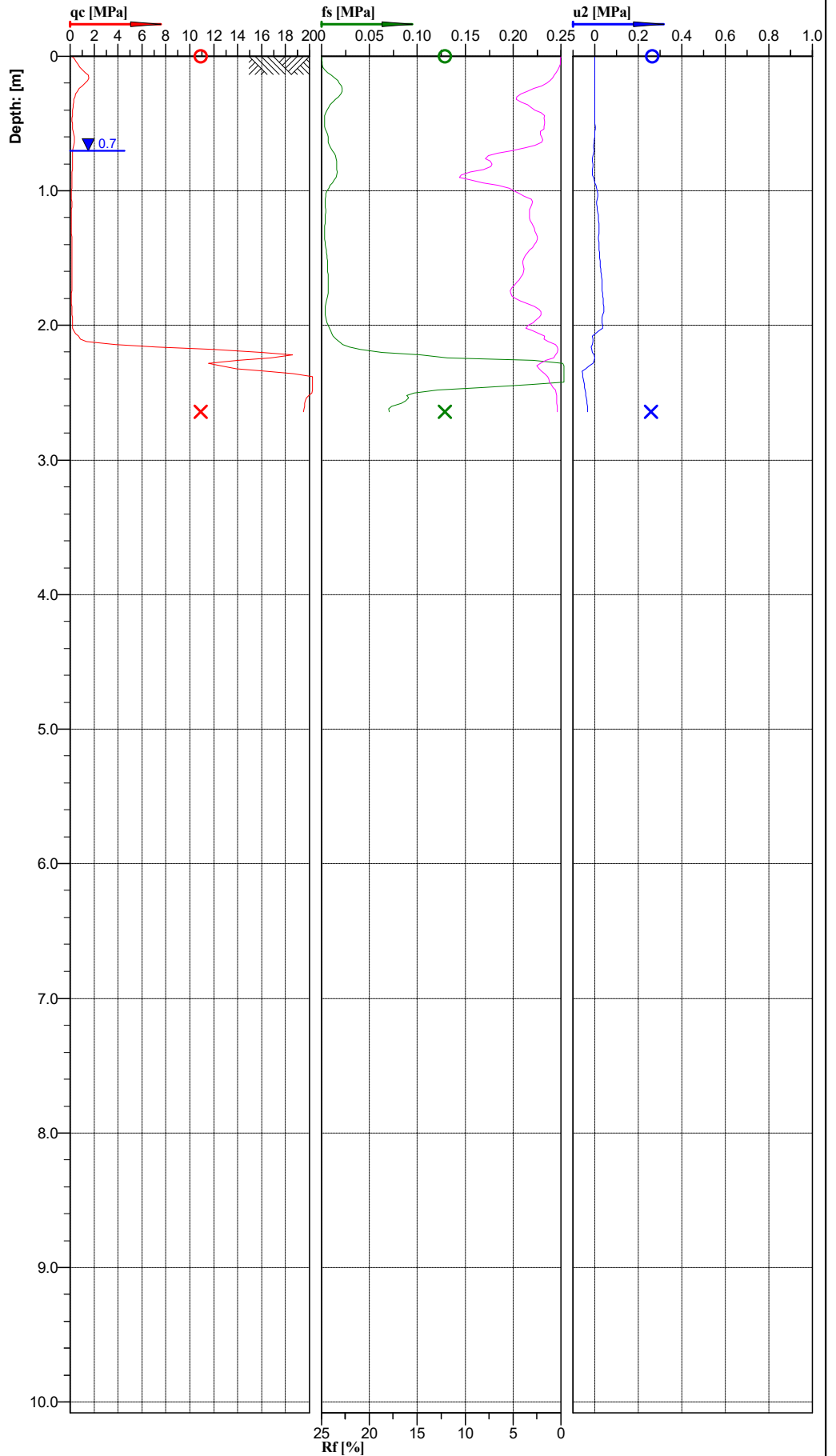
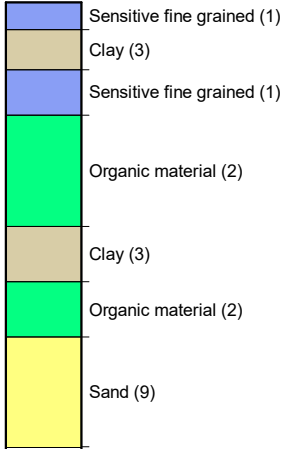


Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150

Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT124
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97980, E 174.76957			File:	CPT124.cpt		



**Classification by  
Robertson 1986**



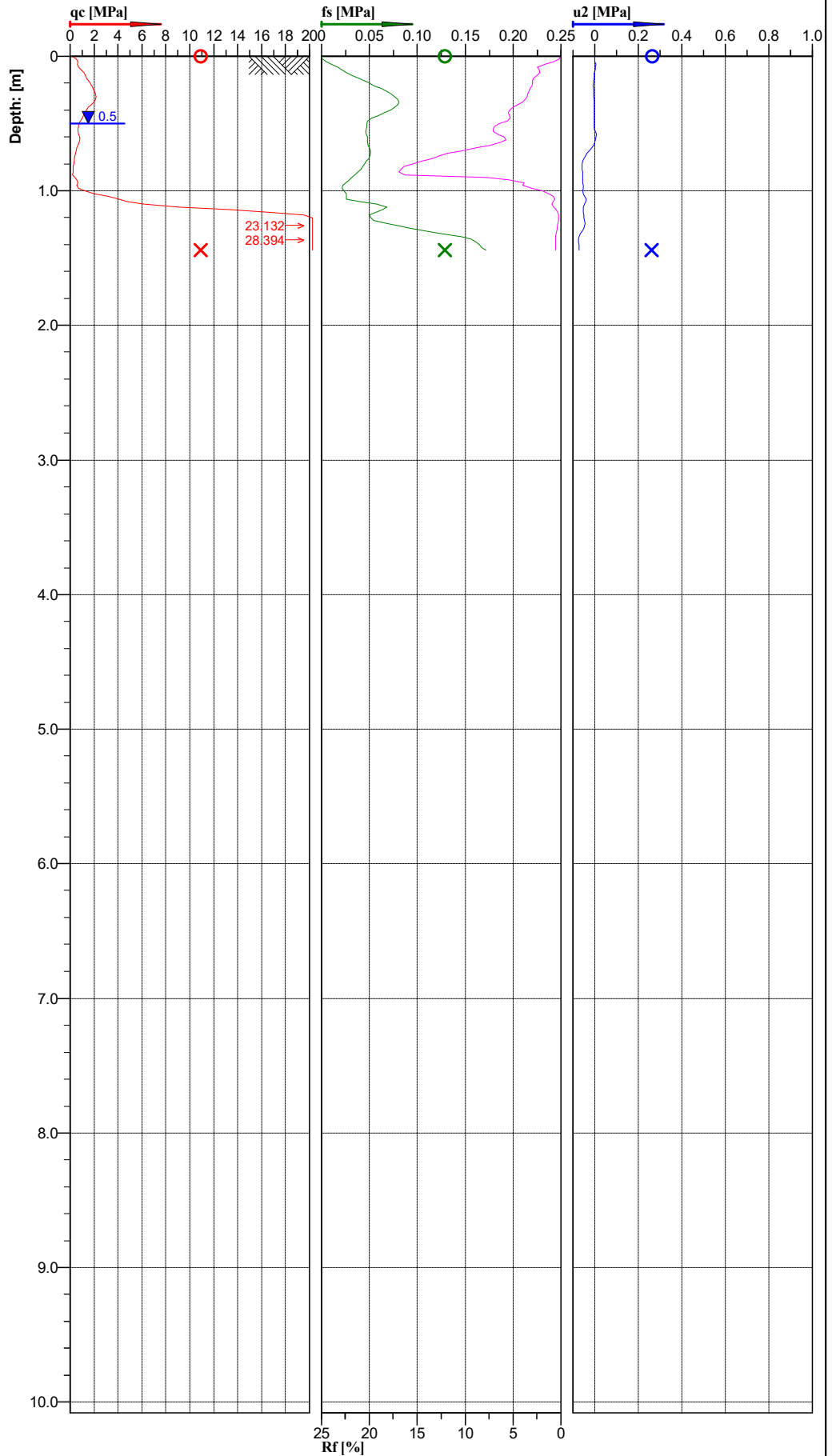
Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT125
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97985, E 174.76886			File:	CPT125.cpt		

**Classification by  
Robertson 1986**

- Clay (3)
- Clayey silt to silty clay (5)
- Clay (3)
- Organic material (2)
- Gravely sand to sand (10)

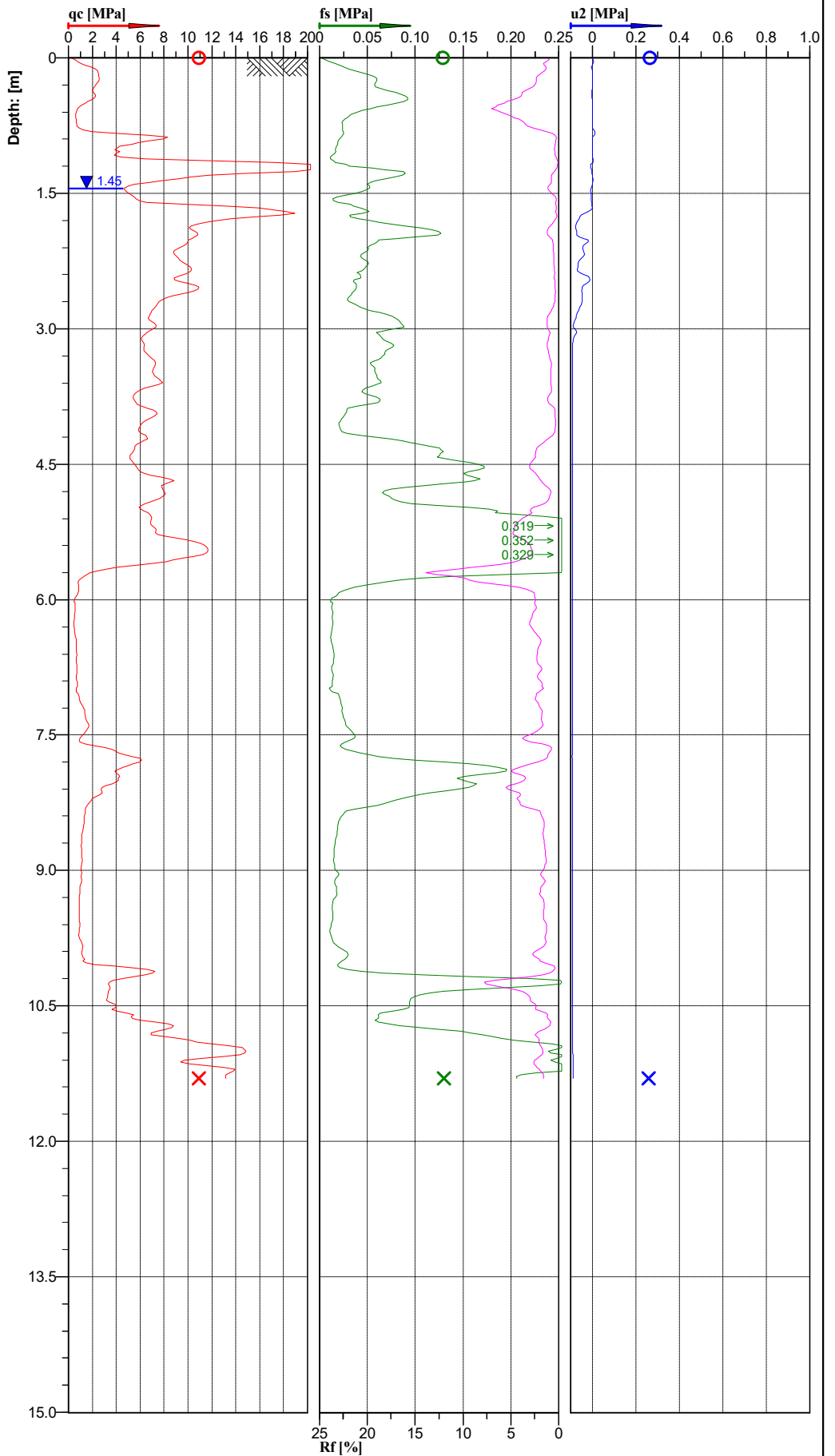
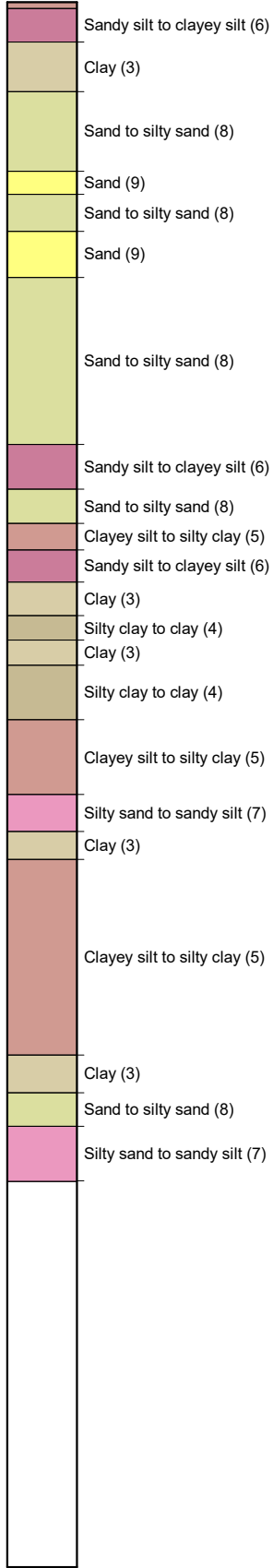


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT126</b>
Project ID:	Client: <b>INITIA</b>	Date: 1/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.98045, E 174.76866		File: CPT126.cpt	

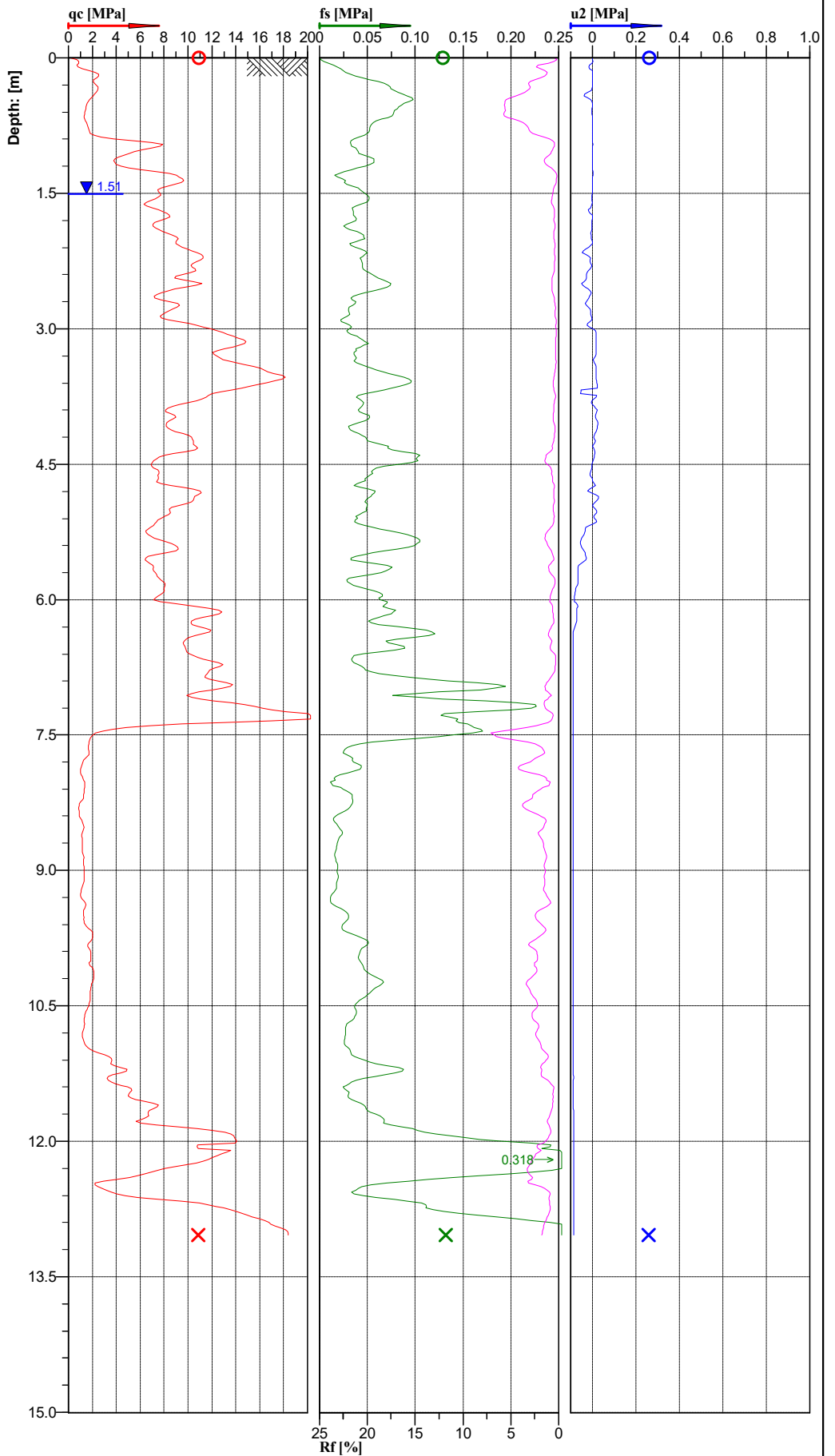
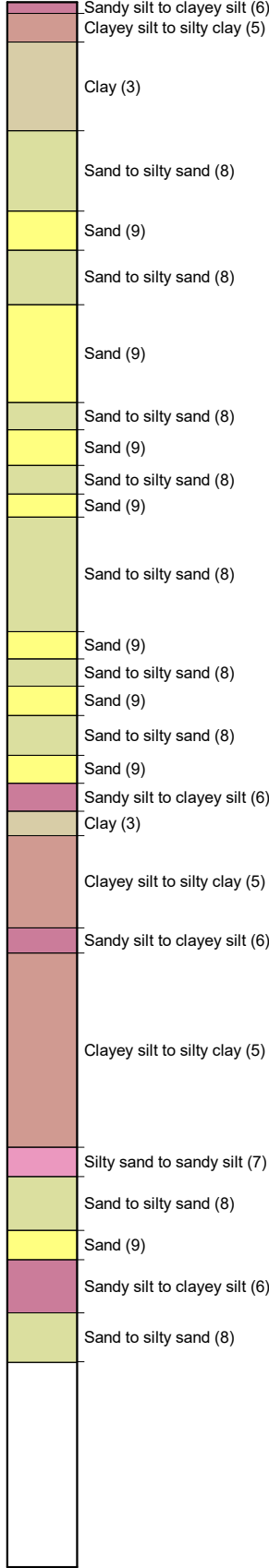
**Classification by Robertson 1986**



Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150

Location: AUCKLAND	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT127
Project ID:	Client: INITIA	Date: 1/11/2021	Scale: 1 : 67
Project: VILLA MARIA		Page: 1/1	Fig.:
S 36.98108, E 174.76868		File: CPT127.cpt	

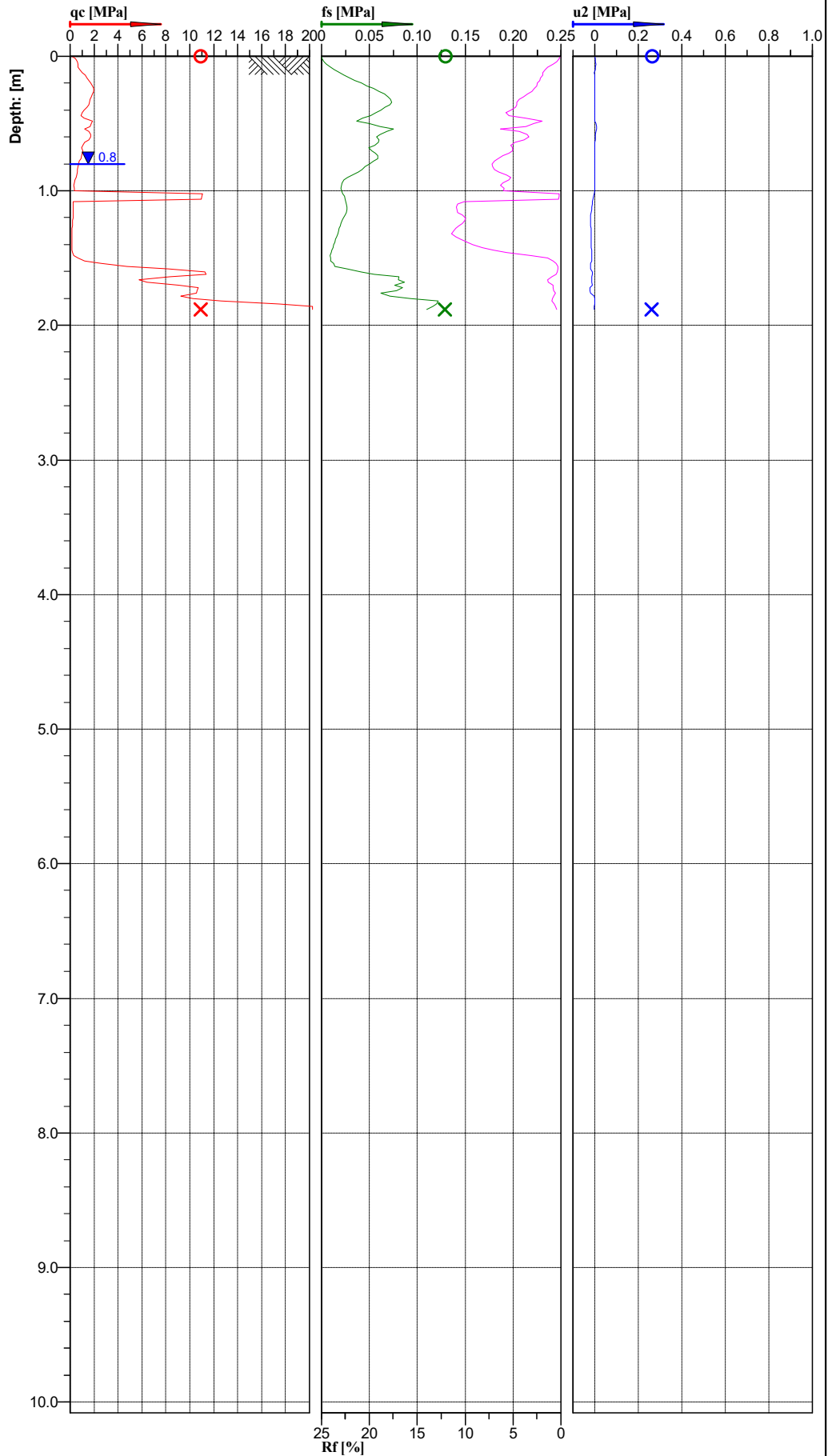
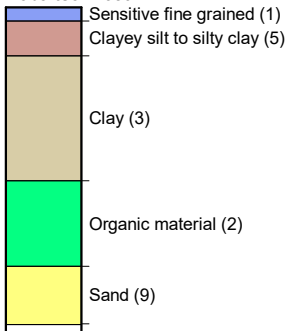
**Classification by Robertson 1986**



Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150

Location: AUCKLAND	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT128
Project ID:	Client: INITIA	Date: 1/11/2021	Scale: 1 : 67
Project: VILLA MARIA		Page: 1/1	Fig.:
S 36.98074, E 174.76802		File: CPT128.cpt	

**Classification by  
Robertson 1986**

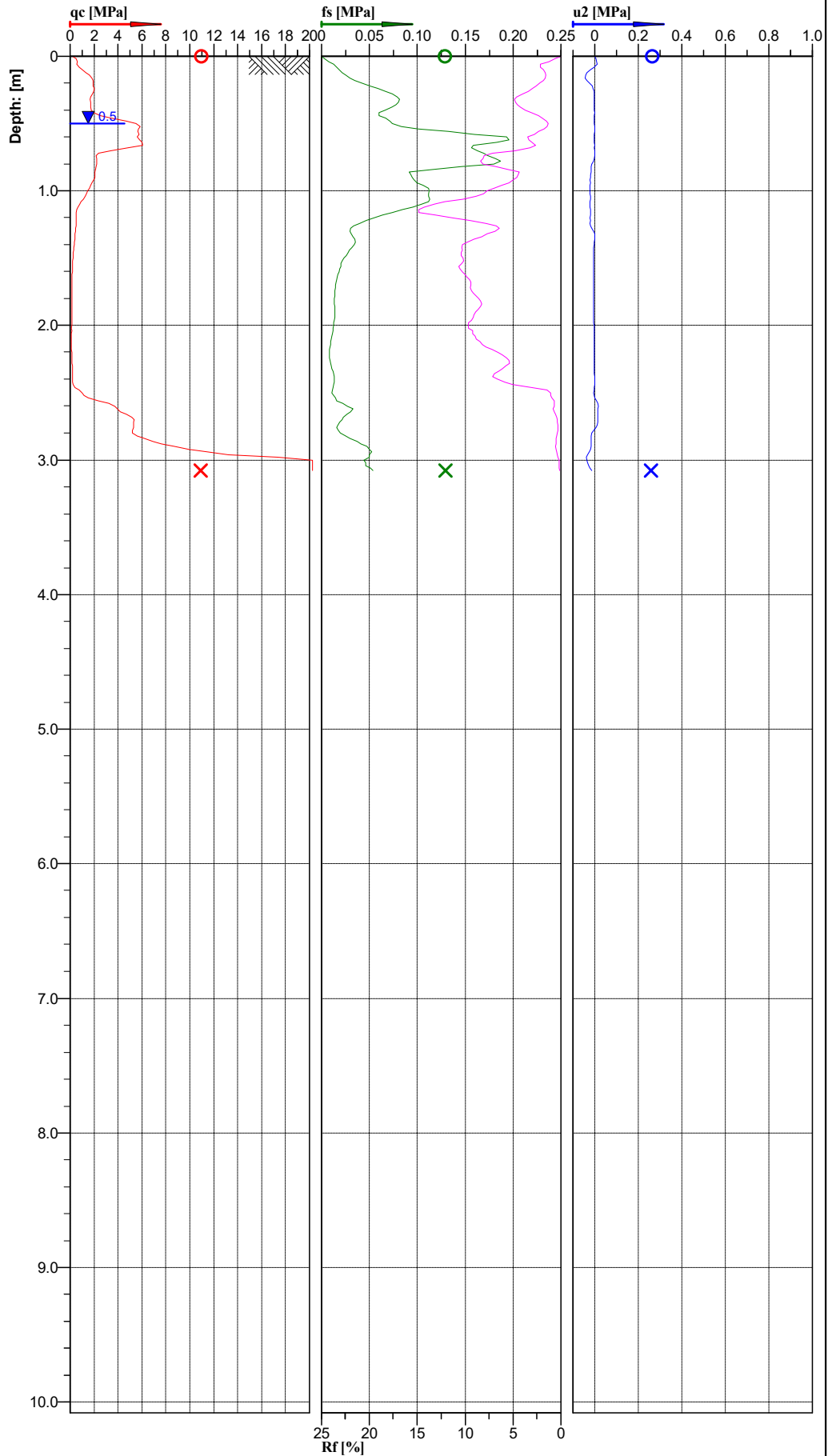
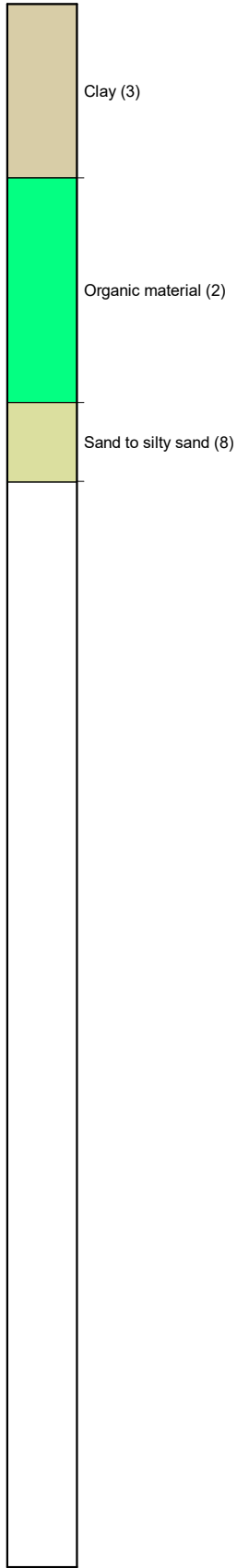


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT129
Project ID:		Client:	INITIA	Date:	2/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97985, E 174.76828			File:	CPT129.cpt		

Classification by  
Robertson 1986

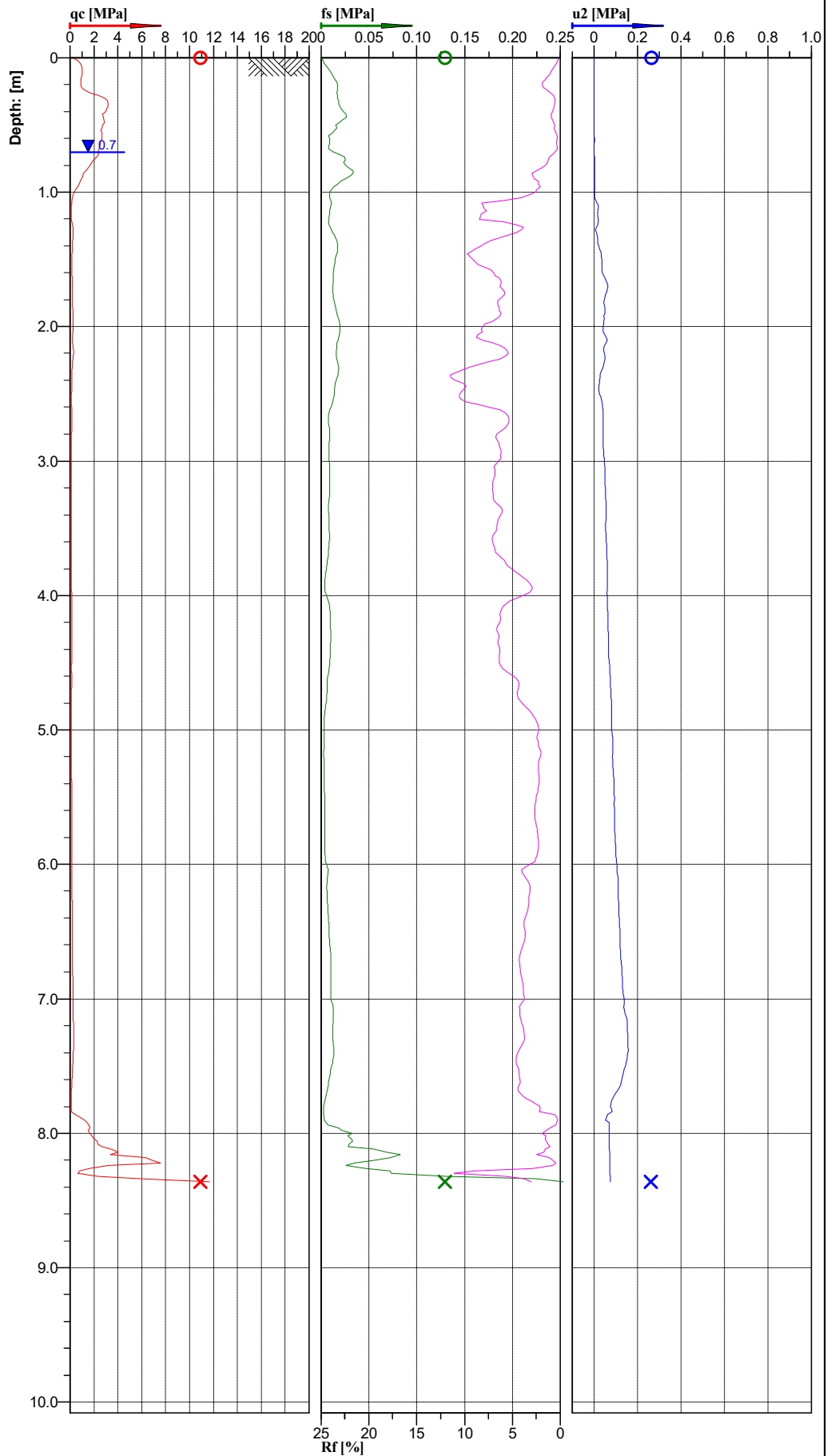
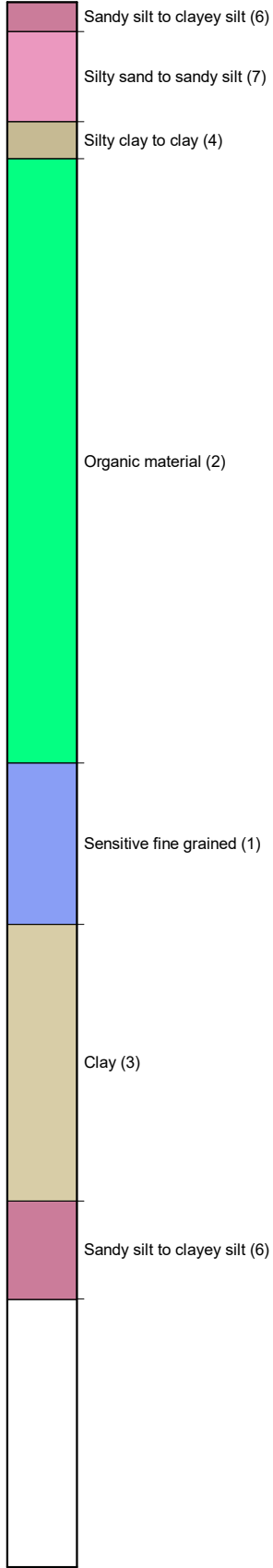


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT130
Project ID:		Client:	INITIA	Date:	1/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97930, E 174.76802			File:	CPT130.cpt		

**Classification by  
Robertson 1986**

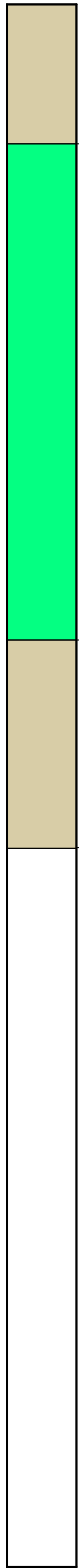


Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT131
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97886, E 174.76842			File:	CPT131.cpt		

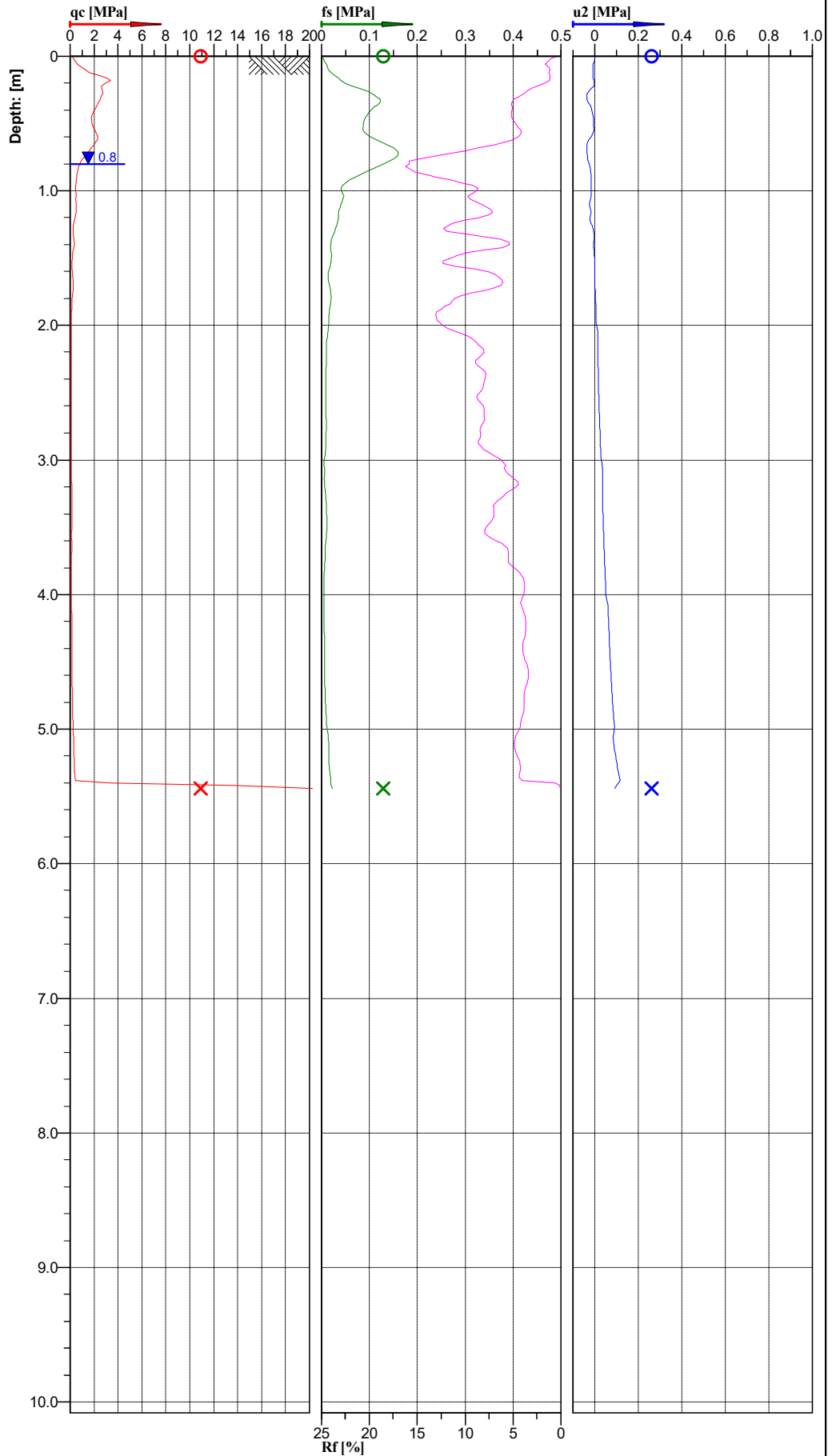
Classification by  
Robertson 1986



Clay (3)

Organic material (2)

Clay (3)



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT132
Project ID:		Client:	INITIA	Date:	1/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97869, E 174.76794			File:	CPT132.cpt		

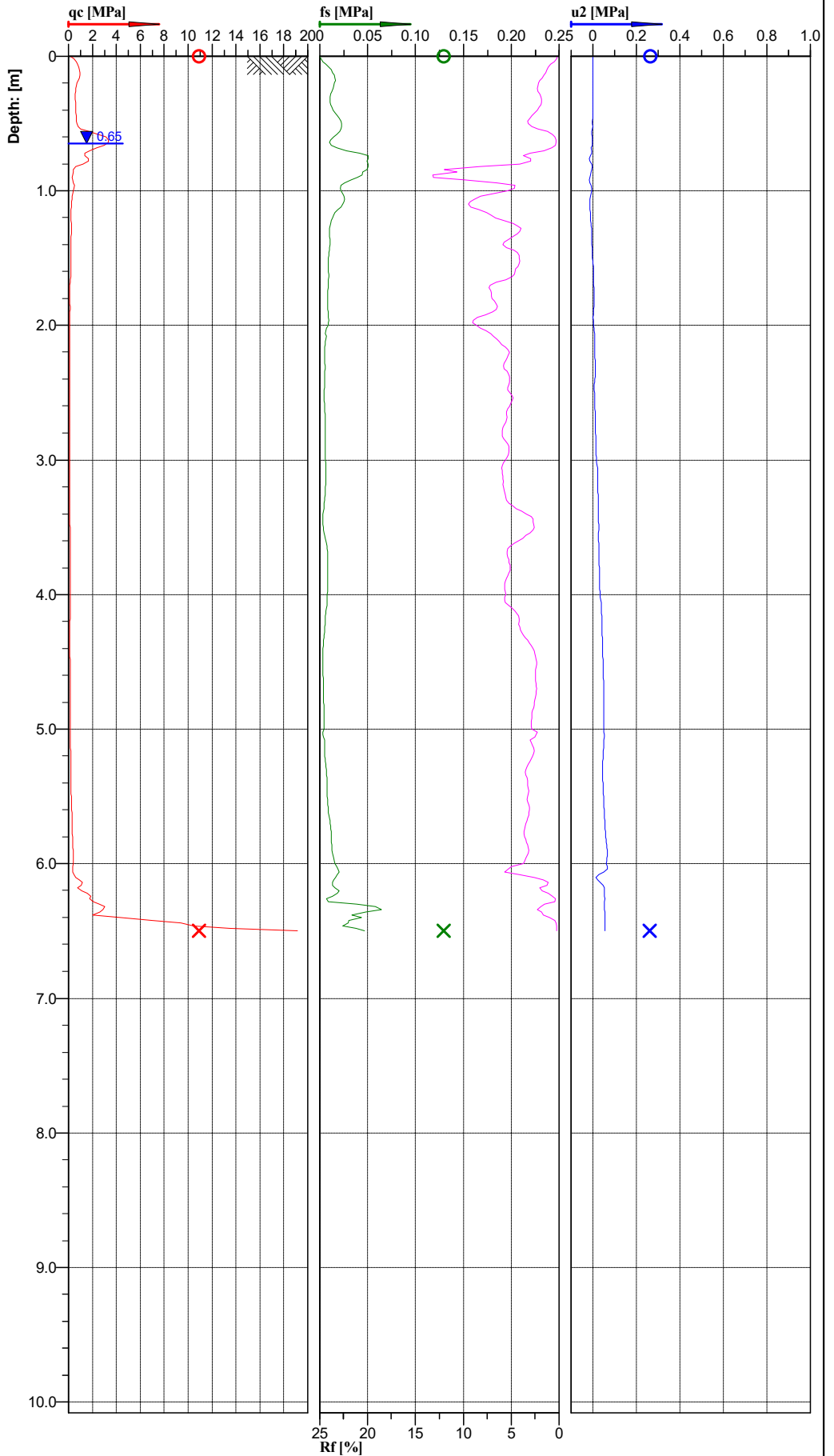
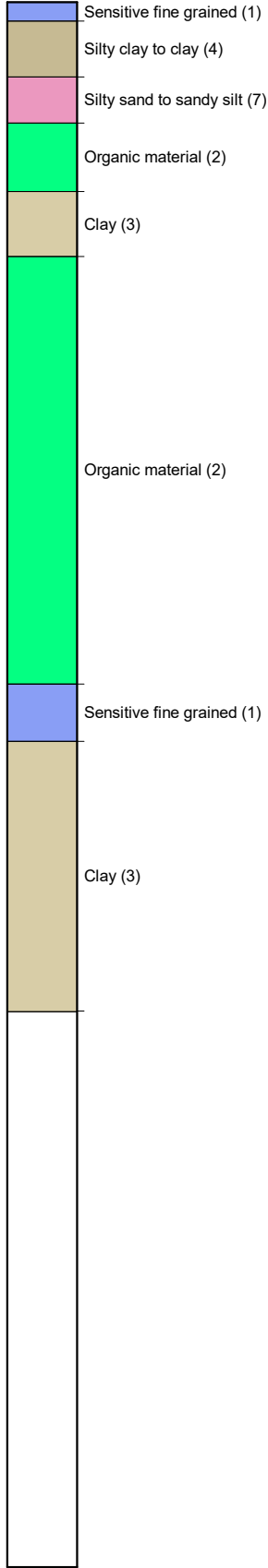


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150





**Classification by  
Robertson 1986**

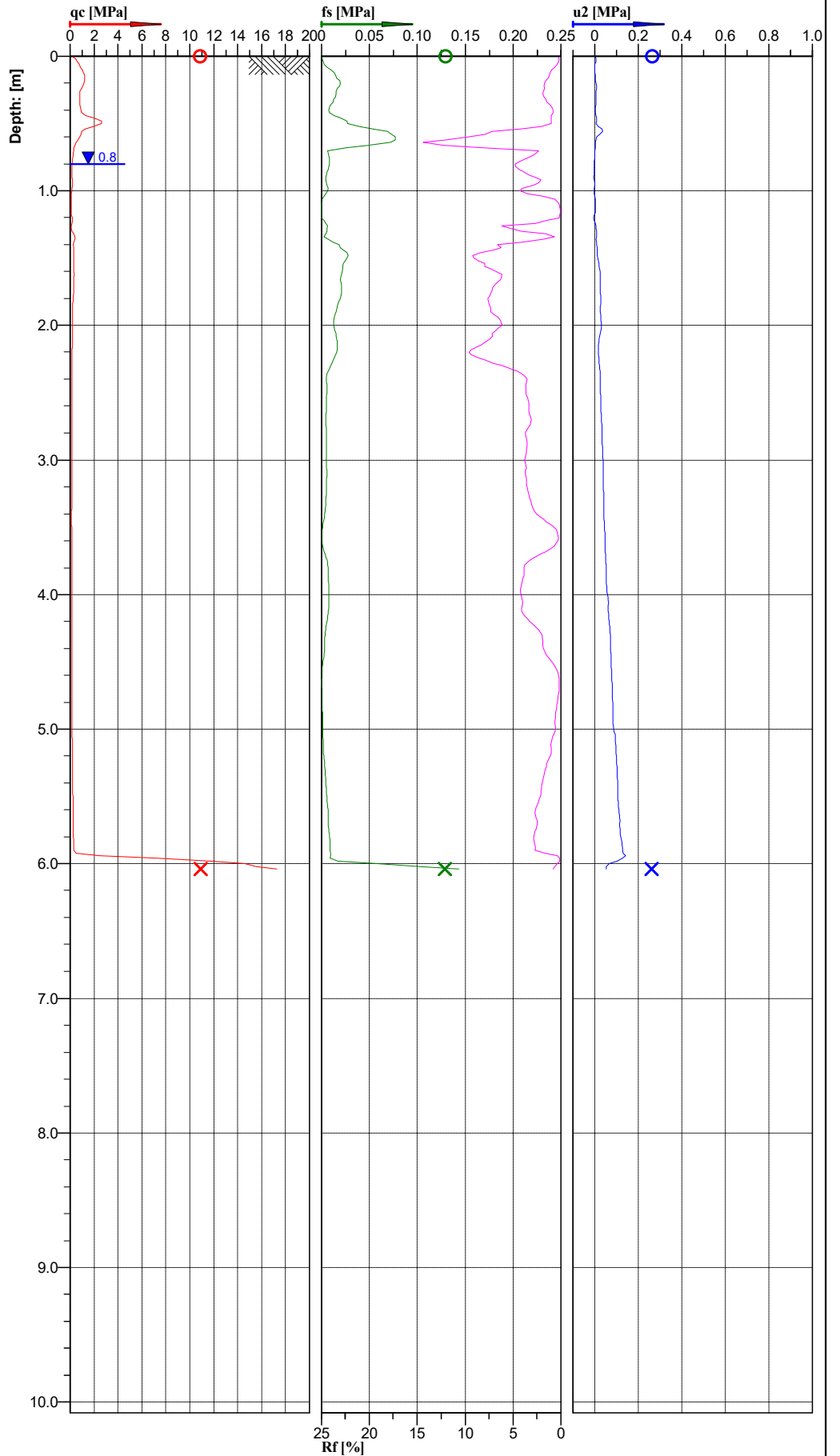
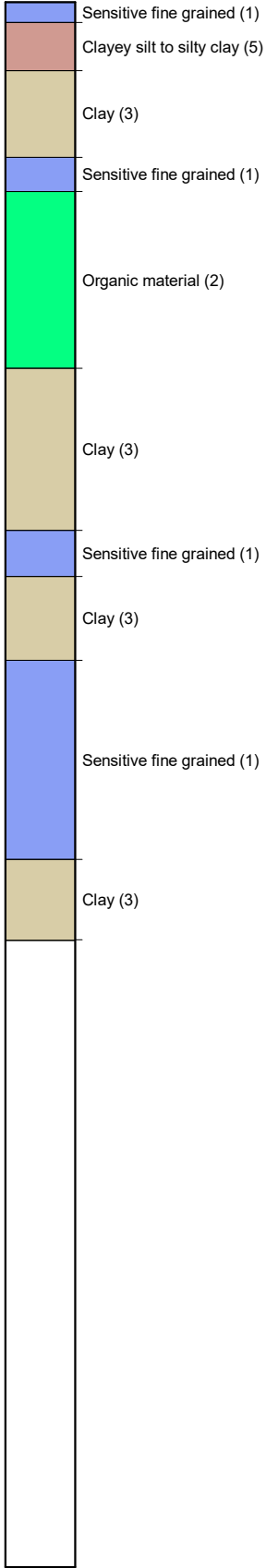


Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT133
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97828, E 174.76828			File:	CPT133.cpt		

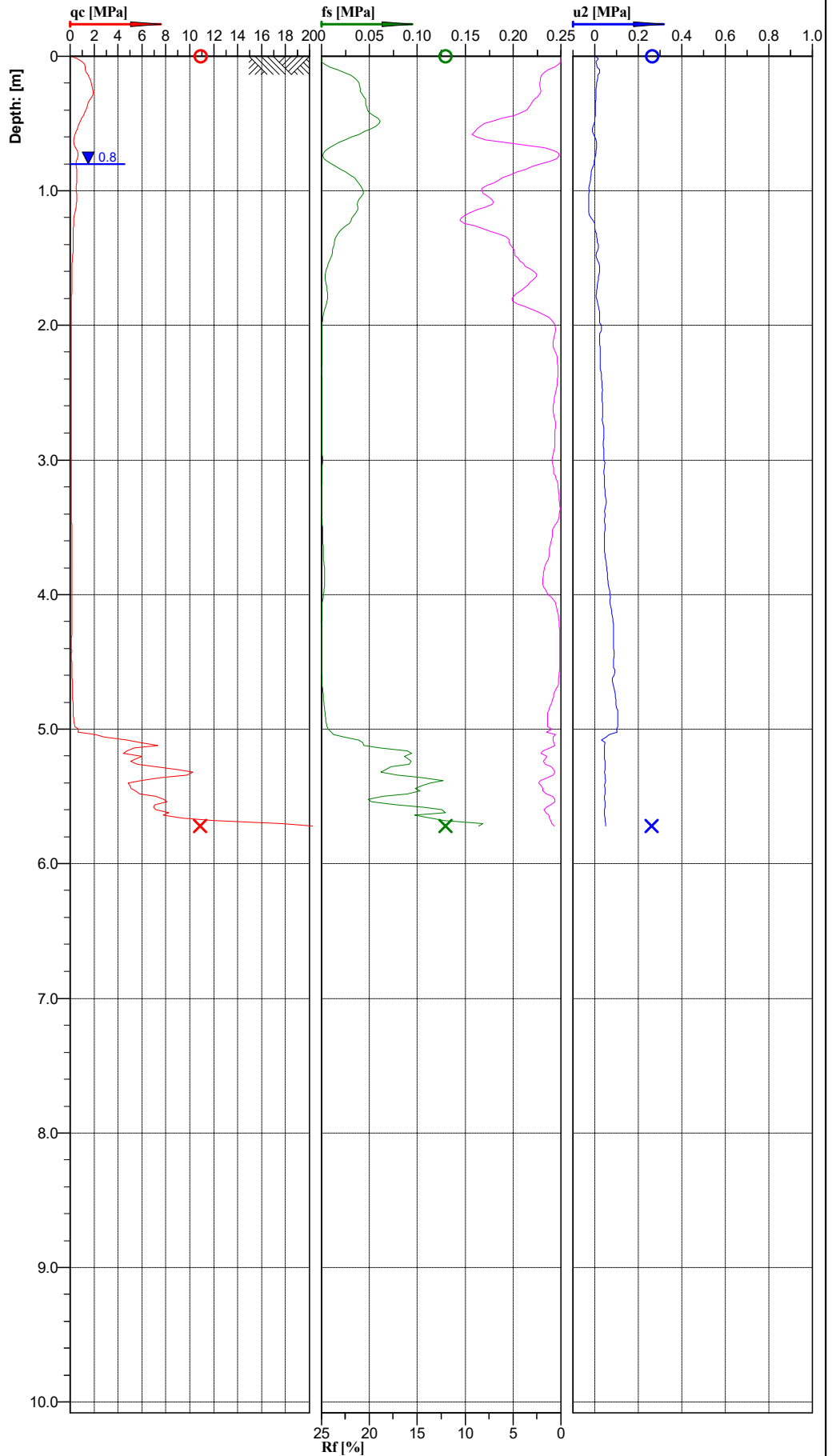
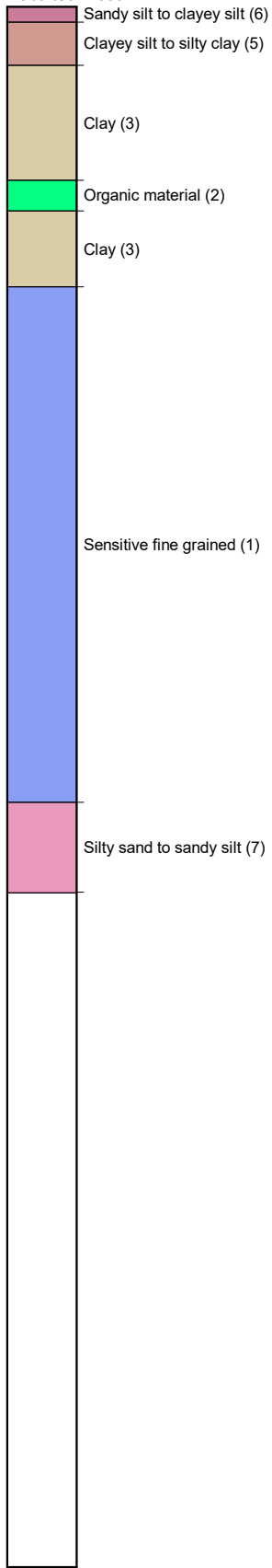
**Classification by  
Robertson 1986**



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT134
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
S 36.77845, E 174.76880				File:	CPT134.cpt		



**Classification by  
Robertson 1986**

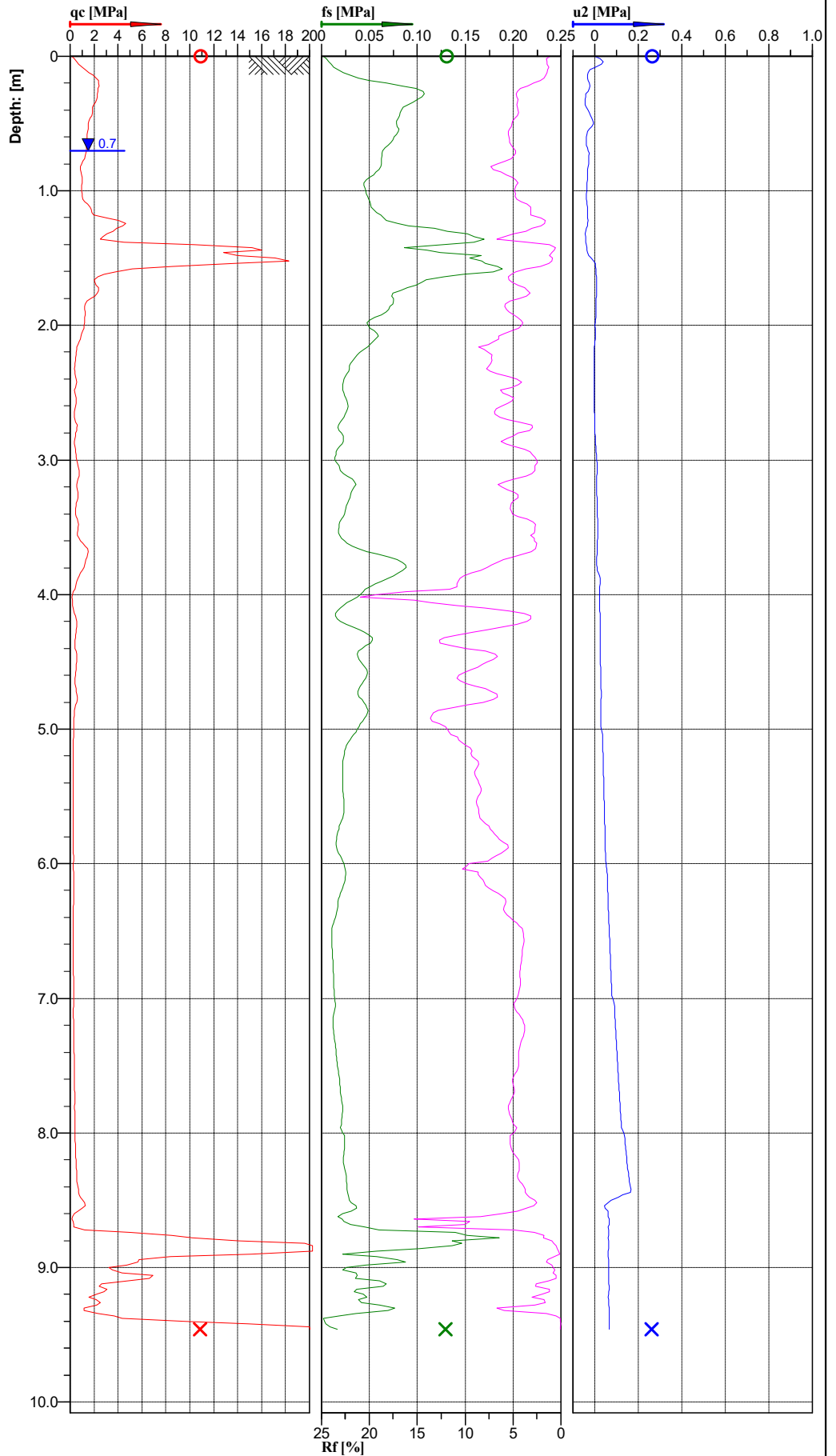
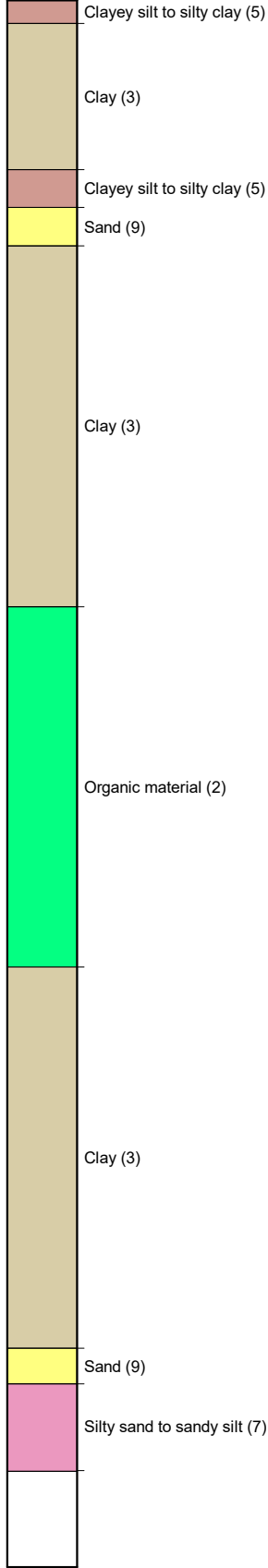


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT135
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97800, E 174.76875			File:	CPT135.cpt		

**Classification by  
Robertson 1986**

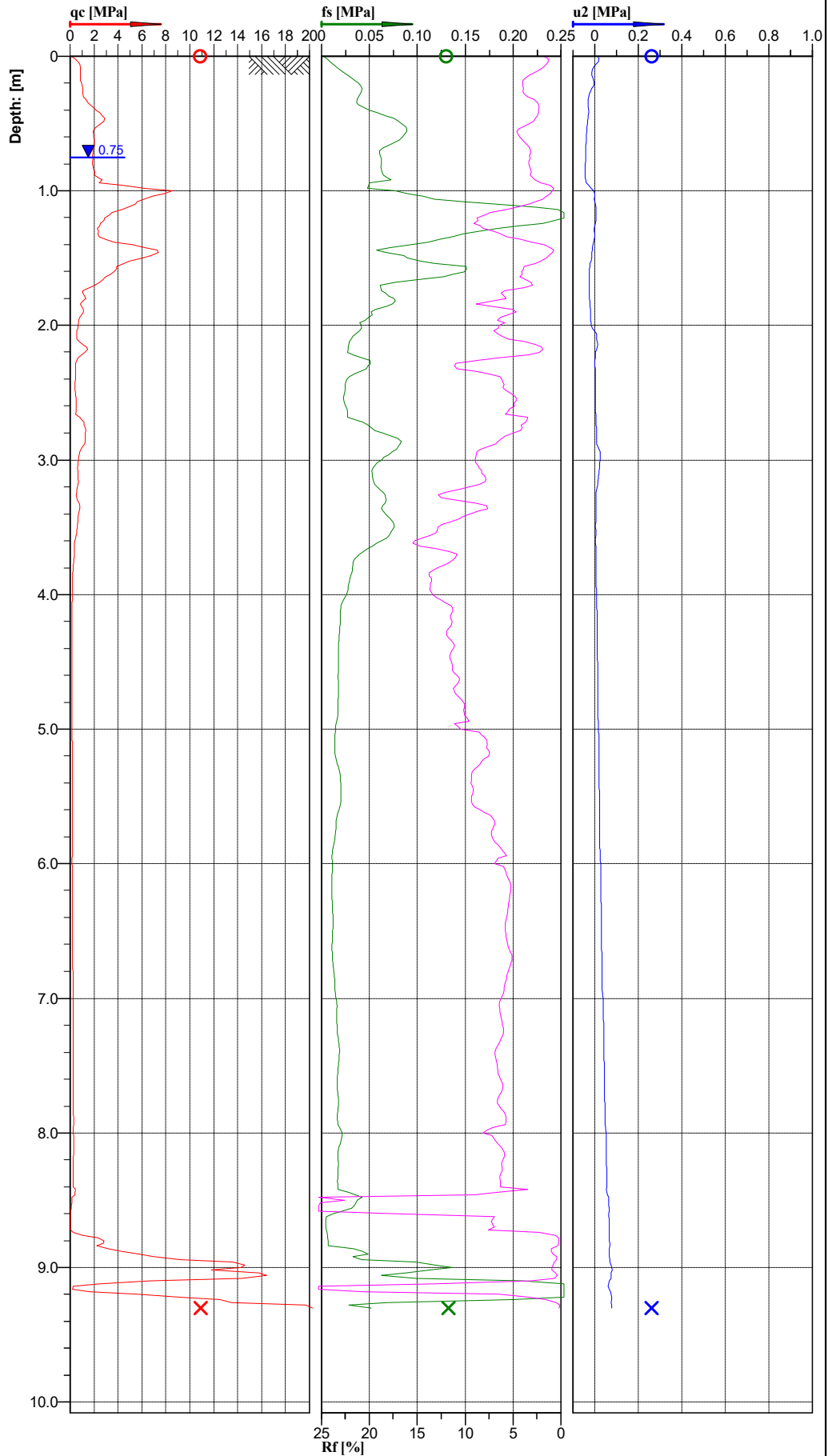
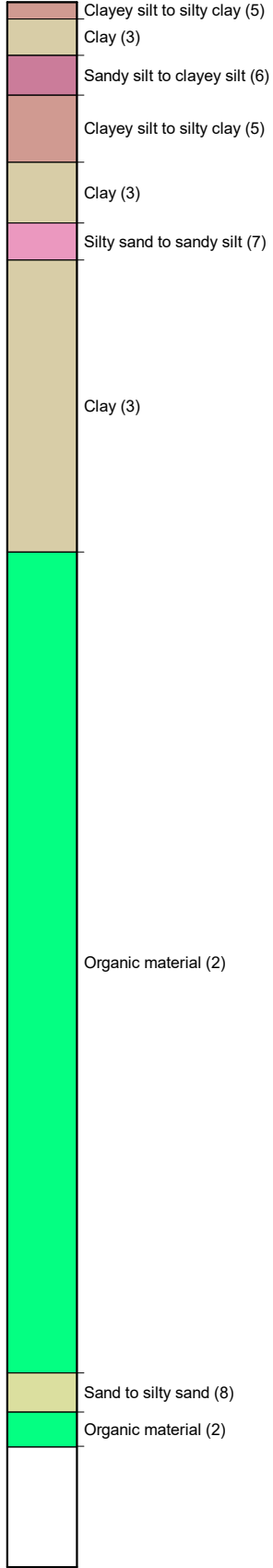


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT136
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97789, E 174.76776			File:	CPT136.cpt		

**Classification by Robertson 1986**

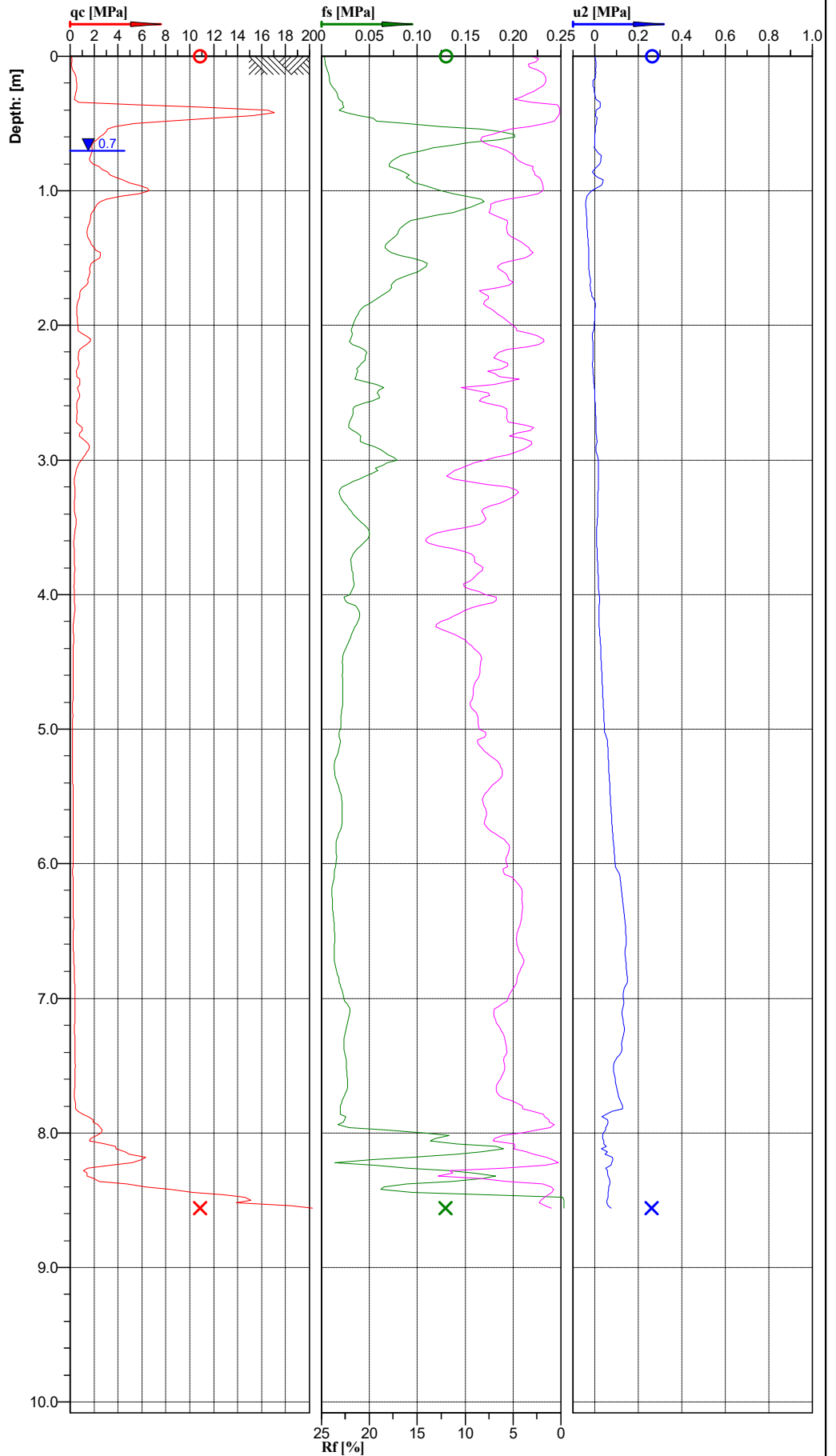
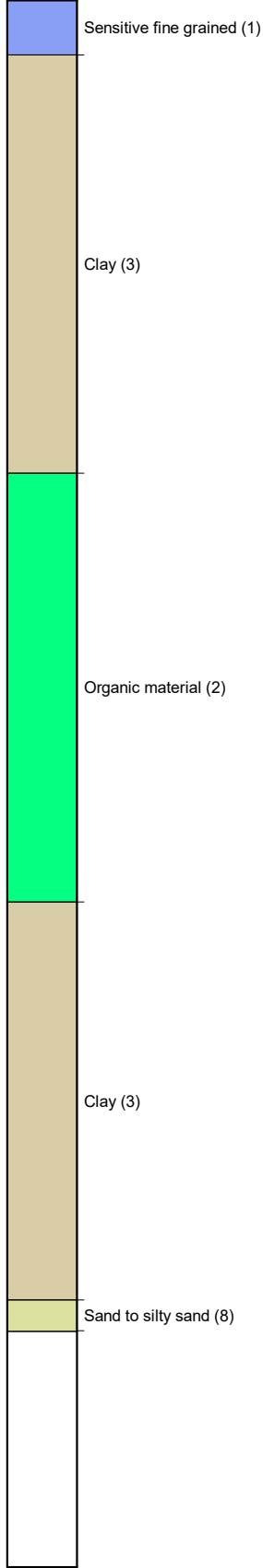


Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150



Location: AUCKLAND	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT137
Project ID:	Client: INITIA	Date: 3/11/2021	Scale: 1 : 45
Project: VILLA MARIA		Page: 1/1	Fig.:
S 36.97741, E 174.76784			File: CPT137.cpt

Classification by  
Robertson 1986

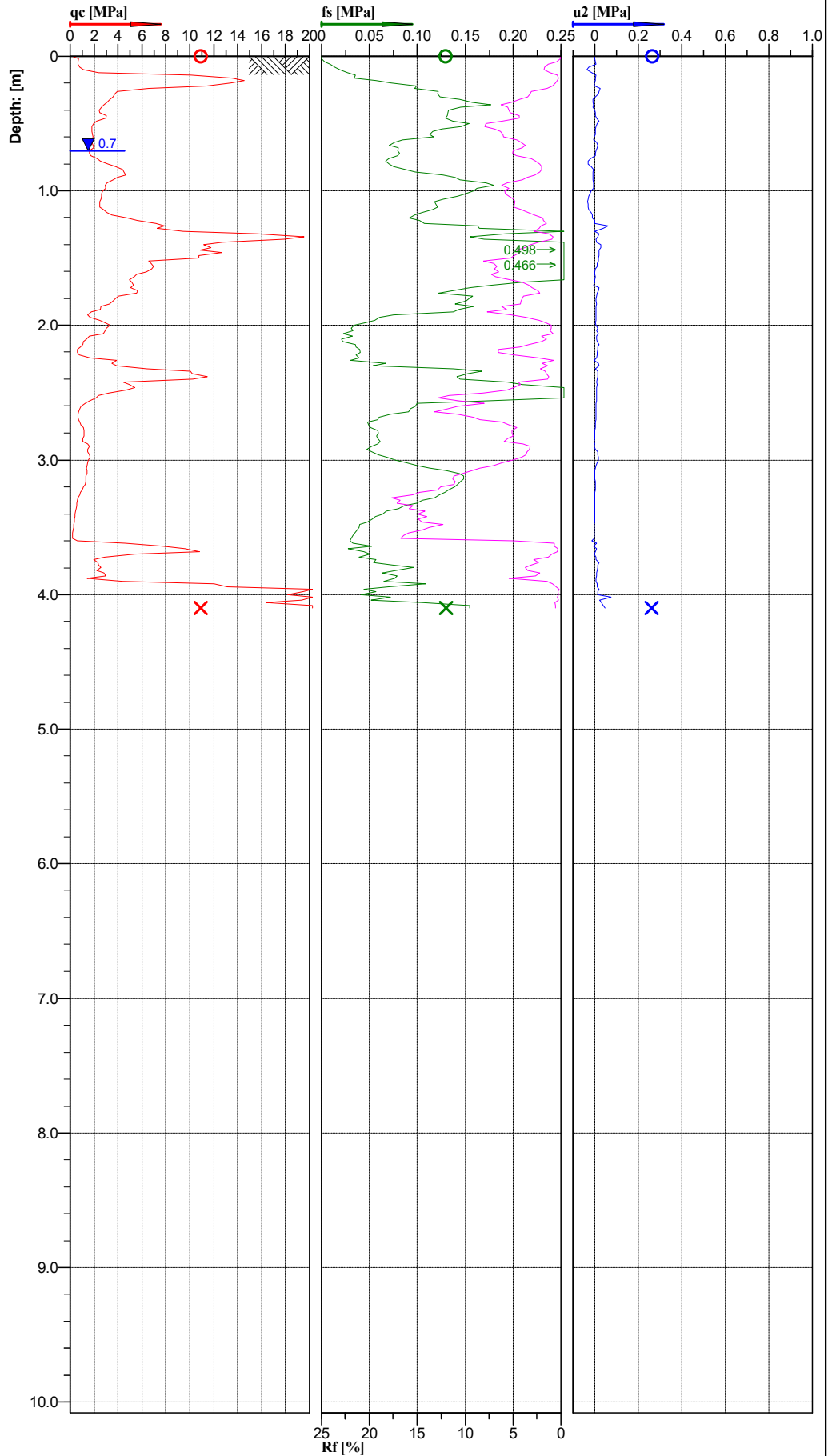
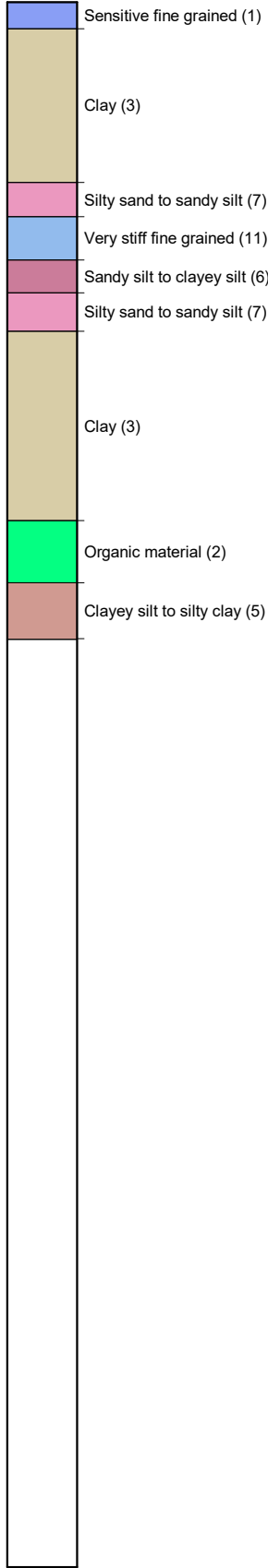


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT138
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.97688, E 174.76770			File:	CPT138.cpt		

**Classification by  
Robertson 1986**



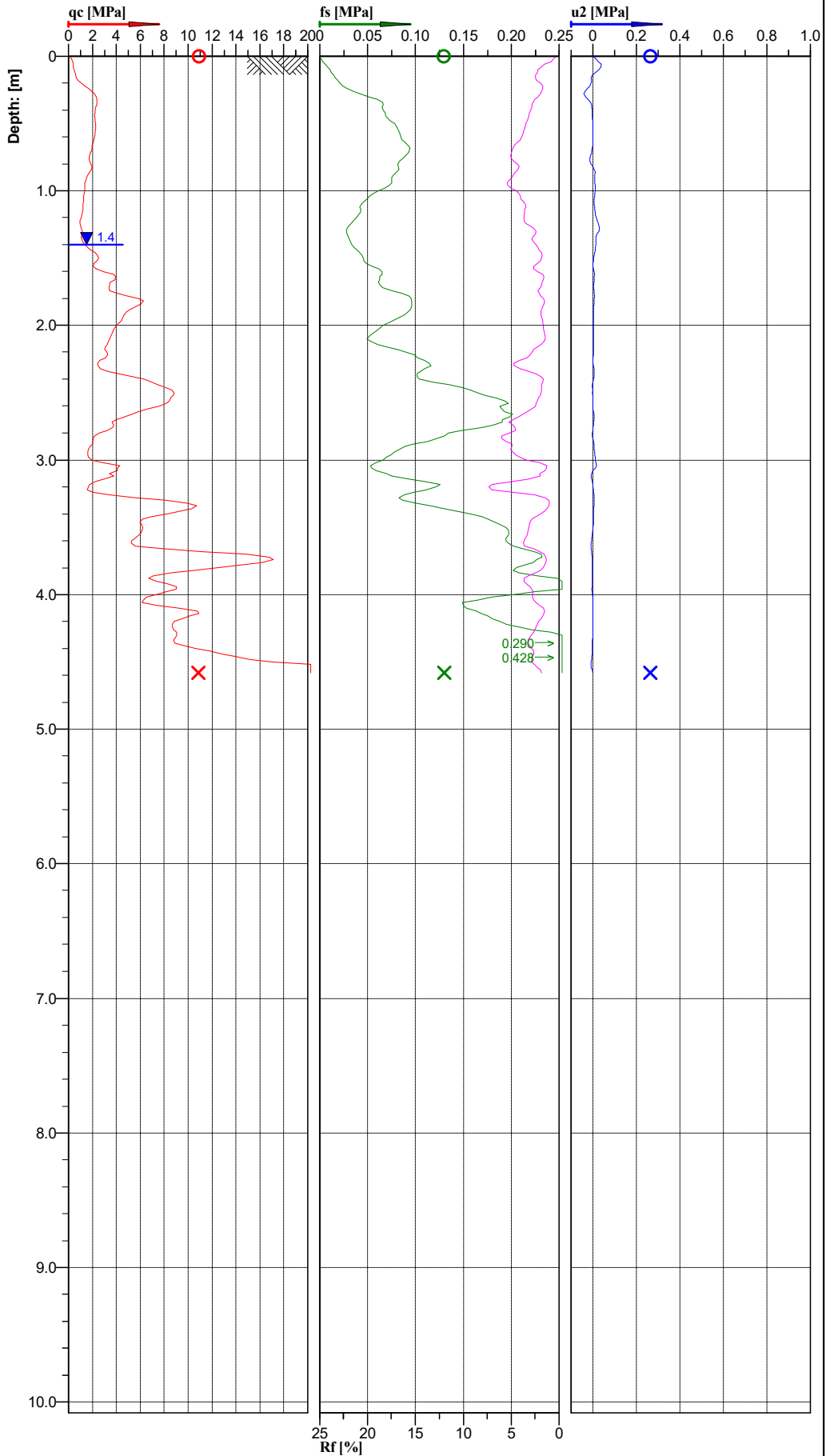
Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT139
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
S 36.97613, E 174.76859				File:	CPT139.cpt		

**Classification by  
Robertson 1986**

- Sensitive fine grained (1)
- Clayey silt to silty clay (5)
- Clay (3)
- Clayey silt to silty clay (5)
- Sandy silt to clayey silt (6)
- Silty sand to sandy silt (7)
- Sandy silt to clayey silt (6)
- Silty sand to sandy silt (7)
- Clay (3)
- Sandy silt to clayey silt (6)
- Sand to silty sand (8)
- Sandy silt to clayey silt (6)
- Silty sand to sandy silt (7)



Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150

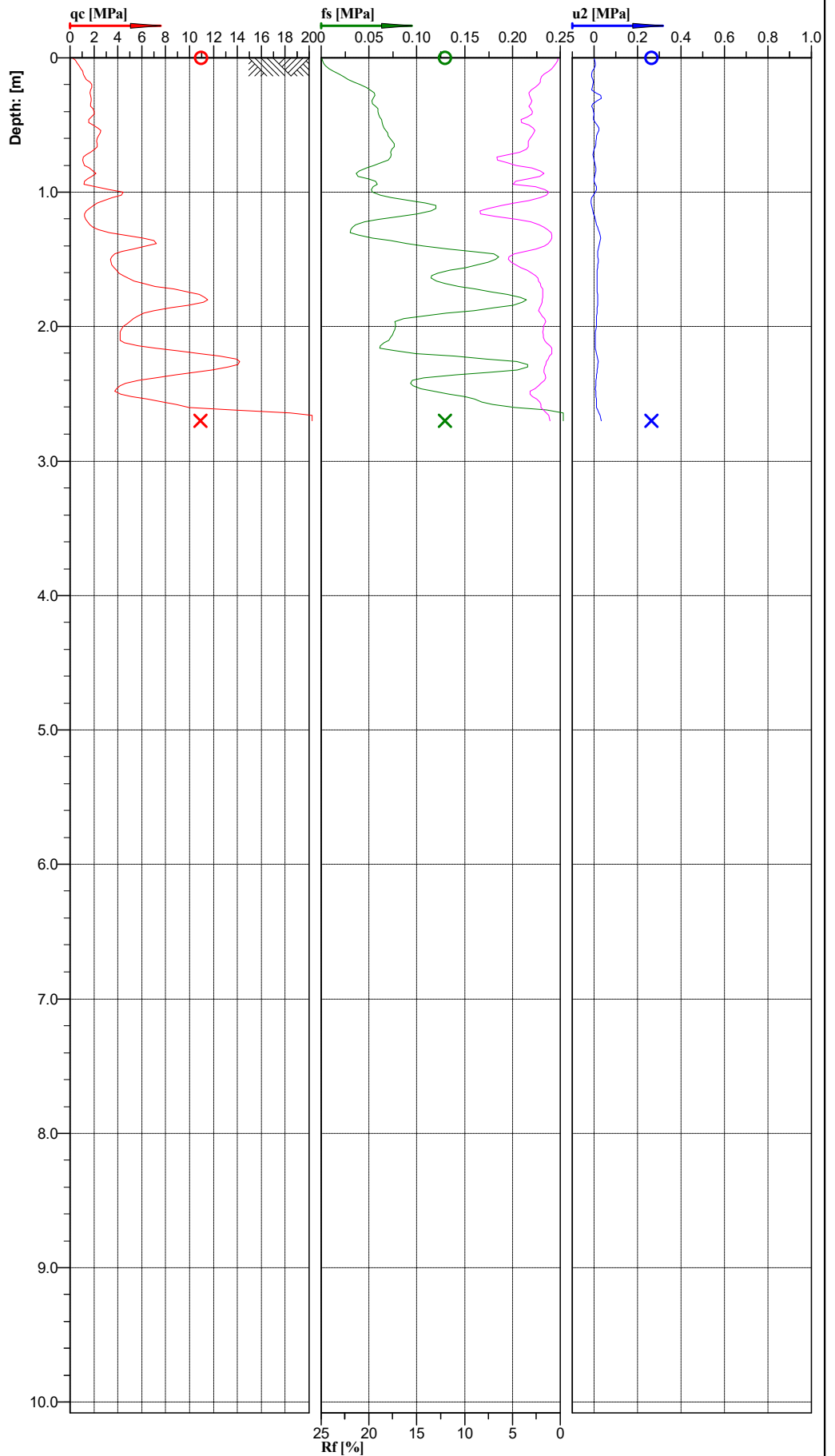


Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT142</b>
Project ID:	Client: <b>INITIA</b>	Date: 3/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.97967, E 174.76497		File: CPT142.cpt	



**Classification by  
Robertson 1986**

- Sensitive fine grained (1)
- Clayey silt to silty clay (5)
- Clay (3)
- Silty sand to sandy silt (7)
- Sand to silty sand (8)
- Silty sand to sandy silt (7)



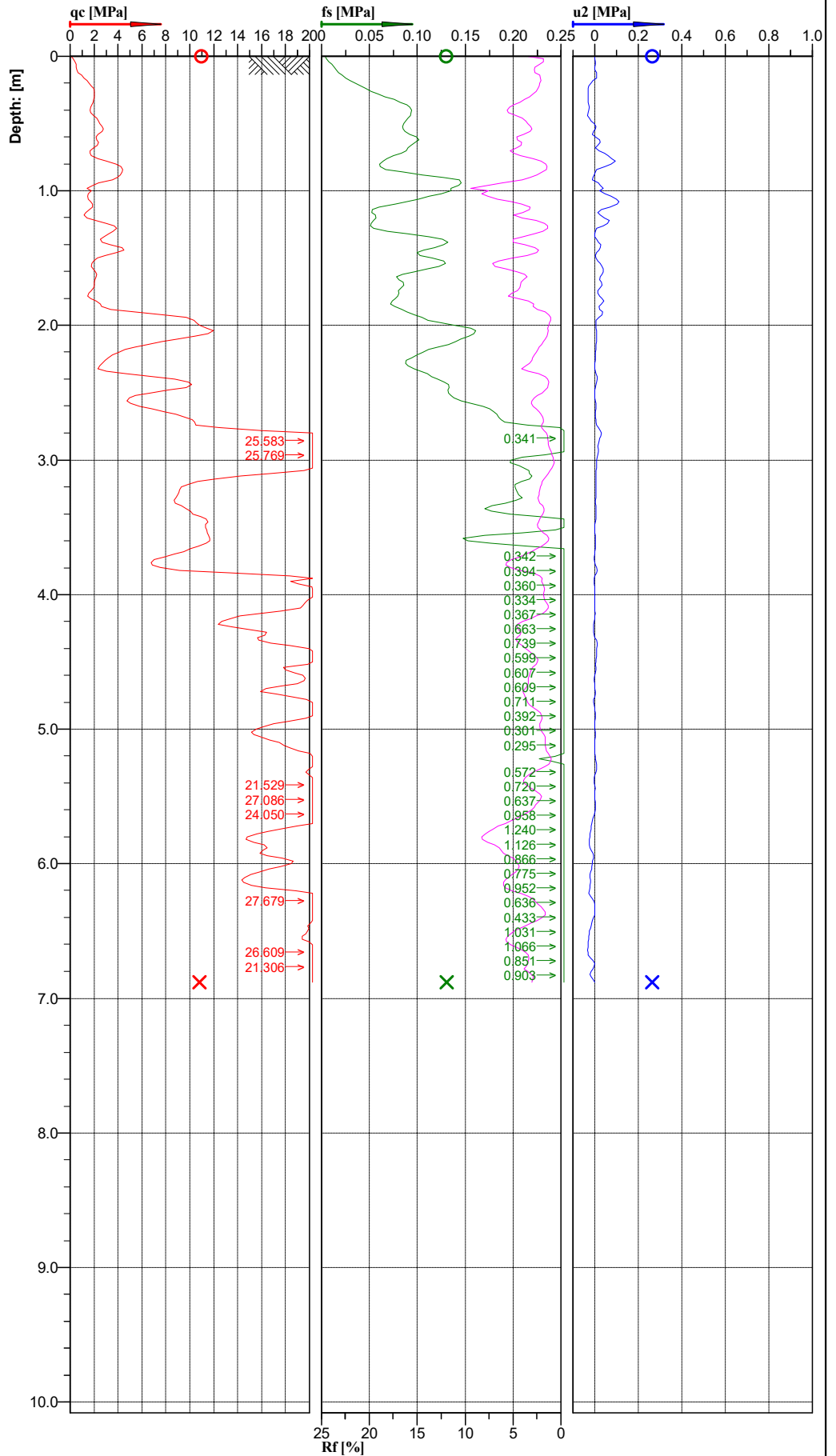
Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT143</b>
Project ID:	Client: <b>INITIA</b>	Date: 3/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.98013, E 174.76375		File: <b>CPT143.cpt</b>	

**Classification by Robertson 1986**

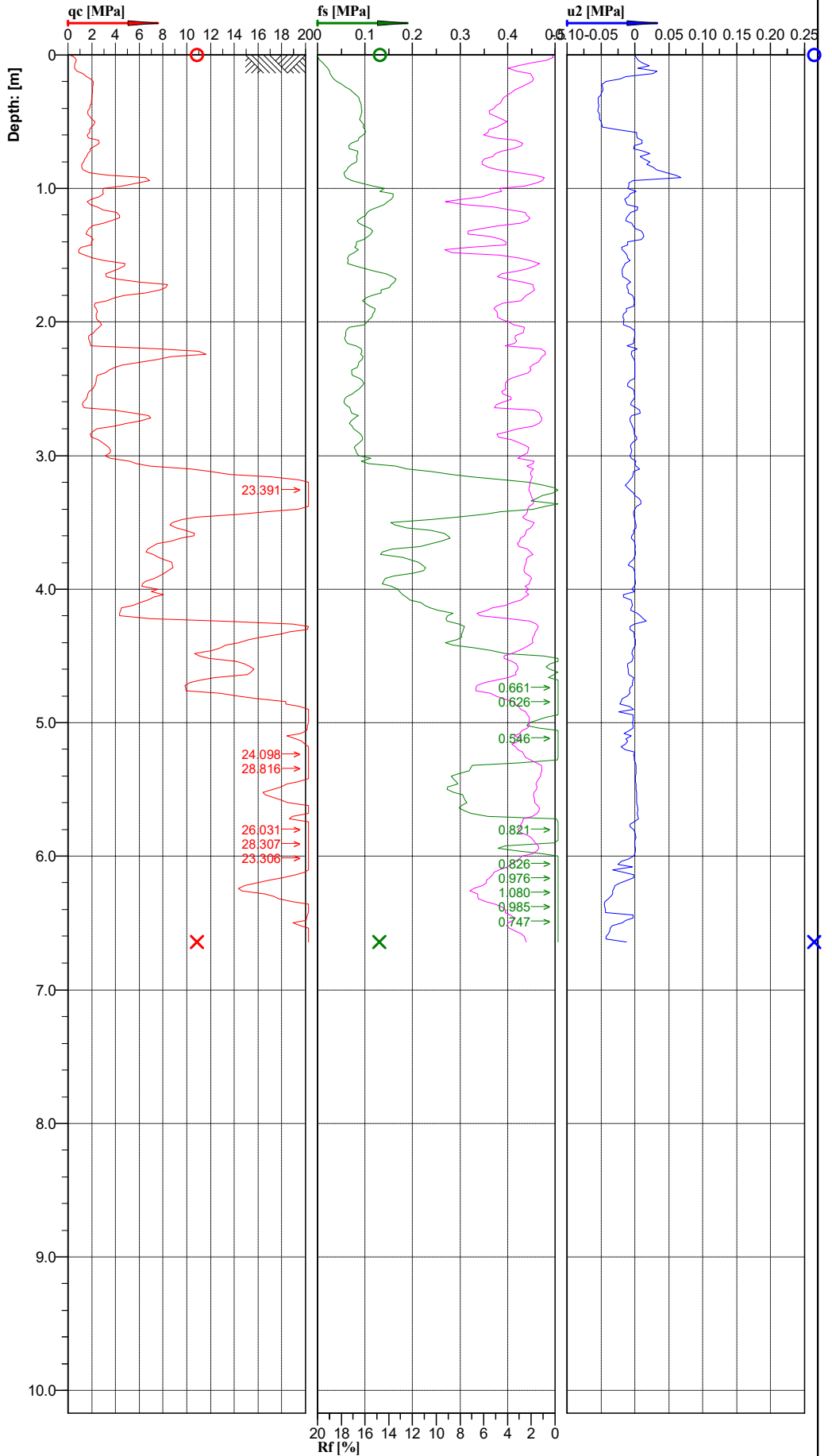
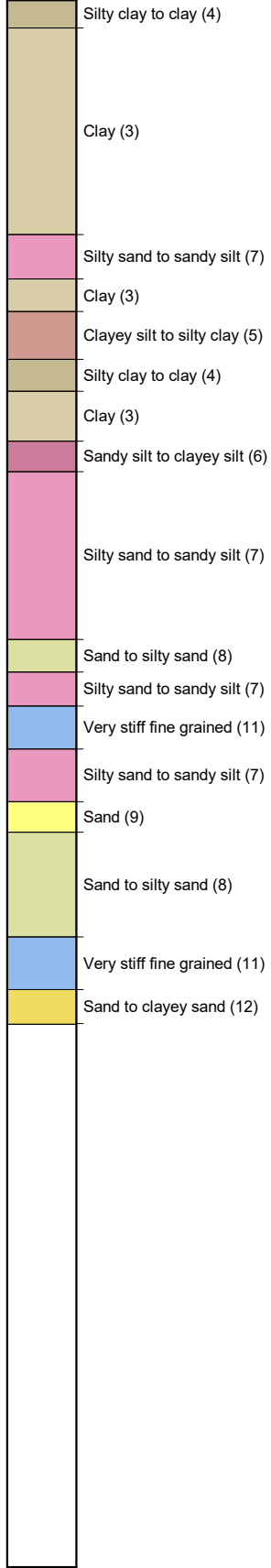
- Sensitive fine grained (1)
- Clayey silt to silty clay (5)
- Clay (3)
- Sand to silty sand (8)
- Clayey silt to silty clay (5)
- Silty sand to sandy silt (7)
- Sand (9)
- Silty sand to sandy silt (7)
- Very stiff fine grained (11)
- Sand to silty sand (8)
- Very stiff fine grained (11)
- Sand to clayey sand (12)
- Sand to silty sand (8)
- Sand to clayey sand (12)
- Very stiff fine grained (11)
- Sand to silty sand (8)
- Sand to clayey sand (12)



Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150

Location: AUCKLAND	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT144
Project ID:	Client: INITIA	Date: 3/11/2021	Scale: 1 : 45
Project: VILLA MARIA		Page: 1/1	Fig.:
S 36.98065, E 174.76352		File: CPT144.cpt	

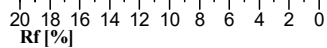
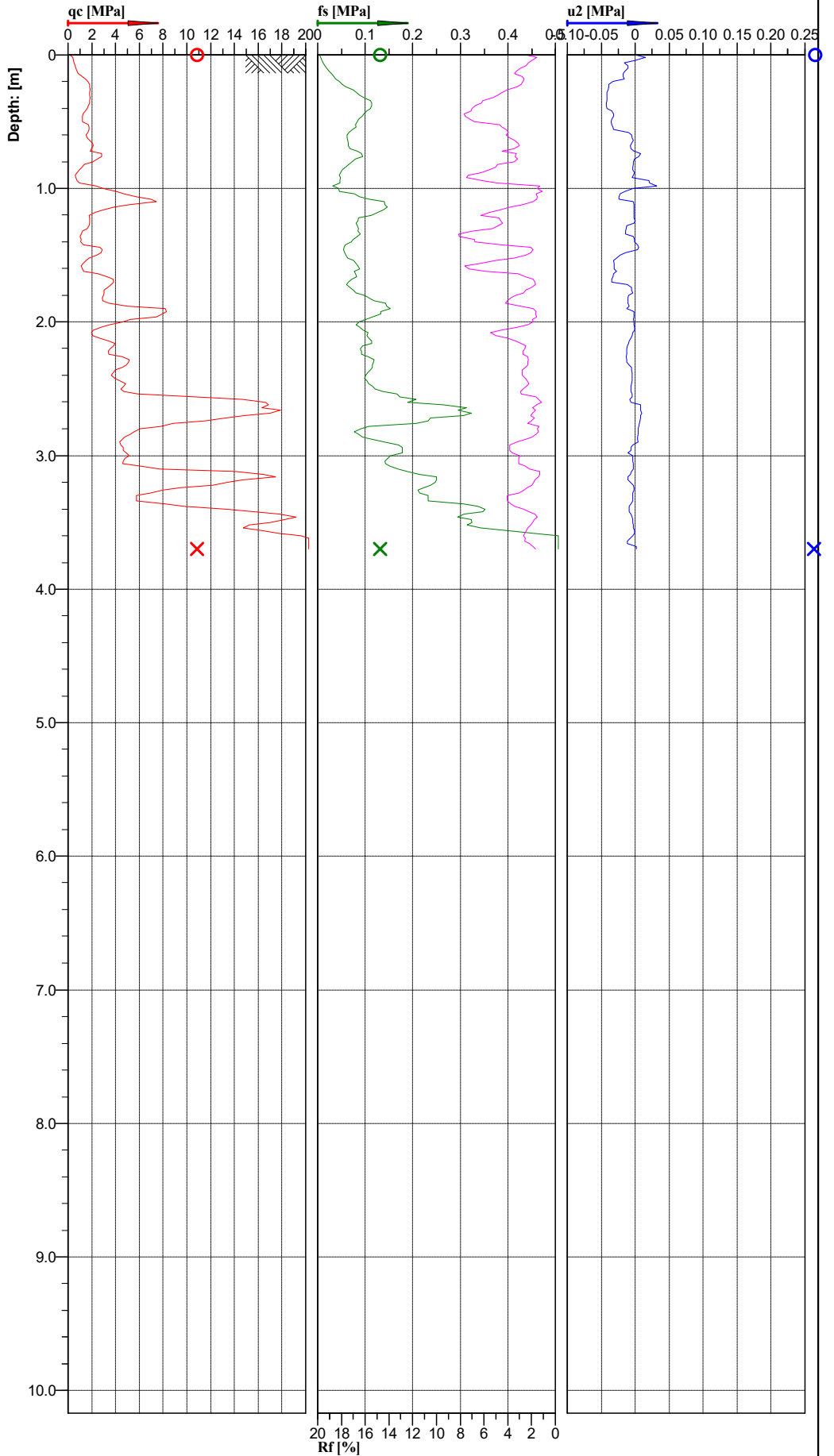
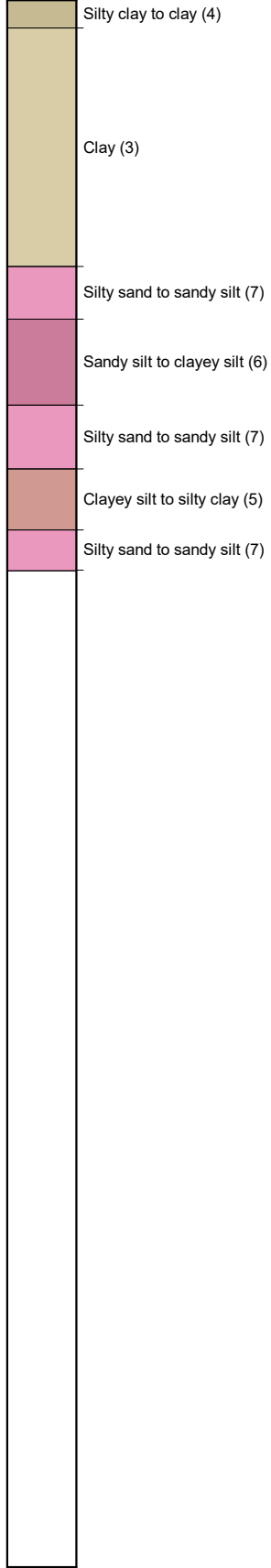
**Classification by  
Robertson 1986**



Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150

Location: AUCKLAND	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT145
Project ID:	Client: INITIA	Date: 3/11/2021	Scale: 1 : 45
Project: VILLA MARIA		Page: 1/1	Fig.:
S 36.98114 E 174.76398		File: CPT145.cpt	

Classification by  
Robertson 1986

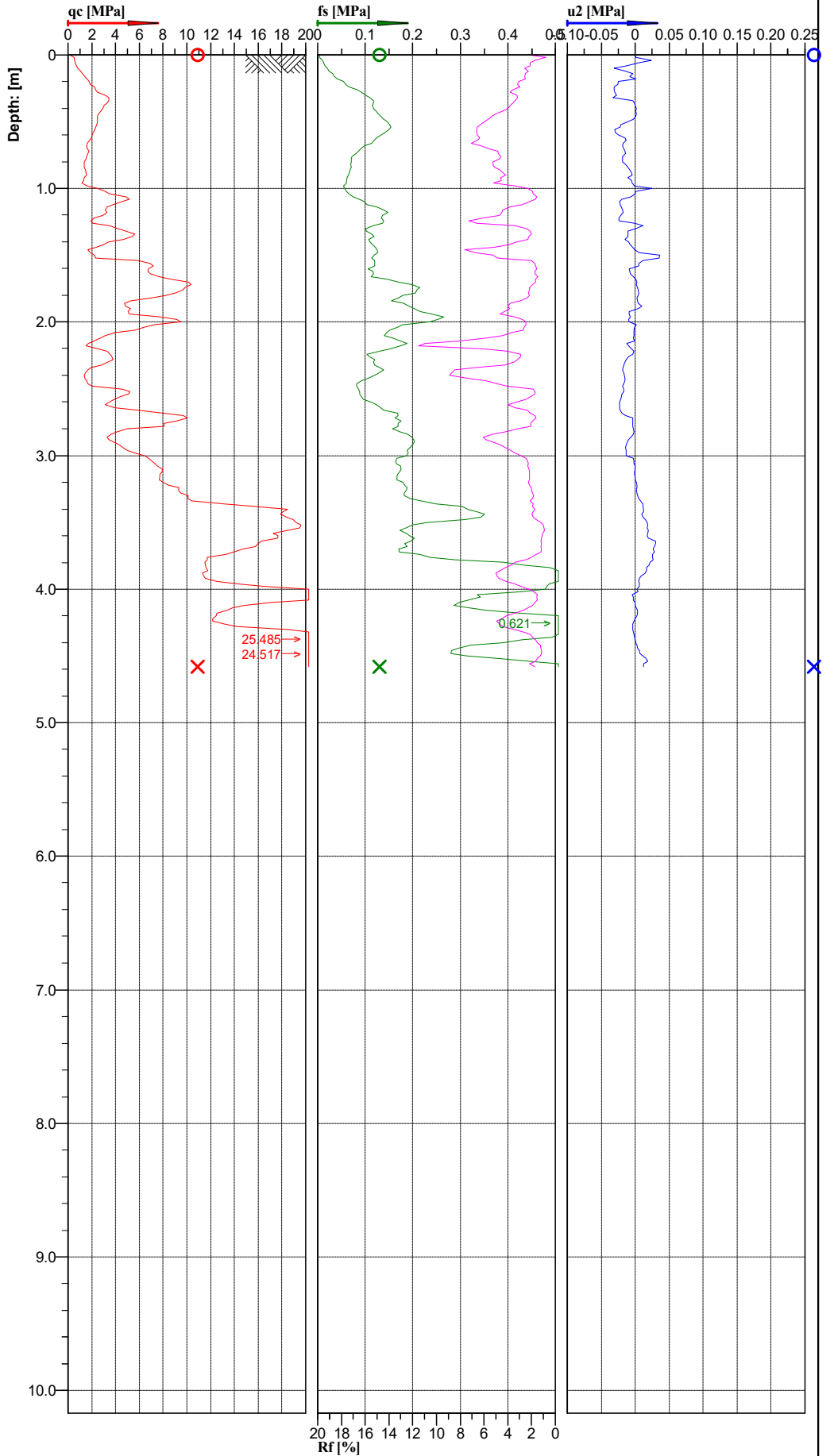
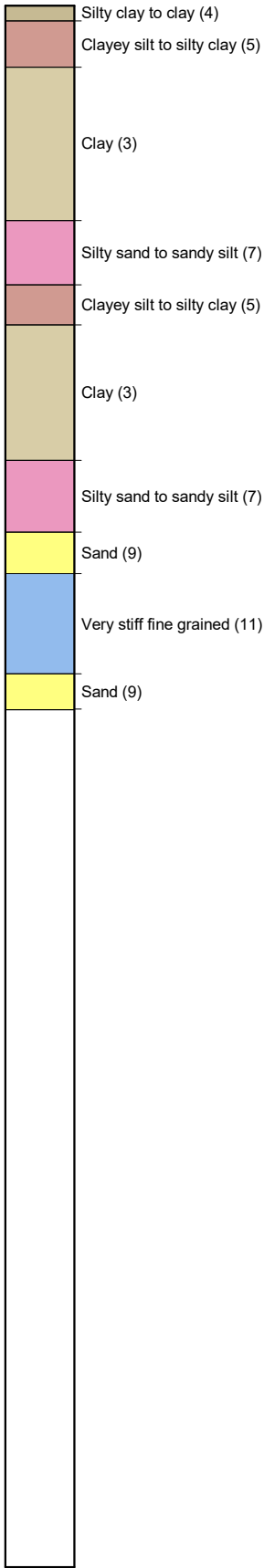


Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT146
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.98058 E 174.76445			File:	CPT146.cpt		

**Classification by  
Robertson 1986**

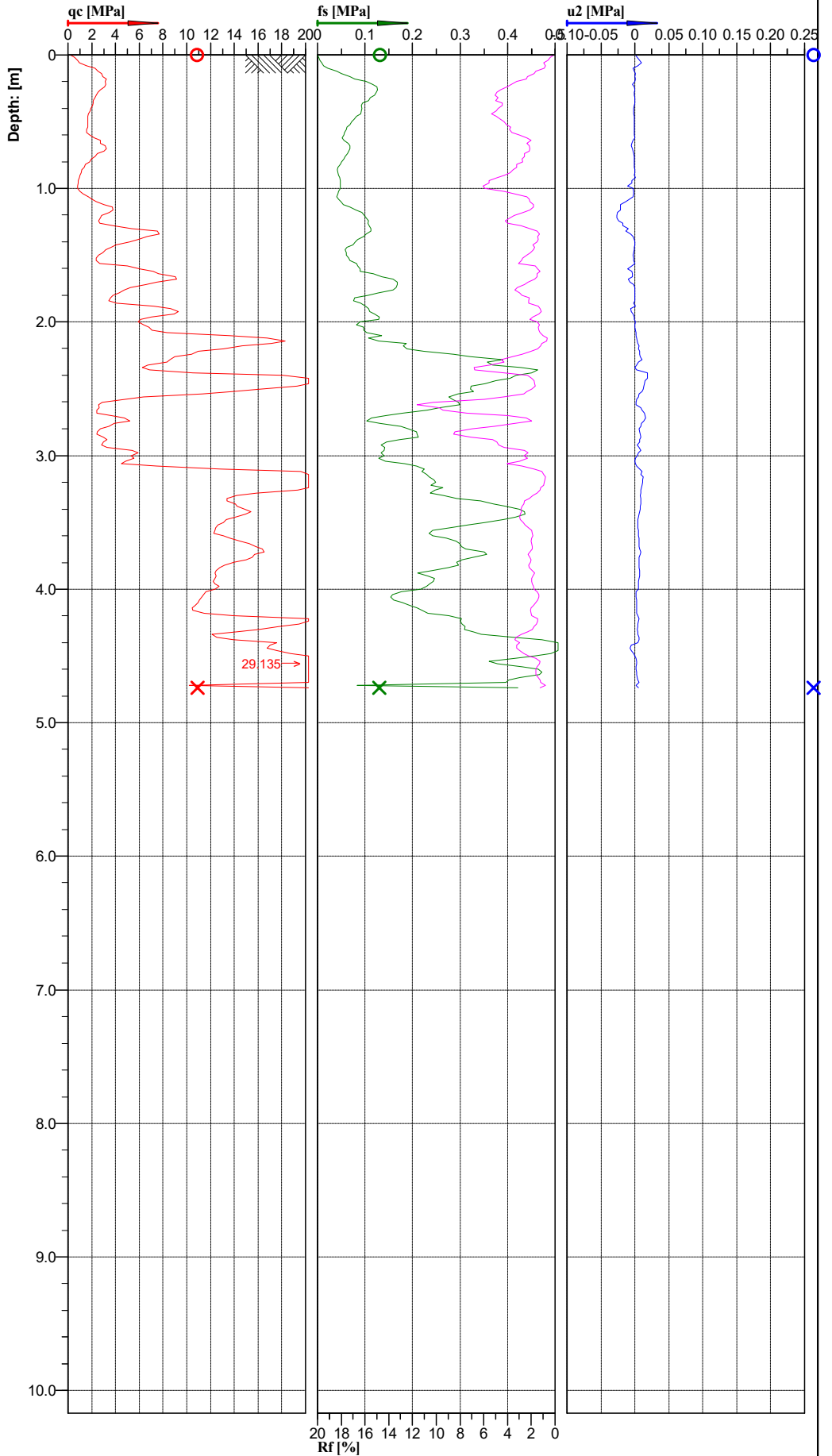
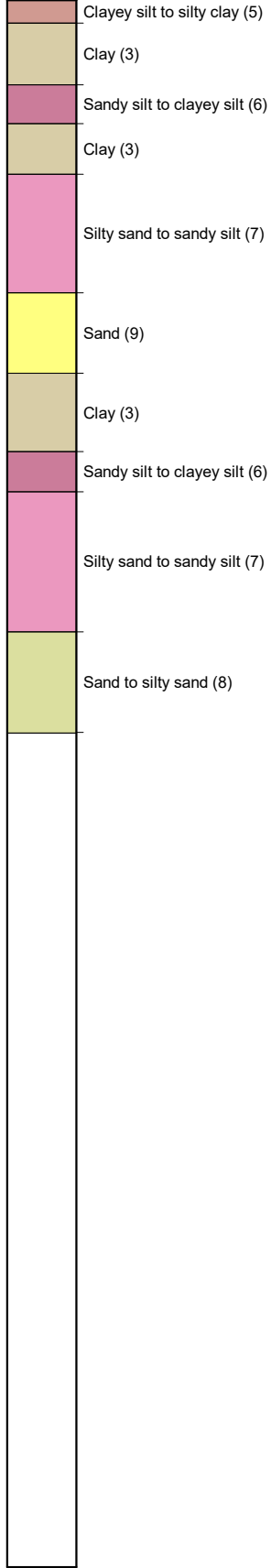


Cone No: 5557  
 Tip area [cm<sup>2</sup>]: 10  
 Sleeve area [cm<sup>2</sup>]: 150



Location:	AUCKLAND	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT147
Project ID:		Client:	INITIA	Date:	3/11/2021	Scale:	1 : 45
Project:	VILLA MARIA			Page:	1/1	Fig.:	
	S 36.98080 E 174.76494			File:	CPT147.cpt		

**Classification by  
Robertson 1986**



Cone No: 5557  
Tip area [cm<sup>2</sup>]: 10  
Sleeve area [cm<sup>2</sup>]: 150



Location: <b>AUCKLAND</b>	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: <b>CPT148</b>
Project ID:	Client: <b>INITIA</b>	Date: 3/11/2021	Scale: 1 : 45
Project: <b>VILLA MARIA</b>		Page: 1/1	Fig.:
S 36.98114 E 174.76552		File: <b>CPT148.cpt</b>	

## Appendix GFR-C: Initia Laboratory Test Results

- One-Dimensional Consolidation Tests;
- Natural Water Content Tests;
- Organic Content tests;
- Atterberg Tests





Our Ref: 1100737.0000/Rep 1  
Customer Ref: P-000982  
26 February 2021

Initia Geotechnical Specialists  
Unit 13, Level 1,  
114 St Georges Bay Road,  
Parnell 1052

Attention: Mr Nathan Hickman

Dear Nathan

**VM**

**Laboratory Test Report**

Samples from the above mentioned site have been tested as received according to your instructions and the results are included in this report. Results apply only to the sample tested.

Descriptions are enclosed for your information, but is not covered under the IANZ endorsement of this report.

This report has been prepared for the benefit of Initia Geotechnical Specialists, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This report may be reproduced only in full.

Samples not destroyed during testing will be retained for one month from the date of this report before being discarded. If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report prepared by:

Sim Tirunahari  
I am the author of this document  
2021.02.26 16:19:31 +13'00'

.....  
Sim Tirunahari  
Soils Laboratory Manager  
Approved Signatory

Authorised for Geotechnics by:

.....  
Steven Anderson  
Project Director

Report checked by:

.....  
James Kimiangatau  
Laboratory Technician



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

26-Feb-21

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1 Hill Street, Onehunga, Auckland 1061

p 64 9 356 3510

GEOTECHNICS www.geotechnics.co.nz



Your Job No.: **P-000982**

Site: **VM**

Our Job No.: **1100737.0000**

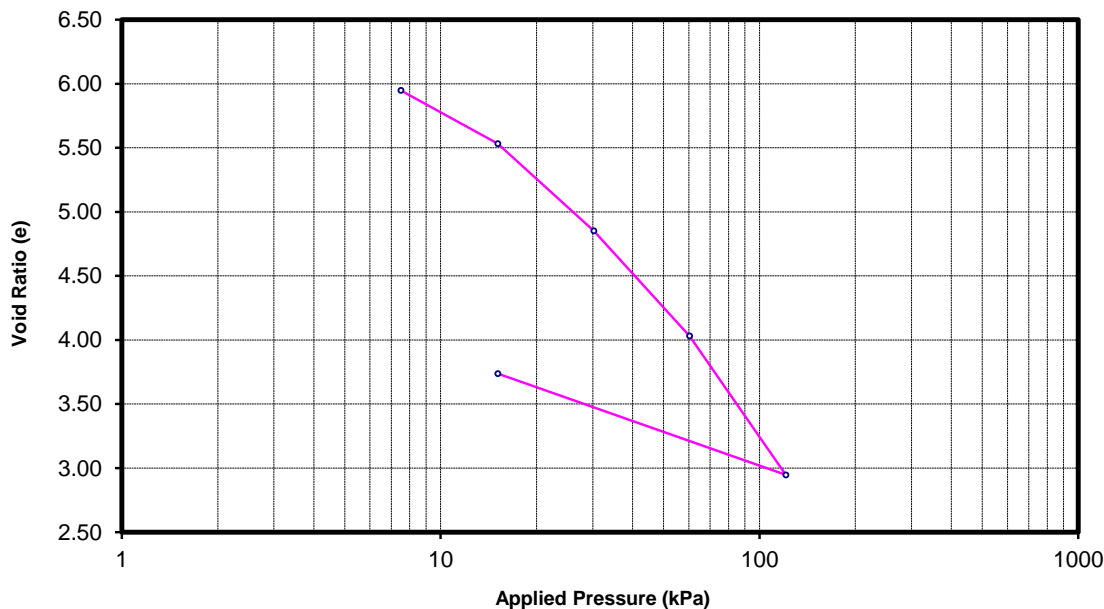
BH No.: **BH3**

Sample ID.: **2**

Depth: **4.75-4.80 (m)**

Test Method Used: NZS 4402:1986 Test 7.1 One-Dimensional Consolidation

**ONE-DIMENSIONAL CONSOLIDATION TEST**



Pressure (kPa)	Void Ratio (e)	Pressure Increment (kPa)	Coefficient of Consolidation Cv (m <sup>2</sup> /yr)	Coefficient of Volume Compressibility Mv (m <sup>2</sup> /MN)
As received	0			
Preload	7.5	0 to 7.5	NA	8.0
	15.1	7.5 to 15.1	0.59	7.8
	30.2	15.1 to 30.2	0.42	6.9
	60.3	30.2 to 60.3	0.28	4.7
	121	60.3 to 121	0.17	3.6
Unload	15.1	121 to 15.1	NA	NA

Sample History: Undisturbed core trimmed at NWC.

Description: Organic SILT with minor clay, soft, light greenish grey mixed with dark brown.

Initial Dry Density (t/m<sup>3</sup>): 0.24 Initial Water Content: 345%

Solid Density (t/m<sup>3</sup>): 1.75 (Assumed) Initial Saturation: 95%

Temperature During Testing: Max = 20 °C Min = 19 °C

Remarks: SQR of time fitting method was used. We have assumed a value of 1.75 t/m<sup>3</sup>. The calculations of void ratio are affected by the solid density value.

The test results are IANZ accredited but the sample description is not IANZ accredited.

Approved Signatory Sim Tirunahari

Date 26/02/2021

Our Ref.No. 1100737.0000/Rep 1



1 Hill Street, Onehunga, Auckland 1061

p 64 9 356 3510

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Your Job No.: **P-000982**

Site: **VM**

Our Job No.: **1100737.0000**

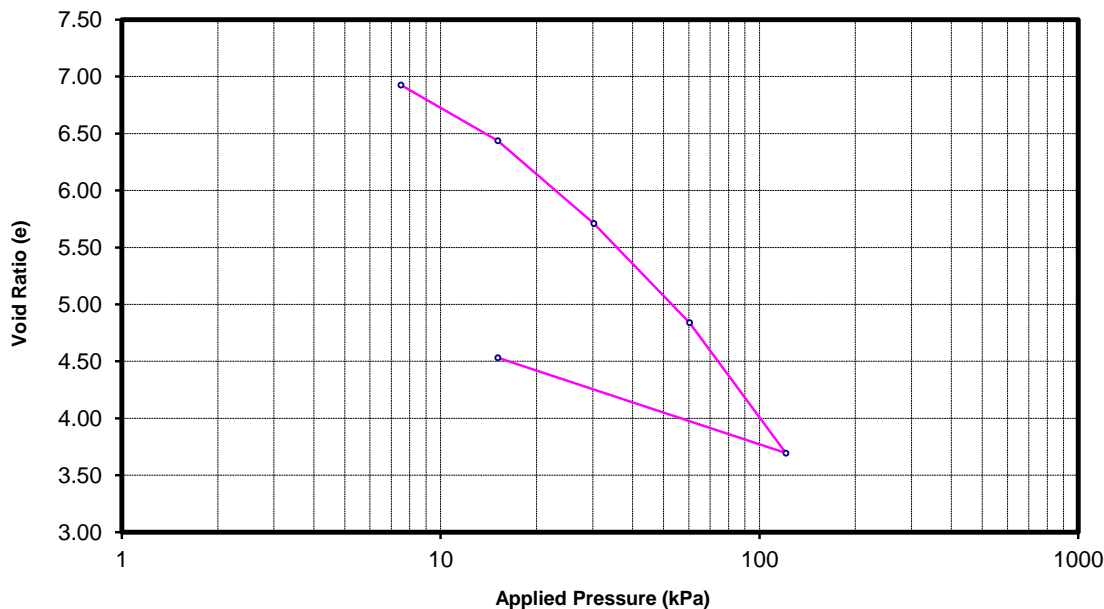
BH No.: **BH4**

Sample ID.: **1**

Depth: **3.30-3.35 (m)**

Test Method Used: NZS 4402:1986 Test 7.1 One-Dimensional Consolidation

**ONE-DIMENSIONAL CONSOLIDATION TEST**



Pressure (kPa)	Void Ratio (e)	Pressure Increment (kPa)	Coefficient of Consolidation Cv (m <sup>2</sup> /yr)	Coefficient of Volume Compressibility Mv (m <sup>2</sup> /MN)
As received	0	7.684		
Preload	7.5	6.927	0 to 7.5	NA
	15.1	6.438	7.5 to 15.1	0.33
	30.2	5.710	15.1 to 30.2	0.27
	60.3	4.841	30.2 to 60.3	0.19
	121	3.696	60.3 to 121	0.13
Unload	15.1	4.532	121 to 15.1	NA

Sample History: Undisturbed core trimmed at NWC.

Description: Organic SILT with minor clay, soft, light greenish grey mixed with dark brown-black.

Initial Dry Density (t/m<sup>3</sup>): 0.17 Initial Water Content: 501%

Solid Density (t/m<sup>3</sup>): 1.50 (Assumed) Initial Saturation: 98%

Temperature During Testing: Max = 20 °C Min = 19 °C

Remarks: SQR of time fitting method was used. We have assumed a value of 1.50 t/m<sup>3</sup>. The calculations of void ratio are affected by the solid density value.

The test results are IANZ accredited but the sample description is not IANZ accredited.

Approved Signatory Sim Tirunahari

Date 26/02/2021

Our Ref.No. 1100737.0000/Rep 1

**ONE DIMENSIONAL CONSOLIDATION PROPERTIES  
TEST RESULT REPORT**



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH105-02  
 Sample depth: 4.50-4.95m Specimen depth: 4.75-4.80m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sampling method: Push Tube  
 Sample description: Brown; clayey SILT

Project No: 1-LA636.00  
 Lab Ref No: AL7487/1  
 Client ref: P-000982-2  
 Order No: P-000982-2

**SOIL PROPERTIES**

Specimen Dimensions:		Initial Wet Density	pbi (t/m <sup>3</sup> )	1.22
Diameter (mm):	50.02	Initial Dry Density	pdi (t/m <sup>3</sup> )	0.41
Initial height (mm):	20.00	Final Dry Density	pdf (t/m <sup>3</sup> )	0.67
Final height (mm):	12.40	Initial Void Ratio	eo	5.66
Initial mass of sample (g):	47.92	Final Void Ratio	ef	3.13
Note: ** Void ratio is not IANZ Accredited due to Solid Density value being assumed.		Initial Degree of Saturation	Si (%)	95
		Final Degree of Saturation	Sf (%)	99
		Solid Particle Density	*Gs (t/m <sup>3</sup> )	2.75
		INITIAL Water Content	Wi (%)	195.3
		FINAL Water Content	Wf (%)	112.7

\*Gs is Assumed

**CONSOLIDATION PROPERTIES**

PRESSURE RANGE (kPa)	Pressure Increment (dp)	**Void Ratio (e)	Intercept t90 (min)	Volume Compressibility Mv=m <sup>2</sup> /MN	Coefficient of Consolidation Cv=m <sup>2</sup> /year	Coeff. of Permeability k=m/year
0 - 12.5	12.5	5.63	3.4	-	-	-
12.5 - 25	12.5	5.57	20.17	0.80	2.20	0.017
25 - 50	25	5.41	13.31	0.96	3.20	0.031
50 - 100	50	4.75	121.15	2.10	0.34	0.007
100 - 200	100	3.75	104.54	1.70	0.32	0.005
200 - 400	200	2.92	83.58	0.87	0.27	0.002
400 - 200	-	2.94	-	-	-	-
200 - 50	-	3.13	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Test Methods:	Notes:
One Dimensional Consolidation Test. NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.75hr intervals Square root of time fitting method was used for Cv calculations All information provided by client
Water Content NZS 4402:1986 Test 2.1	

Date tested : 05-08/04/22 Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
 Date reported : 21/04/22 This report may only be reproduced in full

IANZ Approved Signatory  
 Thirusen Pillay  
 Designation : Senior Civil Engineering Technician  
 Date : 21/04/22  
 CSF 2120 (10/20)



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ONE DIMENSIONAL CONSOLIDATION PROPERTIES

Applied Pressure vs Void Ratio TEST REPORT

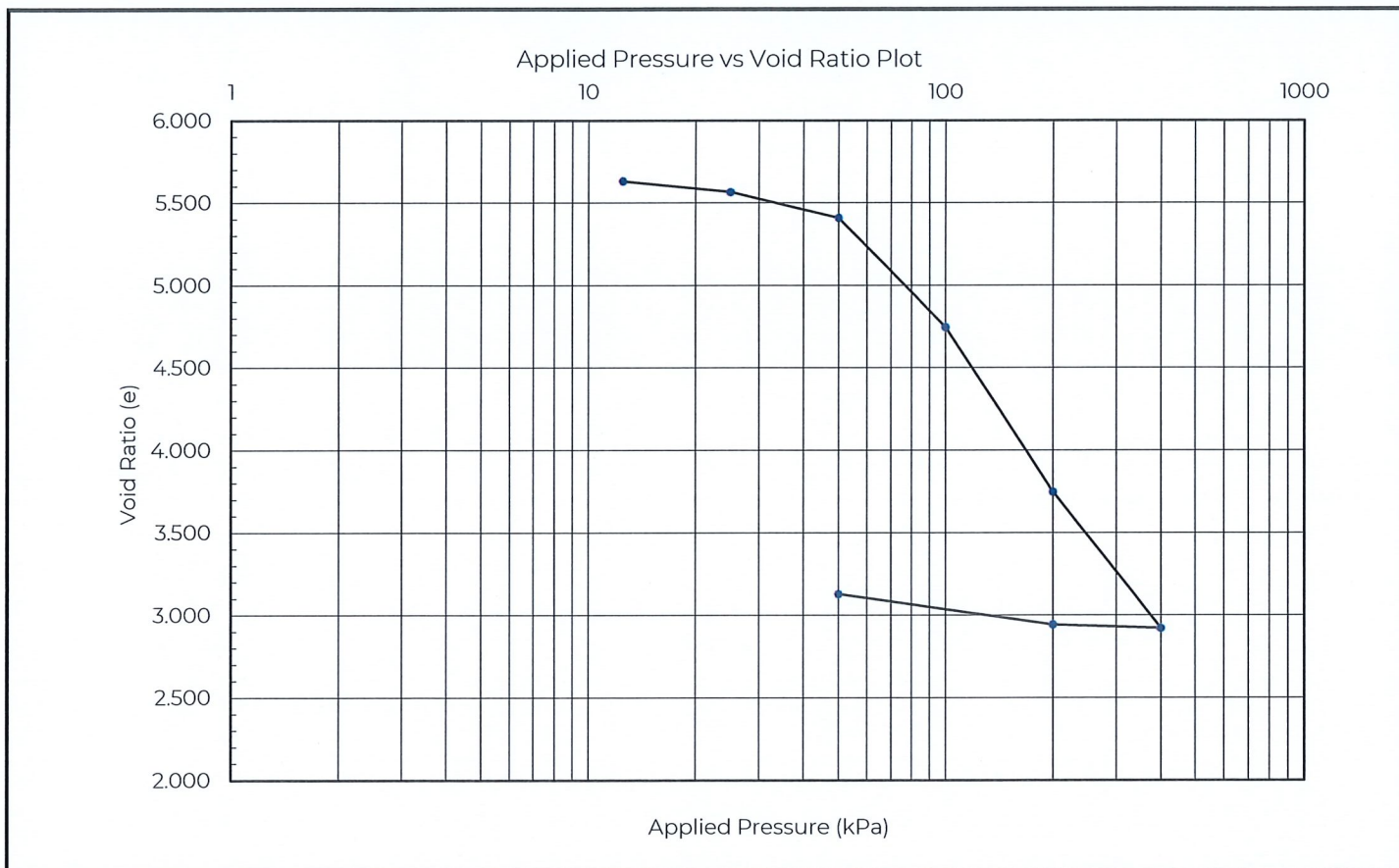


Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH105-02  
 Sample depth: 4.50-4.95m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sample description: Brown; clayey SILT

Specimen depth: 4.75-4.80m

Sampling method: Push Tube  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17CS2

Project number: 1-LA636.00  
 Lab ref number: AL7487/1  
 Client ref: P-000982-2  
 Order No: P-000982-2



Test Method:	Notes:
One Dimensional Consolidation Test: NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.75hr intervals All information provided by client

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date tested : 05-08/04/22  
 Date reported : 21/04/22

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*Thirushen Pillay*  
 Senior Civil Engineering Technician  
 Date : 21/04/22



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Page 2 of 2  
 Telephone +64 9 415 4660  
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PLASTICITY INDEX FOR SOILS  
TEST REPORT



Project : Villa Maria  
 Location : Villa Maria Mangere  
 Client : Initia Limited  
 Contractor : Not Stated  
 Sampled by : Bruno  
 Date sampled : 04-26/03/22  
 Sampling method : Push tube  
 Sample description : Brown; clayey SILT  
 Sample condition : As Received  
 Sample reference: BH105-02  
 Sample depth: 4.50 - 4.95 m  
 Specific depth: 4.50 - 4.75 m

Project No : 1-LA636.00  
 Lab Ref No : AL7487/2  
 Client Ref No : P-000982-2  
 Order No : P-000982-2

Test Results

Liquid Limit :	294
Plastic Limit :	86
Plasticity Index :	208
Natural Water Content :	211.3

Test Methods	Notes
Liquid Limit NZS 4402 : 1986, Test 2.2	Materials used: Passing 425um sieve
Plastic Limit NZS 4402 : 1986, Test 2.3	
Plasticity Index NZS 4402 : 1986, Test 2.4	
Water Content NZS 4402 : 1986, Test 2.1	All information supplied by Client

Date tested : 21/04/22  
 Date reported : 22/04/22

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
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 Thirushen Pillay  
 Designation : Senior Civil Engineering Technician  
 Date : 22/04/22



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ORGANIC CONTENT  
TEST REPORT



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sampled by: Bruno  
 Sampling method: Push Tube  
 Sample description: Brown; clayey SILT  
 Sample condition: As Received  
 Sample reference: BH105-02  
 Sample depth: 4.50 - 4.95 m  
 Specific depth: 4.50 - 4.75 m

Date sampled: 04-26/03/22

Project number: 1-LA636.00  
 Lab ref number: AL7487/3  
 Client ref number: P-000982-2  
 Order number: P-000982-2

Test Results

Organic Content (%): 9

Test Methods	Notes
Organic Content: NZS 4402 : 1986 : Test 3.1.2	Sample descriptions are not covered by IANZ All information supplied by Client

Date tested : 11/04/22  
 Date reported : 21/04/22

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 Thirushen Pillay  
 Designation : Senior Civil Engineering Technician  
 Date : 22/04/22



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**ONE DIMENSIONAL CONSOLIDATION PROPERTIES  
TEST RESULT REPORT**



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH110-02  
 Sample depth: 4.50-4.95m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sampling method: Push Tube  
 Sample description: Brown; clayey SILT with organics;  
 Wet  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17CS1

Specimen depth: 4.85-4.90m

Note: This report is not IANZ Accredited due to the length of the loadings. Client requested 1-2hours per a loadings. Should have went for 24hours. Some of the plots were interpolated.

Project No: 1-LA636.00  
 Lab Ref No: AL7487/4  
 Client ref: P-000982-2  
 Order No: P-000982-2

**SOIL PROPERTIES**

Specimen Dimensions:		Initial Wet Density	pbi (t/m <sup>3</sup> )	1.10
Diameter (mm):	50.06	Initial Dry Density	pdi (t/m <sup>3</sup> )	0.30
Initial height (mm):	19.96	Final Dry Density	pdf (t/m <sup>3</sup> )	0.54
Final height (mm):	11.15	Initial Void Ratio	eo	8.15
Initial mass of sample (g):	43.27	Final Void Ratio	ef	4.11
Note: ** Void ratio is not IANZ Accredited due to Solid Density value being assumed.		Initial Degree of Saturation	Si (%)	90
		Final Degree of Saturation	Sf (%)	97
		Solid Particle Density	*Gs (t/m <sup>3</sup> )	2.75
		INITIAL Water Content	Wi (%)	266.7
		FINAL Water Content	Wf (%)	144.6

\*Gs is Assumed

**CONSOLIDATION PROPERTIES**

PRESSURE RANGE (kPa)	Pressure Increment (dp)	**Void Ratio (e)	Intercept t90 (min)	Volume Compressibility Mv=m <sup>2</sup> /MN	Coefficient of Consolidation Cv=m <sup>2</sup> /year	Coeff. of Permeability k=m/year
0 - 12.5	12.5	7.87	1.71	-	-	-
12.5 - 25	12.5	7.45	150.87	3.80	0.27	0.010
25 - 50	25	6.89	143.25	2.70	0.26	0.007
50 - 100	50	5.89	289.00	2.50	0.11	0.003
100 - 200	100	4.81	268.96	1.60	0.09	0.001
200 - 400	200	3.78	253.82	0.89	0.07	0.001
400 - 200	-	3.76	-	-	-	-
200 - 50	-	4.11	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Test Methods:	Notes:
One Dimensional Consolidation Test. NZS 4402:1986 Test 7.1	Sample is saturated during test.
Water Content NZS 4402:1986 Test 2.1	Load Increments applied at 3.27hr intervals
	Square root of time fitting method was used for Cv calculations
	All information provided by client

Date tested : 05-08/04/22      Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
 Date reported : 21/04/22      This report may only be reproduced in full

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*Thirushen Pillay*

Designation : Senior Civil Engineering Technician

Date : 21/04/22

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ONE DIMENSIONAL CONSOLIDATION PROPERTIES

Applied Pressure vs Void Ratio TEST REPORT



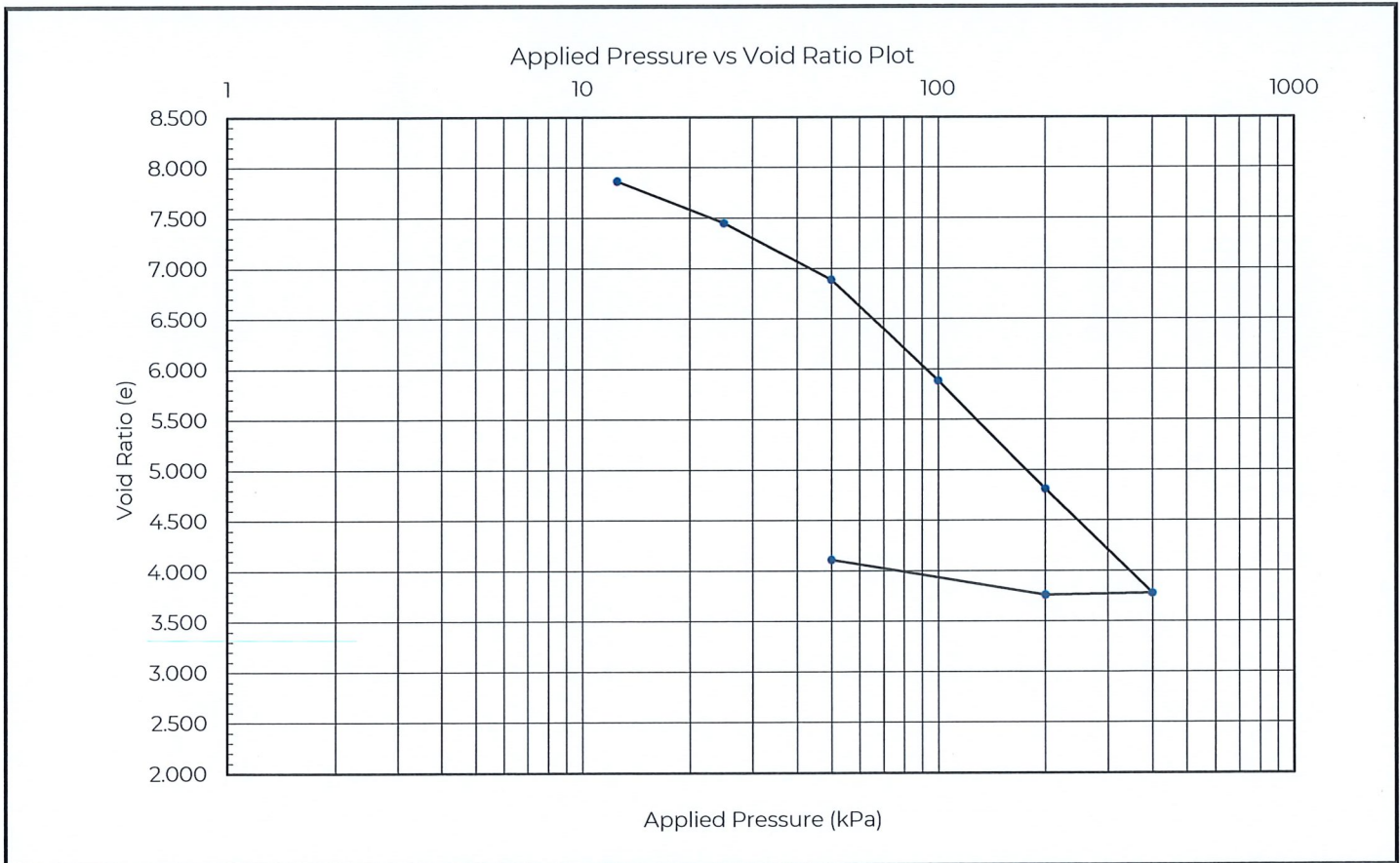
Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH110-02  
 Sample depth: 4.50-4.95m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22

Specimen depth: 4.85-4.90m

Note: This report is not IANZ Accredited due to the length of the loadings. Client requested 1-2hours per a loadings. Should have went for 24hours. Some of the plots were interpolated.

Sample description: Brown; clayey SILT with organics; Wet  
 Sampling method: Push Tube  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17CSI

Project number: 1-LA636.00  
 Lab ref number: AL7487/4  
 Client ref: P-000982-2  
 Order No: P-000982-2



Test Method:	Notes:
One Dimensional Consolidation Test: NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.27hr intervals All information provided by client

Date tested : 05-08/04/22  
 Date reported : 21/04/22

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Thirushen Pillay  
 Senior Civil Engineering Technician  
 Date : 21/04/22

CSF 2120 (10/20)



PLASTICITY INDEX FOR SOILS  
TEST REPORT



Project : Villa Maria  
 Location : Villa Maria Mangere  
 Client : Initia Limited  
 Contractor : Not Stated  
 Sampled by : Bruno  
 Date sampled : 04-26/03/22  
 Sampling method : Push tube  
 Sample description : Brown; clayey SILT with organics; Wet  
 Sample condition : As Received  
 Sample reference: BH110-02  
 Sample depth: 4.50 - 4.95 m  
 Specific depth: 4.80 - 4.95 m

Project No : 1-LA636.00  
 Lab Ref No : AL7487/5  
 Client Ref No : P-000982-2  
 Order No : P-000982-2

Test Results	
Liquid Limit :	446
Plastic Limit :	143
Plasticity Index :	303
Natural Water Content :	265.2

Test Methods	Notes
Liquid Limit	NZS 4402 : 1986, Test 2.2
Plastic Limit	NZS 4402 : 1986, Test 2.3
Plasticity Index	NZS 4402 : 1986, Test 2.4
Water Content	NZS 4402 : 1986, Test 2.1
	Materials used: Passing 425um sieve
	All information supplied by Client

Date tested : 21/04/22  
 Date reported : 22/04/22

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
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*Thirushen Pillay*

Designation : Senior Civil Engineering Technician

Date : 22/04/22



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ORGANIC CONTENT  
TEST REPORT



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sampled by: Bruno  
 Sampling method: Push Tube  
 Sample description: Brown; clayey SILT with organics; Wet  
 Sample condition: As Received  
 Sample reference: BH110-02  
 Sample depth: 4.50 - 4.95 m  
 Specific depth: 4.65 - 4.80 m

Date sampled: 04-26/03/22

Project number: 1-LA636.00  
 Lab ref number: AL7487/6  
 Client ref number: P-000982-2  
 Order number: P-000982-2

Test Results

Organic Content (%): 20

Test Methods	Notes
Organic Content: NZS 4402 : 1986 : Test 3.1.2	Sample descriptions are not covered by IANZ All information supplied by Client Sample taken for this test has more moisture content than it's related atterberg limit test.

Date tested : 11/04/22  
 Date reported : 22/04/22

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
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 Designation : Senior Civil Engineering Technician  
 Date : 22/04/22



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**WATER CONTENT  
TEST REPORT**



Project : Villa Maria  
 Location : Villa Maria Mangere  
 Client : Initia Limited  
 Contractor : Not Stated  
 Sampled by : Bruno  
 Date sampled : 04-26/03/22  
 Date Received: 1/04/2022  
 Sampling method : Push tube  
 Sample description : See below  
 Sample condition : As Received

Project No :	1-LA636.00
Lab Ref No :	AL7487/7-8
Client Ref No :	P-000982-2

**Test Results**

Laboratory Reference	Sample Reference	Sample Description	Depth of Sample (m)	Water Content %
AL7487/7	BH02-01	Organic silts and Peat	1.50 - 1.95	210.1
AL7487/8	BH107-01	Organic silts and Peat	1.50 - 1.95	734.4

Laboratory Reference	Specific Depth(m)
AL7366/7	1.85 - 1.95
AL7366/8	1.85 - 1.95

**Test Method**

NZS 4402: 1986 Test 2.1  
 All information provided by client

Date tested : 14/04/22  
 Date reported : 21/04/22

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
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 All information supplied by Client

**IANZ Approved Signatory**

Thirushen Pillay  
 Designation : Senior Civil Engineering Technician  
 Date : 21/04/22



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**ONE DIMENSIONAL CONSOLIDATION PROPERTIES  
TEST RESULT REPORT**



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH104A-01  
 Sample depth: 1.50-1.95m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sampling method: Push Tube  
 Sample description: Peat  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17D

Specimen depth: 1.80-1.85m

Project No: 1-LA636.00  
 Lab Ref No: AL7487/9  
 Client ref: P-000982-2  
 Order No: P-000982-2

**SOIL PROPERTIES**

Specimen Dimensions:		Initial Wet Density	pbi (t/m <sup>3</sup> )	0.97
Diameter (mm):	50.20	Initial Dry Density	pdi (t/m <sup>3</sup> )	0.11
Initial height (mm):	19.78	Final Dry Density	pdf (t/m <sup>3</sup> )	0.27
Final height (mm):	8.23	Initial Void Ratio	eo	23.28
Initial mass of sample (g):	38.10	Final Void Ratio	ef	9.10
Note: ** Void ratio is not IANZ Accredited due to Solid Density value being assumed.		Initial Degree of Saturation	Si (%)	90
		Final Degree of Saturation	Sf (%)	94
		Solid Particle Density	*Gs (t/m <sup>3</sup> )	2.75
		INITIAL Water Content	Wi (%)	759.3
		FINAL Water Content	Wf (%)	312.5

\*Gs is Assumed

**CONSOLIDATION PROPERTIES**

PRESSURE RANGE (kPa)	Pressure Increment (dp)	**Void Ratio (e)	Intercept t90 (min)	Volume Compressibility Mv=m <sup>2</sup> /MN	Coefficient of Consolidation Cv=m <sup>2</sup> /year	Coeff. of Permeability k=m/year
0 - 12.5	12.5	22.07	1.22	-	-	-
12.5 - 25	12.5	19.91	7.46	7.50	5.30	0.390
25 - 50	25	16.89	5.99	5.80	5.40	0.300
50 - 100	50	13.49	12.77	3.80	1.80	0.069
100 - 200	100	10.73	20.00	1.90	0.77	0.014
200 - 400	200	8.70	13.84	0.86	0.73	0.006
400 - 200	-	8.93	-	-	-	-
200 - 50	-	9.10	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Test Methods:	Notes:
One Dimensional Consolidation Test. NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.75hr intervals Square root of time fitting method was used for Cv calculations All information provided by client
Water Content NZS 4402:1986 Test 2.1	

Date tested : 05-08/04/22  
 Date reported : 21/04/22

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*Thirushen Pillay*

Designation : Senior Civil Engineering Technician

Date : 21/04/22

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ONE DIMENSIONAL CONSOLIDATION PROPERTIES

Applied Pressure vs Void Ratio TEST REPORT

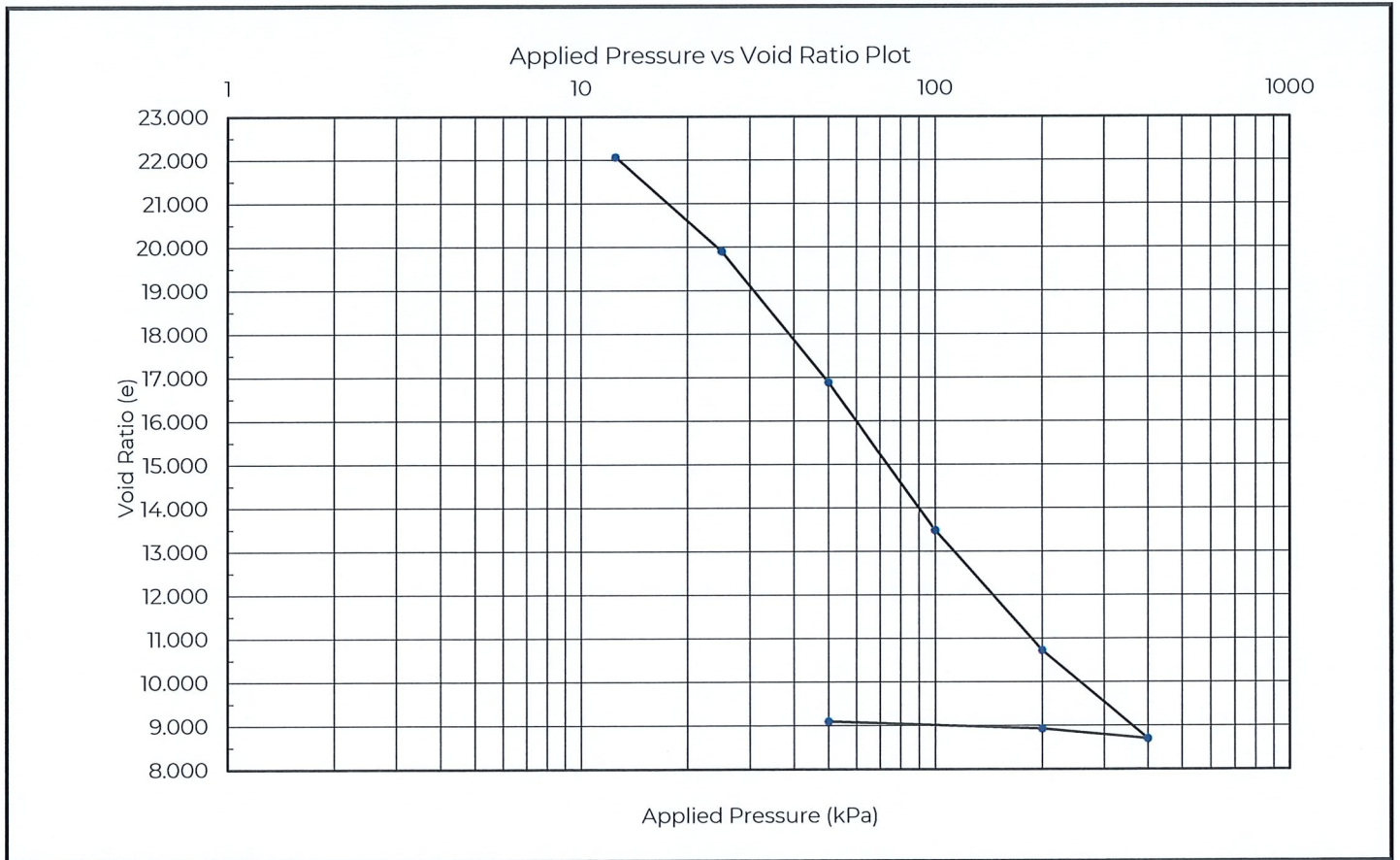


Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH104A-01  
 Sample depth: 1.50-1.95m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sample description: Peat

Specimen depth: 1.80-1.85m

Sampling method: Push Tube  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17D

Project number: 1-LA636.00  
 Lab ref number: AL7487/9  
 Client ref: P-000982-2  
 Order No: P-000982-2



Test Method:	Notes:
One Dimensional Consolidation Test: NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.75hr intervals All information provided by client

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date tested : 05-08/04/22  
 Date reported : 21/04/22

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 Senior Civil Engineering Technician  
 Date : 21/04/22



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CSF 2120 (10/20)

Page 2 of 2

**ONE DIMENSIONAL CONSOLIDATION PROPERTIES  
TEST RESULT REPORT**



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH104A-02  
 Sample depth: 3.00-3.45m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sampling method: Push Tube  
 Sample description: Brown; organic clayey SILT  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17C

Specimen depth: 3.25-3.35m

Project No: 1-LA636.00  
 Lab Ref No: AL7487/10  
 Client ref: P-000982-2  
 Order No: P-000982-2

**SOIL PROPERTIES**

Specimen Dimensions:		Initial Wet Density	pbi (t/m <sup>3</sup> )	1.11
Diameter (mm):	50.34	Initial Dry Density	pdi (t/m <sup>3</sup> )	0.26
Initial height (mm):	16.00	Final Dry Density	pdf (t/m <sup>3</sup> )	0.53
Final height (mm):	7.70	Initial Void Ratio	eo	9.76
Initial mass of sample (g):	35.40	Final Void Ratio	ef	4.17
Note: ** Void ratio is not IANZ Accredited due to Solid Density value being assumed.		Initial Degree of Saturation	Si (%)	94
		Final Degree of Saturation	Sf (%)	95
		Solid Particle Density	*Gs (t/m <sup>3</sup> )	2.75
		INITIAL Water Content	Wi (%)	334.7
		FINAL Water Content	Wf (%)	143.7

\*Gs is Assumed

**CONSOLIDATION PROPERTIES**

PRESSURE RANGE (kPa)	Pressure Increment (dp)	**Void Ratio (e)	Intercept t90 (min)	Volume Compressibility Mv=m <sup>2</sup> /MN	Coefficient of Consolidation Cv=m <sup>2</sup> /year	Coeff. of Permeability k=m/year
0 - 12.5	12.5	8.97	72.81	-	-	-
12.5 - 25	12.5	8.02	268.44	7.60	0.09	0.007
25 - 50	25	6.95	283.83	4.80	0.07	0.003
50 - 100	50	5.63	249.89	3.30	0.06	0.002
100 - 200	100	4.54	172.86	1.60	0.06	0.001
200 - 400	200	3.68	122.18	0.78	0.06	0.000
400 - 200	-	3.78	-	-	-	-
200 - 50	-	4.17	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Test Methods:	Notes:
One Dimensional Consolidation Test. NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.75hr intervals Square root of time fitting method was used for Cv calculations All information provided by client
Water Content NZS 4402:1986 Test 2.1	

Date tested : 05-08/04/22      Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
 Date reported : 21/04/22      This report may only be reproduced in full

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*Thirushen Pillay*

Designation : Senior Civil Engineering Technician

Date : 21/04/22

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ONE DIMENSIONAL CONSOLIDATION PROPERTIES

Applied Pressure vs Void Ratio TEST REPORT

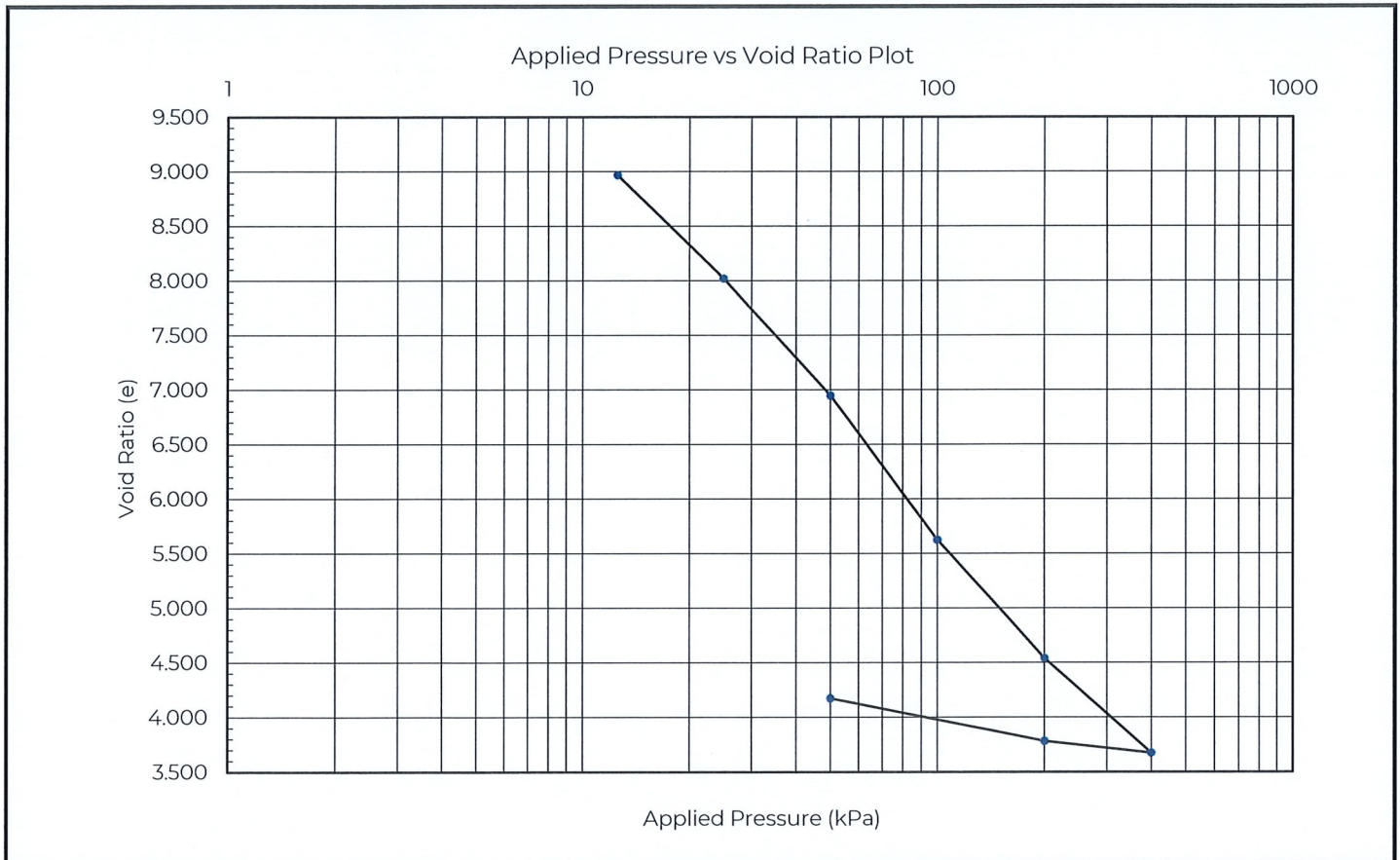


Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH104A-02  
 Sample depth: 3.00-3.45m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sample description: Brown; organic clayey SILT

Specimen depth: 3.25-3.35m

Sampling method: Push Tube  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17C

Project number: 1-LA636.00  
 Lab ref number: AL7487/10  
 Client ref: P-000982-2  
 Order No: P-000982-2



Test Method:	Notes:
One Dimensional Consolidation Test: NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.75hr intervals All information provided by client

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date tested : 05-08/04/22  
 Date reported : 21/04/22

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*Thirushen Pillay*  
 Senior Civil Engineering Technician  
 Date : 21/04/22



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**ONE DIMENSIONAL CONSOLIDATION PROPERTIES  
TEST RESULT REPORT**



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH106-01  
 Sample depth: 1.50-1.95m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sampling method: Push Tube  
 Sample description: Brown; clayey SILT  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17CS1

Specimen depth: 1.75-1.80m

Note: This report is not IANZ Accredited due to the length of the loadings. Client requested 1-2hours per a loadings. Should have went for 24hours. Plots were interpolated.

Project No: 1-LA636.00  
 Lab Ref No: AL7487/11  
 Client ref: P-000982-2  
 Order No: P-000982-2

**SOIL PROPERTIES**

Specimen Dimensions:		Initial Wet Density	pbi (t/m <sup>3</sup> )	1.08
Diameter (mm):	50.06	Initial Dry Density	pdi (t/m <sup>3</sup> )	0.23
Initial height (mm):	19.96	Final Dry Density	pdf (t/m <sup>3</sup> )	0.51
Final height (mm):	8.96	Initial Void Ratio	eo	11.03
Initial mass of sample (g):	42.60	Final Void Ratio	ef	4.40
Note: ** Void ratio is not IANZ Accredited due to Solid Density value being assumed.		Initial Degree of Saturation	Si (%)	93
		Final Degree of Saturation	Sf (%)	95
		Solid Particle Density	*Gs (t/m <sup>3</sup> )	2.75
		INITIAL Water Content	Wi (%)	374.3
		FINAL Water Content	Wf (%)	152.4
*Gs is Assumed				

**CONSOLIDATION PROPERTIES**

PRESSURE RANGE (kPa)	Pressure Increment (dp)	**Void Ratio (e)	Intercept t90 (min)	Volume Compressibility Mv=m <sup>2</sup> /MN	Coefficient of Consolidation Cv=m <sup>2</sup> /year	Coeff. of Permeability k=m/year
0 - 12.5	12.5	9.88	224.63	-	-	-
12.5 - 25	12.5	8.85	309.76	7.60	0.12	0.009
25 - 50	25	7.59	361.00	5.10	0.08	0.004
50 - 100	50	6.19	324.00	3.30	0.07	0.002
100 - 200	100	4.95	320.41	1.70	0.05	0.001
200 - 400	200	3.91	254.06	0.87	0.04	0.000
400 - 200	-	4.00	-	-	-	-
200 - 50	-	4.40	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Test Methods:	Notes:
One Dimensional Consolidation Test. NZS 4402:1986 Test 7.1	Sample is saturated during test.
Water Content NZS 4402:1986 Test 2.1	Load Increments applied at 3.27hr intervals
	Square root of time fitting method was used for Cv calculations
	All information provided by client

Date tested : 11-14/04/22  
 Date reported : 21/04/22

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Approved  
 Thirusen Pillay  
 Designation : Senior Civil Engineering Technician  
 Date : 21/04/22  
 CSF 2120 (10/20)



ONE DIMENSIONAL CONSOLIDATION PROPERTIES

Applied Pressure vs Void Ratio TEST REPORT

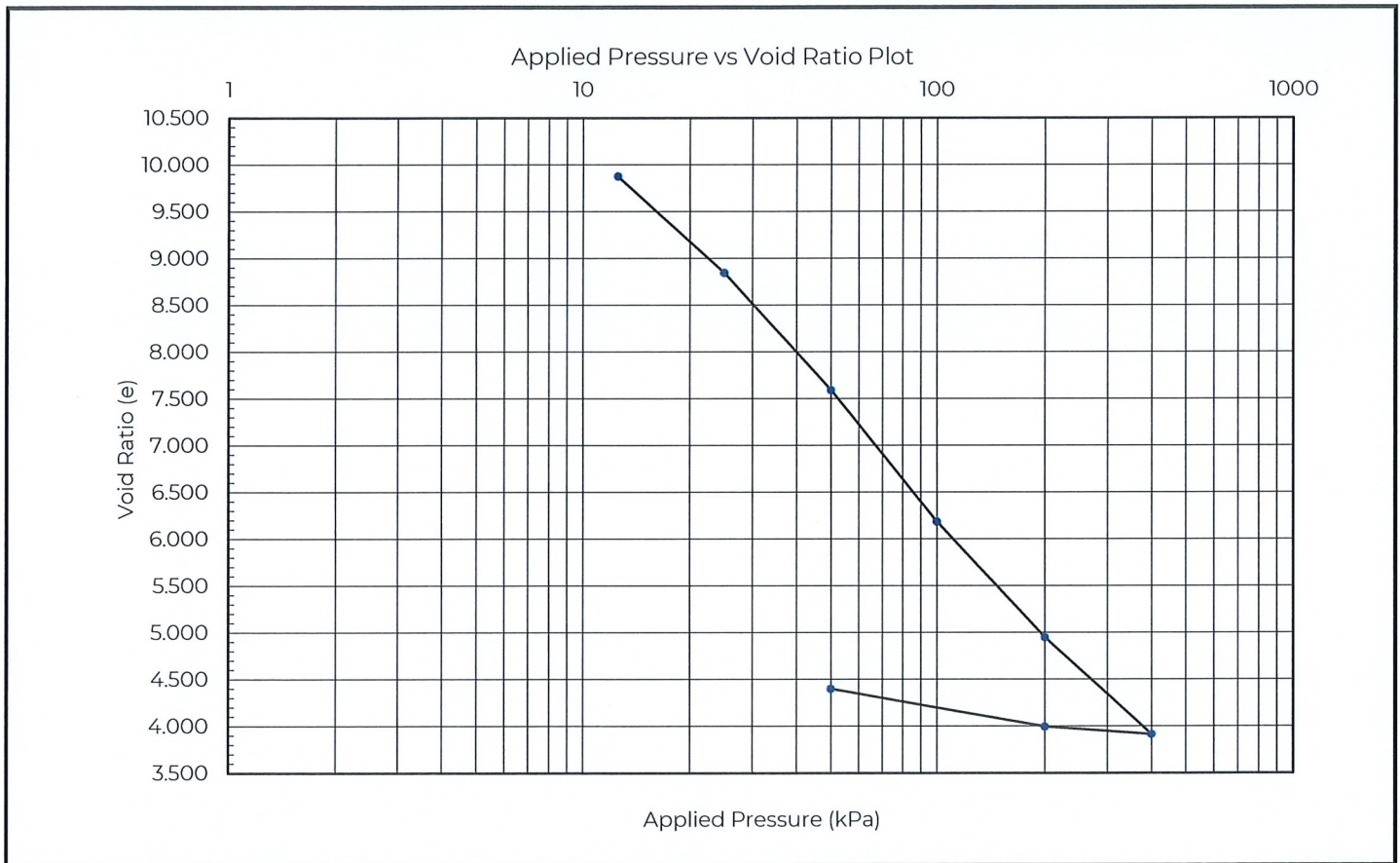


Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH106-01  
 Sample depth: 1.50-1.95m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sample description: Brown; clayey SILT  
 Sampling method: Push Tube  
 Sample condition: As received  
 OEDOMETER APPARATUS No: SI7CS1

Specimen depth: 1.75-1.80m

Note: This report is not IANZ Accredited due to the length of the loadings. Client requested 1-2hours per a loadings. Should have went for 24hours. Plots were interpolated.

Project number: 1-LA636.00  
 Lab ref number: AL7487/11  
 Client ref: P-000982-2  
 Order No: P-000982-2



Test Method:	Notes:
One Dimensional Consolidation Test: NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.27hr intervals All information provided by client

Date tested : 11-14/04/22  
 Date reported : 21/04/22

This report may only be reproduced in full

Approved  
 Thirushen Pillay  
 Senior Civil Engineering Technician  
 Date : 21/04/22

CSF 2120 (10/20)

**ONE DIMENSIONAL CONSOLIDATION PROPERTIES  
TEST RESULT REPORT**



Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH108-01  
 Sample depth: 3.00-3.43m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sampling method: Push Tube  
 Sample description: Brown; clayey SILT  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17CS2

Specimen depth: 3.38-3.43m

Project No:	1-LA636.00
Lab Ref No:	AL7487/12
Client ref:	P-000982-2
Order No:	P-000982-2

**SOIL PROPERTIES**

Specimen Dimensions:		Initial Wet Density	pbi (t/m <sup>3</sup> )	1.12
Diameter (mm):	50.02	Initial Dry Density	pdi (t/m <sup>3</sup> )	0.28
Initial height (mm):	20.00	Final Dry Density	pdf (t/m <sup>3</sup> )	0.57
Final height (mm):	10.02	Initial Void Ratio	eo	8.69
Initial mass of sample (g):	43.98	Final Void Ratio	ef	3.85
Note: ** Void ratio is not IANZ Accredited due to Solid Density value being assumed.		Initial Degree of Saturation	Si (%)	93
		Final Degree of Saturation	Sf (%)	93
		Solid Particle Density	*Gs (t/m <sup>3</sup> )	2.75
		INITIAL Water Content	Wi (%)	294.3
		FINAL Water Content	Wf (%)	130.8
		*Gs is Assumed		

**CONSOLIDATION PROPERTIES**

PRESSURE RANGE (kPa)	Pressure Increment (dp)	**Void Ratio (e)	Intercept t90 (min)	Volume Compressibility Mv=m <sup>2</sup> /MN	Coefficient of Consolidation Cv=m <sup>2</sup> /year	Coeff. of Permeability k=m/year
0 - 12.5	12.5	8.17	64.99	-	-	-
12.5 - 25	12.5	7.37	188.18	7.0	0.21	0.014
25 - 50	25	6.25	156.50	5.30	0.21	0.011
50 - 100	50	5.14	108.24	3.10	0.23	0.007
100 - 200	100	4.27	66.97	1.40	0.27	0.004
200 - 400	200	3.56	44.47	0.67	0.30	0.002
400 - 200	-	3.62	-	-	-	-
200 - 50	-	3.85	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Test Methods:	Notes:
One Dimensional Consolidation Test. NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.27hr intervals Square root of time fitting method was used for Cv calculations All information provided by client
Water Content NZS 4402:1986 Test 2.1	

Date tested: 11-14/04/22      Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.  
 Date reported: 21/04/22      This report may only be reproduced in full

IANZ Approved Signatory  
 Thirushen Pillay  
 Designation: Senior Civil Engineering Technician  
 Date: 21/04/22



Test results indicated as not accredited are outside the scope of the laboratory's accreditation

ONE DIMENSIONAL CONSOLIDATION PROPERTIES

Applied Pressure vs Void Ratio TEST REPORT



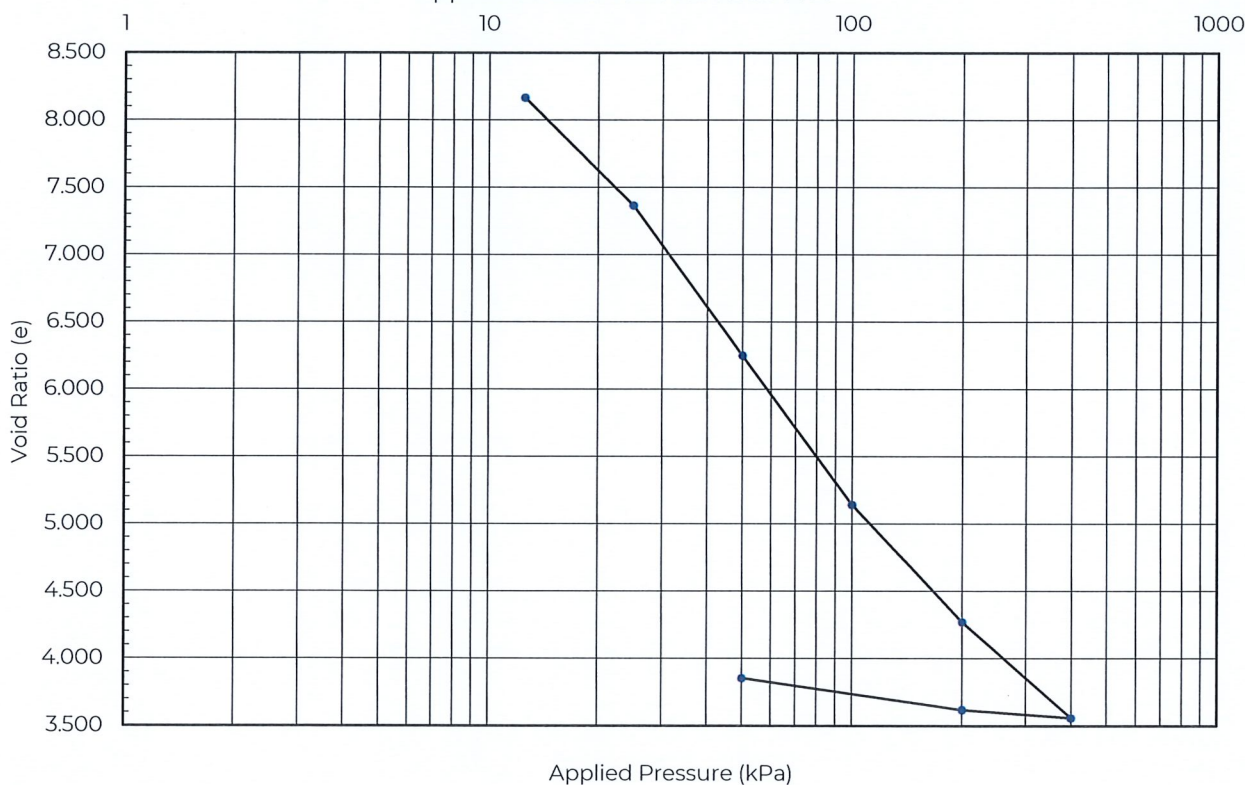
Project: Villa Maria  
 Location: Villa Maria Mangere  
 Client: Initia Limited  
 Contractor: Not Stated  
 Sample reference: BH108-01  
 Sample depth: 3.00-3.43m  
 Sampled by: Bruno  
 Date sampled: 04-26/03/22  
 Sample description: Brown; clayey SILT

Specimen depth: 3.38-3.43m

Sampling method: Push Tube  
 Sample condition: As received  
 OEDOMETER APPARATUS No: S17CS2

Project number: 1-LA636.00  
 Lab ref number: AL7487/12  
 Client ref: P-000982-2  
 Order No: P-000982-2

Applied Pressure vs Void Ratio Plot



Test Method:	Notes:
One Dimensional Consolidation Test: NZS 4402:1986 Test 7.1	Sample is saturated during test. Load Increments applied at 3.27hr intervals All information provided by client

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date tested : 11-14/04/22  
 Date reported : 21/04/22

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IANZ Approved Signatory

*Thirushen Pillay*  
 Senior Civil Engineering Technician  
 Date : 21/04/22



Test results indicated as not accredited are outside the scope of the laboratory's accreditation

CSF 2120 (10/20)

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## Appendix GFR-D: Historical Investigation Results

- D1 - Harrison Grierson
- D2 - CMW Geosciences



# BOREHOLE LOG - HA01-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Logged by: HN	Position: E.1757384.0m N.5906424.0m	Elevation: RL 13.70m	Hole Diameter: 50mm
Checked by: MJC	Survey Source: Hand Held GPS (NZTM)	Datum: AUCKHT1946	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)			Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks	
		Depth	Type & Results									5	10	15		
				13.7 13.6			TOPSOIL GM: Gravelly silty SAND: Dark brown. Dense. Gravel comprises mostly black volcanic clasts up to 10mm and rare grey silty clasts. Gravel more abundant in some layers. (Lithic Tuff)									
		0.4	Peak = UTP					D to M	D		HA					
		0.8	Peak = UTP													
							Borehole terminated at 0.8 m								20	

Termination reason: Difficult drilling in dense sands.

Remarks: No groundwater encountered.

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

# BOREHOLE LOG - HA02-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Logged by: HN Position: E.1757470.0m N.5906468.0m Elevation: RL 10.30m Hole Diameter: 50mm  
 Checked by: MJC Survey Source: Hand Held GPS (NZTM) Datum: AUCKHT1946 Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)			Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results									5	10	15	
				10.3			TOPSOIL								
				10.2			ML: Sandy SILT: Dark greyish brown with trace subangular to subrounded gravel up to 10mm. Low plasticity. (Lithic Tuff)			H					
		0.4	Peak = UTP							M					
		0.8	Peak = UTP				... at 0.70m, ...becoming silty SAND with occasional gravelly beds of black vesicular airfall clasts.				HA				
		1.2	Peak = UTP				Borehole terminated at 1.2 m							18	
														20	

Termination reason: Refusal on hard ground.

Remarks: No groundwater encountered.



# BOREHOLE LOG - HA04-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Logged by: HN	Position: E.1757506.0m N.5906429.0m	Elevation: RL 8.00m	Hole Diameter: 50mm
Checked by: MJC	Survey Source: Hand Held GPS (NZTM)	Datum: AUCKHT1946	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results										
				8.0			TOPSOIL						
		0.4	Peak = UTP	8.0			SM: Silty SAND: Dark greyish brown with trace subangular to subrounded gravel up to 10mm and rare weathered silty clasts. Medium dense. (Fill)	M	VL		HA	1, 2, 2, 4, 4, 4, 4, 5	
		0.8	Peak = UTP	7.5			SM: Silty SAND: Brown with trace rootlets. Medium dense. (Lithic Tuff)	M	MD			9	
							Borehole terminated at 0.8 m					19, 20, 20, 20	
					1								
					2								
					3								
					4								
					5								

Termination reason: Refusal on hard ground.

Remarks: No groundwater encountered.



# BOREHOLE LOG - HA05-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Logged by: TK	Position: E.1757435.0m N.5906309.0m	Elevation: RL 7.60m	Hole Diameter: 50mm
Checked by: MJC	Survey Source: Hand Held GPS (NZTM)	Datum: AUCKHT1946	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)			Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results									5	10	15	
				7.6			TOPSOIL								
		0.4	Peak = 79kPa Residual = 22kPa	7.3			CL: Silty CLAY: Brown mottled orange with trace gravel, cobbles and rootlets. Low plasticity. (Tauranga Group Alluvium)		St						
		0.8	Peak = 117kPa Residual = 19kPa				... at 0.60m, ...with trace carbonaceous inclusions.								
		1.2	Peak = UTP				... at 1.30m, ...becoming dark greyish brown with minor fine to medium gravel.		VSt		HA	8	9	12	
		1.6	Peak = 221+				... at 1.70m, ...becoming dark blackish brown with minor organic fragments (organic odour) and trace cobbles.		H			6	5	6	
		2.0	Peak = 221+				Borehole terminated at 2.0 m					12	9	11	
												19			
												4	6		
												3	5		
												3	3		
												5	8		
												10	9		
												8			
												5			
												3			
												3			
												6			
												6			
												7			
												7			
												10			
												6			
												11			
												9			
												9			
												17			
												12			
												20			

Termination reason: Refusal on cobbles.

Remarks: No groundwater encountered

# BOREHOLE LOG - HA06-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Well		Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)			Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
Groundwater	Depth	Type & Results	5									10	15		
				6.1		[Hatched pattern]	TOPSOIL								
		0.4	Peak = UTP	5.8		[Cross-hatched pattern]	MH: SILT minor clay: Brown mottled orange with trace gravel and cobbles. Low plasticity. (Tauranga Group Alluvium)	M	VSt to H		HA				
		0.8	Peak = UTP	5.2		[Cross-hatched pattern]	ML: Gravelly SILT: Dark grey. Low plasticity. (Tauranga Group Alluvium)	W							
					1		Borehole terminated at 0.9 m						20		

Termination reason: Refusal on hard ground.

Remarks: No groundwater encountered.

# BOREHOLE LOG - HA07-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Logged by: TK		Position: E.1757862.0m N.5906174.0m		Elevation: RL 7.50m		Hole Diameter: 50mm								
Checked by: MJC		Survey Source: Hand Held GPS (NZTM)		Datum: AUCKHT1946		Angle from horizontal: 90°								
Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks	
		Depth	Type & Results											
				7.5			TOPSOIL							
		0.4	Peak = 173kPa Residual = 28kPa	7.2			MH: Clayey SILT trace gravel and cobbles: Reddish brown. Low plasticity. (Tauranga Group Alluvium)							
		0.8	Peak = 173kPa Residual = 35kPa	7.0			CL: Silty CLAY: Greyish brown mottled orange with trace fine to medium gravel. Low plasticity. (Tauranga Group Alluvium)	M	VSt		HA			
		1.2	Peak = UTP	6.4			ML: Gravelly SILT: Dark grey mottled orange. Low plasticity. (Tauranga Group Alluvium) ... at 1.00m, ...fine to medium gravel becoming minor and becoming wet. ... at 1.30m, ...becoming wet to saturated.	W W to S	H					
							Borehole terminated at 1.5 m							
												15		
												12		
												19		
												9		
												15		
												20		
												8		
												20		

Termination reason: Refusal on hard ground.

Remarks: Groundwater encountered at 1.0m

# BOREHOLE LOG - HA08-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Well		Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
Groundwater	Depth	Type & Results											
				7.1			TOPSOIL:	M to W					
		0.4	Peak = 196kPa Residual = 47kPa	6.8			MH: Clayey SILT: Orangey brown with trace gravel and cobbles. Low plasticity. (Tauranga Group Alluvium)		VSt				
		0.8	Peak = UTP	6.4			CL: Silty CLAY: Greyish brown mottled orange with trace fine to medium gravel. Low plasticity. (Tauranga Group Alluvium)	M			HA		
		1.2	Peak = 142kPa Residual = 28kPa	6.2			MH: SILT minor clay: Brown mottled orange with trace fine gravel. Low plasticity. (Tauranga Group Alluvium)	H					
							... at 1.10m, ...becoming light brown mottled brown.						
				5.8			ML: Gravelly SILT: Dark grey. Low plasticity. (Tauranga Group Alluvium)	w...	VSt				
							Borehole terminated at 1.4 m					20	

Termination reason: Refusal on hard ground.

Remarks: No groundwater encountered

# BOREHOLE LOG - HA09-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 2

Logged by: HN/TK		Position: E.1757912.0m N.5905986.0m		Elevation: RL 8.30m		Hole Diameter: 50mm							
Checked by: MJC		Survey Source: Hand Held GPS (NZTM)		Datum: AUCKHT1946		Angle from horizontal: 90°							
Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
		Depth	Type & Results										
				8.3			Gravelly TOPSOIL						
		0.4	Peak = UTP on gravel	8.2			MH: SILT: Dark brown with some hard subrounded clasts up to 15mm and occasional black vesicular clasts. Low plasticity. (Lithic Tuff)						0.0-0.4m: Spade used to excavate first 400mm due to difficult drilling. 0.3-3.0m: DCP beside hole.
		0.8	Peak = UTP on gravel										
		1.2	Peak = 186kPa Residual = 34kPa				... at 1.10m, ...with trace clay. Gravel less prominent.						
		1.6	Peak = 140+	6.9			MH: Clayey SILT trace very fine sand: Dark brown with occasional volcanic clasts intermixed. Crumbly. Low plasticity. (Lithic Tuff)						
		2.0	Peak = 140+	6.5			CH: Silty CLAY: Brown with white specks. High plasticity. (Tauranga Group Alluvium)						
		2.4	Peak = UTP on gravel	6.2			MH: Clayey SILT: Light brownish grey with common subangular to subrounded clasts intermixed. Low plasticity. (Tauranga Group Alluvium) CH: Silty CLAY: Light greyish brown with some volcanic clasts up to 20mm. High plasticity. (Tauranga Group Alluvium)						
		2.8	Peak = UTP on gravel	6.1			... at 2.50m, ...with trace rootlets and rare dark brownish black laminations. ... at 2.70m, ...becoming sandy CLAY.						
		3.2	Peak = 155kPa Residual = 34kPa	5.5			ML: Clayey SAND: Dark reddish brown with trace gravel. Loosely packed. (Lithic Tuff) ... at 3.00m, ...intermixed with dark grey clayey sand. ... at 3.10m, ...grading into dark grey very coarse clayey sand with some very fine gravel sizes. Loosely packed but cohesive clays.						
		3.6	Peak = UTP										3.6-3.8m: DCP at base of hole. 3.6-5.4m: Poor returns and difficult drilling. No shear vane testing due to DCP.
				4.0			MH: Sandy clayey SILT grading to silty CLAY: Dark grey to greyish brown. Rare black inclusions. Low plasticity silts. High plasticity clays. (Tauranga Group Alluvium)						

Termination reason: Poor returns and caving.

Remarks: Groundwater encountered at 3.6m

# BOREHOLE LOG - HA09-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 2 of 2

Logged by: HN/TK	Position: E.1757912.0m N.5905986.0m	Elevation: RL 8.30m	Hole Diameter: 50mm
Checked by: MJC	Survey Source: Hand Held GPS (NZTM)	Datum: AUCKHT1946	Angle from horizontal: 90°

Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results										
							Borehole terminated at 5.4 m						

Termination reason: Poor returns and caving.

Remarks: Groundwater encountered at 3.6m

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

# BOREHOLE LOG - HA10-09

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 19/07/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Logged by: HN/TK		Position: E.1757945.0m N.5906071.0m		Elevation: RL 13.20m		Hole Diameter: 50mm						
Checked by: MJC		Survey Source: Hand Held GPS (NZTM)		Datum: AUCKHT1946		Angle from horizontal: 90°						
Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results									
				13.2		TOPSOIL						
		0.4	Peak = UTP on gravel	13.2	X X X X	MH: SILT: Dark brown to dark reddish brown with some subangular to subrounded clasts up to 10mm. Low plasticity. (Lithic Tuff)	D					
		0.8	Peak = UTP on gravel		X X X X	... at 0.30m, ...with trace clay. Gravel becoming common and up to 20mm.						
		1.2	Peak = UTP		X X X X	... at 0.70m, ...becoming fine SAND trace silt.						
		1.6	Peak = UTP	11.9	X X X X	ML: Silty SAND to sandy SILT: Brown and homogeneous. Low plasticity. (Lithic Tuff)	D to M					
		2.0	Peak = UTP		X X X X	... at 1.90m, ...with trace clay.						
		2.4	Peak = UTP	10.8	X X X X	... at 2.20m, ...occasional beds with subrounded gravel up to 5mm.	H		HA			
		2.8	Peak = 217+		X X X X	ML: Silty SAND: Dark greyish brown with volcanic clasts up to 20mm. (Lithic Tuff)						
		3.2	Peak = 217+	10.3	X X X X	MH: Clayey SILT minor sand and fine gravel: Dark greyish brown. Low plasticity. (Tauranga Group Alluvium)						
		3.6	Peak = 217+		X X X X							3.6m: Hard drilling.
		4.0	Peak = 217+		X X X X		M					
		4.4	Peak = 217+		X X X X							
						Borehole terminated at 4.4 m					20	
											22	
											20	

Termination reason: Gravel collapse down hole.

Remarks: No groundwater encountered

# BOREHOLE LOG - HA11-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 07/08/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 2

Logged by: HN		Position: E.1757372.0m N.5906251.0m		Elevation: RL 7.20m		Hole Diameter: 50mm							
Checked by: MJC		Survey Source: Hand Held GPS (NZTM)		Datum: AUCKHT1946		Angle from horizontal: 90°							
Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks	
		Depth	Type & Results										RL (m)
08-08-2019	▲	0.4	Peak = UTP	7.2	[Graphic Log]	TOPSOIL	M						
		0.8	Peak = 170kPa Residual = 15kPa Peak = Clast interference	7.0		MH: Clayey SILT: Dark greyish brown with trace subrounded to subangular gravel up to 10mm. Trace rootlets and black organic specks. Low plasticity. (Fill?)	D to M	VSt				0.5m: Surface of sample coming up wet. Inner sample dry to moist.	
		1.2	Peak = UTP	6.2		CH: Sandy gravelly CLAY: Dark grey and highly plastic. Coarse sand to medium sized gravel clasts, subrounded to subangular. Rare very fine rootlets. (Tauranga Group Alluvium)						1.0m: Poor to no returns.	
		2.0	Peak = UTP on clasts	1.2		... at 1.50m, ...occasional gravel up to 20mm.			HA				1.5m: DCP through clast.
		3.2	Peak = 65kPa Residual = 46kPa	4.9		MH: Clayey SILT: Dark reddish brownish black. High plasticity. (Organic?) (Tauranga Group Alluvium)	M						2.3m: DCP through clast. Continued drilling with poor to no returns and soft.
				3		... at 2.80m, ...with roots.	F to St					2.8m: Can push auger down without drilling.	
				3.2		Borehole terminated at 3.2 m						3.2-3.7m: DCP sunk from self-weight. 3.2m: Could push shear vane down by hand to 3.8m.	
				4								3.7-5.3m: Muck and roots on tip of DCP. Organic odour.	
				5									

Termination reason: Difficult drilling through muck and held up on shallow gravel.

Remarks: Groundwater encountered at 0.5m



# BOREHOLE LOG - HA11-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 07/08/2019  
 Borehole Location: See site plan



1:25 Sheet 2 of 2

Logged by: HN		Position: E.1757372.0m N.5906251.0m		Elevation: RL 7.20m		Hole Diameter: 50mm							
Checked by: MJC		Survey Source: Hand Held GPS (NZTM)		Datum: AUCKHT1946		Angle from horizontal: 90°							
Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results										
					6							5 10 15	
					7								
					8								
					9								
					10								

Termination reason: Difficult drilling through muck and held up on shallow gravel.  
 Remarks: Groundwater encountered at 0.5m  
 This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# BOREHOLE LOG - HA12-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 07/08/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Logged by: HN		Position: E.1757311.0m N.5906198.0m		Elevation: RL 8.30m		Hole Diameter: 50mm							
Checked by: MJC		Survey Source: Hand Held GPS (NZTM)		Datum: AUCKHT1946		Angle from horizontal: 90°							
Well	Groundwater	Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results										
				8.3			TOPSOIL	M					
				8.2			MH: Clayey SILT: Brown laminated orangey brown and dark brown with trace rootlets. High plasticity. (Ash)	D to M					
		0.4	Peak = UTP	7.9			CH: Silty CLAY: Dark brown with trace fine gravel sized volcanic clasts. High plasticity. (Ash) ... at 0.50m, ...with trace sand.	M	H		HA		0.4m: Difficult drilling and poor returns.
		0.8	Peak = UTP	7.6			ML: Clayey SILT trace sand: Dark brown with some fine to medium gravel sized clasts (predominantly black vesicular volcanics, occasionally grey silty clasts, rare pumiceous fragments). Low plasticity. (Lithic Tuff)	D					
		1.0	Peak = UTP	1			Borehole terminated at 1.0 m						

Termination reason: Refusal on hard ground.  
 Remarks: No groundwater encountered.  
 This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# BOREHOLE LOG - HA13-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 07/08/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Well		Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
Groundwater	Depth	Type & Results											
				12.7			Gravelly TOPSOIL	D					
		0.4	Peak = UTP on clasts	12.5			MH: Clayey SILT: Reddish brown with trace black and grey subangular fine to medium gravel sized volcanic clasts and rare pumiceous fragments. Low plasticity. (Lithic Tuff)	H			HA		0.5m: Hand sample is loose sand, but inferred to be welded in-situ.
		0.8	Peak = UTP	12.2			SC: Gravelly clayey SAND: Dark brown with some black vesicular lapilli. Dense. (Lithic Tuff)	M					
							Borehole terminated at 0.8 m	D					
					1							13	
												14	
												20	
					2								
					3								
					4								
					5								

Termination reason: Difficult drilling on hard ground.

Remarks: No groundwater encountered.

# BOREHOLE LOG - HA14-19

Client: Villa Maria Estate Ltd  
 Project: Villa Maria - Montgomerie Road & Northern Blocks  
 Site Location: Mangere  
 Project No.: AKL2019-0121  
 Date: 07/08/2019  
 Borehole Location: See site plan



1:25 Sheet 1 of 1

Well		Samples & Insitu Tests		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	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
Groundwater	Depth	Type & Results											
				16.6			TOPSOIL						
		0.4	Peak = UTP	16.6			MH: Clayey SILT: Dark brown with some fine to medium gravel sized volcanic clasts. Low plasticity. (Fill)	D to M	H				
		0.8	Peak = UTP	16.2			SC: Gravelly clayey SAND: Dark brown. Fine to coarse gravel sized volcanic clasts. Dense. (Lithic Tuff)						
							... at 0.80m, ...occasional thin brown silty (ash?) layers.	M	D		HA	8	0.8m: DCP through hard ground. Encountered 6 blows/100mm at 1.1m inferred thin ash layer.
		1.2	Peak = UTP				... at 1.20m, ...becoming moist to wet. Possible slow seepage (no pooling).	M to W				6	1.1m: 6 blows/100mm inferred thin ash layer.
							Borehole terminated at 1.5 m					15	
												20	

Termination reason: Refusal on hard ground.

Remarks: No groundwater encountered.

# HAND AUGER BOREHOLE LOG - HA01-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: AA Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757378.3mE; 5906105.5mN Projection: NZTM  
 Elevation: 8.00m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			8.0			OL: TOPSOIL						
	0.4	Peak = 124kPa Residual = 28kPa		7.8		CL: Silty CLAY with some basalt rock fragments: dark orange brown mottled orange. Low Plasticity, rock fragments are fine to medium gravel sized. (Auckland Volcanics) ... at 0.40m, ...becoming brownish grey mottled orange and yellow	M	VSt				
				7.3		SC: Clayey fine to medium SAND with some basalt rock fragments: orange brown mottled yellow. Well graded, sub-angular, rock fragments are fine to medium gravel sized. (Auckland Volcanics) ... at 0.80m, ...becoming dark grey	W					
						Borehole terminated at 0.9 m	S	VD				
				1							15	
											20	

Termination Reason: To Hard To Continue Auguring

Shear Vane No: 2904 DCP No: 1

Remarks: Groundwater encountered at 0.7m. DCP Conducted from 0.9m to 1.1m.

# HAND AUGER BOREHOLE LOG - HA02-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: AA Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757416.6mE; 5906054.2mN Projection: NZTM  
 Elevation: 7.50m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)
	Depth	Type & Results							
			7.5			OL: TOPSOIL			
			7.4			SM: Silty fine to medium SAND: light brownish grey. Sub-angular, poorly graded. (Auckland Volcanics)			
	0.4	Peak = UTP				... from 0.40m to 3.60m, ...no sample recovery	M	VL	
	0.8	Peak = UTP				SW: Gravelly medium SAND: orange brown. Well graded, sub-angular, gravel is fine to medium basalt rock fragments. (Auckland Volcanics)		D	
			6.7						
				1				L	
				2				S	
				3				MD	
				4				VD	
				5				D	
						Borehole terminated at 3.6 m			

Termination Reason: To Hard To Continue Auguring

Shear Vane No: 2904 DCP No: 1

Remarks: Groundwater encountered at 0.8m. DCP conducted from 0.0m to 5.0m.

# HAND AUGER BOREHOLE LOG - HA03-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: AA Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757525.7mE; 5906045.3mN Projection: NZTM  
 Elevation: 6.50m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)					
	Depth	Type & Results							5	10	15			
			6.5	6.4		OL: TOPSOIL								
	0.4	Peak = 41kPa Residual = 14kPa				ML: Sandy SILT with trace basaltic rock fragments: light brownish orange. Low plasticity, basalt rock fragments are medium gravel sized. (Auckland Volcanics)	F							
	0.8	Peak = 55kPa Residual = 19kPa		5.9		Pt: PEAT: dark brownish black. Highly fibrous. (Tauranga Group)	St							
	1.2	Peak = 47kPa Residual = 6kPa		5.3		OH: Organic CLAY: Dark brownish black. High plasticity. (Tauranga Group)	W							
	1.6	Peak = 41kPa Residual = 14kPa												
	2.0	Peak = 33kPa Residual = 14kPa		2		... from 2.00m to 2.40m, ...with some fine to medium sand								
	2.4	Peak = 33kPa Residual = 10kPa												
	2.8	Peak = 41kPa Residual = 17kPa												
	3.2	Peak = 44kPa Residual = 11kPa		3		... from 3.00m to 5.00m, ...poor recovery								
	3.6	Peak = 39kPa Residual = 14kPa												
	4.0	Peak = 39kPa Residual = 14kPa		4										
	4.4	Peak = 50kPa Residual = 19kPa												
	4.8	Peak = 50kPa Residual = 28kPa												
				5		Borehole terminated at 5.0 m								

Termination Reason: Target Depth Reached

Shear Vane No: 2904 DCP No:

Remarks: Groundwater encountered at 1.3m.

# HAND AUGER BOREHOLE LOG - HA04-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: AA Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757677.4mE; 5906060.3mN Projection: NZTM  
 Elevation: 6.50m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			6.5			OL: TOPSOIL						
			6.4			MH: Sandy SILT: light brown. Low plasticity, sand is fine. (Auckland Volcanics)	D					
	0.4	Peak = 28kPa Residual = 6kPa					M					
			5.9			Pt: PEAT: dark brownish black. Highly fibrous (Tauranga Group)	F					
	0.8	Peak = 36kPa Residual = 11kPa					W					
			1									
	1.2	Peak = 19kPa Residual = 14kPa		5.3		OH: Organic CLAY : dark brownish black. High plasticity. (Tauranga Group)	S					
			1.6									
	1.6	Peak = 30kPa Residual = 17kPa										
			2.0									
	2.0	Peak = 33kPa Residual = 11kPa		2								
			2.4									
	2.4	Peak = 28kPa Residual = 14kPa					S					
			2.8			... from 2.50m to 3.70m, ... poor recovery	F					
	2.8	Peak = 33kPa Residual = 22kPa		3								
			3.2									
	3.2	Peak = 44kPa Residual = 19kPa										
			3.6			Borehole terminated at 3.6 m	H					
	3.6	Peak = UTP										20
				4								
				5								

Termination Reason: To Hard To Continue Auguring. Likely Basalt Boulder.

Shear Vane No: 2904 DCP No: 1

Remarks: Groundwater encountered at 1.1m. DCP conducted from 3.7m to 3.8m.



# HAND AUGER BOREHOLE LOG - HA05-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: AA Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757674.5mE; 5905953.6mN Projection: NZTM  
 Elevation: 5.50m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			5.5			OL: TOPSOIL						
			5.4			ML: Sandy SILT with trace organics: light brown. Low plasticity, sand is fine to medium. (Auckland Volcanics)	M	F				
	0.4	Peak = 33kPa Residual = 6kPa	5.2			Pt: PEAT: dark brownish black. Highly fibrous. (Tauranga Group)						
	0.8	Peak = 55kPa Residual = 17kPa					W	St				
			4.6			OH: Organic CLAY: dark brownish black. High plasticity. (Tauranga Group)						
	1.2	Peak = 44kPa Residual = 14kPa		1		... from 1.30m to 5.00m, ...poor recovery						
	1.6	Peak = 33kPa Residual = 14kPa										
	2.0	Peak = 33kPa Residual = 11kPa		2								
	2.4	Peak = 30kPa Residual = 8kPa										
	2.8	Peak = 28kPa Residual = 8kPa										
	3.2	Peak = 41kPa Residual = 14kPa		3			S	F				
	3.6	Peak = 44kPa Residual = 11kPa										
	4.0	Peak = 41kPa Residual = 17kPa		4								
	4.4	Peak = 33kPa Residual = 11kPa										
	4.8	Peak = 33kPa Residual = 14kPa										
				5		Borehole terminated at 5.0 m						

Termination Reason: Target Depth Reached

Shear Vane No: 2904 DCP No:

Remarks: Groundwater encountered at 1.0m.

# HAND AUGER BOREHOLE LOG - HA06-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: AA Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757547.8mE; 5905891.3mN Projection: NZTM  
 Elevation: 6.50m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			6.5			OL: TOPSOIL						
	0.4	Peak = 69kPa Residual = 14kPa	6.4			ML: Sandy SILT: light brown. Low Plasticity. (Auckland Volcanics)	M	St				
	0.8	Peak = 19kPa Residual = 8kPa	6.0			Pt: PEAT: dark brownish black. Highly fibrous. (Tauranga Group)	W	S				
	1.2	Peak = 33kPa Residual = 14kPa	5.3			OH: Organic CLAY with some sand: dark brownish black. High plasticity, sand is fine. (Tauranga Group)						
	1.6	Peak = 28kPa Residual = 11kPa										
	2.0	Peak = 30kPa Residual = 8kPa										
	2.4	Peak = 41kPa Residual = 14kPa										
	2.8	Peak = 44kPa Residual = 17kPa										
	3.2	Peak = 39kPa Residual = 19kPa					S	F				
	3.6	Peak = 47kPa Residual = 19kPa										
	4.0	Peak = 39kPa Residual = 14kPa										
	4.4	Peak = 47kPa Residual = 19kPa										
	4.8	Peak = 55kPa Residual = 28kPa						St				
						Borehole terminated at 5.0 m						

Termination Reason: Target Depth Reached

Shear Vane No: 2904 DCP No:

Remarks: Groundwater encountered at 0.9m.

# HAND AUGER BOREHOLE LOG - HA07-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: FS Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757442.0mE; 5905819.0mN Projection: NZTM  
 Elevation: 6.70m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			6.7			OL: TOPSOIL						
	0.4	Peak = 123kPa Residual = 29kPa	6.4			ML: Sandy SILT: Brown. Low plasticity, sensitive. Sand is fine. (Auckland Volcanics)	M	VSt				
	0.8	Peak = 43kPa Residual = 13kPa	6.1			Pt: PEAT: dark brownish black. Highly Fibrous. (Peat)		F				
			5.6			OL: Organic SILT: light brown silt. Low Plasticity. Very poor to no recovery. Auger and shear vane pushed through. (Tauranga Group)						
			4.2			GP: Fine to medium GRAVEL: dark grey. Poorly graded, angular. Basalt fragments. (Auckland Volcanics)	S	VS				
						Borehole terminated at 2.6 m						20

Termination Reason: To Hard To Continue Auguring

Shear Vane No: 1620 DCP No: 1

Remarks: Groundwater encountered at 0.6m. DCP conducted from 2.6m to 2.7m.

# HAND AUGER BOREHOLE LOG - HA08-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: FS Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757517.0mE; 5905748.0mN Projection: NZTM  
 Elevation: 9.00m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			9.0			OL: TOPSOIL						
	0.4	Peak = 163kPa Residual = 51kPa	8.7			ML: SILT with trace sand: brown. Low plasticity, moderately sensitive. Sand is fine. (Auckland Volcanics)		VSt				
	0.8	Peak = 120kPa Residual = 45kPa										
	1.2	Peak = 50kPa Residual = 15kPa	8.0	1		CH: Silty CLAY with trace sand: brown mottled orange and light brown. High plasticity, moderately sensitive to sensitive. Sand is fine. (Auckland Volcanics)		M				
	1.6	Peak = 120kPa Residual = 18kPa				... from 1.80m to 2.00m, contains some fine to medium, subangular to angular basalt fragments.		St to VSt				
				2		Borehole terminated at 2.0 m					12	20
				3								
				4								
				5								

Termination Reason: To Hard To Continue Auguring

Shear Vane No: 1620 DCP No: 1

Remarks: Groundwater encountered at 1.9m. DCP conducted from 2.0m to 2.2m.

# HAND AUGER BOREHOLE LOG - HA09-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: FS Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757374.0mE; 5905761.0mN Projection: NZTM  
 Elevation: 8.00m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			8.0		[Hatched pattern]	OL: TOPSOIL						
			7.7		[Cross-hatched pattern]	ML: SILT with minor sand: brown. Low plasticity, moderately sensitive. Sand is fine. (Auckland Volcanics)  ... at 0.60m, contains minor fine to medium subangular gravel. Becoming dark brown.	M	St to VSt				
			7.0	1	[Cross-hatched pattern]	ML: Sandy SILT: brown. Low plasticity, moderately sensitive. Sand is fine. (Auckland Volcanics)	M to W	St				
			6.5		[Cross-hatched pattern]	ML: SILT with some sand and some gravel: brown. Low plasticity. Sand is fine. Gravel is fine to medium, subangular. (Auckland Volcanics)	S	H				
						Borehole terminated at 1.6 m						20
				2								
				3								
				4								
				5								

Termination Reason: To Hard To Continue Auguring

Shear Vane No: DCP No: 1

Remarks: Groundwater encountered at 1.5m. DCP conducted from 1.6m to 1.7m.

# HAND AUGER BOREHOLE LOG - HA10-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: FS Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757062.0mE; 5905893.0mN Projection: NZTM  
 Elevation: 15.40m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			15.4			OL: TOPSOIL						
	0.4	Peak = >187	15.0			ML: SILT with trace sand: dark brown. Low plasticity, sensitive. Sand is fine. (Auckland Volcanics)						
	0.8	Peak = UTP				... from 0.80m to 2.00m, contains intermittent 100mm to 150mm beds with fine to medium, subangular gravel.						
	1.2	Peak = 128kPa Residual = 27kPa										
	1.6	Peak = UTP	14.0			SP: Sandy SILT with trace gravel: brown. Low plasticity. Sand is fine grained, poorly graded. Gravel is fine to medium grained, subangular, basalt fragments. (Auckland Volcanics)						
	2.0	Peak = UTP		2		Borehole terminated at 2.0 m						
											12	
											14	
											8	
											6	
											10	
											4	
											10	
											12	
											20	
											20	

Termination Reason: To Hard To Continue Auguring

Shear Vane No: 1620 DCP No: 1

Remarks: Groundwater not encountered. DCP conducted from 2.0m to 3.0m.

# HAND AUGER BOREHOLE LOG - HA11-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: FS Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757019.0mE; 5905813.0mN Projection: NZTM  
 Elevation: 15.00m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			15.0			OL: TOPSOIL						
	0.4	Peak = 127kPa Residual = 27kPa	14.7			ML: SILT with minor sand: brown. Low plasticity, sensitive. Sand is fine. (Auckland Volcanics)	M					
						... at 0.60m, contains some fine sand and trace fine gravel.	W					
	0.8	Peak = 131kPa Residual = 29kPa	1				S	VSt to H				
	1.2	Peak = UTP										
						... at 1.40m, contains trace fine sand.	W to S					
	1.6	Peak = UTP	13.3			ML: Sandy SILT with minor gravel: brown. Low plasticity. Sand is fine. Gravel is fine to medium. (Auckland Volcanics)						
	2.0	Peak = UTP	2			Borehole terminated at 2.0 m						
									4			
									5			
									5			
										15		
											20	

Termination Reason: To Hard To Continue Auguring

Shear Vane No: 1620 DCP No: 1

Remarks: Groundwater encountered at 0.8m. DCP conducted from 2.0m to 2.5m.

# HAND AUGER BOREHOLE LOG - HA12-20

Client: Villa Maria Estate Limited  
 Project: Villa Maria Estate  
 Site Location: Mangere, Auckland, New Zealand  
 Project No.: AKS2020-0029  
 Date: 30/06/2020  
 Borehole Location: Refer to site plan



Logged by: FS Checked by: RT Scale: 1:25

Sheet 1 of 1

Position: 1757106.0mE; 5905773.0mN Projection: NZTM  
 Elevation: 17.00m Datum: MT EDEN

Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests		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)			
	Depth	Type & Results							5	10	15	
			17.0			OL: TOPSOIL						
	0.4	Peak = >187	16.7			ML: SILT with some clay and trace sand: brown. Low plasticity. Sand is fine. (Auckland Volcanics)	M	H				
	0.8	Peak = 100kPa Residual = 30kPa	16.2			ML: SILT with some sand and trace gravel: brown. Low plasticity, moderately sensitive. Sand is fine. Gravel is fine. (Auckland Volcanics)						
	1.2	Peak = UTP		1				VSt to H				
	1.6	Peak = UTP	15.4			ML: Sandy SILT with trace gravel: brown. Low plasticity. Sand is fine, poorly graded. Gravel is fine. (Auckland Volcanics)	W	H				
	2.0	Peak = UTP		2								
						Borehole terminated at 2.2 m						
										10		
										8		
											14	
												18
												20
				3								
				4								
				5								

Termination Reason: To Hard To Continue Auguring

Shear Vane No: 1620 DCP No: 1

Remarks: Groundwater not encountered. DCP conducted from 2.2m to 2.7m.



# CMW Geosciences – SOIL (Field Logging Guide)

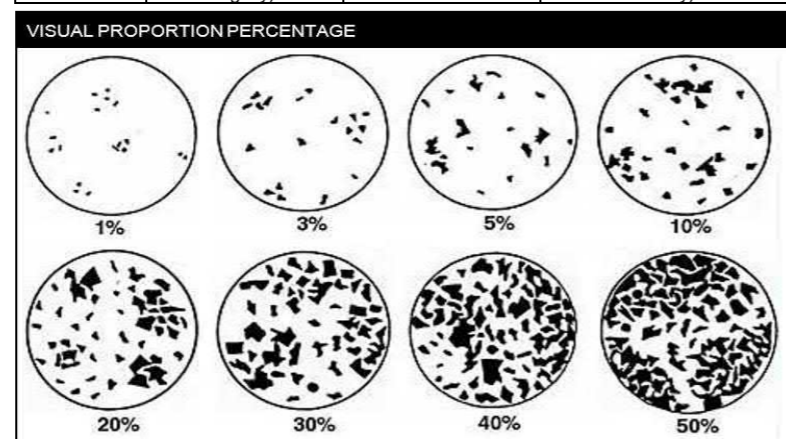


## SEQUENCE OF TERMS:

**Fine:** Soil Symbol – Soil Type – Colour – Structure – (Consistency) – (Moisture) – Bedding – Plasticity – Sensitivity – Additional Comments – Origin/Geological Unit  
**Coarse:** Soil Symbol – Soil Type – Colour – Structure – Grading – Particle shape – (Relative Density) – (Moisture) – Bedding – Additional Comments – Origin/Geological Unit

BEHAVIOURAL SOIL CLASSIFICATION SYSTEM				
Major Divisions (behaviour based logging)	Soil Symbol	Soil Name		
Coarse grained soils more than 65% >0.06mm	Gravel >50% of coarse fraction >2mm	Clean gravel <5% smaller 0.075mm	GW	Well graded gravel, fine to coarse gravel
		Gravel with >12% fines	GP	Poorly graded gravel
			GM	Silty gravel
	Sand ≥50% of coarse fraction <2mm	Clean sand	SW	Well-graded sand, fine to coarse sand
		Sand with >12% fines	SP	Poorly graded sand
			SM	Silty sand
Fine grained soils 35% or more <0.06mm	Exhibits dilatant behaviour	inorganic	ML	Silt
			MH	Silt of high plasticity
		organic	OL	Organic silt
	No dilatant behaviour	inorganic	CL	Clay of low plasticity
			CH	Clay of high plasticity
		organic	OH	Organic clay
Highly Organic Soils	Pt	Peat		

PROPORTIONAL TERMS DEFINITION			
Fraction	Term	% of Soil Mass	Example
Major	(...) [UPPER CASE]	≥50 [major constituents]	GRAVEL
Subordinate	(...) [lower case]	20 – 50	Sandy
Minor	with some...	12 – 20	with some sand
	with minor...	5 – 12	with minor sand
	with trace of (or slightly)	< 5	with trace of sand (slightly sandy)



GRAIN SIZE CRITERIA											
TYPE	Boulders	Cobbles	COARSE			FINE			Silt	Clay	ORGANIC
			Gravel	Sand							
Size Range (mm)	200	60	coarse 20	medium 6	fine 2	coarse 0.6	medium 0.2	fine 0.06	0.002		
Graphic Symbol											

ADDITIONAL GRAPHIC LOG SYMBOLS	
Term	Symbol
Topsoil	
Fill	
Bitumen	
Concrete	

ORGANIC SOILS / DESCRIPTORS	
Term	Description
Topsoil	Surficial organic soil layer that may contain living matter. However, topsoil may occur at greater depth, having been buried by geological processes or man-made fill, and should be termed a buried topsoil.
Organic clay, silt or sand	Contains finely divided organic matter; may have distinctive smell; may stain; may oxidize rapidly. Describe as for inorganic soils.
Peat	Consists predominantly of plant remains. <b>Firm:</b> Fibres already compressed together <b>Spongy:</b> Very compressible and open structure <b>Plastic:</b> Can be moulded in hand and smears in fingers <b>Fibrous:</b> Plant remains recognisable and retain some strength <b>Amorphous:</b> No recognisable plant remains
Rootlets	Fine, partly decomposed roots, normally found in the upper part of a soil profile or in a redeposited soil (e.g. colluvium or fill)
Carbonaceous	Discrete particles of hardened (carbonised) plant material.

SHADE AND COLOUR		
1	2	3
light dark mottled streaked	pinkish reddish yellowish brownish greenish bluish greyish	pink red orange yellow brown green blue white grey black

SOIL STRUCTURE	
Term	Description
Homogeneous	The total lack of visible bedding and the same colour and appearance throughout
Bedded	The presence of layers
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Polished	Fracture planes are polished or glossy
Slickensided	Fracture planes are striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensoidal	Discontinuous pockets of a soil within a different soil mass

GRADING (GRAVELS & SANDS)	
Term	Description
Well Graded	Good representation of all particle size ranges from largest to smallest
Poorly Graded	Limited representation of grain sizes – further divided into: Uniformly graded: Most particles about the same size Gap graded: Absence of one or more intermediate sizes

ROUNDING/PARTICLE SHAPE			
Rounded	Subrounded	Subangular	Angular

CONSISTENCY TERMS FOR FINE SOILS			
Descriptive term	Undrained Shear Strength (kPa)	Diagnostic Features	Abbreviation
Very Soft	<12	Easily exudes between fingers when squeezed	VS
Soft	12-25	Easily indented by fingers	S
Firm	25-50	Indented by strong finger pressure and can be indented by thumb pressure	F
Stiff	50-100	Cannot be indented by thumb pressure	St
Very Stiff	100-200	Can be indented by thumb nail	VSt
Hard	200-500	Difficult to indent by thumb nail	H

DENSITY INDEX (RELATIVE DENSITY) TERMS FOR COARSE SOILS				
Descriptive term	Density Index (RD)	SPT "N" value (blows/300mm)	Dynamic Cone (blows/100mm)	Abbreviation
Very Dense	> 85	> 50	> 17	VD
Dense	65 - 85	30 - 50	7 - 17	D
Medium dense	35 - 65	10 - 30	3 - 7	MD
Loose	15 - 35	4 - 10	1 - 3	L
Very loose	< 15	< 4	0 - 2	VL

Note:

- Where strength data cannot be confirmed Loosely Packed (LP) and Tightly Packed (TP) may be used.
- No correlation is implied between Standard Penetration Test (SPT) and Dynamic Cone Penetrometer (Scala) Test values.
- SPT "N" values are uncorrected.

MOISTURE CONDITION					BEDDING THICKNESS (Sedimentary)		BEDDING INCLINATION	
Condition	Description	Coarse Soils	Fine Soils	Abbreviation	Term	Bed Thickness	Term	Inclination (from horizontal)
Dry	Looks and feels dry	Runs freely through hands	Hard, powdery or friable	D	Thinly laminated	< 2mm	Sub-horizontal	0° - 5°
					Laminated	2mm - 6mm	Gently inclined	6° - 15°
Moist	Feels cool, darkened in colour	Tends to cohere	Weakened by moisture, but no free water on hands when remoulding	M	Very thin	6mm - 20mm	Moderately inclined	16° - 30°
					Thin	20mm - 60mm	Steeply inclined	31° - 60°
					Moderately thin	60mm - 200mm	Very steeply inclined	61° - 80°
Wet			Weakened by moisture, free water forms on hands when handling	W	Moderately thick	0.2m - 0.6m	Sub vertical	81° - 90°
					Thick	0.6m - 2m		
					Very thick	> 2m		
Saturated	Feels cool, darkened in colour and free water is present on the sample			S				

PLASTICITY (CLAYS & SILTS)	
Term	Description
High plasticity	Can be moulded or deformed over a wide range of moisture contents without cracking or showing any tendency to volume change
Low plasticity	When moulded can be crumbled in the fingers; may show quick or dilatant behaviour

SENSITIVITY OF SOIL	
Descriptive Term	Shear Strength Ratio = $\frac{\text{undisturbed}}{\text{remoulded}}$
Insensitive, normal	< 2
Moderately sensitive	2 – 4
Sensitive	4 – 8
Extra sensitive	8 – 16
Quick	> 16

# HARRISON GRIERSON CONSULTANTS LIMITED

## Document Control Record

Client Penihana Nominees Limited

Project George Bolt Memorial Drive, Mangere

Project No. 09.11143.1

Document Geotechnical Investigation Report

### ISSUE AND REVISION RECORD

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Villa Maria Land Portfolio Database - Jamie Parr - Goodman - 11/12/2020 10:25:10 PM - 113.197.98.122

**PENIHANA NOMINEES LIMITED**  
**George Bolt Memorial Drive, Mangere**  
**Geotechnical Investigation Report**

December 1999  
Reference 09.11143.1

## 1.0 INTRODUCTION

This report presents the results of a geotechnical investigation of the site enclosed by George Bolt Memorial Drive, Montgomerie Road, Oruarangi Road and Oruarangi Creek, Mangere. The site adjoins the Auckland International Airport. The purpose of the investigation was to determine geotechnical constraints or limitations on development.

The investigation is based on a desktop study and walkover inspection of the site.

This report presents the results of the desktop study and walkover inspection and discusses the potential limitations on development. Recommendations for a geotechnical investigation to determine subsurface conditions are also provided.

## 2.0 SITE DESCRIPTION

The site has an area of 150ha located on George Bolt Memorial Drive as shown on drawing 11143-G01.

The site is predominantly flat to gently sloping at an elevation of 10m to 15m. In the northwest corner, the site drops via moderate slopes to a flat surface at RL 6m. The flat area is inferred to be the floor of a volcanic crater.

The majority of the site is currently used for horticulture and pastoral farming. On the western edge of the crater floor is a cool store. Steep slopes within the cool store area are assumed to be the result of quarrying.

The site drains by a dendritic pattern of gullies. The gullies have moderate to very steep slopes with near vertical banks in places. The slopes leading down to the creek range from undulating to steep.

## 3.0 GEOLOGY

The geological assessment of the site is based on our walkover inspection and reference to the following geological map:

- Kermode, L.O. 1992: Geology of the Auckland Urban area. Scale 1:50,000. Institute of Geological and Nuclear Sciences geological map 2. 1 sheet + 63p. Institute of Geological and Nuclear Sciences Ltd., Lower Hutt, New Zealand.

The anticipated geology is alluvium, peat and volcanic tuff. The alluvium overlies most of the site. A tuff ring forms the Waitomokia volcano crater. Peat forms the crater floor. The alluvium is described as pumiceous mud, sand and gravel with some organic rich layers. The alluvium can be up to 60m thick. The peat is described as highly organic, soft and compressible.

The observations made during the walkover inspection in general concur with the reported geology. Observations in the field indicate that a thin layer of tuff and ash overlies the site near the tuff ring. It is expected that the surface layer of ash and tuff will thin rapidly from the crater.

#### 4.0 WALK OVER INSPECTION

A senior engineering geologist from Harrison Grierson Consultants Limited inspected the site. On the steep gully slopes and creek banks there was evidence of soil creep, and a shallow slump was noted at one location.

No evidence of any slope instability was observed beyond the influence of the gully and creek slopes.

The steep batters in the crater rim appear to be due to quarrying. Volcanic tuff is exposed in the near vertical batters. Basalt gravel and orange brown silt was exposed in cut banks along the creek bank.

Organic soils were observed in the walls of the drainage ditches that drain the crater floor.

#### 5.0 SLOPE STABILITY

The stability assessment is based on our experience with similar soils in the area and our field observations. Based on the foregoing it is our opinion that the natural slopes at the site up to slopes of 1V:5H are likely to have an adequate stability state. A subsurface geotechnical investigation is required to confirm subsurface conditions and the stability state of slopes at the site.

Some evidence of soil creep and shallow slumping at one location was noted on the steep creek and gully slopes. Slopes steeper than 1V:5H should be appraised by a geotechnical engineer with regard to slope stability. The areas influenced by steeper slopes should be delineated in a detailed geotechnical investigation of the site.

#### 6.0 FOUNDATION CONSIDERATIONS

##### 6.1 ALLUVIUM AND TUFF AREAS

The soils in areas underlain by alluvium and tuff can range from soft to stiff. Generally, alluvium and tuff is suitable for design bearing pressures of 100kPa for working stress design or 150kPa for limit state design. Actual bearing capacities of the alluvium or tuff will need to be determined by specific ground investigation targeted specifically where structures are to be located.

Consolidation settlement occurs in silts and clays. Consolidation settlement occurs due to a significant increase in loading on the soils due to filling or construction of structures.

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Consolidation settlement within the tuff and non-organic alluvium is generally not a constraint for residential or light industrial development. Within the alluvium, layers of soft soil or organic soils can occur which have the potential for significant settlement under relatively light loads.

A subsurface investigation should be carried out to classify the alluvial and tuffaceous soils and where appropriate carry out laboratory testing to determine the settlement potential of these soils.

## 6.2 PEAT

The crater floor is assumed to be underlain by highly organic soils of an unknown thickness. The lateral extent of the peat is inferred to be limited to the crater floor and may extend under the toe of the internal crater slopes.

Peat is highly organic and compressible. Significant settlements are anticipated under applied loads. Bearing capacities of the peat soils are anticipated to be low.

Specific investigation and laboratory testing of the peat should be carried out to determine the constraints/limitations on development of the areas underlain by peat.

## 7.0 DEVELOPMENT

As indicated above the areas underlain by peat are likely to settle under loadings from buildings or filling. The presence of peat has significant limitations on the development potential of the crater floor area.

Geotechnical investigation of the crater floor is required to determine what form of development if any is possible on the peat areas. Development limited to lightweight flexible structures may be possible subject to the results of a geotechnical investigation of the area. Piling of structures founding on firm strata at depth may be possible. However, greater expense than normal will be involved in any roading and underground service construction.

On the alluvium and tuff areas, conventional development should be possible. Areas influenced by the steeper creek and gully slopes will require specific geotechnical assessment, to determine their suitability and or constraints on development.

## 8.0 FURTHER GEOTECHNICAL INVESTIGATION

It is apparent from our walk over inspection that the geology of the site concurs with the interpretation published on the geological map.

Subsoil investigation will be required to characterise the soil types and strengths, possibly with some laboratory testing to determine founding conditions for structures located on alluvium and tuff. Slope stability assessment of the gully and creek banks will be required to determine the stability and influence of these slopes on development.

Due to the presence of basalt gravel, hand augered boreholes may not penetrate through the soils, particularly tuff. Investigation using machine excavated test pits or machine boreholes may be required to investigate the areas overlain by tuff. Hand augered boreholes could be used in areas underlain by alluvium where conventional residential development or lightweight flexible structures are proposed. Machine boreholes are

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recommended where non-conventional residential, heavy, brittle or settlement sensitive structures are proposed.

The crater floor is assumed to be underlain by peat. If development of the crater floor is proposed then investigation by cone penetration tests and machine boreholes to provide samples for laboratory testing is recommended. If development on the internal slopes of the crater is proposed then the lateral extent of the peat needs to be determined.

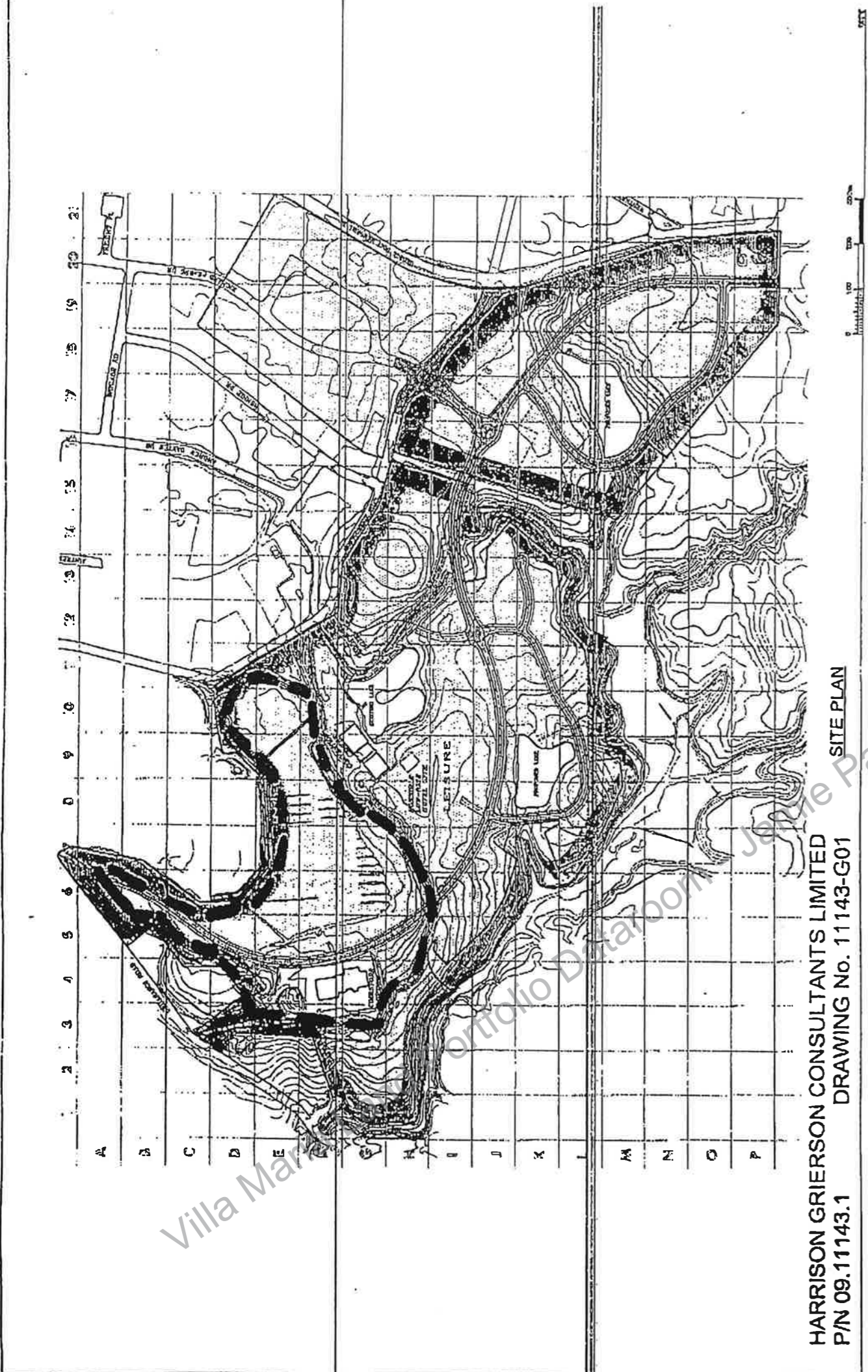
**9.0 CONCLUSION**

The site, exclusive of the crater floor, appears to be generally suitable for development. There are geotechnical constraints on development immediately adjacent to the gully and creek banks with regard to slope stability issues. Within the crater, there are significant constraints or limitations on development. Detailed investigation of the crater floor is required to determine the feasibility of developing this area.

**Harrison Grierson Consultants Limited**

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Villa Maria Land Portfolio Dataroom - Jamie Parr - Goodman - 11/12/2020 10:25:10 PM - 113.197.98.122



HARRISON GRIERSON CONSULTANTS LIMITED  
 P/N 09.11143.1 DRAWING No. 11143-G01

SITE PLAN

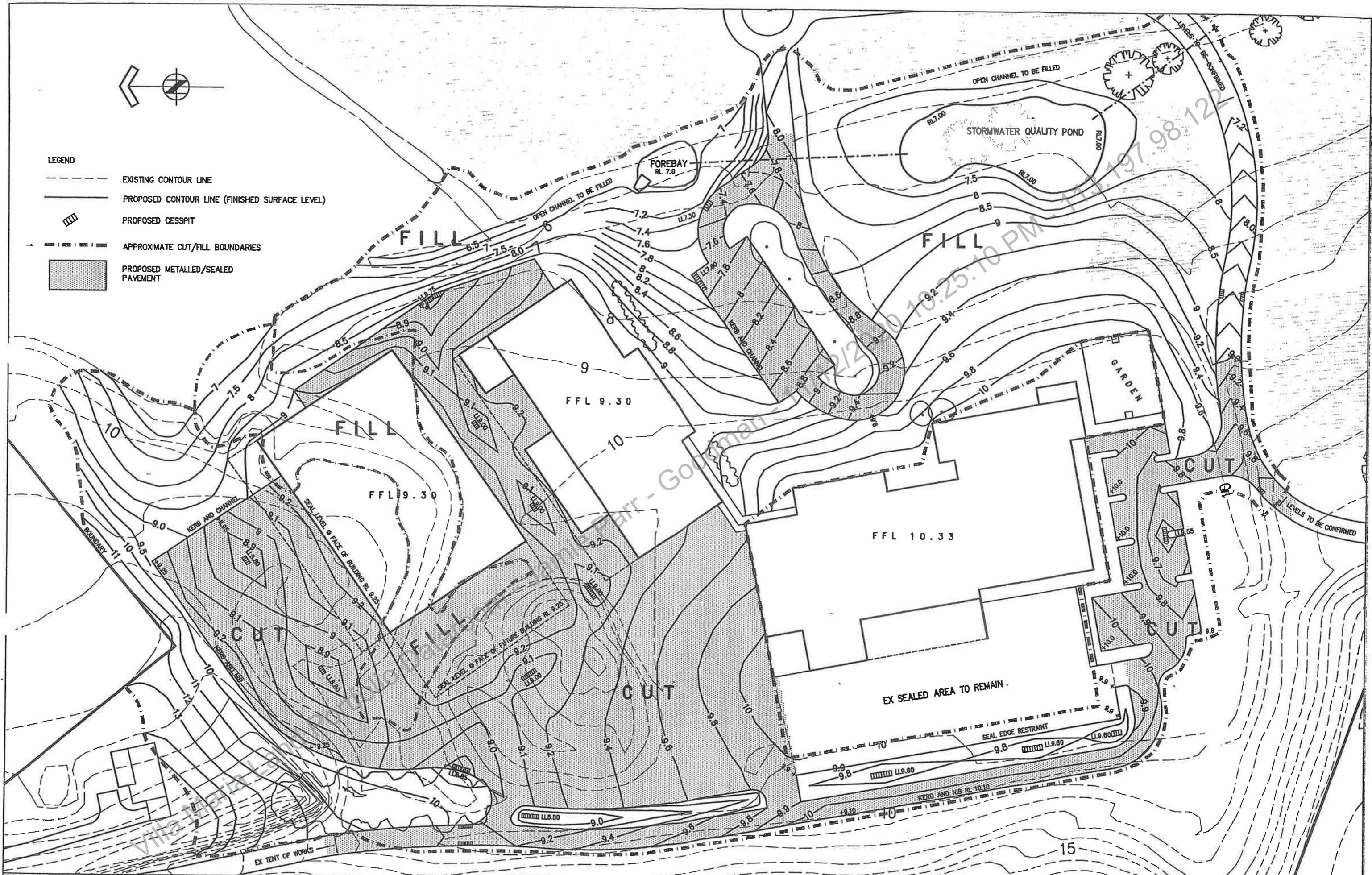


MASTER INDEX



Villa Mar

Portfolio Database - Jaime Par... Goodman - 11/12/2020 10:25:10 PM - 113.197.98.122



SURVEYED BY:	DRAWN BY:	STM
DATE SURVEYED:	DATE PLOTTED:	
SORMAP REF:	CAD REFERENCE:	12865-PAV
DESIGNED:	CAD XREF'S:	
CHECKED:	APPROVED:	

**HARRISON GRIERSON**  
  
 CONSULTING ENGINEERS SURVEYORS PLANNERS

PROJECT: **VILLA MARIA DEVELOPMENT**  
 470 ORUARANGI ROAD  
 MANGERE

TITLE: **EARTHWORKS/PAVEMENT**  
 CONCEPT PLAN

PROJECT No:	09.12885.1	REV
DRAWING No:	12865-PAV	
ORIGINAL SCALE:	1:500	A1
REDUCED SCALE:	1:1000	

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**NOTES**  
 1 : AREAS AND DIMENSIONS ON THIS PLAN ARE SUBJECT TO FINAL SURVEY  
 2 : TOTAL AREA = 92.4015ha

PROPOSED EASEMENT			
PURPOSE	SHOWN	SERVIENT TENEMENT	DOMINANT TENEMENT
STORMWATER	(A)	LOT 2 HEREDON	LOT 3 HEREDON
STORMWATER	(B)	LOT 1 HEREDON	LOTS 2 & 3 HEREDON
STORMWATER	(C)	LOT 2 HEREDON	LOT 1 HEREDON

**NOTE:**  
 FINAL POSITION OF EASEMENTS TO BE CONFIRMED BY FINAL SURVEY.

SURVEYED BY:	SRIH	DRAWN BY:	MCC
DATE SURVEYED:		DATE PLOTTED:	10/11/00
SORMAP REF:		CAD REFERENCE:	12306-SS01
DESIGNED:		CAD XREF'S:	
CHECKED:		APPROVED:	

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**HARRISON GRIERSON**  
 CONSULTING ENGINEERS SURVEYORS PLANNERS

PROJECT: PENIHANA NOMINEES  
 470 ORUARANGI ROAD  
 MANGERE

TITLE: PROPOSED SUBDIVISION OF  
 LOT 2 DP 61746 AND Pt LOT 2 DP 35436

A SEWER MANHOLES AND LINES ADDED	TM	09/00	PROJECT No:	09.12306.1
			DRAWING No:	12306-SS01
REF			ORIGINAL SCALE:	1:3000
AMENDMENTS	BY	DATE	REDUCED SCALE:	

## ORUARANGI CREEK

### SUBSOIL INVESTIGATION

July 2000  
Project No. 09.12297.2

Thirteen machine boreholes were drilled at the above site on 25 and 26 July 2000, the locations of the holes being as shown on the attached sketch, and which were determined by the client. The purpose of the holes was to obtain information to assist in ascertaining likely foundation conditions for any future building development on the site.

Boreholes were logged and the logs are attached hereto. Standard Penetration Tests (SPT) were carried out in all holes at about 1.5 metre intervals, except for boreholes MB11, MB12 and MB13 which were wash-drilled through peat until a harder material was encountered. SPT results are shown on the borelogs.

The results of the investigation are discussed in four separate areas:

- A. Area between existing building and crater floor MB1-MB5.
- B. "Coffee Hill" MB6.
- C. Crater rim, south-east of the existing building MB7-MB10.
- D. Crater floor MB11-MB13.

#### AREA A:

Boreholes MB1 to MB5 are reasonably consistent, with a firm to stiff silt overlying a silt/gravel matrix, both of volcanic origin. Borehole MB3 has 2.5 metres of uncontrolled fill overlying this sequence. The fill is variable, contains non-biodegradable inclusions and should not be relied upon for building foundations. Piling of foundations in this area is an option, with competent material being at 2.9 metres depth. If any building is proposed in the vicinity of MB3, further investigation should be carried out to determine the extent of the fill.

The material in the other four boreholes appears to be suitable for shallow building foundations. Any basement excavation is likely to encounter variable strength material at its base, but is unlikely to encounter weak or soft material. Ground water varied in the boreholes from 1.5 metres depth to 3.8 metres depth. Being measured in mid-winter, these levels are unlikely to ever be much higher.

#### AREA B:

Borehole MB6 was drilled from the top of "coffee hill." A slight amount of topsoil was underlain by ground coffee beans and silt to a depth of 2.8 metres. Dense sand and a silt/gravel matrix, which are suitable for foundations, underlies the bean/silt mixture.

The bean/silt mixture should not be relied upon for building foundations, due to its high organic content and consequent high susceptibility for consolidation.

The silt/bean mixture appears to be rather impermeable, as ground water was encountered at 1.2 metres depth, which is probably above surrounding ground levels.

**AREA C:**

Boreholes MB7 to MB10 were drilled in the rim area, south-east of the existing building. Borehole MB9 was drilled in the lower area, almost at the crater floor level, MB10 slightly uphill and holes MB7 and MB8 at a higher elevation on the crater rim.

The upper boreholes, MB7 and MB8 were reasonably consistent in that volcanic gravels underlie firm to stiff, slightly organic, volcanic silt. MB8 contained a layer of very dense sand between 2.6 metres and 3.5 metres depth. However, the materials in these two holes vary in strength. In MB7, the material is quite weak to at least 2 metres depth, but is stiff at 3 metres. In MB8, the material is weak to about 1.5 metres, but stiff at 2 metres depth. Ground water was encountered in those holes at 4.2 metres and 3.3 metres depth respectively.

A cellar dug into the side of the hill at the location of MB7/MB8 should not encounter great difficulty, except that the upper 2 metres or so of soil from the surface is relatively weak and would need retaining. Below 3 metres depth, de-watering would be necessary.

Further down the slope, borehole MB10 contained 400mm of topsoil and peat followed by firm silt to one metre and then silty sand (SPTs of 11, 9, 12) to end of bore at 5 metres, interrupted by a thin band of volcanic gravels. Groundwater was at 1.5 metres depth. Building foundations in this area would probably need to penetrate 1.5 metres below the ground surface. The lowest borehole, MB9, encountered peat to 1.6 metres depth and volcanic gravels at 2.1 metres. Ground water was at 0.8 metre depth. Building foundations in this area would need to penetrate through to the gravels. If building is proposed in this area, further investigation should be carried out to determine the extent of the peat (horizontal and vertical). It is possible that the peat encountered in boreholes MB9 and MB10 is a "finger" extending in from the crater floor area. However, the general topography of the site suggests more that peat may be present along much of the eastern side of the crater floor.

**AREA D:**

Three boreholes, MB11, MB12 and MB13 were drilled in the crater floor. These holes were wash-drilled until solid ground was encountered, so that no information regarding the peat was gathered. Depths of peat were 2-3 metres, 5.8 metres and 2.1 metres respectively. Volcanic gravels underlay the peat in boreholes MB11 and MB13, but in MB13 these were weak down to 4 metres depth.

In hole MB12, a very soft greenish grey, organic silt underlay the peat to 8.2 metres depth, where solid basalt was encountered. Ground water was at 0.8 metre, 1.1 metre and 0.7 metre depth respectively in MB11, MB12 and MB13.

**SUMMARY:**

- Area A: Conditions generally suitable for shallow building foundations except for 2.5 metres of uncontrolled fill in MB3.
- Area B: Coffee beans encountered to 2.8 metres depth – not suitable for foundations or filling elsewhere.
- Area C: Shallow peat encountered in MB9 and MB10. Weaker ground encountered in MB7 and MB8. Building foundations in this area may need to penetrate to 2 metres below existing ground levels.

Area D: "Good" ground encountered at 2.3 metres, 8.2 metres and 4 metres respectively in MB11, MB12 and MB13. See profile attached.

General: Once competent ground was encountered, in no case was peat or soft ground encountered at a lower level. Area A is mostly good. Area C may require specific foundation design for buildings.

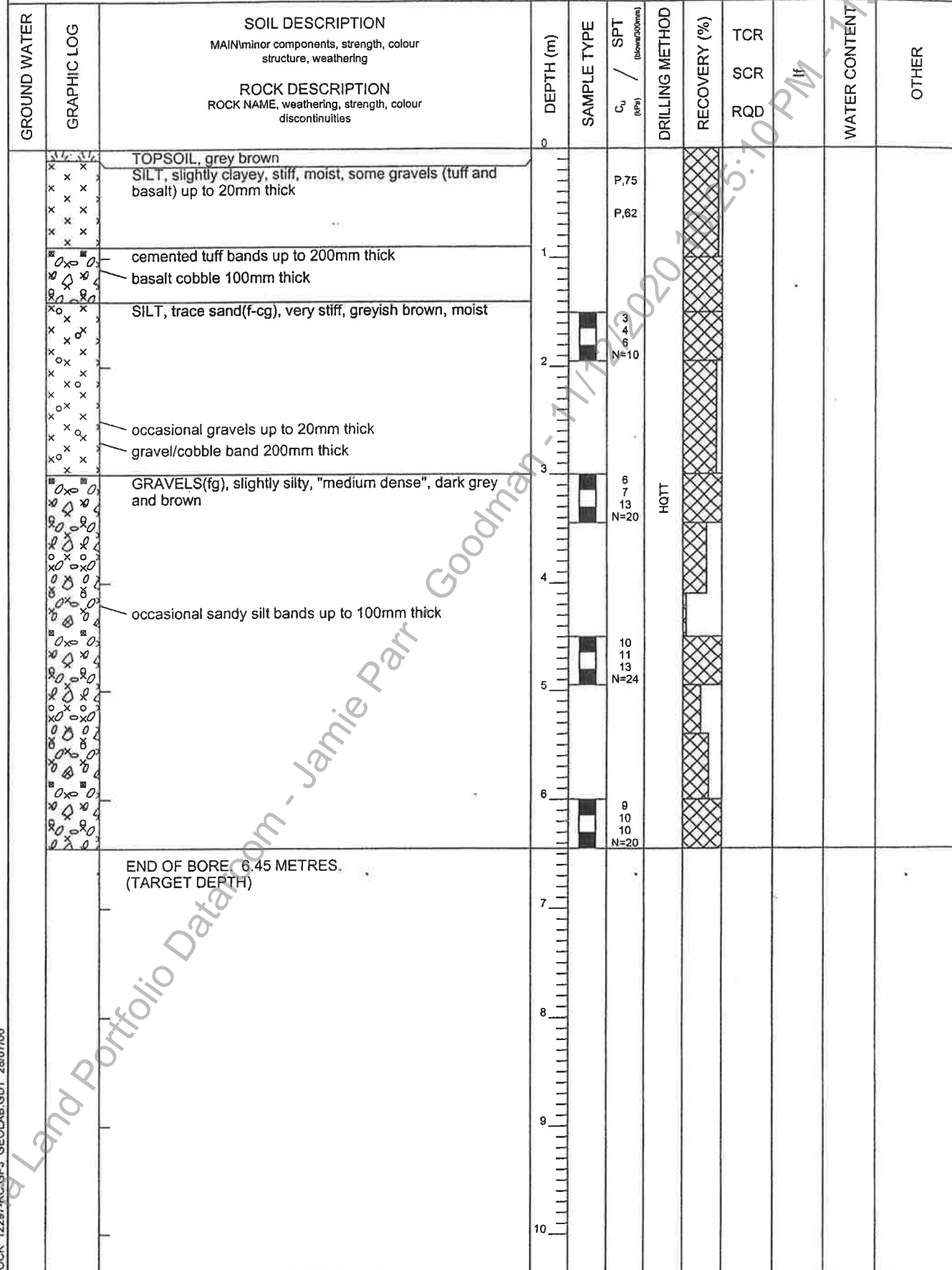
Harrison Grierson Consultants Limited

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Villa Maria Land Portfolio Dataroom - Jamie Parr - Goodman - 11/12/2020 10:25:10 PM - 713.197.98.122

<b style="font-size: 24pt;">geolab</b> air, soil & water laboratory services	CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 1 Sheet 1 of 1
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Drill Type: TECHDRILL 150 (HOTT) Drilled By: DRILLWELL Date Started: 8:50am 25/7/00 Date Finished: 25/7/00	Project No: 09.12297.2 Coordinates: Ground Elevation: Water Level: 26/7/00 BLOCKED @ 2.5m	Logged By: GIH Checked By: GIH Shear Vane No:
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ROCK 12297-FC-GPJ GEOLAB.GDT 28/07/00



air, soil & water  
laboratory services

CLIENT: PENIHANA NOMINEES Ltd  
PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE

BOREHOLE No: MB 2  
Sheet 1 of 1

Drill Type: TECHDRILL 150 (HQTT) Project No: 09.12297.2 Logged By: BPM  
 Drilled By: DRILLWELL Coordinates: Checked By: GIH  
 Date Started: 10:45am 25/7/00 Ground Elevation: Shear Vane No:  
 Date Finished: 25/7/00 Water Level: 1.50m 26/7/00

GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION	DEPTH (m)	SAMPLE TYPE	SPT (blows/200mm)  C <sub>u</sub> / (kPa)	DRILLING METHOD	RECOVERY (%)	TCR	SCR	RQD	WATER CONTENT	OTHER
		ROCK DESCRIPTION ROCK NAME, weathering, strength, colour discontinuities										
		TOPSOIL, grey brown SILT, some clay, some sand(f-mg), stiff, dark grey and brown gravel/cobble band 100mm thick becomes sandy(fg), dark grey volcanic gravel band 200mm thick	0									
		GRAVELS(fg), sandy(f-cg), trace silt, "loose" dark grey saturated with silt slightly sandy (fg) bands up to 70mm thick	1		P,75							
			2		4 5 6 N=11	HQTT						
			3		5 4 6 N=10							
			4		4 3 4 N=7							
		END OF BORE. 4.95 METRES. (TARGET DEPTH)	5									
			6									
			7									
			8									
			9									
			10									

ROCK 12297-RC.GPJ GEOLAB.GDT 28/07/00

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CLIENT: PENIHANA NOMINEES Ltd

PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE

BOREHOLE No: MB 3

Sheet 1 of 1


Drill Type: TECHDRILL 150 (HQT)  
Drilled By: DRILLWELL  
Date Started: 12noon 25/7/00  
Date Finished: 25/7/00

Project No: 09.12297.2  
Coordinates:  
Ground Elevation:  
Water Level: 2.50m 26/7/00

Logged By: BPM  
Checked By: GIH  
Shear Vane No:

GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	ROCK DESCRIPTION ROCK NAME, weathering, strength, colour discontinuities	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (Blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR	SCR	RQD	WATER CONTENT	OTHER
		FILL, topsoil, grey brown		0								
		FILL, mainly silt, trace sand(f-mg), stiff, dark grey and brown		0.5	P,100							
		occasional gravels up to 10mm thick		1								
		plastic (PVC) inclusions		1.5	P,75							
				2	N=2.5							
		SILT, trace clay, very stiff, dark grey brown, volcanic ash, occasional rootlets		3		HQTT						
		GRAVELS(fg) basaltic, slightly sandy(f-cg), "loose", dark grey saturated with silt slightly sandy (fg) bands up to 60mm thick		3.5	12 Bouncing							
		cobbles up to 90mm thick occasional cavities		4	N>50							
				5	10							
				5.5	26							
				6	24							
				6.5	N=50							
		END OF BORE. 4.95 METRES. (TARGET DEPTH)		5								
				6								
				7								
				8								
				9								
				10								

ROCK 12297-RC-GPJ GEOLAB.GDT 28/07/00

		CLIENT: PENIHANA NOMINEES Ltd PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 4 Sheet 1 of 1						
Drill Type: TECHDRILL 150 (HQTT) Drilled By: DRILLWELL Date Started: 1:30pm 25/7/00 Date Finished: 25/7/00	Project No: 09.12297.2 Coordinates: Ground Elevation: Water Level: 3.80m 26/7/00	Logged By: BPM Checked By: GIH Shear Vane No:							
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering  ROCK DESCRIPTION ROCK NAME, weathering, strength, colour discontinuities	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (N <sub>60</sub> ) / (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR SCR RQD	WATER CONTENT	OTHER
		TOPSOIL, grey brown SILT, trace sand(fg), firm, grey and brown gravel/cobble band 80mm thick GRAVELS(fg), slightly sandy(f-cg), silty, some clay "loose" cemented bands up to 70mm thick dark grey brown	0 1 2 3 4 5 6 7 8 9 10	P,120 P,50 2 2 2 N=4 12 9 6 N=15 6 6 8 N=14	HQTT				
		END OF BORE. 4.95 METRES (TARGET DEPTH)							

ROCK 12297-RC.GPJ GEOLAB.GDT 28/07/00



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CLIENT: PENIHANA NOMINEES Ltd

PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE

BOREHOLE No: MB 5


Sheet 1 of 1

Drill Type: TECHDRILL 150 (HQTT) Project No: 09.12297.2  
 Drilled By: DRILLWELL Coordinates:  
 Date Started: 2:45pm 25/7/00 Ground Elevation:  
 Date Finished: 25/7/00 Water Level: 2.90m 26/7/00


Logged By: BPM  
 Checked By: GIH  
 Shear Vane No:

GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	ROCK DESCRIPTION ROCK NAME, weathering, strength, colour discontinuities	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (0-psi) / (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR	SCR	RQD	WATER CONTENT	OTHER
		FILL, mainly scoria gravel 20mm thick		0								
		SILT, slightly clayey, some sand(f-cg), very stiff, dark grey and brown, occasional rootlets (tuff)		0.5								
		some red brown mottles		1	P,150							
		basalt gravel band 100mm thick		1.5								
		silt, sand(f-cg), cemented gravels (tuff), greenish brown		2	2.5 2.5 N=5	HQTT						
		GRAVELS(fg), sandy(f-cg), trace silt, "loose" dark grey saturated with silt slightly sandy (fg) bands up to 70mm thick		3	7 4 4 N=8							
		washing mainly gravels up to 10mm thick, easy drilling 4.0m-4.5m		4								
		END OF BORE. 4.95 METRES. (TARGET DEPTH)		5	6 6 6 N=12							
				6								
				7								
				8								
				9								
				10								










ROCK 12297-RC.GPJ GEOLAB.GDT 28/07/00

 air, soil & water laboratory services		CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 6  Sheet 1 of 1						
Drill Type:	TECHDRILL 150 (HQTT)	Project No:	09.12297.2	Logged By:	BPM				
Drilled By:	DRILLWELL	Coordinates:		Checked By:	GIH				
Date Started:	8.00am 26/7/00	Ground Elevation:		Shear Vane No:					
Date Finished:	26/7/00	Water Level:	1.20m 26/7/00						
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (kPa) / (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR SCR RQD	WATER CONTENT	OTHER
		FILL mainly topsoil, grey brown SILT, trace sand(fg), stiff, dark brown black, organic, (ground coffee beans)	0	P,75					
		occasional gravels up to 10mm thick	1	P,80					
		SAND(cg), occasional gravel sized particles cemented tuff	2		HQTT				
		GRAVELS (fg), sandy (f-cg), trace silt, "loose" dark grey, saturated, with silt, slightly sandy (fg) bands up to 70mm thick	3	16 29 30 N=59					
			4						
			5	14 18 20 N=36					
		END OF BORE. 4.95 METRES. (TARGET DEPTH)	5						
			6						
			7						
			8						
			9						
			10						

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 air, soil & water laboratory services		CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 7 3 Sheet 1 of 1										
Drill Type:	TECHDRILL 150 (HQTT)	Project No:	09.12297.2	Logged By:	BPM								
Drilled By:	DRILLWELL	Coordinates:		Checked By:	GIH								
Date Started:	9:30am 26/7/00	Ground Elevation:		Shear Vane No:									
Date Finished:	26/7/00	Water Level:	4.20m 26/7/00										
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION		DEPTH (m)	SAMPLE TYPE	SPT <small>(blows/300mm)</small>	DRILLING METHOD	RECOVERY (%)	TCR	SCR	RQD	WATER CONTENT	OTHER
		MAIN/minor components, strength, colour structure, weathering  ROCK DESCRIPTION ROCK NAME, weathering, strength, colour discontinuities											
		TOPSOIL, grey brown SILT, trace clay, stiff, grey and brown, lithic tuff, occasional rootlets		0									
		GRAVEL, "loose", up to 5mm, some very cemented bands, volcanic occasional silt bands 20mm thick		1									
		SILT, trace sand(fg), very stiff, yellow orange band 100mm thick medium dense		2									
		becomes sandy(f-mg) yellow orange occasional coarse sized particles grey brown		3									
		END OF BORE. 4.95 METRES (TARGET DEPTH)		5									
				6									
				7									
				8									
				9									
				10									

ROCK 12297-RC.GPJ GEOLAB.GDT 28/07/00

 air, soil & water laboratory services		CLIENT: PENIHANA NOMINEES Ltd		BOREHOLE No: MB 8					
		PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE		Sheet 1 of 1					
Drill Type:	TECHDRILL 150 (HQTT)	Project No:	09.12297.2	Logged By:	BPM				
Drilled By:	DRILLWELL	Coordinates:		Checked By:	GIH				
Date Started:	10.30am 26/7/00	Ground Elevation:		Shear Vane No:					
Date Finished:	26/7/00	Water Level:	3.30m 26/7/00						
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (above 500mm) (bpa)	DRILLING METHOD	RECOVERY (%)	TCR SCR RQD	WATER CONTENT	OTHER
 26/7/00		TOPSOIL, grey brown	0						
		SILT, trace clay, firm, dark grey and brown, slightly organic occasional sandy(fg) pockets yellow orange	1	P,50					
		TUFF, silt, clay and gravel matrix, very stiff, yellow orange occasional silt bands 50mm thick	2	P,100					
		volcanic gravel up to 10mm thick	2.47						
		SAND(fg), trace silt, "very dense", grey cobbles up to 90mm thick occasional cavities	3	N=11	HQTT				
		GRAVEL (f-mg), medium dense, up to 20mm thick becomes silty sand(f-cg) occasional silty bands 50mm thick	4	N=21					
		END OF BORE. 4.95 METRES. (TARGET DEPTH)	5	N=20					
			6						
			7						
			8						
			9						
			10						

ROCK 12297-RC.SP.J.GEOLAB.GDT 28/07/00

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






<b>geolab</b> air, soil & water laboratory services	CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 9  Sheet 1 of 1
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Drill Type: TECHDRILL 150 (HQT) Drilled By: DRILLWELL Date Started: 11:35am 26/7/00 Date Finished: 26/7/00	Project No: 09.12297.2 Coordinates: Ground Elevation: Water Level: 0.80m 26/7/00	Logged By: BPM Checked By: GIH Shear Vane No:
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GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering  ROCK DESCRIPTION ROCK NAME, weathering, strength, colour discontinuities	DEPTH (m)	SAMPLE TYPE  Cu / SPT (ppa) / (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR	SCR	RQD	WATER CONTENT	OTHER
		TOPSOIL, grey brown PEAT, poor recovery, washed away	0								
		SILT, trace sand(fg), soft, greenish grey	1								
		SAND(f-cg), silty, "loose" grey	2								
		TUFF, volcanic gravels up to 5mm thick, "loose"	3								
		occasional cobble sized fragments up to 60mm	3.5								
		SAND(f-cg), silty "weakly cemented" grey	4								
		END OF BORE. 4.95 METRES. (TARGET DEPTH)	5								
			6								
			7								
			8								
			9								
			10								

ROCK 12297-FC-GPJ GEOLAB.GDT 28/07/00


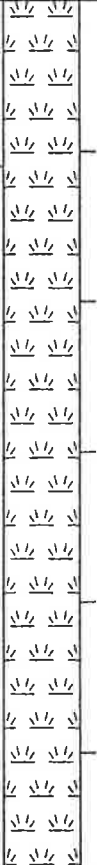
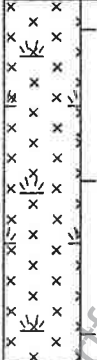
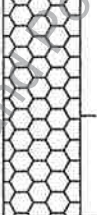
Villa Maria Land Portfolio Dataroom - Jamie Parr - Goodman - 7/11/2020 10:25:10 PM - 73.197.98.722

 air, soil & water laboratory services		CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 10 3 Sheet 1 of 1						
Drill Type:	TECHDRILL 150 (HQTT)	Project No:	09.12297.2	Logged By:	BPM				
Drilled By:	DRILLWELL	Coordinates:		Checked By:	GIH				
Date Started:	12:40pm 26/7/00	Ground Elevation:		Shear Vane No:					
Date Finished:	26/7/00	Water Level:	1.50m 26/7/00						
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR SCR ROD	WATER CONTENT	OTHER
		ROCK DESCRIPTION ROCK NAME, weathering, strength, colour discontinuities							
		TOPSOIL, grey brown	0						
		PEAT, dry, organic wood fragments							
		SILT, trace sand(fg), firm, brown		P.150					
		SAND(f-cg), silty, "loose" brown and grey	1	P.50					
									
			2	5 blows N=11	HQTT				
		TUFF, volcanic gravels up to 10mm thick, "loose"	3	6 blows N=9					
		SAND(f-cg), trace silt, "cemented", grey  becomes a silty sand(f-cg), grey	4	5 blows N=12					
		END OF BORE. 4.95 METRES (TARGET DEPTH)	5						
			6						
			7						
			8						
			9						
			10						

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 air, soil & water laboratory services		CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 11 3 Sheet 1 of 1								
Drill Type:	TECHDRILL 150 (HQ CASING ADVANCER)	Project No:	09.12297.2								
Drilled By:	DRILLWELL	Coordinates:									
Date Started:	1:20pm 26/7/00	Ground Elevation:									
Date Finished:	26/7/00	Water Level:	0.80m 26/7/00								
Logged By:	BPM	Checked By:	GIH								
Shear Vane No:											
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR	SCR	RQD	WATER CONTENT	OTHER
		SILT, sandy(cg), tuff	0								
		PEAT	0.5								
		GRAVEL, volcanic	2.5								
			3.0	7 5 8 N=11	HQ CASING ADVANCER						
			4.5	6 5 4 N=9							
		END OF BORE. 4.75 METRES. (TARGET DEPTH)	5.0								
			6.0								
			7.0								
			8.0								
			9.0								
			10.0								

ROCK 12297-RC/GPJ-GEOLAB.GDT 28/07/00

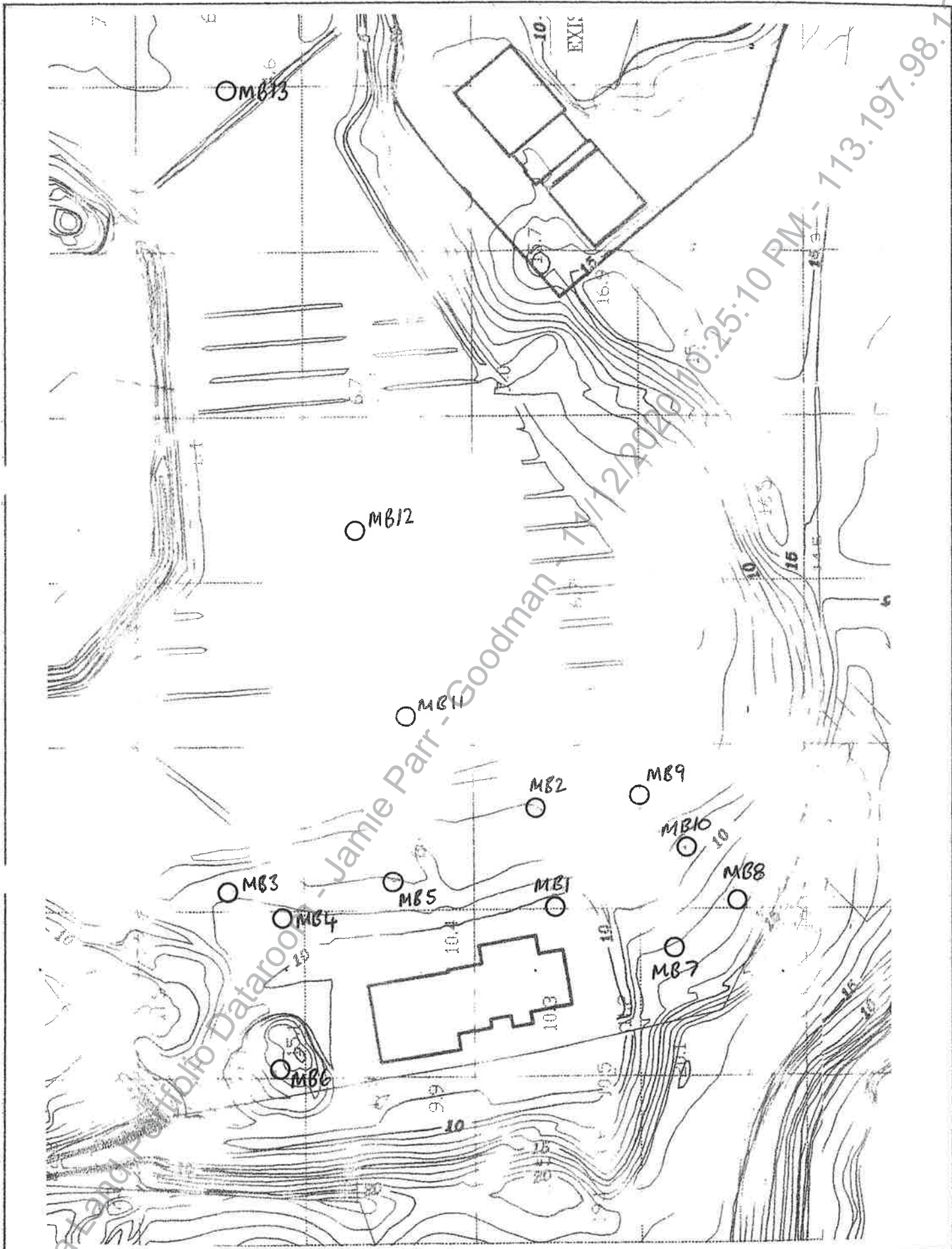
 air, soil & water laboratory services		CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 12  Sheet 1 of 1						
Drill Type:	TECHDRILL 150 (HQ CASING ADVANCER)	Project No:	09.12297.2						
Drilled By:	DRILLWELL	Coordinates:							
Date Started:	2:20pm 26/7/00	Ground Elevation:							
Date Finished:	26/7/00	Water Level:	1.10m 26/7/00						
Logged By:	BPM	Checked By:	GIH						
Shear Vane No:									
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	DEPTH (m)	SAMPLE TYPE Cu / SPT (kPa) / (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR SCR ROD	WATER CONTENT	OTHER
		PEAT	0 to 5.8		HQ CASING ADVANCER				
		SILT, slightly clayey, very soft, greenish grey, organic	5.8 to 8.7	N=0					
		BASALT, rock layer	8.7 to 9.7	N>50					
		END OF BORE. 9.70 METRES. (TARGET DEPTH)	9.7						

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 air, soil & water laboratory services		CLIENT: PENIHANA NOMINEES Ltd  PROJECT: MOUNT GABRIEL, ORUARANGI RD, MANGERE	BOREHOLE No: MB 13 3 Sheet 1 of 1								
Drill Type:	TECHDRILL 150 (HQ CASING ADVANCER)	Project No:	09.12297.2	Logged By:	BPM						
Drilled By:	DRILLWELL	Coordinates:		Checked By:	GIH						
Date Started:	3:50pm 26/7/00	Ground Elevation:		Shear Vane No:							
Date Finished:	26/7/00	Water Level:	1.70m 26/7/00								
GROUND WATER	GRAPHIC LOG	SOIL DESCRIPTION MAIN/minor components, strength, colour structure, weathering	DEPTH (m)	SAMPLE TYPE C <sub>u</sub> / SPT (blows/300mm)	DRILLING METHOD	RECOVERY (%)	TCR	SCR	RQD	WATER CONTENT	OTHER
		TOPSOIL, grey brown	0								
		PEAT									
		SILT, occasional gravels tuff									
		PEAT, with volcanic gravel inclusions									
			1								
			1.8	8 13 11 N=24							
		volcanic gravels up to 10mm thick	2								
			3	1 0 1 N=1	HQ CASING ADVANCER						
			4								
			4.8	21 16 14 N=30							
		END OF BORE. 4.75 METRES. (TARGET DEPTH)	5								
			6								
			7								
			8								
			9								
			10								

ROCK 12297-RC.GPJ GEOLAB.GDT 26/07/00



<b>HARRISON GRIERSON</b> <b>HG</b> CONSULTING ENGINEERS SURVEYORS PLANNERS	SURVEYED:	DRAWN BY: <i>AW</i>	PROJECT No: 09-12297-2
	DATE	DATE PLOTTED: 7/00	DRAWING No:
	SDRMAP REF:	CAD REF:	12297-G01
	DESIGNED:	APPROVED:	ORIGINAL SCALE (A4): 1:3000
FIGURED DIMENSIONS TO BE USED IN PREFERENCE TO SCALED DIMENSIONS		CHECKED:	