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Project 91181.00
24 January 2020
R.036.Rev0
MJB:lg

Attention: Chris Farrington / Alex Moulis

Email: chris@domagroup.com.au; alex@domagroup.com.au

Dear Chris Farrington / Alex Moulis

Response to Department of Planning and Environment SEARs
Proposed Mixed Use Development
42 Honeysuckle Drive, Newcastle

1. Introduction

Douglas Partners Pty Ltd (DP) has conducted geotechnical and environmental investigations and associated reporting for the proposed mixed use development at 42 Honeysuckle Drive, Newcastle. It is understood that the proposed development has been modified to convert the approved development comprising a hotel, retail space, internal car parking and serviced apartments into a hotel, retail space, commercial space and internal car parking. We understand that an amendment to the development application (DA) is currently being prepared and needs to address the Department of Planning and Environment (DPE) Planning Secretary's Environmental Assessment Requirements (SEARs) dated 6 November 2019.

It is understood that there will be no significant changes to the building structure (i.e. footings, depth of excavation, landscaping, building footprint or heights etc) and the proposed changes are predominantly associated with the modification of upper level serviced apartments to commercial space and removal of the proposed pool to the ground floor (refer to Drawing A.03.000[2] dated 8 January 2019).

Based on the above understanding, the current contamination and geotechnical investigations conducted by DP and the associated remediation action plan (RAP) and acid sulfate soil management plan (ASSMP) are considered suitable for the amended development. Further investigation is therefore not warranted.

2. Limitations

Douglas Partners Pty Ltd (DP) has prepared this letter for this project at 42 Honeysuckle Drive, Newcastle with reference to DP's proposal 19 September 2018 and acceptance received from Mr Alex Moulis of Doma Holdings (Honeysuckle) Pty Ltd dated 21 September 2018. This letter is provided for the exclusive use of Doma Holdings (Honeysuckle) Pty Ltd for this project only and for the purposes as described in the report.

It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during previous investigations. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd

Reviewed by

Matthew Blackert
Senior Associate

Stephen Jones
Principal

Attachments: About this Report
Drawing A.03.000[2] - Ground Level Plan

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

	Carpark	ACC Carpark	Motorbike
GL	18		
L01	34	6	2
L02	34	6	2
L03	34	6	2
L04-CP	31		6
TOTAL	151	18	12

TOTAL Carpark Spaces	169
TOTAL Motorbike Spaces	12

HONEYSUCKLE DRIVE

COTTAGE CREEK

PUBLIC DOMAIN (PARKLAND) 5469m2

LOBBY 236m2

CAFE 71 m2

SUB. 5600

SWITCH

PUMP ROOM

OFFICE 68m2

LUGGAGE STORE 35 m2

SERVICES

EOT 123m2

GYM 296m2

LAUNDRY 103 m2

GROUND CARPARK 18 cars

LOADING

WASTE STORE

PLANT

Dis Rm

OUTSIDE GYM AREA

EXISTING COMMERCIAL BUILDING 15M

EXISTING OPEN AIR CARPARK

42 HONEYSUCKLE DRIVE

EXISTING RAIL CORRIDOR

Revision	Date	Description	Initial	Checked
2	08.01.20	For Information	DE	DE
1	10.12.19	For Information	EN	DE

S12109_ Doma
Honeysuckle Drive, Newcastle

Ground Level Plan

Scale	1:200 @A1 1:400 @ A3
Drawn	Checked
Project No.	S12109
Status	FOR INFORMATION
Plot Date	8/1/2020 8:49 PM
Plot File	S:\12100-12199\s12109_doma_honeysuckledri\70_CAD\Plots\D... ...\A03.000[1].dwg
Drawing No.	[Revision]

A03.000[2]

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Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Mixed Use Development
42 Honeysuckle Drive, Newcastle

Prepared for
Doma Holdings (Honeysuckle) Pty Ltd

Project 91181.00
October 2017

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	91181.00	Document No.	R.001.Rev0
Document title	Report on Geotechnical Investigation Proposed Mixed Use Development		
Site address	42 Honeysuckle Drive, Newcastle		
Report prepared for	Doma Holdings (Honeysuckle) Pty Ltd		
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Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Michael Harris	John Harvey	27 October 2017

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Status	Electronic	Paper	Issued to
Revision 0	1	0	Mr Chris Farrington, Doma Holdings (Honeysuckle) Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		27 October 2017
Reviewer		27 October 2017

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Report on Geotechnical Investigation
Proposed Mixed Use Development
42 Honeysuckle Drive, Newcastle

1. Introduction

This report presents the results of a geotechnical investigation undertaken for a proposed mixed use development at 42 Honeysuckle Drive, Newcastle. The investigation was commissioned in a service order dated 16 August 2017 by Chris Farrington of Doma Holdings (Honeysuckle) Pty Ltd and was undertaken with reference to Douglas Partners Pty Ltd (DP) proposal NCL170375 dated 15 August 2017.

It is understood that a nine storey building development is proposed. Further details on the proposed development are outlined in Section 3 of this report.

The purpose of this report is to provide geotechnical comments on excavation conditions, retaining wall design parameters and footings. Comments on subsurface conditions and footing design parameters are based on existing in-house DP information including four cone penetration tests (CPTs: L22-1 to L22-4) undertaken for previous proposed developments at the site as well as CPT and boreholes undertaken as part of current investigation for this project.

This investigation comprised a review of available information, CPT and borehole investigation followed by preparation of this engineering report. The current investigation included 11 CPTs (301 to 311). The details of the field work are presented in this report, together with comments and recommendations on the issues listed above.

This investigation was undertaken concurrently with environmental investigations which have been reported separately under this DP job number, and no further comment in regards to soil contamination is provided in this report. This report should be read in conjunction with the contamination reports undertaken for this project.

It is understood that mine subsidence investigations and associated modelling has been completed by others and as such has not been commented on in this report.

For the purpose of this assessment, the client supplied drawings of the proposed development are listed below and are attached in Appendix D:

- DWG: A03.101 Rev A, titled “Ground Floor Plan”, dated 27.9.2017.

2. Site Description

The site is identified as 42 Honeysuckle Drive (Lot 22 DP1072217), Newcastle, and is shown in Drawing 1, attached in Appendix D.

The site is a trapezoidal shaped allotment situated at the western end of the Honeysuckle, and has a plan area of 3728 m^2, and site levels ranging from about 2.1 m AHD to 3.8 m AHD. The site is bounded by the following land:

- Part Lot 23 (floodway) and Cottage Creek to the north-west;
- Honeysuckle Drive to the north-east;
- Hunter Water Corporation building to the south-east;
- Great Northern Railway Corridor (railway tracks have been recently demolished and removed) to the south-west.

At the time of field work the site was vacant, predominantly grassed and contained mounded fill. A fill mound covers the majority of the site footprint, which has raised site levels 1.5 m to 2 m above the street level. The fill mound extends into the adjacent allotment to the west (Lot 23) and batters down to Cottage Creek;

The site is shown in Figure 1 below.

Figure 1: Aerial View of Site

3. Proposed Development

It is understood that the proposed development will comprise the following:

- A nine storey mixed use building, with parking, serviced apartments and retail development on the ground floor, four storeys of parking and hotel rooms above the ground floor and an additional four storeys of residential apartments above the hotel;
- The ground floor level is proposed at approximately RL2.5 (AHD) to RL3.0 (approximately 0.5 m to 1.5 m below existing site levels) which is marginally above existing street levels (i.e. no basement proposed). The far southern part of the site will require filling by up to 0.5 m to reach base slab level;
- Localised deeper excavations will be required for the five lift pits (assume approximate invert level of RL1.5);
- Localised deeper excavations in the order of RL0 will be required for subterrain fire tanks (to be confirmed subject to the findings of this investigation);
- Column loads are understood to be 6500 kN compression and 2000 kN tension.

4. Data Review and Regional Geology

The 1:100,000 scale Newcastle Coalfield Regional Geology map (Sheet 9321, NSW Department of Mineral Resources, 1995) indicates that the site is underlain by Quaternary aged Alluvium comprising sand, silt, clay and gravel sediments deposited under water during a period of higher sea level. These alluvial deposits are underlain by rock of the Permian aged Newcastle Coal Measures, including sandstone, siltstone, tuff, conglomerate and coal.

The 1:25,000 scale Acid Sulphate Soil Risk Map for Newcastle (Sheet 9232-S2, NSW Department of Land and Water Conservation, 1995) indicates that there is a high probability of acid sulphate soils occurring between 1 m and 3 m below natural ground level at this site.

Previous investigations at the site and in the near vicinity encountered an upper soil profile comprising fill (mainly sand) to 3 m deep, over weak alluvial soils including a “soft” clay layer to depths of up to about 6 m. Medium dense to dense sand is typically present below the weak soils to depths of about 15 m, underlain by stiff to hard clay, with bedrock at about 40 m depth. The groundwater table has been recorded at levels in the range 0.1 to 0.7 AHD during 2009 and 2010.

5. Field Work Methods

Field work was undertaken in the period 15 to 16 September 2017 and comprised the following:

- Seven cone penetration tests (CPTs 305, 306, 307, 308, 309A, 310A and 311) and four piezo-cone penetration tests (CPTu 301A, 302, 303B, and 304A). The tests were continued to depths ranging from 15 m to 30 m respectively;
- The CPTs were conducted using a purpose-built truck-mounted CPT rig. A 35 mm diameter instrumented cone and friction sleeve assemble was hydraulically thrust into the soil at a rate of about 2 cm/sec. Cone tip resistance, sleeve friction and inclination from vertical were recorded by a computer data acquisition system for subsequent plotting and analysis. The piezocone was also used to perform dissipation tests, consisting of halting the cone penetration within a suitable material, and monitoring the decrease in pore pressure with time;
- Upon completion of each test, the remnant hole was dipped to determine the depth to the water table;
- Four bores, Bores 201 to 204 were drilled to about 6.0 m depth using a purpose built geotechnical drilling rig, and where undertaken as part of the environmental investigation, in situ standard penetration tests were not carried out in the bores;
- Groundwater monitoring wells (piezometers) were installed Bores 201 to 203. A data logger was installed in Bore 202 to measure groundwater levels;
- The bores and CPTs were set out by a geotechnical engineer who logged the subsurface profile and also collected representative samples for strata identification;
- The surface level of the test locations was measured by a DP site engineer to approximately $\pm$ 0.1 m in accuracy, which is considered similar to the surface levels as shown on the site survey plan supplied by the client. Co-ordinates of the test locations were recorded using a hand held GPS which is considered to be accurate within 15 m depending on satellite coverage.

The test locations were set out in the field from site features using a hand tape and are presented in Drawing 1, Appendix D.

6. Field Work Results

The subsurface conditions encountered in the bores are presented in the attached borehole logs and the results from the CPTs are attached in Appendix B, together with an inferred strata description, based on published correlations between cone resistance, friction ration and soil type. These should be read in conjunction with the accompanying notes in Appendix A which explain the descriptive terms and classification methods used in the reports.

6.1 CPT and CPTu

The results are summarised in Table 1 below.

Table 1: Summary of CPT Results

Test Location	CPT303B	CPT308	CPT307	CPT310A	CPT311	CPT304A	CPT301A	CPT306	CPT302	CPT305	CPT309A
Surface RL (AHD)	3.9	3.8	2.2	3.8	3.8	3.8	3.8	3.9	3.8	3.7	3.6
Material Description	Depth Range (m)										
Filling - Typically Sand	0-2.6	0-2.11	0-2.34	0-2.67	0-2.1	0-2.26	0-3.88	0-4.04	0-2.2	0-3.75	0-2.82
Sand - Loose to dense	2.6-4.52	2.11-3.94	-	2.67-4.08	2.1-4.12	2.26-4.13	-	-	2.2-3.79	-	2.82-3.32
"Weak Alluvial" soils - loose sand and soft to firm clay	4.52-4.78	3.94-4.94	2.34-3.45	4.08-4.78	4.12-4.62	4.13-5.04	3.88-4.46	4.04-4.49	3.79-4.86	3.75-4.52	3.32-4.28
"Upper" Loose to Medium Dense Sand Layer	4.78-9.03	4.94-10.14	3.45-9.16	4.78-11.06	4.62-8.95	5.04-8.53	4.46-10.36	4.49-10.76	4.86-10.53	4.52-9.69	4.28-9.38
"Central" Medium Dense to Dense Sand Layer	9.03-15.35	10.14-14.56	9.16-12.93	11.06-14.39	8.95-14.77	8.53-14.87	10.36-14.87	10.76-14.69	10.53-14.44	9.69-14.61	9.38-14.77
"Lower" Clay - Stiff or Better	15.35-30.3	14.56-18.0	12.93-16.00	14.39-18.00	14.77-18.06	14.87-16.04	14.87-30	14.69-18.0	14.44-16.0	14.61-16.00	14.77-18.0
Top of "Central" Medium Dense or Dense Sand Layer RL (AHD)	*-5.13*	*-6.34*	*-6.96*	*-7.26*	*-5.15*	*-4.73*	*-6.56*	*-6.86*	*-6.73*	*-5.99*	*-6.23*
Thickness of "Central" Medium Dense or Dense Sand Layer (m)	6.32	4.42	3.77	3.33	5.82	6.34	4.51	3.93	3.91	4.92	4.94
Reason for Termination (m)	LOI	LOI	LOI	LOI	LOI	LOI	LOI	LOI	LOI	LOI	LOI
Termination Depth (m)	30.3	18	16	18	18.07	16.04	30	18	16	16	18
Depth to Observed Free Groundwater (m)	3.6	3.2	1.7	1.8	3.5	3.5	-	-	-	3.4	3.2
RL to Free Groundwater (AHD)	0.3	0.6	0.5	2	0.3	0.3	-	-	-	0.3	0.4

Notes to Table 1:
NE = not encountered
LOI = limit of investigation
REF = refusal

The results of dissipation testing at CPT 302 (4.68 m depth) and 304A (4.9 m depth) indicate the upper “soft” clay layer has horizontal coefficients of consolidation (c_h) of about 29 and 3 m^2/year, and the remaining tests did not provide useable results due to limited pore pressure dissipation and saturation of the piezo-cone.

Several attempts at penetrating the filling with the CPTs was required, due to obstructions in the filling (i.e. likely large particles such concrete or similar), especially at locations CPT 309A, 310A, 301A and 303B.

6.2 Boreholes

Bores 201 to 204 were undertake predominantly for sampling for environmental purposes and typically encountered silty sand filling up to 3.7 m depth overlying sand and clayey sand to 6.0 m depth.

6.3 Groundwater

Free groundwater was encountered in the CPTs at depths ranging from 1.7 m to 3.5 m depth (RL0.3 to RL2.0) and the inferred depth of groundwater, based on collapsing CPTs, was at depths of 1.8 m to 3.2 m.

Free groundwater was encountered in the bores at depths ranging from 2.4 m to 3.0 m depth during drilling and within piezometers at 2.1 m to 3.4 m depth (approximately RL0.4) on the 14 September 2017.

Based on data logger monitoring from Bore 202 free groundwater was observed at RL0.2 to RL0.7, typically RL0.5 during mid-September to mid October 2017. The results are presented in Figure B1 attached.

This level would be influenced by direct infiltration from rainfall and tidal levels in Cottage Creek and the harbour. During extreme or prolonged wet weather, the groundwater level could rise well above RL0.7 and would ultimately be controlled by the near-surface drainage measures in Honeysuckle Drive and Cottage Creek.

It should be noted that re-charge via rainfall during the few months prior to the investigation would have been limited due to lower than average rainfall. It should be noted that groundwater levels are affected by factors such as climatic conditions and soil permeability and will therefore vary with time.

7. Comments

7.1 Appreciation of Subsurface Conditions

The pertinent subsurface conditions encountered in the abovementioned test locations are further summarised as follows:

- Filling typically comprising silty sand filling with larger particles (possible concrete) ranging up to 4.04 m depth. The filling is considered uncontrolled and variable in density;
- Sand, which is variable in density and ranges from loose to dense, and depth of up to 4.5 m;
- The “Weak Alluvial” typically comprising loose silty sands and soft to firm clay at depths of up to 5.0 m (thickness ranging from 0.3 m to 1.1 m and more typically about 0.5 m);
- The “upper” loose to medium dense sand layer, ranging up to 10.7 m depth;
- The “central” sand layer, which was medium dense to dense ranged from 8.95 m to 15.35 m depth (with the top of the layer ranging from RL-7.6 to RL-4.7), and ranged from 3.3 m to 6.3 m in thickness, and is considered potentially suitable to found piles in depending on structural loads and settlement tolerances;
- The “central” sand layer is underlain by clay (generally of firm, stiff to very stiff and hard clay consistency, but more typically with a lower-bound shear strength of 50 kPa), which could have settlement implications in relation to raft slabs, piled rafts and pile groups. The clay layer was encountered at depth below 12.9 m depth;

- The “top” of rock is at about 39 m to 40 m depth (RL-35.2 and RL-36.4 based on CPT refusal from previous investigations);
- The water table is typically around RL0.3 to RL0.7 based on selected CPT results and groundwater monitoring during September and October 2017, which is below the proposed floor level of 2.50 AHD, and but would be expected to be encountered in localised deeper excavations for tanks and possibly lift pits during construction, which will requiring dewatering.

Consideration has been given to pad footings founded within the sand filling, however these are unlikely to be suitable due to the magnitude of the column loads, the variability and nature of the filling, the relatively low design bearing pressure of the filling and the presence of underlying “weak alluvial” soil layer at shallow depths, which is susceptible to long term consolidation. Therefore consideration should be given to piled foundations, as discussed in the following sections.

7.2 Soil Aggressivity

The results of pH, chloride and sulphate ion concentration analyses, along with the classifications for concrete and steel based on the Piling Code AS 2159 (Ref 2) are summarised in Table 2 below:

Table 2: Results of Soil Aggressiveness Tests

Test Location		Laboratory Testing				Interpretation of Results		
Bore	Depth (m)	pH	EC (µS/cm)	Cl (mg/kg)	SO_4 (mg/kg)	Soil Type (A or B)	Classification for Concrete	Classification for Steel
201	2.3	7.2	40	<10	10	A	Mild	Non Aggressive
201	4	7.5	98	<10	130	A	Mild	Non Aggressive
202	3	7.6	84	24	41	A	Mild	Non Aggressive
202	3.8	7.3	420	<10	660	A	Mild	Mild
202	5.5	7.1	350	<10	550	A	Mild	Mild
204	1	7.5	56	<10	10	A	Mild	Non Aggressive

Notes to Table 2:
EC: Electrical Conductivity SO_4: Sulphates Cl: Chlorides
Soil Type A: High permeability soils (e.g. sands and gravels) which are in groundwater
Soil Type B: Low permeability soils (e.g. silts and clays) or all soils above groundwater

Reference should be made to Tables 6.4.3 of AS 2159 – 2009 (Ref 1) to determine the minimum concrete cover to reinforcement required (for concrete piles), based on this exposure classification and the minimum concrete strength appropriate for the indicated site conditions.

7.3 Subfloor Level Tank and Lift Well Construction

The following excavations are proposed:

- Bulk excavation to RL2.5, and noting the surface level ranges up to RL3.7;
- Localised excavations for lift pits RL1.5;
- Localised deeper excavations for subterrain fire tanks to RL0, however it is understood that this level is subject to adjustment depending on results of this investigation and fire tank design requirements.

The ground conditions comprise sand filling and natural sands to 4 m depth. The “Weak Alluvial” typically comprising loose silty sand and soft to firm clay to depths of up to 5.0 m, which are further underlain by sands.

At the time of investigation, groundwater was observed at RL0.2 to RL0.5 and it should be noted that groundwater has the potential to rise to higher levels.

Thus, excavations to RL0.7 or below will encounter groundwater and dewatering will be required during construction, based on groundwater depths at the time of this investigation.

Such excavations during construction will need temporary or permanent support and dewatering where groundwater is encountered.

Excavation support will be required for lift pits and fire tanks. Driven metal sheet piles could be considered for temporary support. Anchors or props may be needed for temporary restraint of the retaining structure walls.

Selection of the temporary support system will need to take into consideration the presence of water-charged sand within the proposed excavation and the need to install excavation support prior to excavation of such structures.

The contractor should take appropriate safety precautions to protect workers against collapse of excavation walls and batters. Notwithstanding the above, excavations greater than 1.0 m depth are subject to statutory WorkCover requirements.

7.4 Excavation Conditions

Material to be excavated is expected to generally comprise silty sand. Conventional earthmoving machinery such as hydraulic excavators are expected to be suitable for the majority of the excavation.

Any excess soils requiring off-site disposal or re-use during site development should be appropriately classified in accordance with regulatory and statutory requirements and reference should be made to environmental report undertaken by DP for this project.

7.4.1 Dewatering

Large scale dewatering should not be undertaken without assessment of possible effects to adjacent structures.

Care should be taken to avoid drawdown of the groundwater levels beneath adjoining structures, as this could induce settlement. In this regard, re-injection of groundwater may be required externally of the perimeter wall to ensure “normal” external water levels. The relative risk of this will be linked to the type, depth and watertightness of the wall used for basement construction. Further, a hydrogeological investigation may be required to assess pumping rates, including a groundwater pump test and groundwater modelling.

The minimum dewatering requirements will depend on the conditions encountered during construction, on the proposed excavation depths and on the proposed methods.

It is suggested that rather than dewatering for construction that the proposed excavations depths could be revised to above the standing water level at the time of construction.

The permanent design of subfloor tanks and lift pits should consider hydrostatic uplift and appropriate drainage measures.

7.5 Footings

The site contains up to approximately 2 m of typically sand filling and therefore the site is classified Class P with reference to AS2870-2011 (Ref 1).

Due to the depth of filling, the presence of a weak clay layer at 4.0 m to 5.0 m depth and anticipated column loads, shallow pad or strip footings founded within the sand filling are unlikely to be suitable for the proposed building. A piled raft slab maybe technically feasible as a foundation option, but has not been analysed as part of this scope of works and is not discussed further in this report. Therefore consideration in this report has only been given to piled foundations, as discussed below.

Piles may be founded in soil or rock. The depth to rock is expected to be in excess of about 40 m, hence piles founded in rock are expected to be relatively costly. Founding piles in rock is technically feasible and preliminary design parameters are provided in Section 7.6 of this report.

It is recommended that the “central” medium dense to dense sand which was encountered below about 8.5 m to 10.5 m depth (top of layer below RL-5 to RL-7) presents a suitable founding stratum for piles. However, this layer is variable in thickness (3.3 m to 6.3 m) thus careful attention is required for design and installation of piles so as not to “over-drill” and found piles too close to the underlying clay which may lead to excessive settlement.

The pile types considered suitable for this site comprise continuous flight auger (CFA) piles and concrete screw cast piles. Driven piles are unlikely to be suitable due to the potential vibrations associated with installation, taking into account the close proximity of existing buildings. Steel screw piles maybe technically feasible but have limited redundancy in terms of durability, negligible lateral capacity and low tension capacities, and are not preferred at this site. Other pile types could be technically feasible for this site and could be assessed if required.

As a guide, the geotechnical capacity of selected single piles has been assessed at selected CPT locations.

The estimations have been carried out for the following selected piles using in-house software ConePile:

- 0.51 / 0.66 m and 0.56 / 0.71 m diameter screw cast concrete pile (e.g. Atlas);
- 0.60 and 0.75 m diameter (CFA or grout-injected).

Estimates of pile capacities in compression have been undertaken with reference to the piling code AS 2159-2009 (Ref 2). The pile capacities are expressed in limit state terms whereby the Design Geotechnical Strength ($R_{d,g}$) is defined in (Ref 2) as:

$R_{d,g} = \phi_g R_{ug}$, which must exceed the Design Action Effect E_d

R_{ug} is the ultimate geotechnical strength, which is calculated using static theory, and therefore represents an estimate only. The geotechnical strength reduction factor ϕ_g depends on a number of factors including the extent of site investigation, type of analysis and pile testing regime during construction. For the estimates presented below, a value of $\phi_g = 0.52$ was adopted. Higher values of ϕ_g may be justifiable if sufficient load testing is conducted, as per AS 2159-2009. The traditional "allowable" capacity is related to "working" load and is generally lower than $R_{d,g}$, depending on the structural factors applied to determine E_d.

Estimates of geotechnical pile capacities have been determined using selected CPT results (CPTs 301A, 302, 303B, 309A, and 310A) and an in-house program ConePile Version 5.9.1. The plots of estimated pile capacity against depth are included in Appendix C.

From the charts presented in Appendix C, the optimal founding depth with respect to both capacity and potential consolidation of the underlying clay has been presented in Table 1 which shows the geotechnical capacity of single piles founded in the "central medium dense to dense sand" at levels ranging from approximately RL-5.1 to RL-7.2.

Table 3: Estimated Pile Capacities for Selected Pile

CPT	Target Layer Founding Thickness (m)	Founding Depth (RL AHD)	Estimated Design Geotechnical Strength ($R_{d,g}$) [1,2,3] (kN), ϕ_g = 0.52			
			CFA 0.6 m	CFA 0.75 m	SCC[4] 0.51 / 0.66 m	SCC[4] 0.56 / 0.71 m
CPT 301A	4.5	10.8 m (RL-7.1)	1050	1400	2000	2300
CPT 302[5]	3.9	11.0 m (RL-7.2)	850	1300	1800	2000
CPT 303B	6.3	9.5 m (RL-5.6)	1100	1600	1850	2400
CPT 309A	4.9	10.0 m (RL-6.3)	1250	1800	2250	2500
CPT 310A[5]	3.3	11.5 m (RL-7.8)	1000	1300	1900	2300

Notes to Table 3:

CFA - Grout – Injected

SCC - Screw Cast Concrete

1. All pile types, particularly grout piles, should be checked for structural adequacy.
2. Strength Reduction factor (ϕ_g) = 0.52.
3. Group capacities are not necessarily a straight multiple of individual capacities due to interaction effects.
4. Inner / Outer diameter of screw cast concrete pile.
5. Caution during design and construction is advised due to the thin sand bearing layer (i.e. less than 4 m thickness).

Depending on the column load, a single pile may not be able to support the heaviest proposed column loads due to geotechnical capacity limitations. Depending on the pile type and size adopted, the more heavily loaded columns may require a group of several piles (maybe two to three or possibly more).

The foregoing estimated capacities relate to geotechnical strength only, and the structural adequacy of the piles should also be checked, particularly in the case of grout piles. Prospective piling contractors should confirm the pile capacities and founding depths achievable with their equipment. In regard to verification of load capacity at the time of installation, it is noted that screw cast concrete piles have an advantage over grout-injected piles because torque measurements provide an indication of capacity. It is recommended that further CPTs be carried out at a high proportion of pile / pile group locations in order to identify and confirm the strength and thickness of the founding layer (“central medium dense to dense sand” layer).

As a guide for the design of piles using traditional methods, Table 4 presents design parameters of non-displacement type single piles (e.g. CFA piles). Design parameters greater than 10 m to 11 m depth have not been provided as the end bearing capacity may reduce with increasing depth due to the presence of the underlying clays.

Table 4: Pile Design Parameters for Displacement Type Single Piles

Depth (m)	Ultimate Shaft Adhesion (kPa)	Allowable shaft adhesion (kPa)	Allowable End Bearing Pressure (kPa)
1-2	0	0	0
2-3	30	12	0
3-4	20	8	0
3-4	10	4	0
5-6	10	4	0
6-7	15	6	0
7-8	25	10	0
8-9	75	30	2000
9-10	100	40	2000

The allowable design parameters have been based on a factor of safety of 2.5.

The above parameters are for compressive loads. If tension loads are required for design, the above parameters presented in Table 4 should be reduced to 75% of the values presented in the table.

With pile groups, the increase in effective stress, leading to consolidation and settlement of the underlying clay strata becomes as important an issue as the geotechnical capacity. Hence, although individual pile capacity versus depth plots may indicate slightly higher geotechnical capacities below 10 m depth, the founding depths for pile groups should be at or above this level to minimise the potential 'pile group' settlements.

As a guide, the estimated settlement of a single pile and, twin pile and a three pile group are shown in Table 3, for piles founded at 10 m depth. The settlement estimates are been based on the following:

- Pile diameter of 0.75 m;
- Working load of 700 kN per pile (i.e. based on parameters in Tables 3 and 4); and
- Pile spacing of 2.5 diameters (centre to centre) for the pile group.

Table 5: Settlement Estimates for Piles and Pile Groups

Pile Location	'Immediate' Settlement[(1)] (mm)	Consolidation of "Lower Clay layer" (mm)	Total Settlement (mm)
Single Pile	2-5	2-5	5-10
Two or Three Pile Group	5-15	5-15	10-30

Note to Table 5:

1. The settlement of the pile due to sand and interaction effects will not actually be "immediate', as the load is applied gradually as the building is constructed.

The above total settlements could lead to significant differential settlements between columns or other structural elements. The differential settlements will depend on the spatial arrangement of loads and the pile configuration adopted. The total and differential settlements could probably be reduced by utilising a piled raft system, whereby a proportion of the structural load is carried by a stiff raft at ground floor level. Further analysis would be required to assess the feasibility of this option, based on the actual layout of working loads on columns and wall footings.

For all piles care should be taken not to "over drill" piles to depths below the proposed founding levels described above as it could have an adverse impact on settlement, and the geotechnical capacity begins to reduce with depth, due to underlying clay.

7.6 Piles Founded in Rock

Heavy column loads could be supported on piles socketed into the bedrock, to depths below 40 m. Actual pile founding depths could be more, depending on the pile type. At these depths, special piling equipment and/or splicing of piles would be required.

Deep bores from nearby the site which were drilled for mine subsidence investigations indicate initially very low strength rock in the upper 3 m to 5 m of rock, increasing to low to medium, and medium strength with depth. Preliminary design of bored piles could be based on an allowable end bearing pressure of 1500 kPa, and allowable shaft adhesion for rock sockets of 150 kPa to about 40 m depth within very low strength sandstone rock. For deeper piles in the order of 45 m depth the rock is likely to improve in strength (except for possible coal associated with the Yard Seam), and design may be based on an allowable end bearing pressure of 3000 kPa, and on allowable shaft adhesion of 300 kPa, where piles are founded in low to medium strength sandstone, excluding coal.

Bored piles would need to be formed under bentonite or drilled/vibrated steel casing.

In the case of all piles, prospective piling contractors should confirm the appropriate pile depths and capacities achievable with their equipment, taking into consideration the settlement issues.

7.7 Retaining Wall Design Parameters

Temporary excavation support, if installed for the construction period only, and not required to prevent movement of the adjacent ground, may be designed based upon "active" (Ka) earth pressure coefficients. This would comprise any non-propped or laterally unrestrained walls (e.g. cantilever type walls).

Where support for the adjoining ground is to be maintained, the retaining wall would require anchoring or propping by some method in order to minimise lateral displacement upon excavation. The retaining walls are expected to be laterally restrained by the completed structure, and hence the earth pressure distribution in these situations should be based on "at-rest" (Ko) earth pressure coefficients.

The suggested design soil parameters are shown in Table 6 below. The earth pressure coefficients are for level backfill and are unfactored. Any additional surcharge loads, during or after construction, should be accounted for in design.

Table 6: Retaining Wall Design Parameters

Parameter	Symbol	Loose to medium dense sandy Fill or sand (0 to 4 m depth)
Unit weight (above water table)	γ_b	20 kN/m^3
Submerged (buoyant) unit weight (below water table)	γ_{sub}	10 kN/m^3
Angle of Friction	ϕ'	34°
Angle of Wall Friction (concrete surface)	δ	22°
Active earth pressure coefficient	Ka	0.28
At-rest earth pressure coefficient	Ko	0.44
Passive earth pressure coefficient	Kp	3.54

Below the water table, γ_{sub} should be used instead of γ_b, and the contribution of hydrostatic water pressure should be added ($\gamma_w.z_w$, where z_w is the depth below the water table, γ_w = 9.81 kN/m^3).

Free draining material should be used for backfilling behind the wall, such as a single size aggregate of nominal size 10 mm or 20 mm. Alternatively, the wall should be designed for full hydrostatic water pressures.

7.8 Earthquake Subsoil Class

The soil profile contains loose sand interbedded, with a thin layer typically soft to stiff clay underlain by loose, medium dense and dense sand which is further underlain by stiff to hard clay to 40 m depth where rock is anticipated.

Based on the procedures presented in AS1170.4 (Ref 3), the site subsoil classification is Class C_e.

7.9 Earthworks Preparation Measures

The earthworks preparations below the proposed building footprint should be prepared as follows:

- Strip existing surface vegetation and topsoil (if encountered) and filling to design level;
- For the bulk excavation the exposed subgrade should be proof rolled in the presence of a Geotechnical Engineer to confirm subgrade conditions given in this report. Where encountered, “soft” spots should be removed and replaced with engineered fill as outlined below;
- The subgrade should be compacted, by means of a static drum roller of at least 10 tonne static mass, to achieve a density index of at least 80% (AS1289.5.6.1), for a depth of at least 0.3 m;
- Additional filling should comprise granular material such as clean sand or gravelly sand, as encountered within the upper fill profile at the site, and or sandy gravel (imported road base quality material);

- The filling should be compacted in layers not exceeding 0.3 m loose thickness to at least 80% density index; and
- For trafficability purposes it is recommended that the upper 0.3 m of filling comprise a granular platform material such as a DGB20 or similar (i.e. road base quality of CBR≥80% or recycled crushed concrete) and compacted to a dry density ratio of 98% Standard Compaction.

Site preparation / filling should be undertaken in accordance with AS 3798 (Ref 4) and geotechnical inspections and testing.

8. References

1. Australian Standard AS 2870-2011 "Residential Slabs and Footings", 2011, Standards Australia.
2. Australian Standard AS 2159–2009, “Piling – design and installation”, Standards Australia.
3. Australian Standard AS 1170.4 "Structural Design Actions Part 4: Earthquake actions in Australia", 2007, Standards Australia.
4. Australian Standard AS 3798-2007 “Guidelines on Earthworks for Commercial and Residential Developments”, Standards Australia.

9. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 42 Honeysuckle Drive, Newcastle in accordance with DP’s proposal NCL170375 dated 15 August 2017 and service order acceptance received from Doma Holdings (Honeysuckle) Pty Ltd dated 16 August 2017. The work was carried out under DP’s Conditions of Engagement. This report is provided for the exclusive use of for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP’s field testing has been completed.

DP’s advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report
Sampling Methods
Soil Descriptions
Symbols and Abbreviations
Rock Descriptions
Information on Cone Penetration Tests

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

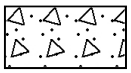
Symbols & Abbreviations

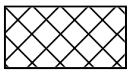
Graphic Symbols for Soil and Rock

General

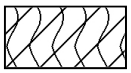

Asphalt

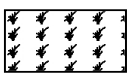

Road base

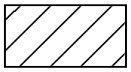

Concrete

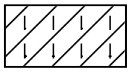

Filling

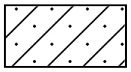
Soils


Topsoil

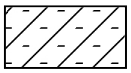

Peat

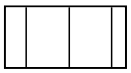

Clay

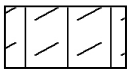

Silty clay

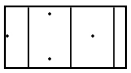

Sandy clay

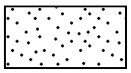

Gravelly clay

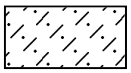

Shaly clay

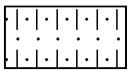

Silt


Clayey silt


Sandy silt

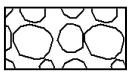

Sand

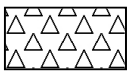

Clayey sand


Silty sand


Gravel

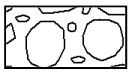

Sandy gravel


Cobbles, boulders

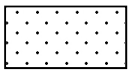

Talus

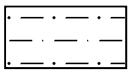
Sedimentary Rocks

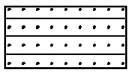

Boulder conglomerate

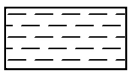

Conglomerate


Conglomeratic sandstone

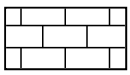

Sandstone


Siltstone

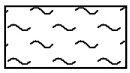

Laminite

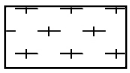

Mudstone, claystone, shale

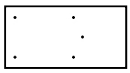

Coal


Limestone

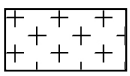
Metamorphic Rocks

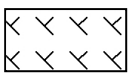

Slate, phyllite, schist

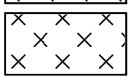

Gneiss

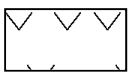

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Cone Penetration Tests

Douglas Partners

Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

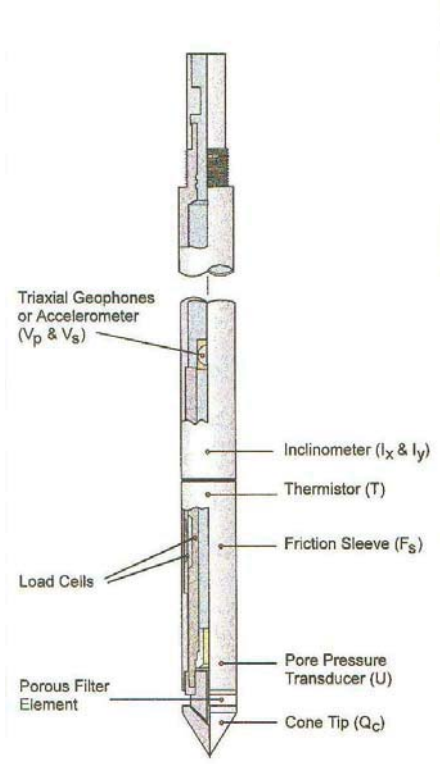


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.

Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (q_c, f_s, i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (σ) plus basic parameters
Seismic	Shear wave velocity (V_s), compression wave velocity (V_p), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Qt) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration Tests

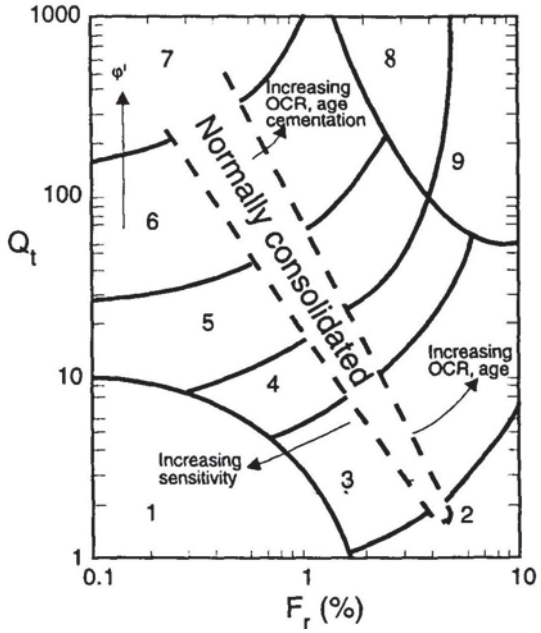


Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation. The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G_0. Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

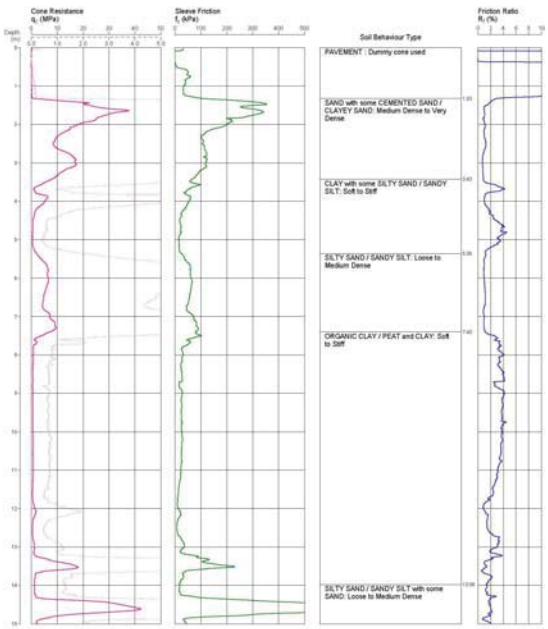


Figure 4: Sample Cone Plot

Appendix B

CPTs – 305, 306, 307, 308, 309A, 301Aand 311
CPTu – 301A, 302, 303B and 304A
Borehole Logs 201 to 204
CPTs – L22-1 to L22-4 (previous investigation)
Figure B1 – Groundwater Pressure Head vs Rainfall Data Logger
Bore 202

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

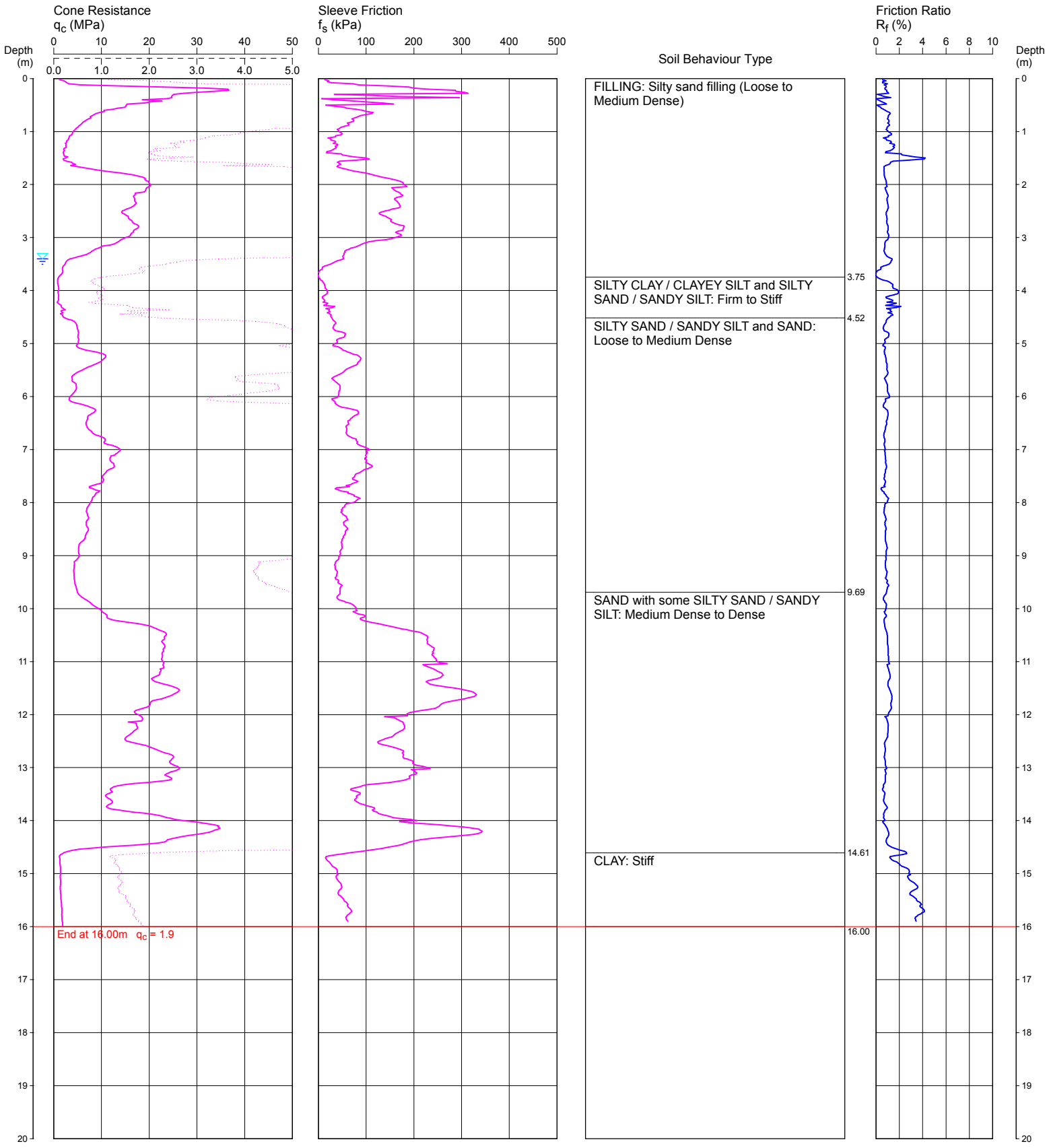
REDUCED LEVEL: 3.7 AHD

COORDINATES: 384354E 6356330N

305

DATE 14/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET DEPTH
GROUNDWATER OBSERVED AT 3.4 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 3.40m depth (assumed)

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Cone ID: 120634 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

REDUCED LEVEL: 3.9 AHD

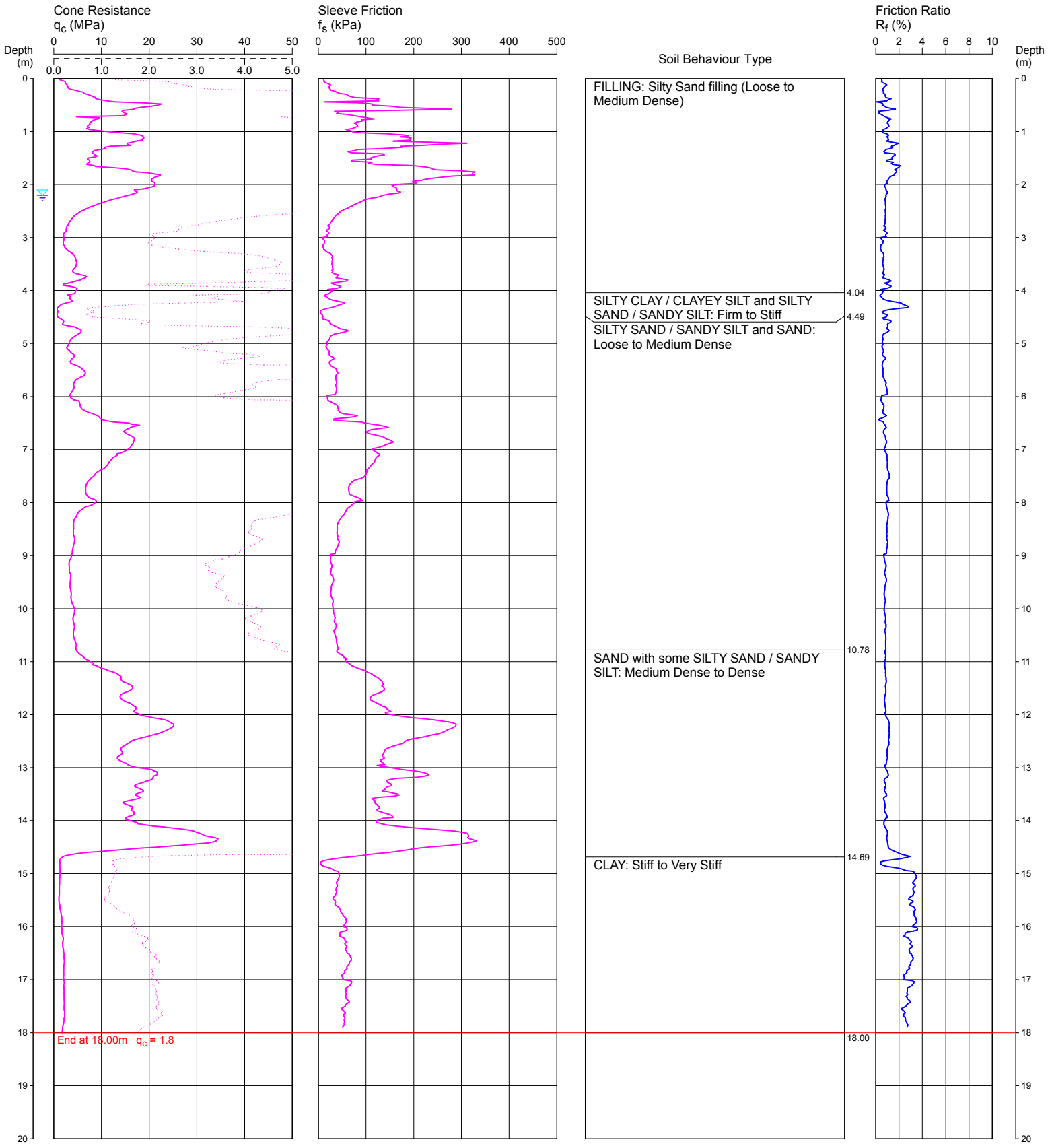
COORDINATES: 384356E 6356305N

306

Page 1 of 1

DATE 14/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET STRATA
HOLE COLLAPSE AT 2.2 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 2.20m depth (assumed)

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Cone ID: 120634 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

REDUCED LEVEL: 2.2 AHD

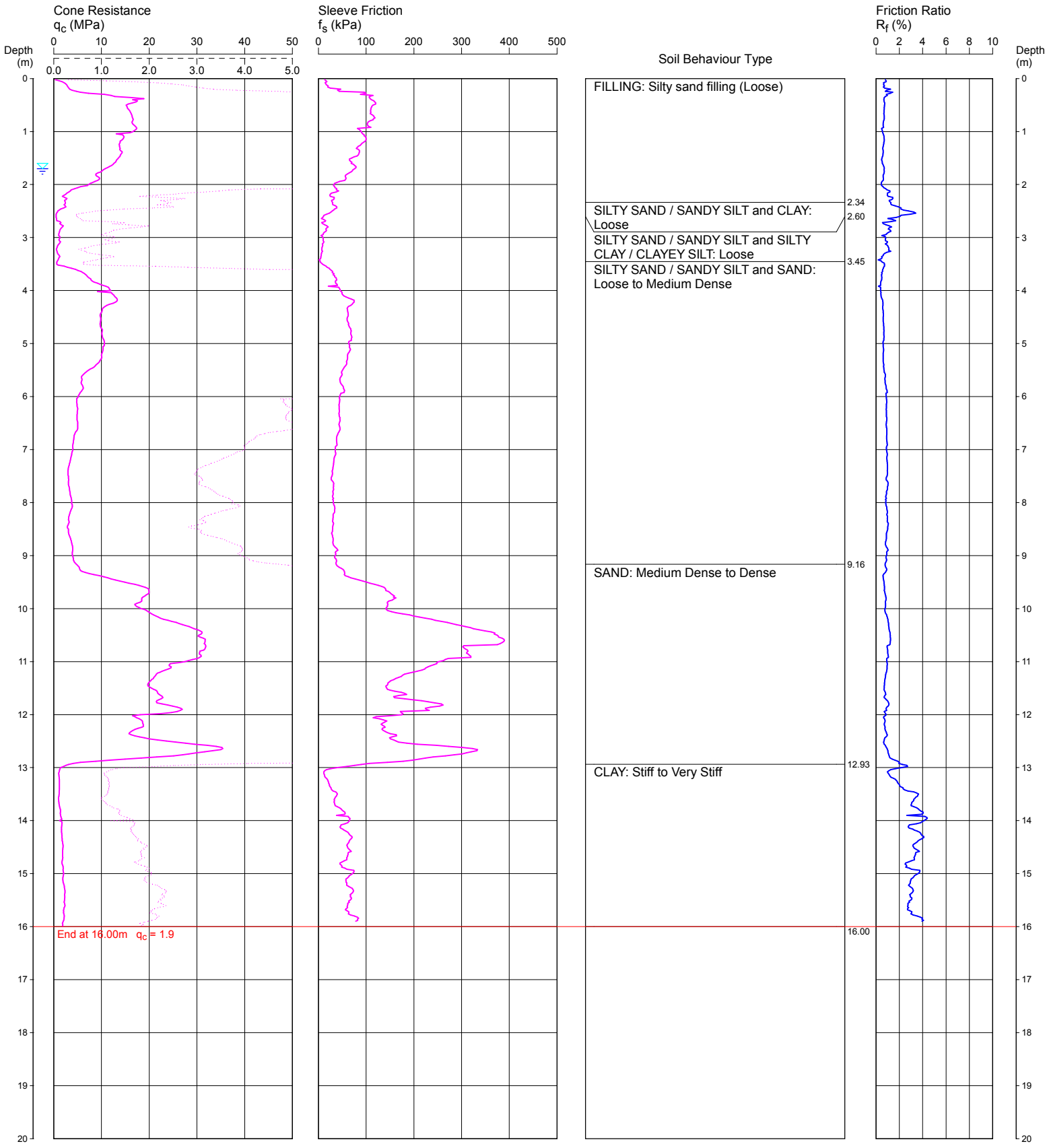
COORDINATES: 384394E 6356293N

307

Page 1 of 1

DATE 14/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET STRATA
GROUNDWATER OBSERVED AT 1.7 m AFTER WITHDRAWAL OF RODS

Water depth after test: 1.70m depth (measured)

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Cone ID: 120634 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

REDUCED LEVEL: 3.8 AHD

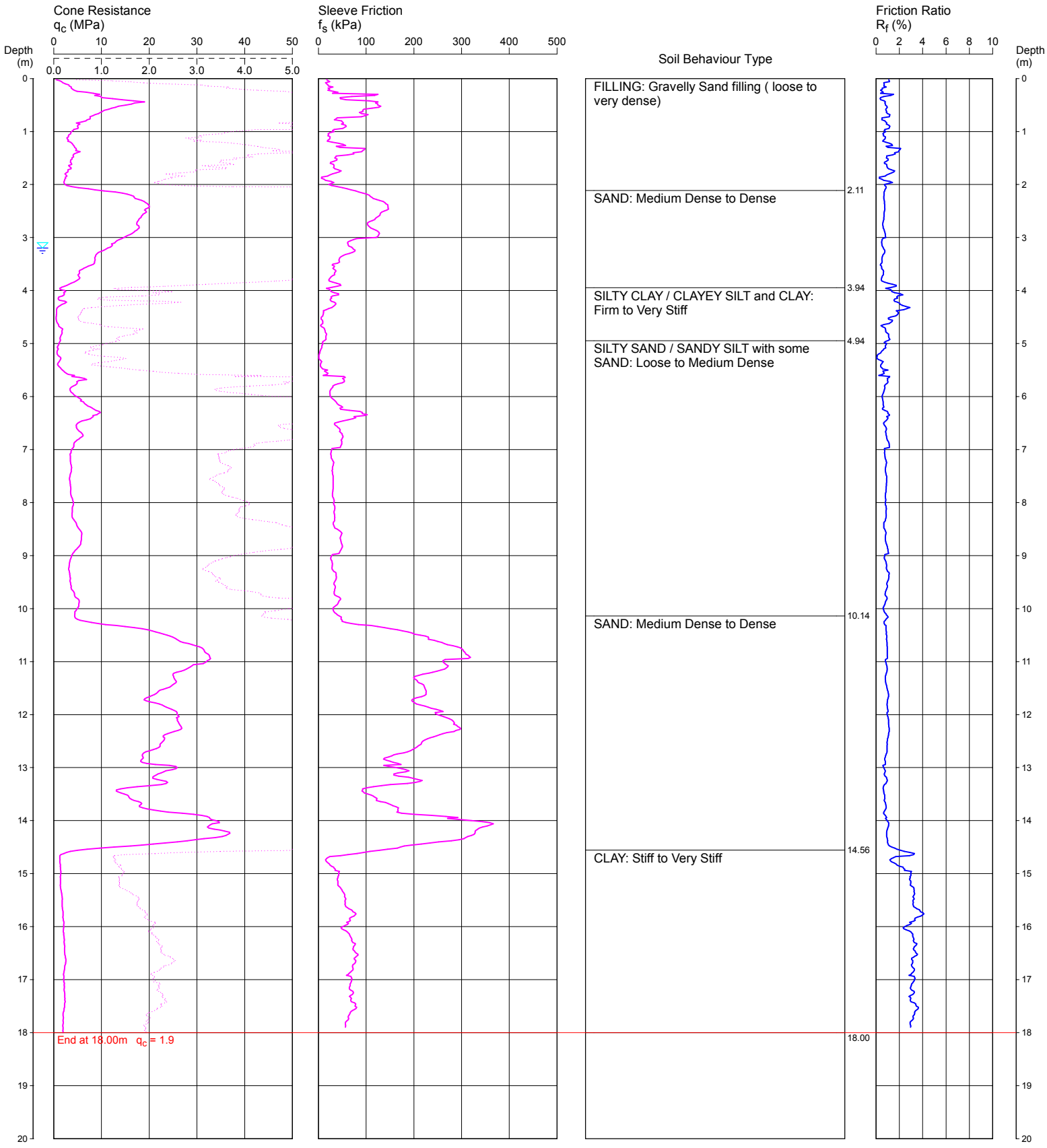
COORDINATES: 384335E 6356301N

308

Page 1 of 1

DATE 14/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET STRATA
HOLE COLLAPSE AT 3.2 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 3.20m depth (assumed)

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Cone ID: 120634 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

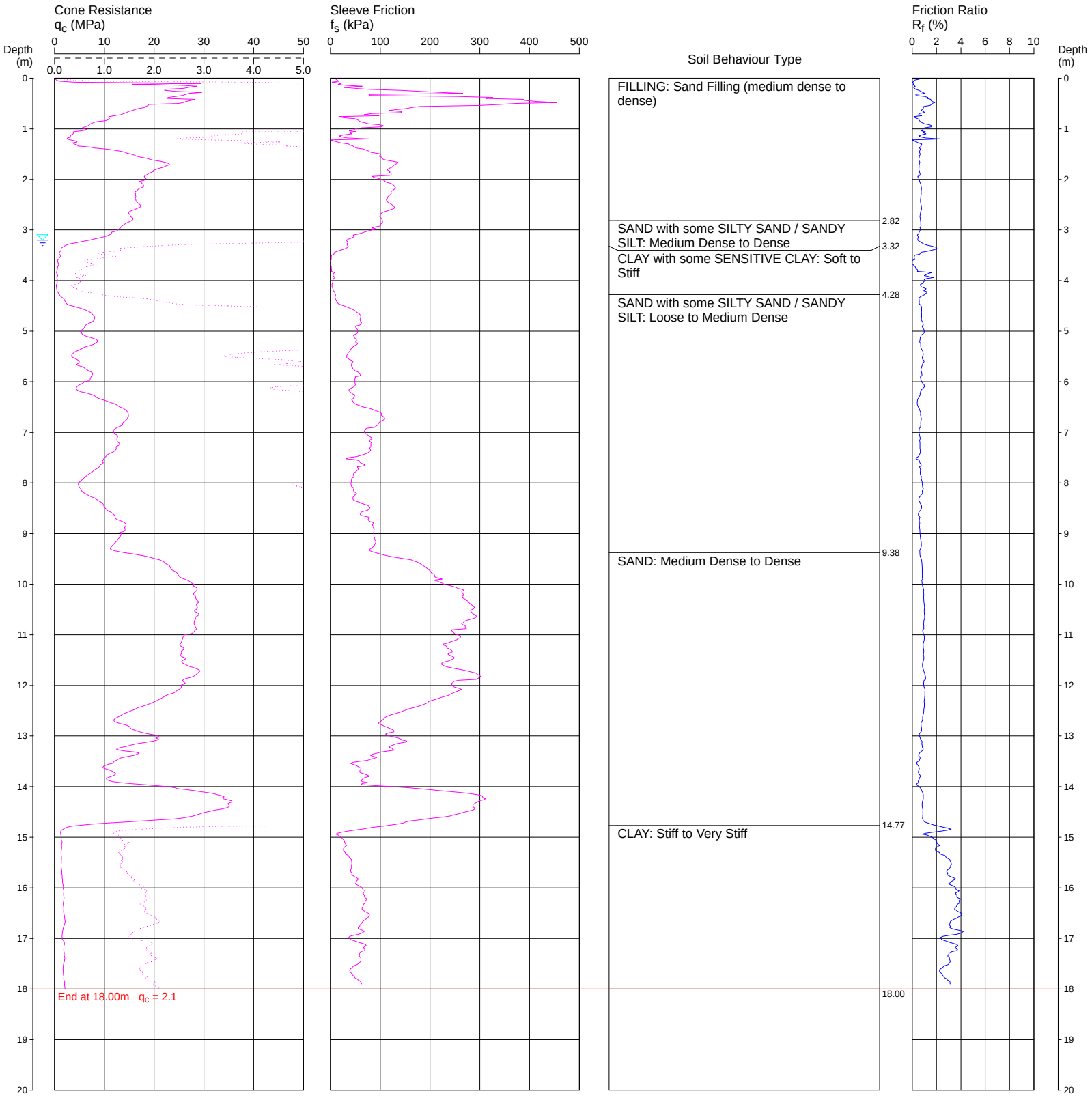
REDUCED LEVEL: 3.6 AHD

COORDINATES: 384340E 6356338N

309A

DATE 14/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET STRATA
GROUNDWATER OBSERVED AT 3.2 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 3.20m depth (measured)

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\309A.CP5

Cone ID: 120634 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE)

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

REDUCED LEVEL: 3.8 AHD

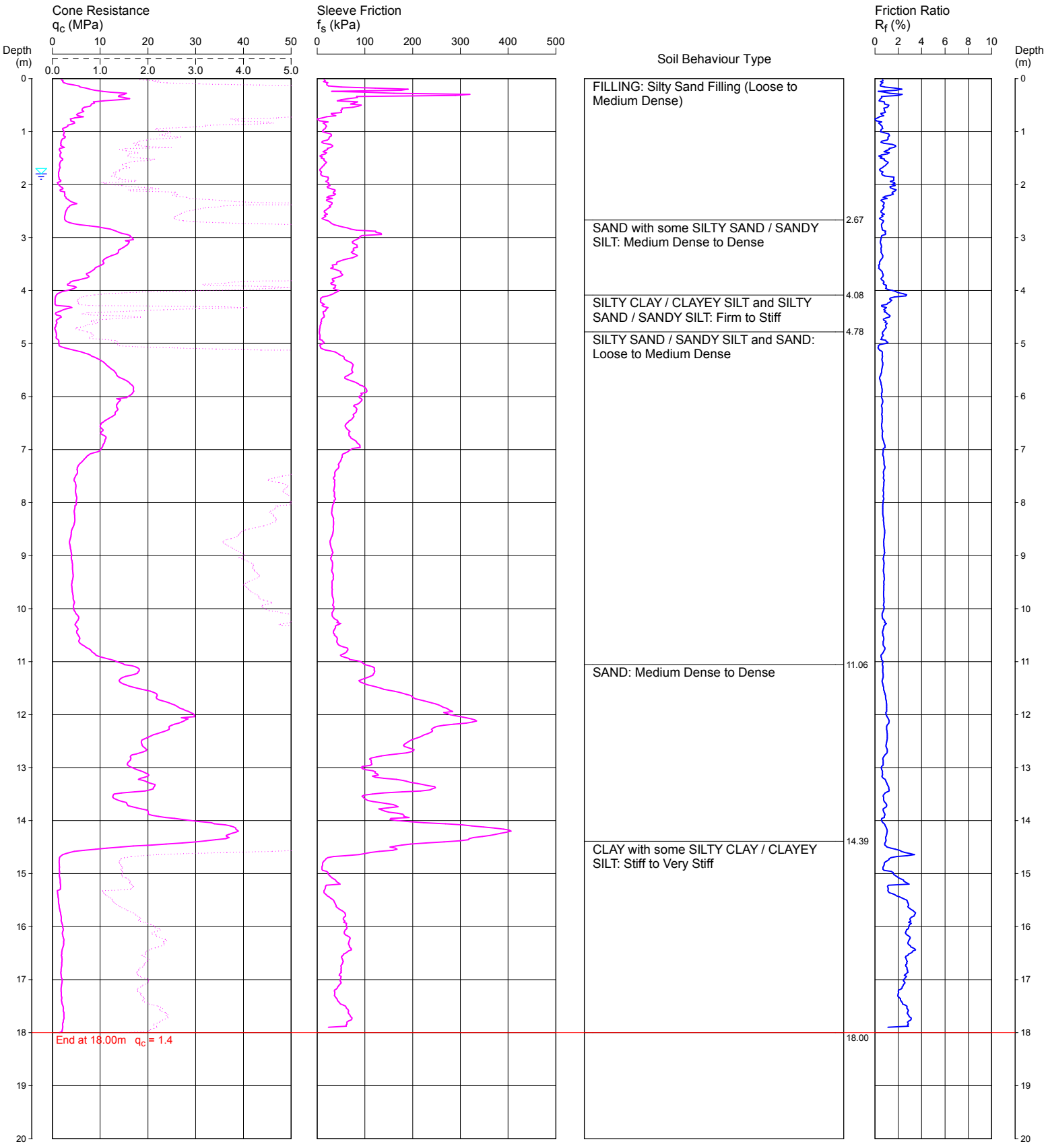
COORDINATES: 384343EE 6356302NN

310A

Page 1 of 1

DATE 14/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET STRATA
HOLE COLLAPSE AT 1.8 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 1.80m depth (assumed)

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\310A.CP5
Cone ID: 120634 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

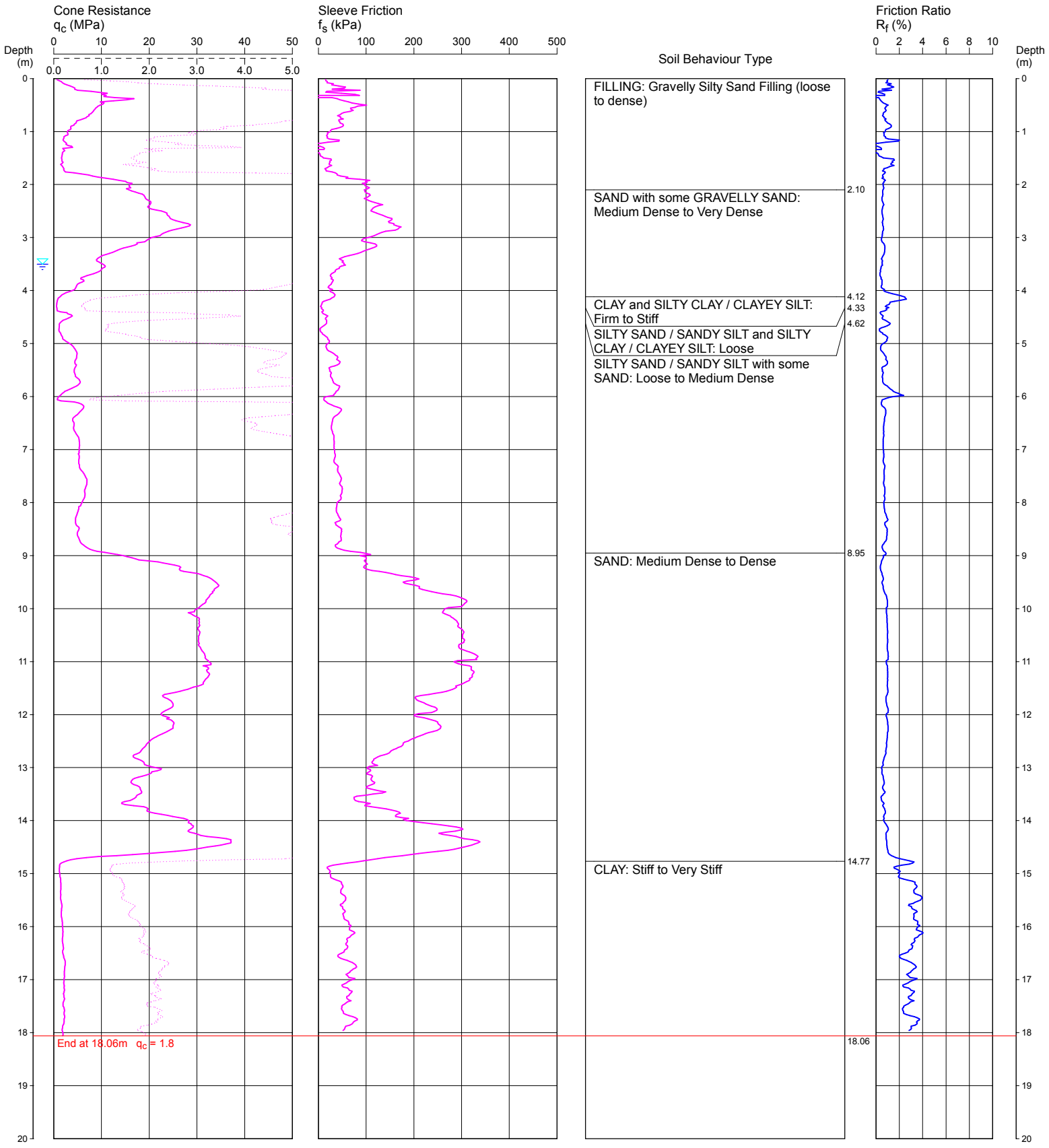
REDUCED LEVEL: 3.8 AHD

COORDINATES: 384349E 6356313N

311

DATE 14/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET STRATA
GROUNDWATER OBSERVED AT 3.5 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 3.50m depth (measured)

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\311.CP5
Cone ID: 120634 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

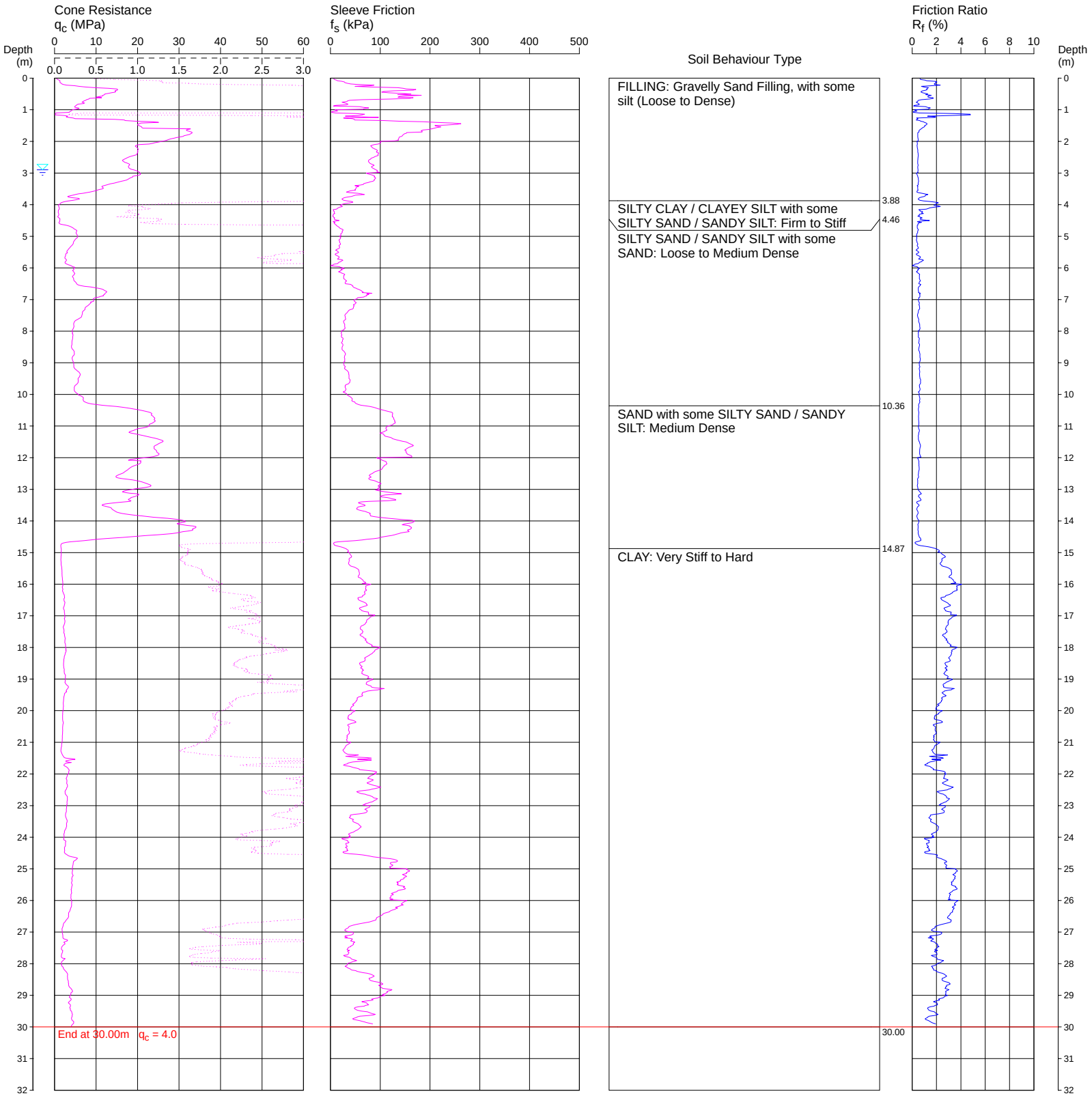
REDUCED LEVEL: 3.8 AHD

COORDINATES: 384347E 6356316N

301A

DATE 13/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET DEPTH
HOLE COLLAPSE AT 2.9 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 2.90m depth (measured)

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\301A.CP5

Cone ID: 160917 **Type:** I-CFXYP20-10

Dissipation Test

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

REDUCED LEVEL: 3.8 AHD

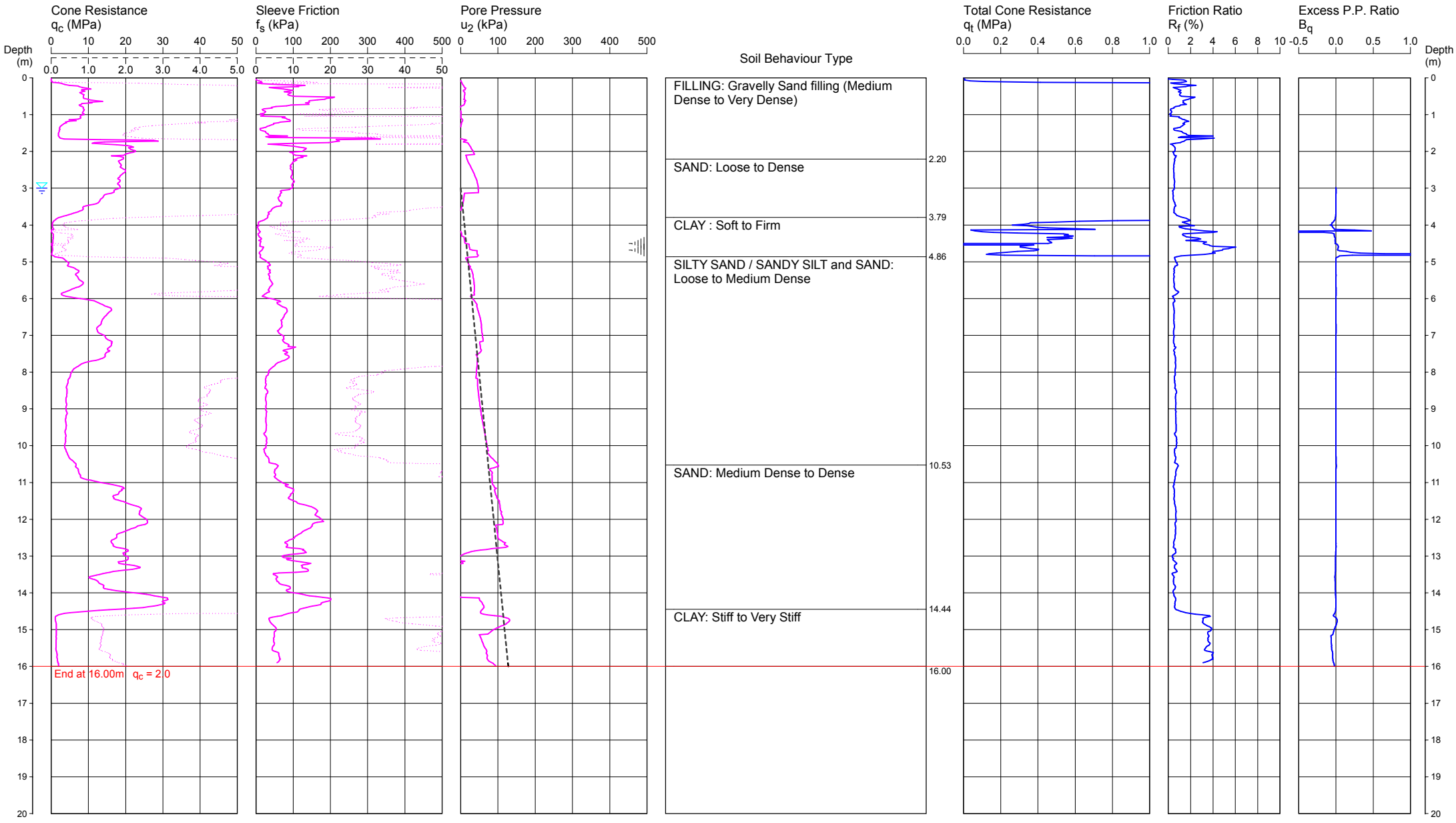
COORDINATES: 384631E 6356313N

302

Page 1 of 1

DATE 13/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET DEPTH
HOLE COLLAPSE AT 2.1 m DEPTH AFTER WITHDRAWAL OF RODS

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\302.CP5

Cone ID: 120539 **Type:** I-CFXYP20-10

Water depth after test: 3.00m depth (assumed)

ConePlot Version 5.9.2

Dissipation Test

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

REDUCED LEVEL: 3.9 AHD

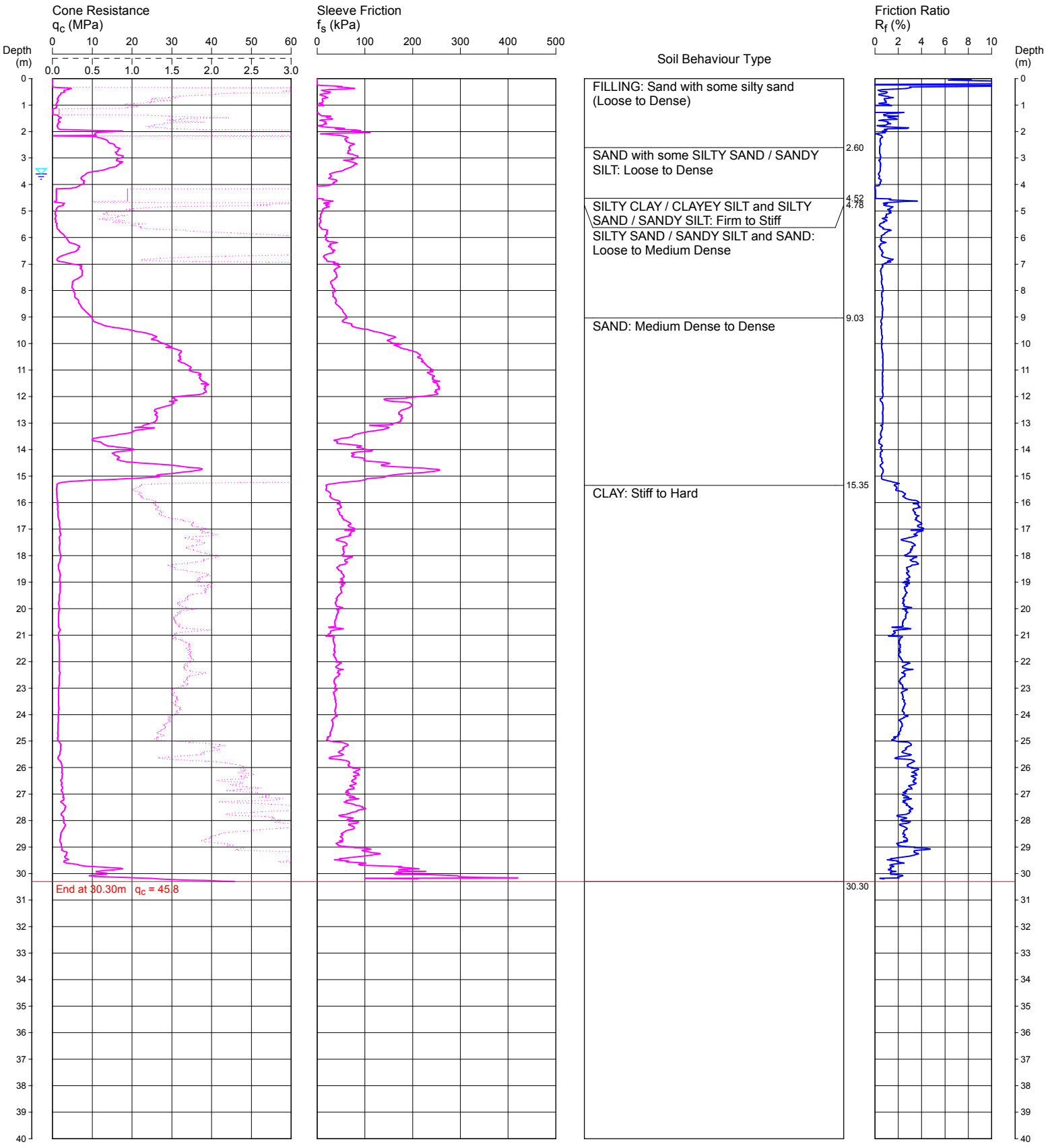
COORDINATES: 384310E 6356312N

303B

Page 1 of 1

DATE 13/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET DEPTH
GROUNDWATER OBSERVED AT 3.6 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 3.60m depth (measured)

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\303B.CP5

Cone ID: 120539 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Dissipation Test

Douglas Partners
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CONE PENETRATION TEST

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

REDUCED LEVEL: 3.8 AHD

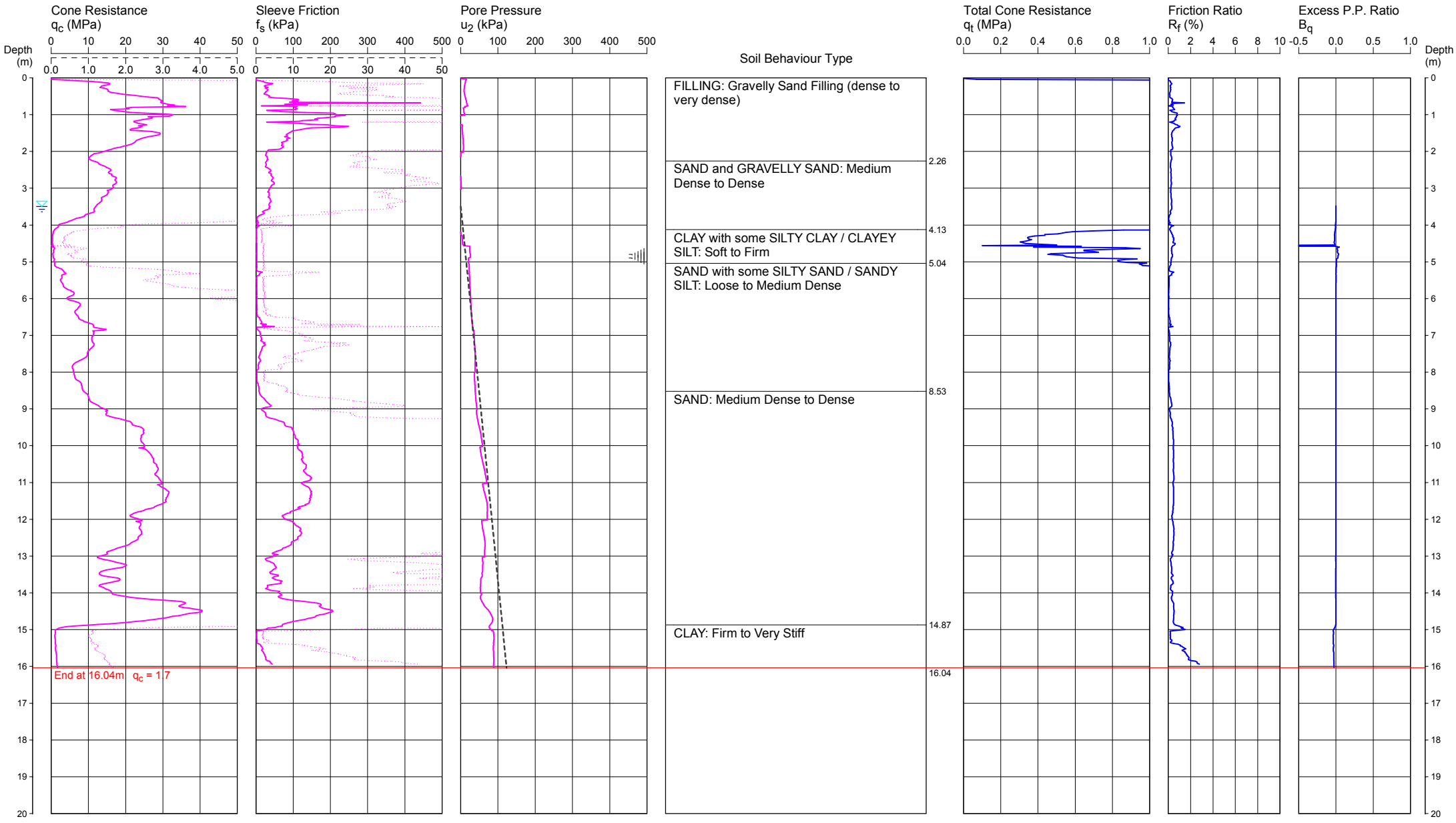
COORDINATES: 384335E 6356301N

304A

Page 1 of 1

DATE 13/09/2017

PROJECT No: 91181



REMARKS: TEST DISCONTINUED AT TARGET DEPTH
GROUNDWATER OBSERVED AT 3.5 m AFTER WITHDRAWAL OF RODS

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\304A.CP5
Cone ID: 160917 **Type:** I-CFXYP20-10

Water depth after test: 3.50m depth (measured)

ConePlot Version 5.9.2

Dissipation Test

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: The Doma Group
PROJECT: Proposed Mixed Use Development
LOCATION: 42 Honeysuckle Drive, Newcastle

SURFACE LEVEL: 3.8 AHD
EASTING: 384371.2
NORTHING: 6356321.8
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 91181.00
DATE: 7/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING - Generally comprising brown silty fine to medium grained sand filling, some rootlets, humid		U	0.2	E	PID<1		From 0m to 0.2m, concrete From 0.2m to 0.5m, backfill
		From 0.4m, trace to some subrounded gravels and trace ash gravel							
	0.8	At 0.6m, sandstone cobble / boulder							From 0m to 1.5m, 50mm diameter Class 18 PVC casing
	1.0	FILLING - Generally comprising dark brown silty sand filling, trace ash gravel, coal and shell, damp		U	1.0	E	PID<1		
				U	1.5	E	PID<1		From 0.5m to 1.0m, bentonite plug
	2.15	FILLING - Generally comprising pale grey, fine to medium grained sand filling, trace subrounded gravel up to 5mm and shell, damp		U	2.3	E	PID<1		
		At 3.0m, wet		U	3.0	E	PID<1	07-09-17	
	3.4	FILLING - Generally comprising dark brown silty fine to coarse grained sand filling, trace to some subangular quarry and ash gravel up to 5mm in size, and trace shells, wet to saturated		U	3.5	E	PID<1		From 1.0m to 6.0m, 2mm washed gravel filter From 1.5m to 6.0m, 50mm diameter Class 18 machine slotted PVC screen
	3.7	SAND - Brown, fine to coarse grained sand, some silt, trace shells, wet to saturated		U	4.0	E	PID<1		
		From 3.8m to 4.7m, dark brown with clay		U	4.5	E	PID<1		
		From 4.5m, dark grey, trace shells		U	5.0	E	PID<1		
				U	5.5	E	PID<1		
	6.2	Bore discontinued at 6.2m, limit of investigation		U	6.0	E	PID<1		End cap

RIG: Geoprobe T098 **DRILLER:** Tucker (Terratest) **LOGGED:** Depczynski **CASING:** Uncased

TYPE OF BORING: 60mm diameter Push tube

WATER OBSERVATIONS: Groundwater observed at ~3.0m during drilling

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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: The Doma Group
PROJECT: Proposed Mixed Use Development
LOCATION: 42 Honeysuckle Drive, Newcastle

SURFACE LEVEL: 3.7 AHD
EASTING: 384349.4
NORTHING: 6356318.3
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 91181.00
DATE: 7/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.4	FILLING - Generally comprising brown, fine to coarse grained silty sand filling, some rootlets and coal, trace subrounded gravel up to 15mm and shell, humid		U	0.2	E	PID<1		From 0m to 0.2m, concrete From 0.2m to 0.5m, backfill
		FILLING - Generally comprising dark brown, fine to medium grained silty sand filling, trace quarry gravel up to 15mm, trace brick fragments, humid		U	0.5	E	PID<1		
	1			U	1.0	E	PID<1		From 0m to 1.5m, 50mm diameter Class 18 PVC casing From 0.5m to 1.0m, bentonite plug
	1.4	FILLING - Generally comprising pale grey, fine to coarse grained sand filling, trace shells, humid		U	1.5	E	PID<1		
	2			U	2.0	E	PID<1		
				U	2.5	E	PID<1		
	2.9	From 2.8m, damp		U	3.0	E	PID<1	07-09-17	
		SAND - Dark grey, fine to coarse grained sand filling, some fine shells, trace subrounded gravel up to 5mm, wet to saturated							
		From 3.6m to 4m, clayey sand band		U	3.8	E	PID<1		From 1.0m to 6.0m, 2mm gravel filter From 1.5m to 6.0m, 50mm diameter Class 18 machine slotted PVC screen
	4	From 4m, trace wood (root)							
		From 4.4m to 4.7m, clayey sand band		U	4.5	E	PID<1		
	5			U	5.0	E	PID<1		
				U	5.5	E	PID<1		
		From 5.7m, grey, trace shells							
	6.0	Bore discontinued at 6.0m, limit of investigation		U	6.0	E	PID<1		End cap

RIG: Geoprobe T098 **DRILLER:** Terratest **LOGGED:** Depczynski **CASING:** Uncased

TYPE OF BORING: 60mm diameter Push tube

WATER OBSERVATIONS: Groundwater observed at ~3.0m during drilling

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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: The Doma Group
PROJECT: Proposed Mixed Use Development
LOCATION: 42 Honeysuckle Drive, Newcastle

SURFACE LEVEL: 2.5 AHD
EASTING: 384299.4
NORTHING: 6356307.2
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 91181.00
DATE: 7/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.5	FILLING - Generally comprising brown silty, fine to medium grained sand filling, some rootlets, trace subangular to subrounded gravels (quarry and ash) up to 5mm in size and shells, humid		U	0.2	E	PID <1		From 0m to 0.2m, concrete From 0.2m to 0.5m, backfill
		FILLING - Generally comprising grey, fine to coarse grained sand filling, some silt, trace shell fragments, humid From 0.7m, trace silt		U	0.6	E	PID <1		
	1			U	1.0	E	PID <1		From 0m to 1.5m, 50mm diameter Class 18 PVC casing From 0.5m to 1.0m, bentonite plug
				U	1.5	E	PID <1		
	2			U	2.0	E	PID=2		
	2.2	FILLING - Generally comprising grey, fine to coarse grained sand filling, trace shell and subrounded gravel up to 10mm in size, damp From 2.4m to 2.8m, clayey sand, trace fine shell band, moderate hydrocarbon / organic odour, wet		U	2.5	E	PID=2	07-09-17	
	2.95	SAND - Dark grey, fine to coarse grained sand, no odour, wet to saturated From 3.2m to 3.6m, clayey sand band		U	3.0	E	PID=2		
				U	3.5	E	PID <1		From 1.0m to 6.0m, 2mm gravel filter From 1.5m to 6.0m, 50mm diameter Class 18 machine slotted PVC screen
	4			U	4.0	E	PID <1		
		From 4.2m to 4.4m, with subrounded gravel up to 10mm in size From 4.4m, fine to medium grained		U	4.5	E	PID <1		
	5			U	5.0	E	PID <1		
				U	5.5	E	PID <1		
	6			U	6.0	E	PID <1		End cap
	6.0	Bore discontinued at 6.0m, limit of investigation							

RIG: Geoprobe T098 **DRILLER:** Terratest **LOGGED:** Depczynski **CASING:** Uncased

TYPE OF BORING: 60mm diameter Push tube

WATER OBSERVATIONS: Groundwater observed at ~2.4m during drilling

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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: The Doma Group
PROJECT: Proposed Mixed Use Development
LOCATION: 42 Honeysuckle Drive, Newcastle

SURFACE LEVEL: 3.2 AHD
EASTING: 384337.6
NORTHING: 6356344.6
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 91181.00
DATE: 7/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - Generally comprising brown silty fine to coarse grained sand filling, some subangular to subrounded gravel up to 30mm (including black ash), trace rootlets, shell		U	0.2	E	PID<1		
				U	0.5	E	PID<1		
	0.7	FILLING - Generally comprising brown, fine to coarse grained sand filling, some silt and subrounded gravel up to 5mm in size, trace coal and shell fragments, humid		U	1.0	E	PID<1		
				U	1.5	E	PID<1		
				U	2.0	E	PID<1		
		From 2.5m, moist		U	2.5	E	PID<1		
		From 2.7m, wet							
	2.9	FILLING - Generally comprising brown silty, fine to coarse grained sand filling, trace shells, wet		U	3.0	E	PID<1		
				U	3.5	E	PID<1		
	3.7	SAND - Brown, fine to coarse grained sand, some silt and trace shells, wet to saturated		U	4.0	E	PID<1		
				U	4.5	E	PID<1		
				U	5.0	E	PID<1		
				U	5.5	E	PID<1		
	6.0	Bore discontinued at 6.0m, limit of investigation		U	6.0	E	PID <1		

RIG: Geoprobe T098 **DRILLER:** Terratest **LOGGED:** Depczynski **CASING:** Uncased
TYPE OF BORING: 60mm diameter Push tube
WATER OBSERVATIONS: Groundwater observed at ~2.7m during drilling
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_x	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)

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT:

PROJECT:

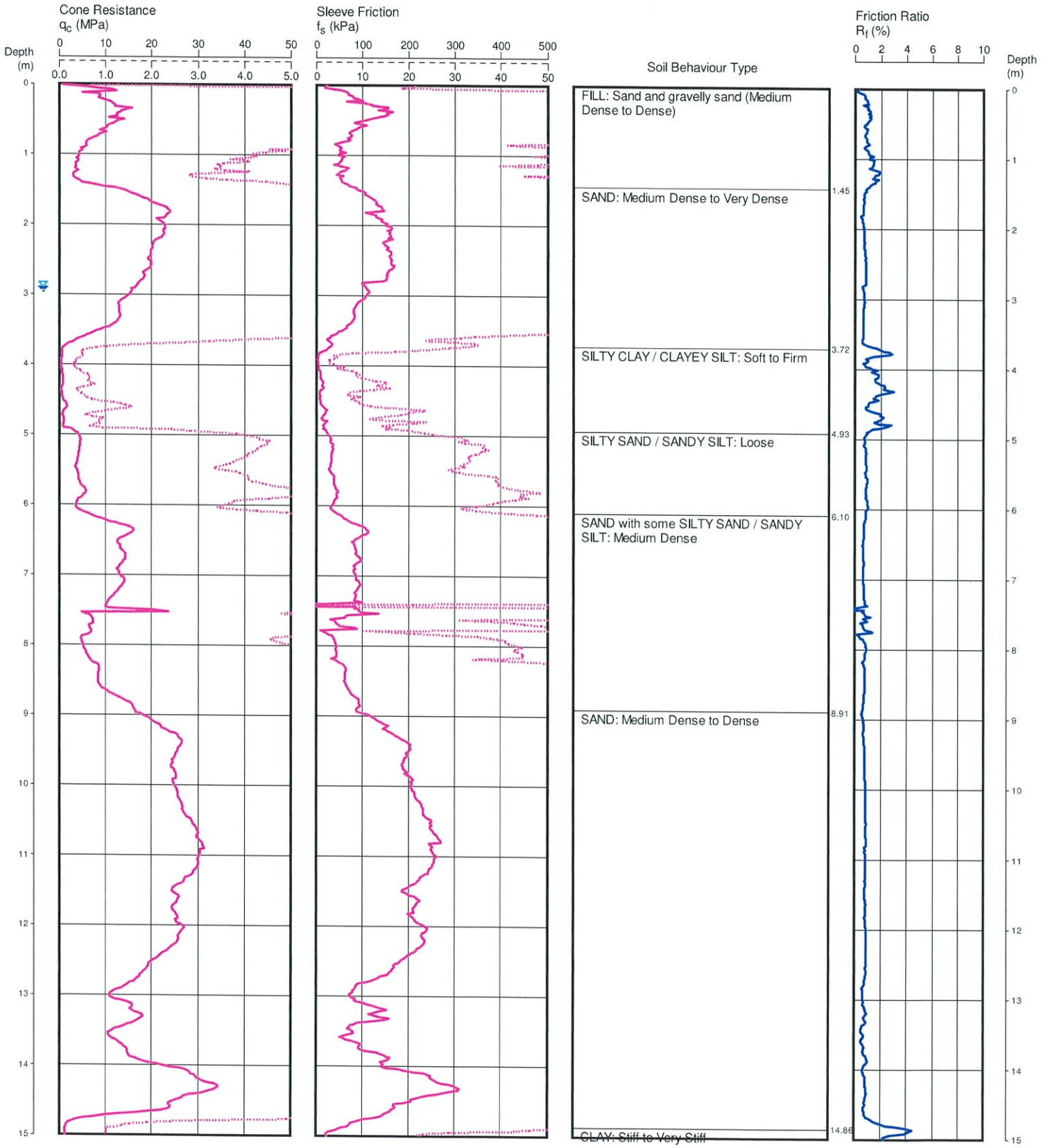
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-01

DATE 17/12/2008

SURFACE RL: 3.65 AHD



REMARKS:

Date
Plotted
Checked

File: P:\39949\Field\Lot 22 Honeysuckle\39949-L22-01.CP5
Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT:

PROJECT:

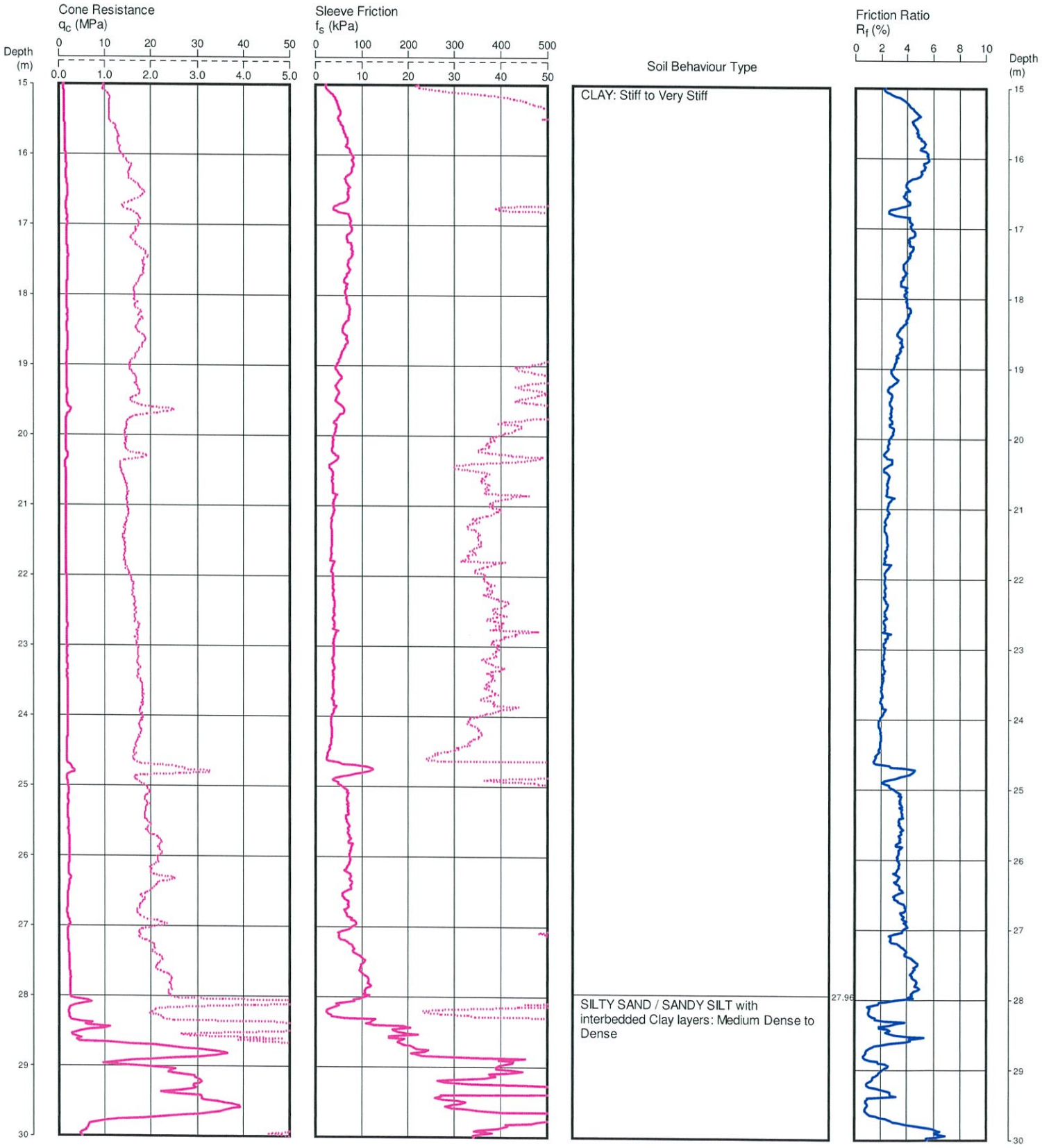
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-01
Page 2 of 3

DATE 17/12/2008

SURFACE RL: 3.65 AHD



REMARKS:

Date
Plotted
Checked

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Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT:

PROJECT:

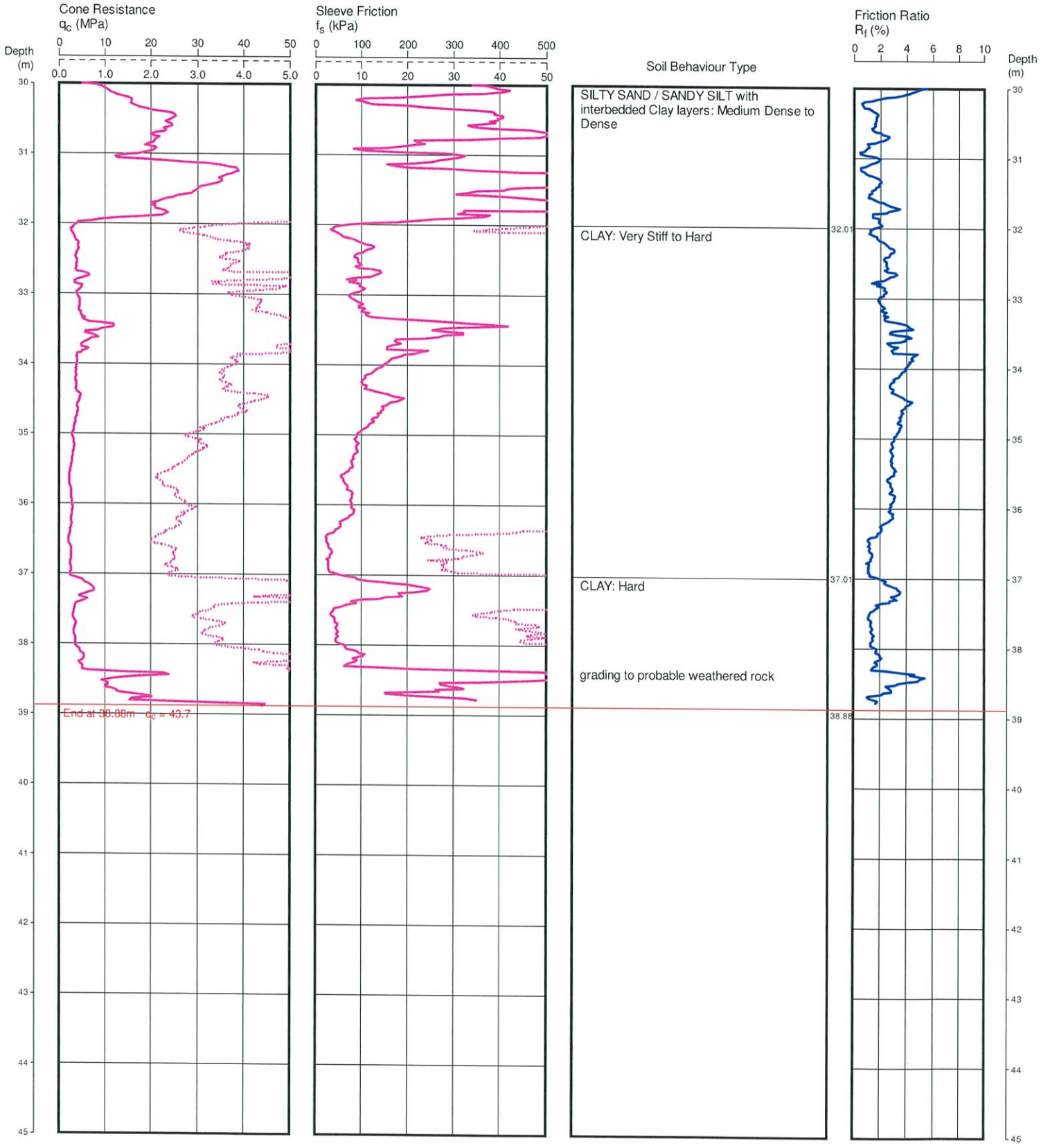
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-01
Page 3 of 3

DATE 17/12/2008

SURFACE RL: 3.65 AHD



REMARKS:

Date
Plotted
Checked

File: P:\39949\Field\Lot 22 Honeysuckle\39949-L22-01.CP5
Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT:

PROJECT:

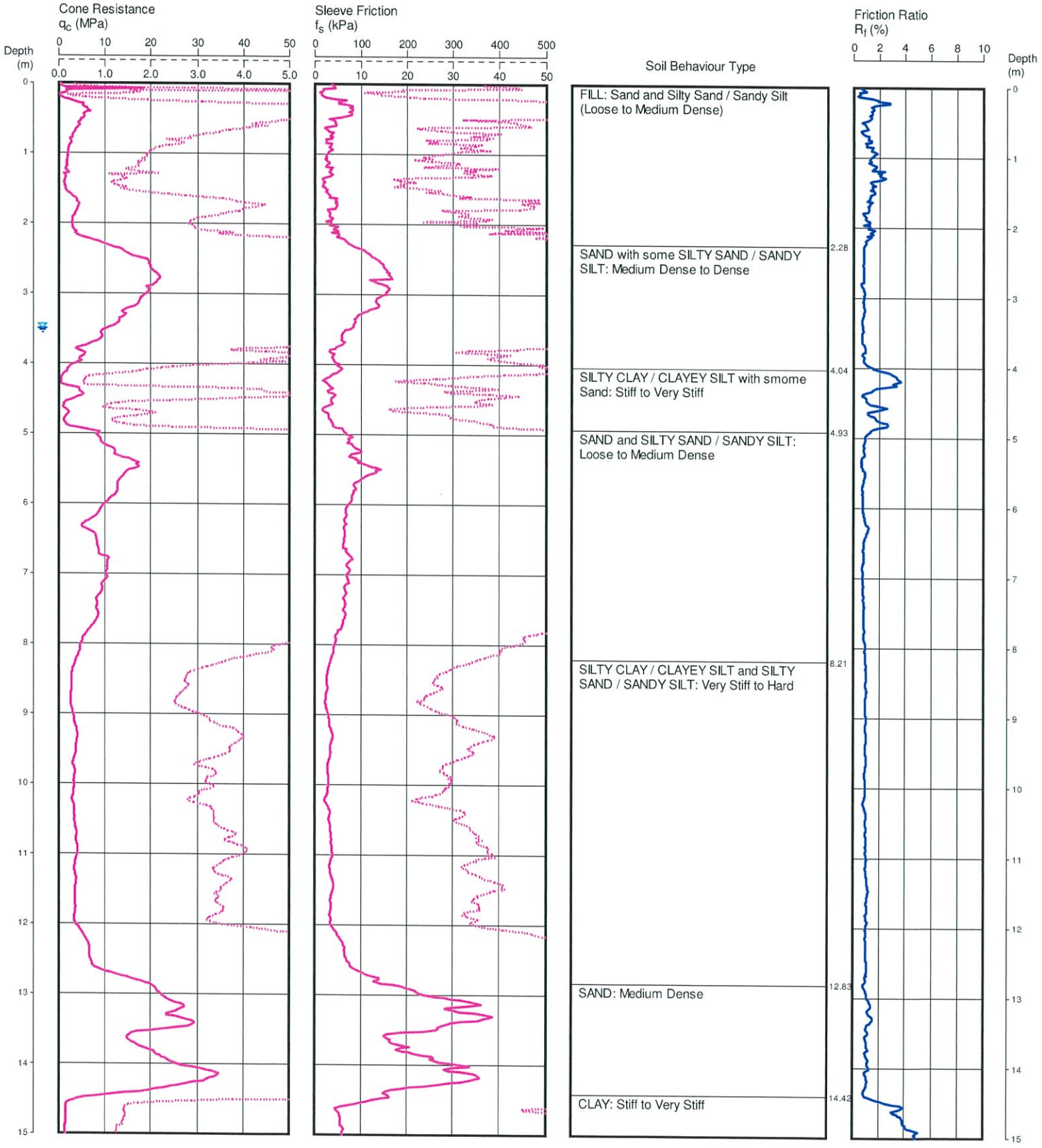
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-02

DATE 17/12/2008

SURFACE RL: 3.80 AHD



REMARKS:

Date
Plotted
Checked

File: P:\39949\Field\Lot 22 Honeysuckle\39949-L22-02.CP5
Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT:

PROJECT:

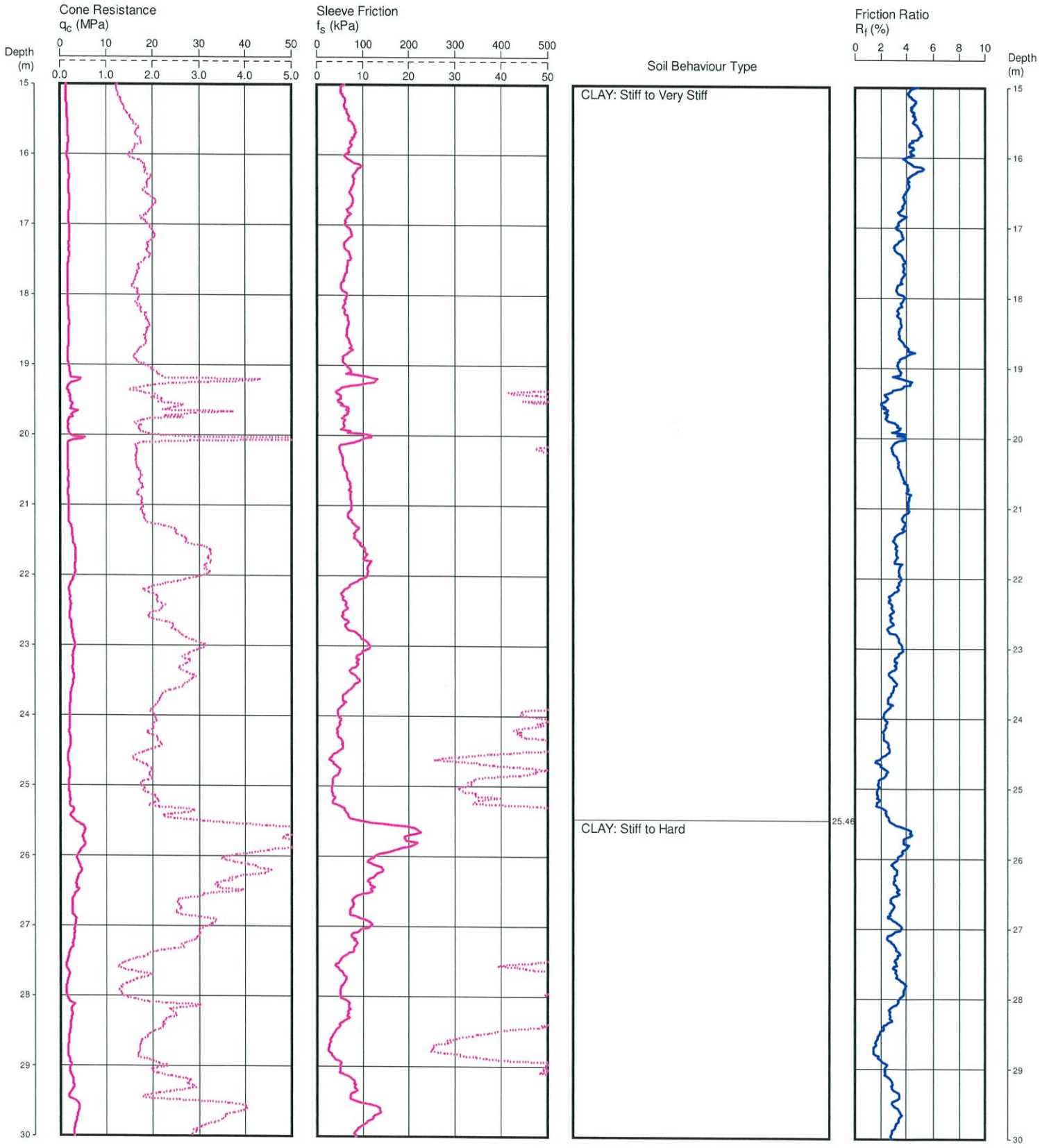
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-02
Page 2 of 3

DATE 17/12/2008

SURFACE RL: 3.80 AHD



REMARKS:

Date
Plotted
Checked

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Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT: !

PROJECT:

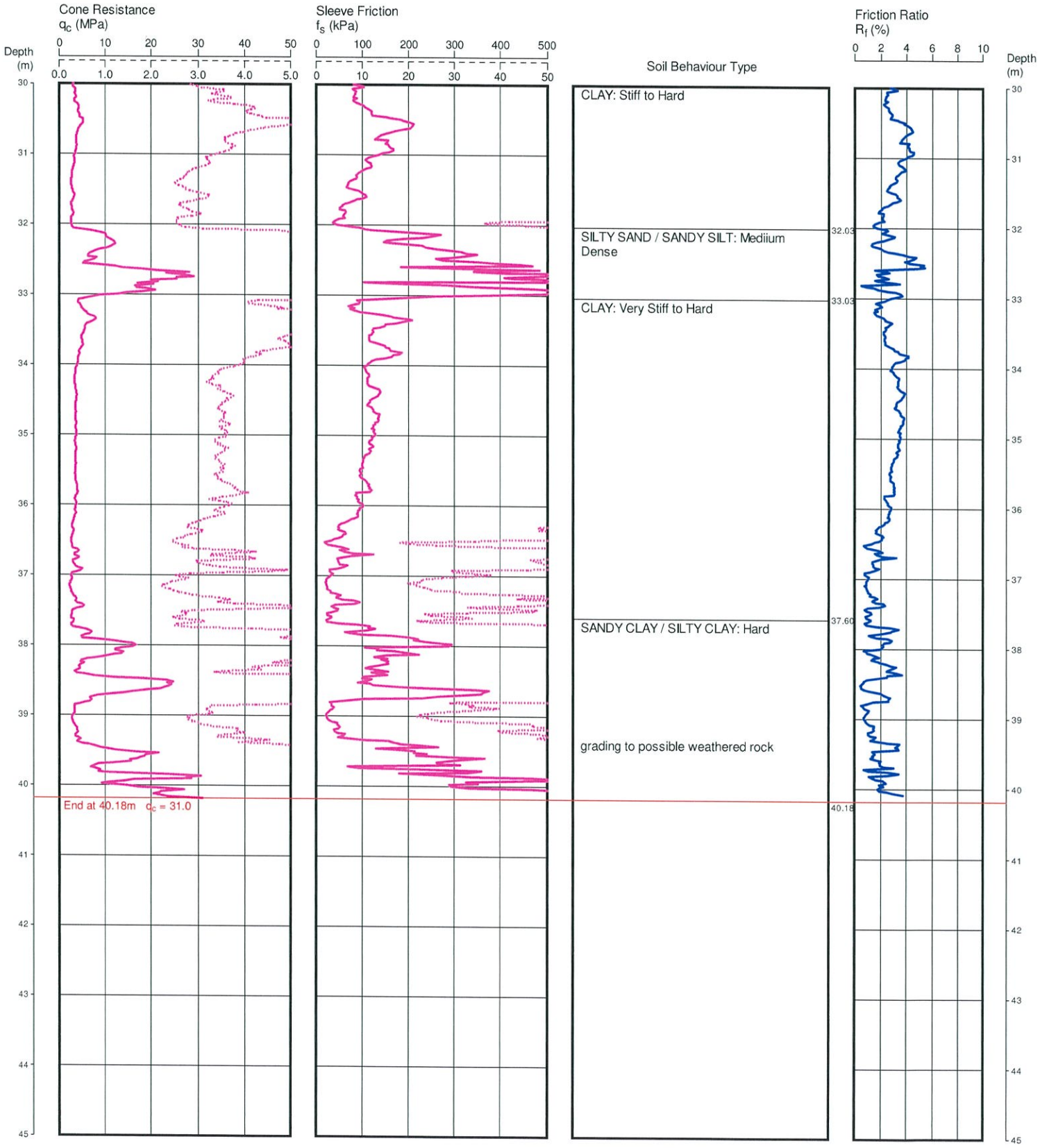
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-02
Page 3 of 3

DATE 17/12/2008

SURFACE RL: 3.80 AHD



REMARKS:

Date
Plotted
Checked

File: P:\39949\Field\Lot 22 Honeysuckle\39949-L22-02.CP5
Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

Douglas Partners
Geotechnics · Environment · Groundwater

CONE PENETRATION TEST

CLIENT:

PROJECT:

LOCATION: HONEYSUCKLE DRIVE, WICKHAM

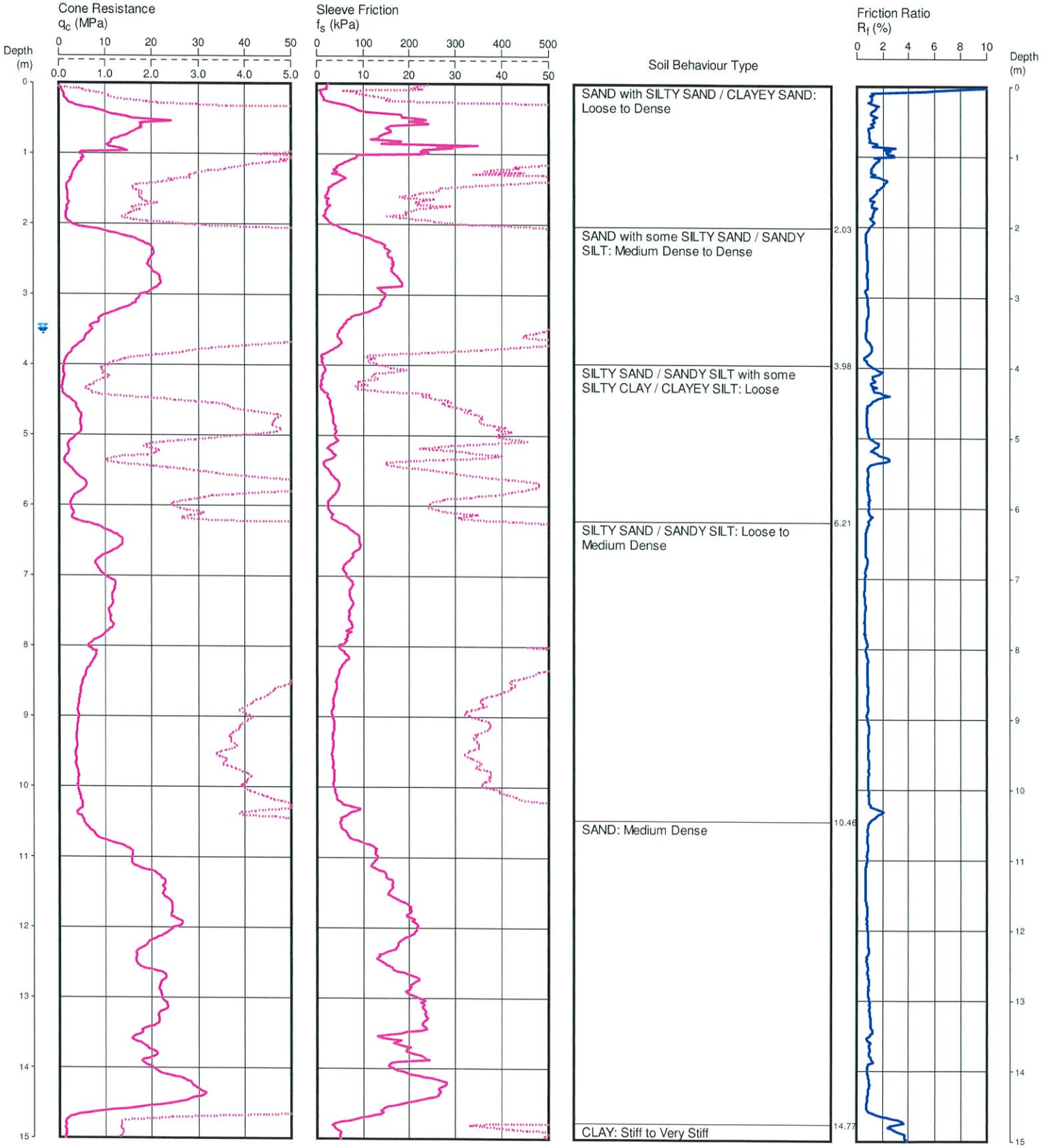
PROJECT No: 39949

L22-03

Page 1 of 2

DATE 17/12/2008

SURFACE RL: 3.78 AHD



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Date	
Plotted	
Checked	

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Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

Douglas Partners
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CONE PENETRATION TEST

CLIENT:

PROJECT:

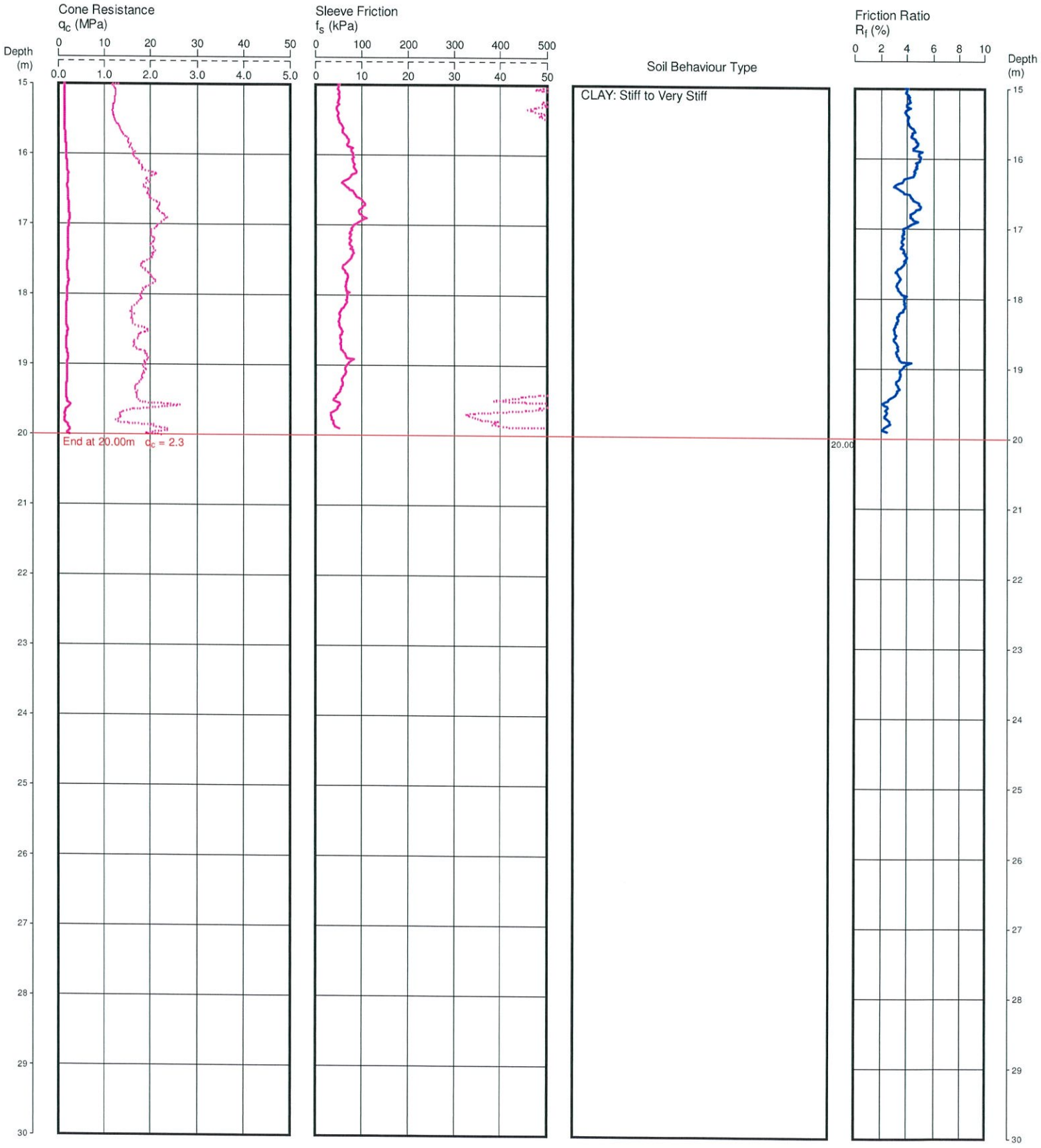
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-03
Page 2 of 2

DATE 17/12/2008

SURFACE RL: 3.78 AHD



REMARKS:

Date	
Plotted	
Checked	

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Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT:

PROJECT:

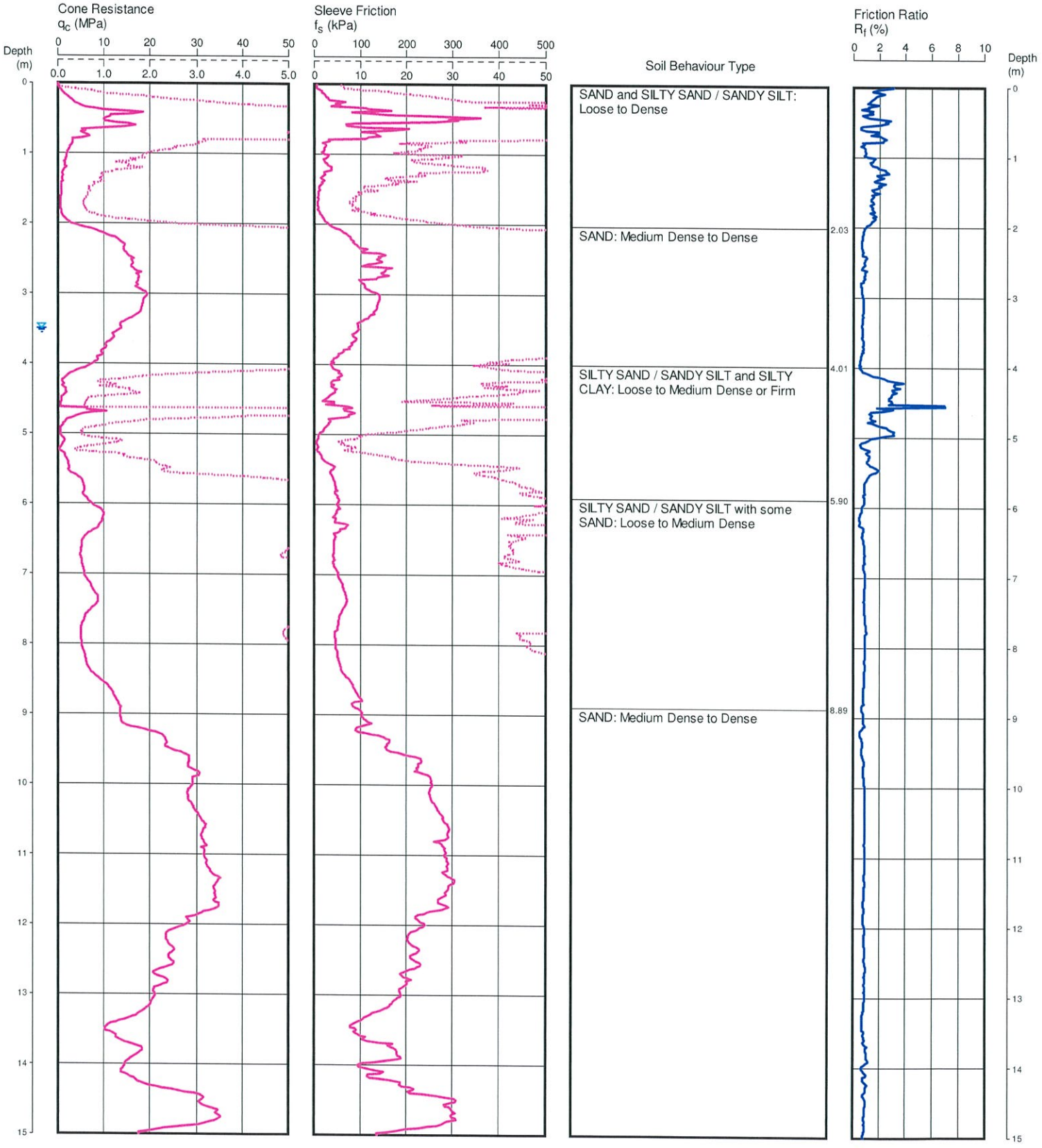
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-04

DATE 17/12/2008

SURFACE RL: 3.94 AHD



REMARKS:

Date	
Plotted	
Checked	

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Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT: I

PROJECT:

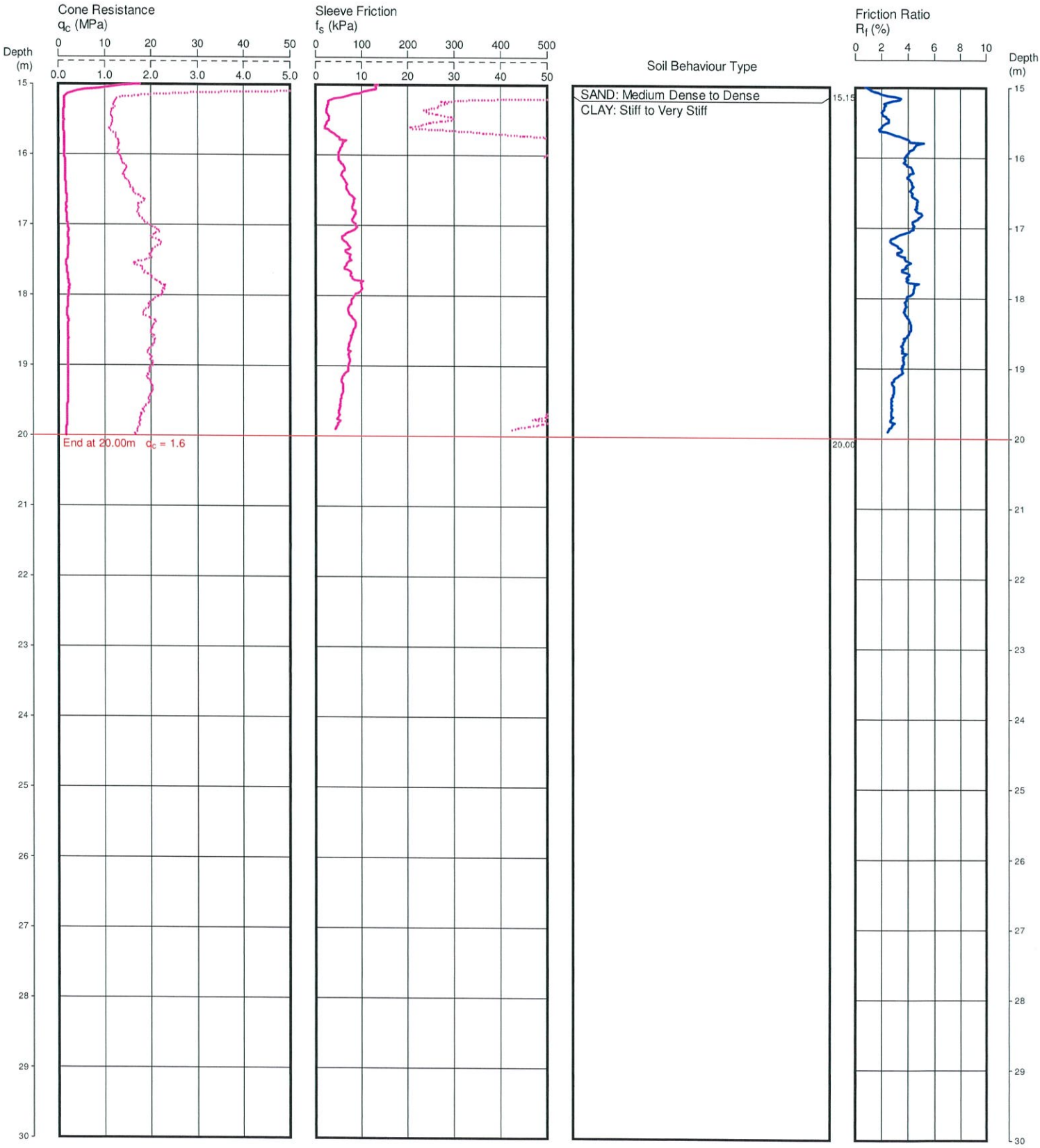
LOCATION: HONEYSUCKLE DRIVE, WICKHAM

PROJECT No: 39949

L22-04
Page 2 of 2

DATE 17/12/2008

SURFACE RL: 3.94 AHD



REMARKS:

Date
Plotted
Checked

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Cone ID: H3 **Type:** 2 Standard

ConePlot Version 5.8.1

Douglas Partners
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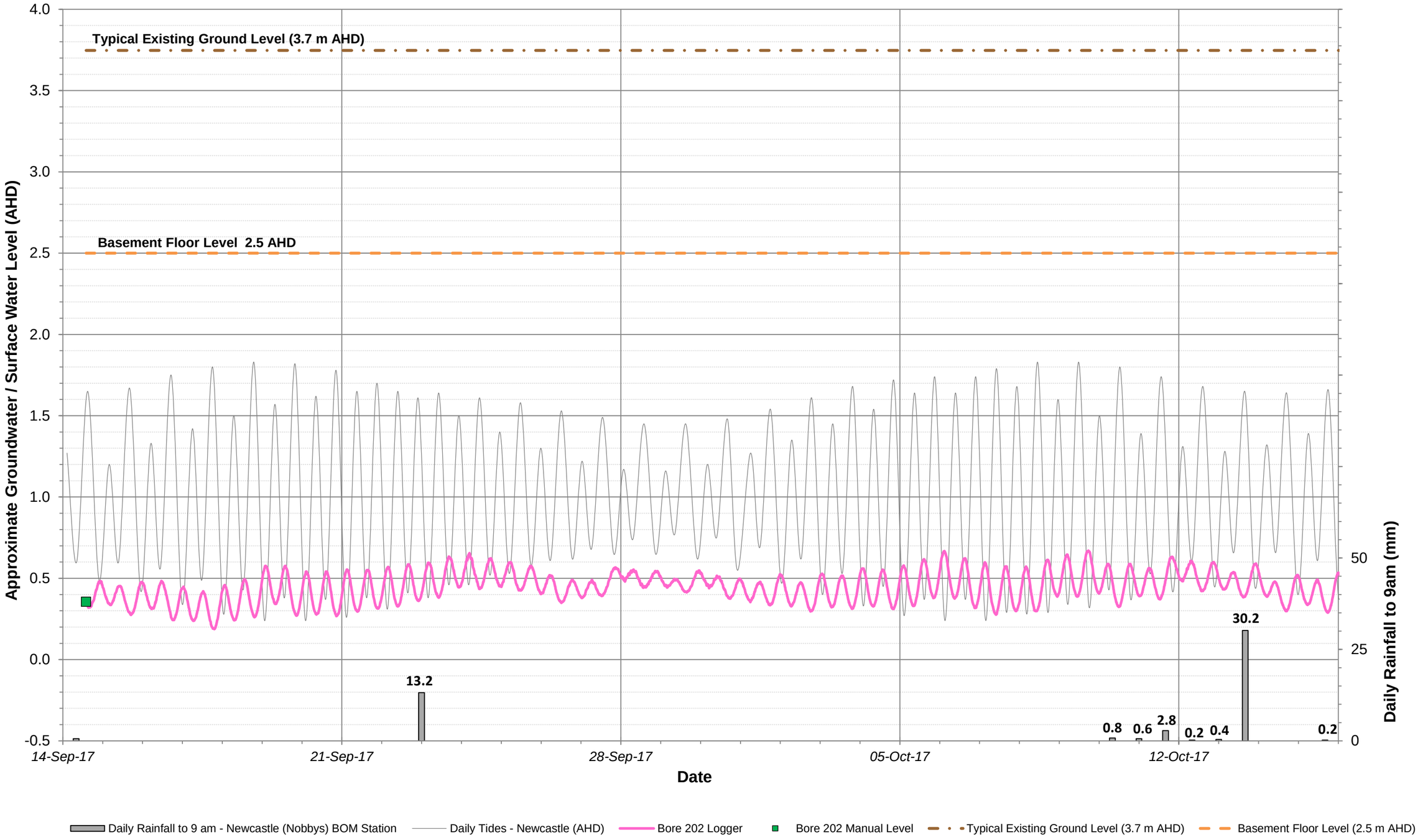


Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: The Doma Group	TITLE: **Groundwater Pressure Head vs Rainfall** **Proposed Mixed Use Development** **42 Honeysuckle Drive, Newcastle**	PROJECT NO: 91181.00
	OFFICE: Newcastle / DRAWN: LCD		FIGURE NO: B1
	SCALE: N/A / DATE: 19.10.17		REVISION: Rev0

Appendix C

ConePile CFA – CPTs 301, 302, 303B, 309A and 310A
ConePile Screw Cast Concrete – CPTs 301A, 302, 303B, 309A and 310A

PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

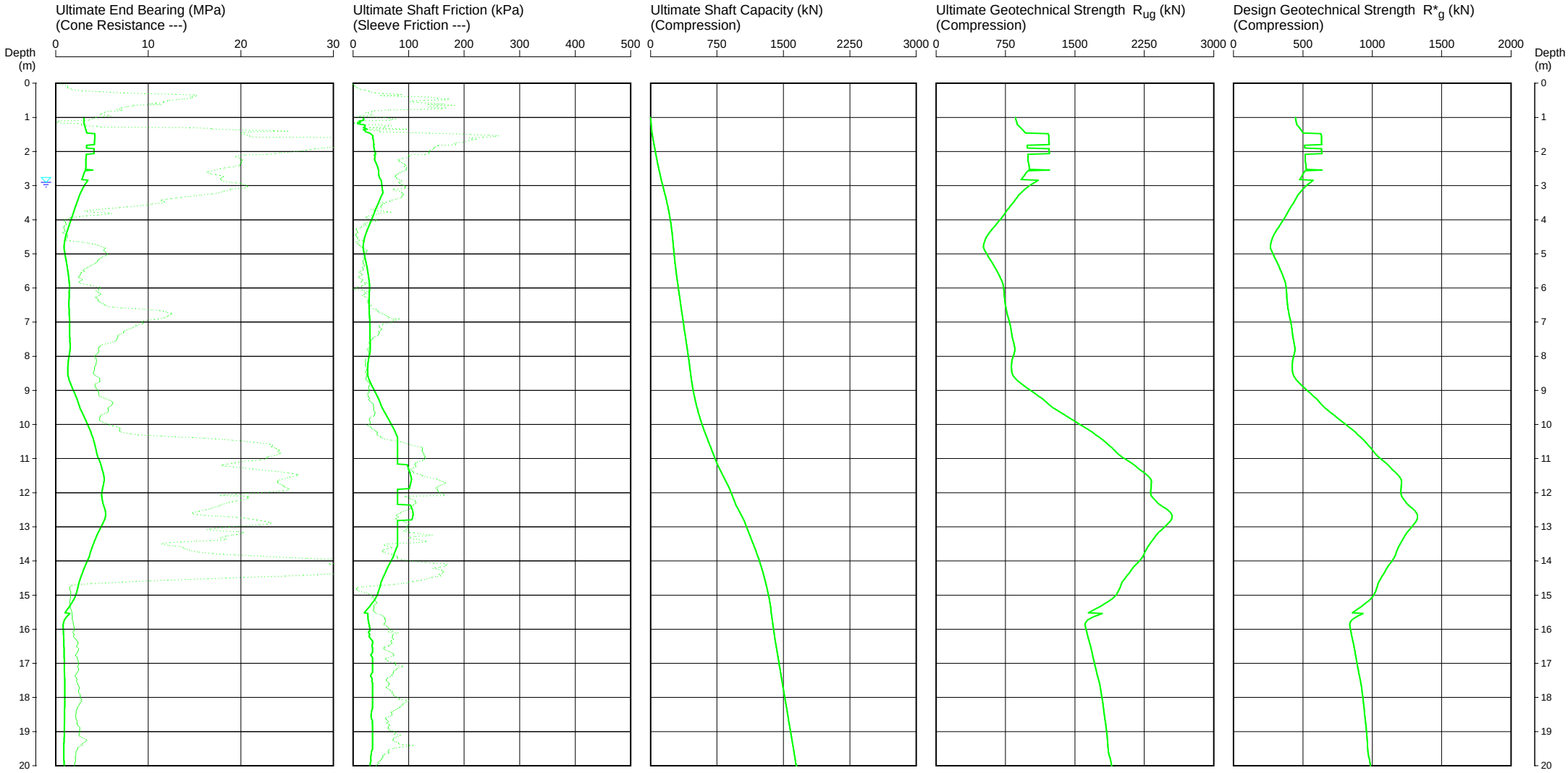
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

301A

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



DISCLAIMER:
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Water depth after test: 2.90m depth

Coordinates: 384347 6356316

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\301A.CP5
Cone ID: 160917 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.75
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

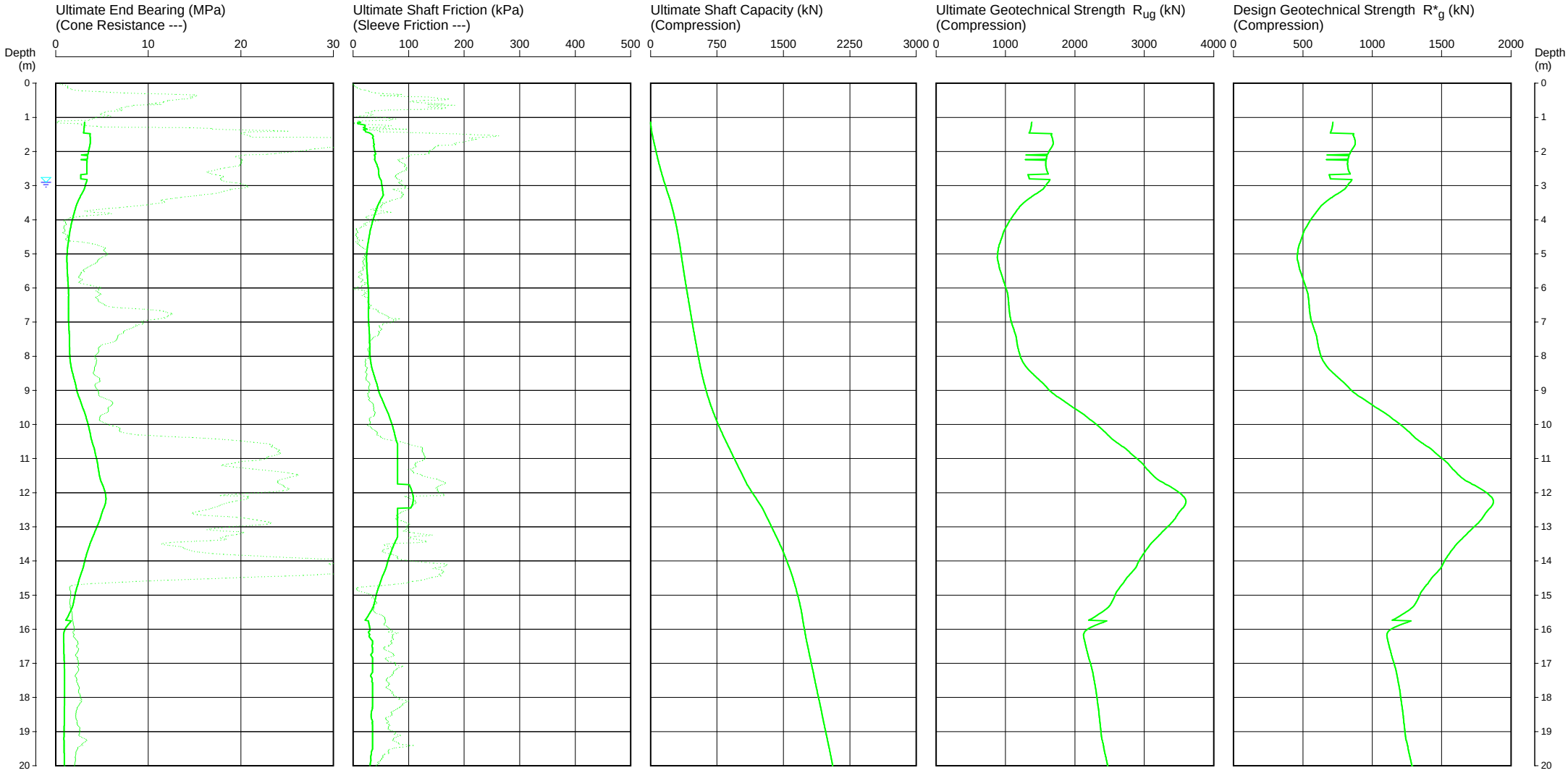
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

301A

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 2.90m depth

Coordinates: 384347 6356316

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\301A.CP5
Cone ID: 160917 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

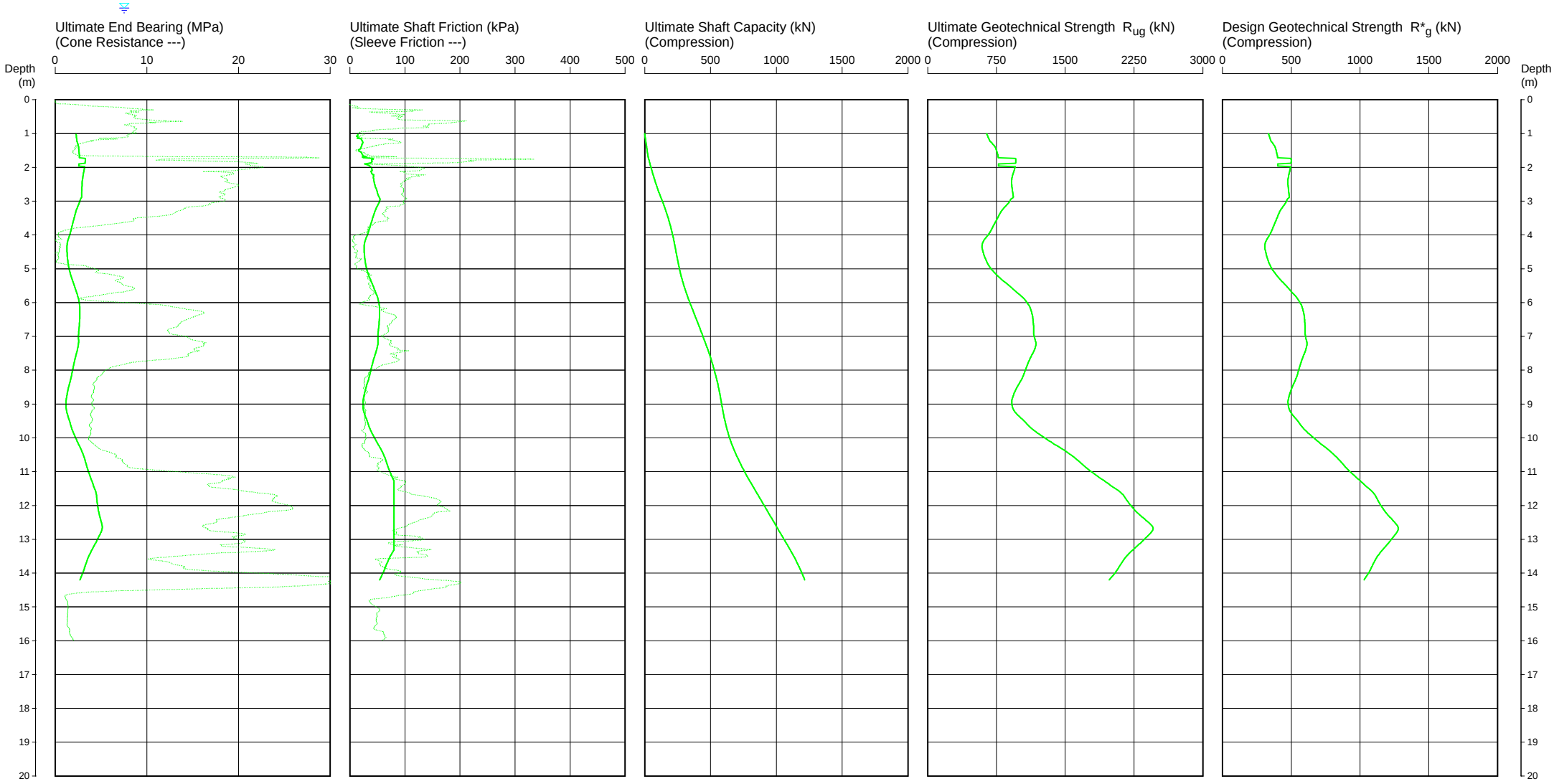
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

302
Page 1 of 1

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 3.00m depth

Coordinates: 384631 6356313

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\302.CP5
Cone ID: 120539 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.75
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

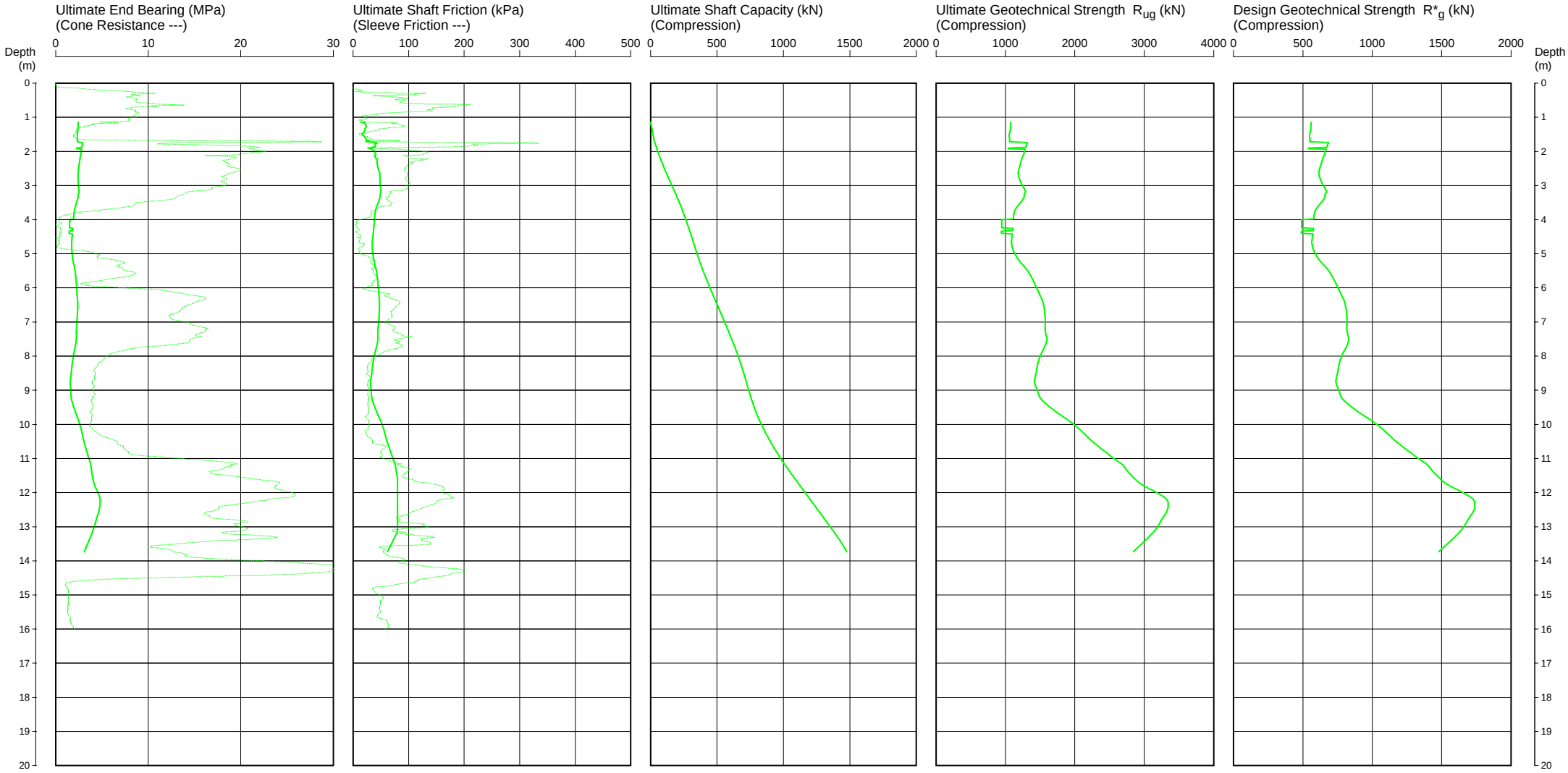
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

302
Page 1 of 1

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 3.00m depth

Coordinates: 384631 6356313

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\302.CP5
Cone ID: 120539 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

Douglas Partners
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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

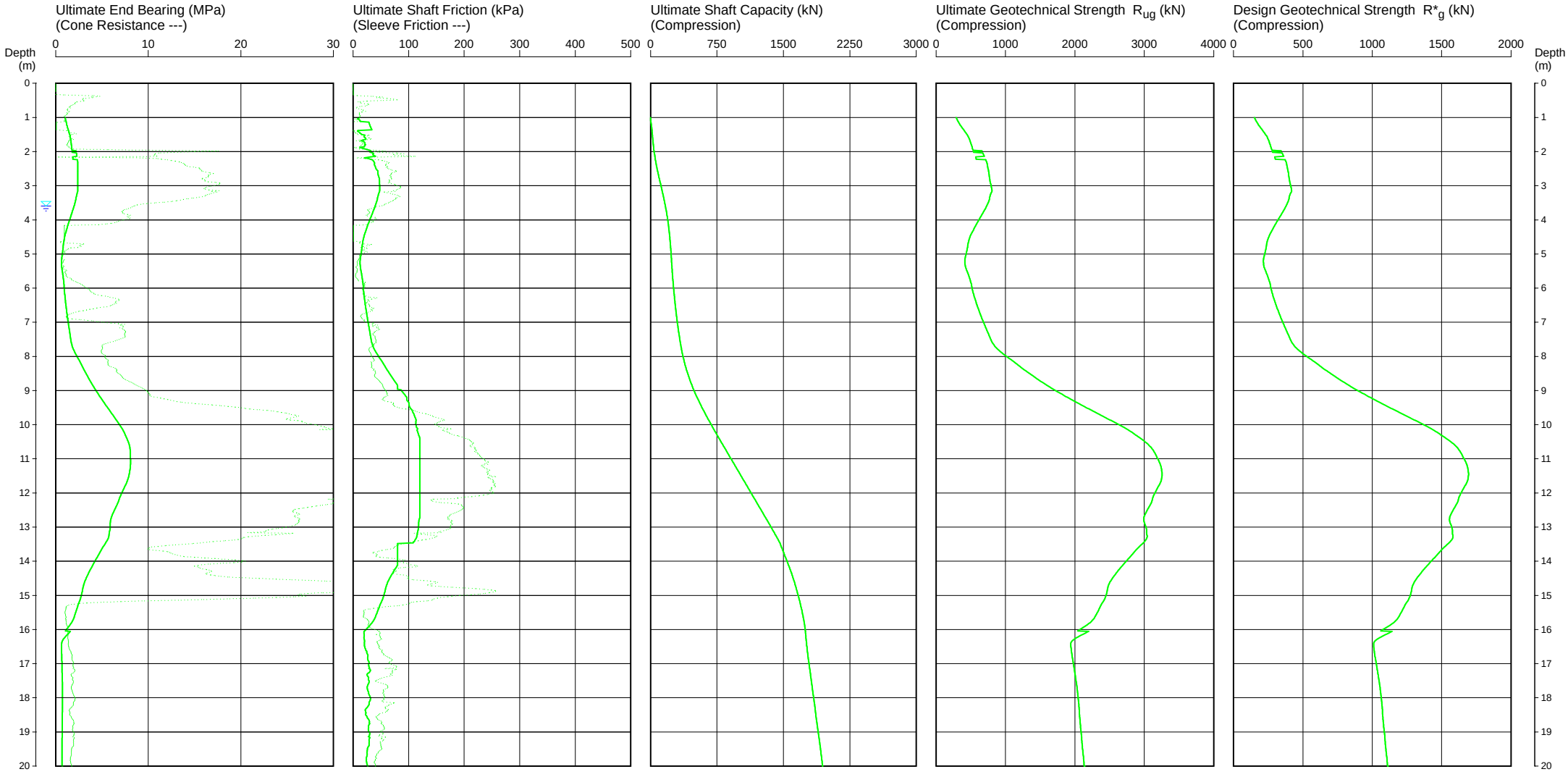
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

303B
Page 1 of 2

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.9 AHD



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Water depth after test: 3.60m depth

Coordinates: 384310 6356312

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\303B.CP5
Cone ID: 120539 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.75
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

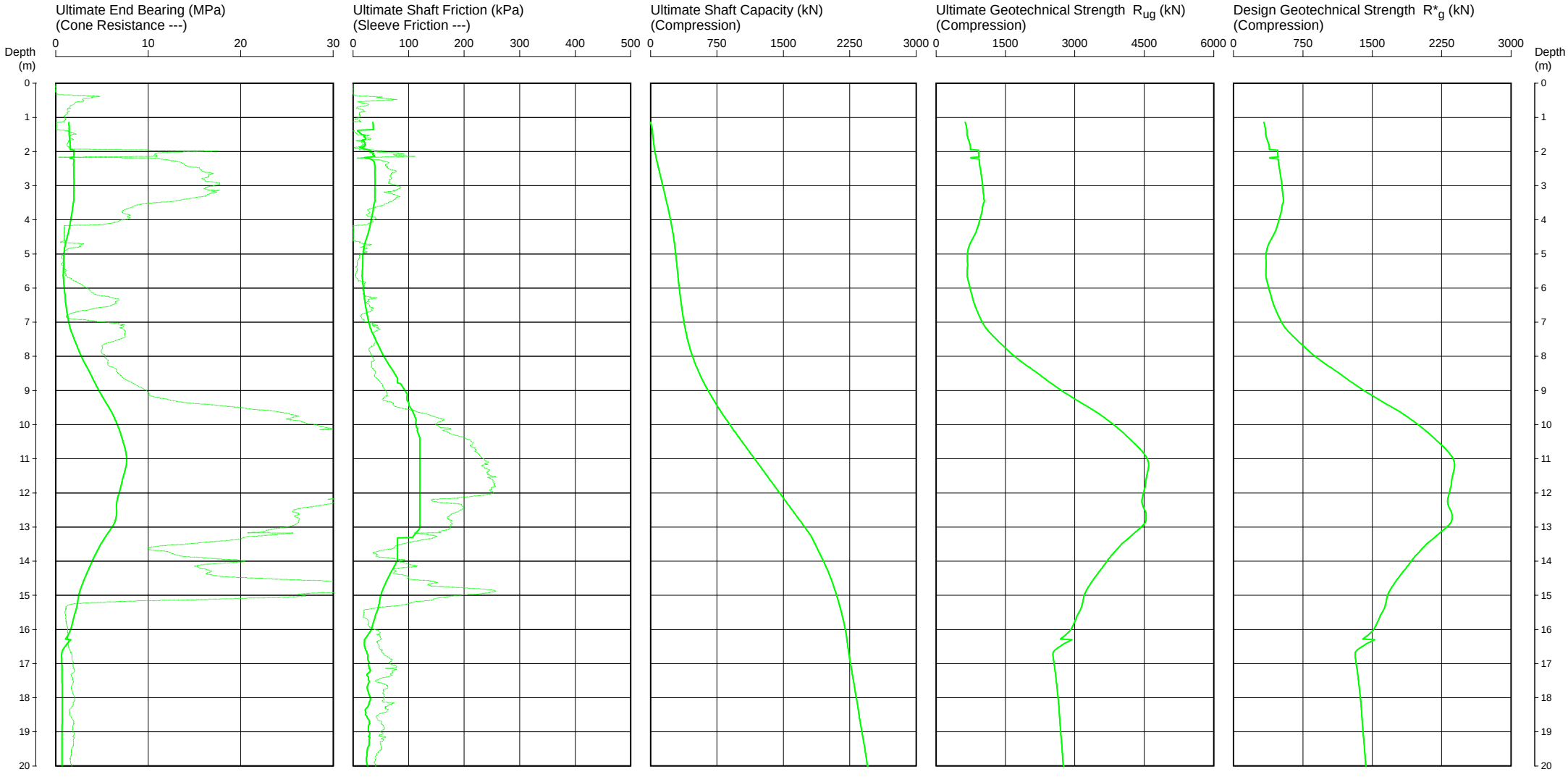
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

303B

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.9 AHD



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Water depth after test: 3.60m depth

Coordinates: 384310 6356312
File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\303B.CP5
Cone ID: 120539 **Type:** I-CFXYP20-10

CorePile Version 5.9.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

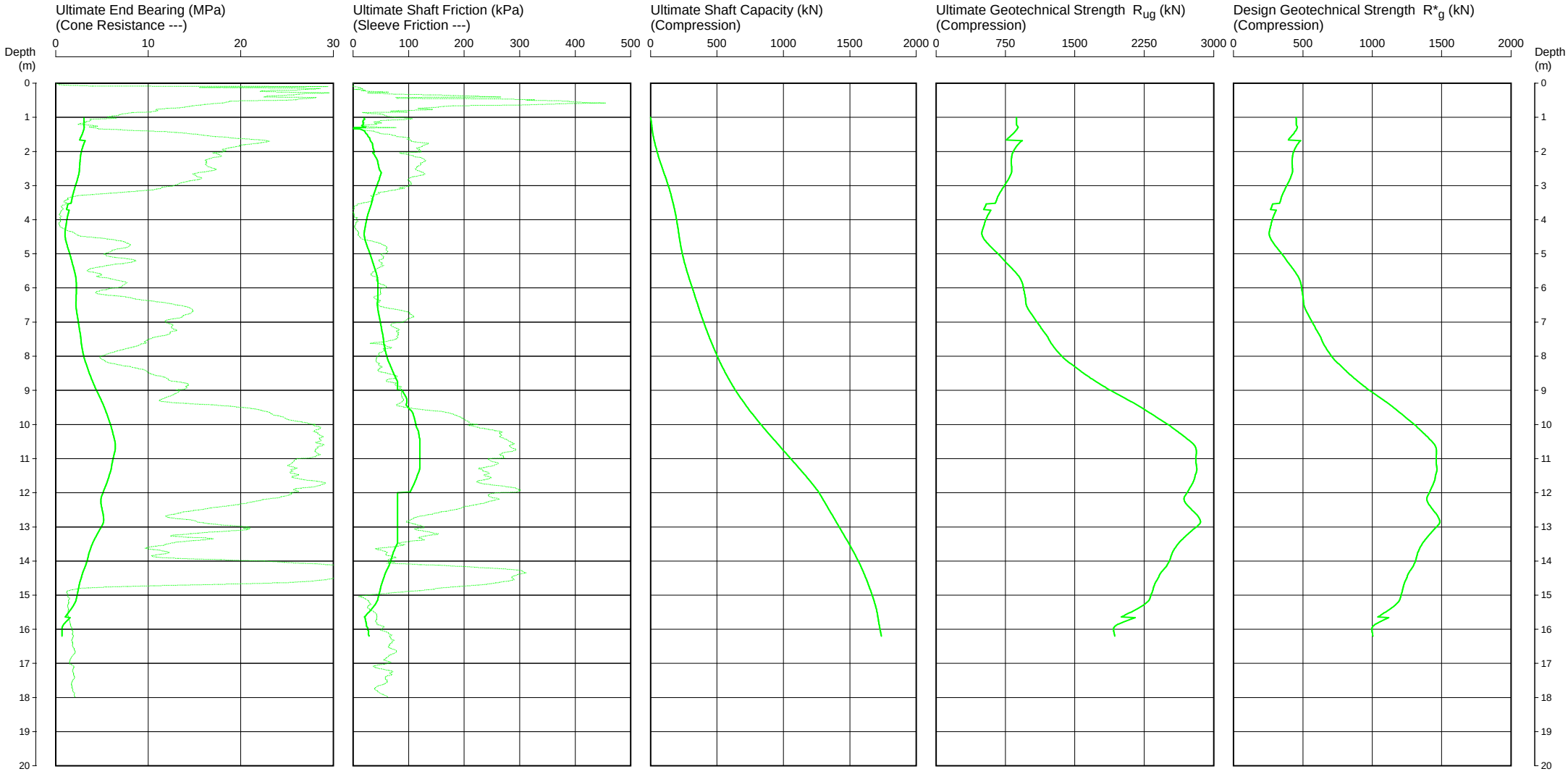
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

309A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.6 AHD



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Water depth after test: 3.20m depth

Coordinates: 384340 6356338

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\309A.CP5
Cone ID: 120634 **Type:** I-CFXY-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.75
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

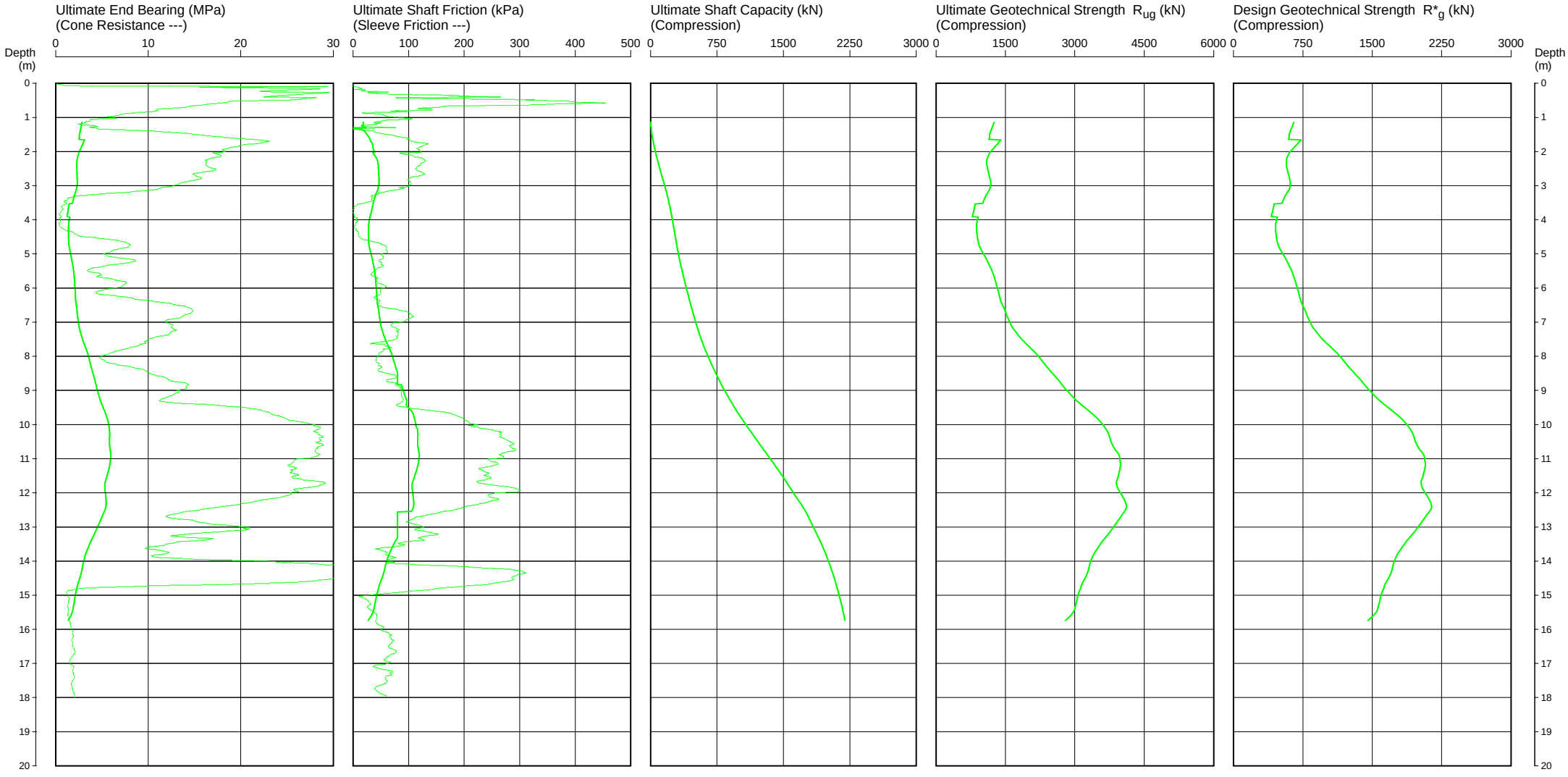
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

309A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.6 AHD



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Water depth after test: 3.20m depth

Coordinates: 384340, 6356338
File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\309A.CP5
Cone ID: 120634 **Type:** I-CFXY-10

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

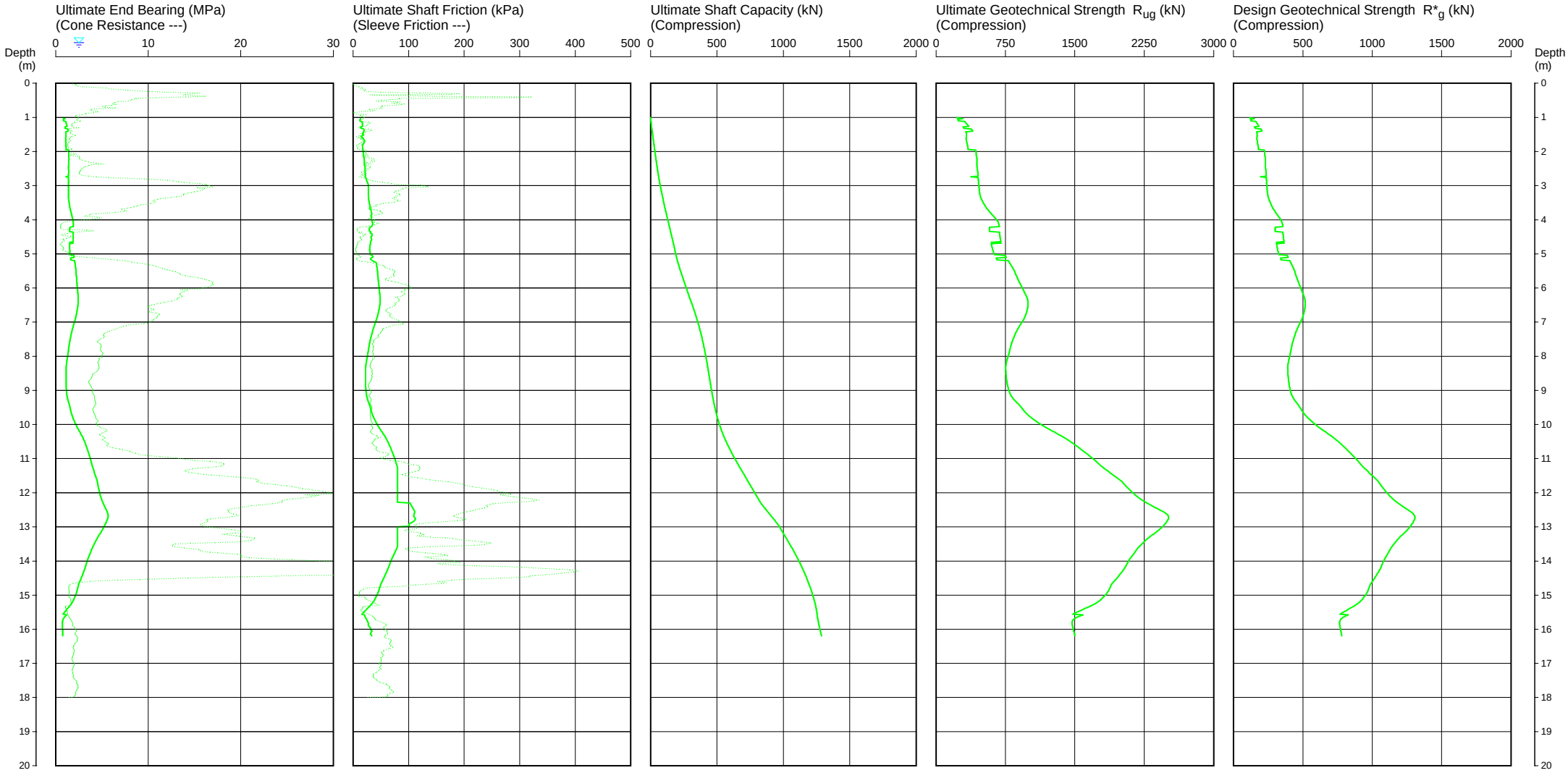
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE)

310A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 1.80m depth

Coordinates: 384343E 6356302N

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\310A.CP5
Cone ID: 120634 **Type:** I-CFXY-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.75
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

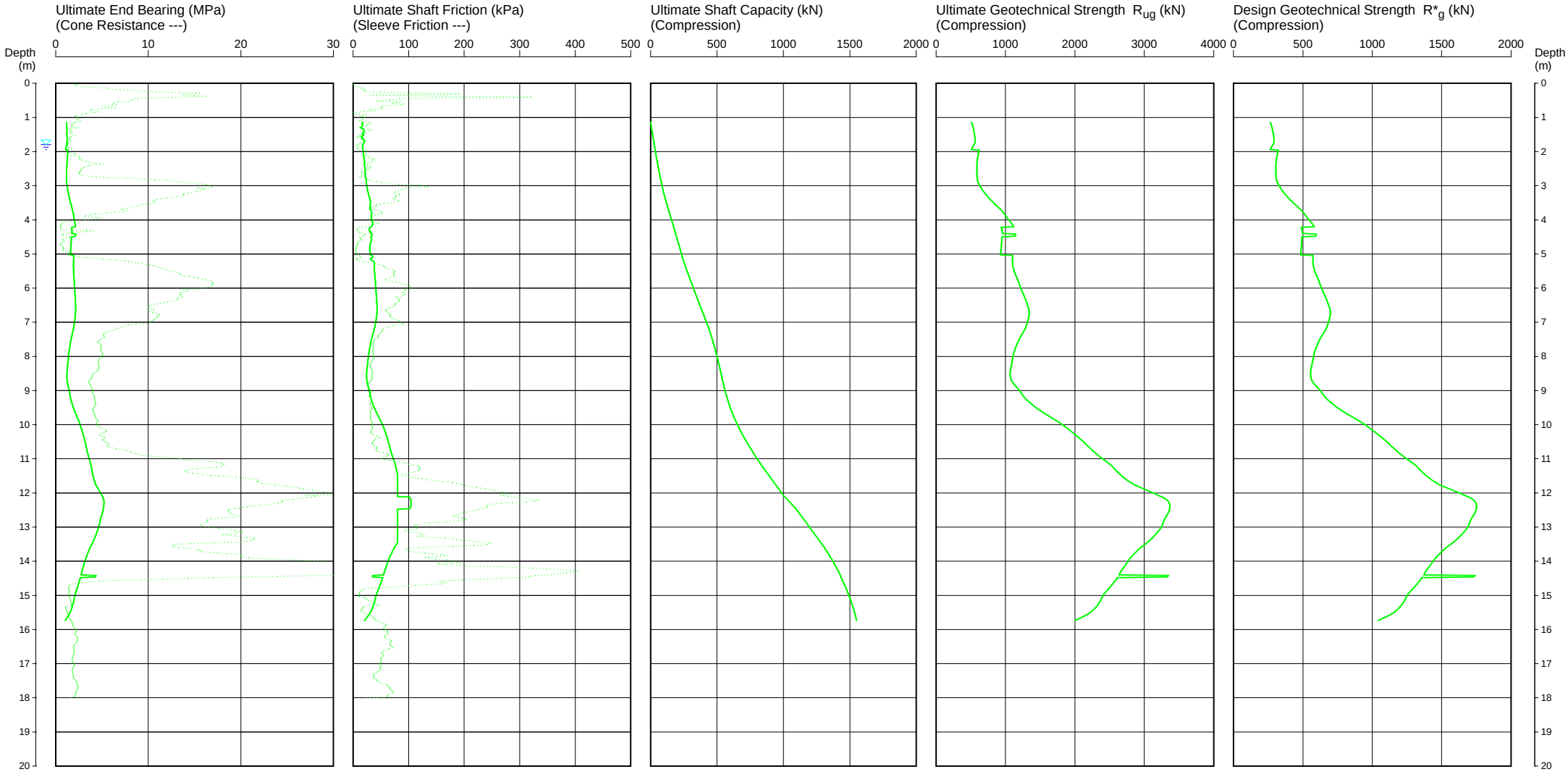
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE)

310A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 1.80m depth

Coordinates: 384343E 6356302N

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\310A.CP5
Cone ID: 120634 **Type:** I-CFXY-10

ConePile Version 5.9.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Screw Cast Concrete
PILE SHAPE: Round Screw
PILE SIZE: Inner Diameter = 0.51 Outer Diameter = 0.66
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

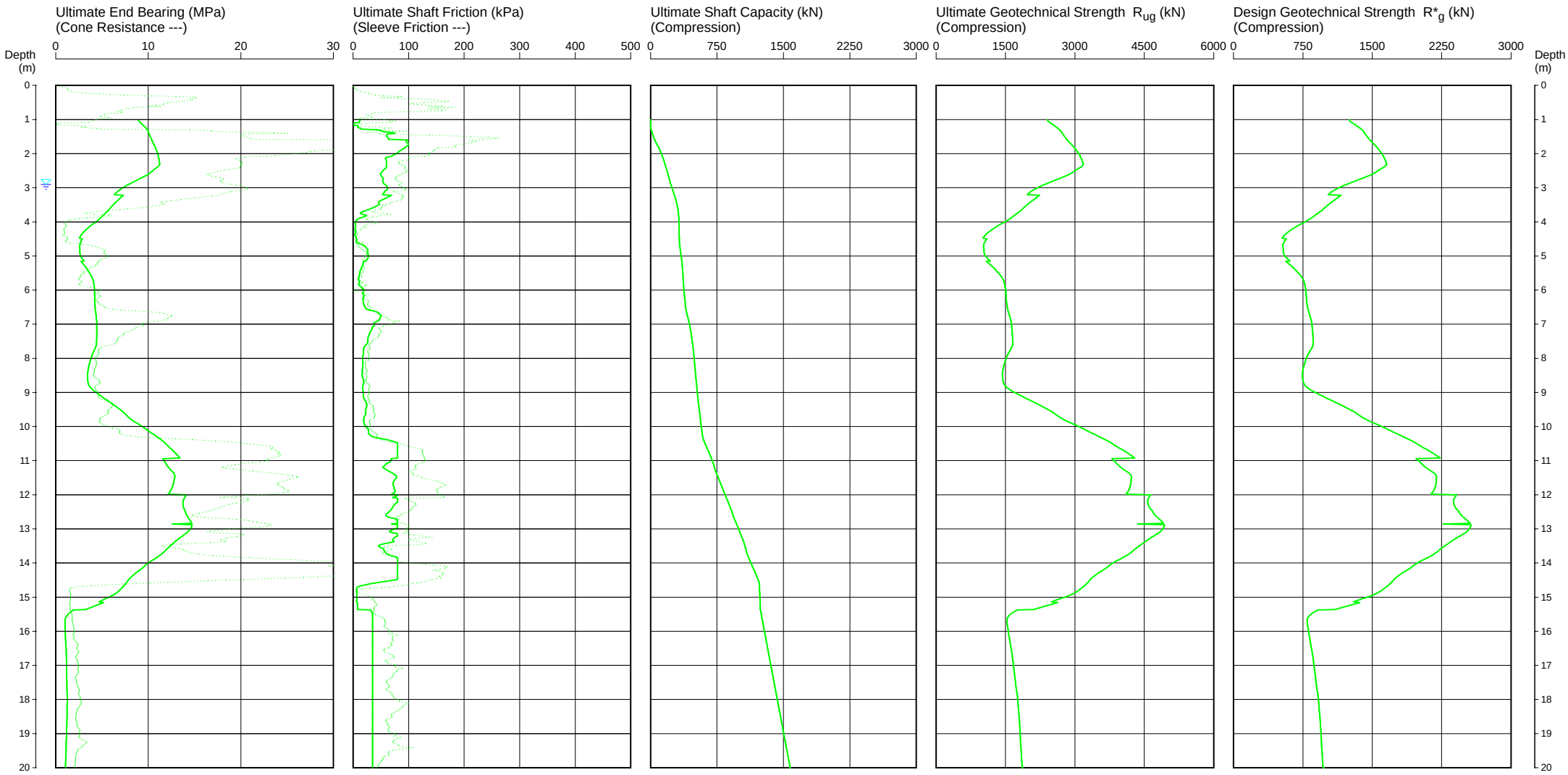
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

301A
Page 1 of 2

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 2.90m depth

Coordinates: 384347 6356316

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\301A.CP5
Cone ID: 160917 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Screw Cast Concrete
PILE SHAPE: Round Screw
PILE SIZE: Inner Diameter = 0.56 Outer Diameter = 0.71
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

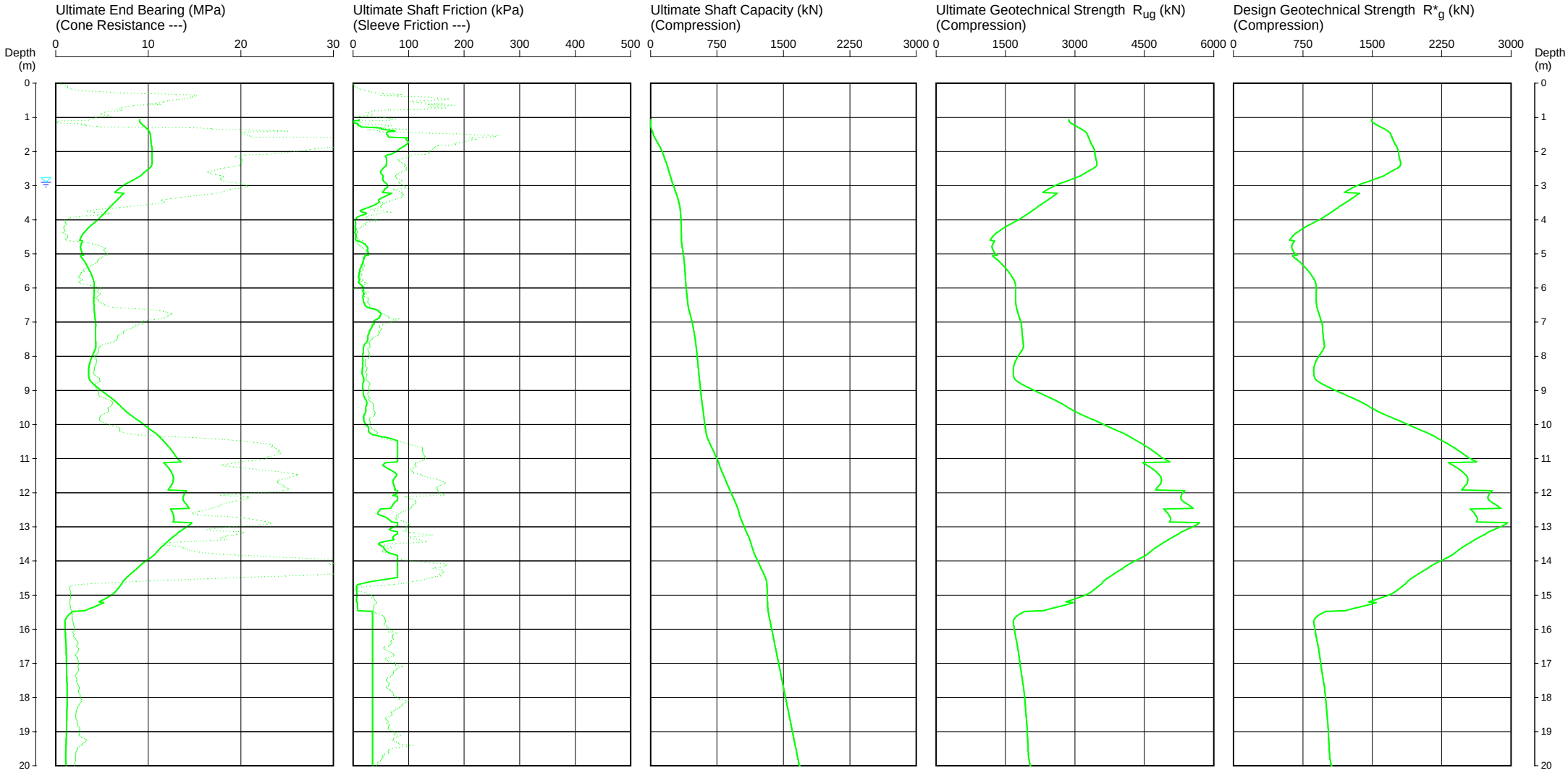
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

301A
Page 1 of 2

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 2.90m depth

Coordinates: 384347 6356316

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\301A.CP5
Cone ID: 160917 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Screw Cast Concrete
PILE SHAPE: Round Screw
PILE SIZE: Inner Diameter = 0.51 Outer Diameter = 0.66
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

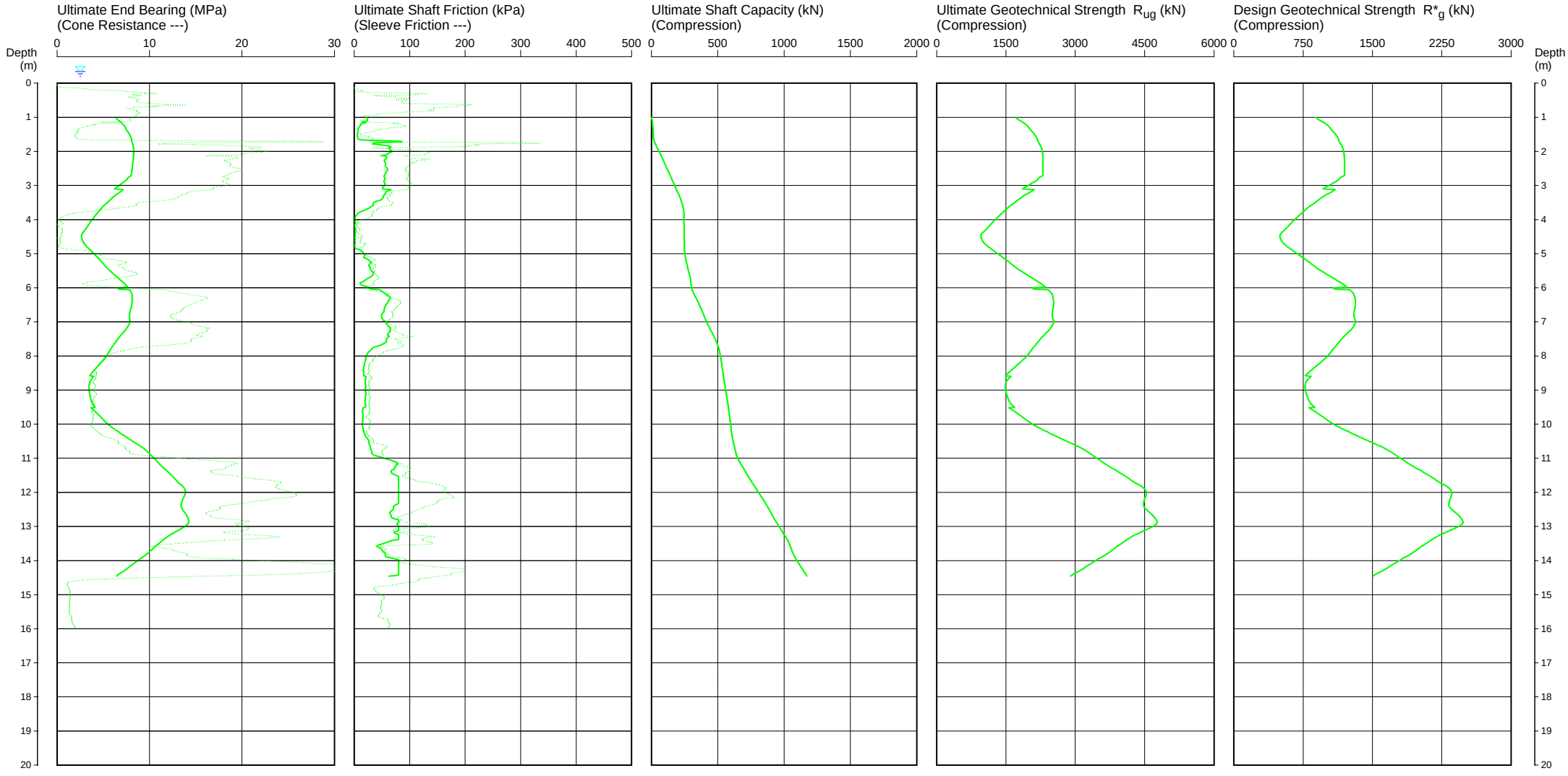
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

302
Page 1 of 1

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 3.00m depth

Coordinates: 384631 6356313

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\302.CP5
Cone ID: 120539 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Screw Cast Concrete
PILE SHAPE: Round Screw
PILE SIZE: Inner Diameter = 0.56 Outer Diameter = 0.71
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

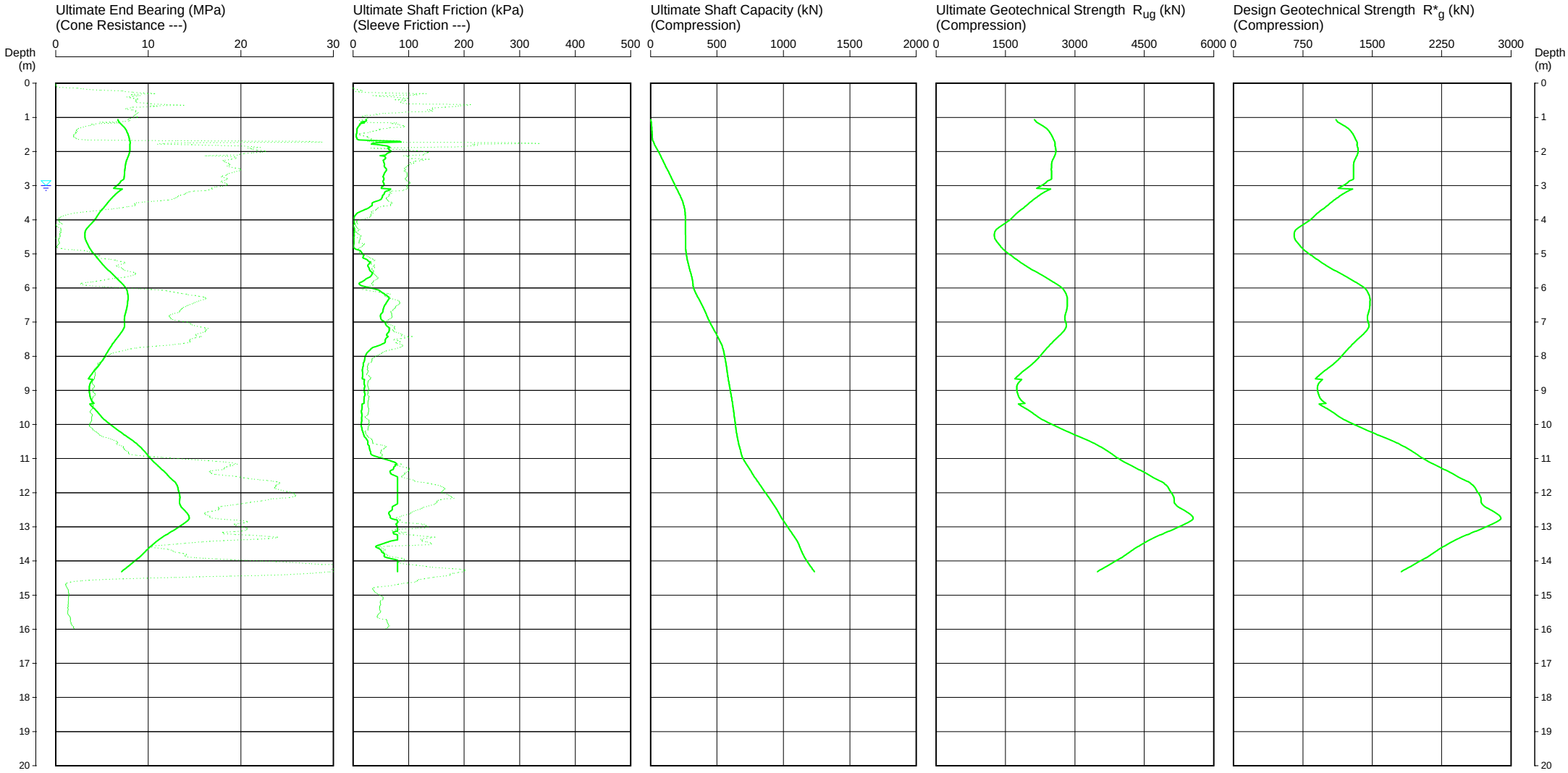
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

302
Page 1 of 1

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



DISCLAIMER:
These capacities have been estimated using accepted static theory, and are a guide only. Suitable verification procedures should be adopted (refer to AS2159), and piling contractors should confirm pile suitability and capacities. Structural capacity should be checked, and due allowance made for inclined or eccentric loads, and possible corrosion effects.

Water depth after test: 3.00m depth

Coordinates: 384631 6356313

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Cone ID: 120539 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Screw Cast Concrete
PILE SHAPE: Round Screw
PILE SIZE: Inner Diameter = 0.51 Outer Diameter = 0.66
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

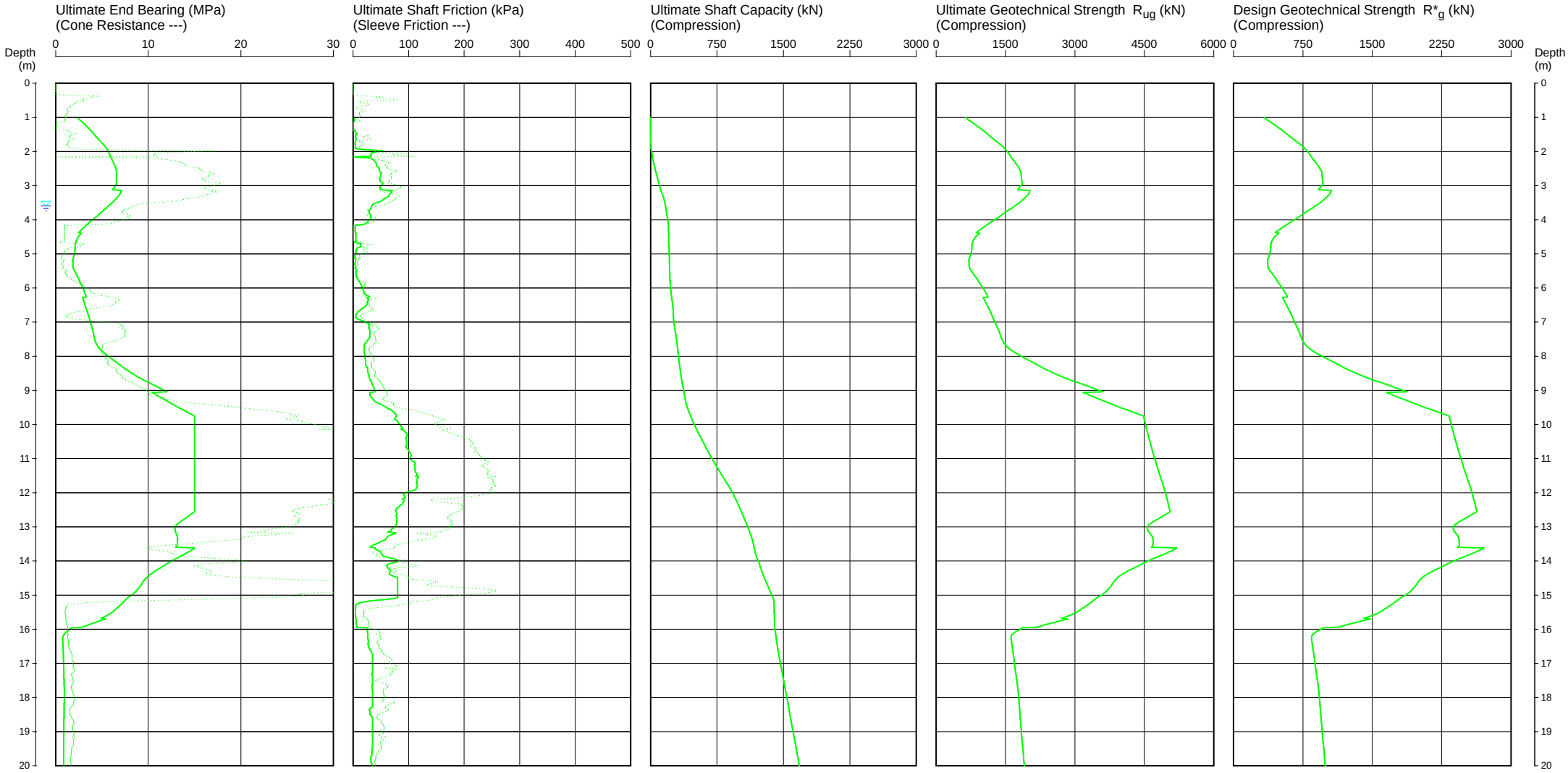
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

303B
Page 1 of 2

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.9 AHD



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Water depth after test: 3.60m depth

Coordinates: 384310 6356312

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\303B.CP5
Cone ID: 120539 **Type:** I-CFXYP20-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Screw Cast Concrete
PILE SHAPE: Round Screw
PILE SIZE: Inner Diameter = 0.56 Outer Diameter = 0.71
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

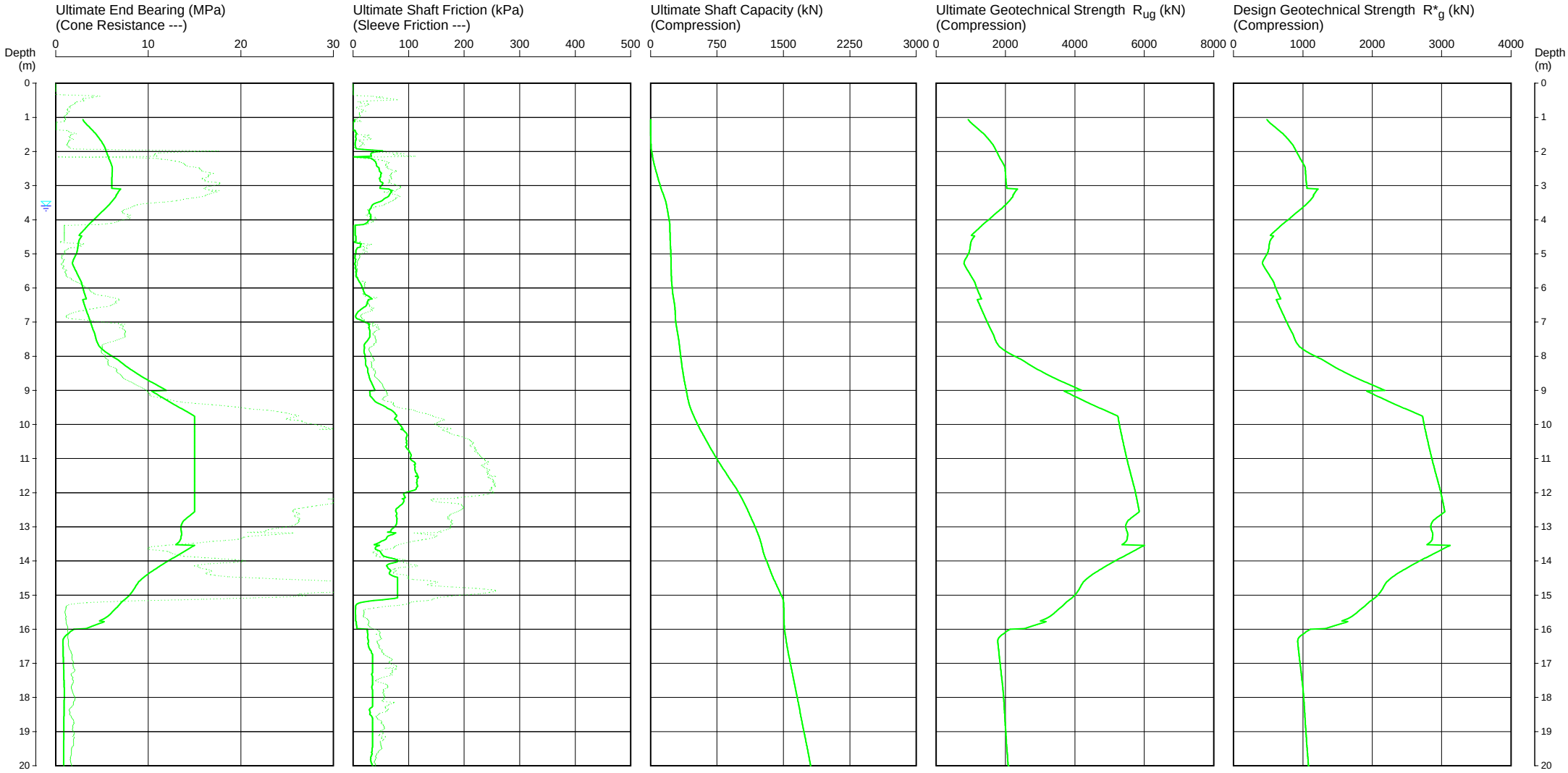
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

303B
Page 1 of 2

DATE 13/09/2017
PROJECT No: 91181
SURFACE RL: 3.9 AHD



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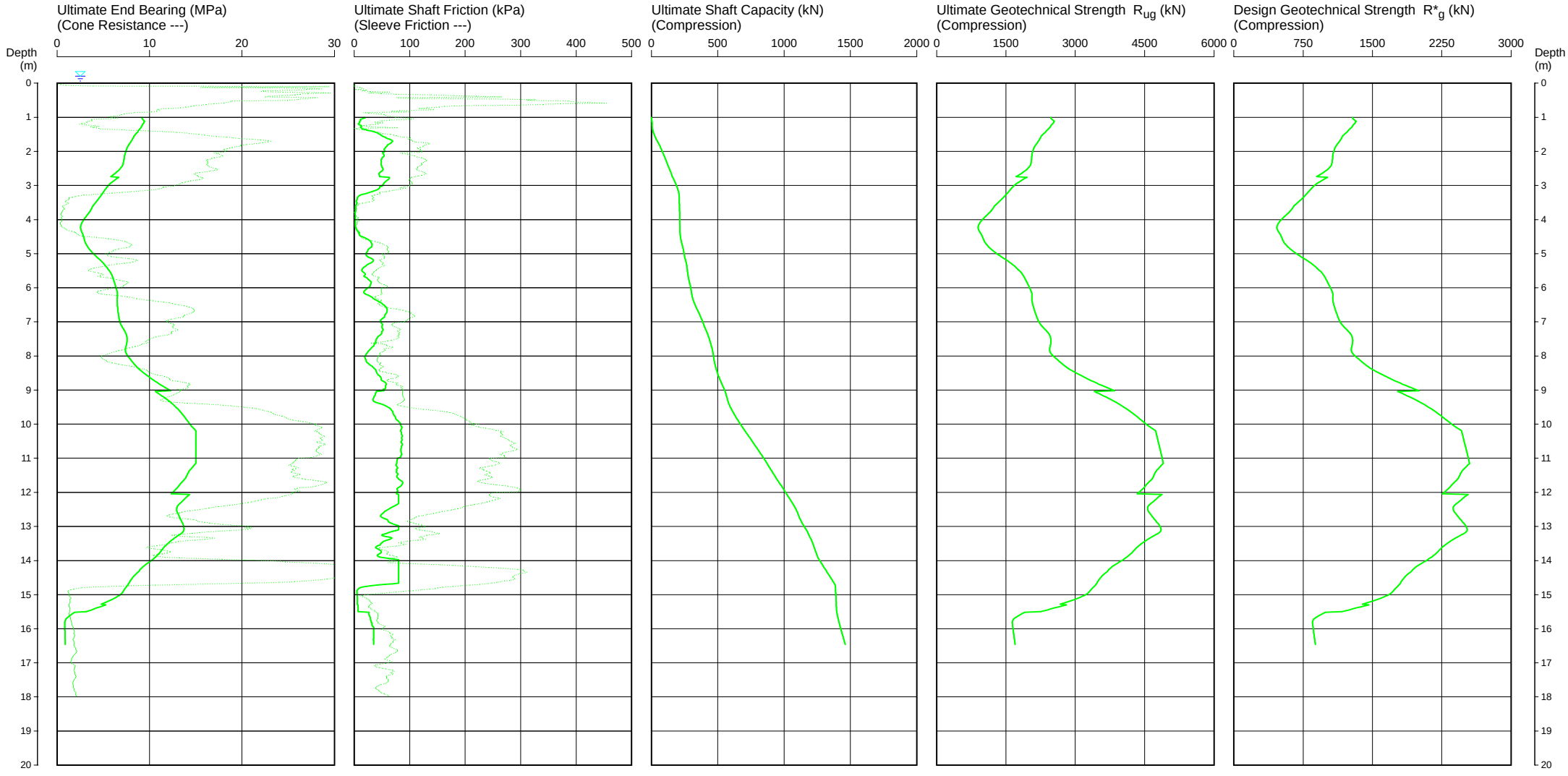
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

309A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.6 AHD



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Water depth after test: 3.20m depth

Coordinates: 384340 6356338

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\309A.CP5
Cone ID: 120634 **Type:** I-CFXY-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics | Environment | Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Screw Cast Concrete
PILE SHAPE: Round Screw
PILE SIZE: Inner Diameter = 0.56 Outer Diameter = 0.71
STRENGTH REDUCTION FACTOR $Ø_g$: 0.52
CALCULATION METHOD: Douglas Method

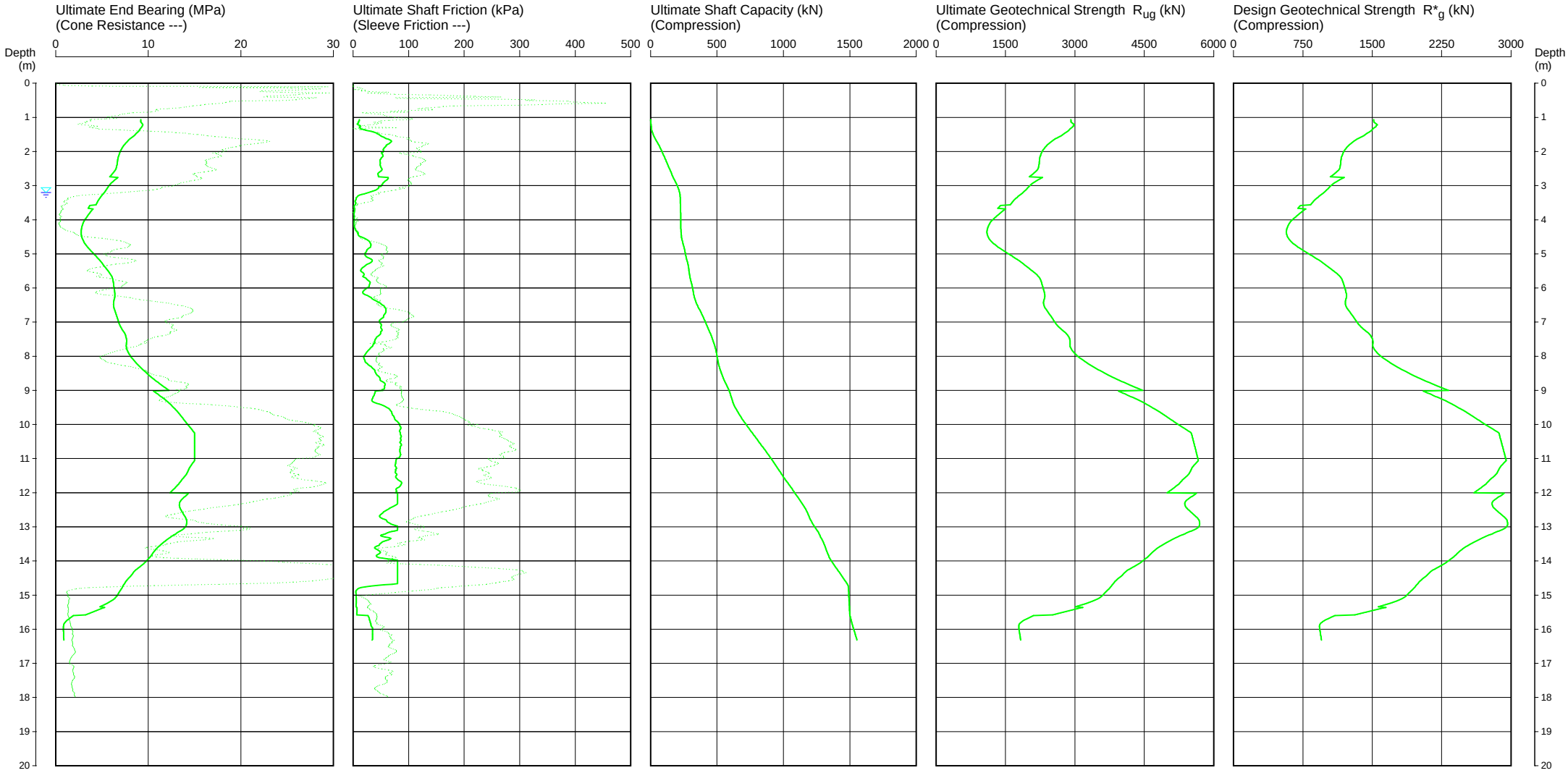
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE) PTY LTD

309A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.6 AHD



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ConePile Version 5.9.1

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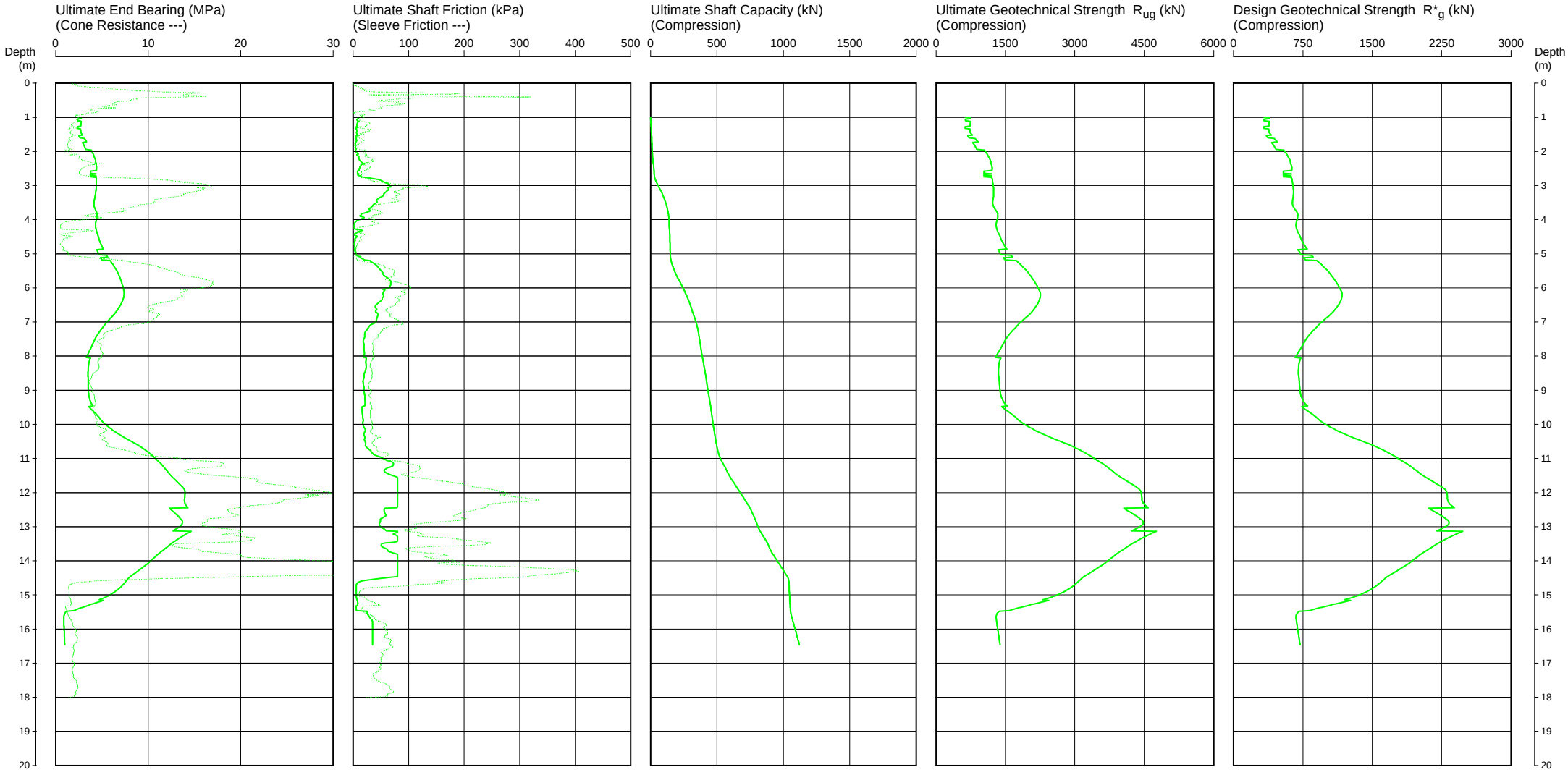
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE)

310A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Water depth after test: 1.80m depth

Coordinates: 384343E 6356302N

File: P:\91181.00 - NEWCASTLE, 42 Honeysuckle Drive, Geo-Env\4.0 Field Work\cptS\91181.00 HONEYSUCKLE\91181.00 HONEYSUCKLE\310A.CP5
Cone ID: 120634 **Type:** I-CFXY-10

ConePile Version 5.9.1

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PILE CAPACITY ESTIMATE

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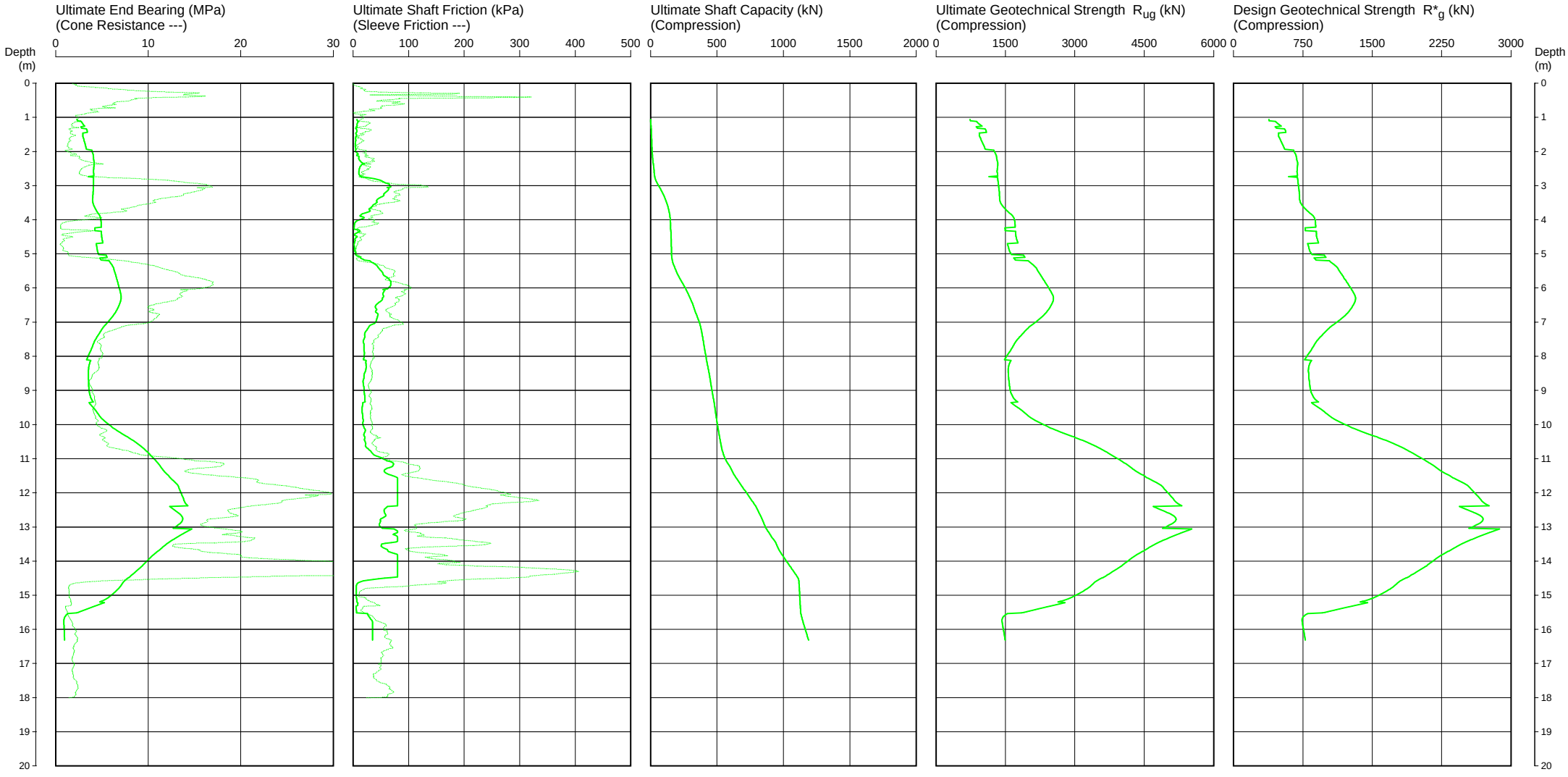
PROJECT: PROPOSED MIXES USE DEVELOPMENT

LOCATION: 42 HONEYSUCLE DRIVE, NEWCASTLE

CLIENT: DOMA HOLDINGS (HONEYSUCKLE)

310A
Page 1 of 1

DATE 14/09/2017
PROJECT No: 91181
SURFACE RL: 3.8 AHD



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Cone ID: 120634 **Type:** I-CFXY-10

ConePile Version 5.9.1

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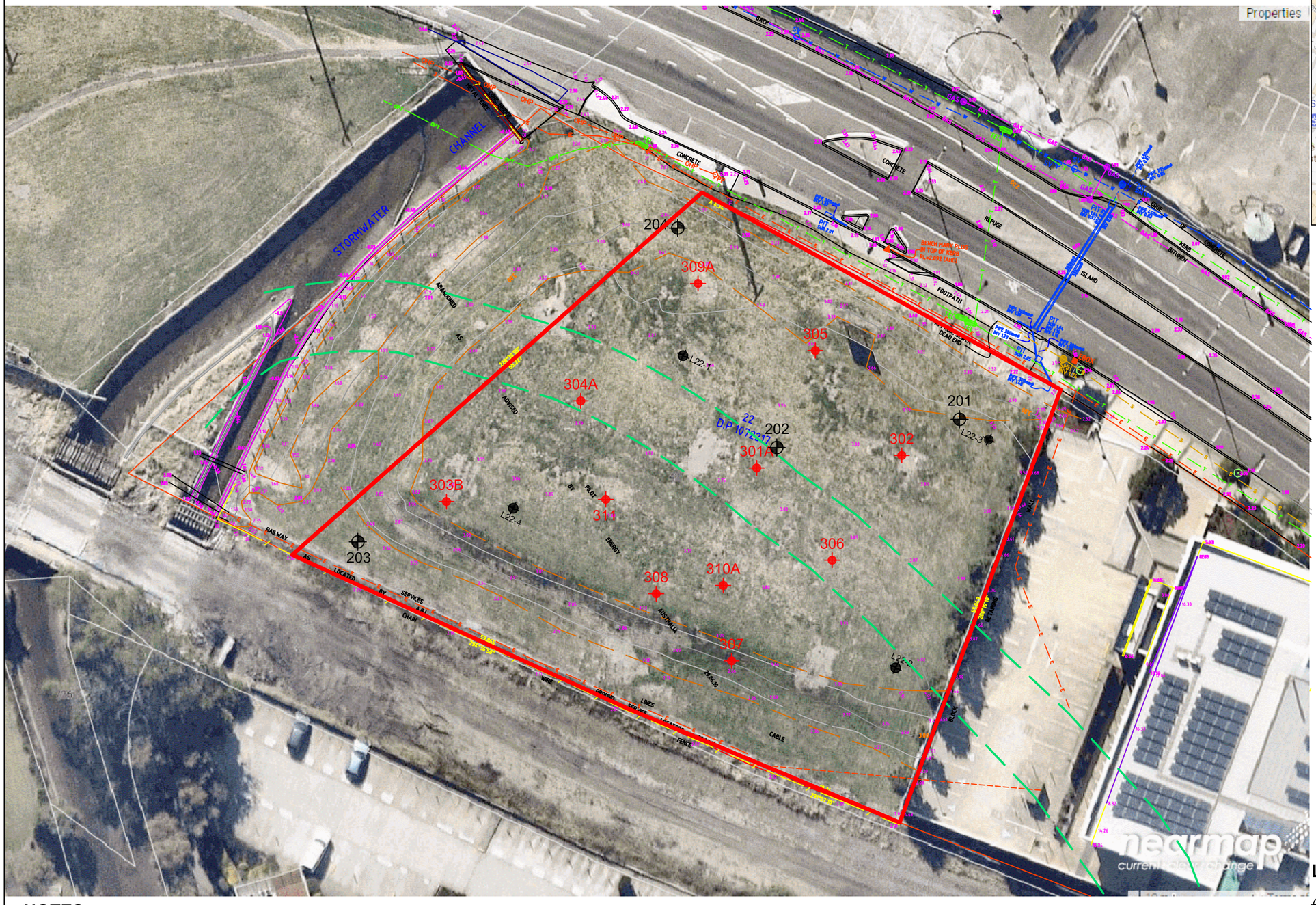
Appendix D

Drawing 1 – Test Location Plan
Drawing supplied by Client – DWG:A03.101 RevA, titled “Ground Floor Plan”, dated 27.9.2017



Locality Plan

NOTES

1. Drawing adapted from plan by de Witt Consulting, Ref 7768 dated 27.07.17, and Nearmap Image dated 27.7.17.
2. Test locations are approximate only and were located using Tape measurement from existing site features.

0 5 10 15 20 30 40 50m

1:500 @ A3

LEGEND

- Borehole Location (current investigation)
- Cone Penetration Test Location (current investigation)
- Cone Penetration Test Location (previous investigation)
- Site Boundary
- Inferred Old Channel from Historical Photos

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CLIENT: The Doma Group		TITLE: **Test Location Plan** **Proposed Mixed Use Development** **42 Honeysuckle Drive, Newcastle**
OFFICE: Newcastle	DRAWN BY: PLH	
SCALE: As shown	DATE: 24.10.2017	

N

PROJECT No:	91181.00.R001
DRAWING No:	1
REVISION:	0

LEGEND

1 Fire Hydrant 600x450mm
2 Fire Hose Reel 900x450mm
3 Fire Control Room 12sqm minimum
4 Exhaust Riser Above 1000x500mm
5 Hotel Fire Mimic (recessed in wall) 400x300mm
6 Cold Water Meter 3000x800x800
7 Subterrain fire tanks with pumps and pump controls
8 Kitchen Exhaust Riser 1200x850
9 Kitchen make-up riser 1200x850mm
10 Building Distribution Room 3600W x 2100D
11 Hydraulic Riser 850x600mm
12 Main Hotel Communications room 4600x3200mm
13 Building Distributor room 4000x1000mm
14 Fire Hydrant recess 450x700mm
15 Communications riser to above 300x150mm
16 Cold Water Pump room 4000x27000mm
17 Comms & Electrical Cupboard and Risers
18 Main Switchroom 6000x4000mm
19 Residential Fire Mimic panel 400x300mm
20 Chamber Substation 4200x4600mm
21 Gas Boundary Regulator 2000x1000x1300mm
22 Secondary Gas Main 1050 kPa
23 200 UPVC Water
24 150 UPVC Sewer
25 Subterrain Fire Pumps and Fire Tanks
26 Stairwell pressurisation shaft/fan room 2300x1900mm
27 Electrical distribution board servicing 650x500mm
28 Stairwell pressurisation shaft/fan room 2300x1900mm
29 Hydraulic riser 200x700mm
30 Electrical meter cupboard 1200x500mm
31 Communications riser below
32 Provide wall wetting sprinklers to louvers
33 Hotel communications riser 300x150mm
34 Hotel communications rack 1200x1200mm
35 Condenser plant for hotel common area
36 MSSB
37 Exhaust riser 1000x500mm
38 Stairwell pressurisation shaft/fan room 2200x650mm
39 Stairwell presurisation relief air riser 2000x1600mm
40 Electrical cable riser to above 1000x200mm
41 Condensers
42 Open Stairwell
43 Residential Storage Cages
44 Fire hydrant recess 700x450mm
45 Hot water riser 200x200mm
46 Hotel hot water plant 2200x3200mm
47 Residential hot water plant 2200x3200mm
48 Gas Boundary Regulator Below 222Wx1000Dx1300H
49 Fire Booster
50 Hotel Fire Mimic
51 Condensors
52 Electrical Distribution Board
53 Pump Room
54 Condenser plant for hotel common area
55 Carpark Electrical distrib. board with riser 800Wx500D

Revision	Date	Description	Initial	Checked
A	–.–.17	For Review	DOMA	BS

42 Honeysuckle Drive
42 Honeysuckle Drive, Newcastle

Ground Floor Plan

Scale	1 : 150 @ A1
Drawn	MDJ Checked VG
Project no.	s12109
Status	DA
Plot Date	28/08/2017 2:30:24 PM
Plot File	\\liv-vfp-01\home$\GAV\Documents\42HONEYSUCKLEDRIVE_BS_ARCH_DA_GAV.rvt
Drawing no.	A03.101
Revision	A

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