Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Industrial Development
49 - 61 Stephen Road, Banksmeadow

Prepared for
ESR Australia

Project 219609.02
November 2024



Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	219609.02	Document No.	R.001.Rev0
Document title	Report on Geotechnical Investigation Proposed Industrial Development		
Site address	49 - 61 Stephen Road, Banksmeadow		
Report prepared for	ESR Australia		
File name	219609.02.R.001.Rev1		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Adam Teoh	Scott Easton	21 December 2023
Revision 1	Adam Teoh	Ray Blinman	8 November 2024

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	-	Daniel Galea, ESR Australia
Revision 1	1	-	Olivia Ridgewell, ESR Australia

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		8 November 2024
Reviewer		8 November 2024

bsi ISO 9001 Quality Management Systems CERTIFIED
FS 604853

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

Executive Summary

This report presents the results of a geotechnical investigation undertaken by Douglas Partners Pty Ltd (DP) to accompany a State Significant Development Application (SSDA) for a proposed a three-storey warehouse and distribution centre development at 49-61 Stephen Road, Banksmeadow. The site is legally described as Lot A in Deposited Plan 190526, Lot 1 in Deposited Plan 1095110, and Lot 1 in Deposited Plan 311767. The site is shown on Drawing 1, in Appendix B.

The objectives of the geotechnical investigation were to:

- Assess the geotechnical suitability of the site for the proposed development.
- Provide recommendations on site preparation and earthworks.
- Provide recommendations on excavation and retaining structures.
- Advise on appropriate foundation systems for the development, including an assessment of allowable bearing pressures and likely settlements.
- Provide suitable parameters for the design of new pavements.

The report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 30 January 2024 and issued for the project (SSD-65924461). In this regard, this report is in response to point 'Soils' contained within the SEARs.

The results of the investigation generally indicate that the soils (fill, aeolian and estuarine sand, and clay) were encountered at depths of up to 12.8 m to 27.2 m (test termination depths). Geotechnical comments and advice have been provided within the report on field work methods and results, laboratory test results, subsurface conditions, which facilitated the development of a geotechnical model for the site. The model informed the provision of advice on excavation conditions and retention, site preparation, pavements and drainage, footings (shallow and piled) and aggressivity.

Based on the results of the investigation, DP considers that the site is geotechnically suitable for the proposed industrial (warehouse) development subject to the implementation of the advice and recommendations provided within this report.

Planning Information

The following information has been provided by the project planner, Urbis, and is included herein, at the request of Urbis and ESR Australia.

Introduction

This report has been prepared to accompany an SSDA seeking consent for the construction and operation of a three-storey warehouse and distribution centre development at 49-61 Stephen Road, Banksmeadow (SSD-65924461).

Specifically, the project comprises:

- Demolition of all existing built form.
- Site preparation works, bulk earthworks and infrastructure/service provisions and/or augmentation.
- Removal of 90 trees on site.
- Extensive remediation of the site.
- Construction and operation of two three-storey warehouse and distribution centre buildings including the following key components:
    - Approximately 57,034m^2 of total GFA comprising:
        - 51,195m^2 of warehouse area.
        - 4,775m^2 of office area.
        - 964m^2 of lobby space.
        - 100m^2 café.
    - Two warehouse buildings of three storeys containing:
        - Twelve (12) units within Warehouse A (3 levels).
        - Twelve (12) units within Warehouse B (3 levels).
- 243 car spaces provided on the ground floor mezzanine carparking area.
- 50 ground floor carpark spaces off Coal Pier Road.
- 20 motorbike parking spaces.
- End of trip facilities.
- Site landscaping works totalling 5,327m^2 (11.06% of the site), and
- Provision of building/business identification signage.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 30 January 2024and issued for the SSDA (SSD-65924461).

Specifically, this report has been prepared to respond to the SEARs requirements listed below.

Item	Description of Requirements	Section Reference
Soils	An assessment of potential impacts on soil resources and riparian land on and near the site, including: • impacts on soil erosion, salinity and acid sulfate soils • details of earthworks, including cut and fill volumes • description of the proposed erosion and sediment controls during construction.	This report currently addresses the requirements for assessment of soils underlying the site. Further reference should be made to: • Section 3 • Section 6 • Section 7.5

Table of Contents

Page

1. Introduction 1
2. Site Description 1
3. Published Data 2
   - 3.1 Soil Landscape 2
   - 3.2 Geology 2
   - 3.3 Acid Sulfate Soils 2
   - 3.4 Salinity 2
   - 3.5 Hydrogeology 3
4. Field Work 3
   - 4.1 Field Work Methods 3
   - 4.2 Field Work Results 4
     - 4.2.1 Site Walkover Observations 4
     - 4.2.2 Boreholes and CPTs 5
   - 4.3 Groundwater 6
5. Laboratory Testing 8
6. Proposed Development 9
7. Comments 9
   - 7.1 Geotechnical Model 9
   - 7.2 Vibrations 13
   - 7.3 Dilapidation 13
   - 7.4 Site Excavation 13
     - 7.4.1 Excavation and Groundwater Conditions 13
     - 7.4.2 Disposal of Excavated materials 14
   - 7.5 Site Preparation and Earthworks 14
   - 7.6 Excavation Support 15
     - 7.6.1 Batter Slopes 15
     - 7.6.2 Shoring/Retaining Walls 16
     - 7.6.3 Ground Anchors 17
   - 7.7 Footings 17
     - 7.7.1 High Level Footings 18
     - 7.7.2 Piled Footings 19
   - 7.8 Pavements 21
   - 7.9 Drainage 22
   - 7.10 Site Classification 22

7.11 Seismic Design 22
7.12 Aggressivity 22
8. Limitations 22

Appendix A: About This Report
Appendix B: Drawings
Appendix C: Field Work Results
Appendix D: Laboratory Test Results

Report on Geotechnical Investigation
Proposed Industrial Development
49 - 61 Stephen Road, Banksmeadow

1. Introduction

This report presents the results of a geotechnical investigation undertaken by Douglas Partners Pty Ltd (DP) for a proposed industrial development at 49 – 51 Stephen Road, Banksmeadow. The investigation was commissioned by Daniel Galea of ESR Australia Pty Ltd and was undertaken in accordance with the scope of works outlined in DP's proposal (ref 219609.01.P.001.Rev0), dated 3 June 2023.

It is understood from the provided information/design drawings that the proposed development will include the construction of two three-storey warehouses, Warehouse A and Warehouse B, along the northern and southern sides of the site, respectively. Hardstand areas will be suspended between each storey of the two blocks, with a mezzanine carpark level located beneath the second level of the hardstand. Heavy vehicle access (such as for trucks) through the site will be from driveways located in the north western and south western corners of the site, off Stephen Road, and at south eastern corner of the site, off Coal Pier Road. Boundary access roads will provide access to heavy vehicles around the site and to a circular ramp, to access upper stories, located in the south eastern portion of site. For light vehicles and pedestrians, pavements and footpaths are proposed along the western boundary adjacent to the northern warehouse, with a separate ramp to the mezzanine carpark level.

A geotechnical investigation was undertaken to provide preliminary information on the subsurface conditions and included:

- 24 cone penetration tests undertaken with a piezometric cone to depths of between 12.8 m and 27.2 m;
- Drilling of 10 boreholes to depths of between 19.7 m to 20.5 m; and
- The collection and testing of laboratory samples.

A contamination investigation was undertaken by DP in conjunction with the geotechnical work. The results of the contamination investigation will be presented in DP's Report (Ref. 219609.01.R.001.Rev1).

2. Site Description

The site is located at 49-61 Stephen Road, Banksmeadow, within the Bayside local government area and is legally described as Lot A in Deposited Plan 190526, Lot 1 in Deposited Plan 1095110, and Lot 1 in Deposited Plan 311767.. The site is situated within an area developed for commercial and industrial uses (also known as Banksmeadow Industrial Precinct), with adjacent properties to the north and south being used for similar land uses. Residential dwellings occupy land on the western side of Stephen Road.

The site is an irregular shaped area of approximately 4.8 hectares. Surface levels within the site are typically flat, falling gently from the western site boundary at a reduced level (RL) of 14 m with respect to the Australian height datum (AHD) down towards the eastern site boundary at RL 8 m AHD.

At the time of the investigation, the site was occupied by a two-storey office building adjacent to Stephens Road, several single-storey warehouses and industrial and manufacturing plants distributed across the site with concrete pavements between them.

3. Published Data

3.1 Soil Landscape

Reference to the Sydney 1:100,000 Soils Landscape Sheet indicates that the site is mapped as being underlain by aeolian Tuggerah soils for most of the site area with the eastern portion mapped as being underlain by disturbed terrain.

The Tuggerah soil landscape typically comprises gently undulating to rolling coastal dune fields comprising marine quartz sand, with shell fragments and interdune silt of Quaternary age. This landscape is generally highly permeable, very low to low in soil fertility and at risk of wind erosion.

The disturbed terrain is likely to comprise level to hummocky terrain extensively disturbed by human activity including complete disturbance, removal or burial of soil. Fill was likely to reclaim estuarine areas, with natural surface elevations raised by the placement of fill. As the fill placed is anthropogenic the properties and materials are variable and subject to the materials placed.

3.2 Geology

Reference to the Department of Regional New South Wales Seamless Geology mapping indicates that the site is underlain by coast deposits and dune facies. These deposits are noted to comprise fine to medium marine sand with podsols of Quaternary age.

3.3 Acid Sulfate Soils

Reference to the CSIRO Australian Soils Resource Information System's Acid Sulfate Soil (ASS) risk mapping indicates the site is mapped as being within an area of low probability of occurrence. Generally, the underlying soils are not anticipated to contain acid sulfate soils although highly localised occurrences may occur, especially at a depth of greater than 3 m below the ground surface.

3.4 Salinity

Reference to the map of salinity potential in Western Sydney 2002 indicates that the site is not within an area of known salinity risk.

Historically, saline soils are found to be present in Western Sydney due to the presence of saline groundwater and brackish creeks, and underlying Bringelly Shale, which has a high salt content that is released during the weathering of the Bringelly Shale or upon exposure to water.

Given that the site is located in an area underlain by aeolian soils (sands), of high permeability that facilitates drainage, salinity does not accumulate to the same extent as Western Sydney and has not been a known issue in the area of Banksmeadow. As such the presence of saline soils within the underlying soils is unlikely.

3.5 Hydrogeology

A search of NSW Department of Primary Industries groundwater bore records for registered groundwater bores indicated that several groundwater bores within the site recorded a standing water level. Groundwater bores GW112835, 112836, 112838, 112840, 112842 to 112844 all recorded a standing water level of 5.3 m below existing surface levels.

4. Field Work

4.1 Field Work Methods

The field work for the geotechnical investigation was conducted over 18 days between 31 July 2023 to 12 September 2023 and included:

- A site walkover inspection by a Principal geotechnical engineer;
- Electronic scanning for buried services at the proposed test locations;
- Coring of the surface asphalt and concrete at the proposed borehole and cone penetration test (CPT) locations;
- Cone penetration tests at 24 locations (CPT101 to CPT124) to refusal at depths of between 12.8 m and 27.2 m. During CPT testing, a ballasted truck-mounted test rig is used to push a 35 mm diameter instrumented cone-tipped probe into the soil using a hydraulic ram system. Continuous measurements are made of the end-bearing pressure on the cone tip and the friction on a 135 mm long sleeve located immediately behind the cone. The cone resistance and friction readings are displayed on a digital monitor and stored on a computer for subsequent plotting of results and interpretation. Further information on the test methods and interpretation of CPT results is provided in the notes included with the results in Appendix C;
- Drilling of ten boreholes (BH201 to BH210) using a track-mounted drilling rig to depths of between 19.7 m and 20.5 m. The boreholes were drilled with solid flight augers in the upper soils (to groundwater or collapsing side walls) and then continued with rotary wash boring methods to the termination depths. Standard penetration tests (SPT) were undertaken at regular depth intervals within each of the boreholes to determine the in-situ consistency and inferred density of the subsurface soils encountered;
- Two groundwater monitoring wells were installed within BH209 and BH210 for groundwater observations as well as sampling for contamination purposes;

- Logging of encountered subsurface conditions was undertaken by a geotechnical engineer who also collected samples of the soil profiles for subsequent laboratory testing; and
- Sampling of soils and rock to assist in logging and to provide specimens for laboratory testing.

All test locations were backfilled with drilling spoil upon completion. The ground surface levels at the CPT and borehole locations were measured relative to AHD using a differential global positioning system (dGPS) receiver, which is generally accurate to within ±0.2 m. Coordinates for each CPT and borehole location are with reference to Map Grid of Australia MGA2020, Zone 56 and have a similar accuracy. Coordinates and ground surface levels are recorded on the CPT plots and borehole logs included in Appendix C.
The CPT and borehole locations are shown in Drawing 1 in Appendix B.

For further information on the subsurface conditions at the site, refer to the DP's contamination assessment report.

4.2 Field Work Results

4.2.1 Site Walkover Observations

During the walkover of the site, by a Principal geotechnical engineer, several observations of the site were made. Along the western boundary of the site, which is adjacent to Stephen Road, there is a two-storey brick office building located in the north western corner of the site. In the south western corner of the site, an on-grade asphalt car park is situated. Along the eastern site boundary shared with 2 Coal Pier Road and also fronting Coal Pier Road, a water-filled basin was noted. The water-filled basin is estimated to hold approximately 600,000 Liters of water, understood to primarily serve as a water source for fire suppression services across the site. Additionally, in the same vicinity, there is a grassed mound and a granular hardstand area located near the south eastern corner of the site.

The remaining portion of the site is predominantly occupied by several large warehouses and industrial equipment, with concrete hardstand areas and driveways in between. During the site walkover buried storage pits and open pits were observed and typically noted to depths ranging between 2 to 3 m.

The ground surface levels within the site were observed to be relatively level within the site, with significant changes in elevation primarily occurring near the site boundaries. Along the western boundary, the surface slopes downward from the footpath along Stephen Road across a garden bed retained by a masonry wall, which stands at approximately 2 m to 3 m in height before reaching a level area on which the car park, office building, and industrial warehouses are situated.

Near the north eastern corner of the site, the surface falls from the level industrial area, passing over a batter, approximately 1 m to 2 m in height, adjacent to the industrial property at 2 Coal Pier Road. In the south eastern corner, the surface levels again fall from the level industrial area and grassed mound, to a vegetated batter and a reinforced earth concrete block wall that stands between 2 m and 3 m in height, before reaching the street level of Coal Pier Road.

Based on the observed changes in surface levels, it is likely that previous earthworks have occurred across the site. The western boundary along Stephen Road appears to have experienced excavation,

or cut, to depths of about 3 m. Towards the east these cut depths likely transition to fill depths of up to 3 m forming the level industrial pad.

4.2.2 Boreholes and CPTs

The general sequence of subsurface materials encountered at the CPT and boreholes locations are summarised in Table 1.

Table 1: Summary of Subsurface Profile

Material	Depth Range to Top of Material (m)	RL Range to Top of Material (m AHD)	Thickness Range* (m)	Description
Pavement / Fill (Existing Fill)	0.0	10.2 to 8.7	0.3 to 6.5	Asphaltic concrete between 30 mm and 40 mm thick at the surface of CPT103 and BH202. Gravelly sand within BH202 (possibly road base gravel) to a depth of 0.4 m. Concrete slabs of between 90 mm and 250 mm thickness at the surface of BH201, BH203 to BH206, BH208, CPT101, CPT102 and CPT104 to CPT117. An unbound or grassed surface was observed at BH209, BH210, CPT121 to CPT124 and BH207. All boreholes encountered general fill predominantly consisting of fine to medium grey and brown sand with varying proportions of sandstone and igneous gravel and some organic, metal and asphalt fragments encountered in some locations. Fill was typically encountered to depths of about 0.5 m to 1.5 m and generally increased towards the east. However, deeper fill was encountered to depths of about 3 m to 6.5 m on the eastern part of the site (BH208, BH209 and BH210) and this fill included hydrocarbon odours, potential asbestos containing materials, clinker, resin, and boulders/rubble in some areas.
Sand (vl-l)	0.4 to 3.7	9.7 to 6.0	1.0 to 4.1	Very loose to loose aeolian sand was encountered below the general fill at BH201 to BH208, CPT103 to CPT110, CPT117 and CPT119 to CPT121. The sand was generally observed to be pale grey to pale brown, fine to medium and moist with some weakly cemented bands.

Material	Depth Range to Top of Material (m)	RL Range to Top of Material (m AHD)	Thickness Range* (m)	Description
Sand (md)	0.3 to 6.5	9.5 to 2.9	0.5 to 3.3	Medium-dense aeolian and estuarine sand was encountered within all test locations excluding CPT117. Generally observed to be pale grey-brown to grey-brown, fine to medium and moist to wet with occasional bands of stiff to hard peaty clay and clay.
Sand (d-vd)	2.3 to 9.0	7.5 to -0.3	4.6 to 15.1	Dense to very dense aeolian and estuarine sand was encountered within all test locations. Generally observed to be grey-brown to dark grey-brown, fine to medium and wet with occasional bands of medium dense sand and stiff to hard peaty clay and clay.
Clay (st-h)	13.3 to 17.0	-3.7 to -7.0	0.4 to 2.0	A peaty clay and clay layer was encountered within the dense to very dense sand at BH203 to BH210, CPT108 to CPT110, CPT112, CPT113, CPT116 to CPT119 and CPT121 to CPT124. Generally observed to be low to medium plasticity, stiff to hard, dark grey and dark brown, with some iron-stained laminations.

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense, st = stiff, h = hard

Organic/sulfuric odours were noted in the soils, generally below the groundwater level, together with hydrocarbon odours at varying locations and depths. Additional boreholes (not disused in this report) have been drilled for the contamination assessment and reference should be made to the DP contamination assessment report for the results of these investigations and details on soil and groundwater contamination.

4.3 Groundwater

Groundwater seepage was observed during the removal of the CPT rods on completion of testing as well as during auger drilling of the boreholes. On completion of BH209 and BH210, monitoring wells were installed on 10 September 2023 and 11 September 2023 and subsequent groundwater measurements were undertaken on 14 September 2023. A summary of groundwater observations has been provided below in Table 2. Reference should be made to the field work results in Appendix C for further details on groundwater observations and the monitoring well construction. Further groundwater observations may also be found in the DP contamination assessment report.

Table 2: Summary of Groundwater Observations.

Test Location	Surface RL (m AHD)	Groundwater Depth (m)	Groundwater RL (m AHD)	Date	Comments
BH201	10.0	4.9	5.1	6/9/2023	Seepage whilst drilling
BH202	10.0	5.7	4.3	1/9/2023	Seepage whilst drilling
BH203	9.9	5.0	4.9	5/9/2023	Seepage whilst drilling
BH204	9.9	5.0	4.9	4/9/2023	Seepage whilst drilling
BH206	9.8	5.0	4.8	8/9/2023	Seepage whilst drilling
BH207	9.7	5.5	4.2	31/8/2023	Seepage whilst drilling
BH208	10.0	5.3	4.7	30/8/2023	Seepage whilst drilling
BH209 (well)	10.1	5.8	4.3	14/9/2023	Measurement in well
BH210 (well)	8.7	4.4	4.3	14/9/2023	Measurement in well
CPT102	10.2	5.4	4.8	7/8/2023	On removal of CPT rods
CPT104	10.0	5.3	4.7	1/8/2023	On removal of CPT rods
CPT105	10.0	4.9	5.1	3/8/2023	On removal of CPT rods
CPT109	9.9	5	4.9	2/8/2023	On removal of CPT rods
CPT112	9.9	5	4.9	7/8/2023	On removal of CPT rods
CPT113	9.9	5.3	4.6	7/8/2023	On removal of CPT rods
CPT116	10.0	5.2	4.8	8/8/2023	On removal of CPT rods
CPT117	9.9	5.3	4.6	8/8/2023	On removal of CPT rods
CPT118	9.8	5.4	4.4	3/8/2023	On removal of CPT rods
CPT119	9.8	5	4.8	8/8/2023	On removal of CPT rods
CPT120	10.0	5.3	4.7	31/7/2023	On removal of CPT rods
CPT123	10.1	5.9	4.2	9/8/2023	On removal of CPT rods
CPT124	8.7	4.8	3.9	31/7/2023	On removal of CPT rods

It is noted that groundwater levels are transient and may fluctuate over time in response to climatic variations, anthropogenic influences, ephemeral seepage flow variations and local flooding influences associated with Botany Basin. The measurements during drilling and in CPT holes are approximate only and may not represent stabilised levels.

Refer to Section 7.1 and Section 7.4.1 for further comments on groundwater.

5. Laboratory Testing

Chemical laboratory testing was carried out on selected soil samples collected during the field investigation. The tests comprised aggressivity testing (chloride, sulfate, electrical conductivity ($EC_{1:5}$) and pH_w) of 24 samples. The detailed laboratory tests results are presented in Appendix D and summarised in Table 3.

Table 3: Summary of Aggressivity Tests Results

Test Location	Depth	Material	Chloride (mg/kg)	Sulfate (mg/kg)	$EC_{1:5}$ (µS/cm)	pH_w
201	0.4 – 0.5	Sand Fill	<10	26	37	3.8
202	2.5 – 2.95	Sand	<10	20	30	7.1
203	5.0 – 5.2	Sand	10	<10	32	7.1
203	7.0 – 7.45	Sand	<10	<10	23	6.6
203	9.0 – 9.45	Silty Sand	<10	<10	14	5.7
203	11.0 – 11.45	Silty Sand	<10	<10	19	6.0
203	13.0 – 13.35	Silty Sand	<10	22	30	5.3
204	1.5 – 1.7	Sand	<10	10	24	4.7
204	5.0 – 5.2	Sand	<10	<10	17	6.5
204	7.0 – 7.45	Sand	20	20	42	6.0
204	10.0 – 10.45	Silty Sand	<10	<10	13	5.6
205	2.5 – 2.95	Sand	<10	<10	9	5.5
205	5.5 – 5.95	Sand	<10	<10	12	6.2
205	6.5 – 6.8	Sand	<10	10	23	6.6
205	8.0 – 8.3	Silty Sand	<10	20	19	5.3
206	6.5 – 6.95	Silty Sand	<10	<10	18	6.5
207	1.0 – 1.45	Sand	<10	10	18	6.6
207	5.5 – 5.95	Sand	<10	<10	17	5.1
207	7.0 – 8.45	Sand	<10	24	28	6.2
207	15.0 – 15.45	Peaty Clay	69	110	160	5.0
209	1.0 – 1.45	Silty Sand Fill	<10	140	190	8.4
209	2.5 – 2.95	Silty Sand Fill	59	63	190	8.5
209	4.0 – 4.45	Silty Sand Fill	57	10	160	6.7
210	2.0 – 2.2	Silty Sand Fill	<10	130	230	8.4

Notes: $EC_{1:5}$ = Electrical conductivity in water pH_w = pH in water
µS/cm = Micro Siemens per Centimetre

6. Proposed Development

Based on the supplied information and concept design drawings, the proposed development will comprise the construction of two three-storey warehouses, identified as Warehouse A and Warehouse B. These structures will be situated on the northern and southern perimeters of the site, respectively. Each storey within these warehouses will house four warehouse units, with individual units spanning an area of 1,400 m^2 to 3,200 m^2.

Between each storey of the two warehouse blocks, hardstand areas will be suspended, and a mezzanine carpark level is also positioned beneath the second hardstand level. Heavy vehicle access (such as for trucks) through the site will be from driveways located in the north western and south western corners of the site, off Stephen Road, and at south eastern corner of the site, off Coal Pier Road. Boundary access roads will provide access to heavy vehicles around the site and to a circular ramp, to access upper floor levels, located in the south eastern portion of site. For light vehicles and pedestrians, pavements and footpaths are proposed along the western boundary adjacent to the warehouse, with a separate ramp to the mezzanine carpark level.

It is also understood that the lowest ground floor of the warehouses and hardstand area has been designed for a finished floor level of RL11.9 m AHD. Earthworks will be required to raise surface levels by approximately 1.5 m to 2.0 m (assuming a bulk earthworks level of 11.6 m AHD) with some localised areas requiring deeper filling such as the south-eastern corner, and for backfilling of underground storage tanks. Perimeter retaining walls may be required and are likely to be similar in height to the raising of surface levels. Trenching and the installation of new services will also be required within a range of ground conditions, including existing uncontrolled fill (to be reinstated as controlled fill) and aeolian/estuarine sands.

7. Comments

7.1 Geotechnical Model

Based on the results on the field investigation, it is apparent that a consistent surfacing of fill, typically between 0.3 m and 1.5 m thickness is present across most of the site, but up to 2.5 m thick in some areas and up to 6.5 m deep in the south eastern corner and retained by reinforced earth retaining walls. Some foreign building rubble inclusions were noted within the fill in BH202, BH206 and BH208 to BH210 and included clinker, organics, metal and glass fragments, fibrous material (possible asbestos), boulders, concrete, ash and hardened resins. The results of the field testing indicate the fill is apparently poorly to moderately compacted, however as documentation associated with the existing fill across the site is not currently available, it is prudent to assume that all fill present within the site is uncontrolled from an engineering perspective.

Below the fill is aeolian and estuarine sand, silty sand and peaty sand encountered to depths of 12.8 m and 27.2 m (test termination depths) and typically grade from moist to wet, and loose to very dense with depth. Occasional stiff to hard peaty/clay bands of up to 300 mm thickness were encountered within the sandy soils at varying depths. These soils are likely to pose trafficability issues if exposed. A working surface comprising crushed concrete or durable rock fill should be provisioned following the stripping of the ground surface and placed in high construction traffic areas to improve trafficability.

Within the estuarine sand, a peaty clay layer of between 0.4 m and 2.0 m thickness was observed at depths of between 13.4 m and 17.0 m. In general, this clay layer is of medium plasticity and very stiff to hard consistency and is present in the eastern portion of the site (within BH203 to BH210, CPT105, CPT108 to CPT110, CPT112, CPT113, CPT116 to CPT119 and CPT 121 to CPT124). The presence of this clay layer will need to be addressed within the design of any piled footings, by either designing the footing as friction piles, reducing the end bearing pressure adopted in design or through further geotechnical investigation to assist in their detailed design.

Groundwater was measured at relatively shallow depths and was generally observed within the aeolian sand at depths of between 5.1 m and 5.9 m (or RL 5.1 m to RL 3.9 m). It must be recognised that groundwater levels fluctuate with prevailing weather/climate conditions as well as with external influences such as dewatering or groundwater use at neighbouring sites. Generally, a temporary rise in groundwater of at least 1 m to 2 m may be expected within sandy soils following heavy and prolonged rainfall. For preliminary assessment purposes, it is suggested that a potential groundwater level at RL6.5 m should be assumed, however this would be subject to further review, long term monitoring in additional wells with data loggers.

The interpreted subsurface profile encountered at the borehole and CPT locations has been grouped into five geotechnical materials. Four cross sections (Sections A-A' to D-D') showing the interpreted subsurface profile between the test locations are shown in Drawing 2 to 5 in Appendix B, respectively. The interpreted depth and RL at the top of the various materials at each test location is shown below in Table 4. Reference should be made to the borehole logs and CPT test results for more detailed information and descriptions of the soil profile. It should be noted that the subsurface profile will likely vary away from and in between test locations due to the high level of variability observed as well as the anthropogenic nature of the fill and other buried obstructions that may be encountered and are not obvious from the surface (such as underground storage tanks or pits).

Table 4: Summary of Geotechnical Model

Material	Depth [m] Reduced Level (m AHD) To Top of Each Material									
	BH201	**BH202**	**BH203**	**BH204**	**BH205**	**BH206**	**BH207**	**BH208**	**BH209**	**BH210**
Pavement / Fill (Existing Fill)	[0.0] (10.0)	[0.0] (10.1)	[0.0] (9.9)	[0.0] (9.9)	[0.0] (9.8)	[0.0] (9.8)	[0.0] (9.7)	[0.0] (10.0)	[0.0] (10.1)	[0.0] (8.7)
Sand (vl-l)	[2.6] (7.4)	[0.4] (9.7)	[0.6] (9.3)	[1.0] (8.9)	[0.7] (9.1)	[0.3] (9.5)	[0.5] (9.2)	[1.7] (8.3)	N.E	N.E
Sand (md)	[3.6] (6.4)	[3.5] (6.6)	[2.5] (7.4)	[4.0] (5.9)	[4.0] (5.8)	[2.0] (7.8)	[2.0] (7.7)	[4.5] (5.5)	[6.5] (3.6)	[5.8] (2.9)
Sand (d-vd)	[4.9] (5.1)	[4.5] (5.6)	[4.5] (5.4)	[5.5] (4.4)	[6.0] (3.8)	[3.0] (6.8)	[3.5] (6.2)	[6.5] (3.5)	[8.0] (2.1)	[9.0] (-0.3)
Clay (st-h)	N.E	[18.0] (-7.9)	[16.8] (-6.9)	[16.8] (-6.9)	[16.4] (-6.6)	[16.5] (-6.7)	[14.8] (-5.1)	[15.5] (-5.5)	[14.5] (-4.4)	[13.6] (-4.9)
Sand (d-vd)	N.E	[19.4] (-9.3)	[18.2] (-8.3)	[17.9] (-8.0)	[17.7] (-7.9)	[17.8] (-8.0)	[16.2] (-6.5)	[16.5] (-6.5)	[15.5] (-5.4)	[14.5] (-5.8)

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense, st = stiff, h = hard, N.E = not encountered

Table 4 continued: Summary of Geotechnical Model

Material	Depth [m] Reduced Level (m AHD) To Top of Each Material									
	CPT101	**CPT102**	**CPT103**	**CPT104**	**CPT105**	**CPT106**	**CPT107**	**CPT108**	**CPT109**	**CPT110**
Pavement / Fill (Existing Fill)	[0.0] (10.0)	[0.0] (10.2)	[0.0] (10.0)	[0.0] (10.0)	[0.0] (10.0)	[0.0] (10.0)	[0.0] (9.9)	[0.0] (10.0)	[0.0] (9.9)	[0.0] (9.8)
Sand (vl-l)	N.E	N.E	[0.4] (9.6)	[1.7] (8.3)	[1.6] (8.4)	[1.5] (8.5)	[0.5] (9.4)	[0.6] (9.4)	[1.0] (8.9)	[0.7] (9.1)
Sand (md)	[2.6] (7.4)	[0.9] (9.3)	[3.7] (6.3)	[2.9] (7.1)	[3.0] (7.0)	[2.5] (7.5)	[3.4] (6.5)	[2.4] (7.6)	[2.5] (7.4)	[2.0] (7.8)
Sand (d-vd)	[5.1] (4.9)	[3.5] (6.7)	[4.4] (5.6)	[4.0] (6.0)	[4.0] (6.0)	[4.0] (6.0)	[4.5] (5.4)	[4.2] (5.8)	[3.4] (6.5)	[3.9] (5.9)
Clay (st-h)	[14.3] (-4.3)	[14.8] (-4.6)	N.E	[14.6] (-4.6)	[18.0] (-8.0)	N.E	[9.2] (0.7)	[17.0] (-7.0)	[16.9] (-7.0)	[16.0] (-6.2)
Sand (d-vd)	[14.6] (-4.6)	[15.2] (-5.0)	N.E	[15.0] (-5.0)	[19.2] (-9.2)	N.E	[10.2] (-0.3)	[18.6] (-8.6)	[18.1] (-8.2)	[17.8] (-8.0)

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense, st = stiff, h = hard, N.E = not encountered

Table 4 continued: Summary of Geotechnical Model

Material	Depth [m] Reduced Level (m AHD) To Top of Each Material									
	CPT111	CPT112	CPT113	CPT114	CPT115	CPT116	CPT117	CPT118	CPT119	CPT120
Pavement / Fill (Existing Fill)	[0.0] (9.9)	[0.0] (9.9)	[0.0] (9.9)	[0.0] (9.7)	[0.0] (9.8)	[0.0] (10.0)	[0.0] (9.9)	[0.0] (9.8)	[0.0] (9.8)	[0.0] (10.0)
Sand (vl-l)	N.E	N.E	N.E	N.E	N.E	N.E	[2.5] (7.4)	N.E	[1.8] (8.0)	[1.7] (8.3)
Sand (md)	[0.5] (9.4)	[0.4] (9.5)	[2.8] (7.1)	[0.5] (9.2)	[0.3] (9.5)	[2.0] (8.0)	N.E	[0.5] (9.3)	[3.5] (6.3)	[3.7] (6.3)
Sand (d-vd)	[2.5] (7.4)	[3.0] (6.9)	[3.3] (6.6)	[3.8] (5.9)	[2.3] (7.5)	[2.8] (7.2)	[3.6] (6.3)	[3.5] (6.3)	[5.3] (4.5)	[5.4] (4.6)
Clay (st-h)	N.E	[16.4] (-6.5)	[15.8] (-5.9)	N.E	N.E	[16.2] (-6.2)	[15.5] (-5.6)	[14.7] (-4.9)	[15.1] (-5.3)	N.E
Sand (d-vd)	N.E	[18.0] (-8.1)	[17.4] (-7.5)	N.E	N.E	[17.6] (-7.6)	[17.1] (-7.2)	[16.7] (-6.9)	[16.9] (-7.1)	N.E

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense, st = stiff, h = hard, N.E = not encountered

Table 4 continued: Summary of Geotechnical Model

Material	Depth [m] Reduced Level (m AHD) To Top of Each Material			
	CPT121	CPT122	CPT123	CPT124
Pavement / Fill (Existing Fill)	[0.0] (9.7	[0.0] (8.9)	[0.0] (10.1)	[0.0] (8.7)
Sand (vl-l)	[3.7] (6.0)	N.E	N.E	N.E
Sand (md)	[4.8] (4.9)	[4.7] (4.2)	[6.0] (4.1)	[5.8] (2.9)
Sand (d-vd)	[5.5] (4.2)	[5.2] (3.7)	[7.8] (2.3)	[8.6] (0.1)
Clay (st-h)	[13.4] (-3.7)	[14.5] (-5.6)	[14.7] (-4.6)	[13.5] (-4.8)
Sand (d-vd)	[14.5] (-4.8)	[15.0] (-6.1)	[15.1] (-5.0)	[14.1] (-5.4)

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense, st = stiff, h = hard, N.E = not encountered

7.2 Vibrations

The use of vibratory and driven methods for compaction plant and to advance shoring boxes or sheet piles for excavation support and foundation piles may be associated with the transmission of vibrations to adjacent occupied and vacant structures.

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibrations at adjacent buildings and structures within acceptable limits. The level of acceptable vibration is dependent on various factors including the type of structure (e.g. reinforced concrete or brick structures etc.), its structural condition, the frequency range of vibrations produced by the construction equipment, the natural frequency of the structure and the vibration transmitting medium.

Ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s vector sum peak particle velocity (VSPPV). This is generally much lower than the vibration levels required to cause structural damage to buildings. The Australian Standard AS2670.2-1990 “Evaluation of human exposure to whole-body vibrations – continuous and shock induced vibrations in buildings (1-80 Hz)” indicates an acceptable day time limit of 8 mm/s VSPPV for human comfort.

Based on the experience of DP and with reference to AS2670, it is suggested that a maximum VSPPV of 8 mm/s (applicable at the foundation level of existing buildings) be employed at this site for both architectural and human comfort considerations, although this vibration limit may need to be reduced for sensitive structures or equipment in the area. Where adjacent structures are founded on loose sands a lower limit of 3 mm/s may need to be considered.

7.3 Dilapidation

Dilapidation surveys should be carried out on any adjacent existing buildings, pavements, services and other infrastructure that may be affected by the earthworks or from the installation of driven piles types (if adopted).

The dilapidation surveys should be undertaken before the commencement of any excavation work or pile driving to document any existing defects so that any claims for damage due to construction-related activities can be accurately assessed.

7.4 Site Excavation

7.4.1 Excavation and Groundwater Conditions

During the proposed works it is anticipated that excavation will be carried out through fill and natural sands. It is anticipated that the majority of the excavation work will include excavation associated with remediation, reworking of existing uncontrolled fill, service tranches, and for foundation piles.

Excavations down to depths approximately of 3 m are anticipated to be above the groundwater level, observed during the investigation, and are expected to be carried out through fill and natural sands, which should be readily excavated using conventional earthmoving equipment such as tracked excavators. It is possible that groundwater levels will fluctuate and possibly rise by 1 m to 2 m in response to prolonged and heavy rainfall and long term groundwater monitoring would be required to

assess fluctuations if required to inform design and construction. If excavations to 4 m depth, such as for buried storage tanks, coincide with dry periods they may be slightly above the groundwater table, but if the excavation coincides with or follows prolonged wet weather it is possible the groundwater may temporarily rise above the excavation level. It is usually necessary for groundwater levels to be a minimum of 1 m below the excavation to allow machinery to operate and this may require some dewatering for deeper excavations. Where possible, excavations should be limited to about 3.0 m depth and planned to avoid prolonged wet weather to reduce potential dewatering requirements.

Trafficability on the sandy soils during construction will generally require the use of tracked plant and machinery. A working surface comprising crushed concrete or durable rock fill should be provisioned following the stripping of the ground surface and placed in high construction traffic areas to improve trafficability.

Depending on the adopted foundation design and piling method, the piles would need to be installed through the fill and production rates will depend largely on the choice of foundation construction methodology, choice of equipment and skill of the operator. It is recommended that piling/foundation contractors make their own assessment of the equipment required to carry out the work as part of their tendering process. Further details of the benefits and limitations of different piling methods are provided in Section 7.6.2.

7.4.2 Disposal of Excavated materials

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines, including the Waste Classification Guidelines (EPA, 2014). This includes fill and natural materials that may be removed from the site.

Additionally, consideration must be given to the presence of potential acid sulfate soils on the site below the water table. If potential acid sulfate soils are to be disturbed or excavated, then an acid sulfate soil management plan (ASSMP) must be in place prior to disturbance/removal of these materials above the groundwater table. Reference should be made to the DP contamination assessment report for details on soil contamination and acid sulfate soils.

7.5 Site Preparation and Earthworks

Preliminary design drawings indicate the proposed warehouses will be created with a lowest finished floor level of approximately RL11.9 m. This level will generally require the importation of fill to raise existing surface levels by approximately 1.5 m to 2.0 m (assuming a bulk earthworks level of RL 11.6 m) but up to about 3.0 m in some areas and in the south-eastern part of the site.

If slab on ground construction is to be considered then all fill will need to stripped and replaced as engineered fill prior to raising of site levels with engineered fill. Impact rolling could be considered to compact the fill in-situ however this may only improve compaction to 1-2 m depth and the results can be variable, and vibrations on adjacent properties musty also be considered. Further advice on impact rolling should be sought if this is to be considered. If slabs/pavements are fully suspended on piles to below uncontrolled fill then the uncontrolled fill may be left in place with nominal compaction

DP propose the following typical site preparation measures:

- Remove all existing structures, pavements, vegetation and root affected soils, and existing fill from the development footprint and stockpile for reuse, or remove from the site, as per the following requirements and those outlined in the contamination assessment report.
- Proof roll the exposed surface using a minimum 10-tonne smooth drum roller in non-vibratory mode. The surface should be rolled a minimum of six times with the last two passes observed by an experienced geotechnical engineer to detect any soft or heaving areas. Remove any additional unsuitable soil identified during proof rolling.
- Compact the exposed base of any rework area to a minimum dry density ratio of 98%, relative to Standard compaction, maintaining the moisture content within 2% of Standard optimum moisture content (OMC) or alternatively to a relative density index of 70%.
- Place suitable site materials, or suitable imported fill, within the rework depth in 300 mm maximum thickness layers and compact to a minimum dry density ratio of 98%, relative to Standard compaction, maintaining the moisture content of the filling within 2% of Standard OMC or alternatively to a relative density index of 70%.

Geotechnical inspection and testing of the fill should be carried out in accordance with a Level 1 standard, as defined in AS3798-2007 Guidelines for Earthworks for Commercial and Residential Developments. Site stripping should be assessed by a geotechnical engineer, who should also advise on any specific requirements for material reuse.

7.6 Excavation Support

7.6.1 Batter Slopes

Unsupported vertical excavations within the fill and sand, above the water table, are not expected to stand vertically. For unsupported excavations, Table 5 provides suggested temporary and permanent batter slopes for excavations up to a maximum height of 3 m. If surcharge loads are applied near the crest of the slope, then further specific geotechnical review and probably flatter batters may be required. Batters are not recommended near existing buildings or services.

Table 5: Recommended Battery Slopes for Exposed Materials

Materials	Maximum Temporary Batter Slope (H : V)	Maximum Permanent Batter Slope (H V)
Uncontrolled Fill	2:1	2.5:1
Controlled Fill	1.5:1	2:1
Sand	1.5:1	2:1

Permanent batters, if proposed, should be protected against erosion and may need to be reduced to 3H:1V, if maintenance of grass surfacing is required.

7.6.2 Shoring/Retaining Walls

Where batter slopes cannot be used, or for excavation below the groundwater table (e.g. possible OSD tanks or similar), shoring walls will be required to support the fill and sand. Support to excavations may consider the use of gravity walls using masonry 'Keystone' block or similar, cantilever walls such as sheet pile or soldier piles, and anchored pile walls for permanent support or temporary support. Shoring boxes may be suitable for localised excavations.

Cantilevered shoring systems are not appropriate where the lateral deflection of the soil must be controlled, such as within the zone of influence of movement sensitive structures, such as footings of the existing warehouse. In particular, careful attention will need to be given to the design of excavation support adjacent to neighbouring structures. The footing type and founding level of any adjacent structures should be considered in the shoring design.

It is suggested that the preliminary design of cantilevered shoring systems (or shoring with one row of anchors or propping) be based on a triangular lateral earth pressure distribution using the earth pressure coefficients provided in Table 6. 'Active' earth pressure coefficient (K_a) values may be used where some wall movement is acceptable, and 'at rest' earth pressure (K_0) values should be used where the wall movement needs to be reduced (i.e. adjacent to existing structures or utilities).

Table 6: Recommended Design Parameters for Shoring Systems

Material	Unit Weight (kN/m^3)	Earth Pressure Coefficient		Effective Cohesion c'(kPa)	Effective Friction Angle (Degrees)
		Active (K_a)	At Rest (K_o)		
Fill (Uncontrolled)	20	0.4	0.6	0	25
Fill (Controlled)	20	0.3	0.5	0	30
Sand (vl-l)	18	0.35	0.5	0	28
Sand (md)	20	0.3	0.45	0	33
Sand (d-vd)	22	0.25	0.4	0	35

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense

The design for lateral earth pressures where multiple rows of anchors or propping are used (i.e. two rows or more of bracing) may be based on a trapezoidal earth pressure distribution. The following earth pressure magnitudes are considered appropriate, where H is the height of soil to be retained, in metres:

- 6H kPa, where some lateral movement is allowed; and
- 8H kPa, where lateral movements need to be limited (e.g. next to buildings and services).

In this trapezoidal load case, the maximum pressure generally acts over the central 60% of the wall, reducing to zero at the top and base of the wall.

The design of the shoring should also allow for all surcharge loads, including building footings, inclined slopes behind the wall, traffic, site sheds, and construction related activities.

Shoring walls should also be designed for full hydrostatic pressures unless drainage of the ground behind impermeable walls can be provided.

7.6.3 Ground Anchors

The use of temporary tieback anchors may be considered to restrict wall movements for temporary and permanent retaining walls.

The preliminary design of temporary anchors within medium-dense sand (or denser) may be based on a friction angle (Φ) of 33 degrees. Trial anchors may be used to determine if higher friction angles/shaft adhesion values are achievable. The anchors should be bonded behind a line drawn up at 45° from the base of the excavation, and proof-loading tests should be carried out to confirm the anchor capacities. Post-grouting techniques may be used to achieve higher capacities.

Movement of anchors in sand is common and care should be taken if anchors are installed under existing buildings to minimise disturbance to foundation materials. The anchors will need to be carefully positioned and possibly inclined at steeper angles to avoid adjacent services and footings for adjacent buildings. It is noted that permission from adjacent property owners will be required before installing soil anchors beneath their land.

It is recommended that only reputable, specialist anchoring contractors be engaged to design and/or install temporary anchors on this site.

7.7 Footings

In the absence of compaction records, the existing fill on the site is considered to be uncontrolled and therefore may exhibit higher variability (and associated variability in foundation pressure and settlement behaviour) than is acceptable for foundation material. It is therefore recommended that any new foundations be taken down to bear on the natural sand. DP notes that the test results indicate that the near-surface fill is generally poorly to moderately compacted and likely to have variable performance across the site.

It is expected that column loads may be relatively high and therefore it is anticipated that foundations comprise piled footings within the medium-dense sand or denser. Smaller isolated structures may be founded on high level footings within engineered fill.

The general design of pad and piled footings may be based on the following material properties and parameters given in Table 8.

Table 8: Design Parameters for Piled Foundation Design

Foundation Stratum	Effective Friction Angle (ϕ') (°)	Effective Cohesion (c') (kPa)	Unit Weight (γ) (kN/m^3)
Fill (Controlled)	28	0	20
SAND: Medium Dense	33	0	20
SAND: Dense to Very Dense	35	0	20
Clay: stiff to hard	25	5	20

7.7.1 High Level Footings

High level footings may be possible for lightly loaded structures and it is recommended that these footings found on similar material to provide uniform support to the proposed structure and to reduce the potential for differential settlements. Table 8 provides suggested footing design parameters for preliminary design of high level footings. The allowable and ultimate end bearing pressures shown in Table 9 are based on material parameters provided in Table 8 and a pad footing with a plan area of 2 m by 2 m, embedment of 0.5 m and a factor of safety equal to 2.5.

Table 9: Suggested Design Parameters for High-Level Footings

Foundation Stratum	Maximum Allowable Pressure (Serviceability)	Maximum Ultimate Pressure (Ultimate)	Young's Modulus, E (MPa)
	End Bearing (kPa)	End Bearing (kPa)	
Fill (Uncontrolled)	Not recommended		
Fill (Controlled)	150	400	10
Sand (vl-l)	Not recommended		
Sand (md)	200	550	30

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense

Foundations proportioned based on the allowable bearing pressures in Table 9 may generally experience total settlements of approximately 1% of the footing width under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

All footings should be inspected by a geotechnical engineer to confirm that foundation conditions are suitable for the design parameters.

7.7.2 Piled Footings

Significant building loads will likely require support on piles founded within or below the medium dense sand, but probably within the dense to very dense sand which is anticipated below depths of about 4 m to 6 m, but up to 8 m to 9 m in the south-eastern corner. The presence of interbedded peaty/clayey bands must also be considered in the pile design.

Continuous Flight Auger (CFA), concrete injected piles could be considered for this site, as could cast in-situ screwed concrete pile types such as Atlas or Omega piles. These types of piles are all associated with relatively low levels of noise and vibration. Screwed cast in-situ concrete piles generally leave a reinforced concrete screw shaped pile and involve lateral displacement of the soil during installation, more efficiently using the in-situ capacity of the soil. Driven piles may also be an option for this site, although specific consideration of the effects of vibration and noise at adjoining properties would be required ahead of adopting this footing type.

Open bored piles will not be appropriate due to the potential for soil collapse and bored piles drilled under bentonite would be required.

Geotechnical inspection of the proposed piles is recommended to assess whether the foundation material is consistent with that assumed by the pile design. CFA piles are a 'blind' piling technique, and therefore it is not possible for these to be inspected by a geotechnical engineer. The CFA piling subcontractor should be required to certify the pile depth, and that the piles have been found in material consistent with the foundation requirements.

7.7.2.1 Axial Design Parameters

Preliminary design of single foundation piles may be based on the values presented in Table 10. Shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the shaft adhesion values for compression in Table 10.

Pile design on this site will be challenging due to the variability of the sand profile and in particular due to the presence of clay bands and seams within the sands at varying depths. There are peaty/clayey bands up to 100-300 mm thick in sand profile and a 0.4 m and 2.0 m thick clay band between about 13.5 m and 17.0 m depth (mainly on the eastern part of the site). Additional CPTs will be required across the site and at heavily loaded column locations to confirm suitable founding depths. Relatively high bearing capacities are possible in consistent medium dense to very dense sand, however the presence of clay bands and weaker layers within the zone of influence of the pile toe will reduce the bearing capacity and also increase settlements. Generally piles should be founded 3 pile diameters above underlying weaker layers. If pile groups are used then the zone of influence is increased and therefore the depth to underlying weaker layers below the pile toe needs to be increased further.

Table 10: Recommended Preliminary Design Parameters for CFA Piles

Material	Maximum Allowable Pressure (Serviceability)		Maximum Ultimate Pressure (Ultimate)(2)		Vertical Young's Modulus E_v (MPa)
	End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)	End Bearing Pressure (kPa)	Shaft Adhesion (Compression) (kPa)	
Sand (md)	800(3)	10	2,000(3)	30	30
Sand (d-vd)	2,000(3)	20	5,000(3)	50	80
Estuarine Clay st-vst (1)	200	10	500	30	15

Notes: vl = very loose, l = loose, md = medium dense, d = dense, vd = very dense

1 not confirmed at all locations, only suitable where confirmed by testing.

2 Ultimate end bearing parameters mobilised at large settlements (i.e. >5% of the pile diameter)

3 Very low end bearing values are likely for bored piles below the water table in cohesionless soils due to the installation effects and the contribution of the base to the load capacity. The toe of the piles may also found on a clay band within the sand. The end bearing should be ignored in this case, unless further investigation is undertaken at all pile locations.

Piles designed using the allowable parameters provided would be expected to experience settlements less than 1% of the pile diameter.

It is noted that the ultimate limit state values provided in the above tables should be reduced by a suitable reduction factor. These pressures are typically mobilised at relatively large settlements /deflections (>5% of pile diameter), and as such serviceability analysis should be undertaken as part of the design process if an ultimate limit state design approach is adopted.

For pile design, a basic geotechnical strength reduction factor, Φ_{gb}, of about 0.52 (or possibly higher) calculated from Table 4.3.2 (A, B, and C) of AS2159-2009: Piling Design and Installation, is considered feasible. However, the structural engineer/pile designer will need to make their own assessment with the final (Φ_{gb}) number being dependent on the design and installation method (and associated risk rating) adopted by the structural engineer. A Φ_{gb} of 0.4 is required if pile load testing is not carried out and the ARR is 2.5 or greater.

7.7.2.2 Lateral Design Parameters

It is understood that lateral loads may be a significant consideration for the design of the piles.

The design for lateral loading (and moments) for piles should be based on appropriate design methods such as that described by either Brinch-Hansen (1961) or Broms (1964). For bored piles socketed into the soil, the ultimate limiting or allowable pressures given in Table 11 may be adopted for preliminary design.

With respect to serviceability, the deflection performance of pile foundations may be estimated using Young's modulus values for lateral loadings (E_h) given in Table 11, together with typical values of the lateral modulus of subgrade reaction (K_h).

Table 11: Preliminary Pile Design Parameters for Lateral Loading of Bored or CFA Pile Types

Unit[1]	Horizontal Young's Modulus E_h (MPa)	Horizontal Modulus of Subgrade Reaction, K_h (kPa/mm) with diameter, d, in mm[2]	Ultimate Lateral Limiting Pressure[3] (kPa)
Sand (vl-l)	6	6,000/d	100
Sand (md)	20	20,000/d	350
Sand (vd-d)	60	60,000/d	700
Clay (st-h)	10	10,000/d	250

Notes: 1 – For soil, the above modulus values are valid for a typical range of operating strains (i.e. ≤1 % strain) and within the elastic stress range; no effect of pile interaction is taken into account and larger modulus values may be appropriate for small strain circumstances (e.g. dynamic or earthquake loading).

2 – Based on published correlations for uniform – isotropic material.

3 – Ultimate lateral resistance for soils has been estimated based on a minimum embedment depth of 2 m above the laterally loaded strata and minimum pile diameter of 0.5 m. The upper 2 m of soil at the surface should be ignored in calculations of lateral capacity using these values.

It should also be noted that the above parameters (both for assessment of lateral load resistance and deflection) are ultimate values and do not incorporate a factor of safety. Because the stress-strain relationship curve for lateral loading is not linear, relatively large strains are required to mobilise full passive pressure but only relatively small strains are required to mobilise approximately half the full passive pressure, therefore it would be prudent to incorporate a factor of safety of at least 2.

The above method uses a simplified 2D ground model to assess soil behaviour. If a complex excavation or geometry must be considered, then a more detailed assessment (e.g. by numerical modelling) may be appropriate.

7.8 Pavements

It is anticipated that the subgrade for the new pavements will generally comprise sand and controlled fill. Based on the predominantly sandy nature of the soils encountered on the site, a preliminary design CBR value of 7% is considered suitable for preliminary design purposes for the sand. CBR values for the placed fill will be subject to the fill materials which should be confirmed by a geotechnical engineer and laboratory testing during subgrade preparation.

Site preparation will be required prior to the construction of the proposed pavements, hardstands, driveways and loading docks. Earthworks recommendations have been provided in Section 7.5 and should be completed with reference to AS3798-2007.

7.9 Drainage

Surface and subsoil drainage should be incorporated into the pavement and floor slab designs to prevent the ingress of moisture into the pavement and sub-floor working platform layers and any subsequent weakening of the pavement and subgrade layers. Subsoil drains should be positioned at a depth of 0.6m below the subgrade level.

7.10 Site Classification

Based on the results of the investigation the site would be classified as Class P, due to the presence of uncontrolled fill and very loose sand.

7.11 Seismic Design

Based on the sub-surface conditions encountered and the presence of very loose sand within some of the investigation locations and in accordance with the requirements of AS1170.4-2007 Structural Design Actions – Earthquake Actions in Australia, the site sub-soil is considered to correlate to Class De (deep or soft soil site). Further investigation and analysis may be possible to refine this classification.

7.12 Aggressivity

In accordance with AS2159-2009, the results of the chemical laboratory testing indicate the:

- Existing fill is typically mildly aggressive to buried concrete and moderately aggressive to buried steel with one sample noted as being severely aggressive to buried concrete (pH of 3.8).
- Aeolian and estuarine sand and clay are moderately aggressive to buried concrete and mildly aggressive to buried steel.

8. Limitations

Douglas Partners (DP) has prepared this report for this project at 49 – 51 Stephen Road, Banksmeadow in accordance with DP's proposal 219609.01.R.001.Rev0 dated 20 July 2023 and acceptance received from Daniel Galea of ESR Australia Pty Ltd. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of ESR Australia 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 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 testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

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 of work for this investigation did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill 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 fill may contain contaminants and hazardous building materials.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

November 2023

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

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.

continued next page

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.

intentionally blank

intentionally blank

Appendix B

Drawings

GENERAL LEGEND:

COL-C - CONCRETE COLUMN
COL-S - STEEL COLUMN
RSD - ROLLER SHUTTER DOOR
DP - DOWNPIPES
RW - RETAINING WALL

GEF - GROUND EXHAUST FAN
SEF - SMOKE EXHAUST FAN
SG1 - SLIDING GATE
SG2 - SWING GATE
SG3 - PEDESTRIAN SWING GATE

SITE BOUNDARY
BUILDING SETBACK
LANDSCAPE SETBACK
SOCIETAL RISK BUFFER ZONE
FNC-1 - PALISADE FENCE 2.4M (H)
FNC-2 - CHAINWIRE FENCE (2.1m H) + BARB

OFFICE AREA
WAREHOUSE AREA
FIRE SERVICES
LANDSCAPE AREA
LOBBY AREA
EXISTING TREES TO BE RETAINED

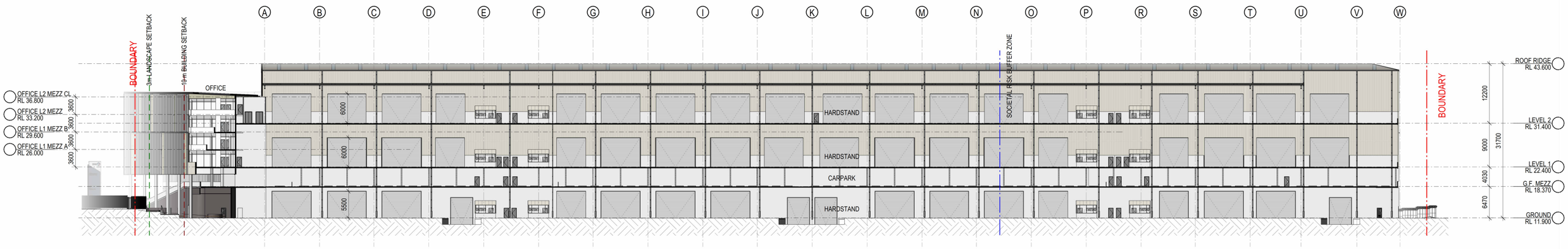
REVISIONS

REV	DESCRIPTION	DATE
P1	ISSUE FOR INFORMATION	21/06/2023
P2	ISSUE FOR INFORMATION	24/07/2023
P3	CONCEPT 2 - FOR REVIEW	03/08/2023
P4	CONCEPT 3 - FOR REVIEW	17/08/2023
P5	CONCEPT 4 - FOR REVIEW	11/12/2023
P6	PRELIMINARY PLANS	16/02/2024
P7	PROGRESS SET	08/04/2024
P8	RAMP COORDINATION	02/05/2024
P9	ADDITIONAL LOBBY STUDY	10/05/2024
P10	PROGRESS SET	31/05/2021
P11	TRAFFIC COORDINATION CAD	11/06/2024
P12	PROGRESS SET	01/07/2024
P13	UPDATED CONCEPT DESIGN	07/08/2024
P14	ISSUE FOR COMMENT	23/08/2024
P15	ISSUE FOR COORDINATION	17/10/2024
P16	DRAFT SSDA ARCHITECTURAL	18/10/2024
P17	ISSUE FOR COORDINATION	29/10/2024

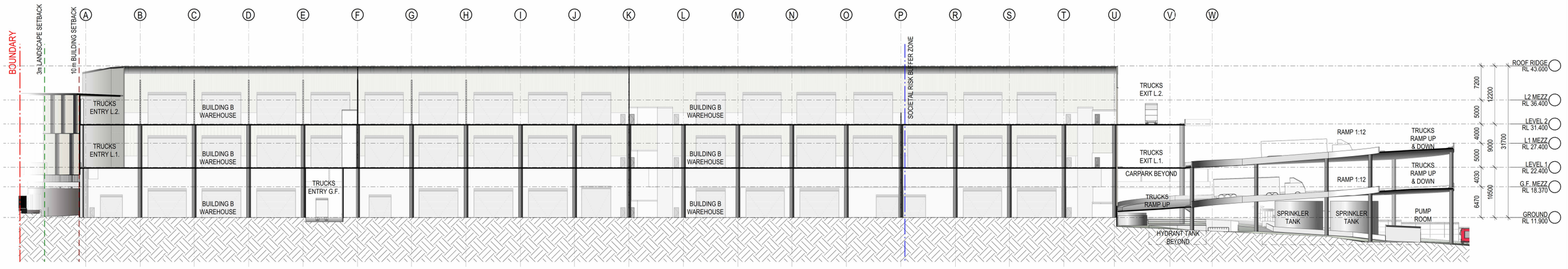
1 GROUND FLOOR PLAN 1 : 500

REVISIONS

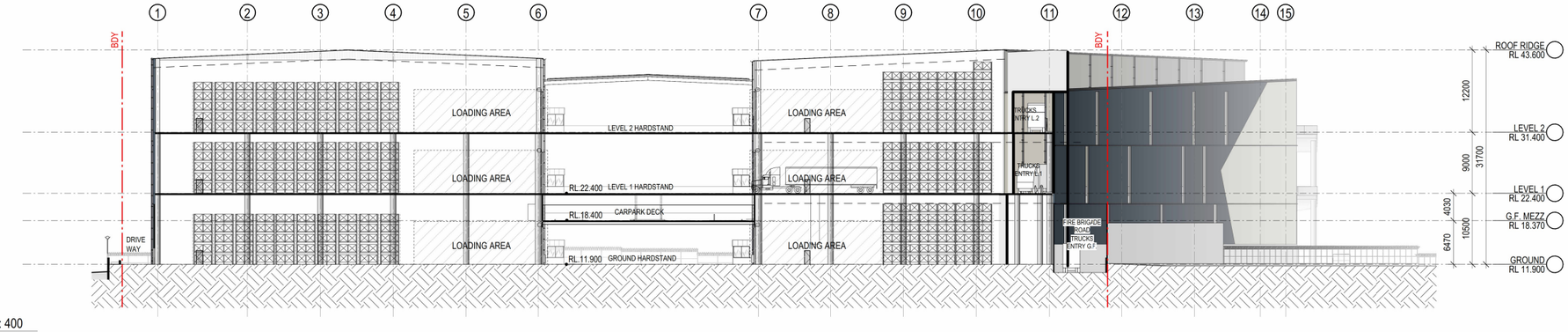
REV	DESCRIPTION	DATE
P1	ISSUE FOR INFORMATION	21/06/2023
P2	ISSUE FOR INFORMATION	24/07/2023
P3	CONCEPT 4 - FOR REVIEW	11/12/2023
P4	RAMP RELOCATION OPTIONS B	29/02/2024
P5	PROGRESS SET	08/04/2024
P6	RAMP COORDINATION	02/05/2024
P7	PROGRESS SET	01/07/2024
P8	ISSUE FOR COMMENT	23/08/2024
P9	DRAFT SSDA ARCHITECTURAL	18/10/2024
P10	ISSUE FOR COORDINATION	29/10/2024



1 SECTION A 1 : 400



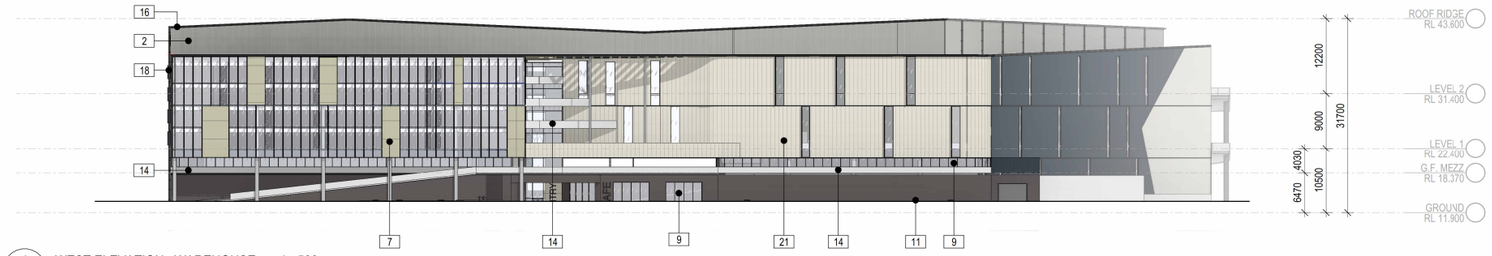
2 SECTION B 1 : 400



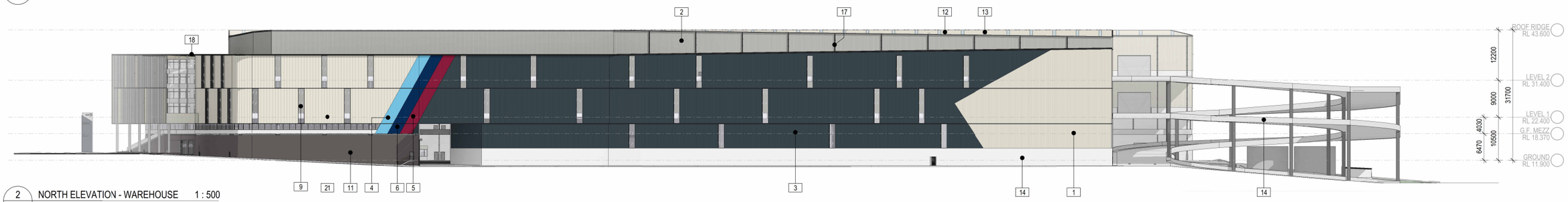
3 SECTION C 1 : 400

REVISIONS

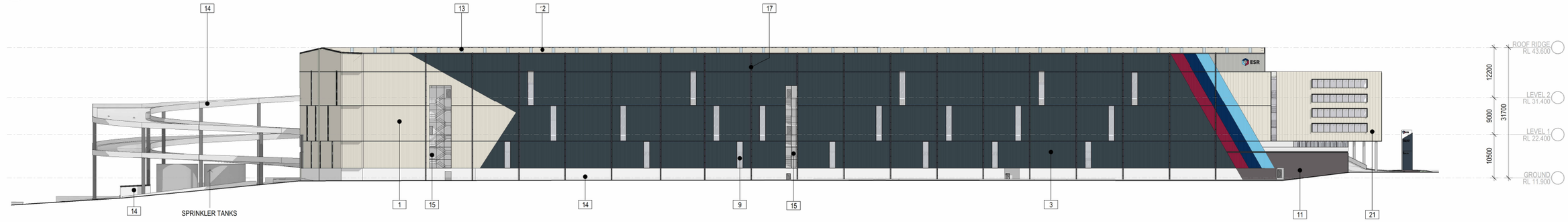
REV	DESCRIPTION	DATE
P1	ISSUE FOR INFORMATION	21/06/2023
P2	ISSUE FOR INFORMATION	24/07/2023
P3	CONCEPT 4 - FOR REVIEW	11/12/2023
P4	PROGRESS SET	08/04/2024
P5	PROGRESS SET	01/07/2024
P6	ISSUE FOR COMMENT	23/08/2024
P7	DRAFT SSDA ARCHITECTURAL	18/10/2024
P8	ISSUE FOR COORDINATION	29/10/2024



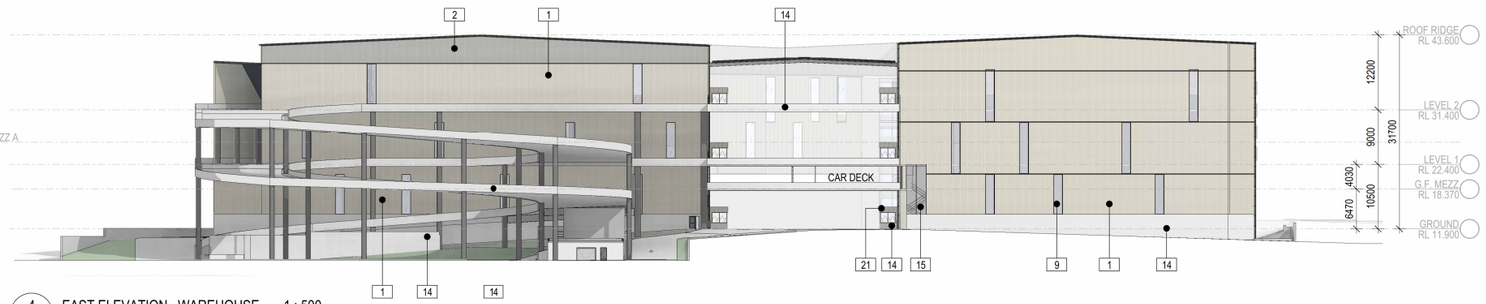
1 WEST ELEVATION - WAREHOUSE 1 : 500



2 NORTH ELEVATION - WAREHOUSE 1 : 500



3 SOUTH ELEVATION - WAREHOUSE 1 : 500



4 EAST ELEVATION - WAREHOUSE 1 : 500

INDICATIVE EXTERNAL FINISHES *FINISHES SUBJECT TO AUTHORITY AND CLIENT APPROVAL*

1. METAL WALL CLADDING - TRIMDEK PROFILE - COLORBOND - SURFMIST
2. METAL WALL CLADDING - TRIMDEK PROFILE - COLORBOND - SHALE GREY
3. METAL WALL CLADDING - TRIMDEK PROFILE - PAINT FINISH - ESR SLATE
4. METAL WALL CLADDING - TRIMDEK PROFILE - PAINT FINISH - ESR LIGHT BLUE
5. METAL WALL CLADDING - TRIMDEK PROFILE - PAINT FINISH - ESR RED
6. METAL WALL CLADDING - TRIMDEK PROFILE - PAINT FINISH - ESR BLUE
7. METAL WALL CLADDING - SOLID ALU. PANELS - BRONZE EFFECT FINISH
8. ALU. FRAME GLAZING SYSTEM - POWDERCOAT FINISH - MONUMENT
9. GLAZING - WINDOW - GLAZED GREY TINT
10. GLAZING - SPANDREL - COLORBACK - BLACK
11. BRICK FACADE -BOWRAL BRAHMAN GRANITE - STRETCHER BOND LAID
12. METAL DECK ROOF SHEETING - COLORBOND - SURFMIST
13. TRANSLUSCENT ROOF SHEETING - OPAL
14. PRECAST CONCRETE PANELS - OFF FORM FINISH
15. MESH SCREEN - METAL - DARK GREY
16. METAL BARGE CAPPING - COLORBOND - MONUMENT
17. DOWNPIPES/GUTTERS - COLORBOND - MONUMENT
18. METAL FASCIAS/WINDOW SURROUNDS - COLORBOND - MONUMENT
19. ROLLER SHUTTER DOOR - GALVANISED STEEL
20. SUNBLADES - LIGHT GREY
21. SEAMLESS METAL CLADDING - COLORBOND - SURFMIST

sba

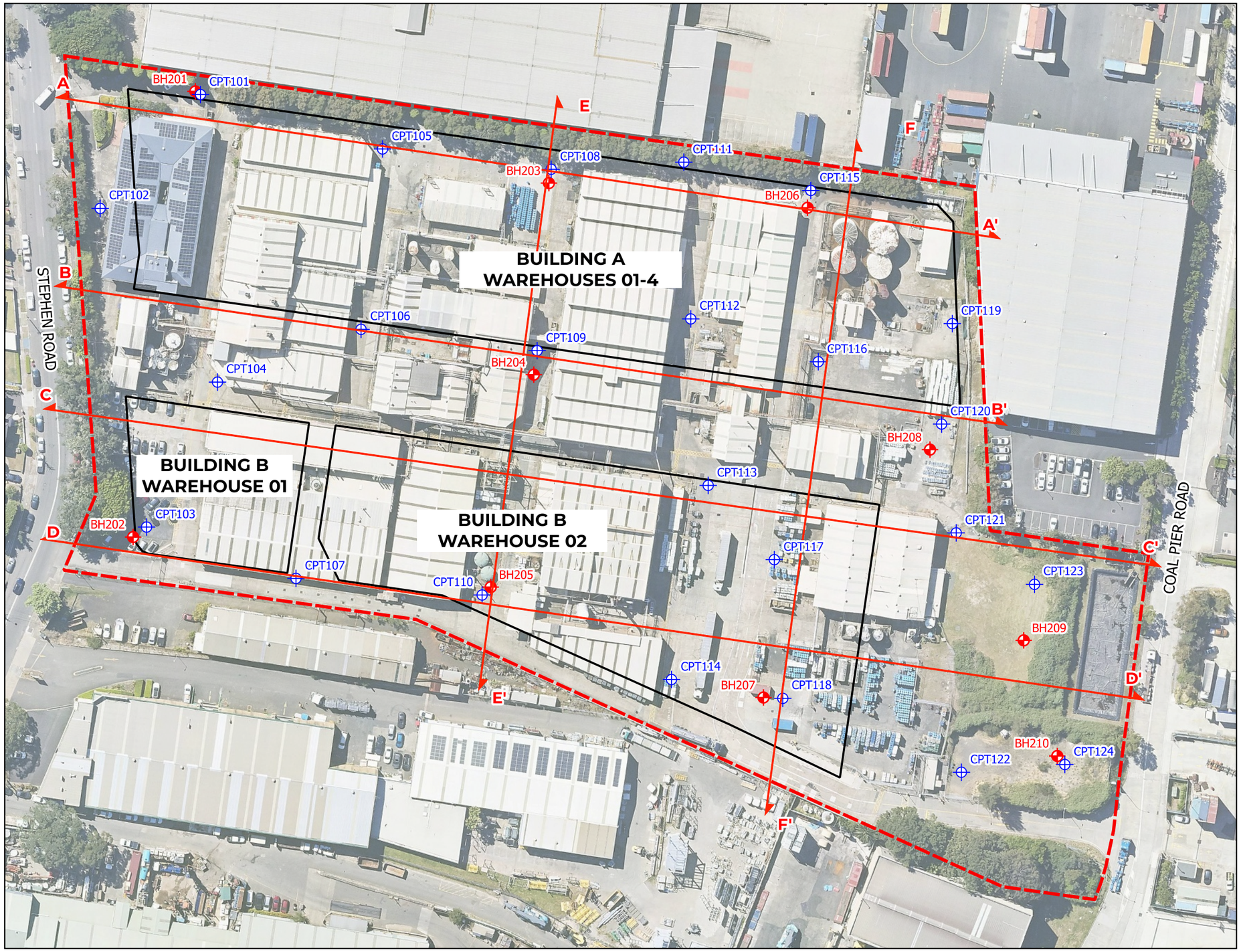
PROPOSED MULTI-LEVEL INDUSTRIAL DEVELOPMENT

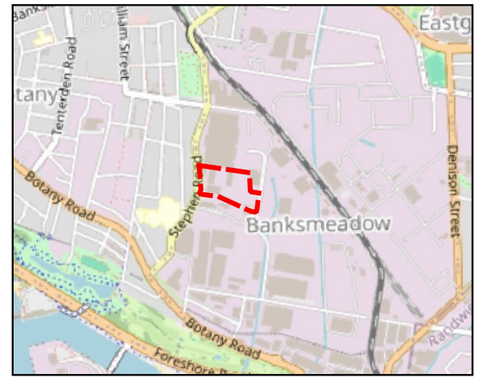
49 STEPHEN RD, BANKSMEADOW. NSW 2019

0m 5 10 20 m

WAREHOUSE ELEVATIONS

Date 29/10/2024 Scale 1:400@A1, 1:800@A3 Project No 23176 DA111 P8





Locality Plan

LEGEND

- Borehole Loaction
- CPT Location
- Approximate Site Boundary
- Proposed Building Outline

Cross Sections

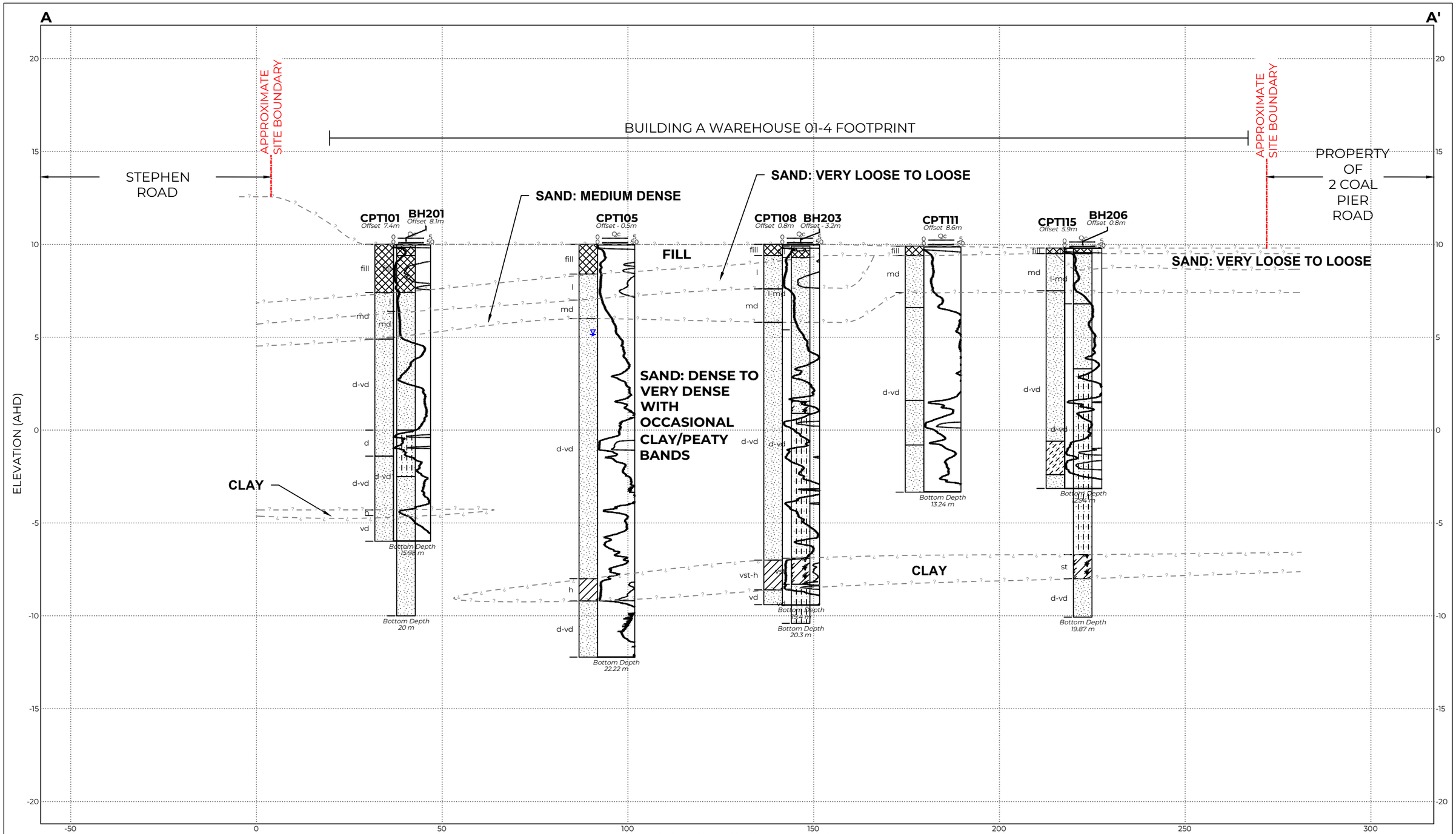
NOTE:
1: Basemap from Metromap (Dated 20.09.2024)
2: Proposed building outlines from ESR Australia Pty Ltd, Project No. 23176, Drawing No. DA100, Revision P17 (Dated 29.10.2024)

0 20 40 60 80 100 m

1:1200@ A3

Douglas PARTNERS

CLIENT: ESR Australia		TITLE: **Test Location Plan**	PROJECT No: 219609.02
OFFICE: Sydney	DRAWN BY: MN/EC	**Proposed Industrial Development**	DRAWING No: 1
SCALE: 1:1200 @ A3	DATE: 08.11.2024	**49 Stephen Road, Banksmeadow**	REVISION: 1



LEGEND

- Concrete
- Filling
- Sand
- Silty Sand
- Sand
- Peaty Clay
- Clay
- Clayey Sand

NOTES:

1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

SOIL DENSITY

- vl - Very Loose
- l - Loose
- md- Medium Dense
- d - Dense
- vd - Very Dense

ROCK STRENGTH

- VL- Very Low
- L - Low
- M - Medium
- H - High

SOIL CONSISTENCY

- vs - Very Soft
- s - Soft
- f - Firm
- st - Stiff
- vst - Very Stiff
- h - Hard

TESTS / OTHER

- Interpreted geotechnical boundary

Horizontal Scale (metres)

Vertical Exaggeration = 5.0

Douglas PARTNERS

CLIENT: ESR Australia		TITLE: **Interpreted Geotechnical Cross-Section A-A'** **Proposed Industrial Development** **49 Stephen Road, Banksmeadow**	PROJECT No: 219609.02
OFFICE: Sydney	DRAWN BY: EC/MN		DRAWING No: 2
SCALE: 1:1000 (H) 1:200 (V) @ A3	DATE: 08.11.2024		REVISION: 2

B

B'

APPROXIMATE SITE BOUNDARY

RETAINING WALL

CPT102
Offset 24.5m

CPT106
Offset 0.5m

CPT109 BH204
Offset 1.9m Offset - 5.2m

CPT112
Offset 17.6m

CPT116
Offset 10.5m

CPT120 BH208
Offset - 2.3m Offset - 10.2m

APPROXIMATE SITE BOUNDARY

PROPERTY OF 2 COAL PIER ROAD

FILL

SAND: MEDIUM DENSE

SAND: VERY LOOSE TO LOOSE

SAND: DENSE TO VERY DENSE WITH OCCASIONAL CLAY/PEATY BANDS

SAND: VERY LOOSE TO LOOSE

CLAY

CLAY

Bottom Depth 16.98 m

Bottom Depth 13.3 m

Bottom Depth 20.86 m

Bottom Depth 21.12 m

Bottom Depth 19.68 m

Bottom Depth 14.45 m

Bottom Depth 20.45 m

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

LEGEND

- Concrete
- Filling
- Sand
- Silty Sand
- Peaty Clay
- Clay

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

SOIL DENSITY
vl - Very Loose
l - Loose
md- Medium Dense
d - Dense
vd - Very Dense

ROCK STRENGTH
VL- Very Low
L - Low
M - Medium
H - High

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

TESTS / OTHER
Interpreted geotechnical boundary

Horizontal Scale (metres)
Vertical Exaggeration = 5.0

Douglas PARTNERS

CLIENT: ESR Australia		TITLE: **Interpreted Geotechnical Cross-Section B-B'** **Proposed Industrial Development** **49 Stephen Road, Banksmeadow**	PROJECT No: 219609.02
OFFICE: Sydney	DRAWN BY: EC/MN		DRAWING No: 3
SCALE: 1:1000 (H) 1:200 (V) @ A3	DATE: 08.11.2024		REVISION: 2

C

C'

APPROXIMATE SITE BOUNDARY

BUILDING B WAREHOUSE 01 FOOTPRINT

BUILDING B WAREHOUSE 02 FOOTPRINT

APPROXIMATE SITE BOUNDARY

STEPHEN ROAD

COAL PIER ROAD

SAND: MEDIUM DENSE

SAND: VERY LOOSE TO LOOSE

SAND: VERY LOOSE TO LOOSE

FILL

SAND: DENSE TO VERY DENSE WITH OCCASIONAL CLAY/PEATY BANDS

CLAY

CLAY

SAND: DENSE TO VERY DENSE

CPT104
Offset :15.1m
Bottom Depth 16.14 m

CPT113
Offset 5.2m
Bottom Depth 21.4 m

CPT117
Offset - 13.6m
Bottom Depth 20.24 m

CPT121
Offset 1.6m
Bottom Depth 24.18 m

CPT123
Offset - 10.1m
Bottom Depth 19.95 m

BH209
Offset - 26.7m
Bottom Depth 23.48 m

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

LEGEND
- Filling
- Sand
- Silty Sand
- Peaty Clay
- Clay

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

SOIL DENSITY
- vl - Very Loose
- l - Loose
- md- Medium Dense
- d - Dense
- vd - Very Dense

ROCK STRENGTH
- VL- Very Low
- L - Low
- M - Medium
- H - High

SOIL CONSISTENCY
- vs - Very Soft
- s - Soft
- f - Firm
- st - Stiff
- vst - Very Stiff
- h - Hard

TESTS / OTHER
- Interpreted geotechnical boundary

Horizontal Scale (metres)
Vertical Exaggeration = 5.0

Douglas PARTNERS

CLIENT: ESR Australia		TITLE: **Interpreted Geotechnical Cross-Section C-C'**	PROJECT No: 219609.02
OFFICE: Sydney	DRAWN BY: EC/MN	**Proposed Industrial Development**	DRAWING No: 4
SCALE: 1:1000 (H) 1:200 (V) @ A3	DATE: 08.11.2024	**49 Stephen Road, Banksmeadow**	REVISION: 2

D

D'

APPROXIMATE SITE BOUNDARY

BUILDING B WAREHOUSE 01 FOOTPRINT

BUILDING B WAREHOUSE 02 FOOTPRINT

APPROXIMATE SITE BOUNDARY

STEPHEN ROAD

COAL PIER ROAD

RETAINING WALL

SAND: VERY LOOSE TO LOOSE

FILL

SAND: MEDIUM DENSE

SAND: DENSE TO VERY DENSE WITH OCCASIONAL CLAY/PEATY BANDS

CLAY

SAND: DENSE TO VERY DENSE

CPT103 BH202
Offset 8.1m Offset 4.7m
Bottom Depth 12.76 m
Bottom Depth 20 m

CPT107
Offset - 0.4m
Bottom Depth 13.52 m

CPT110 BH205
Offset 2.6m Offset 7.1m
Bottom Depth 19.68 m
Bottom Depth 20.25 m

CPT114
Offset - 13.8m
Bottom Depth 14.38 m

CPT118 BH207
Offset - 14.6m Offset - 15.2m
Bottom Depth 20.5 m
Bottom Depth 20.6 m

CPT122
Offset - 28.4m
Bottom Depth 21.3 m

CPT124 BH210
Offset - 21.9m Offset - 19.7m
Bottom Depth 19.74 m
Bottom Depth 27.16 m

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

LEGEND

- Asphaltic Concrete
- Filling
- Sand
- Silty Sand
- Peaty Clay
- Sandy Clay
- Clay

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

SOIL DENSITY
vl - Very Loose
l - Loose
md- Medium Dense
d - Dense
vd - Very Dense

ROCK STRENGTH
VL- Very Low
L - Low
M - Medium
H - High

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

TESTS / OTHER
Interpreted geotechnical boundary

Horizontal Scale (metres)
Vertical Exaggeration = 5.0

Douglas PARTNERS

CLIENT: ESR Australia		TITLE: **Interpreted Geotechnical Cross-Section D-D'** **Proposed Industrial Development** **49 Stephen Road, Banksmeadow**
OFFICE: Sydney	DRAWN BY: EC/MN	
SCALE: 1:1000 (H) 1:200 (V) @ A3	DATE: 08.11.2024	

PROJECT No:	219609.02
DRAWING No:	5
REVISION:	2

E

E'

APPROXIMATE SITE BOUNDARY

APPROXIMATE SITE BOUNDARY

BUILDING A WAREHOUSE 01-4 FOOTPRINT

BUILDING B WAREHOUSE 02 FOOTPRINT

CPT108 *Offset - 1.7m* **BH203** *Offset - 1.9m*

CPT109 *Offset 1.6m* **BH204** *Offset 1.6m*

BH205 *Offset 10.2m* **CPT110** *Offset - 4.4m*

FILL

SAND: LOOSE

SAND: MEDIUM DENSE

SAND: DENSE TO VERY DENSE WITH OCCASIONAL CLAY/PEATY BANDS

CLAY

SAND: DENSE TO VERY DENSE

Bottom Depth 19.4 m

Bottom Depth 20.3 m

Bottom Depth 20.86 m

Bottom Depth 19.4 m

Bottom Depth 20.25 m

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

LEGEND

- Concrete
- Filling
- Sand
- Sand
- Silty Sand
- Peaty Clay
- Clay

NOTES:

1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

SOIL DENSITY
vl - Very Loose
l - Loose
md- Medium Dense
d - Dense
vd - Very Dense

ROCK STRENGTH
VL- Very Low
L - Low
M - Medium
H - High

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

TESTS / OTHER
Interpreted geotechnical boundary

0 20
Horizontal Scale (metres)
Vertical Exaggeration = 5.0

Douglas PARTNERS

CLIENT: ESR Australia		TITLE: **Interpreted Geotechnical Cross-Section E-E'**	PROJECT No: 219609.02
OFFICE: Sydney	DRAWN BY: EC/MN	**Proposed Industrial Development**	DRAWING No: 6
SCALE: 1:1000 (H) 1:200 (V) @ A3	DATE: 08.11.2024	**49 Stephen Road, Banksmeadow**	REVISION: 2

F

F'

APPROXIMATE SITE BOUNDARY

BUILDING A WAREHOUSE 01-4 FOOTPRINT

BUILDING B WAREHOUSE 02 FOOTPRINT

APPROXIMATE SITE BOUNDARY

SAND: MEDIUM DENSE

SAND: VERY LOOSE TO LOOSE

CPT115 *Offset - 13.1m*
BH206 *Offset - 13.3m*
CPT116 *Offset - 3.5m*
CPT117 *Offset - 7.5m*
CPT118 *Offset 1.1m*
BH207 *Offset - 4.6m*

Qc 0 5 50

fill
md
l-md
d-vd
st
h
vl-l
vd

FILL

SAND: DENSE TO VERY DENSE WITH OCCASIONAL CLAY/PEATY BANDS

SAND: MEDIUM DENSE

CLAY

SAND: DENSE TO VERY DENSE

Bottom Depth 12.94 m
Bottom Depth 19.87 m
Bottom Depth 19.68 m
Bottom Depth 20.24 m
Bottom Depth 20.05m

ELEVATION (AHD)

20 15 10 5 0 -5 -10 -15 -20

-50 0 50 100 150 200 250 300

DISTANCE ALONG PROFILE (m)

LEGEND

- Filling
- Sand
- Silty Sand
- Peaty Clay
- Clayey Sand
- Clay

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

SOIL DENSITY
vl - Very Loose
l - Loose
md- Medium Dense
d - Dense
vd - Very Dense

ROCK STRENGTH
VL- Very Low
L - Low
M - Medium
H - High

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

TESTS / OTHER
Interpreted geotechnical boundary

0 20
Horizontal Scale (metres)
Vertical Exaggeration = 5.0

Douglas PARTNERS

CLIENT: ESR Australia		TITLE: **Interpreted Geotechnical Cross-Section F-F'**	PROJECT No: 219609.02
OFFICE: Sydney	DRAWN BY: EC/MN	**Proposed Industrial Development**	DRAWING No: 7
SCALE: 1:1000 (H) 1:200 (V) @ A3	DATE: 08.11.2024	**49 Stephen Road, Banksmeadow**	REVISION: 2

Appendix C

Field Work Results

Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style `XW`. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	`KL`
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	`UK`
No data	Information required to allow classification of the property was not available. For example, if drilling is commenced from the base of a hole predrilled by others	`ND`
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example, providing a description of the strength of a concrete pavement	`NA`

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

intentionally blank

Soil Descriptions

Terminology
Symbols
Abbreviations

November 2023

Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:



The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to its engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub-categories. Refer "identification of minor components" below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, "INTERBEDDED Silty CLAY AND SAND".

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component [1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example (VS).

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as "extremely weathered material" in reports and by the abbreviation code XWM on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be "oversize" may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with "MIXTURE OF".

intentionally blank

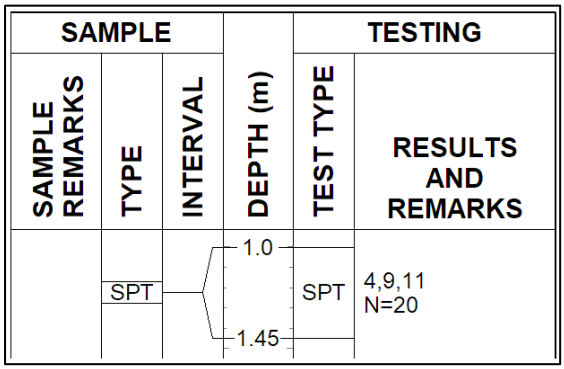
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

November 2023

Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Bulk sample	B
Core sample	C
Disturbed sample	D
Sample from SPT test	SPT
Environmental sample	ES
Gas sample	G
Undisturbed tube sample	U[1]
Water sample	W
Piston sample	P
Core sample for unconfined compressive strength testing	UCS
Material Sample	MT

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y =x blows for y mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Toothed bucket	TB[1]
Mud/blade bucket	MB[1]
Ripping tyne/ripper	R
Rock breaker/hydraulic hammer	RB
Hand auger	HA[1]
NMLC series coring	NMLC
HMLC series coring	HMLC
NQ coring	NQ3
HQ coring	HQ3
PQ coring	PQ3
Push tube	PT[1]
Rock roller	RR[1]
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD[1]
Sonic drilling	SON[1]
Vibrocore	VC[1]
Wash bore (unspecified bit type)	WB[1]
Existing exposure	X
Hand tools (unspecified)	HAND
Predrilled	PD
Diatube	DT[1]
Hollow flight auger	HSA[1]
Vacuum excavation	VE

[1] – numeric suffixes indicate tool diameter/width in mm

Douglas PARTNERS

Cone Penetration Testing

November 2023

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

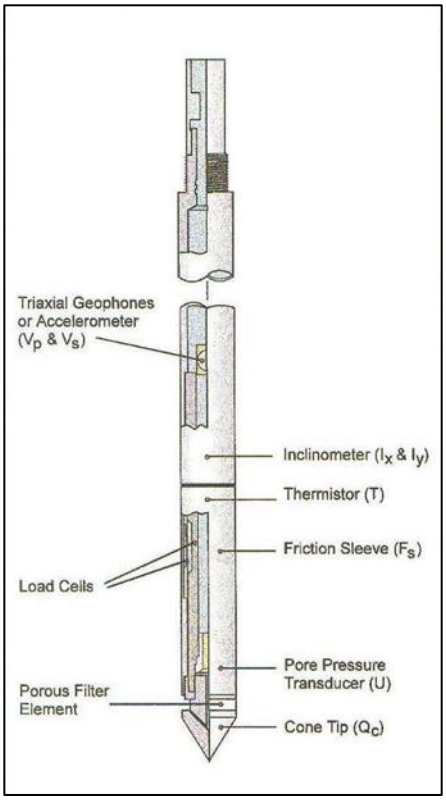


Figure 1: Cone Diagram

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 (qc, fs, i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (□) plus basic parameters
Seismic	Shear wave velocity (Vs), compression wave velocity (Vp), 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 testing

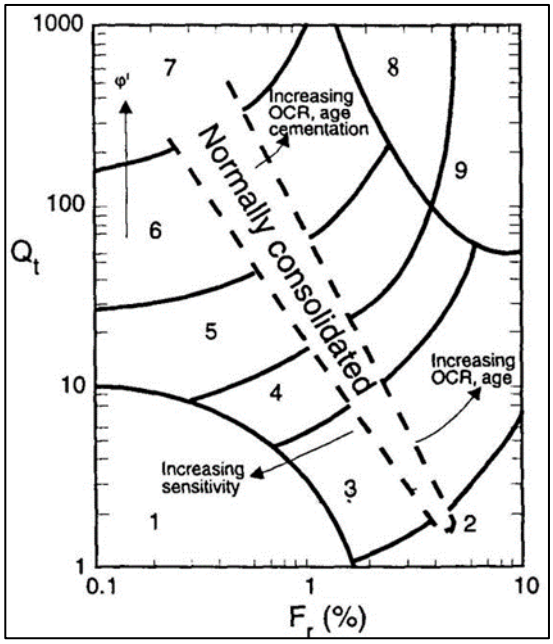


Figure 3: Soil Classification Chart

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 G0. 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.

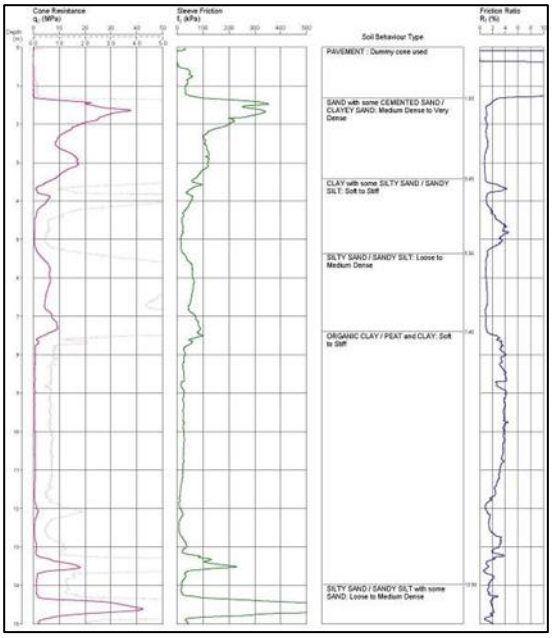


Figure 4: Sample Cone Plot

intentionally blank

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.0 AHD
COORDINATE: E:334535.9, N:6241776.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 201
PROJECT No: 219609.02
DATE: 06/09/23
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	10	0.16	CONCRETE: 8mm steel reinforcement at 0.11m depth						ES		0.16	PID	<1ppm
			FILL / SAND: pale brown and grey; fine to medium; trace fine sandstone gravel.		FILL		M		ES		0.40	PID	<1ppm
		0.60	FILL / SAND: brown and grey; fine to medium; trace fine igneous gravel.								0.50		
	9	1			FILL	(VL)	D		ES		0.90	PID	<1ppm
											1.00	PID	<1ppm
									ES			SPT	1,1,2 N=3
	8	2									1.45		
									ES		1.90	PID	<1ppm
		2.60	SAND (SP): brown and dark brown; fine to medium; with some weakly cemented bands up to 30mm thick.								2.00		
	7	3			AEO	L	D		ES		2.50	PID	<1ppm
												SPT	2,3,2 N=5
		3.60	SAND (SP): pale brown; fine to medium.								2.95		
	6	4				MD	M		ES		4.00	PID	<1ppm
												SPT	4,6,10 N=16
▼ Water Level 06/09/23											4.45		
	5	5									5		
									ES		5.50	PID	<1ppm
												SPT	7,18,28 N=46
	4	6				D to VD					5.95		
					AEO				ES		6.50	PID	<1ppm
												SPT	14,20,20 N=40
	3	7					W				6.95		
									ES		8.00	SPT	17,28,25/100 (HB)
	2	8				VD							<1ppm
											8.40	PID	
	1	9	From 9.00m: pale grey								9		
									ES		9.50	PID	<1ppm
												SPT	16,25/100 (HB)
											9.75		

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.20m, AD to 5.5m, WB to 20.0m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: JS
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

Douglas PARTNERS

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.0 AHD
COORDINATE: E:334535.9, N:6241776.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 201
PROJECT No: 219609.02
DATE: 06/09/23
SHEET: 2 of 2

GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	10.00	[CONT] SAND (SP): pale brown; fine to medium.										
		Silty SAND (SP): dark brown and dark grey; fine to medium; with peaty sands bands, typically 20-50mm in thickness.		EST	D			ES	11.00 - 11.45	11.00	PID SPT	2.5ppm 12,13,25 N=38
	12.50	SAND (SP): brown; fine to medium; trace peaty sand bands, typically 20-50mm thick.			VD			ES	12.00 - 12.30	12.00	PID SPT	<1ppm 18,28 (R)
		14.30m-14.60m: clay band			MD			ES	13.00 - 13.30	13.00	SPT PID	6,30 (R) <1ppm
								ES	14.00 - 14.45	14.00	PID SPT	<1ppm 15,15,11 N=26
						W		ES	15.00 - 15.25	15.00	PID SPT	<1ppm 15,25/100 (R)
				EST						16	SPT	35 (R) No recovery
		17.50m-17.80m: possible clay band			VD					17	SPT	25,25 (R) No recovery
										18	SPT	35 (HB) No recovery
										19	SPT	32,35 (HB) No recovery
		Borehole discontinued at 20.00m depth. Target depth reached.										

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.20m, AD to 5.5m, WB to 20.0m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: JS
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.1 AHD
COORDINATE: E:334517.6, N:6241646.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 202
PROJECT No: 219609.02
DATE: 01/09/23
SHEET: 1 of 2

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	10	0.04	ASPHALTIC CONCRETE: 40 mm		FILL				ES		0.15	PID	6.6ppm
		0.40	FILL / SAND: brown and grey; fine to medium; trace fine to coarse, angular to sub-angular igneous gravel; trace asphalt fragments.								0.25		
			SAND (SP): pale grey; fine.					ES^	ES		0.50	PID	<1ppm
											0.70		
								ES^^	ES		0.80	PID	<1ppm
	9	1									1.00	PID	<1ppm
									ES			SPT	2,3,3 N=6
			From 1.50m: yellow-brown					ES^^^			1.50	PID	<1ppm
									ES		1.70		
	8	2				L					2.00	PID	<1ppm
									ES		2.20		
											2.50	PID	<1ppm
									ES			SPT	1,2,2 N=4
	7	3					M				3.00	PID	<1ppm
									ES		3.20		
											3.50	PID	<1ppm
									ES		3.70		
	6	4				MD					4.00	PID	<1ppm
									ES			SPT	3,6,8 N=14
			From 4.50m: fine to medium								4.50	PID	<1ppm
									ES		4.70		
	5	5			AEO						5.00	PID	<1ppm
									ES		5.20		
						D					5.50	PID	<1ppm
▼ 01/09/23			5.70m-6.50m: slight sulphuric odour						ES			SPT	2,12,18 N=28
	4	6									5.95		
			6.50m-7.50m: slight to moderate sulphuric odour								6.50	PID	<1ppm
									ES			SPT	16,36,37 N=73
	3	7									6.95		
			7.50m: peaty silt lense approximately 10mm thick; slight chemical odour, slight sulphuric odour			VD	W				7.50	PID	1.2ppm
									ES			SPT	14,27,40 N=67
	2	8									7.95		
			From 8.50m: moderate sulphuric odour								8.50		
									ES			SPT	27,39,40/100 (HB) 2ppm
											8.90	PID	
	1	9									9.00	PID	<1ppm
									ES				
		9.70	Silty SAND (SM): dark brown and brown; fine		EST	D					9.70	SPT	22,30,33 N=63 3ppm
									ES				

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
OPERATOR: Ground Test (DB)
LOGGED: ZW
METHOD: DT to 0.04m, AD to 5.7m, WB to 20.0m
CASING: HW to 5.5m
REMARKS: ^Field Replicate BD1/230901; ^^Field Replicate BD2/230901; ^^^Field Replicate BD3/230901

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 3:24:22 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.1 AHD
COORDINATE: E:334517.6, N:6241646.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 202
PROJECT No: 219609.02
DATE: 01/09/23
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			to medium; with peaty sand lense approximately 70 mm thick; strong sulphuric odour.		EST	D						PID	
									ES		10.50	PID	2ppm
												SPT	16,17,25 N=42
											10.95		
									ES		11.50	PID	<1ppm
												SPT	29,75 (HB)
											11.80		
											12		
		12.50	SAND (SP): grey-brown; fine to medium; slight to moderate sulphuric odour.			VD			ES		12.50	PID	<1ppm
												SPT	17,27,27 N=54
											12.95		
									ES		13.50	SPT	28,48,61 N=100
													<1ppm
							W				13.95	PID	
									ES		14.50	PID	<1ppm
			14.65m: interbedded with sandy peat lenses, typically 50-200mm thick; slight sulphuric odour		EST	D			ES		14.65	SPT	10,15,15 N=30
													<1ppm
											14.95	PID	
			From 16.50m: odour not detected						ES		15.50	PID	<1ppm
												SPT	5,15,15 N=30
											15.95		
									ES		16.50	PID	<1ppm
												SPT	16,22,24 N=46
											16.95		
		18.00	Peaty CLAY (OL): dark brown; low to medium plasticity; trace roots and decomposed organics; moderate sulphuric odour.		EST	VSt	w=PL		ES		18.00	PID	11ppm
												SPT	6,7,12 N=19
											18.45		
											19		
		19.40	SAND (SP): pale grey; fine; trace interbedded silty clay lenses 40mm thick. Borehole discontinued at 20.00m depth. Target depth reached.		EST	VD	W		ES		19.50	PID	<1ppm
												SPT	19,39,42 N=81

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
OPERATOR: Ground Test (DB)
LOGGED: ZW
METHOD: DT to 0.04m, AD to 5.7m, WB to 20.0m
CASING: HW to 5.5m
REMARKS: ^Field Replicate BD1/230901; ^^Field Replicate BD2/230901; ^^^Field Replicate BD3/230901

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 3:24:22 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.9 AHD
COORDINATE: E:334639.3, N:6241749.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 203
PROJECT No: 219609.02
DATE: 05/09/23
SHEET: 1 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.25	CONCRETE: 250 mm						ES		0.25	PID	8ppm
		0.60	FILL / SAND: grey-brown; fine to medium; trace fine to medium igneous gravel, rootlets and decomposed organics, trace clinker.		FILL			ES^	ES		0.60	PID	<1ppm
		1	SAND (SP): pale brown; fine to medium; trace iron-cemented nodules.			L					0.80		
											1.00	PID	<1ppm
									ES			SPT	3,5,4 N=9
								ES^^	ES		1.50	PID	<1ppm
											1.70		
		2						ES^^^	ES		2.00	PID	<1ppm
											2.20		
							M				2.50	PID	<1ppm
									ES			SPT	3,5,5 N=10
		3	From 3.00m: pale grey						ES		3.00	PID	<1ppm
											3.20		
						MD			ES		3.50	PID	<1ppm
											3.70		
		4							ES		4.00	SPT	2,4,7 N=11
													<1ppm
					AEO				ES		4.50	PID	<1ppm
											4.70	PID	
▼ 05/09/23		5						ES^^^^	ES		5.00	PID	<1ppm
											5.20		
									ES		5.50	PID	<1ppm
												SPT	5,18,31 N=49
		6									5.95		
		7	7.00m: trace peaty sand lense up to 20mm thick			D	W		ES		7.00	PID	<1ppm
												SPT	5,15,23 N=38
											7.45		
		8							ES		8.00	PID	<1ppm
												SPT	16,18,30 N=48
		8.35	Peaty SAND (SP): dark grey and brown; fine to medium.		EST				ES		8.35		<1ppm
											8.45	PID	
		9.00	Silty SAND (SM): brown; fine to medium; with peaty sand bands, up to 300mm thick; slight to moderate sulphuric odour.		EST				ES		9.00	SPT	17,17,16 N=33
													<1ppm
											9.45	PID	

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.3m, AD to 5.5m, WB to 20.0 m
REMARKS: ^Field Replicate BD1/230905; ^^Field Replicate BD2/230905; ^^^Field Replicate BD3/230905; ^^^^Field Replicate BD4/230905

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: HW to 5.5m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:43:39 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.9 AHD
COORDINATE: E:334639.3, N:6241749.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 203
PROJECT No: 219609.02
DATE: 05/09/23
SHEET: 2 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	11	[CONT] Silty SAND (SM): brown; fine to medium; with peaty sand bands, up to 300mm thick; slight to moderate sulphuric odour.			D			ES		10.45	PID SPT	2.2ppm 8,20,30 N=50
	12	From 11.00m: moderate sulphuric odour; decreasing peaty sand lenses						ES		11.00 11.45 12.00 12.45	PID SPT PID SPT	2ppm 9,15,16 N=31 2ppm 15,25,26 N=51
	13	From 13.00m: grey-brown		EST	VD	W		ES		13.00 13.34	PID SPT	=<1ppm 25,44,15/40 (HB)
	14	From 14.00m: brown and dark brown; with peaty sand band, approximately 200mm thick			D			ES		14.00 14.45	SPT PID	5,19,23 N=42 <1ppm
	15				VD			ES		15.00 15.30	PID SPT	<1ppm 10,35 (HB)
	16							ES		16.00 16.30	PID SPT	<1ppm 16,38 (HB)
	16.80 17	Peaty CLAY (OL): dark grey and brown; low to medium plasticity; trace iron stained laminations; strong sulphuric odour.		EST	VSt	w=PL		ES		17.00 17.45	PID SPT	1ppm 5,7,12 N=19
	18 18.20	Silty SAND (SM): grey-brown; fine to medium.		EST	VD	W		ES		18 18.50 18.80	PID SPT	<1ppm 16,38 (HB)
	19									19		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
OPERATOR: Ground Test (DB)
LOGGED: ZW
METHOD: DT to 0.3m, AD to 5.5m, WB to 20.0 m
CASING: HW to 5.5m

REMARKS: ^Field Replicate BD1/230905; ^^Field Replicate BD2/230905; ^^^Field Replicate BD3/230905; ^^^^Field Replicate BD4/230905

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:43:40 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.9 AHD
COORDINATE: E:334639.3, N:6241749.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 203
PROJECT No: 219609.02
DATE: 05/09/23
SHEET: 3 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	20.00	Silty SAND (SM): grey; medium.		EST	VD	W		ES		20.22	PID SPT	<1ppm 35,25/70 (HB)
		Borehole discontinued at 20.30m depth. Target depth reached.										

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.3m, AD to 5.5m, WB to 20.0 m
REMARKS: ^Field Replicate BD1/230905; ^^Field Replicate BD2/230905; ^^^Field Replicate BD3/230905; ^^^^Field Replicate BD4/230905

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: HW to 5.5m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:43:40 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.9 AHD
COORDINATE: E:334634.9, N:6241693.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 204
PROJECT No: 219609.02
DATE: 04/09/23
SHEET: 1 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.11	CONCRETE: 110 mm						ES		0.15	PID	2ppm
			FILL / SAND: brown; fine to medium; trace metal fragments, iron cemented nodules . From 0.50m: pale grey-brown		FILL						0.25		
									ES		0.50	PID	2ppm
											0.70		
		1.00	SAND (SP): pale yellow-brown; fine to medium; with weakly cemented dark brown bands. From 1.20m: dark brown			L	M		ES		1.00	PID	1ppm
												SPT	2,3,3 N=6
								ES^	ES		1.50	PID	<1ppm
											1.70		
		2						ES^^	ES		2.00	PID	<1ppm
											2.20		
			From 2.50m: grading to pale grey						ES		2.50	PID	<1ppm
												SPT	2,3,4 N=7
		3							ES		3.00	PID	<1ppm
											3.20		
									ES		3.50	PID	<1ppm
											3.70		
		4			AEO	MD			ES		4.00	PID	<1ppm
												SPT	3,9,12 N=21
								ES^^^	ES		4.50	PID	<1ppm
											4.70		
▼ 04/09/23		5						ES^^^^	ES		5.00	PID	<1ppm
											5.20		
						D			ES		5.50	PID	<1ppm
												SPT	5,15,19 N=34
		6									5.95		
		7.00	SAND (SP): pale grey; fine; trace peaty clay lenses, typically 5mm thick; slight sulphuric odour.		EST	VD	W		ES		7.00	PID	<1ppm
												SPT	13,23,36 N=59
											7.45		
		8.00	Peaty SAND (SP): grey and brown; fine to medium; with clay; moderate sulphuric odour, slight hydrocarbon odour.		EST				ES		8.00	PID	2ppm
												SPT	16,41,25/80 (HB)
											8.38		
		9.00	Silty SAND (SM): brown; fine to medium; with peaty clay; moderate to strong sulphuric odour, slight hydrocarbon odour; possible hydrocarbon staining.		EST	D			ES		9.00	SPT	11,19,21 N=40
													5ppm
						VD					9.45	PID	

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
OPERATOR: Ground Test (SS)
LOGGED: ZW
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
CASING: Nil

REMARKS: ^Field Replicate BD1/230904; ^^Field Replicate BD2/230904; ^^^Field Replicate BD3/230904; ^^^^Field Replicate BD4/230904; ^^^^^Field Replicate BD5/230904

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.9 AHD
COORDINATE: E:334634.9, N:6241693.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 204
PROJECT No: 219609.02
DATE: 04/09/23
SHEET: 2 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE		REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	11	[CONT] Silty SAND (SM): brown; fine to medium; with peaty clay; moderate to strong sulphuric odour, slight hydrocarbon odour; possible hydrocarbon staining.		EST	VD				ES		10.45	PID SPT	<1ppm 12,25,38 N=63
		11.00m: slight hydrocarbon and slight sulphuric odour							ES		11.00 11.45	PID SPT	5ppm 16,28,44 N=72
	12.00	SAND (SP): brown; fine to medium; with peat, dark brown peaty clay bands, typically 50mm thick.			D				ES		12.00 12.45	PID SPT	<1ppm 17,24,18 N=42
	13	From 13.30m: dark grey and brown; with peaty clay bands, up to 200mm thick; moderate sulphuric odour			VD	W			ES ES		13.00 13.30 13.41	PID SPT PID	2ppm 11,15,25/110 (HB) <1ppm
	14			EST	D				ES		14.00 14.45	SPT PID	10,20,27 N=47 <1ppm
	15	From 15.00m: brown; slight sulphuric odour			VD				ES		15.00 15.36	PID SPT	<1ppm 20,37,25/60 (HB)
	16								ES		16.00 16.45	PID SPT	<1ppm 15,27,30 N=57
	16.80 17	Peaty CLAY (OL): dark grey and brown; low to medium plasticity; trace iron stained laminations and iron-stained gravel; strong sulphuric odour.		EST	VSt	w=PL		ES^^^^^	ES		17.00 17.45	PID SPT	5ppm 4,8,17 N=25
	17.90 18	SAND (SP): grey; fine to medium; trace carbonaceous clasts and peaty sand lenses (10 -20 mm); slight sulphuric odour.									18		
	19			EST	VD	W			ES		18.50 18.87 19	PID SPT	<1ppm 27,42,25/70 (HB)

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
OPERATOR: Ground Test (SS)
LOGGED: ZW
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
CASING: Nil

REMARKS: ^Field Replicate BD1/230904; ^^Field Replicate BD2/230904; ^^^Field Replicate BD3/230904; ^^^^Field Replicate BD4/230904; ^^^^^Field Replicate BD5/230904

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.9 AHD
COORDINATE: E:334634.9, N:6241693.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 204
PROJECT No: 219609.02
DATE: 04/09/23
SHEET: 3 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	20	[CONT] SAND (SP): grey; fine to medium; trace carbonaceous clasts and peaty sand lenses (10 -20 mm); slight sulphuric odour.		EST	VD	W		ES			PID SPT	<1ppm 24,36,25/100 (HB)
	-1 / 21	Borehole discontinued at 20.40m depth. Target depth reached.								20.40		
	-2 / 22									22		
	-3 / 23									23		
	-4 / 24									24		
	-5 / 25									25		
	-6 / 26									26		
	-7 / 27									27		
	-8 / 28									28		
	-9 / 29									29		
	0											

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
REMARKS: ^Field Replicate BD1/230904; ^^Field Replicate BD2/230904; ^^^Field Replicate BD3/230904; ^^^^Field Replicate BD4/230904; ^^^^^Field Replicate BD5/230904

OPERATOR: Ground Test (SS)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.8 AHD
COORDINATE: E:334622.3, N:6241631.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 205
PROJECT No: 219609.02
DATE: 07/09/23
SHEET: 1 of 3

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/09/23 No free groundwater observed whilst augering	9.80 / 0.00	CONCRETE: no reinforcement observed						ES		0.25	PID	<1ppm
	9.57 / 0.23	FILL / SAND: brown, pale grey and grey; fine to medium; with fine to medium igneous and sandstone gravel; trace clay.	FILL	FILL				ES		0.50	PID	<1ppm
	9.10 / 0.70	SAND (SP): pale grey; fine to medium; with brown and dark brown weakly cemented bands typically 20 to 50 mm thick.		AEO	VL to L	D		ES		0.90	PID	<1ppm
										1.00	PID	<1ppm
								ES			SPT	2,2,2 N=4
										1.45		
										2.50	PID	<1ppm
	7.20 / 2.60	SAND (SP): pale brown and pale grey; fine to medium.			L			ES			SPT	1,2,3 N=5
										2.95		
										4.00		
								ES			SPT	2,6,8 N=14
						M					PID	<1ppm
				AEO						4.45	PID	
					MD							
										5.50	PID	<1ppm
								ES			SPT	2,10,15 N=25
										5.95		
										6.50	PID	<1ppm
	3.10 / 6.70	Silty SAND (SM): grey and dark grey; fine to medium; with peaty sand bands typically 20 to 50 mm thick; moderate sulphuric odour.						ES			SPT	20,33 (R)
										6.80		
						W						
					VD					8.00	PID	3ppm
				EST				ES			SPT	19,31 (R)
										8.30		
										9.00		
								ES			SPT	21,36 (R)
										9.30	PID	6ppm

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: JS
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.8 AHD
COORDINATE: E:334622.3, N:6241631.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 205
PROJECT No: 219609.02
DATE: 07/09/23
SHEET: 2 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
		10.00	[CONT] Silty SAND (SM): grey and dark grey; fine to medium; with peaty sand bands typically 20 to 50 mm thick; moderate sulphuric odour.			D			ES		10.45	SPT PID	12,19,28 N=47 14ppm
	-1		Silty SAND (SM): brown and dark brown; trace peaty sand bands, typically 20-50mm thick; moderate sulphuric odour.		EST						11.00	PID SPT	3ppm 26,43 (R)
	11								ES		11.30		
		11.50	SAND (SP): brown, grey and pale brown; fine to medium; trace peaty sand bands, typically 20 to 50 mm thick; moderate sulphuric odour.								12.00	PID SPT	3ppm 16,33 (R)
	-2								ES		12.30		
	12										13.00	PID	2ppm
	-3								ES		13.45	SPT	14,25,25 N=50
	13						W						
	-4					VD					14.00	PID	<1ppm
	14		From 14.00m: odour not detected		EST				ES		14.30	SPT	20,35 (R)
	-5										15.00		
	15								ES		15.45	SPT PID	16,20,25 N=45 <1ppm
	-6										16.00	PID	4ppm
	16								ES		16.45	SPT	16,14,11 N=25
		16.40	Peaty Silty CLAY (OL): dark grey; low to medium plasticity; with peat layers up to 100 mm thick; moderate sulphuric odour.								17.00	PID	4ppm
	-7				EST	VSt	w<PL		ES		17.45	SPT	6,11,14 N=25
	17												
		17.70	SAND (SP): grey; fine to medium; trace clay and peaty sand.								18.50	PID	<1ppm
	-8								ES		18.80	SPT	24,38 (R)
	18												
	-9				EST	VD	W						
	19												
	-10												

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: JS
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

Douglas PARTNERS

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.8 AHD
COORDINATE: E:334622.3, N:6241631.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 205
PROJECT No: 219609.02
DATE: 07/09/23
SHEET: 3 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	21	[CONT] SAND (SP): grey; fine to medium; trace clay and peaty sand.		EST	VD	W		ES		20.25	SPT	28,25/100 (HB) No Recovery
		Borehole discontinued at 20.25m depth. Target depth reached.										

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: JS
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.8 AHD
COORDINATE: E:334715.0, N:6241742.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 206
PROJECT No: 219609.02
DATE: 08/09/23
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.15	CONCRETE: 150 mm						ES		0.15	PID	1.2ppm
		0.30	FILL / SAND: pale grey; fine to medium; trace igneous and ironstone gravel, trace clinker; decomposed organics.		FILL						0.25		
			SAND (SP): pale grey; fine to medium.					ES^	ES		0.50	PID	<1ppm
						L					0.70		
											1.00	PID	<1ppm
									ES			SPT	2,4,5 N=9
								ES^^	ES		1.50	PID	<1ppm
											1.70		
								ES^^^	ES		2.00	PID	<1ppm
						MD	M				2.20		
											2.50	PID	<1ppm
									ES			SPT	4,9,14 N=23
									ES		3.00	PID	<1ppm
					AEO						3.20		
									ES		3.50	PID	<1ppm
											3.70		
									ES		4.00	PID	<1ppm
												SPT	2,19,24 N=43
											4.45		
▼ 08/09/23								ES^^^^	ES		5.00	PID	<1ppm
											5.20		
									ES		5.50		
												SPT	6,16,21 N=37
						D					5.95		
		6.50	Silty SAND (SM): grey; fine to medium; slight sulphuric odour.						ES		6.50	PID	<1ppm
												SPT	16,21,26 N=47
							W				6.95		
									ES		8.00		
					EST							SPT	20,18,25 N=43
			From 8.35m: with peaty sand bands, typically 50-200mm thick						ES		8.35	PID	<1ppm
											8.45	PID	<1ppm
											9.50	PID	<1ppm
						VD			ES			SPT	18,31 (HB)
											9.80		

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 19.5m
REMARKS: ^Field Replicate BD1/230908; ^^Field Replicate BD2/230908; ^^^Field Replicate BD3/230908; ^^^^Field Replicate BD4/230908

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.8 AHD
COORDINATE: E:334715.0, N:6241742.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 206
PROJECT No: 219609.02
DATE: 08/09/23
SHEET: 2 of 2

GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	11.00	[CONT] Silty SAND (SM): grey; fine to medium; slight sulphuric odour.		EST	VD							
	11.00	Silty SAND (SM): brown; fine to medium; with peaty sand bands, typically 50-200m thick.			D			ES		11.00	PID	<1ppm
										11.45	SPT	11,16,12 N=28
	12				VD					12		
								ES		12.50	PID	<1ppm
										12.73	SPT	25,27/80 (HB)
	13					W				13		
				EST								
	14	From 14.00m: moderate sulphuric odour						ES		14.00	PID	1ppm
										14.45	SPT	10,14,25 N=39
					D							
	15	15.20m: peaty sand lense						ES		15.00	PID	2ppm
										15.45	SPT	4,13,24 N=37
	16									16		
	16.50	Peaty CLAY (OL): dark grey; low to medium plasticity; moderate sulphuric odour.		EST	H	w=PL		ES		16.50	PID	4ppm
	17									16.95	SPT	5,18,18 N=36
	17.80	SAND (SP): brown and grey; fine to medium; trace peaty sand bands, typically 50mm thick; slight sulphuric odour.		EST	D to VD	W		ES		18.00	PID	<1ppm
	18									18.30	SPT	22,25,13 N=38
	19									19		
		Borehole discontinued at 19.87m depth. Target depth reached.						ES		19.50	PID	<1ppm
										19.87	SPT	16,24,20/70 (HB)

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 19.5m
REMARKS: ^Field Replicate BD1/230908; ^^Field Replicate BD2/230908; ^^^Field Replicate BD3/230908; ^^^^Field Replicate BD4/230908

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.7 AHD
COORDINATE: E:334702.1, N:6241599.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 207
PROJECT No: 219609.02
DATE: 31/08/23
SHEET: 1 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0	FILL / Silty SAND: grey and brown; fine to medium; trace clinker, ironstone and sandstone gravel.		FILL				ES		0.50	PID	<1ppm
	0.50	SAND (SP): pale brown; fine to medium; with some weakly cemented bands, up to 30mm thick.								0.70		
	1				L			ES		1.00	PID	<1ppm
											SPT	3,3,5 N=8
		From 1.50m: pale grey and brown						ES		1.50	PID	<1ppm
	2									1.70		
								ES		2.00	PID	<1ppm
										2.20		
		From 2.50m: pale yellow brown			MD	M		ES		2.50	PID	<1ppm
	3										SPT	3,4,6 N=10
								ES		3.00	PID	<1ppm
										3.20		
								ES		3.50	PID	<1ppm
	4									3.70		
		From 4.15m: pale grey						ES		4.00	SPT	3,13,17 N=30
												<1ppm
								ES		4.50	PID	<1ppm
	5			AEO	D					4.70	PID	
								ES		5.00	PID	<1ppm
										5.20		
▼ 31/08/23								ES		5.50	PID	<1ppm
	6										SPT	3,12,20 N=32
										5.95		
		6.50m: trace silty clay laminations						ES		6.50	PID	<1ppm
	7										SPT	13,24,32 N=56
										6.95		
		7.50m: peaty clay lense			VD	W						
	8	From 8.00m: dark grey and grey; moderate sulphuric odour						ES		8.00	PID	<1ppm
											SPT	20,32,42 N=74
										8.45		
	9.00	Silty SAND (SM): brown; fine; moderate sulphuric odour.			D			ES		9.00	SPT	9,13,17 N=30
				EST								<1ppm
					VD					9.45	PID	

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: AD to 5.5m, WB to 20.5m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.7 AHD
COORDINATE: E:334702.1, N:6241599.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 207
PROJECT No: 219609.02
DATE: 31/08/23
SHEET: 2 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			[CONT] Silty SAND (SM): brown; fine; moderate sulphuric odour.			VD						PID	<1ppm
									ES		10.45	SPT	12,21,39 N=60
	11		From 11.00m: brown; trace silty clay bands								11.00	PID	<1ppm
									ES		11.45	SPT	20,35,38 N=73
	12					D					12.00	PID	<1ppm
					EST		W		ES		12.45	SPT	19,21,14 N=35
			12.43m: grey-brown; with clay bands and iron indurated bands										
	13		From 13.00m: pale grey brown; odour not detected			VD					13.00	PID	<1ppm
									ES		13.45	SPT	20,38,42 N=80
	14										14.00		
									ES		14.45	SPT	23,33,34 N=67
													<1ppm
		14.80										PID	
	15		Peaty CLAY (OL): dark grey; low plasticity; trace iron cemented bands, strong sulphuric odour.								15.00	PID	10ppm
					EST	St	w=PL		ES		15.45	SPT	3,6,9 N=15
	16										16.00	PID	10ppm
		16.20							ES		16.20	SPT	4,10,21 N=31
			Silty SAND (SM): grey; fine to medium.						ES		16.45		<1ppm
												PID	
	17		From 17.00m: grey-brown; trace sandy peat lenses; slight sulphuric odour								17.00	PID	<1ppm
									ES		17.45	SPT	15,19,25/100 (HB)
	18				EST	VD	W				18		
			From 18.50m: decreasing peat lenses; odour not detected								18.50	PID	<1ppm
									ES		18.89	SPT	21,35,25/90 (HB)
	19										19		

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: AD to 5.5m, WB to 20.5m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

Douglas PARTNERS

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 9.7 AHD
COORDINATE: E:334702.1, N:6241599.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 207
PROJECT No: 219609.02
DATE: 31/08/23
SHEET: 3 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	20	[CONT] Silty SAND (SM): grey; fine to medium.		EST	VD	W		ES	20.38		PID SPT	<1ppm 30,49,25/80 (HB)
		Borehole discontinued at 20.50m depth. Target depth reached.										

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: AD to 5.5m, WB to 20.5m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

Douglas PARTNERS

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.0 AHD
COORDINATE: E:334750.8, N:6241671.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 208
PROJECT No: 219609.02
DATE: 30/08/23
SHEET: 1 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.14	CONCRETE: 6mm reinforcement at 0.09m						ES		0.20	PID	12ppm
			FILL / SAND: brown; fine to medium; trace fine to medium igneous gravel, glass fragments and ironstone gravel.								0.40		
	9	1	From 0.40m: dark brown with yellow specks, slight hydrocarbon odour		FILL	(VL) to (L)			ES		0.50	PID	12ppm
											0.70		
			1.45m: asbestos containing material						ES		0.80	PID	12ppm
											1.00	PID	<1ppm
									ES			SPT	2,2,2 N=4
											1.50	PID	<1ppm
		1.70							ES		1.70		
	8	2	SAND (SP): pale grey; fine to medium.				M		ES		1.80	PID	<1ppm
											2.00		
											2.30	PID	<1ppm
								ES^	ES		2.50		
					AEO				ES			SPT	2,2,2 N=4
	7	3	From 3.00m: grey			L					2.80		<1ppm
									ES		3.00	PID	<1ppm
												PID	
											3.30	PID	<1ppm
		3.60							ES		3.50		
			Silty SAND (SM): dark brown; fine.								3.80	PID	<1ppm
	6	4							ES		4.00		
												SPT	3,4,5 N=9
							D		ES		4.30		<1ppm
											4.50	PID	
	5	5							ES		4.80	PID	<1ppm
											5.00		
▼ 30/08/23									ES		5.30	PID	<1ppm
						MD					5.50		
					EST							SPT	2,8,15 N=23
	4	6									6		
			From 6.50m: brown, trace interbedded peat and clay lenses, slight sulphuric odour								6.50	PID	<1ppm
									ES			SPT	3,13,21 N=34
	3	7				D					6.95		
			From 7.70m: dark brown, with organic silts, moderate sulphuric odour, possible hydrocarbon staining and hydrocarbon odour				W				7.50		
									ES			SPT	8,16,23 N=39
	2	8.00									7.95		<1ppm
			SAND (SP): pale grey; fine to medium; trace dark grey silty sand lenses; slight to moderate sulphuric odour.									PID	
											8.50	PID	<1ppm
									ES			SPT	21,35,41 N=76
	1	9			EST	VD					8.95		
												SPT	25,30 (HB) no sample recovered

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
REMARKS: ^Field Replicate BD/230830

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.0 AHD
COORDINATE: E:334750.8, N:6241671.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 208
PROJECT No: 219609.02
DATE: 30/08/23
SHEET: 2 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	11 / 1	[CONT] SAND (SP): pale grey; fine to medium; trace dark grey silty sand lenses; slight to moderate sulphuric odour.		EST	VD	W		ES	10.50–10.75	10.50	PID SPT	<1ppm 35,45/100 (HB)
	12 / 2							ES	11.50–11.80	11.50	PID SPT	<1ppm 29,38 (HB)
	13 / 3	From 13.00m: grey, with peaty clay lenses, moderate sulphuric odour						ES	12.50–12.85	12.50	PID SPT	<1ppm 8,35,22/50 (HB)
					D			ES ES	13.50–13.60 13.60–13.95	13.50 13.60 13.95	SPT PID PID	5,17,20 N=37 <1ppm <1ppm
	14 / 4				VD			ES	14.50–14.85	14.50	PID SPT	<1ppm 21,32,14/50 (HB)
	15 / 5											
	15.50	Peaty CLAY (OL): dark grey; low to medium plasticity; trace sand; strong sulphuric odour.		EST	VSt	w=PL		ES	15.50–15.95	15.50	PID SPT	<1ppm 5,7,11 N=18
	16 / 6											
	16.50	Silty SAND (SM): grey-brown; fine; with interbedded peaty clay lenses; trace iron cemented bands; moderate to strong sulphuric odour.										
	17 / 7				D to VD			ES	17.00–17.45	17.00	PID SPT	<1ppm 13,12,18 N=30
	18 / 8			EST		W						
	19 / 9				VD			ES	18.50–18.95	18.50	PID SPT	<1ppm 14,28,36 N=64

NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
REMARKS: ^Field Replicate BD/230830

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

Douglas PARTNERS

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.0 AHD
COORDINATE: E:334750.8, N:6241671.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 208
PROJECT No: 219609.02
DATE: 30/08/23
SHEET: 3 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	-11	21	[CONT] Silty SAND (SM): grey-brown; fine; with interbedded peaty clay lenses; trace iron cemented bands; moderate to strong sulphuric odour.		EST	VD	W		ES		20.45	PID SPT	<1ppm 17,31,40 N=71 no sample recovered
	-12	22	Borehole discontinued at 20.45m depth. Target depth reached.										
	-13	23											
	-14	24											
	-15	25											
	-16	26											
	-17	27											
	-18	28											
	-19	29											

NOTES: [#]Soil origin is "probable" unless otherwise stated. [^]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: DT to 0.2m, AD to 5.5m, WB to 20.0m
REMARKS: ^Field Replicate BD/230830

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.1 AHD
COORDINATE: E:334778.3, N:6241616.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 209
PROJECT No: 219609.02
DATE: 11/09/23
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
11/09/23 No free groundwater observed whilst augering	10	0	FILL / Silty SAND: dark grey-brown; fine to medium; low plasticity silt; with fine to coarse igneous and sandstone gravels; trace concrete fragments, clinker, ash and resin (white and yellow acrylic in appearance) and rootlets; possibly hydrocarbon stained; slight hydrocarbon odour; grass cover.		FILL	VC	M		A/ES		0.20	PID	4ppm	Bentonite	
									ES		0.50	PID	13ppm		
	9	1									0.70				
									ES		1.00				
									ES		1.20	SPT	5,6,5 N=11		
											1.45	PID	20ppm		
	8	2	2.20m: asbestos containing material						ES		2.00	PID	14ppm		
											2.20				
			From 2.50m: with clay and concrete rubble; moderate chemical odour						ES		2.50	PID	137ppm		
	7	3									2.90	SPT	9,15,17/100 (HB)		
									ES		3.50	PID	160ppm		
											3.70				
	6	4	From 4.00m: decreasing anthropogenic inclusions						ES		4.00	SPT	3,8,4 N=12		
											4.45	PID	150ppm		
	5	5	From 5.00m: no observable anthropogenic inclusions; trace rootlets						ES		5.00	PID	267ppm		
											5.20				
									ES		5.50	PID	107ppm		
											5.95	SPT	3,2,2 N=5		
	4	6													
		6.50	SAND (SP): pale grey-brown; fine to medium; slight chemical and hydrocarbon odour.		EST possibly AEO	MD			ES		6.50	PID	12ppm		
	3	7									6.95	SPT	7,11,11 N=22		
							W								
	2	8.00	Silty SAND (SM): brown and dark brown; with interbedded peaty sand bands, up to 200mm thick; slight hydrocarbon odour.		EST	VD			ES		8.00	PID	<1ppm		
											8.30	SPT	12,25 (HB)		
	1	9				D			ES		9.00	SPT	10,15,16 N=31		
											9.45	PID	<1ppm		
						VD									

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: AD to 5.5m, WB to 19.5m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:46:24 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 10.1 AHD
COORDINATE: E:334778.3, N:6241616.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 209
PROJECT No: 219609.02
DATE: 11/09/23
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	0		[CONT] Silty SAND (SM): brown and dark brown; with interbedded peaty sand bands, up to 200mm thick; slight hydrocarbon odour.						ES		10.45	PID SPT	<1ppm 12,22,24 (HB)
	-1	11	From 11.00m: grey-brown; slight sulphuric odour			VD			ES		11.00 11.30	PID SPT	<1ppm 14,26 (HB)
	-2	12	From 12.00m: brown; decreasing peaty sand bands		EST		W		ES		12.00 12.45	PID SPT	<1ppm 9,13,20 (HB)
	-3	13				D			ES		13.00 13.45	SPT PID	10,16,19 N=35 <1ppm
	-4	14	From 14.00m: pale grey-brown			VD			ES		14.00 14.30	SPT PID	17,31 (HB) <1ppm
	14.50		Peaty CLAY (OL): dark grey; low to medium plasticity; moderate sulphuric odour.										
	-5	15	From 15.20m: grading into peaty sand; strong sulphuric odour		EST	St to VSt	w=PL		ES ES		15.00 15.20 15.45	PID SPT PID	4ppm 7,5,10 (HB) <1ppm
	15.50		SAND (SP): grey-brown; fine to medium; slight sulphuric odour.										
	-6	16									16		
	-7	17				VD					17		
					EST		W		ES		16.50 16.73	PID SPT	<1ppm 28,25/80
	-8	18							ES		18.00 18.25	PID SPT	<1ppm 23,25/100
	-9	19	From 19.50m: grey			D					19		
			Borehole discontinued at 19.95m depth. Target depth reached.						ES		19.50	PID SPT	<1ppm 11,19,28 N=47

BACKFILL: Sand backfill; Bentonite
WELL PIPE

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: AD to 5.5m, WB to 19.5m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:46:25 PM

Douglas PARTNERS

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 8.7 AHD
COORDINATE: E:334788.1, N:6241582.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 210
PROJECT No: 219609.02
DATE: 12/09/23
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*]	DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
12/09/23 No free groundwater observed whilst augering		0	FILL / Silty SAND: dark grey-brown; fine to medium; low plasticity silt; with fine to coarse igneous and sandstone gravel and concrete rubble; trace clinker, rootlets; possibly hydrocarbon stained; slight hydrocarbon odour; grass cover.		FILL	VC		M		ES		0.20	PID	5ppm		
										ES		0.50	PID	9ppm		
												0.70				
		1	1.20m: sandstone cobble (possibly boulder)							ES		1.00	PID SPT	<1ppm 11,8/70 (HB)		
												1.45				
		2								ES		2.00	PID	7ppm		
												2.20				
										ES		2.50	PID SPT	12ppm 4,2,3 (HB)		
		3										2.95				
			From 3.50m: trace wire mesh; moderate hydrocarbon and slight chemical odour; hydrocarbon stained							ES		3.50	PID	11ppm		
												3.70				
		4	4.00m: possible boulder sized inclusion							ES		4.00	PID	6ppm		
												4.20				
			From 4.50m: possible void					W								
		5										5				
										ES		5.50	SPT	3,5,5 N=10		
		5.80								ES		5.80	PID	<1ppm		
		6	SAND (SP): dark grey and grey; fine to medium; hydrocarbon stained; slight to moderate hydrocarbon odour.		EST possibly AEO	MD		NDF				5.95	PID	<1ppm	Bentonite	
													PID			
		7								ES		7.00	PID SPT	<1ppm 11,15,19 N=34		
												7.45				
		8										8				
		8.50								ES		8.50	PID SPT	<1ppm 12,10,12 N=22		
		9	Silty SAND (SM): brown and dark brown; with interbedded peaty sand bands, up to 200mm thick; moderate sulphuric and slight hydrocarbon odour.		EST	VD						8.95				
										ES		9.50	PID SPT	<1ppm 8,16,24 (HB)		

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: AD to 5.5m, WB to 19.5m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:18 PM

BOREHOLE LOG

CLIENT: ESR Australia
PROJECT: Proposed Industrial Development
LOCATION: 49-51 Stephen Road, Banksmeadow

SURFACE LEVEL: 8.7 AHD
COORDINATE: E:334788.1, N:6241582.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 210
PROJECT No: 219609.02
DATE: 12/09/23
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS	BACKFILL	WELL PIPE
	11	11.50	[CONT] Silty SAND (SM): brown and dark brown; with interbedded peaty sand bands, up to 200mm thick; moderate sulphuric and slight hydrocarbon odour. From 11.50m: pale brown to pale grey		EST				ES	10.50–10.80	10.50	SPT	16,30 (HB)		
												PID	<1ppm		
	12	13.60	Silty SAND (SM); fine to medium; trace interbedded dark brown peaty sand bands, up to 50mm thick; slight to moderate sulphuric odour. From 12.50m: pale grey-brown		EST	VD	NDF		ES	11.50–11.95	11.50	PID	<1ppm		
												SPT	13,18,26 (HB)		
									ES	12.50–12.80	12.50	PID	1ppm		
												SPT	16,27 (HB)		
	13								ES	13.50–13.60	13.50	PID	<1ppm		
	14	14.50	Peaty CLAY (OL): dark grey; low to medium plasticity; moderate sulphuric odour.		EST	VSt	w=PL		ES	13.60–13.95	13.60	SPT	12,10,8 N=18		
												PID	7ppm		
	15		SAND (SM): grey-brown; fine to medium; slight sulphuric odour.		EST	VD	NDF		ES	14.50–14.73	14.50	SPT	26,25/80 (HB)		
												PID	1ppm		
	16								ES	15.50–15.72	15.50	PID	<1ppm		
												SPT	28,25/70 (HB)		
	17								ES	16.50–16.77	16.50	PID	<1ppm		
												SPT	20,25/120 (HB)		
	18								ES	18.00	18.00	PID	9ppm		
									ES	18.20–18.41	18.20	SPT	6,20,25/110 (HB)		
												PID	4ppm		
	19	19.74	Borehole discontinued at 19.74m depth. Target depth reached.						ES	19.50	19.50	PID	<1ppm		
												SPT	25,25/90 (HB)		

Sand backfill

Bentonite

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: EXPLORA
METHOD: AD to 5.5m, WB to 19.5m
REMARKS:

OPERATOR: Ground Test (DB)

LOGGED: ZW
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log - 21/12/2023 4:47:19 PM

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

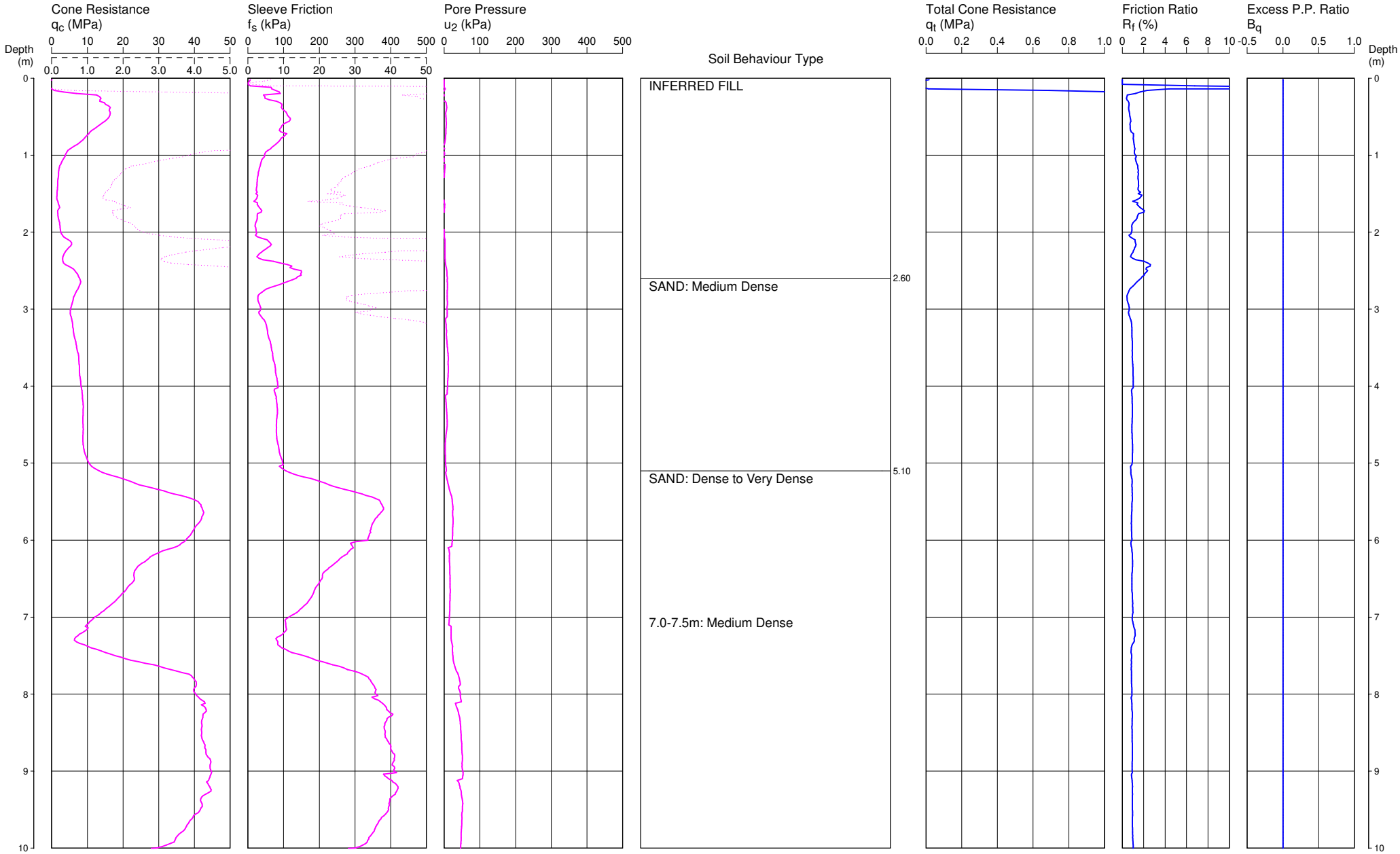
REDUCED LEVEL: 10.0

COORDINATES: 334537.3E 6241775.7N GDA2020

CPT101

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVERTY DENSE SAND. HOLE COLLAPSED AT 4.6M AFTER WITHDRAWAL OF RODS.

File: T:\2019\219609.02 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT101.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

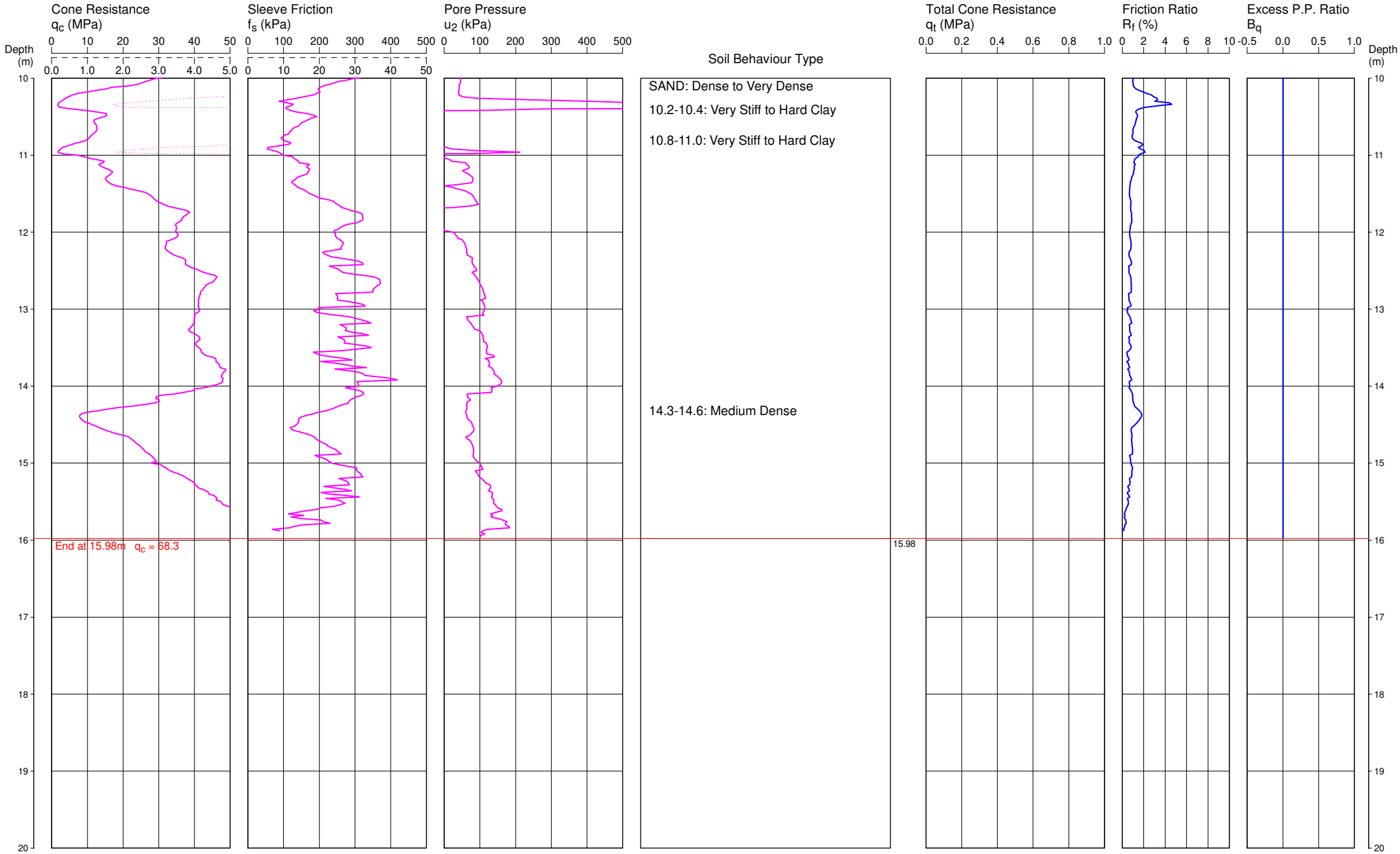
REDUCED LEVEL: 10.0

COORDINATES: 334537.3E 6241775.7N GDA2020

CPT101

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVERTY 2 DESIGNS:SAND\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT101.CP5
HOLE COLLAPSED AT 4.6M AFTER WITHDRAWAL OF RODS.

File: ER2 DESIGNS:SAND\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT101.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

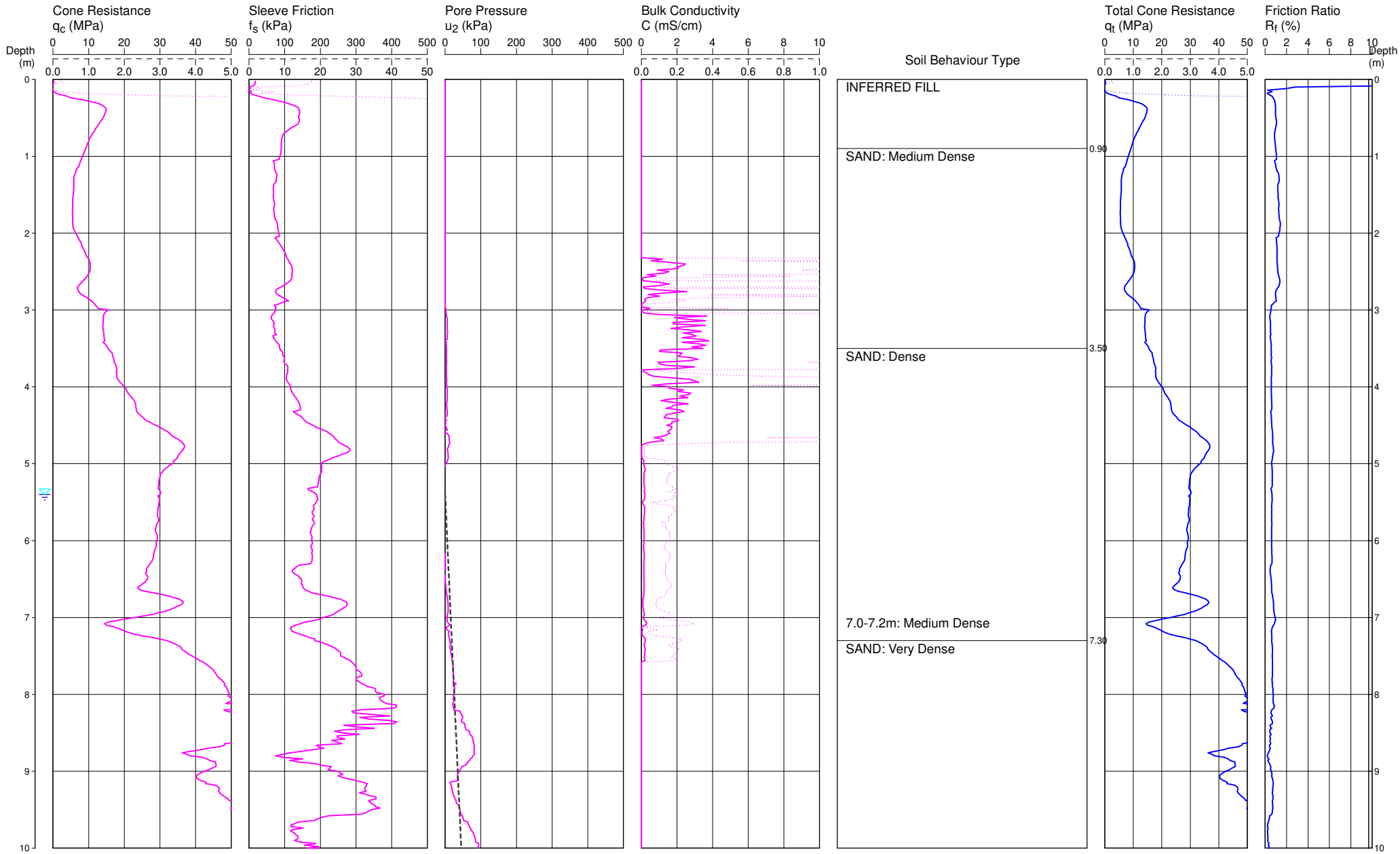
REDUCED LEVEL: 10.2

COORDINATES: 334508.0E 6241742.4N GDA2020

CPT102

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.13M. TEST DISCONTINUED DUE TO BENDING RIVER 2 DENSE SAND. File: P:\219609.02 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT102.CP5
GROUNDWATER OBSERVED AT 5.4M AFTER WITHDRAWAL OF RODS

Cone ID: 210732 **Type:** I-CFXYP20-10

Water depth after test: 5.40m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

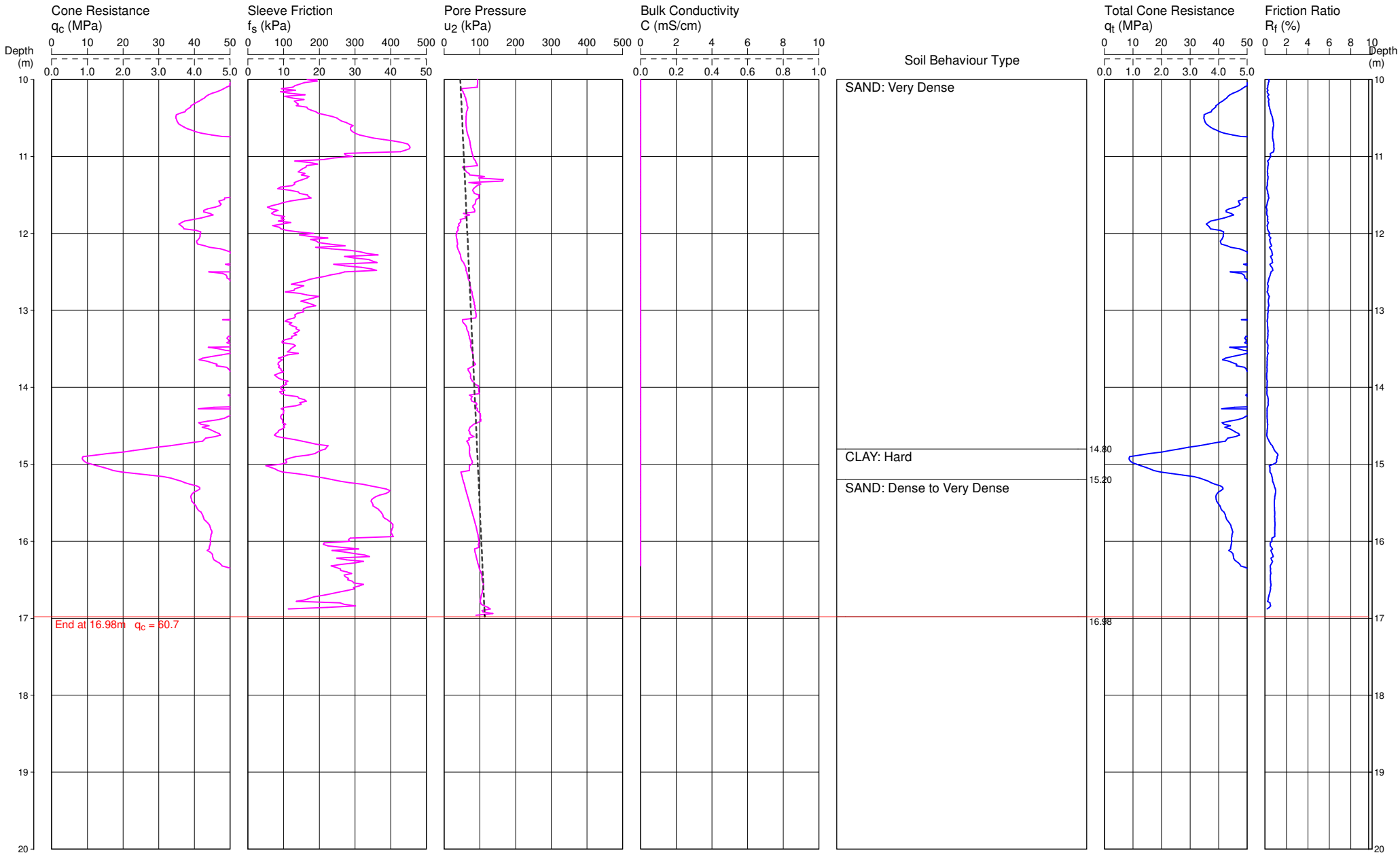
REDUCED LEVEL: 10.2

COORDINATES: 334508.0E 6241742.4N GDA2020

CPT102

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.13M. TEST DISCONTINUED DUE TO BENDING RIVER 2 DENSE SAND. File: P:\219609.02 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT102.CP5
GROUNDWATER OBSERVED AT 5.4M AFTER WITHDRAWAL OF RODS

Cone ID: 210732 **Type:** I-CFXYP20-10

Water depth after test: 5.40m depth (assumed)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

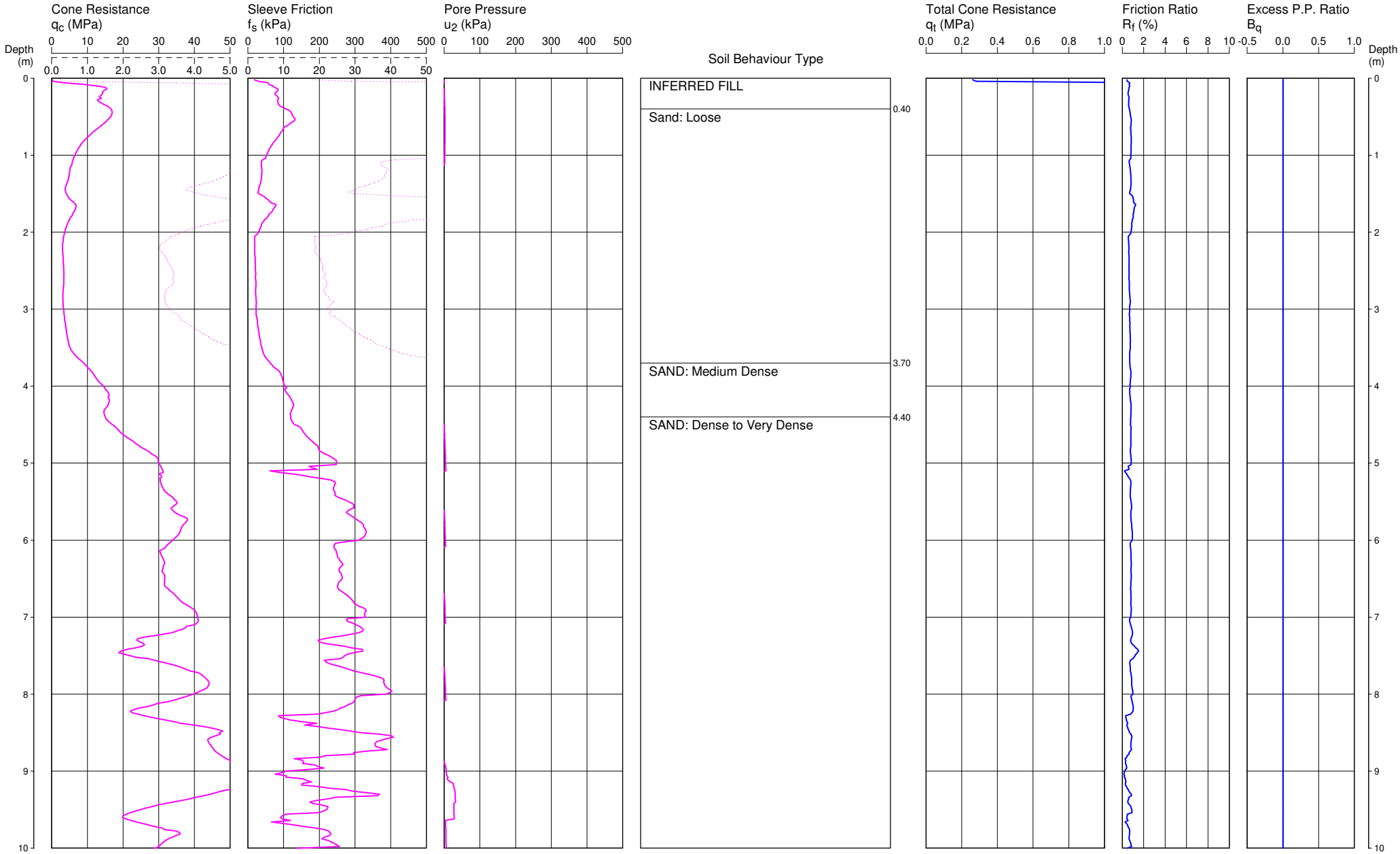
REDUCED LEVEL: 10.0

COORDINATES: 334521.6E 6241649.2N GDA2020

CPT103

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: ASPHALTIC CONCRETE TO 0.03M. TEST DISCONTINUED DUE TO REFUSAL ON VERY DENSE SAND. HOLE COLLAPSED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 Banksmeadow, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT103.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

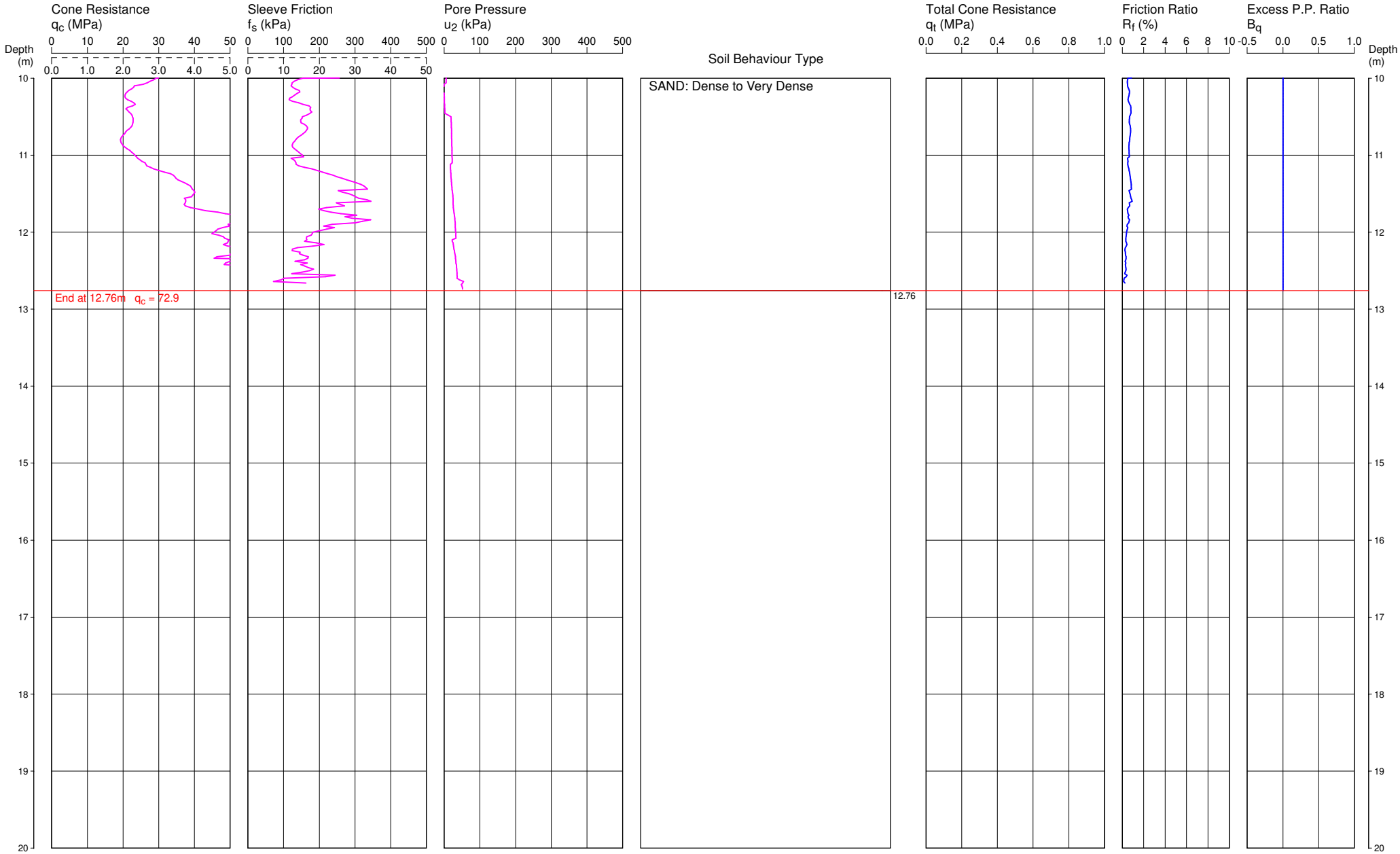
REDUCED LEVEL: 10.0

COORDINATES: 334521.6E 6241649.2N GDA2020

CPT103

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: ASPHALTIC CONCRETE TO 0.03M. TEST DISCONTINUED DUE TO REFUSAL. HOLE COLLAPSED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT103.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

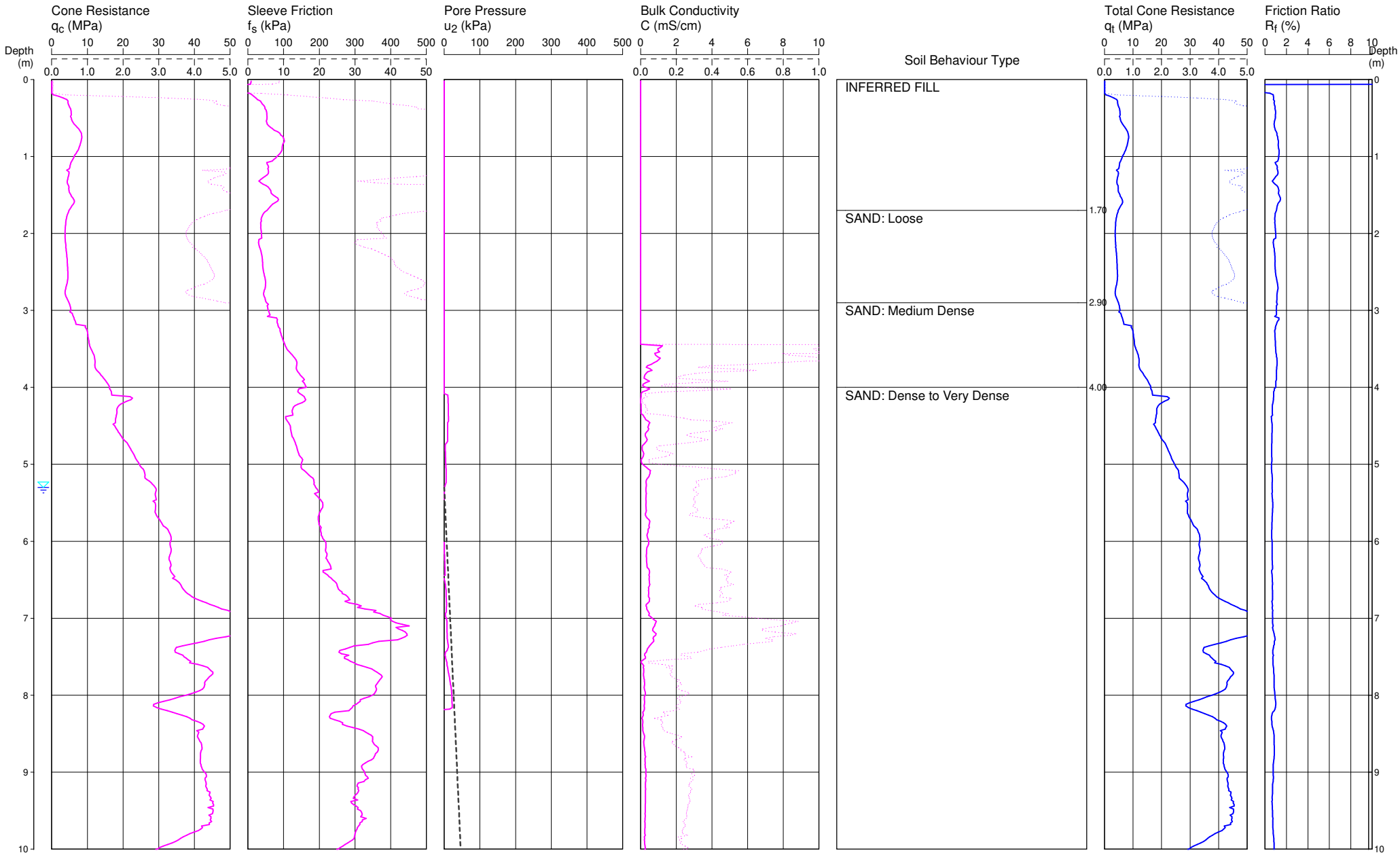
REDUCED LEVEL: 10.0

COORDINATES: 334542.3E 6241691.6N GDA2020

CPT104

DATE 01/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.18M. TEST DISCONTINUED DUE TO BENDING RIVER 2 DENSE SAND. GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: I:\EPY\2019\219609.02\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT104.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (measured)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

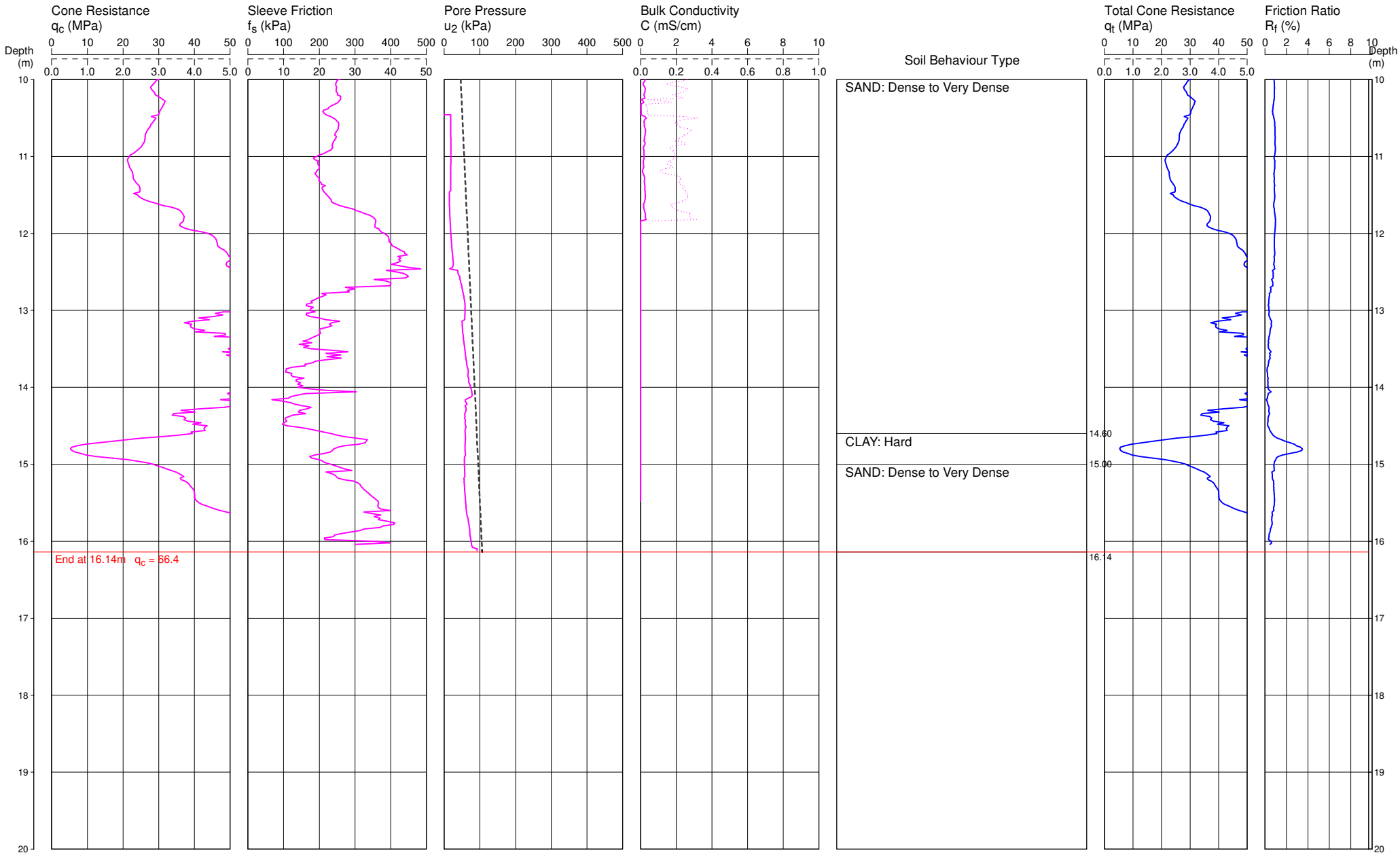
REDUCED LEVEL: 10.0

COORDINATES: 334542.3E 6241691.6N GDA2020

CPT104
Page 2 of 2

DATE 01/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.18M. TEST DISCONTINUED DUE TO BENDING RIVERTY2 DENSE SAND. File: P:\219609.02 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT104.CP5
GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

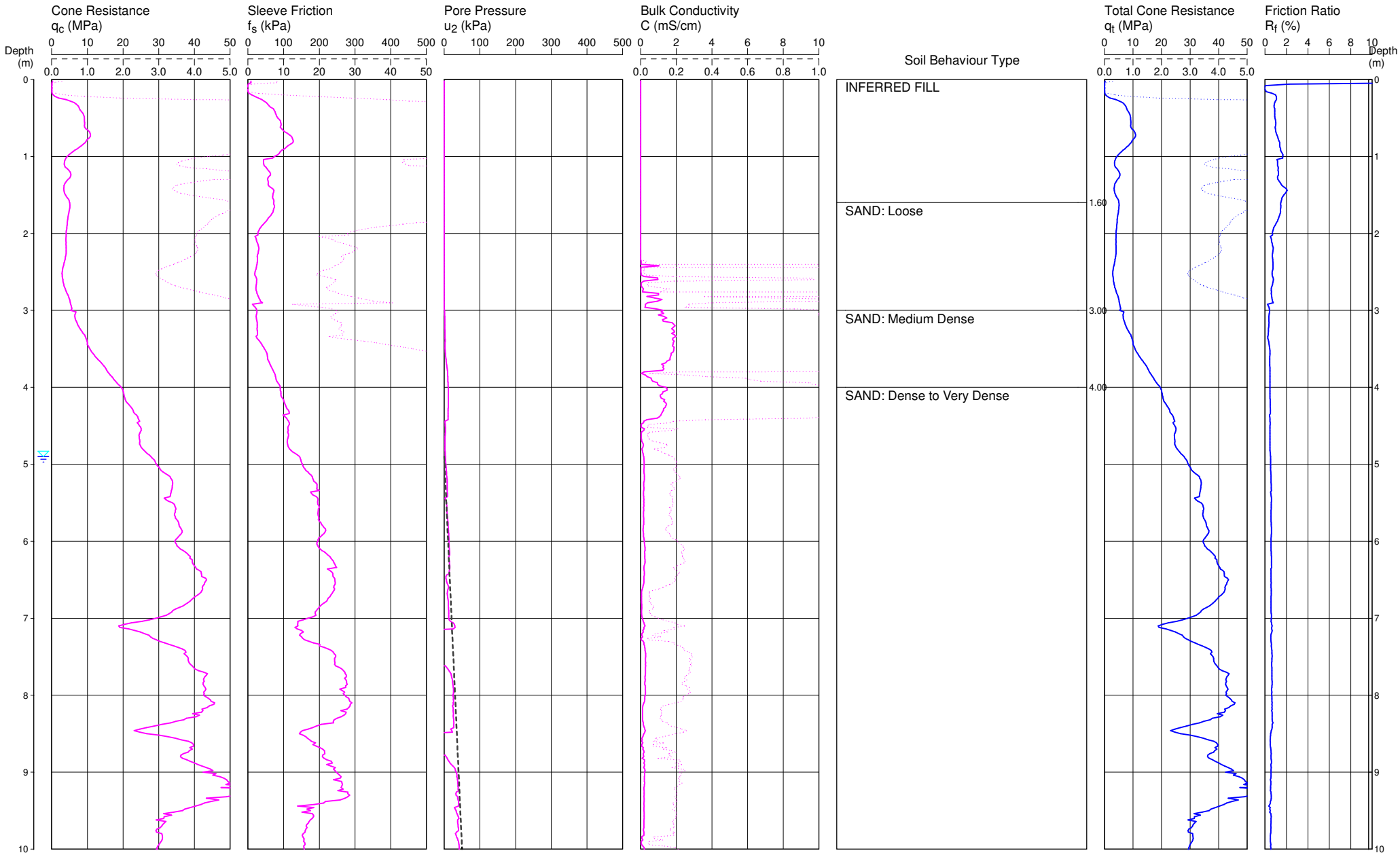
REDUCED LEVEL: 10.0

COORDINATES: 334590.6E 6241759.8N GDA2020

CPT105

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO ROD BOWING.
GROUNDWATER OBSERVED AT 4.9M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT105.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 4.90m depth (measured)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

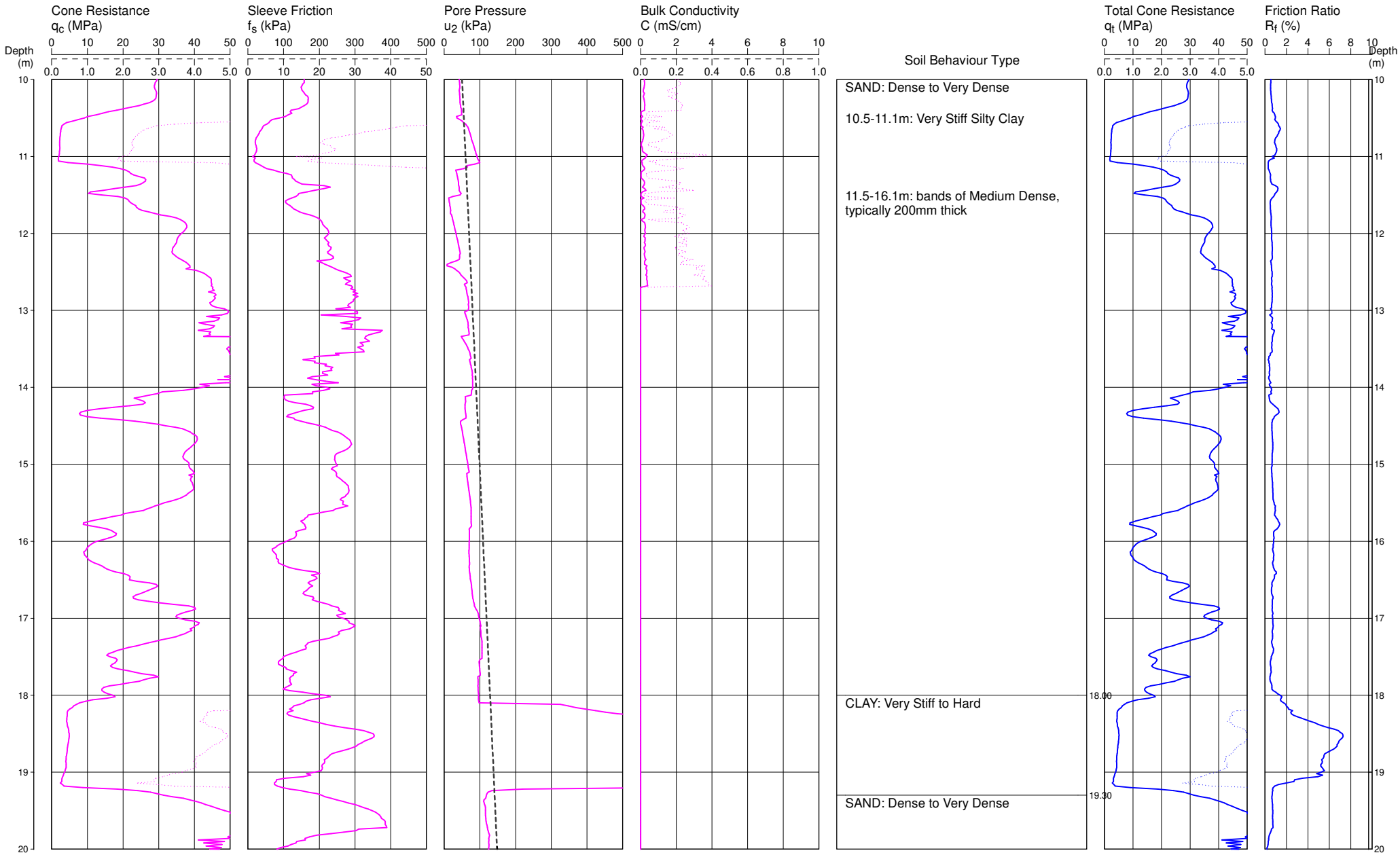
REDUCED LEVEL: 10.0

COORDINATES: 334590.6E 6241759.8N GDA2020

CPT105

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO ROD BOWING.
GROUNDWATER OBSERVED AT 4.9M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT105.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 4.90m depth (measured)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

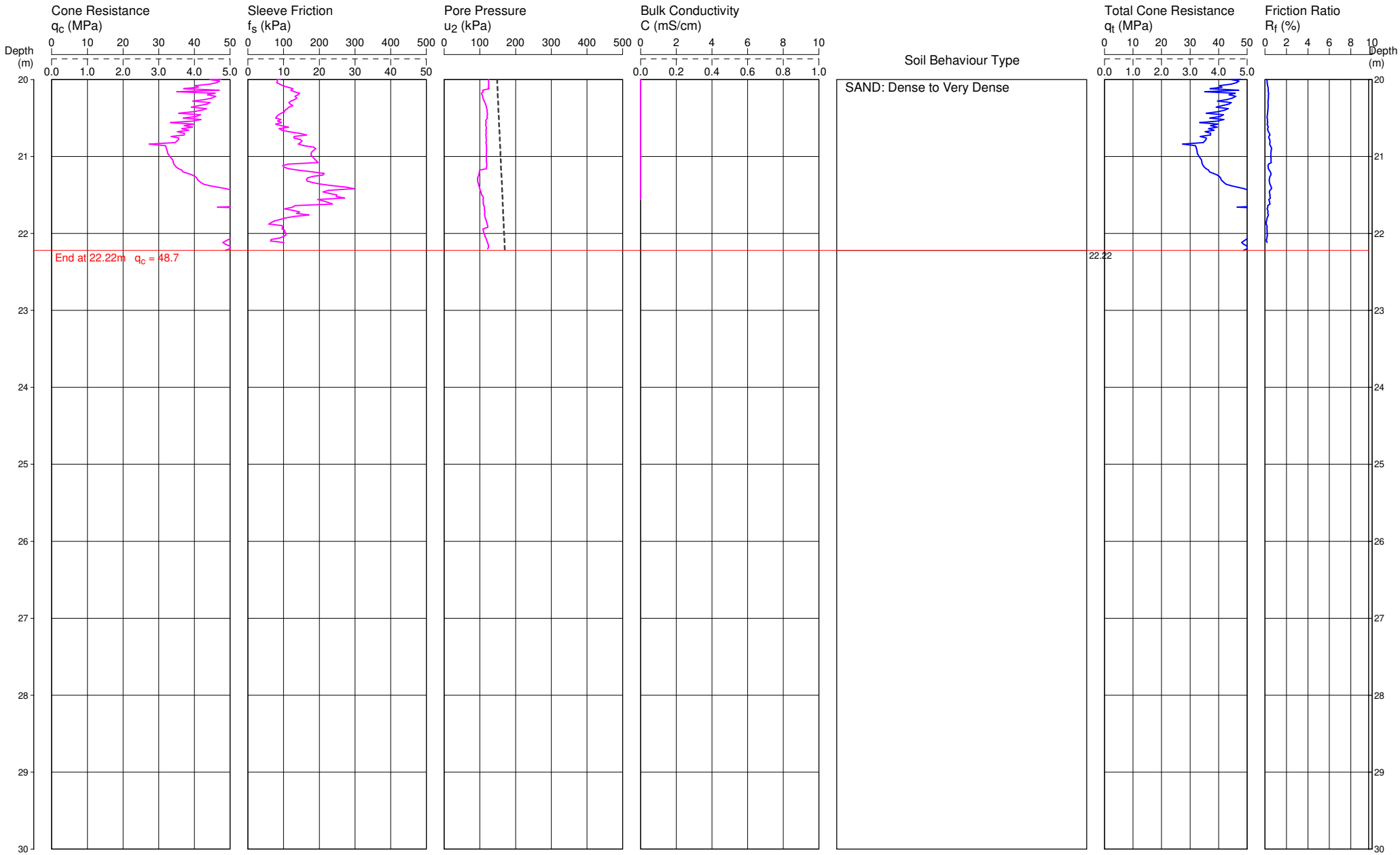
REDUCED LEVEL: 10.0

COORDINATES: 334590.6E 6241759.8N GDA2020

CPT105

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO ROD BOWING. GROUNDWATER OBSERVED AT 4.9M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT105.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 4.90m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

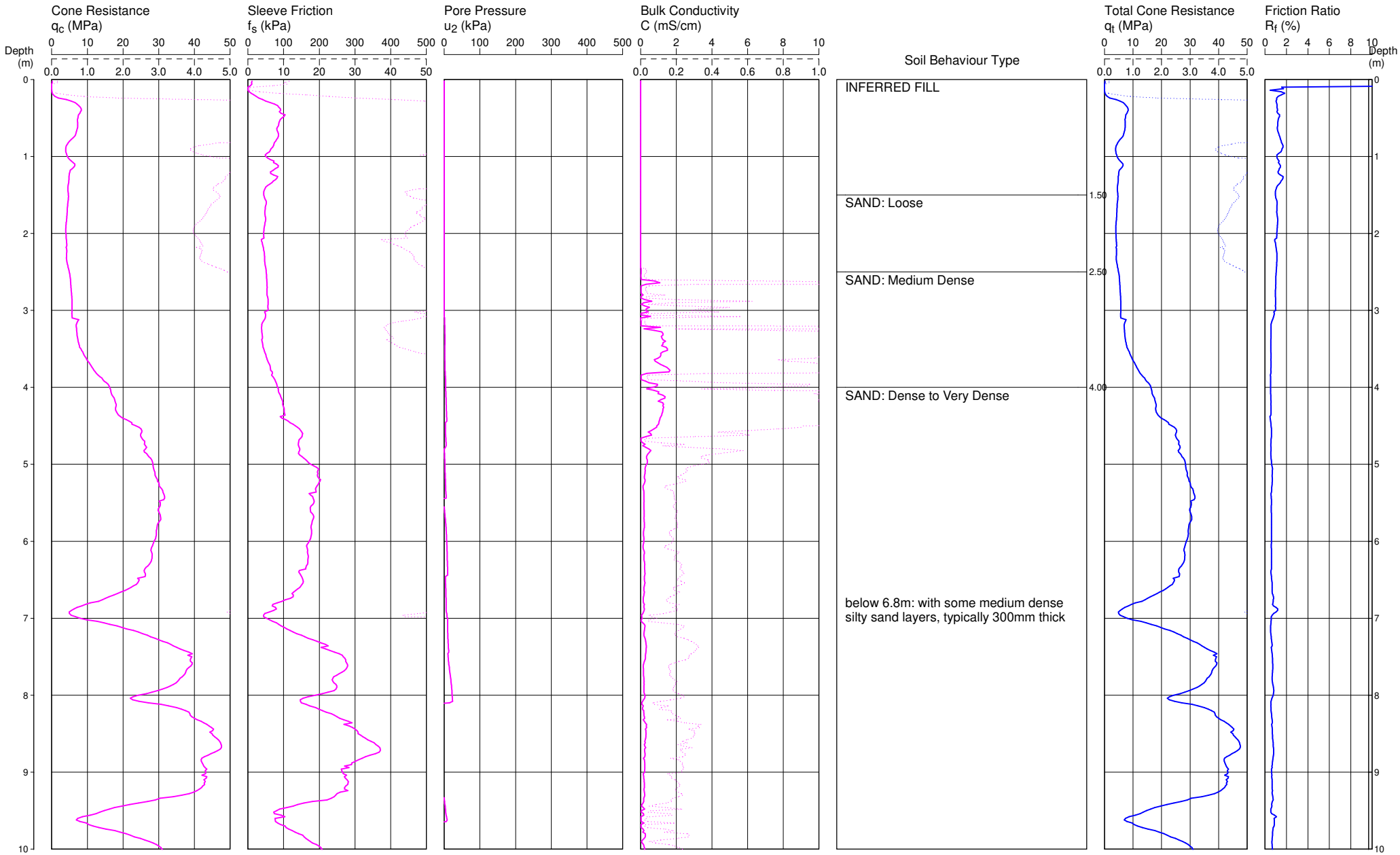
REDUCED LEVEL: 10.0

COORDINATES: 334584.3E 6241707.0N GDA2020

CPT106

DATE 02/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVERTY DENSE SAND. HOLE COLLAPSED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: I:\2021\219609.02\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT106.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

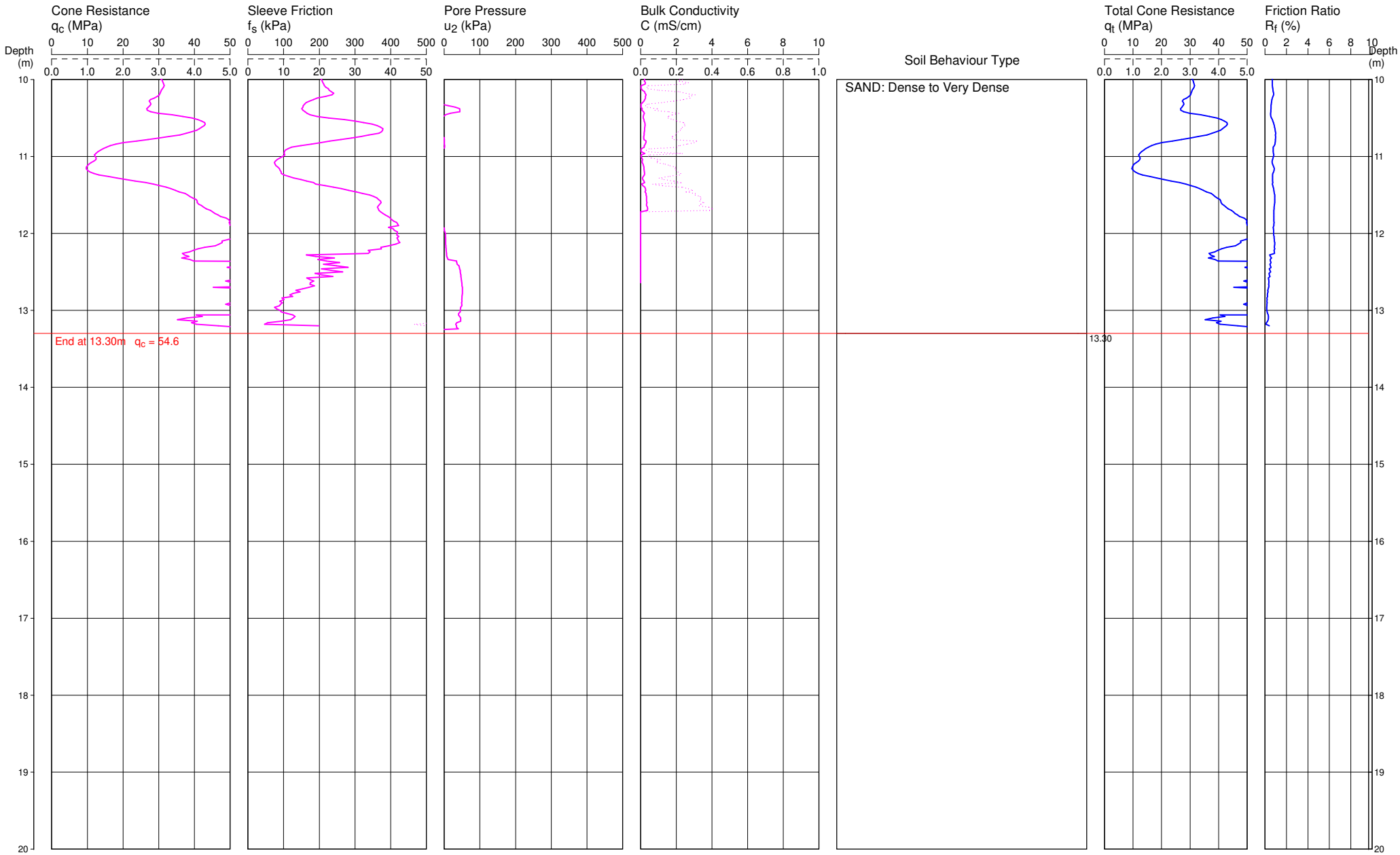
REDUCED LEVEL: 10.0

COORDINATES: 334584.3E 6241707.0N GDA2020

CPT106

DATE 02/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVERTY2 DENSE SAND. HOLE COLLAPSED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: I:\2021\219609.02\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT106.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

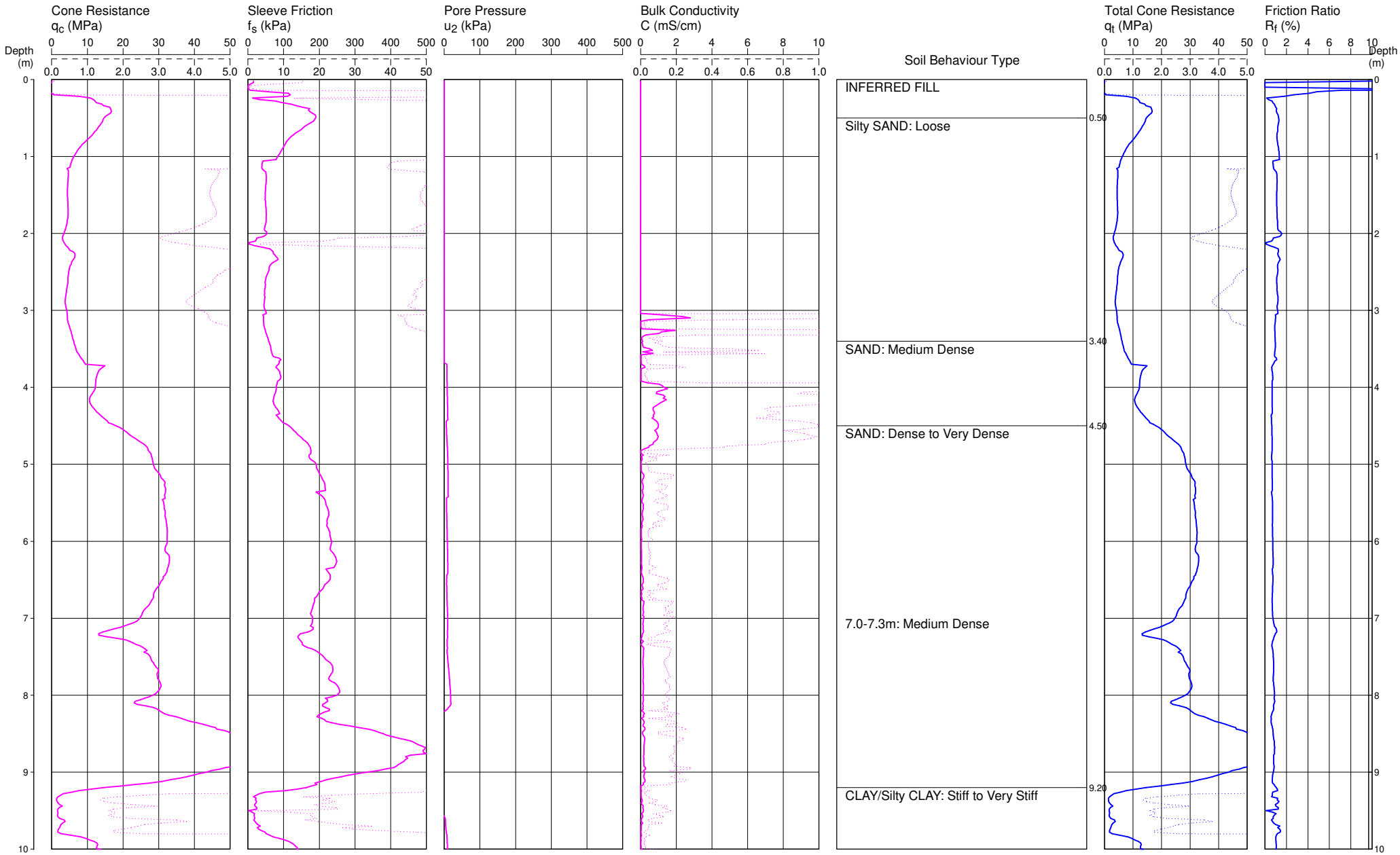
REDUCED LEVEL: 9.9

COORDINATES: 334565.3E 6241634.2N

CPT107

DATE 02/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.16M. TEST DISCONTINUED DUE TO BENDING RIVER 2 DEEP SAND
HOLE COLLAPSED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: ER:\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT107.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

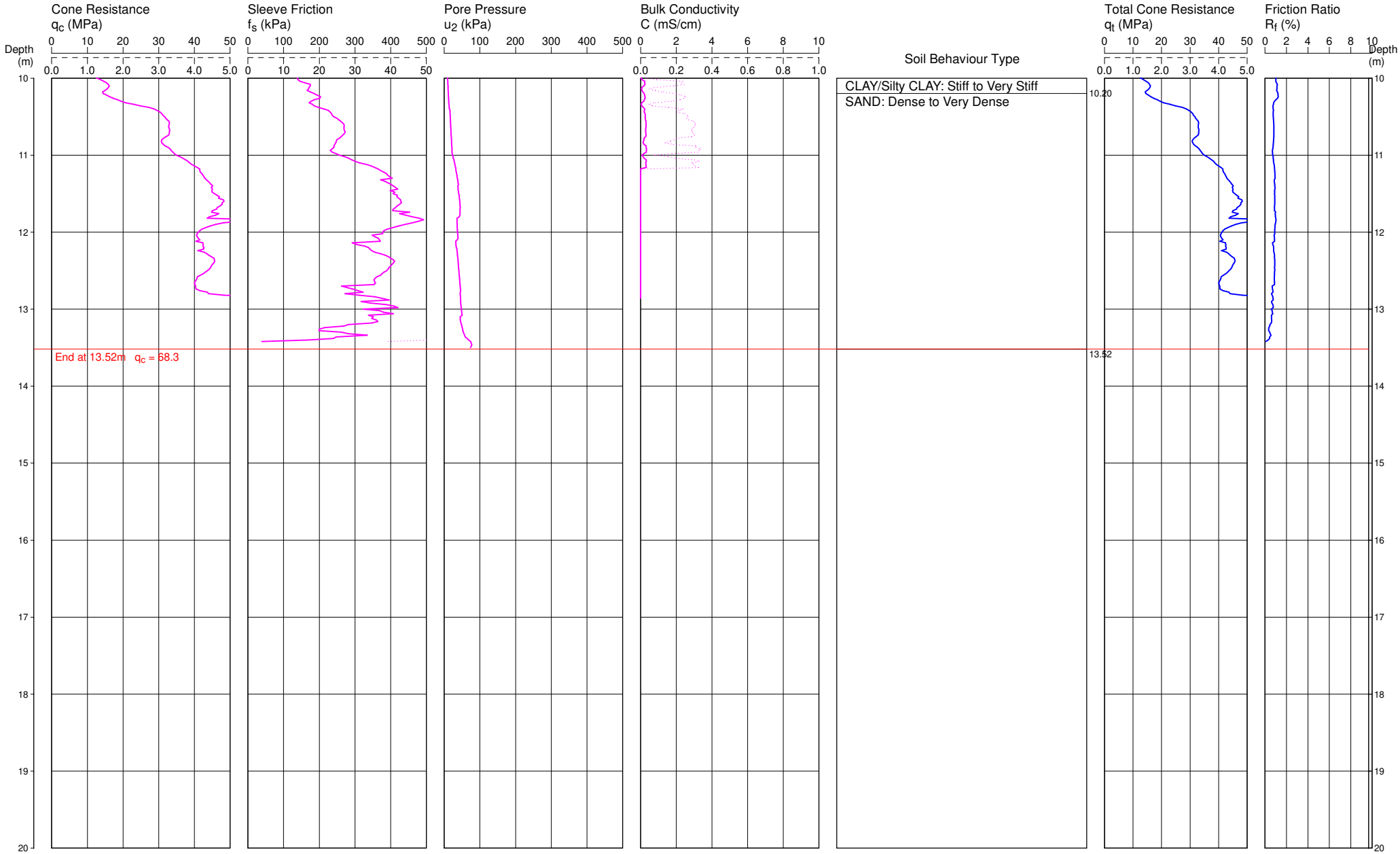
REDUCED LEVEL: 9.9

COORDINATES: 334565.3E 6241634.2N

CPT107

DATE 02/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.16M. TEST DISCONTINUED DUE TO BENDING RIVER 2 DESIGNS SAND
HOLE COLLAPSED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: ER2 DESIGNS SAND - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT107.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49 STEPHEN ROAD, BANKSMEADOW

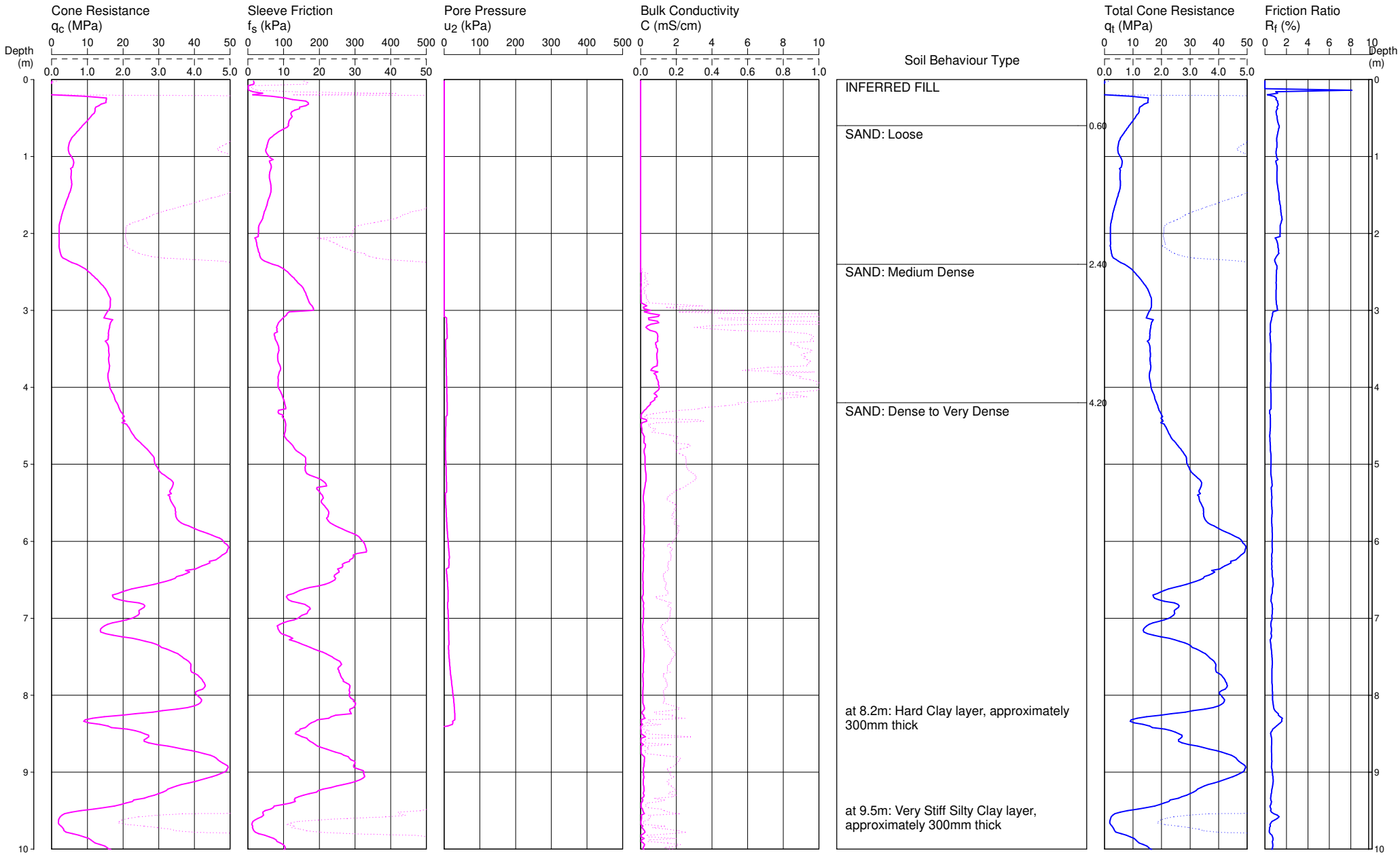
REDUCED LEVEL: 10.0

COORDINATES: 334640.0E 6241753.8N GDA2020

CPT108

DATE 01/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.2M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. HOLE COLLAPSED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT108.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49 STEPHEN ROAD, BANKSMEADOW

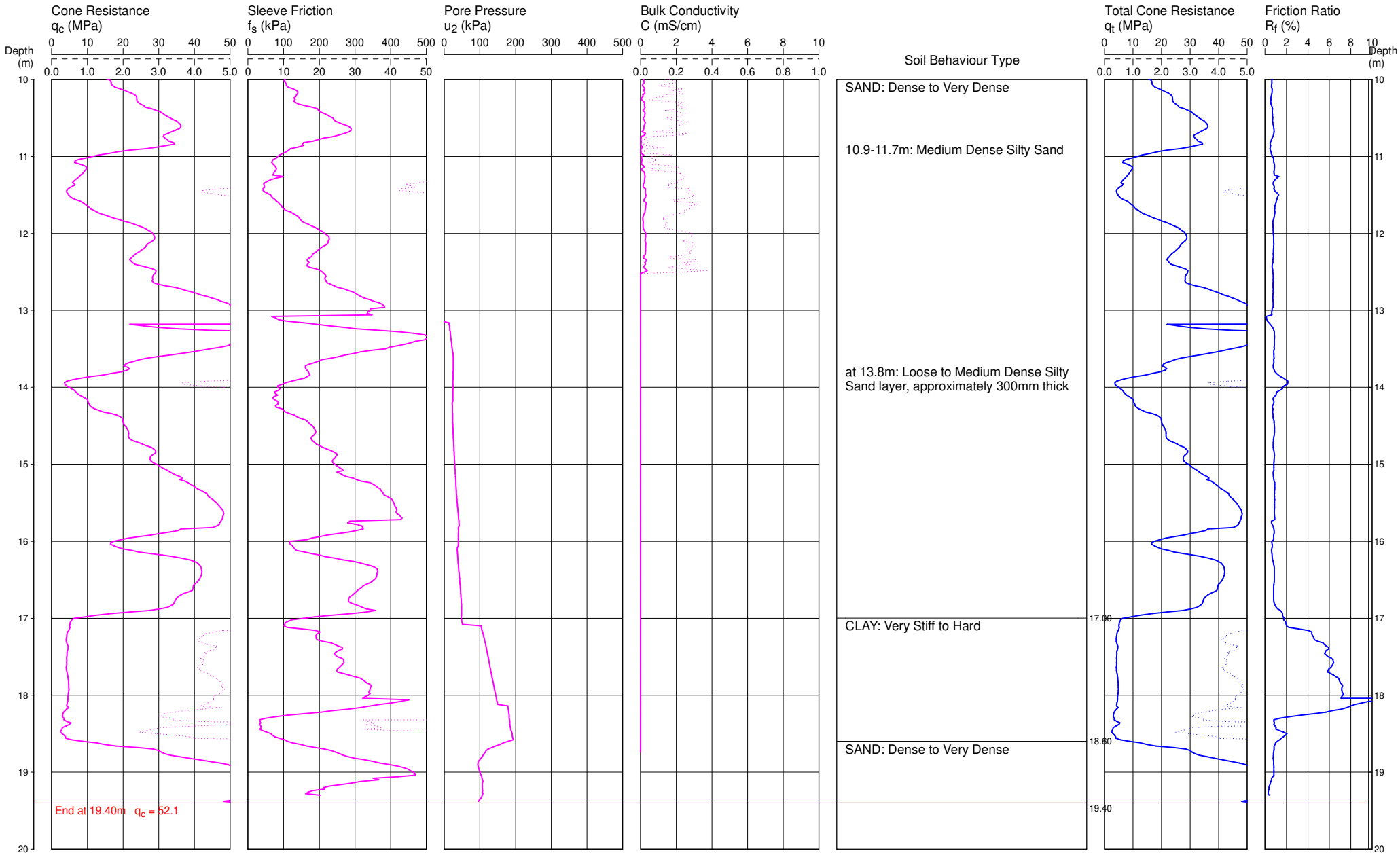
REDUCED LEVEL: 10.0

COORDINATES: 334640.0E 6241753.8N GDA2020

CPT108

DATE 01/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.2M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. HOLE COLLAPSED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: 219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT108.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

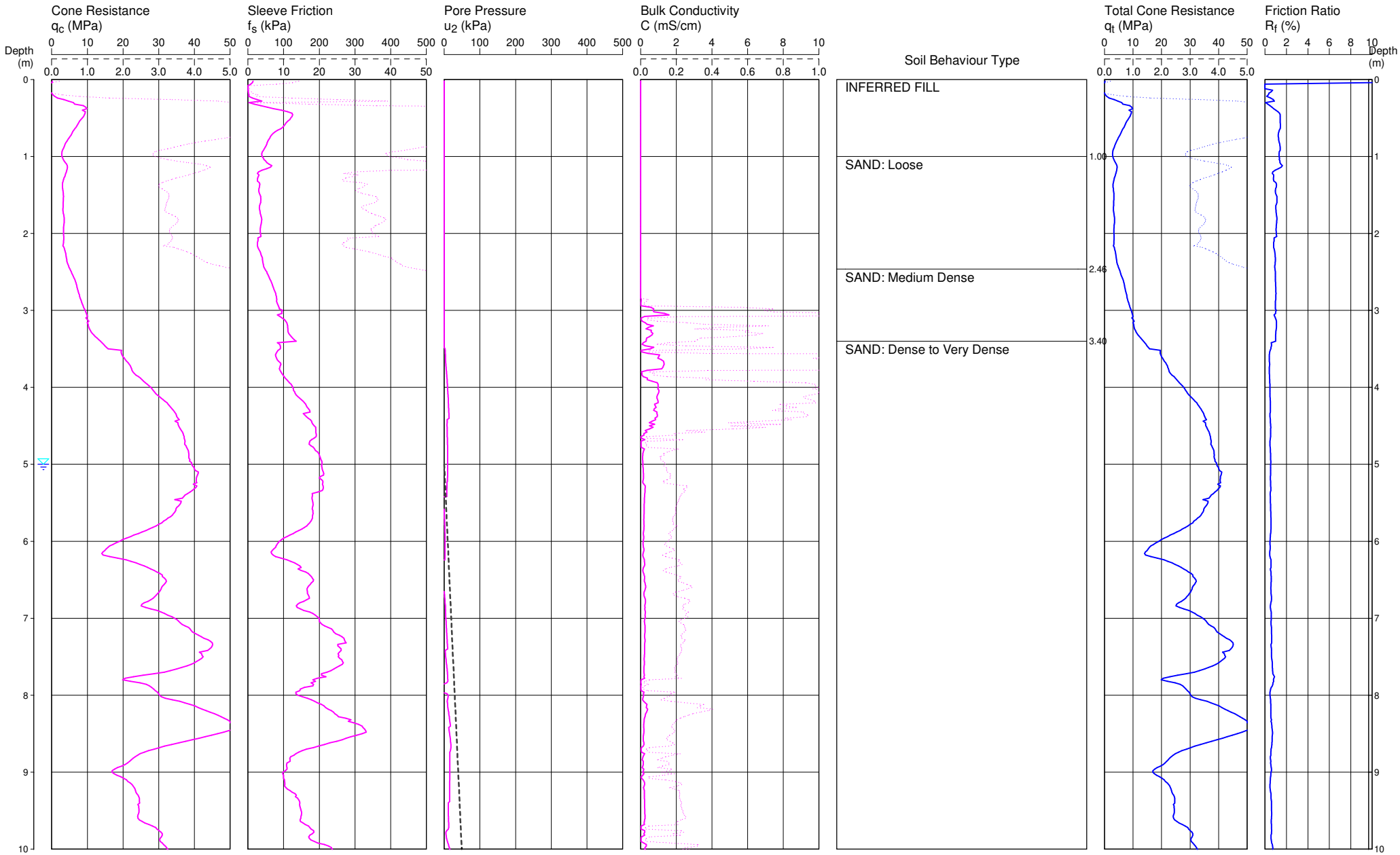
REDUCED LEVEL: 9.9

COORDINATES: 334635.9E 6241700.8N GDA2020

CPT109

DATE 02/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT109.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

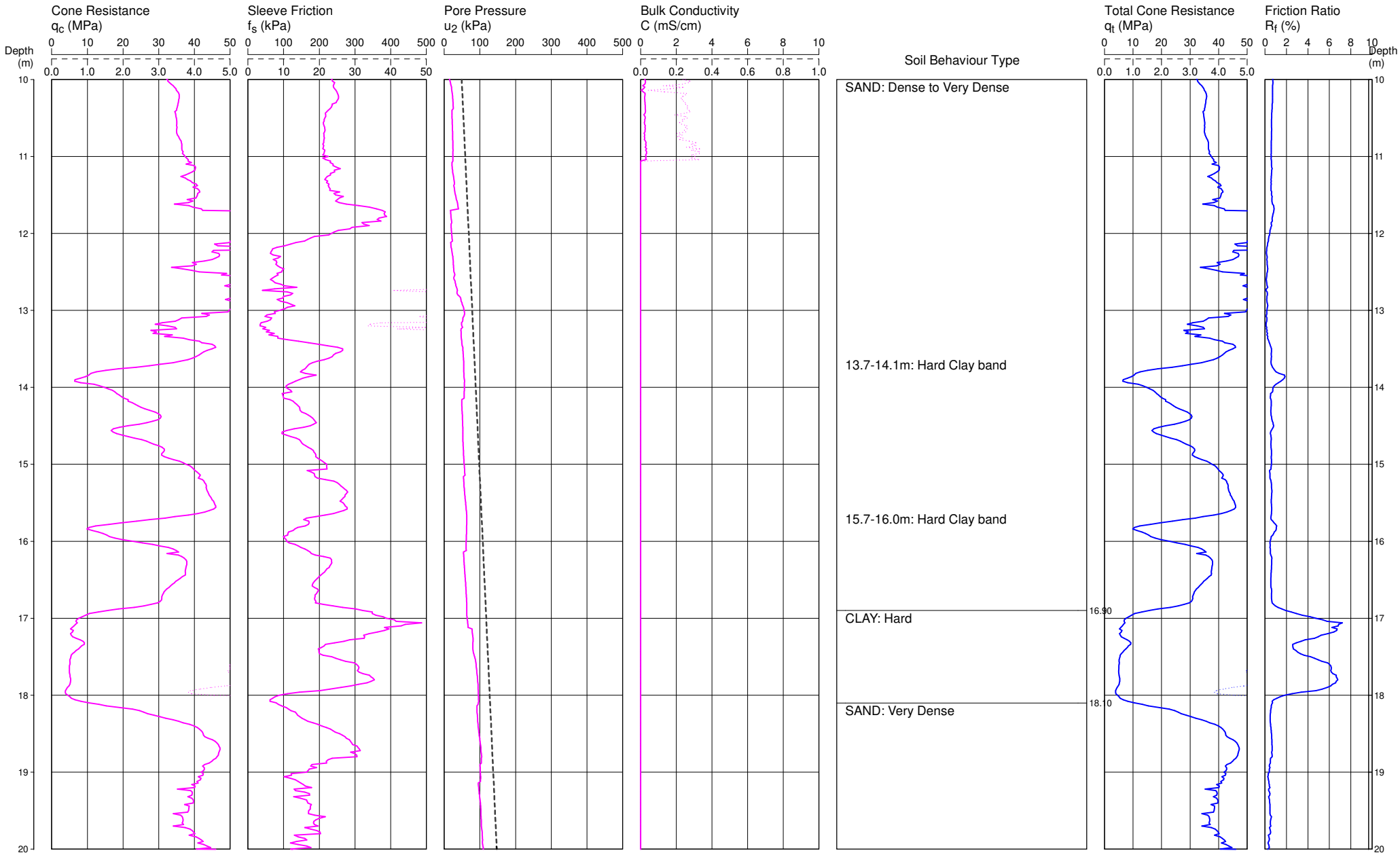
REDUCED LEVEL: 9.9

COORDINATES: 334635.9E 6241700.8N GDA2020

CPT109

DATE 02/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION ON RODS.
GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT109.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

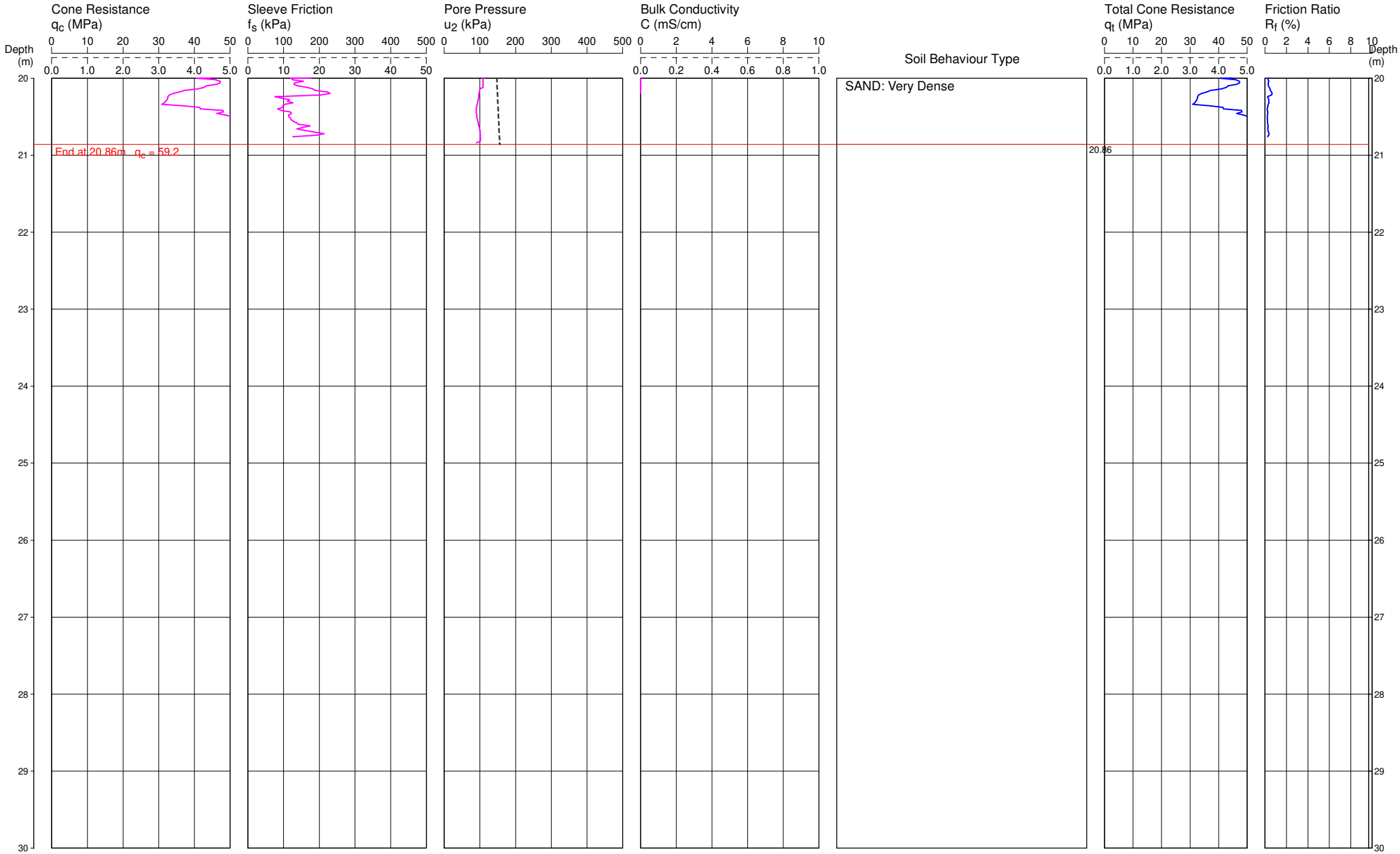
REDUCED LEVEL: 9.9

COORDINATES: 334635.9E 6241700.8N GDA2020

CPT109

DATE 02/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT109.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

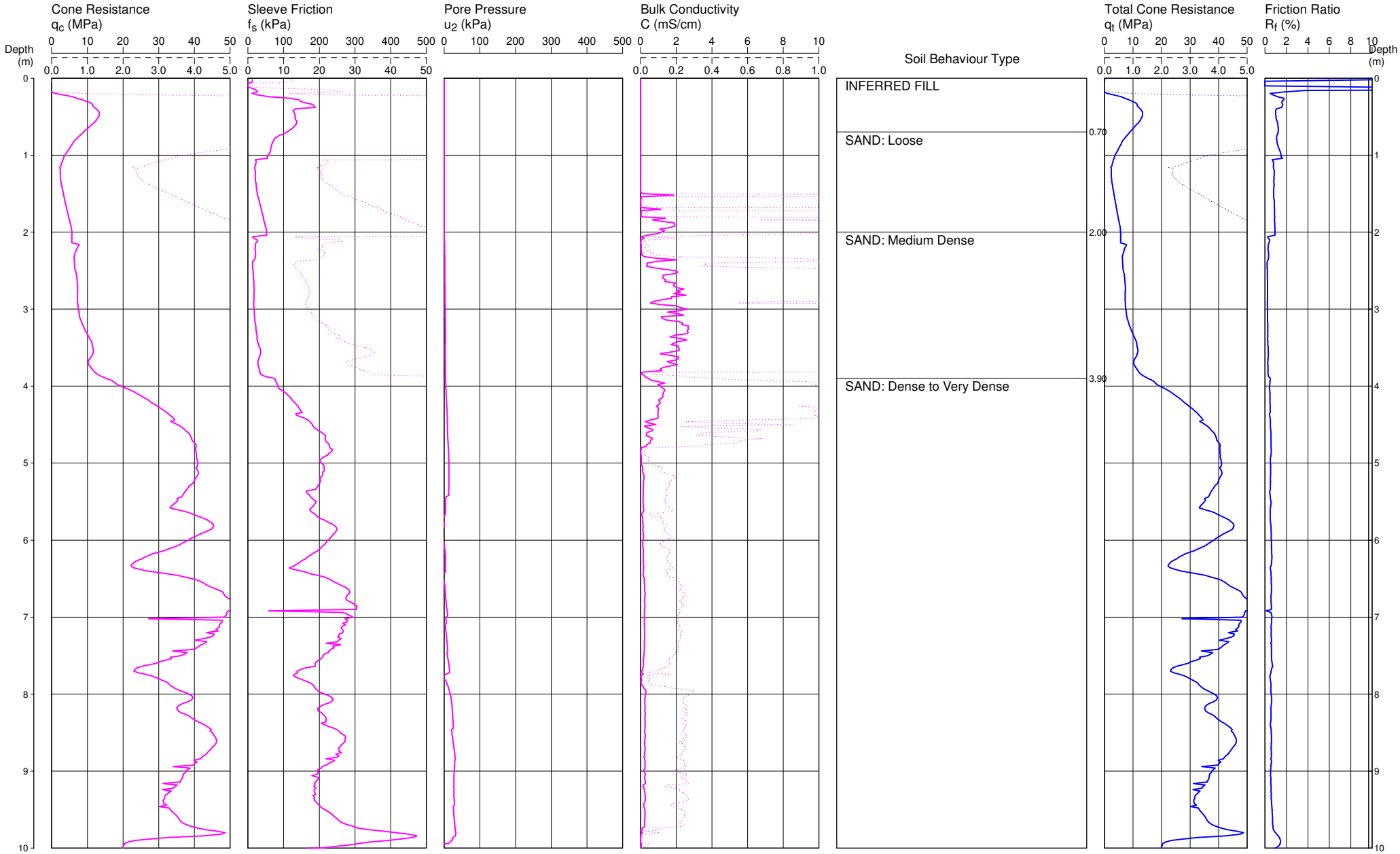
REDUCED LEVEL: 9.8

COORDINATES: 334619.8E 6241629.3N GDA2020

CPT110

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO BENDING RIVERTY DENSE SAND. HOLE COLLAPSED AT 5.1M AFTER WITHDRAWAL OF RODS.

File: I:\2021\219609.02\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT110.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

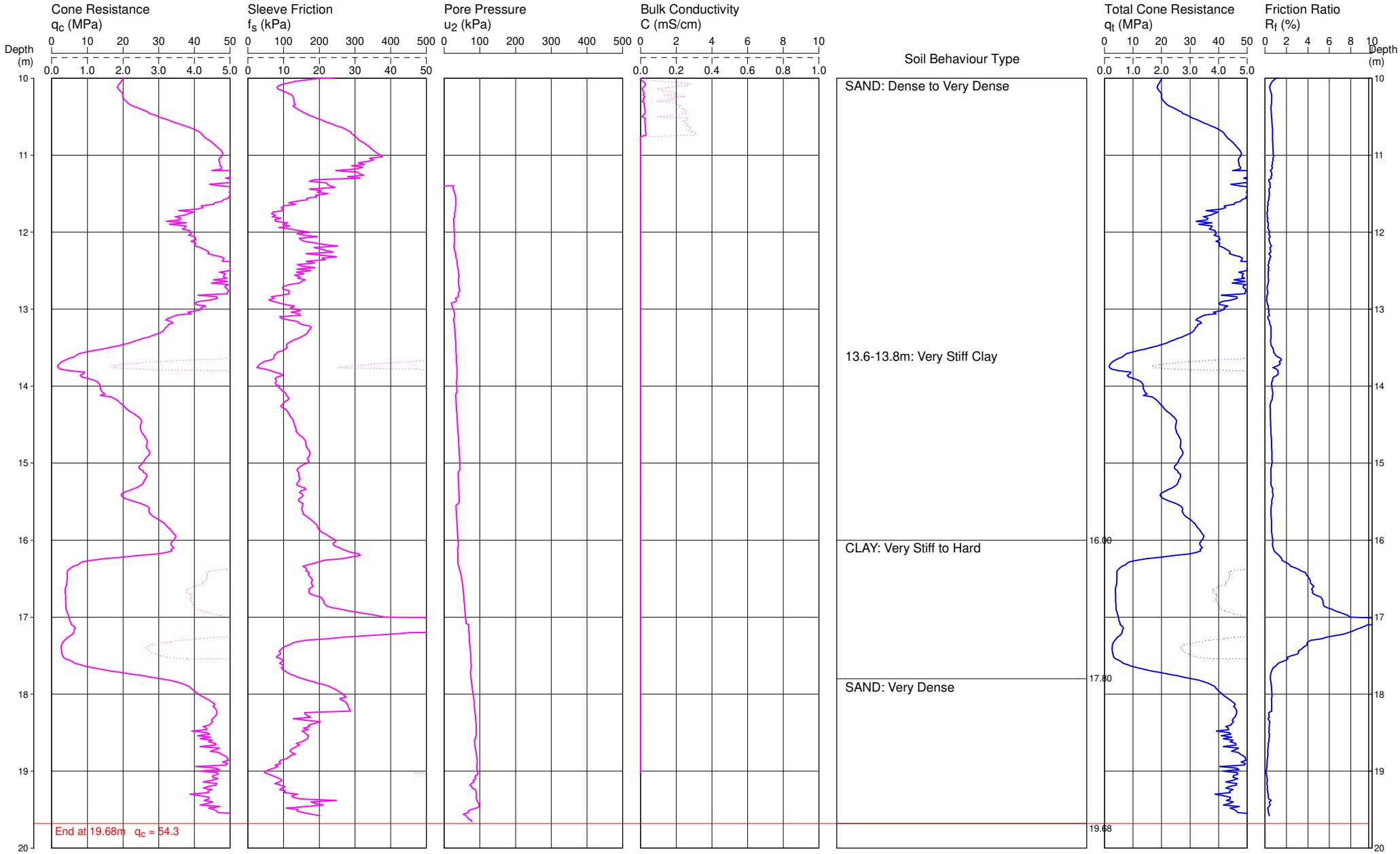
REDUCED LEVEL: 9.8

COORDINATES: 334619.8E 6241629.3N GDA2020

CPT110

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO BENDING RIVERTY DENSE SAND. HOLE COLLAPSED AT 5.1M AFTER WITHDRAWAL OF RODS.

File: ER:\2 DENSE\2 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT110.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

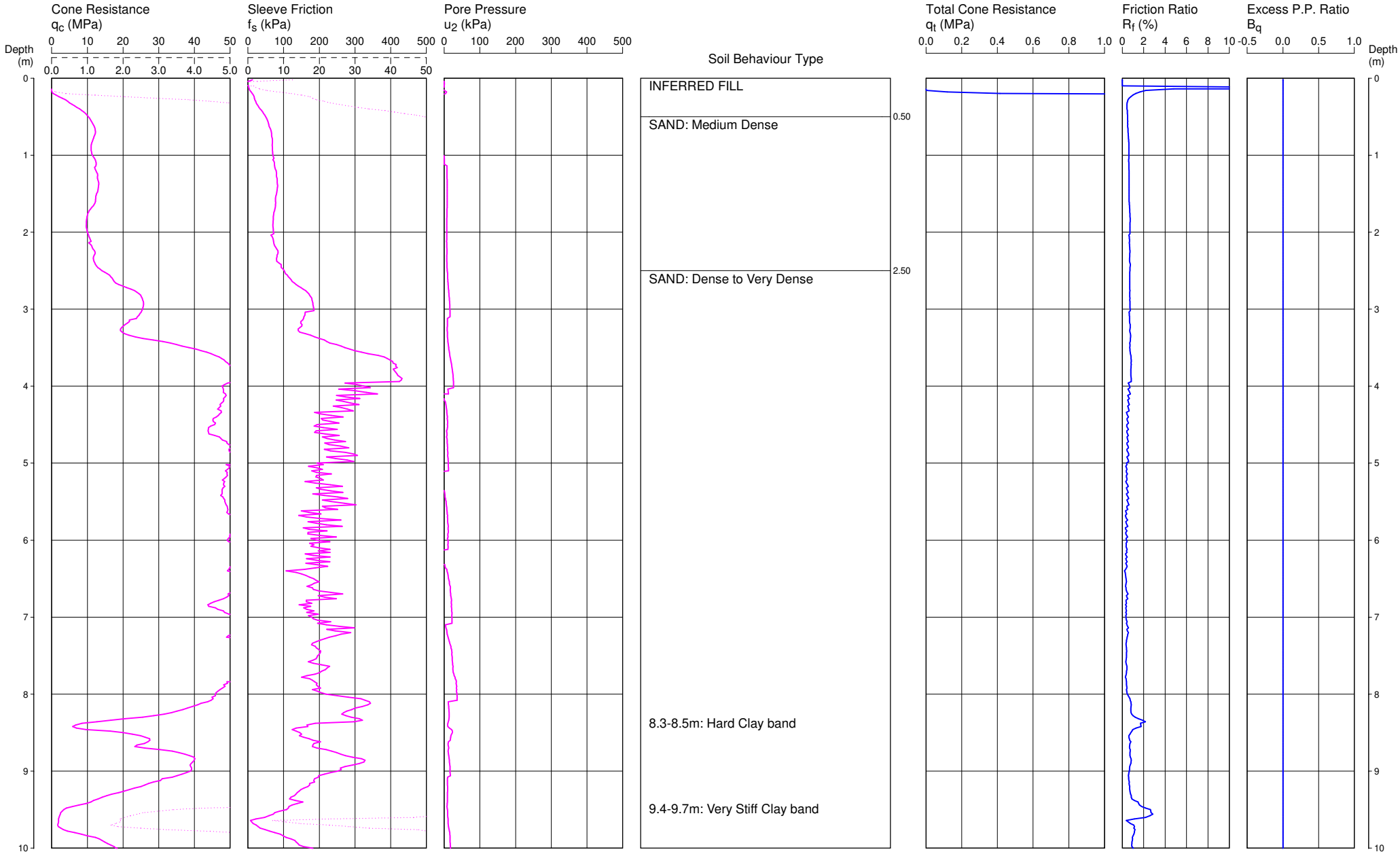
REDUCED LEVEL: 9.9

COORDINATES: 334678.8E 6241755.9N GDA2020

CPT111

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVERSIDE SAND
HOLE COLLAPSED AT 4.6M AFTER WITHDRAWAL OF RODS.

File: ER 2 DESIGNS 2 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT111.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

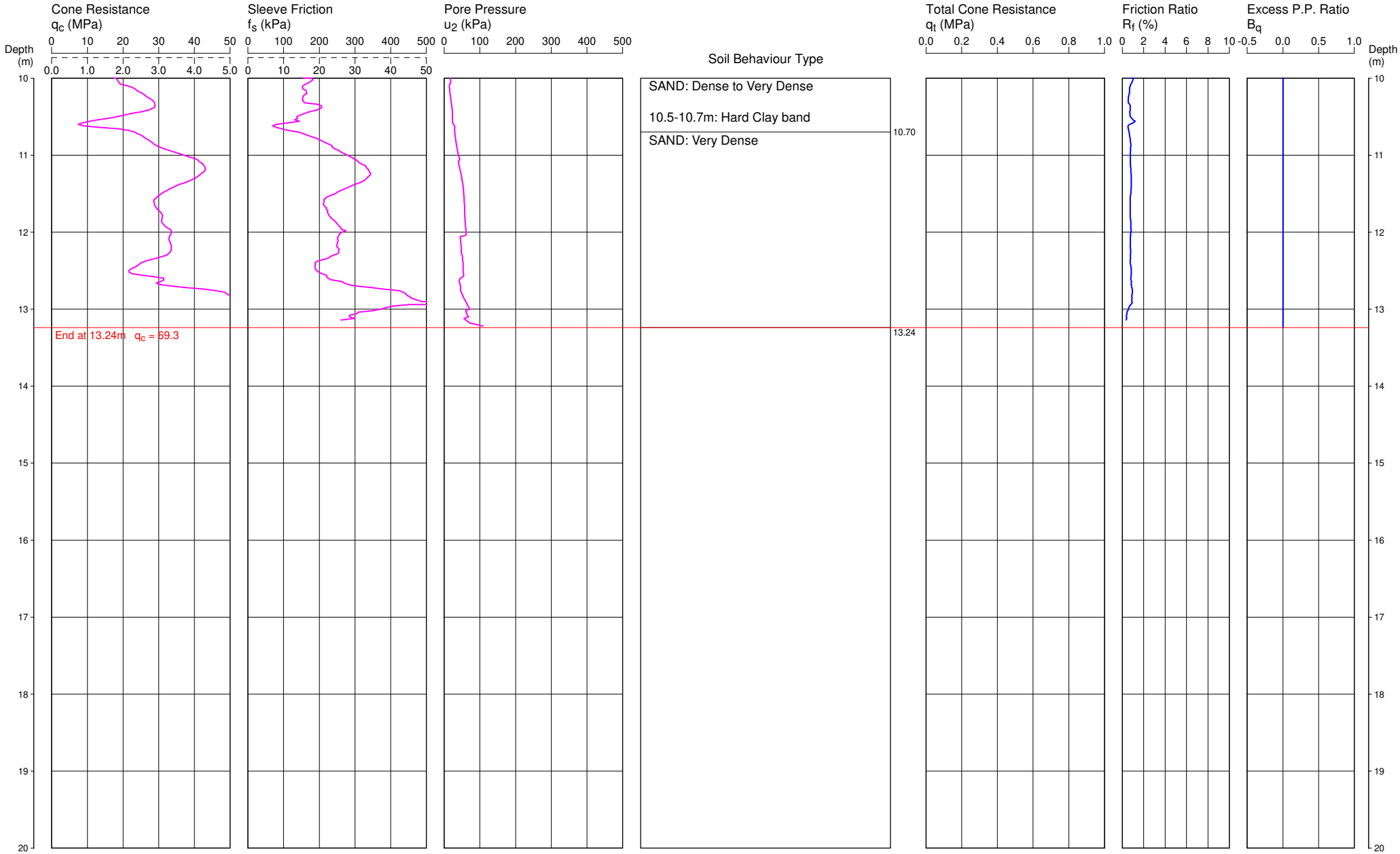
REDUCED LEVEL: 9.9

COORDINATES: 334678.8E 6241755.9N GDA2020

CPT111

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVERTY2 DEPOSIT\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT111.CP5
HOLE COLLAPSED AT 4.6M AFTER WITHDRAWAL OF RODS.

File: ER2 **Cone ID:** 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

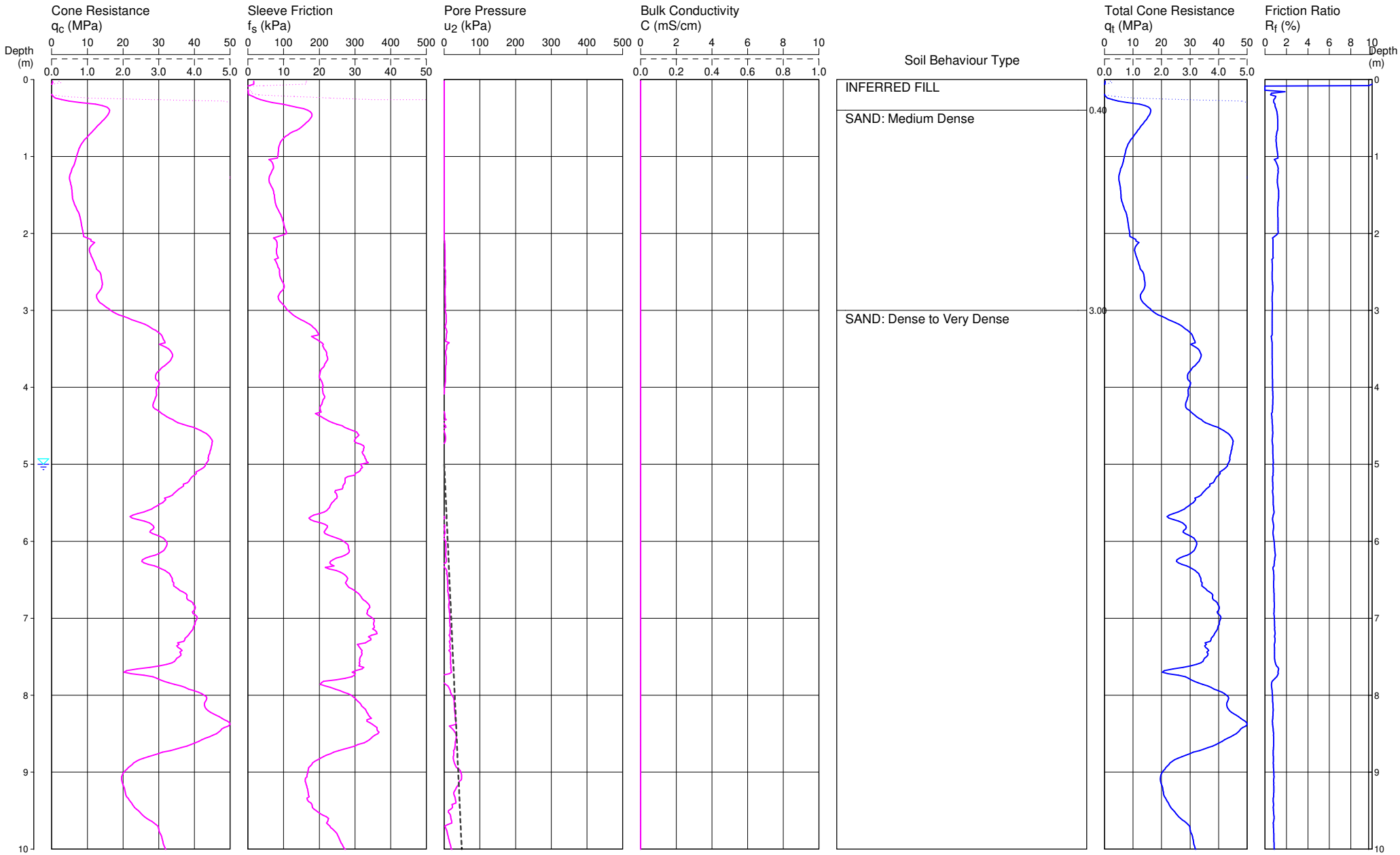
REDUCED LEVEL: 9.9

COORDINATES: 334680.8E 6241710.1N GDA2020

CPT112

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION ON RODS.
GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT112.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

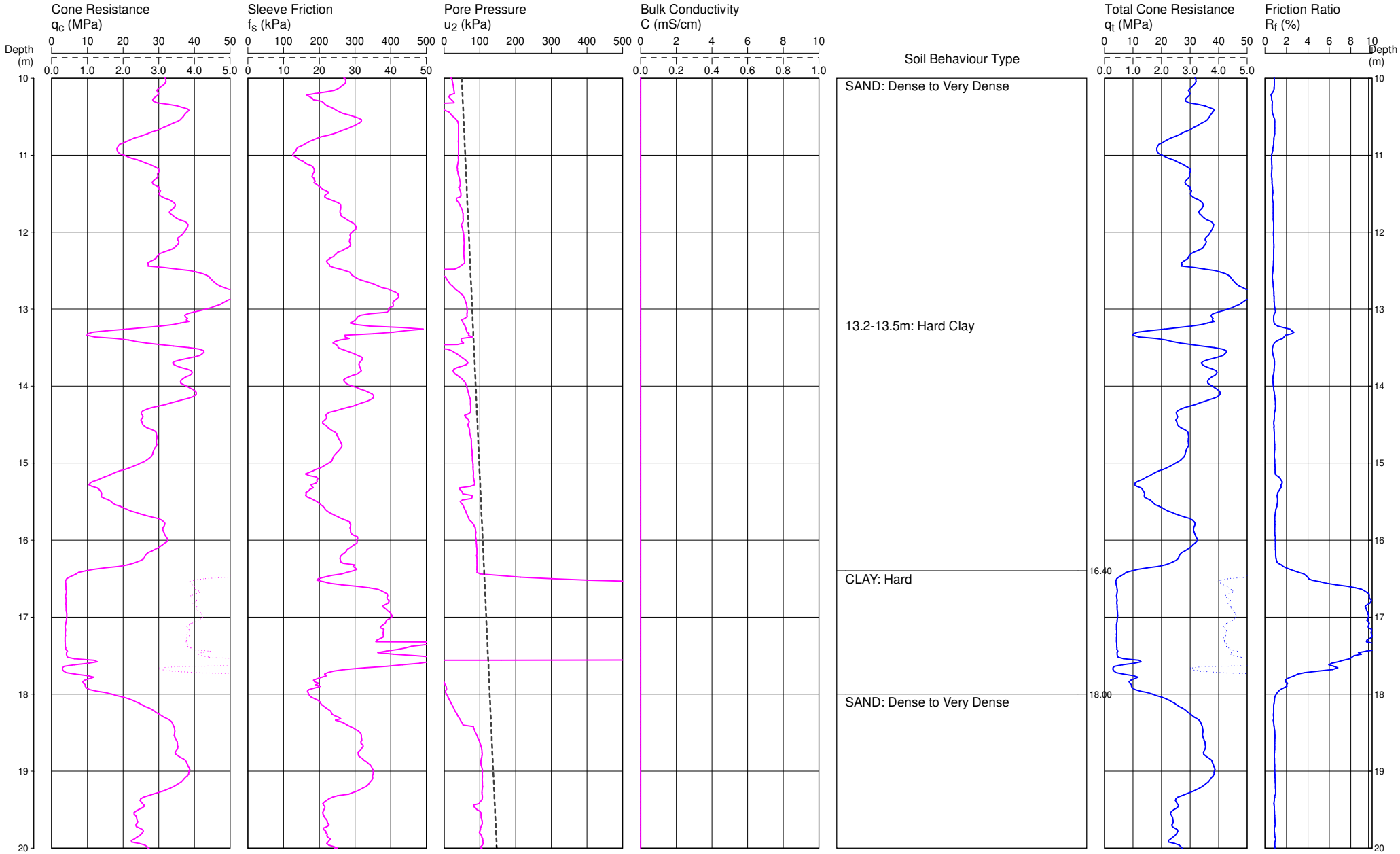
REDUCED LEVEL: 9.9

COORDINATES: 334680.8E 6241710.1N GDA2020

CPT112

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT112.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

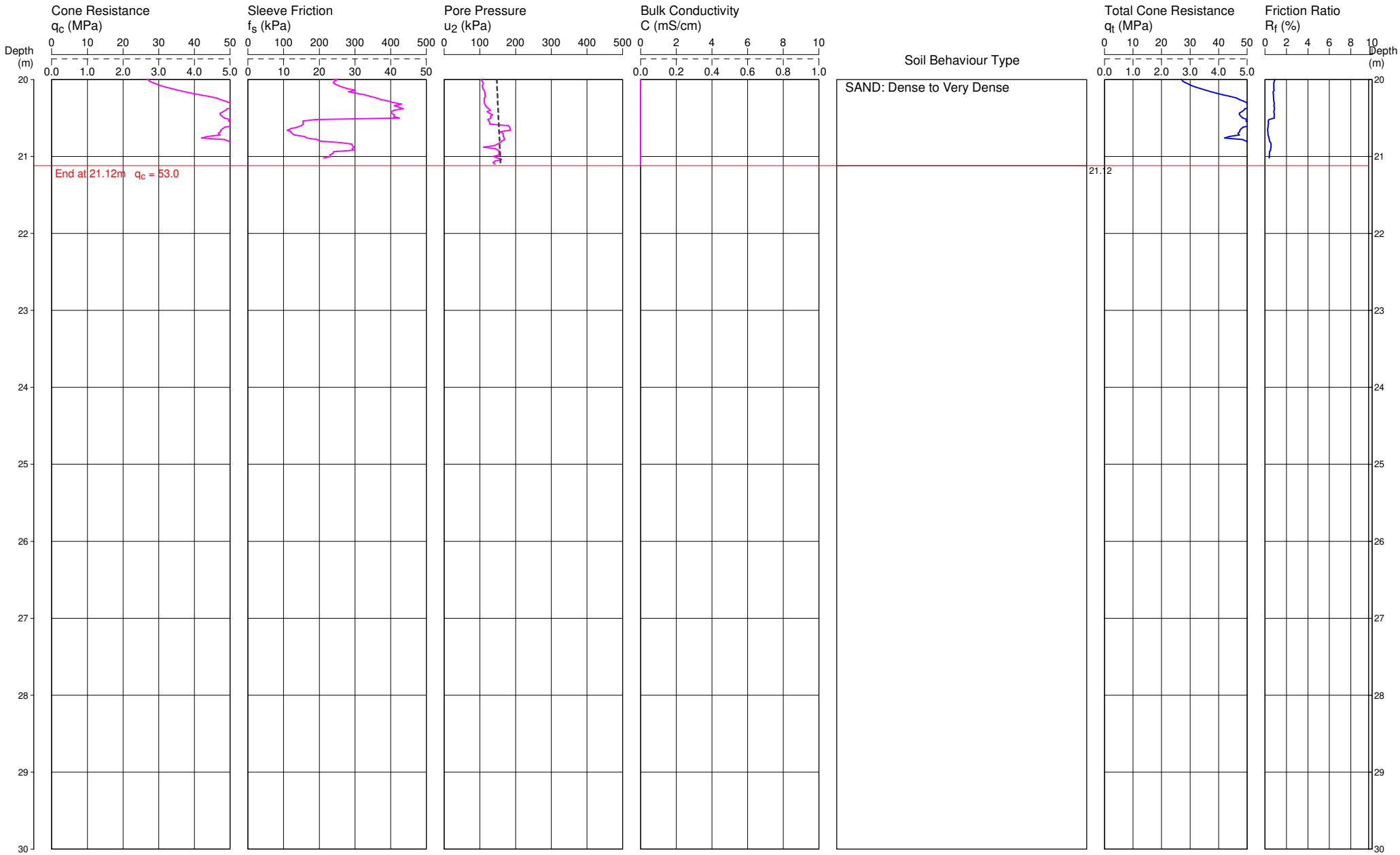
REDUCED LEVEL: 9.9

COORDINATES: 334680.8E 6241710.1N GDA2020

CPT112

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT112.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

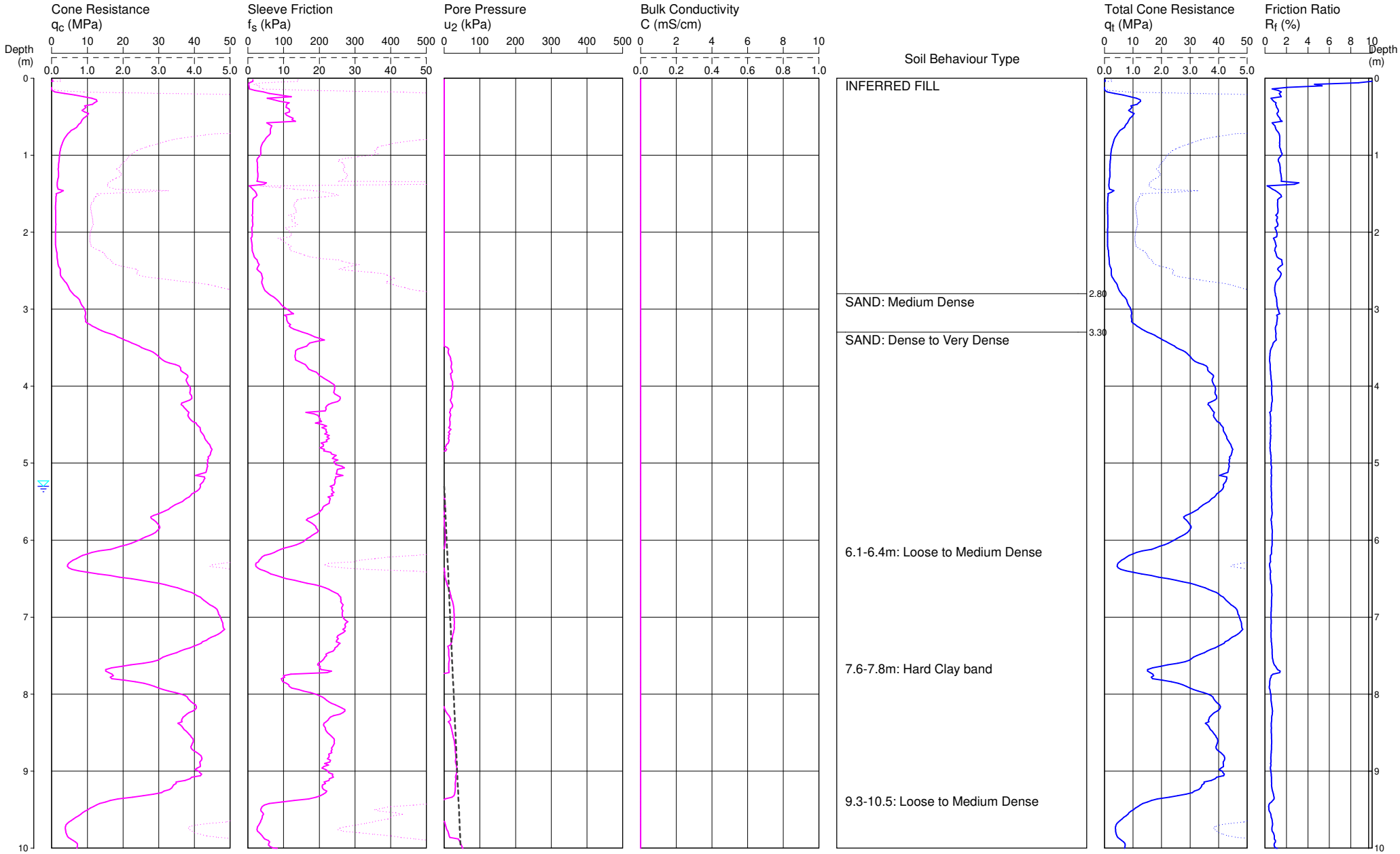
REDUCED LEVEL: 9.9

COORDINATES: 334685.9E 6241661.4N GDA2020

CPT113

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION ON RODS. GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT113.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

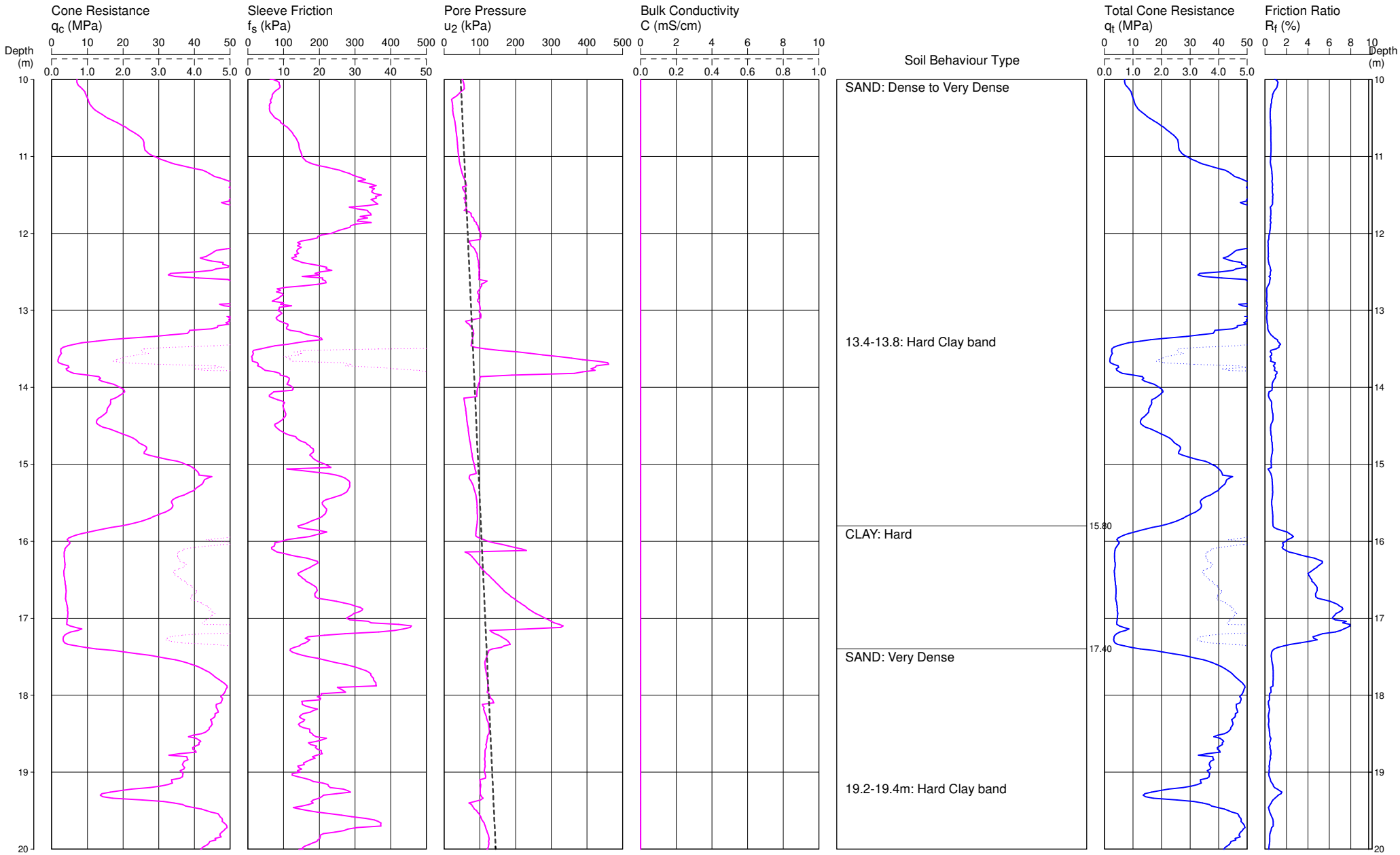
REDUCED LEVEL: 9.9

COORDINATES: 334685.9E 6241661.4N GDA2020

CPT113

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT113.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

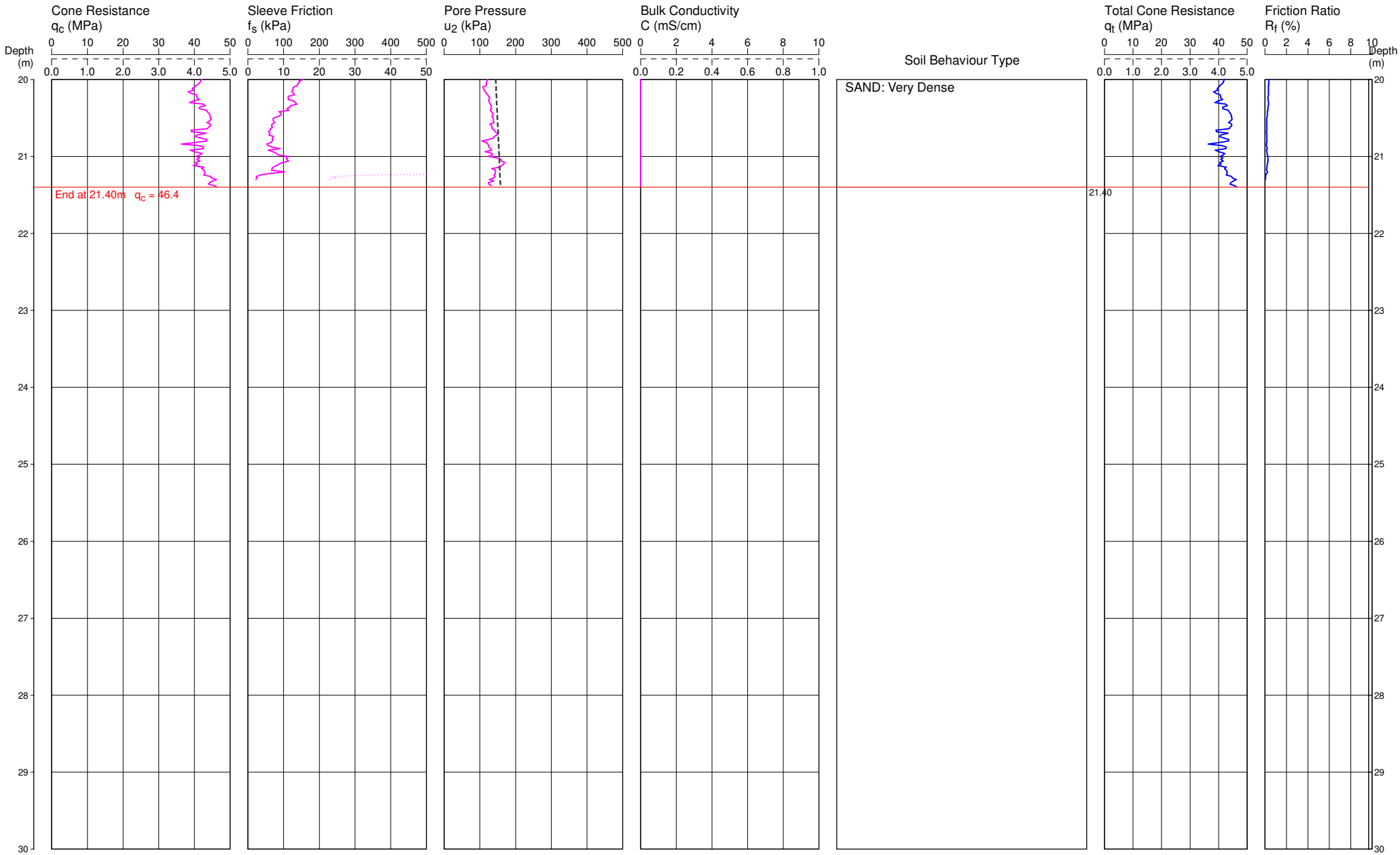
REDUCED LEVEL: 9.9

COORDINATES: 334685.9E 6241661.4N GDA2020

CPT113

DATE 07/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT113.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

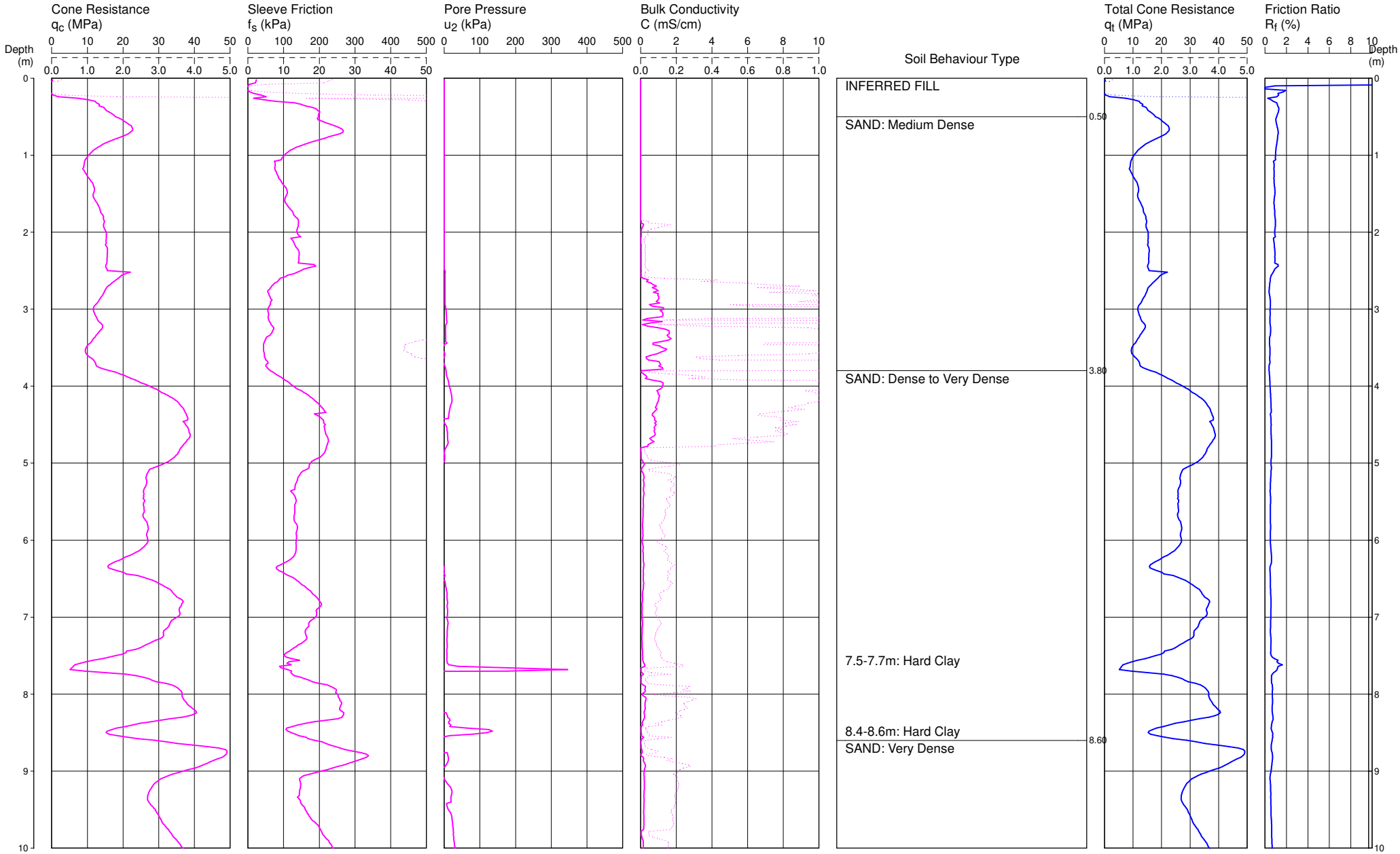
REDUCED LEVEL: 9.7

COORDINATES: 334675.2E 6241604.6N GDA2020

CPT114

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.2M. TEST DISCONTINUED DUE TO BENDING IN VERY DENSE SAND. HOLE COLLAPSED AT 5.2M AFTER WITHDRAWAL OF RODS.

File: Y:\219609.02 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT114.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

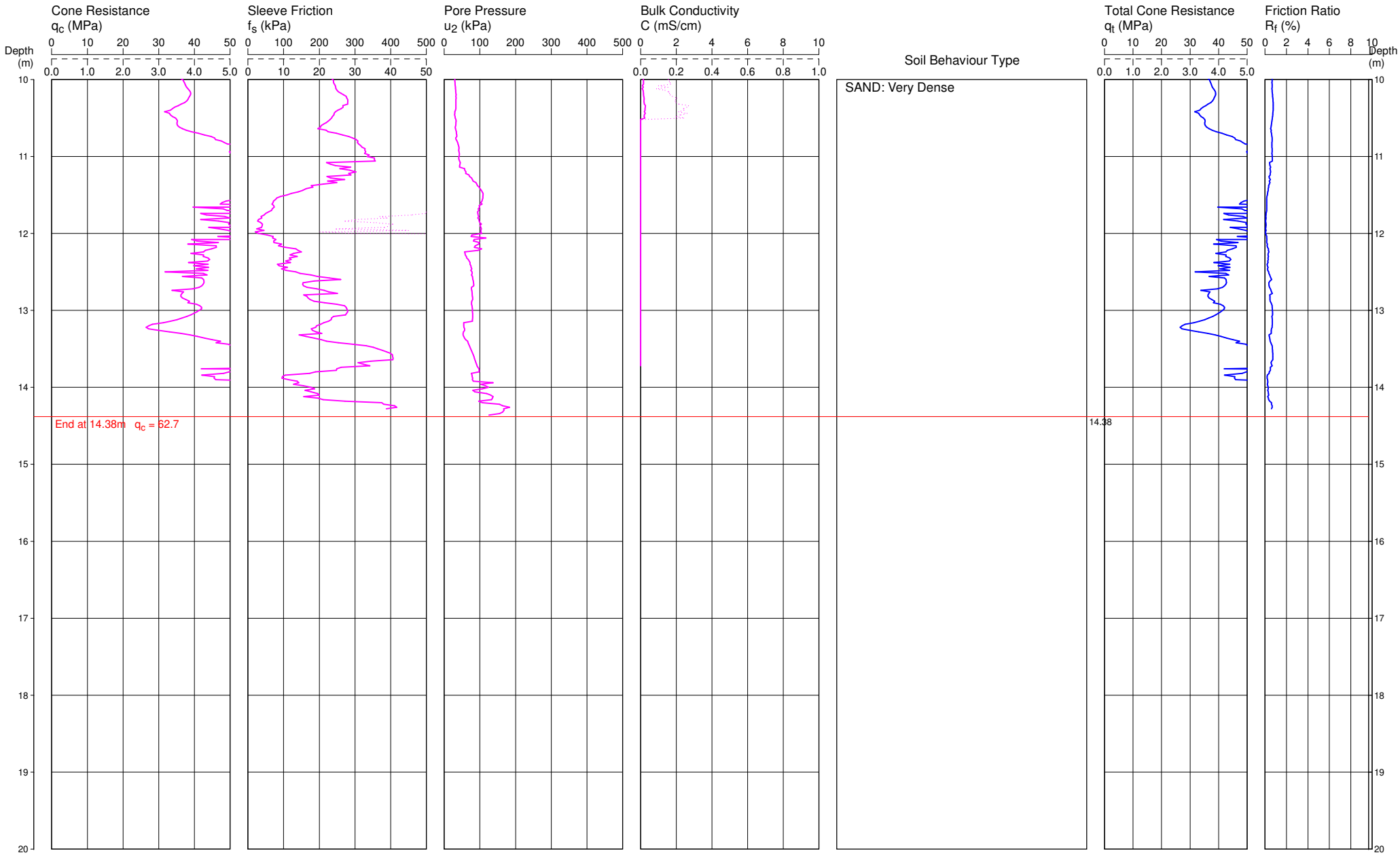
REDUCED LEVEL: 9.7

COORDINATES: 334675.2E 6241604.6N GDA2020

CPT114

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.2M. TEST DISCONTINUED DUE TO BENDING IN VERY DENSE SAND. HOLE COLLAPSED AT 5.2M AFTER WITHDRAWAL OF RODS.

File: T:\219609_BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT114.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

PIEZOCONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

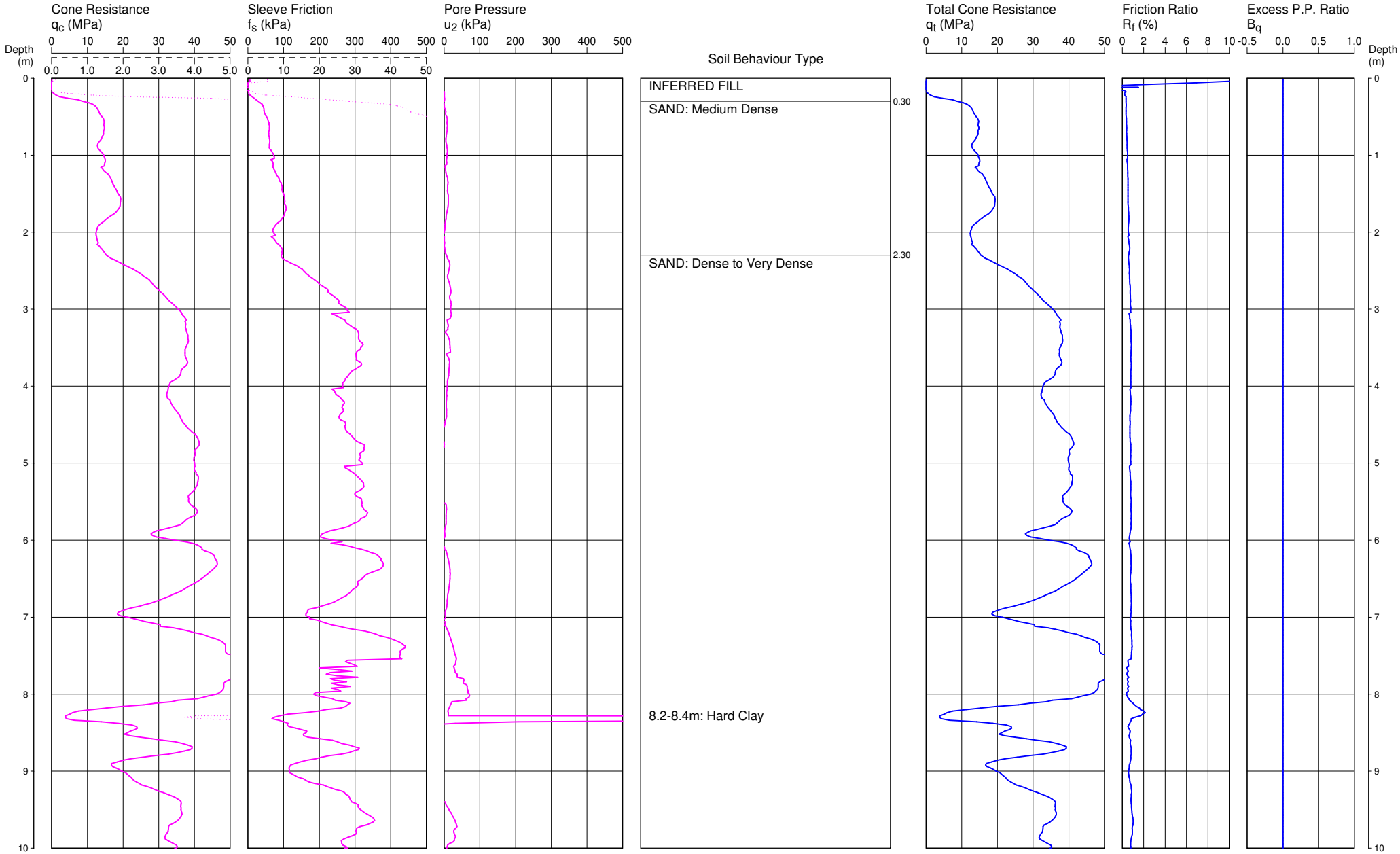
REDUCED LEVEL: 9.8

COORDINATES: 334715.9E 6241747.6N GDA2020

CPT115

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVERTY2 DENSE SAND. HOLE COLLAPSED AT 4.3M AFTER WITHDRAWAL OF RODS.

File: I:\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT115.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

PIEZOCONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

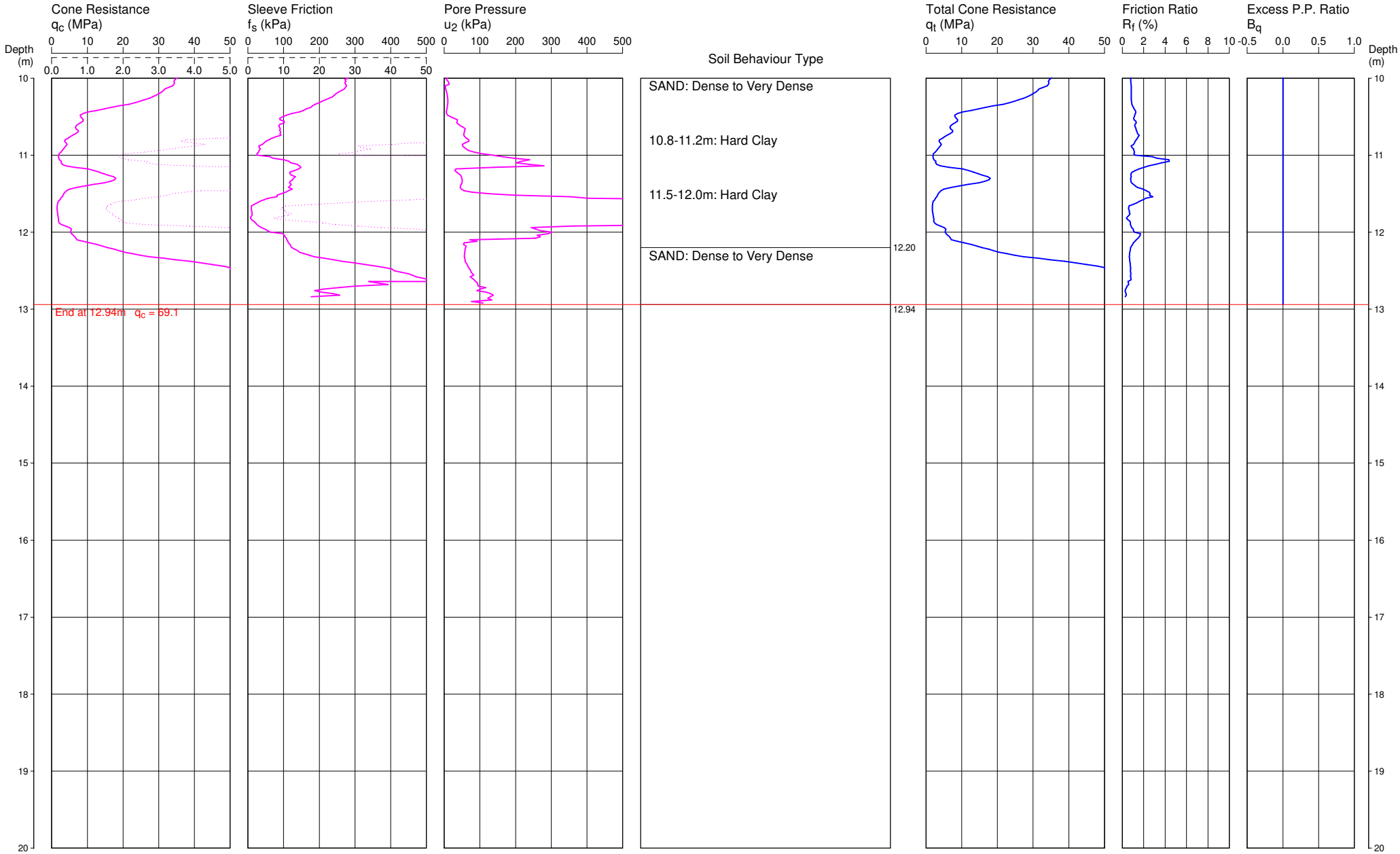
REDUCED LEVEL: 9.8

COORDINATES: 334715.9E 6241747.6N GDA2020

CPT115

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO BENDING RIVETY 2 DENSE SAND.
HOLE COLLAPSED AT 4.3M AFTER WITHDRAWAL OF RODS.

File: I:\2021\219609.02 BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT115.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

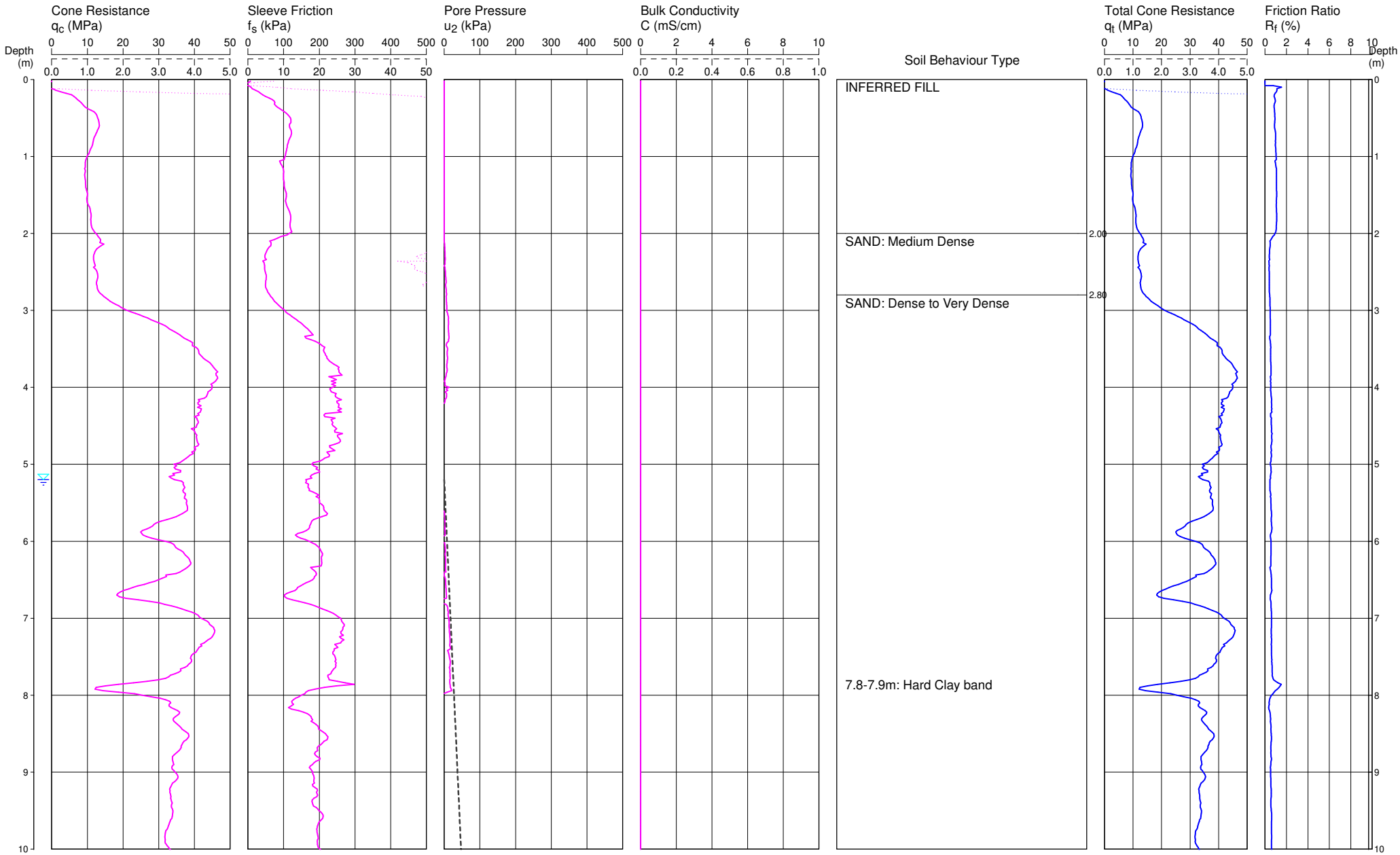
REDUCED LEVEL: 10.0

COORDINATES: 334718.1E 6241697.5N GDA2020

CPT116

DATE 08/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.09M. TEST DISCONTINUED DUE TO EXCESSIVE ROD FRICTION.
GROUNDWATER OBSERVED AT 5.2M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT116.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.20m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

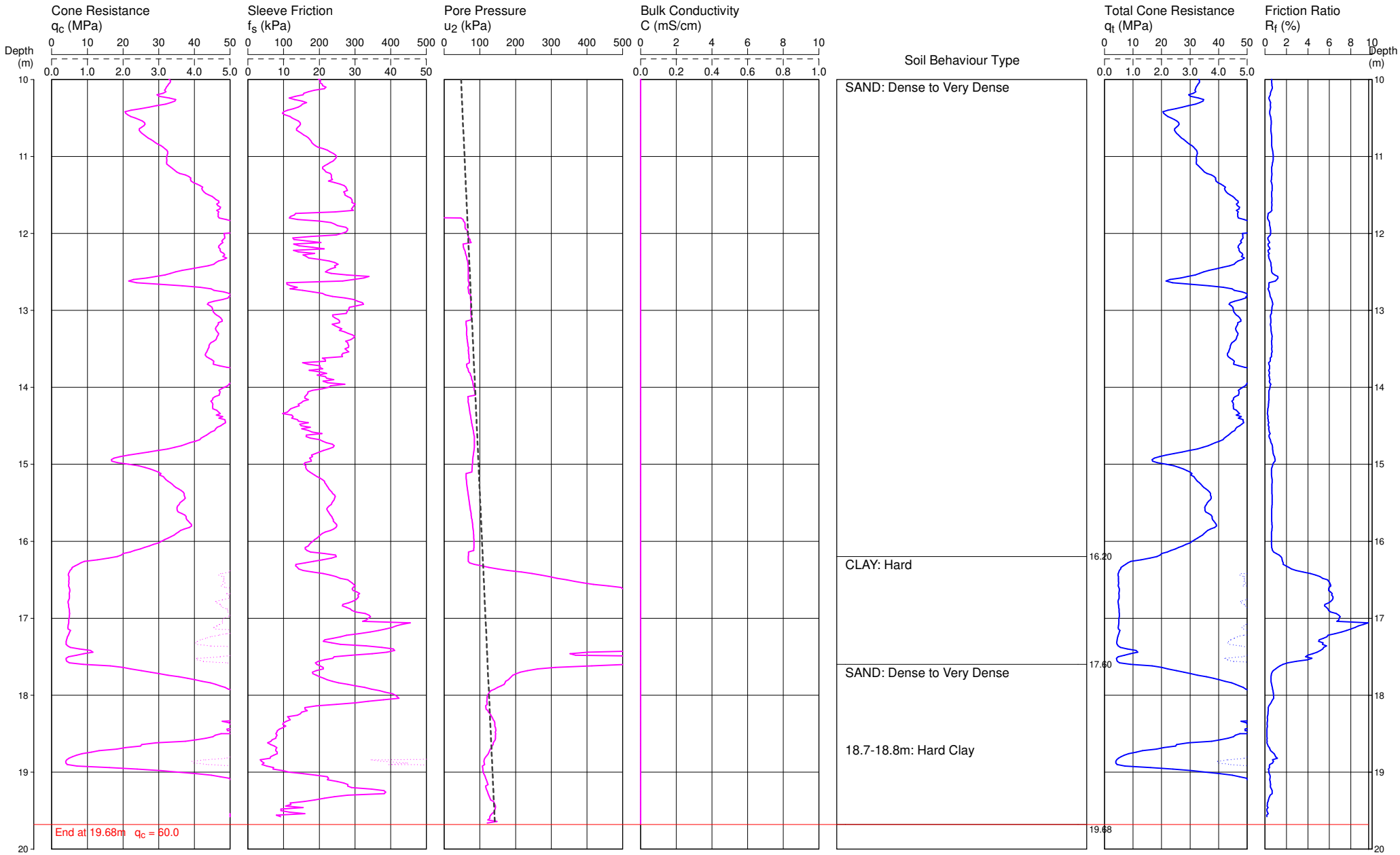
REDUCED LEVEL: 10.0

COORDINATES: 334718.1E 6241697.5N GDA2020

CPT116

DATE 08/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.09M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.2M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT116.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.20m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

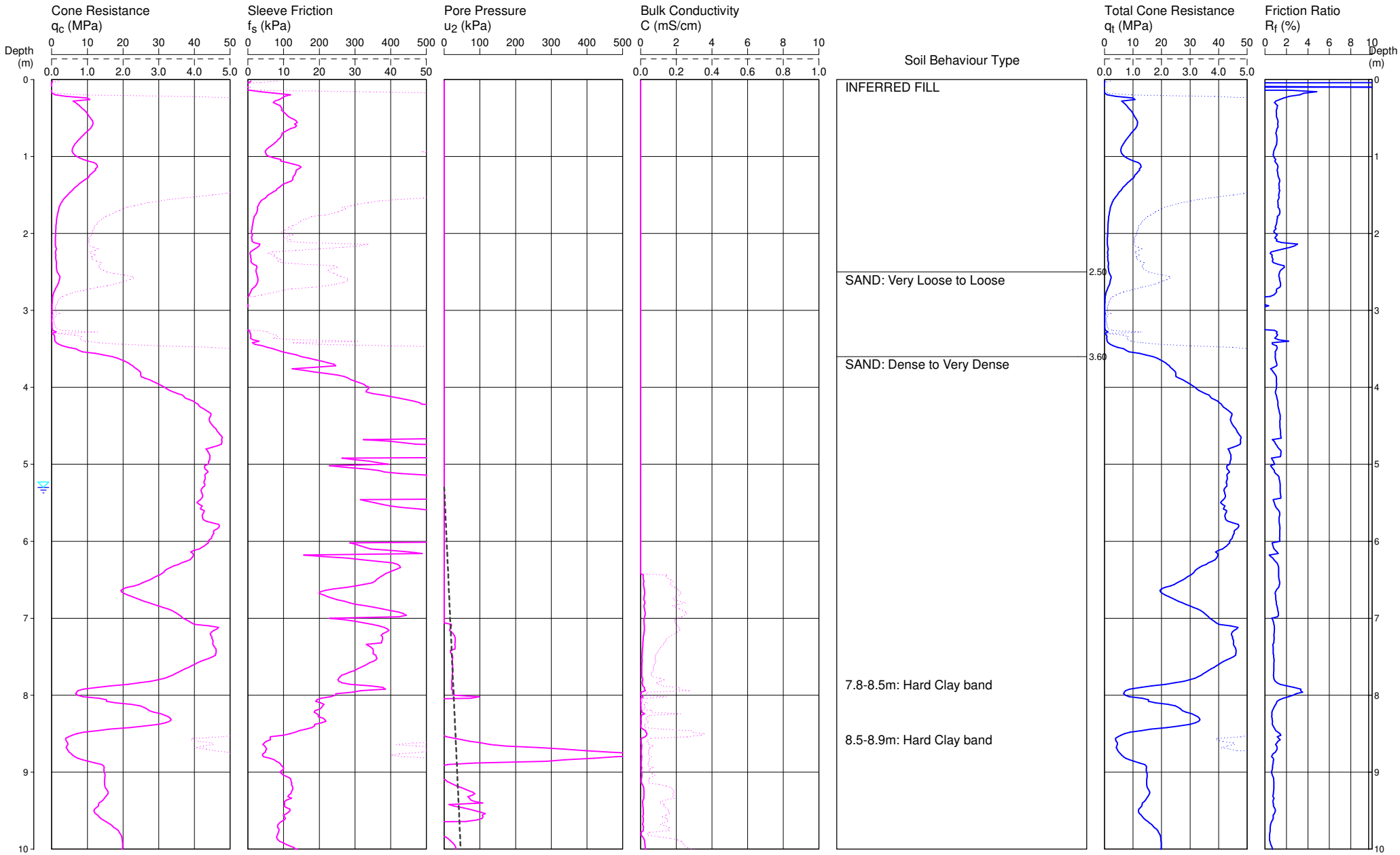
REDUCED LEVEL: 9.9

COORDINATES: 334705.3E 6241639.7N GDA2020

CPT117

DATE 08/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT117.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

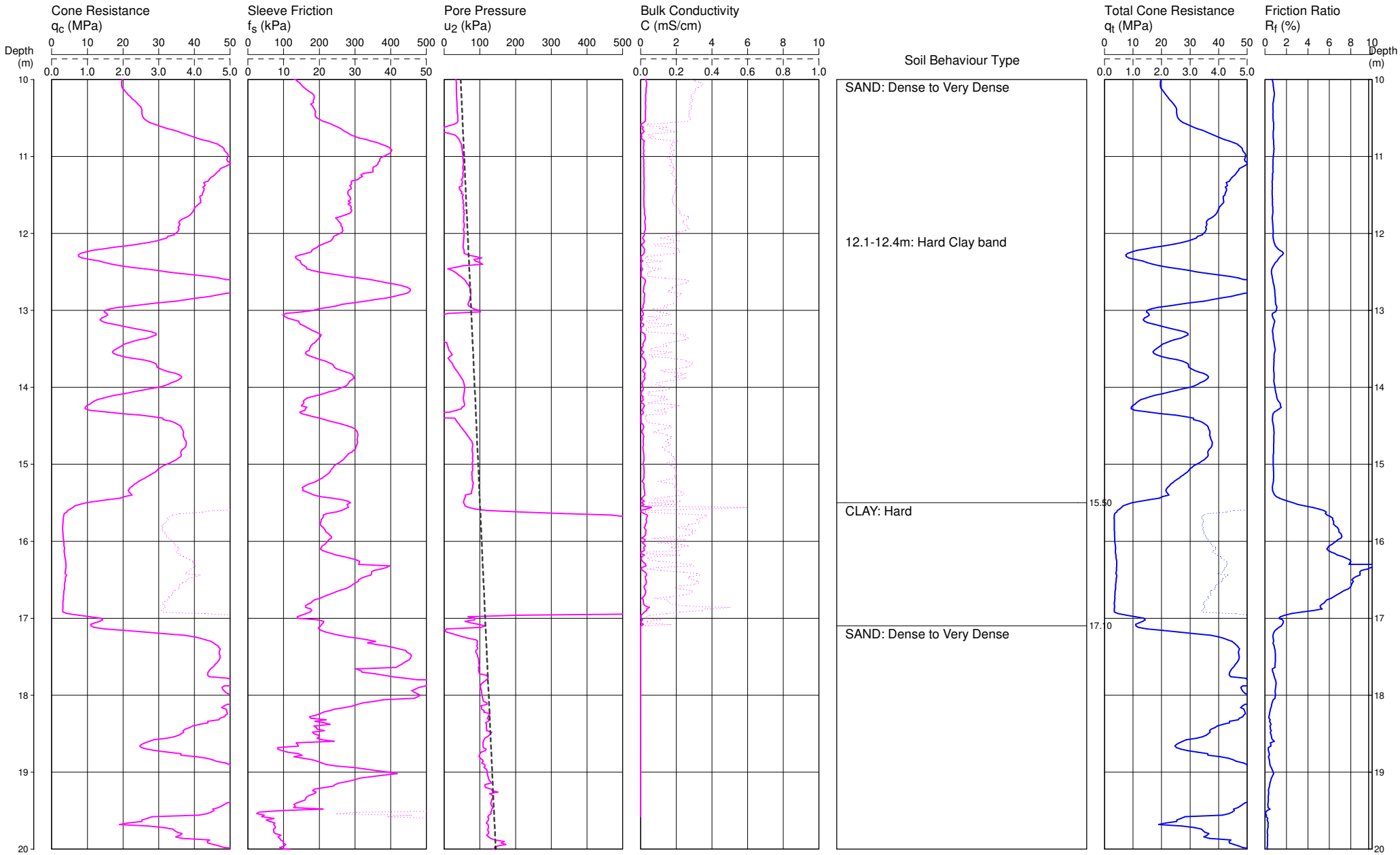
REDUCED LEVEL: 9.9

COORDINATES: 334705.3E 6241639.7N GDA2020

CPT117

DATE 08/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE ROD FRICTION.
GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT117.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

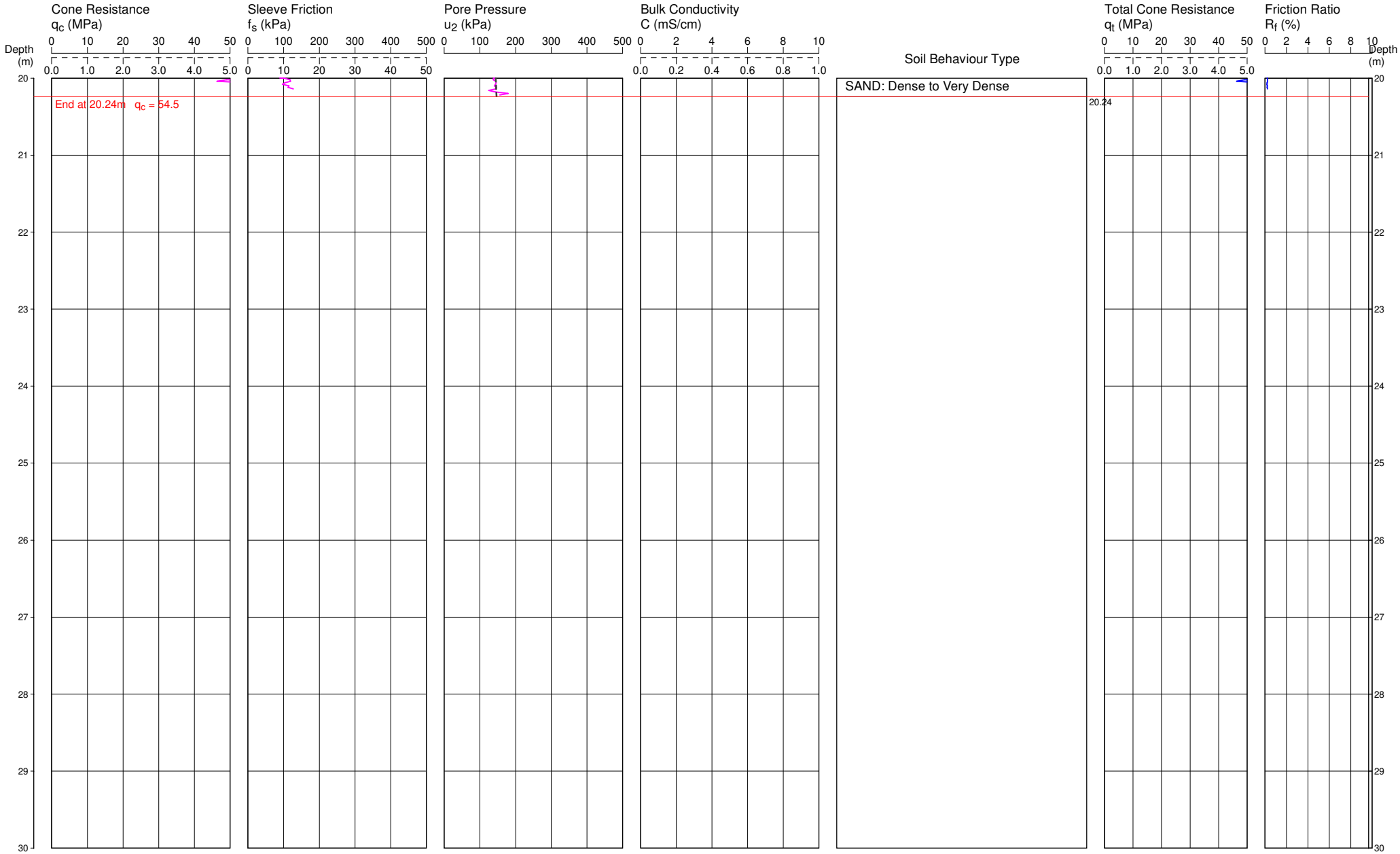
REDUCED LEVEL: 9.9

COORDINATES: 334705.3E 6241639.7N GDA2020

CPT117

DATE 08/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.17M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT117.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

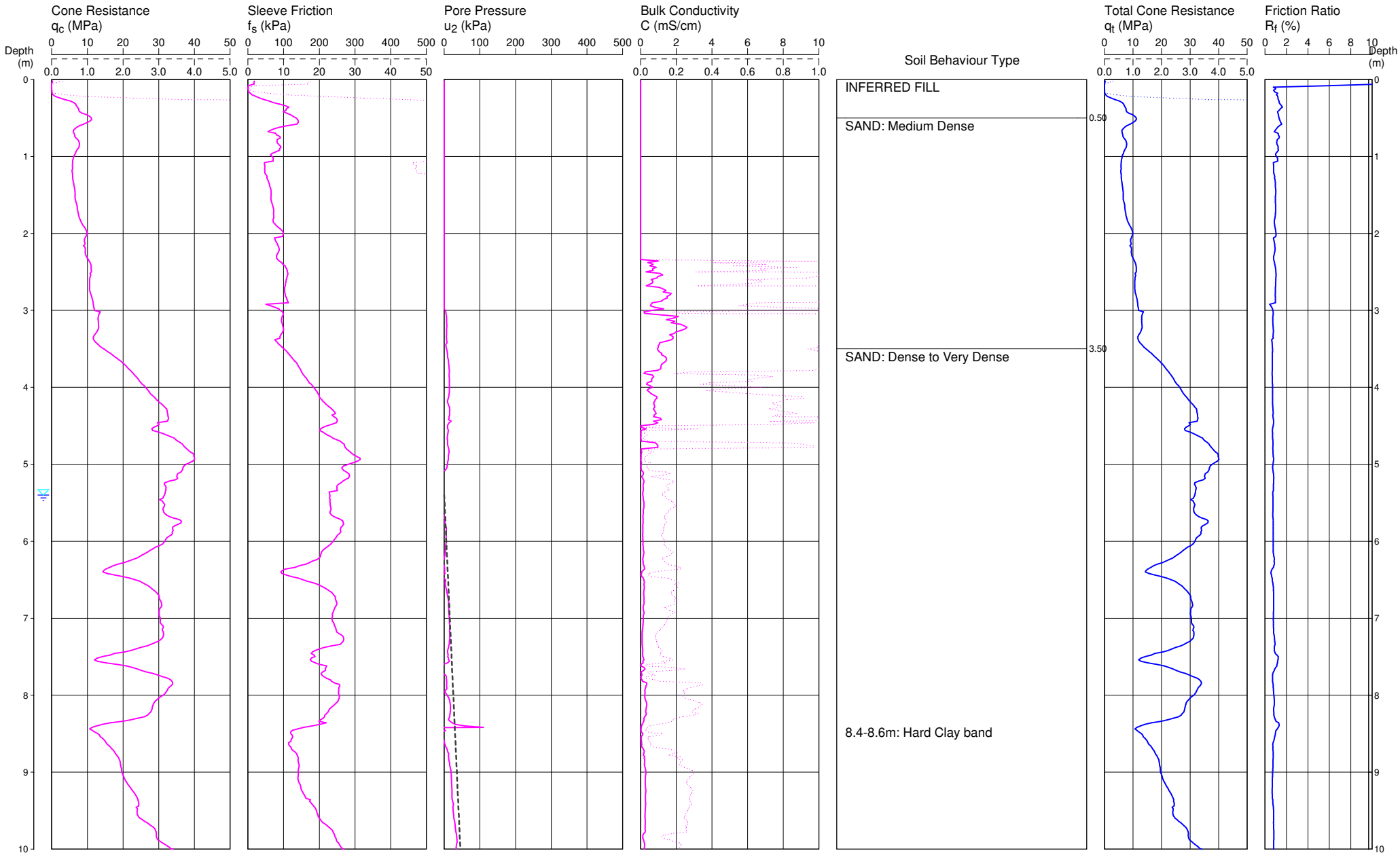
REDUCED LEVEL: 9.8

COORDINATES: 334707.8E 6241599.1N GDA2020

CPT118

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.4M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT118.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.40m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

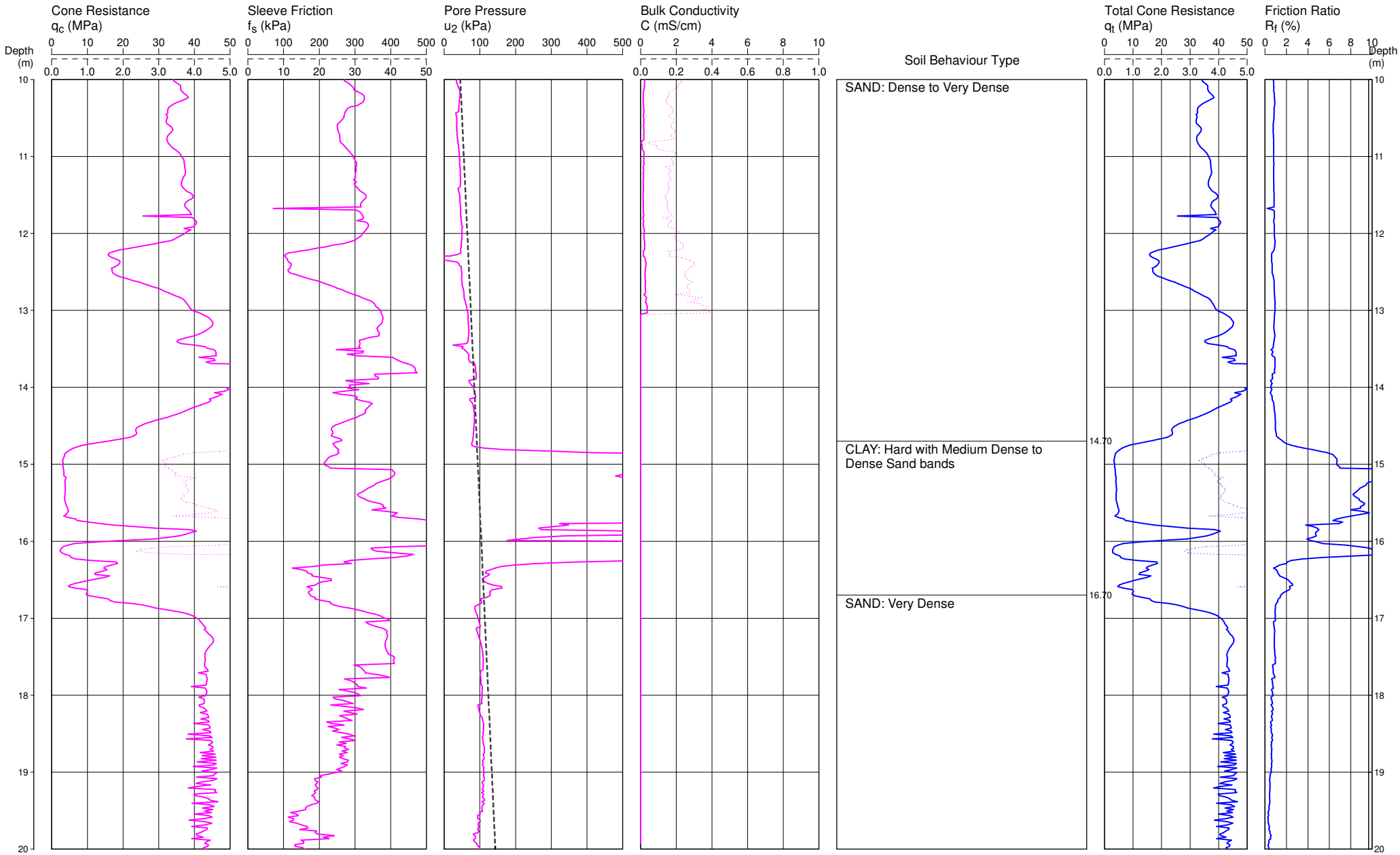
REDUCED LEVEL: 9.8

COORDINATES: 334707.8E 6241599.1N GDA2020

CPT118

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO EXCESSIVE ROD FRICTION.
GROUNDWATER OBSERVED AT 5.4M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT118.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.40m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

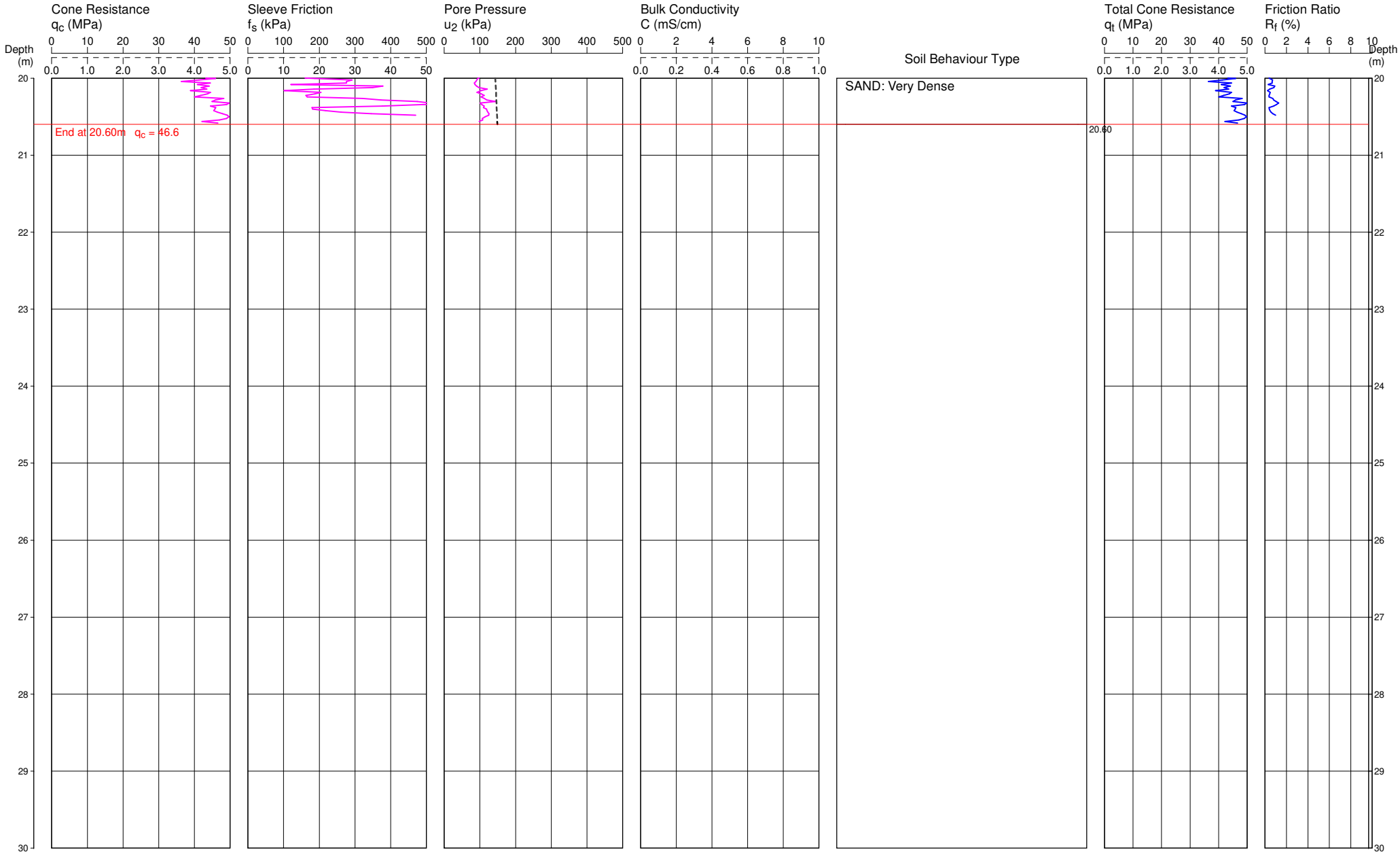
REDUCED LEVEL: 9.8

COORDINATES: 334707.8E 6241599.1N GDA2020

CPT118

DATE 03/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.15M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.4M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT118.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

Water depth after test: 5.40m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

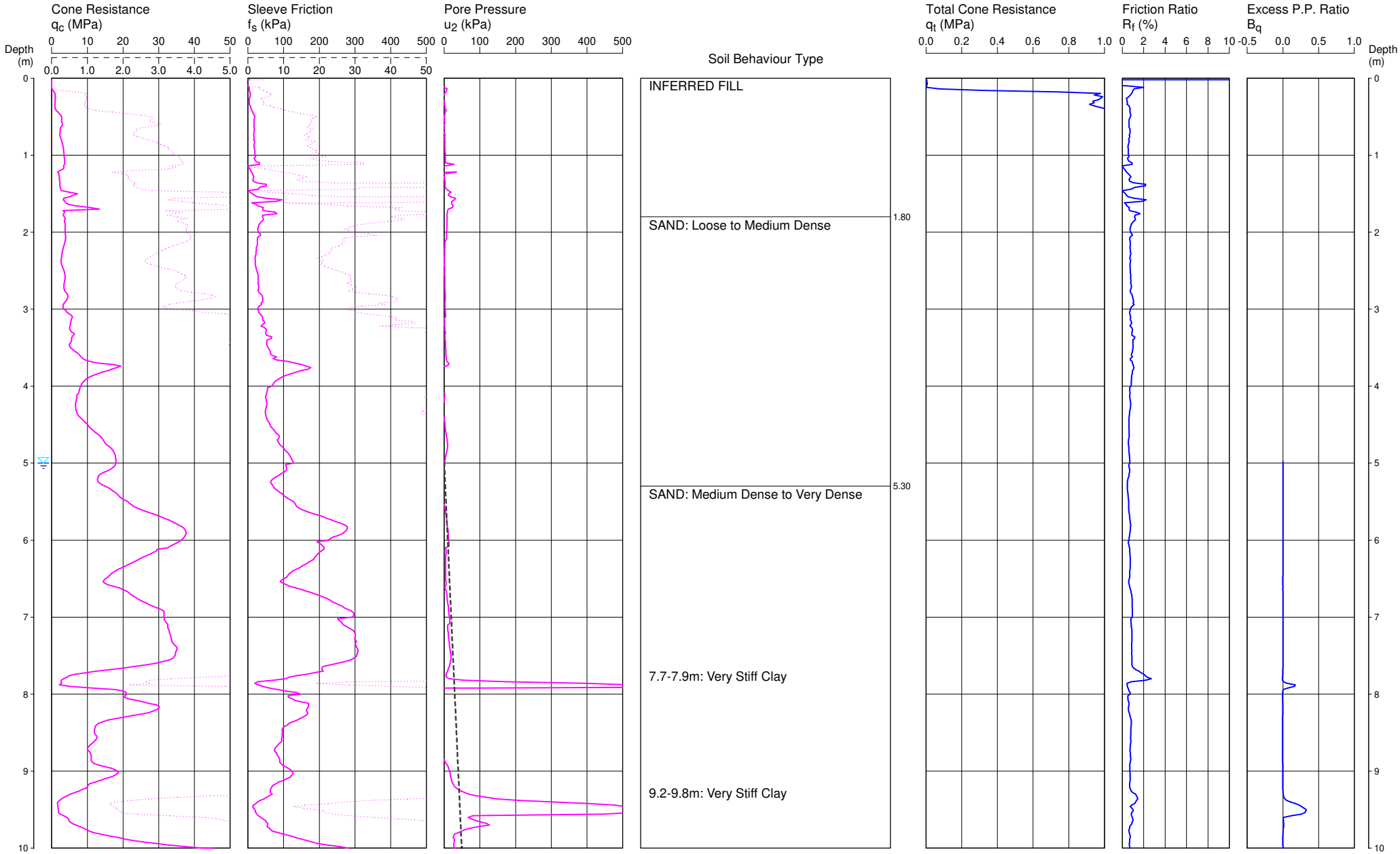
REDUCED LEVEL: 9.8

COORDINATES: 334757.4E 6241708.7N GDA2020

CPT119

DATE 08/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.16M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT119.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

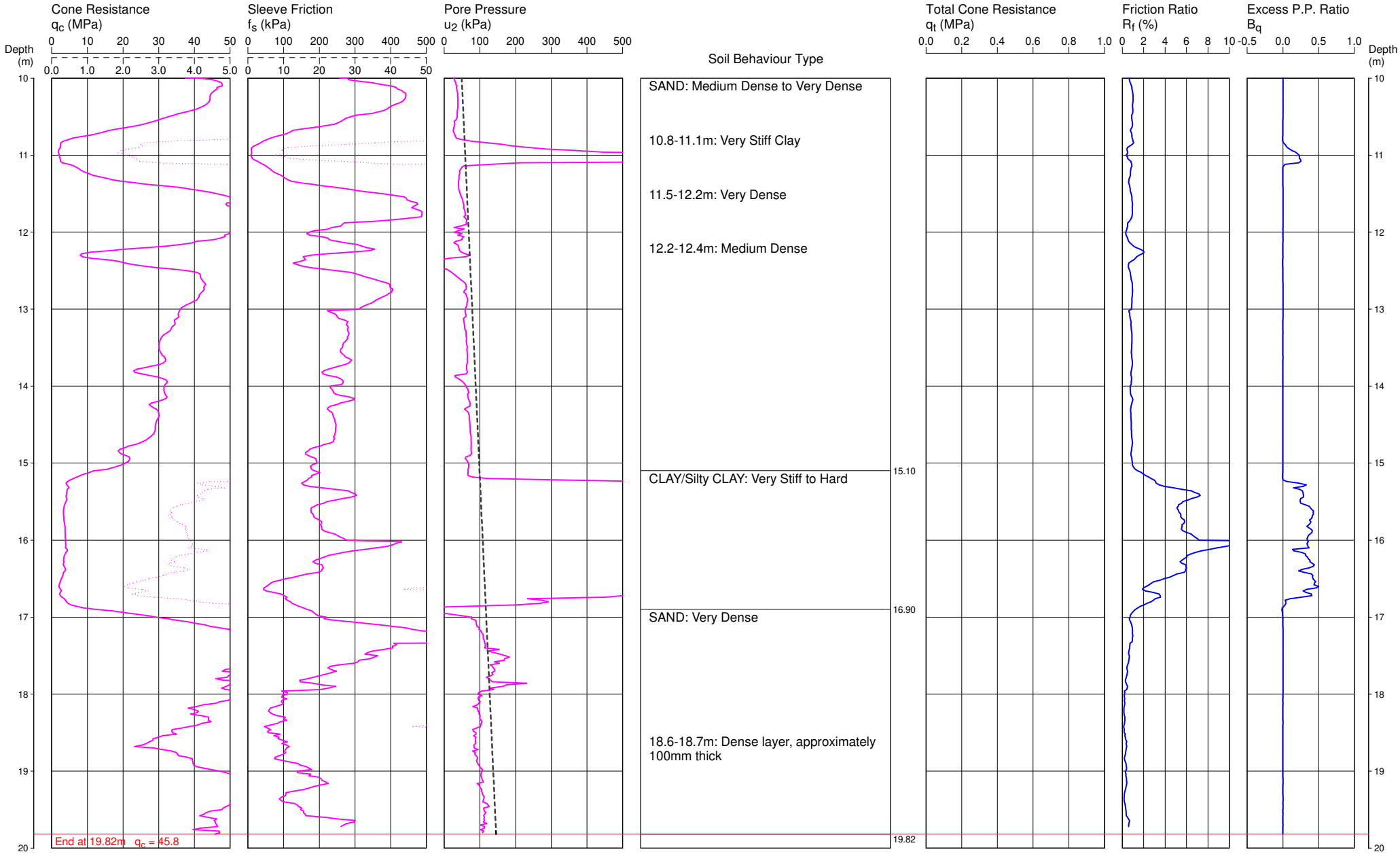
REDUCED LEVEL: 9.8

COORDINATES: 334757.4E 6241708.7N GDA2020

CPT119

DATE 08/08/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.16M. TEST DISCONTINUED DUE TO EXCESSIVE ROD FRICTION. GROUNDWATER OBSERVED AT 5.0M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT119.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

Water depth after test: 5.00m depth (measured)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

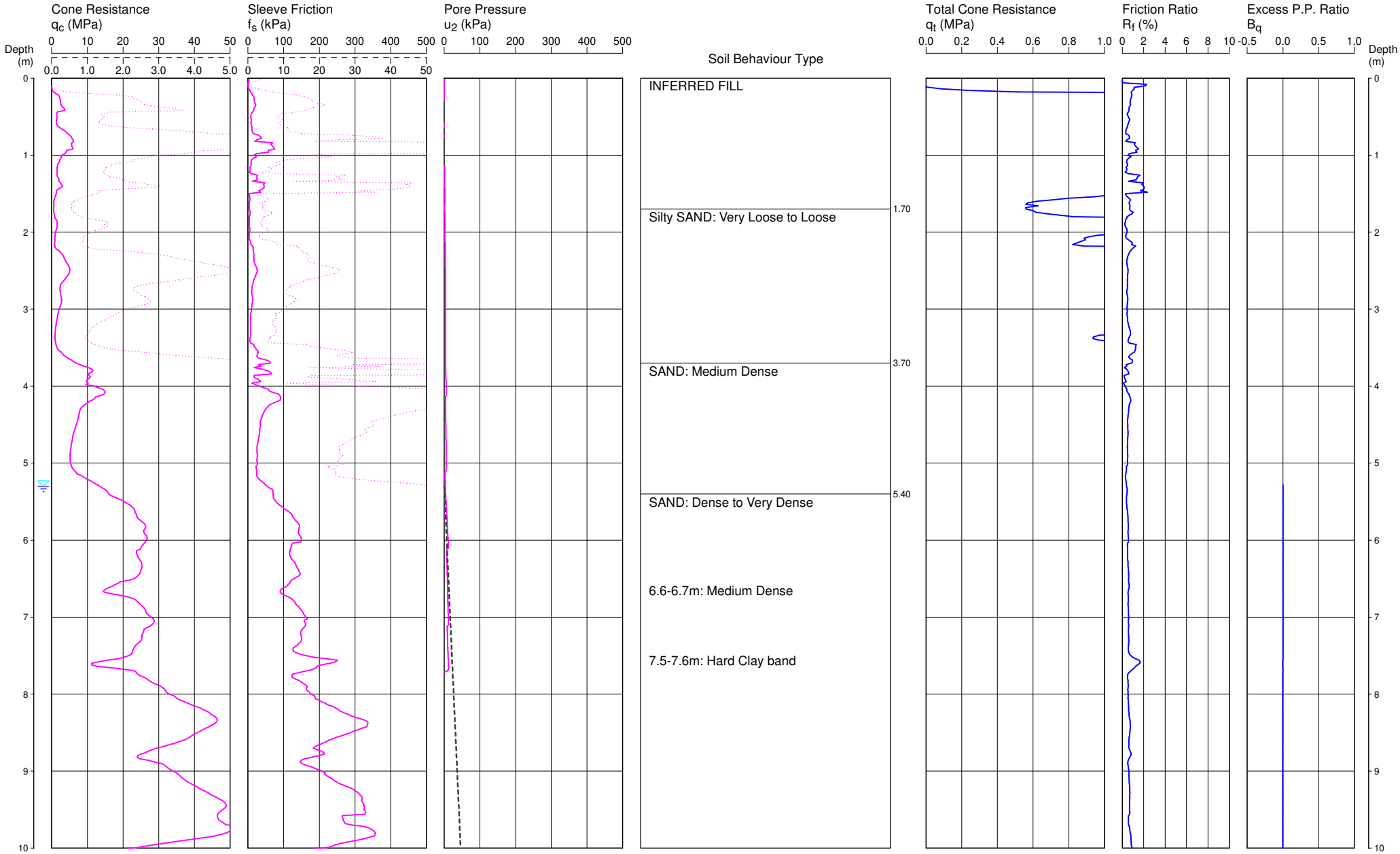
REDUCED LEVEL: 10.0

COORDINATES: 334754.2E 6241679.3N GDA2020

CPT120

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.13M. TEST DISCONTINUED DUE TO BENDING RIVERTY2 DENSE SAND. File: P:\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT120.CP5
GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS.

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (assumed)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

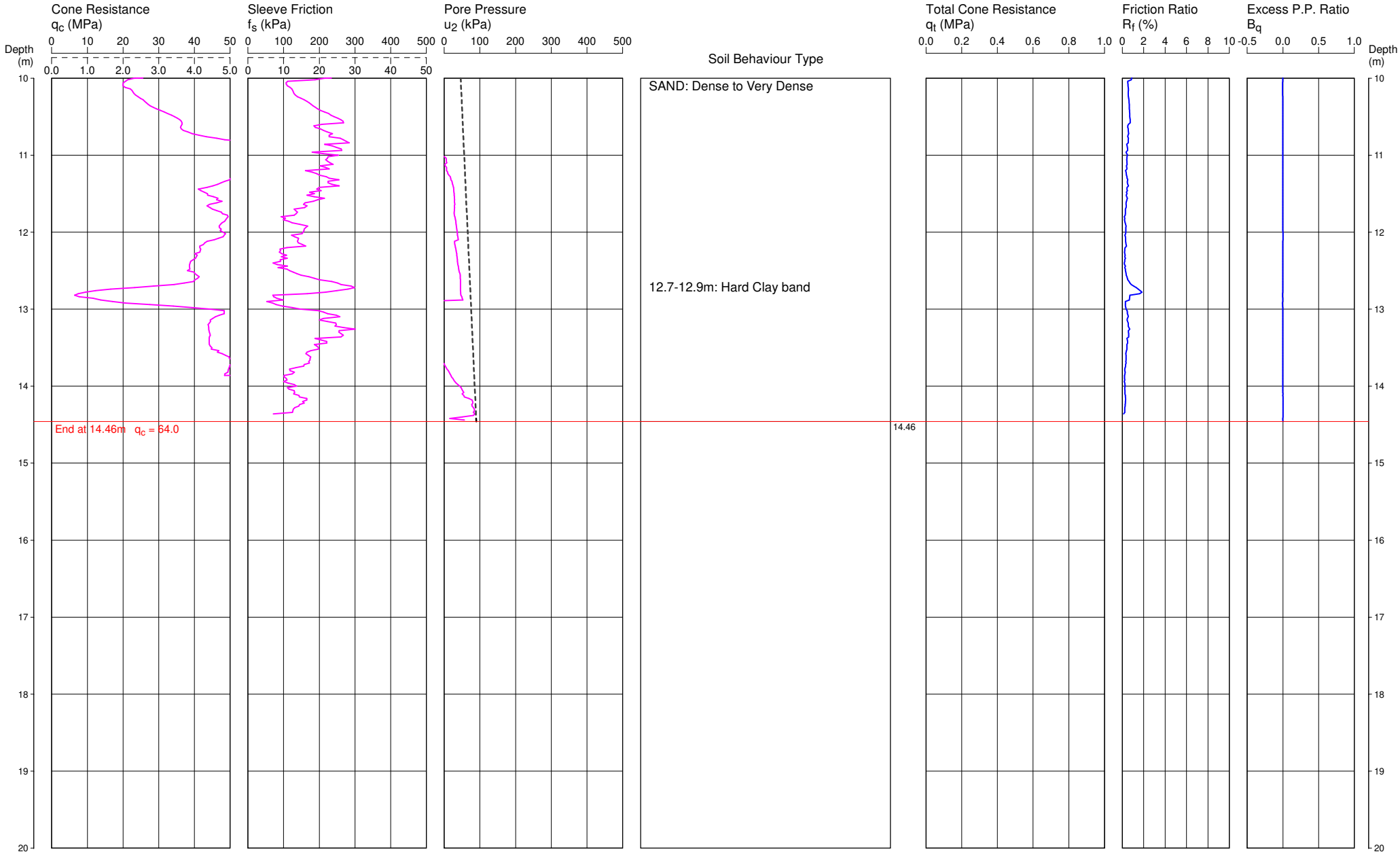
REDUCED LEVEL: 10.0

COORDINATES: 334754.2E 6241679.3N GDA2020

CPT120

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: CONCRETE TO 0.13M. TEST DISCONTINUED DUE TO BENDING RIVERINA DENSE SAND
GROUNDWATER OBSERVED AT 5.3M AFTER WITHDRAWAL OF RODS

File: I:\ENVI\PROJECTS\BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT120.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.30m depth (assumed)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

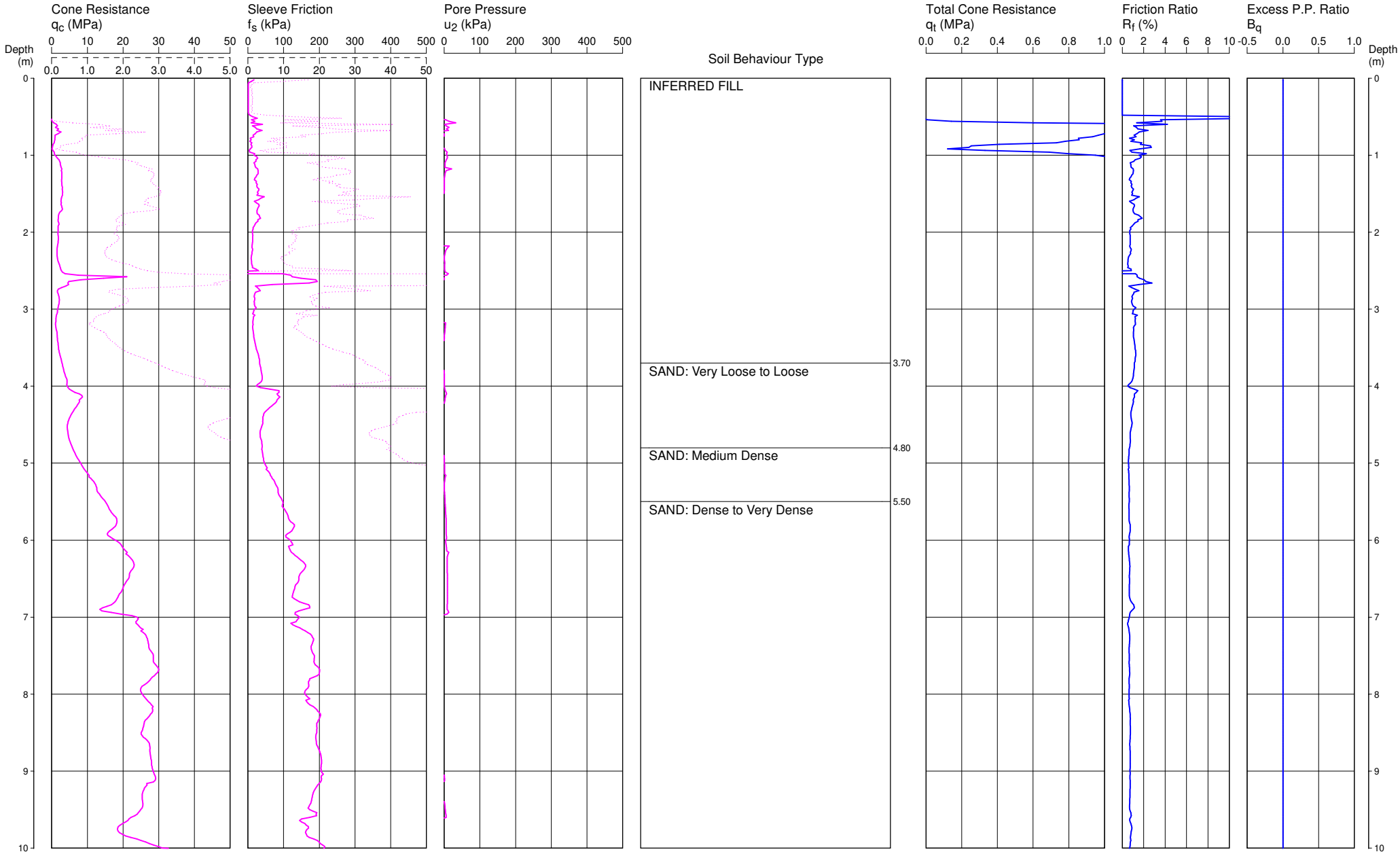
REDUCED LEVEL: 9.7

COORDINATES: 334758.5E 6241647.5N GDA2020

CPT121

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: DUMMY CONE TO 1.5M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. HOLE COLLAPSED AT 3.4M AFTER WITHDRAWAL OF RODS.

File: P:\219609 BANKSMEADOW - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT121.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

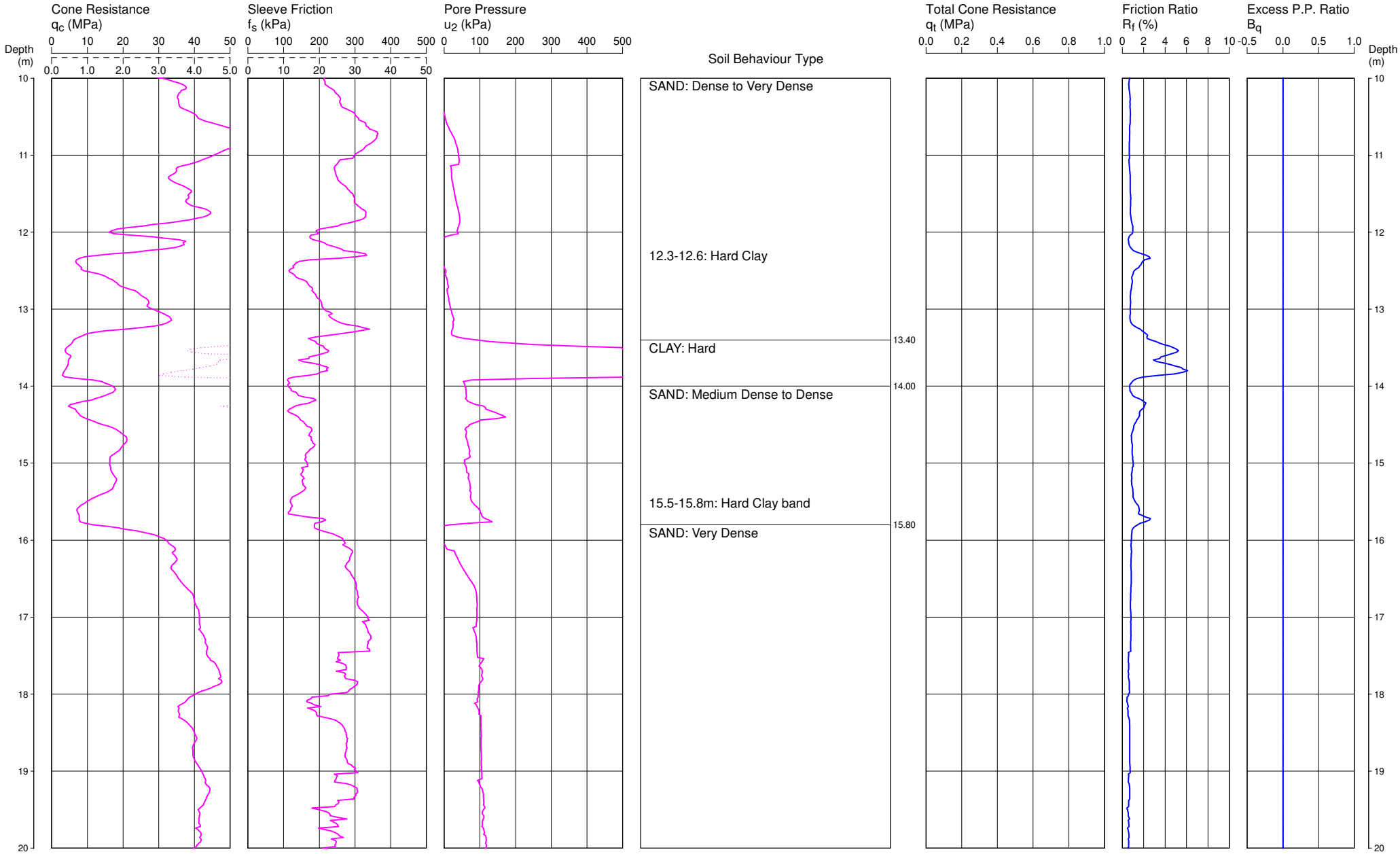
REDUCED LEVEL: 9.7

COORDINATES: 334758.5E 6241647.5N GDA2020

CPT121

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: DUMMY CONE TO 1.5M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. HOLE COLLAPSED AT 3.4M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT121.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

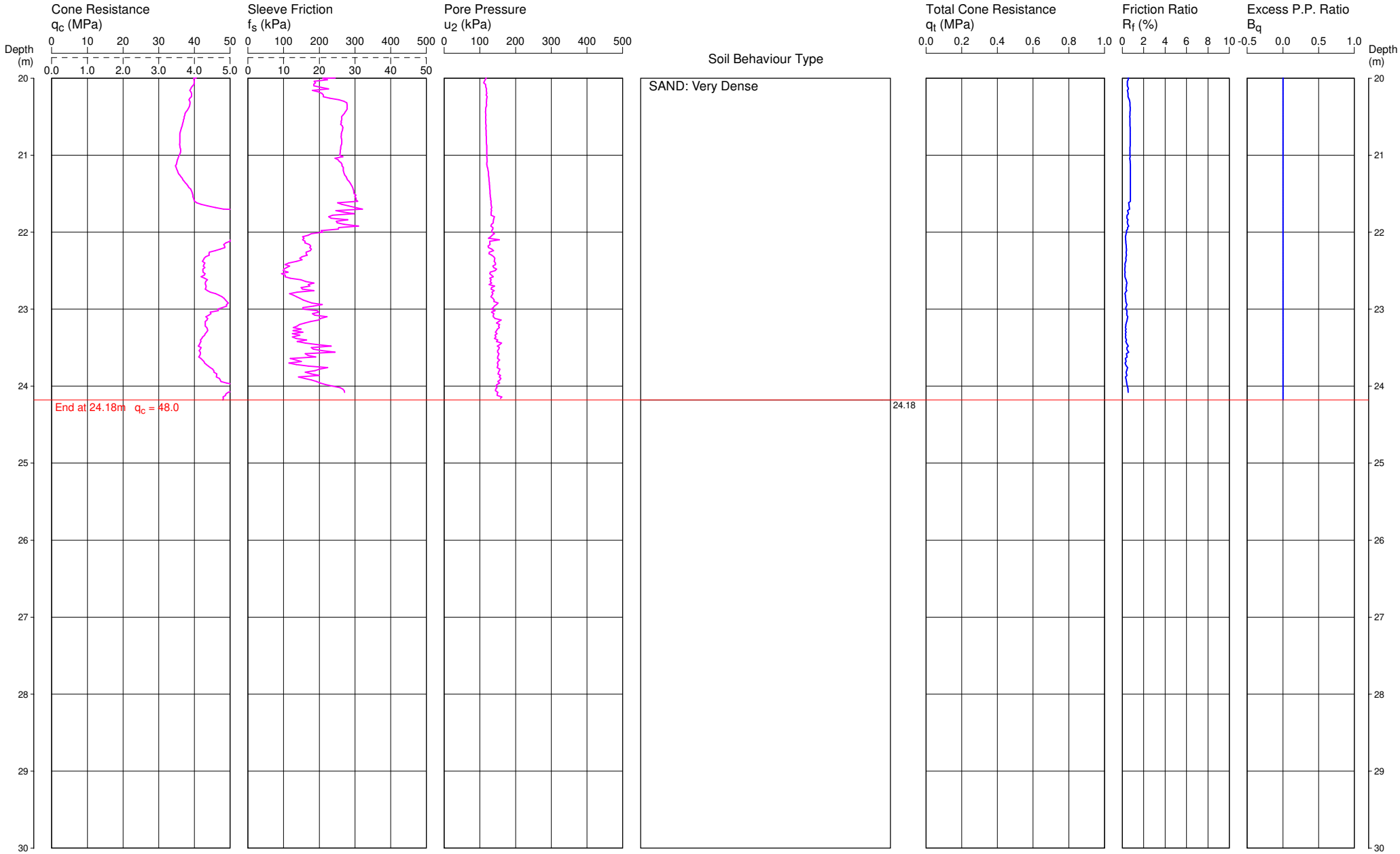
REDUCED LEVEL: 9.7

COORDINATES: 334758.5E 6241647.5N GDA2020

CPT121

DATE 04/08/2023

PROJECT No: 219609.02



REMARKS: DUMMY CONE TO 1.5M. TEST DISCONTINUED DUE TO EXCESSIVE FRICTION. HOLE COLLAPSED AT 3.4M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT121.CP5

Cone ID: 200310 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

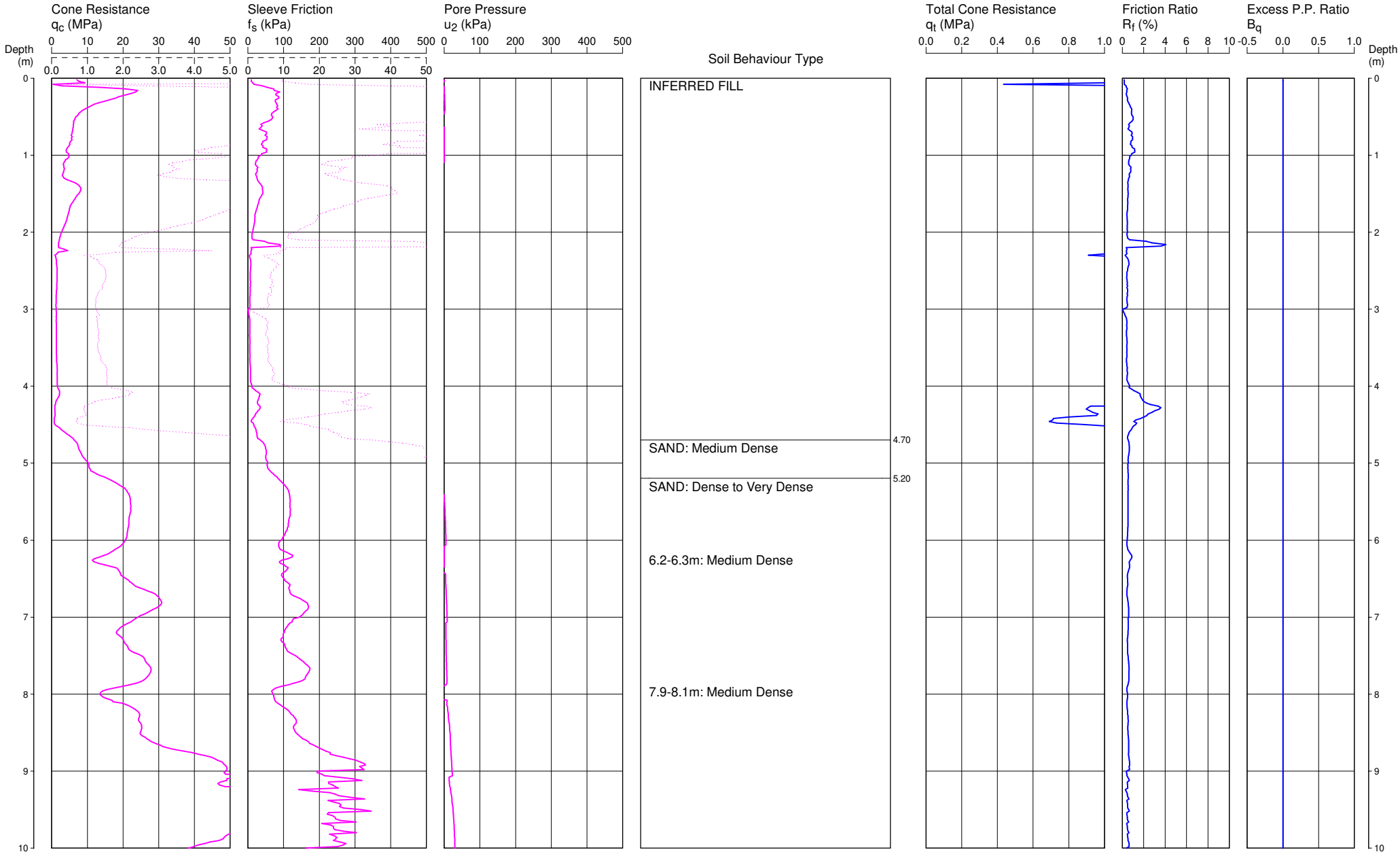
REDUCED LEVEL: 8.9

COORDINATES: 334760.0E 6241577.5N GDA2020

CPT122

DATE 01/08/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. HOLE COLLAPSED AT 4.6M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT122.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

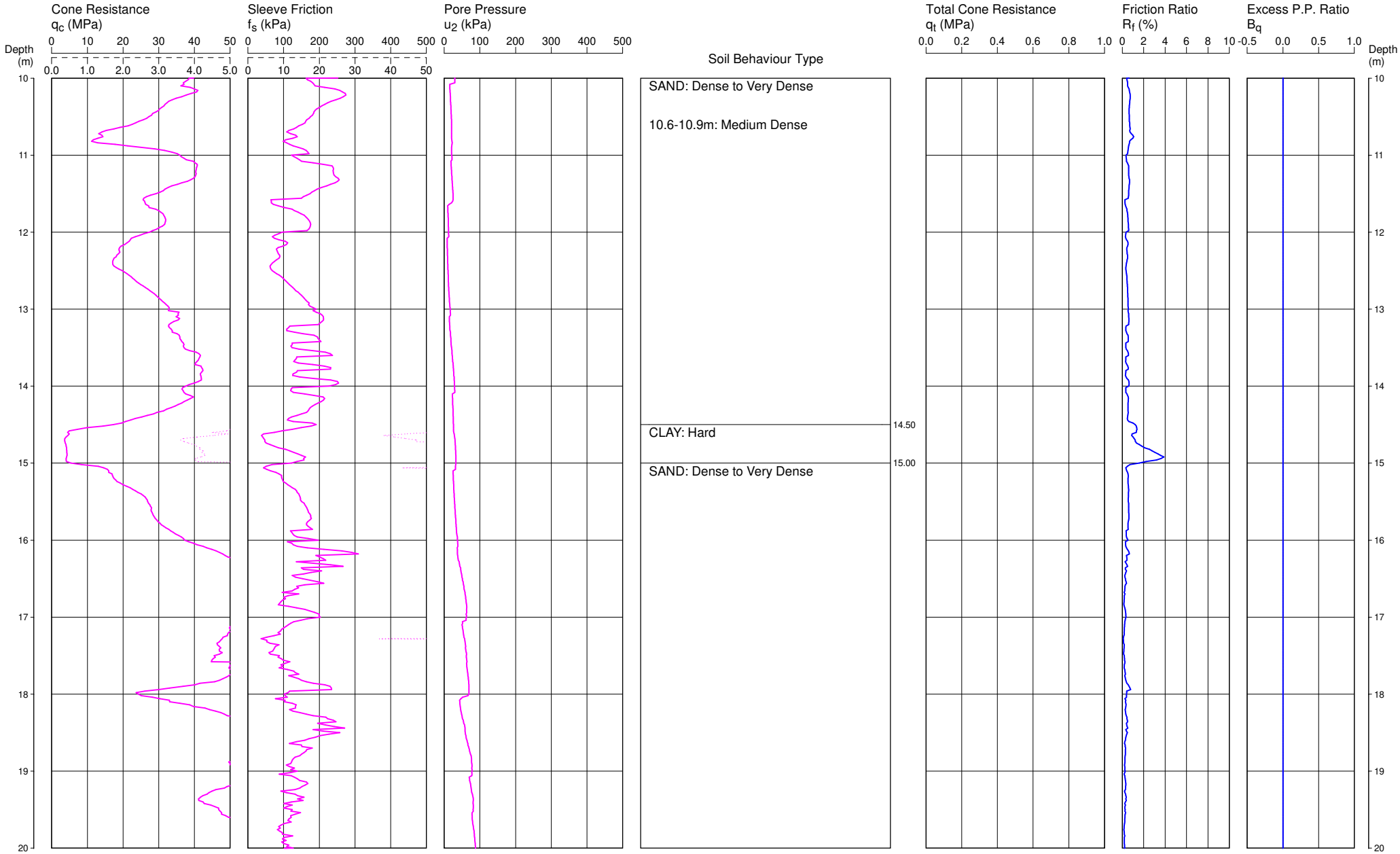
REDUCED LEVEL: 8.9

COORDINATES: 334760.0E 6241577.5N GDA2020

CPT122

DATE 01/08/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. HOLE COLLAPSED AT 4.6M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT122.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

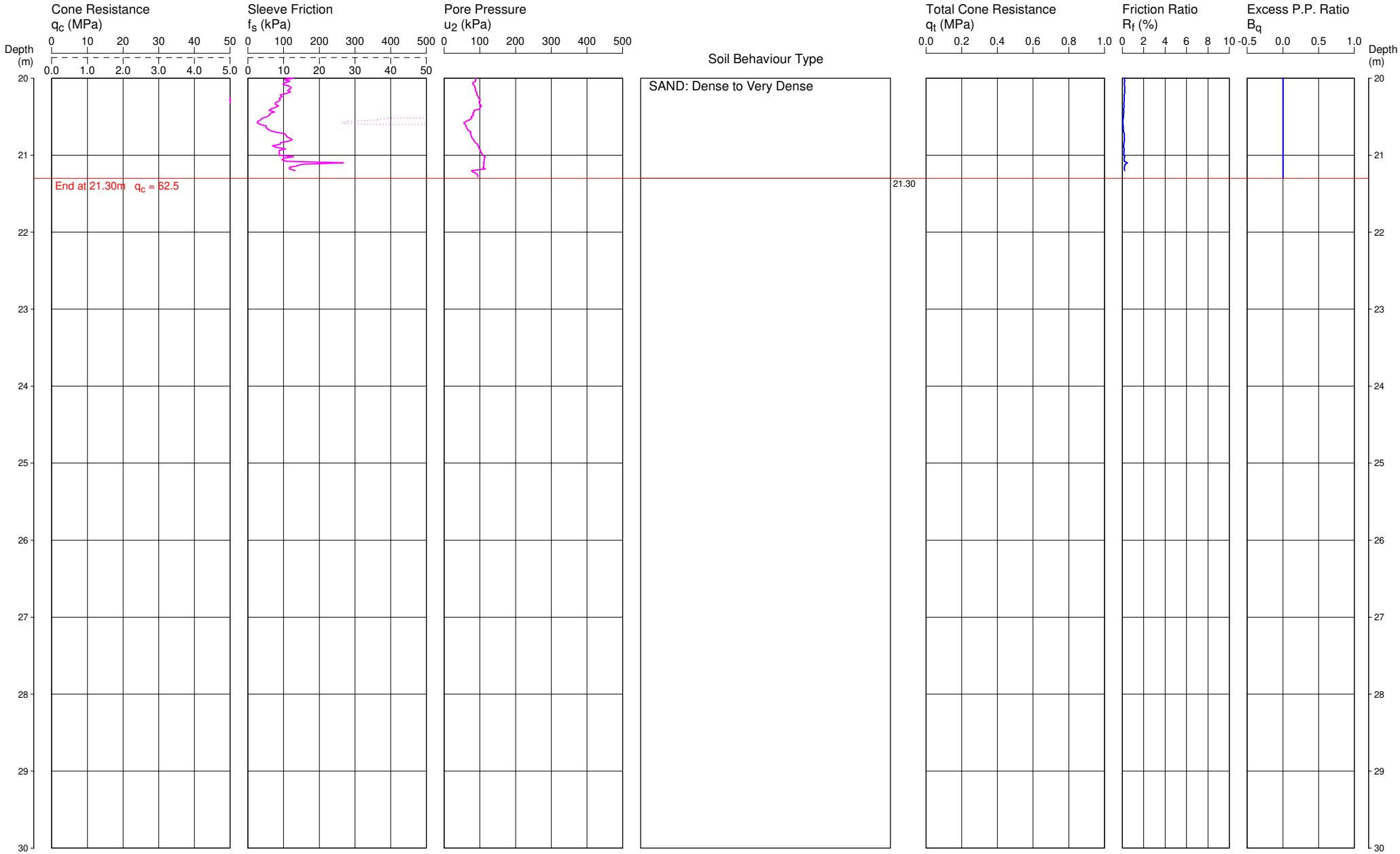
REDUCED LEVEL: 8.9

COORDINATES: 334760.0E 6241577.5N GDA2020

CPT122

DATE 01/08/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. HOLE COLLAPSED AT 4.6M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT122.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

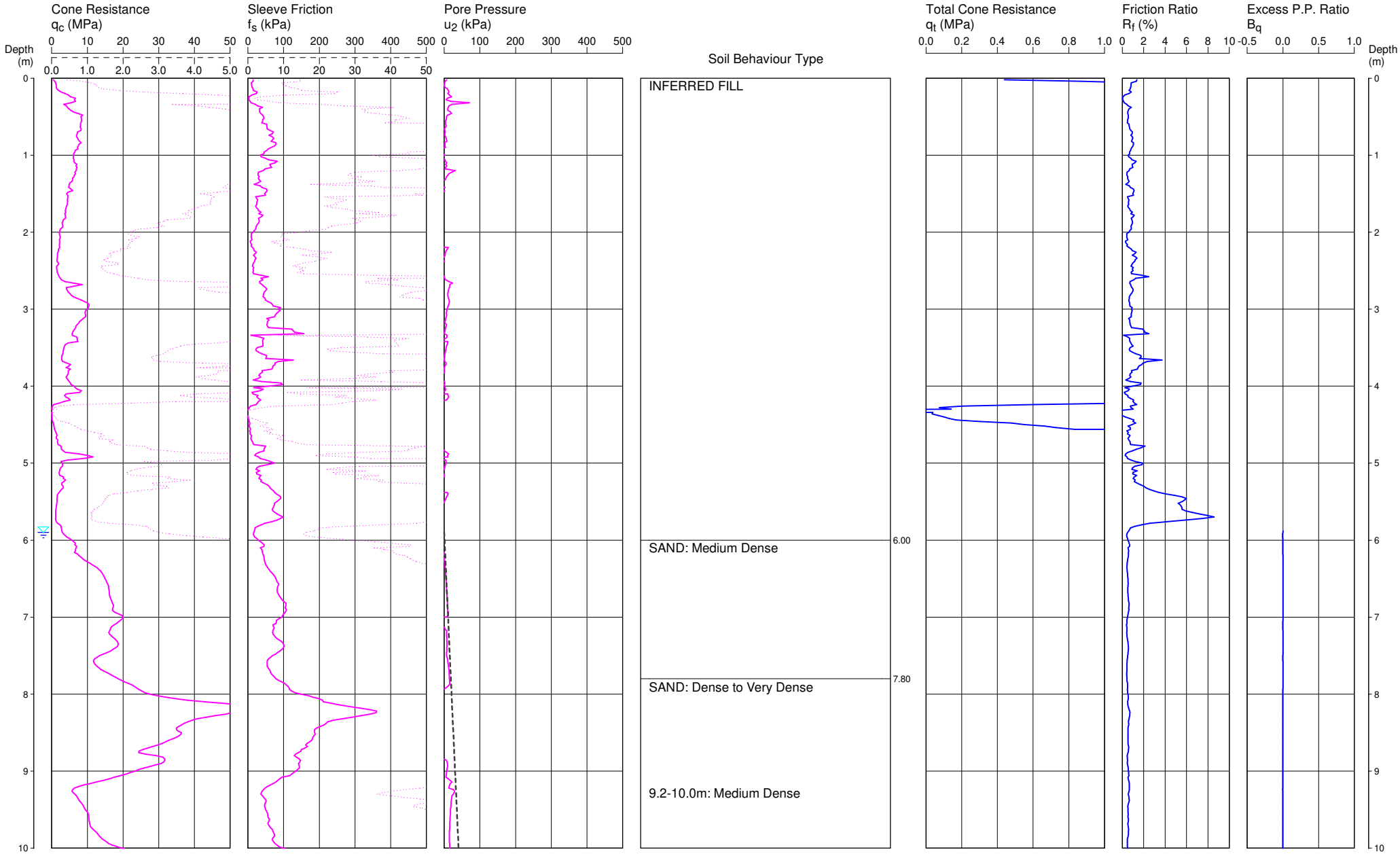
REDUCED LEVEL: 10.1

COORDINATES: 334781.4E 6241632.4N GDA2020

CPT123

DATE 09/08/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. GROUNDWATER OBSERVED AT 5.9M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT123.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.90m depth (assumed)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

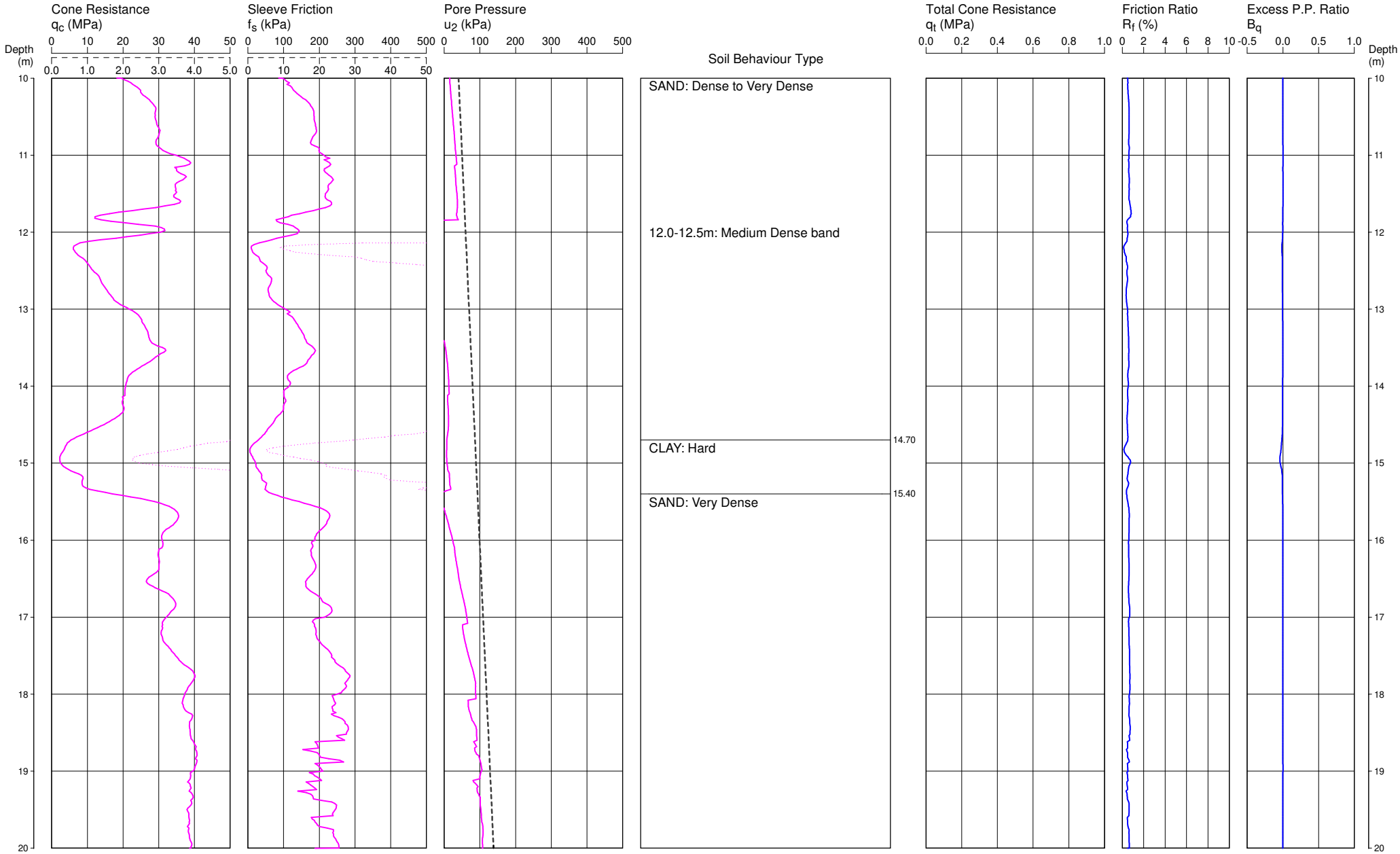
REDUCED LEVEL: 10.1

COORDINATES: 334781.4E 6241632.4N GDA2020

CPT123

DATE 09/08/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. GROUNDWATER OBSERVED AT 5.9M AFTER WITHDRAWAL OF RODS

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT123.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.90m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

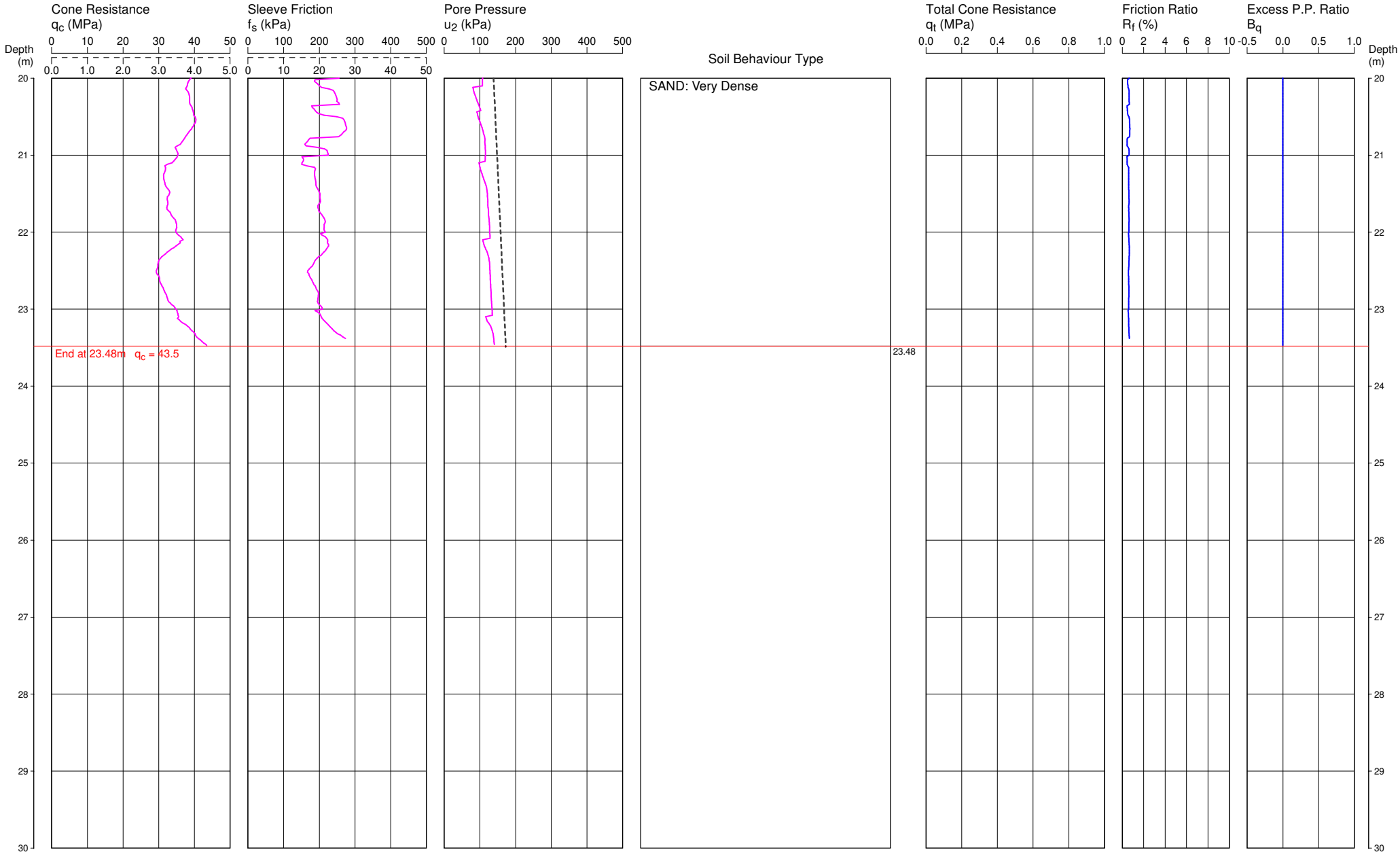
REDUCED LEVEL: 10.1

COORDINATES: 334781.4E 6241632.4N GDA2020

CPT123

DATE 09/08/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. GROUNDWATER OBSERVED AT 5.9M AFTER WITHDRAWAL OF RODS.

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT123.CP5

Cone ID: 210410 **Type:** I-CFXYP20-10

Water depth after test: 5.90m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

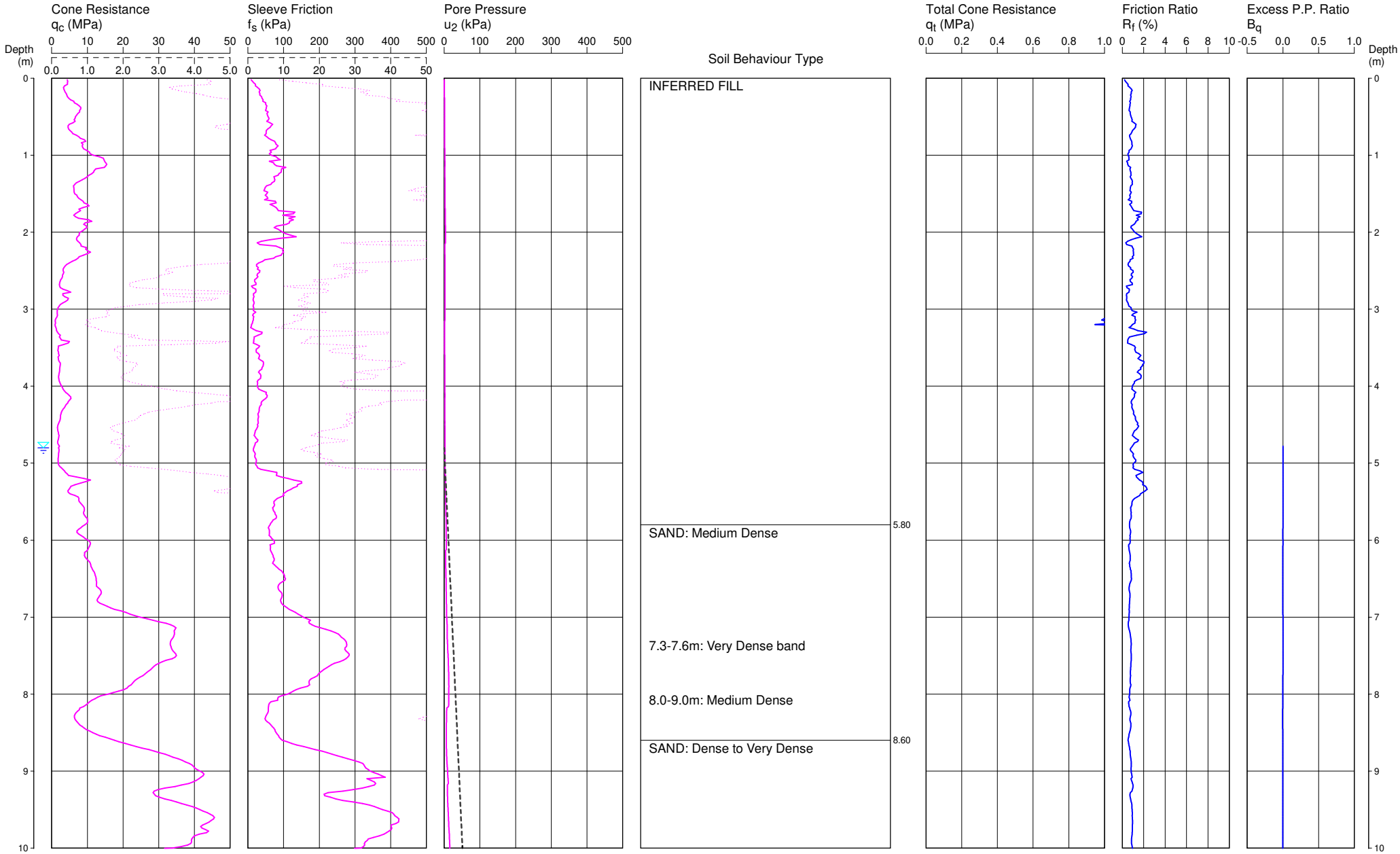
REDUCED LEVEL: 8.7

COORDINATES: 334790.3E 6241579.7N GDA2020

CPT124

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. GROUNDWATER OBSERVED AT 4.8M AFTER WITHDRAWAL OF RODS

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT124.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

Water depth after test: 4.80m depth (assumed)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

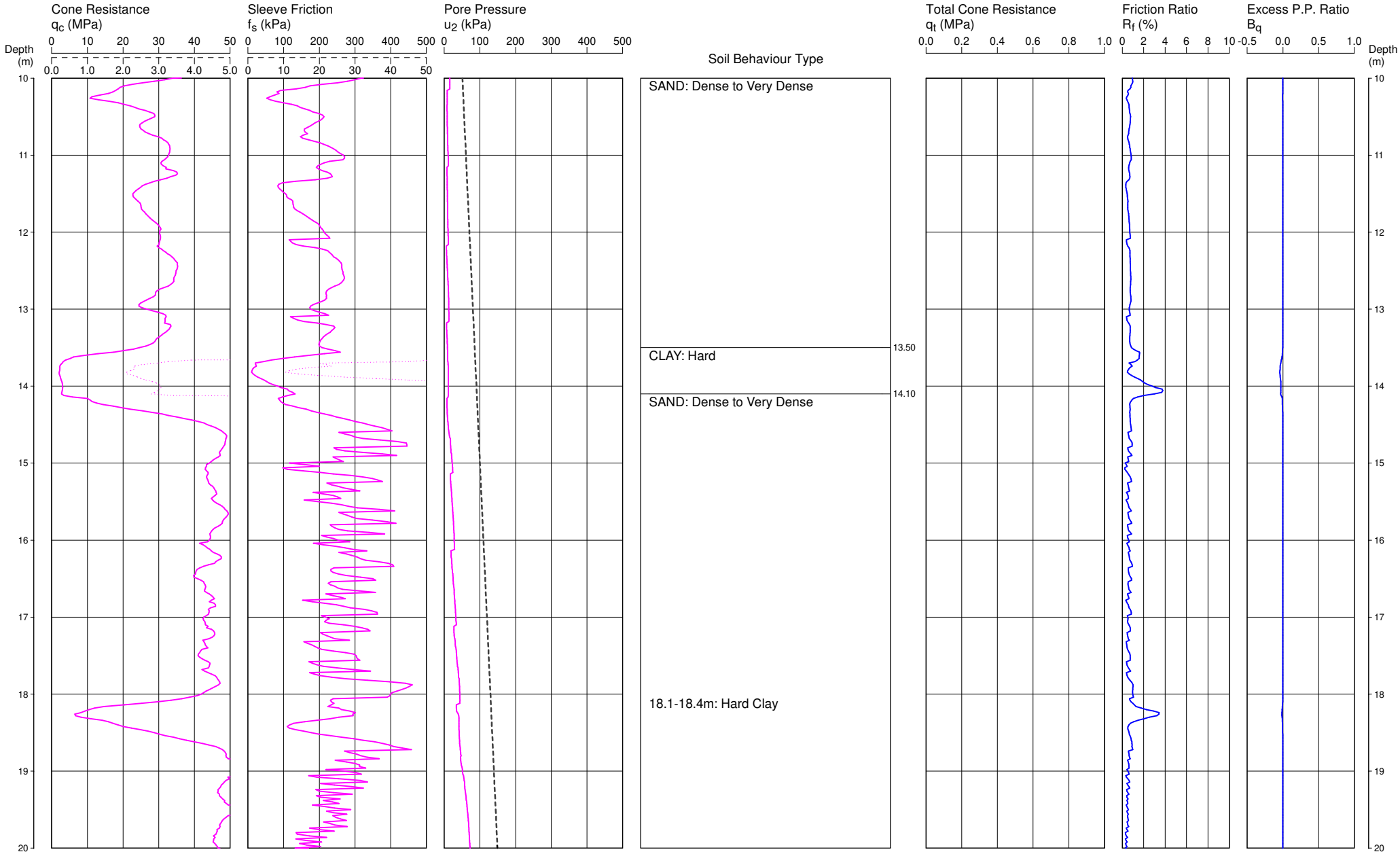
REDUCED LEVEL: 8.7

COORDINATES: 334790.3E 6241579.7N GDA2020

CPT124

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. GROUNDWATER OBSERVED AT 4.8M AFTER WITHDRAWAL OF RODS

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT124.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

Water depth after test: 4.80m depth (assumed)

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

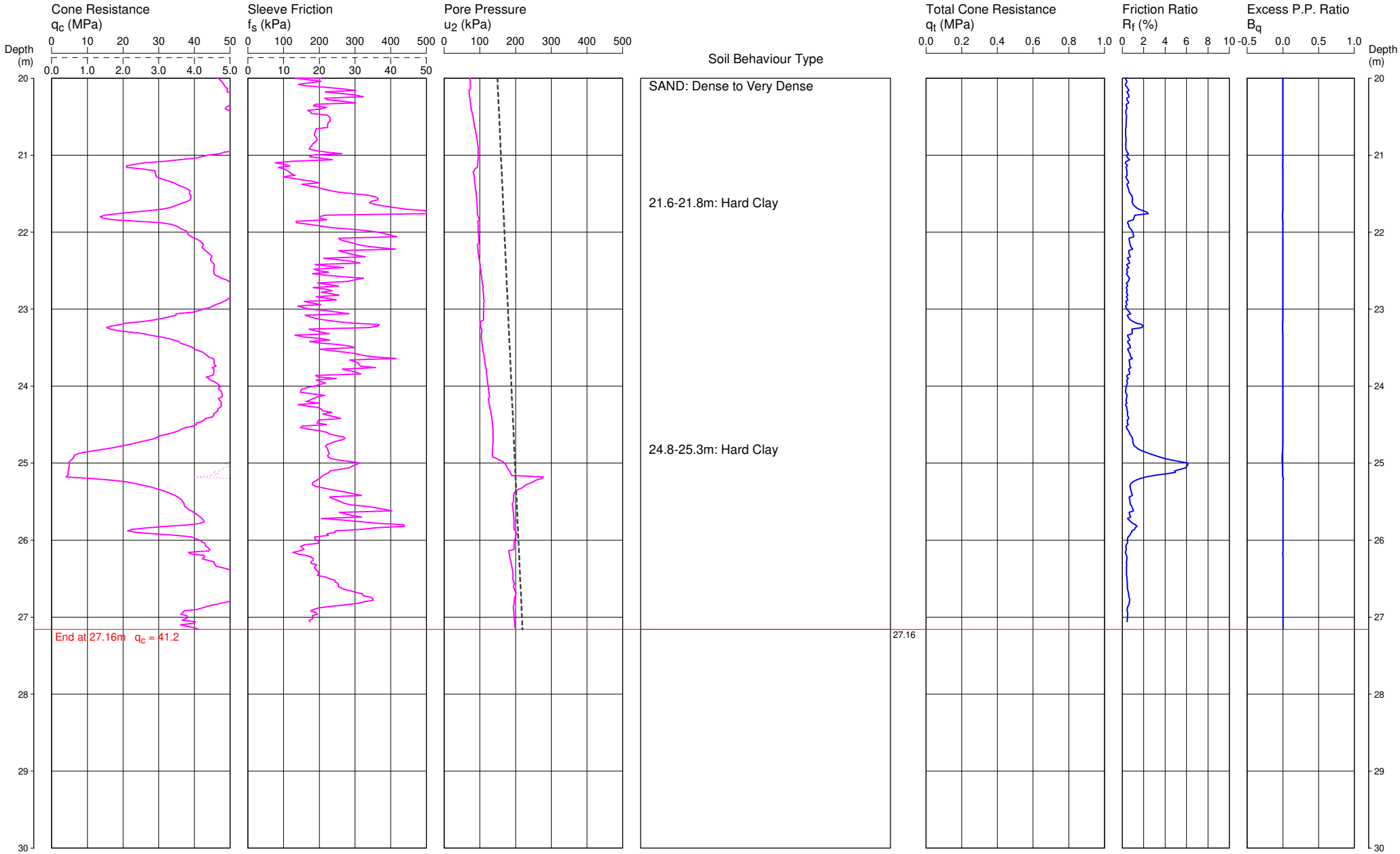
REDUCED LEVEL: 8.7

COORDINATES: 334790.3E 6241579.7N GDA2020

CPT124

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING. GROUNDWATER OBSERVED AT 4.8M AFTER WITHDRAWAL OF RODS

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT124.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

Water depth after test: 4.80m depth (assumed)

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: ESR AUSTRALIA

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 49-51 STEPHEN ROAD, BANKSMEADOW

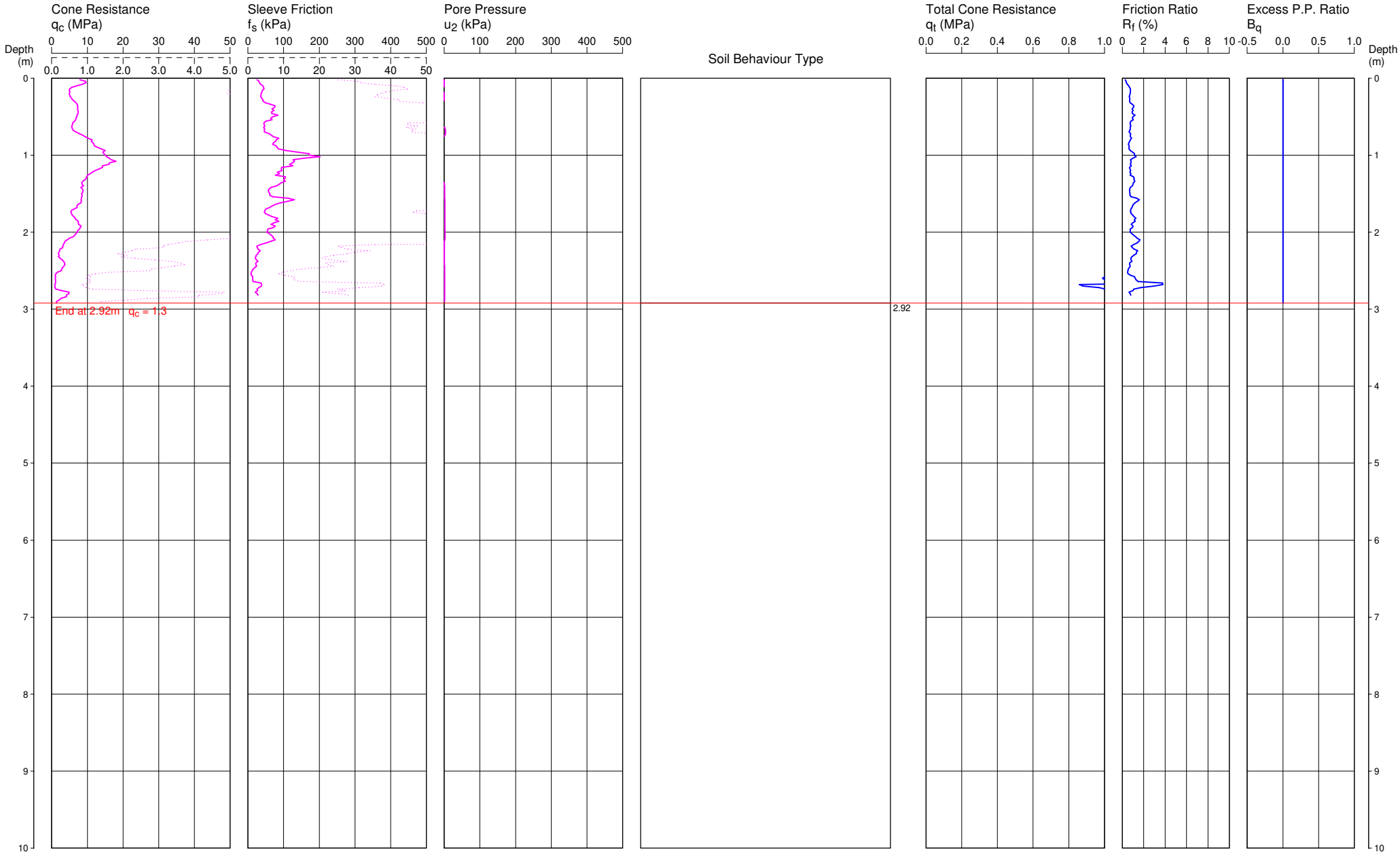
REDUCED LEVEL: 8.7

COORDINATES: 334790.3E 6241579.7N GDA2020

CPT124

DATE 31/07/2023

PROJECT No: 219609.02



REMARKS: TEST DISCONTINUED DUE TO BENDING ON FILLING.
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF ROD

File: P:\219609.02 - BANKSMEADOW, 49 Stephen Road, Geo\4.0 Field Work\4.2 Testing\CP5 Files\CPT124BB.CP5

Cone ID: 210732 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix D

Laboratory Test Results

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 332467-B

Client Details

Client	Douglas Partners Pty Ltd
Attention	David Holden
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**219609.01, Banksmeadow**
Number of Samples	Additional aggressivity analysis
Date samples received	06/09/2023
Date completed instructions received	25/09/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	03/10/2023
Date of Issue	03/10/2023

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Loren Bardwell, Development Chemist
Priya Samarawickrama, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Acid Extractable Cations in Soil						
Our Reference		332467-B-7	332467-B-29	332467-B-31	332467-B-33	332467-B-35
Your Reference	UNITS	202	203	203	203	203
Depth		2.5-2.95	5-5.2	7-7.45	9-9.45	11-11.45
Date Sampled		1/09/23	5/09/23	5/09/23	5/09/23	5/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	28/09/2023	28/09/2023	28/09/2023	28/09/2023	28/09/2023
Date analysed	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023	29/09/2023
Calcium	mg/kg	80	60	90	80	110
Potassium	mg/kg	40	60	70	30	60
Magnesium	mg/kg	70	120	150	50	70
Sodium	mg/kg	40	20	10	20	30

Acid Extractable Cations in Soil						
Our Reference		332467-B-37	332467-B-46	332467-B-51	332467-B-53	332467-B-56
Your Reference	UNITS	203	204	204	204	204
Depth		13-13.35	1.5-1.7	5-5.2	7-7.45	10-10.45
Date Sampled		5/09/23	4/09/23	4/09/23	4/09/23	4/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	28/09/2023	28/09/2023	28/09/2023	28/09/2023	28/09/2023
Date analysed	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023	29/09/2023
Calcium	mg/kg	20	10	30	70	20
Potassium	mg/kg	50	50	70	70	10
Magnesium	mg/kg	50	90	120	160	<10
Sodium	mg/kg	20	10	20	20	20

Acid Extractable Cations in Soil					
Our Reference		332467-B-66	332467-B-69	332467-B-71	332467-B-78
Your Reference	UNITS	207	207	207	207
Depth		1-1.45	5.5-5.95	8-8.45	15-15.45
Date Sampled		31/08/23	31/08/23	31/08/23	31/08/23
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	28/09/2023	28/09/2023	28/09/2023	28/09/2023
Date analysed	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023
Calcium	mg/kg	<10	30	180	230
Potassium	mg/kg	40	70	40	60
Magnesium	mg/kg	70	130	40	210
Sodium	mg/kg	<10	10	10	450

Misc Inorg - Soil						
Our Reference		332467-B-7	332467-B-29	332467-B-31	332467-B-33	332467-B-35
Your Reference	UNITS	202	203	203	203	203
Depth		2.5-2.95	5-5.2	7-7.45	9-9.45	11-11.45
Date Sampled		1/09/23	5/09/23	5/09/23	5/09/23	5/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023	29/09/2023
Date analysed	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023	29/09/2023
pH 1:5 soil:water	pH Units	7.1	7.1	6.6	5.7	6.0
Electrical Conductivity 1:5 soil:water	µS/cm	30	32	23	14	19
Chloride, Cl 1:5 soil:water	mg/kg	<10	10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	20	<10	<10	<10	<10
Bicarbonate Alkalinity as $CaCO_3$	mg/L	88	94	86	56	74
Carbonate, CO_3^{2-} as $CaCO_3$	mg/L	<50	<50	<50	<50	<50
Soluble Hydroxide as $CaCO_3$ *	mg/kg	<50	<50	<50	<50	<50
Soluble Alkalinity as $CaCO_3$ *	mg/kg	88	94	86	56	74

Misc Inorg - Soil						
Our Reference		332467-B-37	332467-B-46	332467-B-51	332467-B-53	332467-B-56
Your Reference	UNITS	203	204	204	204	204
Depth		13-13.35	1.5-1.7	5-5.2	7-7.45	10-10.45
Date Sampled		5/09/23	4/09/23	4/09/23	4/09/23	4/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023	29/09/2023
Date analysed	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023	29/09/2023
pH 1:5 soil:water	pH Units	5.3	4.7	6.5	6.0	5.6
Electrical Conductivity 1:5 soil:water	µS/cm	30	24	17	42	13
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	20	<10
Sulphate, SO4 1:5 soil:water	mg/kg	22	10	<10	20	<10
Bicarbonate Alkalinity as $CaCO_3$	mg/L	<50	<50	78	120	65
Carbonate, CO_3^{2-} as $CaCO_3$	mg/L	<50	<50	<50	<50	<50
Soluble Hydroxide as $CaCO_3$ *	mg/kg	<50	<50	<50	<50	<50
Soluble Alkalinity as $CaCO_3$ *	mg/kg	<50	<50	78	120	65

Misc Inorg - Soil					
Our Reference		332467-B-66	332467-B-69	332467-B-71	332467-B-78
Your Reference	UNITS	207	207	207	207
Depth		1-1.45	5.5-5.95	8-8.45	15-15.45
Date Sampled		31/08/23	31/08/23	31/08/23	31/08/23
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023
Date analysed	-	29/09/2023	29/09/2023	29/09/2023	29/09/2023
pH 1:5 soil:water	pH Units	6.6	5.1	6.2	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	18	17	28	160
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	69
Sulphate, SO4 1:5 soil:water	mg/kg	10	<10	24	110
Bicarbonate Alkalinity as $CaCO_3$	mg/L	<50	78	65	70
Carbonate, CO_3^{2-} as $CaCO_3$	mg/L	<50	<50	<50	<50
Soluble Hydroxide as $CaCO_3$ *	mg/kg	<50	<50	<50	<50
Soluble Alkalinity as $CaCO_3$ *	mg/kg	<50	78	65	70

Moisture						
Our Reference		332467-B-7	332467-B-31	332467-B-33	332467-B-35	332467-B-37
Your Reference	UNITS	202	203	203	203	203
Depth		2.5-2.95	7-7.45	9-9.45	11-11.45	13-13.35
Date Sampled		1/09/23	5/09/23	5/09/23	5/09/23	5/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Date analysed	-	28/09/2023	28/09/2023	28/09/2023	28/09/2023	28/09/2023
Moisture	%	4.1	12	16	18	17

Moisture						
Our Reference		332467-B-53	332467-B-56	332467-B-66	332467-B-69	332467-B-71
Your Reference	UNITS	204	204	207	207	207
Depth		7-7.45	10-10.45	1-1.45	5.5-5.95	8-8.45
Date Sampled		4/09/23	4/09/23	31/08/23	31/08/23	31/08/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Date analysed	-	28/09/2023	28/09/2023	28/09/2023	28/09/2023	28/09/2023
Moisture	%	18	10	4.3	13	13

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.

QUALITY CONTROL: Acid Extractable Cations in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	332467-B-33
Date prepared	-			28/09/2023	31	28/09/2023	28/09/2023		28/09/2023	28/09/2023
Date analysed	-			29/09/2023	31	29/09/2023	29/09/2023		29/09/2023	29/09/2023
Calcium	mg/kg	10	Metals-020	<10	31	90	110	20	118	96
Potassium	mg/kg	10	Metals-020	<10	31	70	80	13	95	101
Magnesium	mg/kg	10	Metals-020	<10	31	150	170	12	113	98
Sodium	mg/kg	10	Metals-020	<10	31	10	10	0	104	110

QUALITY CONTROL: Acid Extractable Cations in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	66	28/09/2023	28/09/2023		[NT]	[NT]
Date analysed	-			[NT]	66	29/09/2023	29/09/2023		[NT]	[NT]
Calcium	mg/kg	10	Metals-020	[NT]	66	<10	<10	0	[NT]	[NT]
Potassium	mg/kg	10	Metals-020	[NT]	66	40	50	22	[NT]	[NT]
Magnesium	mg/kg	10	Metals-020	[NT]	66	70	70	0	[NT]	[NT]
Sodium	mg/kg	10	Metals-020	[NT]	66	<10	<10	0	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	332467-B-29
Date prepared	-			29/09/2023	7	29/09/2023	29/09/2023		29/09/2023	29/09/2023
Date analysed	-			29/09/2023	7	29/09/2023	29/09/2023		29/09/2023	29/09/2023
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	7	7.1	7.0	1	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	7	30	29	3	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	7	<10	<10	0	103	94
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	7	20	20	0	102	74
Bicarbonate Alkalinity as $CaCO_3$	mg/L	50	Inorg-006	<50	7	88	86	2	[NT]	[NT]
Carbonate, CO_3^{2-} as $CaCO_3$	mg/L	50	Inorg-006	<50	7	<50	<50	0	[NT]	[NT]
Soluble Hydroxide as $CaCO_3$ *	mg/kg	50	Inorg-006	<50	7	<50	<50	0	[NT]	[NT]
Soluble Alkalinity as $CaCO_3$ *	mg/kg	50	Inorg-006	<50	7	88	86	2	108	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	56	29/09/2023	29/09/2023		[NT]	[NT]
Date analysed	-			[NT]	56	29/09/2023	29/09/2023		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	56	5.6	5.5	2	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	56	13	16	21	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	56	<10	<10	0	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	56	<10	<10	0	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	50	Inorg-006	[NT]	56	65	64	2	[NT]	[NT]
Carbonate, CO_3^{2-} as $CaCO_3$	mg/L	50	Inorg-006	[NT]	56	<50	<50	0	[NT]	[NT]
Soluble Hydroxide as $CaCO_3$ *	mg/kg	50	Inorg-006	[NT]	56	<50	<50	0	[NT]	[NT]
Soluble Alkalinity as $CaCO_3$ *	mg/kg	50	Inorg-006	[NT]	56	65	64	2	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Samples were out of the recommended holding time for this analysis pH/EC.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 333010-B

Client Details

Client	Douglas Partners Pty Ltd
Attention	David Holden
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**219609.02, Banksmeadow**
Number of Samples	108 Soil, 1 Material
Date samples received	13/09/2023
Date completed instructions received	25/09/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	03/10/2023
Date of Issue	03/10/2023

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Loren Bardwell, Development Chemist
Priya Samarawickrama, Senior Chemist
Steven Luong, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Acid Extractable Cations in Soil						
Our Reference		333010-B-2	333010-B-21	333010-B-23	333010-B-24	333010-B-25
Your Reference	UNITS	201	205	205	205	205
Depth		0.4-0.5	2.5-2.95	5.5-5.95	6.5-6.8	8-8.3
Date Sampled		6/09/23	7/09/23	7/09/23	7/09/23	7/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/09/2023	26/09/2023	26/09/2023	26/09/2023	26/09/2023
Date analysed	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Calcium	mg/kg	140	50	70	80	40
Potassium	mg/kg	50	40	100	90	10
Magnesium	mg/kg	100	80	210	230	20
Sodium	mg/kg	20	10	30	20	30

Acid Extractable Cations in Soil						
Our Reference		333010-B-44	333010-B-56	333010-B-58	333010-B-60	333010-B-79
Your Reference	UNITS	206	209	209	209	210
Depth		6.5-6.95	1-1.45	2.5-2.9	4-4.45	2-2.2
Date Sampled		8/09/23	11/09/23	11/09/23	11/09/23	12/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/09/2023	26/09/2023	26/09/2023	26/09/2023	26/09/2023
Date analysed	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Calcium	mg/kg	60	18,000	7,700	3,900	11,000
Potassium	mg/kg	80	250	200	410	310
Magnesium	mg/kg	170	1,300	1,500	370	1,300
Sodium	mg/kg	10	230	320	210	370

Misc Inorg - Soil						
Our Reference		333010-B-2	333010-B-21	333010-B-23	333010-B-24	333010-B-25
Your Reference	UNITS	201	205	205	205	205
Depth		0.4-0.5	2.5-2.95	5.5-5.95	6.5-6.8	8-8.3
Date Sampled		6/09/23	7/09/23	7/09/23	7/09/23	7/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Date analysed	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
pH 1:5 soil:water	pH Units	3.8	5.5	6.2	6.6	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	37	9	12	23	19
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	26	<10	<10	10	20
Soluble Bicarb as $CaCO_3$ *	mg/kg	<50	<50	<50	55	<50
Soluble Carbonate as $CaCO_3$ *	mg/kg	<50	<50	<50	<50	<50
Soluble Hydroxide as $CaCO_3$ *	mg/kg	<50	<50	<50	<50	<50
Soluble Alkalinity as $CaCO_3$ *	mg/kg	<50	<50	<50	55	<50

Misc Inorg - Soil						
Our Reference		333010-B-44	333010-B-56	333010-B-58	333010-B-60	333010-B-79
Your Reference	UNITS	206	209	209	209	210
Depth		6.5-6.95	1-1.45	2.5-2.9	4-4.45	2-2.2
Date Sampled		8/09/23	11/09/23	11/09/23	11/09/23	12/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Date analysed	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
pH 1:5 soil:water	pH Units	6.5	8.4	8.5	6.7	8.4
Electrical Conductivity 1:5 soil:water	µS/cm	18	190	190	160	230
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	59	57	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	140	63	10	130
Soluble Bicarb as $CaCO_3$ *	mg/kg	60	1,500	1,800	300	2,400
Soluble Carbonate as $CaCO_3$ *	mg/kg	<50	<50	<50	<50	<50
Soluble Hydroxide as $CaCO_3$ *	mg/kg	<50	<50	<50	<50	<50
Soluble Alkalinity as $CaCO_3$ *	mg/kg	60	1,500	1,800	300	2,400

Moisture						
Our Reference		333010-B-2	333010-B-21	333010-B-23	333010-B-24	333010-B-25
Your Reference	UNITS	201	205	205	205	205
Depth		0.4-0.5	2.5-2.95	5.5-5.95	6.5-6.8	8-8.3
Date Sampled		6/09/23	7/09/23	7/09/23	7/09/23	7/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/09/2023	26/09/2023	26/09/2023	26/09/2023	26/09/2023
Date analysed	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Moisture	%	4.2	4.2	20	18	17

Moisture						
Our Reference		333010-B-44	333010-B-56	333010-B-58	333010-B-60	333010-B-79
Your Reference	UNITS	206	209	209	209	210
Depth		6.5-6.95	1-1.45	2.5-2.9	4-4.45	2-2.2
Date Sampled		8/09/23	11/09/23	11/09/23	11/09/23	12/09/23
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/09/2023	26/09/2023	26/09/2023	26/09/2023	26/09/2023
Date analysed	-	27/09/2023	27/09/2023	27/09/2023	27/09/2023	27/09/2023
Moisture	%	17	10	13	16	6.2

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.

QUALITY CONTROL: Acid Extractable Cations in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			26/09/2023	[NT]	[NT]	[NT]	[NT]	26/09/2023	[NT]
Date analysed	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
Calcium	mg/kg	10	Metals-020	<10	[NT]	[NT]	[NT]	[NT]	103	[NT]
Potassium	mg/kg	10	Metals-020	<10	[NT]	[NT]	[NT]	[NT]	95	[NT]
Magnesium	mg/kg	10	Metals-020	<10	[NT]	[NT]	[NT]	[NT]	105	[NT]
Sodium	mg/kg	10	Metals-020	<10	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	333010-B-21
Date prepared	-			27/09/2023	2	27/09/2023	27/09/2023		27/09/2023	27/09/2023
Date analysed	-			27/09/2023	2	27/09/2023	27/09/2023		27/09/2023	27/09/2023
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	3.8	3.9	3	98	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	37	43	15	104	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	<10	<10	0	104	87
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	26	32	21	101	73
Soluble Bicarb as $CaCO_3$ *	mg/kg	50	Inorg-006	<50	2	<50	<50	0	[NT]	[NT]
Soluble Carbonate as $CaCO_3$ *	mg/kg	50	Inorg-006	<50	2	<50	<50	0	[NT]	[NT]
Soluble Hydroxide as $CaCO_3$ *	mg/kg	50	Inorg-006	<50	2	<50	<50	0	[NT]	[NT]
Soluble Alkalinity as $CaCO_3$ *	mg/kg	50	Inorg-006	<50	2	<50	<50	0	100	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Samples were out of the recommended holding time for this analysis pH/EC, Soluble Alkalinity.