



**REPORT TO
NORTHERN BEACHES COUNCIL**

**ON
GEOTECHNICAL INVESTIGATION**

**FOR
PROPOSED COMMUNITY CENTRE**

**AT
CORNER PITTWATER ROAD AND JACKSON ROAD,
WARRIEWOOD, NSW**

Date: 5 February 2021

Ref: 33681SDrpt

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DOCUMENT REVISION RECORD

Report Reference	Report Status	Report Date
33681SDrpt	Final Report	5 February 2021

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CPT Result Sheets JK1 to JK4

Figure 1: Site Location Plan

Figure 2: Investigation Location Plan

Report Explanation Notes

Appendix A: Borehole logs and CPT Result Sheets from Previous DP Report

1 INTRODUCTION

This report presents the results of a supplementary geotechnical investigation for the proposed community centre at the corner of Pittwater Road and Jackson Road, Warriewood, NSW. The location of the site is shown in Figure 1. The investigation was commissioned by Cody Mather of Northern Beaches Council by Purchase Order No. P0140006, dated 24 November 2020. The commission was on the basis of our fee proposal, Ref. P52917HD dated 23 October 2020.

We have been provided with architectural drawing prepared by Terroir (Project No: 19319, Drawing Nos. DA-000-00, DA-001-01, DA-002-02, DA-003-03, DA-004-04, DA-005-01, DA-006-05, DA-006-51 to DA-006-54, DA-007-40 and DA-007-41, Revision 1, dated 18 December 2020) and site survey plans prepared by LTS Lockley (Ref: 50601 001DT, Sheets 1 to 3, dated 29 January 2019).

Based on the provided information, we understand that following demolition of the existing buildings and pavements on site, construction of a multi-use community centre and extended on-grade car park are proposed. Some minor excavation to a maximum depth of about 0.3m will be required in the south-eastern corner of the site, but the remainder of the site will require filling to achieve the building Finished Floor Level (FFL) at 4.1m.

The purpose of the investigation was to obtain supplementary geotechnical information on the subsurface conditions, and to use this as a basis for providing comments and recommendations on earthworks, drainage, footing design, retaining wall design, on-grade floor slabs, external pavements, and landslide risk management.

2 BACKGROUND INFORMATION

Douglas Partners (DP) have previously completed geotechnical investigations for the subject site, the results of which are presented in their report (Project No. 86745, Document No. R.001.Rev0, dated 23 April 2019).

The previous DP investigation comprised four Cone Penetration Tests (CPT101A to CPT104) completed to termination depths of 12m (CPT102 to CPT104) and a refusal depth of 16.5m (CPT101A), seven boreholes (BH101 to BH105, HA106 and HA107) auger drilled to depths between 1.5m (HA107) and 4.0m (BH102). Two bulk soil samples were submitted for four-day soaked California Bearing Ratio (CBR) testing and select soil samples were submitted to Envirolab Services Pty Ltd for soil pH, chloride, sulfate and electrical conductivity (to test soil aggression).

The relevant borehole logs, CPT results sheets, soil aggression and CBR testing results from the previous DP report are attached in Appendix A and the locations of these tests are also shown on the attached Figure 2.

3 CURRENT INVESTIGATION PROCEDURE

The fieldwork for the current investigation was carried out on 11 November 2020 and comprised four additional CPT tests (JK1 to JK4) completed to depths between 16.09m (JK2) and 22.30m (JK3) below the existing surface levels, using our 24 tonne truck-mounted CPT rig.

The test locations are shown on the attached investigation location plan (Figure 2). The surface RLs at the test locations were estimated by interpolation between spot levels indicated on the survey plan which forms the basis of Figure 2. The datum is the Australian Height Datum (AHD).

Prior to commencement of the fieldwork, the CPT locations were scanned for the presence of buried services by a specialist sub-contractor.

The CPT involved continuously pushing a testing probe with a 35mm diameter conical tip into the subsoil profile using the hydraulic rams of a ballasted truck-mounted rig. Measurements were made during testing of the end resistance of the cone tip and the frictional resistance of a separate 134mm long sleeve located directly behind the cone. The testing was carried out using a piezocone, which measures pore water pressures within the soils and provides an indication of the depth of the groundwater and soil properties.

We note that the CPT does not recover soil samples and the strength/relative density and composition of the subsurface materials were assessed by interpretation of the CPT results using published and in-house correlations.

Groundwater observations were also made following extraction of the CPT rods. No long-term groundwater monitoring was carried out.

Our geotechnical engineer (Baki Lahil) was present on a full-time basis during the fieldwork and set out the test locations, directed the buried services scan, and operated the computerised data collection system during testing. The CPT results (including an interpreted subsoil profile and pore water pressure profile) are attached, together with a glossary of logging terms and symbols used.

Contamination screening of the site soils and groundwater were outside the agreed scope of the investigation.

4 RESULTS OF INVESTIGATION

4.1 Site Description

The site is located on a north facing hillside which generally slopes at about 3°. The site is bounded by Jacksons Road to the south, Pittwater Road to the east and Boondah Road to the west. Boondah Reserve, which comprises grass playing fields, is located to the north. The site generally slopes down to the north at between about 2° to 3°.

At the time of fieldwork, the site contained two centrally located single storey brick buildings with no basement. Concrete and asphaltic concrete (AC) surfaced carparks and driveways surround the western building. The existing AC surfaced car park areas were generally in fair condition with some with some uneven pavements likely caused by root jacking, crocodile cracking, potholes and ravelling. Some resurfaced pavement was also noticed within the site.

Small to large trees and garden beds were located mainly along the site boundaries but were also scattered throughout the site. An unlined drainage swale was located adjacent to the north-west corner of the existing eastern building.

4.2 Subsurface Conditions

Reference to the 1:100,000 Geological Series Sheet for Sydney indicates the site is underlain by deep alluvial deposits comprising silty clay and silty sand. The subsurface conditions encountered at the test locations comprised a limited thickness of surficial fill overlying the expected alluvial sands and clays. For detailed subsurface conditions at each test location, reference should be made to the attached CPT results sheets. A summary of some of the more pertinent subsurface information is outlined below.

Pavement

Concrete pavement 140mm thick was encountered from the surface in JK4 and asphaltic concrete 100mm thick was reported from the surface in BH101 to BH104.

Fill

A limited thickness of fill comprising gravelly sand, clayey sand, sand and clay was encountered from surface of each JK1 to JK3, BH105, HA106, HA107, CPT101A to CPT104 and beneath the concrete pavement in JK4 and BH101 to BH104. The fill extended to depths between about 1.2m (HA107) and 2.8m (CPT101A). From the CPT results the fill was assessed to be generally poorly to moderately compacted with a limited thickness of well compacted fill encountered in the upper 0.5m depth of JK1. In the augered boreholes inclusion comprising various gravel, silt, and organic content along with building rubble were observed in the fill profile.

Alluvial Soils

Alluvial soils comprising predominately very loose to medium dense sands over silty clay of very stiff and hard strength, were indicated below the fill at each investigation location down to the CPT termination depths of 16.13m (JK1) and 16.09m (JK2) and refusal depths of 22.30m (JK3), 18.75m (JK4) and 16.50m (CPT101A)

A soft to firm strength sandy peat layer about 1.2m thick was encountered below the fill in BH103 and extended to a depth of about 2.6m.

Inferred Weathered Bedrock

Weathered bedrock was inferred at the CPT refusal depths of 22.30m (JK3), 18.75m (JK4) and 16.5m (CPT101A), however as the CPT cannot penetrate rock, the presence of rock cannot be confirmed.

Groundwater

Groundwater was indicated during CPT probing and borehole drilling at the following depths.

Investigation Location	Approximate Groundwater Depth (m)	Approximate Groundwater RL (mAHD)
JK1	2.9	0.4
JK2	2.2	0.8
JK3	2.9	0.0
JK4	3.3	0.7
BH101	2.3	1.2
BH102	2.0	1.8
BH103	2.3	1.5
BH104	2.5	1.6
BH105	2.0	2.0
HA106	2.2	1.9

4.3 Previous Laboratory Test Results

The soil aggression tests completed by Envirolab Services shows the site soils to vary for alkaline to acidic, to have sulfate contents not greater than 31mg/kg, chloride content not greater than 820mg/kg and resistivity greater than 2,500 ohm.cm.

The two four-day soaked CBR test samples comprised combining a soil sample from BH101 with a sample from BH102 and a sample from BH105 with a sample from BH106; these combined samples resulted in CBR values of 15% and 14%, respectively.

5 Stability Assessment

The site is located within the former Pittwater Local Government Area (LGA), however, the proposed development site is located outside all Hazard Zones as identified on the 'Pittwater Geotechnical Hazard Map'. Excavation for the proposed development is expected to be significantly less than 1m depth and filling to raise site level to be a maximum of height of about 0.8m, therefore, we consider that the site does not meet the criteria required for a Geotechnical Risk Management in accordance with the 'Geotechnical Risk Management Policy for Pittwater – 2009'.

6 COMMENTS AND RECOMMENDATIONS

6.1 Excavation

The following recommendations should be read in conjunction with the NSW Government 'Code of Practice Excavation Work' dated January 2020.

6.1.1 Excavation Methods

Construction of the proposed community centre will require demolition and of the existing buildings, structures and pavements, and removal of vegetation. Following this, all top soil and root affected soil, and any deleterious or contaminated existing fill should be stripped. Stripped topsoil and/or root affected soils should be stockpiled separately as they are is not considered suitable for reuse as engineered fill but may be reused for landscaping purposes. Guidelines on offsite disposal of soils are provided in Section 7 below.

Excavation for the proposed community centre will extend to a maximum depth of about 0.3m below the existing surface levels. The excavations will extend through the fill profile which can be readily excavated using the bucket attachment on a hydraulic excavator.

6.1.2 Groundwater Seepage

Excavation is not expected to extend below the groundwater table, however, Intermittent groundwater and surface inflow may occur within excavations following periods of heavy rain. We expect inflows to be very small volume and managed by infiltration into the sandy subgrade. Inspection and monitoring of groundwater seepage during excavation is recommended, so that any unexpected conditions, which may be revealed can be incorporated into the drainage design

6.2 Temporary Excavation Batters and Retention

6.2.1 Temporary Excavation Batters

Temporary batter slopes no steeper than 1 Vertical (V) in 1.5 Horizontal (H) in sandy soils are considered appropriate and can be accommodated within the site geometry.

Stockpiles of construction materials, excavation spoil etc, must be kept well clear of the crest of these batters to avoid surcharging the slope.

Some instability of temporary sand batters may occur at, or below, the level of any groundwater seepage, especially after rain periods, and sand bagging may be required to stabilise the lower portion of these batters. Conventional retaining walls may be constructed at the base of the batters and subsequently backfilled

6.2.2 Retention Design

The following earth pressure coefficients and subsoil parameters may be adopted for the design of conventional retaining walls and landscape walls.

- Free-standing cantilever walls which are retaining areas where movement is of little concern (i.e. landscape walls), should be designed using a triangular lateral earth pressure distribution and an 'active' earth pressure coefficient K_a , of 0.35, for the soil profile and extremely weathered sandstone profile, assuming a horizontal retained surface.
- A bulk unit weight of 20kN/m^3 should be adopted for the soil profile.
- Any surcharge affecting the walls (e.g. sloping surfaces, construction loads, etc) should be allowed for in the design using the appropriate earth pressure coefficient from above.
- The retaining walls should be designed as drained, and measures taken to provide permanent and effective drainage of the ground behind the walls. Subsurface drains should incorporate a non-woven geotextile fabric such as Bidim A34, to act as a filter against subsoil erosion. The subsoil drains should discharge into the stormwater system or dissipated in landscaped areas.
- Lateral toe restraint may be achieved by embedment of the wall into the soil below bulk excavation level or design surface level. A triangular lateral earth pressure distribution should be used with a 'passive' earth pressure coefficient, K_p , of 3 adopted for the soil and provided a Factor of Safety of at least 2 is used in order to reduce the high deflections that are associated with achieving a full passive case. Any localised excavation in front of the walls, such as for buried services, etc, should also be taken into account in the wall design.

6.3 Earthworks

6.3.1 Subgrade Preparation

The presence of poorly compacted and variable fill to depths of around 1.2m to 2.8m would generally dictate that raising site levels with engineered fill for the community centre building and car parks be undertaken from the existing surface levels. A working platform comprising high strength crushed rock might also be required, at least in some areas not currently covered by pavements, if heavy piling rigs are to be used.

No particular earthworks would be required for the subgrade below floor slabs that will be fully suspended.

For the proposed car parking areas a flexible pavement design involving an asphaltic concrete (AC) surface over high-quality basaltic, fine crushed rock is recommended. Flexible AC pavements are preferable from a maintenance viewpoint given the soft, compressible soils beneath the fill in some parts of the site. By constructing new pavements over the uncontrolled filling and underlying soft soils, there will always be a higher-than-normally-accepted risk of ongoing settlement related problems occurring. The extent of this potential problem can be assessed from the performance of the existing pavement which may be considered "acceptable". The only 'no-risk' alternative for the perimeter pavements would be to fully suspend concrete slabs on piles which is unlikely to be economically feasible. An alternative to forming a subgrade for the

on-grade car park pavements would be to remove say the upper 0.6 m below the design subgrade level and replace this with select engineered fill compacted in layers, as described in the following. It is suggested that site preparation and placement of engineered filling for lightly loaded car park pavements at near present surface levels should incorporate the following.

Following stripping of topsoil and any root affected soils, completion of any localised excavations or removal of the upper fill zone as described above, the sandy subgrade should be proof rolled a minimum 8 tonne deadweight smooth drum vibratory roller, following thorough moistening of the sand subgrade if required. Proof rolling should be carried out under the direction of an experienced earthworks superintendent or geotechnical engineer to assist in the detection of soft or unstable areas.

To assist with proof rolling, we recommend that a thin layer of road base (75mm thick) or crushed sandstone be placed over the sand subgrade to improve near surface compaction and prevent shearing during rolling. The road base would also provide a base for external paved areas.

Care will need to be exercised close to any existing nearby structures, paved surfaces and any buried services as ground borne vibrations caused by the proof rolling may cause damage/instability. Ground vibrations should be qualitatively monitored by the site supervisor and if there are any causes for concern during proof rolling, then further geotechnical advice should be sought and/or the non-vibration (static) mode of the roller used. As the nearest houses are about 25m away from the site this issue should not be a problem but should still be monitored.

6.3.2 Engineered Fill

General

Engineered fill required to backfill soft spots and, raise site levels, should be free from organic materials, other contaminants and deleterious substances and have a maximum particle size not exceeding 40mm. We expect that excavated sandy fill and alluvial sands (if applicable) may be used as engineered fill. Engineered fill should be placed in layers of maximum 200mm loose thickness and compacted with the above mentioned roller to achieve a minimum density index (I_D) of 70% for the sandy soils. However, the I_D may be reduced to 65% in landscaped areas.

Backfill to conventional retaining walls should also comprise engineered fill comprising the excavated sands (if applicable), otherwise well graded imported granular materials such as blue metal or crushed concrete would be suitable for this purpose provided it is also free of deleterious substances and has a maximum particle size not exceeding 40mm. Imported well graded granular fill should be compacted to at least 98% of Standard Maximum Dry Density (SMDD) and within 2% of their Standard Optimum Moisture Content (SOMC). The compaction requirement may be reduced to 95% of SMDD in landscaped areas, where some settlement can be tolerated. Such fill should be compacted in horizontal layers as described above or a hand held plate compactor (whacker packer) when backfilling behind retaining walls. Care will be required to ensure excessive compaction stresses are not transferred to the retaining walls.

As an alternative, single sized granular material (or ‘no fines’ gravel) may be used as backfill to the landscape retaining walls and this would also act as the drainage behind the wall and would only require nominal compaction (with no compaction testing). The drainage material should be wrapped in a non woven geotextile fabric (e.g. Bidim A34) to act as a filter against subsoil erosion. Further, retaining wall backfill should be provided with a cap of at least 0.3m thickness of compacted crushed sandstone at surface level to reduce the likelihood of surface water surcharging the retaining wall.

Edge Compaction

In order to achieve adequate edge compaction where fill platforms are proposed, we recommend that the outer edge of each fill layer extend a horizontal distance of at least 1m beyond the design geometry. The roller must extend over the edge of each placed layer in order to seal the batter surface. On completion of filling, the excess under-compacted edge fill should be trimmed back to the design geometry. Any fill platform supporting structures should extend at least 1m beyond the structure.

The ‘tying in’ of engineered fill to temporary cut batter slopes can be achieved by locally benching the cut slopes in no greater than 0.4m high steps. This can be carried out progressively as the height of engineered fill increases.

Service Trenches

Backfilling of service trenches must be carried out using engineered fill in order to reduce post-construction settlements. Due to the reduced energy output of the rollers that can be placed in trenches, backfilling should be carried out in maximum 150mm thick loose layers and compacted using a trench roller, a pad foot roller attachment fitted to an excavator, and/or a whacker packer. Due to the reduced loose layer thickness, the maximum particle size of the backfill material should also reduce to 75mm. The compaction specifications provided above are applicable.

Earthworks Inspection and Testing

Density tests should be carried out at the frequencies outlined in AS3798 (Table 8.1) for the volume of fill and application involved.

Based on the nature of the proposed earthworks, we recommend that Level 1 control of fill placement and compaction in accordance with AS3798-2007 be carried out, including for the trench backfill. Due to a potential conflict of interest, the GITA should be directly engaged by Norther Beaches Council, and not by the earthworks contractor or sub-contractors.

6.4 Footing Design

Based on the results of our investigation, due to the presence and thickness of sandy fill, the site is classified as Class P, in accordance with AS 2870 – 2011, “Residential Slabs and Footings”. Given the deep, uncontrolled fill present in the building areas, high level footings are not considered appropriate.

Foundation piles founded at least 4 pile diameters below BEL into alluvial silty sand of at least loose relative density (identified in the CPT logs from depths ranging between about 5.2m and 6.7m) may be designed for

an allowable end bearing pressure of 250kPa. In most locations except JK1 and JK2 there is layer of loose to medium dense sand at around 7m depth, for 0.45m diameter steel screw piles found in this loose to medium dense sand an allowable end bearing pressure of 650kPa may be adopted. Such piles would have to be installed close to the CPT locations in order to “calibrate” the installation. Defining the transition to the looser material in JK1 and JK2 will require continual monitoring. Piles founded in silty clay of at least very stiff strength (identified in the CPT logs at depths between about 12.1m and 13.1m) may be designed for an allowable end bearing pressure of 400kPa.

Based on the encountered high groundwater level and the collapsible nature of the upper sandy soils, conventional bored piles will not be suitable. Based on our discussion with Damian Hadley of Cantilever Consulting Engineers, we understand the use steel screw piles are preferred, which we consider to be suitable to support the proposed development.

The prospective piling contractors should be provided with a full copy of this report so that appropriate drilling rigs and equipment are brought to site.

We recommend that the initial stages of pile drilling be witnessed by a geotechnical engineer to check that the pile embedment depths are consistent with the investigation results.

The load carrying capacity of the steel screw piles will need to be certified by the piling contractor.

6.5 Working Platform

Piles will be installed using a tracked piling rig or tracked excavator which might need to be provided with a suitable working platform determined by a geotechnical engineer. The design of the working platform will need to be based on the loadings and track dimensions supplied by the contractor for the specific equipment proposed. Further, the assessment of the working platform thickness will need to be based on the methodology outlined in BRE 2004 ‘*Working Platforms for Tracked Plant*’. As screw piles are normally installed with a medium sized tracked excavator a platform is not likely to be required.

The working platform, if required, may need to be constructed using DGB20 (or a similar durable granular material approved by the geotechnical engineer) compacted to at least 95% Modified Maximum Dry Density (MMDD) using a large roller.

Density tests should be regularly carried out on the working platform materials to confirm the above density has been achieved. The frequency of density testing should be at least one test per layer per 1,000m² or three tests per visit, whichever requires the most tests. Level 2 testing of fill compaction is the minimum permissible in AS3798-2007. However, our preference would be for Level 1 control of fill placement and compaction, in accordance with AS3798-2007..

Further advice can be given once details of the proposed tracked equipment have been provided.

6.6 Soil Aggression

Based on the advice provided in AS2159-2009 “Piling Design and Installation” for corrosion protection and durability and in AS2870-2011 “Residential Slabs and Footings” we note that the laboratory chemical test results have indicated that the following Exposure Classifications are applicable:

- Steel screw piles below the groundwater: ‘Mild’ (based on Table 6.5.2 (C), in AS2159-2009),
- Concrete in sulfate soils: ‘B2’ (based on Table 5.2 in AS2870-2011).

6.7 Floor Slabs and External Pavement

6.7.1 General Issues

Slab-on-grade construction for floor slabs is not recommended due to the risk of long term settlement, which would be mostly differential, affecting performance. External paved areas could be constructed on-grade as discussed in the proceeding Sections provided the site preparation is carefully controlled.

We therefore recommend that the community centre floor slabs be full suspended from the screw piles.

6.7.2 External Pavements

Based on the previous CBR test results and provided subgrade preparation is carried out as described in Section 6.3.1 above we recommend that the pavements be designed based on a CBR value of 5% which equates to a short term Young’s Modulus of 50MPa if the subgrade is well prepared.

We note that the recommended CBR value is lower than that obtained from the laboratory test results. We have downgraded the laboratory values to take the scale effects of the gravel into account as well as the variability of the uncontrolled fill which is present. If the upper layer of the subgrade is improved, as discussed above, a slightly higher CBR value may be appropriate, but this would have to be assessed during the construction phase where additional testing could be completed.

6.8 Further Geotechnical Input

The following is a summary of the further geotechnical input which is required and which has been detailed in the preceding sections of this report:

- Possible working platform design for tracked equipment.
- Witnessing installation of piles.
- Geotechnical inspection of the proof rolling and testing of compaction.

7 GENERAL COMMENTS

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. As an example, special treatment of soft spots may be required as a result of their discovery during proof-rolling, etc. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and JK Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

The long term successful performance of pavements is dependent on the satisfactory completion of the earthworks. In order to achieve this, the quality assurance program should not be limited to routine compaction density testing only. Other critical factors associated with the earthworks may include subgrade preparation, selection of fill materials, control of moisture content and drainage, etc. The satisfactory control and assessment of these items may require judgment from an experienced engineer. Such judgment often cannot be made by a technician who may not have formal engineering qualifications and experience. In order to identify potential problems, we recommend that a pre-construction meeting be held so that all parties involved understand the earthworks requirements and potential difficulties. This meeting should clearly define the lines of communication and responsibility.

Occasionally, the subsurface conditions between the completed test locations may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

A waste classification is required for any soil and/or bedrock excavated from the site prior to offsite disposal. Subject to the appropriate testing, material can be classified as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM), General Solid, Restricted Solid or Hazardous Waste. Analysis can take up to seven to ten working days to complete, therefore, an adequate allowance should be included in the construction program unless testing is completed prior to construction. If contamination is encountered, then substantial further testing (and associated delays) could be expected. We strongly recommend that this requirement is addressed prior to the commencement of excavation on site.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of JK Geotechnics. We have used a degree of care, skill and diligence normally



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CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIEWOOD, NSW

Job No.: 33681PD

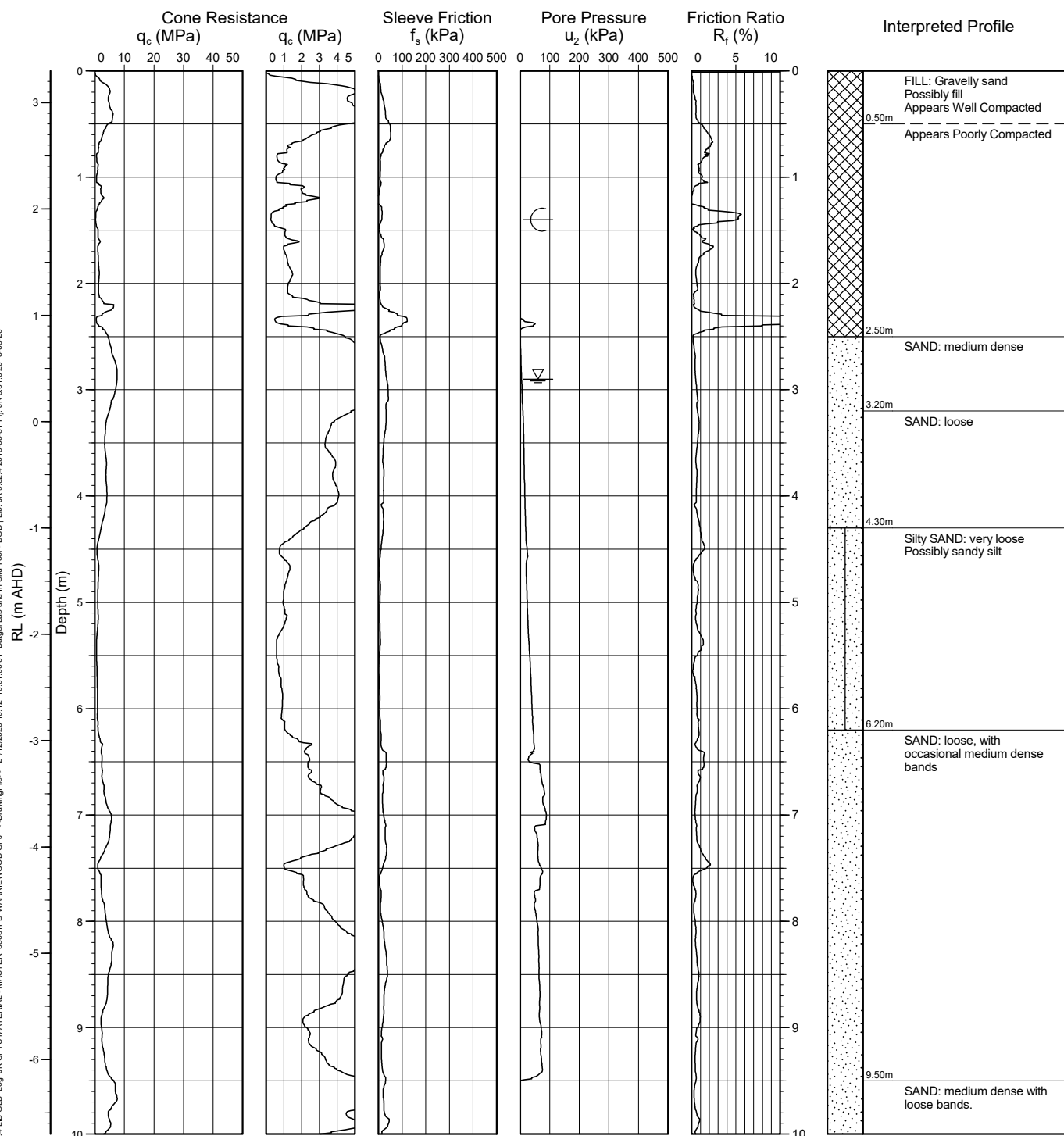
R.L. Surface: ~3.3 m

Data File: J:\6f\33681PD Warriewood

Date: 30/11/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIEWOOD, NSW

Job No.: 33681PD

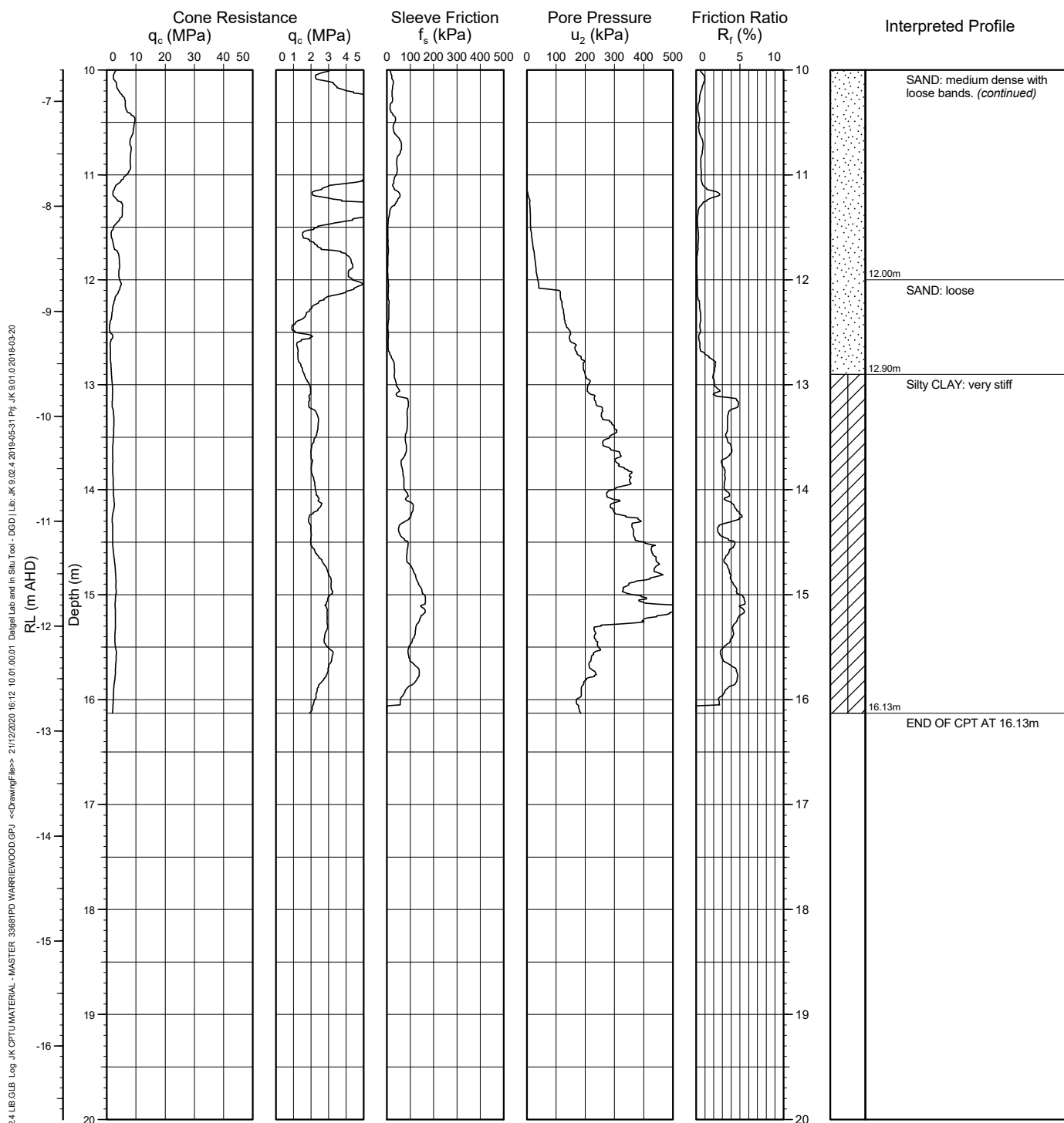
R.L. Surface: ~3.3 m

Data File: J:\6f\33681PD Warriewood

Date: 30/11/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
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CONE PENETROMETER TEST RESULTS

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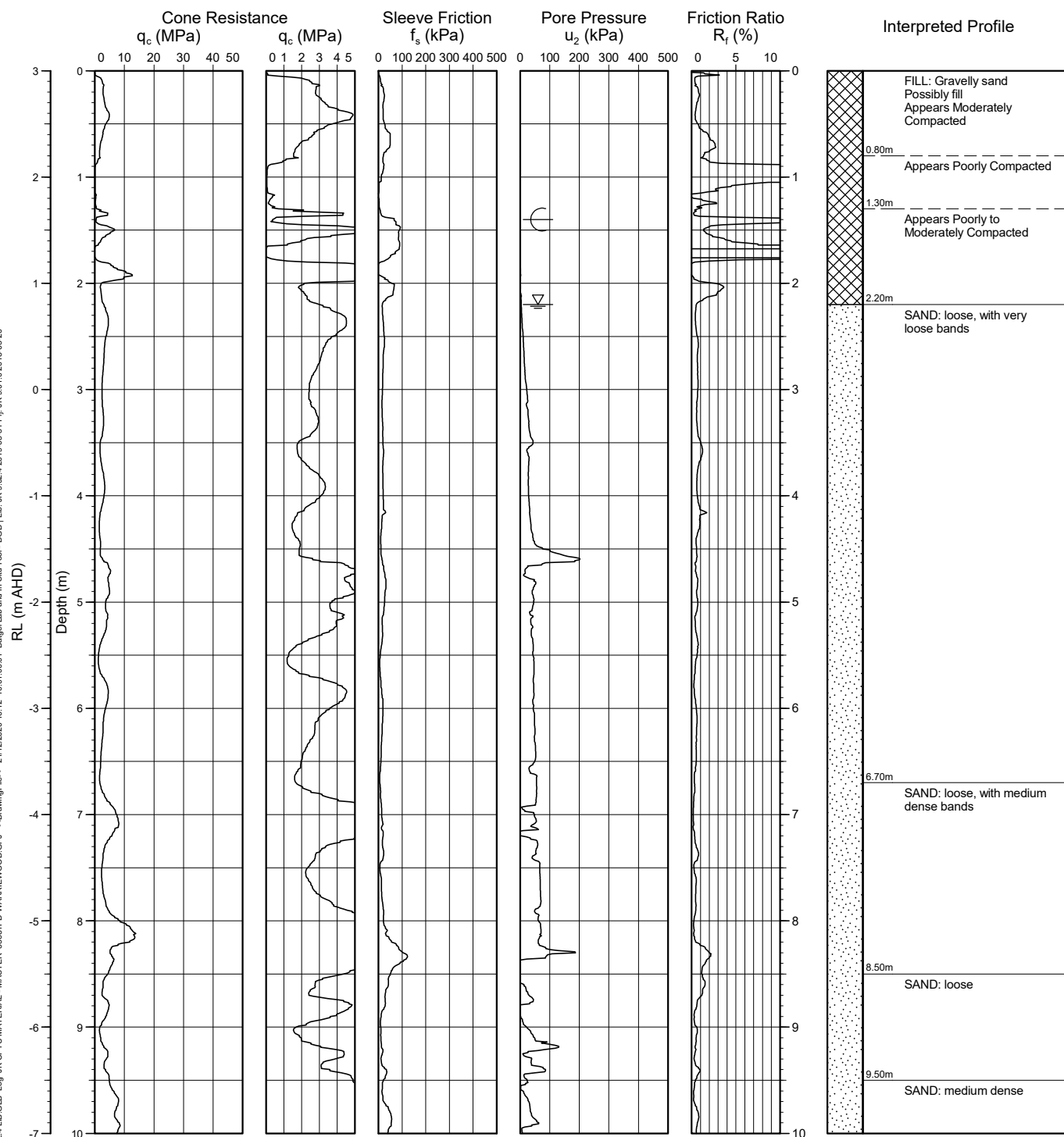
R.L. Surface: ~3.0 m

Data File: J:\6f\33681PD Warriewood

Date: 30/11/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIEWOOD, NSW

Job No.: 33681PD

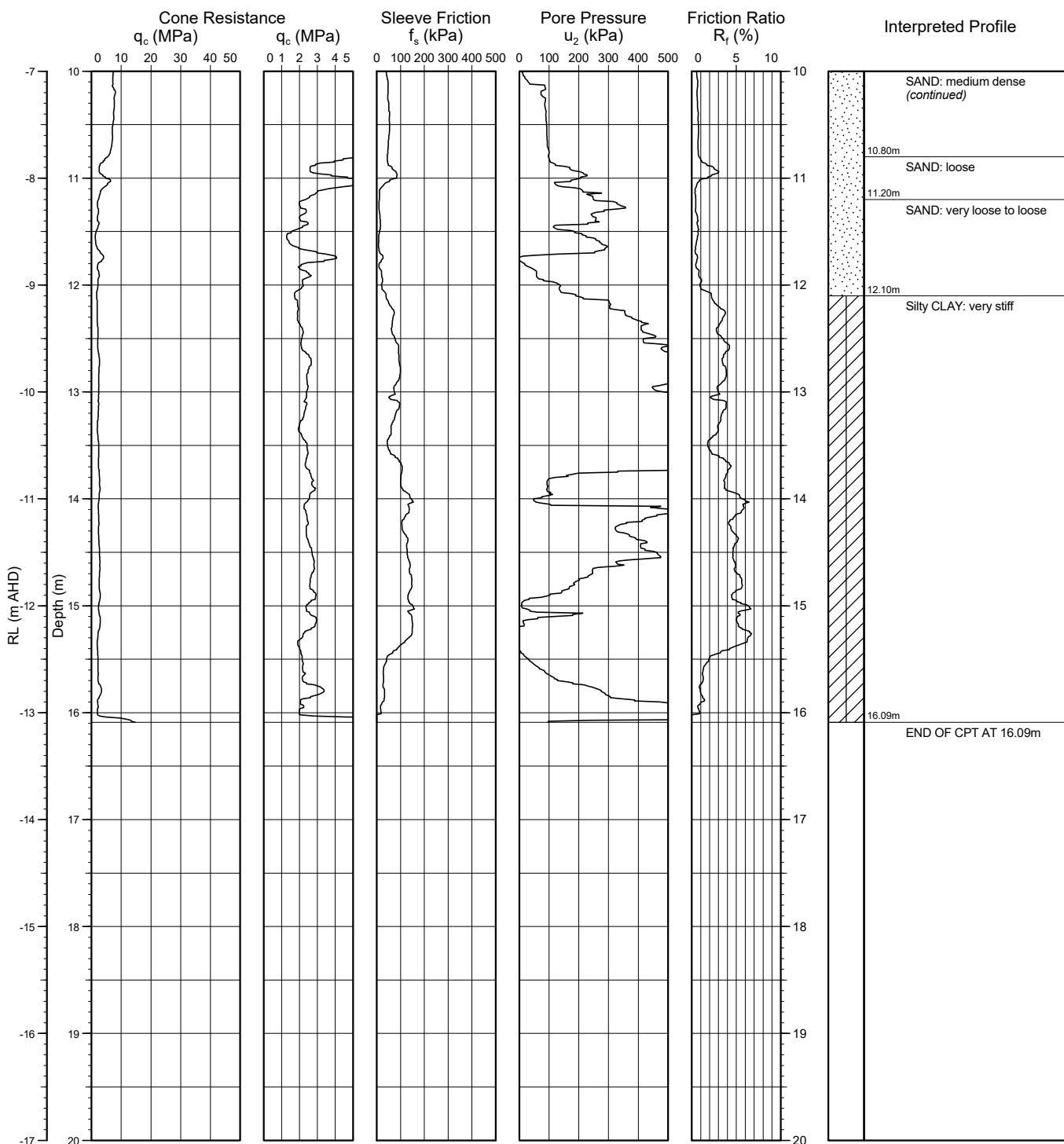
R.L. Surface: ~3.0 m

Data File: J:\6f\33681PD Warriewood

Date: 30/11/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIWOOD, NSW

Job No.: 33681PD

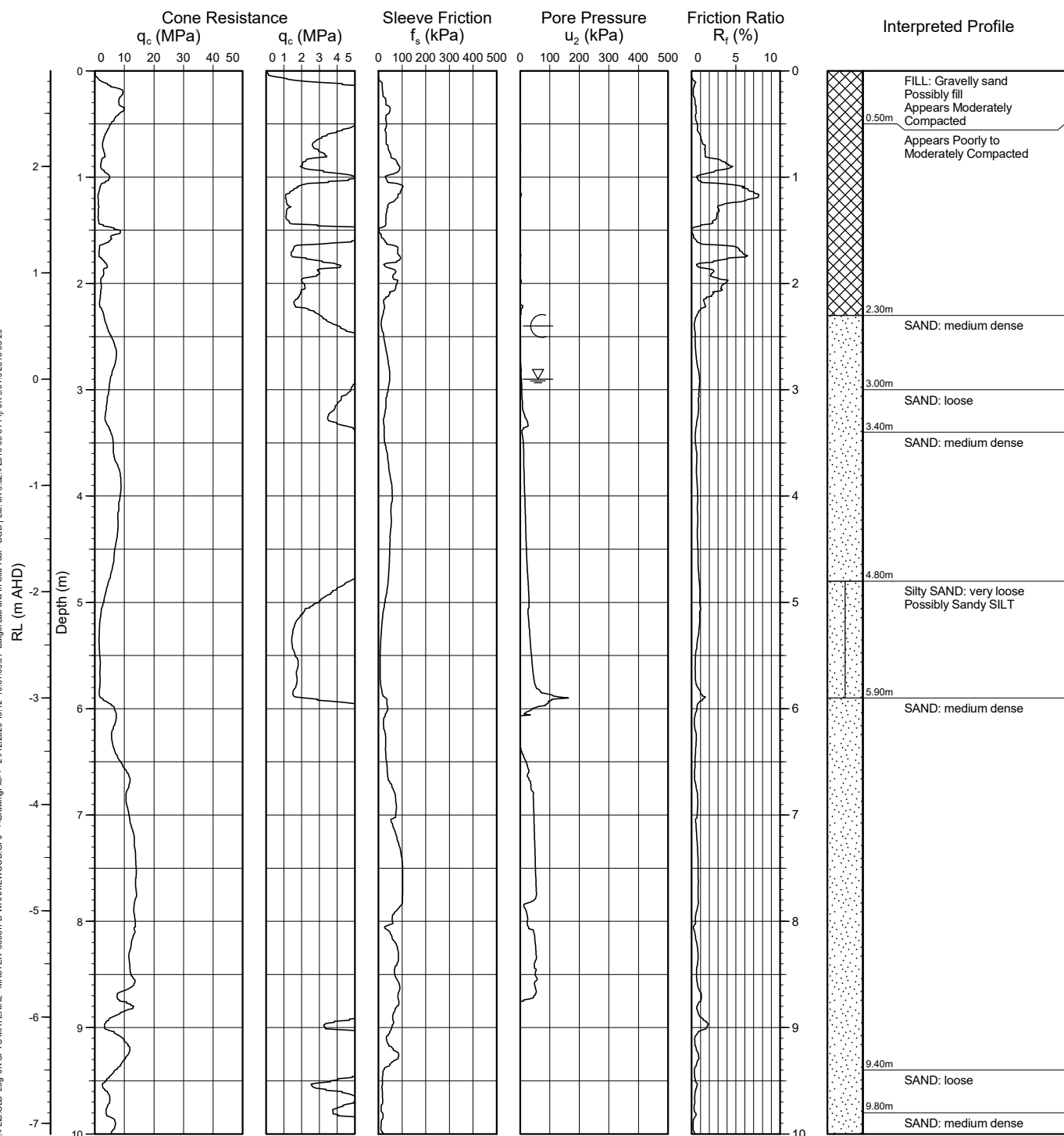
R.L. Surface: ~2.9 m

Data File: J:\6f\33681PD Warriewood

Date: 1/12/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIEWOOD, NSW

Job No.: 33681PD

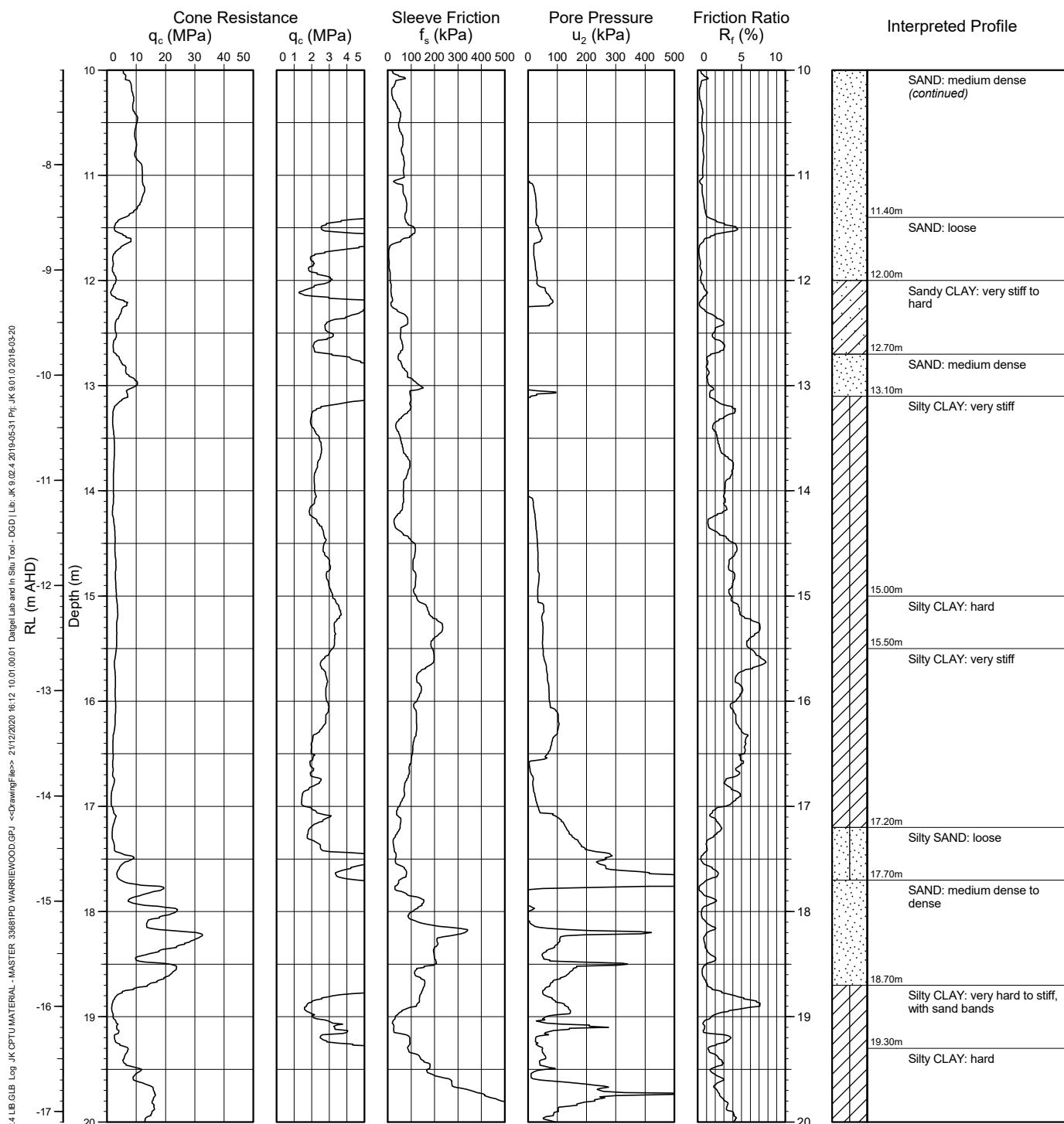
R.L. Surface: ~2.9 m

Data File: J:\6f\33681PD Warriewood

Date: 1/12/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIEWOOD, NSW

Job No.: 33681PD

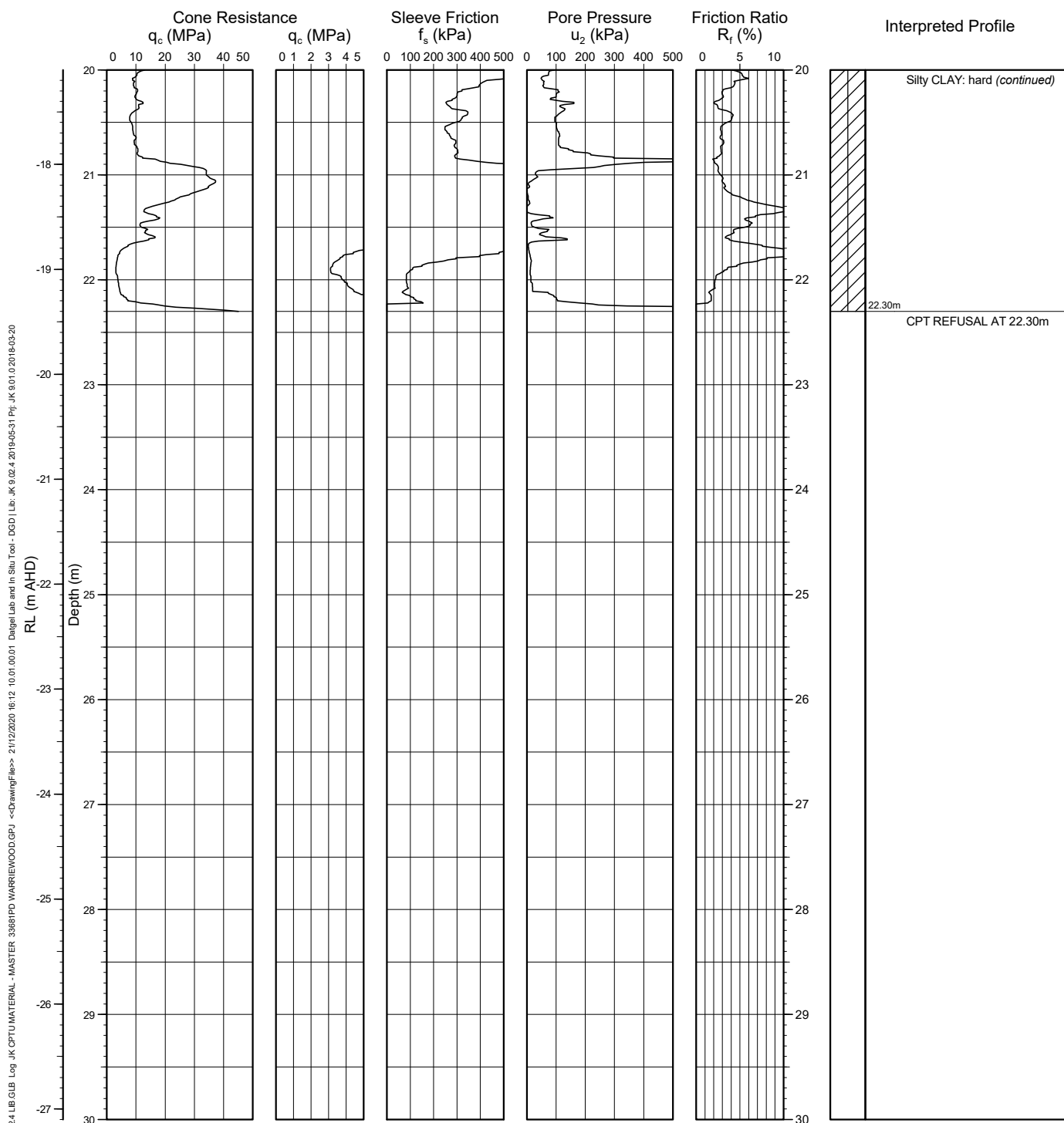
R.L. Surface: ~2.9 m

Data File: J:\6f\33681PD Warriewood

Date: 1/12/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIEWOOD, NSW

Job No.: 33681PD

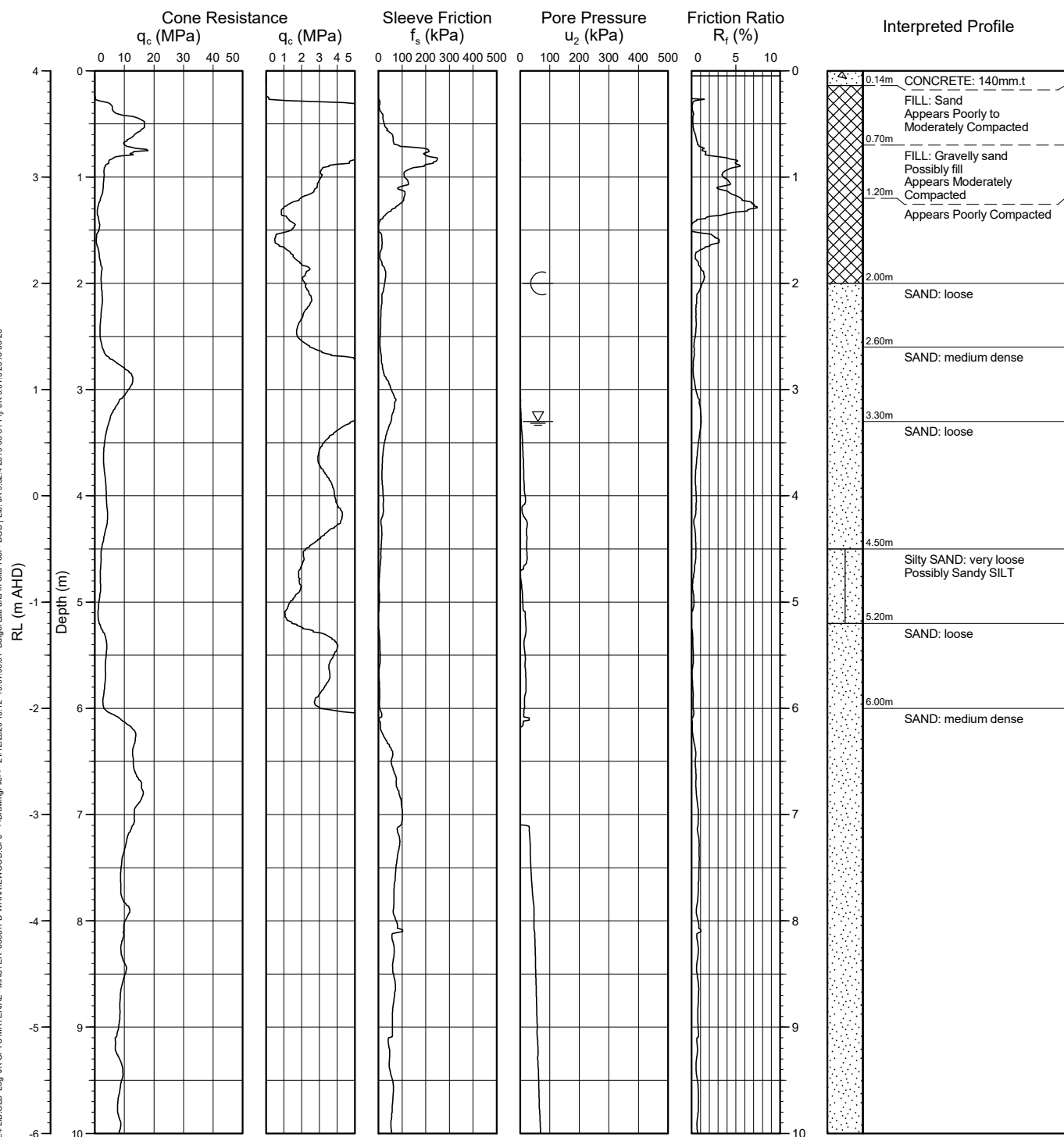
R.L. Surface: ~4.0 m

Data File: J:\6f\33681PD Warriewood

Date: 1/12/20

Datum: AHD

Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

CONE PENETROMETER TEST RESULTS

Client: NORTHERN BEACHES COUNCIL

Project: PROPOSED COMMUNITY CENTRE

Location: PITTWATER ROAD & JACKSON ROADS, WARRIEWOOD, NSW

Job No.: 33681PD

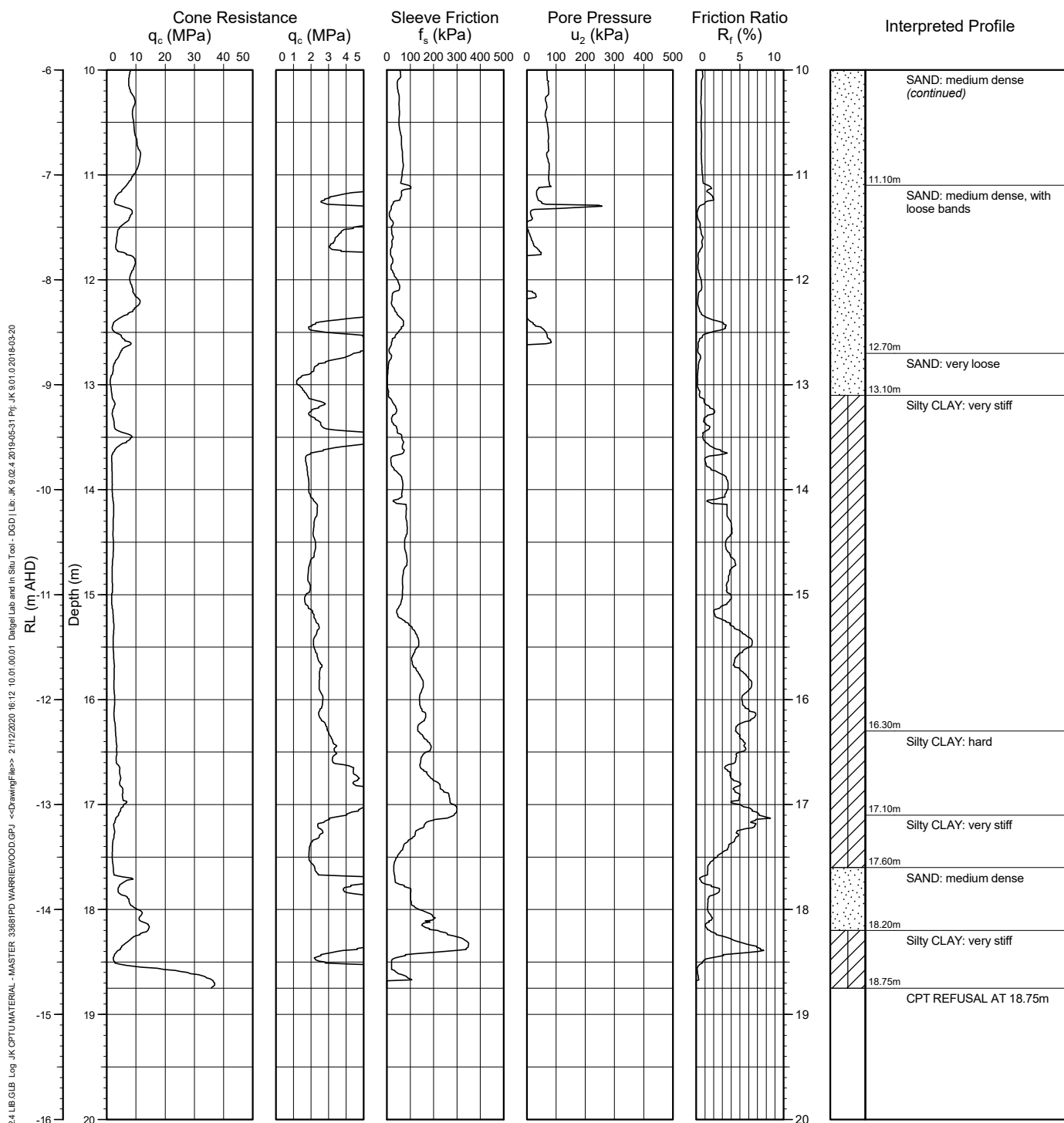
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Data File: J:\6f\33681PD Warriewood

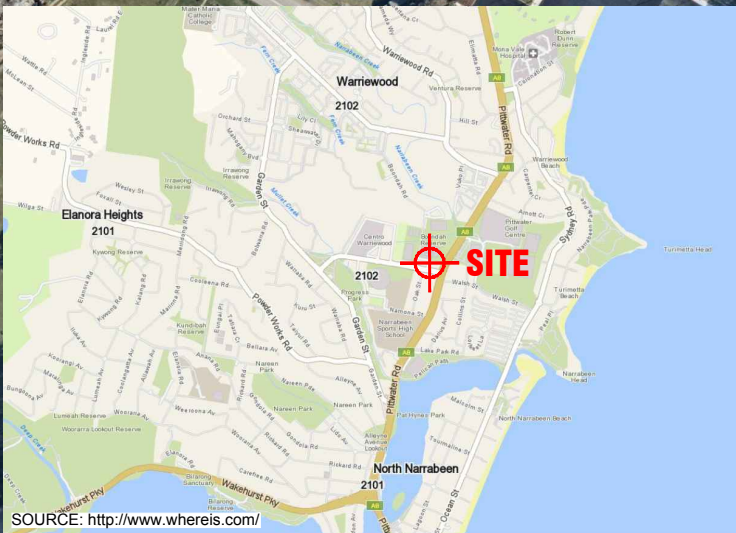
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Operator: B.A.



Interpreted by: B.A.
Checked by: N.E.S.

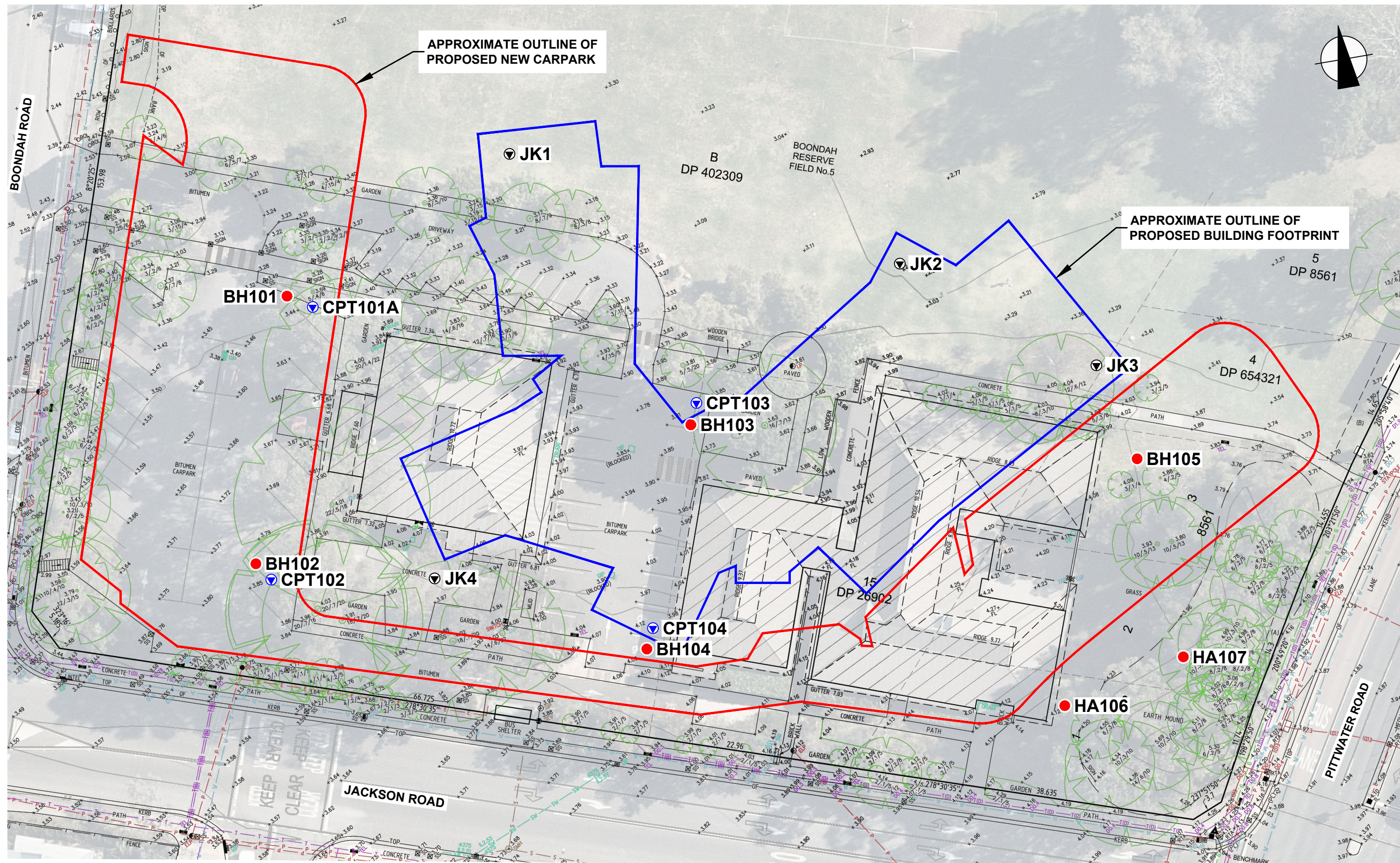


AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

Title: SITE LOCATION PLAN	
Location: PITTWATER AND JACKSONS ROADS, WARRIWOOD, NSW	
Report No: 33681PD	Figure No: 1
JKGeotechnics	



This plan should be read in conjunction with the JK Geotechnics report.



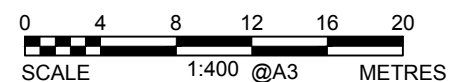
LEGEND

- CONE PENETROMETER TEST (CPT)
- DP CPT, 2019
- DP BOREHOLE, 2019

NOTES:

- JK1 TO JK4 ARE FROM THE CURRENT INVESTIGATION.
- THE REMAINING TEST LOCATIONS ARE FROM THE PREVIOUS DP INVESTIGATIONS.

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM



This plan should be read in conjunction with the JK Geotechnics report.

Title:

TEST LOCATION PLAN

Location: PITTWATER AND JACKSONS ROADS,
WARRIEWOOD, NSW

Report No: 33681PD

Figure No: 2

JKGeotechnics





APPENDIX A

BOREHOLE LOG

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre
LOCATION: Pittwater Road and Jacksons Road,
 Warriewood

SURFACE LEVEL: 3.5 AHD
EASTING: 342393
NORTHING: 6270139
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 86745.00
DATE: 26/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
	0.1	ASPHALTIC CONCRETE																			
		FILLING - yellow-brown, sand filling with some gravel, humid																A/E			
3	0.5	FILLING - dark brown sand filling, trace silt and gravel, humid																			
																		A/E B			
1																					
	1.2	FILLING - dark brown clay filling with some gravel, trace sand, moist																			
3		1.5-1.6m: glass fragments																	A/E		
2																					
	2.3	FILLING - dark brown peaty sand filling with decomposed vegetation, gravel and steel fragments, strong organic odour																			
1	2.5	Bore discontinued at 2.5m Hole collapsing below 2.3m depth, unable to obtain sample																			
3																					
0																					
4																					
1																					

RIG: Explora

DRILLER: JS

LOGGED: RK

CASING: Uncased

TYPE OF BORING: SFA

WATER OBSERVATIONS: Free groundwater measured at 2.3m depth

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre
LOCATION: Pittwater Road and Jacksons Road, Warriewood

SURFACE LEVEL: 3.8 AHD
EASTING: 342390
NORTHING: 6270108
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 86745.00
DATE: 26/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
	0.1	ASPHALTIC CONCRETE																			
		FILLING - dark-brown and brown, sand filling with some gravel, humid																A/E			
3	0.5	FILLING - dark brown clayey gravelly sand filling, some decomposed vegetation, strong organic and peat odour																			
	1																	B			
	2																	A/E			
	2	1.8m: steel bar 2.0m: wet																A/E			
	2.3	SAND - dark brown, fine to medium sand, wet																			
	3																		A/E		
	4																				
	4.0	Bore discontinued at 4.0m																			

RIG: Explora

DRILLER: JS

LOGGED: RK

CASING: Uncased

TYPE OF BORING: SFA

WATER OBSERVATIONS: Free groundwater measured at 2.0m depth

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre
LOCATION: Pittwater Road and Jacksons Road,
 Warriewood

SURFACE LEVEL: 3.8 AHD
EASTING: 342439
NORTHING: 6270125
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86745.00
DATE: 26/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
	0.1	ASPHALTIC CONCRETE																				
		FILLING - yellow-brown sand filling with some gravel, humid																				
	0.7	0.7m: dark brown																				
	1.4	PEAT/PEATY SAND - brown fine to medium peat/peaty sand with sand lenses, humid																				
	2.3	2.3m: wet																				
	2.6	SAND - pale grey, fine to medium sand, humid																				
	3.5	Bore discontinued at 3.5m																				
	4.0																					
	4.4																					

RIG: Explora

DRILLER: JS

LOGGED: RK

CASING: Uncased

TYPE OF BORING: SFA

WATER OBSERVATIONS: Free groundwater measured at 2.3m depth

REMARKS: * Duplicate sample taken

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre
LOCATION: Pittwater Road and Jacksons Road,
 Warriewood

SURFACE LEVEL: 4.1 AHD
EASTING: 342435
NORTHING: 6270099
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86745.00
DATE: 26/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
4	0.1	ASPHALTIC CONCRETE																			
		FILLING - dark yellow-brown sand filling with some gravel, humid																			
		0.6m: yellow-brown with trace gravel																	A/E		
1																			A/E		
3		1.3-1.5m: dark grey																	A/E		
	1.8	FILLING - dark brown, clayey sand filling with some gravel and trace building rubble (nails, terracotta fragments, steel brackets), humid																	A/E*		
2		2.3m: moist																			
2	2.4	SAND - pale grey fine to medium sand, wet																	A/E		
		2.5m: wet																			
3	3.0	Bore discontinued at 3.0m																			

RIG: Explora

DRILLER: JS

LOGGED: RK

CASING: Uncased

TYPE OF BORING: SFA

WATER OBSERVATIONS: Free groundwater measured at 2.5m depth

REMARKS: * Duplicate sample taken

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre
LOCATION: Pittwater Road and Jacksons Road,
 Warriewood

SURFACE LEVEL: 4.0 AHD
EASTING: 342491
NORTHING: 6270122
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86745.00
DATE: 26/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
		FILLING - yellow-brown sand filling with some gravel and trace silt, humid																					
	1.0	1.0m: with some clay																	A/E				
	1.6	FILLING - dark grey sand filling with trace gravel, humid																					
	1.8	1.8m: glass fragments																					
	1.9	1.9m: becomes moist																					
	2.0	SANDY CLAY: dark grey sandy clay with some peat, wet																	A/E				
																			A/E				
	3.0	Bore discontinued at 3.0m																					

RIG: Explora

DRILLER: JS

LOGGED: RK

CASING: Uncased

TYPE OF BORING: SFA

WATER OBSERVATIONS: Free groundwater measured at 2.0m depth

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre
LOCATION: Pittwater Road and Jacksons Road,
 Warriewood

SURFACE LEVEL: 4.1 AHD
EASTING: 342483
NORTHING: 6270093
DIP/AZIMUTH: 90°/-

BORE No: HA106
PROJECT No: 86745.00
DATE: 26/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
4 <																					

RIG: Hand Tools

DRILLER: RK

LOGGED: RK

CASING: Uncased

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: Free groundwater measured at 2.2m depth

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre
LOCATION: Pittwater Road and Jacksons Road,
 Warriewood

SURFACE LEVEL: 4.9 AHD
EASTING: 342496
NORTHING: 6270099
DIP/AZIMUTH: 90°/--

BORE No: HA107
PROJECT No: 86745.00
DATE: 26/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	0.7	FILLING - dark grey sand filling with some gravel and trace building rubble (terracotta and glass fragments), humid																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								

RIG: Hand Tools

DRILLER: RK

LOGGED: RK

CASING: Uncased

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater encountered

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

CONE PENETRATION TEST

CLIENT: Northern Beaches Council

PROJECT: Warriewood Valley Community Centre

LOCATION: Pittwater Road and Jacksons Road, Warriewood

REDUCED LEVEL: 3.5

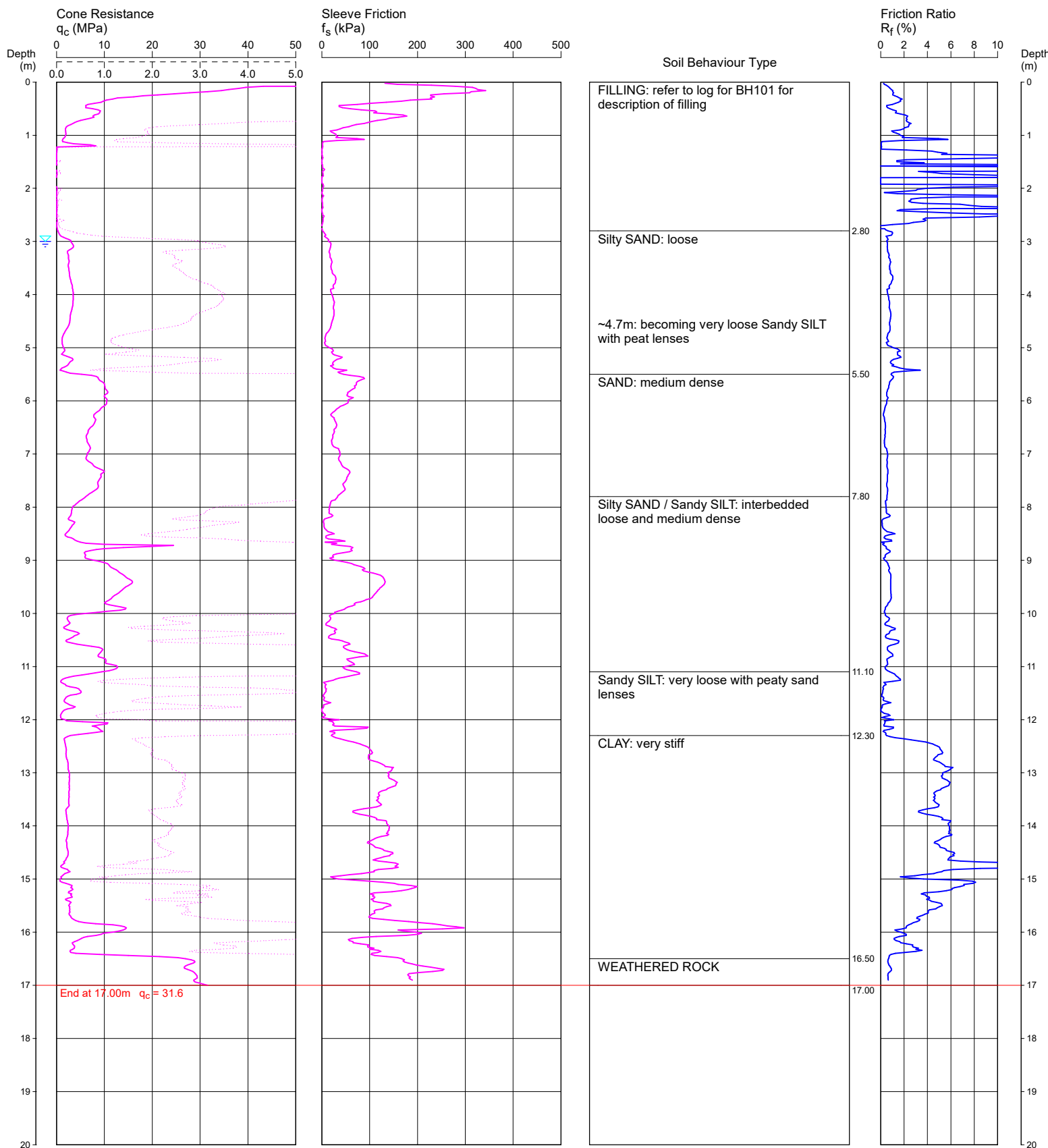
COORDINATES: 342396E 6270138N

CPT101A

Page 1 of 1

DATE 21/03/2019

PROJECT No: 86745



REMARKS: DUMMY CONE FROM 1.2 TO 3 m DEPTH TO PENETRATE FILLING. TEST DISCONTINUED AT TARGET STRATA.

Water depth after test: 3m

File: P:\86745.00 - WARRIEWOOD - Community Centre Geo\4.0 Field Work\4.2 Testing\CPT101A - COMBINED.CP5

Cone ID: 170707

Type: I-CFY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: Northern Beaches Council

PROJECT: Warriewood Valley Community Centre

LOCATION: Pittwater Road and Jacksons Road, Warriewood

REDUCED LEVEL: 3.8

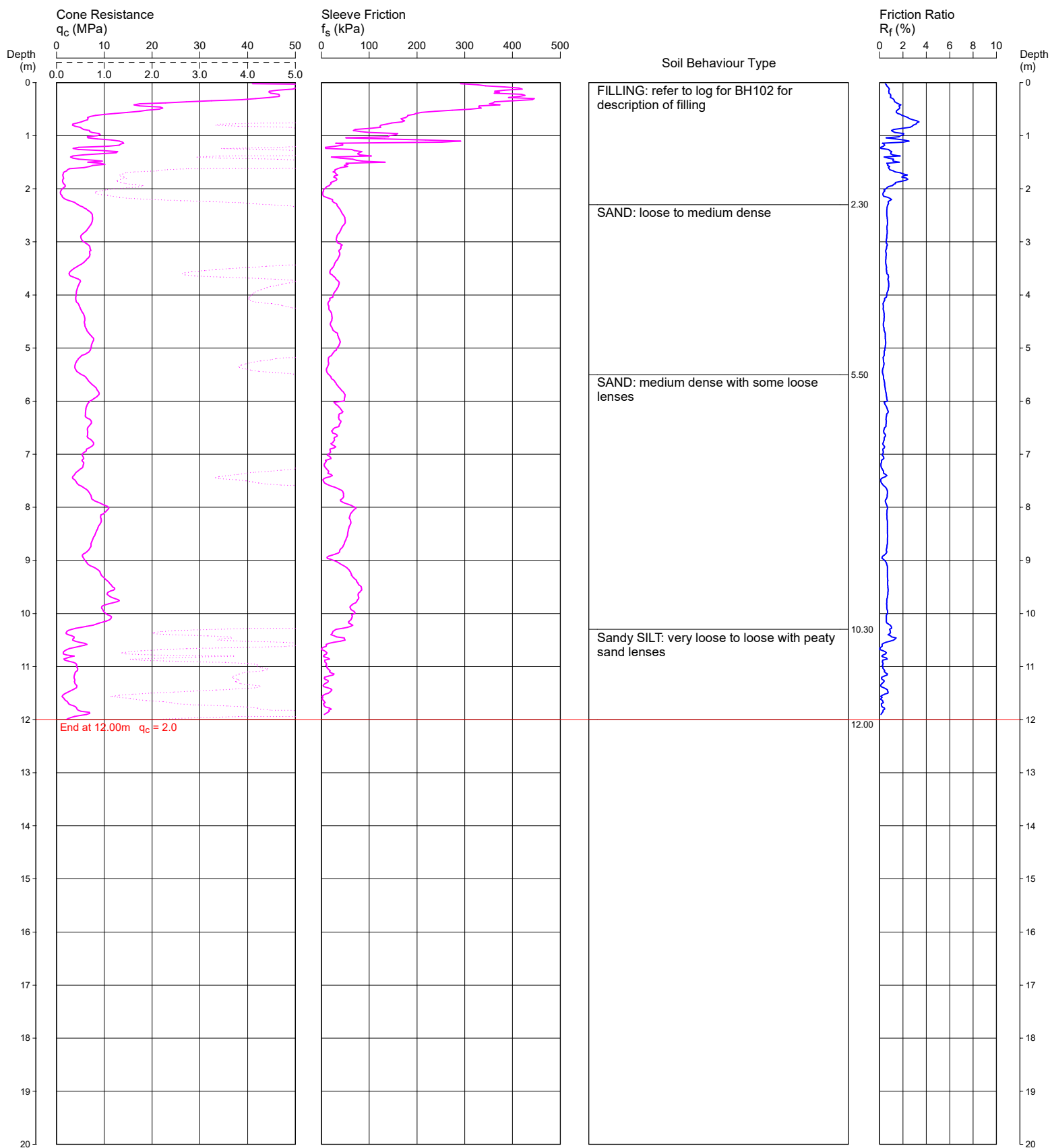
COORDINATES: 342392E 6270106N

CPT102

Page 1 of 1

DATE 21/03/2019

PROJECT No: 86745



REMARKS: TEST DISCONTINUED AT TARGET DEPTH.
 HOLE COLLAPSE AT 1.5 m AFTER WITHDRAWAL OF RODS.

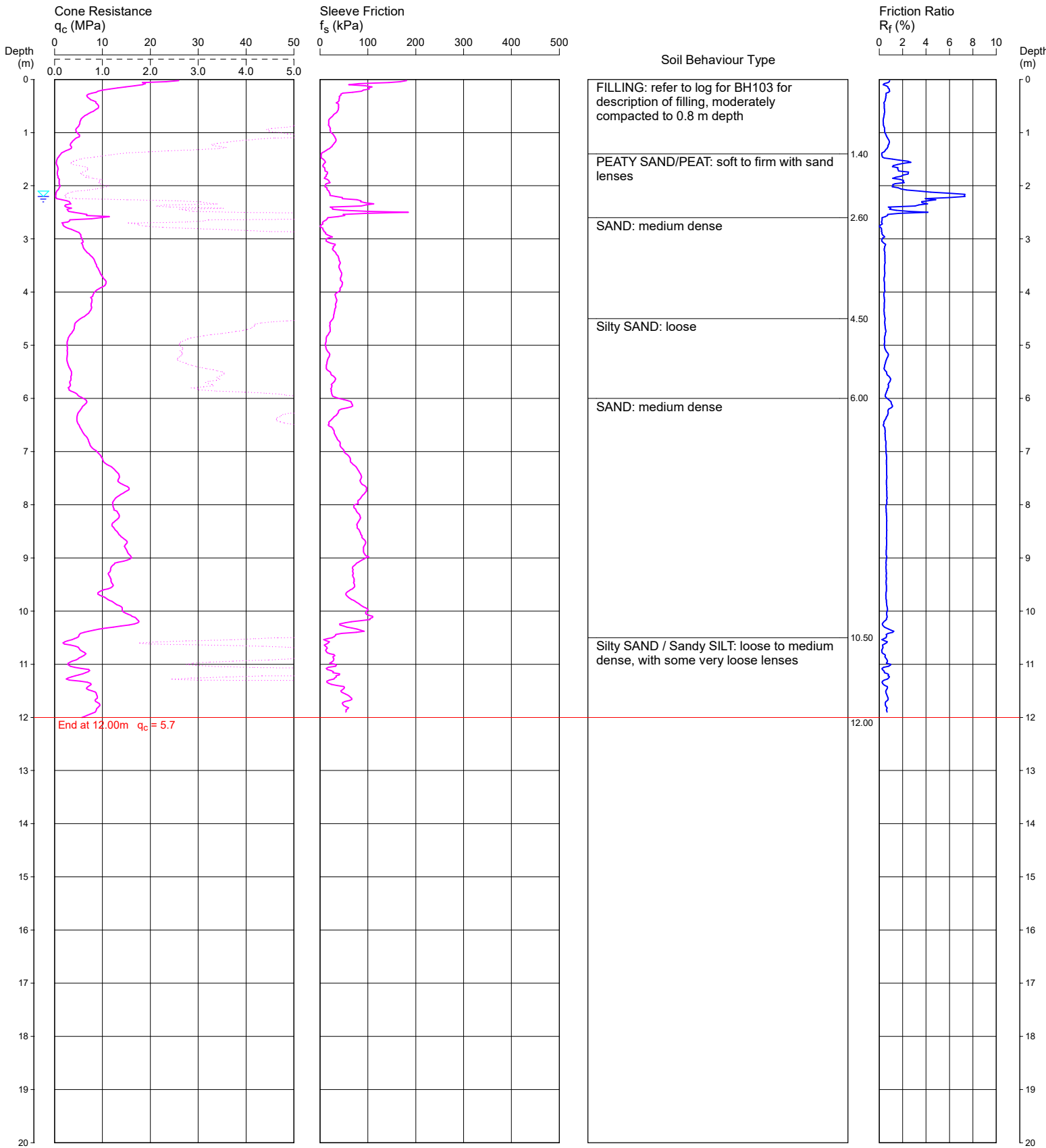
CONE PENETRATION TEST

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre

LOCATION: Pittwater Road and Jacksons Road, Warriewood
REDUCED LEVEL: 4.1
COORDINATES: 342435E 6270102N

CPT103

Page 1 of 1
DATE 21/03/2019
PROJECT No: 86745



REMARKS: TEST DISCONTINUED AT TARGET DEPTH.

Water depth after test: 2.2m
File: P:\86745.00 - WARRIEWOOD - Community Centre Geo\4.0 Field Work\4.2 Testing\CPT103.CP5
Cone ID: 170707 Type: I-CFXY-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

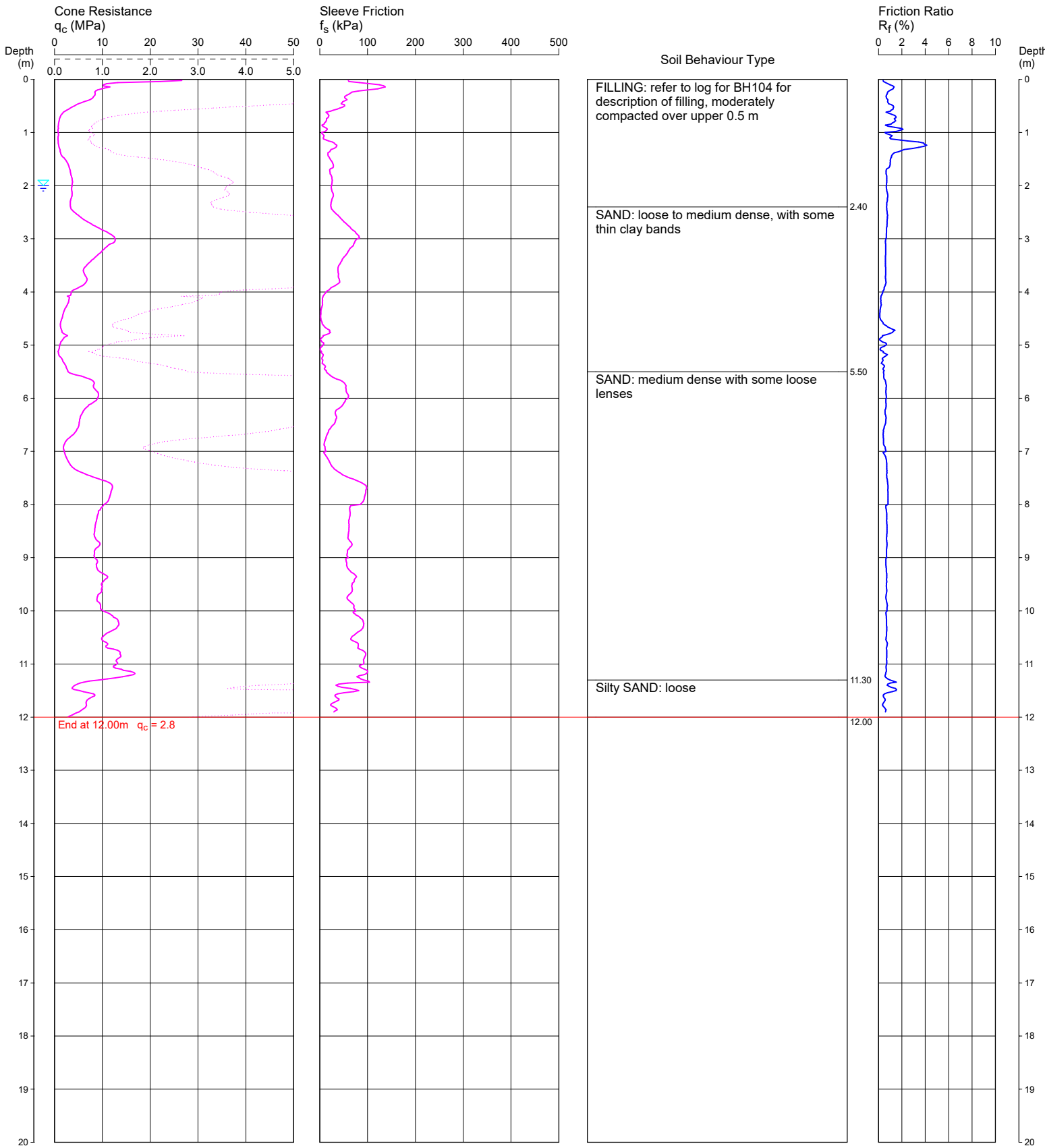
CONE PENETRATION TEST

CLIENT: Northern Beaches Council
PROJECT: Warriewood Valley Community Centre

LOCATION: Pittwater Road and Jacksons Road, Warriewood
REDUCED LEVEL: 3.8
COORDINATES: 342439E 6270125N

CPT104

Page 1 of 1
DATE 21/03/2019
PROJECT No: 86745



REMARKS: TEST DISCONTINUED AT TARGET DEPTH.

Water depth after test: 2m
File: P:\86745.00 - WARRIEWOOD - Community Centre Geo\4.0 Field Work\4.2 Testing\CPT104.CP5
Cone ID: 170707 Type: I-CFY-10

ConePlot Version 5.9.2
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Material Test Report

Report Number: 86745.00-1
Issue Number: 1
Date Issued: 10/04/2019
Client: Northern Beaches Council
 PO Box 882, Mona Vale NSW 1660
Contact: Simon Gray
Project Number: 86745.00
Project Name: Warriewood Valley Community Centre
Project Location: Pittwater Road and Jacksons Road, Warriewood
Work Request: 4246
Sample Number: 19-4246A
Date Sampled: 26/03/2019
Dates Tested: 28/03/2019 - 08/04/2019
Sampling Method: Sampled by Engineering Department
Sample Location: BH101 & BH102 (0.5-1.5m)
Material: Filling - dark brown gravelly sand filling

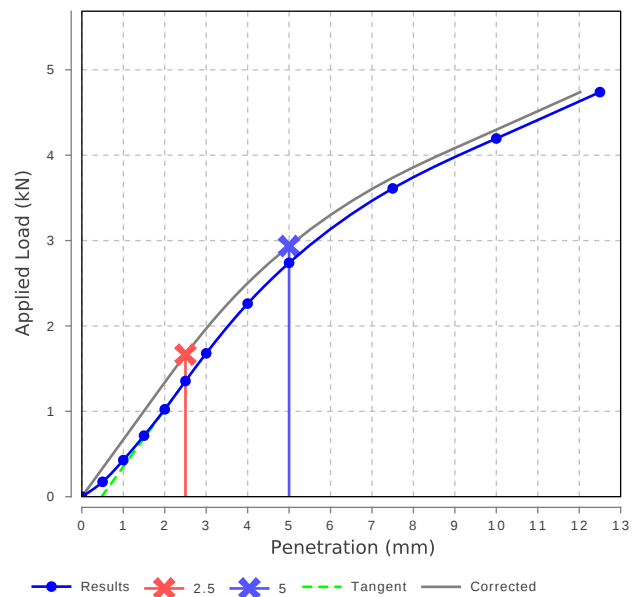


Mick Gref

Approved Signatory: Mick Gref
 Senior Technician
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	15		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.86		
Optimum Moisture Content (%)	12.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m^3)	1.86		
Field Moisture Content (%)	12.4		
Moisture Content at Placement (%)	11.9		
Moisture Content Top 30mm (%)	13.2		
Moisture Content Rest of Sample (%)	13.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	144		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	2.8		

California Bearing Ratio



Material Test Report

Report Number: 86745.00-1
Issue Number: 1
Date Issued: 10/04/2019
Client: Northern Beaches Council
 PO Box 882, Mona Vale NSW 1660
Contact: Simon Gray
Project Number: 86745.00
Project Name: Warriewood Valley Community Centre
Project Location: Pittwater Road and Jacksons Road, Warriewood
Work Request: 4246
Sample Number: 19-4246B
Date Sampled: 26/03/2019
Dates Tested: 28/03/2019 - 08/04/2019
Sampling Method: Sampled by Engineering Department
Sample Location: BH105 & BH106 (0.5-1.5m)
Material: Filling - Yellow brown sand filling



Mick Gref

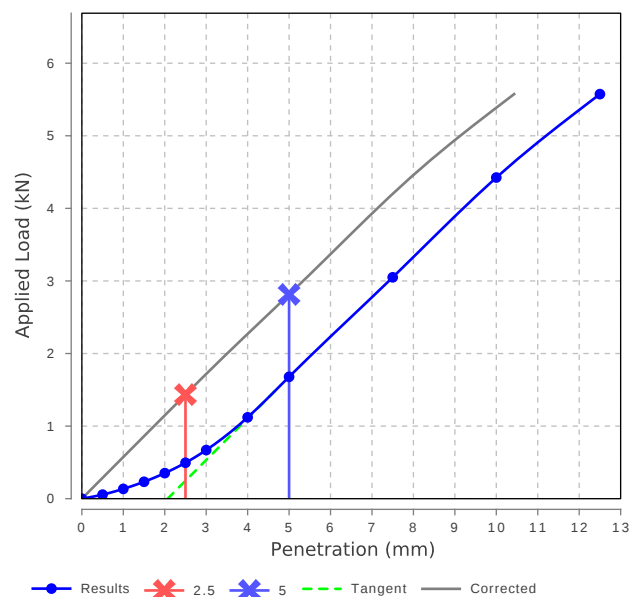
Approved Signatory: Mick Gref

Senior Technician

NATA Accredited Laboratory Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	14		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.86		
Optimum Moisture Content (%)	14.5		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	98.0		
Dry Density after Soaking (t/m^3)	1.87		
Field Moisture Content (%)	10.6		
Moisture Content at Placement (%)	14.2		
Moisture Content Top 30mm (%)	14.7		
Moisture Content Rest of Sample (%)	14.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	120		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.8		

California Bearing Ratio



Misc Inorg - Soil					
Our Reference		214498-4	214498-8	214498-13	214498-15
Your Reference	UNITS	102-3.5	103-3.3	105-2.5	106-1.7
Depth		3.5	3.3	2.5	1.7
Date Sampled		26/03/2019	26/03/2019	26/03/2019	26/03/2019
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	01/04/2019	01/04/2019	01/04/2019	01/04/2019
Date analysed	-	01/04/2019	01/04/2019	01/04/2019	01/04/2019
pH 1:5 soil:water	pH Units	4.4	7.5	5.9	8.7
Electrical Conductivity 1:5 soil:water	µS/cm	400	25	46	53
Chloride, Cl 1:5 soil:water	mg/kg	31	10	10	10
Sulphate, SO4 1:5 soil:water	mg/kg	820	10	22	<10