GEOTECHNICAL INVESTIGATION REPORT

MANGAPAPA SCHOOL

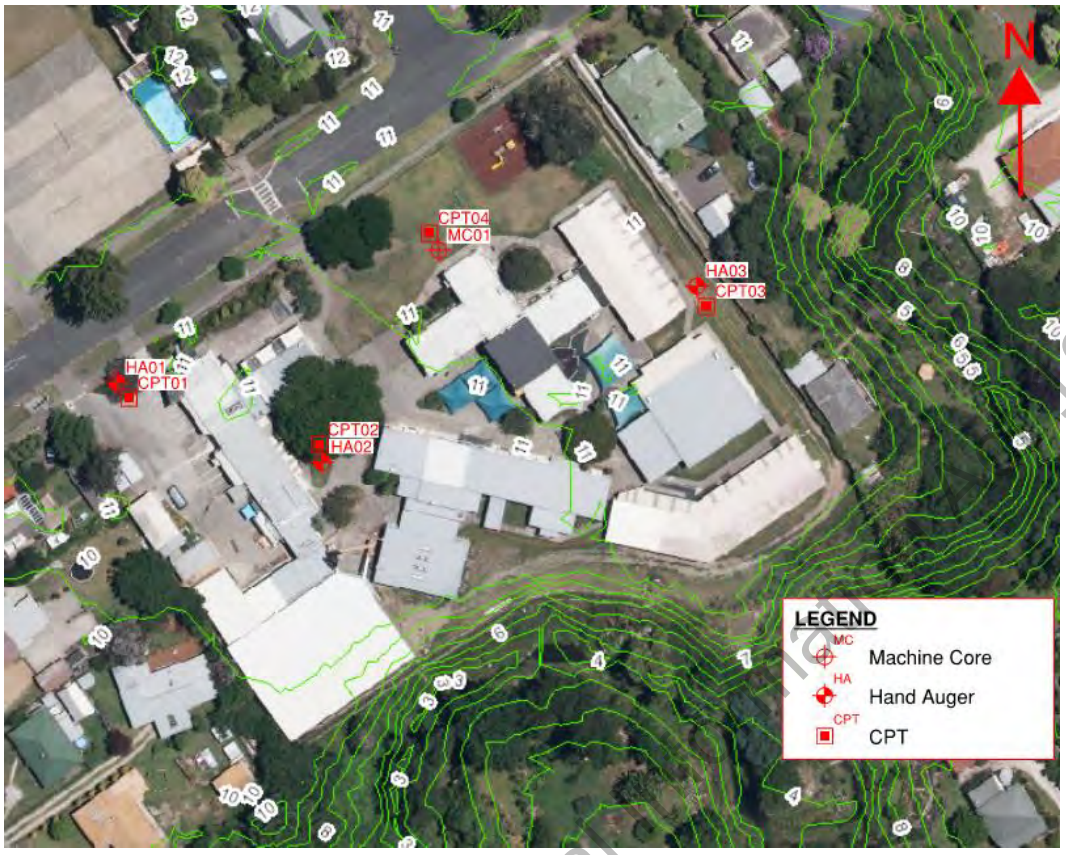
(PROJECT)

MINISTRY OF EDUCATION

(CLIENT)

19.01.2018

MANGAPAPA SCHOOL



Prepared for:	Ministry of Education, C/- Frequency Projects
Date:	19. 01. 2018
Project no:	17-0708
Revision:	1.0 (Final)
File path:	P:\17-0708MangapapaSchoolandTologaBayAreaSchool\060BCDGeotechnical\064Reports\Draft\Mangapapa School

Prepared by:

Louis Higgison
Junior Geotechnical Engineer
BCD Group Ltd

Reviewed and approved for release by:

Lowry Shuler
BSc (Civil Engineering), CPEng, CMEngNZ
Senior Geotechnical Engineer
BCD Group Ltd

TABLE OF CONTENTS

Attachments

1 INTRODUCTION

BCD Group Limited (BCD) has been engaged by the Ministry of Education, C/- Frequency Projects to undertake a geotechnical site investigation and reporting for the proposed development at the above referenced site at Mangapapa School in Gisborne (Figure 1: Location Plan).

This report presents the results of the conducted investigations and provides foundation recommendations in relation to the 'good ground' requirements of NZS3604:2011 *Timber Framed Buildings*.

1.1 Site Description

The site is essentially level and at the time of investigation, was fully covered by ankle height vegetation with existing buildings located proximal to each of the testing locations.

1.2 Geology

The published geological map (Edbrook, S. W., 2001, Geology of the Raukumara Area, 1:250,000 geological map 6) shows that the site is underlain by the HOLOCENE SHORELINE DEPOSITS.

HOLOCENE SHORELINE DEPOSITS is described as beach sand, gravel and shell of the modern coastal plain; young marine terrace cover beds comprising gravel, sand, peat and mud.

2 FIELD INVESTIGATIONS

Fieldwork was carried out by BCD on the 18th December 2017 with testing locations set out by BCD in relation to existing buildings and areas that would provide results which are representative of the locality. The subsurface conditions within the site were investigated with three hand augers (HA01 to HA03) with dynamic penetration resistance testing (Scalas) up to 3m deep, three static Cone Penetration Tests (CPT01 to CPT04) to depths of 20m to 30m, and one machine corehole (BH01) to a depth of 15m conducted to assess the strength and consistency of the subsoils.

The test locations are shown on the attached Site Plan (Figure 2), with hand auger logs (HA01-HA03) presented in Appendix A.

2.1 Subsoil Profile

HA01 and HA02 revealed 300-500mm of TOPSOIL, underlain by SANDs of varying thickness to the depth of the hand augers (target depth 3m below present ground level). HA03 revealed 200mm of TOPSOIL followed by sandy SILT followed by SANDs to the depth of the hand augers.

The CPT testing revealed the top 5m – 6m of subsoil to consist of alternating layers of SAND, gravelly SAND and SAND mixtures of varying thickness, which are underlain by predominantly clays-clay to silty clay with small lenses of clayey silt to silty clay and SANDs.

The core drilling revealed 400mm of TOPSOIL, underlain by SANDs until a depth of 5.1m below ground level. This in turn was followed by CLAYs (containing organic material) to the depth of the bore hole (15m). At a depth of 14.5m a 200mm lens of SAND was revealed.

2.2 Groundwater

Groundwater was not encountered in the hand augers during the investigation, although moisture content was noted to increase with depth. Groundwater was encountered at depths of 1.3m to 3.5m at the CPT locations at the time of the testing.

3 PROPOSED DEVELOPMENT

No plans were available at the time of the investigation, however we understand that single-storey relocatable lightweight timber framed buildings are to be supported on timber pole foundations detailed in accordance with NZS3604:2011.

4 FOUNDATION ASSESSMENT

The following recommendations and opinions are based upon data from observations made on-site, the conducted hand augers and in-situ soil strength testing. Inferences about the nature and continuity of subsoils away from the exploration holes are made but cannot be guaranteed.

4.1 Assessment Criteria

The NZS3604:2011 *Timber Framed Buildings* definition of 'good ground' requires subsoil to be capable of permanently withstanding an Ultimate Geotechnical Bearing Capacity of 300kPa (Allowable Bearing Capacity of 100kPa with a safety factor of 3.0) below the proposed foundations. Scala penetrometer (considered to be more appropriate in determining soil strength in granular soils) results greater than 5 blows per 100mm for two times the width of the proposed foundation (3 blows per 100mm thereafter) achieve this criteria.

For subsoils to permanently withstand a load, subsoil must **not** be susceptible to:

- Potentially compressible ground – such as organic material (peat/topsoil), fill material (unless appropriately certified), soft cohesive material or loose granular material.
- Expansive soils – such as cohesive material swelling and contracting due to seasonal variation of water content.
- Potential movement – such as slope instability, erosion or effects from tree roots which may cause movement in excess of 25mm.

4.2 'Good Ground' Assessment

The near surface subsoils showed to be granular in nature and vary considerably in strength, therefore 'potentially compressible ground' is anticipated within the top 1.9m – 2.3m of the subsoils.

The near surface subsoils did not demonstrate plastic properties and therefore 'expansive soils' are not anticipated.

The conducted in-situ strength testing indicates a geotechnical ultimate bearing capacity of 300kPa can be achieved at depths of 1.9m – 2.3m below present ground level beneath the loose surficial sands.

Based upon the conducted investigation and the site walkover, the site does not meet the 'good ground' requirements of NZS3604:2011, due to the presence of 'potentially compressible ground' found on site.

4.3 Foundation Recommendations

The subsoils to a depth of 1.9m -2.3m bgl do not meet the 'good ground' requirements of NZS3604:2011, due to the presence of 'potentially compressible ground' (very loose to dense, highly variable SAND soils). However, a 'Specific Engineering Design' timber pile foundation may be used to support the proposed development in the form of pile foundations with a suspended concrete floor slab or timber floor.

4.3.1 Timber Pile Foundations

Driven tanalised timber pile foundations requiring 'Specific Engineering Design' may be utilised to support the development. Piles should be driven to achieve a required 'set' into the underlying SANDs, which based on the conducted hand auger testing, could extend to depths greater than 3.0m below present ground level. The pile diameter, design driving set and pile layout will be subject to specific engineering design based on the design load of the structure and the strengths available within the soils at the site. Such design is outside the scope of this report.

The underlying SAND soils across the site showed a significant amount of variability in strength. Therefore, test piles should be undertaken in order to reduce construction risk by confirming the required pile depth onsite once the pile diameter and design driving set has been confirmed by specific structural engineering design. Test piling would involve a minimum of two test piles driven per building; one at each corner, monitored by an appropriately qualified geotechnical engineer. Data obtained from these test piles would facilitate refinement beyond the minimum required design of the remaining piles. Subject to approval from the supervising engineer, test piles may be used as production piles for the proposed structures.

Care should be taken during pile driving to limit the impact of vibration on nearby buildings and buried services. Where vibration risks are considered likely a pre-construction survey of the surrounding area is recommended to record the construction of buildings and services.

4.4 Seismic Assessment

4.4.1 Assessment Criteria

The seismic design criteria for the proposed Importance Level 2 educational facility has been assessed in accordance with the New Zealand Transport Agency (NZTA) Bridge Manual[1] which gives a weighted magnitude of 6.4 for the 1 in 500 years earthquake in the Gisborne area.

This is different from the approach recommended in NZS1170.5[2], as the peak ground accelerations are normalised to a magnitude 7.5 earthquake. Earthquake magnitude is a measure of the energy released in the earthquake which in turn relates to the number of cycles during the shaking. The number of cycles has a large effect on the generation of excess pore pressure and hence liquefaction triggering. The Gisborne historical earthquake records confirm no magnitude 7.0+ earthquakes have been recorded in the area since 1947. Additionally, the nearest active fault lines to the Mangapapa area are the Repongaere Fault (approximately 20km away), the Arakihi Fault (approximately 22km away) and the Otoko-Totangi Fault (approximately 25km away).

NZS1170.0[3] requires that structures are designed to 'limit states' known as Ultimate Limit State (ULS), where the structure must remain sound enough to allow evacuation and preserve life (though possibly be irreparably

[1] New Zealand Transport Agency. (2013). *Bridge manual* (3rd ed.). Wellington, New Zealand.
[2] Standards New Zealand. (2004). *NZS1170.5:2004: Structural Design Actions – Part 5: Earthquake Actions New Zealand*. Wellington, New Zealand.
[3] Standards New Zealand. (2004). *NZS1170.0:2002: Structural Design Actions – Part 0: General Principles*. Wellington, New Zealand.

damaged for the design event) and Serviceability Limit State (SLS) where the structure remains functional following the SLS design event.

Based upon the results of the conducted geotechnical investigations, published geology and our knowledge of the area, the site is categorised as a 'shallow soil site' (Subsoil Class C). Structural engineering design of the structure may use the more conservative "deep soil site" (Subsoil Class D).

The Design Life and Importance Level for the proposed development are assessed as '50 years' and 'Level 2' respectively. The peak ground accelerations (PGAs) calculated and adopted for this geotechnical assessment in accordance with NZTA Bridge Manual 3rd Edition are summarised in Table 1 below. It should be noted that only the peak ground accelerations, determined from the Bridge Manual methodology, will be used for the liquefaction analysis.

Based upon the conducted CPT and HA results, a groundwater table at 1.3m bgl has been adopted for the liquefaction analysis.

Table 1: Geotechnical PGA Design Values

Importance Level	Design Life (years)	Limit State	Annual Probability of Exceedance	R Value	Peak ground Accelerations (g)
2	50	SLS	1/25	0.25	0.10
		ULS	1/500	1	0.38

4.4.2 Liquefaction Analysis

We have conducted an assessment of the liquefaction risk and consequent ground movement in general accordance with the NZ Geotechnical Society publications, Module 1: Overview of the guidelines[4] and Module 3: Identification, assessment and mitigation of liquefaction hazards[5] using the CPT data.

The data derived from the CPT tests were analysed using the CLiq (v1.7.1.14) software developed by Geologismiki. This software calculates the soil resistance against liquefaction using the Idriss and Boulanger procedure[6], along with a fines correction by Robertson and Wride[7]. The Liquefaction Potential Index (LPI) was calculated based on the method prescribed by Iwasaki et al.[8].

The calculated free field settlements for the soils within the upper 20m of the ground surface are detailed in Table 2 below. Typical liquefaction analysis results are presented in Appendix D.

[4] New Zealand Geotechnical Society. (2016). *Earthquake geotechnical engineering practice: Module 1 – Overview of the guidelines*. Wellington, New Zealand.
[5] New Zealand Geotechnical Society. (2016). *Earthquake geotechnical engineering practice: Module 3 – Identification, assessment and mitigation of liquefaction hazards*. Wellington, New Zealand.
[6] Idriss, I & Boulanger, R. (2008). *Soil liquefaction during earthquakes*. Earthquake engineering research institute.
[7] Robertson, P. & Wride, C. (1998). Evaluating cyclic liquefaction potential using the cone penetrometer test. *Canadian Geoetchnical Journal,* 35(3), 442-459.
[8] Iwasaki, T., Tokida, K., Tatsuoka, F., Watanabe, S., Yasuda, S. & Sato, H, (1982). Microzonation for soil liquefaction potential using simplified methods. Paper presented at the *Proceedings of the 3rd internation conference on microzonation, Seattle* (Vol. 3, pp. 1310-1330).

Table 2: Liquefaction Induced Settlements – Shallow Foundation Option

Design Case	Annual Probability of Exceedance	PGA Design Value	Liquefaction Induced Settlement (mm)	Differential Settlement (mm/6m)
SLS	1/25	0.09	<10mm	<5mm
ULS	1/500	0.38	35mm	<25mm

Seismic induced liquefaction at the site is considered to be low risk under the SLS condition, with less than 10mm of total settlement calculated. The ULS load resulted in higher liquefaction induced settlements (up to 35mm). The differential settlements for the ULS case were calculated to be less than 25mm/6m across the subject site. This magnitude of settlement is not considered severe.

4.4.3 Lateral Spread Analysis

Lateral spreading is the movement of a soil mass towards a free face or slope (i.e. gully or water body). Lateral spread is typically associated with seismic events and especially when liquefaction occurs. Lateral spreading can result in significant lateral displacements extending behind any free face which applies lateral pressure to buried structures or piles within the zone of lateral movement.

The subject site is located approximately 20m away from a steep river bank, which drops 6m – 7m to a small stream at the base. Our assessments indicate up to 450mm of lateral spread can be expected for the subject site under ULS seismic loading conditions.

5 CONCLUSION

HA01 and HA02 revealed 300-500mm of TOPSOIL, underlain by SANDs of varying thickness to the depth of the hand augers (target depth 3m below present ground level) for. HA03 revealed 200mm of TOPSOIL followed by sandy SILT followed by SANDs to the depth of the hand augers. The CPT testing revealed the top 5m – 6m of subsoil to consist of alternating layers of SAND, gravelly SAND and SAND mixtures of varying thickness, which are underlain by predominantly clays-clay to silty clay with small lenses of clayey silt to silty clay and SANDs. The core drilling revealed 400mm of TOPSOIL, underlain by SANDs until a depth of 5.1m below ground level. This in turn was followed by CLAYs (containing organic material) to the depth of the bore hole (15m). At a depth of 14.5m a 200mm lens of SAND was revealed. Groundwater was not encountered in the hand augers during the investigation, although moisture content was noted to increase with depth. Groundwater was encountered at depths of 1.3m to 3.5m at the CPT locations at the time of the testing.

The subsoils to a depth of at least 2.0m bgl generally do not meet the 'good ground' requirements of NZS3604:2011, due to the presence of 'potentially compressible ground' (very loose to dense, highly variable SAND soils). However, a 'Specific Engineering Design' timber pile foundation may be used to support the proposed development in the form of pile foundations with a suspended concrete floor slab or timber floor.

Test piling would involve a minimum of two test piles driven per building; one at each corner, monitored by an appropriately qualified geotechnical engineer. Data obtained from these test piles would facilitate refinement beyond the minimum required design of the remaining piles. Based on the results from the CPT and HA testing, it is expected that pile embedment's in the order of 3.0m.

Seismic induced liquefaction at the site is considered to be low risk under the SLS condition, with less than 10mm calculated. The ULS load resulted in higher liquefaction induced settlements (up to 35mm). The

differential settlements for the ULS case were calculated to be less than 25mm/6m across the subject site. This magnitude of settlement is not considered severe.

The subject site is located approximately 20m away from a steep river bank, which drops 6m – 7m to a small stream at the base. Our assessments indicate up to 450mm of lateral spread can be expected for the subject site under ULS seismic loading conditions. Although differential lateral movement between piles (lateral stretch) is possible during the ULS event, collapse of a conventional timber-framed, single-storey building supported on the proposed pile foundations is considered unlikely.

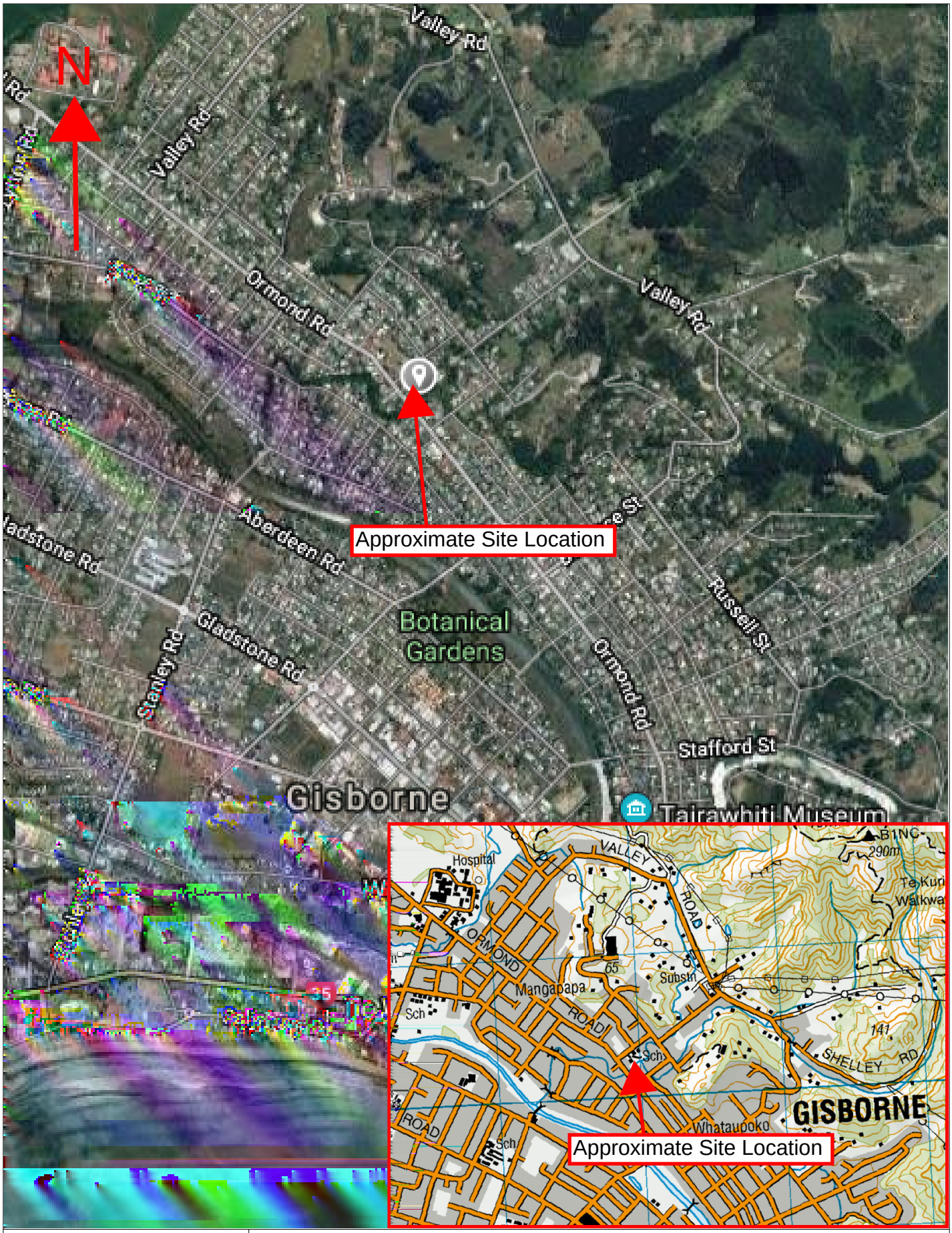
6 REPORT LIMITATIONS

In the event of an earthquake and upon a suitable structural evaluation, the proposed structures would likely be serviceable upon relevelling.

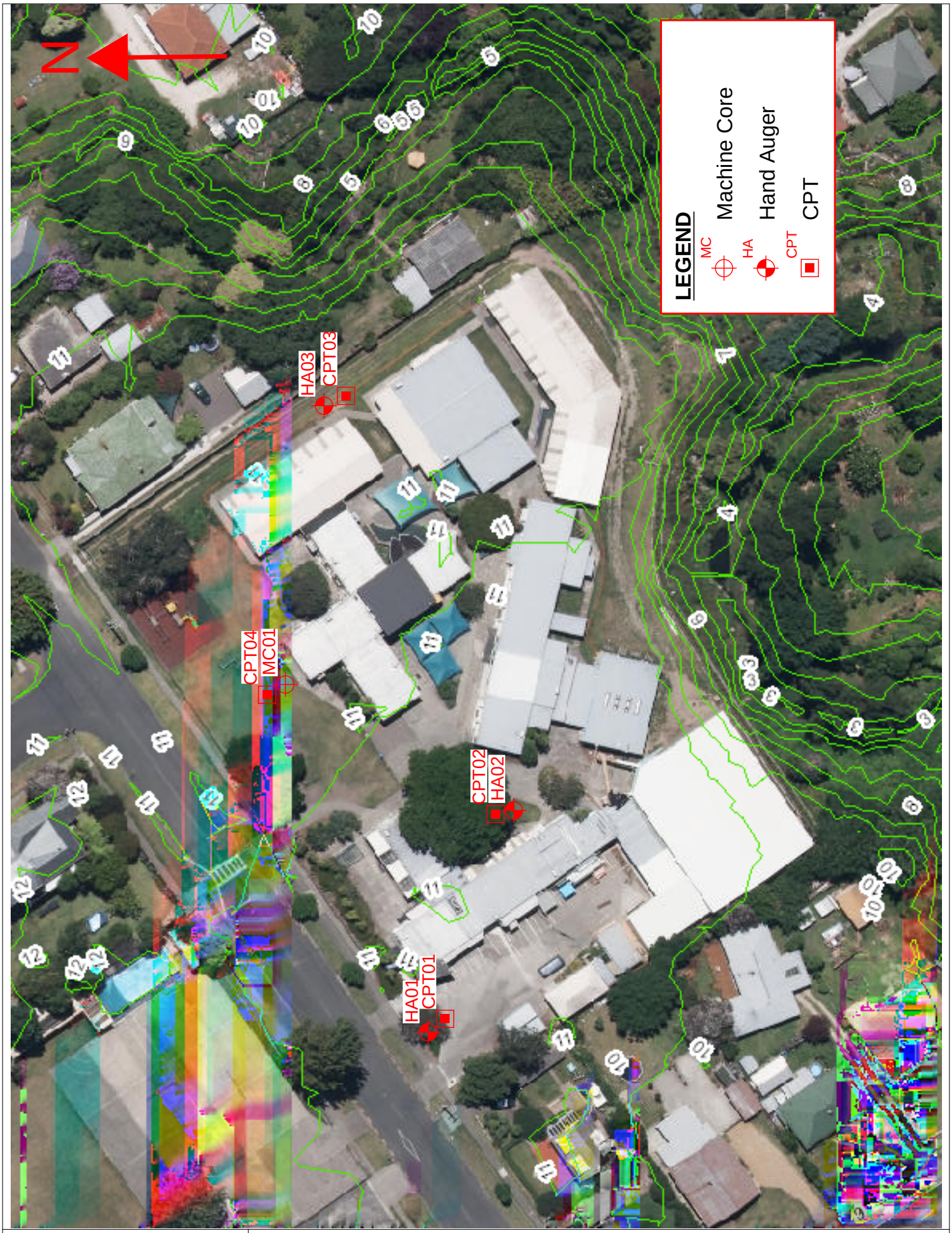
The recommendations given in this report are based upon limited site data from discrete tests. Variations in ground conditions can exist across the site. This report has been prepared for our client for their purposes. It is not to be relied upon or used out of context by any other person without reference to BCD Group Ltd. The reliance by other parties on the information or opinions contained in this report shall, without prior review and agreement in writing, be at such parties' sole risk.

Engineering design and/or engineering design recommendations have been made based on the preliminary information provided to BCD. Should these recommendations be utilised for construction, BCD are to sight approved Building Consent drawings to ensure compliance with recommendations made within this report. If a Producer Statement 4 or construction observation is required from BCD (see BCD report and/or consent requirements from council), we are to be contacted prior to construction to outline appropriate inspections milestones.

BCD have been engaged to provide geotechnical services only, we recommend the proposed works be checked against current District and Regional Council plans or checked by a registered planner.



BCD GROUP STRUCTURAL AND CIVIL ENGINEERING | PLANNING | GEOTECHNICAL	Project Title: Mangapapa School, Gisborne				
	Sheet Title: Location Plan				
	Drawn: L.R.	Date: 12-12-2017	Scale: NTS	Job No: 17-0708	Figure: 1



BCD GROUP
STRUCTURAL AND CIVIL ENGINEERING | PLANNING | GEOTECHNICAL

Project Title: Mangapapa School, Gisborne

Sheet Title: Site Plan

Drawn:	Date:	Scale:	Job No:	Figure:
L.R.	12-12-2017	NTS	17-0708	2

APPENDIX A - Hand Auger Logs

Soil Description

Log Identification: HA01

Investigation method	Geological Unit	Field Description	Depth (meters)	Undrained Shear Strength (kPa) Peak / Residual	Field Test Data: Scala Penetrometer (blows per 100mm drop) — Blow count	Plot of Scala results (Very loose / Loose / Medium Dense / Dense; 0 1 2 3 4 5 6 7 8 9 10)	Groundwater Level
HAND AUGER	TOPSOIL	Sandy TOPSOIL; dark brown. Very loose to loose, dry.	0.5		1, 2, 2, 1, 0.3		Groundwater not encountered during testing.
	HOLOCENE SHORELINE DEPOSITS	Fine grain SAND; light brown. Very loose, dry.			0.3, 0.3, 1, 1, 0.5		
		Fine to medium grain SAND; brown. Very loose, dry.	1.0		0.5, 0.5, 0.5, 0.5, 0.5		
			1.5		0.5, 0.5, 1, 1, 1		
			2.0		1, 3, 6, 10, 13		
		SAND, with trace of shell fragments; light greyish brown. Medium dense to dense, dry.	2.5		17, 10, 13, 15		
			3.0				
		End of hand auger at 3.0m - Target depth.	3.5				
			4.0				
			4.5				
			5.0				
			5.5				

Notes:

1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. Soils have been described in general accordance with NZ Geomechanics Society "*Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*", December 2005
3. Undrained shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "*Guideline for Hand Held Shear Vane Test*", August 2001.
4. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.

BCD GROUP
Consulting Engineers and Planners
bcdgroup.nz
HAMILTON | 240 Ulster St, Hamilton | p 07 839 9107
NEW PLYMOUTH | Level 3/53 Broughan St, New Plymouth | p 06 757 5051

Job name: Mangapapa School and Tologa Bay Area School
Site location: 5 Rua St, Mangapapa, Gisborne

Date of investigation: 18/12/17

Job Number: 17-0708
Shear Vane ID: N/A
Logged By: LR
Checked By: BM

Soil Description

Log Identification: HA02

Investigation method	Geological Unit	Field Description	Depth (meters)	Undrained Shear Strength (kPa) Peak / Residual	Field Test Data: Scala Penetrometer (blows per 100mm drop) — Blow count	Plot of Scala results (Very loose / Loose / Medium Dense / Dense; 0 1 2 3 4 5 6 7 8 9 10)	Groundwater Level
HAND AUGER	T/S	Gravely TOPSOIL; light brown. Loose to dense. Below 0.2m, moist.	0.0		2, 5, 8, 8, 7		Groundwater not encountered during testing.
	HOLOCENE SHORELINE DEPOSITS	SAND, with trace silt; light yellowish brown. Very loose to dense, moist.	0.5		5, 4, 4, 3, 3		
		Below 0.9m, light brown.	1.0		3, 2, 2, 3, 2		
			1.5		1, 1, 1, 1, 2		
		Below 2.0m, light yellowish brown.	2.0		3, 2, 2, 8, 12		
		Below 2.3m, dense.	2.5		12, 8, 10, 10		
		Below 2.8m, trace of shell fragments.	3.0				
		End of hand auger at 3.0m - Target depth.	3.5				
			4.0				
			4.5				
			5.0				
			5.5				

Notes:

1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. Soils have been described in general accordance with NZ Geomechanics Society "*Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*", December 2005
3. Undrained shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "*Guideline for Hand Held Shear Vane Test*", August 2001.
4. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.

BCD GROUP

Job name: Mangapapa School and Tologa Bay Area School
Site location: 5 Rua St, Mangapapa, Gisborne

Date of investigation: 18/12/17

Job Number: 17-0708
Shear Vane ID: N/A
Logged By: LH
Checked By: BM

Soil Description

Log Identification: HA03

Investigation method	Geological Unit	Field Description	Depth (meters)
HAND AUGER	T/S	Sandy TOPSOIL; light brown. Loose to dense, dry.	0.0
	HOLOCENE SHORELINE DEPOSITS	Sandy SILT; light brown. Loose to dense, mosit.	0.5
		SAND; light yellowish brown. Very loose to loose, moist.	1.0
		Below 1.0m, dark yellowish brown.	1.5
		Below 1.6m, light yellowish brown. Below 1.7m, medium dense to very dense.	2.0
		Below 2.1m, light orangish brown. Below 2.2m, trace of gravel and shell fragments.	2.5
		Below 2.4m, light grey.	3.0
		End of hand auger at 3.0m - Target depth.	3.5
		R* = Refusal (excessive blows)	4.0
			4.5
			5.0
			5.5

Field Test Data

Undrained Shear Strength (kPa) Peak / Residual	Scala Penetrometer (blows per 100mm drop)		Groundwater Level
	Blow count	Plot of Scala results (Very loose / Loose / Medium Dense / Dense; 0 1 2 3 4 5 6 7 8 9 10)	
	3		Groundwater not encountered during testing.
	15		
	14		
	8		
	3		
	2		
	2		
	1		
	2		
	2		
	2		
	3		
	3		
	3		
	2		
	2		
	3		
	4		
	4		
	9		
	13		
	13		
	7		
	13		
	20+		
	R*		

Notes:

1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. Soils have been described in general accordance with NZ Geomechanics Society "*Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*", December 2005
3. Undrained shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "*Guideline for Hand Held Shear Vane Test*", August 2001.
4. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.

BCD GROUP

Job name: Mangapapa School and Tologa Bay Area School
Site location: 5 Rua St, Mangapapa, Gisborne

Date of investigation: 18/12/17

Job Number: 17-0708
Shear Vane ID: N/A
Logged By: LH
Checked By: BM

APPENDIX B - CPT Results

CPT
TEST REPORT

Client :	**BCD Group Ltd**
Project :	**Mangapapa School**
Location :	**5 Rua St - Gisborne**
Hole Number:	**1**
Tested by :	**J Kavanaugh/ N Oosthuizen**
Date tested :	**20/12/17**
Coordinates :	**E: 2036898**
	N: 5710289
	EL: 8m
Water level :	**EOH - Dipped - GWL @ 2.1m**

Project No :	**2-68000.00**
Lab Ref No :	**HA2212_01**
Client Ref No :	

Test Results

Start Time	**08:45:00**
Time at penetration	**00:00:00**
End Time	**00:00:00**
Reference level	**0**
Ground level	**0**
Predrill	**0**
Penetration Depth	**20**
Remarks	**Target Depth**
GPS Type	**Garmin eTrex 20**
GPS Accuracy	**+ / - 3m**
GPS Reference Grid	**NZTM**
GPS Datum	**MSL**
Rig Type	**GeoMil Panther 100/ Flex 200**
Rig ID	**CPT03**
Reaction Force	**Dead weight 10/22 tonnes**
Data Acquisition (Digitizer)	**GeoMil GME500**
Acquisition Program	**GeoMil CPTest**
Reporting Program	**GeoMil CPTask**
Cone Type	**C10 (10 Tonne Compression)**
Cross Sectional Area	**10cm2**
Cone Area Ratio	**0.8**
Fluid Type	**Silicone Fluid**
Friction Reducer	**0.55m behind base of cone**
Application Class (ISO 22476-1)	**2**
Test Type (ISO 22476-1)	**TE2 (Measured Cone and Sleeve)**
Back Fill Method	**Bentonite**
Observations During Testing	**None**

Date tested : 20/12/17
Date reported : 20/12/17

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 20/12/17

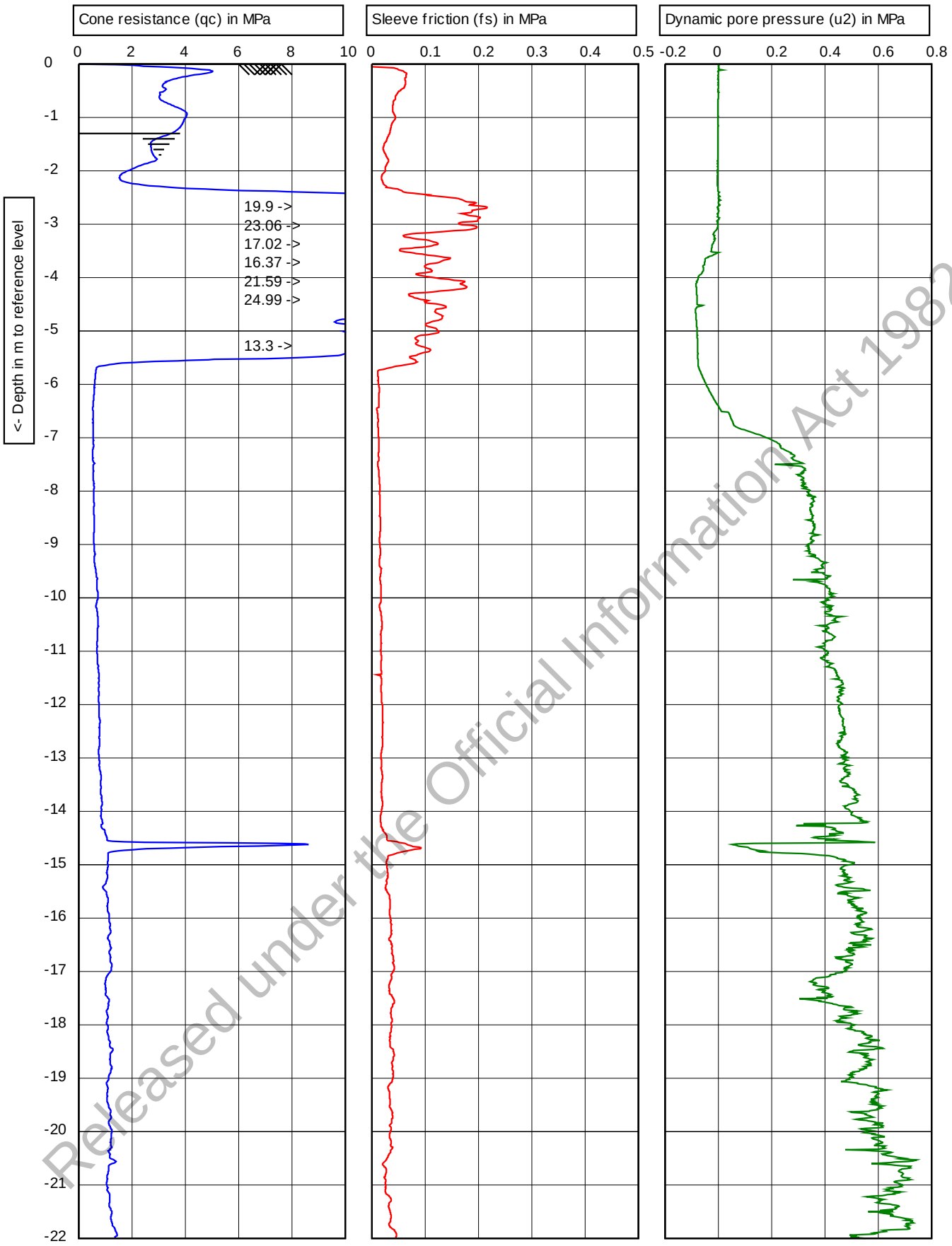
IANZ ACCREDITED LABORATORY

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

Quality Management Systems Certified to ISO 9001

,

Telephone
Facsimile
Website



OPUS

IANZ ACCREDITED LABORATORY

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

1.44

u2
150 cm²
10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012

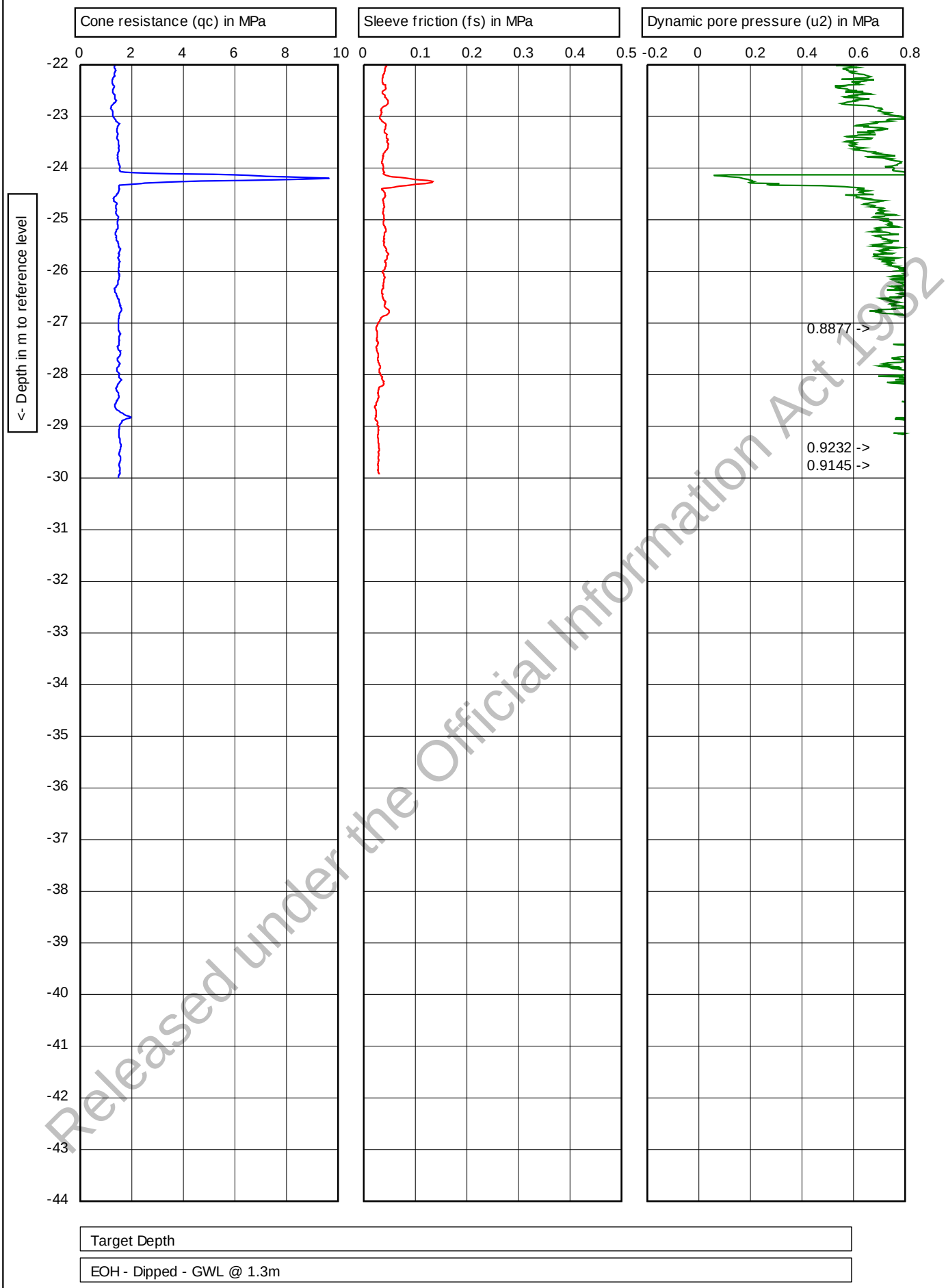
G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**

Location: **5 Rua St - Gisborne**

Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** **1/12**



OPUS
IANZ ACCREDITED LABORATORY
Graphs indicated as not accredited are outside the scope of the laboratory's accreditation

u2
150 cm²
10 cm²

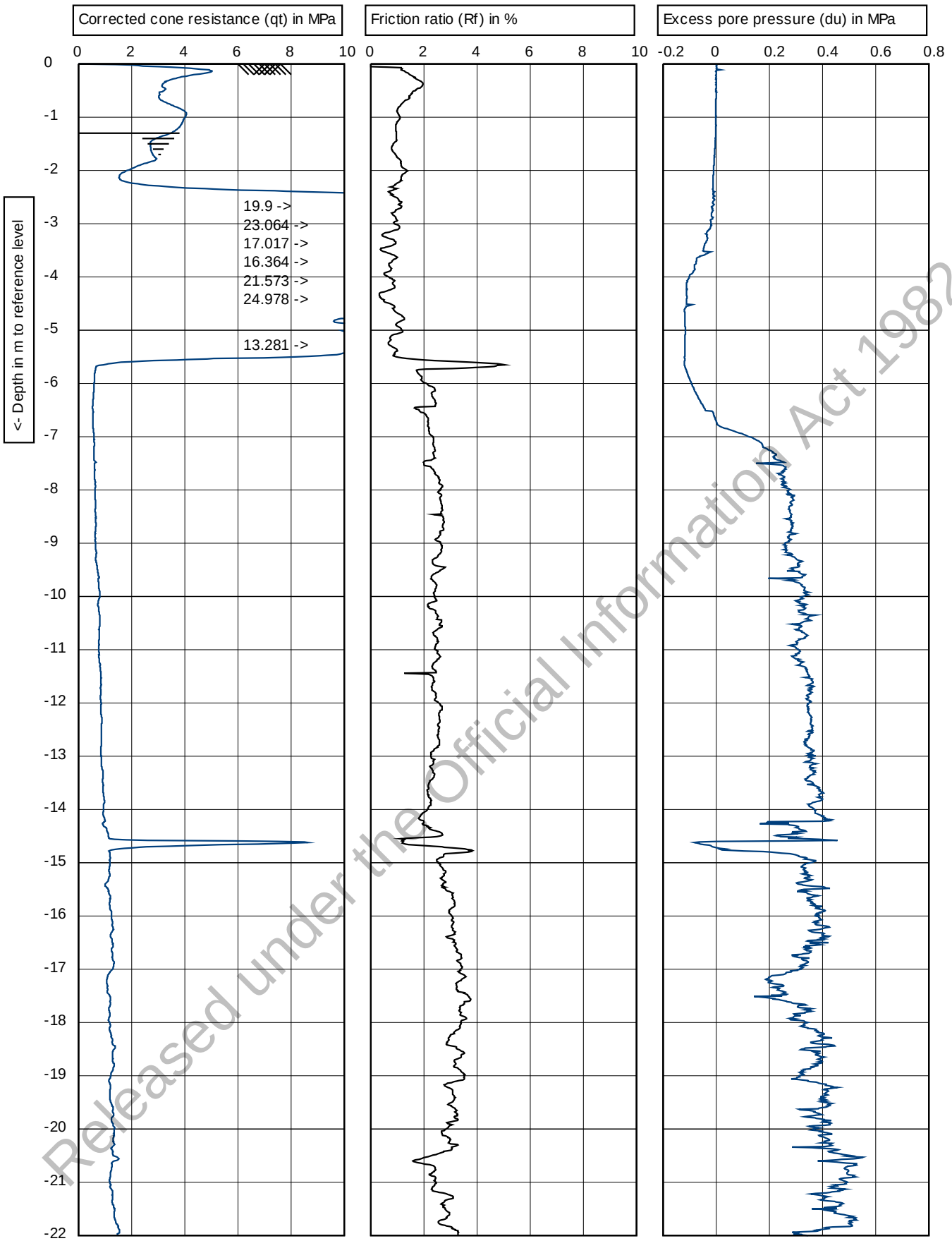
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** **2/12**

1.44



OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

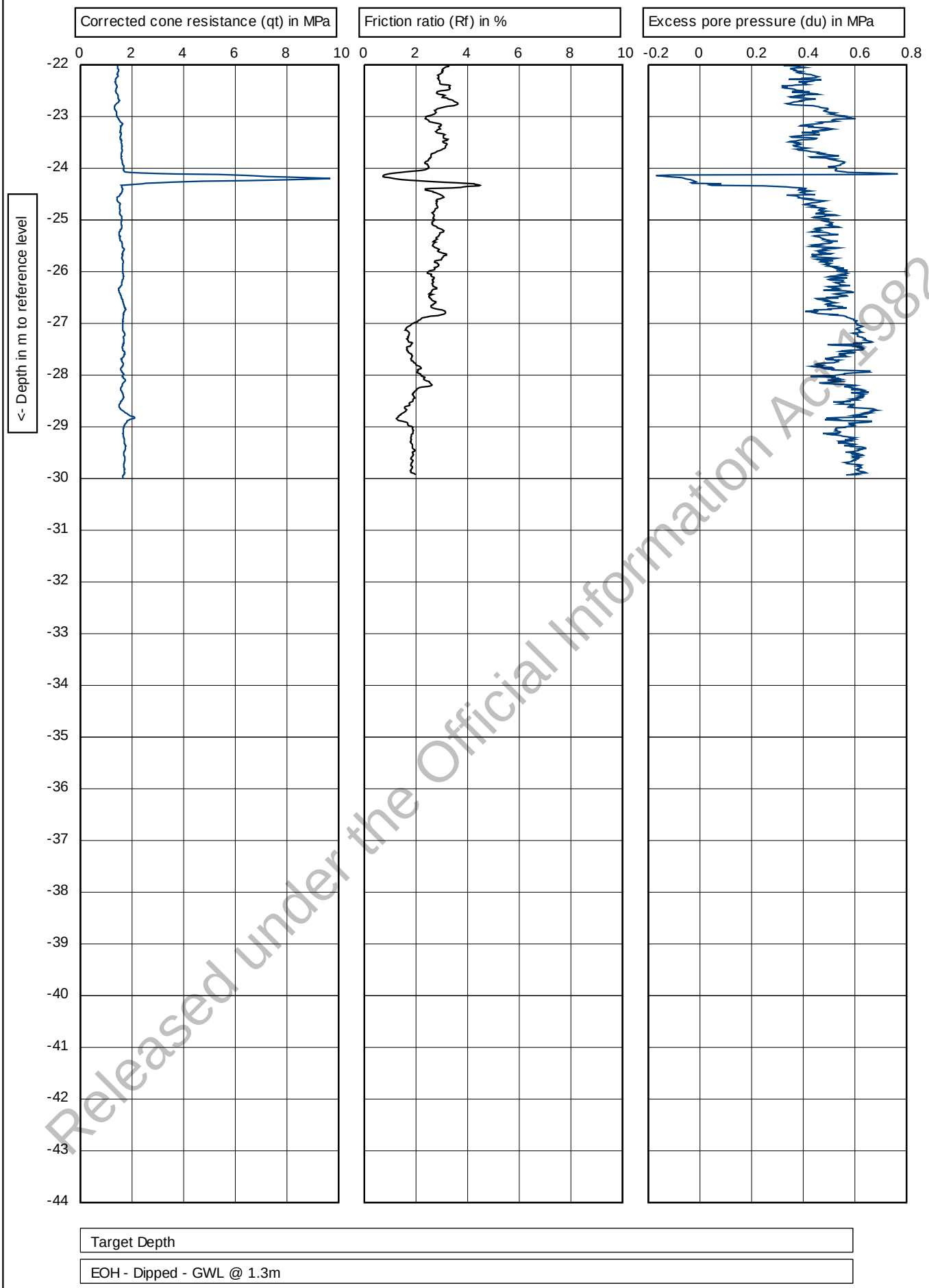
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** 3/12

1.44



Target Depth

EOH - Dipped - GWL @ 1.3m

OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

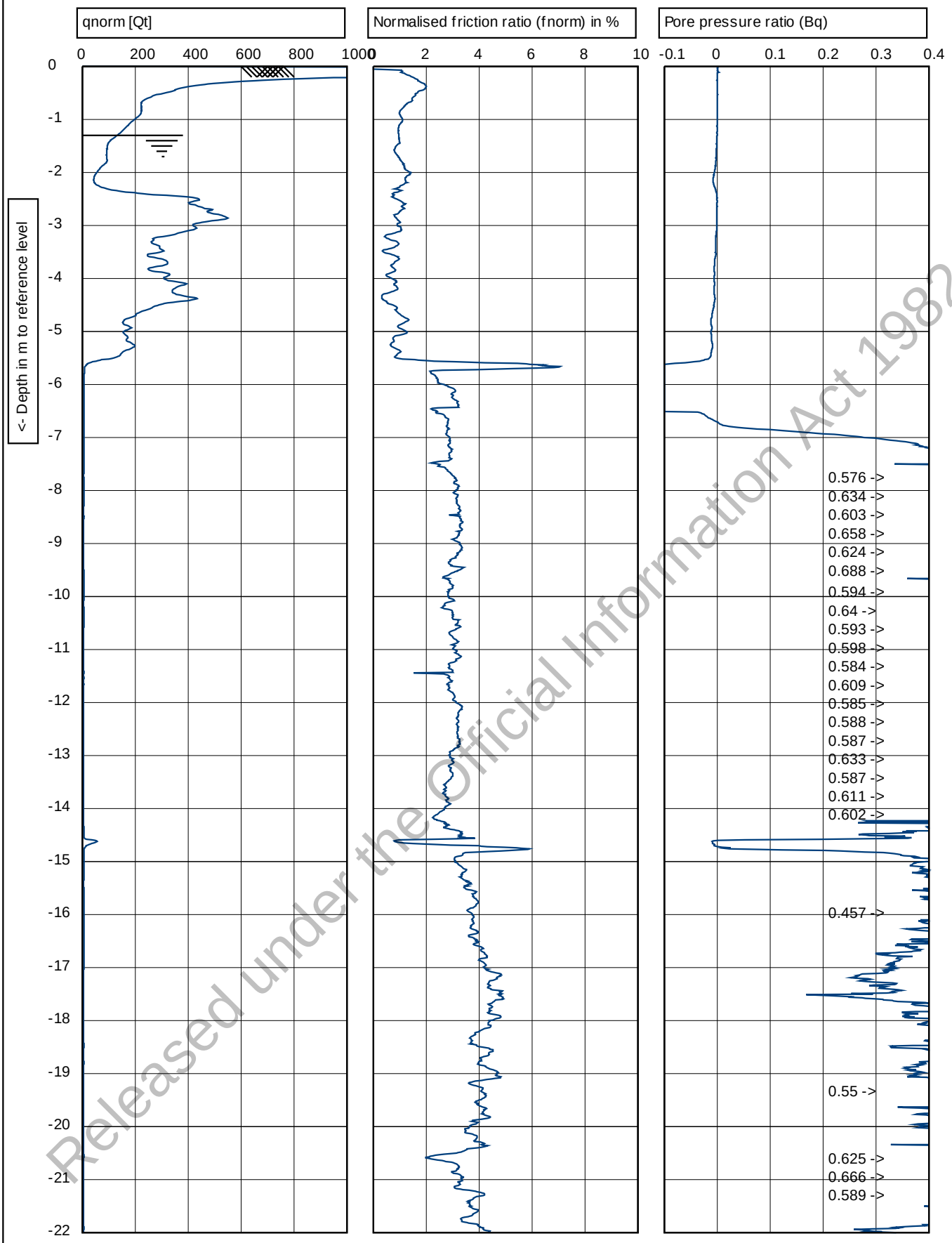
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** 4/12

1.44



OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

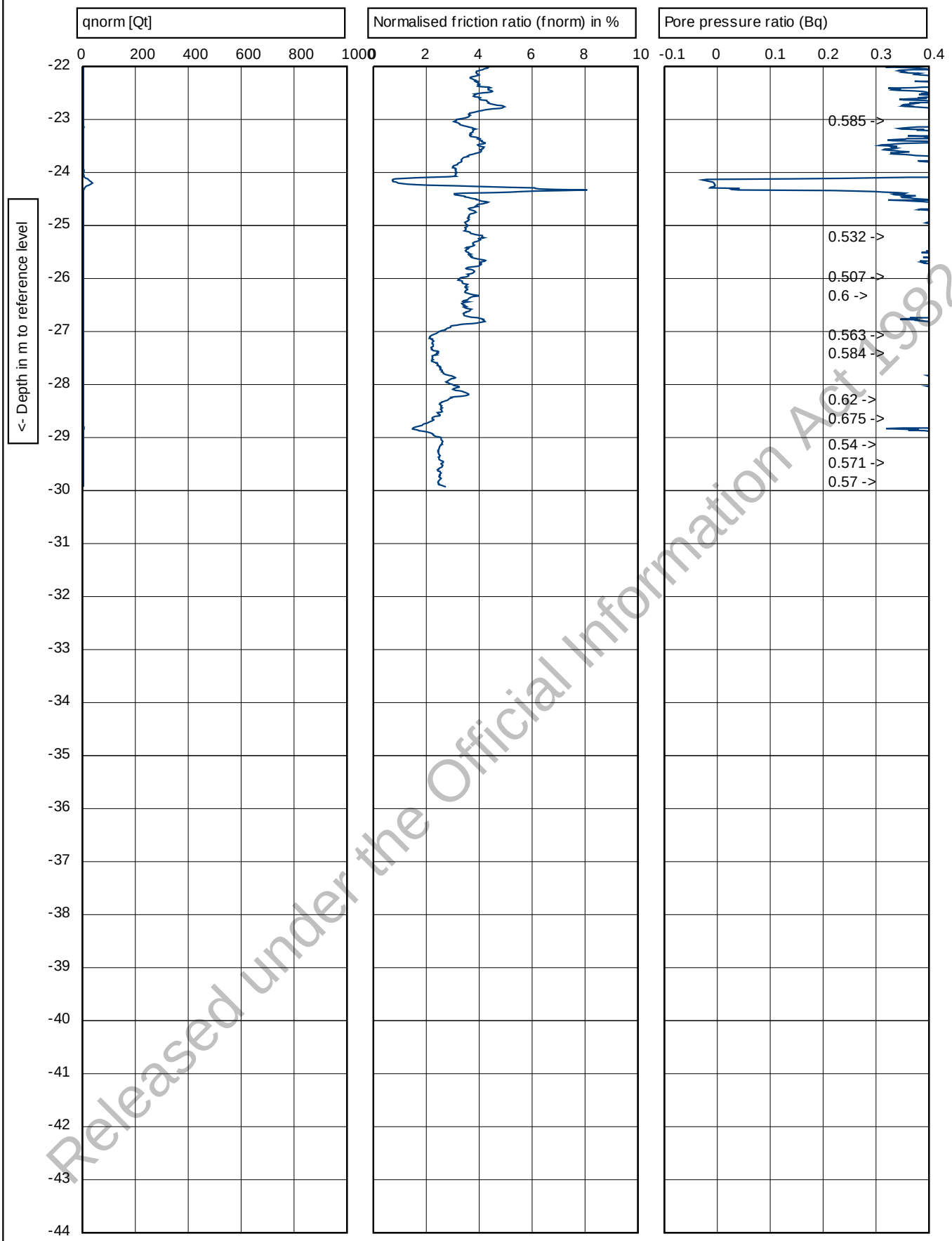
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** 5/12

1.44



Target Depth

EOH - Dipped - GWL @ 1.3m

OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

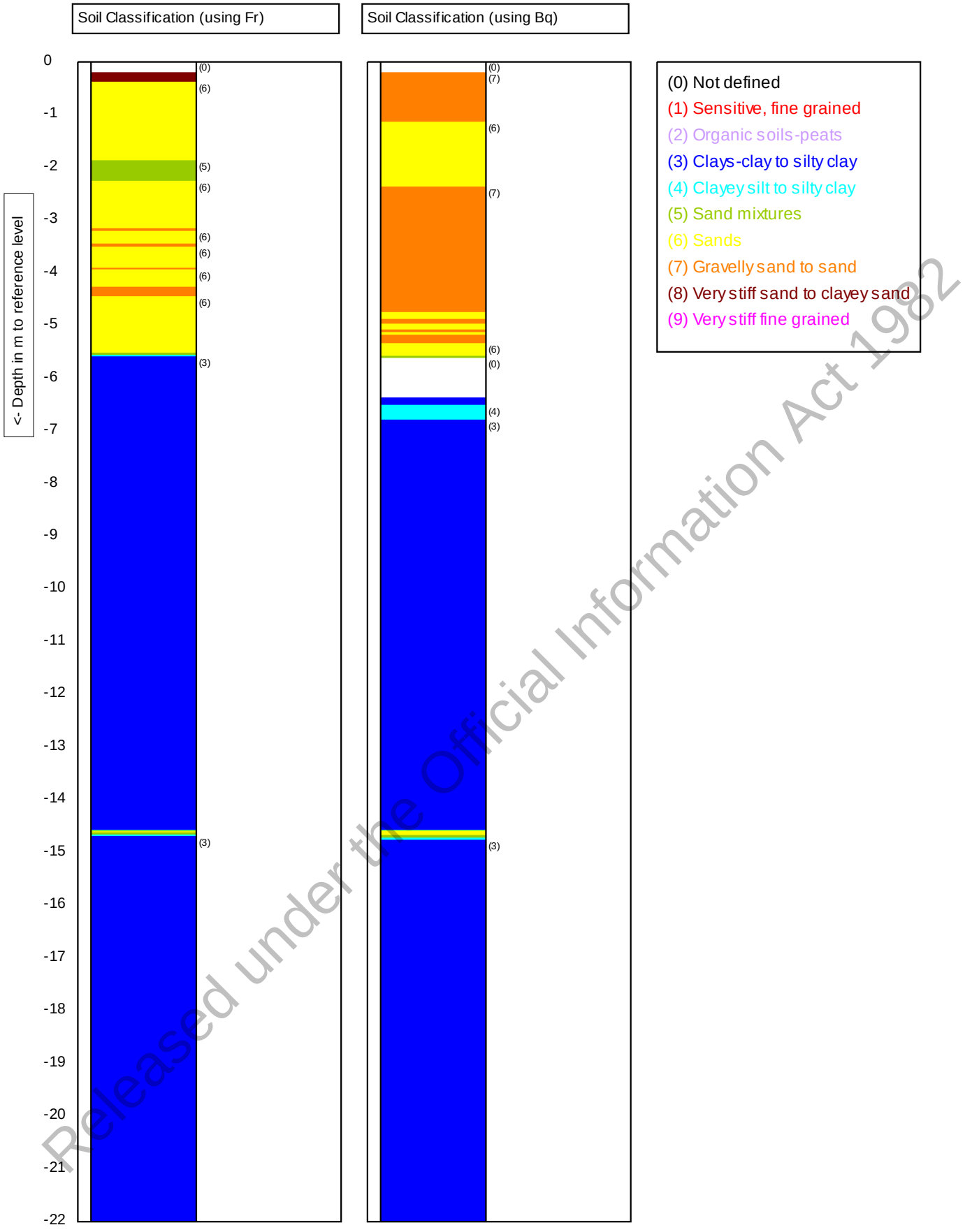
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** 6/12

1.44

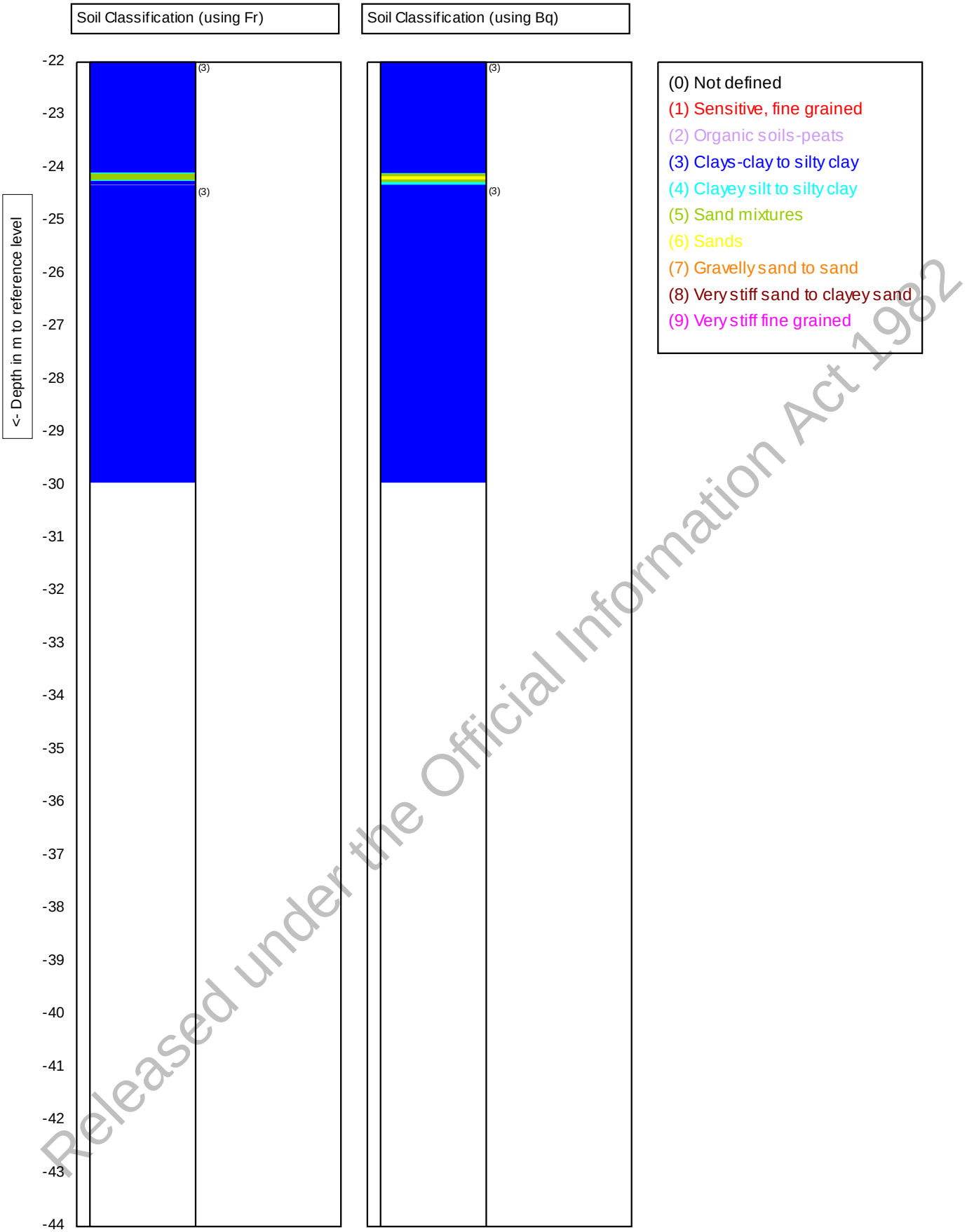


OPUS

Graphs on this page are not IANZ accredited

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	0.00 m Predrilled
G.L.: 0.00 m MSL	W.L.: -1.30 m	Date:	20/12/2017
Project: Mangapapa School		Cone no.:	C10CFIIP.C14434
Location: 5 Rua St - Gisborne		Project no.:	2-68000.00_HA2212
Position: 2036953, 5710315 NZTM		CPT no.:	04 7/12

1.44



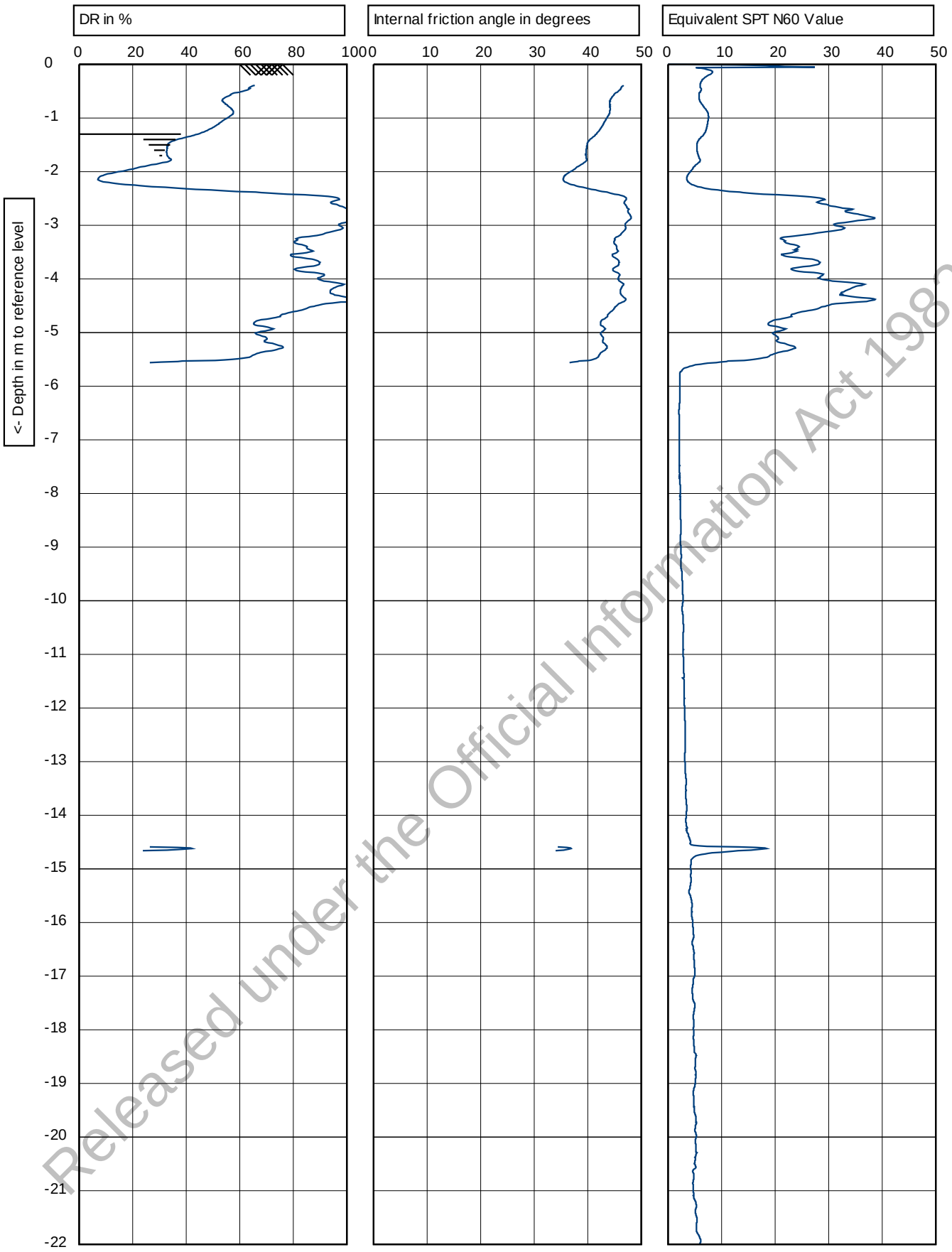
OPUS

Graphs on this page are not IANZ accredited

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	0.00 m Predrilled
G.L.: 0.00 m MSL	W.L.: -1.30 m	Date:	20/12/2017
Project: Mangapapa School		Cone no.:	C10CFIIP.C14434
Location: 5 Rua St - Gisborne		Project no.:	2-68000.00_HA2212
Position: 2036953, 5710315 NZTM		CPT no.:	04 8/12

u2 150 cm² 10 cm²

1.44



OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

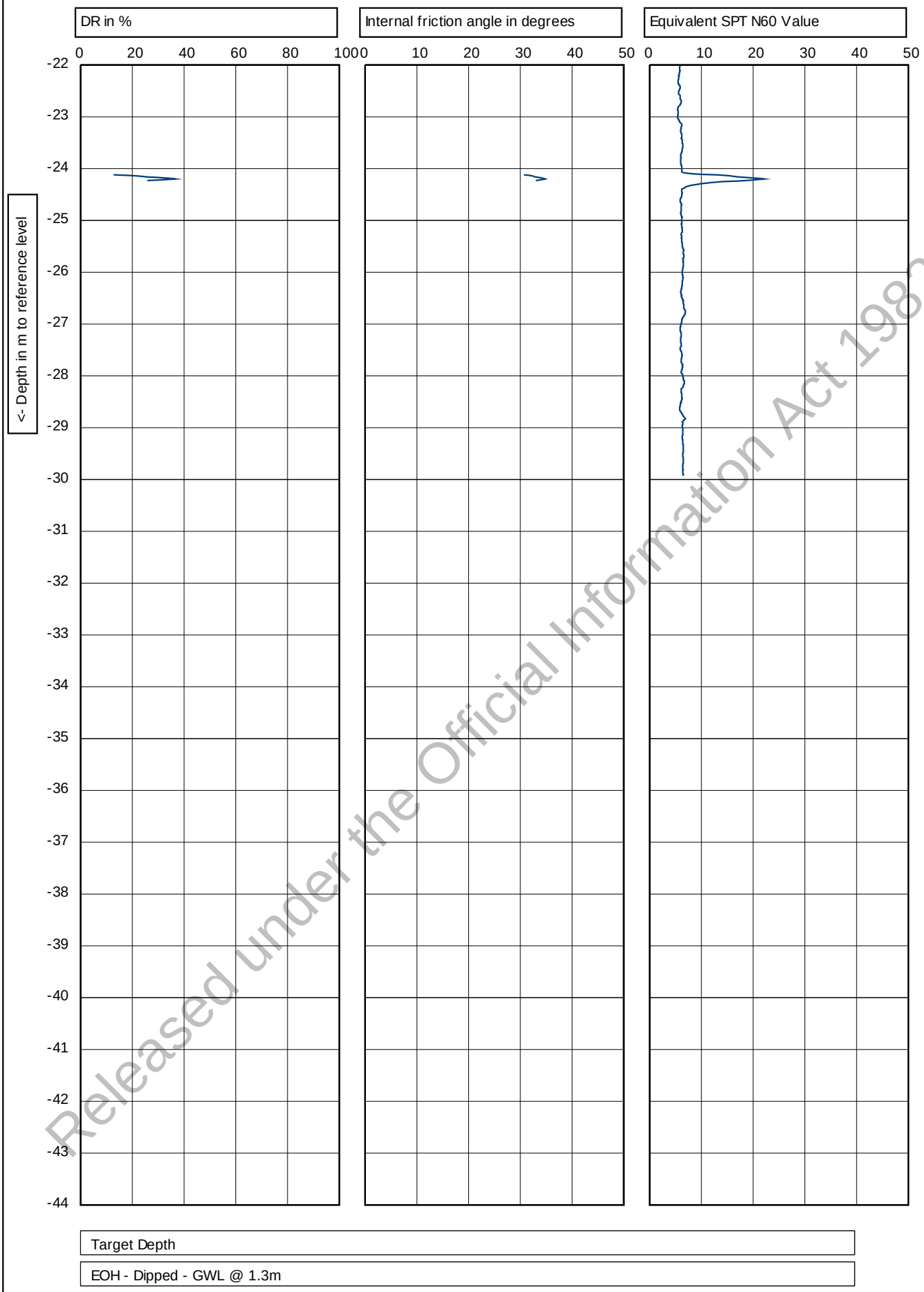
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** **9/12**

1.44



Target Depth

EOH - Dipped - GWL @ 1.3m

OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

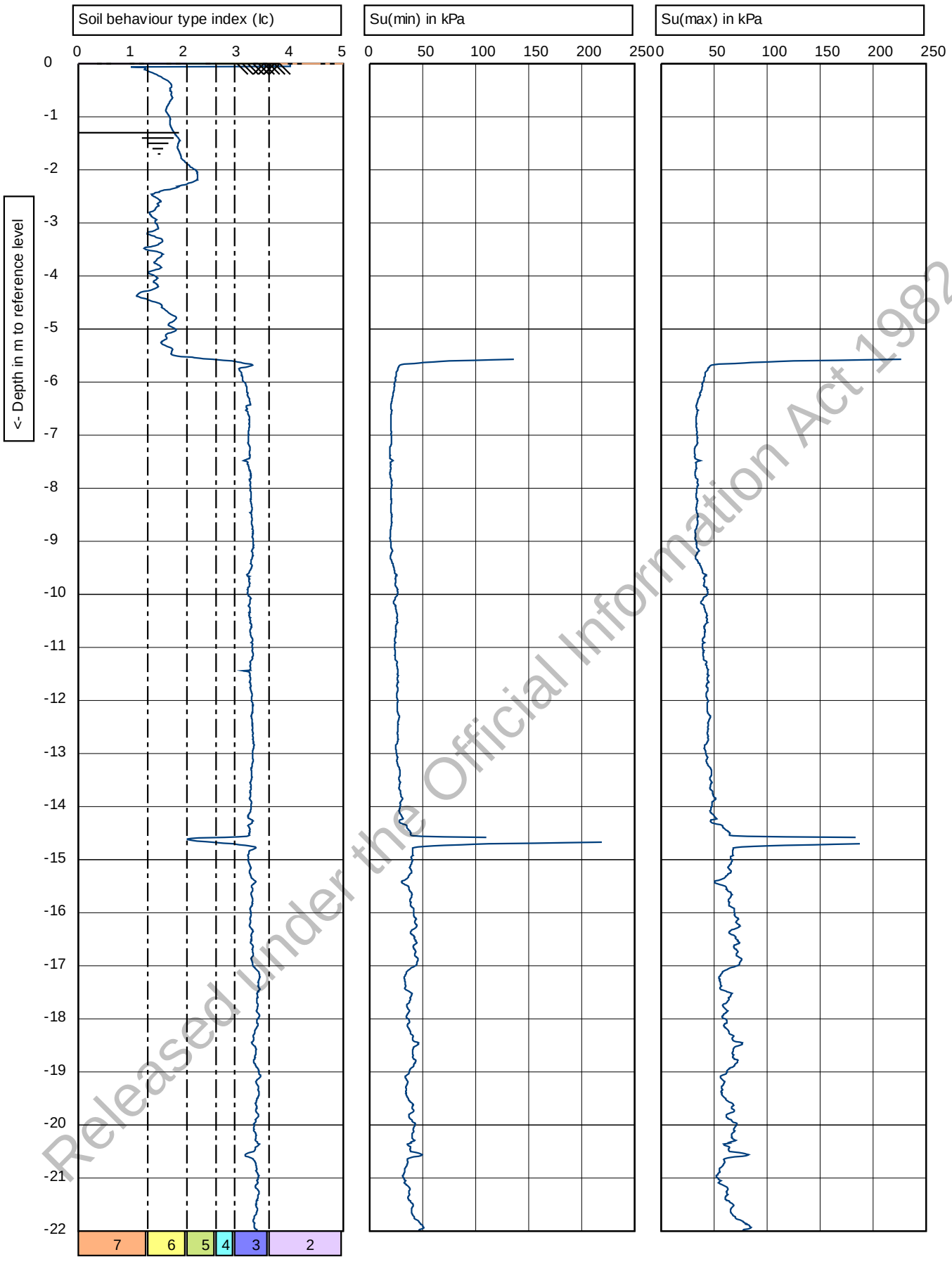
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** **10/12**

1.44



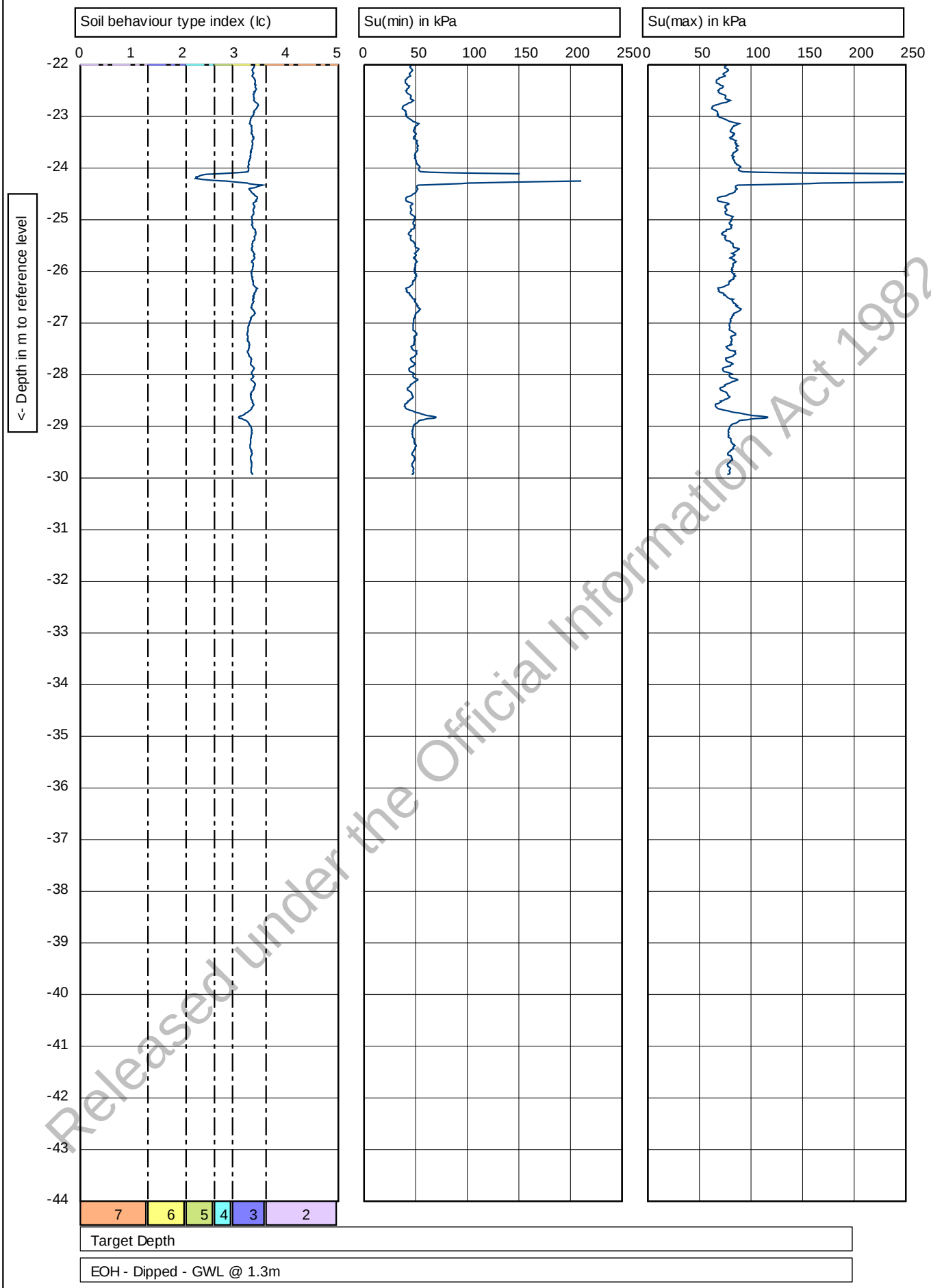
OPUS

Graphs on this page are not IANZ accredited

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	0.00 m Predrilled
G.L.: 0.00 m MSL	W.L.: -1.30 m	Date:	20/12/2017
Project: Mangapapa School		Cone no.:	C10CFIIP.C14434
Location: 5 Rua St - Gisborne		Project no.:	2-68000.00_HA2212
Position: 2036953, 5710315 NZTM		CPT no.:	04 11/12

u2 150 cm² 10 cm²

1.44



OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

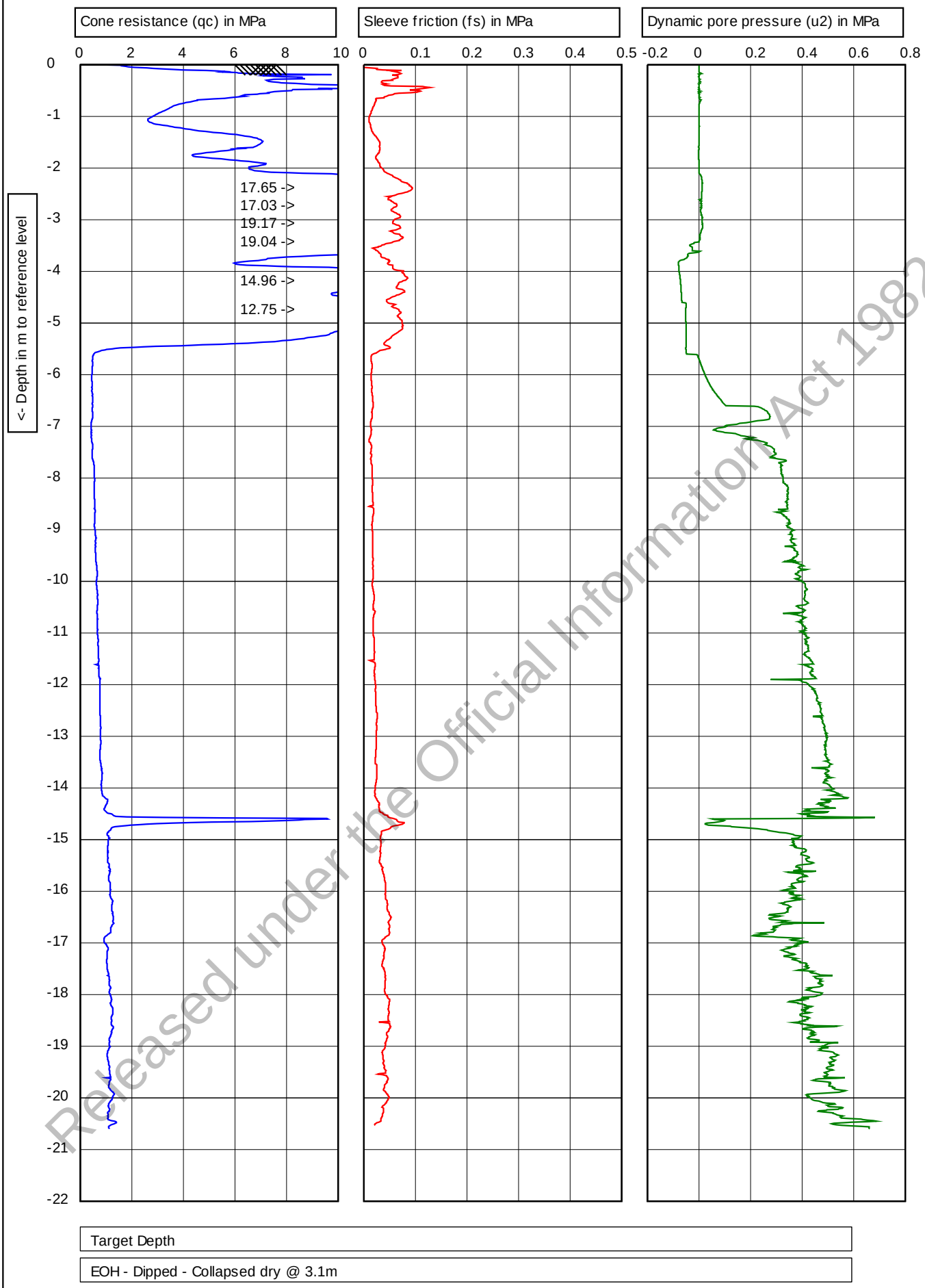
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.30 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036953, 5710315 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**20/12/2017**
Cone no.:	**C10CFIIP.C14434**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**04** 12/12

1.44



Target Depth

EOH - Dipped - Collapsed dry @ 3.1m

OPUS

IANZ ACCREDITED LABORATORY

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

1.44

u2 150 cm² 10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012

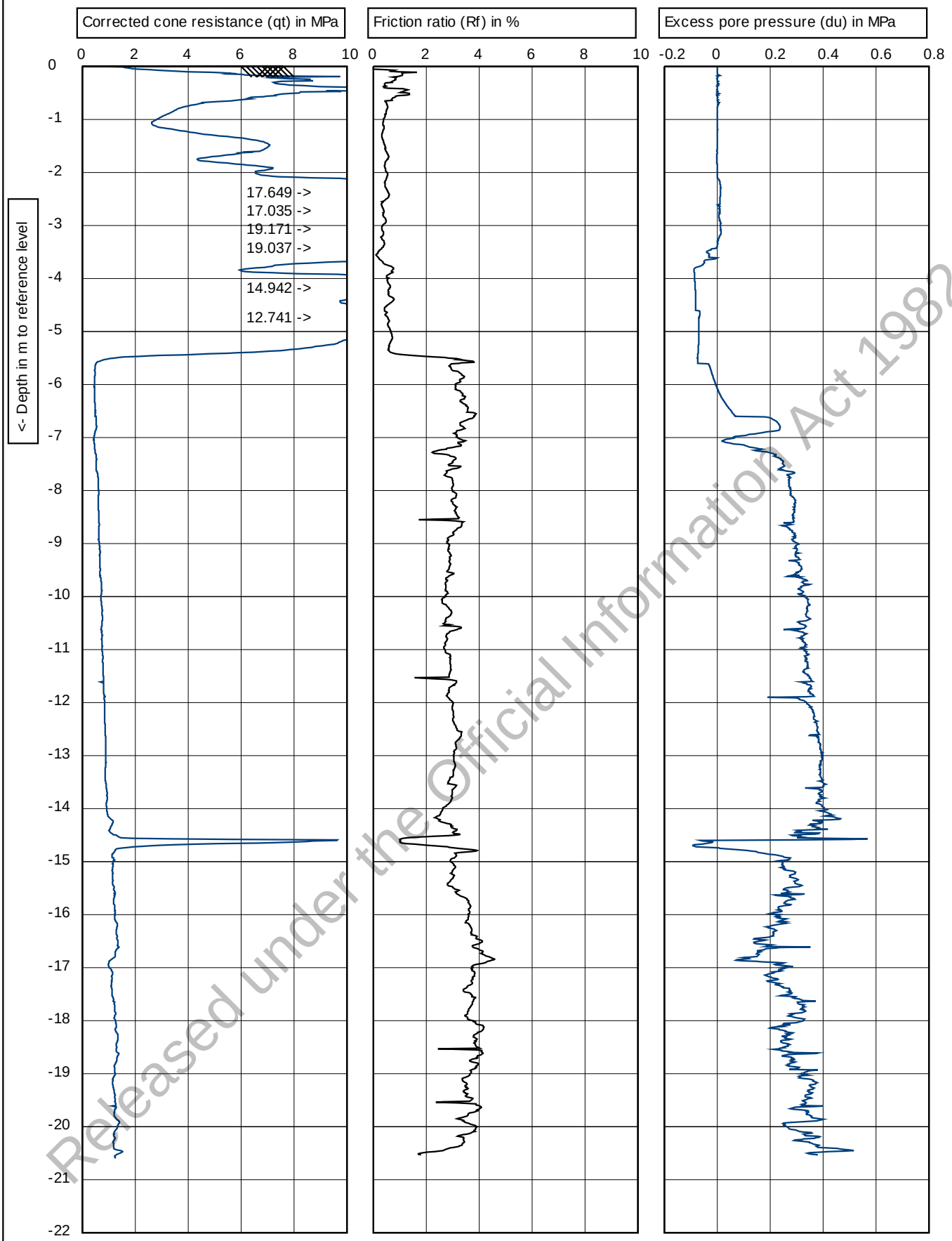
G.L.: **0.00 m MSL** W.L.: **-3.10 m**

Project: **Mangapapa School**

Location: **5 Rua St - Gisborne**

Position: **2036942, 5710286 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**18/12/2017**
Cone no.:	**C10CFIIP.C14427**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**S02** **1/6**



OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

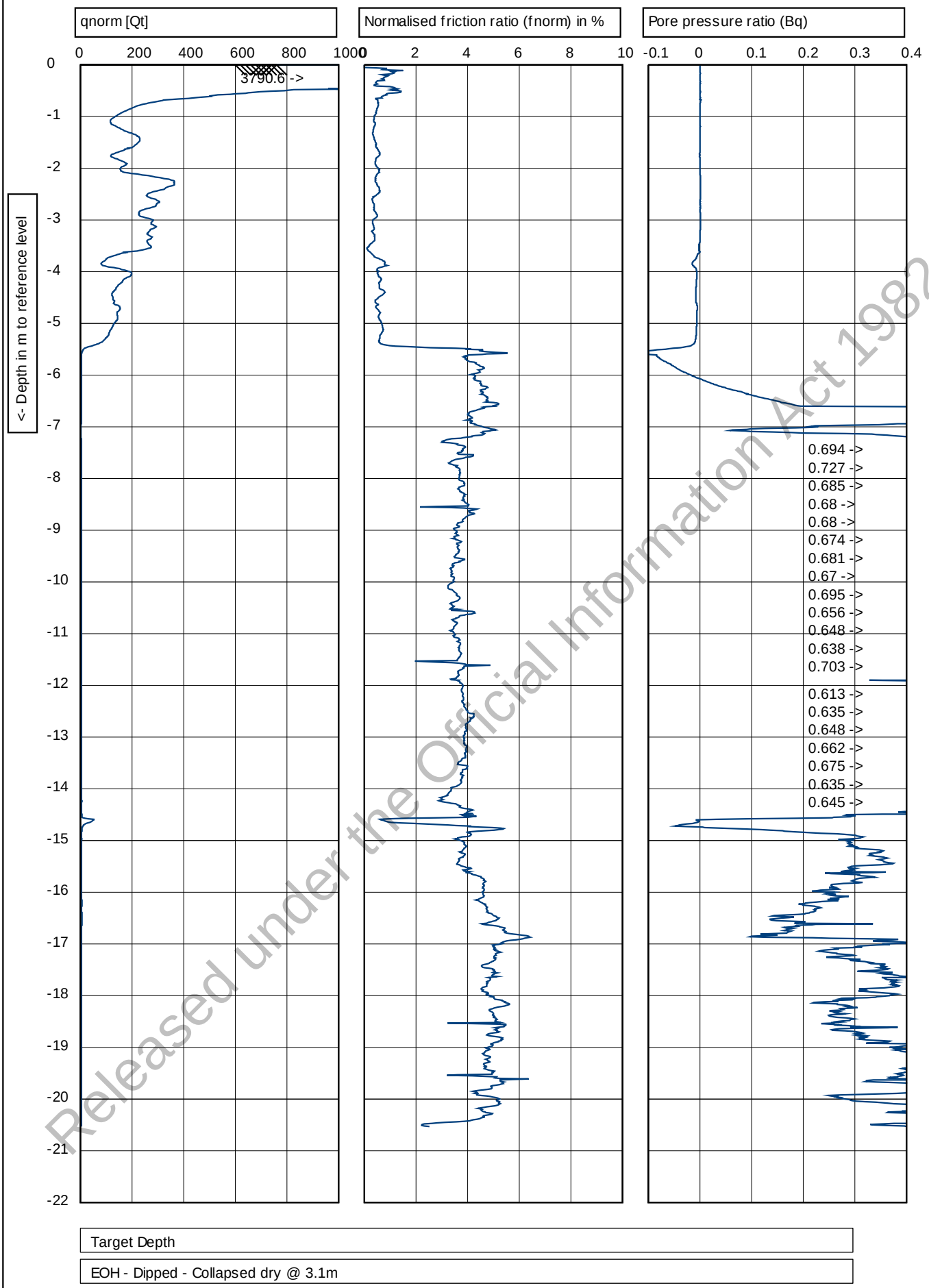
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-3.10 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036942, 5710286 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**18/12/2017**
Cone no.:	**C10CFIIP.C14427**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**S02** **2/6**

1.44



Target Depth

EOH - Dipped - Collapsed dry @ 3.1m

OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

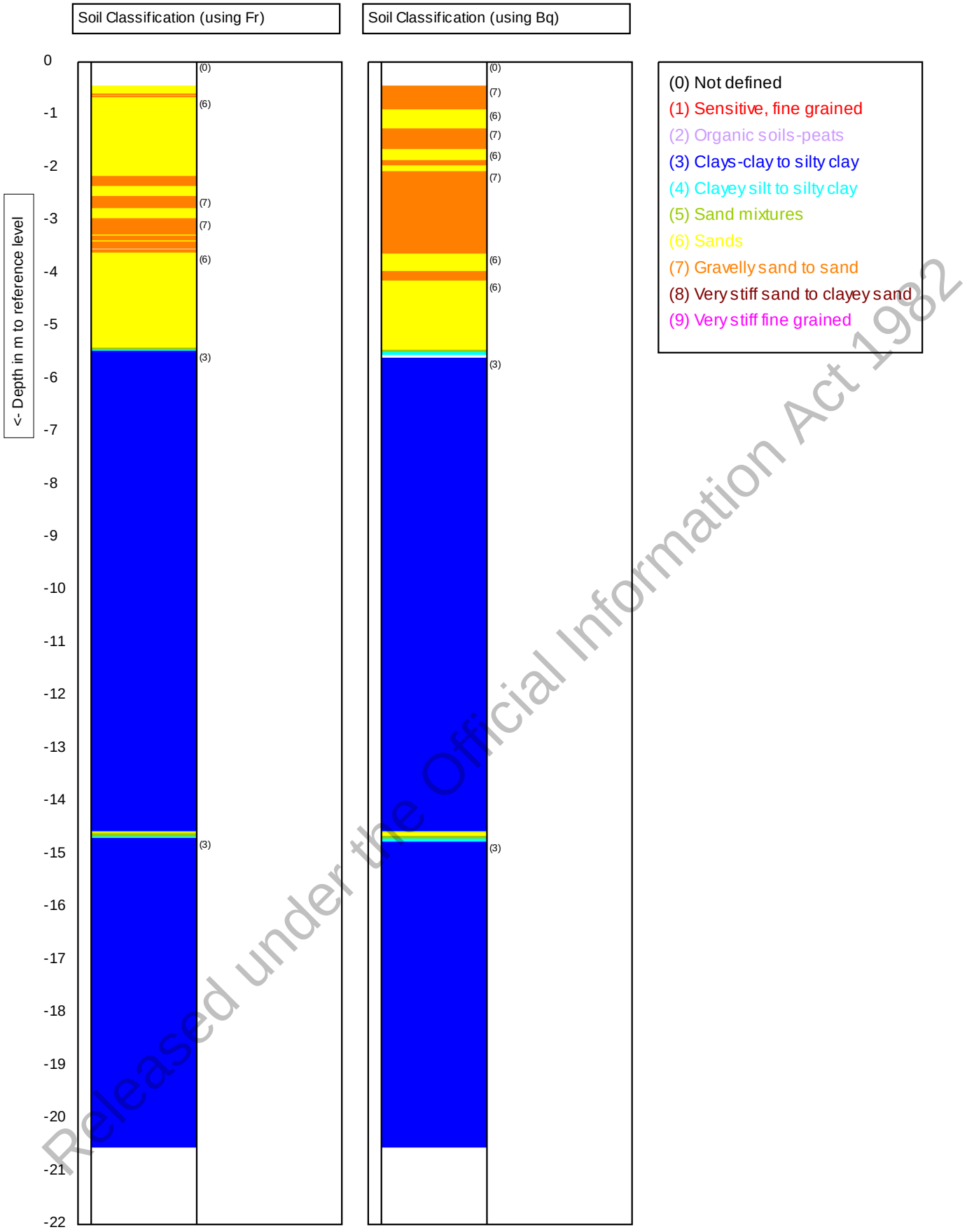
Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-3.10 m**

Project: **Mangapapa School**
Location: **5 Rua St - Gisborne**
Position: **2036942, 5710286 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**18/12/2017**
Cone no.:	**C10CFIIP.C14427**
Project no.:	**2-68000.00_HA2212**
CPT no.:	**S02** **3/6**

1.44



OPUS

Graphs on this page are not IANZ accredited

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	0.00 m Predrilled
G.L.: 0.00 m MSL	W.L.: -3.10 m	Date:	18/12/2017
Project: Mangapapa School		Cone no.:	C10CFIIP.C14427
Location: 5 Rua St - Gisborne		Project no.:	2-68000.00_HA2212
Position: 2036942, 5710286 NZTM		CPT no.:	S02 4/6

1.44